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Th3

Prepared March 16, 2021 for March 18, 2021 Hearing

To: Commissioners and Interested Persons

From: Susan Craig, Central Coast District Manager
Kevin Kahn, Central Coast District Supervisor

Subject: Additional hearing materials for Th3
CDP Number 4-82-300 Review (Oceano Dunes)

This package includes additional materials related to the above-referenced hearing item as follows:

Additional Group correspondence received in the time since the staff report was distributed

March 8, 2021

To: OceanoDunesReview@coastal.ca.gov

Re: Public Comment on March 18, 2021, Agenda Item 3 - Oceano Dunes CDP Review

The Dunes Alliance is a coalition of community and environmental organizations active on the California Central Coast and dedicated to the safe and environmentally sustainable use and enjoyment of the Guadalupe-Nipomo Dunes Complex, including the Oceano Dunes State Vehicular Recreation Area (ODSVRA) and Pismo State Beach (PSB).

We support the recommendations of Coastal Commission staff for changes to Coastal Development Permit CDP 4-82-300 as amended, to improve the management and operation of the ODSVRA and PSB and move toward full compliance with the Local Coastal Plan and California Coastal Act.

Sincerely,

Andrew Johnson, California Representative
Defenders of Wildlife

Sue Harvey, Conservation Chair
Sierra Club Santa Lucia Chapter

Arlene Versaw, Co-Founder
Concerned Citizens for Clean Air

Brad Snook, Vice Chair
Surfrider San Luis Obispo

Fred Collins, Tribal Administrator
Northern Chumash Tribal Council

Jeff Miller, Senior Conservation Advocate
Center for Biological Diversity

Ilona Shakibnia, Representative
Friends of Oso Flaco Lake

Herbert Smith, Board Member
American Woodland Conservancy

Mary Ciesinski, Executive Director
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Gordon Hensley, Executive Director
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Doug Tait, Conservation Chair
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March 8, 2021

Via Electronic Submission

California Coastal Commission
725 Front Street
Suite 300
Santa Cruz, CA 5060

Considering OHV Use at ODSVRA – March 18, California Coastal Commission Hearing

Dear Commissioners:

On behalf of the Dunes Alliance, we submit these comments regarding the Coastal Commission's March 18 hearing to review Coastal Development Permit (CDP) 4-82-300 issued to the California Department of Parks and Recreation (State Parks) for operation of the Oceano Dunes State Vehicular Recreational Area (ODSVRA). The Dunes Alliance is a group of local community and environmental organizations interested in preserving Oceano Dunes as a natural and recreational preserve.[1] Oceano Dunes is a unique and invaluable resource that lies on the lands and waters of the Northern Chumash tribe. Dunes Alliance members are connected to Oceano Dunes for a variety of reasons – whether as residents, wildlife enthusiasts, or practicing tribal members – but they share a commitment to limiting ODSVRA's use to light-footprint recreational opportunities and to restoration of the dunes as a healthy ecosystem.

In these comments, supplementing any separate public comments submitted by the Dunes Alliance or its individual members, we evaluate four legal issues. First, as explained below, staff's recommendation to eliminate off-highway vehicle (OHV) use from ODSVRA aligns closely with the goals of the Coastal Act and best serves the local community. Second, State Parks does not have an affirmative statutory mandate to continue permitting OHV use in ODSVRA. Third, continued OHV use at ODSVRA is inconsistent with the federal Endangered Species Act and its California counterpart, a fact that provides additional support for staff's recommendations. Finally, we present additional information and legal analysis of local environmental justice issues that should inform the Commission's decision.

In sum, staff's recommendation to phase out OHV use on the fragile dune system and protected coastal resources of ODSVRA constitutes sound public policy and is entirely consistent with applicable state law, including the Coastal Act, the Off-Highway Motor Vehicle Recreation Act, and the California Endangered Species Act.

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[1] The organizations in the Dunes Alliance are the Santa Lucia Chapter of the Sierra Club, the San Luis Obispo Chapter of the Surfrider Foundation, the Northern Chumash Tribal Council, Defenders of Wildlife, San Luis Obispo Coastkeeper, the Environmental Center of San Luis Obispo (ECOSLO), the Center for Biological Diversity, Concerned Citizens for Clean Air, Morro Coast Audubon, American Woodland Conservancy, and Friends of Oso Flaco Lake.

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I. The California Coastal Commission Has the Legal Authority to Restrict Off-Highway Vehicle Use in the Park

The conservation of coastal resources is the animating force behind the Coastal Act.[2] The California Coastal Act was enacted to "[p]rotect, maintain, and, where feasible, enhance and restore the overall quality of the coastal zone environment and its natural and artificial resources."[3] The Legislature specified that the coastal zone is one of the state's "most precious natural resources" and that the protection of coastal resources is paramount in coastal management decisions.[4] When conflicts arise between provisions within the Coastal Act, they must be "resolved in a manner which on balance is the most protective of significant coastal resources."[5] In *McAllister v. Coastal Commission*, the court held that "when a provision of the Coastal Act is at issue, we are enjoined to construe it liberally to accomplish its purposes and objectives, giving the highest priority to environmental considerations."[6]

The Coastal Act provides a comprehensive scheme to govern land use for the entire coastal zone of California[7] and gives the Commission "primary responsibility for implementation" of the legislation.[8] The Commission and local governments regulate coastal zone development through the Coastal Development Permit (CDP) process. CDPs are required for any individual or agency seeking to undertake a development in the coastal zone.[9]

As a development in the Coastal Zone, the ODSVRA and the surrounding recreational area (hereinafter referred to jointly as "the Park") requires a CDP to operate. The Commission first issued a temporary CDP to State Parks for operation of the Park – denominated CDP 4-82-300 – in 1982, including conditions that limited OHV use.[10] Since then, the Commission has periodically updated the conditions for CDP 4-82-300 to reflect the needs of the coastal zone.[11] As staff reports and mounting evidence demonstrate, further amendment to the CDP is now required to protect access to light-footprint recreation, unique ecosystems and species, and the continued viability of Oceano Dunes as a coastal resource for generations to come.

Below, we provide five points of law that should guide the Commission's decision, all of which warrant – and indeed, mandate – the elimination of OHV use at the Park. First, most of the Park is designated as environmentally sensitive habitat area (ESHA), a highly protected category of

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[2] Cal. Pub. Res. Code § 30000 et seq. All statutory references are to the Public Resources Code unless otherwise noted.
[3] Cal. Pub. Res. Code § 30001.5(a).
[4] Cal. Pub. Res. Code § 30344.
[5] Cal. Pub. Res. Code § 30007.5.
[6] 169 Cal. App. 4th 912, 928 (2008) (interpreting Cal. Pub. Res. Code § 30009).
[7] *Surfrider Found. v. Martins Beach 1, LLC*, 14 Cal. App. 5th 238, 249 (2017).
[8] Cal. Pub. Res. Code § 30330
[9] Cal. Pub. Res. Code § 30600.
[10] Initial conditions included barring night riding north of the sand highway, barring OHV use on vegetated dune areas, and prohibiting vehicle use south of Oso Flaco Creek. CAL. COASTAL COMM'N, Oceano Dunes Coastal Development Permit 4-82-300 (Prepared for July 2019 Hearing), Ex. 4, 2. https://documents.coastal.ca.gov/reports/2019/7/Th12a/Th12a-7-2019-exhibits.pdf.
[11] CAL. COASTAL COMM'N, Oceano Dunes Coastal Development Permit 4-82-300 (Prepared for July 2019 Hearing), Ex. 4, 35. https://documents.coastal.ca.gov/reports/2019/7/Th12a/Th12a-7-2019-exhibits.pdf.

land on which development is extremely limited and activities that are inconsistent with coastal resource protection – such as OHV use – are precluded. Second, continued OHV use at the Park does not comply with the Coastal Act's other mandatory Chapter 3 provisions. Third, the Coastal Act's provisions protecting agencies from redundant regulations do not limit the Commission's authority to enforce Coastal Act protections in the coastal zone or provide an affirmative defense for State Parks to ignore Commission mandates. Fourth, the Commission has a public trust obligation to protect the tidelands and the wildlife that depend on them, both of which demand phasing out OHV use at the Park. Fifth and finally, CDP conditions can change over time to respond to coastal needs, and the Commission has the authority to eliminate OHV use as a condition to protect coastal resources.

A. The Park Is an Environmentally Sensitive Habitat Area that Demands Heightened Protection

The Commission and local governments work in tandem to identify coastal areas that merit special protection, including designating ESHA, defined as "any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments."[12] Reflecting their vulnerability, ESHAs are to "be protected against any significant disruption of habitat values."[13]

Development on ESHA is strictly limited by statute and precludes OHV use at the Park. Section 30240 of the Coastal Act provides that "only uses dependent on [habitat] resources shall be allowed" in ESHA.[14] The courts have confirmed that only those uses that "are dependent on the resources to be protected *and* that do not significantly disrupt habitat values" may be permitted in ESHA.[15] Among the developments that have not met this definition are residential construction with an alternative habitat built nearby,[16] a three-hole golf course on private property,[17] and a public roads project.[18] Even developments adjacent to ESHA – including parks – must be "designed to prevent impacts which would significantly degrade [ESHA]" and be compatible with the "continuance of those habitat and recreation areas."[19]

The Commission has primary responsibility for protecting ESHA and cannot balance economic interests – as claimed by State Parks – against the preservation of habitat. While section 30240 is silent on who must ensure that ESHA is protected, the court found in *Douda v. California Coastal Com.* that "[b]ecause it was not otherwise *specifically* provided, the primary

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[12] Cal. Pub. Res. Code § 30107.5.
[13] Cal. Pub. Res. Code § 30240.
[14] Cal. Pub. Res. Code § 30240.
[15] *See McAllister*, 169 Cal. App. 4th at 929 (emphasis added) (describing "those resources" as "the resources that make an area a protected habitat—i.e., plant or animal life or their habitats [that] are either rare or especially valuable because of their special nature or role in an ecosystem").
[16] *See Bolsa Chica Land Tr. v. Superior Court,* 71 Cal. App. 4th 493, 507 (1999).
[17] *Feduniak v. California Coastal Com.,* 148 Cal. App. 4th 1346, 1376 (2007).
[18] *City of San Diego v. California Coastal Com.*, 119 Cal. App. 3d 228 (1981).
[19] Cal. Pub. Res. Code § 30240.

responsibility for implementing section 30240, by default, must go to the Commission."[20] In *Bolsa Chica Land Tr. v. Superior Court*, the court added that "while compromise and balancing in light of existing conditions is appropriate and indeed encouraged under other applicable portions of the Coastal Act, the power to balance and compromise conflicting interests cannot be found in section 30240."[21] In short, once ESHA is identified, the Commission – and all other state agencies – cannot ignore the protection it mandates for sensitive lands.

The San Luis Obispo County LCP governs land use policy in the county's coastal zone, including in the Park.[22] The LCP identifies nearly all of the Park – including all of the current ODSVRA riding area – as ESHA.[23] The Commission's LCP Review describes the protected dune habitats as "some of the most important, and most endangered, stands of the central coast's dwindling environs."[24] Indeed, the Park is part of the Guadalupe-Nipomo dune complex, the largest intact coastal dune system in the world.[25] The protected areas include both sparsely and heavily vegetated dunes, as well as sandy beaches and nearby areas that serve as habitat.[26] For protection of shorebirds – such as the western snowy plover and California least tern – the Commission's LCP Review recommends designating and protecting all "habitat, or potential habitat . . . as ESHA."[27] Finally, the LCP provides for working with land managers to ensure developments are "sited and designed to prevent impacts that would significantly degrade [ESHA] and shall be compatible with the continuance of such habitat areas."[28]

The courts have been clear that section 30240 of the Coastal Act "unambiguously establishes two restrictions on development in [ESHA] areas: (1) there can be no significant disruption of habitat values; and (2) only resource-dependent uses are allowed."[29] As the court explained in *McAllister*, "the use of 'and' in section 30240(a) to conjoin the two restrictions means that they both apply equally to any development in [ESHA]."[30] OHV use in the Park violates both of these statutory requirements.

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[20] 159 Cal. App. 4th 1181, 1194, (2008).
[21] 71 Cal. App. 4th 493, 508 (1999).
[22] CAL. COASTAL COMM'N, San Luis Obispo County's Local Coastal Program Periodic Review (2001). https://www.coastal.ca.gov/recap/slosum.html.
[23] CAL. COASTAL COMM'N, County's ESHA Combining Designation and Areas Containing Federally-Listed Species, http://www.coastal.ca.gov/recap/slo/slo-map-4-a.pdf; CTY. OF SAN LUIS OBISPO DEP'T OF PLANNING AND BUILDING, South County-Coastal Planning Area Rural Combining Designation Map. https://www.slocounty.ca.gov/Departments/Planning-Building/Forms-Documents/Coastal-Zone-Maps/South-County-Coastal-Planning-Area-Maps/South-County-Coastal-Planning-Area-Combining-Desig.pdf.
[24] CAL. COASTAL COMM'N, San Luis Obispo County's Local Coastal Program Periodic Review, Ch. 4: Environmentally Sensitive Habitat Areas (ESHA), 170 (2001). http://www.coastal.ca.gov/recap/slo/slo-ch4.pdf.
[25] The Nature Conservancy, Guadalupe-Nipomo Dunes, https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/guadalupe-nipomo-dunes (last visited Feb. 19, 2021).
[26] *See supra* note 24.
[27] *Id.* at 183.
[28] CTY. OF SAN LUIS OBISPO, San Luis Obispo County Coastal Plan Policies, Environmentally Sensitive Habitats, 6-20. https://www.slocog.org/sites/default/files/documents/Appendix%20D_0.pdf.
[29] *McAllister*, 169 Cal. App. 4th at 928.
[30] *Id.,* 169 Cal App. 4th at 930; *see also Sierra Club v. California Coastal Com*., 12 Cal. App. 4th 602, 617 (1993); *Feduniak v. California Coastal Com.*, 148 Cal. App. 4th 1346, 1376 (2007) ("development in ESHA areas themselves is limited to uses dependent on those resources, and development in adjacent areas must carefully safeguard their preservation").

First, OHV use is severely degrading a unique dune habitat and harming the species that occupy it. As noted repeatedly in the Commission's staff report, OHV use is "disturbing dune physical attributes and stability [and] destroying dune vegetation and leading to lower plant diversity and cover."[31] Indeed, the Commission has documented CDP violations directly related to dune degradation, such as riding on vegetation, riding through Arroyo Grande Creek, and take of endangered species.[32] To manage sand dunes for OHV use, State Parks has even graded areas in the Park with heavy equipment, disturbing shorebird habitat.[33] There is no plausible reading of the Coastal Act that would allow such destructive activities in designated ESHA.

Second, contrary to State Parks assertions, OHV use is not dependent on protected ESHA resources. OHV enthusiasts have access to other sand dunes for recreational use elsewhere in California, and there is nothing about the particular recreational use occurring at the Park that is dependent on the protected ESHA resources; to the contrary, OHV use on these dunes destroys the very features that warrant ESHA protection. On the other hand, there are many resource-dependent uses of this habitat, including "nature education and research, hunting, fishing, and aquaculture,"[34] that are impeded or impaired by today's dominant motorized use.

Finally, staff's proposal to move camping activities north of Pier Avenue appears consistent with the Commission's statutory mandate under section 30240. The recommendation to move camping activities reflects the fact that the beach area between Pier Avenue and Grand Avenue is one of the few small areas of the Park that is not deemed ESHA.[35] In finding that the northern section of beachfront is not ESHA, the Commission's staff ecologist noted the area is a "flat sandy beach area" and not part of the dunes complex that provides valuable habitat to shorebirds and other species.[36] As opposed to the rest of the Park, the northern area can support "more intensive recreational uses" such as beach camping without degrading dunes habitat or violating the Coastal Act's ESHA provisions.[37] Eliminating OHV use and moving camping areas north would better protect ESHA, and in turn, comply with Coastal Act requirements.

B. Current Operations in the Park Do Not Meet Other Coastal Act Chapter 3 Standards

Because the Park falls within the coastal zone between the first public road and the ocean, the CDP must include a finding that the development is "in conformity" with all of the Coastal Act's

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[31] CAL. COASTAL COMM'N, Memo Oceano Dunes Coastal Development Permit 4-82-300 Review, 87 (Prepared for March 18, 2021 Hearing). https://documents.coastal.ca.gov/assets/oceano-dunes/Report.pdf.
[32] CAL. COASTAL COMM'N, Oceano Dunes Coastal Development Permit 4-82-300 (Prepared for July 2019 Hearing), 57-58. https://documents.coastal.ca.gov/assets/oceano-dunes/July%2011,%202019%20Report.pdf.
[33] Letter from California Coastal Commission to Lisa Mangat, California State Parks Director (July 3, 2020), 1-2. https://www.biologicaldiversity.org/species/birds/western_snowy_plover/pdfs/CCC-cease-and-desist-letter-7-3-20-Oceano-Dunes.pdf.
[34] *McAllister,* 169 Cal. App. 4th at 924 (citing Big Sur Land Use Plan, Section 3.3).
[35] *See supra* note 31 at 14.
[36] *See supra* note 31 at 83-84; CAL. COASTAL COMM'N, Memo Oceano Dunes Coastal Development Permit 4-82-300 Review, Ex. 11 (Prepared for March 18, 2021 Hearing).
[37] *See supra* note 31 at 14.

Chapter 3 requirements.[38] Among those provisions is section 30213, which provides that "lower cost visitor and recreational facilities shall be protected, encouraged, and, where feasible, provided."[39] Here, OHV use – a recreational activity requiring the purchase or rental of expensive equipment – is interfering with lower cost alternatives, such as camping or day-use visits. The San Luis Bay Area Plan recognized that "vehicle use of the beach and dunes has led to many conflicts between recreation users of the area."[40] The conflict between these two values should be decided in favor of the lower-cost alternative, namely non-OHV use of the Park.

Chapter 3 of the Coastal Act also provides that scenic and visual qualities "shall be considered and protected as a resource of public importance."[41] In particular, development is to be limited to "minimize the alteration of natural land forms."[42] As noted by Commission staff in its 2019 report, ODSVRA is a part of the Guadalupe-Nipomo Dunes Complex, a "significant and sensitive ecological system."[43] In fact, the Nature Conservancy describes the area as the "largest intact coastal dune ecosystem on Earth."[44] The Park is an "integral part" of the larger complex and includes "several landscapes elements [that] are only found in Oceano Dunes. . . ."[45]

OHV use in the Park has a significant effect on the quality of the dunes themselves through erosion and degradation. The Commission's staff ecologist describes OHV use as "one of the most significant threats to Oceano Dunes" because OHVs "compact the sand, kill beach macro-invertebrates, and destroy wrack and the associated invertebrate community that serve as food resources for shorebirds and fish."[46] Additionally, the erosive effects of OHV use on the dunes are obvious and undeniable.[47] State Parks used heavy equipment to groom the Park in June 2020, compacting sand and removing wrack to provide for future OHV use.[48] Such damage to the dune ecosystem should be considered as a serious mark against State Parks' compliance with Chapter 3.

C. State Parks' Management of the Park Does Not Undermine or Supersede Commission Authority

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[38] Cal. Pub. Res. Code § 30604(c).
[39] Cal. Pub. Res. Code § 30213.
[40] CTY. OF SAN LUIS OBISPO, San Luis Bay Area Plan (Coastal), 6-14 (Revised April 2007). https://www.slocounty.ca.gov/Departments/Planning-Building/Forms-Documents/Plans-and-Elements/Area-Plans/Coastal-Zone/San-Luis-Bay-Coastal-Area-Plan.pdf.
[41] Cal. Pub. Res. Code § 30251.
[42] Cal. Pub. Res. Code § 30251.
[43] *See supra* note 32 at 14.
[44] *See supra* note 25.
[45] CAL. COASTAL COMM'N, Oceano Dunes Coastal Development Permit 4-82-300 (Prepared for March 2021 Hearing), Ex. 9, 4.
[46] *Id.* at 22.
[47] A case study of OHV use on sand dunes found that vehicles destroyed one-fifth of dune front in the areas they were permitted and that Four Wheel Drive vehicle traffic is "unlikely to be compatible with strategies that explicitly emphasize the sustainable use and conservation of coastal assets." Luke Thompson and Thomas Schlacher, *Physical Damage to Coastal Dunes and Ecological Impacts Caused by Vehicle Tracks Associated with Beach Camping on Sandy Shores: A Case Study from Fraser Island, Australia*, 12 J. OF COASTAL CONSERVATION 67, 80 (2008). https://www.jstor.org/stable/pdf/40301473.pdf?refreqid=excelsior%3Af1bc97fd180e9cbe57c8473effc838e7, 80.
[48] Use of the equipment violated endangered species laws and the conditions of the CDP. *See supra* note 33.

State Parks' status as a state agency does not change the legal effect of the Coastal Act on its actions. Section 30401 provides that the Coastal Act "does not increase, decrease, duplicate or supersede the authority of any existing state agency."[49] State Parks appears to interpret this language as constraining the Commission's authority to enforce the Coastal Act or to provide State Parks with a vested right to determine the future of the Park. That reading is incorrect. Chapter 4 of the Coastal Act makes clear that the Commission has sole authority to carry out the statute's duties and responsibilities[50] and that "[a]ll state agencies shall carry out their duties and responsibilities in conformity with [the Coastal Act]."[51] Although the Coastal Act does not supersede the authority of other state agencies, that language "shall not be construed to limit in any way the [Coastal Commission's] regulatory controls over development."[52] In short, as long as the Commission does not "set standards or adopt regulations that duplicate regulatory controls established by any existing state agency," all other state agencies, including State Parks, must comply with the mandates of the Coastal Act, as implemented through the Commission's CDP.[53]

Eliminating motorized recreation does not "duplicate regulatory controls established" by State Parks. Indeed, the Coastal Act provides for "coordination and cooperation between the Coastal Commission and other state agencies."[54] The Commission is simply exercising its authority to protect coastal resources at Oceano Dunes through conditions to the CDP.[55]

D. The Commission Has a Duty to Protect the Public Trust

Separate from its Coastal Act obligations, the Commission is required to comply with common law public trust doctrine. American public trust doctrine dates back to a century-old United States Supreme Court decision finding that the state holds lands in navigable waters "in trust for the people of the state, that they may enjoy the navigation of the waters, carry commerce over them, and have liberty of fishing therein, freed from the obstruction or interference of private parties."[56] In California, public trust land encompasses all navigable lakes, streams, tidelands, and nonnavigable tributaries of navigable waterways.[57] As a state agency, the Commission has an affirmative duty to "protect people's common heritage of streams, lakes, marshlands and tidelands, surrendering that right of protection only in rare cases when abandonment of that right is consistent with purposes of trust."[58]

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[49] Cal. Pub. Res. Code § 30401.
[50] Cal. Pub. Res. Code § 30400 (noting the Legislature's intent in Chapter 4 was to minimize duplication and conflict among existing state agencies).
[51] Cal. Pub. Res. Code § 30402.
[52] *Id*.
[53] *Id*.
[54] 50 Cal. Jur. 3d Pollution and Conservation Laws § 342, *Coordination with state agencies*.
[55] At worst, any perceived conflict involving the Parks' mandate is one that should be harmonized with the Coastal Act under a typical statutory interpretation analysis. *See Big Creek Lumber Co. v. Cty. of Santa Cruz*, 38 Cal. 4th 1139, 1161 n. 16 (2006) (explaining that "when interpreting statutory provisions 'intended to further two separate objectives,' we have "stressed the importance of attempting to harmonize these goals" (quoting *Far West Financial Corp. v. D & S Co.,* 46 Cal.3d 796, 810 (1988)).
[56] *Illinois Cent. R. Co. v. State of Illinois,* 146 U.S. 387, 452 (1892).
[57] *See Nat'l Audubon Soc'y v. Superior Court,* 33 Cal. 3d 419, 437 (1983) (holding that the public trust doctrine "protects navigable waters from harm caused by diversion of nonnavigable territories").
[58] *Id.* at 441.

Public trust considerations overlap with the other points made in this letter, particularly those related to endangered species and recreation. The public trust doctrine has evolved to require public agencies to consider environmental protection and preservation of wildlife.[59] While recreation is a public use, the Commission is not "burdened with an outmoded classification favoring one mode of utilization over another."[60] Indeed, the California Supreme Court noted half a century ago:

> There is a growing public recognition that one of the most important public uses of the tidelands – a use encompassed within the tidelands trust – is the preservation of those lands in their natural state, so that they may serve as ecological units for scientific study, as open space, and as environments which provide food and habitat for birds and marine life, and which favorably affect the scenery and climate of the area.[61]

Through the LCP, both the Commission and San Luis Obispo County bear responsibility to protect the public trust.[62] The fiduciary duty bestowed on the Commission mandates that it protect public trust lands and ensure the lands are available to future generations. OHV use is inconsistent with public preservation as vehicles' harmful effects can seriously and irreparably alter the tidelands and surrounding areas.[63] Moreover, as documented below, OHV use presents a clear and present danger to the wildlife in the Oceano Dunes ecosystem. As such, eliminating OHV use in the Park would be the most effective action the Commission could take to protect the public trust.

E. CDPs Can Mandate All Reasonable Conditions to Respond to Coastal Needs

The Commission implements its Coastal Act mandates through issuance of CDPs for any "development," broadly defined.[64] In a CDP, the Commission may set "reasonable terms and conditions . . . to ensure that such development or action will be in accordance with the provisions [of the Coastal Act]."[65] A permit condition will be deemed reasonable by the courts where it is related to a legitimate governmental purpose, such as protecting the public's right to access the tidelands under the Coastal Act.[66] In fact, courts test the reasonableness of a condition by "answering the question: is there any reasonable basis to support the legislative determination of the regulation's wisdom and necessity?"[67]

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[59] *Ctr. for Biological Diversity, Inc. v. FPL Grp., Inc.*, 166 Cal. App. 4th 1349, 1359-60 (2008).
[60] *Marks v. Whitney*, 6 Cal. 3d 251, 259 (1971).
[61] *Id.* at 259-60.
[62] *Ctr. for Biological Diversity* 166 Cal. App. 4th at 1369 (holding that a county and other "subdivisions and agencies" of the state must protect public trust resources).
[63] OHV riding has an effect on sand surface stability, affecting dune formation and natural processes in tidal areas. CAL. COASTAL COMM'N, Memo Oceano Dunes Coastal Development Permit 4-82-300 Review, Ex. 11, 18 (Prepared for March 18, 2021 Hearing).
[64] Cal. Pub. Res. Code § 30600.
[65] Cal. Pub. Res. Code § 30607.
[66] *Grupe v. California Coastal Com.*, 166 Cal. App. 3d 148, 171 (1985).
[67] *See Liberty v. California Coastal Com.*, 113 Cal. App. 3d 491, 499 (1980).

Moreover, the understanding of an appropriate development and related conditions in the coastal zone can change over time, with no preference for current conditions or management. In *Liberty v. California Coastal Com.*, the court recognized that the Commission is "not confined to the narrow circumspection of precedents, resting on past conditions which do not cover and control present day conditions obviously calling for revised regulations to promote the health, safety, morals or general welfare of the public."[68]

The Commission also does not need to show any special reverence for the status quo, such as preserving OHV use at the Park. Where, as here, the permitholder has failed to rectify harm to coastal resources and to bring an activity into compliance with Coastal Act mandates, there is "no authority which requires [the Commission] to pursue a course shown to be inadequate, thus compounding an existing condition."[69] Adoption of staff's well-supported recommendations for CDP amendments that will finally begin to correct decades of non-compliance is squarely within the Commission's authority and, therefore, should easily survive judicial challenge as a legitimate exercise of the Commission's statutory obligations.

State Parks has failed to regulate the Park consistent with the conditions in the CDP. Since initial issuance of CDP 4-82-300, the Commission has expected State Parks to update its entrances to the Park to prevent adverse effects to ESHA and promote more typical beach access.[70] Nearly forty years later, the entrances remain unchanged. State Parks has also failed to enforce the Commission's mandated vehicle limits that are based on vehicles' impacts to coastal resources.[71] State Parks' failure to comply with the conditions set by the historical iterations of CDP 4-82-300 undermines the Commission's mandate to properly manage the coastal zone through the Coastal Act. And as noted above, violations of the Coastal Act's Chapter 3 protections and endangered species laws only compound this long-standing non-compliance with the CDP.

The San Luis Obispo County LCP, South County Area Plan, and San Luis Bay Area plan contemplate a scenario in which State Parks cannot, or will not, comply with the conditions of the CDP. Specifically, the South County Area Plan reads:

> Should the terms and conditions of the coastal permit not be enforced *or accomplished* or should they not be sufficient to regulate the use in a manner consistent with the protection of resources, public health and safety and community values, then under the county's police powers, *the imposition of an interim moratorium on ORV use* may be necessary to protect resources while long-range planning, development of facilities and requisition of equipment and manpower is completed.[72]

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[68] *Liberty*, 113 Cal. App. 3d at 499.
[69] *Id*.
[70] *See supra* note 11 at 22.
[71] *See supra* note 11 at 24.
[72] CTY. OF SAN LUIS OBISPO, South County Area Plan, 8-8 (1988).
https://www.slocounty.ca.gov/Departments/Planning-Building/Forms-Documents/Plans-and-Elements/Area-Plans/Coastal-Zone/South-County-Coastal-Area-Plan.pdf. (emphasis added).

Here, San Luis Obispo County, through an LCP certified by the Commission, has explicitly acknowledged that State Parks does not have universal authority over the Park. Additionally, the LCP sets the floor for what authorities may do to enforce the Coastal Act, not the ceiling.[73]

The San Luis Bay and South County area plans that cover portions of the Park provide additional specific protections from CDP violations related to OHV use. The South County Area Plan, for example, requires any approval of a CDP for the Park to include a finding that State Parks "is making a commitment for sufficient manpower to ensure resource protection, enforcement and access control in conformance with the conditions of Coastal Development Permit No. 4-82-30[0]A."[74] Given the continued failures to adequately protect endangered species and natural resources, the Commission cannot make the necessary finding that State Parks' management of ODSVRA complies with CDP 4-82-300, the San Luis Obispo County LCP, local area plans, or the Coastal Act.

II. State Parks Is Not Required to Maintain OHV Recreation in the Park

The Off-Highway Motor Vehicle Recreation Act ("OHV Act")[75] allows State Parks to discontinue OHV use where it is detrimental to ecological resources like wildlife and soil. In its draft Public Works Plan ("PWP") and draft Environmental Impact Report ("draft EIR"), State Parks repeatedly cites the OHV Act and related provisions to argue that the agency is legally barred from implementing the Coastal Commission staff's recommendations and ban OHVs in the Park.[76] As explained below, this argument is legally flawed and does not reflect the language of the statute, the intent of the Legislature, or the State Parks' own past practice and precedent.

A. Since 1982, the OHV Act Has Required that State Parks Protect and Conserve Ecological Resources Such as Wildlife, Water, and Soil

The Legislature enacted the OHV Act in its modern form in 1982, following increased OHV use and concerns about public land and natural resources. As the California Attorney General explained in her 2013 legal opinion, the 1982 statute "addressed such matters as complying with environmental quality standards and soil conservation standards; providing law enforcement on all system lands; protecting wildlife habitat and cultural and archaeological resources; closing and restoring damaged areas; and providing instruction to off-highway motorists in such matters as safety, trail etiquette, avoiding trespass, and preventing damage to lands and natural resources."[77]

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[73] *Yost v. Thomas*, 36 Cal. 3d 561, 572 (1984) (explaining that once an LCP has been approved by the Commission, the County may "decide to be more restrictive with respect to any parcel of land, provided such restrictions do not conflict with the [Coastal] act.")

[74] CTY. OF SAN LUIS OBISPO, South County Area Plan, 8-8 (1988). https://www.slocounty.ca.gov/Departments/Planning-Building/Forms-Documents/Plans-and-Elements/Area-Plans/Coastal-Zone/South-County-Coastal-Area-Plan.pdf.

[75] Cal. Pub. Res. Code § 5090.01 et seq.

[76] State Parks argues that banning OHV use conflicts with their responsibility to manage Oceano Dunes in a way that is consistent with their legal mandate to promote accessible recreation. Second, State Parks argues that banning OHVs is forbidden under ODSVRA's current classification as a State vehicular recreation area. Lastly, State Parks claims that it does not have the power to reclassify ODSVRA.

[77] Cal. Off. of the Att'y Gen., Opinion Letter No.11-601, (Jun. 12, 2013), https://oag.ca.gov/system/files/opinions/pdfs/11-601_0.pdf.

In sum, the "central purpose of this legislation was to protect public safety and to protect, repair, and restore public lands and natural resources, while facilitating the appropriate use of off-highway vehicles."[78]

The legislative intent to balance recreational opportunities with ecological imperatives is evident throughout the OHV Act, including in its legislative findings. The Legislature found that "[t]he indiscriminate and uncontrolled use of [OHVs] may have a deleterious impact on the environment, wildlife habitats, native wildlife, and native flora."[79] To address these concerns, the OHV Act lays out a framework to ensure that SVRAs are managed sustainably and tasks the Division of Off-Highway Motor Vehicle and Recreation ("the Division")[80] with the "planning, acquisition, development, *conservation*, and *restoration* of lands in the state vehicular recreation areas."[81]

The Legislature defined "off-highway recreation" to include "*both* motorized recreation and *motorized off-highway access to nonmotorized recreation activities*."[82] Thus, OHV driving through fragile dune ecosystems is not the only recreational activity contemplated under the OHV Act. Off-highway recreation includes RV and car camping on the beach – but only if those activities do not unduly damage natural resources.[83]

B. Subsequent Statutory Amendments Bolster and Prioritize Environmental Protection

The Legislature amended the OHV Act in 1987, in 2002, and again in 2017, each time reaffirming its desire to ensure that any OHV use on land managed by State Parks prioritize the conservation of ecological resources. Most recently the 2017 amendments, in the form of SB 249, imposed significant new environmental restrictions on the Division because "more [is needed] to be done to improve conservation and restoration efforts and minimize conflicts that frequently arise in [SVRAs]."[84] SB 249 "strengthens environmental protection measures and better integrates the program with [State Parks] by clearly delineating resource protection and conservation requirements, including requiring standard monitoring and adaptive management practices, and establishing a standard process for avoiding and addressing resource degradation."[85]

The statutory language reinforces the legislative intent to strengthen environmental protection. For instance, the definition of "conservation" was clarified to include protection of habitats and cultural resources.[86] The amended law requires that periodic reports submitted to the Governor

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[78] *Id.*
[79] Cal. Pub. Res. Code § 5090.02(a)(3).
[80] Cal. Pub. Res. Code § 5090.05.
[81] Cal. Pub. Res. Code § 5090.32(a) (emphasis added).
[82] Cal. Pub. Res. Code § 5090.02(a)(2).
[83] Cal. Pub. Res. Code § 5090.02(c)(4)
[84] SENATE RULES COMMITTEE, SB 249 SENATE FLOOR ANALYSES, AT 7 (SEP. 14, 2017), https://leginfo.legislature.ca.gov/faces/billAnalysisClient.xhtml?bill_id=201720180SB249.
[85] *Id.*
[86] Cal. Pub. Res. Code § 5090.10

and Legislature must now include information about environmental issues that have arisen at SVRAs, including "actions undertaken to ensure compliance with federal and state Endangered Species Acts, local air quality laws and regulations, federal Clean Water and regional water board regulations, or permits."[87] In addition, the Division must prepare and implement "management and wildlife habitat protection plans" that are "developed in consideration of statutorily required state and regional conservation objectives."[88]

The 2017 amendments also strengthen Public Resources Code section 5090.35 pertaining to soil conservation standards, habitat protection programs, and cultural and archeological resources. This provision denominates public safety, appropriate utilization of land, and conservation of natural and cultural resources as "of the highest priority in the management of [SVRAs]" and directs the Division to "take steps necessary to prevent damage to significant natural and cultural resources within [SVRAs]."[89] It also requires the Division to prepare "a wildlife habitat protection that conserves and improves wildlife habitats for [SVRAs]"[90] and to review and update soil conservation standards by the end of 2020.[91] In short, the Legislature has imposed increasingly more protective legal obligations on State Parks, which is responsible for much more than just maximizing OHV use in SVRAs.

The 2017 amendments to the OHV Act targeted the very wildlife habitat destruction, soil erosion, and air quality impacts that have plagued the Park for decades. Yet instead of making operational and management changes to address these myriad problems, State Parks proposed in 2017 that the Coastal Commission hold off amending the CDP while it created a PWP. The Coastal Commission initially believed that the PWP would address the Coastal Act, LCP, and CDP issues. But instead of "taking a fresh look at the Parks' uses, management, and configuration,"[92] the proposed PWP would actually exacerbate coastal resource impacts by proposing to open more sensitive habitat to destructive OHV use while entirely ignoring the Commission's directive to evaluate a phaseout of OHV use.

C. Where OHV Use Cannot Be Maintained Consistent with Ecological Standards, State Parks Must Close OHV Use to Restore Lands

The OHV Act directs State Parks to close and restore areas that cannot be maintained within soil conservation standards[93] or wildlife habitat protection standards.[94] If an area cannot be maintained for long-term use, State Parks is required to restore the "land to the contours, the plant communities, and the plant covers to those on surrounding lands or at least those that

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[87] Cal. Pub. Res. Code § 5090.24(h)(6).
[88] Cal. Pub. Res. Code § 5090.32(g).
[89] Cal. Pub. Res. Code § 5090.35(a).
[90] Cal. Pub. Res. Code § 5090.35(c)(1).
[91] Cal. Pub. Res. Code § 5090.35(b).
[92] *See supra* 32 at 56.
[93] Cal. Pub. Res. Code § 5090.35(b)(3).
[94] Cal. Pub. Res. Code § 5090.35(c)(3). *See also* Cal. Pub. Res. Code § 5090.02(c)(4) (finding that where areas cannot be maintained "to appropriate established standards for sustained long-term use," the area should be closed to use to prevent accelerated erosion.)

existed prior to OHV use."[95] In the draft EIR, State Parks only acknowledges a duty to "temporarily"[96] close noncompliant areas. However, the OHV Act does not limit protective and restorative measures to short-term closures. Public Resources Code section 5090.02(c)(4) indicates that permanent closure may be necessary to restore damaged areas to their pre-OHV condition.

More broadly, the OHV Act states that "[i]f off-highway motor vehicle use results in damage to any natural or cultural resources or damage within sensitive areas, appropriate measures shall be promptly taken to protect these lands from any further damage."[97] Eliminating OHVs may be necessary "for the conservation of cultural resources and the conservation and improvement of natural resource values over time."[98] Sensitive areas established within SVRAs must be managed to preserve both "rare or endangered plant and animal species and their supporting ecosystems,"[99] and "zones which represent significant places or events in the flow of human experience in California." Section 5090.43(c) goes on to state that the protective measures may include setting up physical barriers and "*shall* include the restoration of natural resources and the repair of damage to culture resources."[100] Thus, while the statute does not provide an exhaustive list of the measures that could be taken to "protect [SVRAs] from any further damage," phasing out OHV use is clearly one of them.[101]

Indeed, State Parks has not shied away from eliminating OHV use in the past to protect ecologically valuable lands from further damage. In 1977, State Parks recommended that "ORV activity should not be permitted" in the Inglenook Fen area.[102] After conducting a detailed report in the area, the agency at the time noted that the "fen and dune ecosystem . . . are extremely fragile" and took the appropriate steps to protect ecological resources.[103] State Parks further recommended restricting visitation to a smaller area than was historically allowed and to only allow groups accompanied by an interpretive guide. As the Inglenook Fen example and the text of the OHV Act show, State Parks has never had a mandate to support vehicular recreational activities at the expense of natural resources.

Finally, State Parks' assertion that it does "not have the authority to phase out OHV activity in the SVRA on its own" is false.[104] As explained above, State Parks already has authority to eliminate OHV use from ODSVRA in order to protect ecological resources, and it does not need the Legislature's permission to reclassify a State Park unit. Park classifications[105] are not indefinitely fixed. Even after a unit is classified, "there is reserved the power to repeal, amend,

[95] Cal. Pub. Res. Code § 5090.11.
[96] *See* Attachment 1: CAL. DEP'T OF PARKS & RECREATION, DRAFT PUB. WORKS PLAN & DRAFT ENV'T IMPACT REP 19-2 (2020).
[97] Cal. Pub. Res. Code § 5090.43.1(c).
[98] Cal. Pub. Res. Code § 5090.43(a).
[99] Cal. Pub. Res. Code § § 5019.71.
[100] Cal. Pub. Res. Code § 5090.43(c).
[101] Cal. Pub. Res. Code §5090.43(a).
[102] CAL. DEP'T OF PARKS & RECREATION, INGLENOOK FEN; A STUDY AND PLAN, (1977).
[103] *Id.*
[104] *See supra* 96 at § 12.2.2.1 (2020).
[105] These classifications include SVRAs and: State Recreation Area, Underwater Recreation Area, Beaches, Wayside Campgrounds, and State Urban Recreation Areas.

or modify this section [classifying units] as may from time to time hereafter be necessary and proper."[106] State Parks has the option to reclassify ODSVRA if it wishes, but in any event, reclassification is not a barrier to eliminating OHV use at the Park.[107]

III. Protection of Endangered Species in the ODSVRA Requires Eliminating OHV Use

California's coast is home to hundreds of intricate, delicate, and irreplaceable ecosystems. Oceano Dunes is no exception. As part of the largest coastal dune tract in California, Oceano Dunes provides essential habitat to unique flora and fauna.[108] Among the wildlife that inhabit the Guadalupe-Nipomo Dunes – of which Oceano Dunes is a part – are eight threatened or endangered animal species and 22 special status plants.[109]

Balancing recreational activities with habitat protection has been a paramount concern ever since the Commission granted CDP 4-82-300 to State Parks in 1982. Two bird species, the western snowy plover and the California least tern, have garnered particular concern because of their dwindling numbers and vulnerability to human activity. These species are protected by federal and state endangered species laws that aim to ensure the birds do not face extinction.[110] Through the CDP review process, the Commission must ensure that endangered species are adequately protected in the Park.

A. The Federal Endangered Species Act Requires Protection of Listed Species, Particularly the Snowy Plover and the California Least Tern

To protect listed species, the federal Endangered Species Act prohibits all persons – including both federal and state agencies – from taking or authorizing take of any individual of that species.[111] "Take" is broadly defined as "any action that harms or harasses listed species."[112] "Harm" is further defined to include any act that actually kills or injures wildlife, including "significant habitat modification or degradation."[113] And "harass" is defined as "intentional or negligent actions that create the likelihood of injury to listed species by annoying them to such an extent as to disrupt normal behavioral patterns."[114] Importantly, government regulations

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[106] Cal. Code Regs. tit. 14, § 4753.
[107] See generally Cal. Pub. Res. Code § 5002.1, Cal. Pub. Res. Code § 5002.2(b)(c), and Cal. Pub. Res. Code § 5002.3.
[108] U.S. National Park Service, Nipomo Dunes-Point Sal Coastal Area, https://www.nps.gov/subjects/nnlandmarks/site.htm?Site=NIDU-CA (last accessed Mar. 4, 2021).
[109] U.S. Fish and Wildlife Service, Guadalupe-Nipomo Dunes, https://www.fws.gov/refuge/Guadalupe-Nipomo_Dunes/Wildlife_and_Habitat/Wildlife.html (last accessed Feb. 19, 2021).
[110] Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Pacific Coast Population of the Western Snowy Plover, 58 Fed. Reg. 12864-01 (Mar. 5, 1993); California least tern is listed federally in Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Reviews, 70 Fed. Reg. 39327 (July 7, 2005).
[111] 16 U.S.C. § 1538.
[112] 16 U.S.C. § 1532.
[113] 50 CFR § 17.3 (2006).
[114] *Id.*

authorizing third parties to engage in harmful actions can constitute an illegal take.[115] Not only is State Parks potentially liable for a take of listed species in the Park, but the continued tolerance of harmful motorized recreation as part of the CDP could open the Commission to similar take liability.

State Parks understands this risk. It has recently attempted to immunize its actions from ESA liability by seeking an incidental take permit. The U.S. Fish and Wildlife Service ("Service") manages authorization procedures for so-called "incidental take" – or take incidental to the carrying out of an otherwise lawful activity.[116] To obtain an incidental take permit, an applicant must prepare a Habitat Conservation Plan (HCP) and the Service must make a number of factually supported findings, including that (1) any take is incidental; (2) incidental take is minimized and mitigated to the maximum extent practicable; (3) adequate funding for the plan will be provided; and, (4) taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.[117]

After nearly four decades of operating the Park without any take authorization, State Parks finally released a draft HCP in July 2020.[118] According to the proposed HCP, four animal species and six plant species would be covered by an incidental take permit for Oceano Dunes, including both the western snowy plover and the California least tern.[119] The draft HCP submitted to the Service would provide a 25-year permit authorizing incidental take of snowy plovers and other endangered species.[120] The Service issued a draft Environmental Assessment on the proposed HCP in September 2020.[121]

The unique habitat covered by the draft HCP is essential for the protection of snowy plovers. In 2012, the Service finalized its designation for swathes of the Park to be critical habitat for snowy plovers – over objections from State Parks – and determined that the park "plays an important role in conservation of the western snowy plover . . . [that] may increase due to climate related changes, including sea-level rise."[122] State Parks' draft HCP notes that the Park represents

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[115] *See Coal. for a Sustainable Delta v. John McCamman,* 725 F. Supp. 2d 1162, 1167 (E.D. Cal. 2010) (citing *Strahan v. Coxe*, 127 F.3d 155, 163 (1st Cir. 1997) for the proposition that the ESA applies to "third parties that allow or authorize acts that exact a taking and that, but for the permitting process, could not take place."); *see also Cascadia Wildlands v. Kitzhaber*, 911 F. Supp. 2d 1075, 1085 (D. Or. 2012) (finding that "state officials can indeed be liable for directly authorizing third-party activities . . . that are likely to result in take.").
[116] 16 U.S.C. § 1539.
[117] *Id.*
[118] CAL. STATE PARKS OFF-HIGHWAY VEHICLE RECREATION DIV. STATE PARKS, Draft Habitat Conservation Plan for the California Department of Parks and Recreation Oceano Dunes District (July 2020). https://www.oceanodunesshcp.com/files/managed/Document/60/ODD%20HCP_Posted%20Nov%202020_Redlined%20From%20February%20Draft.pdf.
[119] *Id.* at 1-4. The other covered animal species in the HCP are the California red-legged frog, and the Tidewater goby. The covered plant species are Marsh sandwort, La Graciosa thistle, Surf thistle, Beach spectaclepod, Nipomo Mesa lupine, and Gambel's watercress. *Id.* at 1-4, 1-5.
[120] U.S. FISH AND WILDLIFE SERVICE, *Draft Environmental Assessment for the Oceano Dunes District Habitat Conservation Plan Activities Associated with Issuance of Endangered Species Act Section 10(a)(1)(B) Permit in San Luis Obispo County, California*, 4 (September 2020).
[121] *Id.*
[122] Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover; Final Rule, 77 Fed. Reg. 36733 (June 19, 2012).

nearly half of the suitable snowy plover habitat in the Guadalupe-Nipomo Dunes Complex, including tracts that were identified as the most favorable for the shoreline bird.[123] And it concedes that "lands managed by State Parks were identified as critical to the long-term survival of the [snowy plover]" and that State Parks must monitor and manage the snowy plover population.[124] In short, all stakeholders agree that the Park represents essential habitat for the western snowy plover.

Moreover, the draft HCP details the extent to which the current operation of the Park harms snowy plovers, and most troublingly, proposes to present them to even greater future harm. Among the activities covered by the HCP, motorized recreation has the greatest effect on the snowy plover.[125] Nests are found on open areas of the back beach or dunes where vegetation is sparse or nonexistent.[126] The nests are often several hundred feet from the nearest water source and can be found outside of existing nest enclosures.[127] Effects from motorized recreation are present even when the vehicles themselves are gone, such as when birds decide to roost in tire tracks or their nests are disturbed to the point where they are abandoned.[128] The risk from motorized recreation exists equally at night; snowy plover chicks have been killed during night riding.[129]

To gain belated incidental take liability protection, State Parks proposes a set of avoidance and mitigation measures aimed at minimizing risk and ensuring any take is accidental. Forty-six of these measures are directed to mitigating motorized recreation, which is far more than any other activity and reflects the unique threat motorized recreation poses to snowy plovers.[130] The measures range in their intrusiveness from simply mandating increased outreach regarding endangered species at the Park to additional physical measures such as the construction of fencing to protect individual nests found in the riding area.[131] Some of the measures, such as eliminating one of the large nesting exclosures used by shorebirds, actively *reduce* conservation efforts. State Parks' promised mitigation measures are overdue and insufficient. Their adoption will not adequately address the take of endangered species in the Park.

In evaluating whether State Parks will, in good faith, implement these promised measures, the Commission should consider that agency's long history of failure to improve compliance with the ESA. OHV use was identified as a threat to the western snowy plover in its original federal listing in 1993.[132] State Parks has known the risk of motorized recreation to endangered species at the Park and failed to minimize those risks for decades. CDP 4-82-300 has included special conditions on OHV use related to the protection of snowy plovers and other endangered species

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[123] *See supra* note 118 at 5-3, 5-4.
[124] *Id.* at 3-13.
[125] *Id.* at 4-4.
[126] *Id.* at 3-7.
[127] *Id*. at 4-3.
[128] *Id.* at 4-8.
[129] *Id*. at 4-6.
[130] *Id.* at 5-15-5-25.
[131] *Id.* at 5-15, 5-17.
[132] Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Pacific Coast Population of the Western Snowy Plover, 58 Fed. Reg. 12870 (Mar. 5, 1993).

since at least 2001.[133] Yet, unauthorized take of snowy plovers has occurred consistently throughout State Parks' management of the area.

Even if implemented, the measures are insufficient to adequately protect the western snowy plover. Some of the avoidance and mitigation measures only reiterate existing State Parks commitments, such as maintaining seasonal fencing around snowy plover nesting areas.[134] Others provide regulations that seem to miss the problem, such as providing extra State Parks staff for high-use weekends rather than restricting the activities themselves. Finally, others simply ignore consensus views on what actions are needed to protect shorebirds. For example, the avoidance and mitigation measures propose mechanical trash removal in areas where snowy plovers are actively present.[135] As noted by the California Department of Fish and Wildlife (CDFW), such a proposal ignores that the trash removal "alter[s] the beach ecosystem" and "may reduce or eliminate the HCP area's ability to continue to serve as a suitable stopover for migrating and overwintering birds."[136] Similarly, the use of fencing for single nests or smaller exclosures in riding areas does not provide the needed buffers to protect snowy plovers and terns and can actually result in additional "take" due to predators keying in on the exclosures or birds colliding with the fences intended to protect them.

Collectively, the avoidance and mitigation measures reflect State Parks' failure to prioritize protecting endangered species. For the reasons above, they cannot be relied upon to adequately protect the western snowy plover in the Park. Instead of applying myriad mitigation measures in a futile attempt to negate the impact that OHV use is having on the snowy plover population, the Commission can and should act to protect the species by phasing out OHV use at the Park.

The Service's preliminary analysis of the proposed HCP is also flawed, largely because the agency relies on State Parks' legal analysis of governing statutes. While the Service concedes that eliminating vehicle use would "likely be required to avoid habitat disturbance and potential for take of [California least tern] and [western snowy plover]," it nonetheless disregards a no-OHV option on the grounds that it would be "incompatible with the recreational purpose of the SVRA."[137] The Service then parrots State Parks' argument that section 5090.01 et. seq mandates continued vehicular use in the Park. As explained above, this position is not supported by the statutory language or legislative intent. The Commission should not make the same mistake.

B. The California Endangered Species Act Prohibits Even Incidental Take of the California Least Tern

California's own Endangered Species Act and other state protections also have significant implications for the Park. Under the California Endangered Species Act, the California least tern was listed as endangered in 1971 and is "fully protected" under the California Fish and Game

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[133] *See supra* note 11.
[134] *See supra* note 118 at 5-18.
[135] *Id.* at 5-36.
[136] Letter from the California Department of Fish and Wildlife to Ronnie Glick, Senior Environmental Scientist, California Department of Parks and Recreation (June 1, 2020).
[137] *See supra* note 120 at B-1.

Code.[138] Under state law, the CDFW has jurisdiction over fully protected species[139] and can only allow take for "necessary scientific research."[140] In contrast to the federal regime, California law explicitly forbids CDFW or any other agency from "issuance of a permit or license to take a fully protected bird."[141] Accordingly, there are no circumstances that provide State Parks (or the Coastal Commission) to lawfully allow incidental take of this species, even if the Service were to approve the HCP and authorize incidental take under federal law.

California least terns are endangered due to a loss of habitat to human development and recreation.[142] At the Park, the bird nests on the dunes from April to August, particularly within the southern portion of the open riding area.[143] Nests can be abandoned by California least tern due to human activities in the vicinity.[144] Like snowy plovers, least tern habitat in the Park is deemed critical for the species to meet its recovery goals.[145]

Despite the impossibility of receiving permission to take California least tern, State Parks included the bird in its draft HCP. In a June 2020 letter, the CDFW concluded that State Parks' draft HCP and Draft Environmental Impact Review "do not adequately identify or mitigate the Project's significant . . . impacts on biological resources."[146] On the possible take of fully protected species, the CDFW noted that take avoidance measures must meet "very high measures of effectiveness."[147] If State Parks cannot ensure "full avoidance" of take, the CDFW recommends State Parks "cease all ongoing operations and maintenance activities and refrain from implementation of new activities that could potentially result in take of any fully protected species."[148] Given CDFW's jurisdiction over fully protected birds and the take from vehicle use admitted in the HCP, State Parks cannot proceed under the current plan without violating California law.

Separate from the Fish and Game Code's prohibition on the incidental take of fully protected species, the California Endangered Species Act itself also prohibits any take of a listed species.[149] Incidental take is only allowed under the state statute where (1) there is federal incidental authorization under the ESA and CDFW finds "consistency" under CESA[150] or (2) CDFW provides its own incidental take authorization that ensures impacts are "fully mitigated," mitigation is adequately funded, and incidental take will not jeopardize the continued existence of the species.[151] Because State Parks has not received either a consistency determination or a CDFW incidental take permit, CESA provides that the agency cannot allow activity that kills

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138 Cal. Fish and Game Code § 3511(b)(6).
139 *See supra* note 136 at 8 (citing Cal. Fish and Game Code § 3511).
140 Cal. Fish and Game Code § 3511(a).
141 Cal. Fish and Game Code § 3511(a).
142 *See supra* note 118 at 3-29.
143 *Id.* at 3-31.
144 *Id.* at 3-31.
145 *Id.* at 3-32.
146 *See supra* note 136 at 9.
147 *Id.* at 8.
148 *Id.* at 9.
149 Cal. Fish and Game Code § 2080.
150 Cal. Fish and Game Code § 2080.1.
151 Cal. Fish and Game Code § 2081.

least terns. Moreover, as noted above, the draft HCP is inadequate and not likely to satisfy the take requirements of CESA. Rather, State Parks would need to prepare and obtain CDFW approval for a Natural Community Conservation Plan, which unlike an HCP must include conservation actions that improve the overall condition of the species.[152]

Finally, the legal analysis of State Parks' ability to protect endangered species in the Park should consider the actions of the agency itself. Beyond its decades-long delay in complying with the Commission's permit conditions and developing an HCP, State Parks has also failed to deliver a wildlife habitat protection plan as required by California law.[153] And in July 2020, this Commission ordered State Parks to cease and desist its illegal grading, fencing, staking, and bird removal activities in California least tern and western snowy plover habitat.[154] At every turn, State Parks has proven that the legally required protection of endangered species is not the agency's priority. Given State Parks' failure and the legal mandates discussed throughout this letter, the Commission should act to protect endangered species within the Park by eliminating OHV use.

IV. Environmental Justice Considerations Demand Eliminating OHV Use

In 2016, the Legislature amended the Coastal Act to require that at least one of the Governor's appointments to the Commission must represent communities vulnerable to disproportionate pollution burdens and vulnerable to issues of environmental justice[155] and to allow the Commission to expressly consider environmental justice, or the equitable distribution of environmental benefits, when acting on a CDP.[156] The statute defines "environmental justice" as "the fair treatment and meaningful involvement of people of all races, cultures, incomes, and national origins, with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies."[157] Specifically, environmental justice includes "the deterrence, reduction, and elimination of pollution burdens for populations and communities experiencing the adverse effects of that pollution, so that the effects of the pollution are not disproportionately borne by those populations and communities.[158]

In 2019, the Commission adopted an Environmental Justice Policy. In order to effectuate this Environmental Justice Policy, the Commission must give "[a]t a minimum, the meaningful consideration of recommendations from populations and communities most impacted by pollution into environmental and land use decisions."[159] Currently, operations at ODSVRA are obstructing "the availability of a healthy environment for all people."[160] The Coastal Commission should carefully consider why and how Oceano, a relatively poor and 44 percent

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[152] Cal. Fish and Game Code § 2800 *et seq.*
[153] *See* Cal. Pub. Res. Code § 5090.35.
[154] *See supra* note 33.
[155] Cal. Pub. Res. Code § 30301(f).
[156] Cal. Pub. Res. Code § 30694(h).
[157] Cal. Pub. Res. Code § 30107.3.
[158] Cal. Pub. Res. Code § 30107.3(b)(2).
[159] Cal. Pub. Res. Code § 30107.3(b)(4).
[160] Cal. Pub. Res. Code § 30107.3(b)(1).

Hispanic community, is being forced to endure air pollution and nuisance from OHV use without any measurable economic benefit.

A. OHV Use at the Park Contributes to Persistent Poor Air Quality and Dust Pollution

The Oceano Dunes region has dangerously high levels of PM_{10} in the air – at times the worst in the entire country.[161] Several times each year, San Luis Obispo County is in "nonattainment" under the Clean Air Act[162] and the California Ambient Air Quality for PM_{10} standards.[163] Between May 29, 2012 and October 19, 2017, the San Luis Obispo District received 133 complaints from residents downwind of the Park.[164] Between May 1, 2012 and March 31, 2017, there were 363 days when the San Luis Obispo District observed violations of state PM_{10} standards at one or more of air quality monitoring sites in the area.[165] In the Coastal Commission's 2019 Environmental Justice Policy, the Commission committed to working "with relevant public agencies to consider project impacts to air quality and soil health in disadvantaged communities which reduce the positive health and recreational benefits associated with coastal access and coastal resources for pollution-burdened communities."[166] Transitioning away from high-impact vehicle use is long overdue and will improve the health and air quality for those around the Park, as well as curb the loss of coastal sands and soils.

Eliminating OHV use will have a major positive impact on restoring vegetation on the dunes and thus significantly improve the air quality for the surrounding communities. The prolonged high-intensity motorized use of OHVs has contributed to the region's air quality problems.[167] OHV activity destroys key vegetation areas and dune structures which causes increased erosion and sand movements and more dust emissions when the wind blows.[168] Additionally, areas in the Park subject to the most intense OHV activity usually produce the highest PM_{10} dust emissions.[169] For example, studies have shown that the Le Grande tract, where a considerable amount of riding and camping occurs, significantly contributes to the PM_{10} emissions affecting downwind residents.[170] Even during the period when the Park was closed to OHV use, "decades

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[161] PM_{10} is particles with diameters that are 10 micrometers and smaller. They can be inhaled and cause serious health problems.
[162] U.S. Env't Prot. Agency, *8-Hour Ozone (2015) Nonattaintment Areas by State/County/Area*, Green Book, (current as of January 31, 2021), https://www3.epa.gov/airquality/greenbook/jncty.html.
[163] SAN LUIS OBISPO AIR POLLUTION CONTROL DISTRICT, 2018 ANNUAL AIR QUALITY REPORT, (2018), https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/2018aqrt-FINAL.pdf
[164] Stipulated Order of Abatement #17-01, at 5 (May 2018), https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/Filed%20%26%20Approved%20SOA%20Case%2017-01%20Apr-30-18.pdf.
[165] *Id.*
[166] CALIFORNIA COASTAL COMMISSION, 2019 ENVIRONMENTAL JUSTICE POLICY, AT 11 (Mar 8, 2019), https://documents.coastal.ca.gov/assets/env-justice/CCC_EJ_Policy_FINAL.pdf.
[167] Memorandum from the Scientific Advisory Group on SAG comments on the temporary closure of Oceano Dunes State Vehicular Recreation Area (ODSVRA) and impacts on particulate matter (PM) emissions (Apr. 6, 2020), https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/SAG%20Letter.pdf
[168] SAN LUIS OBISPO AIR POLLUTION CONTROL DISTRICT, FREQUENTLY ASKED QUESTIONS; AIR QUALITY AND THE TEMPORARY CLOSURE OF OCEANO DUNES (JUNE 30, 2020), https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/June2020FAQ-42.pdf
[169] *See supra* note 167.
[170] *See supra* note 164, at 6.

of OHV activity have fundamentally altered the natural beach-dune landscape, making the dunes significantly more susceptible to PM_{10} emissions than they would be in a natural state."[171] Due to the windy coastline, there will never be a complete elimination of natural PM_{10} emissions from the dunes. But eliminating OHV use is a crucial step towards the Oceano community consistently meeting state and federal air quality standards.

The air quality is so poor that in April of 2018, the San Luis Obispo Air Pollution Control District ("the District") entered into a Stipulated Order of Abatement ("Abatement Order")[172] with State Parks directing them to adopt a Particulate Matter Reduction Plan ("PM_{10} Plan") and Annual Report and Work Plan ("Annual Report") to reduce PM_{10} emissions by at least 50 percent within four years.[173] Additionally, the Abatement Order established a Scientific Advisory Group to monitor air quality and mitigation strategies. The District has since attempted to work with a reluctant State Parks to fulfil the Abatement Order's mandates.

Despite the District and the Scientific Advisory Group's efforts, State Parks has been an unenthusiastic partner in solving the air-pollution problem. Although State Parks agreed to the Abatement Order, it denied all the allegations therein. State Parks also denied violating California Health & Safety Code section 41700, District Rule 402, or District Rule 1001.11. State Parks instead focuses primarily on the "natural causes" of high concentration of PM_{10} in the air, such as wind and the sand that makes up the dunes themselves, while ignoring that the natural causes of poor air quality are exacerbated by OHV use.[174] In the 28 pages where State Parks discusses air quality issues in the draft EIR, it mentions OHV use only twice.[175] Indeed, it appears that State Parks is not taking seriously the commitment to emissions reduction standards. For example, one of the Frequently Asked Questions regarding the Oceano Dunes draft PM_{10} Plan Public Workshop in June 2019 was: "Why are the recommendations from the Scientific Advisory Group (SAG)[176] not being followed?"[177] And the District noted in its draft Annual Report that State Parks has "failed to outline a path to achieving the goals of the Abatement Order."[178]

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[171] *See supra* note 167.
[172] State Parks and San Luis Obispo Air Pollution Control District entered the Stipulated Order of Abatement pursuant to California Health & Safety Code § 42451.
[173] *See supra* note 96 at 9-12.
[174] *See supra* note 96 at § 6.3.1.1.
[175] The first reference of OHVs is regarding an unsupported study where there was no finding that OHV use causes air pollution. The second reference was about daily OHV limits at ODSVRA.
[176] The Scientific Advisory Group also "recommends that OHMVR engage with a subset of SAG members to seriously consider scientifically-justified alternatives to the current 50% emission reduction target that may more directly reflect the impact of dust mitigation treatments on downwind airborne dust concentrations. See Memorandum from Scientific Advisory Group on SAG Review of Draft [Annual Report & Work Plan], (Aug. 31, 2020), https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/SAG%20comments%20on%20Draft%20ARWP%208-1-2020%20-%20FINAL.pdf
[177] *See supra* note 168.
[178] Memorandum from San Luis Obispo County Air Pollution Control District on California Department of Parks and Recreation's August 1, 2020 Oceano Dunes SVRA Draft 2020 Annual Report & Work Plan in Response to Stipulated Order of Abatement Number 17-01 (Sep. 4, 2020) https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/SLOAPCD%20Comments_2020_Draft%20ARWP_Dated%20Aug%201%202020%20sent%209-4-20.pdf.

State Parks is still far from achieving the goals set out in the Abatement Order, and the PWP proposal to expand OHV use would further hinder the achievement of those goals. State Parks' own analysis, confirmed by the Scientific Advisory Group analysis, has shown that at least "500 acres of dust control mitigations would be needed" to comply with the [Abatement Order]."[179] Mitigation measures include fencing off large areas to OHV use and, most importantly, revegetating areas with seed, seedlings, and ground cover.[180] As of 2019, 132 acres of the mitigations have been installed, leaving an estimate of 368 acres needed to comply with Abatement Order condition 2c by the 2022 deadline.[181] To reach the 368-acre goal in four years, State Parks would need to mitigate around 90 acres each year. However, State Parks initially recommended only 23 acres of new mitigation for the 2019-20 ARWP cycle and only 40 acres in the 2020-21 cycle.[182] The lack of serious commitment put the District and the Scientific Advisory Group in the position of having to explicitly ask State Parks to add 90 acres each year to its mitigation strategies. The final 2020 Annual Report submitted by State Parks does not mention the 500-acre goal at all.[183]

The Coastal Commission should not postpone action in hopes that the air quality will improve. In the draft EIR, State Parks refuses to attribute the high PM_{10} levels to OHV use at all.[184] It is likely that State Parks will continue to slow-walk the District, in the same fashion it has impeded the Coastal Commission. The threat of "severe health risks despite years of effort to reduce or eliminate dust emissions from the OHV riding area" is why the San Luis Obispo Health Commission "strongly supports the Coastal Commission's Staff recommendations to phase out OHV activity . . . and take action to address the health concerns of our residents."[185]

B. Northern Chumash Tribal Resources in ODSVRA Demand Eliminating OHV Use

The lands on which the Park sits have, of course, not always been a motorized recreation park. In fact, the coastal areas of San Luis Obispo County were occupied by the Chumash tribe prior to

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[179] CAL. DEP'T OF PARKS & RECREATION, OFF-HIGHWAY MOTOR VEHICLE RECREATION DIVISION, DRAFT PARTICULATE MATTER REDUCTION PLAN PRELIMINARY CONCEPT (MAR. 28, 2019), https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/PrelimConcept_DraftPMRP_20190328_to%20APCO.pdf
[180] *See supra* note 168.
[181] SAN LUIS OBISPO COUNTY, AIR POLLUTION CONTROL DISTRICT, RESPONSE TO STATE PARKS' ANNUAL REPORT WORK PLAN AND SPECIFIC COMMENTS ON ANNUAL REPORT WORK PLAN, 2-3 (AUG. 26, 2019), https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/Aug%2026%202019%20APCD%20Response%20to%20SP-Aug%201%202019%20ARWPCOMBINED.pdf.
[182] Memorandum from Scientific Advisory Committee on SAG Review of Draft Annual Report & Work Plan 8-1-2020 (Aug. 31, 2020), https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/SAG%20comments%20on%20Draft%20ARWP%208-1-2020%20-%20FINAL.pdf.
[183] CAL' DEP'T OF PARKS AND RECREATION, OFF-HIGHWAY MOTOR VEHICLE RECREATION DIVISION, OCEANO DUNES STATE VEHICULAR RECREATION AREA DUST CONTROL PROGRAM, 2020 ANNUAL REPORT AND WORK PLAN (SEP. 30, 2020), https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/2020ARWP_4thDraft_20200930_reduced.pdf.
[184] *See supra* 96 at § 6.2.2.
[185] Letter from San Luis Obispo Health Commission to California Coastal Commission (Jul. 9, 2019).

European settlement.[186] The Northern Chumash, a distinct branch of the larger tribe, lived along San Luis Obispo Bay. Indeed, nomenclature of the area stems from tribal language; Pismo stems from the word "Pismu" in Northern Chumash, meaning "place where there is tar."[187] The modern Northern Chumash Tribal Council is recognized in the local community and has sought both state and federal recognition.[188] As part of their effort to preserve their ancestral home, the Tribal Council has advocated for the creation of a Chumash Heritage National Marine Sanctuary that would protect the waters and tidelands of the entire San Luis Obispo Coast.[189]

In recent years, California's state government has prioritized receiving input from Native American tribes in the state. Governor Jerry Brown's Executive Order B-10-11 provided that "it is the policy of this Administration that every state agency and department subject to my executive control shall encourage communication and consultation with California Indian Tribes."[190] The order explicitly specified that its references to tribes "include all Federally Recognized Tribes and *other California Native Americans*."[191] The Newsom Administration incorporated Executive Order B-10-11 in its own Executive Order N-15-19, which additionally provided that California Native Americans have "meaningful input into legislation, regulations, and policies on matters that may affect tribal communities."[192] Moreover, the Coastal Commission has recently prioritized building a "meaningful partnership to ensure that tribes are valued and respected contributors to the management of California's coast."[193]

The Northern Chumash Tribal Council is a member of the Dunes Alliance and an outspoken opponent of OHV use at the Park. In its comment letter on State Parks' Public Works Plan, the Tribal Council wrote that the State Parks document "lacks California Native American perspectives, indigenous spiritual understandings, indigenous religious comprehensions, and respect for the human beings that have lived on the Dunes for all time, a Chumash cathedral of life."[194] The Tribal Council has urged ending OHV use at the Park to preserve Chumash Sites and ensure access to those sites for practicing tribe members.[195]

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[186] Arielle Ben-Hur, *The Chumash Heritage National Marine Sanctuary: An Exploration of Changing the Discourse on Conservation*, PITZER SENIOR THESES 105, 28 (2020). https://scholarship.claremont.edu/cgi/viewcontent.cgi?article=1108&context=pitzer_theses.
[187] Randall Milliken and John Johnson, *An Ethnogeography of Salinan and Northern Chumash Communities - 1769 to 1810*, FAR WESTERN ANTHROPOLOGICAL RESEARCH GROUP, 102 (2005). https://www.researchgate.net/publication/285404168_An_Ethnogeography_of_Salinan_and_Northern_Chumash_Communities_-_1769_to_1810.
[188] Fred Collins, *The Northern Chumash Tribal Council*, The SLO Coast Journal (September 2012), http://slocoastjournal.net/docs/archives/2012/sept/pages/chumash.html.
[189] *See supra* note 186 at 2.
[190] Gov. Edmund G. Brown Jr., Exec. Order B-10-11 (Sep. 19, 2011). https://www.ca.gov/archive/gov39/2011/09/19/news17223/index.html.
[191] *Id.* (emphasis added)
[192] Gov. Gavin Newsom, Exec. Order N-15-19 (June 18, 2019). https://www.courts.ca.gov/documents/BTB25-PreConTrauma-02.pdf.
[193] CAL. COASTAL COMM'N, Environmental Justice Policy 6 (adopted March 8, 2019). https://documents.coastal.ca.gov/assets/env-justice/CCC_EJ_Policy_FINAL.pdf.
[194] Letter from Northern Chumash Tribal Council to Kevin Kahn, District Supervisor, Central Coast District Office, California Coastal Commission (Jan. 26, 2021).
[195] *Id.*

State Parks' management of the Park has fallen well short of the stated goals of the Newsom Administration. The State Parks draft PWP argues that plans to continue, and even expand, OHV use at the Park will not impact any tribal cultural resources.[196] State Parks bases its conclusion in part on not identifying "any tribal cultural resources in the PWP planning area."[197] The Tribal Council disputes that State Parks has engaged in meaningful consultation, describing the draft PWP as "a boiler plate determination of archaeologist and institutional dogma [that] should open everyone's eyes to the white washing of the Chumash Culture."[198] The Commission should act where State Parks has not to ensure the Northern Chumash's opposition to OHV use in the Park is heard.

C. OHV Use Comes at the Expense of the Oceano Community

OHV use has many costs with few benefits, if any, for those who live adjacent to the Park. Oceano is a community where almost half are Hispanic or Latinx and the average income is $28,277 compared to California's $36,955 average. The Oceano community is not only burdened with air pollution, but also with limited economic development of the beachfront, high noise levels, disruptive events and concerts, increased crime, and additional trash – all associated with OHV use at ODSVRA. Other nearby communities like Avila and Pismo Beach do not have these problems, and they also do not have motorized beach access.

Moreover, OHV activity at ODSVRA does not appear to provide local economic benefit. Oceano's and Pismo Beach's populations are 7,487 and 8,168 respectively. Even though the populations are roughly the same and a higher percentage of the Oceano population works in the civilian labor force than does the Pismo Beach population, there are approximately 1,000 more firms in Pismo Beach City than in Oceano. In 2012, Oceano had $9.8 million in retail sales, or roughly six percent of the $162.6 million in retail sales in Pismo Beach during the same period. A January 2021 report revealed that when vehicle use at ODSVRA was suspended for the COVID-19 pandemic, there were no negative economic impacts to the local economy.[199] This shows that OHV users are not major economic contributors to the local community; their absence will, therefore, have no significant impact on the local economy. The report also found no negative impact from suspending OHV use on unemployment rates and that small businesses in the Oceano area outperformed those in nearby counties during the time OHV use was shut down. The speculative fear of an economic downturn in Oceano if vehicles are banned from the beach did not materialize, confirming that "dubious" assumptions[200] underlie State Parks' 2016 conclusion that ODSVRA contributes hundreds of millions of dollars to the local economy.[201]

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[196] *See supra* note 96 (Section 4) 4-102.
[197] *Id*.
[198] *See supra* note 194.
[199] PRATISH ANILKUMAR PATEL, ECONOMIC IMPACT FROM SUSPENSION OF VEHICULAR USE AT THE OCEANO-DUNES SVRA, (2021)
[200] Letter from Pratish Patel to California Coastal Commission on Oceano Dunes District-California State Parks Economic Impact Analysis Report 2016/2017 Prepared by SMG Consulting, (Jul. 9, 2019), https://calmatters.org/wp-content/uploads/2020/11/ODSVRA-Econ-Report-Discredited.pdf.
[201] CAL. DEP'T OF PARKS & RECREATION, ECONOMIC IMPACT ANALYSIS REPORT 2016/17 BY SMG CONSULTING, https://ohv.parks.ca.gov/pages/1170/files/Final-Oceano_Dunes_SVRA_2016_2017_3-5-18.pdf.

Furthermore, before the early 1970s, people could drive on the beach in Pismo Beach and Morro Bay.[202] In fact, the State Parks Commission worked with the Morro Bay city council and ordered the vehicle ban.[203] The Pismo Beach city council closed beach driving a few years later after losing a vehicle beach ramp to storms.[204] "Within two years, the depressing little town had become a resort destination."[205] Similar to Pismo Beach's economic upward trajectory after banning driving on the beach, Morro Bay has higher median per capita income, higher median household income, and significantly higher median housing values than Oceano.[206]

Oceano CDP Demographic Comparison Table[207]			
Demographics	Oceano, CA	Pismo Beach City, CA	California
Total Population	7,487	8,168	39,512,223
White	79.0%	88.2%	71.9%
Black	1.0%	2.8%	6.5%
Hispanic or Latinx	44.9%	12.2%	39.4%
White, not Hispanic or Latinx	45.2%	80.6%	36.5%
Asian	6.3%	1.7%	15.5%
Native American, American Indian, Alaska Native	1.1%	0.3%	1.6%
Median Housing Value	$392,000	$768,600	$505,000
Median Household Income	$67,742	$84,484	$75,235
Median Income Per Capita	$28,277	$60,912	$36,955
Persons without health insurance	12.7%	8.9%	7.5 %
Foreign Born Persons	20.4%	7.7%	26.8%
Firms (2012)	443	1,475	3,548,449
In civilian labor force 2015-2019	60.8%	54.9%	63.3%
Total retail sales, 2012 ($1,000)	9,845	162,621	481,800,461

The contrast between Oceano and Pismo Beach City, adjacent communities of roughly the same size, raises significant economic justice implications. The Coastal Commission has recognized that "by the late 1970s neighborhoods that have benefited from decades of discrimination against racial minorities translated that benefit into higher property values, despite the end of widespread

[202] *Getting Cars Off the Beach in…Morro Bay*, SANTA LUCIAN (Sierra Club, Santa Lucia Chapter, San Luis Obispo Cnty., Ca.), Feb. 2020, at 9, https://www.sierraclub.org/sites/www.sierraclub.org/files/sce/santa-lucia-chapter/lucians/santa_lucian_2020_01_JanFeb.pdf.
[203] *Id.*
[204] *Id.*
[205] *Id.*
[206] U.S. Census Bureau, *Morro Bay city, California*, Quick Facts (last visited Mar. 4, 2021), https://www.census.gov/quickfacts/morrobaycitycalifornia.
[207] U.S. Census Bureau, *California; Pismo Beach city, California; Oceano CDP, California*, Quick Facts (last visited Feb. 19, 2021), https://www.census.gov/quickfacts/fact/table/CA,pismobeachcitycalifornia,oceanocdpcalifornia/PST045219

public and official housing discrimination."[208] Unfortunately, Oceano does not appear to be exempt from this trend. The median housing value, number of firms, and total retail sales levels in Oceano are far below Pismo Beach figures. The average owner-occupied home in Pismo Beach is worth roughly 96 percent more than the average owner-occupied home in Oceano. Homeownership rates are particularly telling in the United States, where homeownership has continuously been a method for building wealth. People of color on average are less likely to be homeowners, and if they are homeowners their home value is often a fraction of their white counterparts.[209]

The non-economic costs to living near ODSVRA are taxing on the Oceano community as well. For one, "[n]oise from vehicle recreation is highest in [ODSVRA], where OHV activity is permitted."[210] According to State Parks, "OHVs can generate noise levels in the range of 80-90 dBA" close to vehicles and 70-80 dBA around 50 to 100 feet away from the vehicle.[211] Recommendations for noise exposure for low-density residential uses is less than 60db L_{dn}.[212] The OHMVR Division receives complaints that OHV noise can be heard in residential areas.[213] Not only is typical OHV use a nuisance, but State Parks also permits large events that cause additionally high levels of noise and traffic. In 2014, for example, Huckfest "drew more than 11,000 people from across the country . . . to see trucks and buggies flying dozens of feet into the air over sand crests at the Oceano Dunes SVRA."[214] Likewise, the 2018 Oceano Music Fest was advertised as having "70+ hours of continuous sound over 4 days on two alternating stages."[215]

State Parks has failed its responsibility to protect SVRAs "from damage and preserve the peace therein."[216] As stated above, "the protection of public safety" is one of the highest priorities in the management of SVRAs.[217] Regulations prohibit the operation of an OHV ". . . negligently or willfully in such a manner as to pursue, harass, endanger, or injure any person or animal."[218] Despite these rules, the Park has been described as possibly "the most dangerous state park in California."[219] Off-roading on these hilly dunes has tragically led to injuries and deaths taking

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[208] CAL. COASTAL COMMISSION, 2019 ENVIRONMENTAL JUSTICE POLICY, AT 11 (Mar. 8, 2019), https://documents.coastal.ca.gov/assets/env-justice/CCC_EJ_Policy_FINAL.pdf.
[209] *See generally* Richard Rothstein, *Color of Law: A Forgotten History of How Out Government Segregated America* (2017).
[210] *See supra* 104 at 16.0 (2020).
[211] *Id.*
[212] *Id.*
[213] *Id.*
[214] Kaytlyn Leslie, *Huckfest truck-jumping competition at Oceano Dunes is canceled*, The Tribune, (Oct. 8, 2015), https://www.sanluisobispo.com/news/local/article39088569.html.
[215] Monica Vaughan, *Is Oceano Dunes the next hot venue for overnight music fests? One is coming next month*, The Tribune, (Sep. 19, 2018), https://www.sanluisobispo.com/entertainment/music-news-reviews/article218692650.html. The 2018 Oceano Music Fest was canceled but has been rescheduled to take place in 2021.
[216] Cal. Pub. Res. Code § 5008(a).
[217] Cal. Pub. Res. Code § 5090.35(a).
[218] Cal. Code Regs. tit. 14, § 4354.
[219] Julie Cart, *The dust-up over California's off-road beach; COVID highlights conflicts over air pollution, crime and accidents on California's central Coast*, High Country News, (Nov. 25, 2020), https://www.hcn.org/articles/recreation-the-dust-up-over-californias-off-road-beach.

place at the Park. Reports of speeding, driving under the influence, and inexperienced users in the Park are common. Park rangers made about 47 arrests in 2016, 89 in 2017, 82 in 2018 (including 49 felony arrests, including some for gang-related activity, assault, and rape),[220] and 84 in 2019.[221]

In 2018, the California Statewide Law Enforcement Association stated that California State Parks rangers with the Resource Protection Peace Officers Association "have major public safety concerns for park visitors and rangers, and the perceived lack of concern by State Parks management."[222] On busy weekends at the Park, "rangers can't oversee the safe riding habits of all."[223] Vacationing, drinking alcohol, night riding, and off-roaders free to roam 1,500 acres of open dunes "sometimes combust to create a potent brew."[224] Though there is no definitive record of fatal accidents at the Park, The San Luis Obispo Tribune has identified 44 OHV accident fatalities, including children, between 1992 and 2019.[225] In 2019, an unpermitted concert led to a mass shooting where a gunman allegedly opened fire on a crowd of people, leaving six people injured.[226] The Oceano Dunes Rangers and San Luis Ambulance reported that most OHV users reside outside of San Luis Obispo County.[227] Clearly, State Parks' proposal to increase OHV use – when it already does not effectively enforce public safety rules – will further burden the local community.

Nor can the high burdens and minimal benefits to the community be justified as a way to provide low-cost recreational access to its parks. A new ATV can cost between $2,000 and $17,000,[228] with the most popular models priced at no less than $6,000.[229] In State Parks' own

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[220] *See supra* note 219.
[221] Kasey Bubnash, *Grand jury finds county public safety uninhibited by activities at Oceano Dunes*, New Times SLO, (Jul. 1, 2020), https://www.newtimesslo.com/SLOthevirus/archives/2020/07/01/grand-jury-finds-county-public-safety-uninhibited-by-activities-at-oceano-dunes.
[222] California Statewide Law Enforcement Association, *California State Parks Rangers Fear for Your Safety and Their Own; Rangers Call State Parks a 'Department in Crisis,'* cslea.com, (Mar. 28, 2018), https://cslea.com/2018/03/california-state-park-rangers-fear-for-your-safety-and-their-own/.
[223] SAN LUIS OBISPO COUNTY GRAND JURY, PUBLIC SAFETY SERVICES AND THE OCEANO DUNES, AT (Jun. 24, 2020) https://drive.google.com/drive/folders/1fATlSdbl0hX4iUgG7jniUaE6BXGuEa0M.
[224] *See supra* note 219.
[225] *Death toll at Oceano Dunes: At least 44 OHV accident fatalities since 1992*, The San Luis Obispo Tribune Editorial Board, The Tribune, (Jul. 19, 2020), https://www.sanluisobispo.com/opinion/editorials/article231413543.html.
[226] Scott Middlecamp and Monica Vaughan, *6 injured in early morning shooting at Oceano Dunes, suspected gunman arrested*," The Tribune, (May 5, 2019), https://www.sanluisobispo.com/news/local/crime/article230050314.html. The San Luis Obispo County District Attorney later dropped charges on a then 19-year-old in late 2020 due to insufficient evidence.
[227] *See supra* note 223 at 7.
[228] *See generally ATVs For Sale In Arroyo Grande, CA*, GoRollick.com, (last visited Feb. 19, 2021), https://gorollick.com/r/inventory/atvs-for-sale-in-arroyo-grande-california/atvs/93420/-/-/-/-/showroom?utm_source=blog&utm_medium=atvs&page=1.
[229] *See generally Most Popular ATVs*, PowerSports.com, (last visited Feb. 19, 2021), http://www.powersportstv.com/most-popular/atvs.php.

commissioned study of ODSVRA users, the average household income of survey respondents was $115,000, while the median household income for those who live in Oceano is $28,277.[230]

V. Conclusion

We appreciate the opportunity to provide comments on staff's recommended revisions of CDP 4-82-300 and the future of Oceano Dunes. If anything, the December 2020 draft PWP shows an increasing divergence between the Commission's and State Parks' vision for the Park. State Parks' proposed approach is inconsistent with law, devalues the needs of the local community, and ignores the protection of sensitive natural resources. Under the Coastal Act's mandates, the Coastal Commission has the authority to begin a new chapter at the Park. The COVID-19 closures have been a positive example of what Oceano Dunes could be without high-impact motorized use. In the short term, more people can enjoy the beach and new types of light-footprint recreation can take the place of destructive vehicle use. In the long term, endangered species will have a better chance of survival, the damaged and eroding dunes will heal, and local public health will improve. Our clients believe, passionately, that the time to make necessary change is now and they urge the Commission to act upon its staff recommendations to eliminate OHV use at the Park.

We appreciate your further attention to this important matter.

Respectfully submitted,

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Submitted on behalf of the following Dunes Alliance organizations and the Oceano Beach Community Association: Santa Lucia Chapter of the Sierra Club, the San Luis

[230] *See supra* note 201. This study estimated that ODSVRA provided a $243 million economic benefit to San Luis Obispo County. An uncommission academic report found substantial issues with this "Economic Impact Analysis," such as not even considering permeant costs (such as lower home values) suffered by Oceano residents.

Obispo Chapter of the Surfrider Foundation, the Northern Chumash Tribal Council, Defenders of Wildlife, San Luis Obispo Coastkeeper, the Environmental Center of San Luis Obispo (ECOSLO), the Center for Biological Diversity, Concerned Citizens for Clean Air, Morro Coast Audubon, and Friends of Oso Flaco Lake.

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State of California – The Resources Agency
Department of Parks and Recreation

P. O. Box 2390, Sacramento 95811

Jim Suty, President
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March 8, 2021

Grover Beach City Council
154 South Eighth Street
Grover Beach, California 93433

Via email: gbadmin@groverbeach.org

Subject: Grover Beach Council Meeting Regarding the Oceano Dunes SVRA

Friends of Oceano Dunes (Friends) is writing to provide comments to the Grover Beach Staff Report for the March 8, 2021 meeting.

Friends would like to respond to the Staff's page 2 comment regarding the

"concerns raised about the methodology of this study and a critique of this study was done in 2019 by a Cal Poly Real Estate Finance professor which indicated that the State Parks study overestimated the level of economic impact."

Unfortunately, the Cal Poly professor took a very biased critique of the economic impact study and used non-standard tactics to bolster his personal opinion. **This review is not a Cal Poly sponsored or authorized review, nor was it peer reviewed and raises the question to its accuracy.**

The professor states (emphasis added):

"No one compensated me to write this report. ***All errors are my own****."*

"*I break up the analysis in two parts.* ***The first part concerns circumstantial evidence****." "****The second part concerns what is closest to the smoking gun evidence****."*

Let us highlight some very straight forward concerns with the professor's "two part" analysis:

Circumstantial Evidence:

The professor admits (emphasis added):
"As claimed before, economic impact analysis is social science, and ***I am constrained by data availability****.* ***Therefore, I do not have a true measure of a smoking gun.****"*

The professor decided to use Google Trends data as part of his "analysis". Per the professor he says: *"Modern life revolves around Google. To appreciate the pivotal nature of google, go back to April 2020 when an average person did not understand the COVID symptoms. According to a*

New York Times article titled "Google Searches Can Help Us Find Emerging COVID-19 Outbreaks"

So the professor uses the term "Beach ATV" as his key search terms for his self-proclaimed "*Circumstantial Evidence involving Google Trends Data***".** As a life long off-roader and duner of the Oceano Dunes…I have never heard of or used the term "Beach ATV". **If the search term does not fit…then it is not legit!**

Smoking Gun Evidence:
The professor claims his smoking gun study of "*the time series of the number of unemployed in the County*" proves his analysis is true…well, let's review it.

The professor states: "*I use the number of unemployed labor force at a MSA level"* MSA is Metropolitan Statistical Area, *"rather than at a county level since it is a better measure of the economic impact."*

In other words, the professor manipulated the data set to get the answer he wanted. **He did not analyze Grover Beach, Oceano, Pismo or Arroyo Grande where the direct Oceano Dunes impact is felt**. Ask the ATV rental businesses if they were impacted, ask the gas stations and supermarkets…I know the answer, and I bet you do to. **There is an impact**!

The professor also focused on the Transit Oriented Tax (TOT) or better known as the bed tax comparing Oceano to Avila pre and post COVID and claimed this is another "Smoking Gun". However, the part that was missing is that the over 1,000 campsites are not included in his analysis. In other words, **people camping do not pay into the TOT, but they do contribute to the economy ignoring this key fact skews the analysis**.

The professor has only used anecdotal evidence and his self-proclaimed words still ring true "***Therefore, I do not have a true measure of a smoking gun***."

Sincerely,

Jim Suty

CC: Tom Roth
Board of Directors

Protecting Our Historic OHV Culture for Future Generations

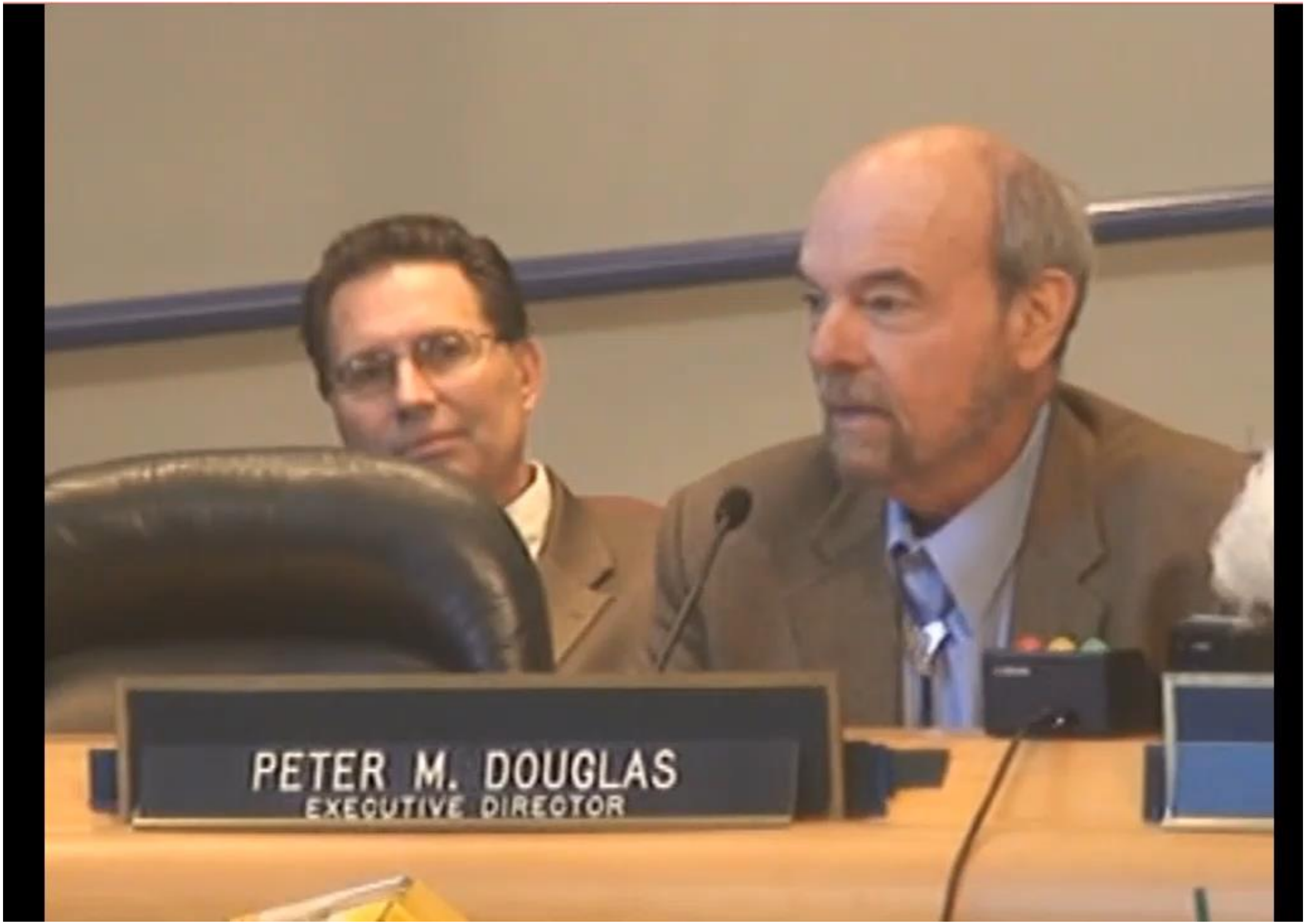
CCC Response
July 11, 2019

My name is Jim Suty, I am the founder and President of Friends of Oceano Dunes.

I am also the State Appointed OHV representative on the TRT (since inception 18 years).

We represent the ~2 million annual visitors to the Oceano Dunes.

We Fight to Protect
Access For All &
Ensure No-Net-Loss!


PETER M. DOUGLAS
EXECUTIVE DIRECTOR

Environmental justice is defined as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies" in Government Code Section 65040.12. In 2016, the Governor signed AB 2616 (Burke), which amended the Coastal Act and gives the Commission new authority to specifically consider environmental justice when making permit decisions. This legislation also cross-references existing non-discrimination and civil rights law in the government code and requires the governor to appoint an environmental justice Commissioner to our board.

https://www.coastal.ca.gov/env-justice/

Environmental Justice is Meant for All

culture noun

cul·ture | \ ˈkəl-chər \

Definition of *culture* (Entry 1 of 2)

1 a **:** the customary beliefs, social forms, and material traits of a racial, religious, or social group

also **:** the characteristic features of everyday existence (such as diversions or a way of life) shared by people in a place or time

// popular *culture*

// Southern *culture*

https://www.merriam-webster.com/dictionary/culture

Our Unique & Historic Culture is "a way of life" that is "shared by people in a place"… the Oceano Dunes

FRIENDS OF OCEANO DUNES
www.oceanodunes.org

Protecting Our Historic OHV Culture for Future Generations

CCC Response
July 11, 2019


CALIFORNIA STATE PARKS
OFF-HIGHWAY MOTOR VEHICLE RECREATION DIVISION
OHV

Law Enforcement • Public Safety • Education • Partnerships

Public Safety Program

California State Park's Off-Highway Motor Vehicle Recreation (OHMVR) Program was founded on the principle that "effectively managed areas and adequate facilities for the use of OHVs [off-highway vehicles] and conservation and enforcement are essential for ecologically balanced recreation" (Public Resource Code (PRC) Section 5090.02 (b)). The OHMVR Division Public Safety Program provides statewide leadership in OHV-related enforcement. Emphasis is placed on educating the public regarding OHV laws and regulations to encourage voluntary compliance and consistent enforcement to curb illegal activities and protect cultural and natural resources.

OHMVR Division law enforcement staff advise and assist city, county, and federal law enforcement agencies that provide public safety services related to OHV recreation. In addition to providing direct assistance through deployments to assist local law enforcement programs, they conduct training for these agencies to promote consistent statewide implementation of OHV laws. Staff also meet with stakeholders and law enforcement agencies around the state to identify issues, encourage partnerships, and resolutions to improve public safety.

Education and Outreach

Education and public outreach are key components of the OHMVR Division law enforcement program. Personal contacts on the trail and at special events provide opportunities for law enforcement staff to facilitate connections between the interests of the visitors and the values of the OHMVR Program. These one-on-one contacts give staff the opportunity to provide information about trail conditions, rules, regulations, safety gear, and resource protection. Visitors often remark that they appreciate these interactions with staff and remember their conversations long after their visit.

Besides making personal contacts, OHMVR Division law enforcement staff attend county fairs, youth and career fairs, and other special events with the Division outreach team to promote responsible recreation, wildlife conservation, and recreational opportunities. The OHMVR Division also assists local law enforcement and federal agencies with patrols and outreach during busy weekends on popular trails and at special events. Law enforcement staff feel that these outreach efforts and personal contacts have gone a long way towards changing OHV recreational culture.

Furthermore, education and safety grants funded by the OHMVR Grants and Cooperative Agreements Program (Grants Program) provide money for projects that teach OHV vehicle safety, environmental stewardship, respect for

http://ohv.parks.ca.gov/pages/25010/files/OHMVR%20LE%20Info%20Bulletin-May_2017.pdf

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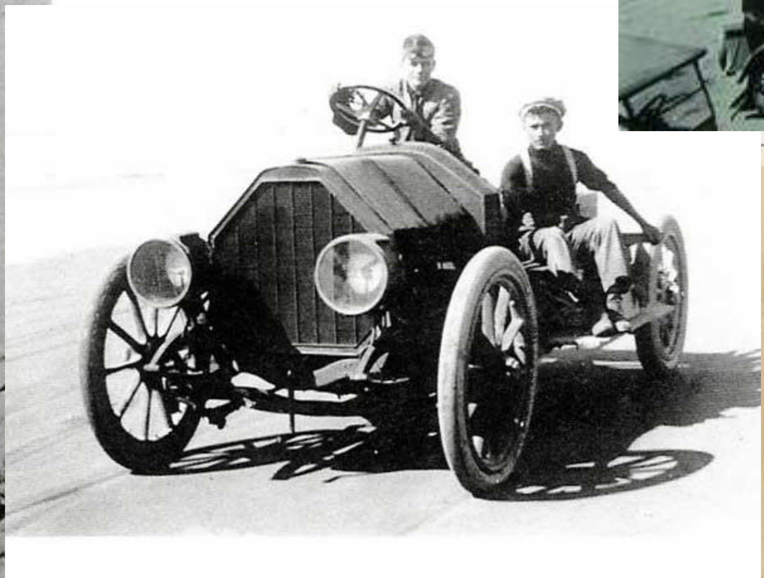
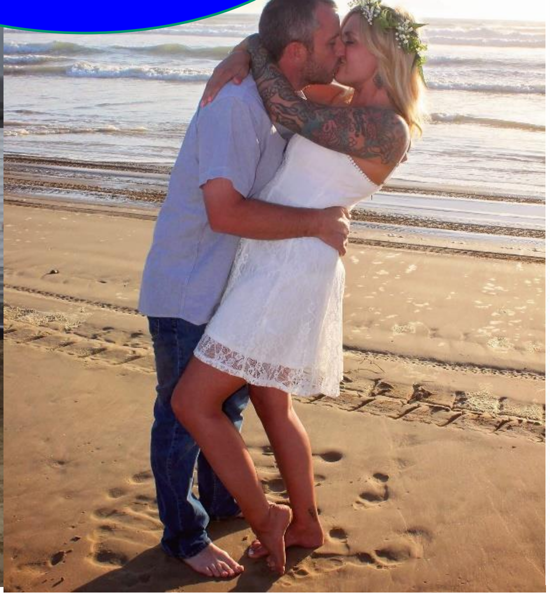
CCC Needs to Protect Our Culture, Not Destroy It

Traditions



Early automobile at Oceano-Pismo Beach *(circa 1905)*.

Celebrations




Togetherness

1970

Camping &
OHV
Recreation

CCC Needs to Protect Our Culture, Not Destroy It

Environmental justice is defined as "the fair treatment of people of **all** races, **cultures**, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies"

State Legislated Oceano Dunes State Vehicular Recreation Area

My name is Jim Suty, I am the founder and President of Friends of Oceano Dunes.

I was the State Appointed OHV representative on the TRT from inception in 2001 to conclusion in 2018

Friends represent the ~2 million annual visitors to the Oceano Dunes.

We Fight to Protect Access For All & Ensure No-Net-Loss!

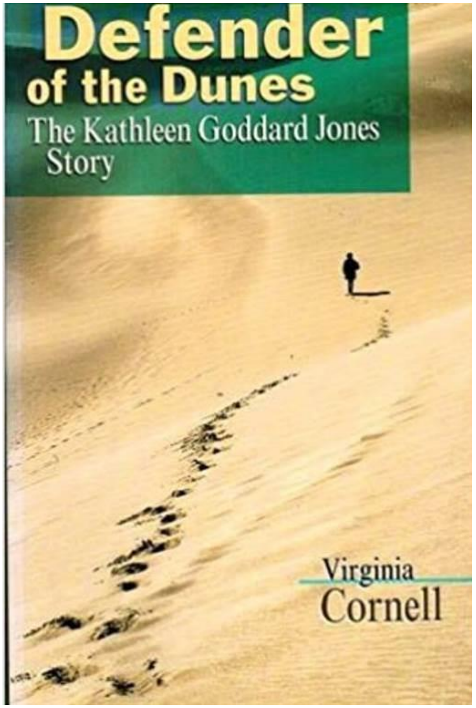
State Legislated Oceano Dunes State Vehicular Recreation Area

Staff recommendation

Staff recommends fundamental changes at the Park through modifications to the base CDP's terms and conditions. First and perhaps most critically, staff recommends that all OHV use be eliminated at the Park. Although staff believes that OHV use in ESHA is not consistent with the LCPs or Coastal Act, leading to a conclusion that such uses should cease immediately, staff recognizes that this is a large State Park and a significant operation. It may take some time to modify the way in which the Park operates (including related to budgeting, planning, and making the physical changes needed) and the ways in which users adjust to the new Park offerings. Thus, staff recommends a five-year transition, where the area allotted to vehicular/OHV use would only be allowed on a temporary basis (and could even be reduced in the interim subject to State Parks' planning efforts).

The Oceano Dunes SVRA is a State Legislated OHV Park – CCC Does Not Have the Authority

State Legislated Oceano Dunes State Vehicular Recreation Area



“But subsequent to that meeting in late 1974 there was developed the general development plan, called The Pismo State Beach and Pismo Dunes SVRA (State Vehicle Recreation Area) General Management Plan and Natural Resources Development Plan for these two sections of state park ownership.”

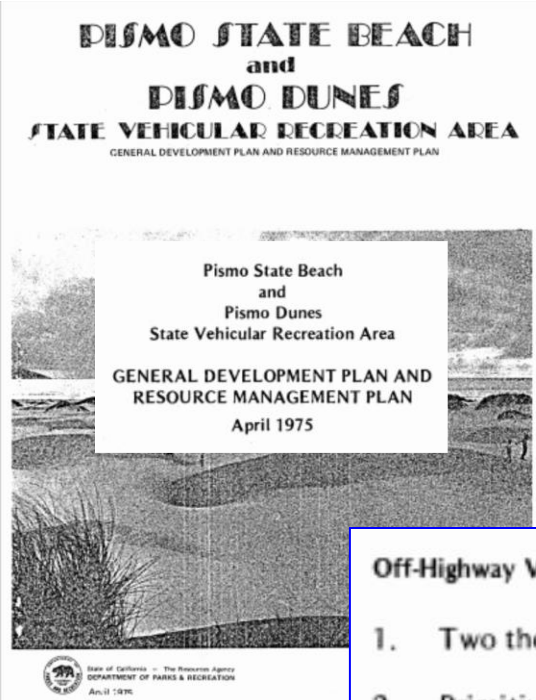
“And in-that document, **which is an excellent document, the management plan was made clear**, including the major entrance at the Callender area, which has now become a point of argument again among some groups.

The whole thing is a mess, except that the **Coastal Commission has been very helpful, and the county superiors have astonishingly been very helpful. They have now unanimously decided, in their LCP [local coastal plan] , to prohibit off-road vehicle recreation south of Oso Flaco Creek. The Coastal Commission has laid down some firm requirements of the state. One is that they shall control vehicles by erecting "non-climb" fencing. Much of the fencing has been done.”**

https://digitalassets.lib.berkeley.edu/roho/ucb/text/sierra_club_nationwide2.pdf

The Environmental Community and the Off-Road Community worked together and defeated the Nuclear Power Plant being built in the dunes…we then worked together to establish the protected Southern Dunes and the Oceano Dunes SVRA

State Legislated Oceano Dunes State Vehicular Recreation Area



Plan Format

The Public Resources Code provides that after each unit of the State Park System is classified, the Department of Parks and Recreation must prepare a general development plan and resource management plan for that unit. The Department must then submit the plans to the State Park and Recreation Commission for approval. It is the responsibility of the commission to schedule a public hearing to consider such approval.

In the case of Pismo Beach, there are two plans that have been reviewed by the commission and the public: one plan for Pismo State Beach and the other for Pismo Dunes State Vehicular Recreation Area. These areas are contiguous, and consideration of either plan requires an understanding of the total proposal encompassing the two individual units of the State Park System. For this reason the two plans have been included under a single cover.

On February 27, 1975, the California Coastal Zone Conservation Commission, South Central Coast Region, conducted a public hearing to consider this plan. The regional commission approved the plan at that meeting, and the terms and conditions of the approval appear in the appendix to this publication.

Off-Highway Vehicle* Recreation

1. Two thousand acres of sand dunes for off-highway vehicle recreation
2. Primitive camping facilities for dune vehicles
3. Inland camping area for off-highway vehicle users
4. Vehicle association center with administration facilities for off-highway vehicle recreation
5. Concession-operated facilities for dune vehicle service, rental, and storage and food service
6. Operation center with information and first aid facilities

The 1975 General Plan for the Pismo Dunes State Vehicular Recreation Area

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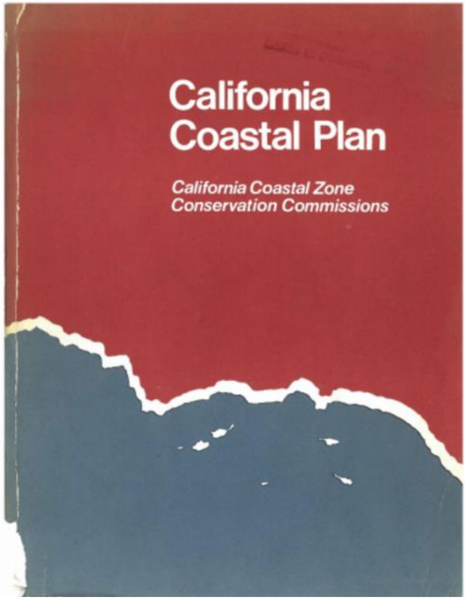
www.oceanodunes.org

State Legislated Oceano Dunes State Vehicular Recreation Area



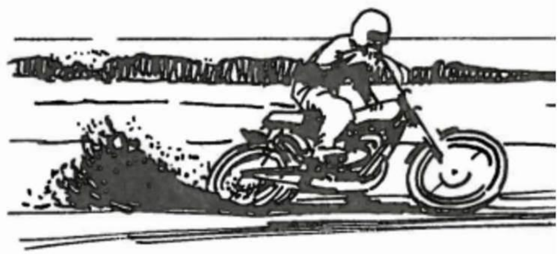
California Coastal Plan

California Coastal Zone Conservation Commissions

December 1975

Recreation (Pg 63)

143. Restrict Off-Road Recreational Vehicles along the Coast. Off-road recreational vehicle (ORV) use in the intertidal and oceanfront areas shall be permitted only in (a) that portion of Pismo Beach in San Luis Obispo County where such use



is presently permitted and controlled by the California Department of Parks and Recreation, and (b) such other coastal areas where ORV use is presently permitted and where all of the following standards are met: (1) the ORV use shall not adversely affect coastal plant or animal life, water quality, air quality, or other natural resources, and shall not conflict with other recreational uses; (2) the ORV use shall not result in noise levels that exceed 65 dBA at a distance of 50 feet from the noise source; (3) adequate support facilities shall be provided (e.g., rest rooms, holding tank dump stations, first aid facilities); and (4) a private operator or public agency shall assume responsibility for the management of the area to ensure that the ORV use is limited to the area designated for such use, and that the area is closed to ORV use if the above standards are not continually met.

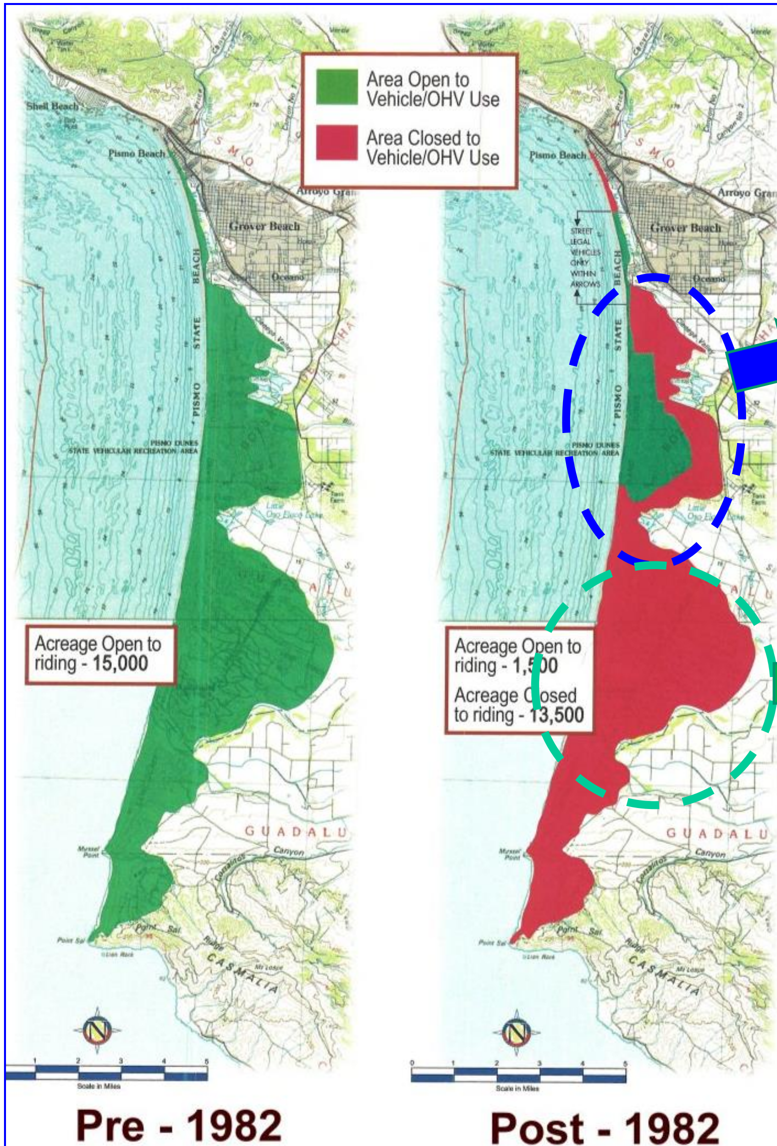
Shall Be Permitted

- Coastal plants are fenced off and protected
- Animal life is thriving
- Water quality has never been an issue
- Air Quality is due to natural events (Saltation) not OHV.
- Noise limits in place

The 1975 California Coastal Plan allowed for continued OHV use…"Shall Be Permitted"

You can download here (it is 305MB): "California Coastal Plan" by California Coastal Zone Conservation Commissions (ggu.edu)

State Legislated Oceano Dunes State Vehicular Recreation Area



<u>Oceano Dunes State Vehicular Recreational Area</u>

OHV $ fund a very robust Endangered Species Program which has the best breeding success for the Western Snowy Plover and California Least Tern than **<u>ANYWHERE</u>** else in the state.

