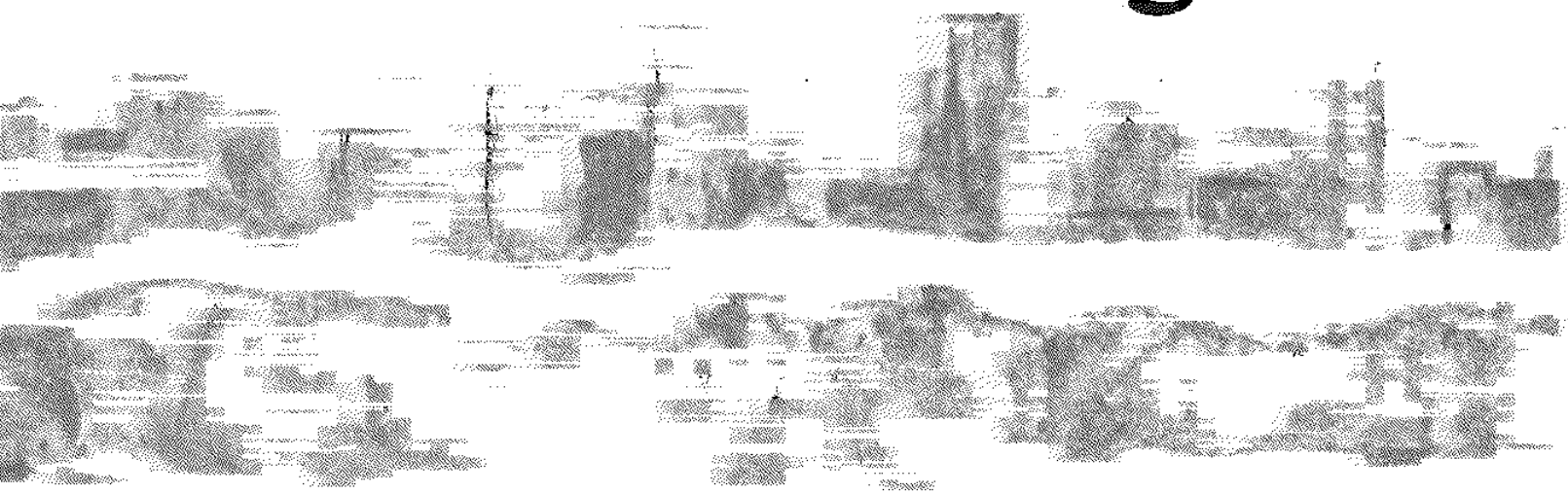
California Coastal Catalog



The American Littoral Society
special publication #10

Year of the Coast 1980

California Coastal Catalog

An Ecological Guide to the Planning and Conservation of the California Coast

Compiled by

John Clark
Visiting Professor

With

Debra D. Loh and James D. Caudill

And

Eileen Allen
David R. Boyer
William S. Hopkins
Alexis I. Strauss
Judith R. Trumbo
Jeff L. Whisler
Cynthia D. Wilbur
Catherine Williams

Masters Degree Candidates
The University of California at Los Angeles
School of Architecture and Urban Planning

Illustrated by

Rhonda Evans
Duke University

The American Littoral Society, Sandy Hook, Highlands, New Jersey 07732

ACKNOWLEDGEMENT

Support for the preparation of this document was provided by the California Sea Grant Program, The Conservation Foundation, the University of California at Los Angeles, and the Griffis Foundation.

NOTICES

This work is the result of research sponsored by NOAA, Office of Sea Grant, Department of Commerce, under grant number 04-8-M01-189, Project R/NP-1-8G, and funds provided by the California State Resources Agency. The U.S. Government is authorized to produce and distribute reprints for governmental purposes, notwithstanding any copyright notation that may appear hereon.

John Clark is Director of Coastal Programs for the Conservation Foundation, Washington, D.C. He served as Visiting Professor at UCLA's School of Architecture and Urban Planning from January to July, 1979, teaching and assisting ten second year masters degree candidates with their comprehensive project. The products "Ballona Wetlands Study" and the "California Coastal Catalog" were accepted in partial fulfillment of their degree requirements.

Contents

Reader's Guide

The object of the California Coastal Catalog is to present, as concisely as possible, primary information on coastal ecology and on ecological aspects of the coastal planning and management process authorized under the California Coastal Act of 1976. Readers will benefit by understanding the following features of the catalog:

- The catalog is organized as an encyclopedia with its content presented in brief subject articles arranged in alphabetical order by title.

- The titles of the articles are mostly the ecological subjects dealt with in the "Local Coastal Program Manual" (LCPM) (Version of 9/30/77) of the California Coastal Commission.

- If "Wetlands Restoration," for example, is of immediate concern to you (P. II-18 of the LCPM, Sect. 30411 (b) (3) of the Coastal Act), you can find that specific title alphabetically in the W's.

- Cross-references are given to related information appearing under other titles in the encyclopedia.

- Wherever appropriate, the articles are organized as follows: a) definition of title subject, b) relevance to the 1976 Coastal Act, c) factual narrative, d) practical tips, e) cross references, f) literature citations.

- Example permit appeal cases (denoted by *) are cited at the end of many articles; copies of the full texts of any of these are available from the State Commission.

Authors

The articles in this encyclopedia were prepared by the ten masters degree candidates working on this project. Authors are identified by their initials at the end of each article as follows:

Debra D. Loh, DL
Eileen Allen, EA
David R. Boyer, DB
William S. Hopkins, WH
Alexis I. Strauss, AS
James D. Caudill, JC
Judith R. Trumbo, JT
Jeff L. Whisler, JW
Cynthia Wilbur, CWB
Catherine Williams, CW

Reviewers

The generous assistance of the following experts in reviewing individual articles in the encyclopedia is appreciated:

Jan Atwood
Ann Chaney
Judy Clark
Grant DeHart
Tom Dickert
Charles Dill
Charles Dock
Forrester Einarson
Pamela D. Emerson
Rim Fay
Brian Farris
Norman Flette
Curtis Fossom
Jeffrey Frautschy
Maeton C. Freel
Susan Gates
Ray Gorman
Carl Hetrick
Bruce E. Jones
Paul Kelly
Jack Klavin
Terry Mansfield
Keith McDonald
Eric Metz
Chris Onuf
Donald A. Phillip
Judith Rosener
Nancy A. Sackman
Ann Sands
Lewis Schinazi
James A. Schuler
William Shortall
Jim Slauson
David Smith

Preface

The coastal catalog was created to aid the coastal planning and management program enacted by the State Legislature as the California Coastal Act of August, 1976. The Act was passed in response to the findings of a study conducted between 1973 and 1975 by the California Coastal Zone Conservation Commissions. This study was authorized by Proposition 20, a citizen initiative approved by the State's voters in November, 1972, which set up the Commission, gave it temporary land use permit powers within a designated coastal zone, and directed a planning study for the coast.

The Coastal Act requires each of 68 local coastal jurisdictions (15 counties and 43 cities), to prepare, by January 1981, a plan for the conservation of its coastal resources. It also requires a showing that the plan will be enforced