This is “balanced land use”

Approximately 1.5 to 2.0 Million Visitors

<u>Guadalupe Dunes National Wildlife Refuge</u>

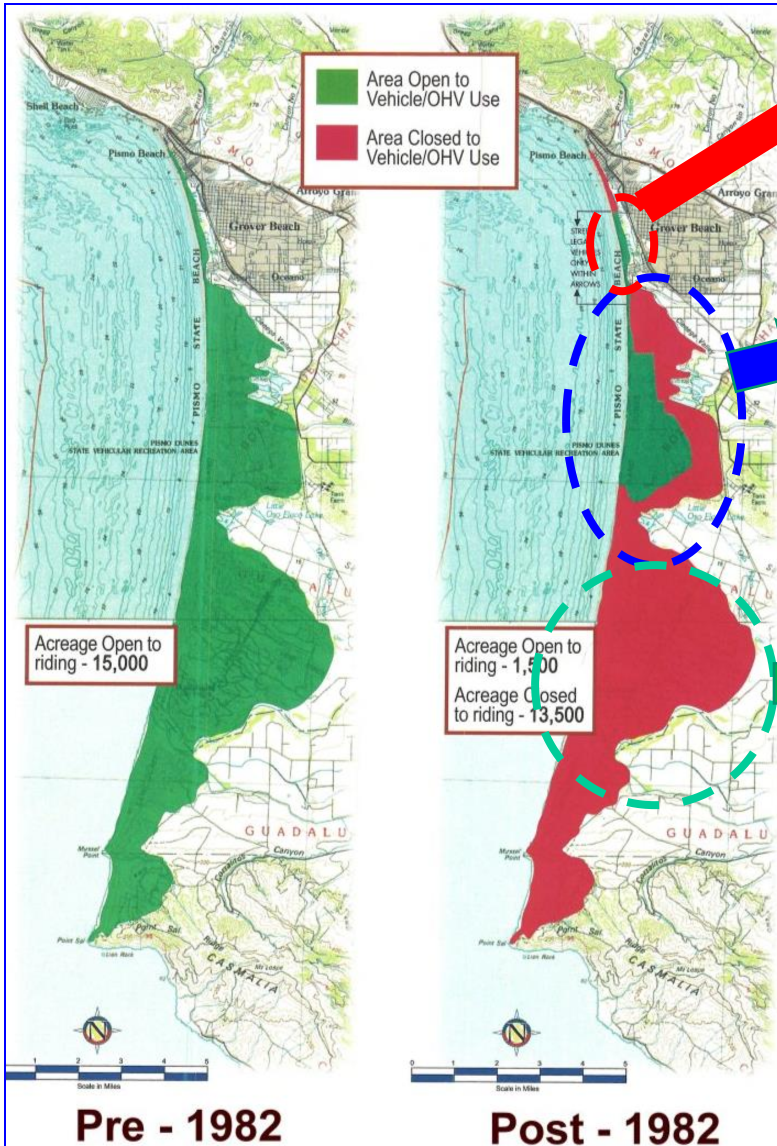
They don’t have enough $ to fund an Endangered Species Program. They do not manage invasive vegetation or predators. They have a very poor Western Snowy Plover program and **<u>NO</u>** California Least Terns.

This is “close and forget”

Approximately 10,000 visitors

Adjacent Properties…Very Different Results

State Legislated Oceano Dunes State Vehicular Recreation Area



CCC Staff Recommendation

Oceano Dunes State Vehicular Recreational Area

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Adjacent Properties...Very Different Results

State Legislated Oceano Dunes State Vehicular Recreation Area

In 1982, the California Coastal Commission ("CCC") approved a Coastal Development Permit (CDP 4-82-300) for Oceano Dunes State Vehicular Recreation Area ("Oceano Dunes SVRA"). The CDP has been amended several times since 1982 and set in motion a 40-year debate over access to and recreation at Oceano Dunes SVRA. State Parks is attempting to synthesize permitting and provide solutions to this 40-year challenge through the draft Public Works Plan (PWP).

State Parks and the CCC jointly agreed on the idea of a PWP as a viable option to examine future operations and management at Oceano Dunes SVRA. The PWP includes Oceano Dunes SVRA and Pismo State Beach, which constitute State Parks' Oceano District ("the District"), and is a long-range land use management plan for compliance with the California Coastal Act ("Coastal Act") that is reviewed and approved by the CCC. The PWP allows for a comprehensive permit for large or multi-phase projects and examines future operations and management decisions holistically.

State Legislated Oceano Dunes State Vehicular Recreation Area

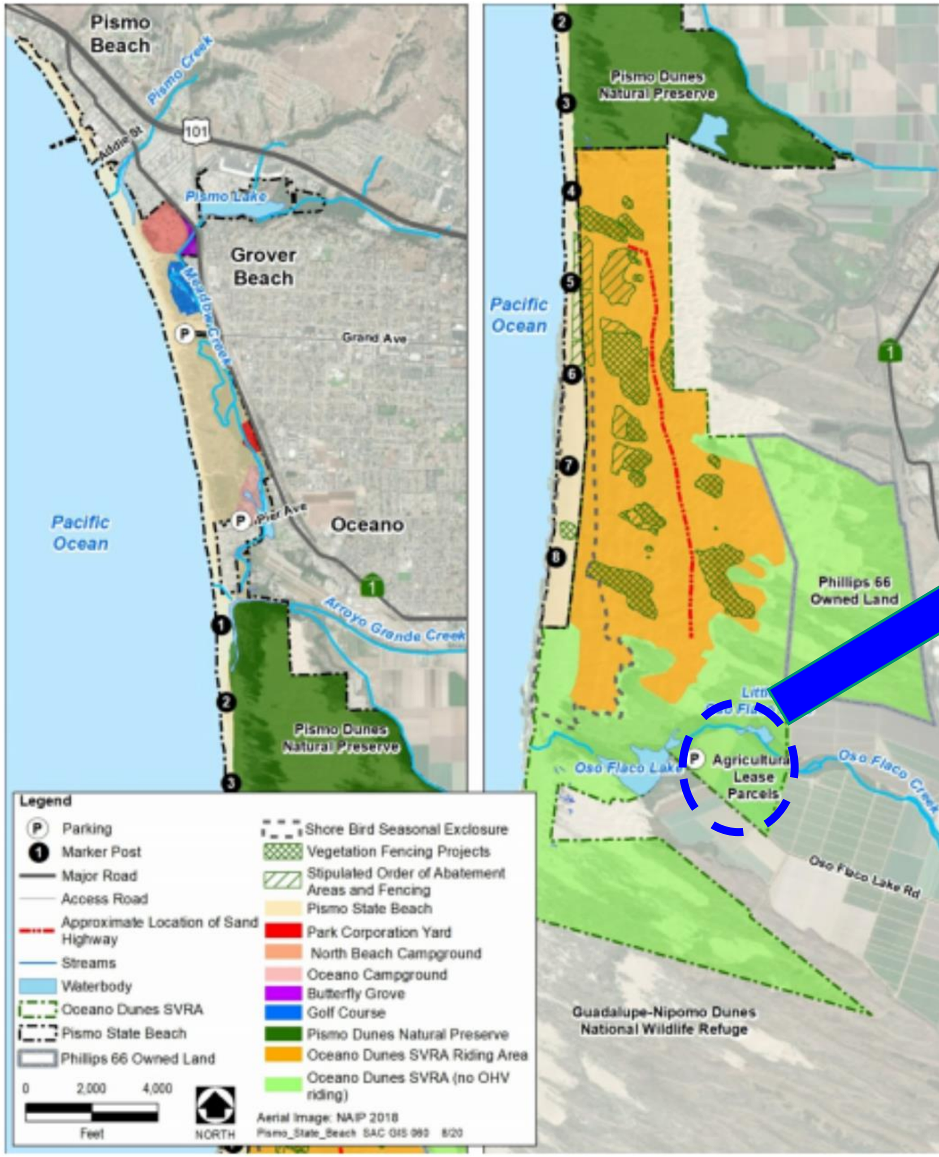


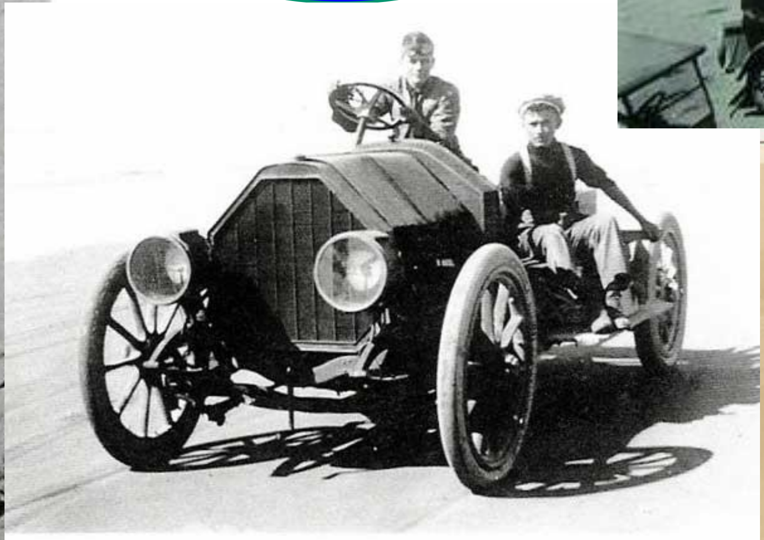
Figure 1-2. Existing Park Land Use and Facilities

...re 3-2. Oso Flaco Improvement Project Location

Farmland was purchased for a campground several decades ago and has been leased as farmland.

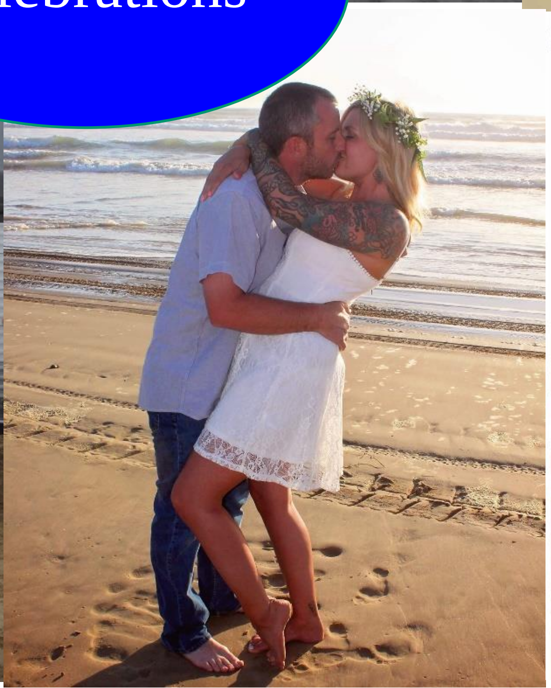
Making a campground with dune access only converts the Ag Land and does not harm Oso Flaco or the Protected Dunes to the South.

Documented Historical Use



Early automobile at Oceano-Pismo Beach *(circa 1905)*.

Celebrations




Togetherness


1970


Camping & OHV Recreation is Our Culture

LAW OFFICES OF THOMAS D. ROTH
ONE MARKET, SPEAR TOWER, SUITE 3600
SAN FRANCISCO, CALIFORNIA 94105
(415) 293-7684
Rothlaw1@comcast.net

March 12, 2021

By Email
OceanoDunesReview@coastal.ca.gov

Kevin Kahn
California Coastal Commission
725 Front Street
Suite 300
Santa Cruz, CA 95060

Re: **Comments and Objections of Friends of Oceano Dunes on the Coastal Commission Review of CDP 4-82-300, Oceano Dunes State Vehicular Recreation Area, San Luis Obispo County, California**

Dear Government Officials:

This firm represents Friends of Oceano Dunes, a California nonprofit watchdog association, which represents approximately 28,000 users of Oceano Dunes SVRA ("Friends"), and member Jim Suty. This letter is sent on behalf of Friends and its members, including member Jim Suty.

Friends objects to the Coastal Commission's proposed changes to the coastal development permit for Oceano Dunes, and the Commission's critique of the proposed public works plan ("PWP").

Friends also is submitting supporting documentation for inclusion in the administrative record.[1] These materials are on several CDs (submitted herewith),

[1] Friends has made its best efforts to include all supporting documentation and arguments, but state agencies are proactively seeking to block Friends efforts to obtain public records. Friends has requested public records from several state agencies under the California Public Records Act ("PRA"). These records are relevant to the comments and objections made herein. Unfortunately, these state agencies have engaged in a coordinated effort to withhold those records, and they have not been released as required by state law. Friends has filed numerous lawsuits in state court to compel release of the

and, in addition, a separate CD is included that contains the administrative record in *Friends v. Coastal Commission,* San Luis Obispo County Superior Court, Case, No. 17cv-0576. All of these CDs should be included in the administrative record here.

More detailed objections and comments are provided below:

Violation of Due Process

Procedural due process requires that administrative hearings be conducted "before a reasonably impartial, noninvolved reviewer." *Nasha LLC v. City of Los Angeles* (2004) 125 Cal.App.4th 470, 483. Likewise, CCP § 1094.5 requires a fair hearing.

Friends' due process and fair hearing rights have been violated.

Here, the Commissioners have repeatedly and for years evidenced bias against the OHV community and Friends of Oceano Dunes' users at Oceano Dunes. The OHV community and Friends cannot get a fair hearing from the Commission because the Commissioners have pre-hearing determined that they want to eliminate OHV use at Oceano Dunes.

The effort to eliminate OHV use at Oceano Dunes also exceeds the Commission's authority and violates the separation of powers doctrine. OHV use at Oceano Dunes is legislatively authorized. The Commission has no authority to

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records. In *Friends v. CARB*, Sacramento County Superior Court Case No. 34-2020-80003442, and *Friends v. State Parks*, Sacramento County Superior Court, Case No.34-2019-80003281, Friends seeks release of public records related to an inter-agency agreement concerning the implementation of dust control measures at Oceano Dunes SVRA. In *Friends v. State Parks*, Sacramento County Superior Court, Case No. 34-2020-8000-3496, Friends seeks release of public records related to computer modeling of dust emissions and the closure of Oceano Dunes SVRA during the pandemic even when State Parks has opened all other SVRAs. In *Friends v. California Department of Fish and Wildlife*, Sacramento County Superior Court, Case No. 34-2020-8000-3541, Friends seeks release of public records related to sensitive species issues at Oceano Dunes SVRA. Friends reserves the right to supplement its submission of supporting documentation to FWS after the close of the public comment period and even during any subsequent litigation, given the state agencies' coordinated refusal to produce all relevant records related to Oceano Dunes SVRA, forcing Friends to seek judicial remedies in state court. Courts are permitted to admit extra-record evidence: (1) if admission is necessary to determine whether the agency has considered all relevant factors and has explained its decision; when supplementing the record is necessary to explain technical terms or complex subject matter; or when plaintiffs make a showing of agency bad faith. *Lands Council v. Forester of Region One of the United States Forest Serv.,* 395 F.3d 1019, 1030 (9th Cir. 2004).

eliminate that use by amending a development permit that it approved nearly 40 years ago to allow that use.[2]

The Governor's appointment to the Coastal Commission for the South Central Coast, including San Luis Obispo has been vacant for some time. Hence, while oversight of Oceano Dunes is a critical issue for SLO County, there has been no local representative on the Commission to help the full Commission understand the issues from a local perspective. This is a form of bias against local interests, including business interests that depend on OHV recreation in order to survive.

Violation of the SVRA Act

The CCC's proposed changes to the CDP are a drastic change from nearly 40 years of precedent and violate the SVRA Act.

The CCC proposes to eliminate all OHV within 5 years. The CCC admits on p. 11 pf its staff report that State Parks opines that elimination of OHV at an OHV park would be unlawful. CCC staff merely states that it doesn't believe that's the case, without further explanation. In fact, staff set forth additional statements that contradict and are inconsistent with its "belief" (which is not substantial evidence) that eliminating OHV does not violate the SVRA Act. CCC staff opines that the Coastal Act and the SVRA Act are "co-equal state laws and must be harmonized." But elimination of OHV is not harmonization. It exceeds the CCC's authority.

Indeed, the Coastal Act itself limits the CCC's powers in this regard. Pub. Res. Code § 30401 provides "Except as otherwise specifically provided in this division, **enactment of this division does not increase, decrease, duplicate or supersede the authority of any existing state agency**." Section 30401 further states that ". . . the commission shall not set standards or adopt regulations that duplicate regulatory controls established by any existing state agency pursuant to specific statutory requirements or authorization."

The CCC is violating these limits by seeking to amend an existing permit that purports to decrease and supersede State Parks' authority over Oceano Dunes SVRA. It sets standards and regulatory controls that are different and

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[2] In footnote 186, the CCC writes: "On this point some OHV [commenters] have referred to old quotes from Peter Douglas, the Commission's former Executive Director, to suggest that the Commission lacks the authority to redesignate the Park. However, the point being made in these quotes is that it is not the Commission's role to designate State Park units, that is up to State Parks, and if any laws need to be changed, the State Legislature. Mr. Douglas' prior statements have nothing to do with the Commission's authorities under the Coastal Act and the LCPs, which exist now as they did when he was so quoted." That is a ridiculous statement. The point of the Peter Douglas quote is that there are limits to the CCC's authority under the Coastal Act, and the CCC's powers don't extend to closing a park or eliminating OHV use at a state-authorized SVRA.

more restrictive than established by State Parks or the state laws governing SVRAs.

Pub. Res. Code § 5090.43(a) provides that "State vehicular recreation areas consist of areas selected, developed, and operated to provide off-highway vehicle recreation opportunities." Oceano Dunes was selected expressly because it is uniquely suited for OHV recreation. The CCC blessed that use in 1982 or nearly 40 years ago. It has repeatedly amended the permit authorization, each time allowing that same use decade after decade.

Pub. Res. Code § 5090.43(a) provides that "Areas shall be developed, managed, and operated for the purpose of providing the **fullest appropriate public use of the vehicular recreational opportunities present** . . . while providing for the . . . conservation and improvement of natural resource values over time." There is nothing in this statutory authority that remotely suggests that State Parks, or any other agency, has the authority to eliminate OHV use at a park expressly created and designated for OHV use. Indeed, the statute commands the "fullest" OHV use. Elimination of OHV invades State Parks' statutory mandate to provide the fullest public use of OHV at Oceano Dunes.

State Parks has bent over backwards to conserve lands within the SVRA, setting aside at least **72 percent** of the park for conservation. One can argue that Parks is not complying with the SVRA Act because allowing only 28 percent of the area for OHV and camping is not the "fullest" use for recreational opportunities. But it is absolutely clear that eliminating OHV *entirely* exceeds the CCC's authority. The CCC cannot ignore the SVRA Act. The CCC itself stated that it should harmonize and balance the competing statutory mandates, but then completely ignores its own advice.

Pub. Res. Code § 5090.43(b) provides that "To protect natural and cultural resource values, sensitive areas may be established within state vehicular recreation areas where determined *by the department* to be necessary to protect natural and cultural resources." This provision does not authorize the elimination of all OHV in a SVRA. Otherwise, it would have said that. Rather, it simply allows certain areas in an SVRA to be established for conservation. But more importantly, that **decision is granted to State Parks, not the CCC**. Therefore, the CCC's effort to convert the entire SVRA into a non-OHV park for conservation purposes exceeds the CCC's authority and violates both the SVRA Act and the Coastal Act. Indeed, management of those areas is also delegated expressly to State Parks.

Likewise, Pub. Res. Code § 5090.43(c) authorizes the closure of certain "sensitive areas" within an SVRA, not the entire SVRA. If the Legislature authorized the closure of an entire SVRA it would have provided such authorization. It did not.

Also, Pub. Res. Code § 5090.32(a) expressly grants *State Parks* the authority to plan, acquire, develop, **conserve and restore** "lands in the state vehicular recreation areas." Notice that the CCC is granted **no authority** under this provision.

Pub. Res. Code § 5090.32(b) expressly grants *State Parks* the authority to manage, maintain, administer, and operate "lands in the state vehicular recreation areas." Notice that the CCC is granted **no authority** under this provision.

Pub. Res. Code § 5090.32(l) grants *State Parks* the authority to provide for the "conservation of natural and cultural resources, including appropriate mitigation." Notice that the CCC is granted **no authority** under this provision.

As Parks articulated, the no OHV amendment conflicts with State Park's responsibility to manage state parkland in a manner consistent with governing laws (Pub. Res. Code § 5008, § 5090.2(b), § 5090.35(a)) while promoting accessible recreation. At Oceano Dunes SVRA, this alternative would not meet the statutory mandate of managing the unit under its current classification (Pub. Res. Code § 5090.14.1).

For all these reasons, the CCC proposal violates the SVRA Act, and the Coastal Act, and exceeds the CCC's authority over the SVRA.

The CCC has jumped the shark. It has no authority to direct State Parks to ban all OHV at a park expressly authorized for OHV use, especially where that use has lawfully existed for 40 years, and where the use pre-dated even the creation of the CCC.

In fact, there is a "tell" in the language that the staff uses. Staff writes: "both laws *suggest*" that closure is allowed. *Suggest?* The law either allows the CCC to close a park owned, operated and managed by State Parks or it doesn't. It doesn't. The use of the word "suggest" shows that the CCC doesn't believe its own yarn.

This is a power play, plain and simple. It's classic CCC. "The law says what we say it means." Thanks, Humpty Dumpty. (From Lewis Carroll, *Through the Looking Glass*: " 'When I use a word,' Humpty Dumpty said in rather a scornful tone, 'it means just what I choose it to mean — neither more nor less.' 'The question is,' said Alice, 'whether you can make words mean so many different things.' 'The question is,' said Humpty Dumpty, 'which is to be master — that's all.") The CCC has made clear it wants to be "master." The Legislature hasn't bestowed any such power on the CCC.

The CCC attempts to create an "out" for its untenable position by claiming that certain areas in the northern portion of the SVRA "provide a potential location for the Commission to consider recreation types that might be more intensive than general beach use." First, the word "potential" is a giveaway that the CCC has no intention of authorizing more intensive use here. Otherwise, it would have included that recommendation. It didn't. Second, the CCC doesn't even mention allowing OHV in this or any area of the park. The CCC clearly intends to end all OHV within the OHV park. That's what it says: ". . . [S]taff recommends that **<u>all OHV</u>** use be eliminated at the Park." (p. 16.)

That's unlawful.[3]

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[3] The CCC argues that the Coastal Act allows it to eliminate OHV because the majority of the park is ESHA. Not so. Pub. Res. Code § 30240 provides: "(a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas. (b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas." State Parks has deemed the large sand dunes at Oceano Dunes a unique coastal setting and area for OHV recreation. Section 30240 seeks to protect not only "habitat" but "recreation areas." The uniqueness of the coastal OHV recreation experience at Oceano Dunes is precisely why that location was selected by the State of California for state-sanctioned OHV recreation in the 1970s. State Parks has deemed OHV at this location to be a coastal-dependent use, and the unique sand dunes formation is fundamental to the unique OHV experience. This unique OHV recreation is "dependent on those resources," i.e., dependent on the unique sand dunes formations next to the coast. So, the CCC's task is to "protect" those resources, which means not only the literal habitat and sand, but also the recreation area. The CCC is failing to do this. In sum, the Coastal Act ESHA provisions not only don't allow the CCC to justify the elimination of OHV recreation at this location, but they mandate that the CCC help protect it.

The CCC also argues that "The base CDP . . . only temporarily authorized [OHV recreation] so that Parks would have time to explore modifications to Park operations to address coastal resource issues, including impacts to ESHA." That's bunk. The CDP does not say the uses authorized are temporary, or that the use may in the future be eliminated completely. The fact that the CCC has authorized OHV recreation for nearly 40 years shows that the authorization was not temporary. While the CCC, the County and Parks anticipated that the use may be adjusted, no one thought the use would be eliminated. That, in part, is what Peter Douglas was saying in the video clip. The CCC has reviewed the CDP many times over the decades and the CCC never suggested that all OHV would be eliminated.

The CCC also argues "Specifically, evidence demonstrates that vehicular/OHV activity in dunes is one of the most disruptive activities that could be pursued therein, leading to broad degradation of these sensitive dune resources. Substantial evidence also shows that such uses have significant adverse impacts on sensitive species that reside in dune habitat. In addition, vehicles and OHVs destroy the natural dune structure and landform, including the surface area and associated dune vegetation, limit the ability of dune-adapted species to thrive there, including sensitive species protected under the state and federal endangered species acts, and essentially prohibit the dunes from achieving their natural habitat equilibrium." Totally false. The dust control measures

Finally, the CCC also violates the law by purporting to ban OHV five years from now. Since the dune system is dynamic, there is no way for the CCC to determine *now* that five years from now the system can't support OHV recreation. The CCC lacks substantial evidence for such a determination.

Violation of the Coastal Act Recreational Resources Protection Provisions

In addition, the CCC proposed action also violates the Coastal Act.

Recreational land is a coastal resource. Relevant Coastal Act provisions include: Pub. Res. Code § 30001.5(c): Legislature finds and declares that a fundamental goal is to "maximize public access to and along the coast and maximize public recreational opportunities in the coastal zone . . . ."; Pub. Res. Code § 30213 mandates that "lower cost . . . recreational facilities shall be [protected] . . . ."; Pub. Res. Code § 30525(d) defines "sensitive resource value" to include public recreational areas where quality of the recreational experience is dependent on the character of the surrounding area; see also Pub. Res. Code §§ 30116(b), 30221 [ocean front land suitable for recreational use shall be protected for recreational use], and 30223 [upland areas to support coastal recreational use must be protected]. Courts characterize coastal recreational lands and areas as a "resource." CEQA requires study of significant impacts on the environment. Pub. Res. Code § 21060.5 defines "environment" to mean the physical conditions "existing within the area which will be affected by a proposed project, including *land*, air, water, minerals, flora, fauna, noise, objects or historic or aesthetic significance." "A project will normally have a significant effect on the environment if it will . . . conflict with established recreational . . . uses of the area." *Baldwin v. City of L.A.* (1999) 70 Cal.App.4th 819, 842. We have that here. The elimination of all OHV recreation fails to maximize coastal recreational opportunities that have existed for more than 100 years (pre-dating the Coastal Act), and that have been permitted by the CCC since 1982.

That violates the Coastal Act.

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are equally disruptive. In fact, they are more disruptive because they will cause increased predation and take of sensitive species that dwarfs any take by OHV. Any degradation by OHV can be mitigated below significance, and has been mitigated by regulatory and operational limitations and programs implemented by State Parks.

The CCC also argues that the dust emissions are caused by OHV. That is not true. In any event, dust emissions and air pollution is not relevant factor under Pub. Res. Code § 30240. It concerns impacts to non-ESHA areas, not impacts to ESHA.

The CCC also argues OHV must be banned to address environmental justice issues. That argument is addressed separately in this letter.

Violation of CEQA's Stable Project Description Requirement

In addition, the CCC proposed action also violates CEQA's stable project description requirement.

CEQA demands that a project description remain stable. "An accurate project description is necessary for an intelligent evaluation of the potential environmental effects of a proposed activity." *San Joaquin Raptor v. County of Stanislaus* (1994) 27 Cal.App.4th 713, 730; *Mira Monte Homeowners Assn. v. County of Ventura* (1985) 165 Cal.App.3d 357, 366 [The CEQA process "must be open to the public, premised upon a full and meaningful disclosure of the scope, purposes, and effect of a consistently described project . . . ."]. One of CEQA's fundamental broad policies is meaningful public disclosure to the public and decision-makers. Providing stable, accurate and meaningful disclosure of the extent and nature of a project, along with its corresponding significant environmental impacts, is the whole point of CEQA. The CCC, even under a certified regulatory program, cannot base its approval on a document that doesn't comport with this basic, substantive CEQA requirement. *Living Rivers Council v. State Water Resources Control Bd.* (2017) 15 Cal.App.5th 991.

Is there a stable, consistent project description here? No. The record shows that the CCC completely changed the project at the last minute. Let's review project description and the timeline.

This project started as a PWP. State Parks told the CCC nearly 3 years ago it was proposing a PWP to replace the 1982 CDP. The CCC worked with State Parks to create that PWP.

On May 9, 2018, State Parks issued a "Notice of Preparation of an Environmental Impact Report Pismo State Beach and Oceano Dunes State Vehicular Recreation Area Public Works Plan." That document included a project description. There is no mention of closing the SVRA to OHV, closing Pier Avenue, or shifting camping to the north, or any of the other changes pressed by the CCC now at the last minute.

In that same month, State Parks held scoping meetings for the public. There was no mention of closing the SVRA to OHV, closing Pier Avenue, or shifting camping to the north, or any of the other changes pressed by the CCC now.

In August 2018, State Parks released a scoping report for the PWP. There was no mention of closing the SVRA to OHV, closing Pier Avenue, or shifting camping to the north, or any of the other changes pressed by the CCC now. The CCC provided no comment at the scoping hearings.

In February 2019, State Parks held a PWP Project Concepts Public Meeting. There was no mention of closing the SVRA to OHV, closing Pier

Avenue, or shifting camping to the north, or any of the other changes pressed by the CCC now. The CCC provided no comments.

In June 2019, State Parks issued a summary of comments on the PWP plan and concepts. There was no mention of closing the SVRA to OHV, closing Pier Avenue, or shifting camping to the north, or any of the other changes pressed by the CCC now. The CCC provided no comments.

That same summer, State Parks released FAQs regarding the PWP. There was no mention of closing the SVRA to OHV, closing Pier Avenue, or shifting camping to the north, or any of the other changes pressed by the CCC now. The CCC provided no comments.

In July 2019, State Parks held stakeholder meetings. Parks announced that CCC hearings on Oceano Dunes in July 2020 "allows us to continue to work diligently on the PWP – for completion by Summer 2020." There was no mention of closing the SVRA to OHV, closing Pier Avenue, or shifting camping to the north, or any of the other changes pressed by the CCC now. The CCC provided no comments.

At the July 11, 2019 CCC public hearing, the CCC never mentioned closing the SVRA to OHV, closing Pier Avenue, or shifting camping to the north, or any of the other changes pressed by the CCC now. Parks also announced that it was "working in partnership with our stakeholders and the Commission throughout this process."

In December 2019, State parks held additional public meetings on the PWP. There was no mention of closing the SVRA to OHV, closing Pier Avenue, or shifting camping to the north, or any of the other changes pressed by the CCC now. The CCC provided no comments.

In the Spring of 2020, State Parks released FAQs regarding the PWP. There was no mention of closing the SVRA to OHV, closing Pier Avenue, or shifting camping to the north, or any of the other changes pressed by the CCC now. The CCC provided no comments.

In May 2020, Parks released a summary of public comments. The CCC provided no comments.

In December 2020, Parks released the Pismo State Beach and Oceano Dunes State Vehicular Recreation Area Draft Public Works Plan and Draft Environmental Impact Report. In the alternatives section, Parks evaluated the No OHV Use Alternative, where use of any vehicle identified in CVC § 38010 and 38012 as an OHV would be phased out and eliminated from the Park over five years as suggested by California Coastal Commission staff. Parks rejected this alternative because ". . . the No OHV Alternative conflicts with State Park's responsibility of managing state parkland in a manner consistent with governing laws (PRC § 5008, § 5090.2(b), § 5090.35(a)) while promoting accessible recreation. In Oceano Dunes SVRA, this Alternative would not meet the statutory mandate of managing the unit under its current classification (PRC § 5090.14.1). This Alternative would ultimately require a reclassification of the SVRA to a State Recreation Area, State Beach, or State Park. As outlined in greater detail below, State Parks does not have the authority to phase out OHV activity in the SVRA on its own, the OHMVR Commission and the State Parks and Recreation Commission, or the Legislature would need to approve a change in the Park's use and classification (§ 5019.50 and 5090.24)."

State Parks and the public understood that the CCC would be setting a hearing in March 2021 to debate and consider the PWP. But, shockingly, and without telling State Parks, the CCC, in mid-February 2021, issued a critique of the PWP, but did not set a formal hearing on the PWP for March 2021. Rather, the CCC announced its intention to amend the 1982 CDP drastically and in a way that fundamentally changed the PWP proposal. This is a classic bait and switch.

The CCC demands that comments be filed by March 12, 2021, when it announced this changed at the close of business on February 17, 2021. That gives the public 22 days to analyze a fundamental change on regulating the SVRA not by a PWP as proposed but by fundamentally changing the existing CDP.

So for more than 33 months, the public was lead to believe that the PWP would allow OHV recreation and the existing entrances would be in place, and in the last 22 days before the public hearing, the CCC completely changed that without even having a formal hearing on the PWP. That is egregious.

In *North Coast Rivers Alliance v. Kawamura* (2015) 243 Cal.App.4th 647, 652-653, the court held that the California's Department of Food and Agriculture's environmental review violated CEQA's "stable project description" requirement because "at the last minute" the Department approved a pest control approach rather than a pest eradication plan, thus changing the scope of the originally proposed seven-year program. Here, ending OHV at an OHV park is a massive change by rejecting the PWP without even having a formal hearing on it. The CCC substituted its "project" for the Project proposed by State Parks in the PWP.

Additionally, this is certainly "last minute."

In fact, as late as February 23, 2021, State Parks announced on its website that it would extend public comment on the PWP and associated EIR "if a California Coastal Commission hearing for these draft documents is scheduled after March 2, 2021 . . . ." State Parks and the public understood that the CC would be holding a hearing on the PWP on March 18, 2021. But the CCC staff then said there would be no hearing. Instead, the hearing would only be on amending the existing permit. That violates the stable project description doctrine. It is confusing not only to the public and Friends, but also to State parks, the agency that manages the park.

For these reasons, the CCC's action violates CEQA's stable project description requirement.

Violation of Coastal Act PWP Environmental Information Policies Set Forth in PRC § 30605

Pub. Res. Code § 30605 provides the Commission "shall, by regulation, provide for the submission and distribution to the public, prior to public hearings on the plan, detailed environmental information sufficient to enable the commission to determine the consistency of the plans with the policies of this division."

For the same reasons set forth herein as to why the CCC Is violating CEQA, the agency also is violating Pub. Res. Code § 30605 environmental information policies.

Violation of Coastal Act PWP Regulations

State Parks submitted a PWP to the CCC in accordance and compliance with 14 CCR §§ 13353 and 13357(a)(1) [State Parks may submit PWP to the "Commission for review and certification. The purpose of the Commission review of the plan shall be to define the scope of review of any subsequent project contained in the plan."]

Section 13355 requires the CCC to distribute environmental information on the PWP to the public prior to public hearing on the plan. The CCC "shall provide the opportunity for public comment in response to the environmental information prior to the close of the public hearing on the plan."

The CCC never officially released such information, but instead included a discussion of environmental considerations in its staff report on a *separate* action, the amendment of the CDP. The CCC has set no public hearing on the PWP, at all. Section 13355 contemplates a public hearing on a proposed PWP, but the CCC has held none, and does not intend to hold one. This violates the agency's own regulations.

Section 13357(a)(2) [and (3)] requires the CCC to consult "with the affected local government who may recommend modifications necessary for the proposed plan to adequately carry out the certified local coastal program." The CCC failed to do that here.

The CCC shall set and hold a public hearing on the PWP, but the CCC never did that here. See 14 CCR § 13357(3).

For these reasons, the CCC failed to comply with basic requirements for processing and considering a proposed PWP, in violation of its own regulations and Pub. Res. Code § 30605.

The CCC's Change Is Inconsistent with PRC § 30605, and the Applicable LCP Policies; and Exceeds the CCC's Authority by Attempting to Dec Facto Amend the Certified SLO County LCP

Pub. Res. Code § 30605 also states: "If any such plan for public works is submitted after the certification of local coastal programs, any such plan shall be approved by the commission only if it finds, after full consultation with the affected local governments, that the proposed plan for public works is in conformity with certified local coastal programs in jurisdictions affected by the proposed public works."

There is no evidence that the Commission consulted with SLO County staff regarding conformity with the LCP.

Even if the CCC shifted away from the PWP, the certified LCP must be considered as guidance in evaluating amendments to the CDP.

The Commission's proposed changes are inconsistent with the SLO County LCP in the following ways:

The LCP acknowledges that the SVRA is famous for driving on the beach and recreational vehicle use at the SVRA. See p. 3-6 LCP ["Combined, the state beach and vehicular recreation area are the major visitor attraction within the coastal zone with over three million visitors per year."] The CCC ignores this, or seeks to make findings that are inconsistent with the findings in the LCP.

The LCP authorizes beach and inland camping area for off-highway vehicle users. See p. 3-6, LCP ["Camping is also allowed on the beach and within the dunes."] The CCC proposes to end this entirely or substantially.

The LCP encourages the expansion of camping at the SVRA to meet need: "To meet increasing demands for overnight camping and to ensure that lower-cost recreational facilities are available, the State Department of Parks and Recreation should be encouraged to implement their development plans as soon as possible." p. 3-7, LCP. The CCC reduces camping, and eliminates it in many locations. That's exactly the opposite of the LCP policy. The LCP includes a finding that "The determination of carrying capacity is a complex process, requiring consideration of many variables. While **some habitat areas (such as dry sandy beaches) can tolerate a high intensity of daytime recreational use**, others (such as wetlands) can tolerate only a very low level of use." Id., p. 3-8. The CCC ignores this finding and fails to develop a proposal that is consistent with this finding. This is an unlawful de facto amendment of the LCP, which exceeds the CCC's authority.

The LCP establishes that the SVRA serves dual purposes: "This situation gives the state park system a dual role in providing recreational opportunities while protecting environmental resources." p. 3-8, LCP. The LCP clearly does not require or even authorize the complete end of OHV recreation.

LCP Recreation Policy 1 states: "Coastal recreational and visitor-serving facilities, especially lower-cost facilities, shall be protected, encouraged and where feasible provided by both public and private means. Removal or conversion of existing lower cost facilities and opportunities in areas designated with the "V" Visitor Serving Overlay in the LUE shall be prohibited unless the use will be replaced by a facility offering comparable visitor serving or recreational opportunities." The CCC's proposal is inconsistent with Policy 1 because it eliminates substantial lower cost facilities provided by beach camping, and because it eliminates coastal OHV recreation, which State Parks has determined is a coastal dependent use.

LCP Recreation Policy 5 provides "The State Department of Parks and Recreation should give high priority to development of existing holdings unless undertaken for environmental protection only. Future acquisitions for park expansion should occur in conjunction with an approved development plan. [THIS POLICY SHALL BE IMPLEMENTED AS A STANDARD.]" In other words, OHV recreation should be developed at the existing facility created for that purpose. The CCC turns this policy on its head by forbidding and ending all OHV at Oceano Dunes SVRA.

LCP Recreation Policy 7 provides: "The State Department of Parks and Recreation should provide lower cost recreation facilities such as overnight camping and youth hostels where possible. [THIS POLICY SHALL BE IMPLEMENTED AS A STANDARD.]" The CCC rejects this policy by reducing or ending camping.

On p. 3-10 of the LCP, the County writes: "The State Department of Parks and Recreation has become the major provider of recreational opportunities within the county's coastal zone. State park development along the coastline offers a variety of amenities, from primitive campsites to full recreational vehicle hook-ups." The CCC's plan is inconsistent with this because it would eliminate many of the camping amenities that the LCP relies on and encourages.

On p. 3-11 of the LCP, the County writes: "Pismo State Beach is unique because its hard sand surface supports vehicle use. Nowhere else in California can the experience of driving along a beach for several miles be found. On major holidays, traffic is often bumper to bumper on much of the 7-1/2 miles available to vehicles. Often in conjunction with vehicular use of the beach is beach camping. This drive-on camping is also unique in California. In the city of Pismo

Beach, vehicular use of the beach is prohibited." The CCC proposal reduces this use to such extent that it can only be deemed inconsistent with the LCP.

Also on p. 3-11 of the LCP, the County finds: "The dunes provide off-road vehicle users with opportunities for a variety of recreation uses. Dune tours, competition events and primitive camping are the most popular. Access to the dunes is presently available from the beach or via Oso Flaco Road. The dunes provide for other recreational activities as well as including hiking, horseback riding, fishing, hunting, and nature study. Much of these activities are centered around the Dune Preserve unit and the Oso Flaco Lake area." The CCC ignores these recreational resources and rejects OHV recreation outright, which is inconsistent with the LCP's policies and findings.

On p. 3-13, the LCP finds: "Recreation vehicle use is the dominant recreational element and will continue within the two park units, consistent with availability of staffing and facilities of the State Department of Parks and Recreation." The CCC ignores this finding by eliminating OHV recreation.

On p. 3-18, the LCP finds: "Through the previously discussed policies, programs and standards, the Coastal Act goal of **maximizing recreational opportunities consistent with protection of coastal resources has been met**. Section 30213 of the Act requires the protection, encouragement, and where feasible, provisions for lower cost recreation facilities. Through the future development of overnight camping as required in programs and standards for both private and public recreation development, this policy has been addressed. The act also gives priority to recreational and visitor-serving land uses. Areas have been identified within each community and appropriate areas in the rural portion of the county where recreation uses would be permitted. Policies in the Act concerning the impact of recreation development on coastal resources have been addressed through detailed standards for both public and private recreation development which require siting consistent with protection of these resources." In other words, the LCP recognizes the impacts of OHV recreation and camping, but also recognizes that they contribute to Coastal Act recreational policies and coastal resources. The CCC's proposal to eliminate camping and OHV recreation is completely contrary to these findings and the LCP.

The LCP allows OHV recreation. The CCC proposes to end this.

The LCP allows OHV recreation on the La Grande Tract. The CCC proposes to end this.

These inconsistencies, and the CCC's efforts to override the LCP findings and policies, constitute an unlawful de facto amendment of the CCC-certified LCP, in excess of the CCC's authority and jurisdiction, and also violate PRC § 30605.

The CCC also fails to explain why it rejects the LCP as guidance.

The CCC proposal is also inconsistent with the County's SOUTH COUNTY AREA PLAN, as follows:

Page 8-8 provides: "Passive recreational uses . . . should be provided for in the sensitive vegetated areas restricted from OHV use." This shows that OHV use is contemplated and approved; otherwise, why would only certain areas be "restricted from OHV use."

Page 8-8 also provides: "Approval of the GDP for inclusion into the County's LCP, or approval of a coastal development permit for a development within either Pismo Beach State Park or the Pismo Dunes State Vehicular Recreation Area, shall be subject to a finding that the State Department of Parks and Recreation is making a commitment for sufficient manpower to ensure resource protection, ordinance enforcement and access control in conformance with the conditions of Coastal Development Permit No. 4-82-30A. Should the terms and conditions of the coastal permit not be enforced or accomplished or should they not be sufficient to regulate the use in a manner consistent with the protection of resources, public health and safety and community values, then under the county's police powers, the imposition of an *interim* moratorium on ORV use may be necessary to protect resources while long-range planning, development of facilities and requisition of equipment and manpower is completed. (LCP)" This section shows that cessation of OHV may only be on a temporary basis while new plans are being put in place. It also shows that the County has authority to do that, not the CCC.

Also on p. 8-8, the plan states that "Primary access for off-road vehicles into the dunes will be as indicated in Coastal Development Permit No. 4-82-30A." Since the 1982 CDP authorizes boteh Pier and Grande entrances, the CCC has no authority to close Pier, since doing so now would be inconsistent with the LCP.

On page 8-9, the plan authorizes "back dunes camping." The CCC proposal is inconsistent because it eliminates such camping.

Page 8-9 authorizes OHV "hill climbs and competitions." The CCC proposal is inconsistent because it eliminates all OHV recreation.

On page 8-9, the plan provides: "Beach camping in conformance with the numerical limitations of Coastal Development Permit No. 4-82-30A shall be permitted where it can be established that: a) administration of the entire park unit would not be adversely affected, b) control of total users can be maintained within acceptable carrying enforcement/ capacity. The General Development Plan must identify area(s) for beach camping which would minimize conflicts with other users of the sandy beach. (It is estimated each campsite can accommodate from five to eight persons). Consistent with the provisions of Coastal Development Permit No. 4-82-30A, this limit can be adjusted either upward or downward based on monitoring of the impacts of this use. (LCP)" The CCC has not met these standards in order to eliminate and reduce camping at the SVRA.

Policy 9 provides "ORV use shall be permitted only in identified unfenced vehicular use area. These areas are identified in Figure 4. No recreational ORV use will be allowed in the designated natural areas. These buffer areas reflect areas required for habitat protection and generally recognize the established lease agreement with Union Oil for the areas adjacent to the eastern portion of the park. ORV is prohibited in all vegetated areas. (LCP)" This policy clearly authorizes OHV use. The CCC proposal is inconsistent because it attempts to end all OHV recreation at Oceano Dunes.

The CCC proposal also is inconsistent with the General Development Plan for the SVRA. Recommendations in the Parks' General Development Plan for the SVRA include:

. Six miles of hard sand beach for automobile touring.
. Oceano and North Beach campgrounds for tent and trailer camping.
. Two thousand acres of sand dunes for off-highway vehicle recreation.
. Primitive camping facilities for dune vehicles.
. Inland camping area for off-highway vehicle users.
. Vehicle association center with administration facilities for off-highway vehicle recreation.
. Concession-operated facilities for dune vehicle service, rental, and storage and food service.

The CCC proposal is inconsistent with all of these recommendations and policies, and as such the proposed amendment to the CDP is inconsistent with the Coastal Act.

SLO County LCP Map 2 (Buffer) Is Erroneous and Is Overridden by LCP Text; the CCC Interpretation Is Contradicted by the County and the County Has Authority to Interpret Its Own LCP

To the extent that it is asserted that the La Grande Tract is buffer under the LCP and OHV is not allowed, that is false. County Planning officials have recognized that the "buffer" map is contradicted flatly by the text of the LUP. California law is that the text supersedes any graphic depictions or maps. In addition, County Staff has stated that the map is in error and should be corrected.

The County's position is that the LCP buffer map was "background information and advisory, but not regulatory or a critical component of the LCP." Indeed, the text of the LCP states expressly that OHV is allowed in a large portion of the La Grande Tract. The Commission has previously asserted that the map was included intentionally to reflect the long-term goal of the LCP. There is no evidence of this. It is simply a "spin" by Commission staff. Further, the

Commission has no authority to tell the County what the County's LCP means. The Commission exceeds its authority in attempting to do so. The Coastal Act leaves it up to the County to decide what's in its LCP. The Commission doesn't get to decide. *San Diego Unified Port Dist. v. California Coastal Com.* (2018) 27 Cal.App.5th 1111, 1134 ["The act . . . leaves wide discretion to a local government not only to determine the contents of its land use plans, but to choose how to implement these plans.].) Also, from a practical perspective, the Commission's interpretation was created decades after the adoption and certification of the LCP in 1984 and 1988. Accordingly, the Commission's view has no value as legislative history and is better characterized as revisionist history if not pure fiction.

The CCC staff has previously stated: "the [LaGrande Tract] LCP inconsistency issue was not resolved, it remains outstanding to this day . . . ."

The CCC doesn't get to decide what the LCP means. That's the County's role. And there is no evidence in the record that the CCC consulted the County recently on this issue. The CCC is just interpreting the LCP the way it wants to, ipse dixit. That doesn't fly.

The Commission admits that the LaGrande Tract has been used for OHV recreation since 1982, or nearly 40 years. The public's OHV use over such a long period of time has created a prescriptive easement in the public trust for public recreational use.

Violation of CEQA By Failing to Analyze the Impacts of Eliminating OHV Recreation

The Coastal Act unambiguously protects land suited for oceanside recreation. Pub. Res. Code, § 30221 provides, in relevant part, that "oceanfront land suitable for recreational use shall be protected for recreational use." Land suited for oceanfront recreation is a coastal resource that must be protected. The CCC has authorized dust control measures that will impact the physical environment by eliminating the resource of oceanfront recreational lands. Similarly, Pub. Res. Code, § 30223 provides that "upland areas necessary to support coastal recreational uses shall be reserved for such uses, where feasible." State law protects these areas as coastal resources, and courts characterize these recreation areas as protected "resources." *McAllister v. County of Monterey* (2007) 147 Cal.App.4th 253, 272 ["These policies are designed to protect certain identified resources, including recreation, sensitive habitat, and scenic resources. . . . §§ 30223 [upland recreation] . . . ."]; *Big Creek Lumber Co. v. County of Santa Cruz* (2004) 115 Cal.App.4th 952, 974 ["Chapter 3 policies" are designed to protect certain identified resources, including recreation, sensitive habitat, and scenic resources."].) Impacts to Coastal Act protected areas must be analyzed under CEQA. See *Banning Ranch, supra*, 2 Cal.5th 918, 936 [California Supreme Court invalidated a permit because the city failed to recognize its dual obligations to address "environmentally sensitive habitat areas" under both the Coastal Act and CEQA.]

Here, the CCC staff completely disregards its obligation to protect coastal recreational areas by banning OHV at a park expressly established to facilitate and promote OHV recreation.

The CCC Erroneously Justifies Its Actions Based on False Environmental Justice Claims, and Based on Statutes That Are Unconstitutional and Illegal

The CCC justifies, in part, its ban on OHV recreation on Pub. Rec. Code § 30604(h): "When acting on a coastal development permit, the issuing agency, or the Commission on appeal, may consider environmental justice, or the equitable distribution of environmental benefits throughout the state."

Pub. Res. Code § 30107.3(a) defines "Environmental justice" as "the fair treatment and meaningful involvement of people of all races, cultures, and incomes and national origins with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. (b) "Environmental justice" includes, but is not limited to, all of the following: (1) The availability of a healthy environment for all people.
(2) The deterrence, reduction, and elimination of pollution burdens for populations and communities experiencing the adverse effects of that pollution, so that the effects of the pollution are not disproportionately borne by those populations and communities.(3) Governmental entities engaging and providing technical assistance to populations and communities most impacted by pollution to promote their meaningful participation in all phases of the environmental and land use decision making process. [and] (4) At a minimum, the meaningful consideration of recommendations from populations and communities most impacted by pollution into environmental and land use decisions."

The CCC asserts that "while Park users gain a unique form of coastal recreation, it comes at a cost that disproportionately impacts underserved communities. This presents a textbook case of environmental injustice." The CCC then uses this in part to justify ending OHV recreation at Oceano Dunes.

This analysis is flawed, unlawful and is not supported by substantial evidence.

The core error is the CCC's assertion that Oceano Dunes disproportionately impacts underserved communities.

First, the CCC fails to define "underserved" communities, and, in any event, that is not the correct legal standard for considering "environmental justice." Pub. Rec. Code § 30604(h) allows the CCC to "consider" "environmental justice." Pub. Res. Code § 30107.3 which defines "environmental justice" does not in any way define that term with respect to "underserved" communities, whatever that means.

Second, Pub. Rec. Code § 30604(h) is void for vagueness because it fails to explain in what way the CCC may "consider" "environmental justice" in evaluating a permit. Clearly, the CCC may not balance "environmental justice" considerations against other Coastal Act policies, which is what the CCC did here. Even if balancing was allowed, Pub. Res. Code § 30007.5 requires that policy conflicts be resolved in a manner that on balance is most protective of significant coastal resources, i.e., coastal recreation resources. The CCC failed to do that here. In addition, § 30007.5 mandates that the broader policy of concentrating development is more protective overall of coastal resources rather than singling out other policies. The CCC ignored that this park was created in order to focus OHV recreation at a single location rather than having it spread up and down the coast in SLO and neighboring counties. Statutes "must provide a standard or guide against which conduct can be uniformly judged by courts and administrative agencies." *Morrison v. State Board of Education* (1969) 1 Cal.3d 214, 231. Where the terms of a statute are so vague as to not give sufficient notice of what precisely is permitted or prohibited, this vagueness is a violation of due process. Here, Pub. Rec. Code § 30604(h) allows the CCC to "consider" "environmental justice," but fails to provide any standards for how the CCC is supposed to do that or how the policy relates to other Coastal Act polices, or other applicable state laws.

Likewise, Pub. Res. Code § 30107.3 is void for vagueness. The terms "fair treatment" and "meaningful involvement" are so vague and subjective that no reasonable person can know what they mean or how the terms will be applied. See *Haynes v. Level 3 Commc'ns, LLC*, 167 F. App'x 712, 715 (10th Cir. 2006)[recognizing that "[a]ssurances of fair treatment . . . are unenforceable" in the context of promissory estoppel]; *Michaels v. BJ's Wholesale Club, Inc.* (D.N.J. June 19, 2014, No. 2:11-05657 (KM)(MCA)) 2014 U.S.Dist.LEXIS 83980, at *52.)[The term "fair treatment" is too vague to permit contract enforcement.]; *Vasey v. Martin Marietta Corp.*, 29 F.3d 1460, 1465 (10th Cir. 1994)[Assurances of fair treatment are unenforceable.]; *Rood v. General Dynamics Corp.*, 444 Mich. 107, 141, 507 N.W.2d 591, 608 (1993)[promise of fairness, without more, is too vague to judicially enforce.]; *McGlynn v. New Jersey Public Broadcasting Authority* (1981) 88 N.J. 112, 175 [With such a vague set of guidelines as "basic fairness" and "fair treatment" the courts will either, like the FCC, abandon their role completely, or ultimately become, in effect, the arbiter of what is fair and equitable in campaign coverage.]

Third, and related to the second point, Pub. Rec. Code § 30604(h) "impermissibly delegates basic policy matters to . . . judges, and juries for resolution on an ad hoc and subjective basis, with the attendant dangers of arbitrary and discriminatory application." *Grayned v. City of Rockford,* 408 U.S. 104, 108–109 (1972); see also *Yakus v. United States*, 321 U.S. 414, 426 (1944) ["A delegation is overbroad . . . if we could say that there is an absence of standards for the guidance of the Administrator's action, so that it would be impossible in a proper proceeding to ascertain whether the will of [the legislative branch] . . . has been obeyed."] "An unconstitutional delegation of authority occurs when a legislative body (1) leaves the resolution of fundamental policy issues to others or (2) fails to provide adequate direction for the implementation of that policy." *Carson Mobilehome Park Owners' Assn. v. City of Carson* (1983) 35 Cal.3d 184, 190. See also *Bayside Timber Co. v. Board of Supervisors*, 20 Cal. App. 3d 1 (1971) ["(1) truly fundamental issues should be resolved by the Legislature, and (2) that any grant of legislative authority must be accompanied by safeguards adequate to prevent its abuse. Lacking the required safeguards such a grant of authority is an unconstitutional delegation of legislative power.]

Here, Pub. Rec. Code § 30604 has no standards or "safeguards to prevent its abuse" to guide CCC consideration of environmental justice. That violates the nondelegation doctrine, rendering the statue unconstitutional and unlawful. Pub. Res. Code § 30107.3 has the same flaw.

Further, a violation of the nondelegation doctrine cannot be cured by agency regulation or some other effort by the agency to adopt in its discretion a limiting construction of the statute.

Fourth, data shows that the communities that the CCC claims are being harmed by Oceano Dunes are not principally Hispanic communities (or any minority community), and therefore, there is no unfair treatment or burden on that community. Nor are the "effects of the pollution . . . [being] disproportionately borne" by the Hispanic community.

The CCC asserts that Oceano and Nipomo are underprivileged communities "disproportionately" impacted by OHV use at Oceano Dunes. The CCC claims that poorer and more Hispanic/Latino communities are suffering the most from adverse air quality.

The statement that Oceano and Nipomo are disproportionately affected can be tested. These communities, by location and demographics, can be checked via the United States Census – both the Decennial Census for locations and the American Community Survey 2018 5-Year Data for demographics. As another proxy for poverty, home values can be compared from Zillow.com and the American Community Survey 2018 5-Year Data.

Oceano Census Designated Place exists mainly (>85%) outside of the high-PM10 air monitor forecast zones. The part of Oceano CDP within the Nipomo Mesa 2 and NRP forecast regions exists within a Census Block Group that extends beyond that portion, but that Block Group has a federal poverty rate of <11%. The median home value is $738,000, more than double that of Oceano as a whole ($350,700) and greater than the median value of owner-occupied housing units in the San Luis Obispo-Paso Robles-Arroyo Grande, CA Metro Area of $537,900. The percent of population of Hispanic/Latino origin in the Block Group is 4.3%, as compared to Oceano as a whole at 44.6%. The area affected by air quality issues is not representative of the Oceano Census Designated Place. In this case, whiter and wealthier denizens of Oceano are disproportionately affected by adverse air quality.

Nipomo is mainly (>85%) in the high-PM10 air monitor forecast zones, and is 41.5% Hispanic/Latino. However, the CCC neglected to mention the 0% poverty rate and high median home value "adjacent and downwind" communities of Blacklake ($716,000, 7.5% Hispanic/Latino), Callender ($677,500, 28% Hispanic/Latino), and Woodlands ($761,800, 4.7% Hispanic/Latino) which exist fully within the high-PM10 air monitor forecast zones and are geographically closer to the sand dunes.

As a proportion of those communities affected as compared to San Luis Obispo County as a whole, which is 22.9% Hispanic/Latino and has a poverty rate of 12.7%, there is a disproportionate impact to communities with less Hispanic/Latino proportion, lower poverty rates, and higher home values. As a proportion of population impacted compared to the average for San Luis Obispo County: ~32.2% Hispanic/Latino – higher than the average & ~7.5% poverty rate – lower than the average.

Thus, the entire basis for the CCC's environmental justice analysis stems from the demonstratively false premise that underprivileged communities are "disproportionately" impacted by OHV use at Oceano Dunes. The CCC's assertion is not supported by substantial evidence or the law.

Further, the CCC's analysis of environmental justice is filled with falsehoods and wrongheaded statements.

On Page 6, the CCC writes: "Here, the beaches fronting the community of Oceano are given over to vehicles, and general non-vehicular beachgoing activities are thus significantly curtailed." That statement ignores that Pismo State Beach is part of this complex and the portion of Pismo State Beach north of Grand Avenue is closed to vehicle traffic. This provides miles of walking and beach enjoyment without any vehicle interference. In addition, the Pismo Dunes Natural Preserve is a 695-acre subunit of Pismo State Beach with undisturbed sand dunes, dune slack, and freshwater wetlands. The preserve extends from the south bank of Arroyo Grande Creek south to the northern boundary of Oceano Dunes SVRA. It is bounded on the west by the seaward toe of the foredune at Pismo State Beach. The preserve is open to pedestrian and equestrian access and closed to vehicle use. There also is a 70-acre Pismo Lake area inland of and disconnected from the rest of Pismo State Beach that is open to the public, and where vehicles are prohibited.

When staff makes statements like tribes want what the law requires, the CCC is being selective about what laws it applies. The law also requires the preservation of coastal OHV activities, but the CCC ignores those laws.

In a similar fashion, when the staff it wants to assess the CDP in terms of the needs of disadvantaged communities and cultures, it ignores the OHV community and culture. The Merriam-Webster dictionary defines "culture" to mean "the characteristic features of everyday existence (such as diversions or a way of life) shared by people in a place or time." Thus, there is a clear and long-standing OHV culture at Oceano Dunes. (See attached power point.) But the CCC ignores that culture. It deems other cultures more important. It has no such authority.

On page 111, the CCC writes: "Conversely, OHV proponents raise concerns regarding impacts to their culture and traditions if their use of the only vehicular recreation area on the immediate coast of California were further restricted or prohibited. They cite the low day use fees ($5 for street-legal vehicles) and low overnight camping fees ($10) as a Coastal Act priority use, and say that passive beach use can easily coexist with vehicles, and that non- vehicular users also have other options on the coast. And, because OHV use at the Park predates some of the downwind residential development, some have said the impacted residents in those underserved communities should adjust or move. Ultimately, they argue that 'access for all' needs to extend to access for vehicular/OHV enthusiasts." But then the CCC doesn't explain adequately why it isn't protecting that culture under the "environmental justice" rubric.

It says: "Their contention raises the central question of how the Commission should weigh competing claims of environmental justice. The answer can be found in Section 30107.3 of the Coastal Act. In enacting that section, the Legislature's intended goal was to provide for:

'The availability of a healthy environment for all people, [and] The deterrence, reduction, and elimination of pollution burdens for populations and communities experiencing the adverse effects of that pollution, so that the effects of the pollution are not disproportionately borne by those populations and communities.'

"People from all backgrounds enjoy motorized recreation at the Park, including some who come from underserved communities. But this does not provide justification for continued OHV use in the dunes, because the activity itself is what is causing the disproportionate burdens to the local underserved communities. The benefits of recreation neither justify nor negate the burdens they cause for others. Nor can other inequities experienced by residents from underserved communities further inland be mitigated by the imposition of burdens on another environmental justice community nearer the coast."

Section 30107.3 is unlawful for the reasons set forth above. But even if it's not, it provides no basis for selecting certain other communities and cultures over the OHV culture. Friends disputes that OHV creates dust emissions, but rather it is a natural occurrence. But, in any event, the OHV riders experience the same dust as everyone else. And the adjacent communities also benefit economically from the OHV activity.

You could eliminate all pollution by closing the beach and park not only to OHV, but to all humans, regardless of the activity. But the environmental justice laws don't authorize the override of other statutory mandates such as the operation of an OHV park that has existed for decades, with the express purpose of concentrating the activity at one location because, on balance, focusing the activity at one location minimizes impacts compared to allowing the activity throughout a county or a region. Both the Coastal Act and the SVRA Act mandate that approach. Since the Coastal Act and the SVRA Act mandate that approach, the CCC cannot then use that concentration as justification for eliminating the lawful activity. That's what the CCC is doing here. It basically says "environmental justice," as vague as that term is, trumps all other state law. Nope. The Legislature never intended such a result.

To the extent that the environmental justice statutes are enforceable, the CCC fails to treat the OHV culture and community fairly with respect to the enforcement of environmental laws including the Coastal Act and endangered species laws. As noted herein, there has been a long history of bias by the CCC against OHV at Oceano Dunes.

The CCC Has a Pattern and Practice of Violating CEQA and the Coastal Act

One of the fundamental purposes of the CEQA process is to provide public agencies and the public with detailed information about the effect which a proposed project is likely to have on the environment, and to mitigate or avoid any significant impacts whenever feasible. Moreover, "[o]nly through an accurate view of the project may the public and interested parties and public agencies balance the proposed project's benefits against its environmental cost, consider appropriate mitigation measures, assess the advantages of terminating the proposal and properly weigh other alternatives." *City of Santee v. County of San Diego* (1989) 214 Cal. App. 3d 1438, 1454.

The CCC has a pattern and practice dating back to 2013 of violating the Coastal Act and CEQA when purporting to approve dust control measures at Oceano Dunes SVRA.

Beginning in 2012, State Parks began efforts to implement Rule 1001 dust monitoring and control measures through a dust control project/program.

That year, State Parks began implementing a series of seasonal dust control measures. To evade the Coastal Act's requirement for a regular coastal development permit, State Parks applied for annual "emergency" permits from 2013-2016 from the Respondent and Defendant CCC. The CCC granted these emergency permits each year, 2013-2016. In a separate pending lawsuit, San

Luis Obispo County Superior Court Case No. 16CV-0160, Petitioner Friends challenged the CCC's authority to issue an "emergency" permit for the 2016 seasonal activities, rather than a regular coastal development permit which requires a public hearing and public comment. That lawsuit is pending. The CCC 2013-2016 approvals reflect the agency's pattern and practice of approving dust control measures in a piece-meal fashion without a regular coastal development permit as required by the Coastal Act for all development within the coastal zone.

In 2017, State Parks failed to apply to the CCC for any type of coastal development permit for additional seasonal dust control measures. Unilaterally, the CCC issued an illegal March 29, 2017 determination that a coastal development permit was not required because the seasonal measures constitute abatement of a public nuisance. In a separate pending lawsuit, San Luis Obispo County Superior Court Case No. 17CV-0267, Petitioner Friends challenged the CCC's authority to waive the permit requirement based on nuisance abatement because the statute that the CCC relied upon does not apply to special districts like the Air District, or State Parks. The CCC 2017 waiver reflects the agency's continuing pattern and practice of approving dust control measures in a piece-meal fashion without a regular coastal development permit as required by the Coastal Act for all development within the coastal zone.

Pressed by Friends to stop relying on these illegal maneuvers, State Parks finally pursued a regular coastal development permit from the CCC for the dust control measures.

State Parks' first application to the CCC for a regular coastal development permit was for approximately 100 acres of dust control. However, on September 14, 2017 – years after State Parks submitted its application to the CCC – the CCC staff unilaterally enlarged the scope of the coastal development permit authorization. The CCC staff recommended for the first time that the coastal development permit authorize a vastly expanded version of the dust control measures. Specifically, the CCC staff proposed changing the permit by massively expanding the dust control measures in the following ways: (a) eliminating the setback and exclusions in the project area that State Parks had imposed expressly to avoid take of sensitive species, including the endangered California least tern, and adverse impacts to that bird's habitat; (b) removing any limitation on the amount of acreage of vegetation (or seasonal measures such as wind fencing), i.e., eliminating the cap on annual acreage (20 acres of vegetation and 40 acres of seasonal measures), and dispensing with the total acreage cap of 100 acres over five years, allowing for unlimited acreage if deemed "necessary"; and (c) allowing the dust control measures to be installed closer to the shore and within foredunes even though those areas are deemed sensitive habitat. The CCC staff report described these changes as a "slight" modification to State Parks' application. So, while State Parks carefully crafted a proposal to achieve dust emission reductions, while at the same time avoiding take of the California least tern, or adverse modification of the bird's sensitive habitat, the CCC threw out these environmental protections, and instead authorized dust control measures to be placed literally anywhere in Oceano Dunes SVRA, with no limitations on the amount or location of dust control measures so long as the Air District determined that its placement was "necessary." The CCC also disregarded express findings in State Parks' 2017 EIR for the dust control measures that expanding the measures in such a way would result in significant additional environmental impacts, including impacts to recreational resources and the California least tern and its habitat. The CCC issued a 159-page staff report that recommended that the permit authorize this expanded version of the dust control program.

On September 14, 2017, the full Coastal Commission held a hearing on the coastal development permit application and the expanded dust control program recommended by the CCC staff.

Friends filed a legal challenge to the CCC's approval on the basis that the CCC expanded the dust control authority without studying the environmental impacts of that expansion as required by CEQA. In *Friends of Oceano Dunes v. Coastal Commission*, Case No. 17cv-0576, San Luis Obispo County Superior Court, the Court issued a Final Judgment and Peremptory Writ of Mandate on February 26, 2020 commanding the CCC to set aside its approval and permit. State Parks never proposed the massive expansion that the CCC purported to approve in September 2017. Rather, State Parks had proposed a more modest 100-acre dust control project, and the CCC insisted on trying to give it expanded authority.

In response to the adverse ruling by the Court, State Parks and the CCC agreed behind the scenes that the CCC would step back from its massive expansion, and instead approve a modified version of State Parks' initial 2017 100-acre dust control proposal. But in that modified project, the CCC refused to study the reasonably foreseeable expansion of the dust control measures. Thus, the full Commission had incomplete information on the full extent of the environmental impacts on the likely enlarged scope of dust control measures. This also misleads the public as to the full environmental and coastal recreation resource impacts.

Again, in 2020, the CCC approved an expanded project without evaluating the environmental impacts of all reasonably foreseeable expansions of the dust control measures, again, seeking to avoid its CEQA obligations, and in a way that ignored the Coastal Act's protections of recreational resources.

Now, in modifying drastically at the last minute the proposed PWP, the CCC has violated CEQA's mandate to maintain a stable project description, failed to study impacts to recreation, and side-stepped the Coastal Act's protections for recreational resources.

The CCC's repeated conduct and refusal to comply with the Coastal Act and CEQA irreparably harms and will continue to irreparably harm Petitioner and the public in that the CCC's actions expose Friends, its members and the public to environmental degradation of the natural and recreational resources at Oceano Dunes SVRA due to the CCC's failure to evaluate, understand, and mitigate the impacts of the dust control measures, including impacts to coastal recreation resources, ESHA and sensitive species and their habitat.

The Dust Control Measures Have Much Greater Impacts on Sensitive Species Than OHV Recreation

Evidence shows that the dust control measures have much greater impacts to sensitive species than OHV recreation.

The entire 48-acre dust control area is located within critical habitat for the western snowy plover. Dr. Rob Roy Ramey has concluded in two reports that the expanded vegetation even in the general vicinity of plover and the least tern nesting will result in increased take of those species due to protective cover provided to predators of the birds. State Parks itself concluded in the 2017 EIR that increased take would occur with the placement of vegetation in or near WSP or CLT nesting habitat.

The CCC also rejected core design elements and mitigation measures that State Parks proposed in 2017. For instance, the CCC eliminated State Parks' design feature/mitigation measure of prohibiting planting new vegetation within 1,100 feet of the shoreline. State Parks proposed this in order to avoid the most active habitat of protected shorebirds such as the California least tern. See AR 1423 ["Planting vegetation in this critical habitat area could impact active nests by providing habitat for predators to hide and stalk nesting . . . California least terns . . . . The proposed Dust Control Program largely avoids this impact by setting back the Program area at least 1,100 feet from the mean high tide line and avoiding USFWS critical habitat areas."] The CCC abandoned this proposed 1,100 foot setback by authorizing dust control measures in the 48-acre are that is directly in WSP critical habitat and CLT occupied habitat.

In addition, there is concrete evidence at Oceano Dunes that placing dust control measures, i.e., vegetation, on dunes causes significant depressions on the backside of the vegetation due to wind action. This destabilizes the dunes. The CCC ignores this, provides no countervailing evidence, and fails to adequately consider an important relevant factor. In doing so, the CCC violates the Coastal Act by failing to protect against disruption of habitat values and degradation of ESHA. Pub. Res. Code § 30240.

Conclusion

As detailed above, the CCC's proposed action exceeds its authority, is arbitrary and capricious, fails to proceed in a manner required by law, is not supported by substantial evidence, and prejudicially abuses its discretion.

For all these reasons, the full Commission should reject staff's effort to ban all OHV and the CCC should re-engage with Parks to develop the PWP, as the CCC repeatedly said it would during the past 3 years.

Sincerely,

/s/

Tom Roth

Cc: Jim Suty, President, Friends of Oceano Dunes

Supporting document submission sent under separate cover

March 8, 2021

Dear Chair Padilla and Commissioners,

Concerned Citizens for Clean Air previously sent you a letter dated February 24, a copy of which is attached, in strong support of your staff's proposal for the future of the Oceano Dunes. For the first time in decades, the Coastal Commission has the chance to right so many wrongs, to heal the long-standing assault on the Coastal Act, the fragile coastal environment, coastal wildlife, tribal lands, and public hands. Our first letter primarily concerned the air quality issue, which is important but not the whole story when it comes to the SVRA.

As the staff report documents, the long standing issues of: 1) damage to the coastal resources; 2) neglect of the unincorporated community of Oceano ; 3) Environmental Justice issues in Oceano and Nipomo; and 4) failure to address the concerns of the Northern Chumash are equally important.

There is no explanation for why the California Department of Fish and Wildlife and the United States Department of Fish and Game have failed to enforce the regulations related to the threatened and endangered species under its purview. The "suggestions" they have made in the past have and will continue to be ignored by State Parks. It is very fortunate that the Coastal Act contains stronger provisions for protecting these plants and animals. We strongly urge you to do so.

Despite all the millions of dollars the sport of off-roading is reported to bring to San Luis Obispo County, that money does not "trickle-down" to the residents of Oceano. There is one park, few sidewalks and fewer crosswalks. Real improvements will probably not occur until the current patterns of use are changed. You have the ability to make that change.

The Northern Chumash have been in this fight longer than any of us. They have consistently asked for protection of their sacred sites. They feel the Commission has not consulted with them sufficiently in the past. Vehicles disturb the sacred natural spaces, which should be cherished along with their rich history. The recommendations take steps to remedy this.

Lastly, after further consideration, we encourage you to consider a **three-year phase-out** of vehicles on the dunes instead of your staff's suggested five years. This time frame would coincide with the ending of the Stipulated Order of Abatement, in December 2023. If the air quality improvements are not achieved, the Grand Jury recommended the closure of the La Grande Tract by the Board of Supervisors. A three-year phase out would end in March or April 2024, thus negating the need for Board of Supervisors' action. Further, it is hard to imagine why State Parks would need more than three years to simply post signs for no vehicle travel south of Pier Avenue and to arrange beach camping north of Pier Avenue.

Given State Parks OHV Division's inclination to change directors, we strongly recommend nailing down the transition process now. As we have seen with the draft PWP/EIR and Habitat

Conservation Plan; 18 months becomes 24 months, becomes 36 months and then you get a plan that is totally unacceptable. Do not give them the opportunity to run out the clock for five years and then ask for another five-year extension.

Many thanks to the staff for the excellent report and recommendations. We are looking forward to the Commission finally bringing this park into compliance with the Coastal Act and all other laws and regulations. Thank you for your consideration.

Arlene Versaw and Rachelle Toti
Co-founders of Concerned Citizens for Clean Air

Concerned Citizens for Clean Air

February 24, 2021

Dear Director Ainsworth and Coastal Commissioners,

Concerned Citizens for Clean Air is in full support of your staff's recommendations and the five-year phase-out proposal.

After 11 years of fighting for clean air, countless meetings and very slow progress, we were shocked to read this paragraph on page 95, footnote 104 of the staff report: "In 1977, State Parks published a study conducted by an interdisciplinary team of University scientists on the threats to Inglenook Fen and Ten Mile Dunes in Mendocino County, now McKerricher State Park. The study found that under natural conditions, dune surfaces slowly build a surface armor of grains too large to be entrained by wind. OHVs break and churn this protective crust and expose smaller particles that are entrained by prevailing winds, promoting erosion of the dunes. The report recommended that OHV use be prohibited, and a subsequent management plan reflected that determination."

Thus, it is clear that State Parks knew all along that it was destroying the dune surface in the Oceano Dunes SVRA. Yet, from 2010 to the present State Parks staff has denied any causal relationship between OHV activity and our air pollution!

Enough is enough. CCCA has tried for 10 years to get mitigation installed and co-exist with the OHV park. Now we see that will never happen. The 2021 mitigation is **temporary** and is arriving 5 months late. State Parks' original options for this year included NO mitigation in the riding area at all. See four options attached. The Air Pollution Control District, which approved **temporary** mitigation appears to be exhausted by the intransigent opposition to any restoration in the most emissive areas.

According to the Commission's staff report, 156 acres have been closed in the past two years. The Stipulated Order of Abatement agreement runs for about two and a half more years and it may take 500 or more closed acres to reach the SOA's goal of achieving a 50% reduction in emissions. Yet this year's mitigation is only "**temporary**", which tells you all you need to know. State Parks OHV Division is leaving the door open to remove as much vegetation as possible once the Hearing Board oversight ends.

It would like to end the Commission's oversight as well. It would like you to agree to let it work things out with the APCD, California Department of Fish and Wildlife and the U.S. Fish and Wildlife Department on its own. You see how well that has worked out for us (residents), the Plovers and Steelhead so far.

We clearly remember the emails and public testimony at your meetings in 2015, 2017 and 2019. Our friends and neighbors came before you and spoke of their breathing difficulties, lung problems, and new medications. Some of those people are now dead.

Approve the motion to implement staff recommendations. Begin the phase out immediately by including a yearly reduction in the number of vehicles allowed south of Pier Avenue. This will slowly improve the dune surface, so at the end of five years, we have less dust emissions.

Sincerely,
Arlene Versaw and Rachelle Toti
Concerned Citizens for Clean Air

Cc: SLO County Board of Supervisors
SLO County Air Pollution Control Board
Richard Corey, Calif Air Resources Board

Submitted via email

Th3

California Coastal Commission
c/o Central Coast District Office
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Santa Cruz, CA 95060
OceanoDunesReview@coastal.ca.gov
ExecutiveStaff@coastal.ca.gov

RE: Support for Staff Recommendations for Oceano Dunes Coastal Development Permit Review 4-82-300, Condition Compliance, Special Meeting March 18, 2021, Item 3

Dear Coastal Commissioners,

On behalf of the members, staff and supporters of the Center for Biological Diversity (Center), we submit these comments in support of the California Coastal Commission staff recommendations for Oceano Dunes CDP Review, Condition Compliance, Special Meeting March 18, 2021, Item 3.

The Center is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 1.7 million members and online activists throughout California and the United States, including individuals who visit and enjoy the ODSVRA for recreational, wildlife observation, scientific, and other purposes. The Center has worked for many years to protect imperiled plants and wildlife, open space, air and water quality, and overall quality of life for people and wildlife in San Luis Obispo County in general and has been actively engaged in efforts to protect imperiled species and their habitats in and near the Oceano Dunes State Vehicular Recreation Area (ODSVRA). The Center also joined the letter from the Stanford Environmental Law Clinic dated March 5, 2021, which addresses State Parks' erroneous claims that the No OHV alternative would conflict with State Park's legal mandates to prioritize OHV use and would require a reclassification of the park.

Because of ongoing bird mortalities—primarily from vehicle strikes—to federally threatened snowy plovers, in October 2020 the Center filed a lawsuit in federal court against the California Department of Parks and Recreation for violations of Section 9 of the federal Endangered Species Act for taking western snowy plovers at ODSVRA. Although State Parks is in the process of preparing a federal Habitat Conservation Plan (HCP) under Section 10 of the federal Endangered Species Act and accompanying NEPA/CEQA reviews, those draft documents make it clear that the proposed HCP will not only perpetuate the taking of snowy plovers, but will also unlawfully reduce protections for listed species and habitats.

Proposed Special Conditions to Coastal Development Permit Terms and Conditions

The Center strongly supports the Coastal Commission staff recommendations for new Special Conditions in the Coastal Development Permit (CDP) terms and conditions, to protect coastal resources. These include the following special conditions:

(1) Eliminating all OHV use at the ODSVRA, with a five-year transition period to complete phase-out.

(2) Providing a new, accessible vehicular beach camping area between West Grand and Pier Avenues, while providing limited access for hike- and bike-in camping in the southern part of the ODSVRA, consistent with the extensive areas of ESHA in that part of the park.

(3) Immediate closure of the Pier Avenue entrance to the park.

(4) Immediate adoption of the recommended changes identified by the Commission in July 2019, including reducing off-road vehicle use and eliminating exceptions to use limits; making seasonal habitat exclosures permanent and year-round; extending fencing; seasonally prohibiting vehicle crossing of Arroyo Grande Creek; prohibiting night riding; implementing required dust controls; predator management; and increasing enforcement, among other changes.

Many of the staff recommendations address issues that the Center has previously identified in comments to and other communications with State Parks, including:

- The need for greater protections for the sensitive and threatened species by increasing the protected areas for the species during breeding season and protecting non-breeding season loafing and resting areas;
- Eliminating vehicular crossings of Arroyo Grande Creek to protect water quality and habitat for aquatic species including threatened South-Central California Coast steelhead and endangered tidewater goby;
- Establishing a "carrying capacity" cap on the daily number of vehicles that are allowed in the ODSVRA based on the best available science to reduce conflicts with natural resources and endangered species;
- Protection of the Oso Flaco Lake Natural Area including converting the adjacent State Parks land that is currently leased for agricultural purposes into a restoration project that would help to remediate the water quality issues affecting Oso Flaco Lake;
- Protection of dune vegetation to provide habitat for dune species and reduce emissive dust; and
- Managing trash that subsidizes predators which then prey on sensitive species including snowy plovers and least tern eggs and chicks. Reduction of trash in general and preventing predator access to it will reduce predator pressure on plovers and terns. ODSVRA has not adequately ensured adequate trash bins are available that are fully

covered to reduce subsidies to predators or timely and sufficient trash pick-up during and after heavy-use weekends.

The Center appreciates that the staff recommendations appropriately look towards the future and also urges the Commission to consider the effects of climate change and modeled sea level rise when evaluating the need for additional modifications to the operations at ODSVRA to protect coastal resources.

Request for Modification of Special Condition 1

While we strongly support the staff recommendations, we are concerned that the five-year transition period for elimination of all OHV use in the ODSVRA affords State Parks the opportunity for further foot-dragging, which has characterized the entire history of this CDP. The five-year transition period is, in itself, a reasonable period for phasing out OHV use, and it appears the intent of Special Condition 1 is to promote a gradual phase-out. However, without interim milestones or similar terms, we are concerned that no phase-out of use will occur at all, leaving State Parks in a position to exploit its own delay at the end of the five-year transition period and seek relief from the condition.

The Center therefore requests that Special Condition 1 be modified to establish specific milestones or waypoints toward the goal of eliminating all OHV use in the ODSVRA by the end of the transition period through a step-wise phase-out, including specific reductions in numbers of OHVs allowed daily at Oceano Dunes each year starting from no more than the current 1,000 street legal vehicles and 1,000 green vehicles per day allowed under the Phase 2 reopening. If State Parks is unable or unwilling to meet the specific milestones provided by the Commission, the Special Condition should provide that the Oceano Dunes south of Arroyo Grande Creek be closed to all OHV use from March 1 to November 1 each year to protect nesting birds until the phase-out is completed. The annual compliance reports discussed on page 17 of the staff recommendation can be used to measure State Park's adherence to these milestones and allow the Commission to take any needed remedial action.

Proposed Public Works Plan

The Center has serious concerns regarding the proposed Public Works Plan (PWP) initiated by State Parks for both the Pismo State Beach and the ODSVRA to provide "a long-range land use management plan for compliance with the California Coastal Act." The Center is preparing comments on the current draft to be submitted by March 18, 2021. Much like the draft HCP, the draft PWP shows that State Parks does not take seriously the need to protect coastal resources, including rare habitats and imperiled species, in either the short- or long-term or the additional protections that will be needed as climate change affects these costal resources. Because State Parks will not provide the protections needed under the Coastal Act, it cannot be approved in lieu of a CDP.

Conclusion

In conclusion, the Center supports the recommendations in the Coastal Commission Staff Report regarding needed changes to the existing CDP terms and conditions in order to protect vulnerable populations of imperiled species, the coastal strand and dune habitats, and local air and water quality. We urge the Commission to adopt the proposed staff recommended Special Conditions 1-4, with one modification of Condition 1 requiring the establishment of interim milestones subject to the Commission's review through the annual reporting process.

Sincerely,

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March 5, 2021

Thursday, March 18, 2021- Special Hearing
Oceano Dunes State Vehicular Recreation Area Coastal
Development Permit 4-82-300 Review
Support Staff's Recommendations

Coastal Commission Chair Steve Padilla and Commissioners:

Dear Chair Padilla:

The Western Alliance for Nature strongly supports the staff recommendation to uphold the Coastal Act and finally deal with the long history of State Park violations at Oceano Dunes State Vehicle Recreation Area.

Support for the staff is critically important to the entire ecosystem, the law and this Commission's exercise of its legal jurisdiction. We will not delve into the way in which the continued use of Oceano Dunes is inconsistent with the Coastal Act or with impacts on the ecosystem and listed species, those are blatantly obvious and others will deal with them. Our issues deal with the history and legality of the demand by State Parks that you ignore your responsibilities and the Coastal Act.

This has gone on for 40 years, with State Parks always asking for time to deal with the issues. Well the time has now arrived to deal with them particularly since State Parks has made it clear with the PWP that they never intend or intended to meet the law. I was on the Commission 20 years ago when the Commission reviewed the existing "temporary" CDP and State Parks came in and pleaded with the Commission to give them more time and promised to work cooperatively with the Commission. Unfortunately I believed them and voted to do just that. We created the TRT, which has turned out to be meaningless because State Parks never intended it to be anything other than that. We also created a Commissioner Committee of two to work with State Parks. I was one of those two commissioners. We went to Sacramento, met with the Secretary of Resources and a Representative of State Parks who sat there and told us how they were sorry for the delay and would work with us. We discussed what that meant but after that day we never heard from State Parks again. Now we understand why. They never intended to. Their current PWP and legal statements make it clear that they have no regard for the Coastal

Act, Agency cooperation, or the independent authority of any other agency- particularly this Commission - but also Air Quality, Fish & Wildlife, Water Quality. They certainly have no regard for the endangered species act. Most importantly to this Commission are their absurd statements that they don't have to and that their obligation is only to OHV use. The Off-Highway Motor Vehicle Recreation Act (OHV Act) does NOT require that State Parks allow the use of OHV's over all other laws and regulations. Just the opposite and it certainly does not specify where and how much OHV use might be allowed. Your staff has put in requirements that in fact go overboard in allowing OHV use in a park that should have none. It does not eliminate it. It simply puts them in the area where it can do the least damage and cuts down the impacts of the OHV use and places meaningful and realistic conditions on them.

Your staff has covered the Environmental Justice issue well, particularly making it clear that while the OHVers claim that there are individuals from underserved communities among their members, that does not entitle the activity to over-ride the law. It is also unclear as to how many "individuals" that means since there has been no study done and OHV use is an expensive hobby. Regardless, the activity affects the underserved communities surrounding the park and about who can use the park and those activities impact public access. Other uses are precluded by OHV use, particularly without any legitimate controls. While State Parks has no say over what types of flags are flown it is clear that the flying of confederate flags and sexually suggestive ones serve as an impediment to most people of color and families with children. This commission has not allowed anything that in any way impedes public access or tends to discourage the use of public areas. Certainly the flying of these flags serves as more of an impediment than an archway or even a gate. Thus, State Parks is party to allowing the OHVs to create an environmental justice issue as it pertains to public access.

Why would State Parks take the position it has. Why would they deliberately, and it certainly appears deliberate, seek to over-ride all state laws and meaningful public access and environmental protections in favor of OHVs? There is one obvious answer- MONEY. The money comes from registration and user fees and a portion of gasoline taxes paid by off-road vehicle owners. It is a dedicated funding source making off-roaders the park's chief constituency. State Parks Division of Highway Motor Vehicle and Recreation's dedicated funding source creates a relationship that drives management decisions and prioritizes motorized recreation above all else, The OHV division could care less about any other users of the park. That income should not be a concern of yours. It is not a basis for any exemption from the laws and certainly not any basis for an over-ride of the Coastal Act.

Finally, if you do not take a firm stand you will not only abandon your jurisdiction in this instance but set a precedent that any other agency can do what State Parks has done- thumb their noses at this commission and simply ignore your jurisdiction. It is certain to set a precedent. You need to support your staff and take a firm stand and not allow this to continue.

There is one concern we have with the staff conditions. They give State Parks another 5 years to transition to the new entrance and other conditions. That is an escape mechanism that will allow State Parks to continue to evade the issue. They can do nothing in these next 5 years and then come back and ask for more time. This commission should set annual milestones that are required for State Parks to meet. If State Parks does not meet any milestones, then the final conditions should kick in. There should be no ability to extend the permit any longer.

The people of Oceano, the environment and the general public are relying on you to take a meaningful stand and say that enough is enough and approve the permit special conditions.

Sincerely,

Sara J. Wan

Sara J. Wan
Executive Director
Western Alliance for Nature

Cc: Jack Ainsworth
Steve Hudson
Dan Carl
Commissioners Aminzadeh, Bochco, Brownsey, Escalante, Groom, Hart, Rice, Turnbull-Dayna.BochoDSanders, Uranga, Wilson,

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March 12, 2021

Jack Ainsworth, Executive Director, California Coastal Commission
Steve Padilla, Chair of the California Coastal Commission
455 Market Street, Suite 300
San Francisco, CA. 94105

Re: Oceano Dunes State Vehicular Recreation Area

Sent via email to mailto:OceanoDunesReview@coastal.ca.gov

The California Off-Road Vehicle Association (CORVA) has been advocating for off-road and motorized vehicle enthusiasts at all levels of government for 50 years. In addition to California residents, we speak for thousands of visitors who come to our state to enjoy the unique landscapes we have to offer. One of the most unique, and most prized experiences for our community, above all others, is found at Oceano Dunes State Vehicular Recreation Area (ODSVRA). On behalf of the California Off-Road Vehicle Association, our thousands of members, member clubs and associated business sponsors, we would like to express our complete opposition to the staff proposal to phase out off-road recreation at the Oceano Dunes State Vehicular Recreation Area.

CORVA traces its roots back to the area then known as Pismo Beach, where we held our first meeting. Just as every origin story contains reference to a 'sacred place', this area holds an especially important meaning for us as an organization and for our members. We are disappointed that the California Coastal Commission (CCC) staff is calling for the equivalent of its destruction by proposing a loss of access to the area. The material released by staff in preparation for the March 28 meeting is rife with bias and innuendo, conjecture, and hearsay, and in many cases largely lacking in peer-reviewed science. Therefore, we must conclude that the proposal is driven by bias against off-road recreation instead of a scientifically based need for closure.

Additionally, we strongly believe that the staff proposal has purposely misrepresented conditions at Oceano Dunes and failed to recognize the extraordinary environmental work the California Department of Parks and Recreation has undertaken in the park. This includes one of the most successful breeding programs for the Western Snowy Plover among all such programs along the coastline of California. The staff report lacks recognition of this success, along with many other successful environmental programs and protections DPR has

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undertaken at the park in collaboration with the California Department of Fish and Wildlife. This is just one example of Coastal Commission staff either excluding pertinent facts or including misleading information masquerading as fact.

As recently as 2012, courts have determined that off-road recreation is consistent with the California Coastal Act and does not violate ESHA, but staff, in the report, have ignored court-settled opinions in favor of recommending biased actions.

> Per Section 30240 Environmentally sensitive habitat areas; adjacent developments
>
> (a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas.
>
> (b) Development in areas adjacent to environmentally sensitive habitat areas and *parks and recreation areas* shall be sited and designed to prevent impacts which would significantly degrade those areas and shall be compatible with the continuance of those habitat and recreation areas.
>
> This section calls out Parks and Recreation areas as needing special consideration, equivalent to that for environmentally sensitive habitat. Facilities operated by DPR would fall into this category that requires special consideration with respect to activities that occur within them.

With respect to environmental justice and tribal concerns, we contend that there is an opportunity for meaningful improvement in this area, but to tie these vastly different and unrelated issues solely to the elimination of OHV use is a gross oversimplification.

The staff report states on page 6:

> "Park changes that might allow Oceano to capitalize on its beach-fronting location, allowing the community enhanced opportunity for revitalization, including through directly connecting the community to its beach, would bring with it the types of opportunities that help other California beach towns to prosper. Similarly, a Park without OHV use allows for the tribes to access their ancestral and sacred spaces without the noise and habitat degradation that this use brings. In other words, by eliminating vehicular and OHV uses in ESHA, consistent with the Coastal Act and LCPs, there is also the potential to help both the directly inland communities and the five-cities area realize new opportunities for community revitalization and enhancement. Such action would also be consistent with tribal interests and recommendations."

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The above statement is pure speculation and offers no rational connection between the issues of economic revitalization and tribal access and impacts to resources by OHV use. It is difficult to understand what action this paragraph calls for, other than elimination of OHV use. It seems to indicate that economic revitalization of the area will magically occur if OHV use is eliminated.

Later sections of the staff report include a more detailed discussion of various economic impact studies and points out that businesses related to OHV activity may eventually be replaced by those that cater to non-motorized recreation but there no discussion of the actual economics of how this transition would work. With respect to tribal concerns, the Park presently keeps sites of tribal interest fenced off and protected from adverse effects. Tribal concerns are a valid issue and deserve a more in-depth discussion. It is unclear how tribal members would be better able to visit their sites and sacred spaces simply by eliminating OHV use and taking no other action.

Reading the proposal for ODSVRA, it is clear staff chose to define public access and public recreation opportunities by what <u>they</u> deem politically and/or socially acceptable. Merely reading the way staff callously dismisses the importance of access to motorized recreation enthusiasts, we have concluded that motorized travel is a type of recreation staff does not value. But clearly, statute does not allow the CCC or staff to make judgements of this nature, but in reality, statute clearly acknowledges that members of the public recreate in coastal areas in many ways. The staff report also includes various other misinterpretations of statute to justify their proposal that serve to usurp the authority of DPR to manage parks in accordance with their mission.

Among the harshest provisions of the staff report is the recommendation on page 16 that: "the Pier Avenue entrance to the Park be closed immediately and the natural dune and bluff conditions restored." There is no supporting analysis for the closure of this access road such as studies of the effects of displacing a large volume of traffic from this route. This recommendation is clearly unworkable and at a minimum requires further study.

At the same time "Staff recommends a new vehicular beach camping area between West Grand and Pier Avenues, including for ADA vehicle access. Staff recognizes that these unique recreational access opportunities are revered at the Park, including as it is the only State Park in California where such vehicle access and beach camping is allowed." If Pier Avenue is closed what access would there be to this adjacent area for ADA and non-motorized access? There is no detail of how this would work and apparently it will be left up to State Parks to figure this out. Of course, the CCC will need to approve any additional parking or beach access in the area.

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It is unclear with this proposal how the public would obtain access to the entire area of the Park south of Pier Avenue. Without motorized access visitors who wish to engage in water related activities such as surfing, surf casting, and beach walking will have no alternative except to carry all their gear across an expanse of dry sand and as much as several miles down the beach. This will eliminate beach access for all but the youngest and fittest visitors, or those with the resources for equestrian use. Other visitors will need to use the limited vehicular access from Grand Avenue but will not be able to reach areas south of Pier Avenue except using non-motorized equipment. There is some limited access through the community of Oceano via sand trails from Strand Avenue through vacant lots, but there is presently no public beach parking in this residential area. We seriously question the unintended effects closing Pier Avenue without providing any alternative beach access. This action hardly seems consistent with the direction in the LCP or the Coastal Act that indicate a maximum amount of public access should be provided.

> Per section 30001.5 of the California Public Resources Code, part of the responsibility of the CCC is the following: "*Maximize public access to and along the coast and maximize public recreational opportunities in the coastal zone consistent with sound resources conservation principles and constitutionally protected rights of private property owners."*
>
> Additionally, section 30001.2 of the Coastal Act recognizes that; "*… electrical generating facilities, refineries, and coastal-dependent developments, including ports and commercial fishing facilities, offshore petroleum and gas development, and liquefied natural gas facilities, may have significant adverse effects on coastal resources or coastal access, it may be necessary to locate such developments in the coastal zone in order to ensure that inland as well as coastal resources are preserved and that orderly economic development proceeds within the state."*

The above sections acknowledge that some coastal areas may be managed with different criteria because their operations and purposes are critical for the economic wellbeing of residents and communities in California. The intent of this section is to allow the CCC to recognize their inherent importance. Certainly, a valued and widely popular State Park deserves the consideration the above statute allows. Yet nowhere is this represented in the proposal as staff appears to desire above all else that ODSVRA be closed to OHV use.

The importance of ODSVRA cannot be underestimated to the local community. If the proposal as written should be unwisely adopted at the March 18h meeting, responsibility for the resulting detriments to gas stations, restaurants, motels and hotels, supermarkets and all other businesses in the area would fall squarely on the shoulders of the CCC.

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It is unconscionable how staff of the CCC appear to easily dismiss the consequences of their proposal by paying little attention to the negative effects it will have to the small cities surrounding ODSVRA and their ability to fund schools and local facilities. The pervasive attitude of "this isn't my problem" inherent in the document cannot be overlooked.

These are specific areas of the proposal we find significantly inadequate:

1. Page 30 of the ODSVRA Review Report contains an unacceptable amount of conjecture and hypothesis in 'suggesting' that the South County Coastal Area Plan, a component of the LUP that was adopted in 1984 calls for limiting riding and access in the La Grande Tract and is reinterpreting components of the plan to support their proposal.

2. There is only one report from the Technical Review Team (TRT) available on the CCC website which, contrary to the ODSVRA Review Report, does not indicate the need for establishing a permanent exclosure area. Rather the one TRT report on the website indicates they did not feel that establishing a permanent exclosure was necessary.

3. With respect to the Arroyo Grande creek crossing, State Parks currently does not allow vehicles to cross the creek when it flows, so Parks seems to have accepted this condition, but reserves the right to study how to better manage the creek crossing, which seems reasonable. In fact, this approach seems more reasonable than an inflexible seasonal closure that was previously suggested at the January 12, 2017 and hearing the CCC approved Condition #5, which was based on recommendations from NOAA Fisheries In those recommendations, NOAA slightly revises DPR's operating guidelines with respect to the Creek. Staff's view at the time was that these recommendations are reasonable steps to address potential problems and are closely related to current DPR actions. Yet there is no explanation in the 2019 report for the rejection of this recommendation and imposition of a seasonal closure in its place.

4. The LCP clearly carves out the Dunes as an SVRA despite it being in a Sensitive Resource Area.

5. According to statute, the CCC has broad discretion how to manage activity in an ESHA. The interpretation presented in the ODSVRA Review Report is redefining allowable activities to align with the ideological bias presented by staff that support the proposal for eventual closure.

6. The proposal made to reduce numbers of entrants has no scientific basis, and more than when the original numbers were set, which were based on historical use. There

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are no studies cited to indicate ODSVRA can no longer accommodate the same numbers.

In the proposal calling for closure of ODSVRA, staff of the CCC has redefined, reinterpreted and almost rewritten historical documents to support their viewpoints. It is an attempt by staff to hoodwink the public into accepting what we contend is just a point of view. Citations from court cases involving developers throughout the Review Report mislead the public into equating recreation and public access in a State Park with private for-profit development. The two are not the same, nor should they be presented as such, as it is highly disingenuous. Throughout the report, staff has engaged in the not-so-subtle denigration of the millions of recreationists who visit Oceano Dunes every year by encouraging and repeating propaganda. This behavior is inconsistent with the values of the State of California and is specifically unbefitting behavior by representatives of an agency purported to represent all Californians.

As an organization representing citizens of California, it is abhorrent and alarming to us, that the Coastal Commission would choose to battle against another state agency rather than work together to facilitate solutions. The staff report was obviously prepared over a considerable amount of time, using a considerable amount of taxpayer resources. This report undermines a highly regarded state agency, ignores the importance of that agency's work and ignores DPR's stated mission to the people of California.

In summary, we believe that this proposal violates the very reason the CCC was created – to insure access to coastal areas to the public. The form of recreation is not up to the CCC to find politically correct.

Public Resources Code section 30320(a) and (b) state the CCC must adhere to the following mandates:

> *The people of California find and declare that the duties, responsibilities, and quasi-judicial actions of the commission are sensitive and extremely important for the well-being of current and future generations and that the public interest and principles of fundamental fairness and due process of law require that the commission conduct its affairs in an open, objective, and impartial manner free of undue influence and the abuse of power and authority.*
>
> *It is further found that, to be effective, California's coastal protection program requires public awareness, understanding, support, participation, and confidence in the commission and its practices and procedures. Accordingly, this article is necessary*

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to preserve the public's welfare and the integrity of, and to maintain the public's trust in, the commission and the implementation of this division.

…Reasonable restrictions are necessary and proper to prevent future abuses and misuse of governmental power so long as <u>all members of the public</u> are given adequate opportunities to present their views and opinions to the commission through written or oral communications on the official record either before or during the public hearing on any matter before the commission.

We contend that the proposal for ODSVRA has not complied with the above mandate. Instead, the proposal has ignored the interest of a significant portion of the public as well as the fundamental principles of fairness and has released a draconian proposal in a manner that is neither open, objective, impartial nor free from influence.

The staff report lacks:

- Public Awareness
- Support
- Understanding
- Participation
- Public Trust

Because the proposal to phase out off-road recreation in Oceano Dunes is neither environmentally necessary nor fiscally responsible, the only conclusion we are left with, is that this recommendation is politically motivated. Therefore, CORVA calls for this proposal to be rescinded and repudiated immediately.

On behalf of the Board of Directors,
CORVA, California Off-Road Vehicle Association

Amy Granat
Managing Director

March 12, 2021

California Coastal Commission
725 Front Street, Suite 300
Santa Cruz, CA 95060

RE: Oceano Dunes Coastal Development Permit 4-82-300 Review – **Th3**

Dear Commissioners:

Please accept these comments from AMA District 36 (D36), a non-profit recreation group, in regards to agenda item Th3 being presented at the California Coastal Commission (CCC) hearing on March 18, 2021.

D36 strongly opposes the CCC staff recommendation to phase out OHV use at the Oceano Dunes State Vehicle Recreation Area (ODSVRA). D36 believes that CCC staff continues to base their "close the park to OHV use" proposal on a false narrative that strangely ignores various and highly successful conservation efforts at ODSVRA including their nationally recognized snowy plover and least tern breeding programs.

On September 14, 2017, CCC executive Director Jack Ainsworth stated, "The vehicular park is allowed under statute." The Coastal Commission does not have the authority to phase out the legislatively designated off-highway vehicle park."

D36 believes a vote to approve the CCC staff recommendation places the agency in legal jeopardy by precipitating a much anticipated flurry of legal filings by OHV interests to challenge that decision. There is apparently an agreement between California State Parks and the CCC to use OHV Trust Funds monies to cover legal costs incurred by the CCC in defending any decisions related to OHV use at the ODSVRA. If true, a vote in support of the proposed phase-out of OHV would be highly unethical and an abuse of the OHV Trust Fund.

D36 appreciates your review of this comment letter and urges the CCC to reject the staff proposal.

Respectfully submitted,

Don

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Government Affairs
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cc: CA State Parks
CA Off-Highway Motor Vehicle Recreation Commission

Friends of Oso Flaco Lake

(located along the southern coast of San Luis Obispo County)
Find Us on Facebook!

February 18, 2021

California State Parks ODSVRA
(via OceanDunes.PWP.EIR@parks.ca.gov)
California Coastal Commission
(via OceanoDunesReview@coastal.ca.gov)

Subjects:

- Opposition to draft PWP/EIR Oso Flaco Lake "Improvement Project"
- Support for California Coastal Commission Staff Report dated 2/16/2021

Dear California State Parks and California Coastal Commission:

The Friends of Oso Flaco Lake is a local, California Central Coast group comprised of over 600 individuals and organizations who are dedicated to support the Oso Flaco Lake Natural Area as it is today, for people and wildlife.

We are opposed to all elements of the Oso Flaco Lake "Improvement" Project contained in the Draft PWP/EIR. Consistent with the attached presentation, we believe the project to be:

(1) Bad for people, including school groups and local residents, who visit the Oso Flaco Lake Natural Area to seek a tranquil, natural environment for hiking, fishing, birdwatching, outdoor education, and respite;

(2) Detrimental to the rich and ecologically diverse wildlife, including rare plants and animals, that are abundant at Oso Flaco Lake;

(3) Contrary to the Coastal Act and Local Coastal Programs (which protect prime agricultural land and Environmentally Sensitive Habitat Areas) and other state and federal laws; and

(4) Very unpopular. Since 2019, California State Parks has received multiple thousands of comments in opposition to the commercial and heavy recreational development envisioned at Oso Flaco Lake in the PWP/EIR, and yet, those comments were completely ignored as evidenced by this latest draft document released at the end of 2020.

We also agree with the California Coastal Commission that the Oso Flaco Lake project "presents what appear to be serious LCP inconsistencies related to agricultural conversion and ESHA degradation" and the CCC "does not believe that the [OFL project] is approvable, nor does it believe it shows that the PWP effort is moving in the right direction." (July 12, 2019 letter from CCC to CA State Parks)

For these reasons, we urge you to reject the Oso Flaco Lake "Improvement" Project and keep Oso Flaco Lake Natural Area just the way it is – a beautiful, serene, and rich area that doesn't need improvement.

Also, if California State Parks is looking to develop low-cost, low-impact camping for broad public use along the Central Coast, we support that wholeheartedly. But please, put that in an area that doesn't require the conversion of prime agriculture nor the degradation of an extremely sensitive, rare, and important natural environment.

Finally, we have reviewed the Coastal Commission staff report dated February 16, 2021 and support its recommendations. It's been a long time coming and it's the right answer for the Central Coast, from the perspective of public health, economic vitality for the region, wildlife protection, environmental justice, community fairness, and access to the beach and coast, for all people.

Sincerely,

Ilona Shakibnia (co-founder)

Kara Woodruff (co-founder)


The Oso Flaco "Improvement" Project:
A Terrible, Horrible, No Good, Very Bad Plan
League of Women Voters
February 15, 2021

Background: the Guadalupe-Nipomo Dunes

GND stretches from Pismo Beach to Point Sal

<u>Key Points/Properties</u>:

-OHV Entrances:

Grand Avenue (Grover Beach)

Pier Avenue (Oceano)

-Pismo Dunes Preserve

- Dune Lakes and Black Lake and Canyon

-Oceano Dunes SVRA

-Oso Flaco Lake Natural Area

-GND National Wildlife Refuge

-Guadalupe Restoration Project (Chevon/Unocal)

-Rancho Guadalupe Dunes (SB County Parks)

-Point Sal Reserve (SB County Parks, State Parks, USBLM)

<u>There's a LOT going on in the Dunes</u>

Why the PWP Oso Flaco Lake "Improvement" Project is Terrible, etc.

1. It's bad for (most) people. To the detriment of current users (including locals, school groups, visitors), it would completely and irrevocably transform this beautiful, serene, and peaceful natural and agricultural region into a noisy hub of commercial and RV activity;

2. It's bad for wildlife. It undermines this unique ecological setting, in which birds and rare plants and animals are abundant;

3. It doesn't comply with the law; and

4. The project has high public opposition.

1. It's Bad for People






Oso Flaco Today:

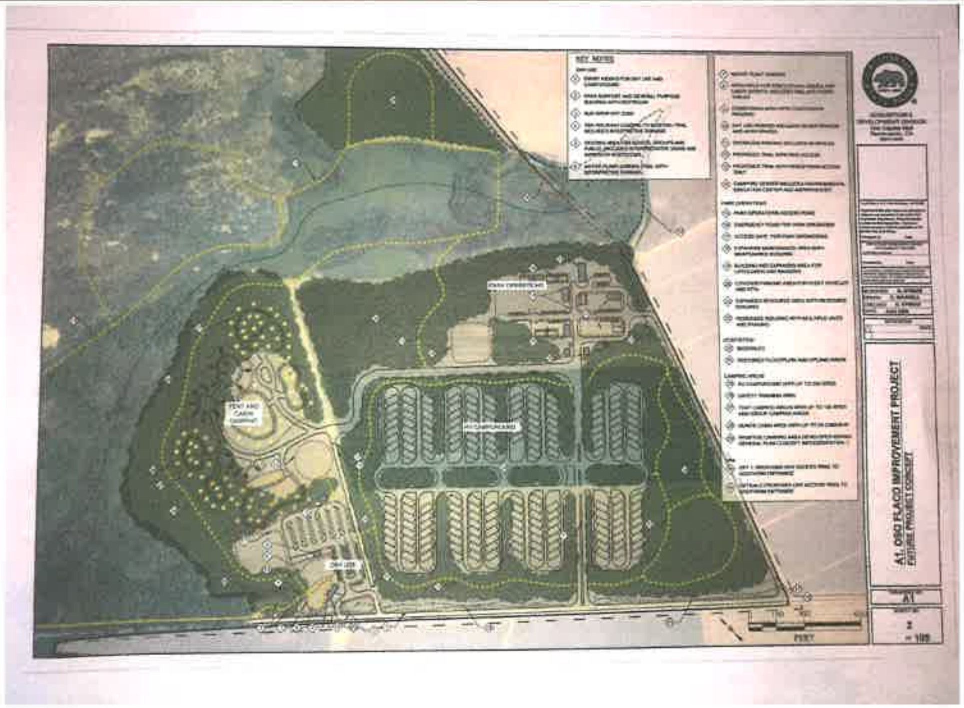
-Used by Guadalupe, Santa Maria, and other local residents for beach access, fishing, and enjoying the tranquil environment;

-Field trip destination for local school kids to study and enjoy nature;

-Outdoor group activity for events sponsored by the Dunes Center, Audubon, and many others; and

-Part of Santa Maria Valley – highly productive ag region with largest concentration of Class I & II soils in SLO County

State Parks OHV's Vision for Oso Flaco



To the detriment of current users (including locals, school groups, and visitors), it would completely and irrevocably transform this beautiful, serene, and peaceful natural and agricultural area into a noisy hub of commercial and RV activity.

State Parks OHV's Vision for Oso Flaco

Oso Flaco Lake Natural Area, envisioned by State Parks OHV Division:

- The conversion of 120 acres of prime agricultural and dune land;
- 200 RV campsites and with 12 restroom/shower buildings;
- 100 drive in tent sites with 8 restroom/shower buildings;
- 20 cabins;
- 40 parking spaces for large vehicles, including RV's, buses, and trailers; 60 parking spaces for additional parking; 45 parking spaces for fleet and emergency response vehicles (including ATV's, trailers, and watercraft); 95 parking spaces for year-round staff parking; and 30 parking spaces for seasonal staff parking;
- Many, many other structures and facilities including three new dump stations, a half-acre multi-purpose area, permanent concession buildings with a camper convenience store, amphitheater, office buildings, staff residences, maintenance and storage equipment and facilities, and single and multi-family residences for year-round and seasonal staff; and
- A new vehicle trail connecting the above Oso Flaco Lake development to a new southern entrance to the Oceano Dunes off-highway vehicle driving area.

2. It's Bad for Wildlife

-OFLNA designated an "Environmentally Sensitive Habitat Area" (ESHA) under Coastal Act;

-Cultivated portions designated as "prime agricultural land" under Coastal Act;

-The "hottest hot spot" in SLO County for birding and 300 species of birds reported here;

-Critical habitat along the Pacific Flyway for migratory birds;

-Long list of sensitive plant and animal species including the least tern, brown pelican, southwestern pond turtle, marsh sandwort, gambel's watercress, prickly phlox, gooseberry, etc.

-USFWS designated this region as the most unique and fragile ecosystem in California, ranking #1 on the list of habitats in need of protection.

What Happens When You . . .

Convert 120 acres;

Build 320 campsites;

Add 270 parking spaces;

Erect multiple facilities;

Construct residences;

Connect a new OHV vehicle trail to Oceano Dunes SVRA; and

Develop the infrastructure to support the above, including water/sewer, electricity and widening Oso Flaco Lake Road, creating

24/7 noise, dust, crowds, trash, air pollution, and artificial light

Will the birds stay? Will the area still support the rich biodiversity?

We've been down this road before; we know what happens.

3. The Project Doesn't Comply with the Law

California Coastal Act Section 30240(a):

Environmentally sensitive habitat areas (ESHAs) **shall be protected against any significant disruption** of habitat values, and only uses dependent on such resources shall be allowed.

California Coastal Act Section 30240(b):

Development in areas adjacent to ESHAs and parks and recreational areas shall be sited and **designed to prevent impacts** which would significantly degrade such areas and shall be compatible with the continuance of such habitat areas.

California Coastal Act Section 30241:

The maximum amount of prime agricultural land shall be maintained in agricultural production to assure the protection of the areas' agricultural economy, and conflicts shall be minimized between agricultural and urban uses . . .

(e) By assuring that public service and facility expansions and nonagricultural development **do not impair agricultural viability** . . .

California Environmental Quality Act

The **CEQA** process is designed to identify and disclose (in an EIR) to decision makers and the public the **significant environmental impacts** of a proposed project prior to its consideration and approval.

(The PWP/EIR is profoundly deficient in its identification and disclosure of environmental impacts to the Oso Flaco Lake region.)

4. The Project Has High Public Opposition

THE TRIBUNE

LETTERS TO THE EDITOR

Readers condemn State Parks' plan to develop Oso Flaco for OHV use

BAD PLAN IS RECYCLED

"Forty years ago I worked with the Dunes Task Force . . . seeking to limit the expansion of the [SVRA} into the sensitive habitats surrounding Oso Flaco Lake. We cited the Local Coastal Plan and studies by the California Department of Fish and Game that recognized the Oso Flaco Lake region as the most sensitive and valuable ecological region in California.

We took the director of State Parks on a tour through the area and . . . [b]y 1980, the SVRA shelved its plans.

Fast forward to 2019. [State Parks] has proposed similar plans to those we stalled almost 40 years ago. Nothing has changed. Oso Flaco Lake is still the most sensitive and valuable natural habitat in California. "

4. The Project Is Opposed by the Community

- Over 2000 letters in opposition submitted to State Parks on first PWP draft ("State Parks Seeks Additional Input" – really?);

-Opposed by many groups including Audubon Society, Oceano Beach Community Association, Northern Chumash Tribal Council, Surfrider Foundation, Sierra Club, ECOSLO, The Nature Conservancy, FOOFL, Center for Biological Diversity, etc.

-Opposed by the Coastal Commission:

The OFL project "presents what appear to be serious LCP inconsistencies related to agricultural conversion and ESHA degradation" and the CCC "does not believe that the [OFL project] is approvable, nor does it believe it shows that the PWP effort is moving in the right direction." July 12, 2019 letter from CCC to CA State Parks

The Oso Flaco "Improvement" Project:

A Terrible, Horrible, No Good, Very Bad Plan

Agree?

Send your comments NOW to OceanoDunesReview@coastal.ca.gov

and OceanoDunes.PWP.EIR@parks.ca.gov

- **Virtually Attend** Coastal Commission meeting on 3/18/21 (Cal-Span.org)

Friends of Oso Flaco Lake (Find Us on Facebook!)

MORRO COAST AUDUBON SOCIETY

Audubon CALIFORNIA

March 11, 2021

To: California Coastal Commission
Via Electronic Submission: OceanoDunesReview@coastal.ca.gov

Re: **Oceano Dunes CDP Review**

Dear Commissioners:

We are pleased to submit these comments regarding the Coastal Commission's March 18 hearing to review Coastal Development Permit (CDP) 4-82-300.

Morro Coast Audubon Society fully supports the recommendations of Coastal Commission staff for changes to the CDP as amended: to improve the management and operation of the Oceano Dunes State Vehicular Recreation Area (ODSVRA), and move toward full compliance with the Local Coastal Plan, the California Coastal Act, and the Endangered Species Act.

Importantly, we wholeheartedly support the recommended five-year transition phasing out of OHV over five years. We believe the California Coastal Commission must acknowledge the "elephant in the room" – the OHV activity that damages sensitive species and habitats, as there is more than enough evidence of the harm done by vehicles operating in the dunes.

We also fully support the March 8, 2021 comment letter you received from the Environmental Law Clinic, Mills Legal Clinic at the Stanford Law School – that the proposed phase out of OHV use on the fragile dune system and protected coastal resources of the ODSVRA constitutes sound public policy and is entirely consistent with applicable state law.

The Time is Now

This is the best moment in the last 35 years to restrict off highway vehicles, clean up downwind air quality, protect endangered species and biodiversity, pursue economic and environmental justice for the community of Oceano and surrounding communities, and develop sustainable and affordable passive recreational opportunities – a defining moment for the Oceano Dunes. These issues at the ODSVRA have lingered for decades. The Coastal Commission should not continue to push resolution of these issues into the future at the expense of the environmentally sensitive resources present at the ODSVRA. We believe the clock has run out on State Parks after nearly four decades of resistance, missed promises, and missed deadlines.

Executive Order N-82-20

As one of the 48 California chapters of the National Audubon Society, we have previously provided comments on aspects of the environmental degradation taking place at the ODSVRA, particularly as it relates to endangered bird species. However, it is the time to think about a more holistic approach to the Oceano Dunes, and Governor Newsom's '30 by 30' Executive Order provides us with that framework.

It is a given that we need to protect habitats and ecosystems; however, that alone will not be enough to preserve what is left of our pristine places. We also need to reverse declines. Ensuring ecosystem resilience, the ability to recover from harmful practices and respond to changing climate conditions, will require ecosystem restoration to reestablish and rebuild systems that have been altered. This is particularly true along California's coastline, where the few beaches remaining are being impacted by coastal erosion, sea-level rise, and ocean acidification.

Furthermore, the well-being of our communities and economic stability are interconnected with our natural and cultural resources and sites such as the Oceano Dunes need to be managed with this approach.

California is a biodiversity hotspot, as is the Guadalupe-Nipomo Dunes Complex, but many species in the dunes are experiencing unprecedented threats both locally and along the Pacific Flyway from a host of issues, including climate change. We will have to move beyond managing endangered species facing extinction to a more holistic approach that keeps our plant and animal communities resilient to climate change and our incredible biodiversity intact. Shifting from ad-hoc crisis management to a broader proactive strategy requires new thinking.

The California Natural Resources Agency, State Parks, and the Coastal Commission are directed to achieve Governor Newsom's '30 by 30' goal, and to prioritize actions that promote biodiversity protection, habitat restoration, and sustainably managed landscapes. These fit in well with the Coastal Commission staff's recommended changes to the Coastal Development Permit and we believe the protection of the ODSVRA's biodiversity should be included in developing and reporting strategies to the governor no later than February 1, 2022.
Guiding principles of Executive Order N-82-20 that pertain to ODSVRA:

1. Promote healthy lands that provide multiple benefits including improved air quality, thriving communities, and economic sustainability.
2. Building climate resilience to reduce the risk from extreme climate events (sea-level rise in Oceano).
3. Expanding equitable outdoor access and recreation for all Californians.

We would like to briefly expand on equitable outdoor access. In a nutshell, equity in access allows <u>everyone</u> to visit.

California is the first state to set priorities and incorporate equity, Indigenous People, and access to nature. The goal is to ensure that disadvantaged communities, including communities of color and tribal communities, have a voice and equitable access to a healthy and safe environment. Both Audubon California and Morro Coast Audubon are committed to ensuring that these programs provide benefits to communities that have been deprived of healthy air and access to nature.

This executive order provides an opportunity to close the "nature gap" – as people of color are much more likely to live in communities that are nature deprived. We know California's access to parks and nature is fundamentally unequal. This inequity exists on many levels including people not feeling comfortable and safe once they can access these natural areas. Currently at the ODSVRA, the mantra "Access for All" is a falsehood – with the off-road vehicles on the beach and dunes.

Other passive users at the ODSVRA who do not feel comfortable or desire not to recreate in traffic, noise, and vehicle exhaust are excluded – including residents of disadvantaged adjacent communities. As a result, the current status of "access for some" does not align at all with Executive Order N-82-20.

Concluding our thoughts on the Governor's '30 by 30' plan, we bring to your attention the following, and suggest they are relevant to issues at the Oceano Dunes.

1. Restoring the natural landscape at the ODSVRA, that has been damaged by OHV use, can be one of the most effective and inexpensive ways to combat the climate crisis and make our coastline more resilient for future generations.

2. This executive order also directs state agencies to develop programs that promote healthy land management practices – to sequester carbon in plants and soil and to continue appropriate farming. It also encourages collaboration to ensure that farmers, conservationists, and other stakeholders work together to maintain the strong economy of agriculture. We should be storing more carbon in our soils – not removing prime agricultural land, as proposed in the State Park's Public Works Plan to develop the Oso Flaco Lake region.

P.O. BOX 1507 ▪ MORRO BAY, CA 93443 ▪ 805-772-1991

www.morrocoastaudubon.org

3. Healthy societies, resilient economies, and thriving businesses rely on "nature". And it is worth noting that people (tourists) love visiting "nature"- not a degraded habitat. An economic impact to consider.

We urge State Parks to develop a new access plan for the Oceano Dunes, first starting with asking surrounding communities what they want to see in the park and how they would like to access it. Then State Parks should develop a new plan that provides diversified public access for residents and visitors alike.

Morro Coast Audubon wholeheartedly agrees with California Natural Resources Secretary Wade Crowfoot who stated, ". . .we need to protect people and nature from the impacts of climate change. Given the state's abundance of nature and the pressure it faces amidst modern society, we need to take new actions to protect our one-of-a-kind community of plants and animals." Secretary Crowfoot continues, ". . .too many cannot safely access our state parks and beaches – we need to expand all Californian's access to parks and nature."

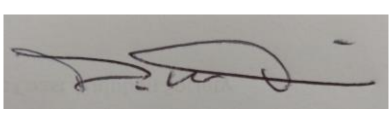
Now is the time for us to take a different path for the ODSVRA, a path that matches the Governor's goals to protect biodiversity, provide for climate resilience, and increase access to nature for <u>all</u>.

Conclusion

In conclusion we urge you to ask yourselves: Shall a discretionary recreational pursuit have a negative impact on human health, natural resources, environmental justice, and equity in recreational access? You must decide for yourselves what is <u>most</u> important.

The Oceano Dunes is simply too biologically sensitive for environmentally destructive OHV activity. We must all recognize that public policy concerns, and our knowledge of the impacts to the ODSVRA, have changed since vehicular use was first introduced at the Oceano Dunes. We believe that State Parks needs to change direction and designate the Oceano Dunes as a non-vehicular park – a park that <u>all</u> Californians can enjoy.

Sincerely,



Douglas Tait
Conservation Chair
Morro Coast Audubon Society

Andrea Jones
Director of Bird Conservation
Audubon California

Ventura Audubon Society

March 11, 2021

California Coastal Commission
725 Front Street, Suite 300
Santa Cruz, CA 95060
OceanoDunesReview@coastal.ca.gov

Subject: Oceano Dunes Coastal Development Permit 4-82-300 Review

Dear Chairman Padilla and Commissioners,

On behalf of the Ventura Audubon Society and its 600 members, we wish to encourage your support of the staff recommendations and analysis presented in the Staff Report of Coastal Development Permit 4-82-300.

Our chapter's mission is the conservation and restoration of bird populations and wildlife habitat. Birds thrive where ecosystems are diverse, and diversity benefits all form of life including humans. Birds also offer us a richer, more beautiful, and healthful place to live and are important species in the function of our environmentally sensitive habitat areas or ESHA.

Oceano Dunes supports numerous protected species and their habitats which constitute ESHA. In fact, it may be one of the few sites in California that functions as a significant source population[1] for the federally and state listed California Least Tern. For example, the California Least Tern, whose population and breeding success may be characterized as a sink population in some areas of Ventura County [ACVC1] makes the ESHA areas of Oceano Dunes even more important to these species at risk of extinction.

Oceano Dunes and the proposed Off-Road Vehicle expansion areas are critical to our California Least Tern and Snowy Plover populations in the State of California and our Country. The State Park Oceano Dunes webpage states the following about its Least Tern population: "Although the colony is small, Oceano Dunes has been one of the top contributors to the number of juveniles produced each year in California." See Exhibit X. [ACVC2] We concur with this assessment based upon State Parks required 2019 Annual Nesting Reports for the California Least Tern and Western Snowy Plover submitted to the California Department of Fish and Wildlife (CDFW) and United States Fish and Wildlife Service (USFWS)[2].

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[1] A source population produces a flow of young to other habitats, verses a sink population area where there is ahigh death rate of the offspring and breeding success is low.

[2] 2019 Report:
https://fws.gov/arcata/es//birds/WSP/documents/siteReports/California/2019%20Oceano%20Dunes%20SVRA%20Least%20Tern%20and%20Snowy%20Plover%20Annual%20Report%20and%20Attachments.pdf

The report describes how the Oceano Dunes habitat is a feeder for other California Least Tern populations:

> "In 2019, there were 78 least terns (47 adults and 31 juveniles), all banded to individual as chicks at ODSVRA, documented at one or more sites other than ODSVRA. One was seen in south San Francisco Bay at Eden Landing Ecological Reserve, Alameda County, and two each at Camp Pendleton and Naval Base Coronado, both in San Diego County. The majority were seen in Santa Barbara County at nearby RGDCP (63) and VAFB (23) and represented post-season dispersal from the ODSVRA breeding colony."

Coastal Commission Staff analysis within the Staff Report found that Off-Highway Vehicle Use within the Oceano Dunes State Park area significantly disrupted the habitat values of environmentally sensitive habitat areas and therefore Off-Road Vehicle use in these areas was in violation of the California Coastal Act. We would concur with that assessment and like to refer the Commission to additional evidence of this ESHA habitat disruption which is located in the 2019 USFWS and CDFW Nesting Report:

- Pg. 15- "Following the nesting season, and for the five-month period October through February, camping, street legal vehicles, and off-highway vehicles use large portions of the Southern Exclosure. This recreational use results in large areas of flattened terrain and barren sand, with very limited scattered natural debris and vegetation. Each year, staff place material in 6, 7, and 8 exclosures to offer more areas of disruptive cover, provide shelter from wind and blowing sand, reduce exposure to predators, and augment potential nesting substrate for terns and plovers."

If further evidence is needed of the impacts of Off-Road Vehicle Use on ESHA is needed, please request such reports from CDFW or USFWS for previous years.

We believe that the Coastal Commission staff have presented a sufficient argument that shows that Off-Road Vehicle Use, a human activity, easily disturbs and degrades a rare and especially valuable habitat (federally and state listed species) and that it is in clear violation of Coastal Act Section 30107.5 which states-

"Any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments".

We hope the Commission recognizes the importance of this area to the State of California and upholds the Coastal Act with the overwhelming evidence provide by your Staff's research. The proposed State Park's Public Works Plan is in violation of the Coastal Act and the record shows that the Commission has given them ample time to comply with the Coastal Act. We applaud Staff and the Commission for upholding the Coastal Act and would like to note that State Parks mission statement includes language that aligns with the protection of ESHA:

> "The mission of California State Parks is to provide for the health, inspiration and education of the people of California <u>by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resource</u>s, and creating opportunities for high-quality outdoor recreation."

Lastly, we are aware that State Parks scientists monitor the nesting of Western snowy plover and California least terns at Oceano Dunes and that some of the fees paid by OHV's partially fund the monitoring and banding work. This is important work that must continue. A new source of funds will be needed. Perhaps, these funds could come from camping fees.

Sincerely,

Bruce E. Schoppe

____

Bruce E. Schoppe
vpconservation@venturaaudubon.org
Vice President, Conservation
Ventura Audubon Society

Cynthia Hartley

____

Cynthia Hartley
ed@venturaaudubon.org
Executive Director
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CC. California Coastal Commission: OceanoDunesReview@coastal.ca.gov

CALIFORNIA
NATIVE PLANT SOCIETY

March 3, 2021

California Coastal Commission
455 Market Street, Suite 300 San Francisco, CA 94105

Submitted electronically to: OceanoDunesReview@coastal.ca.gov

RE: Comments on the Pismo State Beach Oceano Dunes State Vehicular Recreation Area Draft Public Works Plan and Draft EIR (December 2020)

The California Native Plant Society, San Luis Obispo Chapter has made extensive comments on State Park's Draft Public Works Plan and Draft EIR. We are attaching those comments to this letter, which will also serve as our comments to the California Coastal Commission.

The California Native Plant Society (CNPS) is a non-profit organization with more than 10,000 members in 35 Chapter across California and Baja California, Mexico. Our Mission is to increase understanding and appreciation of California's native plants and to conserve them and their natural habitats through education, science, advocacy, horticulture and land stewardship. The San Luis Obispo Chapter has approximately 250 members on the Central Coast, the area within which this project is located. Several of our members are scientific experts with extensive knowledge of the California and central coast dune ecosystems and have assisted with the analysis of this project. In keeping with our Mission, we offer the following comments on the Public Works Plan and Draft EIR.

CNPS considers that existing OHV activity violates habitat conservation and protection, and that proposed changes in use will aggravate those impacts. We provide numerous comments on the Draft PWP and Draft EIR which illustrate our concern.

The attached document *CNPS Comments SVRA PWP DEIR* are provided in Word and PDF form. Thank you for your consideration

David H Chipping

David H. Chipping: Conservation, CNPS SLO Chapter
1530 Bayview Heights Drive
Los Osos, CA 93402
(805) 528-0914
dchippin@calpoly.org

CC: Melissa Mooney, Chapter President SLO Chapter of CNPS
Kevin Kahn: District Supervisor
Dan Carl: North Central Coast and Central Coast

CALIFORNIA NATIVE PLANT SOCIETY

March 3, 2021

California State Parks
Strategic Planning and Recreation Services Division
1725 23rd Street, Suite 200
Sacramento, CA 95816

Submitted electronically to: OceanoDunes.PWP.EIR@parks.ca.gov

RE: Comments on the Pismo State Beach Oceano Dunes State Vehicular Recreation Area Draft Public Works Plan and Draft EIR (December 2020)

Thank you very much for the opportunity to comment on the Draft EIR for the Oceano Dunes State Vehicular Recreation Area Draft Public Works Plan.

The California Native Plant Society (CNPS) is a non-profit organization with more than 10,000 members in 35 Chapter across California and Baja California, Mexico. Our Mission is to increase understanding and appreciation of California's native plants and to conserve them and their natural habitats through education, science, advocacy, horticulture and land stewardship. The San Luis Obispo Chapter has approximately 250 members on the Central Coast, the area within which this project is located. Several of our members are scientific experts with extensive knowledge of the California and central coast dune ecosystems and have assisted with the analysis of this project. In keeping with our Mission, we offer the following comments on the Public Works Plan and Draft EIR.

Please note that we have previously provided comment on aspects of this plan. Notably, on March 3, 2019, in response to scoping, we provided comments[1] regarding the presence of rare plant species, some of which are federally listed as Endangered, in the project area. At that time, we indicated our belief that a southern entrance to the SVRA should be removed from future development plans. We still hold this belief and a concern for rare plants and sensitive natural communities that could be affected by the project. In addition, on April 30, 2020, we provided comment[2] on the Draft EIR for the Oceano Dunes District Habitat Conservation Plan (HCP). In that letter, we indicated, and still maintain, that, due to the lack of inclusion of certain aspects of the PWP in the HCP, the HCP is demonstrably incomplete and premature.

We will expand upon these comments and provide further comments on the PWP and the Draft EIR below. We have organized our comments into those directed directly at the PWP, and those directed to the DEIR. Comments on the HCP, upon which much of the DEIR is based, are incorporated in our comments on the DEIR.

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[1] Letter dated March 3, 2019 from David Chipping, SLO Chapter Conservation Director, to Ms. Katie Metraux, CA Dept. of Parks and Recreation.
[2] email dated April 30, 2020 from David Chipping, SLO Chapter Conservation Director, to State Parks

PWP, and those directed to the DEIR. Comments on the HCP, upon which much of the DEIR is based, are incorporated in our comments on the DEIR.

1. **Comments on the Public Works Plan**

PWP Issue No. 1. The Oso Flaco Improvement Project would cause irreparable damage and significant impacts to Oso Flaco biological resources. Page 1-20 of the PWP, Section 1.10, states “a Public Works Plan is a vehicle for planning and regulation under Section 30605 of the Coastal Act. It allows certain public agencies (including State Parks) to propose a specific set of projects and other development types occurring in the Coastal Zone that the Coastal Commission certifies as consistent with the Coastal Act.”

We believe the Oso Flaco Improvement (campground) project should be removed in its entirety from the PWP. The “Initial” project includes 38 walk-in campsites in two pods, trails with bike and pedestrian access; day-use parking; and park operations buildings. The project affects 1.3 acres of coastal dune scrub, 4.1 acres of riparian vegetation, 2.0 acres of wetland and other amounts of sensitive habitats, according to the DEIR, Table 7-1. CNPS will provide evidentiary support in our comments on the DEIR on the following reasons why both the Initial and Future projects should be removed from the PWP:

(a) The introduction of large crowds and motor vehicles adjacent to an area functioning as a nature reserve of great significance violates the spirit of the Coastal Act by degrading both habitat and the current experience of birders and other nature lovers.

(b) Proposed pedestrian nature trails impinge on riparian buffers, in some cases by as much as two thirds of the accepted 300 ft buffer and are shown in maps to actually penetrate wetlands around Little Oso Flaco Lake. Maps seem to include planted woodlands within active camping areas that would not fit the requirements of a buffer.

(c) The Oso Flaco Future project shows OHV access Trail (Option 2) passing immediately adjacent to Gambel’s watercress and then through central dune scrub via an unpaved road; Option 1 appears to pass through a wax myrtle thicket and up an active dune face (see Fig’s 7-1, 7-2 in DEIR.)

(d) Future OHV trails are shown connecting the proposed campground to the OHV riding areas that pass through recognized rare plant habitat, especially where a hypothetical OHV trail from the Phillips 66 Santa Maria Refinery area is added.

(e) Increased crowds and the proximity of trails to the lake shore will result in trespass and significant impacts to shoreline habitat.

(f) An increased concentration of OHV use at the extreme southern end of the riding area will increase sand migration toward the lake, especially if OHV trails enter the riding areas through active dune lobes.

(g) The project violates the Local Coastal Plan's protection of prime agricultural plan and makes apparently false claims that ownership by State Parks may preclude such consideration.

PWP Issue No. 2. The proposed changes in the 40 Acres area destroy habitat and devalue past investment in dune restoration. The PWP recognizes that State Parks restored habitat west of Oso Flaco Lake both in compensation for OHV damage within the SVRA and to impede the movement of sand toward the lakes. The PWP describes an intention to increase OHV riding in open sand areas and to construct a new OHV trail connecting the Boneyard and Maidenform Flats areas. This both destroys past public investment, degrades a vegetation alliance with G3/S3 ranking (10% of the restored area), impacts habitat of covered animal species, introduces OHV noise disturbance closer to the Oso Flaco Boardwalk and Nature Trail, and appears to be completely unnecessary as the riding areas are connected by open sand further to the north. The northernmost occurrence of giant coreopsis is located at Little Coreopsis Hill within this 40-acre area. The western end of the new OHV trail appears to connect with the existing Oso Flaco service road, and if this is a planned intent for administrative use, it is not mentioned in the PWP.

PWP Issue No. 3. The PWP Fails to identify mitigation sites. The PWP assumes that take or degradation of upland and wetland habitats can be mitigated to levels of 'no significant impact' by the DEIR, and thus on-site take of habitat under the PWP can be restored. However, neither the PWP nor the DEIR identify areas suitable or available for restoration. Supposed riparian restoration on prime agricultural land at, and north of, the campground may be possible due to high water table but would lack ecological function due to proposed trails and other human disturbance. There are no proposed restoration sites for habitat destroyed in the 40 acres.

The PWP makes many references to the existing restoration program. For example, PWP Section 4.3.4.5, under Policy Consistency (pg. 4-76), states " *Habitat restoration efforts are implemented in conjunction with an aggressive invasive plant and animal control program to generally improve ecosystem health, and with comprehensive habitat, special-status species and water quality monitoring systems. The Park's Wildlife Habitat Protection Program (WHPP) has been developed to standardize a broad range of scientifically accepted techniques and practices appropriate for monitoring the health of the unique habitats and special-status species found within the Park."* We note, however, that State Parks offer no quantitative evidence of their success, such as evidence of the net gain or net loss of habitat when restoration acreage is compared to acreage lost to weeds, sand invasion etc. While the Biodiversity Management Plan, on pg. 9, notes that State Parks restores 12-15 acres per year, there is no data on annual habitat loss. This should be addressed in assessing State Park's capacity to augment the restoration program as new mitigation areas are created under the PWP.

PWP Issue No. 4. It is inappropriate to include development within the Phillips 66 Refinery property in the PWP without consideration of requirements associated with decommissioning, abandonment, and possible clean-up associated with the existing oil and gas operations, as well as additional information on important resources, such as individuals, populations, and habitat for Nipomo Lupine (also see DEIR issue No.6). As stated in the PWP Existing Conditions (PWP Section 3.3.14.2), about 250 acres of the 1,780-acre property is currently occupied by a refinery that processes heavy, high-sulfur crude oil. There is no discussion on the process or timeline that would be required for the decommissioning, abandonment, and possible clean-up associated with the existing oil and gas operations, which would be needed prior to consideration of any change in Land Use designation. The entire property, not only the area that supports the facility, would need to be assessed for potential contamination and it is expected that any impacts associated with abandonment and clean-up would need to be addressed before the property was available for alternative use. If these activities result in impacts to natural resources, there may be mitigation opportunities within the property boundaries (i.e, onsite mitigation), which would also need to be completed prior to change in land use or property ownership/management.

Additionally, the DEIR states the biological and cultural resources information within the Southern Access Route project area is limited or lacking, therefore the DEIR cannot adequately assess potential project impacts even on a conceptual level. For example, Section 3.3.14 of the PWP includes a description of a major future development on the Refinery site, including features such as a campground, walking trails, access routes, and earthen berms, between the existing refinery footprint and Highway 1 that includes a potential new access road. Portions of this property support core habitat for Nipomo lupine, and US Fish and Wildlife Service (USFWS) considers this to be the only extant population in the world (Final HCP, pgs. 3-70, Section 3.4.5.1). Combined with additional impacts generated by a proposed trail from the refinery to the OHV riding areas, we find this to be unacceptable. The critical status of the plant is reflected in the language of the HCP (pgs. 3-70 – 3-71): *"Because Nipomo Mesa lupine exists in a single, small population (Section 3.4.5.2) it is vulnerable to extinction from random events (USFWS 2009d). For example, the small population may be vulnerable to catastrophic environmental events such as drought and wildfire and demographic factors such as inbreeding. In addition, coastal development and possible expansion of oil refinery activities (USFWS 2009d) potentially threaten the existing populations of Nipomo Mesa lupine. Expansion of invasive plants, such as perennial veldt grass and iceplant, within the backdune scrub community also threatens this species (USFWS 2000b, 2009d)".*

CNPS is also concerned that an Incidental Take Permit issued by USFWS under the mitigation of the AMMs listed in the HCP will be applied to future take of the species and species habitat if the Refinery Plan comes to fruition.

PWP Issue No. 5. HCP Potential Future Covered Activities are Limited. There appear to be only 10 future activities covered in the HCP (See HCP DEIR, pg. 6-123), and they do not include the Oso Flaco campground or the Phillips 66 site. We recognize that the Oso Flaco campground is considered a “PWP Project,” which would entail “separate CEQA review” (HCP DEIR, pg. 6-150). CNPS is concerned about the potential for simply extending the mitigation AMMs and Incidental Take Permits to future projects, and the resultant failure to include future projects in the cumulative impacts analysis of PWP-covered projects.

PWP Issue No. 6. The definition of Environmentally Sensitive Habitat Areas (ESHA), as described in the DEIR Section 7.2.3, is not consistent with the San Luis Obispo County LCP. Title 23 of the San Luis Obispo County (SLO Co) Code, Coastal Zone Land Use Ordinance, Local Coastal Program (Adopted March 1, 1998; Certified by the California Coastal Commission October 7, 1986; Revised September 2018), should be used to clearly identify areas of designated ESHA as well as unmapped ESHA, within the project area. While the definition of ESHA (i.e., a type of Sensitive Resource Area where plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could easily be disturbed or degraded by human activities and development) is provided in the DEIR, the application is limited to vegetated areas, which is not consistent with the LCP definition. The definition of unmapped ESHA is the same as ESHA with the following requirements: *The existence of Unmapped ESHA is determined by the County at or before the time of application acceptance and shall be based on the best available information. Unmapped ESHA includes but is not limited to:*

> *a. Areas containing features or natural resources when identified by the County or County approved expert as having equivalent characteristics and natural function as mapped other environmental sensitive habitat areas;*
> *b. Areas previously known to the County from environmental experts, documents or recognized studies as containing ESHA resources;*
> *c. Other areas commonly known as habitat for species determined to be threatened, endangered, or otherwise needing protection.*

The PWP relies on DEIR analysis, which falsely implies that ESHA standards are only applicable in vegetated areas and not in open sand. The California Coastal Commission considers all the lands south of Arroyo Grande Creek to be ESHA, including the beach and active dunes. Consideration of the impacts to potential open sand species habitat do not appear to be sufficiently addressed by the PWP. As noted by Coastal Commission Staff " *All of the habitats within Oceano Dunes meet the definition of environmentally* *sensitive habitat area (ESHA). The area is teeming with rare vegetation communities and rare plants and animals. It also supports habitat that is especially valuable because of its special nature or role in the ecosystem. The Oceano Dunes habitats are threatened by development and human activities such as off-highway vehicle use. The only natural area in Oceano Dunes that is not considered environmentally sensitive habitat is the beach area of Pismo State Beach between West Grand Avenue and Arroyo Grande Creek*. (California Coastal Commission Staff Report "Ecological Significance of the Oceano Dunes," Feb 16, 2021.)

Additionally, the DEIR focuses on specific areas of mapped ESHA with little consideration for areas that potentially support unmapped ESHA, including unmapped ESHA that was identified during County review of the Phillips 66 Rail Spur Project, which was denied partly because of unmapped ESHA (see https://agenda.slocounty.ca.gov/IIP/sanluisobispo/file/getfile/56198). The DEIR provides insufficient review of existing information and consideration of both physical (soils, topography) and biological (vegetation type, presence of special status species) conditions to provide an adequate assessment of impacts to ESHA and unmapped ESHA.

PWP Issue No. 7. Protection of Agricultural Lands under the Local Coastal Plan (LCP) is misstated. The PWP claims on pg. 4-109 that there is Local Coastal Plan consistency, citing absence of archeological or historic sites in the Oso Flaco Lake area. This ignores the following, taken from the South County Area Plan, pg. 6-1:

"*Agriculture has historically been, and still is, the most widespread use of land in the South County Planning Area. Agricultural practices of varying degrees of intensity involve over two-thirds of the planning area. Any appreciable loss in farm acreage should be avoided. (LCP)*
Prime valley lands should be protected exclusively for agriculture. Large portions of the Nipomo and Santa Maria Valleys are in agricultural preserves and should be retained as primary farming areas. (LCP)
The Dune Lakes are a series of 10 freshwater lakes located in adjacent sand dunes. This property is in agricultural preserve and is unique in that it includes a wildlife preserve in addition to agricultural uses on the portions of the property that lie in the Cienega Valley. This land should be retained in agricultural preserve to protect the farmland and the wildlife habitat." (LCP)

This states that agricultural lands and wildlife preserves are considered to be protected entities under the Coastal Act and by San Luis Obispo County. Furthermore, CNPS considers the statement in PWP Section 4.5.2.3, pg. 4-100, to be an unacceptable use of the term "appreciable": *"The proposed site restoration and transition to park and habitat uses would not result in appreciable loss of farm acreage or agricultural viability given the extent of large tracts of contiguous farmlands adjacent to the project area."*.

PWP Issue No. 8. There is little consideration of sea level rise in the PWP. The only mention of sea level rise in the PWP is at the start of Chapter 3:

"*Adaptability. Consider the effects of climate change and sea-level rise during planning and investment decisions for infrastructure. Create flexible operations and maintenance procedures that can easily be adapted in response to environmental change.*"

There is no further discussion of the issue, but there is a real problem that decreasing beach width and high wave run-up will impact both available camping space and the safety of use of the beach as a highway. A possible mitigation might be to move camping further back into the dunes, possibly impacting protected foredunes. Changing hydrology will also impact Meadow Creek, Arroyo Grande Creek and other areas.

PWP Issue No. 9. Sufficiency of the Biodiversity Management Plan. There are three mentions of a Biodiversity Management Plan (BMP) in Chapter 2 of the PWP, in the context of creek crossing and predator management. We would appreciate indication of the breadth of a BMP in monitoring the success of mitigation developed through the AMMs described in the DEIR and HCP. We have reviewed a Biodiversity Management Plan prepared by CDFW and dated January 2021 that was made available to us. We are in agreement with the majority of the recommendations contained in this document, including the recommendation to prepare a Natural Communities Conservation Plan (NCCP).

DEIR Issue No. 10. Failure to evaluate groundwater elevation and its control at the proposed Oso Flaco campground. Chapter 13 of the DEIR addresses Hydrology and Water Quality. Several issues are unresolved. While the DEIR correctly shows that the site is not included in the FEMA 100-year flood maps, it fails to address the observed slow drainage of the site during heavy rains. It does not address the high water table under the property, and the resultant difficulty in developing the site with subsurface pipes, foundations, and other types of infrastructure necessary for development. Of particular concern is how wastewater will be handled and how drinking water will be supplied to the site. The low water quality and presence of toxins has been indicated in waters of the campground area (PWP, Section 4.4.4.3; DEIR, Section 13.2.4.3). Toxins are also present in the waters surrounding and under the Phillips 66 Santa Maria Refinery, and thus a replacement water supply would be required from elsewhere (EDC letter to SLO Board of Supervisors March 9, 2017 concerning Phillips 66 Appeal of Denial of Project).

CNPS is concerned that, faced with a high water table, State Parks may be faced with changing the culvert capacity under the Oso Flaco causeway in order to lower the level of Little Oso Flaco Lake and thereby lower the local water table and facilitate faster surface water drainage. It is our understanding that the causeway was the subject of a recent "culvert" resizing rebuild. This rebuild reduced the static pool elevation in the north pond by lowering the grade of the culvert and thus increased the pond to pond flow. The reduction in pond elevation generated by the culvert re-engineering coincided with the apparent loss of the historic *Nasturtium gambelli* population on the northeast bank of the causeway as a result of subsequent surface drying. Predictably, any engineered drainage efforts are likely to destabilize the marsh habitat that supports *Arenaria* and *Nasturtium*.

An issue not discussed in the PWP or DEIR is consideration of possible pesticide clean-up operations at Oso Flaco Lake and Oso Flaco Creek. Although no specific engineering projects have been proposed, development of the campground south of the lake may inhibit choice of potential clean up operations, and therefore might inhibit options to protect rare plant populations at the lake.

The presence of pesticides in the waters of Oso Flaco Creek and Little Oso Flaco Lake is well documented. In a 2010 Report to the Central Coast Regional Water Quality Control Board titled "*Santa Maria River Watershed and Oso Flaco Creek Watershed TMDL Monitoring Study – Final Report*" (available at waterboards.ca.gov/water_issues/programs/tmdl/records/region_3/2010/ref3823pdf) pesticide contamination of the water of Little Oso Flaco Lake and Oso Flaco creek is reported. The report states, on pg. 56: *"One concern in the current study (sic) is identification of high incidences of water toxicity in Oso Flaco Creek and Lake. Oso Flaco Lake is considered one of the most ecologically important water bodies in this area. The current results did not allow identification of the causes of this toxicity. Future studies in Oso Flaco Lake should include more detailed toxicity identification evaluations, combined with comprehensive chemical analyses of water."*

The document "*2016 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies and Disposition Santa Maria Valley Management Area*" by Luhdorff and Scalmanini Consulting Engineers (April 2017; available at www.cityofsantamaria.org) notes on pg. 20: "*... In addition to the elevated TDS and nitrate concentrations described above, the streams in the western and southern portions of the SMVMA have been reported to be degraded by pesticides, primarily pyrethroid insecticides and the organophosphate pesticides chlorpyrifos and diazinon (CCRWQCB, May 2011). The streams, which include the lower Santa Maria River, Orcutt Creek, Green Canyon, and Oso Flaco Creek, also have elevated turbidity and temperature*."

In 2018, Coastal San Luis Resource Conservation District was awarded the Remediation of Pesticides in Oso Flaco Watershed project, funded by the State Water Resource Control Board (SWRCB). CSLRCD states: *"Based on numerous studies, assessments and planning efforts undertaken by CSLRCD and partners over the past 20 years, the project proposes to remove and remediate sediment from 1.2 miles of Oso Flaco Creek where high concentrations of DDT persist. Excavated sediment is to be remediated on site, deploying a multi-layer remediation process that results in levels of DDT below thresholds protective of aquatic habitats and human health."*

2. **Comments on the Draft EIR**

DEIR Issue No. 1. The DEIR relies too heavily on the HCP to provide the basis for assessing impacts. (example: pg. 1-2 of DEIR) There are several areas where the HCP lacks information and/or simply does not address impacts of aspects of the PWP. For example, the HCP does not have sufficient analysis of new pedestrian trails at Little Oso Flaco Lake nor does it evaluate proposed OHV trails leading from the campground, or the impacts of developing the Phillips 66 Refinery property as a reasonably assumed future phase of the PWP.

DEIR Issue No. 2. The DEIR fails to identify sites suitable for 3:1 required replacement of impacted vegetation types. In replacing wetland habitat buffers and habitat impacted by trails that, on the basis of the maps, appear to directly impact wetlands, proposed plantings within a busy campground are unsuitable as mitigation. When the Oso Flaco Lake area was protected, the net withdrawal of OHV-impacted habitat was intended to compensate for damage already existing in the riding areas. This PWP offers only increases in the total acreage subject to disturbance, with no details of where and how permanent mitigation spaces will be incorporated into the PWP.

DEIR Issue No. 3. Section 7.4 of the DEIR fails to describe impacts to open sand areas, which constitute ESHA. Section 4.3 of the DEIR also includes incorrect statements as to the consistency of the project with LCP policy. As mentioned above, we believe the DEIR erroneously states, in section 7.2.3, that ESHA encompasses only the vegetated areas of the dunes, and therefore obscures the fact that everything south of Arroyo Grande Creek is considered ESHA by the County and the Coastal Commission. This includes both the beach and open sand dune areas.

We appreciate the listing of several coastal plan policies related to protection of ESHA in Section 4.3.4 of the DEIR (Policy 1, Land Uses Adjacent to ESH; Policy 2, Permit Requirement, Policy 3, Habitat Restoration; Policy 7, Protection of ESH; Policy 8, Principally Permitted Use; Policy 13, Diking Dredging or Filling of Wetlands; Policy 16, Adjacent Development; Policy 17, Wetland Buffer, and Policy 18, Wetland Buffers Less Than 100 Feet, in addition to others relating to Riparian Vegetation and other resources). In addition, Section 4.3.4.5 of the DEIR identifies and lists Sensitive Resource Areas and ESHA.

Text on pg. 4-69 and 4-70 explains how site-specific determinations are sometimes necessary to adequately map SRA and ESHA. This is often true, but in defining foredune, middune, and backdune habitats, one cannot limit the definition to areas where only vegetation is present. In addition, text on pg. 4-72 describes the pedestrian trail improvements proposed for the Oso Flaco Lake "Improvement" project, and gives acreages for direct impacts, including loss of habitat, but does not address the indirect impacts of these pedestrian trails, and considers them to be "resource-dependent." This section also describes the Options for the OHV access trails, which are explained to be conceptual, but would result in significant impacts to wetland and riparian areas, and then proposes that taken together these improvements would "protect and enhance ESHA." This is sidestepping the issue at the very least, if not totally absurd.

We attach two figures to this letter (Attachments 1 and 2) showing mapping of County Sensitive Resource Areas Combining Designations in addition to Coastal Zone Terrestrial, Riparian, and Wetland Habitat taken from the County's Land Use View mapping application.

DEIR Issue No. 4. Failure to perform botanic surveys undermines species impact determinations. Section 7.3.1 of the DEIR, pg. 7-6, states that "*No focused special-status species surveys were conducted in support of this EIR*." CNPS considers that this reveals a fundamental flaw of the DEIR in its failure to document the basis under which State Parks claims to have optimized the PWP to avoid impacts. No data is presented to support the claim that plans have been optimized to minimize species take. The Oso Flaco Lake Complex, for example, provides habitat for two critically endangered plant species: Gambel's watercress and the marsh sandwort. We understand from the CDFW Oceano Dunes Biodiversity Management Plan (2021, pg. 34) that surveys for watercress have not been conducted since 2013, and surveys for sandwort were conducted by others in 2020. However, this report goes on to state that "*Without current botanical surveys for both of these species, the status, genetic makeup, and associated management actions needed to prevent the extirpation of these populations cannot be assessed*." We agree with this, and with CDFW's recommendation for comprehensive surveys.

DEIR Issue No. 5. The DEIR fails to independently analyze impacts to HCP-covered species, inadequately addresses cumulative impacts, and instead refers back to the HCP DEIR. We agree with the statement in Section 7.2.2 that the AMMs listed in the HCP EIR Appendix B are not to be considered mitigation, but both the HCP and this DEIR fail to quantify potential cumulative losses due to the uncertainty of success of some of the AMMs.

Table 7-1 on pg. 7-7 of the DEIR shows acreage impacts for everything but the Refinery area and the connecting trails. As stated above in PWP Issue No. 4, the refinery area is core habitat for Nipomo lupine, and therefore the location should be reflected in estimates of the cumulative impacts and required mitigation spaces for impacted species.

Page 7-6 of the DEIR, Section 7.3.1.1, Impacts to Special Status Species, states "*any single impact of these routine activities would be small, habitats would be restored onsite following implementation of the activities whenever possible, and any acreage that could not be restored onsite would be compensated for under the proposed habitat restoration of the Proposed Development Projects and the restoration/planting and habitat* *enhancement activities already ongoing in the Park."* This falsely assumes that there is available unoccupied and suitable space available for off-site replacement of habitat degraded or destroyed by routine activities, but this is unsupported by quantifiable evidence (as, for example, wetland impacts).

DEIR Issue No. 6. The DEIR does not adequately address impacts to Special Status plant species. Pages 7-25 through 7-27 of the DEIR, Impact 7-7, identifies potential significant impacts in known habitat of special status plants, or plant communities considered to be protected under the requirements of ESHA designation. However, there is no analysis of proposed land use changes in known Nipomo lupine habitat along the proposed OHV trail from the refinery site, or the extensive development proposed east of the refinery, including a new access road from Highway 1. The DEIR should include an analysis of the effects of the project on what is described in the HCP as a 'single population' of the plant. Instead, the DEIR states that surveys will be conducted, and mitigation proposed in the future. There is no identified replacement habitat to compensate for take. While Mitigation Measure 7-1 requires restoration and compensation for natural vegetation loss, the actual practicality of this is doubtful.

Whereas *Table 7-1 Habitat Impact Acreage on PWP Proposed Development Projects* and *Table 7-2 Habitat Impact Acreage of PWP Small Development Projects* list potential impacts by eleven habitat types (most of which are ESHA), Mitigation Measure 7-1 *Restore and Compensate for Impacts on Native Vegetation Communities and Special-status Species Habitat* is very broad and does not specifically state that restoration activities of various projects will match the same type of habitat types that are disturbed. Effects on sensitive natural communities/ESHA are often evaluated in Chapter 7 Biological Resources as being less than significant or of beneficial impact, because, among other measures, Mitigation Measure 7-1 would restore a net total of sensitive natural communities/ESHA but does not specifically state that these restored natural communities will be in the same proportions of the habitat types that are disturbed. Thus, 50 acres of woodlands planted in the new campground could be used to mitigate for impacts to dune scrub, dune swale and foredunes even though woodlands may not support some of the unique coastal species that are present in the various dune habitats. Mitigation Measure 7-1 provides for general steps to prepare a Habitat Restoration and Revegetation Plan, however, not enough information is provided to determine if these steps are feasible such as where restoration will take place for these different habitat types; if known procedures have been developed to propagate (without adverse effects to limited existing populations), install, and maintain reproducing populations of these rare plants; and success criteria. Can State Parks provide information on the success of their own efforts or those of other organizations to restore these rare plants and unique coastal habitat types rather than deferring the development of details of this restoration mitigation measure to a future Habitat Restoration and Revegetation Plan? Otherwise, it is difficult to determine if such restoration of sensitive dune resources is feasible and therefore if the EIR can find that there is no significant impact or beneficial impact to them. Likewise, can State Parks provide an evaluation of past fencing efforts and enforcement of park rules in protecting sensitive dune habitats thus providing evidence of their feasibility for providing protection in the future?

No provision is made for the permanent protection of any areas restored under Mitigation Measure 7-1. Indeed, the current PWP proposes opening up restored dune ESHA nearest to Oso Flaco Lake to expanded OHV use and trails. This precedence suggests that any areas restored under Mitigation Measure 7-1 could be subject to future disturbance or elimination and thus the mitigation effect is only temporary and therefore insufficient.

The restoration commitments described in Mitigation Measure 7-1 and associated Habitat Restoration and Revegetation Plan do not appear to be discussed in the PWP, HCP or the BMP. Without coordination between these various planning efforts, it is easy to conclude that necessary compensation for adverse impacts to unique coastal resources will be overlooked in future years.

Pg. 7-26 of the DEIR addresses the specific issue of the Oso Flaco Boardwalk and its effects on special status species. We note that the PWP proposes new pedestrian trails around Little Oso Flaco Lake. Both Gambell's watercress and marsh sandwort are 'wet foot' plants that are found either on floating vegetation mats or along the shores of both Oso Flaco Creek and the lakes. For this reason public access should not be permitted on the lake shore. The discussion on page 7-26 gives the impression that avoidance by fencing will only be a feature during construction. Instead of the PWP *adding* protection of natural habitat around the lakes, it instead proposes a series of trails within existing riparian habitat occupied by special status plant and avian species. We note that this is also an issue in regard to avian conservation. We believe that special status plant habitat disturbance will be vastly increased by development of the pedestrian trails and the campground at Oso Flaco Lake, and that the impacts do not appear to have either been addressed or mitigated.

Pg. 7-27 addresses the impacts of the proposed new OHV trail cut through restored coastal dune scrub habitat and its effects on special status plant species. A list of potentially impacted plants from the 40-acre Riding Trail Installation is given. This trail appears to be completely unnecessary, as the open dune areas that are connected by the trail are already connected north of the re-vegetated area. The original 40-acre re-vegetation was to compensate for the impending threat of sand migration eastward into the two lakes, and so removal of any part of that investment is regrettable, and we believe that increased OHV disturbance in this proposed area of the PWP will aggravate future sand motion, and thus the stability and integrity of backdune communities near Oso Flaco Lake.

DEIR Issue No. 7. Pg. 7-28 of the DEIR, Impact 7-8, recognizes impacts to some ESHA- protected communities, but fails to identify adequate mitigation. The DEIR identifies impacts to the silver bush lupine- mock heather dune scrub vegetation alliance, which carries a G3/S3 global and State ranking, indicating it is 'vulnerable'. The very name implies a highly restricted habitat within the world and California. Thus it should be a stated goal of the PWP to minimize impacts to the highest degree possible. However, no mitigation sites for losses of native dune vegetation have been identified. Even though text on pg. 4-37 of the DEIR (par. 1) indicates that the OHV trail in the 40-acre riding area would be "installed with protective fencing…and any planted dune vegetation removal conducted to install the trail would be appropriately mitigated within the park," these areas have not been identified. With regard to riparian vegetation, under Impact 7-8 the DEIR states: "*The Oso Flaco (Initial and Future) Improvement Project also includes installation of a up to 300-foot-wide riparian buffer and extensive planting of native vegetation throughout the project area, resulting in a net gain of riparian habitat in the area*." However, the PWP's maps of the campground include extensive human occupation and pedestrian trails within this buffer.

The PWP and DEIR also do not provide adequate discussion of avoidance or minimization of impacts to the required buffers for designated Environmentally Sensitive Habitat Areas (ESHA) pursuant to Coastal Zone Land Use Ordinance Sections 23.07.170(a)(5) and 23.07.178, which require 100-foot buffers between development and designated or unmapped ESHA (citing to Section 23.05.034(c) 14 Id. at pg. 11 and the requirement for 100-foot ESHA buffers). While there may be allowable uses within ESHA and buffer areas, sufficient detail is lacking to adequately assess the need and the impact to ESHA resources associated encroachment into buffers, especially in the areas of the of the planned Oso Flaco campground and at the Phillips 66 Refinery site. Buffers are required to protect existing resources; it is not clear how a mitigation approach of restoring "buffer" habitat elsewhere in the park protects existing mapped and unmapped ESHA resources in one specific area.

DEIR Issue No. 8. Pgs. 7-31 through 7-34, Impact 7-9, incorrectly characterizes Wetlands impacts as less than significant. We note that the wetland disturbances are mainly around (1) Oso Flaco Lake; and (2) a road through the Meadow Creek drainage at the Park Corporation yard. On pg. 7-29 the DEIR states that "*The Oso Flaco (Initial and Future) Improvement Project also includes installation of a up to 300-foot wide riparian buffer and extensive planting of native vegetation throughout the project area, resulting in a net gain of riparian habitat in the area.*" This statement does not appear to be supported by the maps in Appendix A of the PWP. The pedestrian trail that is shown bordering the west side of the campground follows almost exactly the western edge of the existing cropland and is located, for over much of its length, 150 feet or less from wetland. The campground plans do show additional vegetation being put in place within the core of the campground, and at the western edge, but this does not fit the definition of buffer. The presence of campers in this so-called buffer will have a negative effect on protected species and degrade the quality of the existing riparian woodland through use of the pedestrian trail. This factor was identified in the section of the DEIR dedicated to avian impacts.

Even worse, and suggesting that the maps in Appendix A of the PWP were made without field validation, there is a portion of new pedestrian trail shown running through existing wetland at the east end of Little Oso Flaco Lake (Item 13, Figure A1). This joins a pedestrian trail coming from the vehicular camping area and the connected trails are again shown to cross Oso Flaco Creek on wetland. The trail then turns west along the north shore of Little Oso Flaco Lake on what is now prime agricultural land, and then south west along a stabilized dune. There appear to be no opportunities for a 300 ft. buffer at these locations, although conversion of the agricultural land north of the lake into riparian vegetation would probably be successful. That land has a high water table that would support mitigation planting of riparian vegetation. The potential ecological restoration value of this converted agricultural land into habitat is compromised by the addition of a loop trail through its heart and the proximity of a proposed southern access road a short distance to the north.

The statement on page 7-30 regarding the beneficial impacts is without foundation: "*Additionally, extensive restoration of riparian habitat and other natural vegetation will occur at the Oso Flaco Improvement Project resulting in a net gain of sensitive natural communities/ESHA of up to 24.22 acres, which would be a beneficial impact. As a result, effects on sensitive natural communities/ESHA would be less than significant."*

As we noted earlier, a supposed buffer includes active camping areas and pedestrian trails. Buffer function would be severely degraded by the placement of pedestrian trails within the buffer.

The disturbance caused by introduced trails would be particularly egregious on the south side of Oso Flaco Lake where a proposed pedestrian trail is shown connecting with the existing boardwalk immediately west of the lake. This area contains valuable wetland and has almost no means of human penetration due to the density of the vegetation.

The text on page 7-32 of the DEIR suggests that the impacts to wetlands are from construction only. We have demonstrated above that impacts will be permanent due to disruption of habitat values.

DEIR Issue No. 9. Prime Agricultural Land is Protected, and the value of the land runs independently of the ownership. Chapter 5 addresses the loss of prime agricultural land in the Oso Flaco area, but appears to infer that because State Parks owns this land and it is not under Williamson Act, it is somehow acceptable to convert it. We believe that the value of the land runs independently of the ownership, and it is thereby protected under the Local Coastal Plan Policy 1, Maintaining Agricultural Lands (discussed on page 4-95 of the DEIR).

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DEIR Issue No. 10. Failure to evaluate groundwater elevation and its control at the proposed Oso Flaco campground. Chapter 13 of the DEIR addresses Hydrology and Water Quality. Several issues are unresolved. While the DEIR correctly shows that the site is not included in the FEMA 100-year flood maps, it fails to address the observed slow drainage of the site during heavy rains. It does not address the high water table under the property, and the resultant difficulty in developing the site with subsurface pipes, foundations, and other types of infrastructure necessary for development. Of particular concern is how wastewater will be handled and how drinking water will be supplied to the site. The low water quality and presence of toxins has been indicated in waters of the campground area (PWP, Section 4.4.4.3; DEIR, Section 13.2.4.3). Toxins are also present in the waters surrounding and under the Phillips 66 Santa Maria Refinery, and thus a replacement water supply would be required from elsewhere (EDC letter to SLO Board of Supervisors March 9, 2017 concerning Phillips 66 Appeal of Denial of Project).

CNPS is concerned that, faced with a high water table, State Parks may be faced with changing the culvert capacity under the Oso Flaco causeway in order to lower the level of Little Oso Flaco Lake and thereby lower the local water table and facilitate faster surface water drainage. It is our understanding that the causeway was the subject of a recent "culvert" resizing rebuild. This rebuild reduced the static pool elevation in the north pond by lowering the grade of the culvert and thus increased the pond to pond flow. The reduction in pond elevation generated by the culvert re-engineering coincided with the apparent loss of the historic *Nasturtium gambelli* population on the northeast bank of the causeway as a result of subsequent surface drying. Predictably, any engineered drainage efforts are likely to destabilize the marsh habitat that supports *Arenaria* and *Nasturtium*.

An issue not discussed in the PWP or DEIR is consideration of possible pesticide clean-up operations at Oso Flaco Lake and Oso Flaco Creek. Although no specific engineering projects have been proposed, development of the campground south of the lake may inhibit choice of potential clean up operations, and therefore might inhibit options to protect rare plant populations at the lake.

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DEIR Issue No. 11. Section 16 fails to address noise issues adequately. Chapter 16 addresses noise with a significant amount of text concerning vacuum cleaners, and with nothing on the noise envelopes developed by OHVs. Table 16-1 lists several noise sources, but no ambient campground noise, dirt bike noise and other factors actually pertinent to this project. General highway noise is different that sand buggy OHV noise. It would have been useful to produce noise envelopes for a range of OHV types that can reasonably be expected to appear adjacent to the Oso Flaco boardwalk, by way of example. The project also fails to look at the effect of intermittent high noise levels, which would be more startling after a period or relative quiet.

3. Conclusion

The San Luis Obispo Chapter of the CNPS believes that the Oso Flaco Improvement project should be removed from the public works plan in its entirety because it would violate the spirit of the Coastal Act by significantly degrading habitat for rare and endangered plant species and sensitive natural communities, in addition to degrading the experience of people using the currently designated Oso Flaco Lake Natural Area. We believe the impacts of the Oso Flaco project on biological resources would be significant and unavoidable, as detailed above. The subject dune system is mapped as a County Sensitive Resource Area and Coastal Zone Environmentally Sensitive Habitat Area and

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should be retained as such and in keeping with the Coastal Plan goals and policies. We support the CDFW recommendation to consider developing an NCCP for this area, as this landscape-level approach might serve to reduce impacts even further.

Furthermore, we oppose the proposed future development at the Phillips 66 Santa Maria Refinery site, as described in the PWP, as it, too, will result in significant and unavoidable impacts to biological resources, especially the Nipomo Lupine, a federally listed endangered plant species. It also seems inappropriate to include this project prior to (and without discussion of) the decommissioning, abandonment, and possible clean-up that may be required for a change in the current land use as an oil and gas processing facility.

Lastly, we wish to restate our concern that approval of the HCP appears to be prior approval of an incidental take permit for certain *conceptual* activities under the guise of a "*goal to be proactive administratively and to avoid a future ITP amendment process and NEPA review of the changed ITP should these activities become proposed projects that require ITP coverage*." (HCP DEIR, pg. 2-15). We strongly disagree with this approach. The HCP should follow the detailed Public Works Plan, not precede it.

The attachments showing designated maps of Sensitive Resource Areas and Terrestrial Riparian and Wetland Habitat. Under County LCP Implementation Plan Section 23.11.030, this SRA and these Combining Designations are the same as ESHA.

Thank you for your consideration.

David H Chipping

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Attachment 1: Map of County-designated Sensitive Resource Areas
Attachment 2: Map of Coastal Zone Terrestrial, Riparian, and Wetland Habitat

cc: CA Coastal Commission

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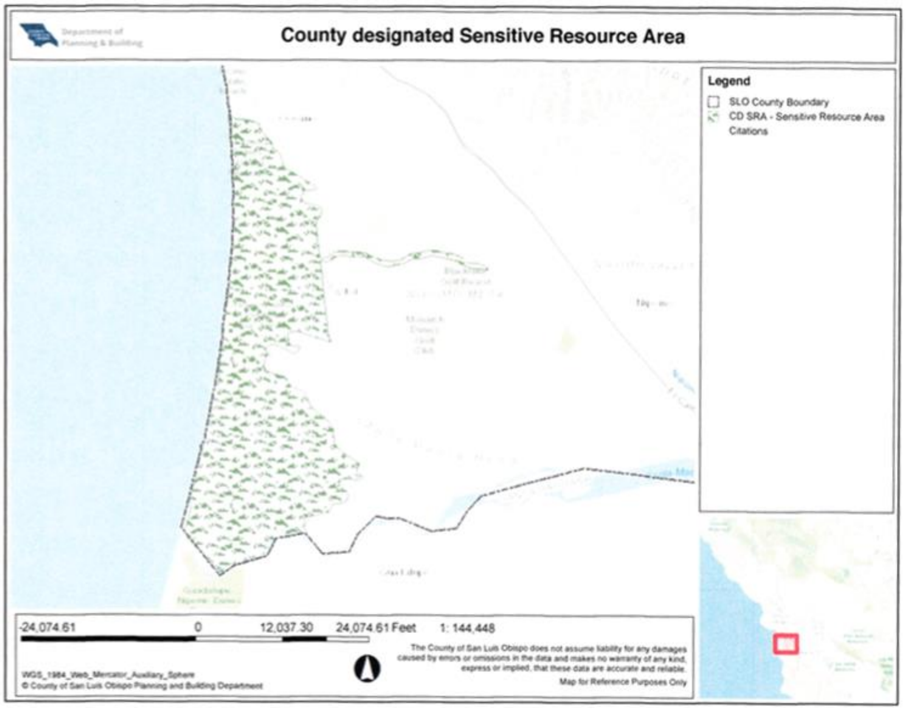
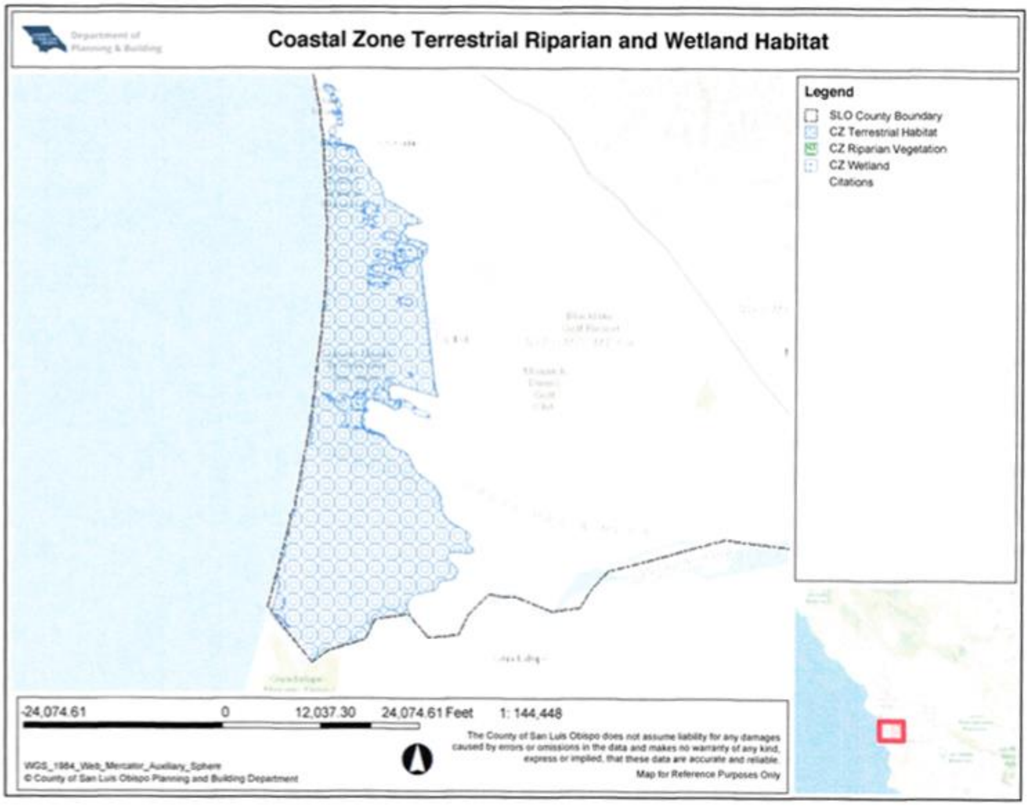
Attachment 1: Map of County-designated Sensitive Resource Areas



Attachment 2: Map of Coastal Zone Terrestrial, Riparian, and Wetland Habitat



South County Chambers of Commerce
Jocelyn Brennan, President/CEO
Jocelyn@southcountychambers.com
www.southcountychambers.com

California Coastal Commission
Re: March 18, 2021, Special Meeting
Oceano Dunes CDP Review
Via electronic mail

Subject: March 18, 2021 Special Meeting Oceano Dunes CDP
Opposition to Voting without a Completed Economic Analysis, nor Regional Representation on the Commission

Dear Chairperson Padilla and Commissioners,

The South County Chambers of Commerce (Chamber) is honored to represent the South San Luis Obispo County business community and its tens of thousands of employees. Our mission is to create partnerships and opportunities to ensure businesses prosper. We wish to impress upon the commissioners that you need not decide on the phased closure of the Oceano Dunes Off-Highway State Vehicle Recreation Area (ODSVRA) at the special meeting on March 18, 2021. In fact, doing so without a completed economic analysis, nor South Central Coast regional representation on the Coastal Commission, may set a dangerous precedent for future proceedings of this magnitude, throughout the Coastal Commission's jurisdictional area.

One of the Chamber's top priorities for the last three years has been to advocate for the continued use of the Off Highway Vehicle (OHV) Recreation Area at the Oceano Dunes State Park and the tourists this amenity brings to our region. We represent the interest of business to government for 750 businesses in South County. The Oceano Advisory Council does not represent the businesses.

In fact, now more than ever, we are committed to being an effective advocate for South County businesses. This is why, though we understand that the local economy and jobs are not central to the Commission's decision-making process, we believe it is important to understand the current state of the South County economy and impacts we already know to be coming to the region in the near future.

Current Economic State and Extent of Known and Unknown Impacts

The South County businesses that will, no doubt, suffer irreparable impacts by taking the action proposed today, are picking up the pieces of the closure caused by the COVID-19 pandemic. These businesses did not have the opportunity to prepare for the pandemic shutdown and its impacts on their operations (in the short, or long term). We believe the extent of these impacts will not truly be known for several years to come.

Recently, the businesses have learned that they may soon be facing another detrimental impact to their business, the closure of OHV and street legal driving at the Oceano Dunes State Park, and thus the OHV tourist spending this brings to their businesses.

Tourism to the Oceano Dunes SVRA is a significant economic driver in South San Luis Obispo County. Visitors and locals have been enjoying the beach in their vehicles since the turn of the last century and a specific economy has formed around this activity.

Prior to COVID, the Chamber and our regional partners had begun to plan and prepare for the decommissioning of the Diablo Canyon Nuclear Power Plant, the largest private employer in San Luis Obispo County. This closure will result in the loss of 1,500 high-wage jobs. Additionally, Phillips 66 has announced the closure of their Nipomo Mesa refinery and the loss of another 200 high-wage jobs.

Importance of a Complete and Current Economic Impact Assessment

There is no recent Economic Impact Assessment to provide measurable data to support an informed decision by the Commissioners. The Commission's mission is to protect coastal access and resources. Therefore, we understand that the local economy and jobs is not central to the Commissioner's decision-making process. The most recent study in 2016 was commissioned by State Parks and did have flaws in the methodology. There is also a conflicting report from Associate Professor Patel that also has methodology flaws. It should also be noted that Patel has been active in his support of the closure of the OHV use at the park.

However, as discussed above, the local economy and jobs are central to the Chamber's mission—and economic development is a top goal for our local cities and unincorporated County communities. We have spoken with several businesses, including several from Oceano, that stated their sales doubled when the OHV riding reopened in February 2021. The Commissioners should also be aware that, to date there has not been a sincere outreach to the Spanish-speaking residents of Oceano. Their voice has not been heard on this issue and many of these residents work in the local restaurants and hotels that will be impacted.

We are scheduled to open a Request for Proposals for an Oceano Dunes State Park Economic Impact Assessment in partnership with the local municipalities: SLO CAL, the San Luis Obispo County Tourism Marketing District, REACH, the Central Coast regional economic development organization; and the County of San Luis Obispo.

Regional Representation on the Coastal Commission

The agenda calls for the Commissioners to make a landmark decision, which may expound powerfully negative impacts upon the South County economy, without the input of a Commissioner representing the impacted region.

The South County Chambers sent a letter to the Governor and the Coastal Commissioners respectfully requesting that the Commission postpone this agenda item until there is a South Central Coast Commissioner appointed to fill the recent vacancy left by Commissioner Erik Howell. The Oceano Dunes SVRA is a longstanding and complicated issue with economic, environmental, and public health components. A South Central Coast Commissioner will need time to become familiar with the history of the park and hear from the local stakeholders.

The weight of this decision merits regional representation. We are unaware of a decision of such magnitude that has been made without representation of the impacted region. In short, our area's seat at the table is vacant, and the proposed action would set a dangerous precedent for future decisions, needlessly, within Coastal Commission jurisdiction. As such, we emphatically implore the commissioners to refrain from taking action on this item this evening.

In Conclusion

We implore the Commission not to make a major decision that will affect the local community until there is a representative from our region and a thorough, unbiased, and robust Economic Assessment has been completed.

There are several recommendations from staff that have not been thoroughly vetted and are unrealistic. For example, the camping area in a section of the beach that regularly experiences high tides that would make camping there impossible. Also, the closure of the Pier Avenue beach egress cannot be done without a traffic study and a parking plan. Therefore, we would like to extend an invitation to the Commissioners and Commission staff to tour the Oceano Dunes State Park, Oceano, and Grover Beach.

The Chamber is grateful for the opportunity to work collaboratively with the Commissioners, Commission staff, State Parks, the local municipalities, and the private sector to ensure our community is prepared and our economy is diversified.

Sincerely,

2021 South County Chambers Board of Directors

Jocelyn Brennan
President & CEO

SURFRIDER FOUNDATION
SAN LUIS OBISPO

March 5, 2021

Steve Padilla, Chair
California Coastal Commission
RE: Th3 Oceano Dunes Coastal Development Permit 4-82-300

Dear Chair Padilla and Commissioners,

Surfrider Foundation is dedicated to the protection and enjoyment of the world's ocean, waves, and beaches, for all people, through a powerful activist network. Surfrider supports the California Coastal Commission's (CCC) efforts to eliminate, as required by the California Coastal Act, the high impacts of Off-Highway Vehicular (OHV) recreation in the Environmentally Sensitive Habitat Area (ESHA) of Oceano Dunes State Vehicular Recreation Area (ODSVRA) and Pismo State Beach (PSB). Surfrider urges the Commission to support staff's recommendation and asks the California Department of Parks and Recreation (DPR) be additionally held to future management of vehicular impacts on the beach between Grand and Pier Avenues.

Staff's recommendations cover many of Surfrider's concerns through conditions in the CDP calling on DPR to:

- Avoid vehicular crossings of Arroyo Grande Creek;
- Maintain Oso Flaco as a nature preserve and conserve prime agricultural land;
- Reduce sand compression, sea level rise and tsunami runup risks to surrounding communities.

However, staff's recommendations do not fully address the following for the beach between Grand and Pier Avenues. We ask that the CDP also require DPR to:

- Avoid emissions and disturbances by heavy machinery in popular coastal recreation areas; and,
- Eliminate risks of recreational vehicles striking nesting birds and marine mammals resting or stranded on the beach.

While Surfrider supports staff's recommended five-year phase-out of vehicular access at ODSVRA, we also support a phased-in approach to monitoring, measuring, and adapting to the impacts continued vehicular day use and proposed car camping will bring to the beach between Grand and Pier Avenues. Surfrider asks the Commission to:

- Consider a peer-reviewed scientific study to evaluate the ongoing impacts of the public's vehicular access to Pismo State Beach, a type of access which is not permitted at any

SURFRIDER FOUNDATION
SAN LUIS OBISPO

other California State Beach. For this study, we recommend CCC staff partner with DPR, the Ocean Protection Council (OPC), and the California Department of Fish & Wildlife (DFW), all which share many of the CCC's concerns for balancing public access with conservation and protection of California's vital coastal resources.
- At a future date, review, or have the Executive Director review, the results of the above study and move to adjust operations (or permitting) to better balance public access with the protection of vital coastal resources along the beach between Grand and Pier Avenues.

Staff's recommendation has made huge strides towards bringing activities at Oceano Dunes and Pismo State Beach into compliance with the Coastal Act. We urge the Commission's support of staff's recommendations and look forward to the day when the State of California adjusts its course and delivers the same vehicle-free beach recreation to Pismo State Beach as it offers elsewhere.

Kind regards,

Brad Snook
Vice Chair, Surfrider Foundation San Luis Obispo
vicechair@slo.surfrider.org

PISMO BEACH
THE CHAMBER
Serving Beach Communities

March 12, 2021

To: California Coastal Commission
Re: Proposed 5 Year Plan for the Oceano Dunes

The Pismo Beach Chamber of Commerce, in conjunction with local businesses, community organizations and residents stand together in our support of the State Parks proposed plan for the use of the Oceano Dunes. We are strongly opposed to the California Coastal Commission's proposed 5 year plan to phase OVH on the Oceano Dunes.

The Pismo Beach Chamber of Commerce has supported our local businesses and residents for 99 years. Our board is comprised of local business owners, retirees, and managers. We represent everything from retail to hospitality to B2B. We are diverse in our businesses, culture, and political beliefs. One thing that we have strongly agreed on as a board is to support the Oceano Dunes in their efforts to stay open.

We know the first-hand economic impact a closure like this causes. Especially, with our recent economic experiences and financial impact of COVID-19. It devastated and rocked most businesses to their core. We watched as our business owners persevered through that crisis. We listened to story after story of the struggles and fight to keep their businesses alive. These businesses not only support their owners and their families but provide hundreds of jobs to our community and help support the economic foundation of the area.

During the closure of the dunes in 2020 another factor came to light that is not being addressed. Our chamber received call after call from individuals who had family members with life-threatening or terminal illnesses or other medical conditions which prohibited them from accessing the beach other than by vehicle. We listened to stories of how the ability to drive on the dunes impacted their mental wellbeing so significantly. Their frustration and sadness as they were unable to help their loved one was palatable and more heart breaking than we can explain. These are families that would not be able to enjoy the concessions that may be proposed in your 5 year plan and closure of the dunes will remove their ability to access those areas.

We know for a fact that the closure of the Oceano Dunes will impact our business community in a negative way. It will also have a negative impact on the well-being for our residents and others from all over the state and country. Therefore we are here today to PLEASE take a moment and understand that the businesses in our community will suffer immensely. We also ask that you take into consideration the human factor that these closures will have.

We also want to state that we are opposed to the proposed closure of Pier Avenue as outlined in the staff's recommendation. By moving all access through the Grand Avenue entrance you will cause traffic issues that will negatively impact not only the Grand Avenue access, but miles of Grand Avenue and Hwy 1 and those businesses in those areas. The train tracks along Hwy 1 at Grand Avenue also pose a great risk and add another factor into traffic flow. We strongly urge that closure of Pier Avenue is not considered until a comprehensive traffic study is conducted. This study should also include the impact that businesses along these corridors will see if customers are unable to easily access their businesses.

We are here to help our business community and residents have a voice in this and not be afraid. Please if nothing else try to consider a middle ground. If we have learned anything over the past year it is that this world is divided and broken but there are still good people that simply want to have a place to continue building their family memories, as they have done for generations.

We love our business community, and we love the Oceano Dunes. I hope that you all take a moment to think about the PEOPLE in this fight, which is simply a fight for what they believe in. Therefore in conjunction with local businesses and organizations we voice our strong opposition to staffs recommended 5 year plan and ask you to stop the plan to close the Oceano Dunes to OVH and work with California State Parks on a plan that will preserve OVH for years to come.

Thank you for your time!

Valerie Mercado

Valerie Mercardo
Chairperson
Pismo Beach Chamber of Commerce

March 12, 2021

Honorable Steve Padilla
California Coastal Commission
45 Fremont Street #1900
San Francisco, CA 94105

Dear Chair Padilla and Commissioners:

We are writing on behalf of the San Luis Obispo County Travel and Tourism industry to request that any decision on the future of the Oceano Dunes State Vehicular Recreation Area be made with local representation on the commission and with credible data and analysis.

Visit SLO CAL is the countywide destination marketing and management organization for San Luis Obispo County (SLO CAL). We represent all lodging properties in the county including hotels/motels, Bed and Breakfasts, RV parks, and vacation rentals. We are active not only in marketing the destination to potential visitors, but also in advocating on behalf of the industry with our local governments, and state and federal officials.

The Oceano Dunes State Vehicular Recreation Area for decades has been recognized as an important asset to the San Luis Obispo County communities. The park attracts over one million visitors annually who contribute to a substantial amount of economic activity to the area, through supporting small businesses, creating jobs and generating millions in tax revenue to provide important services to all county residents.

On March 18, the commission will consider a staff recommendation that will significantly change the existing uses of the ODSVRA and have rippling impacts throughout our county.

We think commission action would be premature.

- There is no coastal commissioner representing the South Central Coast. This seat has been vacant since the beginning of the year, and we firmly believe a weighted decision such as this cannot be made in the absence of this appointee. Local representation on the commission ensures our community's voice as the ODSVRA and future decisions are considered.

- There has not been sufficient time to gather and analyze economic impact data on how the staff recommendations would impact the community. Previous studies have been inconclusive, generating concerns over the methodology and/or the conclusions of the estimated level of economic impact. Visit SLO CAL, in cooperation with a number of regional partners, is in the process of conducting a third-party impartial economic impact assessment to address the gaps in research and provide quality analysis for decision-makers. WE ask that the Commission postpone this important decision until these findings are available.

Moreover, based on the February 18th Coastal Commission staff report, we are particularly concerned with the following recommendations:

1. **Limiting beach camping to the Grand Avenue and Pier Avenue area**: The ODSVRA provides equitable access to our scenic coastline by way of beach camping. It provides low-cost and affordable recreation to Californians of all income levels. By restricting beach camping the opportunity for future generations to enjoy our beaches and south county businesses regresses significantly. The beach camping area is already limited by the daily and seasonal tide changes. Further limitations would make the beach camping area seemingly impossible for year-round accessibility.

2. **Additional restrictions to beach driving and accessibility**: The restriction to beach accessibility will have significantly consequences to the ODSVRA visitation and travelers who not only recreate at the park, but stay, shop, and eat at our local small businesses. The unique experience of driving on the beach provides affordable recreation to all travelers. Without the current ease of accessibility to the park, the commission is denying future generations of enjoying our beaches and other assets the neighboring towns provide. As mentioned, we do not yet have the data to understand how this segmented closure could impact our local economies.

3. **Five-year phase out of the Off-Highway Vehicle Area (OHV):** It is no secret that the OHV component is a popular attraction for the ODSVRA. Off-roading enthusiasts travel from all over California and the world to ride along the scenic coastline. International tourists are particularly drawn to the park because it provides a unique opportunity that is not available elsewhere in California. Our international visitors stay longer in our area and spend more money at local businesses. Without this asset, the attraction to our region would severely diminish. Additionally, the viability of this phase out and whether it could be extended, would provide more time and resources to assist the transition. Our county is also facing the decommissioning of both the Diablo Canyon Nuclear Power Plant and Phillips 66 Oil

Refinery within the same time frame. Those closures will remove over 2,000 jobs and millions in annual earnings for the region. We hope the commission understands the challenges in economic diversity that the San Luis Obispo region will be facing in the coming years and take that into consideration when making this decision.

Because the potential economic impacts of the proposed recommendations are not yet understood, a decision to move forward could present severe unintended consequences for our communities for the foreseeable future.

In light of these factors, Visit SLO CAL requests that the California Coastal Commission hold this item for consideration until the vital economic impact assessment is available to help guide sensible solutions and until a local elected official is appointed to represent our region on the commission.

Thank you for your time and consideration.

All the best,

Chuck Davison, President & CEO
Visit SLO CAL

In partnership with:

Matt Masia, Board Chair
Unincorporated County Tourism Business Improvement District | Highway 1 Discovery Route

Linda Austin, Board Chair
Visit Oceano and Nipomo

CC: Governor Gavin Newsom
Honorable Jordan Cunningham, Assembly District 35
Honorable John Laird, Senate District 17
Dee Dee Myers, Director, Governor's Office of Business and Economic Development
Patricia Ureña, Chair, California Off-Highway Motor Vehicle Recreation Commission
Kevin Kahn, Coastal Commission Central Coast District Supervisor

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OF SAN LUIS OBISPO

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Protecting and preserving San Luis Obispo County's natural environment since 1971

March 12, 2021

California Coastal Commission
725 Front Street, Suite 300
Santa Cruz, CA 95060
via e-mail: OceanoDunesReview@coastal.ca.gov
cc: OceanoDunes.PWP.EIR@parks.ca.gov

Dear California Coastal Commissioners and Staff,

The Environmental Center of San Luis Obispo (ECOSLO) is a 501(c)(3) nonprofit organization that has worked since 1971 to protect natural resources, promote sustainability, and enhance quality of life in San Luis Obispo County through environmental education, advocacy, and action.

ECOSLO strongly supports the recommendations in the California Coastal Commission's (CCC) February 16, 2021 staff report regarding the March 18, 2021 Oceano Dunes Coastal Development Permit 4-82-300 Review. The staff report proposes transitioning drive-in camping at Oceano Dunes State Vehicular Recreation Area (ODSVRA) to Pismo State Beach (PSB) between the Grand Avenue and Pier Avenue beach entrance ramps over a 5-year period while eliminating all motorized recreation, including off-highway vehicle (OHV) use, south of Pier Avenue.

ECOSLO supports CCC staff's recommendations because there is broad consensus that they will help resolve the following serious, decades-long issues at ODSVRA and PSB. These issues have been repeatedly ignored or downplayed by California State Parks' Off-Highway Motor Vehicle Recreation Division (OHMVRD), which oversees ODSVRA.

1) Ecological impacts including habitat destruction or modification, and take of threatened and endangered species. OHV use is a destructive practice that commonly results in loss of vegetative cover, erosion, sedimentation, air pollution, greenhouse gas (GHG) emissions, and habitat loss. Additional adverse impacts from both OHV riding and the associated camping include disturbance of wildlife due to litter, noise (day and night), and lighting at night. Given that nearly all of ODSVRA consists of Environmentally Sensitive Habitat Area (ESHA) as described under the California Coastal Act (CCA) and relevant Local Coastal Programs (LCP), motorized recreation is not an appropriate land use for this area.

   The natural process of foredune accumulation is prevented from occurring at ODSVRA and PSB by park management's use of heavy machinery to maintain vehicle access at the Grand and Pier Avenue entrance ramps and along the beach. In addition, poorly functioning sand track-out devices at the beach ramps mean that tons of sand must be swept up from nearby streets and taken to the landfill each week. This ongoing loss of sand, in combination with sea level rise (see point 2 below), will increasingly have the effect of contributing to the inundation of coastal areas of Grover Beach and Oceano.

In addition, OHV use on dunes that would otherwise be stabilized by vegetation results in large areas of actively moving dunes that contribute to air quality problems downwind (see point 2 below) and in some circumstances, can degrade wetland areas such as the freshwater dune lakes located to the east of ODSVRA.

ODSVRA and PSB contain high-quality habitat for the federally-listed (Endangered) western snowy plover, California least tern, and tidewater goby; the federally-listed (Threatened) California red-legged frog and South-Central California Coast population of steelhead trout; six special-status plant species; and a great richness of other flora and fauna. The ability of many of these species to freely use the habitat they need for survival is severely diminished due to vehicle traffic and drive-in camping at ODSVRA and PSB.

This was demonstrated during the summer of 2020 when these areas were closed to private vehicle traffic due to COVID-19 public health restrictions. Western snowy plovers greatly expanded their nesting and foraging areas into parts of the beach they usually cannot use due to vehicular use. Unfortunately, ODSVRA management chose to respond by eliminating nests and using bird-repelling tactics, actions that if not illegal were highly questionable and resulted in ODSVRA receiving a cease-and-desist order from CCC.

As another example, allowing many hundreds of vehicles daily to drive through the mouth of Arroyo Grande Creek each winter while it is flowing to the sea jeopardizes the local, Threatened steelhead trout population during their critical spawning season.

2) <u>Damaging effects on public health and safety.</u> Respiratory diseases such as asthma and COPD have become an epidemic in the US due to air pollution. Luckily most of San Luis Obispo County enjoys some of the cleanest air in the nation. However, the area of Nipomo Mesa downwind from the OHV riding area at ODSVRA is a glaring exception.

   Research conducted by the San Luis Obispo County Air Pollution Control District (APCD) has repeatedly shown that OHV use at ODSVRA contributes significantly to exceedances of federal and State ambient air quality standards for particulate matter (i.e., dust) downwind of the riding area. On some days, the Nipomo Mesa actually suffers from the worst air quality in the United States. This situation has been identified as a major public health threat by both APCD and the San Luis Obispo County Public Health Department.

   ODSVRA and PSB also generate large amounts of health-damaging air pollution simply due to the exhaust emitted by the thousands of gasoline- and diesel-powered vehicles – often large, fuel-inefficient pickup trucks and SUVs – whose owners the park attracts. Chronic exposure to air pollution such as the dust and exhaust generated at ODSVRA and PSB has been identified as a risk factor that may increase susceptibility to contracting COVID-19.

The heavy vehicular use at ODSVRA and PSB also means that these areas are major contributors to GHG emissions in San Luis Obispo County. Human-caused GHG emissions are produced by diverse sources including transportation, power generation, and industrial activities. In California, the climate-changing effects of these emissions include more (and more intense) heat waves, uncontrollable wildfires, and drought, as well as sea level rise and coastal erosion. All of these effects are already occurring and are expected to continue intensifying. For instance, based on the results of extensive climate change modeling, Pacific Gas & Electric (PGE) (operator of the Diablo Canyon Power Plant in Avila Beach) has conservatively estimated that sea level along the San Luis Obispo County coast could rise 48 inches by the year 2100.

Thus, OHMVRD's operations are both directly (due to foredune/sand removal to preserve beach vehicle access) and indirectly (due to GHG emissions) contributing to the imminent inundation of beaches and other low-lying areas along our coast, including Oceano itself. It is not clear to ECOSLO why a State agency like OHMVRD is neither required nor willing to contribute to the State's nation-leading efforts to protect lives and property by combatting GHG emissions and global climate change.

Finally, ODSVRA is a continual source of needless injuries and deaths from motor vehicle accidents. Emergency room physicians and nurses in San Luis Obispo County have been outspoken about this fact and many of them strongly support the phaseout of OHV use on the beach and dunes.

3) <u>Inappropriate use of land that is culturally significant to local Indigenous communities.</u> The Northern Chumash Tribal Council has stated that ODSVRA and PSB contain ancestral lands that are sacred to them, and that they regard OHV use as inappropriate and offensive degradation of the land. They have also noted that there is a long history of Indigenous voices being disregarded and excluded from the decision-making process around land uses at ODSVRA (see point 4 below). The legitimacy of their beliefs and their right to be heard should be respected by OHMVRD.

4) <u>Environmental injustice for the residents of Oceano, CA.</u> Environmental justice has been defined as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies (Government Code Section 65040.12).

   CCC adopted its Environmental Justice Policy in March 2019. The policy states in part:

   > Generations of injustices towards California's Native American communities, people of color, and other marginalized populations through forms of discriminatory land use policies, desecration of sacred lands and cultural resources, and concentration

> of environmental pollution has resulted in inequitable distribution of environmental benefits and burdens that still disproportionately burden these communities today.

Oceano is an unincorporated community in San Luis Obispo County that is adjacent to PSB. Oceano can be characterized as an historically underserved area whose population is largely low-income and nearly half Hispanic/Latinx, and which bears numerous burdens associated with the operation of ODSVRA and PSB. These burdens include air pollution, noise, traffic congestion and accidents, trash, crime, blight due to lack of economic development opportunities, depressed property values, and lack of safe beach access.

Many of Oceano's residents are justifiably frustrated by the chronic neglect they have experienced at the hands of OHMVRD and San Luis Obispo County. ECOSLO believes that environmental justice for the residents of Oceano should rightfully be a major priority that guides State decisions regarding ODSVRA and PSB.

In addition to the aforementioned points, ECOSLO would like to touch on the following issues:

- Unacceptable Oso Flaco Component of the Public Works Plan (PWP). Most elements of the Oceano Dunes District (ODSVRA + PSB) PWP as proposed are relatively benign and ECOSLO does not currently take any position on them. However, the PWP element in which OHMVRD proposes large-scale development of the Oso Flaco Lake area is deeply misguided, faces significant public opposition, and must be discarded. Despite water quality problems caused by agricultural runoff, Oso Flaco is consistently recognized as some of the highest-quality coastal dune and dune lake habitat left in California. The lake and its surroundings are important waterfowl habitat and special-status plant species are found in the area.

  The development proposed at Oso Flaco includes several hundred campsites and rental cabins, new road access through ESHA to the dunes riding area, other new OHV infrastructure (staging areas and training tracks), and more, all to be built on prime agricultural land in violation of the CCA. These "improvements" would bring many of the same impacts already affecting ODSVRA and PSB (noise, litter, lighting at night) to an area that is currently relatively quiet, litter-free, and enjoyable for passive recreation. As currently proposed in the PWP, development of the Oso Flaco area is inconsistent with the CCA and relevant LCPs, and cannot be supported due to the damage it would inflict upon natural resources and working agricultural resources in the area.

- Inadequacy of the Oceano Dunes District Habitat Conservation Plan (HCP) and its Environmental Impact Report (EIR). The HCP and its EIR have been widely criticized for their inadequacy in protecting the area's biological resources (both special-status and non special-status species) and habitat. ECOSLO believes that eliminating species and habitat protections in order to expand the ecologically destructive activity of OHV use does not constitute a valid use of the HCP process. OHMVRD's proposals would clearly be counterproductive if their aim is to increase the breeding success and long-term population integrity of the affected species. The EIR acknowledges as much in its discussion of the proposed "gradual elimination of the 6 exclosure," which it describes as "a highly productive nesting area for (western snowy plover) and (California least tern)" (HCP EIR, p. S-16).

Specious impact findings: the purpose of an EIR under the California Environmental Quality Act (CEQA) is to disclose facts to decisionmakers regarding potentially significant and adverse impacts to the physical environment from a given project or program. In Section 3.1, the HCP EIR correctly defines this project's "potential impacts" as "the change to the physical environmental conditions that could result from implementation of the HCP" (HCP EIR, p. 3-2).

However, in recent years OHMVRD appears to have fallen into a pattern of claiming in their CEQA documents that the loss of motorized recreational opportunities constitutes a significant adverse environmental impact, and/or that the expansion of motorized recreational uses constitutes a "beneficial impact."

These claims are nonsensical. Loss of recreational opportunities is not an adverse impact to the physical environment, nor is it listed as one under Section XV: Recreation in CEQA Guidelines Appendix G (Initial Study Checklist). As noted in the HCP EIR (Section 8.3.1, p. 8-12), the only two valid questions having to do with recreational impacts under CEQA are:

a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

Whether OHMVRD's proposed reduction of special-status species protection so as to expand OHV use at ODSVRA constitutes an "expansion of recreational facilities which might have an adverse physical effect on the environment" is unclear depending on one's definition of "facilities;" this is something that would likely have to be decided in a court of law.

ECOSLO does not believe that the statement under CEQA Guidelines Section 15063(f) that "public agencies are free to devise their own format for an initial study" constitutes legal permission for a State agency to invent its own impacts, unless a "format" is legally the same thing as an "impact," which seems unlikely.

Similarly, ECOSLO's interpretation of CEQA Guidelines Section 15064, which states in part that determination of significant impacts from a project "calls for careful judgement on the part of the public agency involved," is that "judgement" does not explicitly allow an agency to introduce a brand new impact to CEQA – namely, an impact upon human activities for whatever reason (recreation, economic activity, etc.). CEQA pertains exclusively to impacts on the physical environment.

Finally, the HCP EIR (Table S.1, p. S-14), in the second impact listed under "Recreation," claims that elimination of exclosures protecting nesting habitat for western snowy plover and California least tern would constitute a "beneficial impact" to recreation. Again, this claim is meaningless because CEQA does not recognize a beneficial effect as an impact. The four types of impacts recognized by CEQA are: potentially significant, less than significant with mitigation, less than significant, and no impact. However, if CEQA did explicitly recognize "beneficial impacts," this recognition would pertain to activities that actually benefit the physical environment, not to ecologically damaging activities.

- <u>Flawed and misleading Economic Impact Report.</u> Several years ago, OHMVRD's Oceano Dunes District commissioned the document titled "Economic Impact Analysis Report 2016/17." This report, prepared by SMG Consulting, estimated that the total economic benefit to San Luis Obispo County from Oceano Dunes District operations was $243 million annually.

  Subsequently, Cal Poly San Luis Obispo real estate and economics professor Pratish Patel, PhD, submitted his comments on the validity of the SMG report to CCC as part of the public record for the July 2019 CCC meeting held in San Luis Obispo. Dr. Patel reported significant flaws in the SMG report, including specious and false assumptions in both the survey conducted by SMG and their report, and their failure to clearly explain the methodology used in obtaining their results.

  As noted in the CCC staff report dated February 16, 2021 (pp. 14-15), CCC subsequently obtained an independent, third-party peer review of the SMG report from Dr. Philip King, a San Francisco State University economics professor specializing in the economic impacts of beach and park recreation. Dr. King found that the SMG report did not follow accepted procedures, had an error causing it to grossly overstate the economic benefit of OHV use to San Luis Obispo County, improperly focused on OHV use as if this was the only possible source of recreational revenue from ODSVRA/PSB, and asked "the wrong questions" by failing to consider the economic impacts of multiple types of non-OHV recreation at the park. Dr. King concluded that a non-OHV ODSVRA/PSB would bring in at least as much revenue to the area as the current park catering to OHV users.

  Finally, in follow-on research that was reported in the San Luis Obispo Tribune on February 1, 2021, Cal Poly's Dr. Patel used tax and unemployment data to evaluate the economic effects of closing ODSVRA and PSB to private vehicles for seven months in 2020 due to COVID-19 restrictions. While the closure unquestionably impacted OHV-serving businesses in southern San Luis Obispo County and elsewhere, Dr. Patel found that the closure had no significant overall impact on San Luis Obispo County's economy, and that lodging revenues in Oceano actually increased during the closure. Dr. Patel attributed this to the fact that while OHV user visitation decreased, visitation by non-OHV users increased (see following bullet point).

- Positive opportunities likely to arise upon transitioning away from most motorized recreation at ODSVRA/PSB. During the summer of 2020, for the first time in memory, thousands of San Luis Obispo and Santa Barbara County residents and their families had a chance to safely and enjoyably explore the huge, beautiful, National Seashore-worthy park in their own backyard. This, of course, was due to the COVID 19-related closure of the beach and dunes to private vehicles while the parking lots remained open to vehicles and everything remained open to visitors on foot or bicycle. This situation provided a preview of what ODSVRA and PSB will look like once most motorized recreation is phased out.

  Local residents took advantage of this amazing opportunity (while largely heeding social distancing guidelines) by engaging in low-impact activities like sunbathing, picnicking, beachcombing, playing catch, building sand castles, dog walking, whale watching, birding, wading, swimming, bodyboarding, surfing, kitesurfing, fishing, biking, horseback riding, or just plain strolling up and down the beach and soaking in the natural splendor.

  As noted above, while a small number of local OHV-serving businesses were significantly affected by the closure to vehicles, the closure did not wreck San Luis Obispo County's economy. As vehicular recreation at ODSVRA is phased out, countless new business and recreational opportunities will appear and the area's overall prosperity will increase. This has already occurred in every other coastal community in the state, as town after town has eliminated the noise, dust, trash, and damage associated with driving on the beach and replaced them with a wide variety of sustainable activities that have much broader tourism appeal and bring in at least as much revenue, if not more, than OHV use.

In summary, ECOSLO urges the California Coastal Commission to vote YES on their staff's recommendations for ODSVRA and PSB on March 18, 2021. Serious action is long overdue to address the many dangerous, unlawful, and otherwise unacceptable conditions caused by massive motorized recreational use at our world-class beach and dunes.

Sincerely,

Mary Ciesinski
Executive Director

Ayla-Louise Mateo
Board of Directors - Secretary

Grant Helete
Community Organizer

Christopher Hamma
Advocacy Committee Volunteer

PUBLIC INTEREST COALITION

March 12, 2021

Sent via email: OceanoDunesReview@coastal.ca.gov
To: California Coastal Commission

RE: Stop Oceano Dunes Destruction—Ban OHV / all motorized uses

We support protection and conservation of California's (CA) natural resources and totally support restrictions of all motorized vehicle use on our fragile beaches—especially Oceano Dunes. The CA Coastal Act of 1976 and the Coastal Commission's mission confirm its mandated protection role. This statement explains its process: **"It does so through careful planning and regulation of environmentally-sustainable development, rigorous use of science, strong public participation, education, and effective intergovernmental coordination."**[1]

Protection is the first priority; all other activities are secondary, which include public access and recreational activities. Of all the destructive activities, OHV and/or other motorized vehicle uses on our beaches are probably the worst. The fact that egregious, destructive, and unacceptable motorized vehicle activities have been going on for many decades is totally irrelevant. Just because an activity has decimated environmentally sensitive habitat in the past, in no way constitutes a platform or basis to allow such activities to continue.

From the Coastal Commissions own website, this statement clearly states what just one of the many problems: "***The Commission has found that driving at the Park has degraded dune habitats, harmed native species, caused air quality and public health issues, and made it difficult for the public to walk, swim and enjoy other activities at the beach***."[2]

We commend Coastal Commission staff for excellent reports over many decades.[3] We urge the Coastal Commission to neither "negotiate" any longer (four decades is long enough) nor attempt to "strike an appropriate balance" (there can be none —protecting dune and related coastal resources should be the only goal and the highest mandated priority).

In similar activities, akin to the old adage, "A fool and his money are soon parted," consumers are seduced into purchasing OHV or other types of motorized vehicles and gear with unsupported promises of "fun." The buyer then has to find areas to use the OHV. There can be no justification for allowing any type of motorized vehicles to run roughshod over highly important, fragile natural resources. It is neither the government's obligation nor responsibility to provide any areas for OHV/motorized vehicle uses. The fact that someone purchased what may become a

[1] https://www.coastal.ca.gov/whoweare.html
[2] Oceano Dunes, The Park, Park Issues. http://www.coastal.ca.gov/oceano-dunes/
[3] June 21, 2019, Th12a: "Oceano Dunes State Vehicular Recreation Area Coastal Development Permit 4-82-300 Review, prepared for the July 11, 2019 Hearing."

"white elephant" and/or suffer "buyers' remorse" is no concern of any public regulatory agency.

Although proponents of "Dune Buggies" and other OHV motorized activities that destroy natural resources may claim they have some right to tear around in them on public property, their claims are spurious. A reported OHVer contention is that there is no other place where they can legally ride right next to the ocean.[4] That's correct, and they cannot ride in a myriad of other public government areas either—certain parks, wildlife areas, nor in many restricted places. However, they, as others, can certainly walk out on Oceano Dunes and enjoy its natural resources on foot. They simply have to leave their destructive machines at the gate or at home.

It is for good reason that Oceano Dunes is the only OHV Park on the CA coastline. The activity is too destructive to be allowed on any shoreline along CA's magnificent coastline and is exactly why OHV uses need to be shut down completely and immediately.

Users of motorized vehicles may threaten to not come to San Luis Obispo County if they can't use Oceano Dunes State Park and Pismo State Beach, claiming their absence will cause losses to local revenues. We submit that the value of the natural resource is worth much more than destruction profits, and that no one industry should not only monopolize a resource (many citizens will not visit Oceano Dunes because of the horrific OHV/Dune buggie impacts—including but not limited to air quality, noise, pollution, etc.), but also continue that activity in the face of overwhelming evidence as to its destructiveness.

We urge an immediate ban on all OHV and/or other motorized vehicles on Oceano Dunes with strong enforcement provisions, prosecution for violations, and high deterrence-value penalties.

Thank you for considering our views,

Marilyn Jasper

Marilyn Jasper, Chair

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[4] https://www.bakersfield.com/news/coastal-commission-considers-limiting-off-road-access-to-oceano-dunes/article_5146e044-9d0b-11e9-b7ad-372e9907c924.html

pacific WILDLIFE care

P.O. Box 1134, Morro Bay, CA 93443
(805) 543-WILD (9453)
www.pacificwildlifecare.org
pwcinfo@pacificwildlifecare.org

March 12, 2021

EMAIL CORRESPONDANCE

California Coastal Commission
Subject: Oceano Dunes Coastal Development Permit 4-82-300 Review
OceanoDunesReview@coastal.ca.gov

Dear Chair Padilla & Commissioners,

The mission of Pacific Wildlife Care (PWC), a501c3 nonprofit organization established in 1987, is *to support San Luis Obispo County wildlife through rehabilitation and educational outreach*. PWC is the **only** organization in SLO County that rescues and rehabilitates injured, orphaned, sick and pollution-damaged birds, land/air mammals and reptiles/amphibians with the goal of releasing back to the wild. To ensure professional standards of care for all animal patients, PWC is proud to employ a **full-time wildlife veterinarian**, trained rehabilitation staff, and **200+ trained volunteers** all working diligently to fulfill our mission.

We are licensed by both the California Department of Fish & Wildlife and the U.S. Fish & Wildlife Services. In addition, we are a member organization and primary care facility of the Oiled Wildlife Care Network (OWCN).

No matter what decision is made by the Coastal Commission regarding the future of Oceano Dunes, PWC **remains a vital resource for the SLO County community and visitors** alike who find wildlife in distress—including in the area of Oceano Dunes. In 2020, we served over **2,600 wildlife cases** comprising nearly **200 unique species**. **PWC is open 365 days a year** and operates a volunteer telephone Hotline, **805-543-WILD (9453)**, for the public, and local partner agencies such as State Parks, to report injured and orphaned wildlife. The PWC Hotline receives between **3,000 and 5,000 calls per year.**

Because PWC is committed to caring for wildlife from **all corners of SLO County**, we work in close collaboration with **SLO County partner agencies** providing them our expertise in rescuing and caring for our wild neighbors. Our partners include California Department of Fish & Wildlife, U.S. Fish & Wildlife Services, SLO County Animal Services, SLO County Sheriff's Office, California State Parks, Port San Luis Harbor District, Morro Bay Harbor Department, and Police Departments from all seven incorporated cities in our County.

Most of our wildlife patients are inadvertently affected by human interactions--vehicle and window strikes, fishing hook/line and fencing entanglements, nest destruction from tree, shrub and grass trimming/disturbance, pet dogs and cats, use of poisons and glue traps, lack of available food sources for various reasons and environmental conditions.

As **advocates for wildlife**, we inspire community participation to **reduce harm to our wild neighbors**.

Therefore, on behalf of our organization and our Board of Directors, *we cannot support California State Parks Public Works plan for the Oceano Dunes State Vehicular Recreation Area, which includes Oso Flaco Lake.* We add our names to the long list of local residents and organizations who believe that State Parks' plans are detrimental to the biodiversity of wildlife that is found in abundance at Oso Flaco Lake.

Furthermore, **and precisely in light of our mission**, we ask you *to support Staff's Recommendation and approve the proposed changes to the Oceano Dunes Coastal Development Permit 4-82-300 as amended and outlined in the Staff Report for the Special Meeting on March 18, 2021.*

PWC is a place of refuge where the public can rely on the highest standard of humane treatment of each animal patient until healthy enough to be returned to the wild. While we do not support ongoing high impact activities or new high impact activities at Oceano Dunes, we do wholeheartedly support opportunities for low-impact and low-cost public enjoyment of our incredible wild places.

Respectfully,

Kimberly Perez, President, Board of Directors

Christine Johnson, Executive Director

Board of Directors

Marcelle Bakula, Vice President
Jermaine Washington, Secretary
Kate Capela, Treasurer
Craig Christakos, Member-at-Large
Kathleen Dillon, Member-at-Large
Robert Blakely, Member-at-Large

LEAGUE OF WOMEN VOTERS®
OF SAN LUIS OBISPO COUNTY
Mailing Address: PO Box 4210, San Luis Obispo CA 93403
TEL (805) 782-4040 EMAIL info@lwvslo.org WEBSITE www.lwvslo.org

February 24, 2021

TO: California Coastal Commission (oceanodunesreview@coastal.ca.gov)
California State Parks (OceanoDunes.PWP.EIR@parks.ca.gov)

RE: Public Works Plan for Oceano Dunes SVRA

The League of Women Voters of San Luis Obispo County (LWVSLOCO) has reviewed the Public Works Plan (PWP) for the Oceano Dunes State Vehicular Recreation Area (ODSVRA, or the "Dunes") and its accompanying Draft Environmental Impact Report (DEIR). LWVSLOCO will not be providing in-depth comments on the technical aspects of the DEIR, but rather offers the following comments and recommendations.

1. There are several components of the proposed PWP that have the League's support: namely, improvements to the Monarch Butterfly Preserve area, addressing flooding and updating of existing campgrounds, and conducting maintenance/repair projects, such as replacing the aging boardwalk at Oso Flaco Lake.

2. The PWP represents a tremendous departure from the existing situation at the Dunes and is not appropriate for the area. Creating a large campground with RV spaces, cabins, service support (i.e., convenience store), large parking areas, and other features at the end of Oso Flaco Lake Road will require a tremendous change in infrastructure and will negatively impact a sensitive area of unique environmental value. This development would completely change the character of the Oso Flaco Lake area and conflict with the League's adopted position to "preserve and protect the shoreline, including estuaries, marshland, and other transition zones"; and to "adhere to local coastal plans that support these goals." Future plans to convert the 109 acres currently leased for agricultural production are also in conflict with LWVSLOCO's position to "Pursue policies and actions that further the goals of the Agricultural and Conservation and Open Space Elements to conserve agricultural lands, protect open space, and prevent urban sprawl."

3. The potential acquisition of the Phillips Refinery site, while bold, appears speculative and too intense for the area. Although perhaps better suited for infrastructure support, which are likely already present, the site contains other drawbacks (i.e., hazardous wastes) that will complicate any repurposing of the site. The establishment of a major access to the Dunes riding area from this location would have the damaging effect of cutting through the middle of a designated Environmentally Sensitive Habitat Area (ESHA) with what would certainly be a very busy transportation corridor. This corridor would also require the construction of a major new bridge over the railroad tracks.

4. The past use at the ODSVRA generated the need to develop Habitat Conservation Plans and Particulate Matter Reduction Plans; it does not appear appropriate to introduce disruptive uses into additional sensitive areas that would exacerbate impacts to habitat and potentially increase particulate matter release into areas currently not impacted by these issues.

For the above reasons, the LWVSLOCO recommends that the State Parks Department reconsider the scale, location, and timing of any new development proposed for ODSVRA, to recognize that changes in public policy and our knowledge of impacts regarding the Dunes area have occurred in the intervening years since this use was first introduced to the Dunes. Plans for future improvements need to address the increasing concern of the public for the coastal environment and preservation of resources. LWVSLOCO recognizes the state directive to provide affordable access to the coast for the benefit of all residents. There are other options that will provide a wide range of access while at the same time protecting the very resources to which affordable access is desired.

Thank you.

Cindy Marie Absey and Ann Havlik
Co-Presidents

REACH
Ideas + Action for a Thriving Central Coast

12 March 2021

Honorable Steve Padilla
California Coastal Commission
45 Fremont Street #1900
San Francisco, CA 94105

Subject: March 18, 2021 Hearing on Oceano Dunes Coastal Development Permit 4-82-300 Review

Dear Chair Padilla and Commissioners:

We are writing to request that any decision about the future of the Oceano Dunes State Park be made with credible data and analysis and appropriate local representation on the Commission.

By way of background, REACH is a nonprofit, economic impact organization with a mission to increase economic prosperity on the Central Coast through big thinking, bold action and regional collaboration. Led by the private sector, the organization works in partnership with business, education, government and nonprofit partners to solve the region's most pressing economic challenges in order to establish the Central Coast as a place where current and future generations have the opportunity to thrive. Our organization is focused on ideas and action to create a thriving Central Coast. It is in this spirit that we write to you, today.

We recognize and appreciate the long history of the State Vehicle Recreation Area (SVRA) and Off-Highway Vehicle activities at the Oceano Dunes, as well as the strong opinions and interests on both sides of this issue. At this hearing, our organization is not advocating for either side of this issue, because we do not believe sufficient fact gathering and analysis have been conducted to make an informed decision. To that end, prior to making a decision, we request that the Commission ensure decision-quality analysis is produced to ensure both environmental and economic impacts are independently and objectively understood in a manner consistent with the mission of the Coastal Commission, which is to make decisions through "careful planning, rigorous use of science, strong public participation, education and effective intergovernmental coordination."

The following four items are of concern for the South Central District and we request you give careful consideration and action prior to a decision:

1) **Ensure local representation in this decision**
The South Central seat on the Commission is vacant. This decision is significant for our region and should not be made without a seated representative for our South Central District. We believe strong public participation can only be achieved when our district is represented by an appointee who has been elected to public office by South Central District residents.

2) **Ensure there is an independent, objective and accurate economic impact analysis conducted (impacts on direct, indirect, induced and tax revenue fiscal implications)**
To enable informed decision-making, an independent economic impact analysis is needed that details the current impacts and outputs, as well as modeling for potential future alternative uses impacts. Economic impacts are a significant driver of economic output, not only for the Central Coast, but for California. It's not simply loss of revenue, or a potential reduction of visitors and the induced impacts they create—it's the local context within which such an impact will occur. At this time, San Luis Obispo County is wrestling with three very significant challenges that should be considered:

    1. First, Oceano is a majority 51% Hispanic/Latinx community and median household income is 11% lower than the rest of the county. Oceano is also a state and federal recognized Opportunity Zone, due to underperformance in key achievement and quality of life metrics. It is not understood what the impacts of a closure of the Dunes would be to this community, or what economic alternatives there may be to continue to support the local community. We ask that the Coastal Commission evaluate the impacts to the surrounding community making every effort to ensure participation is accessible to a Spanish-speaking population.

    2. Second, the county's largest and highest-paying private employer, PG&E, is closing Diablo Canyon Nuclear Power Plant in 2025, the same timeframe that the staff report proposes to close the State Park to OHV. For a larger metro, the loss of a single employer and shift in a State Park Use Policy would likely have little impact. However, in our small, rural county, the combined impacts will be significant and should not be taken lightly.

    3. Third, while we're all very thankful for falling COVID-19 case numbers and vaccinations to help us achieve herd immunity, we have yet to start the recovery process from the devastating impacts of the pandemic. Recovery will be required in most every aspect of our lives, not the least of which will be economic. Tourism is a significant part of our regional economy, making up nearly $2B or about 15% of the county GDP.

We will need every visitor resource and attraction in the coming years, or the consequence will, self-evidently, be a slower recovery.

3) **Meaningful public participation from the surrounding impacted community**
Strong public participation is a priority for the Coastal Commission, and it should be inclusive and meaningfully solicit the participation of the community most impacted, not just those most vocal and able to engage in a process designed to favor their participation (this includes vocal advocates on both sides of the closure issue).

To that end, the community of Oceano should provide input into the process, proportional to its majority Hispanic/Laninx population. The process has missed the spirit and intent of the Coastal Act which states in Section 30107.3:

> *(a) "Environmental justice" means the fair treatment and meaningful involvement of people of all races, cultures, and incomes and national origins with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies." (b) "Environmental justice" includes, but is not limited to, all of the following:*
>
> a. *(1) The availability of a healthy environment for all people.*
> b. *(2) The deterrence, reduction, and elimination of pollution burdens for populations and communities experiencing the adverse effects of that pollution, so that the effects of the pollution are not disproportionately borne by those populations and communities.*
> c. *(3) Governmental entities engaging and providing technical assistance to populations and communities most impacted by pollution to promote their <u>meaningful participation in all phases of the environmental and land use decision making process</u>.*
> d. *(4) <u>At a minimum, the meaningful consideration of recommendations from populations and communities most impacted by pollution into environmental and land use decisions.</u>*

Although the staff report references "Environmental Justice" 62 times, we believe the spirit of the definition as defined by the Coastal Act has not been followed. Without a thorough understanding of the impacts, and recommendations of the adjacent impacted community a conclusion cannot be drawn. Along these lines, we are concerned that the Coastal Commission does not provide adequate Spanish translation of its proceedings--such as instructions for comment and public participation, staff reports and exhibits. Without these basic tools, a majority of the residents in the community where this decision would be most acutely felt are disenfranchised. Alternatively, proactive outreach through polling or surveying a sample of this population could be an effective tool in gaining input.

4) **Rigorous use of science and due process surrounding the air quality and other environmental impacts**
   It is important to consider established process and careful planning surrounding this decision. The Commission previously requested State Parks address and mitigate a variety of items in their Public Works Plan (PWP). A draft PWP was only recently completed, and it should be formally responded to first. We encourage the Commission to complete the process required by the California Environmental Quality Act.

We hope our letter conveys our thoughtful and sincere perspective, and desire to advocate for the right and just outcomes for our community. The issue of OHV at the Oceano Dunes is like many other issues—they are highly local and must therefore be considered in the context of our local community. Please wait until an elected member of our community is appointed to the Commission; direct staff to independently assess economic impacts of closure to OHV uses and modeling of alternative uses; and complete PWP process to formally determine which environmental impacts can/cannot be mitigated.

Thank you for your time and consideration.

Sincerely,

Melissa James

Melissa James
President/CEO
REACH

March 12, 2021

Mr. John Ainsworth
Executive Director
California Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

c/o: ExecutiveStaff@coastal.ca.gov

Re: SEMA Recommendation to Continue Permitting OHV Use at Oceano Dunes SVRA

Dear Executive Director Ainsworth:

The Specialty Equipment Market Association (SEMA) respectfully urges the California Coastal Commission (Commission) to make no changes to the current permit that allows off-highway vehicle (OHV) riding at Oceano Dunes State Vehicular Recreation Area. SEMA urges the Commission to allow California State Parks to complete its Public Works Plan (PWP) for long-range management of Oceano Dunes SVRA.

SEMA represents the $46 billion specialty automotive industry comprised of 7,500 member companies nationwide, including over 1,400 members in California. The industry provides appearance, performance, comfort, convenience and technology for passenger and recreational motor vehicles. Many SEMA member companies provide the equipment necessary for enthusiasts to enjoy outdoor recreation.

SEMA also operates the SEMA Action Network (SAN), a nationwide partnership of vehicle clubs, enthusiasts and members of the specialty auto parts industry who want to protect their hobby. Founded in 1997, the SAN has over 130,000 individual and car club members throughout the United States and Canada and is in direct contact with at least several million Americans through electronic communication, publications and social media. A primary mission of the SAN is to support and protect reasonable access to motorized recreation.

Oceano Dunes SVRA provides the only opportunity for outdoor motorized recreation at a state park along California's Pacific coast. It has been enjoyed by outdoor enthusiasts from across the country for decades under a permit first issued by the Commission in 1982. The SVRA is especially valued at a time when the pandemic has forced California residents to stay indoors for extended periods of time.

OHV recreation is an important contributor to the local economy. While bringing pleasure to thousands of enthusiasts, the monies spent at area stores, motels, restaurants and gas stations support jobs and generate tax revenues. The direct impact extends beyond San Luis Obispo County to include Santa Barbara and Ventura Counties. The area is easily accessible by residents from southern and central California.

SEMA respectfully disagrees with conclusions and staff recommendations included in a February 16, 2021 report, and for a need to hold a March 18, 2021 hearing. Scheduling a special hearing seems to be an unwarranted action regarding OHV management issues currently being considered by State Parks. State Parks has not yet finalized its PWP which is currently subject to Commission comment. It would be extraordinary for the Commission to take a unilateral action for land managed by another state agency and land specifically set aside by the State Legislature for OHV activity.

Oceano Dunes SVRA is a valuable resource which is already subject to reduced OHV access to address environmental issues. SEMA respectfully recommends that the California Coastal Commission allow the settlement agreement to be fully implemented under the current permit.

Thank you for your consideration. Please feel free to contact me if you have any questions.

Sincerely,

Daniel Ingber
Vice President, Government and Legal Affairs
202-792-4446; danieli@sema.org

SAN LUIS OBISPO COUNTY FARM BUREAU
4875 MORABITO PLACE, SAN LUIS OBISPO, CALIFORNIA 93401
PHONE (805) 543-3654 SLOFARMBUREAU.ORG

March 12, 2021

Kevin Kahn, District Supervisor
Central Coast District Office
California Coastal Commission
725 Front Street
Santa Cruz, CA 95060

By email to: kevin.kahn@coastal.ca.gov and OceanoDunesReview@coastal.ca.gov

Re: Oceano Dunes Coastal Development Permit 4-82-300 Review

Dear Mr. Kahn,

This letter is in response to your email to me dated Feb. 10, 2021 seeking input on agricultural conversion issues associated with the Oceano Dunes State Park draft plan. Farm Bureau recognizes the significance of recreational opportunities to South County businesses and our region's economic development. As one of State Parks' proposed projects includes conversion of a 116-acre agricultural property near Oso Flaco Lake off of Oso Flaco Road, we want the Commission to be aware of possible impacts to area growers.

Farm Bureau supports private property rights. We also know that taking productive farm ground out of production is detrimental to San Luis Obispo's $2.5 billion agricultural economy. A significant portion of our agricultural economy comes from fruit and vegetable production in South County.

This project may also impact food safety of neighboring farms. Any time an increase in pedestrian or recreational activity occurs in close proximity to a produce field, be it new hiking trails, camping, dog walking, etc., food safety risks increase. Animal or human waste is a known vector of contamination of produce, much of which will be consumed raw. Increasing pedestrian traffic in proximity to produce fields increases the risk of waste coming in contact with raw produce. Growers would be forced to mitigate these new risks through increased buffers, and more productive farm ground would be lost. Having hiking or bike trails close to farms creates liability issues for farmers performing routine agricultural practices like the application of fertilizer or crop protection products. If this project is pursued, the State Park should put buffers in place so neighboring farms are not burdened.

Please reach out to me if you have additional questions.

Sincerely,

Brent Burchett, Executive Director
San Luis Obispo County Farm Bureau

RP SLO County

P. O. Box 1075 San Luis Obispo, California 93406

RECEIVED

MAR 09 2021

CALIFORNIA
COASTAL COMMISSION
CENTRAL COAST AREA

March 6, 2021

Governor Gavin Newsom
1303 10th Street, Suite 1173
Sacramento, California 95817

RE California Coastal Commission Voting to Phase Out the Oceano Dunes Off-Highway Vehicle Recreation Area at March 18, 2021 Meeting

Dear Governor Newsom,

The Republican Party of San Luis Obispo County (RPSLOC) is writing in support of the many small businesses throughout San Luis Obispo County and their thousands of employees.

The RPSLOC is very much OPPOSED to the California Coastal Commission's March 18th meeting staff recommendation that the Oceano Dunes Off-Highway Vehicle Recreation area be phased out over a five-year period.

Due to the present lock down of businesses in San Luis Obispo County, this is not a time for government to further cause chaos and hardships for small businesses...its employers, employees and their families.

It is also interesting to note that California families are no longer allowed to have fun with their children, relatives and friends. Everything is now locked down and regulated! For the last year our children and families have had very little in California to enjoy. Generations of families have shared the Oceano Dunes beach activity and now is not the time to remove one of the few things available to them.

The economy of this county depends on tourism which is the significant economic driver with the Oceano Dunes Off-Highway Vehicle Recreation area being a major player.

The Republican Party of San Luis Obispo County requests that you and the California Coastal Commission OPPOSE the move to phase out the Oceano Dunes Off-Highway Vehicle Recreation area.

Respectfully,

RJ

Randall Jordan
Chairman
Republican Party of San Luis Obispo Party
P.O. Box 1075
San Luis Obispo, California 93406

CC:
California Coastal Commissioner Chair Steve Padilla
California Coastal Commissioner Vice Chair Donna Browney
California Coastal Commissioner Sara Aminzadeh
California Coastal Commissioner Dayna Bochco
California Coastal Commissioner Linda Escalante
California Coastal Commissioner Carole Groom
California Coastal Commissioner Dr. Caryl Hart

California Coastal Commissioner Catherine Rice
California Coastal Commissioner Effie Turnbull-Sanders
California Coastal Commissioner Roberto Uranga
California Coastal Commissioner Mike Wilson
California Coastal Commission Central Coast District Supervisor Kevin Kahn

Paid for by the Republican Party of San Luis Obispo County

15 March 2021

Honorable Steve Padilla
California Coastal Commission
45 Fremont Street #1900
San Francisco, CA 94105

Subject: March 18, 2021 Hearing on Oceano Dunes Coastal Development Permit 4-82-300 Review

Dear Chair Padilla and Commissioners:

The Santa Maria Valley Chamber of Commerce wishes to add our voice to those of numerous other economic development, tourism, and community organizations requesting that any decision about the future of the Oceano Dunes State Park be made with credible data and analysis and appropriate local representation on the Commission.

Prior to making any decision on this issue, we request that the Commission ensure decision-quality analysis is produced to ensure both environmental and economic impacts are independently and objectively understood in a manner that ensures the ultimate decision is in the best interest of all stakeholders involved in this issue.

Specifically, we want to raise the follow items of concern related to this item and request you give careful consideration to each prior to a decision:

1) Local Representation
The South Central seat on the Commission is vacant. This decision is significant for our region and should not be made without a seated representative for our South Central District. We believe strong public participation can only be achieved when our district is represented by an appointee who has been elected to public office by South Central District residents. We note that the Governor's office has recently requested nominations for this position and believe that a delay pending this appointment is not unreasonable.

2) Independent, Objective and Accurate Economic Impact Analysis
To enable informed decision-making, an independent economic impact analysis is needed that details the current impacts and outputs, as well as modeling for potential future alternative uses impacts. While acknowledging the special environmental issues that must be considered relative to this unique asset, the economic impacts must also be fully evaluated and considered as part of any process that will enjoy credibility and public support.

3) Meaningful Public Participation
Strong public participation is a stated priority for the Coastal Commission, and it should be inclusive and meaningfully solicit the participation of the community most impacted, not just those most vocal and able to engage in a process designed to favor their participation (this includes vocal advocates on both sides of the closure issue).

To that end, the community of Oceano, as well as the neighboring communities in southern San Luis Obispo and northern Santa Barbara Counties should be afforded direct and specific opportunities to provide input into the process

Similarly, input from the varied stakeholders associated with the Stake Parks system should also be considered.   This ultimately requires that State Parks' current Public Works Plan process should be allowed to continue to a final plan consistent with the process required by the California Environmental Quality Act.

Thank you for your time and consideration.

Sincerely,

Glenn D. Morris
President/CEO

Jocelyn Brennan
Jocelyn@southcountychambers.com
(805) 489-1488
PO Box 672
Arroyo Grande, CA 93421

February 18, 2021

Governor Gavin Newsom
1303 10th Street, Suite 1173
Sacramento, CA 95814
Via postal and electronic mail

Dear Governor Newsom,

The organizations represented in the letter speak for businesses throughout San Luis Obispo County, Santa Barbara County, and Ventura County and thousands of employees.

The California Coastal Commission staff have announced that the Commission will review the Oceano Dunes State Vehicle Recreation Area's (SVRA) Coastal Development Permit at the March 18th meeting and they recommend that the Off-Highway and Street Legal riding on the beach be phased out over a five-year period.

Tourism to the Oceano Dunes SVRA is a significant economic driver in South San Luis Obispo County. Visitors and locals have been enjoying the beach in their vehicles since the turn of the last century and a specific economy has formed around this activity. The Commissioners will be making a major decision for our community that will have lasting impacts on our community, the economy, and employment.

We respectfully request that the Commission postpone this agenda item until there is a South Central Coast Commissioner appointed to fill the recent vacancy left by Commissioner Erik Howell. The Oceano Dunes SVRA is a longstanding and complicated issue with economic, environmental, and public health components. A South Central Coast Commissioner will need time to become familiar with the history of the park and the local stakeholders.

As the Commission's mission is to protect coastal access and resources, the Chambers mission is to ensure businesses prosper. These are not mutually exclusive goals. We implore the Commissioners and Coastal Commission staff to approach the decision as a collaborative effort to enhance the overall diversity of coastal experiences, wellness of our community, balancing the environmental and economic health of our residents and visitors to the beach.

This decision should not be made until there is a representative from our region and they have had an appropriate allowance of time to become familiar with the issues and visit the park, to make a well-informed vote.

Sincerely,

Jocelyn Brennan President & CEO, South County Chambers of Commerce
Jim Dantona President & CEO, San Luis Obispo Chamber of Commerce
Gina Fitzpatrick President & CEO, Paso Robles Chamber of Commerce
Erica Crawford President & CEO, Morro Bay Chamber of Commerce
Glenn Morris President & CEO, Santa Maria Chamber of Commerce
Linda Small Executive Director, Santa Ynez Chamber of Commerce
Kristen Miller President & CEO, Santa Barbara South Coast Chamber of Commerce

CC:
Jim DeBoo Executive Secretary
Chief Appointments Advisor, Cathryn Rivera-Hernandez
Chief Deputy Appointments Advisor, Morgan Carvajal
Appointments Advisor (CCC), Kristi Stauffacher
Senator Laird, Assemblyman Cunningham
District 3 Supervisor Dawn Ortiz-Legg, District 4 Supervisor Lynn Compton
City Council: Grover Beach, Pismo Beach, Arroyo Grande
CCC Commissioners
CA State Parks Director Quintero
CCC Staff, Jack Ainsworth, Dan Carl and Kevin Kahn

MOTORCYCLE INDUSTRY COUNCIL

SVIA
Specialty Vehicle Institute of America

RECREATIONAL OFF-HIGHWAY VEHICLE ASSOCIATION
ROHVA

California Coastal Commission
725 Front Street, Suite 300
Santa Cruz, CA 95060

March 16, 2021

Re: Oceano Dunes State Vehicular Recreation Area

Dear Commissioners:

The Motorcycle Industry Council (MIC), the Specialty Vehicle Institute of America (SVIA), and the Recreational Off-Highway Vehicle Association (ROHVA) (collectively, the Associations[1]) respectfully oppose the California Coastal Commission's recommendation to phase out off-highway vehicle (OHV) use at the Oceano Dunes State Vehicle Recreation Area (ODSVRA).

On February 17, 2021, the Associations provided a letter to the Coastal Commission detailing numerous concerns with the Department of Parks and Recreation's (DPR) proposed Public Works Plan (PWP) – including the 5-year phase-out study language inserted into the PWP at the request of the Coastal Commission. We understand that since that time thousands of letters have been sent to the Coastal Commission, the DPR, and the Off-Highway Motor Vehicular Recreation (OHMVR) Commission, collectively expressing opposition to restricting or phasing out OHV activity at ODSVRA.

At the February 18, 2021, OHMVR Commission meeting, we provided oral testimony and submitted written comments of our opposition to phasing out off-highway vehicle use at Oceano Dunes. The Associations support OHMVR Commission Chair Ureña's March 10, 2021 letter to Executive Director Ainsworth and Coastal Commission Chair Padilla, and it is our hope that the Coastal Commission will reject the staff's recommendation to study phasing out all OHV activity at ODSVRA.

We remain open to discussions with the Coastal Commission and DPR to preserve access for the OHV community and enhance the culture of OHV safety and responsible ridership at Oceano Dunes.

Sincerely,

Erik Pritchard
President & CEO
MIC, SVIA, and ROHVA

---

[1] MIC, SVIA, and ROHVA are national, not-for-profit trade associations representing hundreds of manufacturers, distributors, and retailers of on- and off-highway motorcycles, all-terrain vehicles (ATVs), and recreational off-highway vehicles (also called side-by-sides), respectively. There are more than 12 million motorcycles and more than 10 million combined ATVs and recreational off-highway vehicles (collectively, "OHVs") in use across the U.S., many of them in California.

INGLENOOK FEN
A Study and Plan

edited by
W. James Barry,
State Park Plant Ecologist
and
Evert I. Schlinger,
Professor of Entomology
Chairman, Division of
Entomology and Parasitology
University of California,
Berkeley

June 1977

Edmund G. Brown Jr.
Governor
State of California

Claire T. Dedrick
Secretary for Resources

Herbert Rhodes
Director
Department of Parks and Recreation

State of California – The Resources Agency
Department of Parks and Recreation

P. O. Box 2390, Sacramento 95811

SENATE CONCURRENT RESOLUTION
No. 36

Introduced by Senator Collier
April 10, 1972

LEGISLATIVE COUNSEL'S DIGEST

WHEREAS, the Department of Parks and Recreation is completing the acquisition of the Ten Mile River dunes in Mendocino County and will proceed with plans for the public use of the area as a unit of the state park system; and

WHEREAS, Within these dunes there lies the Inglenook Fen, a marshy place which, although small in size, possesses remarkable scientific significance; and

WHEREAS, Protection of the scientific value of this fen in conjunction with the public use of the surrounding lands will require a high degree of specialized understanding and planning on the part of the Department of Parks and Recreation; now, therefore, be it

Resolved by the Senate of the State of California, the Assembly thereof concurring, That the Department of Parks and Recreation is directed to solicit assistance from appropriate scientific, educational, and conservation agencies for the purpose of undertaking studies directed at an understanding of the scientific significance of the ecological communities existing in the Ten Mile River beach, dunes and estuary area, and particularly in the Inglenook Fen, sufficient to serve as a basis for those land acquisition, development and protection measures required to maintain in perpetuity the biologic integrity of such sites; and be it further

Resolved, That the Department of Parks and Recreation report its progress on such studies and plans to the Legislature no later than the fifth calendar day of the 1974 Regular Session; and be it further

Resolved, That the Secretary of the Senate transmit a copy of this resolution to the Director of Parks and Recreation.

STATE OF CALIFORNIA—THE RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

DEPARTMENT OF PARKS AND RECREATION
P.O. BOX 2390
SACRAMENTO 95811

June 1, 1977

Honorable James Mills, President pro Tempore
California State Senate
State Capitol
Sacramento, CA 95814

Dear Mr. Mills:

Senate Bill 191, Chapter 1439 (December 1972) mandated the Department of Parks and Recreation to conduct a study of Inglenook Fen, and to prepare a plan for actions necessary to preserve the biological integrity of the fen.

In accordance with the requirements of SB 191, a preliminary report was presented to the legislature in June 1973. Due to the nature and complexity of ecological studies, this study and plan could not be adequately compiled in a short time period. On-going research resulted in new discoveries that necessitated numerous updatings of the study.

I am pleased to forward to you this comprehensive study of Inglenook Fen, a rare and very valuable ecosystem, and a plan for the management and perpetuation of the fen complex.

Sincerely,

Herbert Rhodes

Herbert Rhodes
Director

STATE OF CALIFORNIA—THE RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

DEPARTMENT OF PARKS AND RECREATION

P.O. BOX 2390
SACRAMENTO 95811

June 1, 1977

Honorable Leo T. McCarthy, Speaker
California State Assembly
State Capitol
Sacramento, CA 95814

Dear Mr. McCarthy:

Senate Bill 191, Chapter 1439 (December 1972) mandated the Department of Parks and Recreation to conduct a study of Inglenook Fen, and to prepare a plan for actions necessary to preserve the biological integrity of the fen.

In accordance with the requirements of SB 191, a preliminary report was presented to the legislature in June 1973. Due to the nature and complexity of ecological studies, this study and plan could not be adequately compiled in a short time period. On-going research resulted in new discoveries that necessitated numerous updatings of the study.

I am pleased to forward to you this comprehensive study of Inglenook Fen, a rare and very valuable ecosystem, and a plan for the management and perpetuation of the fen complex.

Sincerely,

Herbert Rhodes
Director

Senate Bill No. 191

CHAPTER 1439

An act relating to Inglenook Fen, and making an appropriation therefor, and declaring the urgency thereof, to take effect immediately.

[Approved by Governor December 29, 1972. Filed with Secretary of State December 29, 1972.]

I am reducing the appropriation contained in Section 3 of Senate Bill No. 11 from $30,000 to $10,000.

The reduced appropriation will be sufficient for the Department of Parks and Recreation to complete the study and plan required by this bill.

With the above reduction, I approve Senate Bill No. 191.

RONALD REAGAN, Governor

LEGISLATIVE COUNSEL'S DIGEST

SB 191, Collier. Inglenook Fen.

Requires the Department of Parks and Recreation to undertake a study and prepare a plan re Inglenook Fen, as specified, and requires the department to submit the study and plan to the Legislature no later than June 15, 1973.

Appropriates $30,000 for purposes of that act.

To take effect immediately, urgency statute.

The people of the State of California do enact as follows:

SECTION 1. The Department of Parks and Recreation shall undertake a study and prepare a plan setting forth those actions necessary to maintain in perpetuity the biologic integrity of that land and water area lying easterly of the Pacific Ocean, westerly of State Highway Route 1, and approximately five miles northeasterly of Fort Bragg, Mendocino County, commonly known as the Inglenook Fen. The department shall solicit the assistance of appropriate scientific, educational, and conservation agencies in undertaking the study and in the preparation of the plan. The plan shall determine the amount, location, and approximate cost of any land deemed by the department necessary for public acquisition together with planning, zoning, or other land use restrictions appropriate for consideration by local government in order to assure protection of the scientific, scenic, educational, and conservation values of the Inglenook Fen and its environs.

SEC. 2. The department shall undertake the study and plan immediately and submit it to the Legislature no later than June 15, 1973.

SEC. 3. There is hereby appropriated from the General Fund in the State Treasury to the Department of Parks and Recreation for use during fiscal year 1972-73 the sum of thirty thousand dollars ($30,000) for the purposes of this act.

SEC. 4. This act is an urgency statute necessary for the immediate preservation of the public peace, health, or safety within the meaning of Article IV of the Constitution and shall go into immediate effect. The facts constituting such necessity are:

The Inglenook Fen is in immediate danger of adverse biologic changes due to projected land use changes which would affect the scientific, scenic, educational, and conservation values of the Inglenook Fen and its environs.

Preface

In pristine times there were several fens scattered along the coast from San Francisco northward. However, at present, Inglenook Fen is the only known coastal fen in California. All other fen-type communities along the coast were destroyed by various coastal developments. Through the efforts of Mrs. John Frankel, volunteer, and Rodney Jackson, consultant, both of the Nature Conservancy, the importance and the uniqueness of the fen were brought to the attention of Senator Randolph Collier. Senator Collier sponsored legislation in the 1972 legislative session (SB 191) directing that the Department of Parks and Recreation submit a study and plan of action regarding Inglenook Fen to the legislature on June 15, 1973. At that time a document entitled *Interim Report on Inglenook Fen Studies* was submitted in partial fulfillment of the requirements of that legislation. Due to the complexity of this study and financing procedures, more time was necessary for a meaningful study and plan to be formulated. This study and plan is now respectfully submitted in full compliance with that legislation.

This study and plan was undertaken by a team of university scientists representing a great number of disciplines. Due to the tremendous complexity of the interrelationships of the dune-fen ecosystem and the fen watershed, only tentative results can be presented within the time and financial allotments of this legislation. From these tentative results, conclusions and recommendations are included as part of the plan for protection of the fen. Continued research and management are needed to ensure the perpetuation of the fen ecosystem. The main threats to the fen ecosystem are development within the watershed, with subsequent water reduction, quality degradation, and the destruction of the dune vegetation cover by off-road vehicular use of the dunes adjacent to the fen. The main purpose of this study is to develop a solution to these problems.

The Inglenook Fen-Dunes Research Group consists of more than thirty research scientists and assistants, and numerous projects have been completed or are in progress. Many members of the study team have contributed freely of their time and have absorbed much of the expense incurred during the progress of this study to help ensure the protection of the fen. Other important projects will be initiated as soon as research support can be supplied.

The study group has a twofold purpose: (1) to prepare a research study for a proposed fen-dune natural preserve for use by the Department of Parks and Recreation in planning its management program for the area; and (2) to undertake and carry out essential research projects, results of which will ensure the preservation (and judicial use) of the area for all future generations.

These studies were initiated with $3,600 made available to the study group in the fall of 1972 by the Nature Conservancy. An additional $10,000 was allocated by SB 191, and these funds were used in part of the research currently reported.

Acknowledgements

A multi-disciplinary research investigation of this kind is difficult to carry out even with the help of more than thirty specialists located in more than five separate institutions. The attempt to undertake this kind of investigation was considered essential if the research results, covering a wide variety of subject areas, were expected to provide meaningful answers.

These kinds of investigations are quite rare in practice. Because of the budget limitations and time restrictions placed on this research group, the results of each separate study varied. Primarily this depended on the feasibility of completion within the time period allotted. Some studies were completed, and some were barely initiated, while many are still in progress. Many of these latter studies will take from one to three years to complete in a scientific manner and in such a way that they can be useful to those who need to manage the use of the land in the Inglenook Fen-Dune Ecosystem Natural Preserve.

Participants in the Study

We gratefully acknowledge the help of numerous persons and institutions in the preparation of this report.

The participants are acknowledged below in relation to their respective institutions.

University of California, Berkeley

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The Nature Conservancy

M. Frankel
R. Jackson

Inglenook Fen Area Residents

M. Lashbrook
R. Ross
W. Allen

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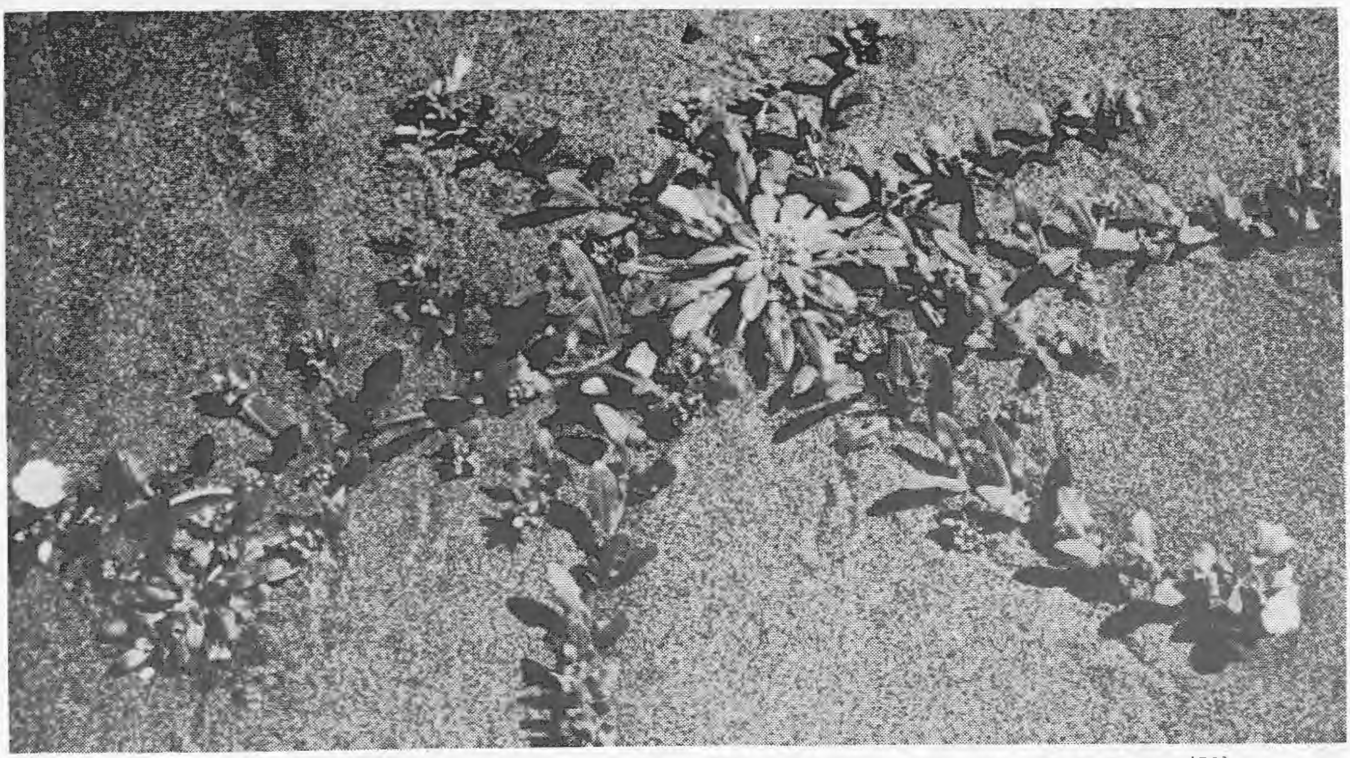
Abstract

During the course of this study, between twenty and thirty new life-forms have been discovered at Inglenook Fen including new species, genera and even a new family. The ecological findings reported in this multi-disciplinary study are of great scientific value. These findings are applied in the formulation of protective measures within the State Park System. The study, with further research, will facilitate the preparation of wetlands and terrestrial ecological management plans. The interpretive and educational implications from this study are practically unlimited; both scientific and popular writings have been stimulated from the data reported in this study.

The Inglenook Fen – Ten Mile Dune complex is found to be an interdependent ecological system of great complexity and fragility. Its perpetuation is in great peril due to off-road vehicular activities in the Ten Mile Dunes, logging activities in the Ten Mile River Watershed, and development activities in the Fen Watershed. Base line data has been collected to monitor these activities.



Oenothera cheiranthifolia, Beach primrose, is common on dunes. Note prostrate growth pattern (F. Andrews 5/73).

Introduction

In the early 1960s Herbert G. Baker, Professor of Botany, University of California at Berkeley, began floristic studies on wetlands ecosystems of the Fort Bragg area. During the course of his investigations, he discovered a number of unique plants with arctic affinities, including one that is not known to occur in other coastal areas of California. Many of these plants appear to be relics left over from the last ice age. Floristic, edaphic, and hydrologic analysis of the wetlands ecosystems led Dr. Baker to classify much of this wetland as a fen-type biotic community, and hence the wetlands area between the Ten Mile Dunes and the Inglenook Grange Hall became known as Inglenook Fen.

Infrared aerial oblique of Inglenook Fen watershed and northern portion of Ten Mile Dunes (W.J. Barry 4/73).


TEN MILE RIVER
INGLENOOK FEN
PACIFIC
OCEAN
FORT BRAGG

GEOGRAPHY and TOPOGRAPHY

Martha Fox

Inglenook Fen, the Ten Mile Dunes, and the watershed of the fen are located on the California coast a few miles north of Fort Bragg, between MacKerricher State Park and the Ten Mile River, in Mendocino County. Mendocino County lies within the Northern Coast Range geomorphic province (Jenkins, 1943).

The topography in this province consists of elongated northwest-trending ridges and valleys that are controlled by the underlying geologic structure. Folding has affected the structure, but faulting is more important in determining the location of the main longitudinal valleys (Cooper, 1967). The water courses of the Fort Bragg area flow toward the west and northwest. They contain deep narrow gorges with a limited amount of bottomland. Numerous small creeks and rivers drain the area west of the interior valleys and flow directly into the Pacific Ocean (California State Department of Water Resources, 1956).

From five miles south of Cape Vizcaino to Bodega Head, with some interruptions, is a terraced shore, backed by mountain slopes less steep than those occurring farther north. The northern portion of the terraced bench is narrow as far as the Ten Mile River but it broadens farther south (Cooper, 1967). The terrain is more mountainous north of the Ten Mile River than it is south of the river. From Fort Bragg to Point Arena, there are several series of terraces that are dissected by stream channels and a few alluvial floodplains.

South of Fort Bragg to Elk, the coast has been eroded by wave action and is highly irregular (Shephard and Wanless, 1971). From just north of Fort Bragg to MacKerricher State Park, there are rocky points. Along the coast from MacKerricher to the Ten Mile River, there is a beach backed by the Ten Mile Dunes.

There are two major land forms within the watershed of the fen: (1) coastal terraces and the associated sand dunes; and (2) the steep slopes of the uplands. The ridge of the uplands adjacent to the fen forms the eastern boundary of the fen watershed. It is dissected by the drainages that feed the fen (Jackson, 1972).

The topography of the terraces of the fen watershed varies from gently rolling to a steep relief (0 to 30°). Weathering and erosion have modified the local terrace patterns. The terrace that the dunes rest upon slopes almost to sea level except at the extreme southern end of the dunes. A few emergent rocks in the surf zone show that erosion of the terrace has occurred.

The Ten Mile Dunes are four and a half miles long. They vary in width from several hundred yards in the south to nearly three-quarters of a mile in the north. The dunes are in the shape of five lobes; three large lobes that compose the main dune sheet in the north and two smaller lobes in the south. The three large lobes are separated by streams. Beyond Laguna Point, a cliffed projection of the terrace shelf, there are several smaller dune lobes that are stabilized except for cultural disturbance. From their perched position, these dunes appear to have had their origin during an earlier dune advance.

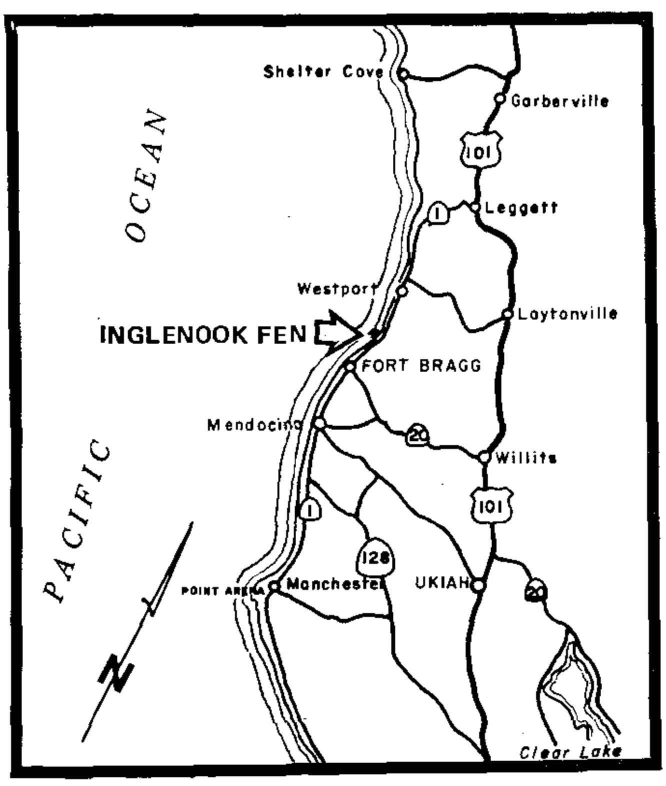


Figure 1
LOCATION MAP

Figure 2
GEOLOGIC TIME SCALE

	RELATIVE GEOLOGIC TIME			ATOMIC TIME millions of years	TIME OF APPEARANCE OF DIFFERENT FORMS OF LIFE	BEDROCK AND SURFICIAL UNITS
	Era	Period	Epoch			
Age of Mammals	Cenozoic	Quaternary	Recent to Holocene	5,000 yrs 5,000 to 20,000 yrs.	Glaciers melted and climates became milder and more arid	Recent Deposits - highly unstable Unconsolidated alluvium, marine terraces and sand dunes
			Pleistocene	2-3	Ice age, evolution of man	Terrace deposits
		Tertiary	Pliocene	12	Age of mammoths	
			Miocene	26	Spread of anthropoid apes	
			Oligocene	37-38	Origin of more modern families of mammals, grazing animals	
			Eocene	53-54	Origin of many modern families of mammals, giant mammals	
			Paleocene	65	Origin of most orders of mammals, early horses	
Age of Reptiles	Mesozoic	Cretaceous	Late Early	136	Appearance of flowering plants; extinction of dinosaurs at end; appearance of a few modern orders and families of mammals.	Franciscan Formation - moderately stable Consolidated marine sedimentary and volcanic rocks.
		Jurassic	Late Middle Early	190-195	Appearance of some modern genera of conifers; origin of mammals and birds; height of dinosaur evolution.	
		Triassic	Late Middle Early	225	Dominance of mammal-like reptiles.	
Age of Invertebrates	Paleozoic	Permian	Late Early	280	Appearance of modern insect orders.	
		Carboniferous Systems: Pennsylvanian	Late Middle Early		Dominance of amphibians and of primitive tropical forests which formed coal; earliest reptiles.	
		Carboniferous Systems: Mississippian	Late Early	345	Earliest amphibians.	
		Devonian	Late Middle Early	395	Earliest seed plants; rise of bony fishes.	
		Silurian	Late Middle Early	430-440	Earliest land plants.	
		Ordovician	Late Middle Early	500	Earliest known vertebrates.	
		Cambrian	Late Middle Early	570	Appearance of most phyla of invertebrates.	
	Precambrian			3,600+	Origin of life; algae, worm burrows.	

GEOLOGY

Martha Fox and W. James Barry

Geologic History

Inglenook Fen, its watershed, and the Ten Mile Dunes occur in one of the most tectonically active regions on earth, the Northern Coast Range of California. As a result of sea floor spreading and plate tectonics, the coastline has been periodically tilted and compressed. The compression has resulted in faulting and folding of the uplifted regions. Erosion has acted continuously to wear them down.

This area of the Coast Ranges has been part of the submerged continental shelf for much of its history. During the upper Jurassic to the upper Cretaceous (70 to 140 million years ago), mountains in the eastern and northern part of California were uplifted. Eroded materials from these uplifted areas were deposited on a shelf bordering the coastline and in an adjacent deep offshore trough or geosyncline. As these ranges were eroded, rocks higher in K-feldspar were exposed, and sediments coming from these rocks increased in their K-feldspar content (Bailey and Irwin, 1959). The sediments deposited in the offshore shelf gradually formed what is known as the Sacramento sequence along the western side of the Great Valley, and the sediments deposited in the trough gradually formed the Coast Ranges.

By the latest Cretaceous or earliest Tertiary period (65 million years ago), the sediment had nearly filled the offshore trough. These sediments and associated volcanic rocks were uplifted and intensely folded to form the initial Coast Ranges. Faulting occurred at the same time (Oakeshott, 1971).

By the Oligocene (37 to 38 million years ago), the Northern Coast Range emerged from the sea. During the middle part of the Miocene (19 million years ago), there was weak compressive deformation of the Coast Ranges (Hinds, 1952). During the Pliocene (3 to 12 million years ago) compressive deformation intensified. In the mid-Pleistocene (1.5 million years ago), a smaller but more important deformation accentuated Pliocene folds and faults and formed new structures of the same sort (Hinds, 1952). The compression increased in severity and reached a climax in the mid-Pleistocene (Oakeshott, 1966). Mid-Pleistocene uplift was rather rapid so that mountain fronts were steepened and masses of slide rock broke loose – jumbles of rock in many places hide scarps – giving an erroneous impression of distribution of rock formation and structures (Hinds, 1952).

Numerous faults were produced, primarily in a northwest to southeast direction, although some were produced perpendicular to that. Profound faulting, roughly parallel to Coast Range structures, probably began in the late Jurassic and was renewed from time to time (Oakeshott, 1971). The San Andreas and other high-angle faults have been in existence at least during the last 25 million years (King, 1966).

The individual fold axes are seldom more than a few miles. The axial trends are usually parallel to major faults. In general the rocks strike northwestward and dip northeastward. There has been strong folding and tilting not only of earlier Jurassic and Cretaceous strata, but also of those that formed during the Cenozoic era, including even some of the youngest strata (King, 1966).

Movements of the rock since the mid-Pleistocene have been predominantly vertical, either upward or downward, but mainly upward. The presence of high-angle faults resulted in the lateral shifts of blocks and strong folding and tilting. At the same time erosion occurred, so that eroded surfaces were overlaid unconformingly by younger strata. Formation of the Coast Ranges in their present form has thus been a complex process from the middle part of the Miocene and has resulted in a complex, sheared, and jumbled structure.

During the Pleistocene epoch, most or all of the coastline was uplifted with respect to base level (Hinds, 1952). The presence of uplifted marine terraces indicates several periods of uplift separated by periods of relative stability. During a period of tectonic stability, the rising seas cut a beach into the coast, and the falling seas deposited the beach material washed down from the adjacent uplands. Then during a period of tectonic activity, the beach was raised above the level of the ocean and became a terrace.

In certain areas there are definite contour intervals between terraces. However, if we travel up or down coast, these intervals change, indicating differences in the rate of uplift that warped the terraces as they rose above the sea. By comparing the elevation of terraces with present sea levels, it becomes apparent that the Pleistocene uplift was not constant from place to place. Terraces and deposits have been elevated hundreds of feet in some areas and a few tens of feet in other areas. Progressively greater deformation of the higher terraces show that deformation has been more or less continuous throughout the late Pleistocene (Christensen, 1966).

During or after these major periods of uplifts and stability, a large faultblock was apparently tilted with the lower end in the north at the Ten Mile River and the upper end in the south in the vicinity of the Garcia River. Along the seaward edge of this block, five wave-cut terraces are recognizable (Barry, 1973). (See Figure 3.)

These terraces are best represented between Mitchell and Jug Handle creeks. Here the terraces are well defined at altitudes of 100, 300, 425, and 650 feet, measured at the nick point, the point at which the buried, wave-cut plateau and the cliff meet (Gardner, 1967; Jenny, 1973).

In the Ten Mile Dune area, the older terraces have been eroded away, due to the northward tilting of the faultblock (Barry, 1973). The youngest and lowest terrace that contains the Ten Mile Dunes is about 50 feet above mean sea level.

At Inglenook Fen the terrace deposits range from a few inches to more than 50 feet thick. According to drillers' logs, the average depth of the terrace deposits in the Inglenook Fen area is 34 feet. The orange-brown colored terrace deposits rest unconformingly on Franciscan graywacke. The bottom four feet of the section consists mainly of well-rounded gray pebbles 3/4 to I inch in diameter. Fine sand and silt fill the interstices between the pebbles and predominate throughout the rest of the section in the widest and most extensive terraces that occur in the vicinity of Fort Bragg (California State Department of Water Resources, 1956). Figure 33 illustrates the geologic features of the Ten Mile Dunes and the Inglenook Fen.

Mineralogy

The watershed of Inglenook Fen occurs in a zone of graywacke called the Franciscan coastal belt and lies along the coast from Cape Mendocino to Point Arena. The coastal belt has an average width of 15 miles and has been separated from the Franciscan central belt directly to the east on the basis of K-feldspar content. The coastal belt has an average K-feldspar content of 7.9 percent. This is higher than the average K-feldspar content of the central belt, which is 7.0 percent (Bailey and Irwin, 1959).

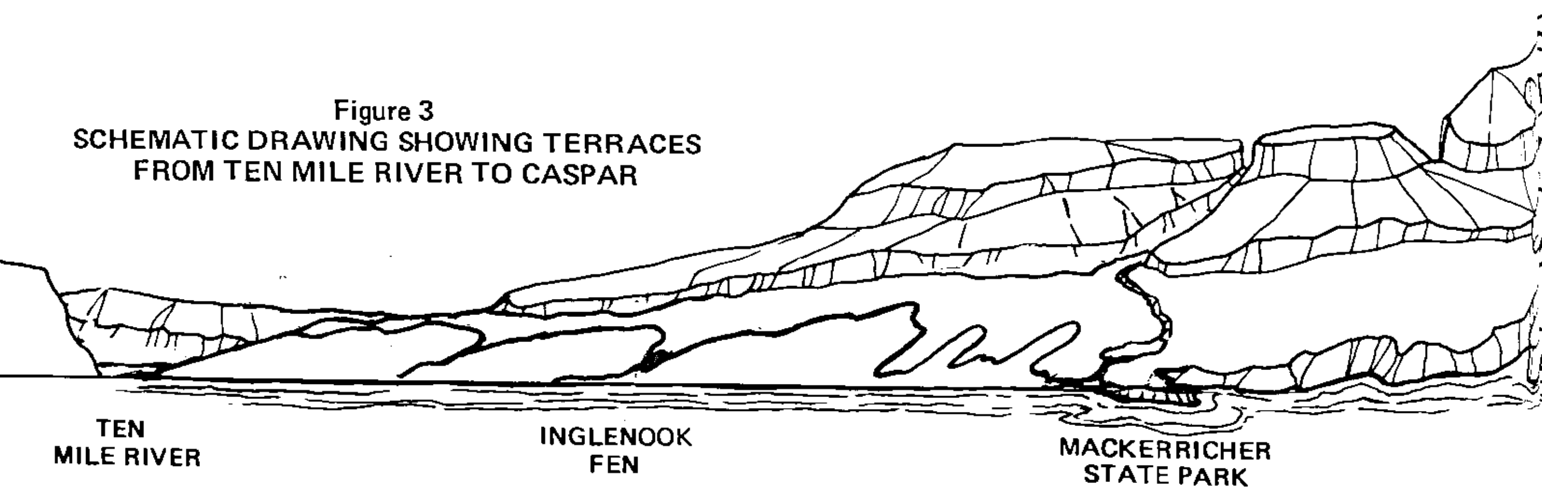
There are other differences between the coastal belt and the central belt. The coastal belt contains more or less cohesive units of graywacke that are less sheared than the other belts of the Franciscan Formation. Also, the coastal belt contains little greenstone, chert, and limestone, which are located at only a few locations in the coastal belt and amount to less than 1 percent of its total area.

Rock samples taken from the vicinity of Fort Bragg show a K-feldspar content of 7 percent, and a specific gravity of 2.65 (Bailey, Irwin, and Jones, 1964). The terraces, beach deposits, dunes, and rocks have the same mineralogical composition; the ratio of feldspar to quartz crystals is 18 to 100.

Climatic Changes and Variations in Sea Level

There is some evidence of periods of world-wide pronounced dune activity linked with exceptional periods of storminess with recurrent astronomical events affecting tidal maxima and there is evidence that this phenomenon induces pronounced dune activity at times of major

Figure 3
SCHEMATIC DRAWING SHOWING TERRACES FROM TEN MILE RIVER TO CASPAR



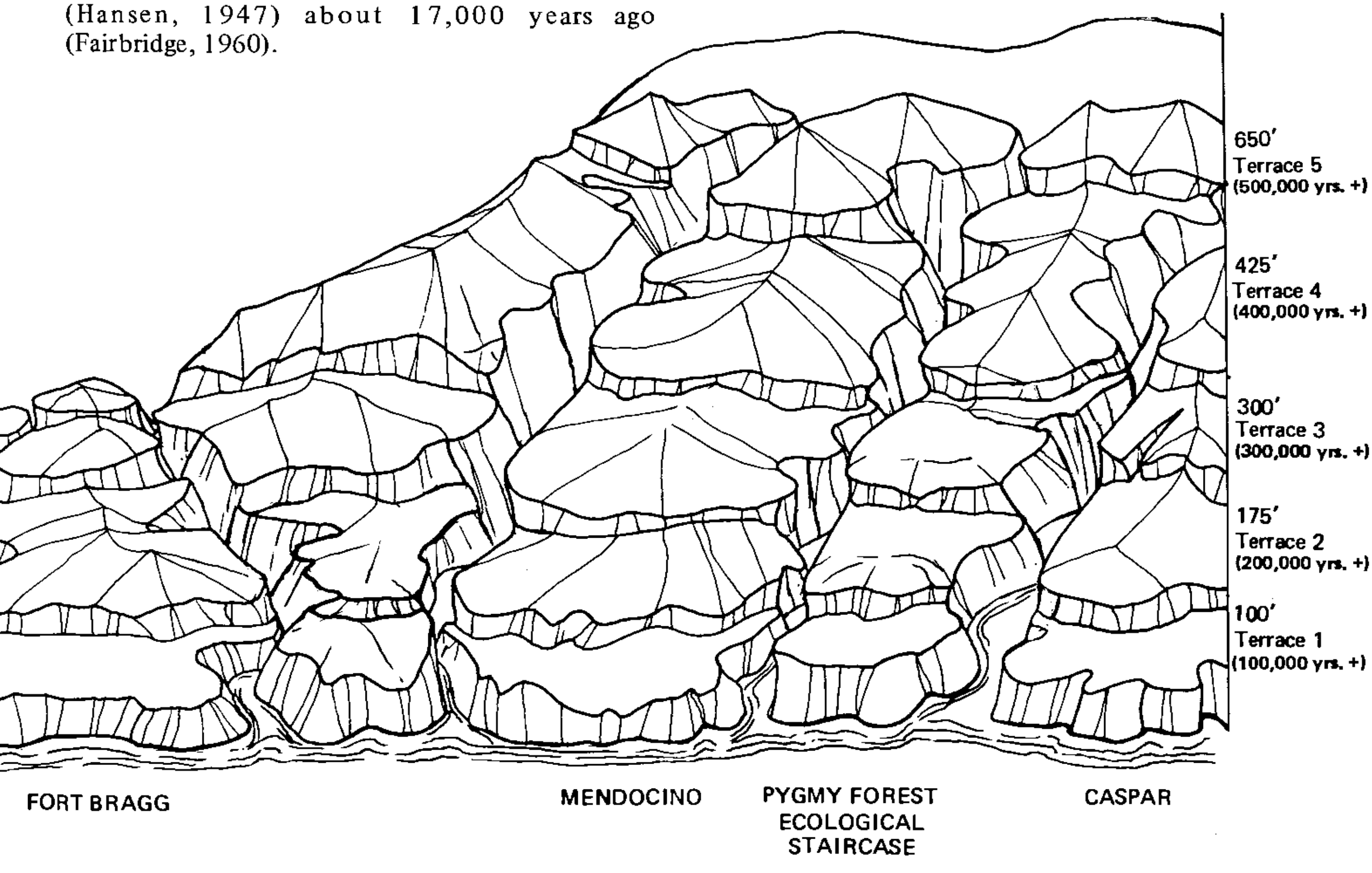
(1700-year cycle) and minor (90-year cycle) tidal maxima.

According to Pettersson's 1914 hypothesis the last major maximum was in 1433 A.D., and we should be reaching the next minor maximum in the 1970 to 1980 period, when it might be expected that storminess noted at the end of the nineteenth century may be repeated. Lamb has recently drawn together evidence that suggests 5, 10, 20, 90, and 200 year climatic cycles may also be operative. There is also much historical evidence (the burial of European coastal settlements during Medieval times) which correlates increased dune activity with increased periods of storminess (Ranwell, 1972).

According to classic glacio-eustatic theory, sea level during the Pleistocene epoch changed in response to the periodic removal of water when glaciers froze and the release of water when glaciers melted. The general decrease in sea level is explained in various ways. Some authors ascribe it to progressive lowering of ocean basins, principally the Pacific floor (Guilcher, 1969). The last major lowering of the shoreline coincides with the maximum of the last or Wisconsin glaciation (Hansen, 1947) about 17,000 years ago (Fairbridge, 1960).

After the low point of the sea level, during the Wisconsin glaciation, a post-glacial rise of sea level resulted from melting of the late Pleistocene continental glaciers of North America and Europe. The Flandrian Rise began about 14,000 years ago and continued rapidly until about 7,000 years ago (Millinan and Emery, 1968).

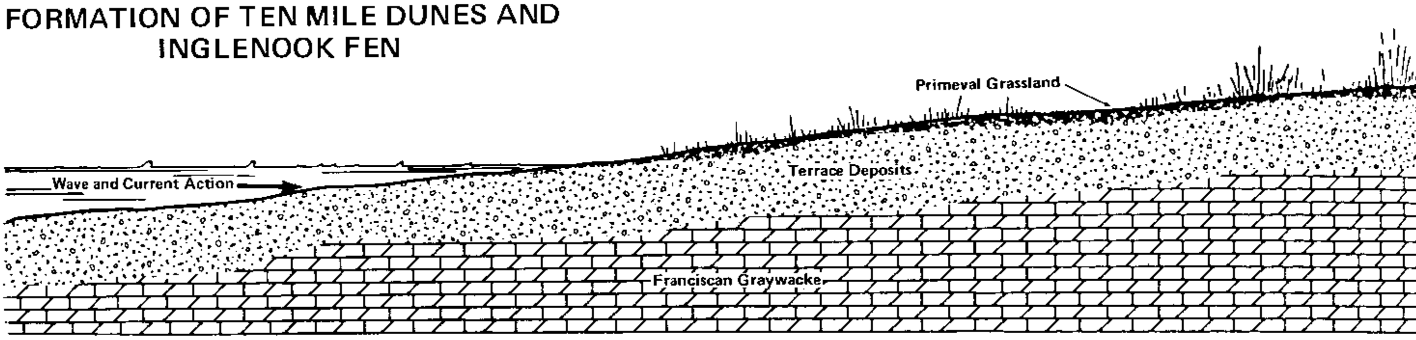
From Elk to Fort Bragg the rise in sea level after glaciation appears to have been offset by general uplifting of the coast (Shephard and Wanless, 1961). Differential movement is suggested by the higher level of coastal terraces in the area near Fort Bragg. There is a slight indication of drowning at the mouths of some of the larger rivers, such as the Big River, but there is little appreciable sedimentation and a virtual absence of broad floodplains. Comparing this to areas in which coastal streams and valleys were drowned by a significant rise in sea level, it can be seen that rivers either kept pace with the drowning by depositing alluvial materials so that fertile plains were formed or that they did not keep pace, and shallow bays and estuaries resulted. If these streams are blocked by sand dunes, lakes form (Wiedemann, 1966).



Dune Formation

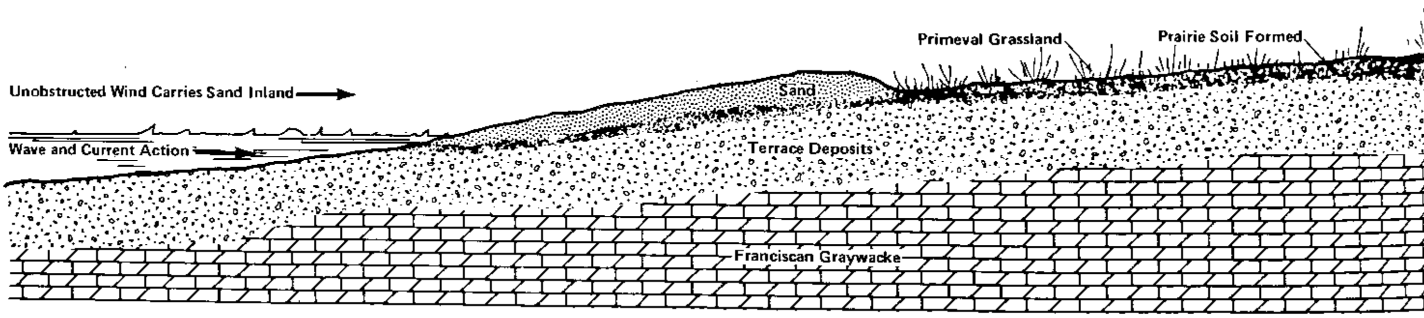
The general features of the present coastline were created during the Flandrian transgression, when sea level was at its highest (about 7,000 B.P.). Sand movement was renewed with the sand moving ahead of the advancing sea. In the period since maximum submergence, the sand dunes have undergone cycles of stabilization and rejuvenation depending upon vegetation, geologic disturbances, and shoreline processes. During the past 6,000 years, the shoreline has been in a state of relative stability, though not without some activity. It is not known whether the sea at that time transgressed the terraces upon which the dunes and the

Figure 4
SCHEMATIC INTERPRETATION OF THE FORMATION OF TEN MILE DUNES AND INGLENOOK FEN



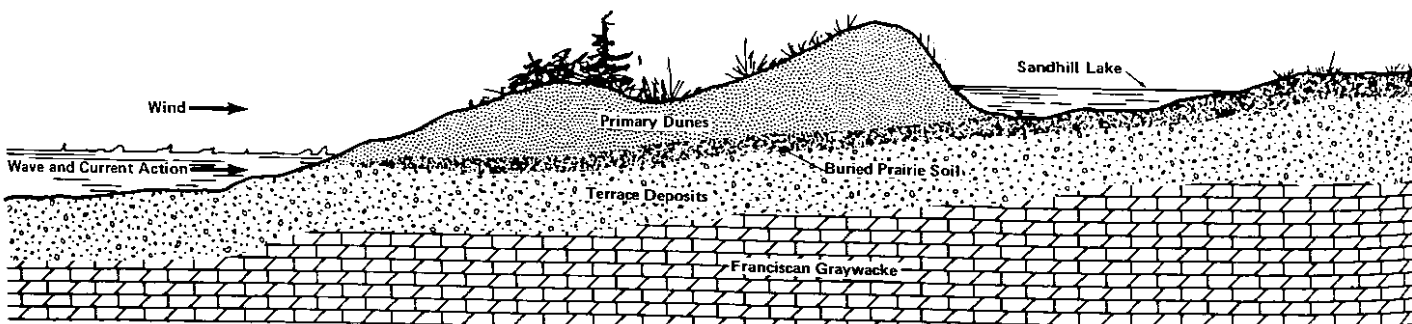
EPISODE I STAGE 1.

A beach is formed from sediments mainly from Ten Mile River (about 7,000 years B.P.)



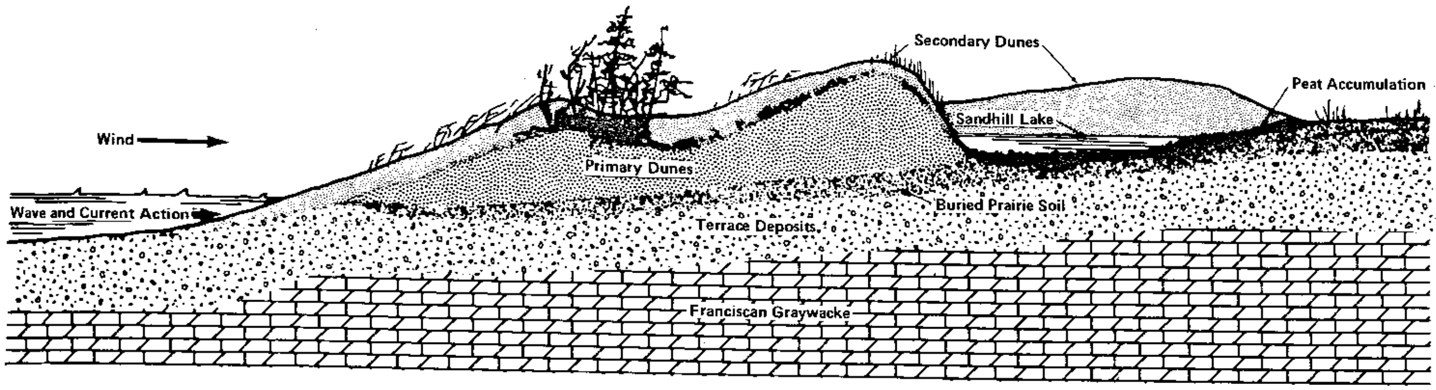
STAGE 2.

Dunes begin to form as wind-blown sand is deposited in grasslands (about 6,000 years B.P.)



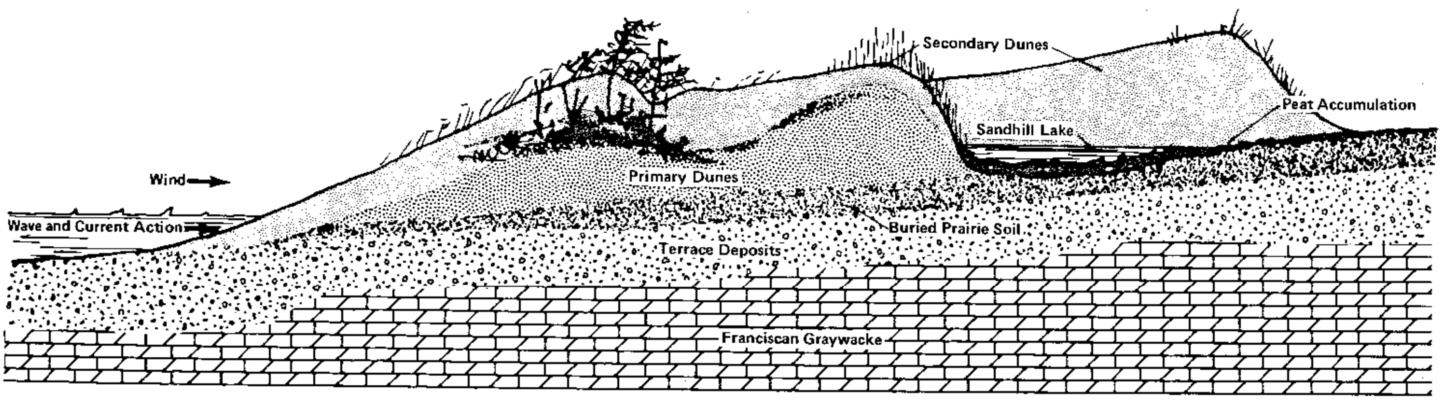
STAGE 3.

Primary dunes are formed and stream blockage occurs forming Sandhill Lake and Inglenook Fen beginning geobioevolutionary processes. Leading arms of some dunes are stabilized by north coastal prairie vegetation (about 5,000 years B.P.)



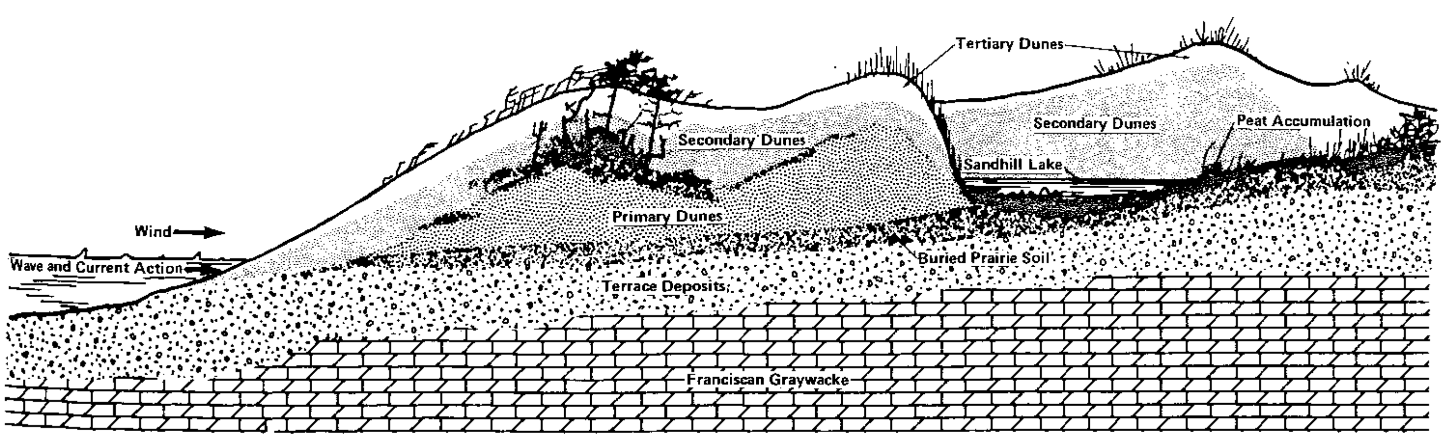
EPISODE II STAGE 4.

Secondary dunes are formed covering primary dunes in many areas (approx. 4,000 years B.P.)



STAGE 5.

Accelerated activity due to increased sedimentation in Ten Mile River. Most dune vegetation formed on primary dunes is covered by new higher dunes (1925-1940).



STAGE 6.

Partial stabilization followed by renewed dune activity due to destruction of stabilizing dune vegetation by OHV's. Sand begins inundating Sandhill Lake and Inglenook Fen. Dunes continue rapid landward movement inundating residential and agricultural properties (1940 to 1976).

fen rest (Baker, 1972). If it did not, the dunes and fen could perhaps be even older. The lack of distinct drowned canyons on the raised terraces indicates that uplift could have kept pace with the rise in sea level.

Cooper (1967) defined two major classes of dunes on the basis of age – Flandrian and pre-Flandrian. Flandrian dunes represent the contemporary phase in a process that has continued through the period of Flandrian transgression and during post-Flandrian time. Their forms are characteristic of dunes on retrograding shores. Dune formation, destruction, and reconstruction have gone on constantly, and the dunes have crept inland.

Cooper further divided the Flandrian dunes into two waves of invasion termed episodes. The dunes of Episode I, the inner and older, are at present stabilized by the north coastal prairie and north coastal scrub communities except for small areas that are still active and that make up a coastal dune biotic community. Episode II is a secondary dune sheet that has moved inland. It is active and has little vegetation. In some areas it has completely overwhelmed Episode I; in other areas it has stopped short of Episode I.

In the Ten Mile Dunes, the earlier advance Episode I has almost been covered by the Episode II. In only two areas does the older sheet extend beyond the final slope of the younger east lobe. One is a narrow strip that is located at the inner margin of the northern lobe. The other remnant, on the south lobe, in 1925 had the shape of a ravine formed by two convergent lee slopes of the older sheet, which had become stabilized while remaining steep, with bishop pines, lowland firs, and tanbarks. By 1952 this forest had been destroyed at the head of the ravine by encroaching masses of the younger dunes (Cooper, 1967). Since then there has been evidence of further encroachment upon this ravine.

Sand supply, shore topography, the climatic regime, and vegetation determine the location and features of sand dunes (Wiedemann, 1966). Initiation of dunes requires a receptive shore (i.e., a beach) for deposition of sand from the sea and low or gently sloping terrain immediately behind it over which the wind-propelled sand can move easily (Cooper, 1958). At the Ten Mile Dunes, the location at which the coastal trend shifts abruptly from south-southeast to south-southwest acts to catch the sand brought in along the shore and is a favorable place for dune formation. The principally southward littoral drift and dominating northwesterly summer wind unite with favorably oriented receptive shores to determine the location of coastal dune areas. The coastal trend is 55°, and the present dominating summer wind direction is N 39° W. The direction of this littoral drift, the movement of the sand by the currents, is determined by the direction from which effective waves come and the angle at which they strike the shore (Cooper, 1967). At the Ten Mile Dune area, the littoral drift is south from the Ten Mile River.

Soil and weathered rock are eroded from the uplands and carried into the sea, where the larger particles, such as sand and gravel, are dropped close to the mouth of the stream, and the clays and silts are dispersed into the sea. Also, some material is eroded by the wave action of the sea. Emergent rocks near the Ten Mile Dunes show that there has been erosion of a more extensive rock surface (Cooper, 1967).

After the sediment has been deposited in the ocean, currents moving in the surf zone transport the sand along the shore as littoral drift. Waves then act to bring the sand up from the sea to the beach where the sand is deposited. Not only is material deposited, but material is also eroded away by the sea. During fair weather, wave action tends to push sand from the sea onto the beach. During storms, the strong wave action tends to remove what has been deposited. The amounts removed and deposited are usually roughly in equilibrium, unless there has been disturbance by man (Soucie, 1973). When the sediment increases in the Ten Mile River, the deposition is greater than when sediments are at a normal sediment level. When watershed erosion is great, sand deposition will increase. If the source of sediment from the Ten Mile River were stopped, the erosion of the beach would tend to be greater than the deposition, and dune formation would subside.

Once the sand is deposited on the beach, the action of the wind forms the sand into dunes. The lower limit for winds to be effective in moving dry sand is 26 kilometers per hour (16 mph). During January southeast winds exceed 26 kph, but sand tends to be wet and movement is minimal. During July when the sand is dry and can be moved, north-northwest winds predominate (Cooper, 1967). The winds pick up the sand grains from the beach and carry them to the southeast, sorting them in the process, until fine, well sorted sands 0.125 to 0.25 millimeter in diameter are deposited in the leeward slopes of dunes near State Highway 1 (California State Department of Water Resources, 1956).

Dune Forms

The principal parts of dunes are – strand, foredune, trough and hinddune. There are a number of topographic features that constitute the basis of the various dune forms – and there are four distinctive types of sand dunes. These are transverse, logitudinal, barchan, and star dunes. Transverse dunes are formed by moderate one-way winds that move only light sand. Logitudinal dunes are produced by stronger one-way winds that move both fine and coarse sand; barchan dunes are formed from relatively small amounts of sand supplied under the influence of a moderate wind of constant direction; star dunes form in areas where the wind blows from all directions. Unlike other dunes, star dunes tend to remain stationary.

Ten Mile Dunes contain a strand and a series of transverse dunes and precipitation ridges.

The beach, or strand, is the relatively narrow strip lying between the water's edge and the uppermost line of effective wave or tide action. A beach is always associated with a maritime dune system, but not necessarily restricted to it. Cowles (1899) divided beaches into lower, middle, and upper sections, the boundaries being determined by tides, wave action, and vegetation. The lower beach, or supra-littoral strip, is usually bare of plants except for dislodged algae. In some areas there is considerable vegetation on the middle and upper beaches; in others, very little.

The initial dune formation is the small transitory tongues of sand formed on the beach when windborne sand is deposited around obstacles such as rocks, kelp, debris, and annual plants. Although usually temporary, these tongue dunes can continue to accumulate sand around pioneer perennial plants and form embryo dunes that are located at or beyond the upper limits of wave action. These embryo dunes form the basis for the foredune, which results from the coalescence and buildup of the embryo dunes along the shore beyond the reach of water action.

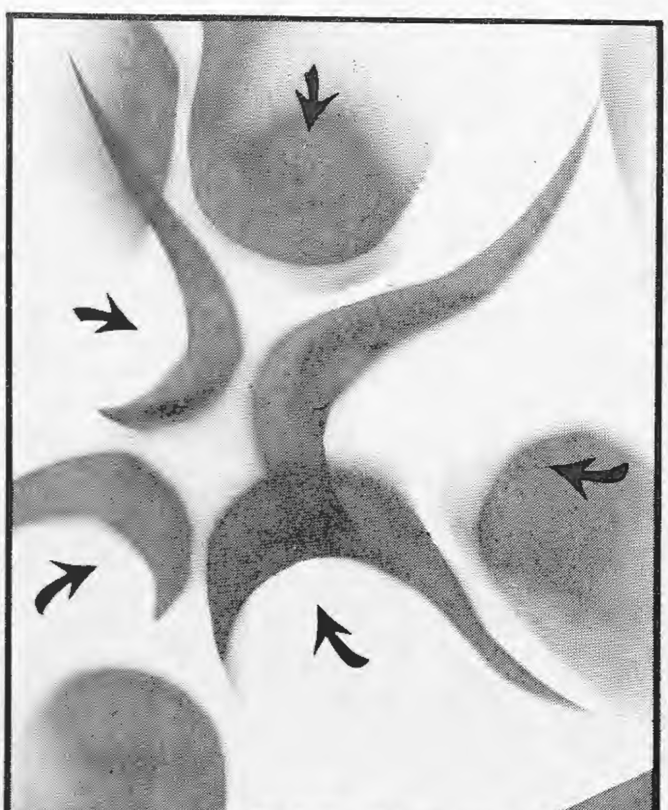
The major features of the younger dune sheet at Ten Mile Dunes are broad, irregularly transverse waves with very gentle windward slopes and low imperfect slipfaces. A system of transverse ridges forms when air flows constantly in one direction, over a land surface level and free of significant obstacles (Cooper, 1967), an extensive area with no vegetation (Wiedemann, 1966); a climate allowing the sand to dry out for weeks or months; and an ample supply of sand (Cooper, 1958). The dune crests of the transverse ridge pattern are

Beach or coastal strand at Ten Mile Dunes (W.J. Barry 4/73).

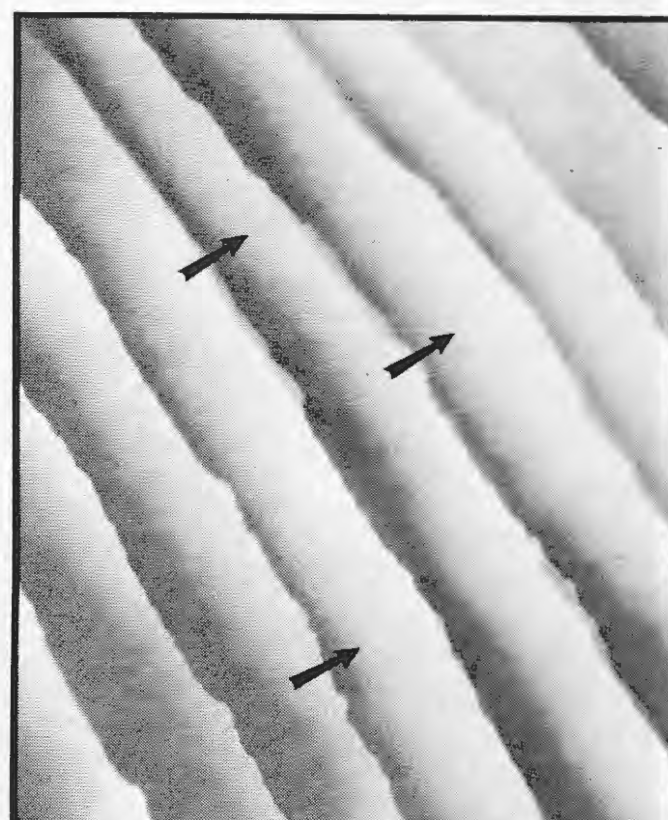
Figure 5
FOUR DISTINCTIVE FORMS OF SAND DUNES

Longitudinal dunes are produced by stronger one-way winds that move both fine and coarse sand.

Barchan dunes are formed from a relatively small sand supply under the influence of a moderate wind of constant direction.



Star dunes form in areas where the wind blows from all directions. Unlike other dunes, star dunes remain stationary.



Transverse dunes are formed by moderate one-way winds that move only light sand.

Looking northward across Ten Mile Dunes. Note the series of transverse dunes and steep precipitation ridges (F. Andrews 5/73).

oriented generally at right angles to the northwest winds of summer (Wiedemann, 1966). The characteristic profile of a mature transverse ridge with a gentle windward slope and a steep lee slope remains essentially unchanged as the ridge progresses. The windward slope has a variable inclination of perhaps 3° to 12°, and the lee slope has a fixed inclination of 33°. The geometric form is essentially constant, so that intercrest distances are a good indication of the magnitude of the ridge. The intercrest distance at the Ten Mile Dune area is 500 meters.

The form and movement of the transverse dunes are determined by the direct air current, whose threads undulate but are free of true vertical motion. Eddies occur abundantly but are powerless to affect the form or movement of transverse ridges to an appreciable degree.

Transverse dunes are not found stabilized under forest cover. Stabilizing vegetation apparently gradually changes the forms of the dunes into those characteristic of stabilized dunes.

The sharp features of transverse dunes developed during the summer can be softened in the winter by the action of wind shift and rain. If only the surface layer of the dunes is moistened by rains, wind can cause miniature blowouts, which soften the outline of the dunes. Locations with a greater exposure to winds have greater softening.

A secondary feature of the transverse ridge is the lee projection, a tongue of sand extending to the leeward from the slipface and apparently attached to it. It is a structure left behind by the next ridge downwind, its upwind end buried by the advance of the slipface of the following ridge (Cooper, 1958).

The interdune depressions, between the ridges of the transverse dunes, are relatively moist habitats. The base of the interdune depressions is set when the water table is reached and the wind is unable to blow away the moist sand. The damp depression then becomes a favorable place for the initiation of vegetation. Water frequently stands in interdune depressions for a good portion of the winter; these depressions thus support hydrophytes. Pioneer species can quickly become established, and development takes place rapidly.

Precipitation ridges form where large quantities of moving sand, driven by strong unidirectional winds, come up against a large, relatively uniform mass of vegetation (e.g., a forest), and a dune builds up to the windward of the obstruction. After the sand reaches a certain height, it begins to spill over the leeward face of the dune into the vegetation below initiating dune advance and invasion of the vegetation. Such a dune is called a precipitation ridge. In the absence of the foredune, or where there is a sufficient sand supply behind this dune, sand is moved inland by the driving force of the seasonal winds. If an area of vegetation is encountered, sand begins to accumulate as a ridge normal to the direction of dominant wind action, because the wind is deflected upward, loses velocity, and drops its load of sand. The ridge will grow in height dependent upon the height of the vegetation. The lee side becomes very steep, and, after a certain angle is reached (about 33° according to many investigators), sand slips down this face, effectively initiating forward movement of the dune and invades any vegetation encountered.

In Peru and Chile, in areas where vegetation is almost absent along the coast, the sand travels inland at least 16 to 24 kilometers (10 to 15 miles) over all obstacles in its path and climbs the coastal mountains to considerable heights (at least 900 meters or 3,000 feet). Similar advances are now occurring just south of the Little Sur River in California. Forests on coasts oppose the inland advance of dunes because the surface air currents lose velocity when they meet the vegetation, and the sand is dropped at the forest edge (Wiedemann, 1966).

Dunes associated with seashores are the result of wave and wind action, which throws up a large barrier dune at the back of the beach. Behind this barrier, there are often smaller dunes caused by wind-carried sand being lifted over the barrier and allowed to settle in its lee.

A number of forces are brought together to form dunes, temperature, wind, mountain ranges, soil composition, littoral drift, and topography are a few of the interrelating factors. The man-caused structures on the soil mantle can bring on a dune growth and start sand buildup with disastrous impacts on nearby developed or productive areas. An example of this is the dust bowl that developed in the Midwest following World War I, (the beginning of dune formation over some of the richest farmlands in the world). Fortunately, soil scientists initiated the planting of cover crops and various cultural methods, which checked wind erosion before dune formation was too great. Excavation on the Sahara shows that ancient civilizations of Africa made a similar mistake. Deep down under some of the heavy dunes that cover the region are irrigation ditches, dams, and the remains of extensive farmlands that can never be recovered.

Series of precipitation ridges invading trough or slack in the more coastal portions of Ten Mile Dunes (P. Rauch 9/72).

A sand dune has a characteristic shape, depending on prevailing winds and amount and origin of sand. Prevailing winds normally blow the dune into a long slope, which rises gently from the place of origin to the crest. Sand blows along this slope and feathers over the crest. After the crest is reached, the sand drops down on the lee of the dune. As a result of this sudden release of particles, the slope of dunes away from the prevailing winds is steeper than that of the windward side. Dune building is a never ending process. These great banks of sand creep relentlessly over the land at speeds of several inches to several feet or more a year. Some dunes may be built up higher than the forest or hills upon which they advance. These dunes may advance over the forest and, many years after a forest has been covered, dead tree trunks and other objects long-buried may begin to reappear in the windward slope.

Sand dunes have long been fruitful hunting grounds for archeologists. Windblown sand creeps along at varying speeds and covers, and eventually uncovers, archeological sites. The fluid state of the sand causes some artifacts to float to the top and, as a result, an area without visible artifacts on one day may give up valuable objects on the next.

Dunes formed a natural dam on Fen Creek creating Inglenook Fen and Sandhill Lake.

Fen and Bog Development

Inglenook Fen was created 4,000 to 6,000 years ago (Baker, 1972) or perhaps before, if the Flandrian Rise did not transgress the seashore. The fen was formed when water draining the adjacent uplands was impeded and collected behind the dunes. The warmer climate of the Hypsithermal (6000 to 1000 B.P.) may have retarded development of the fen so that it may not be more than 3,000 to 4,000 years old. However, Baker (1972), indicates that the fen and some of its biota may have persisted from the Pleistocene as a result of chilly summer fogs in the area (Baker, 1972). Many of the plants of the fen occur in more northern bogs and fens, indicating that the fen is a relic of the last Ice Age.

There are probably two geologic successional trends operating in the fen. One is the succession of an aquatic community to a dry land community, and the other is the development of a raised bog, from the accumulation of organic material, as peat.

The deposition of plant material and sediments within the fen creates a tendency for a succession from aquatic communities to a dry land community. Silt and organic matter accumulate around aquatic plants, and create a suitable medium for the growth of a fen vegetation. In areas where the water is well oxygenated and contains a high level of nutrients, the fen vegetation builds up the soil until it is replaced by the fen-carr community, which in turn is replaced by riparian woodland.

The zonation of the communities of this sequence depends on the level of the water within the fen. The level of the water depends upon the dynamic equilibrium established between the deposition of plant material and sediments within the fen, which tends to fill the fen, and the deposition of sand on the dunes blocking the fen outflow, which tends to raise the water level (Jackson, 1972).

The gradual rise of water can cause succession in the reverse direction, as noted by workers in Australia (Eardley, 1943). As an area becomes increasingly wetter, there is a general successional pattern from drier scrub and fen-carr, to wetter fen, and then to aquatic communities.

This succession can take place in both directions in the plant sequence. The zonation of the plant communities depends on the equilibrium established between these two opposing tendencies and on the degree of fluctuation of the water table. Baker (1972) found that a rather stable hydrosere has been formed at Inglenook Fen leading from fresh water to mesic forest. The various zones are (1) open water with fringing emergent vegetation; (2) almost pure *Carex* and *Heliocharis* tussocks; (3) *Calamagrostis/Cyperaceae/Menyanthes* fen with *Ledum, Sphagnum,* and the like; and (4) fen-carr.

In areas in which the water is less well oxygenated, and the pH and nutrient status are lower, there can be a sequence leading from aquatic plants through sedge mats and bog shrub stages through a bog forest and culminating in a regional mesophytic climax in a centripetal sequence (Dachnowski, 1923). There can also be a succession that ends in a raised bog (Heinselman, 1963). If the rainfall is great enough, and the summers are cool enough for trees to grow on the uplands of a region, bogs may be expected in the lowlands (Deevey, 1958). Bogs do occur in this area, a few miles south of the Ten Mile Dunes, on high terraces.

Bog expansion is caused by the gradual rise of the water level as peat accumulation impedes drainage (Heinselman, 1963). After the flow of water is restricted, the acid peat normally formed from decaying plants under damp conditions is not neutralized or made alkaline as it would be if the ground water had continued draining into the bog (Eardley, 1943). The peat is then watered by precipitation alone, and pH remains acid, favoring the formation of extensive sphagnum mats. The level of nutrients is low at the surface of bogs partly because they are leached by rainwater and partly because the peat absorbs salts and bases. Species of *Sphagnum* have a very high C:N ratio so that they are more difficult to decompose than the remains of peat formed from other species of plants (Waksman and Purvis, 1932 a,b).

Low nutrient level, poor aeration, and acidity of the peat retard the growth of microorganisms that decompose organic matter. The accumulation of dead sphagnum forms a layer of half-decayed organic material or peat, which draws ground water upward, thus permitting still more of the moss to grow on top.

The formation of peat moss eventually reaches an equilibrium with the environment. This equilibrium is controlled by available moisture; the bog reaches a size at which evaporation from the surface of the peat balances the precipitation and the upward flow of groundwater, and growth of the bog stops. Plant debris on the surface of the peat then decays about as fast as it accumulates, and little or no new peat forms. Material below the surface of the bog cannot decay because oxygen cannot reach it, and the nutrient level is low (Deevey, 1958). A change in temperature or rainfall over a long period of time upsets the equilibrium of the bog-forming processes. Raised bogs are especially sensitive to changes in climate. If the climate becomes moister and cooler, the bogs renew their growth both upward and outward. In drier and warmer conditions the surface will stabilize, but air will penetrate deeper into the drying peat, and the zone of decay will thicken downward. If the drought is long continued, the decay will extend down into the older peat, and the bog will further decrease in size (Deevey, 1958).

Typical young dune trough or slack. Note standing water, common in midwinter.

SOILS

W. James Barry and Martha Fox

Soil Morphology

Soil is defined as a natural body, composed of organic and mineral materials, on the surface of the earth in which plants grow. The factors that contribute to the development of different soils are (1) relief – the shape of the landscape and the drainage, (2) parent material – physical characteristics and mineralogical composition of the underlying geologic formation; (3) climate – the meteorological conditions under which the soil has developed; (4) biota – the biological activity resulting from the plants, animals, and microbes living within and/or on the soil; and (5) the length of time the forces of formation have acted upon the soil (Jenny, 1941).

The Influence of Relief on Soil Formation

Relief affects soil development by its influence on drainage, susceptibility to erosion, and its variation of exposure to the sun, wind, and air drainage. Much of the fen watershed is steep, so that the runoff is rapid. The drainage is good to excessive, and the erosion potential is high. The landscape is "young" with deeply incised drainages and steep slopes. Erosion rates on soils formed on Franciscan or similar Cretaceous formations in this very active tectonic zone are among the highest in the world – perhaps 15 centimeters (6 inches) per 100 years under undisturbed conditions and from 10 to 1,000 times that much with the increase of activities that disturb the soil mantle (Jackson, 1972). The terraces are sloped so that the water drains freely toward the sea, unlike level terraces, where drainage is impeded. The contour of the dunes affect the water content in different zones of the dunes.

Parent Material as a Factor in Soil Formation

Parent material is the weathered rock or unconsolidated mass of deposited material from which the soil forms. Upland soils are formed from graywacke sandstone. The terrace soils are formed from softly consolidated deposits of sand. The organic soils of the fen and fen-carr communities are formed from decayed plant material deposited in place, along with some sediment and organic matter brought down from the watershed. The dune lands are formed from sand deposited from the Ten Mile River. The sand was moved to the beach by the waves and formed into dunes by the wind.

Texture, size of mineral particles in the soil, and mineralogical composition of mineral particles in soils are greatly influenced by parent material. The permeability, water-holding capacity, and cation exchange capacity (the ability to hold cationic nutrients) of the soil are influenced by the texture. Sand and gravel have the highest permeability, the lowest water-holding capacity, and the lowest cation exchange capacity, while clays and silts have the least permeability and the greatest cation exchange capacity. Although clay holds the greatest amount of water, loam, which is a mixture of sand, silt and clay, has the greatest amount of water available for plants. The mineralogical composition in the rocks controls the composition of the minerals that are released by weathering.

Climate as a Factor in Soil Formation

Climate consists, in part, of the amount, type, and distribution of precipitation, the variations of temperature, and the direction and intensity of wind. It influences the soils by direct effects on soil development and by indirect effects on plants. Although the climate is cool, moisture present allows fairly rapid weathering of the soil minerals. Since precipitation is generally greater than the evapotranspiration (a combination of evaporation from the ground and the loss of water by plants), sufficient amounts of water percolate through the ground to leach bases and dissolved material from the soil.

The climate, including the presence of fog, influences the kind and quantity of vegetation. Cool temperatures cause an accumulation of organic matter where there is a plentiful vegetative cover. Strong winds and salt sprays from the coast tend to favor grassland development behind the dunes of the first terrace, a result partly due to a marked sodium gradient inland from the ocean (Jenny, 1973). Winds affect erosion of dunes, and water affects erosion of the watershed.

The Biota as a Factor in Soil Formation

Vegetation, burrowing animals, insects, earthworms, bacteria, and fungi are important in the formation of soil. The soils formed under a forest composed of coast redwoods or bishop pines have a mat of litter and duff on the surface of the soil. This mat is acidic and contributes to the acidity of the soil and to the displacement of bases from soil colloids. This litter has a relatively high ratio of carbon-nitrogen, which makes decomposition difficult and slow. The soils formed under grasslands contain organic matter mixed into the surface soil horizon by the activity of earthworms and other organisms.

In the dunes, the vegetation growing there contributes to the stabilization of the sand and to an increase in the amount of organic matter in the surface of the sand. The increase in organic matter increases the moisture-holding capacity of the soil and the cation exchange capacity.

The decaying remains of plants of the fen and fen-carr make up the largest part of the organic soils.

Time as a Factor in Soil Formation

Time influences the extent to which soil-forming processes act upon the soil. In the Empire soils of the uplands of the Inglenook Fen watershed, erosion has nearly equalled the processes of soil formation, so that the soil has been renewed, and the processes of accumulation of clay and sesquioxides in the subsoil have not occurred to a great extent. In the Hugo soils of the uplands of the fen watershed, erosion has probably been slower, so that soil-forming processes have had a greater length of time on the same soil to increase the level of clay and sesquioxides in the subsoil. With the development of soils from parent material, there is generally an increase in organic matter present and an increase in the formation of clay minerals. The dunes undergo a successional pattern with the establishment of vegetation in which the sand develops into soil and evolves along with the vegetation.

Soil Classification

In the Inglenook Fen watershed, soils formed on upland graywacke are classified as Hugo loam, while the soils formed on the older, softer, consolidated terraces are classified as Empire sandy loam. The soils on the lower two terraces are unclassified prairie soils and unclassified duneland soils. Fen and fen-carr soils are organic hydromorphic soils. The general distribution of the soils is shown in Figure 6.

Empire Series

The Empire Series is a member of a fine, loamy, mixed isomesic family of Typic Tropohumults. In the top part of the surface soil, the color is dark reddish brown (moist), brown (dry) loam with a moderate fine to granular blocky structure. It is slightly hard, friable, slightly sticky, and slightly plastic.

In the subsoil or B horizon the color varies from dark brown to yellowish brown to dark reddish brown because of different layers in the parent material. The texture of the subsoil ranges from very fine sandy loam to clay loams. The structure ranges from weak medium subangular blocky structure in the top portion to weak coarse subangular blocky to massive. The consistency ranges from slightly hard to hard, friable to firm, sticky, plastic to slightly plastic. Reaction ranges from medium acid to very strongly acid.

The subsoil grades into weathered, stratified, soft, sedimentary rocks with the color varying from yellow to brown and the texture varying from very fine sandy loam to silty clay loam. The contact of the soil with the soft rock occurs at a depth of 130 to 180 centimeters (50 to 70 inches).

Empire soils occur on moderately steep, dissected, old terraces with broad, relatively flat ridges and narrow drainages. Often the terrace shape is still recognizable. Slopes vary from 10 to 32 percent and are predominantly 20 to 25 percent.

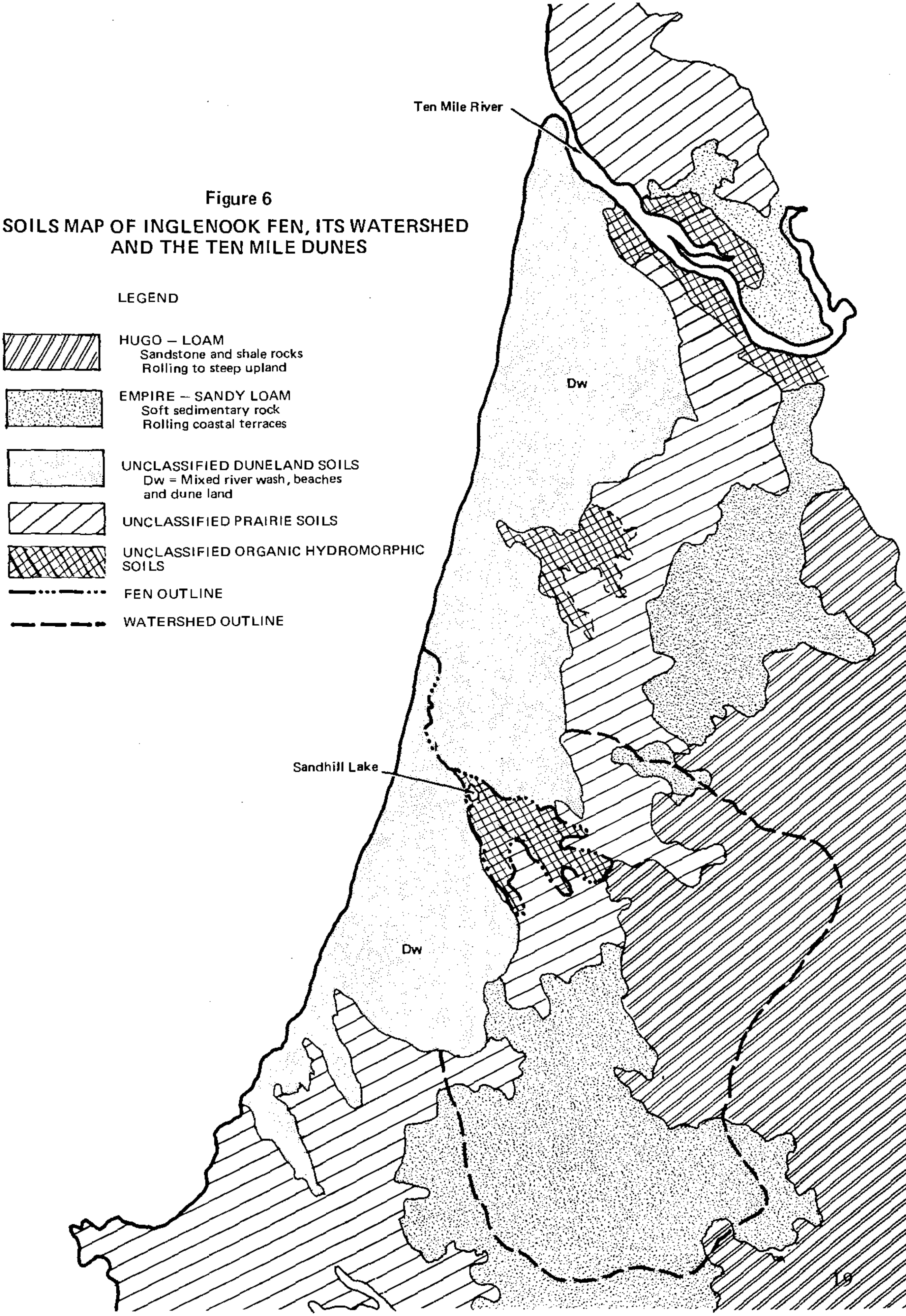
Although the parent materials of the Empire soils are much younger than those of the Hugo, the somewhat gentler slopes result in a slower rate of natural erosion. As a result, under forest vegetation, there has been a greater development of the B horizon than with Hugo soils, with an accumulation of substances leached from the A horizons, including clay and sesquioxides. Thus podzolization, the extreme leaching of part of the surface horizon, is an active process in Empire soils.

The Empire soil is well to moderately well drained. The runoff is slow to medium and the permeability is moderately slow. In "flat" areas, as in the terraces of Jug Handle Creek, drainage may be slow and permeability reduced because of the stratification under the parent material. However, in the Inglenook area, the areas with Empire soils usually have enough slope for good drainage. This soil has severe limitations for septic tank filter fields (Miller, 1972).

The natural vegetative cover is coniferous forest composed of coast redwood, Douglas-fir,

Figure 6

SOILS MAP OF INGLENOOK FEN, ITS WATERSHED AND THE TEN MILE DUNES



and Sitka spruce with understories of California rhododendron, huckleberry, salal, and sword fern. Some areas have been cut over for other uses. Red alder often dominates cut-over sites but eventually is replaced by conifers. Productivity for timber is very high, and productivity for forage is medium.

Hugo Soils Series

The Hugo series is a member of a fine, loamy mixed, mesic family of Dystric Ustochrepts (gray-brown podsol).

The A horizon is soft, friable, slightly sticky, and slightly plastic, ranging in color from grayish brown to pale brown. Its texture ranges from gravelly sandy loam or heavy loam to sandy clay loam. The reaction varies from slightly to medium acid. The structure ranges from strong to moderate, fine and medium granular to subangular blocky.

The B horizon or subsoil horizon varies in color from grayish brown and very pale brown to dark brown and yellowish brown. Texture may be sandy loam, heavy loam, or sandy clay loam. Structure ranges from strong to moderately strong, medium and fine granular, also from subangular blocky to weak massive. It is generally friable throughout with a slight increase of stickiness with depth. It is strongly acid with acidity increasing with depth. The B horizon grades into hard, shattered, medium-grained graywacke sandstone or sometimes abruptly into less shattered, hard, massive sandstone. The depth to the weathered rock is 75 to 150 centimeters (30 to 60 inches).

Hugo soils occur on steep to extremely steep, strongly dissected mountains with sharp narrow ridges and deep V-shaped drainages. Because this soil occurs on steep slopes, natural erosion has more or less kept pace with processes of soil formation so that the subsoil is not as strongly developed as in more level sites, some of which have hardpans.

Hugo soils are well drained with moderate runoff rates. Permeability is moderately rapid and erodibility is low to moderate under natural conditions but is very high on the steeper slopes where vegetation has been removed. Miller (1972) lists these soils as having severe limitations for septic tank filter fields.

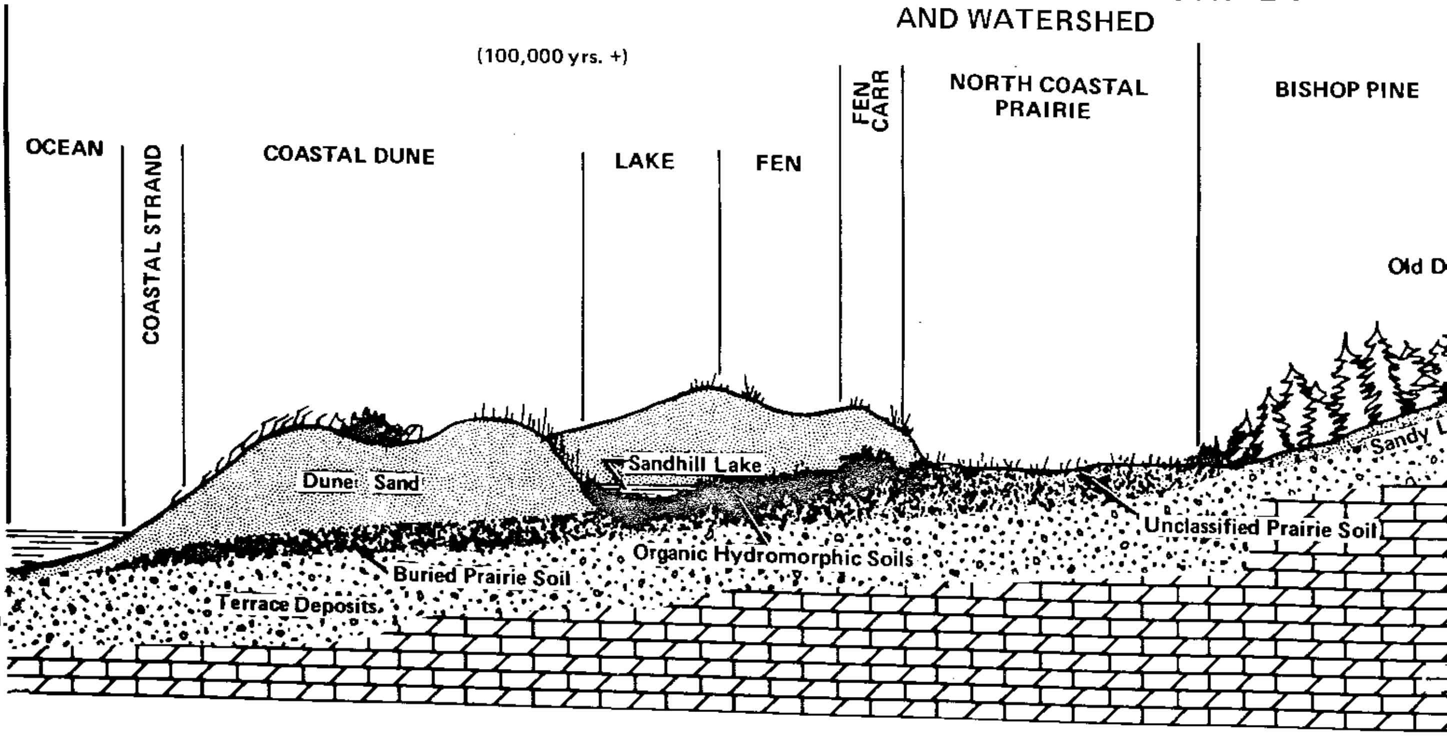
Natural vegetation associated with Hugo soils consists of mixed coniferous and hardwood forests of Douglas-fir, coast redwood, and some Sitka spruce and tanbark oak with an understory of shrubs. Forage production is low, and timber production is good.

Unclassified Prairie Soils

Variation is apparent in soils that underlie grassland cover on the first terrace. Some might have been formed under north coastal prairie, while others were probably formed under forest cover.

A soil profile on the first terrace, in the grassy area near the Grange Hall, indicates formation under north coastal prairie as the profile is typical of prairie soils. It has an A-C horizon; i.e., the surface horizon contacts the stabilized sandy parent material. There is little or no increase in clay content with depth. The surface horizon is dark gray-brown (moist color), strongly acid sandy

Figure 7
CROSS-SECTION OF INGLENOOK FEN AND WATERSHED



loam. The structure of the A horizon consists of very fine and fine crumbs with isolated subangular blocky portions. Consistency is slightly hard, very friable, nonsticky and nonplastic. There are earthworm casts along with medium to fine roots and medium pores. The surface horizon grades gradually into moderately loamy sand that is very friable, slightly sticky, and nonplastic.

A soil sample from a pasture area just south of the fen, above a slight break in slope, shows evidence of subsoil development. This soil probably formed under coast redwood forest and could be considered an Empire variant. A soil sample taken in the grassy area between the two northernmost lobes of the fen contained pieces of bark in the profile, indicating possible development under a forest. According to Rolston Ross (personal communication), this area had indeed been logged and cleared for pasture.

These soils were formed on the stabilized beach and dunes of the first terrace. The topography is gently rolling and contains gentle slopes. The area is affected by the winds and salt spray blowing in from the sea. Runoff is very slight due to high permeability and gentle slopes. The soil is very well drained – much of the rainwater permeates into and through the soil. The vegetation is comprised of grasses and forbs of the north coastal prairie community, with occasional shrubby areas that contain fern, rhododendron, blackberry, stunted Douglas-fir, coyote brush, and other shrubs, with scattered coast redwoods, grand firs, and shore pines. Part of the grassland contains early successional stages leading to redwood forest with shrubby areas and redwood seedlings. It is presently used for cattle grazing. Its suitability for range is good.

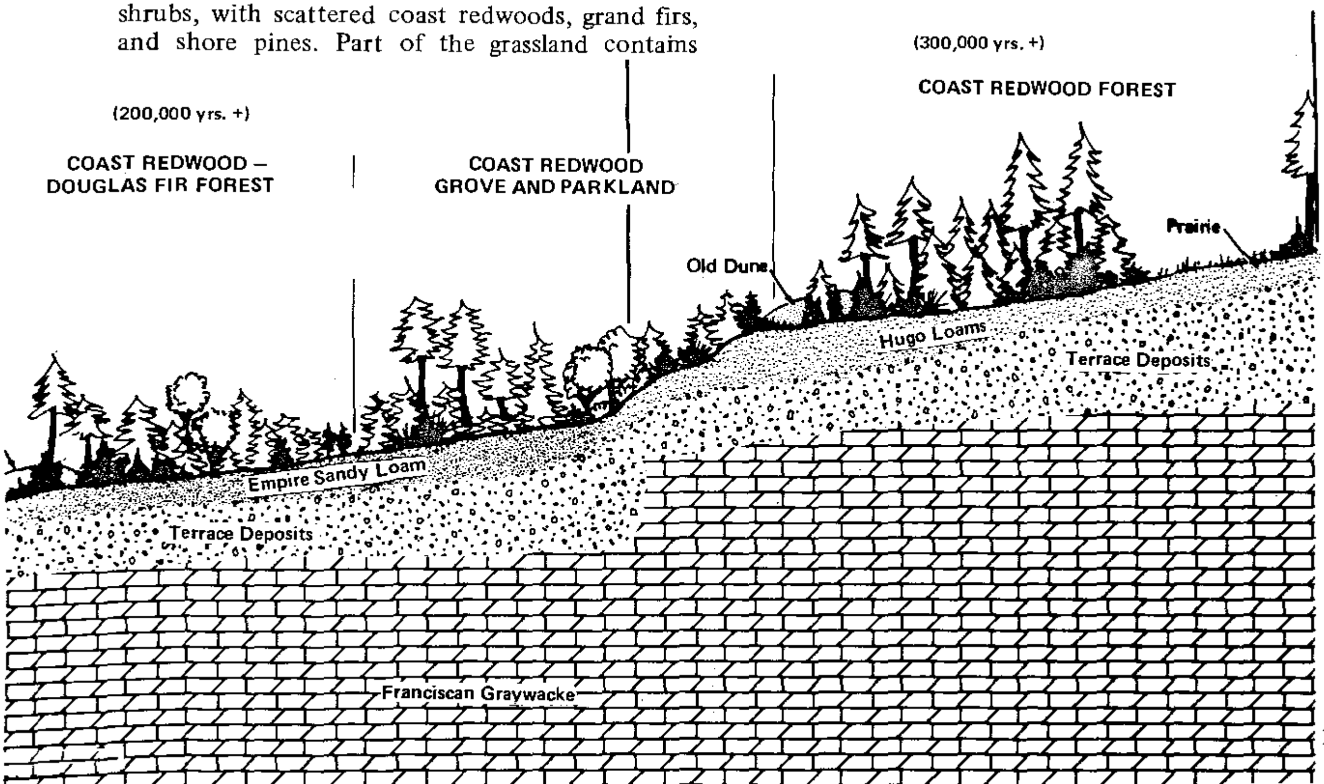
Further analysis of soil samples from the grassland areas are needed to determine the classification and extent of the grassland soils and thereby establish the extent and age of the pristine north coastal prairie ecosystem.

Unclassified Dune Soils

In dune areas there is little buildup of organic matter in the surface horizon, and there has been little translocation of finer particles and colloids from the surface into the subsurface.

Dune soils are gray, medium, and coarse sands with an alkaline reaction. There is little or no buildup of organic matter on the surface except where dense vegetation occurs, as in swales. The structure is single-grained. The drainage is excessive, and the permeability is very rapid; therefore runoff is minimal. Most of the drainage is subterranean and the water-holding capacity is very low.

The unique features of the coastal dune environment are unstable sand, sand abrasion, lack of soil nutrients, strong winds, and frequently a lack of moisture. This specialized harsh environment has drastic effects on biotic community development, thus soil formation is slow.



The reaction of the soil on the dunes is determined by the type of parent material of the sand, by the addition or absence of calcareous material, such as sea shells, and by the processes of soil development, building up of organic matter, and leaching (Wiedemann, 1966). The sand of the Ten Mile Dunes is derived largely from graywacke, which is not a calcareous material. However, there is an input to the dunes of calcareous material, such as sea shells, and the processes of soil development that would increase the acidity of the soil, such as leaching and buildup of organic matter, have not taken place to any large degree. As a result, the reaction of the Ten Mile Dunes is somewhat alkaline (pH 8.1). Turf transplants and tomato culture experiments reveal that nitrogen, phosphate, and potassium were deficient in the soils of a calcareous dune system (Willis and Yemm, 1961). Significant responses to complete fertilizer application were also found in both dune and slack vegetation, resulting in a marked increase in grasses at the expense of low-growing herbs and bryophytes. However, there was no significant response to trace element fertilization (iron, sodium, manganese, zinc, copper or molybdenum) in dunes (Willis, 1963).

Martin and Clements (1939) compared the environment of ridges and swales. Ridges and swales had about the same amount of various minerals, including potassium and phosphorus. As would be expected, the swale sand had more nitrogen and organic matter than that of the ridge, since the swale was nearer the water table and therefore had greater growth of vegetation and deposition of humus.

The concentration of salt in the ground water decreased rapidly with distance from the ocean. In sand dunes the dry season exerts stress on the vegetation due to a combination of drought and salinity. Water applied to the surface of the sand penetrates very rapidly to lower levels. Martin and Clements (1939) found that within seven hours after irrigation of an enclosed area, the water content at a depth of one foot had dropped to within 1.5 percent of the field capacity. The rapid moisture penetration and the low moisture-holding capacity allow the dune surface to dry out quickly after rains. In just a few days of clear weather, the top inch of sand may dry out. The very rapid infiltration of moisture virtually eliminates runoff from the dunes.

Vegetation plays an important role in soil development processes acting upon sand dunes. In these processes the physical and chemical nature of the sand mass in the surface portion is modified. Under grass cover greater humus is incorporated with the sand from the decay of fine grass roots and earthworm activity. Under forest cover a layer of decaying leaf litter is formed on top of the soil. Water picks up acid as it passes through this layer. The water then leaches substances from the upper portion of the soil that are then deposited in the subsoil and gradually form a compact zone of accumulation, the B horizon. If the forest is removed after the B horizon is formed, the B horizon may temporarily resist erosion.

Stabilization of dunes by vegetation is a very gradual process. Plants protect the surface of dunes from wind erosion by binding the surface layer of the dunes with a network of roots and underground stems.

Organic Hydromorphic Soils

The organic hydromorphic soils of the fen and fen-carr are formed from decaying plant remains from fen or fen-carr species, along with silt and organic matter brought down in the drainage. These soils are formed under anaerobic conditions in the presence of a water table. Variations in these soils occur from differences in the factors that influence the formation of organic soils and of the length of time that the organic soils have undergone development. The character of peat is determined largely by the composition of the plant and mineral material that gave rise to it and the processes of alteration, especially decomposition, that have occurred.

From the historical point of view, Heinselman (1963) separated peats into these four broad groups: forest peats, nonforest peats, sedge peats, and aquatic peats. Dachnowski (1923) separated peats into the following three groups: sedimentary layers of peat (which correspond to aquatic peats), fibrous peats (which include the sphagnum peats and nonforest sedge peats), and woody layers of peat (formed under forest or other woody plants).

Eutrophic peats, such as those formed in fens, are rich in calcium and nitrogen; oligotrophic peats, such as those formed in bogs, are poor in these elements. According to Dawson (1956) there is no clearcut division between the two. The percentage of nitrogen is lower in sphagnum moss than in oligotrophic peats. Strong inflows of moderately rich minerotrophic water are associated with the formation of Inglenook Fen. These inflows have a pH in a near neutral range, high amounts of calcium (Ca) and magnesium (Mg), and are quite productive.

Topogenous peats (minerotrophic peats), such as those formed under fens, are formed because of conditions of poor drainage resulting from blocked drainageways and are often concave in cross section. They tend to be eutrophic and are fed by nutrient-rich waters that are fairly high in pH and fairly well oxygenated. Inglenook Fen receives both acid drainage from the watershed and alkaline seepage from the sand dunes.

The ombrogenous peats of bogs (ombrotrophic peatlands) are oligotrophic because they are more isolated from mineral-rich waters due to peat buildup (convex cross section), and consequently, they have a lower pH, a lower concentration of bases and other essential elements, and are poorly oxygenated. The poor oxygenation results in a lower oxygen:carbon dioxide ratio (Heinselman, 1963, 1970). Rapid circulation of groundwater prevents the active growth of the sphagnum mosses and promotes their decay.

Marsh and swamp wetland communities are more similar to fens than to bogs in their water chemistry but differ physically as they develop little peat.

Marshes are usually formed of grass or sedge sods that are frequently interspersed with open water. There is usually little peat. The water is not acid and is usually flowing or occasionally standing.

Swamps are forested wetland communities, usually with little or shallow peat and water that is nearly neutral or slightly acid. The water may be standing or gently flowing. Swamps are usually closer to fens than to bogs on the basis of water chemistry.

According to Baker (1972) the submerged soil near the center of Sandhill Lake contains more mineral than organic matter, but mineral matter decreases and organic matter increases away from the center. In the fen the organic matter content is 50 percent, and in the fen-carr it is 77 percent in the surface litter and 78 percent in the subsurface peat. Sand and mineral particles occur in all zones.

The stratification of the plant remains that form the peat is controlled by plant zonation and therefore by the water level and the seasonal fluctuations of the water level. In a fen proper, vegetation grows where the water level is just above the surface in the winter and just below the surface in the summer (Tansley, 1939). In Inglenook Fen, sphagnum moss occurs in patches, but most of the rest of the peat forms from the remains of flowering plants.

A fen-carr is formed on the zone of peat that is always above the winter water level (Tansley, 1939) but is close to the water table. The peat of a fen-carr is formed largely from woody species.

In the sediments of the pond, there are aquatic peats mixed with mineral sediments.

Soft peat, or muck, is found underneath the surface peats, and it was probably formed from the disintegration of the surface peat.

Heinselman (1963) divided fibrous peat into two categories: herbaceous peat and moss peats. Herbaceous peats are composed of sedge, reed, and grass; these are peats with identifiable components. They are often laminated, stringy, or matted. These peats are porous, usually not very decomposed, and may contain wood fragments and logs.

Moss peats have identifiable remains of sphagnum, Hypnaceae, and other mosses. They are fluffy or spongy, sometimes laminated, and often decomposed. Moss peats containing mostly sphagnum (sphagnum peats) are poorly decomposed. Moss peats contain minor components of herbaceous plants and the stems and leaves of ericaceous shrubs. They may also contain some wood and occasional small logs as inclusions, but the matrix is not woody (Heinselman, 1963). The acidity of sphagnum moss peat is often less than pH 5, and that of the other fibrous peats is greater than pH 5. There are exceptions in both types of fibrous peat (Dawson, 1956).

Fibrous peat layers are formed from an interwoven network of more or less unaltered plant remains. The organic constituents are chiefly derived from roots, rootlets, and rhizomes of herbaceous plants and from mosses. Differences in layers derive from differences in the vegetation that formed each layer. Physical properties, such as the ease of disintegration and decomposition, as well as various other factors, are closely related to the botanical origin of the layers.

Most of the volume consists of pore spaces, and the texture varies from coarse to very fine fibrous material that exhibits a rather loose, porous appearance. Pulpy peat, when present, acts like a cement in a fibrous layer, making it firm and compact when dry. The color of fibrous peat is variable, ranging from gray, red, or yellow-brown to dark brown. Contact with air imparts a darker shade, and admixtures of finely divided organic material add a very dark brown or black color. Mineral salts cause the color to be yellow, brown, or red. The color of fibrous peat samples is mixed, with relatively dark-colored small particles and lighter-colored fibers.

Under conditions of slow drainage, particles of finely-fibered roots oxidize and disintegrate readily into a black, granular material, but when overdrained the particles remain more or less unaltered and dry. The individual layers of fibrous peat are thin to thick bedded. They may occur interbedded with or grading into other kinds of peat. Often fibrous layers must be described in terms of mixtures.

Woody peats, such as those formed under the fen-carr, contain a large amount of woody material from shrubs and/or trees imbedded in a matrix of moss or herbaceous peat. Woody peat layers may include peat derived from heath shrubs, willows and alders, and/or deciduous and coniferous forests. Since the shrubs and trees that form this peat require a lower water table, this peat is aerated and subject to weathering. The woody plant remains are broken down partly into granular debris and partly into irregular-shaped woody fragments. The thickness of the more or less unlayered material over the decomposed material is likely to be uneven, because of local variations in the rate of decay. Therefore, layers of woody peat may show separate layers or an alteration of light and dark material. There may be variations in the kind of plant remains. Woody peat layers vary widely in their composition. Their texture, color, ease or difficulty of decay, and other properties are related to the nature of the plant remains. They may be in various stages of decomposition (Dachnowski, 1923).

Aquatic peats – pulpy sedimentary layers of peat – are found mixed with minerals underneath the water of ponds or in sluggish places underneath streams. Pulpy sedimentary aquatic peat layers are less subject to disintegration than woody and fibrous peat layers, since they themselves are products of disintegration of former water plants, vegetation growing along the shores of water bodies (Dachnowski, 1923), or mineral and organic matter brought down in the water.

Aquatic peats include all of the various aquatic oozes, including gyttja, sapropel, copropel, marl, and the like. Except for isolated logs, there is no wood content (Heinselman, 1963). Transition phases may contain an admixture from fibrous or woody plant remains, varying amounts of shells, chara, marl, diatomaceous earth, or mineral matter, such as silt, sand, and clay.

The plant remains of aquatic peats are relatively small in size. They range in texture from coarse to finely divided material (Dachnowski, 1923) and form a somewhat massive plastic or gelatinous ooze (Heinselman, 1963). The structure is in layers, unless disturbed by currents, that may be impervious, dense, heavy, stiff, and compact. The moist colors are black and dark brown or gray and olive green with darker shades and variations upon exposure to air. This kind of peat shrinks upon drying into a hard, hornlike substance. It generally has good drainage after drying, because it dries into angular fragments that weather into a fine granular dust.

When surface layers of peat are subjected to soil-forming processes, muck and humus form. Muck results from disintegration, and humus results from decomposition of the surface layers of peat. Since humus and muck form only under certain conditions (i.e., after an accumulation of peat is drained), the quantity of humus present has no reference to the relative age of a peat deposit.

Disintegration is a mechanical soil-forming process by which peat materials are broken into separate and smaller fragments of their constituent plant remains. It is the physical breaking down of peat at or near the surface. The causes may be changes in moisture content, particularly from drainage that leads to irregular drying and shrinkage; changes in temperature, particularly the action of freezing and thawing; and the growth of plant roots (Dachnowski, 1923).

The muck resulting from disintegration includes well-decomposed, aggregated, or granular peats without identifiable plant remains. It is usually dark brown to black and friable when moist (Heinselman, 1963). Dawson (1956) defined muck as resulting when the decomposition of an organic soil material becomes high enough to prevent identification of the plant from which it was derived. All the kinds of organic materials found in organic soils decompose into mucks. Mucks are finely divided materials, often of low molecular weight. Muck has an acidity ranging from less than pH 4 to more than 7.5. Samples having pH values of 6 or above may contain free calcium carbonate (Dawson, 1956).

Decomposition consists of alterations undergone by plant remains within the drained and aerated or cultivated surface layers of a peatland and the separation from the resistant material of those constituents that are soluble. Some of the more resistant organic constituents are merely broken into smaller fragments (disintegrated) while others are changed in their nature (decomposed). Soluble organic constituents remain or go into solution and are carried away. The active agents in decomposition are air and microorganisms. Factors that encourage the increased growth of microorganisms, including oxygen, warmth, and an increased supply of nutrients, encourage decomposition.

After decomposition, plant remains are altered to new substances that on the whole are softer, darker, and finer in texture than the original parent material (Dachnowski, 1923). These products of decomposition are commonly referred to as humus. Some of the products make up a very dark-colored, more or less resistant carbonized mixture of organic material, the characteristics of which can no longer be recognized microscopically.

The color may be stained or may be changed by the infiltration of suspended or dissolved organic matter and by compounds of iron, sulfur, lime, or other mineral salts. The horizons that contain considerable amounts of calcium sulfate crystals, oxidized iron, or an admixture of mineral matter washed in from the upland, increase their mineral content after the decomposition and loss of organic matter. Soluble humus may be taken into solution by water and used by growing plants, be deposited underground, or be deposited at the margin of a peat deposit.

Some causes of subsidence have been suggested: oxidation, fire, compaction, shrinkage, and wind erosion (Dawson, 1956). Clayton (1936) and Weir (1950) have suggested oxidation as the major cause of subsidence. Fire, compaction and wind erosion are not important. Shrinkage may or may not be important but increase in bulk density has sometimes been observed, although it is sometimes lacking. Organic soils subside or decrease in elevation when the water table is lowered or when the organic matter is increased. The subsidence immediately after the water table is lowered is greater than the rate several years after drainage (Dawson, 1956). Decomposition favored by manuring, tillage, warmth and conditions of moderate moisture content, fluctuations of water table, lime, and fertilization all favor oxidation (Dachnowski, 1923). Low temperature, dry air, or water containing no oxygen has little effect on altering or dissolving the organic matter of a peat layer.

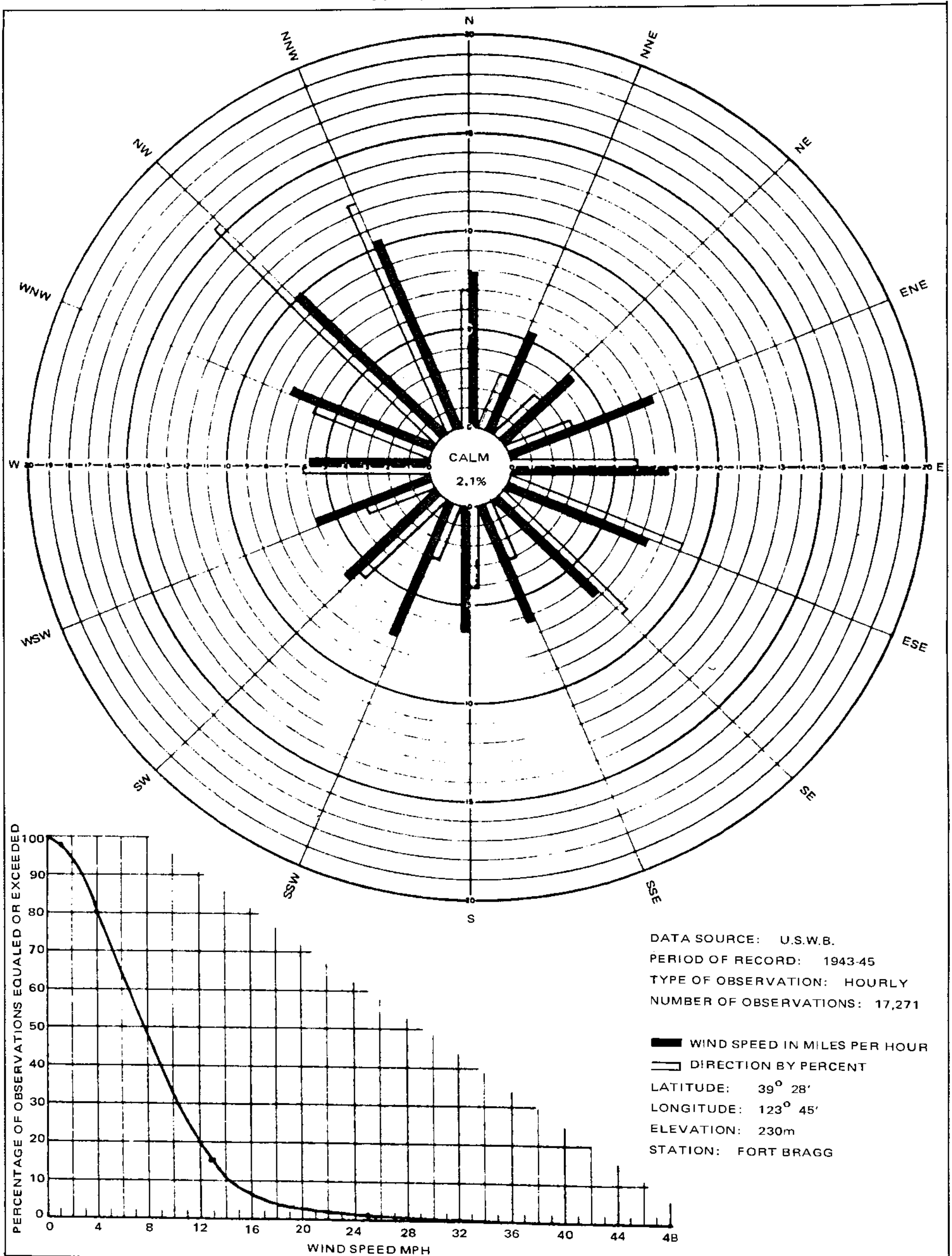
Heinselman (1963) found that, chemically, peat is a variable mixture of complex compounds, including cellulose, lignins, cutins, resins, alkaloids, pectins, fats, proteins, sugar, starches, and their decomposition products. The status of any given sample depends on its original constituents and on the nature of their alteration by microorganisms and chemical reactions (Feustal and Byers, 1930; Wakeman, 1942).

Sphagnum has an extremely high carbon:nitrogen ratio and a high acidity (pH 3.0 to 4.5), that renders it resistant to microbial attack (Wakeman, 1942; Heikurainen and Huikari, 1952; Gorham, 1957). Cellulose-decomposing bacteria inhabit virtually all peats, even below the water table, but sphagnum is much less readily decomposed than the sedge peats of "low moors" (Wakeman and Purvis, 1932, a,b). Decomposition narrows the carbon:nitrogen ratio because certain nitrogenous complexes resist attack more than carbon compounds.

The level of oxygen in soils affects the availability of nutrients, the forms in which they exist, and the ability of many organisms, including bacteria and plants, to grow. The oxygen in stagnant conditions and in bogs drops off to a very low level when the water table is reached. The low level of oxygen is likely to produce reducing conditions.

Plant distribution was found to vary with the state of reduction in the soil (Armstrong and Boatman, 1967). Plants vary in their ability to tolerate reducing conditions and the concomitant production of hydrogen sulfide. For example, the presence of hydrogen sulfide in the rooting medium has been found to stunt the roots of the bog bean *(Menyanthes trifoliata)* (Armstrong and Boatman, 1967).

ANNUAL WIND ROSE



DATA SOURCE: U.S.W.B.
PERIOD OF RECORD: 1943-45
TYPE OF OBSERVATION: HOURLY
NUMBER OF OBSERVATIONS: 17,271

WIND SPEED IN MILES PER HOUR
DIRECTION BY PERCENT

LATITUDE: 39° 28′
LONGITUDE: 123° 45′
ELEVATION: 230m
STATION: FORT BRAGG

CLIMATE

M. Fox and W. J. Barry

The climate of Inglenook Fen, its watershed, and the Ten Mile Dunes is classified as humid mesothermal (Mediterranean or Dry Summer Subtropical). The mean temperature of the coldest month is below 18°C (64.4°F) but above 0°C (32.0°F). There is frequent fog with an annual average of 30 days or more, and the range of the mean annual temperature between the warmest and coldest months is less than 5°C (9.0°F).

Data from the nearby Fort Bragg weather station gives a 20-year average annual temperature of 11.6°C (52.9°F). The January mean temperature is 9.0°C (48.2°F) and the July mean is 13.3°C (55.9°F). There is relatively little variation between the minimum and maximum temperatures during the course of a day and throughout the year; the average monthly variation between the minimum and maximum temperatures is slightly more than 8.3°C (15°F). The average frost-free period is 311 days. Below about 180 meters (600 feet) there are only occasional freezes and snows at the fen and its watershed. Snow falls in moderate amounts above 600 meters (2,000 feet) but only at 1200 meters (4,000 feet) does snow remain on the ground for appreciable lengths of time.

The average annual precipitation at the nearby Fort Bragg station (from the last 20 years) is 973 mm. (38.3 inches). Most of the rainfall occurs between the months of October and May, with occasional rainfall during the dry part of the summer.

The macroclimate of the fen-dune area is similar to that of Fort Bragg, but microclimates vary considerably. Rainfall, humidity and temperature can vary within a very small distance. Also, with increasing elevation there is increasing precipitation and decreasing temperature. Winter storms moving in from the ocean rise over the mountains and create heavy precipitation on the west side of the mountains. Higher elevations are usually cooler. In contrast to the ameliorating effect of more or less permanently moist ground on temperature fluctuations in the marshes, fen, and fen-carr, extremely wide and rapid temperature fluctuations are characteristic of the dune habitat. Such fluctuations are much reduced in damp dunes.

The effect of fog is very important; heavy and recurrent fogs are common along this area of the coast (California State Department of Water Resources, 1964). The presence of fog, particularly during the dry summer months, increases the relative humidity and decreases temperature and sunlight. In doing this, fog decreases evapotranspiration (the loss of water vapor from plants and soil). Also, fog augments the normal rainfall by a process called "fog drip." In this process, fog droplets condense on vegetation and fall to the ground, adding to the total precipitation. Fog drip is not measured in precipitation monitoring programs and yet can be a significant part of the total precipitation received (Hopkins, 1960). Some plants can absorb moisture though leaves. Fog is observed to be more frequent at Inglenook Fen than it is a few miles south at Fort Bragg. Fog is frequent during the summer months and contributes to disjunct plant distributions.

Wind is also an important factor in plant distribution. Wind exerts a profound influence on the growth of dune plants, on the redistribution of organic and inorganic nutrients, on the amount of salt received, on the distribution of propagules, and, above all, shapes the ground where they grow (Ranwell, 1972). The wind in this area is affected by the prevailing westerlies, weather fronts, the deflection of air currents by mountains and hills, and sea and land breezes. During the summer the breezes blow shoreward with the diurnal rhythm reaching high velocity in the afternoon. During the winter they are offshore and usually more gentle.

The prevailing direction of the wind in the summer is north 29°, 30' west. In the winter, the prevailing wind is from the southeast (Cooper, 1967).

One reason for the importance of wind is that it increases evapotranspiration from evaporating surfaces. In addition, wind affects the area close to the ocean by carrying salt spray landward and creating a salt gradient in the soil-vegetation mantle. According to Jenny (1973), salt spray on the first terrace of the series of terraces at Jughandle Creek, several miles south of Fort Bragg, favors growth of more salt-tolerant grassland over forest vegetation.

Wind also affects sand movement intensity and dune orientation. The crests of the series of dune waves lie at right angles to the prevailing summer wind; sand is dry and can be motivated by wind in the summer. Intensity and duration of wind determine the amount of sand that is moved (Cooper, 1958).

Rainfall is greater than evapotranspiration in winter but less in the summer for most climates. There is some soil storage; the amount depends on the soil and vegetation (Thornthwaite and Mather, 1957). With coarser soils, such as those found in the dunelands, water drains rapidly Soils containing finer particles or more organic matter have more capillary spaces for holding moisture and therefore drain more slowly. Thus, loam has greater soil moisture storage than sandy loam, which, in turn, has greater moisture storage than sand. Vegetation affects runoff and moisture storage (water-holding capacity). Forested soils have less runoff and greater moisture storage than prairie or scrub soils.

The distribution and intensity of rainfall and the soil water-holding capacity affect the magnitude and distribution of subsurface and surface runoff.

Each biotic community has a characteristic evapotranspiration rate, which is graphically illustrated in figs. 8 through 11. Evapotranspiration is dependent on the vegetation cover, soil moisture storage, and temperature. It is a very important climatic parameter, which has been given very little consideration by meteorologists, yet more moisture is dissipated to the atmosphere through the process of evapotranspiration of terrestrial ecosystems than is evaporated from the ocean surface. Thus, it is a very important factor in determination of the climate and weather.

Light is often the limiting factor of plant growth. This is especially true of aquatic plants where light penetration in the water column is critical to the lower limits of depth. Shade plants, on the other hand, are limited by high light intensities. It might be assumed that light requirements of pioneer plants on open dunes would be high, but

Figure 8
EVAPOTRANSPIRATION RATE FOR SAND – COASTAL STRAND AND COASTAL DUNE – FORT BRAGG AREA

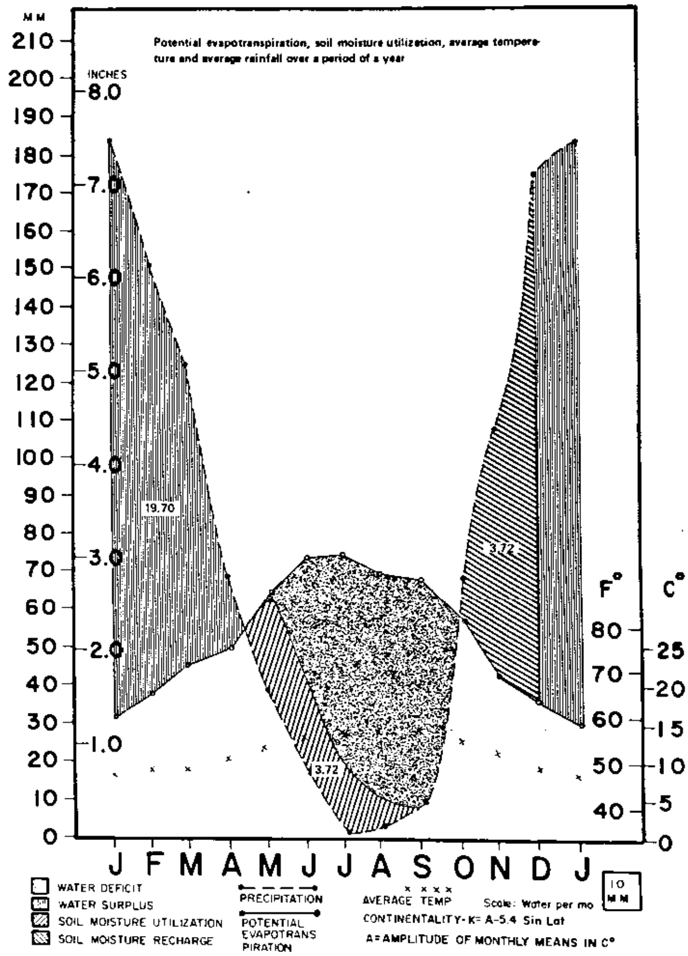
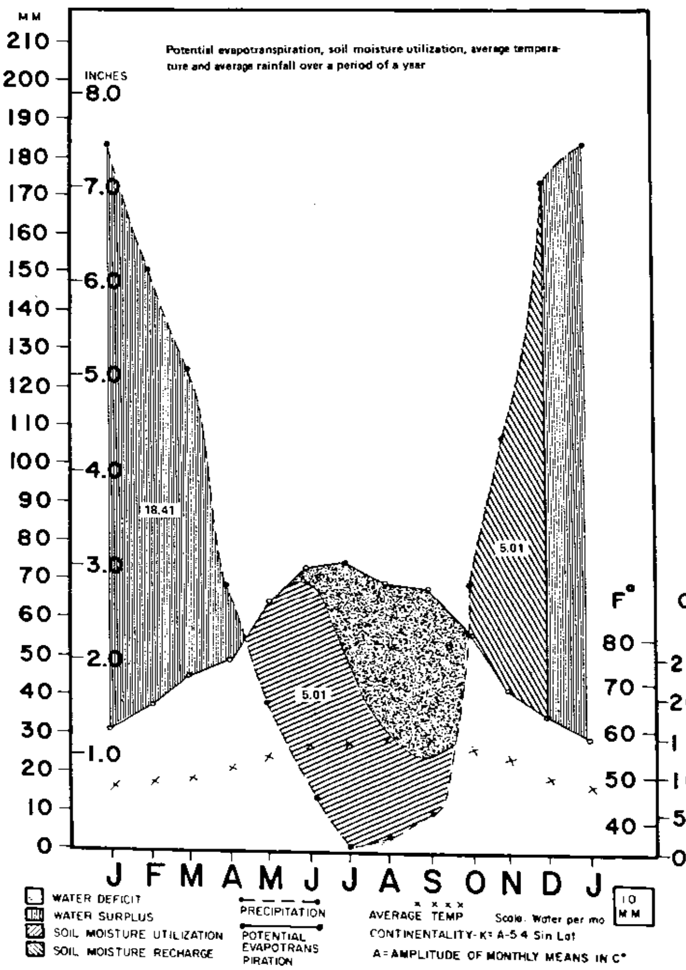


Figure 9
EVAPOTRANSPIRATION RATE FOR EMPIRE SANDY LOAM – NORTH COASTAL PRAIRIE AND NORTH COASTAL SCRUB – FORT BRAGG AREA



this is not necessarily so; for example, *Carex arenaria*, which is associated with the very high light intensities on open sand, is also able to survive in the dense shade of mature pines on the dunes at Holkham in Norfork.

Microclimatic variations are very important in dune systems. The effects of sunlight, temperature, rain and wind change with aspect. Climatic variation tends to be unidirectional across flat surfaces, from seawards to landwards, but where dunes are present a much greater diversity of microclimate is detectable. In different parts of the dune system, vegetation varies according to local shelter effects and proximity to the water table. This is reflected in a complex vegetation mosaic (Ranwell, 1972).

Figure 10
EVAPOTRANSPIRATION RATE FOR HUGO LOAM – REDWOOD FOREST PARKLAND – FORT BRAGG AREA

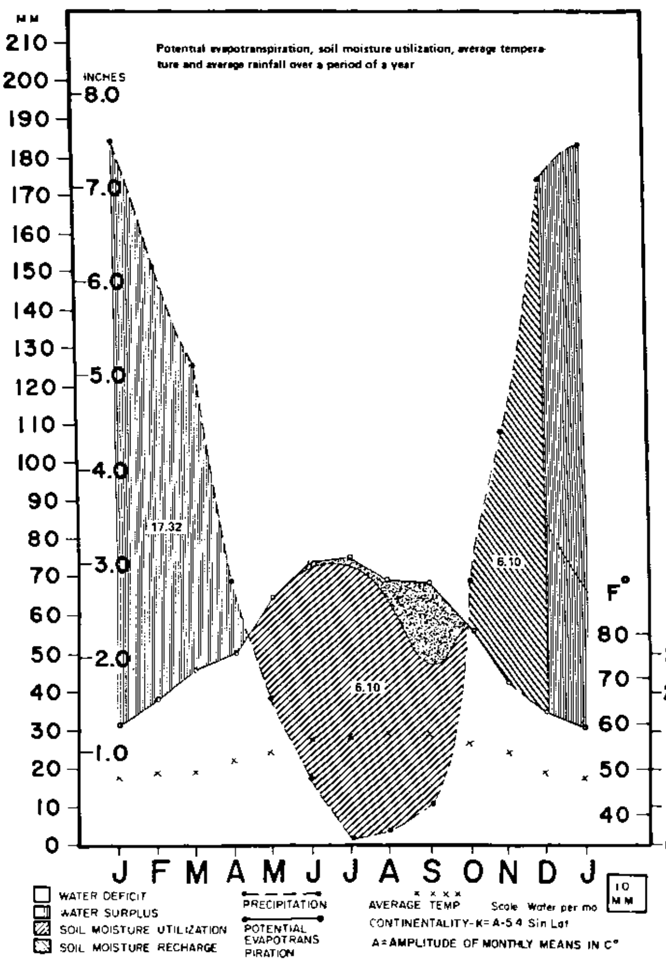


Figure 11
EVAPOTRANSPIRATION RATE FOR SAND (BISHOP PINE FOREST), SANDY LOAM – (REDWOOD GROVELAND) AND LOAM – (REDWOOD FOREST) – FORT BRAGG AREA

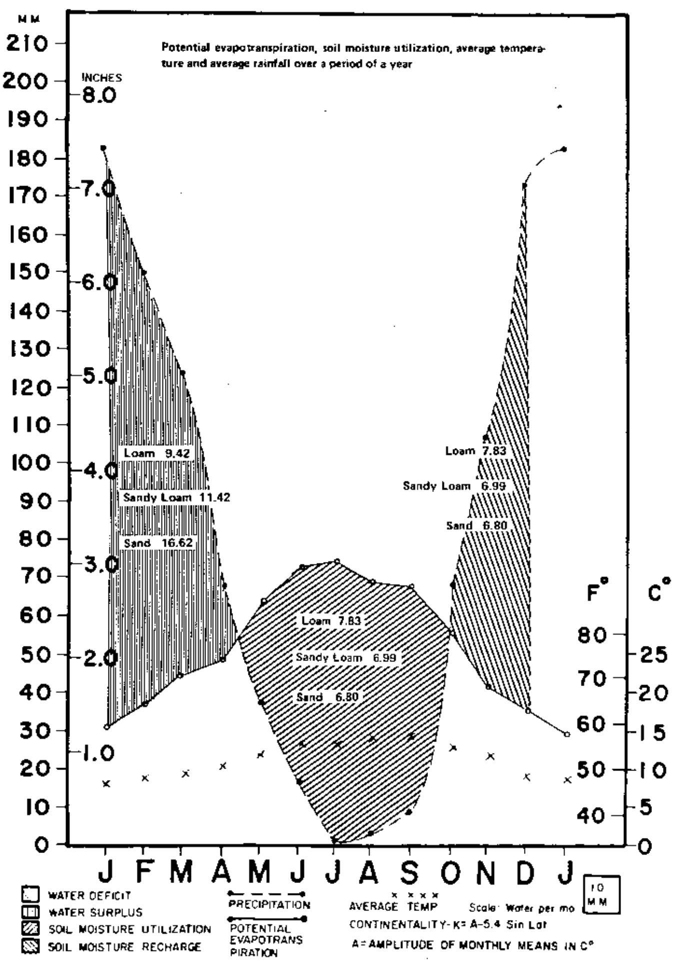
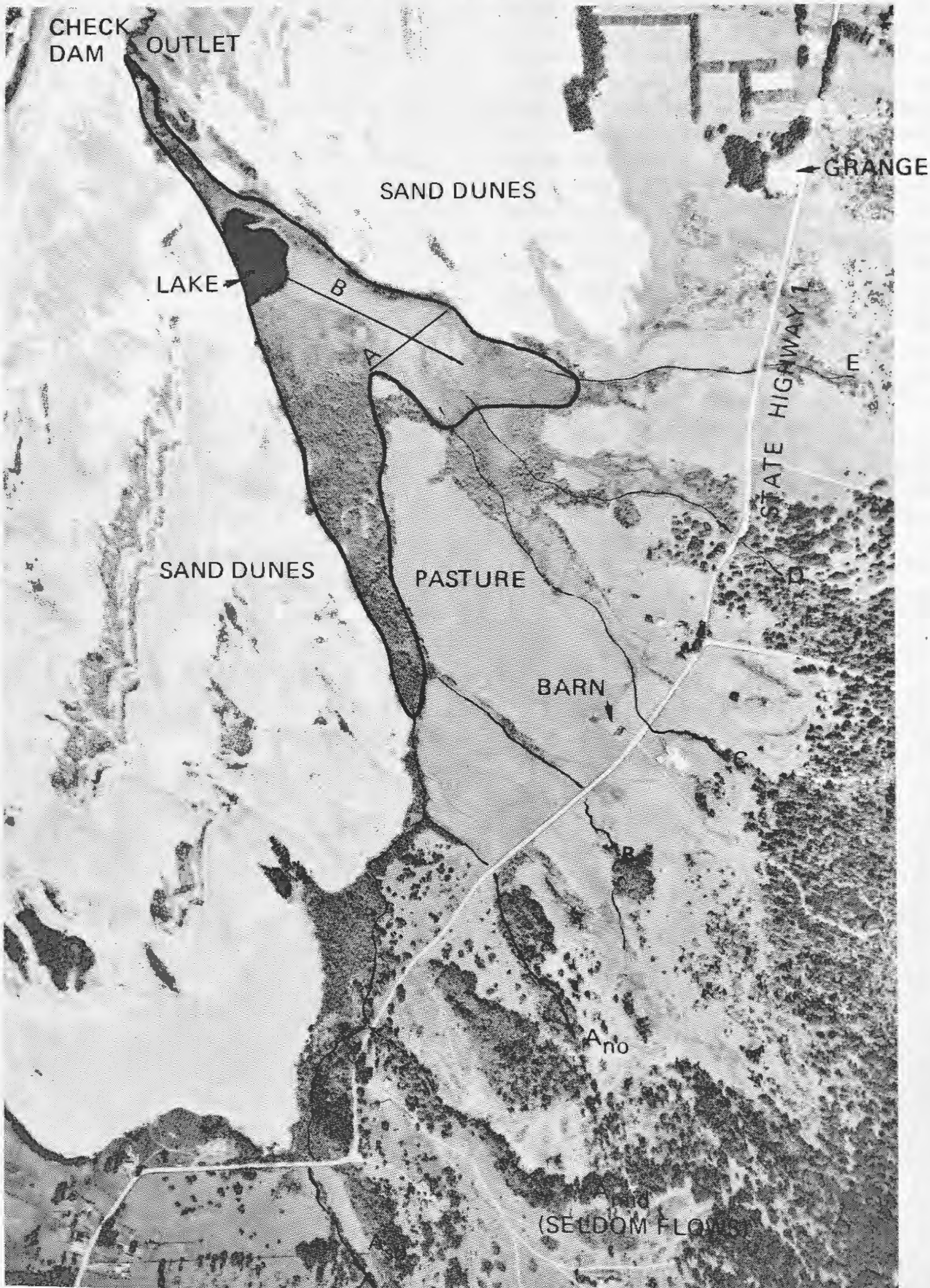


Figure 12
PHOTO OF INGLENOOK FEN SHOWING FEN TRANSECTS (LINES A AND B) AND INLET STREAMS (A TO E)



HYDROLOGY

OF INGLENOOK FEN AND ITS WATERSHED

D. C. Erman and K. Roby

Fens naturally change in geologic time to become bogs. Like any organized, changing system, the rate of change may be strongly influenced by modification of certain critical or controlling factors. The protection of Inglenook Fen by the State Park System does not ensure against possible developments that may affect this rate of change. Because water sources are the key element in peatland evolution (Heinselman, 1970), and because the fen watershed is not contained within state park boundaries, the need to understand the relationships between the water sources and Inglenook Fen are of paramount importance.

The hydrologic study had several objectives. One objective was to determine the sources and amounts of inflowing water to the fen. Related to this objective was the aim of determining the quality of the incoming water, and finally how the quantity and quality affect conditions in the fen.

Data obtained in this hydrologic study will serve as baseline information as well as give insights to fen relationships. If development of the watershed proceeds, this study will suggest some of the key factors that should be followed as a measure of possible impact on the fen.

Stream Flows

Six surface streams (A_{SO}, A_{NO}, B, C, D, E, shown in Figure 12) supply large quantities of fresh water to the fen. These six streams are located in five distinct drainages. Flows were monitored in the six inflowing streams and in the outflowing stream at approximately two-week intervals from November 18, 1972, to November 3, 1973 (Appendix B, Table 1). All measurements were made during the daylight hours.

One of the most interesting results of this work is the relationship between inlet and outlet flows (Appendix B, Table 1 and Figure 13). Jackson (1972) surmised that the predominatly sandy soils of the watershed would result in much subsurface flow. For the entire sampling period the measurable surface inflow averaged only 24.9 percent (20.1 to 66.3) of measurable surface outflow (Appendix B, Table 1). With one exception, September 9, 1973, measurable inflow never exceeded 50 percent of outflow. Thus subsurface flow appears to be much greater than surface flow in this area. While water loss from the fen via evaporation and evapotranspiration would indicate that surface flow from the six inflowing streams represents an even smaller fraction of the total water flow, such factors as runoff from the surrounding sand dunes and direct precipitation on the fen might tend to counterbalance these losses.

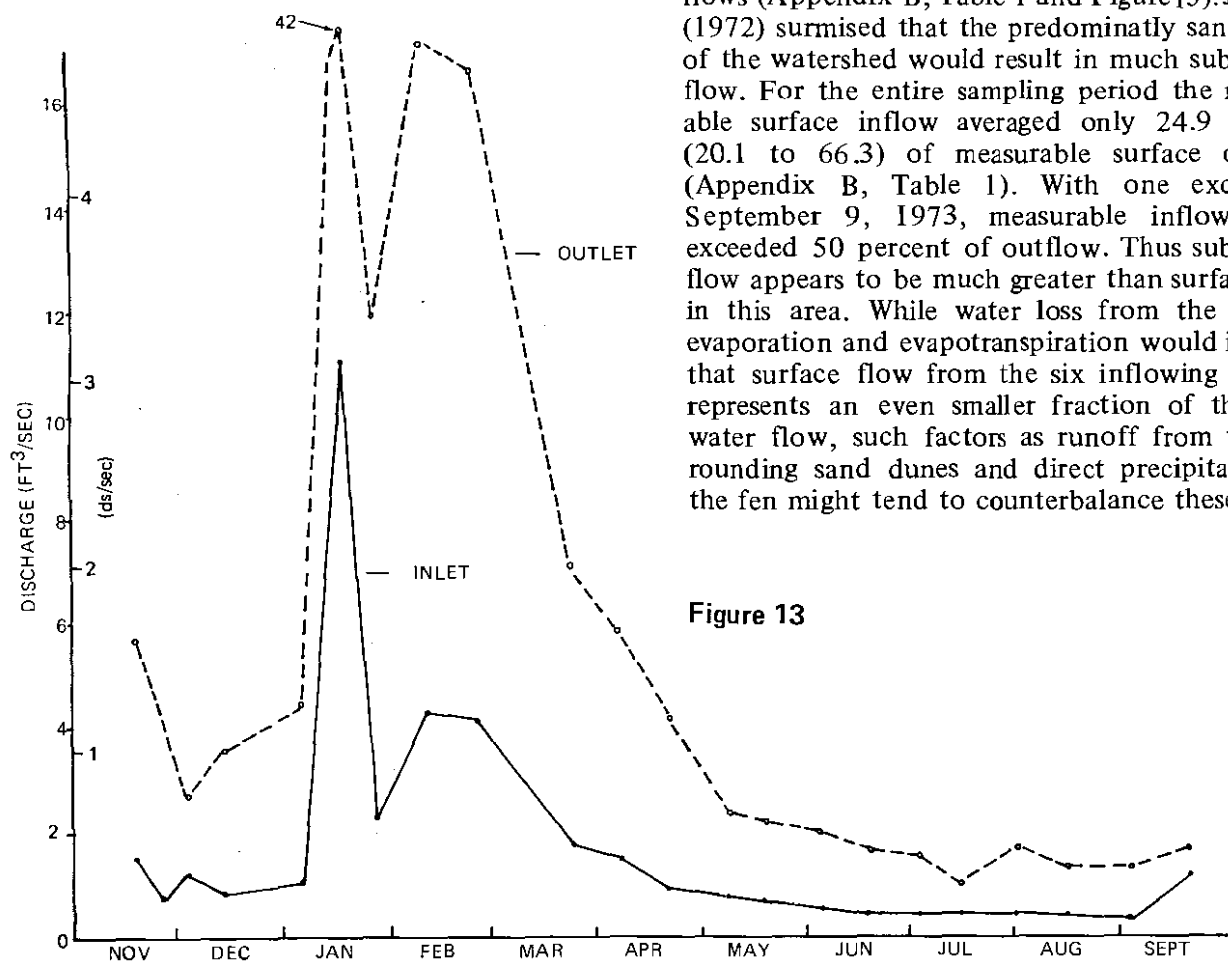


Figure 13

DISCHARGE (FT^3/SEC) FROM ALL INLET STREAMS COMBINED AND THE OUTLET OF INGLENOOK FEN

Extrapolation of these data to a year provided some estimates for the total volume of water carried by each stream in a year (Appendix B, Table 1). The estimated yearly inflow of all surface water was 15.2 million decistere (49.9 million cubic feet) compared to about 6.1 million decistere (200.4 million cubic feet) of outflow. In Appendix B, Table 2 the discharge of each inflowing stream is shown as a percentage of the total inflow, and this is compared with the percentage of the total watershed area for each of the streams. These results indicate differences between size of watershed and amount of surface flow. For example, based on surface flow, watershed A accounts for 18.1 percent of the volume while it covers 42.7 percent of the fen watershed. Watershed B contains 12.4 percent of the area but accounts for 32.3 percent of the total flow. Differences shown in these figures may be due to differences in vegetative cover, soil type, and slope gradient in the five watersheds. Streams A to C drain areas of Empire sandy loam while streams D and E drain areas of Hugo loam. Since we have no data on subsurface flow it may be that when subsurface flow is added, the total contribution of each stream is closer to its percentage of the total watershed.

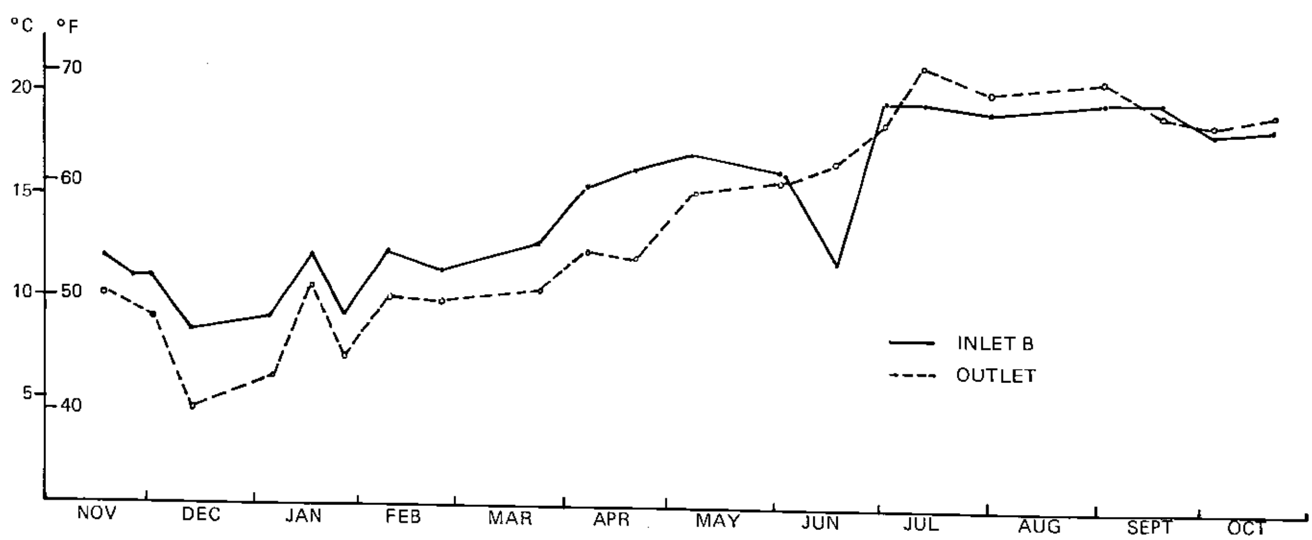
Jackson (1972), in discussing the seasonal patterns of flow in the fen watershed, mentions that only stream E is seasonal. Stream A_{no} was the only intermittent stream during the present study.

Temperature

Temperature data for the inflow and outflow streams of Inglenook Fen and Sandhill Lake are presented in Appendix B, Table 3. Unfortunately, it was not possible to sample the stream at the same time of day on the dates recorded. Daily fluctuations in temperature are unknown for these streams.

As expected, the summer water temperatures (15 to 20°C or 59 to 68°F) were significantly higher than the winter water temperatures (5 to 12°C or 41 to 54°F), although temperatures below 10°C (50°F) were unusual. On each date the streams appear to vary in a similar manner. The average temperatures of streams A_{so} and D were significantly lower than the others. The low values for A_{so} are a result of the stream drying up in summer, and thus there are no high summer temperatures recorded to balance the lower winter temperatures. Stream B's average temperature was significantly higher than that of the other streams, and it also carried the greatest volume of water (Appendix B, Table 1). Seasonal changes in temperature of stream B and the outlet are shown in Figure14.The outlet was warmer in summer than the inlet stream B but cooler than stream B the rest of the year. Temperature data for Sandhill Lake are presented in Appendix Table 3a.

Figure 14
SEASONAL TEMPERATURES OF INLET STREAM B AND THE OUTLET OF INGLENOOK FEN

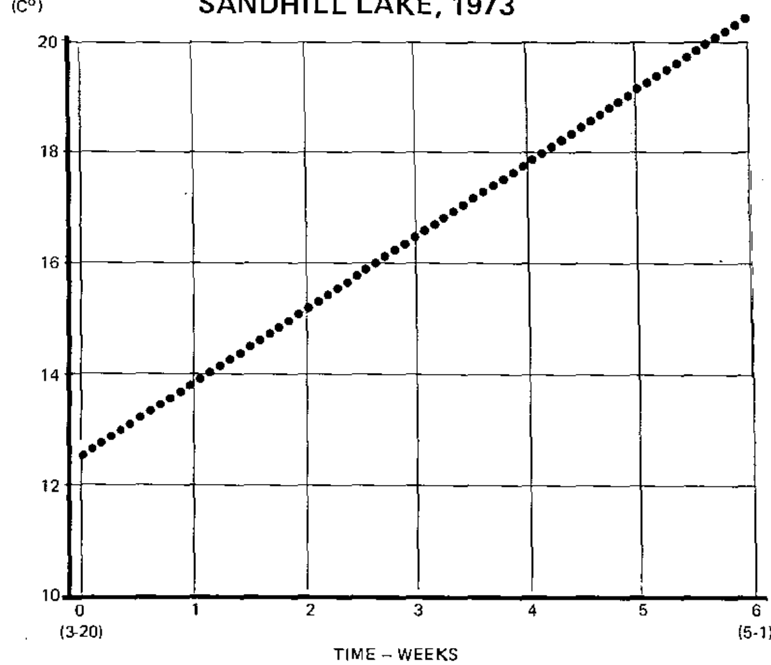


There is a gradual decrease of lake temperature with depth. The amount of energy needed to raise the lake's volume of water to the extent shown seems substantial. The problem is compounded when the lake is calm, as very little area receives heat, and heat conductance in water is not nearly as efficient as mixing caused by wind.

Temperatures were always measured in the afternoon, and no investigation was made to determine if there were daily temperature fluctuations. Since temperature is dependent on geographic and climatic conditions, comparisons with other studies are inappropriate. Welch (1951) states that bog lakes are not significantly different from other lakes of similar area and depth with respect to both absolute temperature and diurnal temperature variations.

Sandhill Lake is thermally stratified. (See Figure 16.) There is a gradual temperature gradient, but the "thermocline characteristics," as described by Odum (1971) and Coker (1954), are not present. Variation in surface and bottom temperature was greatest on May 19, with a difference of 3.6°C. On April 21, the temperature difference was only 1.5°C. It should be noted that whereas May 19 was the calmest day on which tests were run, April 21 was the windiest. It seems reasonable that winds off the ocean have a major impact on mixing the waters of Sandhill Lake.

Figure 15
SURFACE TEMPERATURE VS. TIME, SANDHILL LAKE, 1973



Oxygen

In general, oxygen concentration in inlet streams was near air saturation (average 95 to 101 percent), except for A_{no} which had low oxygen, at low flows (Appendix B, Table 4). For most of the sample period, the outlet had significantly lower oxygen levels than the inlets. This result is expected because of the tremendous amount of decaying material in the fen that would consume oxygen as water flowed through its length. The outlet stream generally was below 60 percent saturation during wet months, but from June to October, when outflows were less than 0.6 dss (2.0 cfs) (Appendix B, Table 1, Figure 13), the oxygen levels were at their highest (89 to 111 percent saturation). The reason for this higher oxygen content in the outlet during low water periods probably reflects less contact of inflowing water with fen peats.

There is measurable water movement across much of the fen surface during the winter months.

Figure 16
TEMPERATURE VS. DEPTH IN SANDHILL LAKE, 1973

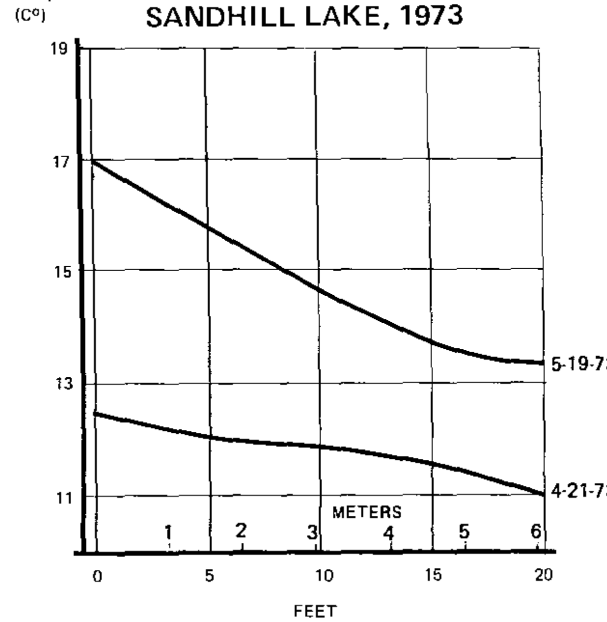
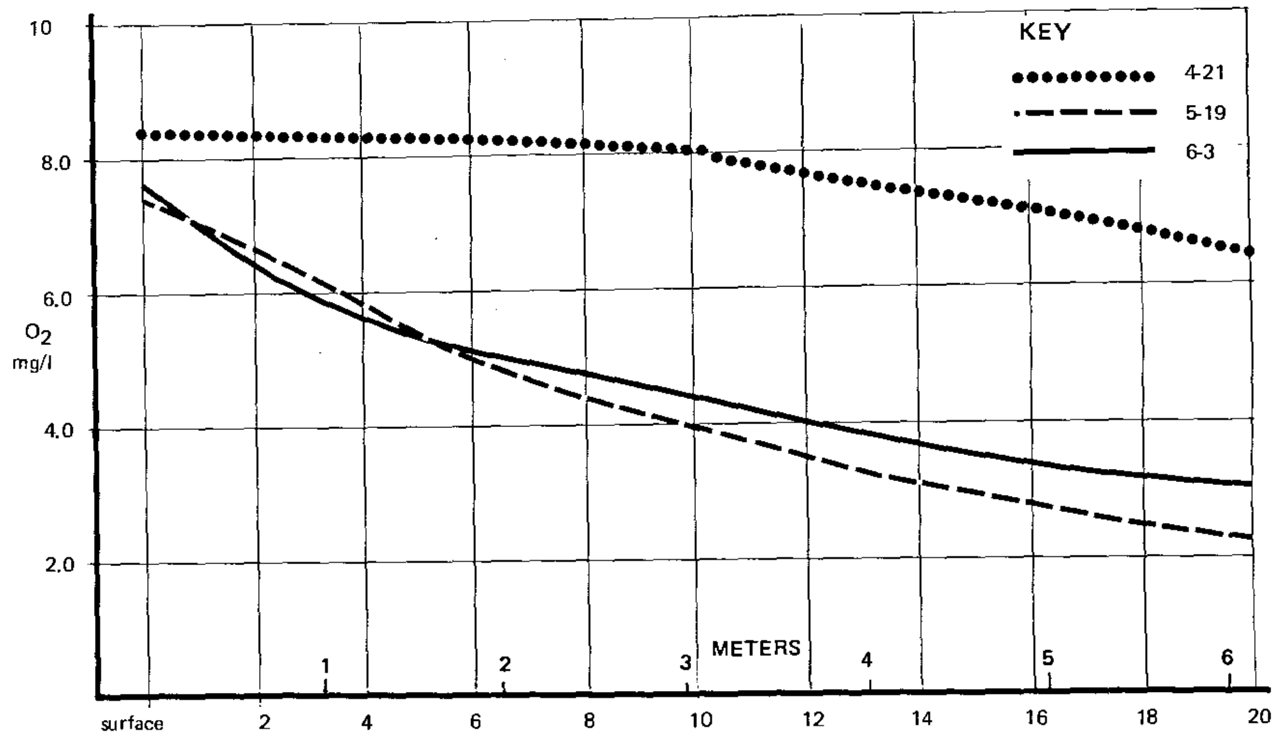


Figure 17
O_2 CONCENTRATION VS. DEPTH IN SANDHILL LAKE, 1973



When inflows diminish to some minimum level (probably at least 0.6 dss combined surface and subsurface), the water tends to move only through the marginal channels ("moats"; e.g., Rigg, 1940) of the fen. It was observed that the sedge area is noticeably drier during June to September, and this observation supports the idea of reduced contact of the sedge area with flowing water and of lower water levels. As long as this oxygen-rich (and relatively mineral-rich) water flows through the central fen, as well as through the marginal "moats," the rate of peat accumulation will be slower than if water flow is confined to the margins.

As peat and living plants in the center of a fen become isolated from flowing water, two characteristic changes occur (Gorham, 1957; Deevey, 1958; Heinselman, 1970). The rate of peat accumulation accelerates with a consequent rising of the surface, and the peaty soils become progressively less rich in nutrients, more acid in pH, and more bog than fen. Changes in the biota accompany such changes in physical-chemical conditions. There is, then, a very important influence of the quantity of water and its oxygen and mineral contents on the rate of succession of a fen system.

In the lake, oxygen concentrations showed stratifying tendencies (8.4 mg/l. at surface to 3.6 mg/l at 6.1 meters or 20 feet). An exception occurred on April 21, a very windy day, when the difference between surface oxygen and 6.1 meter oxygen concentrations was only 1.9 mg/l (Fig. 17). It is probable that wind action was responsible for mixing the gas. Surface oxygen concentration decreases slightly, but this can be partly accounted for by the rise of surface temperature.

Welch (1951) states that bog lake waters usually show lower oxygen content than do nonbog lakes of the same region. He gives a range of 2.5 to 6.0 mg/l oxygen as common values. Studies done by Jewell and Brown (1929) as well as Rigg and Thompson (1919), show high Biological Oxygen Demand (B.O.D.), values for bog lake waters. Bottom samples of Sandhill Lake revealed a thick layer of peaty material. Decomposition of this organic material would doubtless consume large quantities of oxygen. Judging by bottom oxygen concentrations (2.3 to 6.5 mg/l), decomposition of this material is occurring.

pH

The pH determinations of fen streams bear on the successional trend of the fen. The six inflowing streams averaged 5.6 to 7.0 pH, and the outflow averaged 6.6 (Appendix B, Table 5). From May to August, when inflows were derived almost entirely from aquifers rather than runoff, pH was generally above neutral (7.0 – 7.7) or in the case of A_{no} and E, higher than at other periods although less than 7.0. There is a general trend of streams with lower discharge to have lower pH (Appendix B, Tables 1 and 5).

Gorham (1957) suggests a pH of 4.2 as a lower limit of fen conditions. Previous work (Baker, 1972) and our present samples from the sedge-fen region indicate pH levels of 4.5 to 6.0, depending on season (more acid during dry periods).

Tests of oxygen, temperature, and pH were made generally along Transect A (see Figure 12) in association with invertebrate collections. Average values from these collections are given in Appendix B, Table 6. Although samples were taken from areas near the fen edge as well as toward the center, the trend of changes suggested above is nevertheless clear. In winter months high water flushes the entire fen, causing higher oxygen and pH (especially in the central region in the fen). During drier periods, oxygen levels and pH decline in the fen.

The pH of the outflow stream also indicates isolation of water from the central fen region during dry periods. Instead of a lowering of the pH, a condition that would occur if the water were in contact with the more acid central fen, the pH of the outflow increases (Appendix B, Table 5). This change in pH could also result from additions of water that drain the alkaline dunes.

Sandhill Lake's water pH varied little over time or depth, maintaining a value between 6.4 and 6.9 (Appendix B, Table 5a). Much information is available regarding pH in bog lakes. The pH of bog lakes is lower than that of fen lakes, because by definition bogs are more acidic than fens. Sadowsky (1922) reported pH ranges of 3.2 to 9.7 in 20 Russian bog lakes. Gorham (1956) stated that fens had a higher pH than bogs – about 7.0 as compared with about 4.0. Baker (1972) found the pH of Sandhill Lake to be 7.0, indicating a possible slight shift toward acidic conditions since his measurements.

Calcium and Magnesium

Calcium ions in inlet streams averaged 0.143 me/liter (A_{no}) to 0.322 me/l (D) over the period (Appendix B, Table 7). These values are lower than those observed by Baker (1972), who found 0.40 me/l in stream E. The outlet was considerably higher in calcium (0.621 me/l) than the inlets and probably reflects the influence of dunes (Baker, 1972). As a check on the possibility of the dunes influencing the outlet water, a test for silica was made October 7, 1973. If dune water was important, then silica should be much higher in the outlet than in the inlet streams. The average for the six inlets was 3.5 mg/l compared to 8.5 mg/l for the outlet. These results further indicate the relative importance of direct drainage from the dunes into the fen.

Magnesium content (Appendix B, Table 8) averaged slightly higher than calcium in the inlet streams (0.257 me/liter at stream A_{no} to 0.474 at stream D). The outlet averaged 0.470 me/liter, which was less than calcium, and follows the observation of Baker (1972) in this respect also.

Heinselman (1970) noted "Accumulating evidence indicates that the ionic balance and cation content of peatland waters in relation to water sources and hydrotopography are key factors influencing floristics, vegetation types and ultimately peatland evolution." He used pH, and Ca and Mg concentrations of peatland waters in relating peatland types and vegetation. If we use overall averages of the six inlet streams for these factors, we obtain pH = 6.5, Ca = .205 me/l (4.1 ppm), Mg = .342 me/l (4.16 ppm). These values are indicators of weakly minerotrophic waters in Heinselman's classification (1970).

Results for calcium and magnesium in Sandhill Lake correspond closely to those given by Baker. Baker found a Ca concentration of .72 me/l and a Mg concentration of .27 me/l. Results reported here were .70 me/l and .30 me/l respectively.

Phosphate and Nitrate

Soluble phosphate-phosphorus (PO_4-P) (Appendix B, Table 9) was very similar in most of the inlet streams (.07 - .09 mg/l) and was slightly lower than the amount in the outlet (0.12 mg/l). This suggests that $PO_4 - P$ is being released by decomposition, and there is a net loss from the fen. However, subsurface inflows (which are greater than surface) may not have nutrient concentrations similar to the surface inflows, and thus no definite conclusion on PO_4 flux can be reached. The levels obtained may serve as a baseline for the watershed. Occasionally, some streams contained three to five times the average $PO_4 - P$. These higher levels may have resulted from agricultural activities in the watershed, but their intermittent nature does not suggest sewage contamination.

In Sandhill Lake an interesting relationship appeared between phosphate and iron concentrations and oxygen levels. As oxygen concentration decreases, phosphate and iron (Fe) concentrations increase because precipitates form when oxygen is available, and the ions remain in solution when oxygen is not present. Tests made on waters taken from different depths (different oxygen concentrations) showed this relationship. (See Appendix B, Tables 5-11). Unfortunately, chemical tests were not run for April 21. Concentration of Fe and PO_4 in high oxygen conditions would have been interesting. High PO_4-P might also have been due to release by peat decomposition.

Nitrates seem to be retained in the fen (Appendix B, Table 10). The average $NO_3 - N$ in the outlet (0.11 mg/l) is considerably lower than the average of the inlets (.058 to .580 mg/l). The nitrates in the inlet streams follow a pattern similar to the phosphate, although A_{so} was consistently higher in NO_3 and this suggests some basic difference in the immediate vicinity of A_{so} because A_{no} did not appear similarly influenced.

Nitrates, often a limiting factor to plant growth, are available in only minute quantities in the lake (0.02 mg/l) as shown in Appendix B, Table 10a. Welch (1951) stated that bog waters are very poor in available nitrogen. This figure is lower than the values found in streams feeding the fen, but the outlet station on this date was even lower (0.015 mg/l). Nitrates are being utilized by fen vegetation, and are being tied up in the biomass.

Other Chemicals

Results of chemical analysis must be viewed without comparison to similar lakes, as such comparisons were not available. Several interesting relationships are present in Sandhill Lake. First, consider the relationships between apparent low production in the lake and chemical concentrations. Silica is a limiting factor for diatoms, but the silica concentration in the lake water was always around 5.0 ppm. It is obvious that diatoms are not being limited by lack of silica, and the silica is not being depleted by these organisms. However, copper, a micronutrient essential to plants (Odum, 1971) was not detected in the lake water by our methods.

Analyses for iron, silica, copper, chloride, and free acidity for the lake is reported in Appendix B, Table 11.

Color

One characteristic Sandhill Lake has in common with many of the bog lakes studied is its color. Gorham (1951) noted that the waters he studied ranged in degree of brown humus color from slight to moderate to intense. Welch (1951) described bog lake water as having a characteristic "tea" color. Sandhill Lake has such a color, with the intensity of light tea. (See Appendix B, Table 12.) This color is due to substances contributed by the peat deposits on the bottom and margins. Gorham found that when bog lake waters are put on ultrafilter, the color is completely removed, and the filtrate is clear water, indicating coloring is colloidal state and not in true solution. Filtering for microbiological analysis left behind colored filterable material; the filtrate was lighter in color than the unfiltered sample, but not clear.

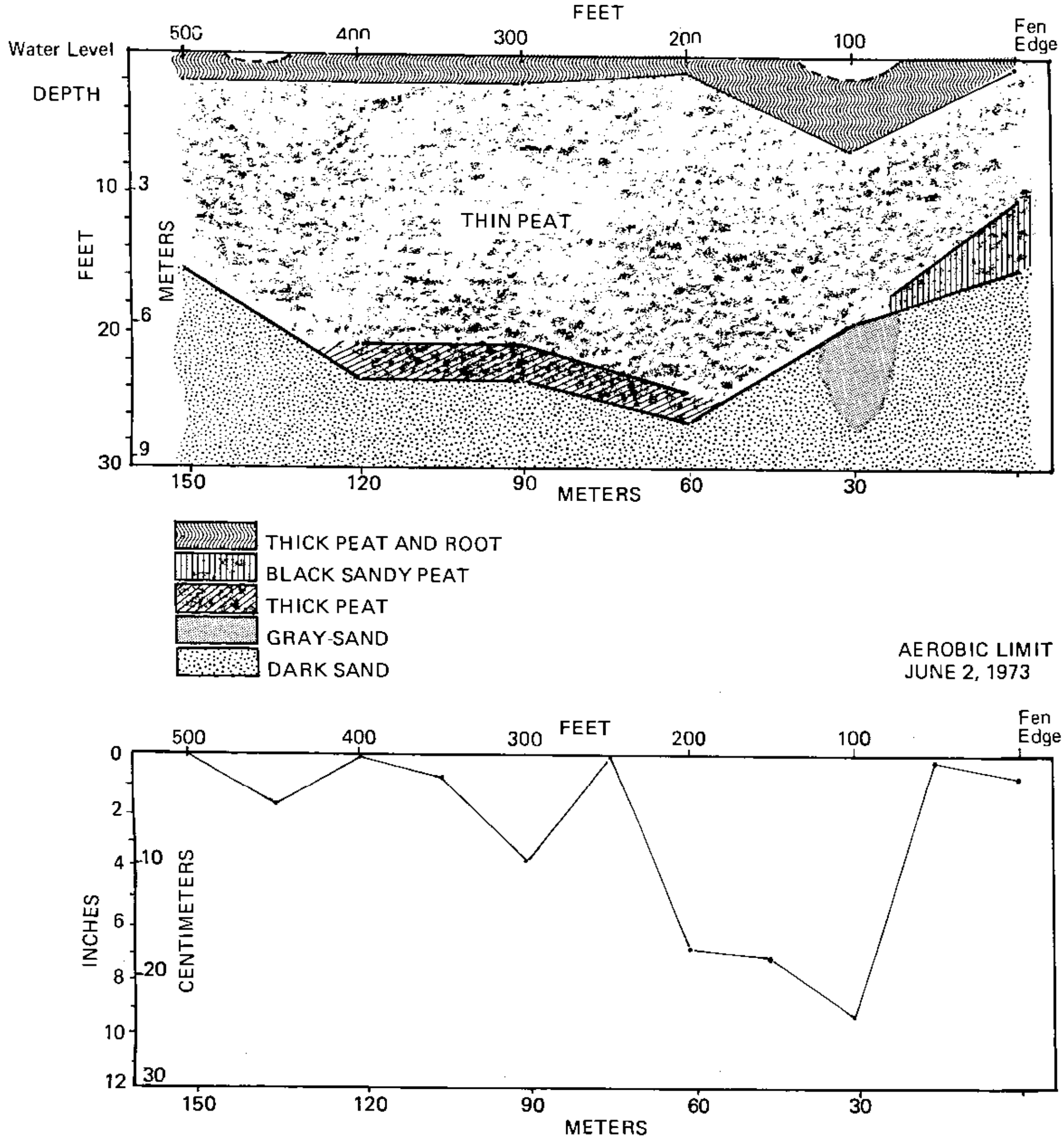
Sediments

One of the major factors that influences the rate of fen-bog succession is the rate of filling of its basin. This filling is accomplished by peat accumulation, dune shifting, and sedimentation from the watershed. Disturbance of the soils in the watershed can rapidly increase the amount of sediments reaching the inlet streams and subsequently the fen. Total sediments from the six inlet streams and the outlet are given in Appendix B, Table 13. Stream A_{so} has the greatest average sediment load (19.9 mg/l) and stream E the lowest (4.24 mg/l). The average from all inlets is considerably higher than the outlet (13.5 mg/l inlets, 4.42 mg/l outlet). On an annual basis this sediment influx is approximately 128 metric tons (141.1 English tons) coming into the fen and 27 metric tons (29.8 English tons) leaving.

The greater amount of sediments entering than leaving, results partly from influx of dune material near the outlet where dunes encroach directly on the stream. Natural dune shifting in addition to disturbance from off-road vehicles on the dunes cause sands to be mobile in the fen vicinity.

Most of the incoming sediments no doubt accumulate, but our methods cannot distinguish net change. The rate of sediment loss from the entire watershed (459.4 ha) amounts to 42 kg/ha per year. Thus fen losses are relatively heavy and indicative of disturbance.

Figure 18
PEAT DEPTH PROFILE ALONG TRANSECT A
AND AEROBIC LIMIT, JUNE 2, 1973



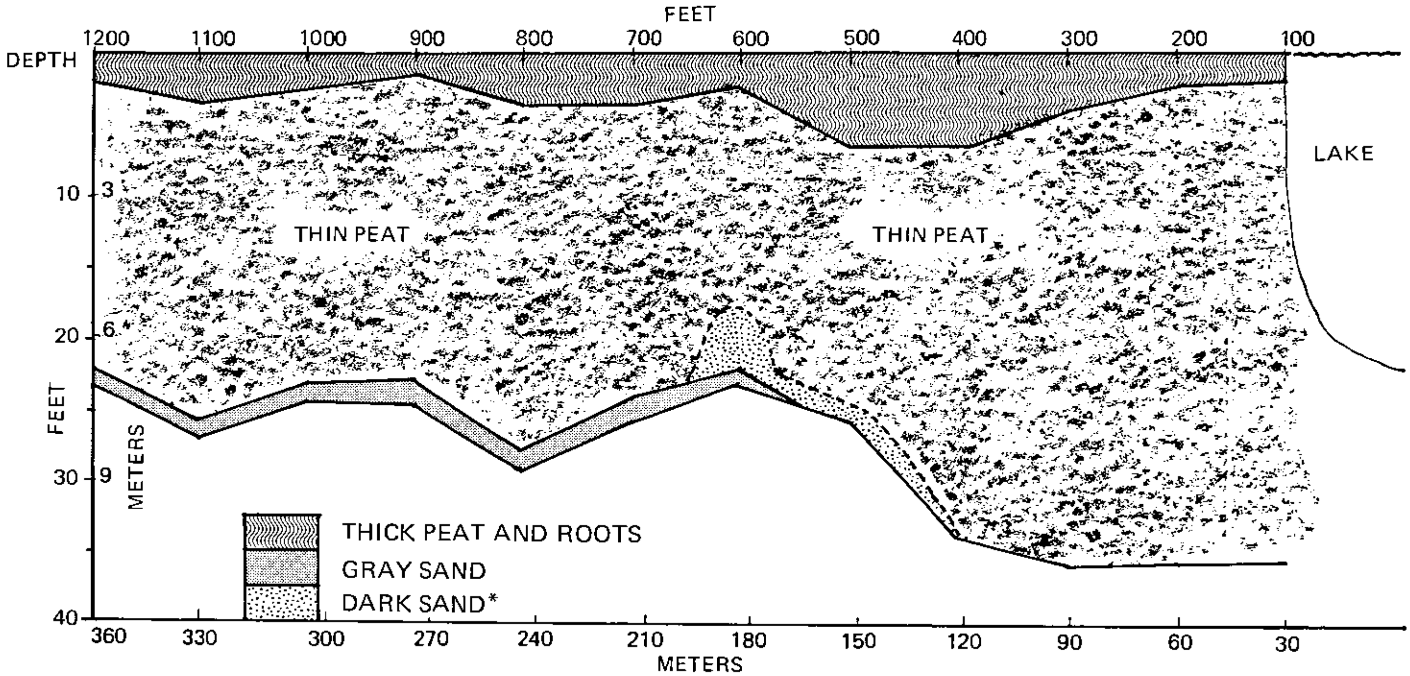
Peat Depth and Aerobic Limit

Two series of cores to determine peat depth were taken along the transects shown in Fig. 12). Transect A was taken across the fen at 3.1 meter (100-foot) intervals (Figure 18). Maximum peat depth was 27 feet along this transect. The peat was composed of three distinct layers: a thin surface layer of dense living plant roots and organic matter (fibrous peat); a thick layer underlying this made up of loose, soft brown peat that was very liquid; and a basal layer in the central fen region of dense peat. Beneath the peat was a dark sandy layer, except on the northern edge (0 to 15 meters or 50 feet), where black organic ooze overlay the dark sandy layer. This segment was probably the result of more rapid decomposition because of the marginal moat directly above it.

Along this same transect, a series of measures of aerobic limit were taken (June 2, 1973) every 15 meters (50 feet). The influence of moving water is apparent in the aerobic limit measures; the limits tend to be deeper where water movement maintains higher O_2 levels and hence deep O_2 penetration (Figure 18).

Another transect, taken in December, 1972 revealed very shallow aerobic limits. Of the 17 samples taken, only 6 had aerobic limits below the thick peat and root surface.

Figure 19
PEAT DEPTH PROFILE ALONG TRANSECT B IN INGLENOOK FEN



*Note sandy ridge at 600 ft. that may be remnant sand dune.

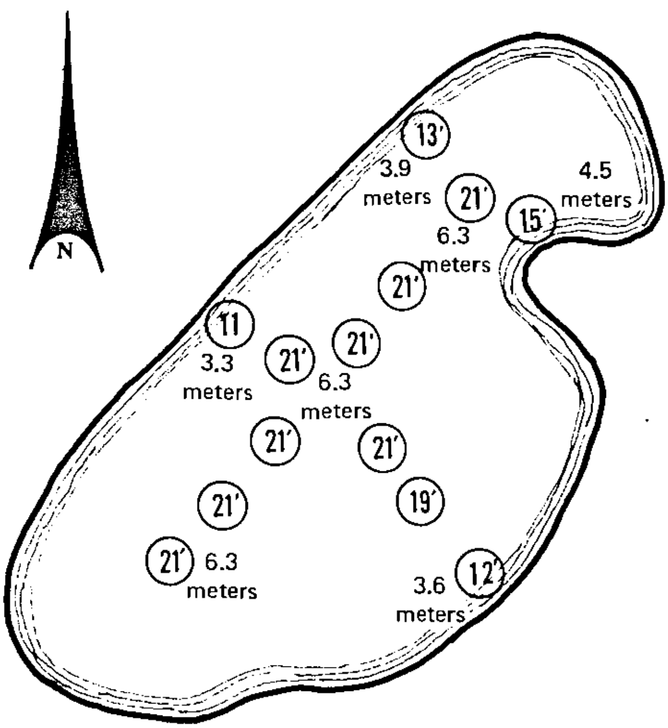


Figure 20
APPROXIMATE DEPTHS OF SANDHILL LAKE

A second transect to determine peat depth was taken down the long axis of the fen (Figure 19), ending at Sandhill Lake. The layers of peat are similar to those in Figure 18. Peat depth was greater as one progressed toward the lake, where the maximum peat depth obtained was over 11 meters (36 feet), the limit of the peat cover. This transect also showed a ridge on the bottom, halfway along its length, that was covered with dark sand. The higher sand-topped ridge may be the remnant of a former dune submerged now by the fen.

Depth Soundings of Sandhill Lake

Depth measures of Sandhill Lake showed that it has even, steep sides that drop off rapidly to 6.3 meters or 21 feet (Figure 20). The peat beneath the lake was of the same loose, watery texture as the similar layer in the fen. Recent work by Heinselman (1970) on a peatland lake showed that even small lakes surrounded by peat may persist for long periods. Early workers on fen-bog lakes believed that the lakes were in terminal stages of succession and would eventually fill in. While this conclusion may still be valid over a very long time period, Heinselman (1970) showed that Myrtle Lake, Minnesota had maintained its size and depth and had even risen with the increase in height of the surrounding peat, rather than filled in.

Transects across the lake indicate that the lake bottom dropped very rapidly, having a depth of approximately 3.3 meters (11 feet) just 1.8 meters (6 feet) from the shoreline. This rapid slope was found on both the western and eastern shores. About 3 meters (10 feet) from the shoreline, water depth was 6.3 meters (21 feet). This 6.3-meter depth was nearly uniform throughout the lake. Heinselman (1963) and Lindeman (1941) show cross sections of bog lakes with profiles similar to those found at Sandhill Lake.

Many studies refer to the presence of a "false bottom" in bog lakes. These mats of vegetation and peat commonly lie a few feet below the water surface and are usually about 3 meters (10 feet) thick. No such "false bottom" was found at Sandhill Lake, although the bottom peat appeared to be thick and viscous. Because of the predominance of false bottoms in bog lake studies, the water depths in these lakes were quite shallow, ranging from 5 centimeters to about 1 meter (Jewell and Brown, 1929). The subsurface topography of Sandhill Lake is quite different from that of the bog lakes.

Hydrologic Discussions and Conclusions

Water entering the watershed as precipitation can leave in one of four ways: evapotranspiration (loss of water vapor from soil and plants); surface flow; deep seepage to groundwater (Cooper, 1969); and subsurface flow. A watershed acts to collect, store, and gradually release water supplies. The distribution of rainfall and the degree of soil storage affect the magnitude and distribution of the subsurface and surface runoff. In the Coast Ranges the volume of storm runoff is large in the winter, and the base flow is much smaller during the rest of the year. All the major streams sustain perennial flow, but many of the smaller creeks become dry or nearly dry during the late summer and early fall. In three rivers in the Coast Ranges – the Eel River at Scotia, the Middle Fork of the Eel near Covelo, and the Napa River near St. Helena – the base flow is less than 1 percent of the total runoff (S.E. Rantz, 1972).

Water that does not run off evaporates or transpires or infiltrates and percolates to shallow depths from which it may appear as groundwater seepage (interflow) at the surface, or it may percolate to perched water tables or deeper underground aquifers. Intake of water into the soil is influenced by the porosity characteristics of the surface layer, vegetation, initial water content, and shrink-swell characteristics (Biggar and Corey, 1959). The greater the vegetative cover and the less steep the gradient, the more water would be expected to move as subterranean flow (Jackson, 1972).

Forest cover reduces runoff more than grassland cover, due to interception in the forest canopy. Although water beneath a forest cover sometimes flows over the surface for short distances, as over matted fallen leaves, it usually enters the soil quickly. Extensive overland flow is rare in an undisturbed forest (Cooper, 1969). Gentle slopes retain water long enough for the liquid to percolate and seep downward (Jackson, 1972). Some of the water entering the soil moves downward by gravity until it reaches a water table; then it moves under a hydraulic gradient through saturated aquifers to a stream or lake.

In steep or rolling topography, much of the runoff accompanying rainstorms or rapid snowmelt takes place by lateral movement through the soil layers near the surface. This runoff is referred to as subterranean flow or interflow. The highly permeable surface layer characteristic of undisturbed forests allows percolation of water more rapid laterally than downward. Subsurface flow is therefore quantitatively more important in forested watersheds than either overland flow or deep seepage (Cooper, 1969).

On the Inglenook Fen watershed, drainage A would be expected to carry the greatest proportion of subterranean drainage. Drainage C would be expected to carry the least proportion of subterranean drainage mainly due to steep topography. Although drainages B and C have similar topography, more water may flow undergound in C because its watershed is more forested (Jackson, 1972). The percentage of the total water flow that flows as subsurface runoff, varies with the slope gradient, the subsoil permeability, and the vegetation cover.

Water percolates downward until it reaches the relatively impermeable Franciscan rock formation, and the flow then becomes horizontal toward the downslope gradient along the terrace-basement rock contact. Thus water enters the fen from subterranean sources. The slope and the terrace structure influence the pathway via which water reaches the fen.

There are no continuous or extensive groundwater aquifers in the Fort Bragg coastal area. Groundwater is stored in marine terrace deposits of clay, silt, sand, and gravel that overlie much of the area, and in the silt, sand, gravel, and stream channel deposits found adjacent to most of the streams. It is found to a minor extent in fractures and joints of the underlying consolidated bedrock. Except locally, these rocks do not absorb, transmit, or yield water readily. In areas where the rocks are highly jointed or fractured, sufficient groundwater may be obtained to satisfy limited needs.

Since the groundwater is not continuous throughout the terraces, the yields may vary greatly within individual terraces and for adjacent wells (California State Department of Water Resources, 1956). Permeability ranges from high in sand and gravel, to very low in silt and clay.

Thinness, small size, and the presence of large amounts of clay and silt limit the capacity of wells and preclude the development of appreciable amounts of water from the marine terraces (California State Department of Water Resources, 1968). The terraces also lack hydrologic barriers on three sides and have an appreciable hydraulic gradient caused by the contact slope of the underlying bedrock and the terrace material, so that water flows down through the terrace deposits toward the sea (California State Department of Water Resources, 1956). Groundwater seepage has been noted in many areas along the contact between the terrace deposits and the underlying bedrock during the winter and spring months and during brief periods of a few days following summer rains. The velocity of groundwater movement may vary from as much as one foot per year to several miles per month. The depth to water averages 7 meters (23 feet) in the terraces of the Inglenook Fen watershed (California State Department of Water Resources, 1956). Well yields in the terraces average 60 lpm (18 gpm), ranging from 1.7 to 240 lpm (0.5 to 70 gpm) in the Inglenook Fen area.

In the Fen watershed, moisture utilization through evapotranspiration is only about 9 percent in coastal strand and coastal dune communities on sand. Utilization is about 13 percent for the north coastal prairie and north coastal scrub on sandy loam. The redwood forest on Hugo loam utilizes about 15 percent of the total annual precipitation.

The importance of Inglenook Fen was well summarized by Baker (1972, p. 415): "Only Inglenook Fen now remains in California to represent this soil-vegetation type adequately, but it is a magnificent example." The persistence of the fen depends on maintaining its contact with an adequate quantity of mineral-rich water. Presently, that amount may be near 0.06 dss (2 cfs) during dry periods. The six streams that feed the fen account for only about 30 percent of the total inflow. But home development in the watershed will necessarily draw on surface and/or subsurface (ground water) supplies.

If one assumes that a family of four uses 400 liters (120 gallons) of water per person per day (a U.S. average), and one assumes different densities in houses per hectare or acre on the watershed, then one can compare expected water use with surface inflows and outflows of the fen (Figure 21). From this figure one can see that beyond one house per hectare or two acres, the amount of water used would constitute most or all of the surface water to the fen during the summer (dry) period. Because of the large subsurface contribution to the fen, the water used would not be a large percentage of expected total inflows. However, the timing of water use and whether water is taken from springs or wells are both important. Summertime is a peak period for water use and a minimum time of flow. For convenience the water use lines are drawn horizontally in Figure 21 rather than in some way to reflect seasonal use. Possible implications of such seasonal use would be to seriously reduce the flow of oxygenated, high pH, and mineral-rich water into the fen at a critical period. As a result an increased trend of peat accumulation and acidification would speed the change from fen to bog (minerotrophic to ombrotrophic peatland).

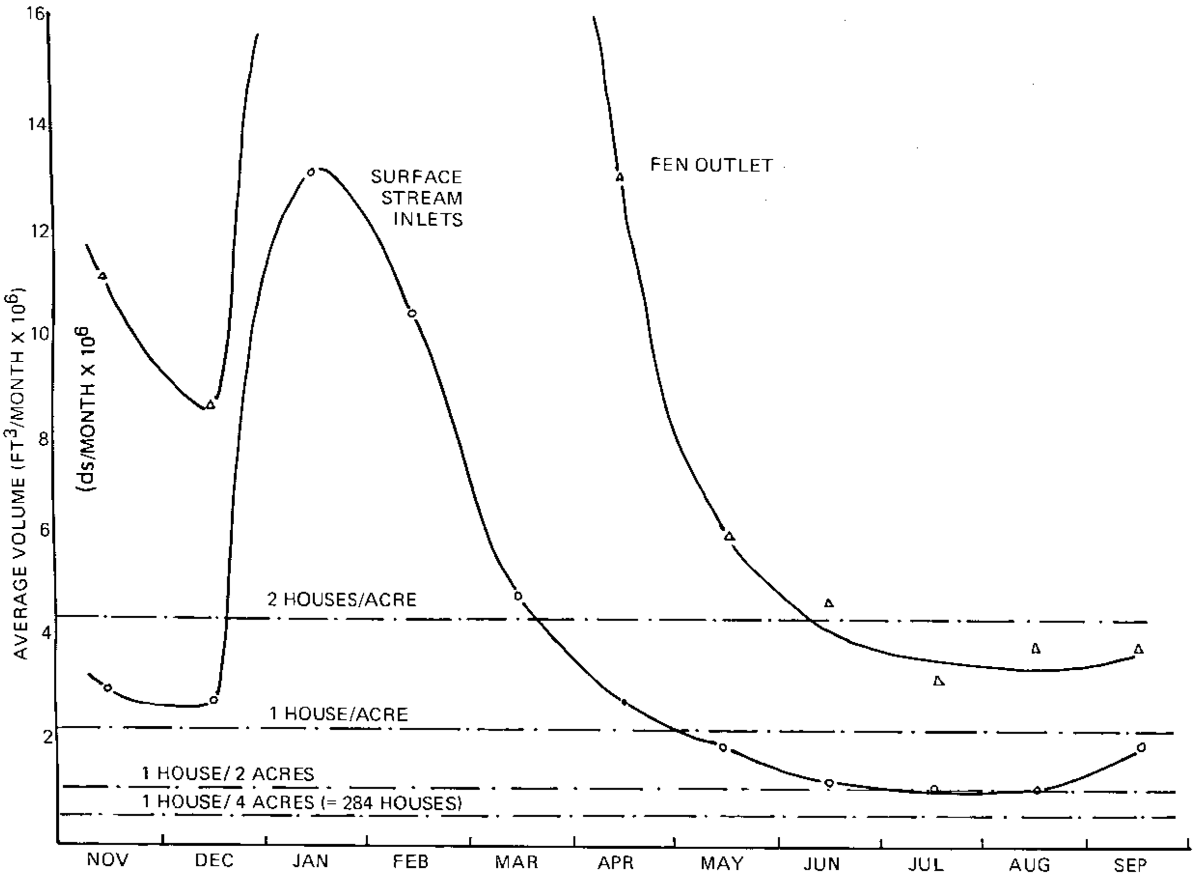
Water withdrawn for domestic use is not all consumed; some part of it is returned to the water table. The quality of the return water will be of lower quality with respect to the fen. Some water brought to the surface by well pumps will also enter surface streams after use. But percolation through the podzolized soils of the watershed should substantially lower the pH. The effect of soil contact on pH is already in evidence as shown by the pH changes during high and low flows. High flows result from surface runoff and infiltration. Contact with soil seems to lower the pH. During the dry periods stream flows are mainly from perennial springs in the headwaters and tend to have higher pH.

Used water will also contain substantial nutrients and will possibly have lower dissolved oxygen than under present conditions. These factors may stimulate surface plant growth as well as retard decomposition; both conditions lead to accelerated change in the fen system.

Development of the fen watershed (homes, roads) or other disturbances (such as logging) lead unavoidably to greater sediment losses than under existing conditions. Presently, the data indicate that sediments are accumulating in the fen at about 2.24 metric tons per hectare (one ton per acre per

Figure 21
AVERAGE MONTHLY WATER FLOW FROM ALL INLETS AND OUTLETS OF INGLENOOK FEN (MILLION FT ^{3}/MONTH)

NOTE:(HORIZONTAL LINES REPRESENT ESTIMATED WATER USE UNDER DIFFERENT DENSITIES OF HOME DEVELOPMENT)



year). During construction this rate of filling would increase dramatically. Even after construction the rate of sediment loss from urbanized watersheds is much greater than before. For example, in an extreme case of complete urban development, runoff water contained as much as 227 mg/l suspended sediments (Weibel, 1969). Currently 13.5 mg/l is entering the fen from the watershed.

Under existing conditions Inglenook Fen is slowly filling and during low flows is showing signs of succession toward bog (ombrotrophic peatland). The process of change from fen to bog (minerotrophic to ombrotrophic) would still require a very long time. But as recent studies of lake succession have shown, a natural successional change in productive status can be tremendously increased by man's activities. The data in this section provide baseline information on some of the key elements essential to preservation of the fen.

NUTRIENT CYCLING

W. James Barry and Martha Fox

Nutrient cycling is dependent on the earth's hydrochemical cycle which is controlled by wind, water vapor, weathering, chemical exchange, biotic assimilation, leaching and water transport. Wind moves across oceans activating elemental and molecular exchange (water, sodium, chloride, sulfate, etc.) between the atmosphere and marine ecosystems. As it crosses land masses, wind picks up surface materials and moisture from terrestrial ecosystems forming atmospheric dust and clouds. When water vapor condensis in the atmosphere, oxides of carbon, nitrogen, etc., and dissolved salts are carried to the earth's surface in raindrops, fog, or snow crystals. Precipitation stimulates chemical and physical weathering of rocks causing the less resistant mineral colloids to dissolve as cations and anions which then may be adsorbed on soil colloidal surfaces. Hydrogen ions, from carbonic and other organic acids, and other ions found in percolating water are exchanged for ions adsorbed on soil colloid surfaces. Nutrients are assimilated by plants and finally returned to the soil, either directly or secondarily by animals and decay organisms. Nutrients are leached through the soil into ground waters, or moved by surface waters into streams. Dissolved and suspended materials are transplanted to the sea where dissolved salts are concentrated in sea water and suspended materials settle to the sea floor. Sediments may be returned to the continents through tectonic activity after long periods of geologic time.

Nutrient cycling in the fen watershed contributes to only a small part of the earth's hydrochemical cycle. Changes in nutrient cycles within the fen will have little effect on the global hydrochemical cycle but will have a significant effect on the natural ecosystems in the watershed.

Nutrient inputs to the watershed from external sources are mainly biotic and atmospheric. Biological inputs are principally materials gathered elsewhere and deposited in the watershed by animals, including man. Human inputs include garbage and body wastes as well as fertilizers.

Fixation of atmospheric nitrogen by soil microorganisms is an important biological input to agricultural croplands or pasturelands, but is of relatively little importance in most climax forest ecosystems.

Nutrients are lost from ecosystems by timber removal, crop harvest, grazing, land clearing, atmosphere losses (volatilization due to fire, and the like), and water and wind transport. The removal of elements by erosion is in some degree selective in that organic matter and fine soil particles, relatively high in mineral nutrients, are more vulnerable to erosion than are the coarser soil and rock fractions (Cooper, 1969).

Biological and biochemical processes in the soil and the addition of anions from precipitation largely governs the yield of anions. Much of the chloride, nitrate and sulfate ions originate from atmosphere sources. The output of these ions is regulated by soil processes, and the majority of these ions are carried into the streams in surface runoff or in subsurface aquifers to the fen and Sandhill Lake.

Cations are found adsorbed on soil colloids and are selectively exchanged for hydrogen ions from the soil water. The hydrogen ions come principally from dissolved carbon dioxide and dissociation of carbonic acid (H_2 CO_3) into hydrogen ions ($H+$) and bicarbonate ions (CO_3.) Dissolved carbon dioxide originates chiefly from soil microbial and plant root metabolism. Only water remaining for some time in interstices between soil particles is likely to pick up an appreciable load of dissolved carbon dioxide and, consequently, to be effective in leaching mineral ions (Cooper, 1969). Thin films of water moving slowly through unsaturated soil make a major contribution to base flow of streams during dry periods (Hewlett, 1961; Elrick, 1963). When water films are in close contact with soil particles for long periods, more ions are picked up by the water; therefore, stream flows during dry periods normally have higher ionic levels than stream flows during wet seasons. Stream ion levels at a given flow rate are often greater when a stream is falling than when it is rising (Toler, 1955; Cooper, 1969). The lower nutrient level when a stream is rising after a rain results because water flows over the surface or through root channels, worm holes, and other openings without coming into real contact with the soil.

The nutrient level rises when stream flow begins to recede because moisture is confined to soil pores, where it comes into intimate contact with active soil colloids. There is a contribution from nutrients adsorbed onto soil particles, as well as soluble nutrients contained within water. Surface runoff contains particulate matter from erosion of the soil mantle (Cooper, 1969). Many of the mineral ions in streams are adsorbed on suspended and colloidal matter resulting from erosion (Livingstone, 1963). For example, data from rivers draining the steppes of central Russia show that sediments are high in nitrogen, phosphorus, potassium, calcium, and magnesium (Kuznetsov, Shelyakina, and Klyukanova, 1965). The phosphorus fraction of these sediments is almost entirely in insoluble form. Activity of bottom-dwelling organisms and other biological processes in lakes and streams may, over time, liberate significant quantities of nutrients from the sediments. Under eutrophic conditions, when there is no oxygen at the bottom of lakes, many nutrients become more soluble and are released into the water. This release of nutrients can cause algae blooms leading to further eutrophication.

The foredunes of the dune system are moderately supplied with nitrogen, phosphorus, bases, and other nutrients derived from detritus washed up on the beach. Farther away from the shoreline, wind sorting removes nitrogenous material, and other nutrients are leached out so that fertility is reduced.

The dunes supply base-rich material to the fen. The water drainage supplies dissolved substances (Jackson, 1972) and substances adsorbed onto mineral particles. Where access to mineral-rich groundwater is limited, as in some blanket bogs and ombrogenous bogs, the nutrient supply depends increasingly on rainfall as the bog grows. Elements scarce in rain, such as phosphorus, become seriously deficient (Heinselman, 1963).

Nitrogen Cycle

Nitrogen (N) makes up 78 to 79 percent of the earth's atmosphere; however, to be utilized by plants, it must be converted to ammonium or nitrate ions. Ionic nitrogen forms are derived from atmospheric nitrogen by electrochemical and biological fixation. Electrochemical fixation (oxidation by lightning) contributes between 2 to 22 kg/ha/yr (1.8 to 20 lbs/ac/yr) via hydration (rainfall), but most nitrogen input to ecosystems is by biological fixation, which contributes 50 to 800 kg/ha/yr (45 to 730 lbs/ac/yr). In the watershed biological fixation is accomplished by symbiosis between rhizobial bacteria and the roots of higher plants of the legume family and between a filamentous bacteria (actinomycetes) and higher plants of the genera *Alnus, Myrica* and *Ceanothus.* Fixation by free-living organisms, such as blue-green algae (*Phylum Cyanophyta*), bacteria (orders *Eubacteriales* and *Pseudomonadales*), and fungi (certain yeasts), is also an important input of nitrogen to ecosystems of the watershed.

The nitrogen input to the watershed by electrochemical and biological fixation is not known and is in need of further investigation. The amounts of nitrogen present in the biomass and geobiomass of different ecosystems within the watershed is also not known and in need of study.

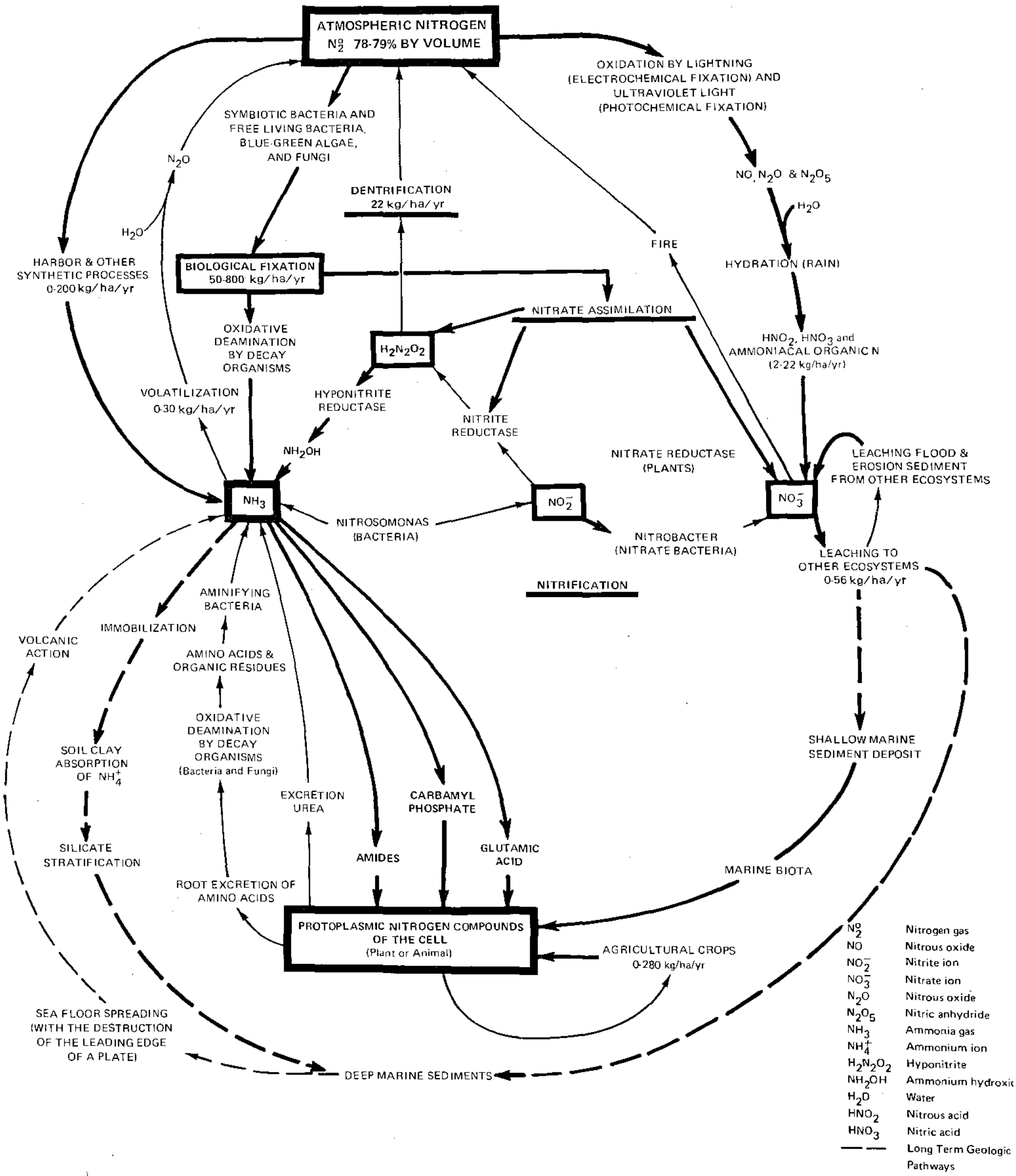
The nitrogen loss rates in the north coastal prairie are about 11 kg/ha/yr (10 lbs/ac/yr). The pastures west of Highway 1, immediately adjacent to the fen, are being fertilized and reseeded with a mixture of subclover, sweet clover, bird's foot trefoil, orchard grass, and perennial ryegrass. Clover crops produce 67 to 90 kg/ha/yr (61 to 72 lbs/ac/yr) of nitrogen. Losses could amount to 50 kg/ha/yr (45 lbs/ac/yr) under solid clover, but a loss of 11 kg/ha/yr is more realistic for the seed mixture above, and the remaining nitrogen is utilized by plants and denitrifying bacteria (Jackson, 1972). In harvested crop areas, about two-thirds of the nitrogen loss is by leaching, and about one-third is by erosion (Biggar and Corey, 1969). Similar nitrogen losses could be expected during house pad and road construction in the watershed. These soil losses would end up in the fen waters.

Nitrogen levels in mature forest ecosystems are usually low. The soil-plant-atmosphere cycle is the dominant process in the nitrogen economy of natural communities. The output of nitrogen in the runoff from actively growing, undisturbed forest ecosystems is nearly in balance with the input in precipitation and fixation (Cooper, 1969). Nitrogen in the biomass of a production coast redwood forest on alluvium was found to be 1247.1 kg/ha/yr (1,150 lbs/ac/yr) (Zinke, personal communication).

Estimates of nitrogen loss from coast redwood forests range from a low of .03 kg/ha/yr to a high of 13.6 kg/ha/yr (0.027 to 12.4 lbs/ac/yr) based on site characteristics. Nitrogen loss on relatively infertile slopes is about one-third less than on fertile alluvial flats. These losses are not unreasonable since 6,720 to 11,200 kg/ha (6,100 to 10,200 lbs/ac) of nitrogen have been estimated as stored within the watershed (Jackson, 1972). Total nitrogen (soil and biomass) of a second-growth Douglas-fir forest was found to be 3,310 kg/ha (3,000 lbs/ac) (Cole, Sessel, and Dices, 1967).

Lawrence (1958) found that young alder thickets five years of age add 157 kg/ha (142 lbs/ac) of nitrogen to the soil each autumn and

Figure 22
THE NITROGEN CYCLE



greatly stimulate the growth of associated cottonwood trees. The major portion of the nitrogen from the springs along the alder side of Castle Lake, California, is in the form of nitrates or perhaps organic forms, which may actually be preferred by some phytoplankton. The loss of nutrients by plant leaves to rain or dew has been recognized for many years (LeClerc and Breazeale, 1909).

Blueblossom (*Ceanothus thyrsiflorus*), a plant typical of successional stages of the redwood forest contributes about 56 kg/ha/yr (51 lbs/ac/yr) of nitrogen to the geobiomass.

A young dune with little or no vegetation may contain only 15 kg/ha (13.6 lbs/ac) of nitrogen per centimeter depth in the surface horizon. A more mature dune supporting grassland contains 43 kg/ha (39 lbs/ac), and a Bishop pine forest contains 50 kg/ha (44.5 lbs/ac) A very old stabilized dune has 100 kg/ha (89 lbs/ac) or more of nitrogen. The input of nitrogen from the dunes to the fen is probably negligible (Jackson, 1972). Organic carbon, and with it total nitrogen, increases with dune age and density of plant cover. The rate of increase is greater in moist slacks due to slower rates of organic matter breakdowns and leaching from dunes. (Ranwell, 1972.)

The ionic ammonium and nitrate forms of nitrogen are very soluble and nitrate-nitrogen is readily leached through the soil profile. Water percolating through the soil may carry considerable amounts of nitrate-nitrogen that eventually find their way into waterways. Ammonium ions are held on the cation-exchange sites in soils, so the concentration of ammonia in the soil solutions is not high although a portion is released into the soil solution. Organic forms of nitrogen may be somewhat soluble and subject to leaching. Ammonia and nitrate are very soluble in water, and runoff water may carry high concentrations if the soil-vegetation mantle has been disturbed; however, surface water normally contains very little inorganic nitrogen. About 95 percent of nitrogen contained in surface runoff is organic and is in detritus form (Bigger and Corey, 1969). Water percolating through well-aerated soils, such as sands and sandy loams, often carries relatively greater amounts of inorganic nitrogen than do surface drainages. Nitrogen in suspended matter is present mainly in the organic form. Some particles may settle out and be covered later by other sediments – they do not contribute significantly to the soluble nitrogen supply. Other organic particles may be attacked by microorganisms, which convert organic nitrogen to soluble inorganic forms.

Fresh organic materials are quite readily decomposed by microorganisms but humified soil organic matter is quite resistant to decomposition. Therefore, the contribution of the suspended organic matter to soluble nitrogen content will depend on the nature of the organic materials (Jackson, 1972).

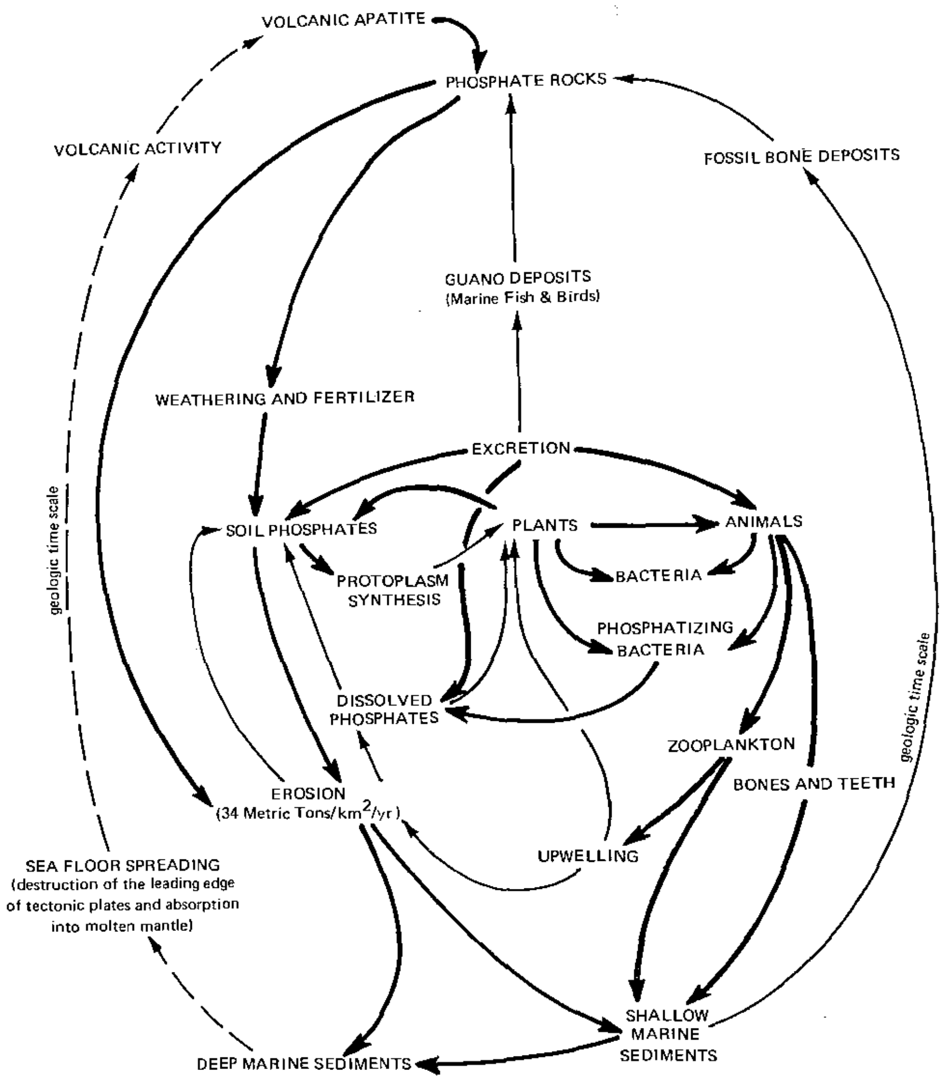
With good aeration and favorable temperature, different microorganisms oxidize the ammonium from the decomposition of organic material to nitrite and then to nitrate, a process called nitrification. Nitrite, which is toxic to most organisms, may accumulate if ammonium in the system is high. If nitrate is exposed to conditions of poor aeration (reducing conditions) , it will be reduced to gaseous nitrogen forms that are lost to the atmosphere, a process called denitrification (Bigger and Corey, 1969).

The nitrogen budget is the most critical factor in the fen's survival. If large increases in nitrogen occur within the ground and the surface waters feeding the fen, a drastic change in the biota will occur. The addition of nitrogen by sewage effluent or percolation of septic tank filter fields combined with the release of naturally occurring nitrogen due to road and house pad construction and the like can lead to the destruction of the fen ecosystem. At two houses per acre, between 3.3 and 11 million kilograms (1.5 to 5 million pounds) of nitrogen will be added to the fen watershed annually. These figures are calculated from data from Figure 15 and the nitrogen concentrations of sewage effluent (25 to 86 mg/l) as reported by Babbit (1958). Current zoning of one house per two acres would contribute between 0.8 and 2.75 million kilograms (0.2 to 0.7 million pounds) of nitrogen to the watershed. Currently 0.46 kg/ha/yr (.410 lbs/ac/yr) of nitrate nitrogen is leaving the watershed in surface streams.

Phosphorus Cycle

Phosphorus (P) is rarely leached out; however, it may be eroded away. The phosphorus levels in soils are quite variable (Jackson, 1972), ranging from 0.01 to 0.13 percent by weight. Phosphorus occurs in both organic and inorganic forms, and neither form is considered to be soluble. The proportions of organic/inorganic forms of phosphorus range from 3/97 to 75/25 percent. The concentrations of phosphorus in the soil solution near the surface seldom exceed 0.2 mg/liter and usually range between 0.01 and 0.2 mg/liter. Subsoil amounts are even lower. Phosphorus applied to the surface of the soil tends to saturate

Figure 23
THE PHOSPHORUS CYCLE



the "fixing sites" at the surface and locally raises the concentration of phosphorus in the soil solution. There is a near equilibrium situation as infiltrating waters carry soluble phosphorus downward, and more dissolves to maintain the concentration in solution. When runoff water contacts surface soil, the phosphorus concentration in the runoff could conceivably approach equilibrium concentration.

The soluble phosphorus concentration of water that has percolated through the soil is usually low because phosphorus precipitates in the subsoil as insoluble forms.

Most phosphorus reaches waterways in surface runoff. Inorganic forms of phosphorus are only very slightly soluble under normal oxidizing conditions; i.e., well-aerated soils and water. In acid soils phosphorus occurs mainly as iron and aluminum phosphate. In alkaline soils it occurs largely as calcium phosphate.

Any phosphorus added as fertilizer or released by decomposition of organic matter is quickly converted to one of these insoluble forms.

In suspended particles phosphorus is present in both organic and inorganic forms. The organic forms undergo microbial transformations. The inorganic forms of phosphorus bonded to iron (Fe), aluminum (Al), or calcium (Ca), in mineral particles, tend to equilibrate with the phosphorus in solution. If particles are high in phosphorus, as are those from the soil surface, they will support a relatively high concentration of phosphorus in solution. In a stream with moderate or high concentrations of soluble phosphorus, the particles low in phosphorus can absorb the phosphorus from the water (Bigger and Corey, 1969). Most phosphorus is fixed by soil particles but a certain amount is in the soil solution. The amount in the soil solution depends on the equilibrium between the processes of release of phosphorus particles and the absorption of phosphorus by soil particles.

On fertilized pasture land, agricultural losses of phosphorus have been estimated to range between 0 and 22.4 kg/ha/yr (0 and 20 lbs/ac/yr), but a more realistic range is probably .05 to 2.2 kg/ha/yr (.045 to 1.9 lbs/ac/yr) (Bigger and Corey, 1969). Fertilizers are being applied west of Highway 1 near the fen at a rate of about 112 kg/ha/yr (100 lbs/ac/yr) of phosphorus. Pasture plants will utilize 20 to 30 percent of the amount applied. A large percentage of the phosphorus remaining will be inactivated as aluminum or iron precipitates in the acid grassland soils. If all the pastures in the fen watershed west of Highway 1 were fertilized on a rotation basis, about 1,132.5 kilograms (1,010 lbs) of phosphorus would be applied annually to the watershed. However, significant amounts would reach the fen only if erosion occurred. (Jackson, 1972).

Phosphorus is typically low in the drainage water from forested ecosystems (Cooper, 1969). According to Zinke (personal communication), the biomass of a redwood forest contains 25 to 344 kg/ha (46 to 306 lbs/ac), and redwood leaf litter contains 1 to 2 kg/ha (.9 to 1.8 lbs/ac).

Estimates of loss in a Douglas-fir forest range from 0.03 kg/ha/yr (0.027 lbs/ac/yr) in unlogged areas to 0.10 kg/ha/yr (.09 lbs/ac/yr) in logged areas. In unlogged areas the loss is 3.4 percent of phosphorus present. In logged areas the leaching rate is 7.7 percent of the phosphorus present (Cooper, 1969). Based on a loss rate of .04 kg/ha/yr, (.036 lbs/ac/yr), approximately 20 kg/yr (18 lbs/ac/yr) of phosphorus may leach into drainages from forests (Cooper, 1969).

According to Bigger, Davis, and Lawton (1953), a highly significant correlation exists between the amount of phosphorus (and potassium) applied to organic soils and the amount of soluble phosphorus (and potassium) that can be extracted from organic soils, such as those of the fen and fen-carr. Phosphorus brought down in sediments and deposited in the bottom of the pond is probably released from the sediments under reducing conditions (Salmi, 1950).

Under aerobic conditions and at pH values representative of most lakes, iron and manganese are present only in sparingly soluble form and in this form enter into precipitated complexes with other substances, notably the phosphate ion and organic solutes.

In their reduced forms (ferrous and manganous ions) on the other hand, these elements are soluble. Under anaerobic conditions a reduction of the precipitated complexes liberates iron, manganese, phosphate, and other materials into solution. Microorganisms can also liberate phosphate under reducing conditions and take it up again when aerobic conditions return (Shapiro, 1967).

When the drainage area of a bog is acid, the waters entering the bog from the area are acid and will contain iron, manganese, and phosphorous, among other elements. Iron exercises control over phosphorus solubility (Dawson, 1956). The low phosphorus contents on the surface of a bog could be the result of the following: (1) there may be poor root growth under the influence of soil-reducing conditions; (2) the soil phosphorus may be low (Pearsall, (1950) has suggested that phosphorus could be lost as phospine from extremely reducing soils); or (3) phosphorus uptake may be curtailed by precipitation on the iron deposits in and around the roots.

Although phosphorus becomes more soluble when a soil is waterlogged (Gasser and Bloomfield, 1955), it has often been found that this is not always associated with enhanced uptake by the plant (Lawton, 1946; Humphries, 1962). However, Biggar, Davis, and Lawton (1953) found that a highly significant correlation exists between the amount of phosphorus applied and the amount of phosphorus and potassium extracted from the soil. The applied phosphorus remained in the surface soil while potassium was found in the 30.5 to 45.7 cm depth. Boyd, Garner, and Haines (1957) found that the main effect of potassium and phosphorus was larger for fen peats than for mineral soils.

High phosphorus levels in water culture of the blueberry have been found to cause iron chlorosis of these plants (Holmes, 1960). Boyd and Hess (1970) have found that the level of phosphorus in the soil where *Typha latifolia* grows is critical in determining shoot sizes of this species. (*T. latifolia* is found at Inglenook Fen.) Hewett (1964) shows the amount of different cations found in the soil where *Menyanthes trifoliata* occurs in North Wales. His data show that the levels of phosphorus are low.

It would seem therefore that changes in phosphorus levels in a fen might induce some undesirable effects on the growth of plants found growing there.

Potassium (K) from potassium humate and calcium peat is more readily available than exchangeable potassium and calcium in mineral soils. Oxidation reduction potentials and pH influence the availability of nutrients. Certain micronutrients, such as iron and manganese (Mn), which form compounds of very low solubility in oxidizing conditions, become transformed to highly soluble salts in reducing conditions, and the nutrition of certain plants may be upset (Armstrong and Boatman, 1967). Available data indicate that pH exercises some control over soluble iron and aluminum, and soluble iron and aluminum exercise even more control over soluble phosphorus (Dawson, 1956). Under aerobic conditions and at pH values, neutral iron and manganese are present only in sparingly soluble form and in this form or above enter into precipitated complexes with other substances, notably the phosphate ion and organic solutes. In their reduced (ferrous and manganous) forms, on the other hand, these elements are soluble. Under anaerobic conditions a reduction of the precipitated complexes liberates Fe, Mn, P, and other materials into solution. Shapiro (1967) has demonstrated that microorganisms can also liberate phosphate under reducing conditions and take it up again when aerobic conditions return.

Organic soils having pH values of 6.0 and above and containing free calcium carbonate tend to be manganese deficient when crops sensitive to this deficiency are grown (Dawson, 1956).

Cation Cycles

In the Inglenook Fen area, most of the sodium (Na) entering the fen comes from the watershed and from salt spray blown in from the sea. The calcium in the fen system is derived largely from leaching of the calcium-rich dune sands. On the watershed, some potassium, magnesium, calcium, and sodium are released by the weathering of rock minerals, and some are brought down in the rainfall. In a study by Likens, Borman, Johnson, and Pierce (1967) on a forested watershed on the east coast, the difference between the input of calcium, magnesium, and sodium in rainfall and the output in runoff was probably equal to the amount released by geochemical weathering. The potassium budget was nearly in balance. The losses from a watershed of these ions are greatly accelerated by clearcutting.

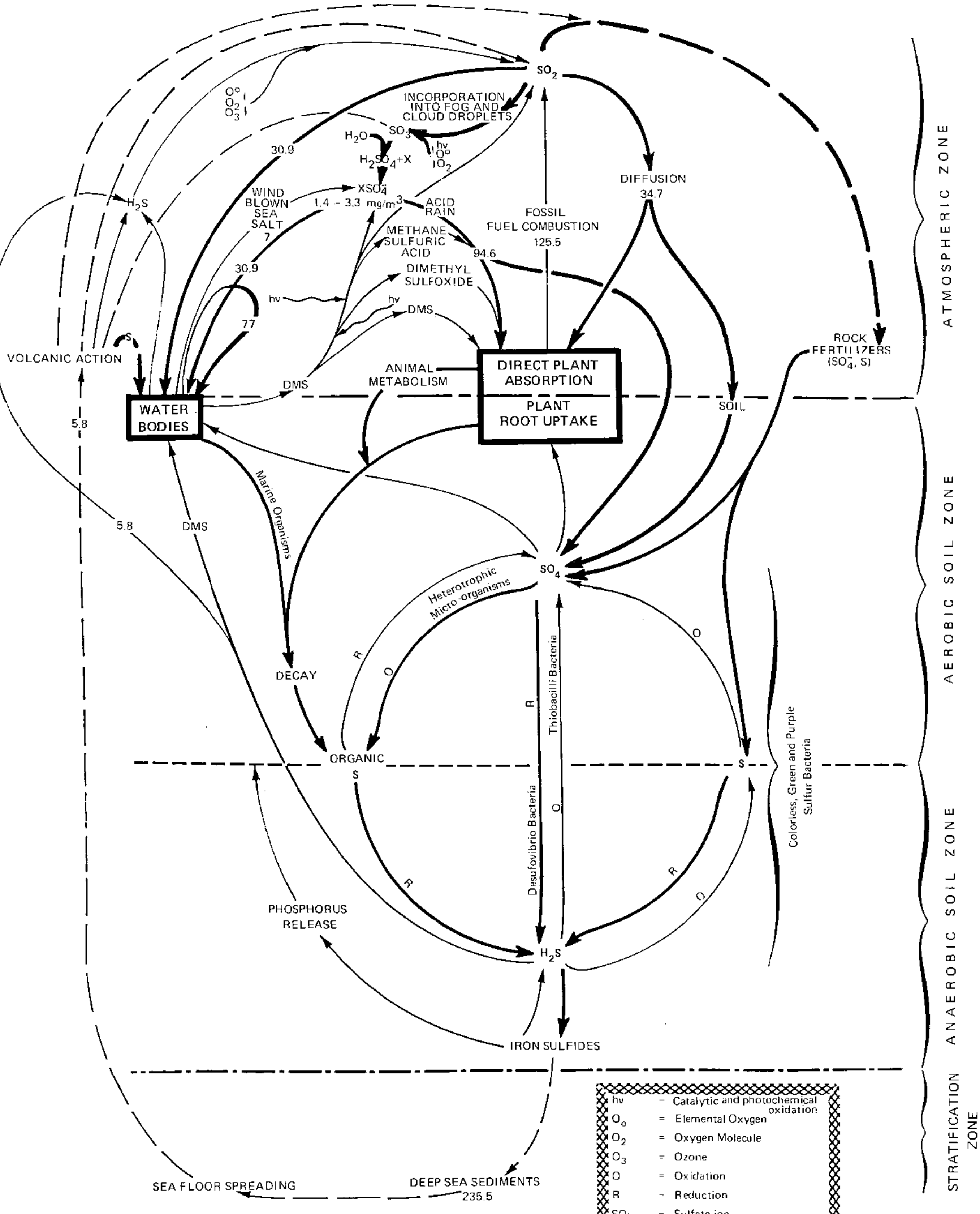
Sulfur Cycle

Sulfates are among the soluble nutrients that occur in drainage water. Coastal pastures are often deficient in sulfur and require sulfur fertilization. The impact of sulfur fertilization on the fen is considered to be negligible, since the levels of sulfate are generally higher for most soils than the levels in the pasture with fertilization. Around 63.8 kg/ha/yr (56 lbs/ac/yr) of elemental sulfur are being applied at three-to-four year intervals. Range plants will utilize about 40 percent of elemental sulfur applied, about 25.8 kg/ha (12 lbs/ac). Since sulfur can leach only in the sulfate form, 13.5 kg/ha (12 lbs/ac) would become available for leaching at each treatment, or about 3.4-4.5 kg/ha (3.04 to 4.10 lbs/ac) annually; 45.3 kilograms (20.5 pounds) of sulfur already applied may have leached into the fen. If all pastures were treated, approximately 226.5 kg (102 pounds) would be leached out annually An increase in sulfur entering the fen would possibly result in a greater production of hydrogen sulfide in the anaerobic zone of the peat deposits and sediments of the different zones of the fen. Hydrogen sulfide is toxic to many organisms, and affects the growth of the roots of many kinds of plants (Jackson, 1972).

There is evidence that some plants can diffuse oxygen out from their roots so that the oxygen forms a protective sheath around the root. The oxygen oxidizes hydrogen sulfide before or as it enters the roots. Iron acts as a sink for oxygen and forms ferrous sulfide with hydrogen sulfide.

It has been demonstrated that growth of plants sensitive to reducing conditions can be improved when groundwater moves. The moving groundwater not only improves the oxygen supply, but also carries away toxic substances and brings soluble bases and other plant nutrients (Armstrong and Boatman, 1967).

Sugawara, Koyama, and Kozqwa (1954) and Tadashiro and Sugawara (1953), in a series of papers on the forms of sulfur in lake mud flooded at high tide by ocean water, observed sulfide, free sulfur, and a solid phase of iron-pyrite-ferrous



hv	=	Catalytic and photochemical oxidation
O_o	=	Elemental Oxygen
O_2	=	Oxygen Molecule
O_3	=	Ozone
O	=	Oxidation
R	=	Reduction
SO_4	=	Sulfate ion
SO_2	=	Sulfur Dioxide
SO_3	=	Sulfur Trioxide
H_2S	=	Hydrogen Sulfide
S	=	Elemental Sulfur
DMS	=	Dimethyl Sulfide
H_2SO_4	=	Sulfuric Acid
X	=	Sulfates
— — —	=	Long-Term Geologic Pathways

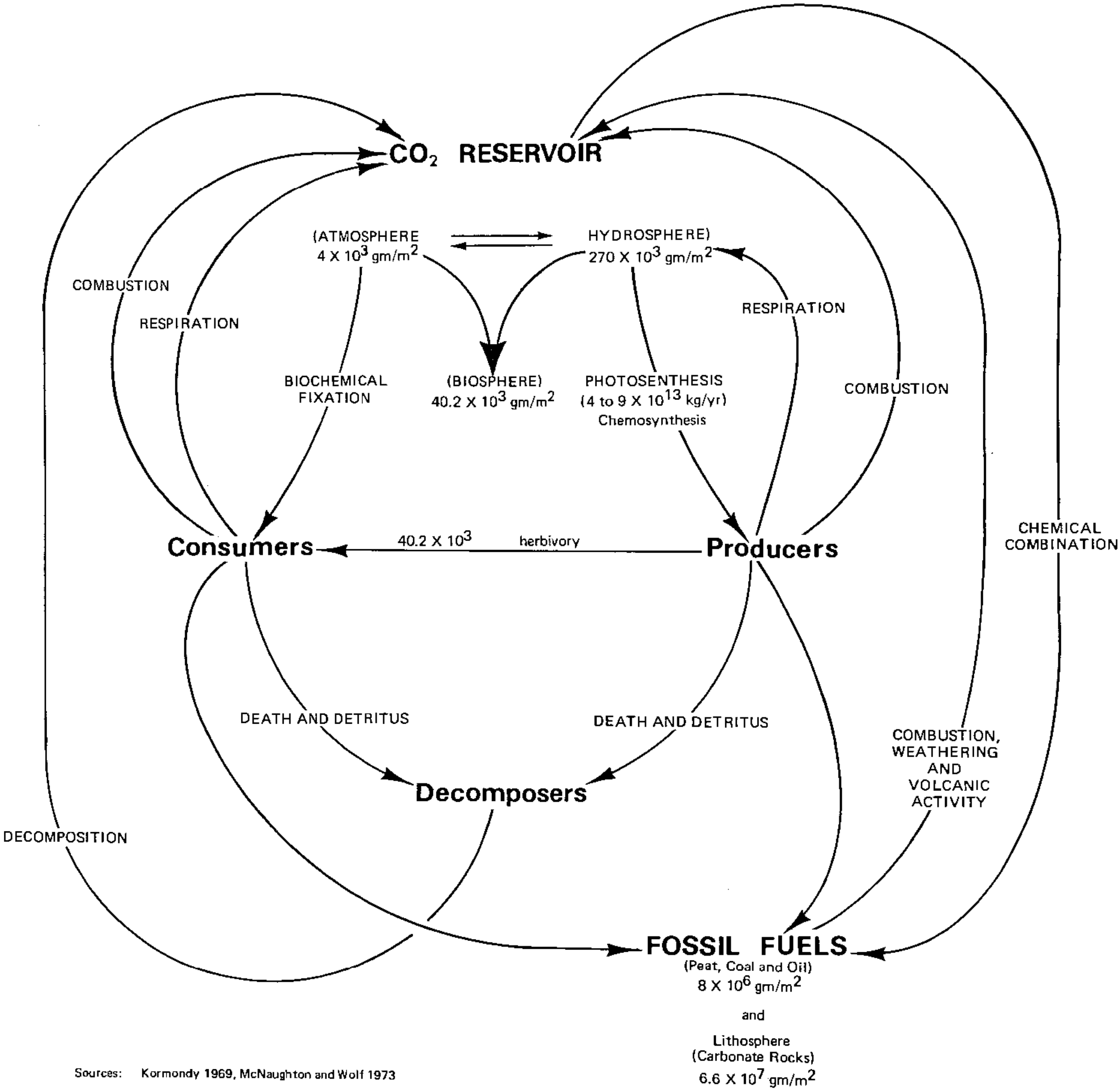
Numbers represent Sulfur transfers in Metric tons/Km2/yr.

Sources: Kellogg, et. al. 1972; Lovelock, et. al. 1972; Odum. 1971. Bolin, Bert and Robert J. Charlson: 1976. on the role of the tropospheric sulfur cycle in the shortwave radioactive climate of the earth. Ambio 5(2): 47-54.

Figure 24
THE SULFUR CYCLE

Figure 25

THE CARBON CYCLE



Sources: Kormondy 1969, McNaughton and Wolf 1973 sulfide. Under reducing conditions sulfur is transformed into hydrogen sulfide. The hydrogen sulfide is absorbed by peat in the presence of ammonia. Oxidation of sulfide to free sulfur is probably the mechanism of absorption. According to Kreulin (1952) both coal and humic acid have large absorbing capacities for hydrogen sulfide, so that perhaps much of the hydrogen sulfide would be absorbed by the peat of the fen.

Man is now contributing about one-half as much as nature to the total atmospheric burden of sulfur compounds, but by A.D. 2000, he will be contributing as much, and in the Northern Hemisphere alone he will produce more than nature (Whaley, Dauwalder, Kephart, 1972). Just what effect this increase will have on the fen is not known. Since the Fort Bragg area is not an industrial area, the atmospheric sulfur concentration will be less than the average, however, the fen will act as a sulfur sink.

Copper

Copper sulfate ($CuSO_4$) has been used to control liver flukes in the moist pasture area near the fen. An application of about 4 parts per million is used. Plants vary greatly in their sensitivity to copper. The toxicity levels vary from 0.2 ppm to 30 ppm. Environmental conditions are important in determining floral sensitivity. Copper absorption is stimulated with a pH range of 5 to 7 but it is depressed at higher or lower levels. The actual situation depends upon the presence or absence of chelating agents, soil and water pH, temperature, and many other factors (Jackson, 1972). There could be a build-up of copper in the fen, since organic soils, such as those typical of the fen, act to retain and collect copper and other metallic ions (Salmi, 1950). Such a build-up would undoubtedly change the species composition of the fen – copper-sensitive species would be eliminated.

Carbon

The carbon cycle is perhaps the simplest of the nutrient cycles. It is a nearly perfect cycle in that carbon is returned to the environment about as fast as it is removed (Kormondy 1969). The bulk of the earth's carbon is immobilized in the lithosphere (the earth's rocky crust) in limestone and other rocks. A second large pool is fossil fuel, the excess of past primary production over consumption and decomposition. The two biologically active pools are in the atmosphere and the hydrosphere (the earth's waters) (McNaughton and Wolf 1973). The basic movement of carbon is from the atmospheric reservoir to producers then to consumers and from these groups to decomposers that return the carbon to the atmospheric-hydrospheric reservoir. The atmospheric portion of the reservoir has a concentration of about 0.03 to 0.04 percent carbon dioxide. The hydrospheric reservoir is estimated to contain more than 50 times as much carbon as the air and tends to regulate the amount in the atmosphere (Kormondy 1969).

Peat is being formed in the fen and fen-carr and represents a substantial addition to the ithosphere, while calcium carbonate is being iberated from the dunes to the hydrospheric pool.

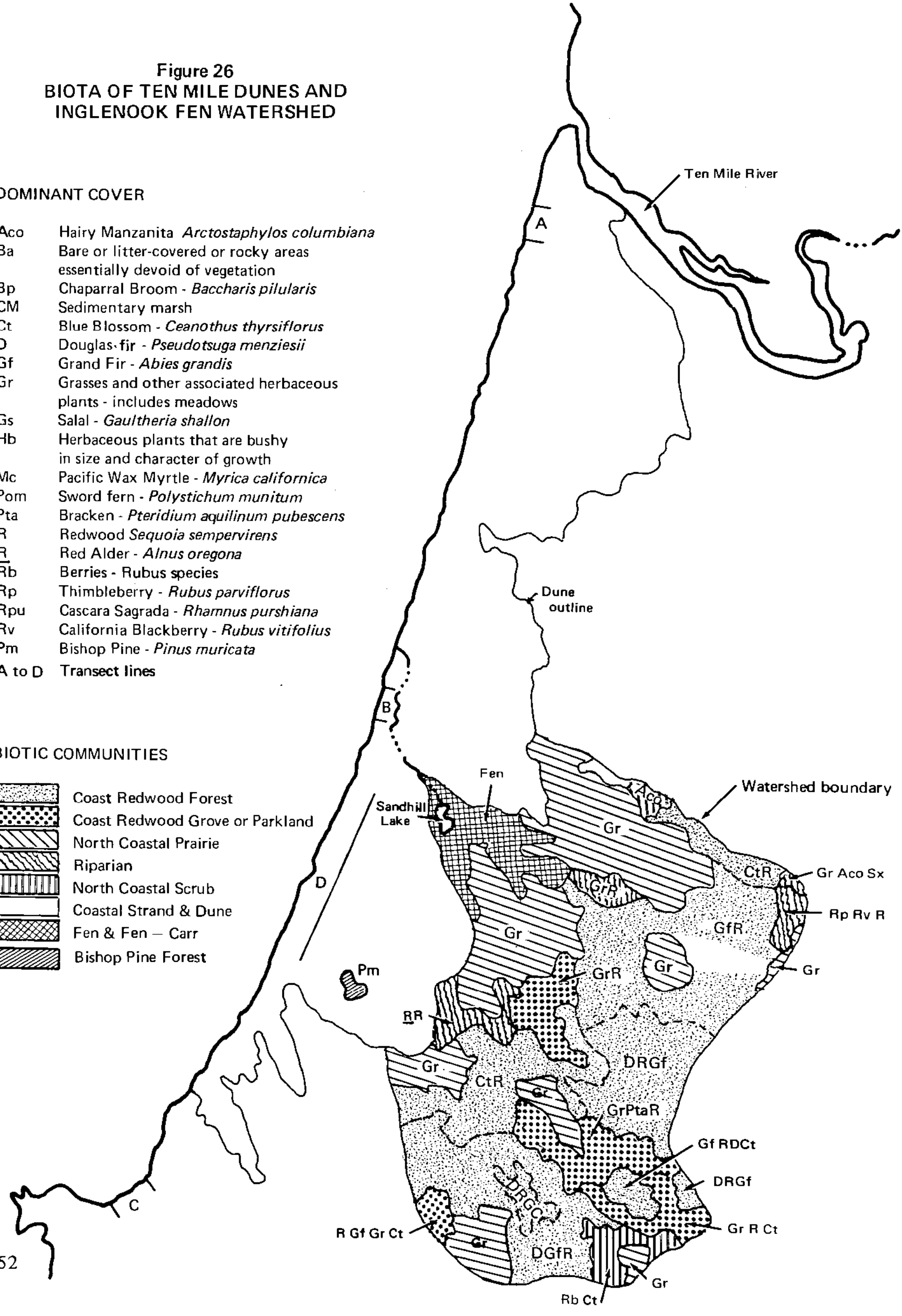
Figure 26
BIOTA OF TEN MILE DUNES AND INGLENOOK FEN WATERSHED

DOMINANT COVER

Aco	Hairy Manzanita *Arctostaphylos columbiana*
Ba	Bare or litter-covered or rocky areas essentially devoid of vegetation
Bp	Chaparral Broom - *Baccharis pilularis*
CM	Sedimentary marsh
Ct	Blue Blossom - *Ceanothus thyrsiflorus*
D	Douglas-fir - *Pseudotsuga menziesii*
Gf	Grand Fir - *Abies grandis*
Gr	Grasses and other associated herbaceous plants - includes meadows
Gs	Salal - *Gaultheria shallon*
Hb	Herbaceous plants that are bushy in size and character of growth
Mc	Pacific Wax Myrtle - *Myrica californica*
Pom	Sword fern - *Polystichum munitum*
Pta	Bracken - *Pteridium aquilinum pubescens*
R	Redwood *Sequoia sempervirens*
R̲	Red Alder - *Alnus oregona*
Rb	Berries - Rubus species
Rp	Thimbleberry - *Rubus parviflorus*
Rpu	Cascara Sagrada - *Rhamnus purshiana*
Rv	California Blackberry - *Rubus vitifolius*
Pm	Bishop Pine - *Pinus muricata*
A to D	Transect lines

BIOTIC COMMUNITIES

- Coast Redwood Forest
- Coast Redwood Grove or Parkland
- North Coastal Prairie
- Riparian
- North Coastal Scrub
- Coastal Strand & Dune
- Fen & Fen — Carr
- Bishop Pine Forest



BIOTIC COMMUNITIES

E. I. Schlinger, W. J. Barry, D. C. Erman
H. G. Baker and R. Kawin

The three major ecosystems occurring in the study area are terrestrial, wetlands, and freshwater ecosystems. Terrestrial ecosystems are defined as those ecosystems that do not normally have standing water tables. Wetland ecosystems include those that normally have standing water tables and in which vegetation rather than open water dominates. These are actually transition zones between terrestrial and aquatic ecosystems (either freshwater or marine). Freshwater ecosystems are defined as those freshwater areas in which open water dominates. These include streams, lakes, and ponds.

Terrestrial ecosystems of the study area include coastal strand, coastal dune, north coastal scrub, north coastal prairie, bishop pine forest, coast redwood grove land, coast redwood park land, coast redwood forest, and riparian woodland. Wetland ecosystems include the fen and the fen-carr. The freshwater ecosystems include the pond community of Sandhill Lake and the ephemeral and live stream communities of the Fen Creek and its tributaries. Biotic communities of the study area are delineated in Figure 26, and species compositions are listed in Appendix C, Tables 15 through 26.

Terrestrial Ecosystems

Coastal Strand

The coastal strand is the portion of the beach lying below the foredunes and above the supralittoral zone. It is not generally subject to inundation of sea water (as is littoral zone) but is strongly influenced by the sea. Salt spray, mist, fog, high winds, blowing and drifting sand, and drifting uprooted marine algae characterize this harsh environment. Strand plants have adapted to the physiological stresses of this environment by becoming prostrate, succulent and deep rooted. Rainwater percolates rapidly through the strand sand. The surface is normally quite dry to a depth of about one foot, and moisture stress due to drought and saline conditions causes severe restrictions on seedling survival. Environmental stresses are greatest as one approaches the supralittoral, where no higher plants survive, but isopods thrive. Sea rocket (*Cakile maritima*), ryegrass (*Elymus mollis*), and *Calystegia soldanella* are the only plants found in the strand community.

One interesting feature of the strand is the energy and nutrient exchange between terrestrial

Coastal strand and partially stabilized dunes. Note trampling by humans.

and marine ecosystems; for example, the addition of nutrients to strand communities by marine algae that washes up onto the beach. Initially, the deteriorating algae provide a moist habitat for a number of terrestrial insects, such as sand flies and marine crustaceans; for example, beach-hoppers (*Orchestoidea californiana*) and some isopod "eel bugs," such as *Alloniscus perconvexus.*

Coastal Dune

On all continents, sand dunes, whether coastal or far inland, give the impression of being barren of life, but, in fact, the dunes ecosystem is alive with numerous specialized inhabitants. Dunes provide a limited environment for living things, but those that have survived are full of ingenious adaptations that make life possible. Through the winds, the dunes themselves appear alive and go through constant changes in form. Some areas remain relatively stable for a time, allowing vegetative cover to become established. These areas may be stabilized initially by heavy sand that resists the wind or by protection from prevailing winds brought on by dune forms.

Rhizomic root system of Douglas bluegrass helps stabilize dunes (W.J. Barry 8/72).

Abronia latifolia, Sand verbena, with 7.9 m (26 feet) of taproot exposed. Deep taproots are an adaptive method of surviving under the extreme drought conditions found in the dunes (P. Rauch 9/72).

Perhaps one of the most important factors in the dune environment is that of radiation. Here temperature is not always a good indication of the heat that small, crawling animals in roots and stems of plants must withstand. On a clear summer day, if the air temperature on a seacoast dune is 16°C (87°F), the temperature 3 inches above the sand may be 19°C (91°F). This temperature increases to 26°C (104°F) one inch above the sand, while the sand surface itself may be as high as 35°C (122°F). Below the surface the temperature gradually lessens.

The absence of fresh water makes dunes fit only for highly specialized plants and animals. Even when heavy rains do occur, water quickly percolates down through the loose particles until it is beyond the reach of all the creatures. Plants that live on dunes must be highly resistant to desiccation and be capable of holding and using what little moisture is available. For this reason, most of them are practically leafless, and the leaves they do bear for a limited time have a waxy covering that tends to inhibit transpiration.

Most dune plants also have low nutrient requirements, since dune sands are quite low in fertility. Only a few plants are capable of surviving and adapting to the hot, dry, and extreme environment of the dunes. The plants in the Ten Mile Dunes normally have thick, long tap roots or bulbous roots. Such root systems are adapted to the storage of energy and moisture through a winter or through a customary annual climatic dry spell.

The dune vegetation helps stabilize the dunes, in most circumstances. Sometimes plants actually help dunes to grow. Larger dunes are often enlarged because of the presence of vegetation on their slopes. The rising wind is slowed by the natural windbreaks, and it is forced to release its sand load, which then builds up about the plants. Once started, a dune will continue to grow provided there is a plentiful supply of sand.

Some types of small desert rodents are dependent upon the dune environment for their livelihood. These rodents live almost entirely on seeds of the dune vegetation, which they store in underground burrows where moisture is a little more prevalent than on the surface. With moisture present, some of these seeds germinate and grow to the surface. The root systems of many dune plants are composed of a main tap root that penetrates deep into the sand and many smaller, secondary roots that spread out and seek moisture and nourishment among the sand particles deep within the dunes.

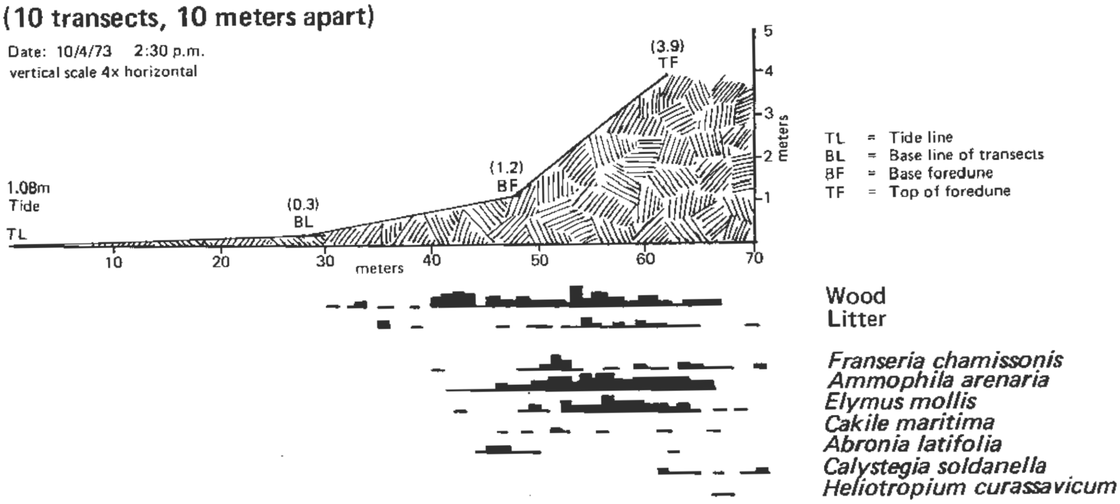
Douglas bluegrass, *Poa douglasii,* is a pioneer invader of dunes (W.J. Barry 8/72).

Coastal dune environments are quite variable due to microclimatic variablilities among the foredunes, dune tops, hinddunes, and swales. The foredune is between the strand on the seaward side and the drift line at the top of the first transverse ridge. The distribution of various plant species of the foredune and strand are illustrated in Figures 27A, 27B, and 27C. *Elymus mollis, Cakile maritima* and *Franseria chamissonis* are the dominant species of the foredune in the watershed area.

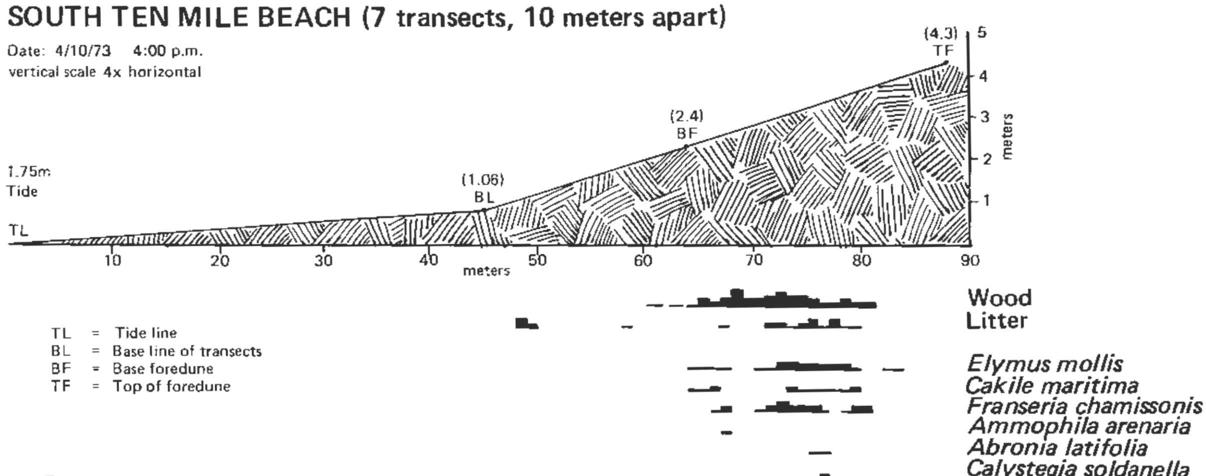
Figure 27
PROFILE OF STRAND AND FOREDUNE VEGETATION

By A. Johnson

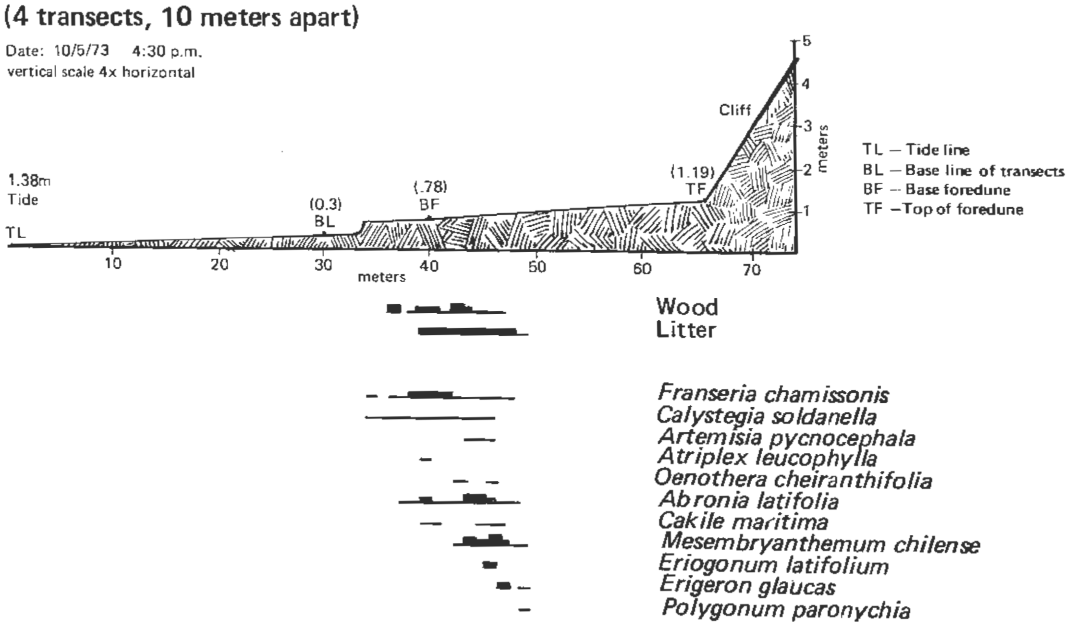
A. NORTH TEN MILE BEACH
(10 transects, 10 meters apart)



B. SOUTH TEN MILE BEACH (7 transects, 10 meters apart)



C. COVE BEACH, MacKERRICHER STATE PARK
(4 transects, 10 meters apart)



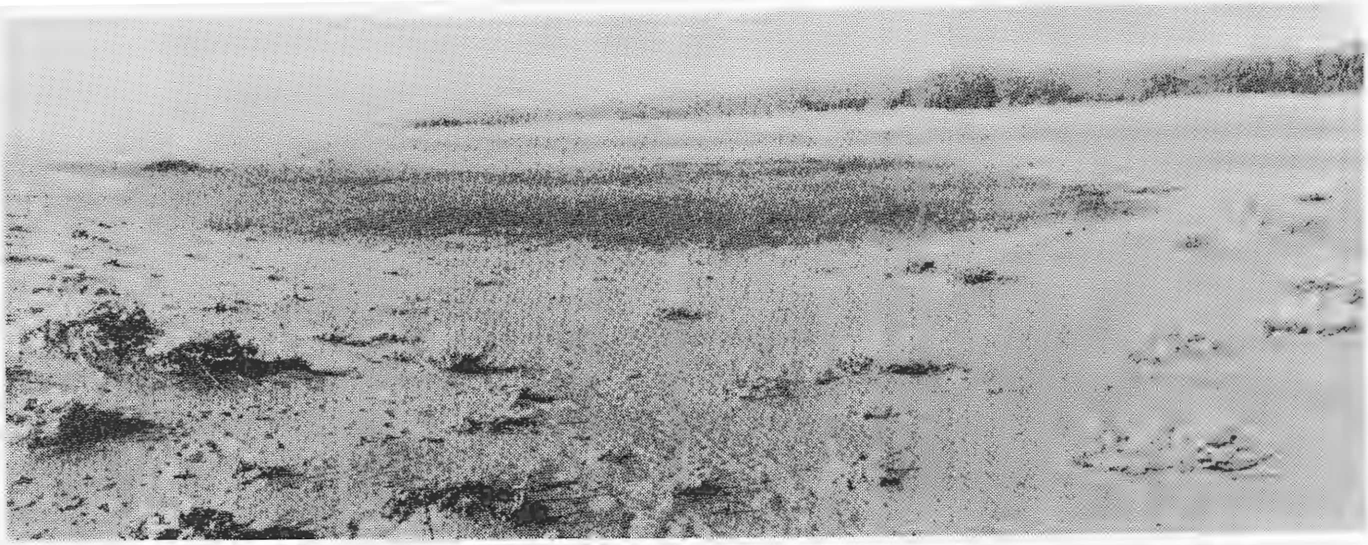
For 0.6 km south of Ten Mile River, the foredunes (3 to 4 m) are built by European beach grass (*Ammophila arenaria*), a species introduced from Europe. Native vegetation forms clumps or hummocks in front of and between the stands of *Ammophila*. The most abundant natives are *Franseria* (Ambrosia) *chamissonis, Abronia latifolia,* and *Elymus mollis. Cakile maritima*, another European introduction, grows in the same situations as the natives, and is especially abundant in the disturbed zone near the mouth of the river. *Franseria* and *Calystegia soldanella,* a cosmopolitan species on temperate strands, may form mixed stands with *Ammophila.* Piled driftwood forms a narrow (5 to 10 m wide) "bench" in front of and among the stands of *Ammophila.*

At 0.6 km south of Ten Mile River, the logging road curves shoreward running along the top of the foredune, which is here occupied (or built by native vegetation. South of here *Ammophila* foredunes occur only for short intervals, most of the area being occupied by natives, particularly *Elymus mollis.* This grass builds dunes that are lower, broader, less steep, and not as continuous as those built by *Ammophila.* At many points *Elymus* grew shoreward down the seaward face of an *Ammophila*-built dune. The two grasses do not form mixed stands. On the north bank of Fen Creek several specimens of *Cakile edentula* were found. This species was introduced to California from its native home on the shores of the northeastern United States before *Cakile maritima,* which has since almost completely replaced it. Stable dunes behind the foredunes 0.5 km south of Fen Creek were covered with *Poa douglasii, Artemisia pycnocephala* and other native foredune species.

A cove beach near Lake Cleone Campground at MacKerricher State Park showed several species characteristic of the cliffs behind the beach coming onto the sand in the lee of large pieces of driftwood, including *Carpobrotus (Mesembryanthemum) chilense, Erigeron glaucus, Artemisia pycnocephala,* and *Eriogonum latifolium.* Where no driftwood protected the backdunes, species characteristic of the open beaches to the north came in: *Abronia latifolia* and *Franseria chamissonis. Ammophila arenaria* and *Elymus mollis* were lacking, however. Perhaps these species need a larger supply of blowing sand for burial than was present at this small beach.

The dune tops are usually dominated by *Lupinus bicolor* var. *umbellatus* and *Artemisia pycnocephala,* while the hinddunes are covered

European beachgrass, *Ammophila arenaria,* stabilizes foredune near the mouth of Ten Mile River (W.J. Barry 8/72).



Coastal dune slack dominated by sedges and rushes, mainly by the rush, *Juncus effusus,* and the sedge, *Carex abrupta* (W.J. Barry 6/75).

with *Poa douglassi* and *Artemisia pycnocephala.* Swales are dominated by thick matts of *Juncus effusis* and *Carex obnupta* and thickets of dune willow (*Salix piperi*). Appendix C, Table 19 lists plants, and Appendix C, Table 18 lists animals found in the coastal dune biotic community.

Below: Coastal dune slack in inland portion of Ten Mile Dunes dominated by the willow, *Salix hookeriana,* and coyote brush, *Baccharis pilularis* (C.A. Barry 1/74).

About 250 species of arthropods (mostly insects and spiders) have been found to inhabit and utilize the dune ecosystem on a year-round basis (Appendix C, Table 16). About 25 of these species were found to nest in the dunes but were also obliged to gain their food resources in the fen ecosystem. Some of these latter species are noted elsewhere in this report. Knowledge about all 250 species varies with each species, but useful information has been gained for some important species and can be presented at this time.

SELECTED, CHARACTERISTIC, HIGHLY ADAPTED ARTHROPODS FOUND TO LIVE ONLY IN DUNE AREAS ADJOINING THE INGLENOOK FEN

Diplopoda (millipedes). One species, *Harpaphe* sp. (possibly new) is very abundant and commonly found walking over the dunes at night. These wandering millipedes apparently represent the dispersing members of the species, since the breeding area is apparently restricted to one dune-surrounded, isolated swale lying about 300 feet north of the central part of the fen. The dominant plant in this swale is a *Juncus* sp., and the millipedes feed on and breed under the dense, wet mats of the *Juncus*.

Acarina (mites). Augustonella tuberculata is a free-living, reddish-brown mite commonly found running wildly over the surface of the dunes during warm sunny days. This mite feeds on dead insects (wasps, beetles, and flies), which often accumulate at the base of wind-blown dunes. Occasionally these mites have been observed feeding on drying or recently emerged (weakened) insects, and sometimes as many as 50 of these large mites were on one dead insect.

Araneae (true spiders). The sand dune trapdoor spider, *Aptostichus standfordianus,* is an abundant member of selected dunes. Studies of this species, the largest spider of the fen-dune ecosystem, indicate that it is quite restricted to slowly moving, well-stabilized (plant-covered) dunes. In one such dune, which is about 200 feet long and 4 to 8 feet high, we have found as many as 150 of these spiders, while on moving dunes or on old, hard-sand, nonmoving dunes, none of these spiders have been found. If these data hold true, we may be able to ascertain the movability rate of any coastal dune by using this spider as a biological indicator of dune stability. *Aptostichus* feeds at night, primarily on a common unknown species of noctuid moth larva. (See below.) The spider itself

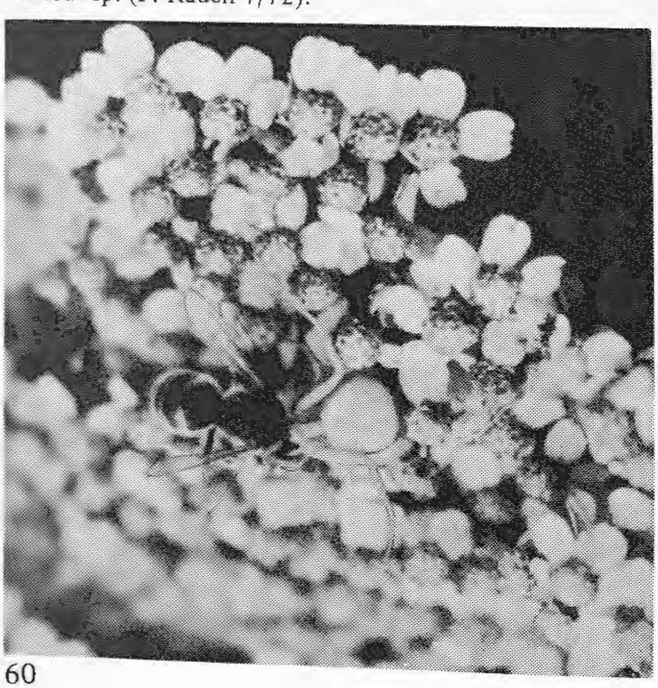
Dune trapdoor spider, *Aptostichus standfordiana* (F. Andrews 5/73).

Trapdoor of the dune trapdoor spider (F. Andrews 5/73).

Excavated turret home of the wolf spider, *Tarantula kochi* (P. Rauch 6/72).

A sand dune crab spider, *Xysticus gulosus* (P. Rauch 6/73).

A crab spider, *Misumenopus* sp., feeding on a sand wasp, *Bembix* sp. (P. Rauch 7/72).



is predated upon by the large black pompilid wasp, *Aporus luxus* (See below.)

A sand dune jumping spider, *Pellenes* sp. (possibly new), is perhaps the most commonly seen spider on the dunes. This unique animal, which walks and jumps around the surface of stable or semistable dunes during the daylight hours feeding on small flies and leafhoppers, has evolved a remarkable protective device for living on windblown sand. The spider finds a small depression in the sand, turns over on its back, and with the aid of the wind which blows sand over its body, proceeds to spin silk, catches the sand particles and in a matter of several minutes covers itself with a silk-lined, sand-covered case, in which it spends the night. This case is heavy enough to withstand severe winds over the dunes.

A wolf spider, *Tarantula kochi,* is found in selected, semiprotected, depressed dune areas. Younger individuals have been observed running over these sand areas, while mature females dig holes, up to four inches deep in the sand, and lay their egg sacs in the protection of a bulbous-shaped sand-covered turret at the top of the hole.

A sand dune crab spider, *Xysticus gulosus,* may be found wandering, crab-like, over most sand dunes in the area that have some vegetative cover. This flat-bodied, sand-loving spider is well adapted to its life spent on the surface of the sand.

Orthoptera (grasshoppers, etc.) The dune-loving grasshopper, *Trimerotropis helferi,* is the only one of several found on the dunes that spends its entire life in or on the sand. The sand-patterned body color enables it to be protected from would-be predators.

Hemiptera (true bugs). The largid bug, *Largus cinctus,* is the largest and most conspicuous bug on the dunes. It can be found feeding on several plants in well-stabilized dune areas. This beetle-like bug does not fly, and in walking over the sand may be protected from predators by walking and looking like some disliked (defensive) tenebrionid, sand beetles.

Another, even more conspicuous sand dune bug is *Lygaeus kalmii kalmii.* This bug appears to be restricted in this dune community to feeding only on the seeds of *Abronia latifolia.* The bright red and black color of this bug may aid its protection from predators.

Coleoptera (beetles). Coelus ciliatus is one of six species of dune-loving tenebrionid beetles. It is the most abundant of these species, and adults are commonly found walking over the sand surface at dusk or at nighttime. Its larvae live in the sand and feed on the roots of several species of dune plants and are a main food source of predaceous insect larvae, such as therevid flies and asilid flies. The adults of this species often make characteristic "mole-like" tracks just under the surface of the sand. Adults of this species also form an important part of the diet of foxes, judging from the fox scats observed on the dunes.

A carabid beetle, *Calathus ruficollis,* departs from the general role of carabids as predators by feeding during the night on the pollen of several plants in well-stabilized dune areas, such as *Chrysopsis villosa* and *Franseria chamissonis.*

A small scarab beetle, *Aegilia crassa,* is known to inhabit the dunes, but its biology has not been observed. The adults are found slowly walking at the base of the dunes only in April or May.

A weevil, *Trigonoscuta pilosa,* can be commonly found in the adult stage feeding day or night on plants, such as *Abronia latifolia* and *Franseria chamissonis.* The larval stages have not been observed, but are presumed to be associated with the roots of these or other dune plants.

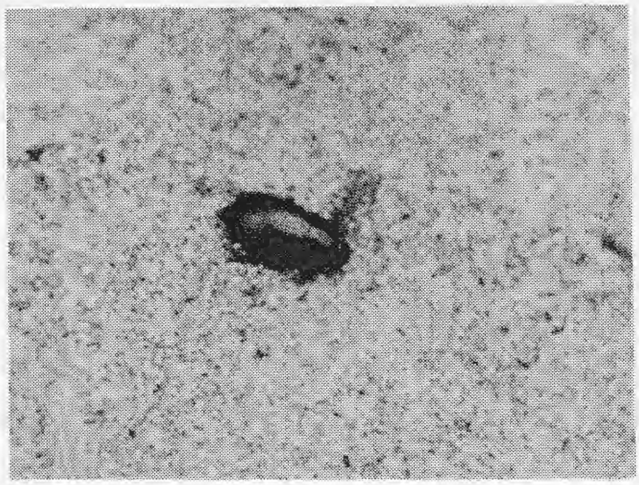
Lepidoptera (butterflies and moths). An identified species of noctuid moth larva (reaching a length of two inches) is a very common species found associated with several dune plants. During the day the larvae are buried in the sand beneath the plants, while at night they were commonly observed crawling over the surface of the sand and often feeding on the leaves of *Abronia latifolia,* which were touching the sand. The larvae of this species form the basic food supply of the sand trapdoor spider, *Aptostichus.*

Adult specimens of the *Lycaenid* butterfly, *Plebeius saepiolus,* have been collected, but its biology is not recorded. It is an important record, since known populations of this species are restricted in California to high alpine areas of the Sierra Nevada.

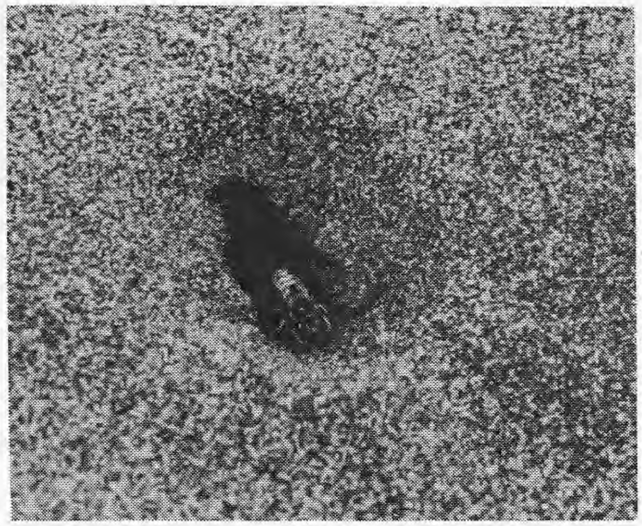
Hymenoptera (bees and wasps). A wild bee, *Anthophora* sp. (near *edwardsii*) is a common springtime pollinator of *Collinsia corymbosa,* a plant occurring in scattered areas throughout depressed areas of the dunes. This bee nests in open sandy areas and spends most of its annual life cycle as a larva in a cell, well beneath the sand.

The pompilid wasp, *Aporus luxus,* is a predator of the dune trapdoor spider, *Aptostichus.* These wasps can be observed walking over the surface of the sand dunes mostly alee of the dunes in areas where they somehow know that their host spiders live, carefully searching for something that indicates the spider's presence beneath.

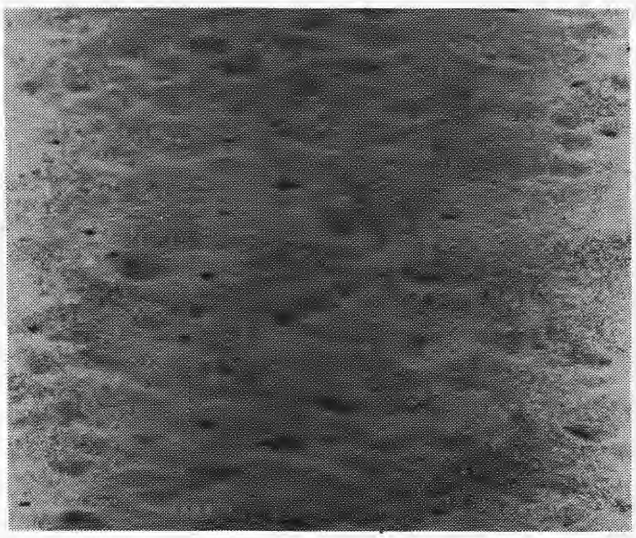
A yellow and black (sometimes white and black) wingless wasp (the female) called



A sand beetle, *Cotinus* sp. (P. Rauch 7/72).



A sand wasp, *Bembix americana comata,* in its burrow (P. Rauch 6/72).



The habitat of the sand wasp is the hard sand of more stabilized dunes. Note abundance of sand wasp burrows (P. Rauch 6/72).

Dasymutilla, is an uncommon dune wasp that can be seen walking over the sand looking for the nests of its host, presumably some dune-nesting bees. The males of this species are winged and are present in the dunes only during the mating season.

There is a whole series of sphecid wasps that nest in the dunes but whose lives are not restricted to the dunes, and these are discussed elsewhere.

Diptera (true flies). There are three species of therevid flies that live in and on the dunes. These species are *Thereva* sp. 1 and 2, and *Chromolepida,* a new species. Adults of each species live in distinctly different dune habitats, but the larvae of all three live underneath the sand, where they feed as predators on the various beetle larvae and moth larvae that feed on the roots of dune plants. These fly larvae are long and wiry, white in color, and snake-like in their movements and can be found easily only by screening the sand.

The striking yellow and black, wasplike conopid fly, *Dalmannia heterotricha,* is a rarely seen dune fly that is a bee parasite. The only other record for this fly is its type locality, Pt. Reyes sand dunes.

The small, numerous, red and black tephretid fruit fly, *Euaresta bellula,* is found associated with and feeding in the flowers of *Franseria chamissonis.* The larvae of this species feed on the seeds of this plant.

A digger bee, *Emphoropsis* sp., digs into dune sand. This bee pollinates Chinese houses, *Collinsia corymbosa* (P. Rauch 6/72).

The small gray and white sand-colored fly, *Anorostoma maculatum,* is one of several helomyzid flies restricted to the dunes. The biology is still unknown but it is presumed that its larva will be found associated with certain species of rodent dung.

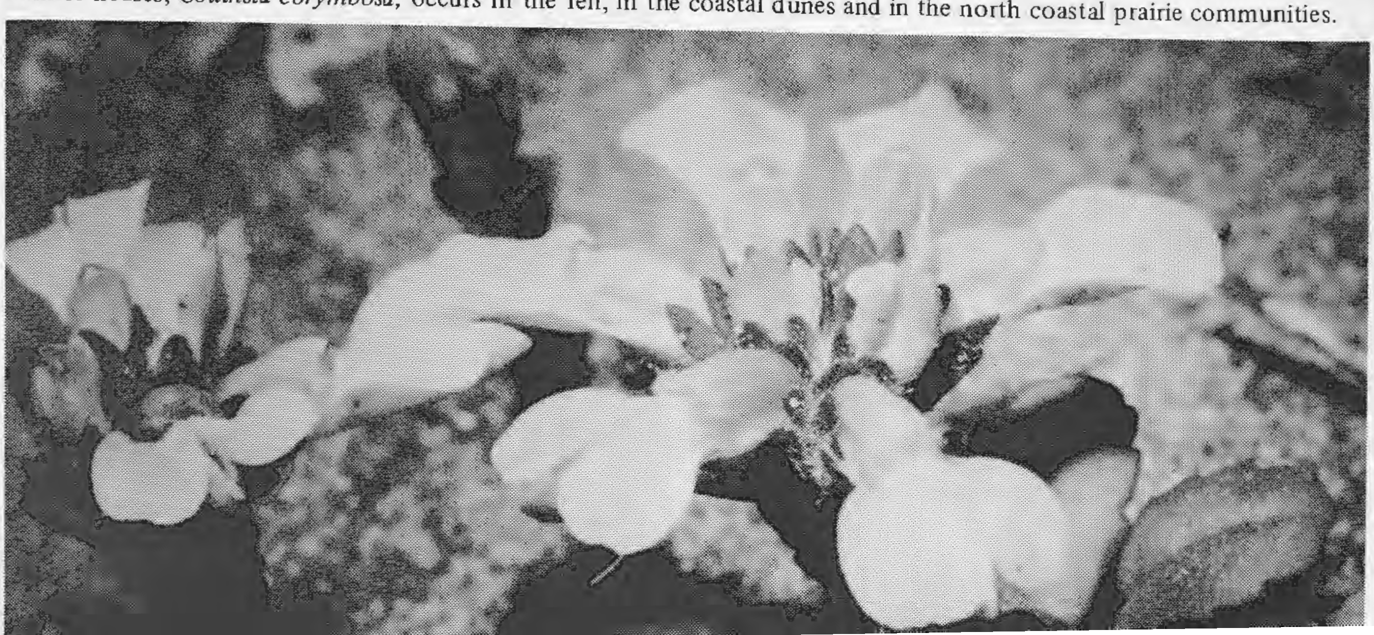
Lasiopogon sp., is the only common dune asilid (robber fly) species present. These flies are well adapted to living on the dunes, and their flight habits are short and low to the ground, a way of keeping from being blown off course by the high winds. The larvae live in the sand and are predacious. The adult flies feed on various tiny insects.

A small tachinid fly, *Stomatomyia parvipalpus,* is at times, in the springtime, a common, dune-active, parasitic fly. The host of this fly is not yet known, but its numbers suggest an association with some common species of moth larvae.

An unidentified sphaerocerid fly, *Leptocera* sp., is a very common fly associated with the seeds of *Abronia latifolia* on the sand after they have broken away from the flower heads. This fly is one of the smallest in the dune ecosystem (about 1.5 mm.). The numbers of this species indicate that its biology may be important to an understanding of the dune ecosystem.

A remarkable, completely wingless fly, a sphaerocerid, *Aptilotus* sp. (possibly new), was found in one of the swales surrounded by dunes. This genus of flies has not been recorded before as occurring in North America, but is known from Europe.

Chinese houses, *Collinsia corymbosa,* occurs in the fen, in the coastal dunes and in the north coastal prairie communities.



North Coastal Scrub

Above: Well-stabilized dune swale containing elements of the north coastal scrub (P. Rauch 7/72).

Below: North coastal scrub biotic community stabilizing dune sands (W.J. Barry 6/72).

The north coastal scrub biotic community is a successional stage in the primary dune and terrace succession of the Mendocino coastal dunes, which are gradually replaced by the north coastal prairie and eventually by the coastal redwood forest.

The physiogonomy is of a generally low growing aspect (less than 1.5 m), becoming more prostrate toward the coast, where it gradiates, usually through a broad ecotone, into the coastal dune community. An excellent example of this plant successional pattern occurs in a north-south axis beginning about 100 meters south of the confluence of Fen Creek and the Pacific Ocean due to the tilting of a large faultblock between Ten Mile River and the Garcia River to the south (Barry, Burns, and Chatfield, 1974). There is an emergence of terrace and cliff formation north of Inglenook Fen and the Ten Mile Dunes. This tilting (sinking portion of the block to the north) has allowed the formation of a gradual and continuous succession from bare sand through strand (Figure 27B, transect D), north coastal sage scrub, and north coastal prairie primary successional sere.

The most important plants of the north coastal scrub community are *Lupinus varicolor*, *Baccharis pilularis*, *Artemisia pyenocephala*, and *Heracleum lanatum*.

Old dunes stabilized by north coastal prairie grasses and herbs (P. Rauch 7/72).

North Coastal Prairie

This community is confined to the north coast of California and southern Oregon and is not well documented as to pristine distribution or species composition. The southernmost locale is at Pt. Lobos State Reserve, where the community occurs in very limited areas and is a disjunct not known to occur again until the Marin coast.

This community was apparently composed of bunch grasses dominated by Idaho fescue (*Festuca idahoensis*) and California oatgrass (*Danthonia californica*); however, much of the area is now dominated by velt grass (*Holcus lanatus*) introduced from Europe.

Two plots were established and examined in the north coastal prairie adjacent to the Inglenook Fen. In each of the observed areas, plant and insect specimens were collected and identified but quantitative data were not collected for insects. One of the areas can be characterized as the coastal strand-north coastal prairie ecotone as compared to the other area, which can be best described as north coastal prairie. According to the grid system, the ecotone plot is located in quadrant 2334, which is located approximately 300 meters inland from the shoreline. (See Figure 28.) The north coastal prairie plot is located in quadrants 3739, 3639, and 3638. (See Figure 29.) Observations of the coastal strand-north coastal prairie ecotone plot were conducted on three separate occasions during the period of September 12, 1973, to October 27, 1973, while the north coastal prairie plot was observed on six separate occasions between July 18, 1973, and October 27, 1973.

Figure 28

DOMINANT PLANT SPECIES OF THE NORTH COASTAL PRAIRIE STRAND ECOTONE

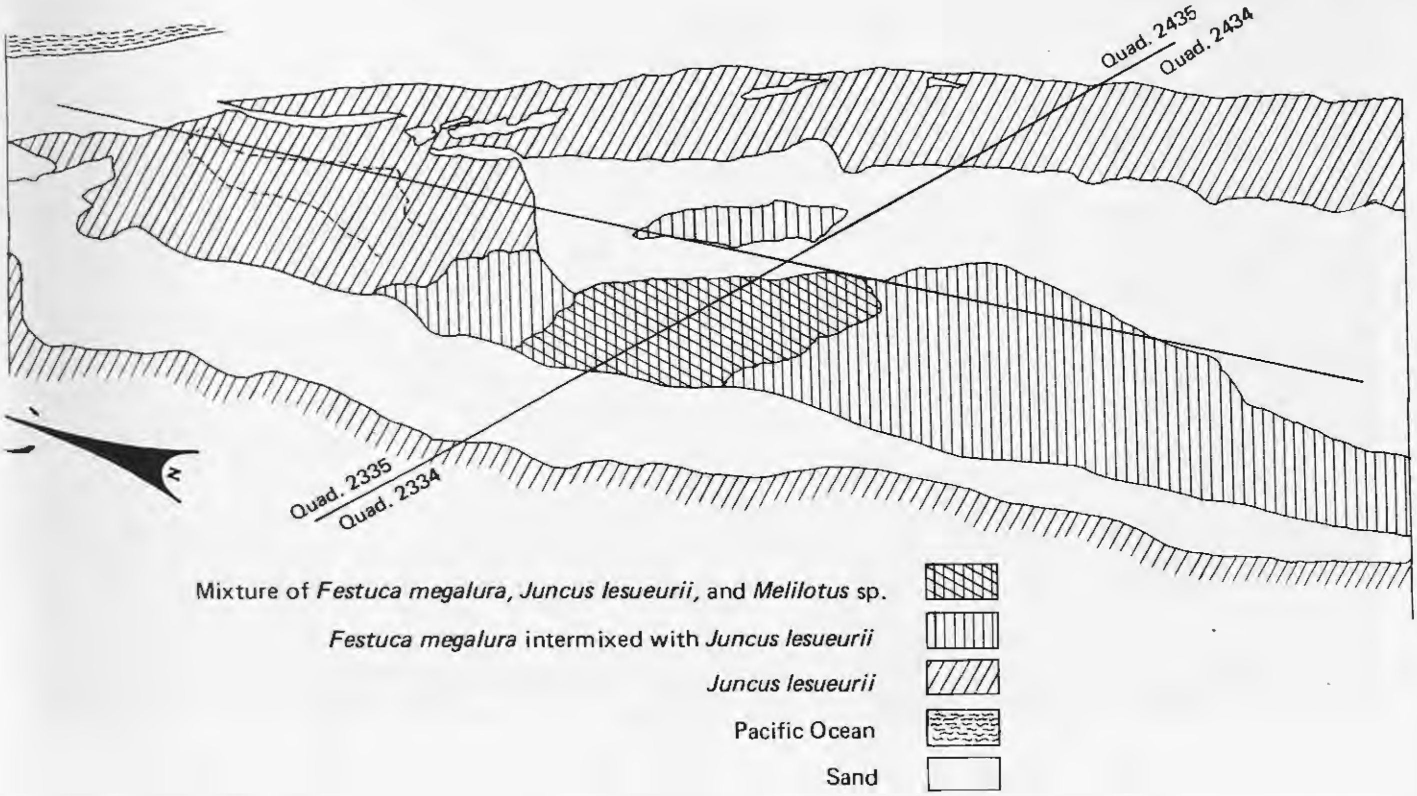
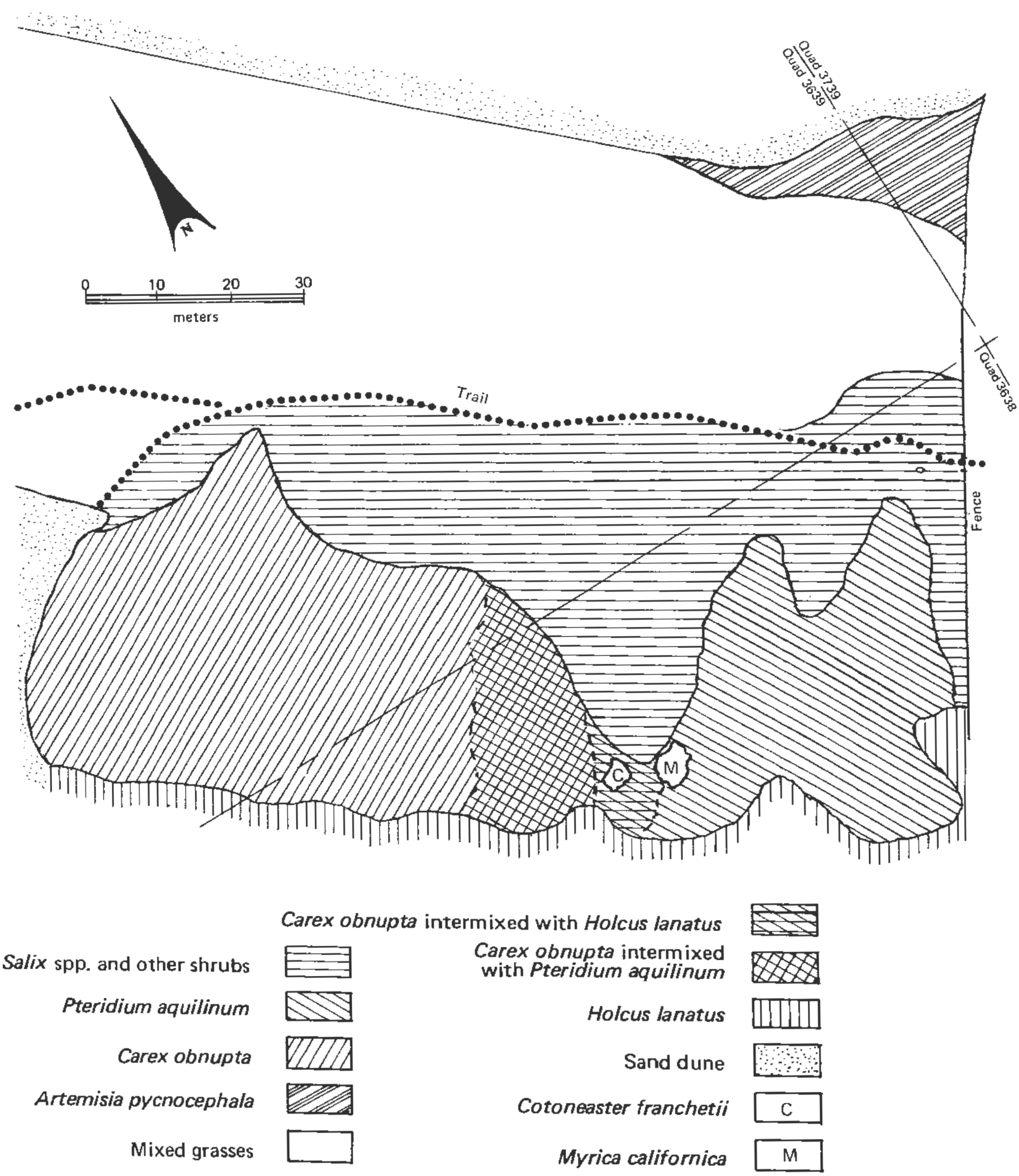


Figure 29

DOMINANT PLANT SPECIES OF THE NORTH COASTAL PRAIRIE



The plants found within the north coastal prairie plot form five distinct zones of vegetation with two clearly defined transitional zones. The limits of the study area (plot) and of the zones of vegetation are indicated on the map of dominant plant species of a north coastal prairie. The plants in this area are bordered by a sand dune on the northeast side of the plot and by the fen-carr on the southwest side. The southeast limit of the plot is formed by a barbed wire fence, which divides the prairie from the grazed pasture. The prairie then continues in a northwesterly direction. The northwest limit of the plot was set arbitrarily at the point where the northwest slope began to level off. From that point the north coastal prairie continues for approximately 100 meters to where it is blocked on three sides by a sand dune formation. Both the northwest and northeast sides of the plot

North coastal prairie biotic community stabilizing dune swales (W.J. Barry 8/72).

slope downward towards the southeast. The slope levels off as it approaches the trail that crosses the prairie.

The dune, which forms a natural boundary along the northeast portion of the plot, contains patches of typical coastal dune vegetation, such as *Franseria chamissonis.* The area below the sand dune community forms a transition zone with the grassland. This ecotone between dune and prairie is dominated by *Artemisia pycnocephala* and some *Eriogonum latifolium* and a few short grasses. The ground cover is mostly exposed sand with little or no litter accumulation present.

The ecotone continues a short distance down the slope, which fades rapidly into a relatively large area dominated by short mixed grasses, which almost cover the entire slope. Most of the short grasses present were not identifiable during the period of observation because they are all annuals that flower during the period between April and July. Those that were identifiable were *Festuca megalura, Bromus rigidus, Bromus mollis* and *Aira caryophyllea.* Various other plants are present in this area, such as *Rumex acetosella,* which occasionally appeared scattered throughout the area. *Rubus vitifolius* occurs only once in this area. In the upper portion of the northwestern slope of the mixed grassland zone, the grasses become much shorter than those in the lower areas, and *Horkelia marinesis* and *Aira caryophyllea* become dominant. In this area there is very little exposed sand. This is due to the combined action of the accumulation of organic matter and the presence of the fibrous root system of the grasses. The soil development is limited to the formation of an A horizon. Both *Plantago lanceolata and Eschscholzia californica* appear to be distributed randomly throughout the mixed grassland area and merge with the area dominated by *Holcus lanatus.*

Holcus lanatus occurs in the mixed grassland region in the form of several scattered tufts that are restricted mostly to the lower southeastern end of the slope. As the slope levels off, *Holcus lanatus* begins to dominate completely the entire area. The ground cover is formed by a dense growth of *Holcus lanatus* tufts and by an unidentified short sedge. The sedge forms large, dense cushions in some areas, and its fibrous root system forms a sod that is 15 centimeters deep. It appears that the cushions formed by the sedge are used as a habitat by small animals as indicated by the presence of fecal droppings.

In this area thistle, *Cirsium* sp., occurred in three places. The largest plant of the three was located approximately five meters west of the gate, adjacent to what appears to be a large accumulation of dead brush.

The ornamental plant *Crocosmia crocosmiiflora* was found a few meters north of the gate.

Carex obnupta forms a sharp boundary with *Holcus lanatus* except in the region where *Carex obnupta* intermixes with *Pteridium aquilinum.* In this area *Holcus lanatus* intermixes with *Carex obnupta* and forms a gap or transition zone between the area dominated by *Carex obnupta* and the area intermixed with *Carex obnupta* and *Pteridium aquilinum.* The rush, *Juncus effusus,* was observed primarily around the outer edges of the area dominated by *Carex obnupta.* Two aggregations of *Solidago californica* were observed by the southern limit of the prairie, which is formed by *Salix* spp. and other shrubs of the fen-carr. In addition to *Solidago californica* there was some *Holcus lanatus* and *Achillea millefolium* present. Both *Rubus vitifolius* and *Myrica californica* were found in this vegetation zone.

A Rein orchid, *Habenaria greenei,* is not known from any other location in California. It occurs in a small prairie strip between the fen and the dunes to the north. Its prairie habitat is rapidly being covered by sand (P. Rauch 7/72).

Carex obnupta forms a transition zone with both *Holcus lanatus,* in which the ornamental plant *Cotoneaster franchettii* was found, and *Pteridium aquilinum,* which also contains some *Holcus lanatus.* The area dominated by *Pteridium aquilinum* also contained *Achillea millefolium, Rubus vitifolius, Holcus lanatus, Cirsium,* and various unidentified composites. In the extreme western end of this area, adjacent to the sand dune that borders the fen-carr, is an aggregation of unidentified composites and *Rhus diversiloba.*

The changes in vegetation in this north coastal prairie community are occurring mainly along a vertical gradient, from high to low elevation. Since the ground is porous and there is little soil development in the upper areas that would tend to retain moisture, it is apparent that moisture is the limiting factor that determines the plant distribution in this prairie community. This is based on the assumption that the seed dissemination system of each plant species is capable of reaching all areas within the community. This would explain the presence of *Carex obnupta* and *Juncus effusus* in probably the only area where moisture is available to plants throughout most of the year.

It should be noted that the zones of vegetation coincide with the drainage pattern of the area. *Holcus lanatus* appears to shade out most of the other plants in areas where it obtains a sufficient amount of moisture to grow. *Pteridium aquilinum* grows in areas that are too xeric for *Carex obnupta* and is able to shade out *Holcus lanatus.*

The potential distribution of each plant species in this area is determined by the availability of moisture to the plant. It is assumed that each area within the community receives an equal amount of rainfall because of the small area that is involved. The amount of condensation of moisture from fog is dependent upon the exposed surface area of the plant. The larger plants like *Carex obnupta, Holcus,* and *Pteridium* should be able to obtain more moisture per unit period of time. This is probably an important factor during the summer months. In the lower area, subsurface waterflow is another important factor. The ability of the soil to retain water against evaporation and drainage is probably the most important factor in determining the amount of water that will be available to the plant. An increase in organic matter and plant cover and a decrease in slope will act to retain water. The amount of accumulation of organic matter and plant cover increased as the slope decreased, thus creating a compound effect.

Bishop pine forest being invaded by dunes in MacKerricher State Park (D. Thorpe 7/64).

The actual distribution of the plants is determined either by their ability to compete with other plants for light or to grow in areas of reduced light intensity, such as the case with the short sedge that forms the ground cover in the area dominated by *Holcus lanatus.*

The presence of *Cotoneaster franchetii, Crocosmia croscomiiflora,* and possibly the pile of dead shrubs indicate that this area has been used in the past for dumping garden debris. Previously this area has been grazed by cattle but appears to have recovered partially from the impact of grazing.

The next step in this study is to complete identification of the plants in this area and to obtain quantitative data on the distribution of the plants. Line transects of both the slope and soil temperature should be recorded. Nothing has been said about the insects because of insufficient information. Continued insect collecting and observation throughout the year is required in order to obtain some understanding of the ecological interactions that occur between the plants and insects in this community. Appendix C, Tables 20a and 20b list biota of this community.

Bishop Pine Forest

A small remnant bishop pine forest is located on the 160-ha (40-acre) BLM tract to the southwest of the fen. Although not in the fen watershed it is of great ecological interest; therefore, it is mentioned in this study. These trees are known to be part of the long-term vegetation succession on dunes. This successional pattern has been described by Jenny (1973) and Barry, Burns, and Chatfield (1974) for the Pygmy Forest Ecological Staircase along Jug Handle Creek several miles to the south.

This remnant forest apparently was much more widespread on stabilized dunes; however, many areas have become unstabilized, and the forest has been inundated with sand. The small island of bishop pine (*Pinus muricata*) and tanbark (*Lithocarpus densiflora*) still holds out against the shifting sands. The understory consists of giant chinquapin (*Chrysolepsis chrysophylla*), wax myrtle (*Myrica californica*), wild cucumber (*Marah oregana*), service berry (*Amelanchier florida*), figwort (*Scrophularia californica*), and sedges (*Juncus* spp.).

Coast Redwood Groveland

The physiognomy of this biotic community is a closed layer of grasses and herbs with trees aggregated into small groves. These groves are dominated by coast redwood (*Sequoia sempervirens*) but may also contain western hemlock (*Tsuga heterophylla*), red alder (*Alnus oregona*), and grand fir (*Abies grandis*). Grasses and herbs are typical of the north coastal prairie already described. The groveland gradiates into the north coastal prairie to seaward and into coast redwood parkland to landward.

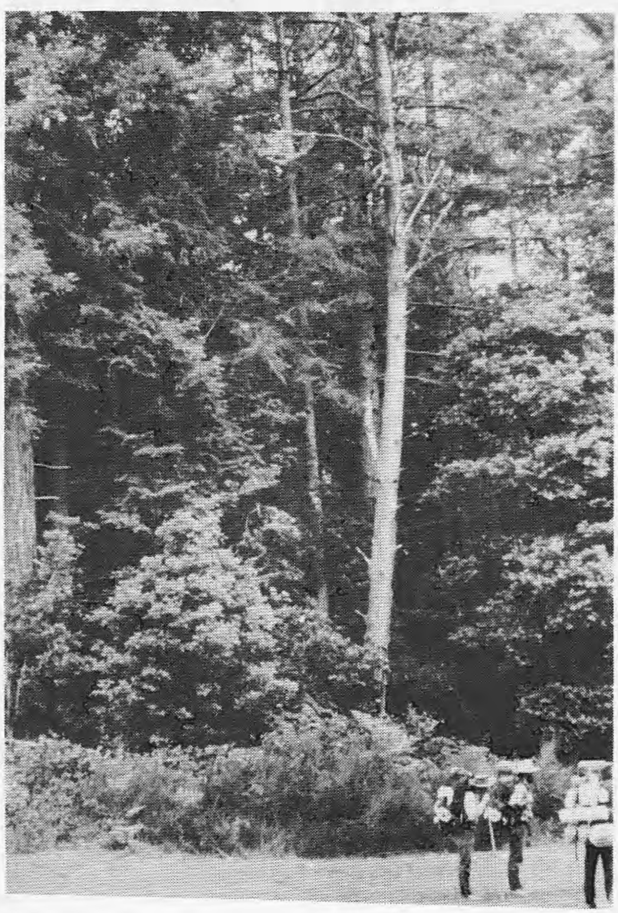
Coast Redwood Parkland

The coast redwood parkland differs from groveland in that it has a closed tree canopy with patches of lower vegetation abundantly distributed over an otherwise continuous phase of forest. Coast redwood is again dominant but Douglas-fir (*Pseudotsuga menziesii*) is abundant. Common understory plants include salal (*Gaultheria shallon*), black huckleberry (*Vaccinium ovatum*), silk tassel (*Garrya elliptica*), wax myrtle, California rhododendron (*Rhododendron macrophyllum*), salmon-berry (*Rubus spectabilis*), and thimbleberry (*R. parviflorus*). Groveland and parklands are partly natural and partly due to logging and clearing activities. Natural parklands and grovelands are due to edaphic conditions. Disturbed areas show typical succession patterns starting with grass and herb cover and climaxing with the coast redwood forest.

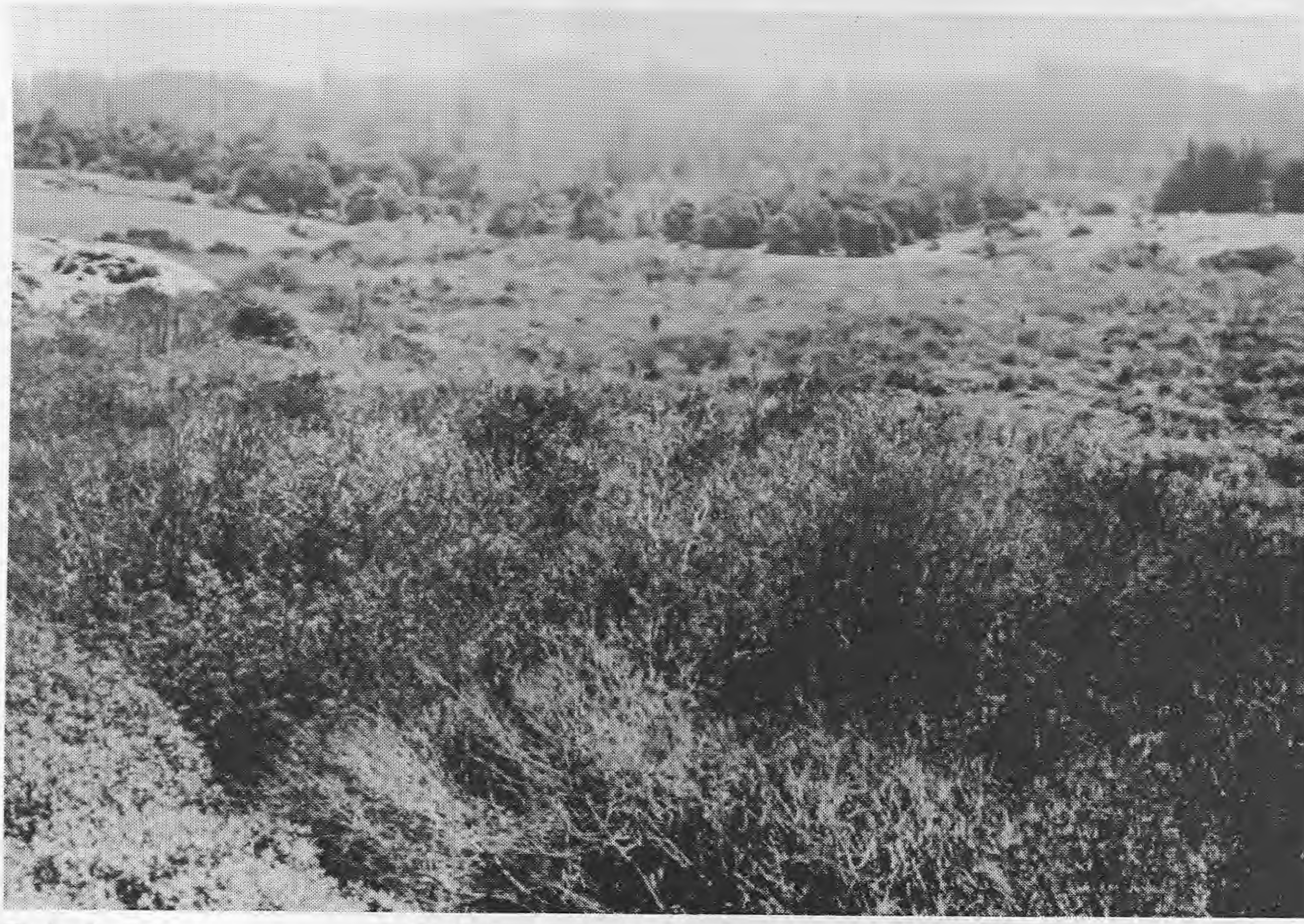
Coast Redwood Forest

This coniferous forest community is considered to be the regional climatic climax community. Coast redwood is dominant on undisturbed sites with deep soil, while Douglas-fir and coast live oak (*Quercus agrifolia*) become abundant in logged-over areas and on shallower soils. Grand fir and western hemlock are also common where salt-laden ocean spray is a factor. The understory is similar to that of coast redwood parkland.

The largest mammal recently observed (1970) is the black bear (*Euarctos americanus*), which is only an occasional visitor to the fen watershed. One of the most abundant mammals is the valley pocket gopher (*Thomomys bottae*). Plants and animals of this community are listed in Appendix C, Table 21.



Coast redwood forest



The fen biotic community was created by the blocking of Fen Creek by dunes (W.J. Barry 7/75).

Wetland Ecosystems

Fen

Floristically a fen is a community intermediate between a bog and marsh. Fen soils are characteristically waterlogged, the summer water level being close to, or conforming with, but not normally above, the ground level. The organic soil formed by a fen is rich in exchangeable bases and is therefore floristically rich and highly productive in contrast to a bog, which forms a poor, highly acid, organic soil and is floristically impoverished, having radically different vegetation from that of a fen. The soil of a fen may be alkaline, neutral, or somewhat acid and may be pure peat or, where silting occurs, it may have varying amounts of mineral soil deposits. Fen soils differ from marsh soils in that a marsh has an inorganic basis, while a fen has an organic basis of formation.

According to Baker (1972), in fens the soil may be pure peat or, if silting is a factor in the basin where the water accumulates, it may contain varying amounts of mineral matter. Often fens are clearly successional stages in hydroseres leading to a primary forest climax. Inglenook Fen appears to be of such a type and is surrounded by a woody fen-carr community.

The literature dealing with environmental conditions and their effect on plants growing in fens is very meager indeed; slightly more research has been done on plants growing in bogs. Practically all the ecological research on fens, to date, has been done in Great Britain and Ireland, and to a lesser extent in Scandinavia and other parts of Europe. In practically all cases the plant species occurring in these fens are different from those of Inglenook Fen. Two exceptions are the bog bean and purple or marsh cinquefoil (*Potentilla palustris*). Although in many cases the same genera are represented, comparisons of environmental requirements or tolerances for different species within a genus are not necessarily reliable.

One of the most interesting plants of the fen is the bog bean (or buck bean). It is of interest to students of reproductive biology by reason of the heterostyle of its flowers (Darwin, 1877; Baker, 1959). The species has a circum-boreal distribution and usually grows in acid waters [pH 3.6 to 7.5 (Olsen, 1923) with optimum range of 5.0 to 6.0

(Spurvey, 1941).] In northern Europe as well as in eastern and northern North America it occurs at sea level as well as in the mountains, but passing southward in western North America the lowland part of the elevational range is supposedly lost. In California, its contemporary altitudinal range is given as 910 to 3,059 meters (3,000 to 10,000 feet) above sea level by Jepson (1939). According to Mason (1957), it is restricted to the Sierra Nevada, while Munz (1959) reports its occurrence only at elevations of 910 to 3,200 meters (3,000 to 10,500 feet) in ponderosa pine forest to subalpine forest. Hewett (1964), in his account of the ecology of the bog bean for the *Biological Flora of the British Isles,* draws conclusions as to the limits for this species in western North America on the basis of the distribution given in Munz (1959).

Menyanthes trifoliata, bog bean, stalk with bean-like seeds (P. Rauch 7/73).

Both long-styled and short-styled plants of the bog bean occur in the Inglenook Fen, so an artificial introduction of the species from one of its well known high-altitude stations becomes an unlikely explanation for this apparently unique occurrence at sea level in California. The naturalness of its occurrence is backed up by the floristic constitution of the vegetation and the insect fauna found here – an association of species that naturally accompanies the bog bean in a series of boggy situations northward along the Pacific coast to Alaska but that is otherwise unknown in California at present. Hansen (1943) records the bog bean from what appears to be the next fen northwards, five miles south of Bandon, Coos County, Oregon. Here again, drainage from land covered by pine trees – shore pine (*Pinus contorta*) is impeded by actively moving sand dunes. The bog bean also occurs in other coastal bogs and fens as far north as British Columbia and Alaska (cf. Rigg, 1922, 1925; Jones, 1936; Hanson and Churchill, 1961, p. 182.)

Baker (1972) believes that the bog bean population in the Inglenook Fen may be a relic from a cooler climatic period in the past (persisting in its present locality because of the chill fogs that beset the Fort Bragg area, particularly during the summer months). Insect associations of polar affinity substantiate his theory. There is another lowland record of the bog bean from San Francisco, where it flourished in a "marsh" until it (and the marsh or fen) became extinct in 1859 (Behr, 1888).

Bloom of the bog bean (W.J. Barry 5/75).

Structure and composition of Inglenook Fen. Inglenook Fen shows a well-marked zonation. It is bounded by the sand dunes, which, of course, have a quite distinct flora, and, at its inland limits, the fen merges with the north coastal prairie of the 100-foot raised beach. The open water environment of Sandhill Lake, the two major vegetation zones within the fen, and the fen-carr presumably represent successive stages in a hydrosere leading from fresh water, which is too deep for rooted phanerogamic vegetation, to a wet forest type, which is rather stable and might not give way to pine forest until some further raising of the land occurs.

The western part of the fen (toward the open water) consists of a zone of almost pure *Carex* and *Heleocharis* tussocks, while the greatest floristic diversity occurs in the central and eastern part of the fen. Topographic diversity within the fen is provided by the tussocks of *Cyperaceae* and especially by the large tussocks of *Calamagrostis* and the build up of material around the bases of the *Ledum* and *Myrica* bushes. Thus, bog bean and *Epilobium adenocaulon* can grow in the same zone in hollows and on tussocks, respectively (Baker, 1972).

All authors who mention changes in water levels in fens are agreed that these cause changes in types of plants found, but White (1932) states that the drainage of fens in Ireland, although favorable to the growth of orchids, may either increase or decrease the abundance of bog bean, purple cinquefoil, and *Carex* spp., depending on the place.

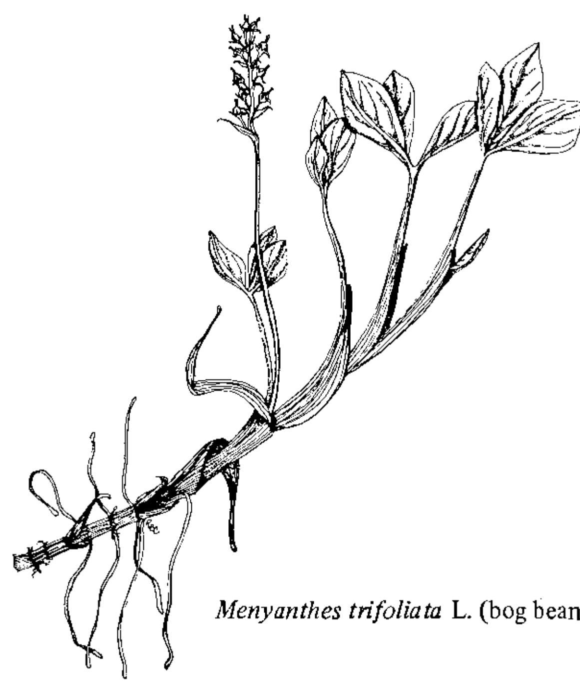
The lowering of the water level in the past at Wicken Fen in England has had the effect of eradicating *Cicuta virosa* and decreasing the abundance of *Myrica gale* and possibly *Heleocharis palustris*. These three genera are represented at Inglenook Fen by other species.

Heinselman (1963) found that slowly moving water was important for the existence of fens in Minnesota. Newbould (1960) stated that fast- or slow-moving water was also necessary for the type of habitat in which bog beans are found in southern England. Hewett (1964) mentions that the bog bean grows better where water flow is not too limited.

Because the water and the peat in the fen have an acid reaction, the presence of such well-known "calcifuges" as *Sphagnum* spp., purple cinquefoil (pH range of 3.5 to 7.5 according to Olsen, 1923), *Blechnum spicant* and *Myrica californica* is not surprising. On the other hand, the reasonably high base status is indicated by the presence of such species as water cress (*Rorippa nasturtium-aquaticum;* pH optimum range of 6.0 to 8.0, according to Spurvay, 1941), *Habenaria dilatata*, and *Lysichiton americanum.* Good descriptions of these "pygmy forest" bogs can be found in Rigg (1933) and McMillan (1956). Appendix C, Table 22 lists the biota of the fen ecosystem.

Relation of Inglenook Fen to other "bogs" and "marshes." Appendix C, Table 15 lists plant species that are common to the Inglenook Fen and a number of coastal "bogs" and "fens" ranging from Alaska southward to southern Oregon. In addition, the last column in the table indicates that some of these species were also present in the extensive "marsh" in San Francisco that Behr (1891) describes as having been destroyed by the growth of the city in the second half of the nineteenth century.

The San Francisco "marsh," which contained black, peaty soil, according to Dr. Kellogg (cited by Brandegee, 1892), was adjacent to a pleasure resort called the Russ Gardens (named after the family who owned it). This was situated on the south corner of the intersection of Sixth and Harrison streets (Eastwood, 1945). Behr (1891, p. 4) describes the situation thus (Dr. Behr's punctuation is preserved): "Near the formerly well-known Russ Gardens there were extensive marshes abounding especially about their borders in interesting plants. Here grew the large flowered dogwood (*Cornus nuttallii*), the buckbean (*Menyanthes trifoliata*), *Epipactis gigantea*, the



Menyanthes trifoliata L. (bog bean)

delightfully fragrant *Habenaria leucostachys*, and *Eriophorum gracile*. In the same vicinity I found in a single locality five specimens of *Botrychium ternatum;* and the Lady-fern (*Asplenium filix-foemina*), grew luxuriantly, often forming root-stocks two feet high, simulating tree ferns." According to Eastwood (1945), Behr also found *Hippuris vulgaris*, and Brandegee (1892) notes that Behr found *Cordylanthus maritimus* (under the name *Chloropyron palustre*) at this "marsh."

No trace remains now of this marshy area, which must have been the southernmost representative of the coastal fen formation along the Pacific Coast of North America. However, it is possible that an impoverished fragment of another example remains about 30 miles north of San Francisco, at the landward end of Point Reyes Peninsula. This is the well-known "Ledum Swamp," where acid waters draining from the quartz-diorite Inverness Ridge (covered with bishop pine and a podzolized soil) are impeded by ancient sand dunes on the peninsula.

Only Inglenook Fen now remains in California to represent this biotic community adequately, but it is a magnificent example. Because of its floristic richness and the completeness of its zonation, and because it is the southernmost example of its kind, this fen should be preserved intact for study and interpretation through the years to come (Baker, 1972).

Drosera rotundifolia L.

Below:
A leaf of the insectivorous, oblong-leafed sundew (W.J. Barry 7/75).

Oblong-leafed sundew, *Drosera rotundifolia*, is found in the eastern portion of the fen (W.J. Barry 7/75).

Fen invertebrates. The dominant group of invertebrates (Appendix C, Table 22) from the fen proper of Inglenook Fen are aquatic Oligochaeta (segmented worms) with a fair number of aquatic fly larvae (*Diptera*). In one sense all records of organisms from North American peatlands (fens, bogs, and related peaty areas) are new to scientists. Somewhat surprisingly, no work exists (except that of Erman) on the fauna of fens, although the flora is now well known. For this reason the interpretation of significance is likely to be colored by lack of comparable data. The only comparable data comes from Erman's work in Sierra Nevada fens that are floristically as well as physically quite different from Inglenook Fen.

The species of Oligochaeta so far identified include some unusual records. *Kinkaidiana freidris* was previously thought to be unique (endemic) to Lake Tahoe (Brinkhurst and Jamieson, 1971). Erman has since shown that *K. freidris* is also abundant in the fens of the Sierra Nevada that are within the Lahontan Basin. Discovery of *K. freidris* in Inglenook Fen certainly extends the range for this species even beyond a common drainage and suggests it is perhaps widespread in California. *Psammoryctides californianus,* while being described from its occurrence in California, still has been found in only the type stream. The identity of a third unusual, potentially new species of the genus *Peloscolex* awaits confirmation by an authority of aquatic Oligochaeta, R. Brinkhurst.

When the species of invertebrates in Inglenook Fen are compared to those of fens in the Sierra Nevada, the following species are common to both: *Kinkaidiana freidris, K. hexatheca* (rare in the Sierra Nevada), *Rhyacodrilus coccineus,* and *Pentaneura indecisa.* Most of the genera of worms and families of insects are likewise the same in both locations.

The presence of *K. freidris* in Lake Tahoe and in peatlands leads to some interesting speculation on the similarities of the habitats. Among the fens the similarity is obvious, although specific details, such as O_2 content, pH, and temperature, are different. But what is the similarity between the bottom of a very deep, very unproductive (oligotrophic) lake and a fen?The answer may be what Baker (1972) suggests as a northern refuge; that is, a temperature condition in the fen that makes it a refuge for organisms that would normally live in more northerly latitudes. A bottom of a deep lake would offer a similar, stable, cold environment, and both lake bottoms and fens have an abundance of organic debris, no doubt well colonized by fungi and bacteria.

The similarity of certain forms in Tahoe and Inglenook Fen also brings into question what the productive status of a system means. Lake Tahoe is considered unproductive (oligotrophic) whereas fens in general are considered to be productive (eutrophic) representatives in peatland succession from fen to bog. Heinselman (1970) points out that eutrophic, mesotrophic, and oligotrophic are terms no longer used in describing peatlands since the emphasis is now on the source of water and minerals.

But the relative meanings of production here are quite important as they may mean the same thing to some organisms or else are of no importance to the animals in question. The use of indicator species (often aquatic worms) for detecting trophic status is well established in lake studies. Thus the similarities of fauna between these dissimilar ecosystems suggests the need for studies of the factors underlying this apparent contradiction. One such study would be to compare the fauna of Inglenook Fen with that of other peatlands (bogs) along the Mendocino coast.

Arthropods inhabiting the Inglenook Fen-dune system. The arthropods (insects, spiders, mites, crustaceans, and so on) comprise about 75 percent of all animal species. Their numbers and kinds in the Inglenook Fen-dune area are equally impressive and perhaps represent an even higher percentage of the animal diversity than in most ecosystems. When the final animal diversity of this area is measured, it is estimated that nearly 90 percent will be represented by arthropods.

Before this study began, there was nothing known about any of these animals in the fen area. Early observations of the area indicated that both a large number of unique niches are present and that several new species occur at the fen. Many northern and European representatives occur here, and several species were found to have obligatory fen-dune interrelationships. Because of these findings, considerable effort was made to survey and associate the arthropods with their particular habitats.

The work of our research survey and study team during 1973-74 has resulted in the identification of at least eight significant arthropod findings as follows:

1. The arthropod fauna consist of 748 identified species. The most representative groups include the moths and butterflies (40 species), the spiders (117 species), the beetles (98 species), the bees and wasps (160 species), and the most abundant group, the flies (247 species).

2. Both the fen and dune communities have a number of apparent endemic species of arthropods. The fen-carr and the ecotone of the fen-carr-dune area also have considerable endemism. Both of these latter areas are narrow geographic units and need to be carefully protected to ensure the survival of these isolated, new, and/or endemic species.

3. The distributional limits of a number of species occur in the area. These limits are exemplified by at least three distinct patterns of occurrence:

   a. About 20 northern, boreal species (known from Oregon, Washington, or Canada) have their known southern records in this area. Some of these species were unknown from California previously and, in fact, have Canada as their only known record.

   b. About 15 coastal and/or sand dune species have the northernmost known record in this locality. Some range extensions were known to include the San Francisco dunes as the earlier-known northern limit of distribution, while other species are known to occur in the Point Reyes dunes.

   c. At least five species have distinct alpine distribution patterns. These records represent considerable disjunct occurrences whose closest records are in alpine areas of the Sierra Nevada. These species clearly reflect a relic situation, probably paralleling some of the plant species that are survivors since at least the last period of glaciation.

4. Each dune swale was found to be quite distinct regarding many plant species and most arthropod species. The recognition of these facts suggests that the subtle nature of these dunes and their swales needs careful consideration for man's use.

5. Several wasps that nest in the dunes capture their prey only in the fen. Other insects that breed in the fen make abundant use of floral nectars of dune plants. Some spiders that generally breed in the fen capture their prey on the edge of the adjoining dunes. Some flies, whose larvae are predators in the dunes, have adults that are predators, in both the dune and the fen.

6. Some bees nest in the dunes and pollinate specific dune plants. Other bees nest in the sand but pollinate flowers in the fen or fen-carr. Still other bees, which nest in twigs in the plants of the fen-carr, appear to pollinate flowers in the fen or prairie areas.

7. Some insects previously thought to be marine species may have adapted to the fresh waters of the fen-carr. The fresh water organisms have not yet been well sampled, but those seen indicate that this habitat has some important isolated species.

8. The derivation of the arthropod fauna can be summarized in light of the preliminary identifications. Most of the dune species apparently reached the dunes from the south coastal route, even though at present the nearest dune formations to the south are the Manchester and Pt. Arena dunes. However, some species appear to be endemic.

   Most of the fen species represent species with northern, boreal, and Canadian distributions. Some of these have similar species in northern Europe. Some species are relicts, having their nearest populations in the alpine areas of the Sierra Nevada. Some species are endemic, while others are obvious small-range extensions of species commonly occurring along the low coastal communities.

   Appendix C, Table 17 lists arthropods from the fen-dune system.

Above: The fen-carr biotic community is similar to the fen community but has woody vegetation dominating (W.J. Barry 8/72).

Lotus aboriginum is found in the fen-carr (P. Rauch 7/73).

Red alder, *Alnus oregona,* is the dominant tree of the fen-carr (P. Rauch 7/73).

Fen-Carr

The physiognomy of the fen-carr differs from that of the fen in that woody shrub or tree species dominate rather than herbaceous species. The fen-carr differs from a swamp in that the water table is generally below or at the soil surface, while a swamp contains standing water the year round. Inglenook Fen is generally surrounded by a fen-carr community but it is best developed to the southeast along the base of the sand dunes. Important woody species are red alder, Labrador tea (*Ledum glandulosum* ssp. *columbianum*), wax-myrtle, and willows (*Salix piperi, S. sitchensis,* and *S. coulteri*). Skunk cabbage (*Lysichiton americanum* California blackberry (*Rubus vitifolius*), and honeysuckle (*Lonicera involucrata* var. *ledebourii*) are common understory plants. (See Appendix C, Table 23.)

Arthropods inhabiting the fen and fen-carr systems. About 500 species of arthropods (mostly insects and spiders) have been found living in Inglenook Fen on a year-round basis. Most of these species never venture beyond the fen-carr margins, but some of those that do (possibly 25 species) were mentioned in the description of the dune community. Collecting and identifying these 500 arthropods has consumed much of our field and laboratory time. However, notes on a few of the more significant, identified species, or groups of species, are detailed below under the two broad categories of wetlands and freshwater aquatic.

Dune weevil on sand verbena (P. Rauch 6/73).

Leafhopper on *Ambrosia chamissonis,* sea ragweed (P. Rauch 7/73).

SELECTED, CHARACTERISTIC, HIGHLY ADAPTED ARTHROPODS FOUND TO LIVE ONLY IN THE INGLENOOK FEN AREA SURROUNDED BY SAND DUNES

Species that are wetlands or plant associated

Diptera (flies). A small, numerous wasp-like syrphid fly, *Neoascia* (new species), was found in the main part of the fen. This genus of flies has not yet been reported from California but is known from the Pacific Northwest and Europe. In Europe, the larva are said to feed on microorganisms in "bogs."

A rare fly, *Acrocera bulla,* is an acrocerid fly, which is an internal parasitoid of spiders. Its host spider, when found, may be an endemic fen or coastal marsh species, judging from the known distribution of the parasite.

There are three species of rare anthomyzid flies living in great abundance in the main part of the fen. These are *Anthomyza pallida* and two, possibly new species of *Anthomyza.* Species of this family are known from the boreal region of North America and Europe, but their biology is unknown. Some believe that the larvae are stem borers.

Another rare fly, the opomyzid called *Geomyza monticola,* is not uncommon in the main part of the fen. This species is known from Canada, but this is the first record from California. Its biology is still unknown.

The family Sciomyzidae, the snail parasites, number no less than five genera and six species. These species are *Limnia severa, Hoplodictya acuticornis, Antichaeta testacea, Tetanocera plebia, T. plumosa,* and *Dictya montana.* These flies are abundant in the fen and are no doubt responsible for balancing out the populations of the several snail species present there. These flies, however, are not present to any great extent in the grass-eaten watershed area where the cattle graze, and the absence of the flies may cause an increase in the snail hosts for the liver flukes that can be a serious pest to cattle.

A new species of *Sylvicola,* an anisopodid fly, has been found in the fen-carr. This family of flies occurs only in limited areas of boreal North America, Europe, and in southern temperate parts of the world, such as Chile and Australia.

Of the several species of Drosophilidae known from the fen, one called *Zygothrica* sp. (possibly new) is found in the fen-carr and is a rare fly. It is apparently known only from Europe.

A rare fungus-feeding fly, the heleomyzid called *Suillia loewi,* is found only in the fen-carr, but other species belonging to the genus *Allophyla* (or closely related to it) are found in the fen.

Of the 25 species of dolochopodid flies occurring in the fen area, two species of the genus *Thripticus* may be singled out as having the possibly rare trait of larvae that are stem feeders. Most larvae of this family are believed to be predators in moist soils.

Collembola (springtails). Of the several species and families of springtails that occur in the fen, *Pseudobourletiella spirata,* a sminthurid, is of particular importance since this is the first record from California of this mostly northern and eastern American species.

Another species, *Neanura barberi,* a species occurring in the Sierra Nevada and coastal counties of California, is interesting because it is luminescent.

Homoptera (leafhoppers, aphids, and cercopids). An unidentified cercopid bug (spittle bug) was found feeding on the leaves of the bog bean and nowhere else. This could be an important insect-plant link between the fen and the Sierran bogs in which the bog bean occurs.

Hemiptera (true bugs). The lygaeid bug, *Kleidocerus modestus,* was found to feed abundantly on the flowers and developing seeds of the Labrador tea and appears to be specific to the fen plant.

Lepidoptera (moths and butterflies). The olethreutid moth, *Olethreutes depracatoria,* whose larvae feed on the leaves of *Veratrum fimbriatum,* is not uncommon in the fen. This is the first coastal record for this species.

A ctenuchid moth larva (unidentified species) was found feeding on *Juncus* species in the lower area of the fen. These beautiful black and red moths are commonly seen during the daytime gathering nectar from both fen and dune flowers.

Araneae (true spiders). A mimetid spider, *Ero* species, is a rather rare spider in the fen. The feeding habits of this family of spiders may cause them always to be uncommon, since they are known to feed only on other spiders, especially spiders of the family Theridiidae.

The tetragnathid spider, *Tetragnatha extensa,* is not uncommon in the fen. Some of these spiders were found to be parasitized by larvae of an ichneumonid wasp.

Hymenoptera (bees, wasps). Although most species of parasitic wasps of the families *Ichneumonidae* and *Braconidae* have not yet been identified, many genera and species collected appear to be restricted in distribution to the fen and fen-carr areas.

Species that are aquatic

Diptera (true flies). One of the most important families of flies in relation to man and animals in the fen is the *Culicidae* (mosquitoes). These biting flies are, for some reason, quite rare, both as collected specimens and as records of bites. Our team of researchers has only had two bites during the entire year of 1973. The reasons for this phenomenon are being investigated, but we suggest that natural or biological control of these mosquitoes is responsible for their low numbers. Altogether we have collected only about 30 adult specimens representing the following five species, which must be breeding in the waters adjacent to the fen: *Culiseta maccrackenae, Aedes increpitus, Anopheles punctipennis, Anopheles freeborni, Culex pipiens.*

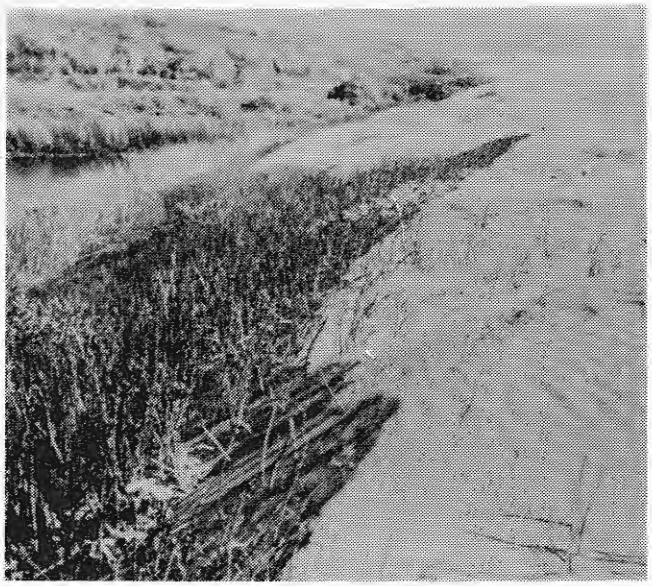
There appear to be nearly 30 species of midges, Chironomidae, breeding in the fen waters. These are for the most part still unidentified, but one interesting species caught at night at the fen about 500 meters from the shoreline was the marine ridge *Paraclunio trilobatus.* We are trying. to determine if this poor flying midge has adapted to breed in some of the fresh water of Sandhill Lake or Fen Creek.

Odonata (dragonflies). Altogether, we have found eight species of dragonflies and damselflies in the fen area. None of these species is considered endemic to this area, but several species are more or less limited to coastal water systems.

Coleoptera (beetles). We have collected about 15 species of water beetles, including Gyrinidae, Hydrophilidae and Dytiscidae, but we do not yet know if much or any endemicity is represented.

Hemiptera (true bugs). About 10 species of water bugs have been sampled from the fen waters, including the families Corixidae, Gerridae, Belastomatidae and Notonectidae. More collecting needs to be done in the waters to determine the endemicity, if any, for these bugs.

There have been representatives of *Trichoptera* (case bearers) and *Ephemeroptera* (May flies) collected from the fen waters. In addition to the insects, we have collected crustaceans (decapods and isopods), annelids (hirudeans, the leaches), and molluscans (snails, slugs, and clams) from the waters of Fen Creek and Sandhill Lake.



Dunes windward of Sandhill Lake and Inglenook Fen are stabilized by scouring rush, *Equisetum hyemale* (W.J. Barry 7/72).

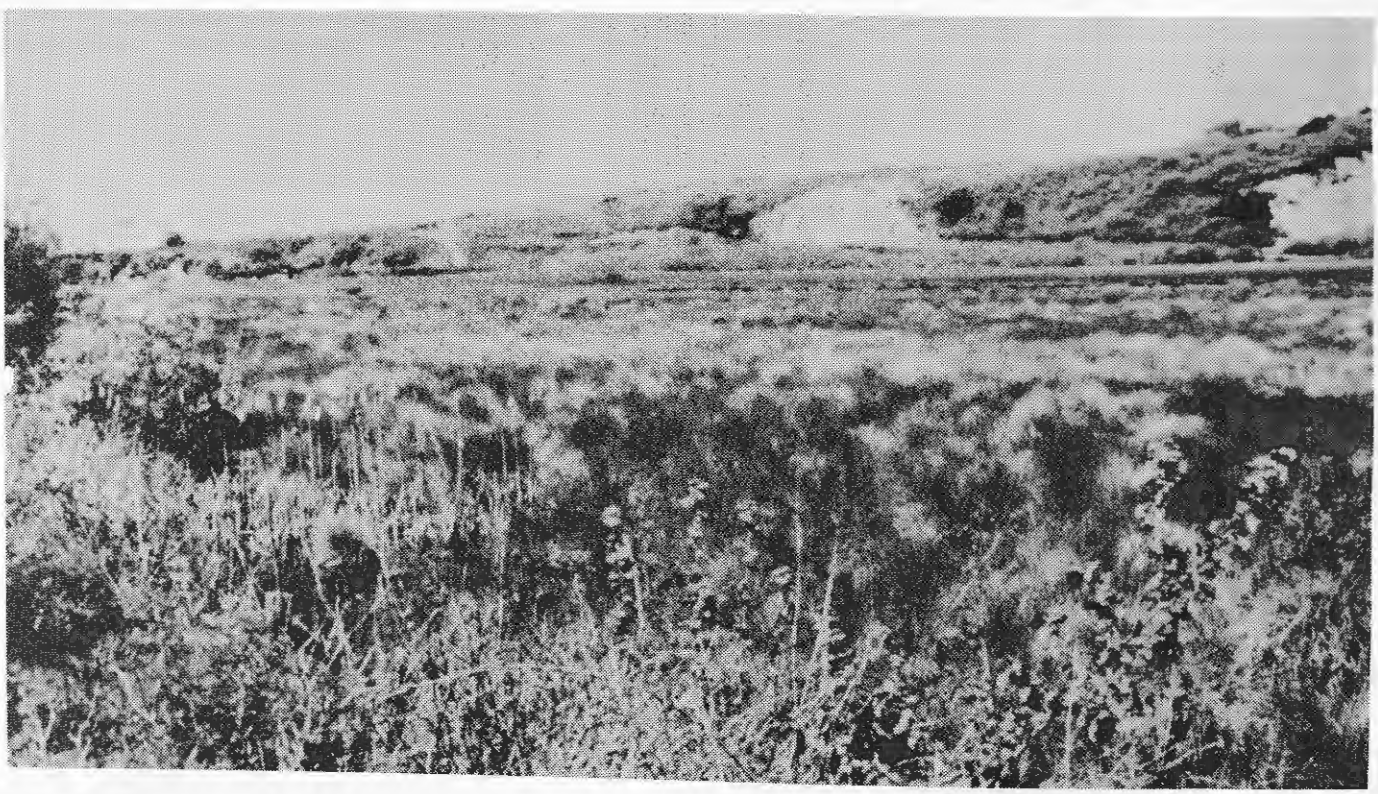
Freshwater Marsh

A small band of freshwater marsh occurs along the perimeter of Sandhill Lake. The vegetation consists of fringing emergent plants. Common cattail (*Typha latifolia*) and tule (*Scirpus acutus*) are dominant. The horsetail (*Equisetum hyemale* var. *robustum*) is a very important marsh plant that helps stabilize the dune-marsh ecotone. The horsetail becomes established near the water's edge and gradually creeps up the face of the dune, multiplying by rhizomes. The parent plant maintains its root connections with the juvenile plants, allowing a translocation of water and nutrients from the saturated soils of the marsh to plants on the dune. Thus the horsetail gradually spreads up slopes – even to the top of the adjacent dunes. These plants thus become a major factor in stabilizing the dunes around Sandhill Lake and Inglenook Fen.

The red-legged frog (*Rana aurora*) is the only known common amphibian of the freshwater marsh. Numerous birds frequent the marsh. Appendix C, Table 24 lists the plants of this community.

A very interesting brackish-water marsh occurs near the mouth of Ten Mile River. No investigations were made, but it appears that this marsh would be important biologically.

Brackish water marsh along Big River illustrates a tussock physiognomy (infrared Ektochrome, W.J. Barry 5/73).



Freshwater Ecosystems

Lentic (Lakes and Ponds) Communities – Sandhill Lake

Lentic ecosystems are distinguished from lotic ecosystems (rivers and streams) by a much less rapid rate of water renewal. The flow per volume of pools in even sluggish rivers will be at most a matter of a few months; in lentic ecosystems, water renewal rate is on the order of years, sometimes even centuries.

Lentic ecosystems are usually subdivided into littoral, limnetic, and profundal zones. The lentic littoral is defined by McNaughton and Wolf (1973) as extending from the water's edge inward to the innermost populations of plants rooted or attached to the lake or pond bottom. In this study it is defined as that area below emergent plants; that is, from the freshwater marsh downward to the limit of rooted or attached plants. This zone has cow lily or pond lily (*Nurphar polysepalum*) as its major component. These plants ring almost the entire shoreline and occur to about 1.5 meters (5 feet).

The remainder of the lake consists of the limnetic zone, which is euphotic open water. This water normally contains plankton, particularly diatoms and green and blue-green algae. However, no plankton were recovered from two tosses of a plankton net (June 3, 1973).

Aquatic insects were observed but not identified; swallows were seen feeding on aquatic insects. Snails and leeches were occasionally observed but not identified. Gill net techniques produced no fish. Several species of ducks are commonly found on the lake.

Coliform tests indicate that coliform bacteria are present; however, they are not of human origin. The bacteria are tentatively identified as *Escherichia freundi.*

The literature on bog and fen lakes is sparse. Jewell and Brown (1929) mentioned one lake they studied that had "an occasional leech." We have collected an unidentified leech (Phylum *Annelida,* Class *Hirudinea*).

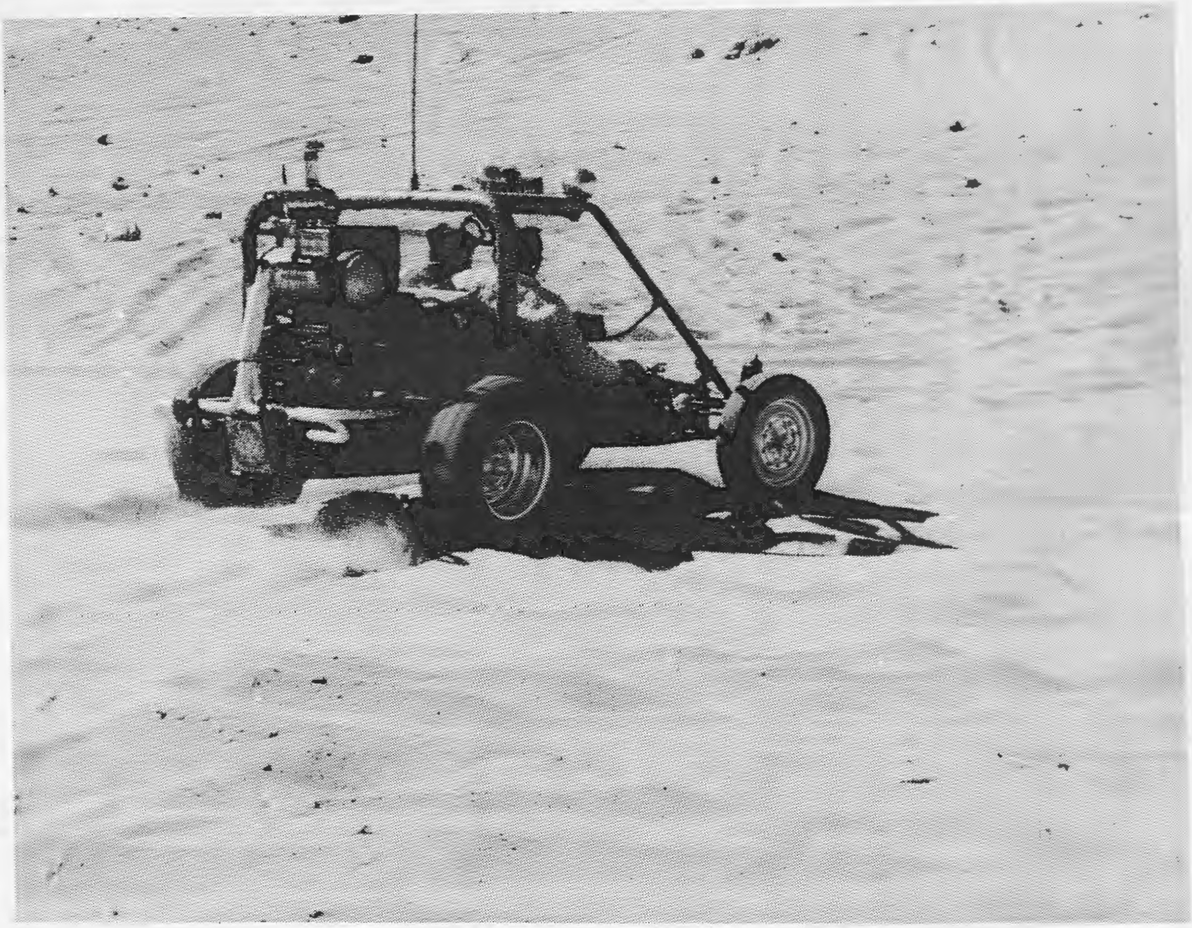
On the whole, bog lakes seem to be very unproductive. Welch (1951) points out the following faunal characteristics of bog lakes. Bog lakes support a fauna characterized by a limited variety of species. While differing considerably among themselves, bog lakes as a class are very low in faunal productivity. Aquatic insects are always present. Small bog lakes completely surrounded by mat and acidic in nature and lacking inlets or outlets usually show a total absence of fishes, Malacostraca, oligochaetes, mollusks, Ephemerida, and coelenterates. The faunal composition of Sandhill Lake definitely needs further investigation.

Lotic and associated marsh communities of Fen Creek below Sandhill Lake. *Nuphar polysepalum*, yellow waterlily, in foreground (W.J. Barry 5/73).

Lotic Communities

The five streams entering Inglenook Fen, and ultimately Sandhill Lake, contain small lotic communities. Fen Creek extends from Sandhill Lake to the sea. These streams are dominated by faunal rather than floral elements. (See Appendix C, Table 25.)

The three-spined stickleback (*Gasterosteus aculeatus*) is the only known fish occupying these streams. Larva of the western toad (*Bufo boreas*), the pacific tree frog (*Hyla regilla*), and the yellow-legged frog (*Rana boylei*) are also common to these waters. One Pacific pond turtle (*Clemmys marmorata*) was recently found near the edge of Sandhill Lake. There are at least six species of freshwater snails, representing several families of the class *Gastropoda.* Jackson (1971) has pointed out that two species of freshwater snails (*Bakerilymnea bulimoides* and *Physa gyrina*) occur in these streams. These snails act as an alternate host for the liver fluke (*Fasciola hepatica*). The snail genus *Gyraulus* has also been identified. Freshwater clams (*Pisidium* sp.) are also present in the stream systems.



MAN'S IMPACT
ON NATURAL ECOSYSTEMS

W. J. Barry, M. Fox and D. MacElfresh

Archeological sites are threatened by sand movement and direct human impact of "pot hunters," etc. (W.J. Barry 7/75).

Pre-European Man

Paleontological evidence shows that the Pleistocene climate of the Mendocino coast was like that of today and certainly capable of supporting man, had he been there; however, no one knows how long the Inglenook Fen area has been occupied (Thomsen and Heizer, 1964). Although the first occurrence of man on the scene is not on record, he has been associated with the fen ecosystem for at least 4,000 years and possibly much longer.

In historic times the area was occupied by the now extinct Coast Yuki, which, according to Kroeber (1953), called themselves *Yukoht-ontilka* (ocean people). To them, the mouth of the Ten Mile River, as well as the river itself, was known as *Metkuyaki* or *Metkuyakem* and was the largest river and watershed in their possession. To the south, Cleone was known as *Mil-hot-em* (deer large), or *Lalim* (lake). Cleone was approximately the southern limit of the Coast Yuki.

Dialectically, the Coast Yuki were a subgroup of the Yuki, an enigmatic people who spoke a language representing a small, isolated speech family (Kroeber, 1925). The homeland of the Coast Yuki stretched for a distance of about 20 miles along the Mendocino Coast. Cook (1956), using demographic methods, estimated the aboriginal population of the Coast Yuki to be around 750. Kroeber (1925) estimated that the population was 500 in 1859, but by 1910 the federal Census showed a population of only 15. The last member of the tribe died more than 40 years ago, and thus occurred the extinction of another American people.

As Thomsen and Heizer (1964) point out, "Time is running out, but with work, luck and dispatch those material effects which have withstood the ravages of time may still be recovered from archeological sites. Some physical evidence of habitation sites is still to be seen despite the ever accelerating inroad of agriculture, road building, and urbanization." Unfortunately, little is known of Coast Yuki culture or of how this unique group came to occupy the territory it held at European contact time. The only conceivable evidence of this culture is through the archeological resources. There are at least 15 archeological sites in the study area. It is not known to what extent Inglenook Fen was used by prehistoric peoples, but certainly the location of sites near it suggests partial subsistence from the fen in one form or another – from birds or other animal species that the fen might attract.

Clearly the area around the fen abounds in archeological potential. Scattered about the western portion of the Ross property and along the adjacent state park and BLM dunes are large stretches of what are known as shell or kitchen

Large shell midden in Ten Mile Dunes (W.J. Barry 5/73).

middens – evidence of ancient Indian campsites. The middens consist primarily of discarded mussel and barnacle shells, but bits of flint, chert, and bones are also present. Sites have been recorded with the Cultural Heritage Section, Department of Parks and Recreation.

Three sites are quite close to the fen. The first of these is a shell midden scattered over sand dunes covering several acres immediately inland from the beach. The shells are primarily of ocean mussel *(Mytilus californianus).* There is also a rather high incidence of barnacle *(Balanus sp.)* shells. Large mammal bones are represented by fractured leg bones of elk, possibly ox, sea lion, a scapula of an immature sea otter, and several ribs of undetermined origin. Abalone, chiton, and cryptochiton are also found in the middens. Thermally fractured stone is obvious but not abundant. No chert chips were observed.

The second site is primarily made up of ocean mussel but barnacles are also abundant. Mammal bones are rare at this particular site. Abalone, chiton and cryptochiton traces are also found. Thermally fractured red sand stones are abundant and chert flakes are common.

The third site is on the right side of Inglenook Creek and has been partially obliterated by off-road vehicle activity. Ocean mussels and barnacles are common here. Elk antler fragments were collected here also. Other sites north of Inglenook Fen have been observed from time to time and may be covered or uncovered daily by the shifting sand.

The 200-to-300-year-old skeletal remains of an adolescent boy, buried at the campsite, were unearthed some years ago at one of the middens about a quarter-mile north of the fen. Included in the find were such artifacts as fish bone gigs, shell beads, magnesite beads, *Olivella* shells, and obsidian points.

In 1910, while work was being done on the Union Lumber railroad bed along the dunes, a group of skeletons was found just south of Ten Mile River, indicating that there was a cemetery there. Since that time, a few skulls and other items have been found between Ten Mile River and the fen.

Today the rich potential of these areas is being undermined by the careless intrusion of persons involved in recreational pursuits – dune buggying, motorcycling, and horseback riding over the dunes. A further hazard is that any general knowledge of the existence of these sites could cause an invasion of curiosity seekers and even of the well-motivated amateur, who, being untrained in archeological recording and retrieval, can cause total destruction of a site. Some immediate preservation and protection is essential *now,* if systematic and intensive research of the extinct tribe of Coast Yuki is to prove fruitful in the future.

In prehistoric times, the impact of the Coast Yuki on the fen was probably minimal. These people apparently gained their livelihood from the sea, although elk and deer were hunted in the fen watershed. Birds were probably also hunted, and plants for food and fiber were undoubtedly gathered from the fen area. Grassland and forest areas were probably burned each autumn, as was the practice of neighboring tribes.

A large increase in population occurred in 1856, when the Ten Mile Township (about 24,000 acres) was made an Indian reservation. Several groups of Indians from Anderson Valley, Ukiah, Round Valley, Russian River Valley, Sulphur Creek, Bodega Bay, Humboldt County, Pit River, Hat Creek, Butte Creek, Feather River, and greater Mendocino County were shipped to the "Mendocino Reservation." This massive assemblage of cultures must have created competition for all types of food and shelter. It is logical to assume that the edible plants and fiber plants of the fen would have been severely exploited during this period.

The reservation was closed when the value of timber resources was realized by the white settlers, who took possession of the land primarily to develop the timber industry (Sandra Metzler-Smith, personal communication).

Logging

The impact of modern man on the fen-dune ecosystem has been a highly significant factor in the acceleration of dune formation. Logging has drastically accelerated erosion processes in the watershed of the Ten Mile River and has therefore affected the rate of deposition of sandy material for the dunes.

Greater erosion in the watershed of the Ten Mile River creates an increase in sediment load in the Ten Mile River. These sediments are deposited at the mouth of the river, are carried southward by ocean currents, and are deposited on the beach. The sand is then carried by wind onto the dunes.

Logging activities during the early part of the century resulted in great erosion. The lumbering industry was developed in Mendocino County during the last part of the nineteenth century. In 1916 and 1917, a railroad was built for the Union

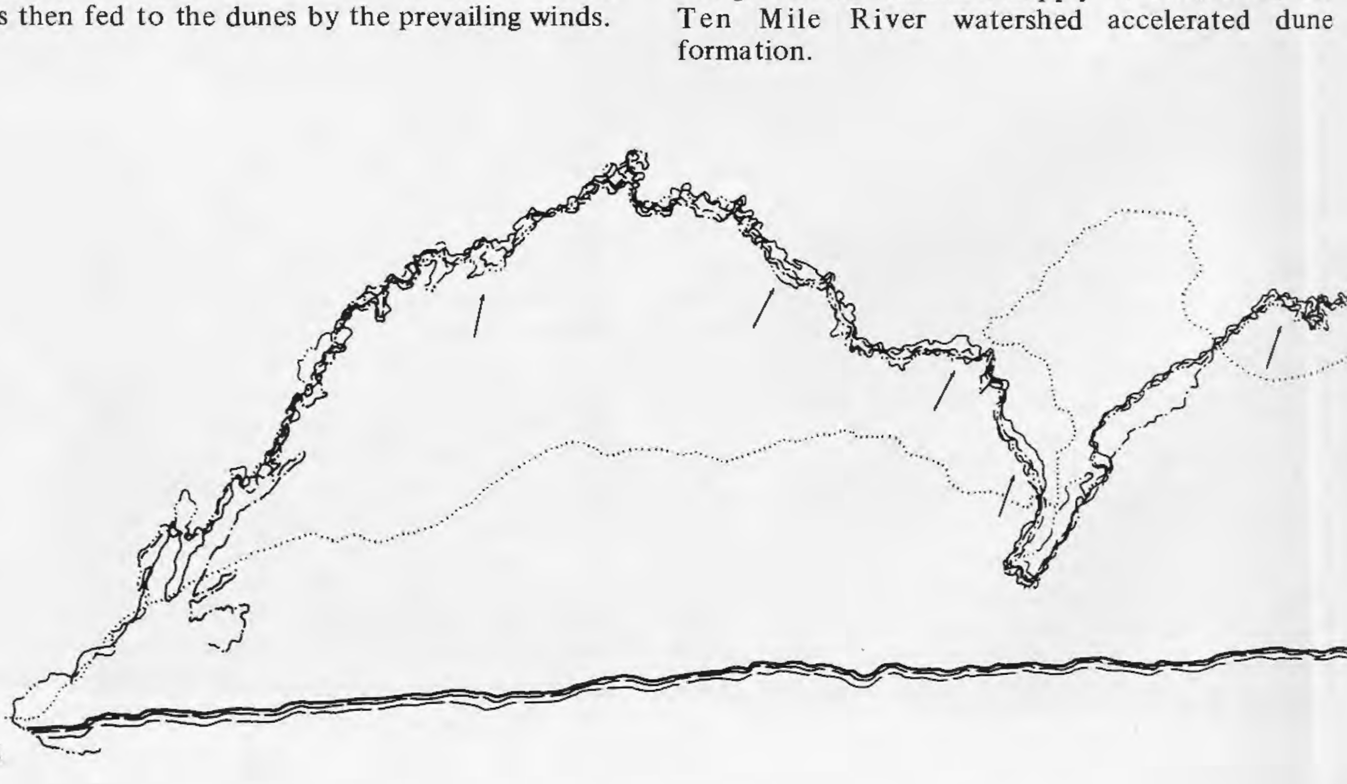
Numerous cut logs in the dunes reflect logging activity (W.J. Barry 8/72).

Lumber Company along the Ten Mile River to open up the area for logging in response to heavy building in San Francisco (Ryder, 1948).

During the early part of the century it was necessary for a large number of logging roads to be built so that ox teams could drag the timber to the landings. Land was cleared around the logs, the logs were cut up, and the branches and bark were stripped off. After the first fall rain the slash was set afire (Andrews, 1958). These practices exposed soil to erosive forces. With the advent of tractor yarding, much larger areas of the soil surface were exposed. As a result, there was a greatly increased supply of sediment carried by the Ten Mile River to the ocean. At this point, littoral drift and wave action carried sand to Ten Mile Beach. This sand was then fed to the dunes by the prevailing winds.

Cooper (1967) noted that moving dunes buried a number of trees after 1925. According to Grover (1940), the dunes encroached upon Highway 1, farm land, and houses between 1920 and 1940. Figure 30 illustrates the dramatic increase in the area covered by the dunes from 1920 to 1943.

In 1940 there were remnants of coniferous forests and north coastal scrub areas in the Ten Mile Dunes, which suggested that much of this area was wooded (Grover, 1940). Much of the area now covered by sand dunes had been cleared by logging and converted to grassland for grazing. Thus, there was an uninterrupted sweep of open land, and sand-bearing winds were not inhibited. This factor, along with an increased supply of sand from the Ten Mile River watershed accelerated dune formation.



Off-Road Vehicles (ORVs)

With the gradual decrease in sediments carried down the Ten Mile River, sand deposits have decreased allowing the establishment of limited vegetation and dune stabilization. Aerial photos indicate that there was some increase in vegetation on the dunes from 1940 until sometime in the 1950s.

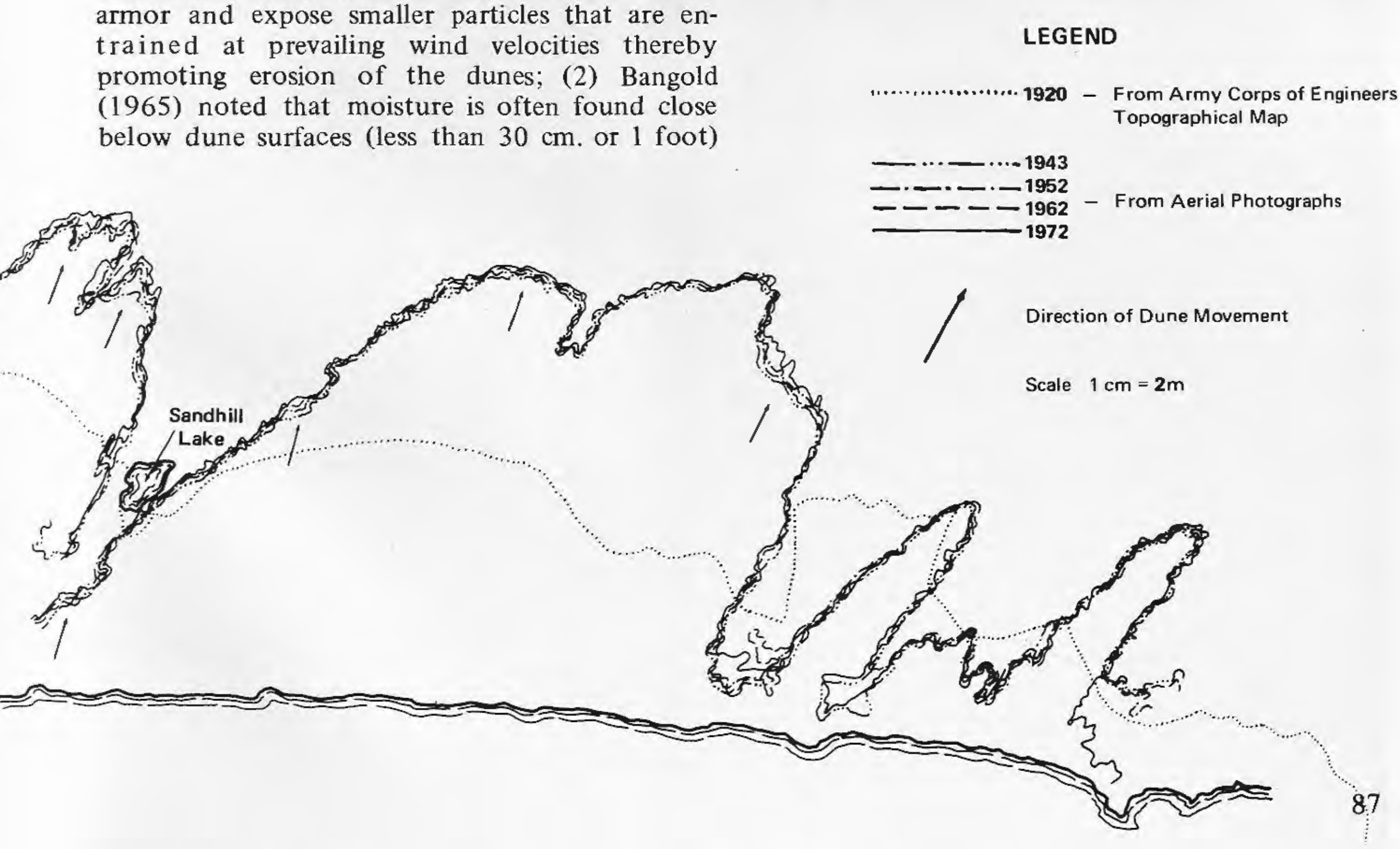
In the 1950s, Cooper (1967) noticed gentle slipfaces on the dunes and thicket vegetation between the dunes. These observations suggest stability of the dunes at that time. However, since then there has apparently been increased disruption of the stabilizing vegetation of the dunes and increased movement of the dunes, apparently from the activities of ORVs.

The dune system again began actively migrating in the 1960s. Factors that affect the rate of migration include: (1) exposure of fines that are readily entrained at prevailing wind velocities; (2) variations in moisture content which provides an element of cohesion; and (3) surface roughness which affects wind flow and turbulence.

ORV activities impact substantially the equilibrium conditions for all three factors, in each case changing them so as to accelerate dune migration: (1) under natural conditions, dune surfaces slowly build a surface armor of grains too large to be entrained by the highest wind velocities to which they are normally exposed. ORVs easily break this armor and expose smaller particles that are entrained at prevailing wind velocities thereby promoting erosion of the dunes; (2) Bangold (1965) noted that moisture is often found close below dune surfaces (less than 30 cm. or 1 foot)

The impact of a single motorcycle track on dune vegetation may take years to erase (P. Rauch 9/72).

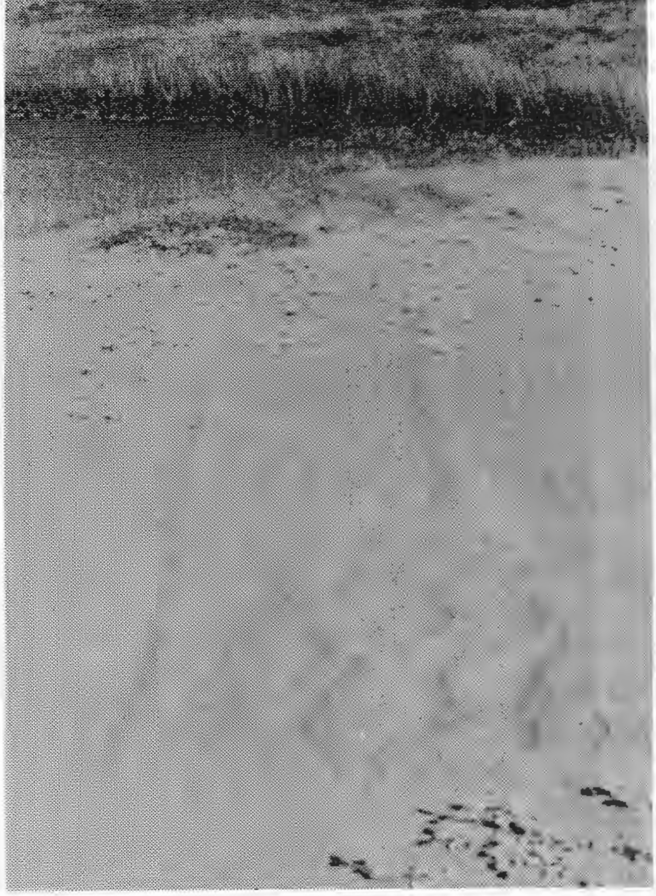
Figure 30
OUTLINE OF TEN MILE DUNES – DUNE EVOLUTION BETWEEN 1920 AND 1972



even in very arid desert dunes. This retention of moisture is due to the low thermal conductivity of the sand. A higher moisture content of the sand provides a very strong inhibiting effect on sand movement, as can be observed by the different angles of repose of damp and dry sands. ORV activities churn the sand so as to expose the lower, damper sand to the air. When it dries it has lost the bonding effect of the moisture; (3) the ripple form of dune surfaces reflects an equilibrium condition between the solid and fluid media. Vehicle ruts change the surface roughness radically and induce turbulence in the air motion. This results in turn in quarrying effects of the wind and increased dune erosion.

All of these effects, not to speak of the use of plant-anchored dunes, result in accelerated wind erosion and migration of the dunes. ORVs cause severe avalanching on the slip faces and breakdown of the equilibrium morphology of the dunes. Of course the dunes attempt to restore this form, but at a new position farther downwind. Excessive movements may not take place during this process, but the effects are additive under repeated use.

The early successional plants that stabilize the dunes are subject to severe damage from ORVs. These plants hold down the sand with roots; increase the amount of organic matter, which tends to form the sand into aggregates less subject to



Above: ORV encroachment on Sandhill Lake area (W.J. Barry 7/72).

Below: The destruction of an archeological site by ORV activity (W.J. Barry 8/72).

Leeward side of blow-outs that were caused by ORV activity in southern portion of Ten Mile Dunes (W.J. Barry 7/72).

wind movement; act as a protective cover against the wind; and create a small boundary layer, which increases the eddying of the wind and thus decreases its erosive force. The plants are able to maintain growth with some burial by sand, and they will eventually stabilize dunes. The altered conditions caused by these plants create an environment for other plants adapted to more mesic conditions. Once these plants are removed, the dunes are subject to wind movement.

The disturbing effects of ORVs have been documented. Impact is in the form of (1) blowouts due to the destruction of vegetation and the subsequent movement of sand by wind from areas disturbed by vehicle traffic; (2) encroachment of the sand upon a house located near the dunes; (3) an increase in the steepness in slipfaces, which indicates increased activity on the dunes; and (4) rapid movement of the sand dunes northeast of the fen.

Windward side of a blow-out caused by ORV activity in southern end of Ten Mile Dunes (W.J. Barry 7/72).

Blow-outs in stabilized dune area caused by ORV activity (W.J. Barry 7/72).

Because of the importance of dune movement in relation to the possible encroachment of sand into the fen and for purposes necessary to the understanding and reasons for the movement of dunes (other than normal wind-caused movement), a preliminary study was started in March 1973.

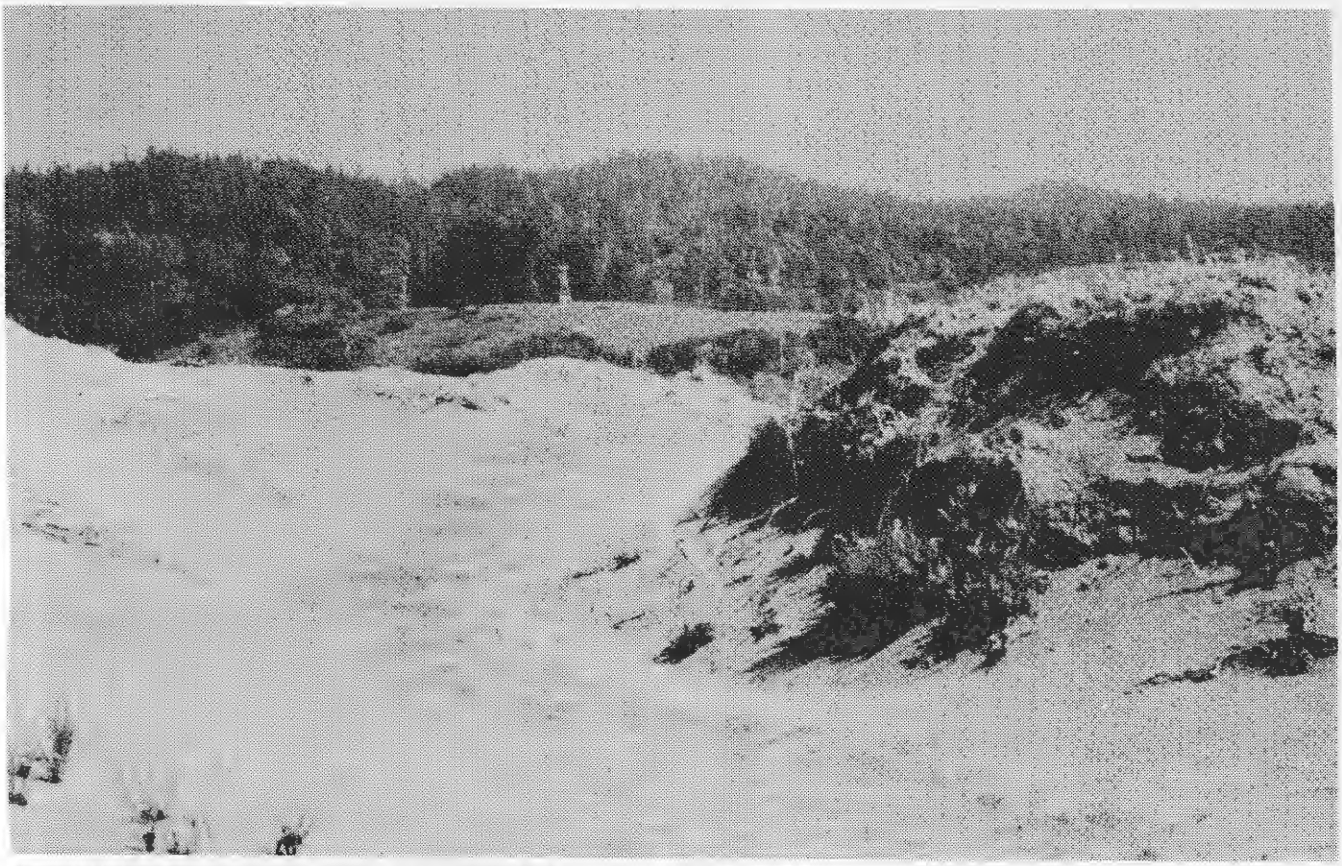
This study is a simple one, mainly because of our limited resources. It involves the measurement of two different adjoining dunes as follows: (A) a large dune, 25 feet high and 150 feet long, the lee side facing in a southwesterly direction, supporting no apparent vegetation on the face or top of the dune; and (B) a small dune, four to eight feet high and 200 feet long, the lee side facing in an easterly direction, supporting heavy- to light-density vegetation on both the slope and the crown of the dune.

Dune A moved a total of five feet between March 15 and October 15, 1973. The absence of vegetation on both the face and the top of the dune, along with a large supply of sand without vegetation for a distance of more than 200 feet to the northwest, are apparently the factors that allowed for this significant movement of a large quantity of sand during this seven-month period. About three of the total five feet of movement noted above was found to occur from March 15 to May 15, 1973, a period of strong and nearly continuous winds.

The examination of this dune for rodents, insects, and spiders revealed that they cannot live in this rapidly moving dune. This, together with the absence of plants on this dune, indicates that this large, sterile dune will continue to move over a very dense plant-covered dune swale until the sand supply nourishing this dune runs out. Judging from the sand supply, this dune would move at the present rate for many years.

The reasons for the absence of plant and animal life on this dune are somewhat speculative, but during this study period, at least 12 different dune-buggy tracks were noted on the dune top and dune sand supply area. The total actual number of dune buggy tracks is not known because the wind-blown sand in this area is so great at times that tracks seen one week were usually covered with sand a week later. The contour of sand in this area and the wind conditions could also be significant factors in this dune movement, either alone or in conjunction with the dune buggy operations.

Sand dune B moved a total of three inches between March 15 and October 15, 1973. No doubt the presence of natural vegetation and the observed, associated sand-dune-dwelling rodents, insects, and the common trapdoor spider all played their part in stabilizing this dune. The absence of



Once stabilized dunes now on the move due to ORV activity (W.J. Barry 7/75).

dune buggy activity, the smaller sand supply behind the dune, and the lower height of this dune also aided in its slower movement pattern. In addition, the fact that this dune faced in an easterly direction and was probably less affected by wind movement contributed to its slowness of movement.

The results of this preliminary study, together with general observations on a number of other dunes in the area, showed several important points: (1) each dune is unique and has its own features and its own history; (2) well-stabilized dunes – those with a good complement of native plant and animal life – are less likely to move any considerable distance than are those without naturally occurring animal and plant life; (3) the fragility of these dunes should be of considerable concern in determining their use, and any form of impact by man, whether it be walking, dune-buggy riding, motorcycle riding, or horseback riding should be taken into account before planning for any or all uses of the dune area; (4) several more sophisticated studies of dune movement should be undertaken immediately to determine whether any form of man's impact can or cannot be tolerated, particularly in dune areas near the northern edge of Inglenook Fen. Dune stabilization techniques also need testing.

Below: Note sand stratification indicating long period of dune stability. Vegetation is helping preserve this dune remnant from wind erosion.

Dune movement measured one foot per week in June 1974 (P. Rauch 6/74).

Residential Development

Some of the effects of residential development are (1) disturbance of the soil-vegetation mantle; (2) increase in human population; and (3) introduction of human sewage.

Disturbance of the Soil-Vegetation Mantle

The removal of vegetation and disturbance of the soil accelerates erosion in the watershed. Most erosion occurs during construction, when the soil has been exposed to the elements. There is significant erosion at cuts, fills, roadsides, culverts, and downstream areas. The exposure of soil during construction can result in sediment production equal to ten times the normal from cultivated lands, 200 times that of grassland, and 2,000 times that of forest lands (Wark and Keller, 1963).

Of all the activities associated with urbanization, the construction of roads and house pads has the most serious impact on the soil mantle. Studies in the north coast ranges show that as road density increases, sediment production increases at an exponential rate. Degree and length of slope are factors in soil erodibility. Not only are steep slopes more subject to erosion but also, as the length of slope increases, the rate of erosion increases. Also as slope increases, cubic meters of cut and fill required for road construction increase exponentially.

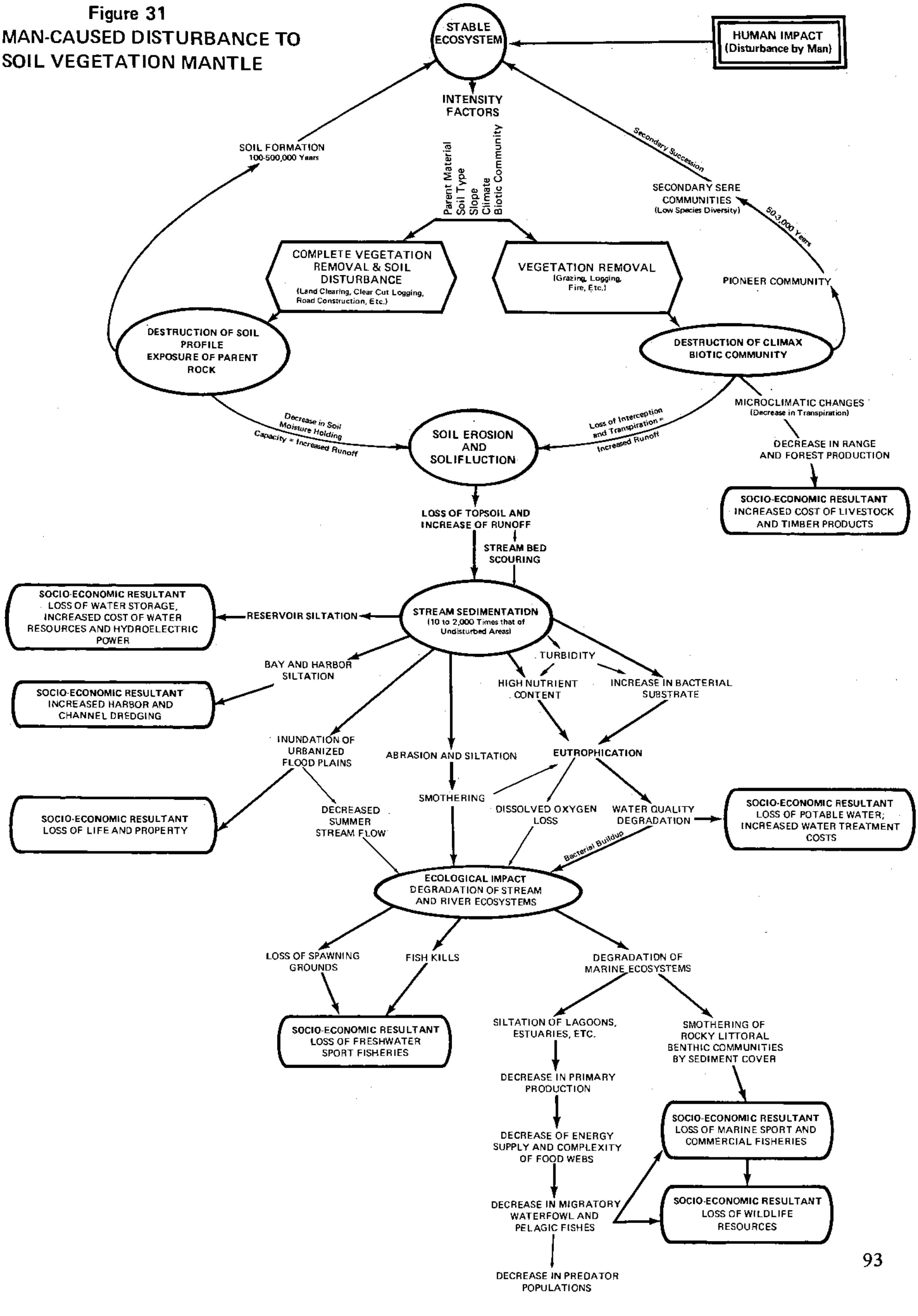
On the north coast in areas where road density is less than one kilometer per square kilometer (one mile per square mile), the erosion rate averages 47 hectoliters per square kilometer (.01 acre feet per year per square mile). However, if road density is 20 kilometers per square kilometer, the erosion rate is 2,860 hectoliters per square kilometer (.6 acre feet per square mile). (California State Division of Soil Conservation, 1971.) Even greater rates can be expected for much of the Ten Mile River watershed, where tractor yarding roads are of very high density. On Simpson Lane slight gullying on part of the road indicates that accelerated erosion has been caused by construction and use of this road.

Impervious surfaces, along with more efficient water conveyance facilities, concentrate and accelerate the water flow and reduce infiltration of water into the soil.

Vegetation and the litter from vegetation intercept the rainfall and allow more of the water to percolate into the soil without running off. Vegetation prevents the raindrops from detaching soil particles. When vegetation is removed, the full impact of raindrops loosens the soil and carries it away. According to Neilson *et al.* (1971), increasing impervious surfaces with buildings, roads, paths, and yards increases the runoff potential 10 to 50 percent. Harris and Rantz (1964) found that in the Permanente Creek watershed during a period of major urban development, storm runoff volume increased dramatically as a result of the increase in impervious surfaces in the project area from about 4 percent of the total area in 1945 to 19 percent in 1958; the ratio of outflow from the area (including channel seepage) to inflow increased from 1.18 to 1.70. The increase in impervious surfaces and faster transportation of water result in greater runoff with reductions in infiltration, transpiration, and evaporation (California State Department of Conservation, 1971).

There is disruption of drainages associated with development. Construction on Simpson Lane has altered the drainage patterns. In one location, water that had previously flowed in a natural channel was altered by development. Afterwards, sediment in the water silted a shallow well. Water now periodically floods the land of one homeowner.

Figure 31
MAN-CAUSED DISTURBANCE TO SOIL VEGETATION MANTLE



Although some sediment is normally contained within streams, an increased sediment load from accelerated erosion would have undesirable effects on the streams of the watershed and especially on the fen. The larger sediment particles have an abrasive action on the organisms living in the streams, and the smaller particles would tend to smother bottom-living organisms in the quieter sections of the streams and Sandhill Lake. The turbidity of the water would decrease transmission of light and cause more of the heat energy of the sunlight to be absorbed in the surface layer. The deeper water of the lake would have less light and heat. The decrease of light at lower depths would decrease the growth of phytoplankton and aquatic higher plants. There would be greater stratification set up between the surface layer and the deeper portion of the pond so that there would be less nutrient and oxygen exchange between the surface and the deeper portion.

Toxic substances, such as pesticides and nutrients absorbed by the soil particles, could be released after the particles have been deposited in the bottom of a body of water. An increase in nutrients brought down in an increased sediment load, along with nutrients from other sources, such as septic leach lines, can disrupt the fen ecosystem. Also, siltation from erosion might clog infiltration areas that percolate water through the soil to groundwater storage. Present data indicate that 46.9 metric tons (51.7 tons) reach the fen per year.

When vegetation is removed, soil is disturbed, or impervious surfaces are created, more runoff occurs, and less moisture is absorbed by the soil. Not only is erosion increased, but there are also greater fluctuations in the amount of soil moisture from season to season. There is less moisture contained in the soil during the dry season and less underground water storage.

An increase in runoff would increase the frequency and amplitude of flooding within the fen and would accelerate stream bank erosion downstream, since the streams would have greater ability to transport sediment. A review of several studies on peak runoff in the northwest shows that the peak runoff in developed areas may be increased by 1.2 to 5 times the peaks of undisturbed rural conditions.

Increase in winter runoff would decrease the recharge of water-bearing aquifers (subsurface water-storing areas) which, according to the California State Department of Water Resources (1956), supply a large part of the water in the area for domestic use. Depletions of aquifers is already a problem with resultant water shortage occuring in some wells on the fen watershed. With increased runoff, the level of the streams flowing into the fen would fluctuate more from season to season and would cause vegetative changes in the fen. The reduction of soil moisture would alter evapotranspiration rates, favoring a shift to more xeric plant communities within the watershed. A reduction of oxygenated surface water flowing through the center of the fen would encourage sphagnum growth with subsequent peat moss accumulation. Eventually a raised bog would be formed, and the fen would be lost. The communities of the fen are controlled largely by the level of the water, and fluctuations created by development could alter the communities present and reduce species composition.

The impacts due to man-caused disturbances to the soil-vegetation mantle are summarized in Figure 31.

Increased Human Population

The direct effects of increased human population are increased pollution – noise, air, and water – and increased water usage. Wildlife would also be affected by increased noise, encroachment on their habitats, and harassment or competition from domestic animals. The greatest threat, however, is contamination of groundwaters.

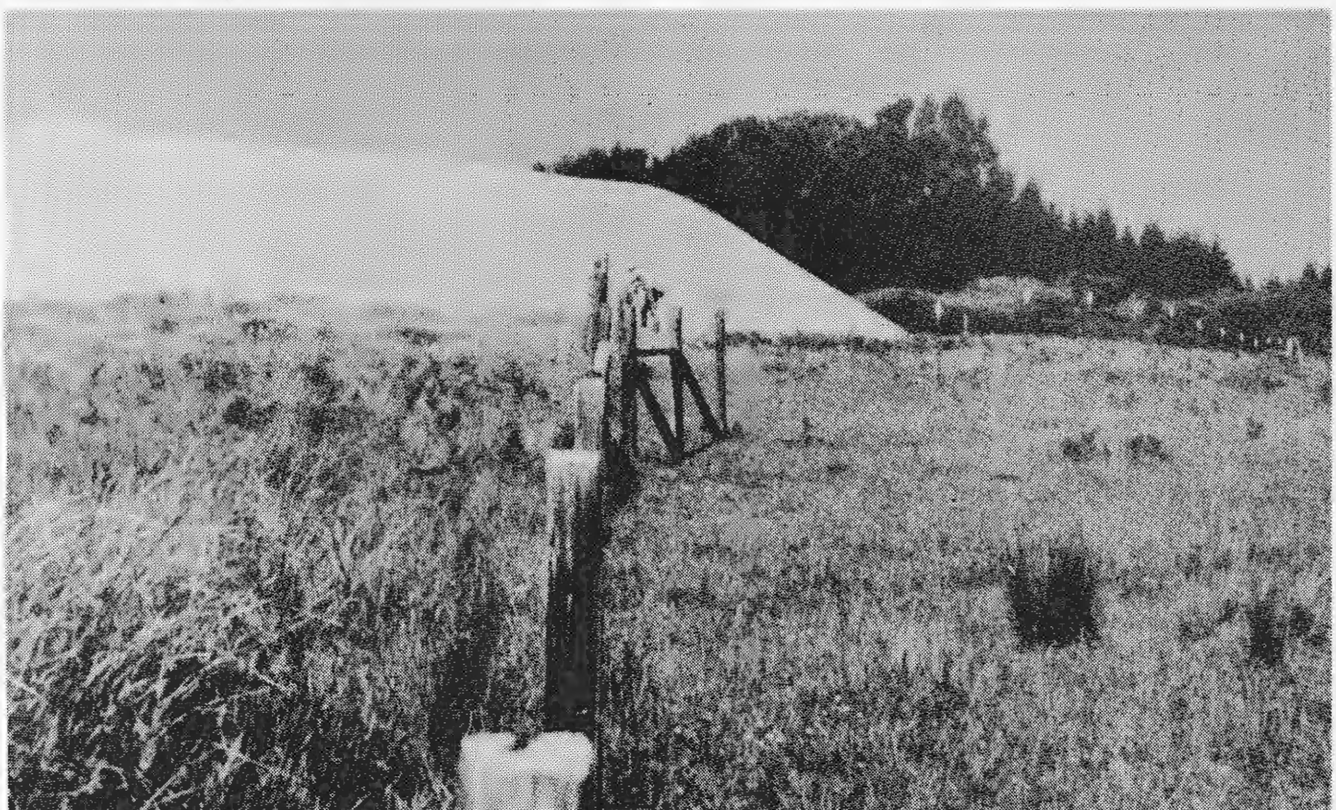
Availability of groundwater may be the limiting factor controlling development in the watershed. One resident family's well pumped only 11 liters/hour (3 gallons/hour) during August, down from 110 liters/hour (30 gallons/hour) during peak production. Water is scarcest during the summer months, which is the period of greatest population. Utilizing a water requirement of 450 liters/day (120 gallons/day) per person and multiplying by the summer population of 146 yields a summer water consumption of 73,290 liters per year (17,520 gallons per year). If too many houses are allowed in one area, both water scarcity and underground water contamination are likely to occur.

Septic Tank Leach Lines

Most of the Inglenook Fen watershed has a slope greater than 9 percent and has severe soil limitations for the building of septic tank leach lines. The effluent from the septic systems can emerge downslope and become surface runoff or it can percolate as groundwater to downstream areas. The soils of the watershed are generally well drained and permeable but east of Highway 1, the

Above: Dune position in the Ross pasture during 1972 (W.J. Barry 7/72).

Below: Dune position in the Ross pasture during 1975. A comparison of the two photos clearly reveals significant dune movement (W.J. Barry 7/75).



shallow terrace deposits are underlain by impervious Franciscan graywacke within a few feet of the surface so that much of the water drains into the fen as subsurface drainage, along the top of the graywacke layer.

Pollutants from sewage can travel both vertically and laterally for considerable distances. Coliform bacteria may penetrate to a depth of 3 meters (10 feet) and move laterally with groundwater over 61 meters (200 feet), but, as a rule, less than 122 meters (400 feet). Anaerobic iron bacteria (bacteria that use iron as a substrate) may occur to a depth of 15 meters (50 feet) and have been traced to springs 480 meters (1,500 feet) from the source of pollution (Burch, 1969).

The California State Department of Water Resources data indicate that the mineralogical composition of the water from wells in the area corresponds fairly closely to the mineralogical composition of the surface water, so that there is probably a close interrelationship between surface water and groundwater. Thus the nutrients present in wastes would be brought down in the drainage to the fen, and the fen would act as a nutrient sink, filtering out nutrients from the waters and adding these nutrients to the biomass of the fen ecosystem.

Each person in the watershed, on the average, contributes nutrients equal to the output of nutrients from 0.4-2 hectares (1 to 5 acres) of watershed. If development occurred so that there was one dwelling per 0.8 hectares (two acres), each containing 3.6 persons, the nutrient output from sewage would be increased about 36 to 180 percent over the natural output (that being leached from the soil and biomass of the watershed).

Zoning and Lot Splits

The 1973 population of the Inglenook Fen watershed was estimated to be 146 residents during the summer months and 110 the remainder of the year. On Simpson Road-Blueberry Lane, located directly above the fen, the winter population may only be 14, whereas 35 dwell there during the summer.

In a survey conducted, the area's residents indicated some opposition to increased density; however, many felt that provisions of the Minor Division Act (Chapter 17, Article II, Section 17-20, of the Mendocino County Code) would prevent it, but this has not been the case. There are approximately 520 hectares (1,284 acres) in the watershed, 197 (485) of which are zoned S-A:B 2

Sand movement has destroyed much of the Ross pasture. Trucks are filled with stumps and slash used to help stabilize the dunes (W.J. Barry 7/75).

New dune encroachment in the fen has created blockage of the normal flow of Fen Creek which may cause increases in mosquito populations (W.J. Barry 7/75).

(two-acre minimum lot size). Some 81 (220) could be broken into minimum lots, and although this probably will not happen, a sizable increase in density is permitted under current zoning. The "Minor Division Act" does not effectively prevent such high densities. A "minor division" is a division of land into two, three or four lots or parcels. However, once any lot changes ownership, it then can be broken again into four parcels or fewer. This process can continue so long as zoning regulations and provisions of the Minor Divisions Committee (County Planning Department) are satisfied. This may soon be occurring in 30 hectares (73 acres) along the east side of State Highway 1 from Simpson Road northward. Ralston Ross has recently sold three 9.7 hectares (24-acre) parcels (parcels 67-13-36, 67-13-37, 67-13-38). One parcel (67-13-36) has already been broken into four lots of six 2.4 hectares (6 acres) each (67-13-41 to 67-13-44). The other two 9.7 hectares (24-acre) parcels have not been further divided; however, one is owned by a local realtor (refer. County Assessor's Map).

A second reason that increased development seems likely to occur within the watershed involves the increasing land values and higher land taxes. One resident's land taxes have increased 1,600 percent in the last four years; further, the timber tax works a hardship upon landowners with forested acreage and increases pressures to log or sell.

It is necessary to limit housing density if Inglenook Fen is to be preserved. Use permits for the construction of such high-density units as schools, motels, or rest homes should be denied, and commercial and industrial use restrictions should be imposed. Furthermore, ecologically fragile areas and areas close to the fen should have stricter zoning regulations than S-A:B 2.

The north and northeast portions of the watershed are also particularly vulnerable because of steep slopes with proximity to the fen. Housing density should be limited on slopes exceeding 9° (moderate erosion hazard) and largely prohibited on slopes exceeding 17° (severe erosion hazard). Disturbance of the slope areas and increased development will increase erosion rates and subsequent sedimentation of the fen basin. Currently 46.9 metric tons (51.7 English tons) of sediment per year are entering the fen through the five streams.

Increased development has resulted in siltation problems within the watershed; for example, construction during 1968-69 on Simpson Road altered the surface drainage of water. Previously the water flowed in natural channels but it now rushes down the hill and onto Mr. Hess' property causing siltation to occur in his shallow well. Consequently, he has had to drill a second, deeper well. Both these instances illustrate that planning and construction in the watershed must be within the ecological limitations of the land.

Inglenook Fen can be preserved only if land use within its watershed is carefully evaluated and controlled through strict nonvariance zoning and judicial tax assessment. Zoning should be based on ecologic limitations of the land, and taxation should be based on both ecological limitations and long-term socioeconomic considerations.

Figure 32
INGLENOOK FEN AND ITS WATERSHED

ECOLOGICAL LIMITATIONS

ON LAND USE

W. J. Barry

Rational land use planning must consider the inherent limitations of the land. These limitations are dependent on environmental factors – both abiotic and biotic. The abiotic or physical environmental parameters are measured with less difficulty and more accuracy than are the biotic environmental parameters.

Abiotic parameters important to land use in the watershed are geologic, edaphic, climatic, and hydrologic. Biotic parameters include phytocoenosic and zoocoenosic.

Limiting geologic factors include geomorphic stability (Figure 33) and relief (Figure 34). Relief has long been considered by land use planners in the form of slope maps; however, geomorphic stability – the inherent structural strength of geologic formations – generally has not been considered.

Important limiting edaphic factors include physical properties of soils, such as depth, water-holding capacity, permeability (of the least permeable horizon), texture, structure, and surface wetability. These physical properties to a large part determine runoff and subsequent erosion. Physical properties of soil series have been measured for a number of benchmark soil profiles for soil series within the state. An erodibility index is currently being developed by the U.S. Soil Conservation Service. This erodibility index includes a climatic stress factor, which is based on the mean annual precipitation. The stress factor multiplied by the erodibility factor of a given soil type gives the erodibility index of a site (Figure 35). The climatic stress factor should also include maximum sensitivity and duration of precipitation.

Hydrologic parameters are important in that pollution of the groundwater (Figure 36) can occur, and groundwater levels can be depleted. Phytocoenosic parameters include the fragility, the regeneration rate and the transpiration rate of the vegetation. A fragility rating for the different biotic communities of California is currently being compiled by the author. Zoocoenosic parameters include the tolerance levels of wildlife to human activity, wildlife populations stability, and the human factor; i.e., level of current human disturbance of the site or area. Other important biotic parameters include habitats of rare and/or endangered plants and animals, unique ecosystems (such as Inglenook Fen), and superior examples of biotic communities of regional or statewide significance.

Cultural factors should also be considered in land use planning. Cultural areas include historical and archeological sites.

The ecological limitations on land use (EL) can be calculated as follows:

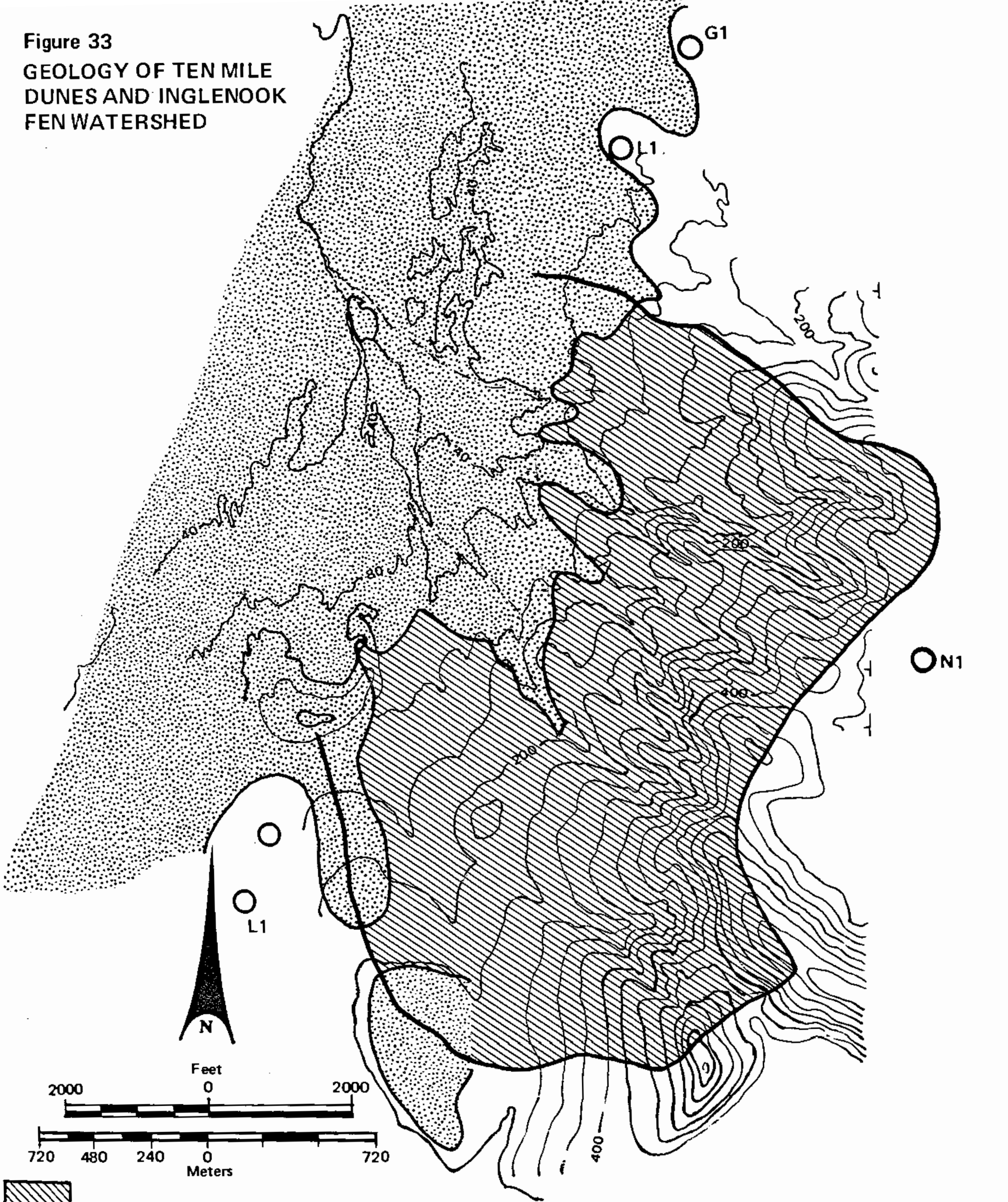
$$EL = f(S,G,E,C,H,P,Z,U,Cu)$$

where S is slope; G is geomorphic stability; E is soil erodibility; C is climatic index; H is hydrologic limitations; P is phytocoensis; Z is zoocoenosis; U is biotic uniqueness; Cu is cultural factors.

A computer analysis of the data presented in this report is needed in order to delineate accurately the ecological limitations of the Inglenook Fen watershed.

Figure 33

GEOLOGY OF TEN MILE DUNES AND INGLENOOK FEN WATERSHED



Franciscan Formation - moderately stable
Consolidated marine sedimentary and volcanic rocks.
Non-waterbearing - however can yield very limited (1.9 - 38 lpm or 0.5 - 10 gpm) quantities of water to wells.
Water runs off with little recharge to subsurface.

Recent Deposits - highly unstable
Unconsolidated alluvium, marine terraces, and sand dunes.
Locally waterbearing - can yield moderate (19 - 28 lpm or 20 - 30 gpm) amounts of water to wells.

O Well logs reported by DWR (1965).

Figure 34
SLOPE CLASSES FOR INGLENOOK FEN & ITS WATERSHED

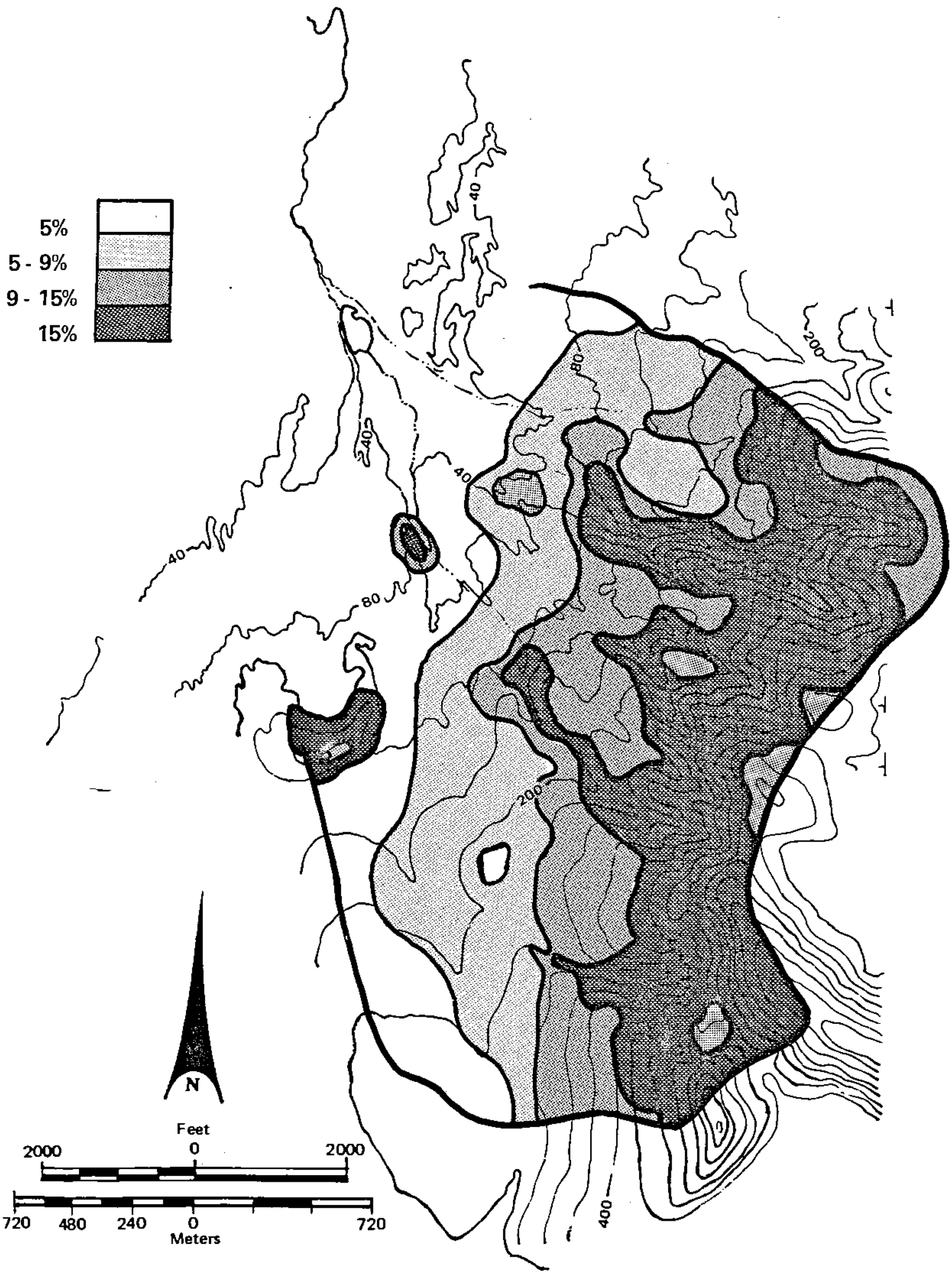


Figure 35
ERODIBILITY RATING, INGLENOOK FEN WATERSHED

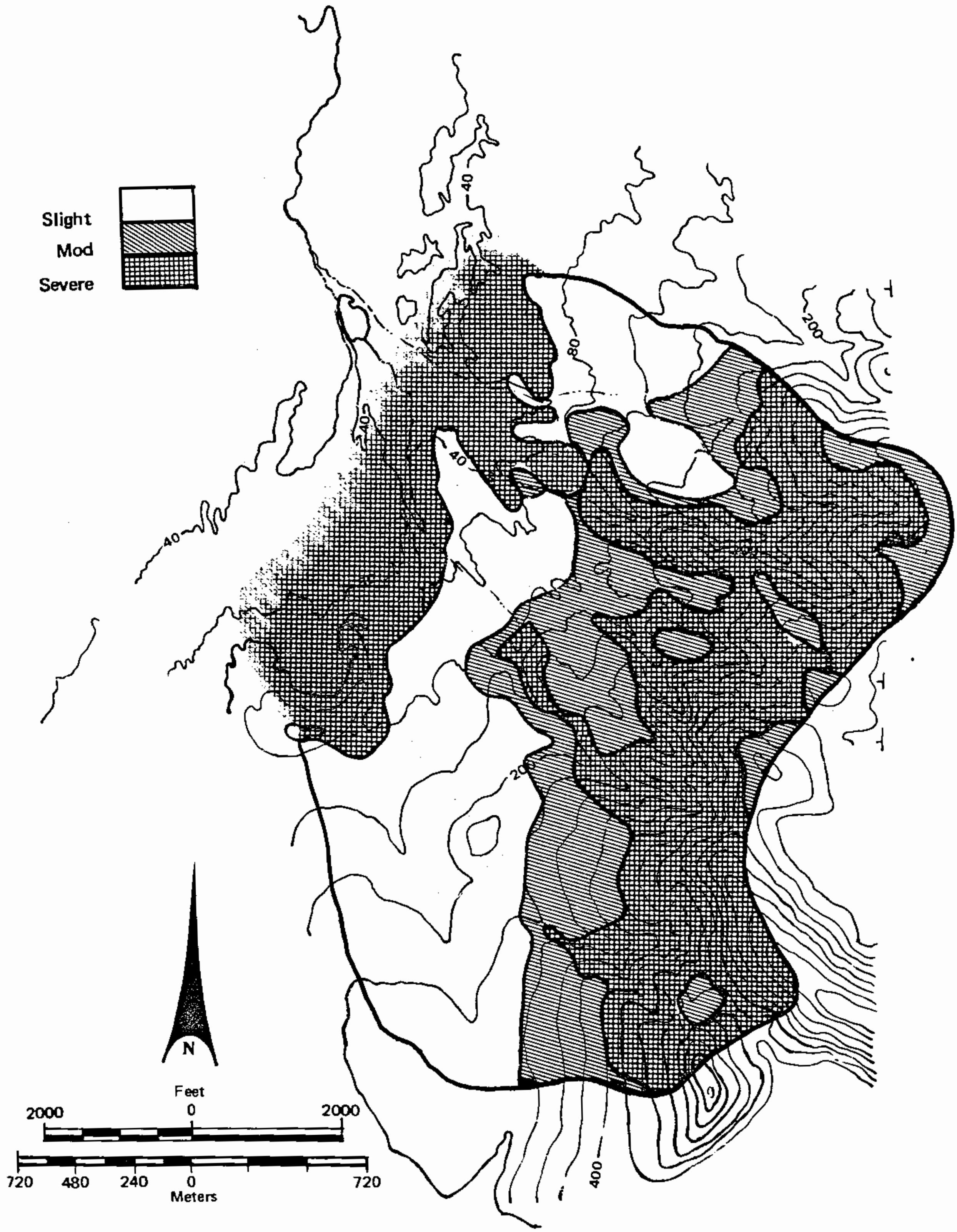


Figure 36

SOIL LIMITATIONS RATING FOR SEPTIC TANK FILTER FIELDS, INGLENOOK FEN WATERSHED

Soil limitation rating based on soil depth, slope, permeability, percolation rate, water table, soil drainage, and overflow or flooding hazards.

Rating according to Soil Survey Manual 169-172. Coarse-textured material may allow contamination of water supply.

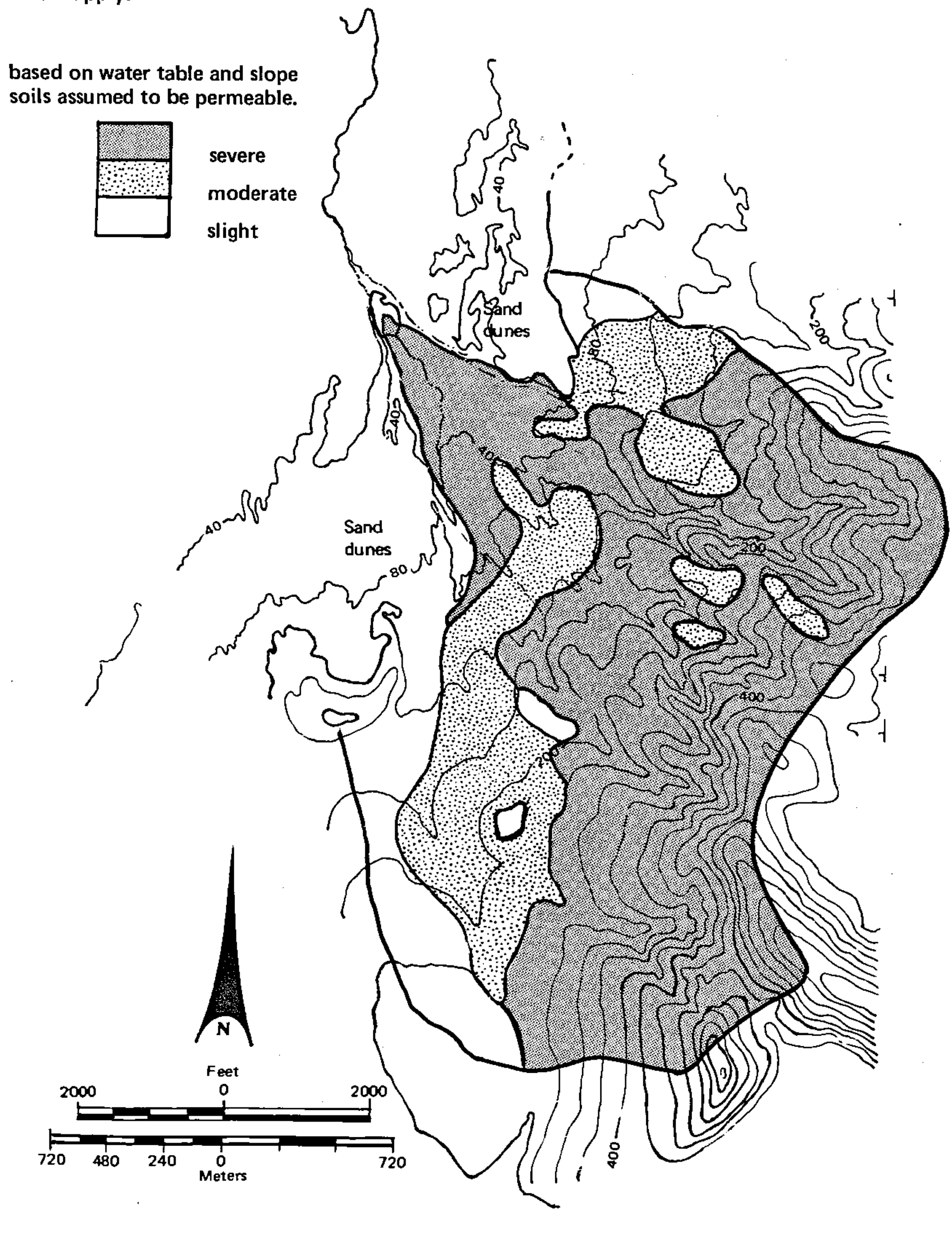


Figure 37
ECOLOGICAL LIMITATIONS
ON LAND USE

SUMMARY

W. J. Barry and M. Frankel

Geologically speaking, Inglenook Fen is at least 5,000 years old and was formed by the blockage of Fen Creek by coastal sand dunes. The fen is undergoing primary or geologic succession towards a fen-carr.

This geobio-evolutionary process is a long-term phenomenon requiring many thousands of years under natural conditions. However, man-caused disturbances to the soil-vegetation mantle greatly accelerate and distort the successional process.

If sediment loads are above natural geologic rates, the succession accelerates toward a bog or marsh.

A diminished water supply to the fen accelerates succession toward a bog. In addition to changes caused by watershed distrubances, changes result from activities on the dunes. The destruction of dune vegetation accelerates dune movement which covers portions of the fen, fen-carr and north coastal prairie biotic communities.

In order to protect the fen-dune ecosystem land, use must be controlled in the watershed and activities must be controlled on the dunes. The greatest danger to the fen appears to be increased sediment loads caused by soil erosion during and after construction of roads, house pads, etc. Soils of the upper watershed have very high erosion hazard potential. Most soils of the watershed have severe physical limitations for septic tank filter fields. These limitations are tied directly to nutrient loads in the ground and surface waters entering the fen.

About 70% of the water entering the fen enters directly from the groundwater aquifer of the watershed.

The fen is acting as a nutrient sink; most nitrogen entering from the watershed is tied up in the soil and vegetation of the fen. Slight increases in nutrient loads would drastically alter the fen vegetation. Fen species will not tolerate high phosphate, hydrogen sulfide, or nitrate levels.

The fen is dependent on adjacent dunes for calcium and pH control.

Loss of surface and groundwater flow from the watershed would tend to turn the fen into a bog community with a drastic decrease in species diversity and community stability. Home development greater than one residence per two acres will have a detrimental effect on the fen.

The Ten Mile Dunes roughly doubled in size between 1920 and 1943. This is attributed to heavy logging activity and subsequent erosion and sedimentation in the Ten Mile River watershed. Most recent dune movements are due to off-road vehicle activity. Some dunes are moving inland at a rate of up to one foot per month. A Rein orchid from Alaska was found, but its prairie habitat was covered with sand during the course of this study, thus the only known California occurrence is recorded and lost.

Uncommon plant species, some of alpine or northern affinity are present in the fen. More than 500 arthropod species have been found in the fen-dune ecosystem. A whole new family of insects was discovered. A number of new genera and species have also been discovered during the study. Some genera and species were found which were previously not known from North America or California.

Natural mosquito control is occurring at the fen. The reasons for this are presently not clear, and more study is needed. More than 250 species of arthropods inhabit the dunes adjacent to the fen. Many are very specific in habitat and food sources. Some are restricted to stabilized dunes, some occur only on moving dunes, and so on.

Significant archeological values occur in the dune area and their protection is of great importance for a better understanding of the prehistoric human ecology of the Mendocino coast.

THE PLAN

W. J. Barry

Zoning Recommendations

In order to preserve the integrity of the fen ecosystem, the ecological limitations on land use within the fen watershed should be carefully considered. Results from studies in progress indicate that restrictions on land use and zoning within the watershed will be necessary if the fen is to survive. One of the greatest threats to the fen ecosystem is the introduction of human waste materials to the waters supplying the fen. The soils of the watershed are generally shallow (less than five feet to bedrock) in upland areas, where most of the current development is taking place. These soils have severe restrictions on placement of septic tank filter fields. In the winter months leach lines may surface, allowing raw sewage to enter the surface water system. The current two-acre minimum lot size zoning is sufficient to protect the fen in low erosion areas, but a more restrictive zoning (4- to 20-acre minimum lot) is needed in moderate and high erosion areas. If more intensive development is allowed, sewage treatment facilities should be provided for exportation or tertiary treatment of sewage. Restrictions on grading and drainage designs should be implemented.

Acquisition

The State Department of Parks and Recreation is currently negotiating acquisition of portions of the fen area. If strict, proper zoning is not maintained in the watershed, acquisition of part or all of the watershed may be necessary in order to protect the integrity of the fen. The current acquisition project should include all the dune system and the marsh area along Ten Mile River. Figure 38 delineates the recommended acquisition plan. The undeveloped east portion of Little Valley (directly east of the fen watershed) has high park values and should be included in a long-range acquisition plan. The perimeter of this valley is ideal for campground development. Assessed values are presently between $800 and $2,000 per acre in this area.

A virgin redwood stand still remains on a BLM parcel on the Little North Fork of Ten Mile River (Sec. 1, T 20 N R 17 W). The natural values of this stand should be investigated.

Classification

The fen-dune system should be classified as a natural preserve within MacKerricher State Park or classified as a State Reserve (separate unit). This preserve should encompass all the dunes south of Inglenook Creek. The dune areas north of Inglenook Creek have been proposed as an off-road vehicular recreation area; however, preliminary investigations on ORV use and dune movement indicate protection is needed. The northern dunes should be incorporated into MacKerricher State Park or into a new State Reserve and should also be considered for natural preserve status.

Protection

ORV activity should not be permitted. This could be accomplished by fencing and/or increased staffing to patrol the proposed preserve area. The fen and dune ecosystems as well as the archeological sites are extremely fragile. Visitation should be limited to the perimeter of the fen via a well-planned nature trail. Entering should be limited to groups accompanied by an interpretive ranger. Sandhill Lake, Inglenook Fen and Fen Creek are recommended for inclusion in the State Water Resources Control Board's system of "Areas of Special Biological Significance." This classification will add federal protection to the Fen, as the program is funded by EPA.

Resource Management

A resource management program should be based on continued ecological monitoring of the fen-dune system. Water quality and quantity should be monitored on a continuous basis. This can best be accomplished by installing on site water quality and quantity sensor devices on each stream inlet and the outlet of the fen. These devices can feed data to a central remote recorder. Permanent plots should be established in each biotic community. Plots should be located both in high and low use areas for determining human impact and carrying capacities of each ecosystem. Plot sizes and numbers must be determined by statistically sound methods. Edaphic relationships should be analyzed for each plot. Soil moisture, temperature, oxygen partial pressure and carbon dioxide partial pressure should be monitored periodically. Percent vegetation cover and species frequency should be established and monitored annually. The microfauna for each plot should be established and monitored periodically.

The scientists who have been investigating the fen have noted that the fen is too fragile to allow much visitation. Scientific and educational use of the fen will need to be carefully coordinated and controlled. The fragility of each ecosystem must be carefully considered in the resource management program. Monitoring of plots will allow changes of use intensities or management practices if degradation is detected.

Entrance to the fen and dune system would be best controlled by organized entry with the presence of an interpretive ranger. Entry to the dunes north of Inglenook will not have to be as closely controlled. However, designated trails may need to be established. The fragility of the dune vegetation is such that all foot traffic must be directed away from vegetated areas.

The north coastal scrub ecosystem is more resilient than the coastal dune and coastal strand. The soils, however, may be quite fragile and access trail design will be important to perpetuating this ecosystem. Wind direction and micro-topography are important environmental parameters to consider.

The north coastal prairie is perhaps the most resilient ecosystem in the study area. However, uncontrolled access can cause damage, especially in wetter areas. Foot and vehicular traffic will cause soil compaction, especially when the soil is saturated. The young, succulent spring growth of annual grasses and herbs also causes seasonal fragility. Summer and autumn use can be much heavier than spring and late winter use.

Native grasses of the north coastal prairie have evolved under conditions of frequent fire and light grazing from Roosevelt elk and blacktail deer. With cultivation, domestic grazing and absence of frequent fire, the species composition has changed drastically in favor of introduced annual species of mediterranean origin. To shift the competitive advantage back to native species, these environmental conditions must be restricted. Management would include annual or biannual autumn prescribed burns and release from grazing pressure.

Forest ecosystems may require periodic burning to restore the natural fire cycle for these ecosystems. The use of fire is not recommended at this time due to the fen's delicate association with the coastal dune complex. The coast redwood groveland, parkland and forest mosaic can only be maintained through the use of prescribed burning at intervals varying from 1 to 25 years.

All trails or park facilities must avoid archeological sites. Internal fences and roads should be removed or obliterated.

The Fen Creek estuary is a feeding ground for shore birds (7/72).

Future Research

The study portion of this report, although lengthy, is far from complete. Soils analyses for the soil types in the watershed are needed. Biomass and energy flow data are required before the dynamics of the fen-dune ecosystem can be understood. The hydrologic cycle data reported are for less than one year. Erroneous conclusions can be drawn from short-term data. At least three consecutive years of study are required before conclusions reported here can be confirmed with certainty.

Much more research is needed on the ecosystem concept of management in the State Park System and on the ecological limitations of land use. Data presented in this study could be used to form a computer model for watershed-ecosystem management. The necessary methodology could be determined after another year's research. After successful application to the fen, the methodology could be systematically applied to resource management problems of other units of the State Park System.

The autecology of most of the organisms associated with the fen is not known and requires further research to determine the place of these organisms in the community and for interpretive purposes.

The natural mosquito control in the fen warrants much further research. Findings would be useful in initiating biological mosquito control in other wetlands of the state.

The archeological sites associated with the fen are a vast storehouse of knowledge of aboriginal human ecology, a storehouse which can be unlocked through scientific excavation and through the evaluation of the data recovered.

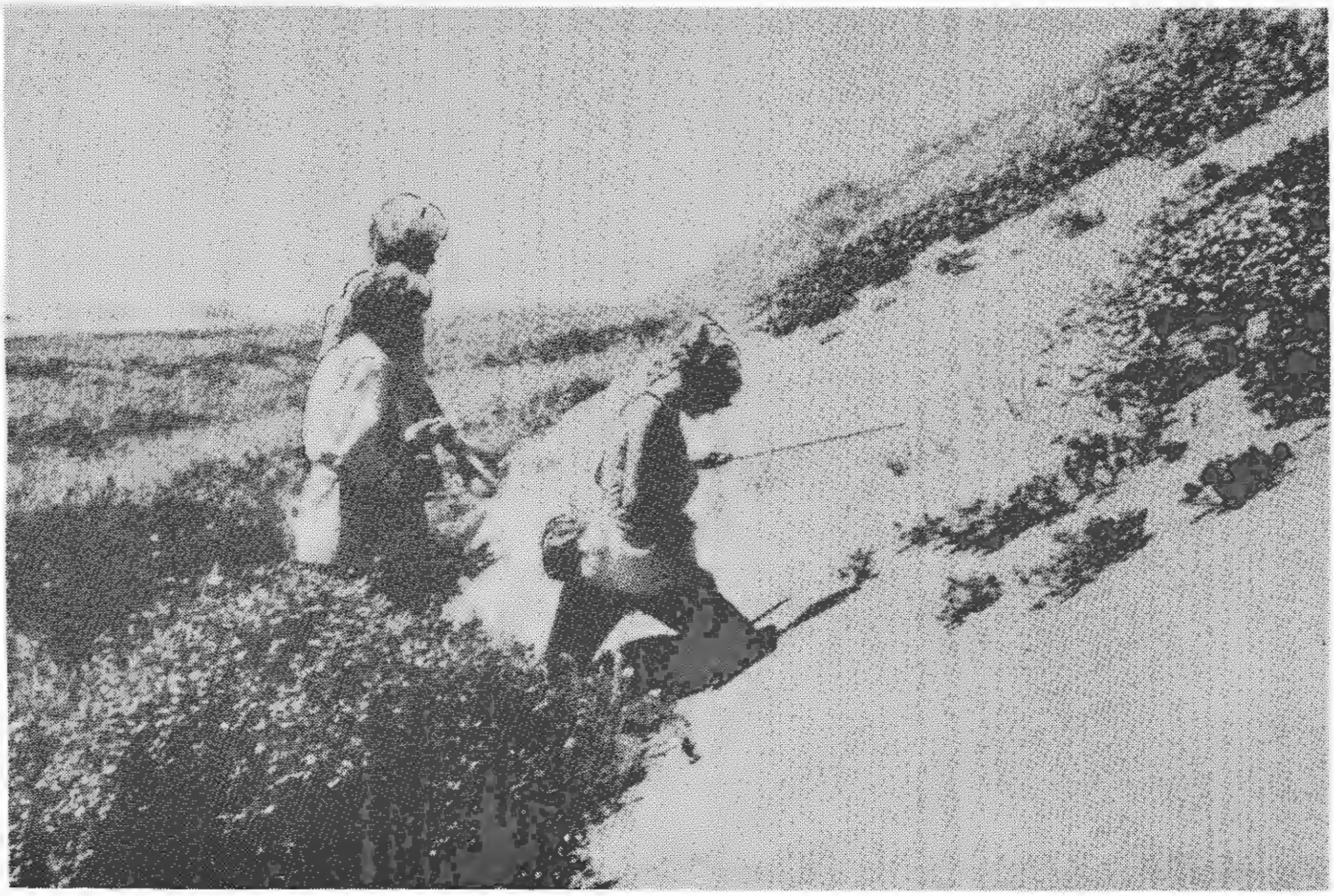
Interpretation

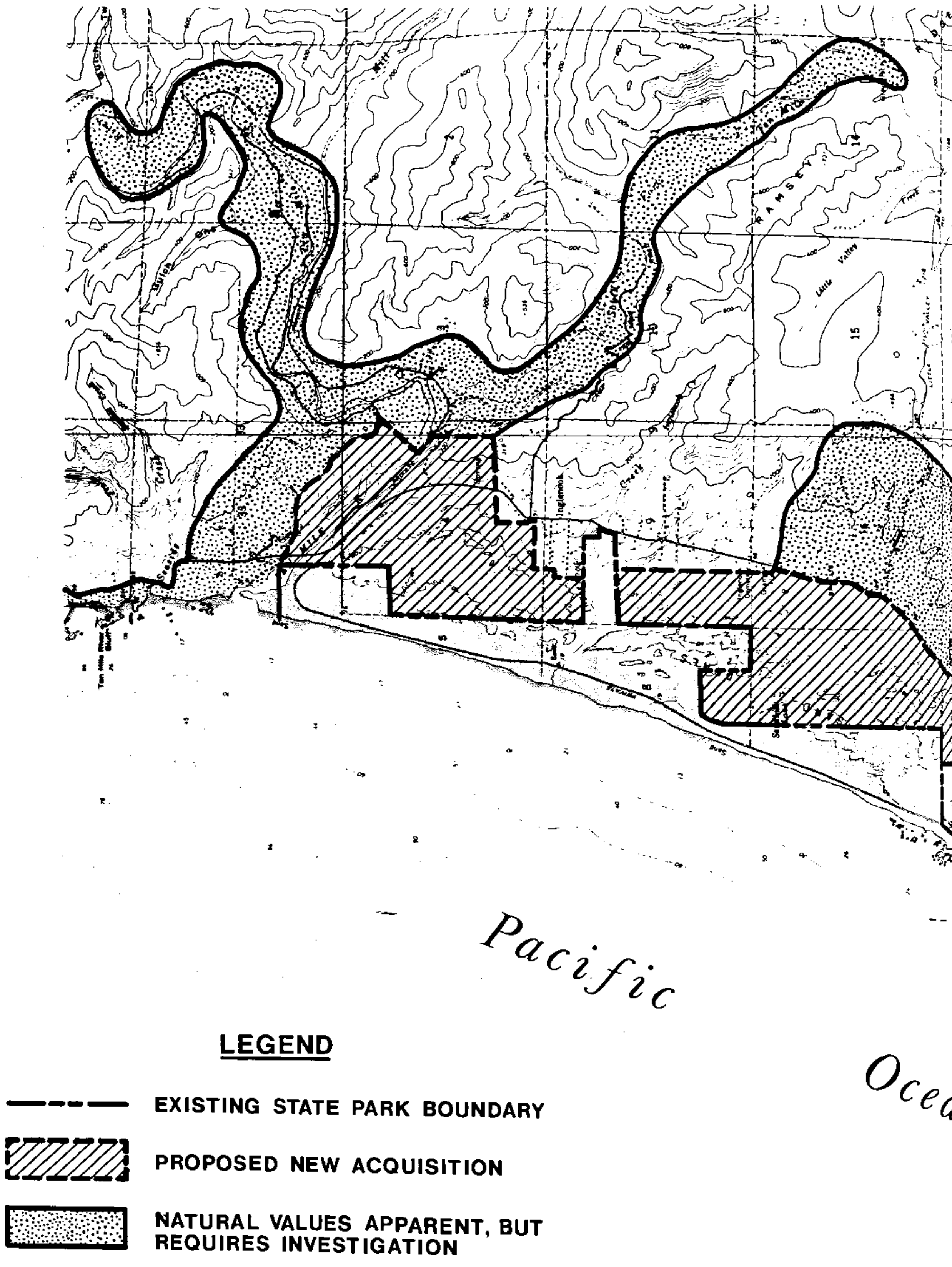
The fen-dune ecosystem has numerous interpretive possibilities. These will be more apparent after research is completed on the fen. The fen-dune story would make a fascinating natural history movie, especially in conjunction with the pygmy forest ecological staircase, which contains the ancient Gorra Dune and several bogs on the highest and oldest terrace. The Gorra Dune is believed to be one of the oldest stabilized dunes on the west coast; it may represent a million years of geobioevolution, contrasting with the young, active Ten Mile Dunes system. The Mendocino coast has a unique ecology and an important natural history, as well as some of the most scenic and diverse landscapes in the state. The chance to appreciate this natural wonderland should be had by all, and could be made possible through interpretive films and books on natural history.

California Native Plant Society field trip to Inglenook Fen. The fen and dunes are often used for educational and interpretive activities (W.J. Barry 7/75).

Drs. E. Schlinger and H. Baker collecting dune insects for study (W.J. Barry 7/72).

Ongoing research on fen and dune insects. Drs. Schlinger and Frankel and Ms. Buegler searching for new species of insects (W.J. Barry 7/75).





Pacific
Ocea
LEGEND
EXISTING STATE PARK BOUNDARY
PROPOSED NEW ACQUISITION
NATURAL VALUES APPARENT, BUT REQUIRES INVESTIGATION

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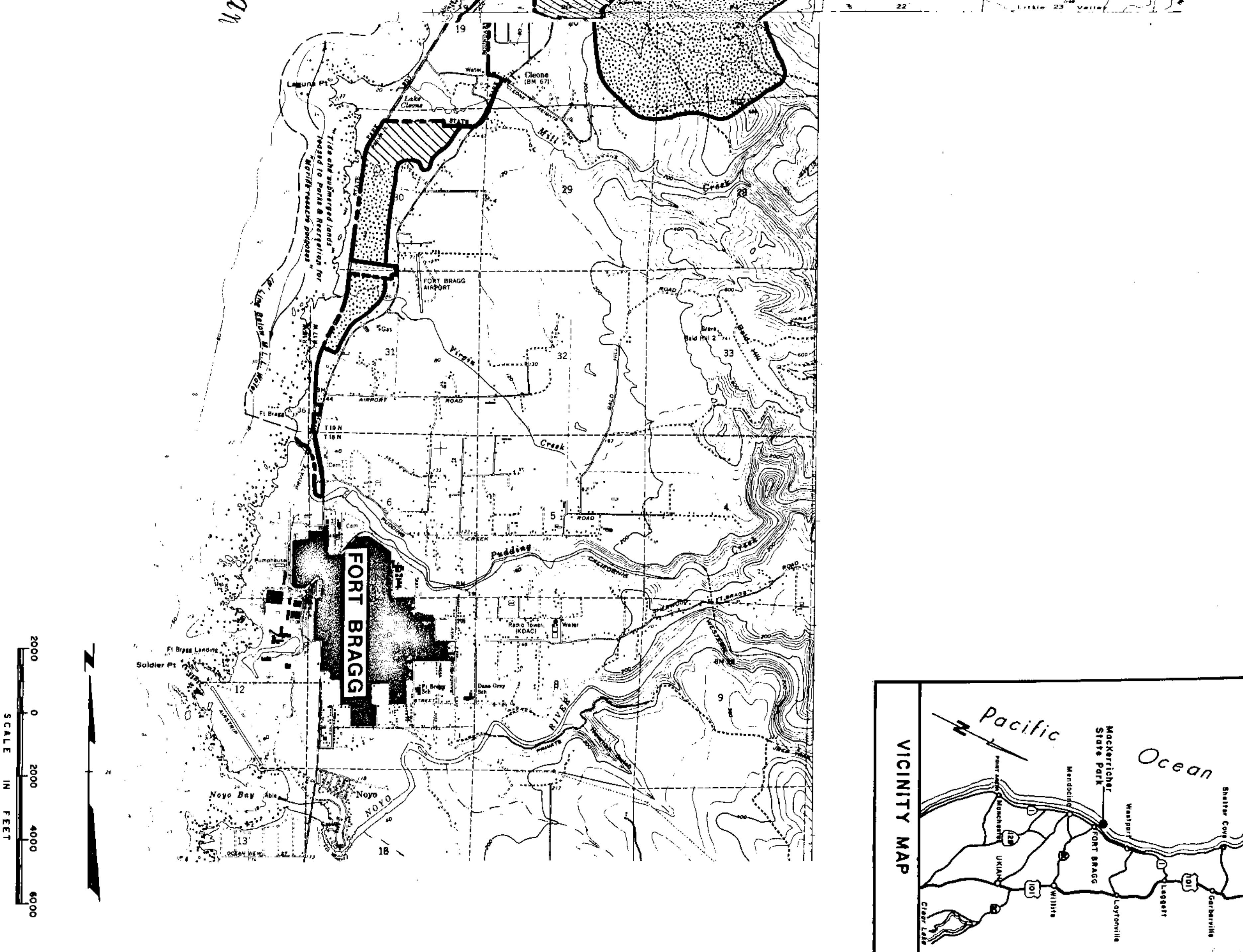

SHEET NO. OF	DRAWING NO.	**Figure 38** INGLENOOK FEN STUDY AND PLAN	RESOURCES AGENCY OF CALIFORNIA DEPARTMENT OF PARKS AND RECREATION APPROVED ____ DATE ____

REVISIONS	DATE	
		DESIGNED
		DRAWN
		CHECKED

Appendixes

CONTENTS
OF
APPENDIXES

Appendix A
METHODOLOGY

Hydrological Methods and Materials

Physical-Chemical

The following factors were measured on a regular basis from the fen streams: discharge, water temperature, pH, dissolved oxygen (O_2) calcium and magnesium content, total suspended sediments, and orthophosphate and nitrate contents. Occasional determinations were made of silica of streams and of aerobic limit, peat depth, 0_2, pH, and temperature of the fen and lake.

Flow was measured in two ways. The first involved catching stream flow in containers whose volume was predetermined. The time required to fill a container was measured with a stopwatch. All streams except A_{no}, A_{so}, and the outlet were measured in this way as they emptied from culverts that passed beneath Highway 1 (Figure 12). The other stream flows were determined by measuring a section for width, average depth, length, and average velocity. Velocity was determined by timing a float over a measured distance.

As measures of flow were obtained, water temperature was determined with a thermistor or mercury thermometer, and oxygen concentration was determined with a YSI Model 51A OO_2-temperature meter or by the Winkler method.

Small water samples were taken for pH determinations. Shortly after collection of the sample, pH was measured with a LaMotte colorimetric comparator (wide range pH 3 to 10 or narrow range pH 5 to 8).

Other water samples were taken for Ca-Mg and PO_4-NO_3 analysis. Samples for Ca-Mg analysis were preserved by addition of perchloric acid, filtered qualitatively before analysis, and brought to a concentration of 0.5 me/1 of strontium chloride to reduce interference. Analysis was performed on a Perkin-Elmer Model 303 atomic absorption flame spectrophotometer.

Separate glass bottles were used for PO_4-NO_3 samples, and they were stored one to three weeks in a refrigerator prior to analysis. Determinations were made on a Hach No. 640 direct reading colorimeter. Orthophosphate was measured by the Hach Stannaver method, and nitrate (after nitrite adjustment) by the cadmium reduction method.

An additional water sample was vacuum-filtered through a glass fiber filter (approximately 0.3 m pore size) that was preweighed. The filter was then oven dried and reweighed to determine total suspended sediments. This procedure would include inorganic as well as organic materials, although the dry organic matter would account for very little of the total dry weight on the filter.

Silica was determined with a LaMotte colorimetric comparator. The depth to which oxygen was present in the fen (aerobic limit) was determined by measuring the distance from surface to where staining developed on implaced redwood stakes (Erman, 1973). The absence of oxygen causes staining; thus the aerobic limit equivalent to the length of the unstained portion of the state. Cores of the fen, made with a Hiller-type peat borer, were made along two transects, A and B (Figure 12), to determine peat depth.

Biological Factors

A single test for coliform bacteria was made in the fen streams. Standard dilutions for presumptive and confirmed tests were made with Hach commercially prepared coliform tubes.

Small cores (three inches in diameter and four inches deep) from about 30 locations in the fen (sedge fen and *Calamagrostis*-sedge-*menyanthes* fen of Baker, 1972) were taken for analysis of invertebrate fauna. The cores were placed in jars, kept cool and wet, and transferred to the laboratory. They were then placed in a wet-funnel extraction apparatus (Erman, 1973), where they were slowly heated until dry. The organisms forced out were preserved in 70 percent alcohol and later slide mounted in a clearing medium and identified. The keys of Brinkhurst and Jamieson (1971) and Usinger (1956) were used to identify the organisms.

A few collections of invertebrates from inlet and outlet streams were made with a hand net and with a Surber Sampler.

Microbiological Methods for Sandhill Lake

Escherichia coli was first isolated by Escherich in 1885 from the feces of a cholera patient. It was subsequently found that the microorganism is a normal inhabitant of the intestinal tract of man and other animals and that it regularly occurs in their feces. Coliforms are also abundant in soil and water. Coliforms are gram negative rods, facultative anerobes, nonspore forming and are able to ferment lactose with production of gas. Although not important as disease producers, their presence in water or food may indicate fecal contamination and the possible presence of enteric pathogens, such as *Salmonella* and *Shigella*,.

Samples were taken May 5 in sterile 50 ml bottles. Water was drawn from the surface of the lake. Membrane filter dilutions of 10^0 through 10^{-4} were run using M-Endo broth. Laural Tryptose broth tubes were also innoculated with samples, dilutions ranging from 10^0 to 10^6. Growth on the M-Endo or fermentation of the LTB with gas production would be a positive test. All tests were negative, and pour plates that were also run showed only a little growth – less than ten colonies.

Fecal *Streptococci* were tested for using Azid Dextrose Broth, AZD, a medium selective for those bacteria. Whereas in the LTB there was growth but no gas production, in AZD there was absolutely no growth.

A larger sample was filtered, and M-Endo was used, as the coliform concentration on the original test was obviously small. Surface plates, incubated at 45°C and 20°C (concentration of sample 10^0, 10^{-1}) were also run.

Plate counts showed over ten times as much growth at 20°C than 45°C. This is significant, because those that grow at 20° and not at 45°C are considered saprophytic types, which are thought to be nonpathogenic to man. The plate counts were below the critical 30-300 count.

Growth also occurred on the M-Endo broth. Comparison MPN found using different volumes of sample correspond fairly well. The average MPN for the membrane filter was about .3, indicating the lake is of high quality from a coliform standpoint. This is not surprising, as water entering the lake is first filtered through about one half mile of fen.

Gram stains and IMViC were made on randomly picked colonies from the membrane filter. Gram stains were found on 20 percent of the colonies (16 stains). Results showed 13 gram-negative rods of various sizes and three gram-positive organisms. A control was run along with the samples. Gram negative organisms are normally predominant in soil and mud, gram positives in water. The results show that the sample organisms were primarily of lake origin (gram positive).

The IMViC differential test is comprised of the following parts: (1) Indole-E. coli can degrade amino acid tryptophane to indole, carbon dioxide and water, while *Aerobacter aerogenes* cannot; (2) Methyl Red-Vogues Proskaver Test is based on differences in the way organisms ferment dextrose. *E. coli* forms acids in its fermentation, while *A. aerogenes* forms butylene glycol – formation of acid (*E. coli*) confirms positive methyl orange test (pH 4.5); and (3) Citrate-*A. aerogenes* can grow on a medium in which citrate is the only source of carbon while *E. coli* cannot.

Results showed random colonies to be negative, positive, negative, positive for IMViC. This means that the bacteria are probably *E. freundi*, (Prescott, 1949) and not fecal in origin.

Three streams of the watershed feeding Inglenook Fen were also studied. Samples were collected May 19 and were tested within 24 hours. In these cases only LTB was used as a presumptive test. Of the three streams, two showed no coliform for dilutions of $10^0 - 10^{-4}$. Growth occurred in some tubes, but there was no gas formation. Stream "B," however, showed the presence of coliform. Confirmatory tests using BGLB were undertaken for stream B, and also the dilutions which had displayed growth in the other streams. BGLB results gave an MPN of 340. A completed test was run on the positives, the method being LTB at 35° and 45°C, and nutrient agar slants at 45°C. These tests showed growth at both 35° and 45°C. This is significant, because the growth at 45°C indicates that the organisms are probably enteric in origin.

Entomological Methods

About once each week during the year, one or more of our research team visited the area for one to three days and sampled for various kinds of arthropods in specified areas. Besides conventional collecting methods, i.e., aerial netting, sweep netting, and various trapping techniques, a D-Vac machine was used in the fen proper. This machine gathered many small, hard-to-see insects and mites, which otherwise would have gone undetected.

Further, many specimens were gathered only after specific observations were made as to their flight habits, movements, nesting food plant associates, feeding habits, pollinating habits, and so on. Each species collected was later labeled and assigned a unique number for data retrieval purposes through computer use.

Each specimen was first carefully recorded in a special ecologically oriented field notebook in such a way as to ensure an eventual readout of any or all ecological and taxonomical information for each specimen of all animal and plant species. The method of use and all raw data are available, but substantial funds are required to keypunch and program these data for efficient use.

Larvae of many insects were collected alive feeding on specific plants, or they were collected by screening them from under plants in sand dunes, and these were brought to the laboratory and reared to associate the adults with the larvae.

A map grid system was devised to locate the precise locality of each collection within a 100-square-meter (or 10-meter-square) area. This was considered extremely important because, as stated above, there were literally hundreds of small, isolated insect-plant niches found to occur within the fen-dune ecosystem.

The several thousand mounted and alcohol-preserved specimens are carefully curated and preserved as a separate research-education collection for further reference. Besides these specimens, many kodachrome slides of the significant arthropods and plant habitats and insect-plant interrelationships have been taken to document our findings. These are also available for further research and educational purposes.

Appendix B
DATA TABLES

Table 1
Discharge (Ft^3/sec) from Surface Inlet and Outlet Streams of Inglenook Fen

Date	Stream A_{so}	A_{no}	B	C	D	E	Total inflow		Total inflow outflow
Nov. 18, 1972	.155	.094	.450	.294	.481	.107	1.581	5.748	.275
Nov. 25	.101	.067	.267	.120	.181	.029	.765	-	-
Dec. 3	.111	.067	.689	.153	.178	.046	1.244	2.723	.457
Dec. 14	.134	.067	.294	.128	.174	.033	.830	3.576	.232
Jan 6, 1973	.186	.112	.318	.152	.249	.051	1.068	4.376	.244
Jan. 13	.653	.794	2.308	3.028	2.383	2.017	11.183	47.134	.237
Jan. 27	.276	.153	.602	.575	.559	.211	2.376	11.797	.201
Feb. 10	.409	.290	1.094	1.053	1.071	.409	4.326	17.319	.250
Feb. 24	.368	.436	1.250	1.000	.749	.433	4.236	16.698	.254
Mar. 24	.276	.110	.434	.318	.530	.126	1.794	7.085	.253
Apr. 7	.267	.118	.375	.255	.404	.083	1.502	5.880	.255
Apr. 21	.152	.045	.330	.138	.222	.035	.922	4.137	.223
May 9	.156	.057	.292	.101	.135	.019	.760	2.381	.319
May 19	.170	.022	.297	.074	.114	.013	.690	2.195	.314
June 3	.118	.000	.235	.074	.083	.008	.518	2.010	.258
June 19	.066	.008	.267	.057	.054	.003	.455	1.68	.270
July 2	.065	.000	.240	.066	.053	.004	.428	1.56	.254
July 14	.103	.000	.240	.048	.052	.004	.447	1.00	.447
Aug. 1	.098	.000	.271	.041	.049	.005	.464	1.69	.274
Aug. 14	.052	.000	.240	.036	.043	.004	.375	1.32	.284
Sept. 4	.007	.000	.267	.032	.033	.001	.340	1.32	.257
Sept. 21	.151	.132	.562	.103	.092	.080	1.120	1.69	.663
Oct. 7	.06	.15	.33	.11	.10	.02	.770	5.56	.138
Oct. 21	.13	.14	.32	.12	.092	.004	.806	1.95	.413
Nov. 3	.08	.016	.257	.023	53	.007	.580	1.69	.258
Mean	.174	.1151	.516	.324	.319	.150	1.583	6.355	.249
S. D.	.140	.174	.497	.629	.522	.406	2.261	9.807	
Total yearly flow Ft^3 ($x10^6$) ds ($x10^6$)	5.49	3 63	16.27	10.22	10.06	4 73	49.92	200.41	

Table 2

Comparison of Surface Stream Inflow and Area of Watershed of Inglenook Fen

Stream	% of total inflow	Approx. Area hectares	Approx. Area acres	% of total watershed area
A (N_O +S_O)	18.1	196	485	42.7
B	32.3	56	140	12.4
C	20.2	93	207	18.3
D	20.0	77	192	16.9
E	9.4	45	111	1.7

Table 3
Water Temperatures (°C) of Inlet and Outlet Streams of Inglenook Fen, 1972-1973

Date	A_{so}	A_{no}	B	C	D	E	Outlet
	Stream						
Nov. 18, 1972	11.0	10.1	11.9	10.1	9.8	10.1	10.1
Nov. 25	10.8	9.8	11.0	9.0	9.0	10.1	-
Dec. 3	10.5	9.9	11.0	10.0	9.5	9.9	8.9
Dec. 14	7.8	5.3	8.3	5.5	4.9	5.0	4.5
Jan. 6, 1973	8.0	6.0	8.9	6.3	5.1	4.9	6.0
Jan. 13	10.9	10.6	12.0	10.1	9.1	10.6	10.3
Jan. 27	9.1	8.6	9.0	7.5	7.2	7.0	7.1
Feb. 10	11.0	10.6	12.1	10.0	9.0	10.0	10.0
Feb. 24	10.7	10.0	11.2	10.0	9.0	10.0	9.8
Mar. 24	10.0	9.7	12.6	9.3	8.0	8.0	10.2
Apr. 7	11.2	10.9	15.2	11.2	8.6	9.1	12.2
Apr. 21	11.5	11.7	16.2	12.8	9.8	12.4	11.8
May 9	12.0	12.5	17.0	14.0	11.0	14.0	15.0
June 3	12.5	13.0	16.0	14.4	12.8	16.8	15.7
June 19	11.7	10.5	11.7	11.1	11.1	15.0	16.2
July 2	16.6	-	19.4	18.0	16.2	17.2	18.3
July 14	17.8	-	19.4	18.4	16.6	20.0	21.2
July 31	17.2	-	17.8	17.8	16.6	18.4	20.0
Sept. 2	17.2	-	19.5	19.5	16.6	20.0	20.6
Sept. 21	17.8	18.4	19.4	18.4	17.2	18.9	18.9
Oct. 7	16.7	16.7	18.1	18.1	15.6	17.2	18.3
Oct. 21	16.7	17.2	18.3	18.1	16.4	18.3	18.9
Nov. 3	13.0	12.0	13.0	12.3	12.0	18	12.0
Mean	12.7	12.0	12.8	12.7	11.3	12.9	13.5
S.D.	3.3	3.4	3.7	4.4	4 0	4 9	5.2

Table 3a
Water Temperatures (°C) of Sandhill Lake, 1973
(METHOD – YSI – 51A 0_2 Meter)

Depth Mi.	Ft.	4-21 (Very windy)	5-9 (Calm)	5-19 (Calm)	6-3 (Slight wind)
Surface		12.5	16.0	17.0	20.5
1.5	5	12.0	15.0	15.7	18.0
3.0	10	12.0	14.0	14.6	17.0
4.6	15	11.5	14.0	13.7	17.0
6.1	20	11.0	13.0	13.4	17.0

Table 4a

Oxygen Concentration (mg/1) and Saturation (percent) of Inlet and Outlet Streams of Inglenook Fen

	Stream						
Date	A_{so}	A_{no}	B	C	D	E	Outlet
Nov. 18, 1972	10.4	10.7	11.3	10.8	12.1	9.2	5.6
	[94]	[95]	[103]	[96]	[106]	[81]	[49]
Nov. 25	12.0	10.8	11.2	11.4	13.0	9.9	-
	[107]	[95]	[100]	[98]	[112]	[87]	-
Dec. 3	10.9	12.6	11.9	10.4	13.4	11.4	4.2
	[97]	[110]	[107]	[92]	[116]	[100]	[35]
Dec. 14	10.2	10.4	11.3	11.8	12.2	11.8	6.8
	[85]	[83]	[96]	[93]	[95]	[92]	[52]
Jan. 6, 1973	10.4	13.6	11.5	12.2	13.0	11.5	7.2
	[87]	[108]	[99]	[99]	[101]	[89]	[57]
Jan. 13	11.2	10.8	12.4		12.6	12.4	7.2
	[100]	[97]	[113]		[108]	[110]	[63]
Jan. 27	11.1	11.9	11.8	11.4	14.6	11.4	6.1
	[95]	[101]	[101]	[95]	[122]	[94]	[50]
Jan. 26	12.8	11.2	12.2	12.0	12.0	11.7	
	[110]	[91]	[102]	[98]	[98]	[96]	
Feb. 10	11.9	11.6	10.7	10.9	11.4	10.6	6.3
	[107]	[103]	[100]	[96]	[98]	[94]	[55]
Feb. 24	9.8	10.4	11.0	10.3	11.9	10.6	6.2
	[87]	[92]	[100]	[90]	[102]	[93]	[52]
Mar. 24	10.9	11.0	10.6	11.5	12.4	11.0	6.7
	[96]	[96]	[98]	[99]	[104]	[92]	[58]
Apr. 7	11.2	10.8	10.0	10.8	12.0	11.1	5.9
	[101]	[97]	[99]	[97]	[101]	[96]	[54]
Apr. 21	10.6	10.4	9.8	10.6	11.4	10.0	6.6
	[96]	[95]	[97]	[100]	[100]	[93]	[60]
May 9	10.6	10.4	10.0	10.6	11.8	9.7	6.2
	[97]	[97]	[102]	[101]	[105]	[93]	[60]
May 19	10.2	10.0	10.1	10.4	11.1	9.9	5.2
	[94]	[92]	[100]	[100]	[100]	[97]	[50]
June 3	10.2	8.5	10.2	10.2	10.7	8.8	4.6
	[95]	[80]	[102]	[99]	[100]	[90]	[45]
June 19	-	7.3	10.0	10.0	10.0	9.4	11.2
	[65]	[91]	[90]	[90]	[92]	[111]	
July 2	11.2	-	10.0	8.8	11.2	10.4	8.4
	[113]	-	[108]	[93]	[112]	[106]	[89]
July 14	9.6	-	10.2	8.2	9.2	-	9.2
	[99]	-	[110]	[90]	[91]	-	[103]
July 31	9.6	-	10.2	9.7	10.4	10.1	10.1
	[96]	-	[104]	[101]	[106]	[107]	[111]

Table 4 (cont.)

Date	A_{so}	A_{no}	B	C	D	E	Outlet
Aug. 13	9.6	-	10.1	8.8	10.6	10.2	9.8
	[-]	[-]	[-]	[-]	[-]	[-]	[-]
Sept. 4	9.3	-	9.8	8.2	11.2	10.0	9.6
	[96]	-	[105]	[90]	[110]	[107]	[101]
Sept. 21	7.3	10.1	9.5	8.7	8.5	10.2	9.8
	[76]	[105]	[100]	[90]	[87]	[107]	[101]
Oct. 7	7.7	5.7	9.5	9.3	9.5	9.9	9.8
	[80]	[57]	[99]	[97]	[96]	[102]	[103]
Oct. 21	7.4	5.4	8.0	6.9	6.7	7.8	8.4
	[7.4]	[57]	[88]	[75]	[69]	[86]	[93]
(ppm) S.D.	1.19	1.87	0.83	1.22	1.29	0.85	2.04
mean	10.3	10.3	10.57	10.21	11.41	10.41	7.34
(Percent) S.D.	9.29	14.19	4.76	3.97	7.43	7.18	24.73
mean	95.85	95.05	101.37	95.63	101.72	95.26	70.43

Table 4b
Oxygen Concentration (mg/l) in Sandhill Lake, 1973
(METHOD – YSI – 51A O_2 Meter

Depth		Date			
Mi.	Ft.	4-21	5-9	5-19	6-3
Surface		8.4	8.6	7.4	7.6
1.5	5	8.2	7.6	5.5	5.4
3.0	10	8.2	6.0	3.8	4.4
4.6	15	7.4	4.6	3.3	3.6
6.1	20	6.5	3.2	2.3	3.2

Table 5a

Hydrogen Ion Concentration (pH) in Inlet and Outlet Streams of Inglenook Fen

Date	A_{so}	A_{no}	B	C	D	E	Outlet
			Stream				
Nov. 18, 1972	6.5	5.5	6.5	6.5	6.5	6.0	6.5
Nov. 25	6.5	5.5	7.0	7.0	6.5	6.0	-
Dec. 3	6.3	5.8	6.5	6.5	6.3	6.0	6.0
Dec. 14	6.0	5.5	6.5	6.5	6.8	6.0	6.5
Jan. 6, 1973	6.0	5.7	6.5	6.5	6.8	6.0	6.0
Jan. 13	6.0	5.5	6.5	6.4	6.5	6.5	6.0
Jan. 27	6.1	5.5	6.5	6.5	6.5	6.0	6.5
Feb. 10	6.2	5.7	6.3	6.5	6.5	6.3	6.0
Feb. 24	6.2	5.5	6.7	6.7	6.5	6.3	6.5
Mar. 24	6.5	5.8	6.7	6.7	6.7	6.5	6.5
Apr. 7	6.4	5.7	6.5	6.8	6.7	6.3	6.5
Apr. 21	6.8	5.9	7.0	7.0	6.9	6.5	6.6
May 9	6.9	5.9	7.1	7.1	7.0	6.4	6.6
May 19	6.8	5.8	6.9	6.8	6.9	6.5	6.6
June 3	7.0	5.8	7.0	7.0	7.0	6.4	6.8
June 19	7.7	5.7	6.8	7.7	6.8	6.6	6.8
July 2	7.5	no flow	7.5	7.7	7.3	6.5	6.8
July 14	7.4	no flow	7.5	7.7	7.5	6.6	6.8
July 31	7.3	no flow	7.3	7.5	7.5	6.6	7.3
Aug. 13	7.0	no flow	7.3	7.5	7.5	6.8	6.9
Sept. 4	7.3	no flow	7.4	7.4	7.3	6.6	6.7
Sept. 21	6.7	5.6	6.7	6.9	6.9	5.6	6.8
Oct. 7	5.8	4.8	6.6	6.8	6.6	5.7	6.6
Oct. 21	6.5	5.3	6.6	6.6	6.6	5.7	6.5
Mean	6.6	5.6	6.8	6.9	6.8	6.3	6.5
S.D.	.53	.25	.36	.45	.37	.33	.33

Table 5b

Hydrogen Ion Concentration (pH) of Sandhill Lake, 1973
(METHOD – La Motte Wide Range pH kit)

Depth Mi.	Ft.	4-21	5-4	5-7	6-3
		Date			
Surface		6.5	6.5	6.7	6.9
1.5	5	6.5	6.4	6.7	6.5
3.0	10	6.5	6.4	6.7	6.5
4.6	15	6.5	6.4	6.7	6.5
6.1	20	6.5	6.4	6.7	6.5

Table 6

Selected Chemical Conditions Along Transect "A" in Inglenook Fen

Date	Oxygen (mg/1)	Temp. (°C)	pH	Number of samples
Dec. 2, 1972	4.9	9.2	6.0	7
Jan. 1, 1973	5.8	7.1	-	4
Feb. 10	5.8	11.2	6.2	4
Feb. 24	8.7	10.0	6.2	4
Mar. 24	6.2	13.9	6.0	6
Apr. 7	3.5	16.8	6.0	6
Apr. 21	3.5	16.8	5.9	5
May 10	2.6	13.3	6.0	3
May 19	3.0	17.2	5.8	3
June 19	2.5	14.6	5.8	8
July 2	3.3	16.0	5.7	3
July 14	0.7	18.3	5.8	6
Aug. 1	3.0	18.0	5.9	6
Aug. 13	0.6	18.7	5.6	2
Sept. 4	3.0	18.8	5.6	5
Sept. 21	3.4	20.0	6.6	3

Table 7a
Calcium Concentration (me/l) in Streams of Inglenook Fen

Date	A_{so}	A_{no}	B	C	D	E	Outlet
	Stream						
Nov. 18, 1972	.250	.221	.238	.312	.365	.192	-
Nov. 27	.181	.194	.194	.304	.326	.187	.370
Dec. 3	.226	.154	.231	.310	.355	.198	-
Dec. 14	.214	.165	.249	.307	.477	.199	.503
Jan. 6, 1973	.130	.112	.125	.223	.262	.113	.395
Jan. 13	.113	.108	.154	.248	.271	.109	.430
Jan. 27	.153	.133	.164	.197	.228	.143	.236
Feb. 10	.136	.136	.125	.200	.239	.155	.541
Feb. 24	.114	.138	.163	.210	.271	.134	.619
Mar. 24	.094	.092	.151	.206	.238	.132	.474
April 4	.053	.040	.080	.153	.176	.101	.550
April 21	.194	.065	.151	.223	.212	.064	.502
May 9	.082	.060	.100	.166	.196	.086	.503
May 19	-	.063	.095	.157	.257	.077	.572
June 3	.056	.057	.097	.178	.245	.075	.572
June 19	.167	.112	.064	.067	.063	.068	.660
July 2	.078	-	.129	.217	.260	.102	.653
July 14	.059	-	.106	.194	.335	.284	.675
Aug. 1	.065	-	.179	.207	.268	.096	.638
Sept. 4	.150	-	.230	.520	.450	.220	-
Sept. 21	.200	.200	.340	.550	.560	.210	1.18
Oct. 7	.290	.340	.330	.550	.700	.280	1.20
Oct. 21	.270	.260	.330	.620	.630	.190	1.11
Nov. 3	.394	.208	.210	.300	.350	.230	0.66
Mean	.160	.143	.176	.276	.322	.152	.621
S.D.	.087	.077	.080	.143	.148	.066	.252

Table 7b
Calcium Concentration (me/l) in Sandhill Lake
[METHOD – EDTA Method (Hach Apparatus)]
(Sample Collected 5-19-73)

Depth Mi.	Ft.	CaO_3	CA
Surface		35	0.7
1.5	5	35	0.7
3.0	10	35	0.7
4.6	15	35	0.7
6.1	20	35	0.7

Table 8a

Magnesium Concentration (me/l) in Streams of Inglenook Fen

Date	Stream A_{so}	A_{no}	B	C	D	E	Outlet
Nov. 18, 1972	.266	.229	.270	.346	.364	.185	-
Nov. 25	.212	.226	.236	.301	.314	.155	.289
Dec. 3	.183	.194	.226	.310	.344	.164	-
Dec. 14	.217	.203	.253	.332	.429	.161	.288
Jan. 6, 1973	.335	.385	.379	.514	.642	.292	.605
Jan. 13	.317	.327	.378	.595	.612	.290	.522
Jan. 27	.377	.287	.396	.389	.443	.262	.353
Feb. 10	.310	.288	.374	.445	.493	.256	.475
Feb. 24	.305	.290	.381	.434	.523	.109	.493
Mar. 24	.275	.267	.387	.525	.526	.276	.468
April 4	.272	.262	.399	.564	.587	.282	.489
April 21	.250	.258	.378	.591	.576	.258	.528
May 9	.254	.251	.385	.605	.615	.268	.543
May 19	.327	.256	.375	.603	.593	.268	.547
June 3	.242	.256	.393	.627	.581	.279	.258
June 19	.263	.251	.388	.640	.590	.281	.572
July 2	.233	-	.382	.642	.581	.294	.563
July 14	.256	-	.392	.640	.585	.308	.551
Aug. 1	.251	-	.402	.668	.567	.258	.497
Sept. 4	.138	-	.222	.384	.317	.164	-
Sept. 21	.227	.271	.144	.291	.208	.367	.440
Oct. 7	.333	.315	.378	.286	.445	.252	.551
Oct. 21	.350	.113	.113	.250	.269	.263	.420
Nov. 3	.394	.208	.349	.242	.182	.234	.410
X	.274	.257	.333	.468	.474	.247	.470
S.D.	.061	.056	.087	.148	.140	.060	.100

Table 8b

Total Hardness and Magnesium (me/l) in Sandhill Lake
(METHOD – Hach Apparatus – Hach Dr-El Coldrimeter)

Depth Mi.	Ft.	Mg/1 $CaCo_3$	me/1	me/mg
Surface		50	1.0	.3
1.5	5	50	1.0	.3
3.0	10	50	1.0	.3
4.6	15	50	1.0	.3
6.1	20	50	1.0	.3

Total hardness – Ca = Mg.

Table 9a
Dissolved Phosphorus (PO4 – P mg/l) in Streams of Inglenook Fen

Date	A_{so}	A_{no}	B	C	D	E	Outlet
	Stream						
Nov. 18, 1972	.05	.04	.08	.44	.09	-	.07
Nov. 25	.02	.03	.01	.02	.00	.02	-
Dec. 3	.02	.01	.02	.13	.03	-	.03
Dec. 14	.05	.05	.04	.09	.02	.02	.07
Jan. 6, 1973	.04	.03	.00	.04	.13	.04	.12
Jan. 13	.03	.04	.25	.05	.08	.34	.02
Jan. 27	.04	.25	.09	.02	.33	.06	.10
Feb. 10	.08	.31	.06	.04	.02	.04	.14
Feb. 24	.27	.16	.07	.07	.01	.02	.14
March 24	.04	.09	.05	.14	.04	.02	.13
April 7	.11	.07	.08	.07	.10	.07	.13
April 21	.05	.10	.05	.11	.20	.04	.16
May 9	.07	.06	.05	.09	.13	.03	.08
May 19	.34	.12	.08	.08	.09	.04	.09
June 3	.06	.13	.05	.03	.06	.04	.37
June 18	.10	.10	.14	.09	.24	.08	.28
July 2	.14	-	.12	.08	.04	.05	.10
July 31	.11	-	.07	.06	.05	.12	.11
Aug. 13	.06	-	.08	.08	.08	.07	.05
Sept. 4	.06	-	.08	.09	.14	.13	.17
Sept. 21	.10	.10	.07	.09	.09	.10	.11
Oct. 7	.11	.06	.13	.07	.07	.08	.14
Oct. 21	.07	.08	.18	.10	.14	.12	.14
S.D.	.08	.07	.05	.08	.08	.07	.08
Mean	.09	.09	.09	.09	.09	.07	.13

Table 9b
Orthophospate (ppm) in Sandhill Lake
(METHOD – HACH-Stannaver)

Depth		Date	
Mi.	Ft.	5-19	6-3
Surface		0.22	0.25
1.5	5	0.20	0.25
3.0	10	0.8	0.25
4 6	15	0.36	0.35
6.1	20	0.57	0.50

Table 10a
Nitrates (NO_3 — N mg/l) in Streams of Inglenook Fen

Date	Stream A_{so}	A_{no}	B	C	D	E	Outlet
Nov. 18, 1972	.215	.080	.280	.170	.180	.060	.025
Nov. 25	.155	.070	.085	.035	.060	.065	-
Dec. 3	.080	.060	.235	.095	.035	.075	.045
Dec. 14	.395	.110	.180	.135	.235	.095	.060
Jan. 6, 1973	.570	.110	.365	.225	.295	.080	.050
Jan. 13	1.01	.250	.230	.290	.210	.065	.090
Jan. 27	1.12	.440	.435	.080	.160	.100	.170
Feb. 10	.845	.840	.170	.215	.215	.065	.315
Feb. 24	.910	.990	.360	.290	.550	.140	.260
March 24	.545	.370	.330	.110	.135	.025	.070
April 7	.675	.110	.282	.110	.190	.050	.045
April 21	.680	.130	.300	.080	.145	.020	.050
May 9	.625	.125	.250	.155	.175	.030	.015
May 19	.580	.075	.280	.040	.240	.005	.020
June 3	.520	.000	.260	.060	.135	.055	.050
June 18	.48	.160	.300	.210	.620	.080	.340
July 2	.04	-	.350	.080	.330	.070	.120
July 14	.51	-	.340	.100	.370	.030	.140
Aug. 1	.75	-	.330	.100	.430	.040	.080
Aug. 14	.59	-	.300	.100	.380	.060	.130
Sept. 4	1.00	-	.310	.060	.600	.040	.080
Sept. 21	.63	.240	.280	.130	.280	.060	.090
Oct. 7	1.00	.150	.295	.225	.350	.040	.320
Oct. 21	.48	.105	.240	.043	.422	.020	.060
S. D.	.290	.264	.073	.074	.159	.030	.098
Mean	.600	.232	.283	.130	.280	.057	.120

Table 10b
Nitrates (mg/l) in Sandhill Lake
[METHOD – Calcium Reduction (Hach)]

Depth Mi.		Mg/1 (sample collected 5-9)
Surface		0.02
1.5	5	0.02
3.0	10	0.02
4.6	15	0.02
6.1	20	0.02

Table 11

Analysis for Iron, Silica, Copper, Chloride, and Free Acidity in Sandhill Lake

IRON (ppm)
[METHOD – 1-10 Phenanthroline (Hach)]

Depth Mi.	Ft.	Date 5-19	6-3
Surface		1.1	.83
1.5	5	1.1	.95
3.0	10	1.1	.86
4.6	15	1.8	1.0
6.1	20	3.0	1.8

SILICA (ppm)
(METHOD – LaMotte)

Depth Mi.	Ft.	Date 4-21	5-19
Surface		4 5	5.1
1.5	5	4 5	5.0
3.0	10	5.0	4.5
4.5	15	5.0	5.0
6.1	20	5.0	5.0

COPPER
(METHOD – Hach)

Depth Mi.	Ft.	Date 4-21	5-19
Surface		0.0	0.0
1.5	5	0.0	0.0
3.0	10	0.0	0.0
4 6	15	0.0	0.0
6.1	20	0.0	0.0

CHLORIDE
(METHOD – Meleril Nitrate) (METHOD – Hach)

Depth Mi.	Ft.	Mg/l Cl
Surface		25
1.5	5	25
3.0	10	25
4.6	15	25
6.1	20	25

Samples Taken 5-19

FREE ACIDITY
(METHOD – Hach)

Depth	Mg/l
Surface	0.0
5'	0.0
10'	0.0
15'	0.0
20'	0.0

Samples Taken 5-19

Table 12

Color, Turbidity, and Percent Transmittance of Sandhill Lake [METHODS – Color – APHA Platinum Cobalt Standard (Hach); Turbidity – (Hach); Percent Trans – (Hach)]

Depth Mi.	Ft.	Color Date 4-21	Color Date 5-4	Turbidity Date 4-21	Turbidity Date 5-9	Percent Trans. Date 4-21	Percent Trans. Date 5.7
Surface		120	85	25	18	97	96
1.5	5	120	80	25	18	97	96
3.0	10	120	100	25	25	97	96
4.6	15	190	100	30	28	95	95
6.1	20	260	120	60	30	91	94

C – Color units – Alpha standard
* – Turbidity units – Fomezin turbidity units
Note: It was recommended samples be centrifuged before color test, but this was not done.
Note: Percent transmission calibrated for distilled water = 100 percent.

Table 13

Suspended Sediments (mg/l) in Streams of Inglenook Fen

Date	A_{so}	A_{no}	B	Stream C	D	E	Outlet
Nov. 18, 1972	41.2	11.2	17.2	17.6	16.4	7.6	-
Nov. 25	20.4	21.2	28.8	17.6	51.2	15.2	7.8
Dec. 3	5.2	18.4	12.8	25.8	6.8	4.0	-
Dec. 14	26.0	30.8	80.4	52.8	-	12.0	2.0
Jan. 6, 1973	37.6	18.8	6.8	2.0	7.2	2.8	2.8
Jan. 13	1.8	3.0	5.2	6.2	6.6	4.2	7.0
Jan. 27	-	4.4	22.4	25.5	14.6	4.5	27.2
Feb. 10	1.0	5.0	5.8	4.8	4.2	1.0	8.4
Feb. 24	2.4	3.2	15.2	10.2	8.0	3.4	8.5
March 24	3.6	6.8	67.0	9.4	14.0	4.4	6.4
April 7	12.7	9.0	11.4	10.0	-	3.8	2.6
April 21	-	5.4	8.0	-	2.2	2.0	4.0
May 9	1.4	11.6	9.2	6.4	2.2	1.2	1.2
May 19	8.6	3.8	6.8	8.4	1.6	5.8	1.4
June 3	7.4	1.4	7.2	7.8	2.0	2.0	5.2
June 18	94.0	1.3	1.2	2.7	52.7	1.2	0.7
July 2	33.1	3.1	5.6	10.3	31.1	0.8	2.1
July 14	52.7	1.7	10.1	7.9	37.3	1.7	1.6
July 31	27.1	20.1	7.2	8.7	57.9	4.1	3.2
Aug. 13	40.0	7.5	18.0	9.3	41.6	2.1	1.3
Sept. 4	36.3	11.9	5.3	14.9	19.7	1.7	0.7
Sept. 22	2.1	10.3	41.9	29.0	4.7	4.8	1.8
Oct. 7	4.2	58.5	8.0	11.4	2.9	2.3	0.6
Oct. 21	7.4	8.8	12.2	10.6	0.2	9.3	1.9
Nov. 3	9.4	0.4	3.5	1.6	3.8	4.0	3.1
Mean	19.9	11.4	16.0	12.5	16.9	4.24	4.41
S.D.	22.9	12.6	20.8	11.6	18.6	3.50	5.59

Table 14
MICROBIOLOGICAL RESULTS

LAKE: LTB – 10^{1}, 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}
ADB – 10^{1}, 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}

Results: negative

Membrane filter – (M-Endo) 10^{0}, 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}

Results: negative

Surface Plates

	45°C	20°C
10^{0}	16	165
10^{-1}	0	23

Millipore filter counts (M-Endo)

	trial 1	trial 2
10 ml	3	4
50 ml	29	16
100 ml	61	46

Gram Stain

16 tests –

13 gram -
3 gram +

IMV:C

Citrate	16^{+}, 4^{-}
Indole	6^{+}, 14^{-}
Vogues Pros.	20^{-}
Methyl Red	20^{+}

Streams

Streams C:E – No positives in LTB 10^{0} to 10^{-4} dilutions

Stream B –

	LTB	BGLB
10^{0}	+++++	++++-
10^{-1}	++++-	+++++
10^{-2}	- - - - -	

LTB at 35° – 10 positive

LTB at 44° – 9 positive

Appendix C

BIOTIC INVENTORIES

Table 15

Species in Common Between a Number of Coastal "Bogs" and "Fens" on the Pacific Coast of North America (Baker, 1972)

	1 Palmer, Alaska (incomplete)	2 Victoria B. C.	3 Olympic Penin. Wash.	4 Bandon Ore.	5 Inglenook Calif.	6 Ledun Swamp (Point Reyes) Calif.	7 San Francisco Calif. (incomplete)
Nuphar polysepalum	+	+	+	+	+		
Potentilla palustris	+	+	+	+	+		
Oenanthe sarmentosa		+			+	+	(+)
Sphagnum sp.	+	+		+	+		
Calliergonella cuspidatum		+			+		
Blechnum spicant					+	+	
Hypericum anagalloides					+	+	
Ledum spp.		+		+	+	+	
Gentiana sceptrum, etc.		+		+	+		
Menyanthes trifoliata	+	+	+	+	+		+
Mimulus guttatus					+	+	
Myrica spp.		+		+	+	+	
Lysichiton americanum				+	+		
Sisyrinchium californicum					+	+	
Habenaria dilatata var. *leucostachys*					+	+	+
Calamagrostis mutkaensis				+	+		
Athyrium filix-foemina					+	+	+
Alnus oregona		+		+	+		
Campanula californica					+	+	
Carex obnupta					+	+	
Heleocharis acicularis				+	+		

1. Hanson and Churchill (1961)
2. Rigg (1922, 1925)
3. Jones (1936)
4. Hansen (1943)
5. Howell (1949)
6. Behr (1891), etc.

Table 16
Arthropoda — Fauna of Inglenook Fen-Dune Ecosystem
Discovered During the Year 1973

Classes	Orders	No. families	No. genera	No. species	Percent species identified
Arachnida	1. *Acarina* (mites)	8	15	20	5
	2. *Araneae* (spiders)	17	65	115	30
Crustacea	1. *Isopoda* (sow bugs)	2	2	2	0
	2. *Amphipoda* (amphipods	1	1	1	0
	3. *Decapoda* (shrimps)	1	1	1	0
Diplopoda	1. *Polydesmida* (millipedes)	2	2	2	0
Insecta	1. *Thysanura* (silverfish)	2	2	3	0
	2. *Collembola* (springtails)	5	8	8	75
	3. *Orthoptera* (grasshoppers)	4	9	9	75
	4. *Dermaptera* (earwigs)	1	1	1	100
	5. *Isoptera* (termites)	2	2	2	100
	6. *Thysanoptera* (thrips)	2	5	8	100
	7. *Odonata* (dragonflies	3	5	8	100
	8. *Ephemeroptera* (mayflies)	1	1	1	0
	9. *Homoptera* (aphids)	6	25	32	2
	10. *Hemiptera* (true bugs)	10	19	19	50
	11. *Neuroptera* (lacewings)	3	3	3	66
	12. *Trichoptera* (casebearers)	3	5	5	0
	13. *Lepidoptera* (moths, butterflies)	19	39	40	70
	14. *Coleoptera* (beetles)	30	85	101	75
	15. *Hymenoptera* (bees, wasps)	29	112	160	10
	16. *Diptera* (flies)	55	151	247	40
	17. *Psocoptera* (psocids)	2	3	6	10
Total 4	23	218	561	794	40

Table 17

Taxonomy, Biology and Ecological Association of most of the Mollusks and Arthropods (Insects, Spiders, Mites, etc.) Located in the Inglenook Fen-Dune Ecosystem.

(Compiled by E.I. Schlinger)

MOLLUSCA (Snails, slugs)
(Identified by W. Voigt and R. Wharton)

Scientific Name	Ecological Zone: Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
HELICIDAE								
Helix aspersa Muller			X					Along stream below fen lake
HELMINTHOGLYPTIDAE								
Helminthoglypta arrosa (Binney)								Feeds on algae in *Juncus* swales
POLYGYRIDAE								
Vespericola columbiana pilosa (Henderson)				X	X			
SUCCINEIDAE								
Quickiella rehderi Pilsbry							X	Feeds on algae in *Juncus* swales
CIRCINA xiidae								
Haplotrema cf. vancouverensis				X	X			Carnivorous
Menetus centervillensis								Aquatic
AURICULIDAE								
Carychium occidentale				X	X			In heavy leaf litter
ARIONIDAE								
Hesperarion ?				X	X			Slug
Total number of species	0	0	1	5	5	0	2	
Species unique to each zone	0	0	1	0	0	0	2	

ACARINA (Mites)
(Identified by D. Price)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
ERYTHRAEIDAE								
Augustsonella tuberculata							*X*	This large, common, free-living red mite is found running rapidly over the dunes, or feeding on dying or dead insects.
(Another 20 species of mites have been collected but are not yet identified.)			X	X		X		
Total number of species	0	0	1	1	1	0	1	
Species unique to each zone	0	0	0	0	0	0	1	

ARANEAE (Spiders)
(Identified by C. Griswold)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
CTENEZIDAE								Trap door spiders
Aptostichus stanfordianus						X	X	Burrows in sand, upper portion of burrow lined and closed with silk. Remains in burrow and captures pre[y] near burrow mouth. Host of Pompili[d] wasp.
SEGESTRIIDAE								
Segestria sp.			X		X			Point 3 pr. legs forward and spring out of hole to capture prey. Found under bark, in logs and fence posts.
AMAUROBIIDAE								
Callobius pictus (Simon)					X			Spider hides under bark, catches prey in web stretching out onto surface.
DICTYNIDAE								Dictynids spin small "hackled-band" webs, usually near tips of leaves or stems.
Dictyna major Menge			X		X			
Dictyna n. sp., *borealis* group							X	Beneath wooden post on sand
Dictyna sp. 1				X				
Dictyna sp. 2			X					
Heterodictyna linsdalei Chamberlin & Gertsch					X			On foliage of trees
Tricholathys sp.						X		grass and rushes
GNAPHOSIDAE								Running hunters with poor eyesight; make no web except a silken nest or sleeping cell.
Zelotes sp.			X			X	X	Under wood, rocks, etc. May wande[r] onto dunes.
Micaria sp.			X					Resenble ants in size, shape, and movement. May wander onto dunes
Drassyllus sp.								

ARANEAE (Spiders)
(Identified by C. Griswold)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
CLUBIONIDAE								Running hunters with poor eyesight; make no web except a silken nest or sleeping cell; usually nocturnal.
Chiracanthium inclusum (Hentz)			X				X	Grassland species, and may occur on vegetation of dune margin.
Clubiona californica Fox			X					On ground, under logs and fenceposts-drier habitats.
Clubiona canadensis Emerton				X	X			Under decaying vegetation and on bushes — moister habitats
THOMISIDAE								Running predators on ground or foliage; poor eyesight; no web
Tibellus oblongus (Walck'.)			X	X	X	X	X	Common except on open dunes.
Xysticus sp.					X			
Thanatus formicinus (Clerk)			X				X	
Rhyssodromus histrioclarus (Keyserling)							X	
Ebo pepinensis Gertsch			X			X		
Philodromus rufus Walck.							X	
Philodromus nr. *gertschi* or *josemitensis*					X			
Philodromus sp.					X			
Misumenops sp.					X			Sit and wait for prey, usually on flowers.
Misumena viata (Clerk)					X			Sit and wait for prey, usually on flowers.
SALTICIDAE								"Jumping spiders" — hunters with excellent eyesight; make no web except silken nest or sleeping cell
Icius vitis (Cockerell)					X			

ARANEAE (Spiders)
(Identified by C. Griswold)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
Pellenes (Evarcha) *hoyi* (Peckham)					X			On trees and bushes
Pellenes mustaciata Chamberlin & Ivie			X					On ground, males occasionally wander onto dunes
Pellenes ummatillus Peckham							X	Highly adapted to dune life — well camouflaged; make nests beneath sand by laying on back in depression, pushing sand up with hind legs and cementing it together with spinnerets — forms a dome0like cell soon covered by blowing sand
Peckhamia scorpiona (Hentz)					X	X		Shape, color, and movements resemble ants
Metacyrba sp.					X			Hunter beneath bark
Talavera minuta (Banks)			X					
Salticus (?) sp.					X			
Eris sp.					X			
Metaphidippus californicus (Peckham)	X	X						Make nests beneath driftwood, hunt on open sand above and below high tide mark
Metaphidippus harfordi (Peckham)					X			Arboreal; possible host of *Acrocera bulla*
Phidippus opifex (McCook)			X					Rare; under wood on ground
Phidippus johnsoni (Peckham)			X		X			Common, on ground, under wood, stones, or bark

Ecological Zone: Littoral, Upper Beach, Prairie Grassland, Fen, Fen Carr, Fen-Dune Ecotone, Dune

ARANEAE (Spiders)
(Identified by C. Griswold)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
			Ecological Zone					
OXYOPIDAE								Running and jumping hunters; good vision
Oxyopes salticus Hentz			X		X			Usually on or near ground. May wander onto dunes
Oxyopes scalaris Hentz			X		X			Arboreal, usually on bushes
LYCOSIDAE								Sharp-eyed, running hunters. Usually diurnal. Females carry eggsac attached to spinnerets, and baby spiders ride on her back
Allopecosa gertschi Schenkel						X	X	Burrow in sand; line burrow with silk
Pardosa tuoba Chamberlin			X			X		
Pardosa ramulosa (McCook)			X			X		Favor moist places than *Tarantula* or *Lycosa*
Pardosa altamontis Chamberlin & Ivie			X			X		
Lycosa sp.			X					
MIMETIDAE								Wandering predators on web-building spiders
Ero sp.					X	X		
THERIDIIDAE								Irregular, sticky webs; poor eyesight potent venom; throw sticky globules at prey
Latrodectus mactans (Fabr.)			X					Webs in dark, dry places, gopher holes.
Crustalina stricta (O.P. Cambridge)						X		
Dipoena malkini Levi						X		
Steatoda sp.			X				X	Webs beneath rocks, logs, fenceposts
Argyrodes fictilium (Hentz)				X	X			Collected with D-Vac from foliage; web unknown; reported as a commensal in webs of large orb-weaving spiders in tropics; abdomen long, worm-like. Considered very rare.

ARANEAE (Spiders)
(Identified by C. Griswold)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
Enoplognatha ovata (Clerk)			X		X	X	X	Webs on low-growing vegetation, ferns, artemesia. Common species
Theridion agrifoliae Levi					X			Webs in trees
Theridion californicum Banks								
Theridion nr. *punctipes* Emerton						X		
Theridion sp. 1					X	X		
Theridion sp. 2			X		X			Bushes in grassland area
Theridion sp. 3					X			
Theridion sp. 4					X	X		
Theridion sp. 5					X			
Theridion sp. 6							X	
Theridion sp. 7					X			
Theridion sp. 8					X			
Theridion sp. 9				X				
SYMPHYTOGNATHIDAE								Rare family of very small spiders; lack book lungs of other spiders; spin tiny orb webs
Chasmocephalon shantzi Gertsch					X	X		
Trogloneta paradoxum Gertsch					X			Perhaps smallest spider in U.S.
TETRAGNATHIDAE								Elongate spiders, hanging sticklike in web; spin orb webs.
Tetragnatha pallescens (Cambridge)						X		
Tetragnatha extensa (Linn.)			X	X	X	X	X	Common; commonest spider in winter in open areas. On dune vegetation where it is extensive enough.
Tetragnatha sp. 3			X		X			
ARANEIDAE								Build orb webs with sticky spiral snare line; poor eyesight; nocturnal or diurnal.
Meta curtisi (McCook)					X	X		Prefer shady, moist, cool places

ARANEAE (Spiders)
(Identified by C. Griswold)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
Cyclosa conica (Pallas)			X	X	X			
Eustala sp.			X			X		
Araniella sp.			X					
Neoscona arabesca (Walck.)			X		X			Common
Metepiera labyrinthea (Hentz)			X		X	X		Common in early summer; host of egg parasite *Tromatobia ovivora*
Araneus trifolium (Hentz)				X		X		Common in late summer
Araneus sp. 1					X			
Araneus sp. 2			X					
Araneus sp. 3					X			
Araneus sp. 4				X	X	X		
LINYPHIIDAE								Very large family, taxonomy poorly known; most abundant family in both species and individuals in North Temperate regions; usually build small sheet webs in sheltered places; list presented here only preliminary, many species remain to be collected and/or identified
Subfamily Linyphiinae								
Microlinyphia pusilla (Sundevall)					X			Very common on bushes in fen, especially *Rubus*
Linyphia sp.			X	X	X			Webs on bushes, and on bark of trees Common
Bathyphantes sp. 1						X		
Bathyphantes sp. 2					X			
Bathyphantes sp. 3			X					
Lephthyphantes sp. 1						X		
Lephthyphantes sp. 2					X			
Lephthyphantes sp. 3					X			
Bathyphantes spp.			X	X	X	X		

Ecological Zone: Littoral, Upper Beach, Prairie Grassland, Fen, Fen Carr, Fen-Dune Ecotone, Dune

	Ecological Zone							
Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
Subfamily Erigoninae								
Erigone sp. 1					X			
Erigone sp. 2				X				On waterlily leaves; fen outflow across dunes
Erigone sp. 3				X				
Erigone sp. 4						X		
Erigone sp. 5					X			
Genus near *Erigone*				X				
Ceraticelus sp. 1			X					
Ceraticelus (?) sp. 2					X			
Spirembolus sp. 1					X			
Spirembolus sp. 2						X		
Diplocephalus sp.						X		
Tortembolus sp. 1				X				
Tortembolus (?) sp. 2				X				
Genus near *Maso*						X		
Erigoninae *sp. 1*						X		
Erigoninae sp. 2					X			
Erigoninae sp. 3				X				
Erigoninae sp. 4						X		
Erigoninae sp. 5						X		
Erigoninae sp. 6						X		
Erigoninae sp. 7						X		
AGELENIDAE								Large and diverse family, particularly well represented in Pacific Northwest. Many undescribed species
Agelenopsis sp.					X			Builds sheet web with tubular retreat at one end.
Hololena sp.			X					Builds sheet web with tubular retreat at one end
Blabomma sp. 1						X		Litter beneath *juncus* on sand
Blabomma sp. 2					X			Leaf litter
Calymmaria new sp.			X		X			Hammock-like sheet webs beneath shady overhangs

ARANEAE (Spiders)
(Identified by C. Griswold)
(Cont.)

Scientific Name	Ecological Zone							Biological Notes
	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	
Cybaeus signifer Simon					X			Webs small or absent; *Callobius*-like; on or under tree bark, nocturnal
Total number of species	1	1	39	17	60	37	15	
Species unique to each zone	0	0	14	8	32	17	6	

COLLEMBOLA (Springtails)

(Identified by V. Landwehr)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
ENTOMOBRYIDAE								
Entomobrya nivalis (L.)				X				
Lepidocyrtus cyaneus Tullberg				X				
Sinella binoculata Schoett				X				
ONYCHIURIDAE								
Onychiurus pseudofimetarius Folsom				X				
SMINTHURIDAE								
Pseudobourletiella spinata MacGillivray				X				
Sminthurinus elegans Fitch				X				
HYPOGASTRURIDAE								
Hypogastrura (Mitchellania) new sp. "U"				X				
NEANURIDAE								
Neanura barberi (Handschin)				X				
Total number of species	0	0	0	8	0	0	0	
Species unique to each zone	0	0	0	8	0	0	0	

ORTHOPTERA (grasshoppers, crickets)

(Identified by E. Schlinger)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
ACRIDIDAE								
Oedaleontus borckii (Stal)							X	Wingless dune dwellers
Melanoplus caroli Gurney			X					
Chorthippus curtipennis californicus Vicery			X					
Trimerotropis helferi Strohecker							X	Cryptic dune dweller
(2 unidentified species)			X					
TETTIGONIIDAE								
Conocephalus fasciatus vicinus (Morse)			X					Common katydid of grassland area
TETRIGIDAE								
Paratettrix mexicanus (Saussure)				X				Water-loving pygmy grasshopper
GRYLLIDAE								
Oecanthus argentinus (Saussure)					X			Nocturnal tree cricket
Total number of species	0	0	4	1	1	0	2	
Species unique to each zone	0	0	4	1	1	0	2	

Ecological Zone: Littoral, Upper Beach, Prairie Grassland, Fen, Fen Carr, Fen-Dune Ecotone, Dune

DERMAPTERA (Earwigs)

(Identified by S. Kuba)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
FORFICULIDAE								
Forficula auricularia L.							X	European earwig — introduced
Total number of species	0	0	0	0	0	0	1	
Species unique to each zone	0	0	0	0	0	0	1	

ISOPTERA (Termites)

(Identified by S. Kuba)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
KALOTERMITIDAE								
Incisitermes minor Hagen					X			
RHINOTERMITIDAE								
Reticulitermes hesperus Banks					X			
Total number of species	0	0	0	0	2	0	0	
Species unique to each zone	0	0	0	0	2	0	0	

THYSANOPTERA (Thrips)

(Identified by R. Kawin)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
THRIPIDAE								
Anaphothrips secticornis (Trybom)			X					Adults feed on the leaves and external parts of grasses and insert their eggs into the tissue of the leaf. The larvae are found mostly in protected areas, such as the sheath. Both the adults and second stage larvae overwinter. Apterous.
Aptinothrips rufus (Gmelin)			X					Grass thrips — live in and feed on the grasses, *Holcus lanatus* and *Deschampsia* spp. The females, larvae and eggs overwinter in the litter. Apterous.
Thrips nigropilosus Uzel						X		Chrysanthemum thrips feed on dicotyledonous hosts. They form aggregated populations on the leaves and are common in the soil and litter but rarely enter flowers. Overwintering occurs in the soil and litter. Brachypterous.
Thrips tabaci Lind						X		Onion thrips are found in flowers and occasionally on the lower side of leaves. They feed on dicotyledonous plants and are found to act as pollinators. The eggs are inserted into the epidermal tissue of the host. All stages may overwinter
PHLAEOTHRIPIDAE								
Bolothrips dentipes (Reuter)			X					Feed on fungal spores and live in leaf litter or on freshly dead wood. Apterous.
Bolothrips rhachiphilus Cott						X		Feed on fungal spores and live in leaf litter or on freshly dead wood. Apterous.
Bolothrips schafferi (Thomasson and Post)				X				Feed on fungal spores and live in leaf litter or on freshly dead wood. Apterous.

Thrips
(Identified by R. Kawin)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
Haplothrips longiceps (Hood)			X			X		Predaceous on arthropods, but will also feed on plant juices and pollen grains. Apterous.
Total number of species	0	0	4	1	0	4	0	
Species unique to each zone	0	0	3	1	0	3	0	

ODONATA (Dragonflies)

(Identified by R. Garrison)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
LIBELLULIDAE								
Sympetrum corruptum Hagen				X				The nymphs are all aquatic and predaceous. Often the adults (also predators) can be found flying over the dunes and other ecological zones, but are more commonly found in the Fen proper.
Sympetrum illotum Hagen				X				
AESHNIDAE								
Aeshna palmata Hagen				X				
Aeshna verticalis Hagen				X				
COENAGRIONIDAE								
Lestes stuttus Hagen				X				
Amphiagrion abbreviatum (Selys)				X				
Ischnura cervula Selys				X				
Ischnura erratica Calvert				X				
Total number of species	0	0	0	8	0	0	0	

EPHEMEROPTERA (Mayflies)

(Identified by S. Kuba)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
BAETIDAE								
Undetermined sp.					X			
Total number of species	0	0	0	0	1	0	0	
Species unique to each zone	0	0	0	0	1	0	0	

HOMOPTERA (Leafhoppers, aphids)

(Identified by S. Kuba)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
CICADELLIDAE								
Draeculacephala sp. 1				X				
Draeculacephala sp. 2				X				
Helochara sp.					X			
Empoasca sp.				X				
Dikraneura sp.				X				
Macrosteles sp.				X				
Idiocerus sp.				X				
Friscanus sp.							X	
Xerophloea sp.						X		
Stragania sp.				X				
Eulonus sp.				X				
nr. Eulonus sp.							X	
(Deltocephalini)								
sp. 1				X				
sp. 2				X				
sp. 3			X					
sp. 4								
sp. 5								
CERCOPIDAE								This very common spittlebug acts like an introduced pest insect, being common on a variety of plant species during the spring and early summer
Philaenus leucophthalmus			X			X	X	
CIXIIDAE								
Cixius sp.				X				
FULGORIDAE								
Pissonotus sp.				X				
Delphacodes sp.				X				
PSYILLIDAE								
Pachysylla sp.					X			
Psylla sp. 1					X			
Psylla sp. 2					X			
APHIDIIDAE (There are at least 8 species of aphids known, but these are not yet identified.)								
Total number of species	0	0	2	13	4	2	3	
Species unique to each zone	0	0	1	13	4	1	2	

NEUROPTERA (lacewings)

(Identified by S. Kuba)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
CHRYSOPIDAE								
Chrysopa carnea Stephen					X	X		Predaceous green lacewing
HEMEROBIIDAE								
Hemerobius pacificus Banks						X		Predaceous brown lacewing
RAPHIDIIDAE								
Agulla astuta Banks							X	Predaceous snakefly
Total number of species	0	0	0	0	1	2	1	
Species unique to each zone	0	0	0	0	0	1	1	

TRICHOPTERA (caddisflies)

(Identified by S. Kuba)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
HYDROPTILIDAE								
Oxyethira sp.					X			
Mayatrichia sp.					X			
PHRYGANCIDAE								
Undet. sp. 1					X			
Undet. sp. 2					X			
LIMNEPHILIDAE								
Chyranda sp.					X			
Total number of species	0	0	0	0	5	0	0	
Total unique to each zone	0	0	0	0	5	0	0	

LEPIDOPTERA (butterflies, moths)

(Identified by J. Powell)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
NYMPHALIDAE								
Vanessa cardui L.			X					
Junonia coenia Hubner						X		
Phyciodes mylitta Edwards			X					
SATYRIDAE								
Coenonympha california Westwood					X			
LYCAENIDAE								
Plebeius saepiolus Boisduval							X	Sierran sp., first coastal record
Plebeius acmon W. & H.							X	
HESPERIDAE								
Hesperia harpalus dodgei Bett							X	1st record of coastal race N of S.F.
Polites sabuleti Bdv.							X	
Ochlodes sylvanoides Bdv.							X	
SPHINGIDAE								
Celerio Lineata F.							X	
ARCTIIDAE								
Apantesis ornata Packard			X					
CTENUCHIDAE								
Scepsis packardii Grote					X			Larvae reared feeding on *Carex*
Ctenucha rubroscapus Men.					X			
NOCTUIDAE								
Caenurgina erechtea (Cram.)							X	
Apamea castanea (Grote)			X					
Pseudorthodes puerlis (Grote)?			X					
Euxoa sp.							X	Larvae nocturnal, dune plant feeders
(2 unidentified species)							X	
PTEROPHORIDAE								
Platyptilia sp.					X			
GEOMETRIDAE								
Nemoria pistaciaria Packard?							X	
Eupithecia sp.							X	Larvae nocturnal, reared on *Ambrosia*
(1 unidentified species)							X	

LEPIDOPTERA (butterflies, moths)
(Identified by J. Powell)
(Cont.)

Scientific Name	Ecological Zone							Biological Notes
	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	
PYRALIDAE								
Pyrausta subsequalis (Gn.)							X	
Crambus anceps Grote			X					
Pediasia dorsipunctella (Kft.)?			X					
TORTRICIDAE								
Olethreutes depracatoria Heinr.				X				First coastal record on *Veratrum*
PHALONIIDAE								
Pnalonidia new sp.					X			This is the first record of this undescribed species from a coastal locality in California. The larvae were feeding on the leaves of *Garrya elliptica* in late April 1973.
GELECHIIDAE								
Aroga sp. nr. *unifasciella* (Bsk.)						X		
(4 unidentified species)								
OECOPHORIDAE								
Depressaria nervosa Haworth				X				Southern most record in Calif.
GLYPHIPTERYGIDAE								
Lotisma trigonana (Wlsm.)			X					
Choreutis gnaphaliella Kft.?			X					
PLUTELLIDAE								
Plutella maculipennis (Cart.)						X		
HELIODINIDAE								
Lithariapteryx abronaeella							X	Northernmost record for species
Schreckensteinia fastaliella							X	Associated with *Rubus*
ELACHISTIDAE								
Elachista new species				X				
Total number of species	0	0	9	3	5	3	15	
Species unique to each zone	0	0	9	3	5	3	15	

COLEOPTERA (beetles)

(Identified by J. Doyen and F. G. Andrews)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
CICINDELLIDAE								Predators as larvae and adults
Omus californicus Esch.			X				X	
Cicindella oregonense LeC.							X	
CARABIDAE								
Scaphinotus interruptus (Mene.)							X	Both are predaceous on snails and lepidopterous larvae
Scaphinotus striatopunctatus (Chand.)							X	
Bembidion transversale, subs.				X			X	Scavengers
Calathus ruficollis DeJean							X	Nocturnal flower feeders
Platynus brunneomarginatus Mannh.						X		Predators under damp wood
Pterostichus sp. 1			X					Under wood
Harpalus sp. 1							X	Found under driftwood
Harpalus sp. 2							X	Found under driftwood
Harpalus sp. 3							X	Found under driftwood
Harpalus sp. 4							X	Found under driftwood
Dicheirus piceus Menet.					X			
DYTISCIDAE								
Agabus sp.				X	X			Predators in aquatic habitats
Hydroporus sp.		X						Predators in aquatic habitats
Rhantus sp.				X	X			Predators in aquatic habitats
Hydrophorus axillaris LeC.				X	X			Predators in aquatic habitats
GYRINIDAE								
Gyrinus plicifer LeC.				X			X	Water surface whirligig swimmers
HALIPLIDAE								
Haliplus sp. (Prob. *gracilus* LeC.)		X						At edge of creek
HYDROPHILIDAE								
Tropisternus californicus LeC.				X	X		X	Aquatic predators
Sphaeridium bipustulatum Fab.			X				X	
Laccobius sp. 1				X				Aquatic predators
Berosis styliferous Horn				X	X			Aquatic predators
Anacaena signaticollis (Fall)				X	X			Aquatic predators
HISTERIDAE								
Hypocarccus lucidulus LeC.							X	Crawling on sand in early evening
Spilodiscus solaris Carno.							X	Walking on dunes in evening

COLEOPTERA
(Identified by Doyen and Andrews)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
HELODIDAE								
Cyphon concinnus LeC.					X			
Cyphon variabilis Thunb.					X			
MELANDRYIDAE								
Anaspis rufa Say					X			
PSELAPHIDAE								
Sonoma sp. 1					X			In dry woody vegetation
(Three unidentified species)					X	X	X	Under vegetation
PHALACRIDAE								
Stilbus sp. 1				X				
Phalacrus sp. 1				X				Associated with *Menyanthes trifoliata*
CHRYSOMELIDAE								
Diabrotica undecimpunctata (Mannh.)			X	X	X	X	X	Adults and larvae general phytophagous feeders
Lina scripta Fab.			X					Larvae feed on alder leaves
Donacia (pusilla? Say)				X				Larvae in submerged plant stems
Glyptoscelis sequoiae Blais.							X	
Altica sp.							X	
Diachus auratus Fab.							X	
Exema conspersa (Mannh.)							X	Larvae casebearers and feed on leaves
SCOLYTIDAE								
Hylastinus obscurus Marsham				X			X	
CURCULIONIDAE								
Trigonoscuta pilosa Mannh.							X	Adults nocturnal feeders on dune plants
Orchestes sp.					X			Adults feed on flowers of willow
Pantomerus godmani Crotch			X					
Cleonus sp. *(poricollis* Mannh.?)							X	Adults feed on flowers of *Erysimum*
Hyperini sp. 1					X			
Apion sp. 1			X					
Elassoptes marinus Horn		X						Under logs and driftwood

COLEOPTERA
(Identified by Doyen and Andrews)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
STAPHYLINIDAE								Scavengers or predators
(Omaliini) sp.					X			Adults on willow flowers
Stenus sp.						X		Under mixed dune vegetation
Staphylinus maxillosus L.			X			X		Predators on dung feeding insects
Bledius sp. 1		X						Under logs
Cafius sp. 1		X						Predators on fly larvae in kelp
(2 Unknown species)							X	In mixed-vegetated dune swales
SILPHIDAE								
Necrophorus guttula Mots.							X	Scavengers
Silpha ramosa Say							X	Scavengers
CANTHARIDAE								
Cantharis sp.		X	X					General predators
Podabrus sp.					X			General predators
Asclera sp.			X					General predators
LAMPYRIDAE								
Lucidota californica Mots.					X			Larvae predaceous in semi-aquatic areas
SCARABAEIDAE								
Aegialia crassa LeC.				X			X	Adults found crawling over dunes
Dichelonyx valida LeC.							X	Larvae root feeders on pine
Aphodius sp.						X		Found associated with dead fawn
Polyphylla crinita LeC.							X	Larvae root feeders
Polyphylla modulata Csy.						X		Larvae root feeders
ELATERIDAE								
Ctenicera anthrax LeC.			X					Larvae called "wireworms"
Limonius sp. 1							X	Some are root feeders, some are
Limonius sp. 2							X	predators; adults called "click beetles"
Cardiophorus sp. 1							X	
MELYRIDAE								
Eutrichopleurus borealis Blaisel.							X	Associated with dune plant flowers
Endeodes collaris LeC.							X	Dune-walking predators
Collops sp.						X	X	Dune-walking predators

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COLEOPTERA
(Identified by Doyen and Andrews)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
			Ecological Zone					
ANOBIIDAE								
Habrobregmus gibbicollis (Le C.)							X	Under wood on dunes
Ptilinus basalis LeC.					X			Under wood on dunes
TENEBRIONIDAE								
Eleodes marginata Esch.			X				X	Crepuscular wandering scavengers
Eleodes scabrosus Esch.			X				X	Crepuscular wandering scavengers
Eleodes tuberculata Esch.			X					Crepuscular wandering scavengers
Coelus ciliatus Esch.							X	Tunnel-track makers in sand
Coniontis eschscholtzii Mannh.			X				X	Nocturnal wandering scavengers
Coniontis sp.							X	Early morning wandering scavengers
Melonastus ater LeC.							X	Under plant debris on dunes
Epantius obscurus LeC.							X	Under driftwood
Phaleromela globosa LeC.							X	In sand under plants
MELOIDAE								
Lytta sp.			X					Adults are flower petal eaters, larvae are predaceous or parasitic
NITIDULIDAE								
Amartus rufipes LeC.							X	Adults feed in flowers of California poppies
PEDILIDAE								
Pedilus (prob. *punctalatus* (LeC.)			X					Feeding on flowers of *Solidago*
COCCINELLIDAE								Predators on aphids, mites, thrips, etc.
Stethorus sp.			X					
Hippodamia quinquesignata punctulata LeC.			X	X				
Hippodamia parenthesis Say			X					
Coccinella californica Mannh.							X	
Coccinella trifasciata Linn.			X					
Scymnus sp. 1 and sp. 2			X			X		
Psyllobora viginti maculata (Say)					X			Fungus feeder
BUPRESTIDAE								
Buprestus sp. 1					X			Larvae are woodborers

COLEOPTERA
(Identified by Doyen and Andrews)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
LATHRIDIIDAE								
Corticaria sp.				X				Fungus feeders
Melanophthalma distinguenda Comolli			X	X			X	Fungus feeders
Melanophthalma herbivagans LeC.					X			Fungus feeders
OEDEMERIDAE								
Copodita quadrimaculata Mots.		X						Under logs
Total number of species	0	7	23	18	22	9	48	
Species unique to each zone	0	7	13	5	14	4	34	

HYMENOPTERA (Bees, wasps, ants)
(Identified by R. Bohart, H. Daly, M. Wasbauer,
E. Schlinger, D. Green, W. Middlekauff, D. Tilles)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
ICHNEUMONIDAE (10 subfamilies, 25 genera, 32 species)								Parasitic wasps of holometabolous insects, and of spiders and spider egg sacs
BRACONIDAE (6 genera, 10 species)								All parasitic on insects
CHALCIDOIDEA (10 families, 30 genera, 50 species)								All parasitic on insects and spider egg sacs
TENTHRIDINIDAE								Larvae phytophagous on various plants
Tenthredo sp.			X					
Allantus mellipes (Norton)					X			
Strongylogaster tibialis Cress.							X	
Empria sp.					X			
Pontania sp.					X			Gallmaker on willow leaves
(Nematine genus?)					X			
ARGIDAE								
Aprosthema bruniventre (Cress.)					X			Larvae phytophagous
SPHECIDAE								
Microbembix californica Bohart							X	Adult wasps feed on flies
Sphex ichneumoneus (Linn.)			X					Predaceous wasps
Ammophila pruniosa Cresson							X	Wasps provision nests with moth larvae
Ammophila dysmica Menke			X					Ibid
Ammophila azteca Cameron			X					Ibid
Podalonia mexicana (Saussure)			X					Predaceous wasps
Gorytes provancheri Handlirsch							X	Predaceous wasps
Philanthus pacificus Cresson							X	Predaceous on adult bees
Dryudella rhimpa Parker							X	Predaceous wasps
Tachysphex angularis Mickel							X	Predaceous on Orthopterans
Tachysphex (sp. nr. *angularis)*							X	Predaceous on Orthopterans
Tachysphex texana (Cresson)							X	Predaceous on Orthopterans
Tachysphex terminatus Smith							X	Predaceous on Orthopterans
Larropsis tenuicornis (Smith)							X	Predaceous wasp
Ancistromma capax Fox							X	Predaceous wasp
Diploplectron peglowi Krombein							X	Predaceous wasps on Heteroptera
Miscophus californicus (Ashmead)							X	Wasps provision nest with spiders
Bembix americana comata Parker	X	X	X	X	X	X	X	Adult wasps catch adult flies in the fen and provision nests in the dunes

HYMENOPTERA (Bees, wasps, ants)
(Identified by R. Bohart, H. Daly, etc.)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
VESPIDAE								
Vespula pennsylvanica (Sauss.)						X	X	Common yellow jacket
Ancistrocerus catskill halophilus Viereck						X	X	Wasps predaceous on Lepidoptera larvae
Stenodynerus blandus (Sauss.)							X	Ibid
CHRYSIDIDAE								Parasites of ground-nesting wasps
Hedychridium fletcheri Bodenstein			X					
Chrysis dorsalis Aaron			X					
Chrysis n. sp. in mss.			X					
TIPHIIDAE								Parasites of scarab beetles in soil
Tiphia sp.							X	
Paratiphia sp.					X			
(*Brachycistine* sp.)					X			
MUTILLIDAE								
Dasymutilla sp.							X	Parasites of *Bembix*
POMPILIDAE								
Aporus luxus (Banks)							X	Predator of sand dune trap-door spider
Aporinellus taeniatus (Kohl)							X	General predators of spider species
Pompilus fumipennis eureka (Banks)							X	General predators of spider species
FORMICIDAE								
Aphaenogaster subterranea occidentalis (Emery.)			X					
Leptothorax nevadensis Wheeler				X				Workers collected crawling on mixed vegetation in fen
Tapinoma sessile (Say)			X	X		X	X	Workers on flowers of *Erysinium* on dunes; a nest was found under old fence post in dunes; common house-infesting ant
Formica spp.			X		X		X	Associated with plants in dunes, sometimes on *Ambrosia*
CERATINIDAE								
Ceratina nanula Cockerell					X		X	Nest in hollow stems, branches.

The column heads Littoral through Dune are grouped under "Ecological Zone".

HYMENOPTERA (Bees, wasps, ants)
(Identified by R. Bohart, H. Daly, etc.)
(Cont.)

Scientific Name	Ecological Zone: Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
APIDAE								Pollinators of various plants
Apis mellifera			X	X	X	X	X	
Bombus sp. 1			X	X	X	X	X	
Bombus sp. 2						X		
Bombus sp. 3							X	
HALICTIDAE								General pollinators
Halictus sp. 1							X	
Halictus sp. 2							X	
Sphecodes sp.							X	
Agapostemon sp.			X				X	
Lasioglossum pavonotum (Cock.)							X	
ADRENIDAE								General pollinators
Andrena sp.			X					
MEGACHILIDAE								General pollinators
Anthidium sp.							X	
Megachile sp. 1							X	
Megachile sp. 2			X					
Osmia sp. 1							X	
Osmia sp. 2							X	
ANTHOPHORIDAE								
Emphoropsis sp.							X	Specific pollinator of *Collinsia*
Melissodes sp.						X		Pollinator of *Chrysopsis villosa*
Melecta sp.							X	Parasitic on otner Anthophorids
Total number of species	1	1	17	5	12	8	40	Plus 32 species Ichneumonidae
Species unique to each zone	0	0	11	1	7	2	31	10 species Bracmidae
								50 species Chalcidoidea

DIPTERA (Flies)
(Identified by M. Buegler, C. Griswold, S. Kuba and E. Schlinger)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
TRICHOCERIDAE					X			"Winter Crane fly"- Larvae feed in decaying vegetable matter
TANYDERIDAE					X			
TIPULIDAE								"Crane flies"-larvae aquatic or semi-aquatic, feeding in decaying vegetable matter or plant roots.
sp. 1				X				
sp. 2						X	X	
sp. 3				X				
sp. 4								
sp. 5				X				
sp. 6				X			X	
sp. 7				X				
probably several other species not yet separated								
TIPULOIDEA								
New Family?					X			Flies key to Tipulidae, but differ in important details of the head, mouth parts, and wings. Possibly represents a family new to science!
PSYCHODIDAE								"Moth flies"-larvae in semi-liquid decaying matter.
Psychoda sp.					X			
DIXIDAE								Larvae aquatic, slow-moving
Dixa sp.				X	X	X		
CHAOBORIDAE								Adults mosquito-like, non-bloodsucking Larvae predators on small aquatic animals, including mosquito larvae.
undet. sp.				X				
CULICIDAE								Mosquitoes; adults blood sucking; larvae aquatic
Anopheles freeborni Aitken					X			
Anopheles punctipennis (Say)					X			
Aedes increpitus Dyar					X			
Aedes sierrensis (Ludlow)					X			
Culiseta maccrackenae Dyar & Knab				X		X		Larvae common only in stream outlet water, near cattle area
Culex pipiens L.					X			

DIPTERA (Flies)
(Identified by M. Buegler, etc.)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
CERATOPOGONIDAE								Larvae aquatic or semi-aquatic; and
Palpomyia sp.				X				
probably several other sp.								
CHIRONOMIDAE								"Midges". Larvae are mostly aquatic.
Paraclunio alaskensis (Coq.)	X							Larvae feed on algae on seashore rocks
Paraclunio trilobatus						X		This "marine" fly has been located only at night on dune
probably 30+ other unidentified species in various habitats				X	X			
ANISOPODIDAE								
Sylvicola new sp.				X	X			
BIBIONIDAE								Adults common at flowers, larvae live in decaying organic matter
Bibio albipennis Say							X	
Dilophus strigilatus McAtee							X	
MYCETOPHILIDAE								"Fungus gnats"-larvae live in fungus.
Undet. sp. 1					X			
Undet. sp. 2						X		
probably very many unidentified species in moist, shady habitats								
SCIARIDAE								Larvae are usually scavengers or fungus feeders.
Bradysia sp.					X			
Eugnoriste sp.					X			
many unidentified spp.								
SCATOPSIDAE								Adults common at flowers
undet. sp.				X				
CECIDOMYIIDAE								Many form galls as larvae in plant tissue or are scavengers, some prey on aphids
many undetermined spp.								
COENOMYIIDAE								Larvae are predators on woodboring larvae
Rachicerus sp.			X					

DIPTERA (Flies)
(Identified by M. Buegler, etc.)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
RHAGIONIDAE								
Rhagio								
sp. A			X					Larvae live in damp soil or leaf mold, predaceous
sp. B					X			
STRATIOMYIIDAE								
Stratiomys laticeps Loew				X				Larvae are aquatic
THEREVIDAE								Larvae are predaceous on root-feeding insect larvae
Metaphragma planiceps Loew			X					
Thereva								
sp. 1							X	
sp. 2							X	
Chromolepida								
new sp.						X		
ASILIDAE								"Robber flies"-predaceous flies; larvae are phytophagous or predaceous
Stenopogon sp.			X					
Nicocles sp.			X			X		
Lasiopogon sp.							X	
Cyrtopogon sp.			X					
Asilus								
sp. 1							X	Summer species
sp. 2			X					Spring species
Cophura sp.			X					
ACROCERIDAE								Larvae develop as internal parasites of spiders
Acrocera bulla Westwood				X	X			Reared from imm. Metaphidippus (Salticidae) spider
BOMBYLIIDAE								Adults are often beelike and feed at flowers. Larvae are predaceous, parasitic, or inquilinous.
Bombylius major Linn.			X				X	Holarctic species common in early spring. It is a parasite of solitary bees.
Lepidanthrax inauratus (Coq.)							X	
Hemipenthes sp.						X		In *Juncus* and *Equisetum* areas
Villa sp.			X				X	Parasite of Lepidoptera larvae
Mythicomyia sp.							X	

DIPTERA (Flies)
(Identified by M. Buegler, etc.)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
PHORIDAE								Larvae of most forms in decaying organic matter
Phora occidentata Malloch					X	X		
Phora sp. A					X	X		
Megasilia								
sp. 1					X			
sp. 2					X			
Aenigmatias sp.					X			In alder litter. A strange, wingless, cockroach-like fly. Other species reported assoc. with ants or termites as larvae.
PIPUNCULIDAE								Larvae endoparasites in leafhoppers; adults insert egg directly into leaf-hopper
Pipunculus (Eudorylus)								
sp. A					X			
sp. B			X					
SYRPHIDAE								Large family with diverse habits, adults usually found at flowers, often bee- or wasp-like "Hover flies"
Neoascia								
sp. 1				X				
new sp.				X				
Melanostoma								
sp. 1				X			X	
sp. 2				X				
sp. 3				X				
Baccha sp.					X			Larvae are aphid predators in arboreal habitats
Syritta pipiens Linn.						X		Larvae recorded from animal dung and sewage, probably in cow dung.
Helophilus latifrons Loew							X	
Sericomyia chalcopyga Loew			X					
Tubifera tenax (Linn.)					X			Larvae "rat-tailed maggots" in slimy decaying matter; adults are bee mimics
Tubifera temporalis Thomson			X		X			Larvae "rat-tailed maggots" in slimy decaying matter; adults are bee mimics
Tubifera occidentalis (Williston)				X				Larvae "rat-tailed maggots" in slimy decaying matter; adults are bee mimics

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
Mesograpta marginata (Say)			X	X	X			
Xylota sp.					X			Larvae probably in wet decaying wood
Toxomerus occidentata Curran					X			Larvae are root feeders, particularly on bulb species.
Cheilosia (Cartosyrphus) sp.					X			Larvae attack plants, mining in stems
Metasyrphus								
sp. 1			X	X				Aphid predator
sp. 2						X		Aphid predator
Allograpta sp.			X		X	X	X	
CONOPIDAE								
Dalmannia heterotricha G. Bohart							X	Fast-flying parasites of bees, inserting egg into host in flight. Species hitherto known only from holotype, Pt. Reyes dunes.
DOLICHOPODIDAE								Larvae are mostly aquatic and predaceous Some adults are predaceous
Dolichopus n. sp.					X			
Dolichopus bruesi Van Duzee		X		X		X		
Dolichopus calainus Brues and Melander			X					Along stream exiting from the fen to the ocean
Dolichopus n. sp.			X		X			Common along streams flowing into and out of the fen
Dolichopus grandis Aldrich				X	X			
Dolichopus hastatus Loew			X	X				
Dolichopus n. sp.			X					Along stream exiting from the fen
Dolichopus ramifer Loew				X	X			
Gymnopternus nigrifacies Van Duzee		X				X		
Pelastoneurus vagens Loew			X		X			Along streams flowing into and out of the fen
Tachytrechus angustipennis Loew		X						Near high beach pool
Hydrophorus innotatus Loew			X			X		Walking on water in calm, still areas
Hereostomus impudicus Wheeler					X	X		
Hydrophorus phoca Aldrich			X					Also found on water
Thrypticus nigripes Van Duzen					X			
Aphrosylus direptor Wheeler	X							Adults found clinging to and flying close to vertical surfaces of rocks in tidal zone

DIPTERA (Flies)
(Identified by M. Buegler, etc.)
(Cont.)

Scientific Name	Ecological Zone: Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
Aphrosylus nigripennis Van Duzee	X							
Dolichopus aurifex Van Duzee			X	X	X			
Aphrosylus praedator Wheeler	X							
Aphrosylus wirthi Harmston	X							
Medetera falcata Van Duzee					X	X		
Medetera n. sp.					X			Moving on *Alnus* trunk
Thrypticus longicauda Van Duzee					X	X		In dense *Juncus* swales
Syntormon variegatum Harmston				X	X			
Diaphorus gibbosus Van Duzee					X			
Campsicnemus milleri Harmston			X					
Calyxochaetus subrinus (Wheeler)					X			
Campsicnemus degener Wheeler				X	X			
Neoparentia n. sp. 1			X					
Neoparentia n. sp. 2					X			
Neoparentia caudata (Van Duzee)			X		X			
Calyxochaetus vegetus Wheeler					X			
Achalcus oregomensis Hrmst. & Miller				X	X	X		In dense vegetation of *Carex* or *Juncus*.
Chrysotus arcuatus Van Duzee					X			
Chrysotus tibialis Van Duzee					X			
Chrysotus californicus Van Duzee					X			
Hercostamus metatarsalis (Thomson)					X			
Sympycnus n. sp.					X			
Sympycnus cuprinus Wheeler			X					Along stream exiting from the fen
EMPIDIDAE								
Empis								
sp. 1					X			
sp. 2			X					
Platypalpus sp.					X			
Oreogeton sp.					X			
Boreodromia sp.					X			
Clinocerinae								
sp. 1						X		
sp. 2						X		
Parathalasius sp. 1							X	Flying over and resting on sand dunes
SCATOPHAGIDAE								
Scatophaga stercoraria (Linn.)			X	X			X	Larvae predators in cow dung, adults also predaceous
Cordilura sp.				X	X	X	X	

DIPTERA (Flies)
(Identified by M. Buegler, etc.)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
ANTHOMYIIDAE								
Hydrophoria sp.			X	X	X			Larvae are aquatic
Hylemya alcathoe (Walker)			X		X			Larvae are root feeders
Undetermined sp. 1					X			
Undetermined sp. 2					X			
Undetermined sp. 3			X		X			
Undetermined sp. 4						X		
Undetermined sp. 5					X			
Undetermined sp. 6							X	
Undetermined sp. 7				X				
MUSCIDAE								
Fannia								
sp. A				X	X			
sp. B					X			
sp. C							X	Bishop pine forest surrounded by dunes
sp. D					X			
Musca domestica Linn.			X					The "house fly"
Graphomya maculata (Scopoli)					X			
Lispe sp.				X				Larvae are aquatic. Adults are predators.
Siphona irritans (L.)					X			Adults bite, particularly cattle.
Limnophora sp.				X				Larvae are aquatic. Adults are predators.
Helina sp.			X		X			Usually along creeks, or in *Rubus* in shady places
Shoenomyza sp.				X		X		Adults are predaceous
Undetermined sp. 1					X			
Undetermined sp. 2				X				
Undetermined sp. 3			X	X		X		
Undetermined sp. 4				X	X			
Undetermined sp. 5					X			
Undetermined sp. 6					X			
Undetermined sp. 7			X*					*Coastal Strand grasses.
Undetermined sp. 8					X			
Undetermined sp. 9				X				Attracted to carrion
Undetermined sp. 10					X			
HIPPOBOSCIDAE								
Lipoptena (Lipoptenella) depressa (Say)			X		X			"Louse fly"-an ectoparasite of deer

DIPTERA (Flies)
(Identified by M. Buegler, etc.)
(Cont.)

Scientific Name	Ecological Zone: Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
CALLIPHORIDAE								
Phormia regina (Meigen)				X				Breed in dung or carrion
Eucalliphora lilaea (Walker)			X		X			
SARCOPHAGIDAE								
Sarcophaga sp.					X		X	
Melanodexia sp.			X		X			
TACHINIDAE								Larvae develop as endoparasites of arthropods or other invertebrates
Stomatomyia parvipalpus (Wulp)							X	Recorded as parasitizing sand crickets
Athrycia cinerea Coq.			X		X			Probably parasitizes Lepidopterous pupae
Bonnetia oenanthus Robineau-Desvoidy			X				X	A Lepidopterous parasite
Gonia								
sp. 1			X					Females deposit thousands of tiny eggs on foliage to be eaten by caterpillars, larvae then develop in Noctuid moth larvae.
sp. 2							X	Females deposit thousands of tiny eggs on foliage to be eaten by caterpillars, larvae then develop in Noctuid moth larvae.
sp. 3							X	Females deposit thousands of tiny eggs on foliage to be eaten by caterpillars, larvae then develop in Noctuid moth larvae.
sp. 4							X	Females deposit thousands of tiny eggs of foliage to be eaten by caterpillars, larvae then develop in Noctuid moth larvae.
Menthozelia sp.					X			
Voria ruralis Robineau-Desvoidy			X					Moth larva parasite
Peleteria sp.			X					Moth larva parasite
Archytas sp.			X					Moth larva parasite
Protodejeania echinata (Thomson)			X		X			Moth larva parasite
LONCHOPTERIDAE								
Lonchoptera furcata (Fallen)				X	X			

DIPTERA (Flies)
(Identified by M. Buegler, etc.)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
OTITIDAE								
Undetermined sp.			X					
TEPHRITIDAE								
Eutreta pacifica Curran			X		X	X		
Trupanea sp.							X	Associated with *Juncus* sp.
Euaresta bellula Snow							X	Larvae develop in flower heads of *Ambrosia.*
SEPSIDAE								
Sepsis punctum (Fabricius)					X			Associated with dung, especially that of cattle.
SCIOMYZIDAE								Larvae are predators or parasites on aquatic or terrestrial snails
Tetanocera plebia Loew.				X	X			
Tetanocera plumosa Loew				X	X			
Dictya montana Steyskal				X	X	X		
Limnia severa Cresson				X	X			
Antichaefa testacea Melander				X				
Hoplodictya acuticornis (Wulp)				X		X		
LAUXANIIDAE								Larvae live in decaying vegetable matter.
Minettia								
sp. 1					X			
sp. 2			X		X	X		
sp. 3			X					
CHAMAEMYIIDAE								Larvae are predators on aphids or mealy-bugs
Chamaemyia sp.					X			
PIOPHILIDAE								Often associated with stored meat or cheeses, carrion, and other decaying organic matter
Prochyliza xanthostoma Walker			X					On dead fawn
SPHAEROCERIDAE								Probably breed in decaying matter or dung.
Leptocera sp.					X			
Copromyza								
sp. A				X				
sp. B				X	X			
Aptilotis sp.				X	X	X		Completely wingless; known from coastal marshes in Europe; first record in this hemisphere

DIPTERA (Flies)
(Identified by M. Buegler, etc.)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
MILICHIIDAE								Associated with seeds of *Abronia*
Meoneura sp. 1							X	
CANACEIDAE								Larvae are marine, associated with kelp or algae
Canaceoides nudata Cresson	X							
EPHYDRIDAE								Large family of small flies, usually aquatic or semi-aquatic, including scavengers, predators, and herbivores.
Ochthera mantis (DeGeer)				X				Head and 1st legs highly modified for predation, resembling a preying mantis.
Notiphila macrochaeta Loew						X		Near stream flowing out of fen, larvae probably scavenge in mud and decaying vegetable matter.
Notiphila occidentalis Cresson						X		Near stream flowing out of fen, larvae probably scavenge in mud and decaying vegetable matter.
Scatella paludum (Meigen)		X						Larvae in algal mats.
Brachydeutera argentata (Walker)							X	
Hydrellia griseola (Fallen)				X	X			Larvae are leaf miners in hydrophilic grasses.
Hydrellia proclinata Cresson				X	X			
Leptopsilopa varipes (Coquillet)				X				
Psilopa compta (Meigen)				X				
Discocerina obscurella (Fallen)					X			
Discocerinini Undetermined sp. 1					X			
Parydra borealis (Cresson)				X		X		
Parydra sp. 2				X				
DROSOPHILIDAE								"Fruit flies"
Drosophila sp.				X	X			
Zygothrica sp. (?)				X	X			First record in North America
CHLOROPIDAE								
Diplotoxa sp.					X	X		In stream flowing out of fen.
Siphonella sp.							X	Near pines, chaparral vegetation.
Elachiptera sp. 1				X	X			Probably bore in grass roots.
Elachiptera sp. 2				X				Probably bore in grass roots.
Oscinella sp.					X			Larvae probably root or stem miners.

DIPTERA (Flies)
(Identified by M. Buegler, etc.)
(Cont.)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
AGROMYZIDAE								Larvae are leaf miners.
Cerodontha dorsalis (Loew)				X				
Melanagromyza sp.				X				
HELEOMYZIDAE								Larvae live in decaying organic materials and animal dung.
Neoleria lutea (Loew)				X				
Suillia loewi Garrett				X		X		
Suilliinae genus nr. *Allophyla*					X	X		
Pseudoleria sp.					X			
Anorostoma wilcoxi Curran						X	X	
Anorostoma maculatum Darlington							X	
TRIXOSCELIDAE								
Trixoscela sp.				X				
ANTHOMYZIDAE								
Anthomyza pallida (Zetterstedt)				X				
Anthomyza sp. 1				X			X	
Anthomyza sp. 2				X	X			
OPOMYZIDAE								Larvae may live in stems of grasses.
Geomyza lurida Loew				X	X			
Geomyza monticola Vockeroth				X				
Total number of species	6	4	52	74	112	38	35	
Species unique to each zone	6	2	26	31	54	11	23	

HEMIPTERA (true bugs)
(Identified by S. Szerlip)

Scientific Name	Littoral	Upper Beach	Prairie Grassland	Fen	Fen Carr	Fen-Dune Ecotone	Dune	Biological Notes
	Ecological Zone							
NOTONECTIDAE								
Notonecta shooteri Uhler				X	X			Aquatic predaceous water boatman
CORIXIDAE								
Callocorixa vulnerata (Uhler)				X				Aquatic algae feeders
GERRIDAE								
Gerris remigis Say				X	X			Common water striders
BELASTOMATIDAE								
Lethocerus americanus (Leidy)				X	X			Predaceous giant water bugs
Belastoma flumineum Say					X			Predaceous giant water bugs
NEPIDAE								
Ranata brevicollis Montandon					X			
PENTATOMIDAE								Stink bugs
Euschistus conspersus Uhler				X				
Chlorochroa uhleri Stal					X		X	
Peribalus sp.				X				
SCUTELLARIDAE								Shield bugs
Eurygaster alternatus Say			X					
LARGIDAE								
Largus cinctus						X	X	
ALYDIDAE								
Alydus pluto Uhler			X					Active wasp-mimicking bugs
Tollius sp.			X					Active wasp-mimicking bugs
LYGAEIDAE								
Kleidocerus modestus Barber					X			Feeding in flower head of *Ledum*
Lygaeus kalmii kalmii Stal							X	
Nysius sp.							X	
Scoloposthesis thomsoni Reuter				X				
Peritrechus saskatchewanensis Barber							X	
Emblethis vicarius							X	
Total number of species	0	0	3	7	7	1	6	
Species unique to each zone	0	0	3	4	3	0	4	

Table 18
Listing of Wildlife Common to the On-Site Area of the Ten Mile Sand Dune
(Compiled by BLM, A. Earl, P. Frankel, H. Ross and M.K. Lashbrook)

Mammals

California myotis bat	*Myotis californicus*
Big brown bat	*Eptesicus fuscus*
Long-eared bat	*Myotis evotis*
Mexican free-tailed bat	*Tadarida mexicana*
Black-tailed jack rabbit	*Lepus californicus*
Brush rabbit	*Sylvilagus bachmani*
Gray squirrel	*Sciurus griseus*
Valley pocket gopher	*Thomomys bottae*
Western harvest mouse	*Reithrodontomys megalotis*
Deer mouse	*Peromycus maniculatus*
California meadow mouse	*Microtus californicus*
Raccoon	*Procyon lotor*
Spotted skunk	*Spilogale putorius*
Striped skunk	*Mephitis mephitis*
Wild house cat	*Felis cattus*
Black-tailed deer	*Odocoileus hemionus columbianus*

Birds

Great blue heron	*Ardea herodias*
Cattle egret	*Bulbulcus ibis*
Turkey vulture	*Cathartes aura*
White-tailed kite	*Elanus leucurus*
Sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperi*
Red-tailed hawk	*Buteo jamaicensis*
Marsh hawk	*Circus cyaneus*
Osprey	*Pandion haliaetus*
American kestrel	*Falco sparverius*
California quail	*Lophortyx californica*
Virginia rail	*Rallus limicola*
Snowy plover	*Charadrius alexandrinus*
Killdeer	*Charadrius vociferus*
Black turnstone	*Arenaria melanocephala*
Sanderling	*Calidris alba*
Western gull	*Larus occidentalis*
Herring gull	*Larus argentatus*
California gull	*Larus californicus*
Ring-billed gull	*Larus delawarensis*
Caspian tern	*Hydroprogne caspia*
Band-tailed pigeon	*Columba fasciata*
Barn owl	*Tyto alba*
Screech owl	*Otus asio*
Great horned owl	*Bubo virginianus*
Short-eared owl	*Asio flammeus*
Saw-whet owl	*Aegolius acadicus*
Vaux's swift	*Chaetura vauxi*
Anna's hummingbird	*Calypte anna*
Rufous hummingbird	*Selasphorus rufus*

Allen's hummingbird	*Selasphorus sasin*
Common flicker	*Colaptes auratus*
Pileated woodpecker	*Dryocopus pileatus*
Red-breasted sapsucker	*Sphyrapicus varius*
Hairy woodpecker	*Dendrocopos villosus*
Downy woodpecker	*Dendrocopos pubescens*
Black phoebe	*Sayornis nigricans*
Western flycatcher	*Empidonax difficilis*
Olive-sided flycatcher	*Nuttallornis borealis*
Violet-green swallow	*Tachycineta thalassina*
Tree swallow	*Iridoprocne bicolor*
Barn swallow	*Hirundo rustica*
Cliff swallow	*Petrochelidon pyrrhonota*
Purple martin	*Progne subis*
Steller's jay	*Cyanocitta stelleri*
Scrub jay	*Aphelocoma coerulescens*
Common raven	*Corvus corax*
Chestnut-backed chickadee	*Parus rufescens*
Bushtit	*Psaltriparus minimus*
Red-breasted nuthatch	*Sitta canadensis*
Wrentit	*Chamaca fasciata*
Long-billed marsh wren	*Telmatodytes palustris*
Robin	*Turdus migratorius*
Varied thrush	*Ixoreus naevius*
Hermit thrush	*Catharus guttatus*
Swainson's thrush	*Catharus ustulatus*
Golden-crowned kinglet	*Regulus satrapa*
Ruby-crowned kinglet	*Regulus calendula*
Water pipit	*Anthus spinoletta*
Cedar waxwing	*Bombycilla cedrorum*
Starling	*Sturnus vulgaris*
Hutton's vireo	*Vireo huttoni*
Warbling vireo	*Vireo gilvus*
Orange-crowned warbler	*vermivora celata*
Yellow-rumped warbler	*Dendroica coronata*
Black-throated gray warbler	*Dendroica nigrescens*
Townsend's warbler	*Dendroica townsendi*
Wilson's warbler	*Wilsonia pusilla*
Western meadowlark	*Sturnella neglecta*
Red-winged blackbird	*Agelaius phoeniceus*
Brewer's blackbird	*Euphagus cyanocephalus*
Brown-headed cowbird	*Molothrus ater*
Purple finch	*Carpodacus purpureus*
House finch	*Carpodacus mexicanus*
Pine siskin	*Spinus pinus*
American goldfinch	*Spinus tristis*
Lesser goldfinch	*Spinus psaltria*
Red crossbill	*Loxia curvirostra*
Rufous-sided towhee	*Pipilo erythrophthalmus*
Savannah sparrow	*Passerculus sandwichensis*
Dark-eyed junco	*Junco hyemalis*
Chipping sparrow	*Spizella passerina*
White-crowned sparrow	*Zonotrichia leucophrys*
Golden-crowned sparrow	*Zonotrichia atricapilla*
Fox sparrow	*Passerella iliaca*
Song sparrow	*Melospiza melodia*

Amphibians

Pacific giant salamander	*Dicamptodon ensatus*
California newt	*Taricha tarosa*
California slender salamander	*Batrachoseps attenuatis*
Black salamander	*Aneides flavi punctatus*
Western toad	*Bufo boreas*
Pacific tree frog	*Hyla regilla*
Red-legged frog	*Rana aurora*
Bull frog	*Rana catesbeiana*

Reptiles

Western fence lizard	*Sceloperus occidentalis*
Alligator lizard	*Gerrhonotus*
Western ring-necked snake	*Diadophis puncta*
Racer	*Coluber constrictor*
Gopher snake	*Pituophis melanoleucus*
Common garter snake	*Thamnophis sirtalis*

Table 19

State of California – The Resources Agency

DEPARTMENT OF PARKS AND RECREATION
BIOTIC COMMUNITY INVENTORY

(compiled by W. J. Barry)

PARK OR AREA: Inglenook Fen Watershed – Ten Mile Dunes

COORDINATES: 39° 32'00"N; 123° 45'30"W

BIOTIC COMMUNITY: Dune

ELEVATION: 0 to 110 feet

SLOPE: 0 to 20°

ASPECT: Northwest to Southeast

PARENT MATERIAL: Franciscan sediments

SOIL TYPE: Beach sand

SYMBOLS:

a.	*abundant*	*ld*	*locally dominant*
c	*common*	*m*	*migrant*
d	*dominant*	*o*	*occasional*
e	*endangered*	*va*	*very abundant*
f	*frequent*	*r*	*rare*
i	*introduced*	*re*	*resident*
la	*locally abundant*	*sv*	*summer visitor*
lc	*locally common*	*wv*	*winter visitor*

PLANT SPECIES:

Tracheophyta	Vascular Plants	Code
Abronia latifolia	Sand verbena	c
Acaena californica	California acaena	o
Achillea borealis	Alpine yarrow	o
Ambrosia chamissonis	Sea ragweed	o
Armeria maritima	Sea pink	o
Artemisia californica	California sagebrush	r
Artemisia pycnocephala	Sagebruch	c
Atriplex leucophylla	Beach saltbush	o
Cakile edentula californica	Sea rocket	o
Cakile maritima	Sea rocket	c,i
Carex obnuta	Sedge	la
Carpobrotus chilensis	Sea fig	o
Chrysopsis villosa var. *bolanderi*	Golden aster	c
Collinsia corymbosa	Chinese houses	lc
Convolvulus soldanella	Shore morning glory	o
Danthonia californica	California oatgrass	o
Daucus pusillus	Wild carrot	o
Elymus mollis	Sea lyme grass	o
Erechtites arguta	Fireweed	r
Erigeron glaucus	Beach fleabane	r
Eriogonum latifolium	Wild buckwheat	c
Erysimum concinnum	Wallflower	o
Eschscholzia californica	California poppy	c
Geranium dissectum	Wild geranium	o,i
Gilia chamissonis	Gillia	r
Gnaphalium japonicum	Cudweed	o
Grindelia charissons var. chanissons	Gum weed	o
Heracleum lanatum	Cow parsnip	o
Holcus lanatus	Velvet grass	c
Hypochoeris radicata	Cat's ear	o,i
Juncus effusus	Bog rush	ld
Juncus lesuevrii	Salt rush	lc
Lathyrus littoralis	Sweet pear	r

Plant Species:

Tracheophyta	Vascular Plants	Code
Lotus sp.	Bird's-foot trefoil	o
Lupinus bicolor var. *umbellatus*	Lupine	c
Marah oreganus	Hill manroot	o
Oenothera cheiranthifolia	Beach primrose	o
Oxalis stricta	Wood sorrell	o
Plantago lanceolata	Ribwort, English plantain	o,i
Poa douglasii ssp. macrantha	Douglas bluegrass	o
Polypodium californicum	California polypody	o
Potentilla egedii	Cinquefoil	o
Rumex acetosella	Sheep sorrel	c
Salix hookeriana	Willow	la
Salix piperi	Dune willow	la
Scrophularia californica	California figwort	lc
Senecio jacobaea	Ragwort	r,i
Sisyrinchium bellum	Blue-eyed grass	o
Sonchus asper	Sow thistle	o,i
Spiranthes romanzoffiana	Ladies' tresses	r

Table 20a

State of California — The Resources Agency

DEPARTMENT OF PARKS AND RECREATION
BIOTIC COMMUNITY INVENTORY

(compiled by W. J. Barry)

PARK OR AREA: Inglenook Fen Watershed

COORDINATES: 39°32'00"N; 123°45'00"W

BIOTIC COMMUNITY: North Coastal, Prairie Coastal

ELEVATION: 50 to 400 feet

SLOPE:

ASPECT:

PARENT MATERIAL: Alluvium

SOIL TYPE:

PLANT SPECIES:

SYMBOLS:

a.	*abundant*	*ld*	*locally dominant*
c	*common*	*m*	*migrant*
d	*dominant*	*o*	*occasional*
e	*endangered*	*va*	*very abundant*
f	*frequent*	*r*	*rare*
i	*introduced*	*re*	*resident*
la	*locally abundant*	*sv*	*summer visitor*
lc	*locally common*	*wv*	*winter visitor*

Bryophyta	**Mosses, Liverworts**	*Code*
Barbula vinealis	Moss	a
Homalothecium pinnatifidum	Moss	a
Tracheophyta	**Vascular Plants**	
Achillea millefolium	Yellow yarrow	r,i
Agrostis tenuis	Colonial bent grass	r,i
Aira caryophyllea	Hairgrass	a,i
Aira praecox	Hairgrass	c,i
Artemisia pycnocephala	Sagebrush	c
Baccharis pilularis	Coyote bush	r
Briza minor	Quaking grass	c,i
Bromus mollis	Soft chess	r,i
Bromus rigidus	Ripgut grass	r,i
Carex sp.	Sedge	la
Carex obnupta	Sedge	la
Cirsium sp.	Thistle	o
Cotoneaster franchetii	Cotoneaster	r,i
Crocosmia crocosmiflora	Crocosmia	r,i
Eriogonum latifolium	Wild buckwheat	lc
Eschscholzia californica	California poppy	c
Festuca megalura	Foxtail fescue	ld
Gnaphalium sp.	Cudweed	r
Habenaria greenei	Rein orchid	o
Holcus lanatus	Velvet grass	ld,i
Horkelia marinensis	Horkelia	la
Juncus sp.	Rush	c
Juncus effusus	Rush	c
Juncus lesueurii	Salt rush	a
Medicago lupulina	Black medick	r,i
Melilotus sp.	Sweet clover	a,i
Myrica californica	Wax myrtle	r
Plantago lanceolata	Ribgrass	c,i

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PLANT SPECIES:

		Code
Poa sp.	Bluegrass	r
Polypogon monspeliensis	Beard grass	o
Polygonum paronychia	Smartweed	o
Pteridium aquilinum var. pubescens	Bracken fern	la
Prunella vulgaris var. atropurpurea	Purple heal-all	o
Rhus diversiloba	Poison oak	o
Rubus vitifolius	California blackberry	o
Rumex acetosella	Sheep sorrel	o,i
Salix sp.	Willow	a
Senecio jacobaea	Tansy ragwort	o
Solidago californica	California goldenrod	o
Chordata	**Chordates**	
Amphibia	**Amphibians**	
Hyla regilla	Pacific treefrog	a
Reptilia	**Reptiles**	
Charina bottae	Rubber boa	o
Eumeces skiltoniasus	Western skink	c
Gerrhonotus multicarnatus	Southern alligator lizard	c
Sceloperus occidentalis	Western fence lizard	c
Thamnophis elegans	Western garter snake	a

Table 20b

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
BIOTIC COMMUNITY INVENTORY
(compiled by W. J. Barry)

PARK OR AREA:	Inglenook Fen Watershed
COORDINATES:	39° 32'00"N; 123° 45'00"W
BIOTIC COMMUNITY:	North Coastal Prairie Swale
ELEVATION:	5 to 15 meters (15 to 50 feet)
SLOPE:	0 – 5°
ASPECT:	East-west
PARENT MATERIAL:	Alluvium
SOIL TYPE:	Unclassified loamy sand

SYMBOLS:

a.	*abundant*	*ld*	*locally dominant*
c	*common*	*m*	*migrant*
d	*dominant*	*o*	*occasional*
e	*endangered*	*va*	*very abundant*
f	*frequent*	*r*	*rare*
i	*introduced*	*re*	*resident*
la	*locally abundant*	*sv*	*summer visitor*
lc	*locally common*	*wv*	*winter visitor*

PLANT SPECIES:

Bryophyta	**Mosses, Liverworts**
Barbula vinealis	Moss
Bryum sp.	Moss
Homalothecium pinnatifidum	Moss
Tracheophyta	**Vascular Plants**
Achillea millefolium	Yarrow
Aira caryophyllea	Silver hairgrass
Aira praecox	Hairgrass
Artemisia pycnocephala	Sagebrush
Baccharis pilularis	Coyote bush
Bellis perennis	English daisy
Briza minor	Little quaking hairgrass
Bromus mollis	Soft chess
Bromus rigidus	Ripgut
Cardamine oligosperma	Bitter cress
Cerastium viscosum	Mouse-ear chickweed
Collinsia corymbosa	Chinese houses
Erysimum menziesii	Wallflower
Gnaphalium sp.	Cudweed
Juncus sp.	Rush
Juncus lesueurii	Salt rush
Luzula subsessilis	Wood rush
Medicago lupulina	Black medick
Melilotus sp.	Sweet clover
Nemophila menziesii	Baby blue-eyes
Poa annua	Annual bluegrass
Poa douglasii	Bluegrass
Poa unilateralis	Bluegrass
Polypogon monspeliensis	Rabbitfoot grass, (Beard grass)
Polygonum paronychia	Smartweed
Sisyrinchium bellum	Blue-eyed grass
Trifolium	Clover
Vulpia bromoides	Fescue
Vulpia myuros	Foxtail fescue

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State of California — The Resources Agency

DEPARTMENT OF PARKS AND RECREATION

BIOTIC COMMUNITY INVENTORY

(compiled by W. J. Barry)

PARK OR AREA: Inglenook Fen Watershed

COORDINATES: 39° 32'00"N; 123° 45'30"W

BIOTIC COMMUNITY: Coast Redwood Forest

ELEVATION: 70 to 400+ feet

SLOPE: 0 to 30°

ASPECT: West

PARENT MATERIAL: Franciscan or alluvial derived from Franciscan

SOIL TYPE: Hugo loam or Empire sandy loam

SYMBOLS:

a.	*abundant*	*ld*	*locally dor*
c	*common*	*m*	*migrant*
d	*dominant*	*o*	*occasional*
e	*endangered*	*va*	*very abunc*
f	*frequent*	*r*	*rare*
i	*introduced*	*re*	*resident*
la	*locally abundant*	*sv*	*summer vis*
lc	*locally common*	*wv*	*winter visi*

PLANT SPECIES:

Scientific Name	*Common Name*	*Co*
Abies grandis	Grand fir	c
Clintonia andrewsiana	Red clintonia	c
Garrya elliptica	Coast silk-tassel	c
Gaultheria shallan	Salal	c
Myrica californica	Wax myrtle	c
Psendotsuga menziesii	Douglas fir	a
Rhododendron macrophyllum	California rhododendron	c
Ribes sanguineum	Red-flowering currant	c
Ribes spectabilis	Salmon berry	c
Sequoia sempervirens	Coast redwood	c
Tsuga heterophylla	Western hemlock	c
Vaccinium ovatum	Black huckleberry	c
Vaccinium parvifolium	Red huckleberry	c

ANIMAL SPECIES:

CORDATA	**CORDATES**	
Mammallia	**Mammals**	
Euarctus americanus	Black Bear	
Thomomys bottae	Pocket Gopher	
Amphibia	**Amphibians**	
Ambystoma gracile	Northwestern salamander	c
Aneides flavipunctatus	Black salamander	c
Ascaphus truei	Tailed frog	c
Batrachoseps attenuatis	California slender salamander	c
Dicamptodon ensatus	Pacific giant salamander	c
Rana boylei	Yellow-legged frog	c
Rhycatriton olympicus	Olympic salamander	c
Taricha granulosa	Rough-skinned newt	c
Taricha tarosa	California newt	c

ANIMAL SPECIES

Scientific Name	*Common Name*	Code
Reptilia	**Reptiles**	
Thamnophis elegans	Western garter snake	a

Campanula californica

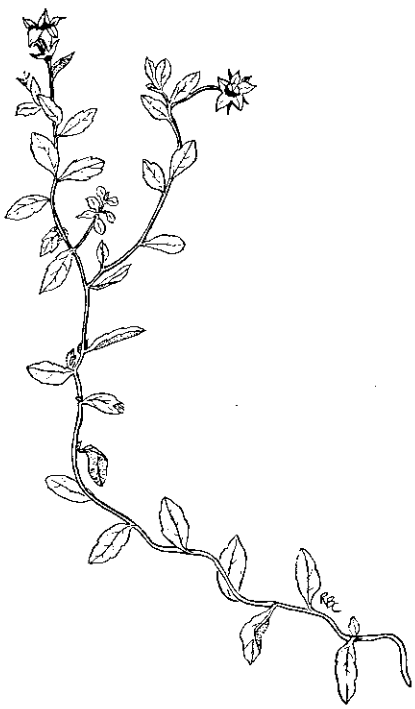

Table 22

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
BIOTIC COMMUNITY INVENTORY
(compiled by W. J. Barry)

PARK OR AREA: Inglenook Fen Watershed

COORDINATES: 39° 32'00"N; 123° 45'30"W

BIOTIC COMMUNITY: Fen

ELEVATION: 30 feet

SLOPE: 0° to 5°

ASPECT: West

PARENT MATERIAL: Herbaceous litter

SOIL TYPE: Hydromorphic

SYMBOLS:

a.	*abundant*	*ld*	*locally dominant*
c	*common*	*m*	*migrant*
d	*dominant*	*o*	*occasional*
e	*endangered*	*va*	*very abundant*
f	*frequent*	*r*	*rare*
i	*introduced*	*re*	*resident*
la	*locally abundant*	*sv*	*summer visitor*
lc	*locally common*	*wv*	*winter visitor*

PLANT SPECIES:

Scientific Name	*Common Name*	*Code*
Angelica lucida	Angelica	o
Calamagrostis nutkaensis	Reedgrass	ld
Campanula californica	Bellflower	o
Carex obnupta	Sedge	ld
Carex vicaria	Sedge	ld
Cicuta douglasii	Water hemlock	c
Collinsia corymbosa	Chinese houses	lc
Drosera rotundifolia	Sundew	lc
Epilobium adenocaulon var. *parishii*	Willow herb	o
Epilobium watsonii var. *franciscanum*	Willow herb	o
Equisetum hyemale	Scouring rush	lc
Gentiana sceptrun	King's gentian	o
Glyceria occidentalis	Manna grass	o
Habenaria dilatata var. *leucostachys*	Rein orchid	o
Habenaria greenei	Rein orchid	r
Hydrocotyle ranunculoides	Marsh pennywort	r
Hypericum anagalloides	St. John's wort	f
Juncus bolanderi	Rush	c
Juncus effusus var. *brunneus*	Rush	c
Juncus effusus var. *pacificus*	Rush	c
Juncus ensifolius	Rush	c
Juncus lesueurii	Rush	c
Juncus phaeocephalus	Rush	c
Ledum glandulosum ssp.. *columbianum*	Labrador-tea	ld
Ludwigia palustris var. *pacifica*	Ludwigia	lc
Lysichiton americanum	Skunk cabbage	lc
Menyanthes trifoliata	Buck bean	a
Mimulus guttatus	Monkey flower	r
Myrica californica	Wax myrtle	ld
Nuphar polysepalum	Yellow waterlily	ld
Oenanthe sarmentosa	Water hemlock	c
Polypogon monspeliensis	Beard grass	lc
Potentilla egedii var. *grandis*	Cinquefoil	lc
Potentilla palustris	Bog cinquefoil	c

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Scientific Name	Common Name	Code
Rorippa nasturtium-aquaticum	Watercress	f
Scirpus acutus	Tule	lc
Scrophularia californica	California figwort	o
Sisyrinchium californicum	Yellow blue-eyed grass	f
Stachys chamissonis	Hedge nettle	
Trifolium wormskioldii	Wild clover	lc
Typha latifolia	Cattail	lc
Veratrum fimbriatum	False hellebore	a
Veronica americana	Brookline	r
VERTEBRATES		
Amphibia		
Hyla regilla	Pacific tree frog	
Rana aurora	Red-legged frog	c
Rana boylei	Yellow-legged frog	c
Reptilia		
Clemmys marmorata	Wester pond turtle	o
INVERTEBRATES		
Annelida		
Lumbriculidae	lumbriculid worms	
Kinkaidiana freidris	lumbriculid worm	o
Kinkaidiana hexatheca	lumbriculid worm	c
Tubificidae	tubificid worms	
Psammoryctides californianus		c
Limnodrilus hoffmeisteri		o
Limnodrilus profundicola		c
Peloscolex		a
Rhyacodrilus coccineus		
Enchytraeidae	enchytraeid worms	
Mesenchytraeus sp.		r
Arthropoda		
Diptera	crane flies	
Tipulidae	biting midges	o
Ceratopogonidae	midges	a
Chironomidae		a
Pentaneura indecisa (Williston)		d
Stratiomyidae		

Table 23

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
BIOTIC COMMUNITY INVENTORY
(compiled by W. J. Barry)

PARK OR AREA: Inglenook Fen Watershed

COORDINATES: 39° 32'00"N; 123° 45'30"W

BIOTIC COMMUNITY: Fen-Carr

ELEVATION: 40 feet

SLOPE: 0 to 10°

ASPECT: Variable

PARENT MATERIAL: Alluvial/Organic

SOIL TYPE: Hydromorphic

SYMBOLS:

a	*abundant*	*ld*	*locally dominant*
c	*common*	*m*	*migrant*
d	*dominant*	*o*	*occasional*
e	*endangered*	*va*	*very abundant*
f	*frequent*	*r*	*rare*
i	*introduced*	*re*	*resident*
la	*locally abundant*	*sv*	*summer visitor*
lc	*locally common*	*wv*	*winter visitor*

PLANT SPECIES:

Scientific Name	*Common Name*	*Code*
Alnus oregona	Red alder	d
Baccharis douglasii	Baccharis	r
Galium trifidum var. *subbiflorum*	Bedstraw	o
Ledum glandulosum ssp. *columbianum*	Labrador tea	a
Lonicera involucrata var. *ledebourii*	Honeysuckle	c
Lotus aboriginum	Bird's-foot trefoil	r
Lysichiton americanum	Skunk cabbage	c
Myrica californica	Wax myrtle	a
Rubus vitifolius	California blackberry	c
Salix coulteri	Willow	a
Salix piperi	Dune willow	a
Salix sitchensis	Willow	a
Scrophularia californica	California figwort	o
Stachys stricta	Woundwort	r
Vicia americana var. *oregana*	Vetch	o
Vicia gigantea	Vetch	o

Table 24

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
BIOTIC COMMUNITY INVENTORY
(compiled by W. J. Barry)

PARK OR AREA: Inglenook Fen Watershed

COORDINATES: 39° 32'30"N; 123° 45'00"W

BIOTIC COMMUNITY: Freshwater

ELEVATION: 10 feet

SLOPE: 0 to 1°

ASPECT: West

PARENT MATERIAL: Stream sediments

SOIL TYPE: Hydromorphic

SYMBOLS:

a.	*abundant*	*ld*	*locally dominant*
c	*common*	*m*	*migrant*
d	*dominant*	*o*	*occasional*
e	*endangered*	*va*	*very abundant*
f	*frequent*	*r*	*rare*
i	*introduced*	*re*	*resident*
la	*locally abundant*	*sv*	*summer visitor*
lc	*locally common*	*wv*	*winter visitor*

PLANT SPECIES:

Scientific Name	*Common Name*	*Code*
Athyruim filix-femina var. *sitchense*	Lady fern	
Azolla filiculoides		
Cicuta douglasii	Douglas water-hemlock	
Equisetum hyemale var. *robustum*	Common horsetail	ld
Galium trifidum var. *subbiflorum*	Bedstraw	
Heleocharis palustris	Spikerush	
Lilaea scilloides	Flowering quillwort	
Nuphar polysepalum	Yellow waterlily	la
Oenanthe sarmentosa	Water hemlock	
Potentilla palustris	Bog cinquefoil	la
Rorippa nasturtium-aquaticum	Watercress	ld
Scirpus acutus	Tule	lc
Typha latifolia	Cattail	la
Veronica americana	Speedwell	

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Table 25a
Some Aquatic Organisms (other than Insects) Collected from Lotic Communities Passing through Inglenook Fen
by D. C. Erman

MOLLUSCA	MOLLUSKS
Gastropoda	Snails
Physidae, *Physa* sp.	Freshwater snails
Planorbidae, *Gyraulus* sp.	Freshwater snails
Bivalva	Clams
Sphaeriidae *Pisidium* sp.	Freshwater clams
ANNELIDA	SEGMENTED WORMS
Hirudinidae	Leeches
ARTHROPODA	ARTHROPODS
Crustacea	Crustaceans
Asellidae *Asellus* sp.	Sow bug
CHORDATA	CHORDATES
Osteichthyes	Bony fishes
Gasterosteidae *Gasterosteus aculeatus*	Three-spined stickleback
Amphibia	Amphibians
Bufons	Western toad (larvae)

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Table 25b

Aquatic Insects Predaceous on Mosquitoes in
Inglenook Fen Lotic (Running) Waters
(Identified by R. Garcia, R. Garrison and W. Voigt)

Hemiptera
- Notonectidae – *Notonecta shooteri* Uhler
- Corixidae – *Callocorixa vulnerata* (Uhler)
- Gerridae – *Gerris regimis* Say
- Belastomatidae – *Lethocerus americanus* (Leidy)
- –*Belastoma flumineum* Say
- Nepidae – *Ranta brevicollis* Montandon

Coleoptera
- Noteridae – *Notomicrus* sp.
- Hydrophilidae - *Berosus styliferous* Horn
- *Anacaena signaticollis* (Fall)
- *Tropisternus californicus* LeConte
- Haliplidae – *Haliplus* sp.
- Dytiscidae – *Hydroporus axillaris* LeConte
- – *Hydroporus* sp.
- – *Agabgus* sp.
- – *Rhanatus* sp.
- Gyrinidae – *Gyrinus plicifer* LeConte

Odonata
- Libellulidae – *Sympetrum corruptum* Hagen
- –*Sympetrum illotum* Hagen
- Aeshnidae – *Aeshna palmata* Hagen
- – *Aeshna verticalis* Hagen
- Coenagrionidae – *Lestes stuttus* Hagen
- – *Amphiagrion abbreviatum* (Selys)
- – *Ischnura cervula* (Selys)
- – *Ischnura erratica* Calvert

Diptera
- Dolichopodidae – *Hydrophorus innotatus* Loew
- – *Hydrophorus phoca* Aldrich
- – (+ 18 species in 11 genera of uncertain predatory habits)

Table 26a
PHYLOGENETIC PLANT CHECKLIST
For Inglenook Fen Watershed
(Compiled by W. J. Barry)

BRYOPHYTA	**Mosses and Liverworts**
Musci	
Pottiales	
Pottiaceae	
Barbula vinealis Brid. (North Coastal Prairie Swale)	Moss
Hypnobryales	
Brachytheciaceae	
Homalothecium pinnatifidum (North Coastal Prairie Swale)	Moss
Eubryales	
Bryaceae	
Bryum sp. 1	Moss
TRACHEOPHYTA	**VASCULAR PLANTS**
Sphenophyta	Horsetail Family
Equisetaceae	
Equisetum hyemale (Fen, Coastal Dunes)	Scouring rush
Equisetum hyemale var. *robustum* (Freshwater marsh)	Common horsetail
horequilinum var. *pubescens* (North Coastal Prairie)	Bracken fern
Pteridium equilinum var. *pubescens*	
Salviniales	
Aspidiaceae	
Athyrium filix-femina var. *sitchensis* (Freshwater marsh)	Lady fern
Polypodiaceae	
Polypodium californicum	California polypody
Coastal dune	
Aalviniaceae	
Azolla filiculoides (Freshwater marsh)	
GYMNOSPERMAE	**GYMNOSPERMS**
Coniferales	Conifers
Pinaceae	Pine family
Abies grandis (Coast Redwood Forest)	Grand fir
Pinus muricata (Bishop Pine Forest)	Bishop pine
Tsuga heterophyla (Coast Redwood Forest)	Western hemlock
Pseudotsuga menziesii (Coast Redwood Forest)	Douglas-fir
Taxodiaceae	Yew family
Sequoia sempervirens (Coast Redwood Forest)	Coast redwood
ANGIOSPERMAE	**ANGIOSPERMS**
Dicotyledoneae	Dicots
Nymphaeaceae	Water lily family
(Fen; Freshwater marsh)	Yellow water lily
Sarraceniaceae	Pitcher plant family
Nyphar polysephalum	Yellow water lily

Droseraceae	Sundew family
Drosera rotundifolia	Oblong-leaved sundew
Geraniaceae	Geranium family
Geranium dissectum	Cranesbill
Oxalidiaceae	Oxalis family
Oxalis stricta	Oxalis or wood sorrel
Hypericaceae	St. John's wort family
Hypericum anagalloides	St. John's wort
Papaveracea	Poppy family
Eschscholzia californica cham.	California poppy
Cruciferae	Mustard family
Cakile edentula californica	California sea rocket
Cakile maritima	Sea rocket
Rorippa nasturtium-aquaticum	Watercress
Cardamine oligosperma (Coastal Prairie Swale)	Bitter-cress
Erysimum concinnum (Dune)	Wallflower
Erysimum Menziesii (Coastal Prairie Swale)	Wallflower
Caryophyllaceae	Pink family
Cerastium viscosum (Coastal Prairie Swale)	Mouse Ear Chickweed
Aizoaceae	Carpet-weed family
Carpobrotus chilense (Dune)	Sea fig
Polygonaceae	Buckwheat family
Eriogonum latifolium (Dune; North Coastal Prairie)	Wild buckwheat
Rumex acetosella L.	Sheep sorrel
Polygonum paronychia (Coastal Prairie Swale; North Coastal Prairie)	Smartweed
Chenopodiaceae	Goosefoot family
Atriplex leucophylla (Dune)	Beach saltbush
Nyctaginaceae	Four-o'clock family
Abronia latifolia (Dune)	Sand verbena
Plantaginaceae	Plantain family
Plantago hookeriana var. *californica* (Coastal Prairie Swale)	Plantain
Plantago lanceplate L. (Dune; Coastal Prairie Swale)	Ribwort, English Plantain
Plumbaginaceae	Leadwort family
Armeria maritima (Dune)	Sea pink
Ericaceae	Heath family
Ledum glandulosum ssp. *columbianum*	Labrador tea
Rhododendron macrophyllum (Coast Redwood Forest)	California rhododendron
Gaultheria shallan (Coast Redwood Forest)	Salal
Vaccinium ovatum (Coast Redwood Forest)	Black huckleberry
Vaccinium parvifolium (Coast Redwood Forest)	Red huckleberry
Gentionaceae	Gentian family
Menyanthes trifoliata (Fen)	Bog bean
Convolvulaceae	Morning-glory family
Convolvulus soldanella (Dune)	Morning-glory
Polemoniaceae	Phlox family
Gilia chamissonis (Dune)	Gilia
Hydrophyllaceae	Waterleaf family
Nemophila Menziessi	Baby blue eyes
Scrophulariaceae	Figwort family
Mimulus guttatus (Fen)	Monkey flower
Scrophum, (Dune; Fen; Coastal Prairie Swale)	California figwort
Collinsia corymbosa (Dune; Fen; Coastal Prairie Swale)	Chinese houses

Veronica americana (Fen; Freshwater Marsh)	Brookline
Labiatae	Mint family
Prunella vulgaris var. *atropurpurea*	Purple heal-all
Stachys chamissonis	Hedge nettle
Stachys stricta (Fen-carr)	Woundwort
Saxifragaceae	Saxifrage family
Ribes spectabilis (Coast Redwood Forest)	Salmon berry
Ribes sanguineum (Coast Redwood Forest)	Red-flowering currant
Rosaceae	Rose family
Horkelia marinensis (North Coastal Prairie)	Horkelia
Potentilla egedii (Dune)	Cinquefoil
Potentilla egedii var. *grandis* (Fen)	Cinquefoil
Potentilla palustris (Fen; Freshwater Marsh)	Bog cinquefoil
Acaena californica (Dune)	California acaena
Rubus vitifolius (North Coastal Prairie; Fen-carr)	California blackberry
Cotoneaster franchettii (North Coastal Prairie)	Cotoneaster
Leguminosae	Pea family
Lupinus bicolor var. *umbellatus* (Dune)	Lupin
Medicago lupulina (North Coastal Prairie; Coastal Prairie Swale)	Black medick
Melilotus sp. (North Coastal Prairie; Coastal Prairie Swale)	Sweet clover
Trifolium wormskioldii (Fen; Coastal Prairie Swale)	Wild clover
Lotus ssp. (Dune)	
Lotus aboriginum (Fen-carr)	
Lathyrus littoralis (Dune)	Sweet pea
Vicia americana var. *oregana* (Fen-carr)	Vetch
Vicia gigantea (Fen-carr)	Pea, vetch
Betulaceae	
Alnus oregona (Fen-carr)	Red alder
Myricaceae	
Myrica californica (North Coastal Prairie; Fen; Fen-carr; Coast Redwood Forest)	Wax-myrtle
Salicaceae	
Salix sp. (North Coastal Prairie)	Willow
Salix hookeriana (Dune)	Willow
Salix piperi (Dune; Fen-carr)	Willow
Salix coulteri (Fen-carr)	Willow
Salix sitchensis (Fen-carr)	Willow
Onagraceae	Evening primrose family
Ludwigia palustris var. *pacifica* (Fen)	Ludwigia
Epilobium adenocaulon var. *parishii*	Willow herb
Epilobium watsonii var. *franciscanum* (Fen)	Willow herb
Oenothera cheiranthifolia (Dune)	Evening-primrose
Camissonia cheiranthifolia (Dune)	Evening-primrose
Anacardiaceae	
Rhus diversiloba T&b. (North Coastal Prairie)	Poison oak

Umbelliferae	Carrot family
Hydrocotyle ranunculoides (Fen)	Marsh pennywort
Daucus pusillus (Dune)	Wild carrot
Cicuta douglasii (Fen; Freshwater Marsh)	Water hemlock
Oenanthe sarmentosa (Fen; Freshwater Marsh)	Water hemlock
Heracleum lanatum (Dune)	Cow parsnip
Angelica lucida (Fen)	Angelica
Garryaceae	Silk-tassel family
Garrya elliptica (Coast Redwood Forest)	Coast silk-tassel
Rubiaceae	Madder family
Galium trifidum var. *subbiflorum* (Fen-carr; Freshwater Marsh)	Bedstraw, madder
Caprifoliaceae	Honeysuckle family
Lonicera involucrata var. *ledebourii* (Fen-carr)	Honeysuckle
Cacurbitaceae	Gourd family
Marah oreganus (Dune)	Oregon wild cucumber
Campanulaceae	Bellflower family
Campanula californica (Fen)	California bellflower
Compositae	Sunflower family
Ambrosia chamissonis (Dune)	Sea ragweed
Baccharis douglasii	Baccharis
Grindelia sp.	
Chrysopsis villosa var. *bolanderi* (Dune)	Golden aster
Solidago californica Nutt. (North Coastal Prairie)	California goldenrod
Bellis perennis L. (Coastal Prairie Swale)	English daisy
Erigeron glaucus (Dune)	Beach fleabane, sea-side daisy
Franseria chamissonis	Sea ragweed
Baccharis pilularis (North Coastal Scrub; North Coastal Prairie; Coastal Prairie Swale)	Coyote brush
Achillea millefolium (North Coastal Prairie; Coastal Prairie Swale)	Yellow yarrow
Achillea borealis (Dune)	Alpine yarrow
Artemisia californica (Dune; North Coastal Scrub)	California sagebrush
Artemisia pycnocephala (Dune; Coastal Prairie Swale; North Coastal Scrub; North Coastal Prairie)	Sagebrush
Senecio jacobaea (North Coastal Prairie; Dune)	Tansy ragwort
Erechtites arguta (Dune)	Fireweed
Gnaphalium japonicum (Dune)	Cudweed
Gnaphalium sp. L. (North Coastal Prairie; Coastal Prairie Swale)	Cudweed
Cirsium sp. (North Coastal Prairie)	Thistle
Hypochoeris radicata (Dune)	Cat's ear
Sonchus asper (Dune)	Sow thistle
Lilaeaceae	Flowering quillwort family
Lilaea scilloides (Freshwater Marsh)	Flowering quillwort
Liliaceae	Lily family
Clintonia andrewsiana (Coast Redwood Forest)	Red clintonia
Veratrum fimbriatum (Fen)	False-hellebore
Araceae	Arum family
Lysichiton americanum (Fen; Fen-carr)	Yellow skunk cabbage

Lemnaceae	Duckweed family
Lemna sp. (Freshwater Marsh)	Duckweed
Typhaceae	Cat-tail family
Typha latifolia (Fen; Freshwater Marsh)	Soft-flag, common cat-tail
Iridaceae	Iris family
Sisyrinchium bellum (Dune; Coastal Prairie Swale)	Blue-eyed grass
Sisyrinchium californicum (Fen)	Yellow blue-eyed grass
Crocosmia crocosmiflora (North Coastal Prairie)	Montbretia
Orchidacea	Orchid family
Habenaria dilatata var. *leucostachys* (Fen)	Rein orchid
Habenaria greenei (Fen; North Coastal Prairie)	Rein orchid
Spiranthes romanzoffiana (Dune)	Ladies' tresses
Juncaceae	Rush family
Juncus sp. L. (North Coastal Prairie; Coastal Prairie Swale)	Rush, wire-grass
Juncus effusus (Dune; North Coastal Prairie)	Rush
Juncus effusus var. *brunneus* (Fen)	Rush
Juncus effusus var. *pacificus* (Fen)	Rush
Juncus lesueurii (Dune; North Coastal Prairie; Coastal Prairie Swale; Fen)	Salt rush
Juncus bolanderi (Fen)	Rush
Juncus phaeocephalus (Fen)	Rush
Juncus ensifolius (Fen)	Rush
Luzula subsessilis (Coastal Prairie Swale)	Wood rush
Cyperaceae	Sedge family
Scirpus acutus (Fen; Freshwater Marsh)	Common tule
Heleocharis palustris (Freshwater Marsh)	Spike rush
Carex sp. (North Coastal Prairie)	Sedge
Carex vicaria (Fen)	Sedge
Carex obnupta (Dune; North Coastal Prairie Fen)	Sedge
Gramineae	Grass family
Bromus mollis (Coastal Prairie Swale)	Soft chess, grass
Bromus rigidus (Coastal Prairie Swale)	Ripgut grass
Festuca megalura (North Coastal Prairie)	Foxtail festuca
Festuca dertonensis (Coastal Prairie Swale)	Fescue
Festuca Myuros (Coastal Prairie Swale)	Foxtail fescue
Glyceria occidentalis (Fen)	Manna grass
Poa sp. (North Coastal Prairie)	Bluegrass
Poa annua (Coastal Prairie Swale)	Annual bluegrass
Poa douglasii (Coastal Prairie Swale)	Douglass bluegrass
Poa douglasii ssp. *macrantha* (Dune)	Douglas bluegrass
Poa unilateralis (Coastal Prairie Swale)	Bluegrass
Briza minor (North Coastal Prairie; Coastal Prairie Swale)	Quaking grass
Elymus mollis (Dune)	Ryegrass
Aira praecox (North Coastal Prairie; Coastal Prairie Swale)	Hairgrass
Aira caryophyllea (Coastal Prairie Swale)	Hairgrass
Holcus lanatus (Dune)	Velvet grass
Danthonia californica (Dune)	California oatgrass

Calamagrostis nutkaensis (Fen)	Reedgrass
Agrostis tenuis (North Coastal Prairie)	Colonial bent grass
Polypogon monspeliensis (Gen; North Coastal Prairie; Coastal Prairie Swale)	Rabbit foot grass

Table 26b
PHYLOGENETIC ANIMAL CHECKLIST
(Excluding Insects)
For Inglenook Fen Watershed
(Compiled by W.J. Barry)

Tubificidae	Tubificid worm family
Psammoryctides californianus (Fen)	Tubificid worm
Limnodrilus hoffmeisteri (Fen)	Tubificid worm
Limnodrilus profundicola (Fen)	Tubificid worm
Peloscolex sp. (Fen)	Tubificid worm
Rhyacodrilus coccineus (Fen)	Tubificid worm
Enchytracidae	Enchytracid worm family
Mesenchytraeus sp. (Fen)	Enchytracida worm
Lumbriculidae	Lumbriculid worm family
Kinkaidiana freidris (Fen)	Lumbriculid worm
Kinkaidiana hexatheca (Fen)	Lumbriculid worm
Iguanidae	Iguanid family
Sceloperus occidentalis (North Coastal Prairie)	Western fence lizard
Anguidae	Alligator lizard family
Gerrhonotus	Aligator lizard
Gerrhonotus multicarnatus (North Coastal Prairie)	Southern alligator lizard
Scincidae	Skink family
Eumeces skiltonianus (North Coastal Prairie)	Western skink
Boidae	Boa family
Charina bottae (North Coastal Prairie)	Rubber boa
Colubridae	Colubrid family
Diadophis punctatus	Western ring-necked snake
Coluber constrictor	Racer
Pituophis melanoleucus	Gopher snake
Thamnophis sirtalis	Common garter snake
Thamnophis elegans (North Coastal Prairie; Coast Redwood Forest)	Western garter snake
Ambystomidae	Mole, salamander family
Rhycatriton olympicus (Coast Redwood Forest)	Olympic salamander
Dicamptodon ensatus (Coast Redwood Forest)	Pacific giant salamander
Ambystoma gracile (Coast Redwood Forest)	Northwestern salamander
Plethodontidae	Lungless salamander family
Batrachoseps attenuatis (Coast Redwood Forest)	California slender salamander
Aneides flavipunctatus (Coast Redwood Forest)	Black salamander
Salamandridae	Newt family
Taricha granulose (Coast Redwood Forest)	Rough-skinned newt
Taricha tarosa (Coast Redwood Forest)	California newt
Bufonidae	True toad family
Bufo boreas	Western toad
Hylidae	Tree frog family
Hyla regilla (North Coastal Prairie; Fen)	Pacific tree frog
Ranidae	True frog family
Rana aurora (Fen)	Red-legged frog
Rana boylei (Coast Redwood Forest)	Yellow-legged frog
Rana catesbeiana	Bullfrog
Ascaphidae	Tailed frog family
Ascaphus truei (Coast Redwood Forest)	Tailed frog

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Testudinidae	Turtle family
Clemmys marmorata (Fen)	Western pond turtle
Vespertilionidae	Evening bat family
Myotis evotis	Long-eared bat
Myotis californicus (Dune)	California myotis bat
Eptesicus fuscus (Dune)	Big brown bat
Molossidae	Free-tailed bat family
Todarida mexicana (T. brasiliensis) (Dune)	Mexican free-tailed bat (Brazilian free-tailed bat)
Leporidae	Rabbit family
Lepus californicus (Dune; North Coastal Prairie)	Black-tailed jack rabbit (hare)
Sylvilagus bachmani (Dune)	Brush rabbit
Sciuridae	Squirrel family
Sciurus griseus (Dune)	Gray squirrel (Western)
Geomyidae	Pocket gopher family
Thomomys bottae (Dune)	Valley pocket gopher
Thomomys bottae (Coast Redwood Forest)	Pocket gopher (Western)
Cricetidae	Mouse family
Reithrodontomys megalotis (Dune)	Western harvest mouse
Peromycus maniculatus (Dune)	Deer mouse
Microtus californicus (Dune)	California meadow mouse (Microtine mice)
Ursidae	Bear family
Euarctus americanus (Coast Redwood Forest)	Black bear
Procyonidae	Raccoon family
Procyon lotor (Dune; Fen; Fen-carr)	Raccoon
Mustelidae	Skunk family
Spilogale putorius (Dune; Coast Redwood Forest; Fen; Fen-carr)	Spotted skunk
Mephitis mephitis (Dune; Coast Redwood Forest; Fen; Fen-carr)	Striped skunk
Felidae	Cat family
Felis cattus (Dune; North Coastal Prairie)	Feral house cat
Cervidae	Deer Family
Odocoileus hemionus columbianus (Dune; Coast Redwood Forest)	Black-tailed deer
Ardeidae	Heron and bittern family
Ardea herodias	Great blue heron
Cathartidae	American vulture family
Cathartes aura	Turkey vulture
Accipitridae	Short-winged, soaring and bird hawk fan
Accipiter striatus	Sharp-shinned hawk
Accipiter gentilis	Cooper's hawk
Buteo jamaicensis	Red-tailed hawk
Circus cyaneus	Marsh hawk
Pandionidae	Osprey family
Pandion haliaetus	Osprey
Falco tinnunculus	Kestrel
Phasianidae	Quail family
Lophortyx californica	California quail

Charadriidae	Turnstone family
Charadrius alexandrinus	Snowy plover
Charadrius vociferus	Killdeer
Arenaria melanocephala	Black turnstone
Scolopacidae	Sandpiper family
Crocethia alba	Sanderling
Laridae	Gull and Tern family
Larus occidentalis	Western gull
Larus argentatus	Herring gull
Larus californicus	California gull
Larus delawarensis	Ring-billed gull
Hydroprogne caspia	Caspian tern
Columbidae	Pigeon and dove family
Columba fasciata	Band-tailed pigeon
Zenaidura macroura	Mourning dove
Tytonidae	Barn owl family
Tyto alba	Barn owl
Strigidae	Owl family
Otus asio	Screech owl
Bubo virginianus	Great horned owl
Asio flammeus	Short-eared owl
Aegolius acadicus	Saw-whet owl
Apodidae	Swift family
Chaetura vauxi	Vaux's swift
Trochilidae	Hummingbird family
Calypte anna	Anna's hummingbird
Selasphorus rufus	Rufous hummingbird
Selasphorus sasin	Allen's hummingbird
Picidae	Woodpecker family
Colaptes cafer	Red-shafted flicker
Sphyrapicus varius	Redbreasted sapsucker
Dendrocopos villosus	Hairy woodpecker
Dendrocopos pubescens	Downy woodpecker
Tyrannidae	Tyrant flycatcher family
Sayornis nigricans	Black phoebe
Empidonax difficilis	Western flycatcher
Nuttallornis borealis	Olive-sided flycatcher
Contopus sordidulus	Western wood pewee
Hirundinidae	Swallow family
Tachycineta thalassina	Violet-green swallow
Iridoprocne bicolor	Tree swallow
Petrochelidon pyrrhonota	Cliff swallow
Progne subis	Purple martin
Hirundo rustica	Barn swallow
Corvidae	Crow and jay family
Cyanocitta stelleri	Steller's jay
Corvus corax	Raven
Paridae	Chickadee and bushtit family
Parus rufescens	Chestnut-backed chickadee
Psaltriparus minimus	Common bushtit

Sittidae	Nuthatch family
Sitta canadensis	Red-breasted nuthatch
Chamacidae	Wrentit family
Chamaca fasciata	Wrentit
Troglodytidae	Wren family
Telmatodytes palustris	Long-billed marsh wren
Turdidae	Thrush and bluebird family
Turdus migratorius	Robin
Ixoreus naevius	Varied thrush
Hylocichla guttata	Hermit thrush
Hylocichla ustulata	Swainson's thrush
Sylviidae	Kinglet and gnatcatcher family
Regulus satrapa	Golden-crowned kinglet
Regulus calendula	Ruby-crowned kinglet
Motacillidae	Pipit family
Anthus spinoletta	Water pipit
Bombycillidae	Waxwing family
Bombycilla cedrorum	Cedar waxwing
Sturnidae	Starling family
Sturnus vulgaris	Starling
Vireonidae	Vireo family
Vireo gilvus	Warbling vireo
Parulidae	Wood warbler family
Vermivora celata	Orange-crowned warbler
Dendroica coronata	Myrtle warbler
Dendroica auduboni	Audubon's warbler
Dendroica nigrescens	Black-throated gray warbler
Dendroica townsendi	Townsend's warbler
Geothlypis trichas	Common yellow-throat
Wilsonia pusilla	Wilson's warbler
Icteridae	Blackbird and oriole family
Sturnella neglecta	Western meadowlark
Agelaius phoeniceus	Red-winged blackbird
Euphagus cyanocephalus	Brewer's blackbird
Molothrus ater	Brown-headed cowbird
Fringillidae	Sparrow and finch family
Carpodacus purpureus	Purple finch
Carpodacus mexicanus	House finch
Spinus pinus	Pine siskin
Spinus tristis	American goldfinch
Spinus psaltria	Lesser goldfinch
Loxia curvirostra	Red crossbill
Pipilo erythrophthalmus	Rufous-sided towhee
Passerculus sandwichensis	Savannah sparrow
Junco oreganus	Oregon junco
Spizella passerina	Chipping sparrow
Zonotrichia leucophrys	White-crowned sparrow
Zonotrichia atricapilla	Golden-crowned sparrow
Passerella iliaca	Fox sparrow
Melospiza melodia	Song sparrow

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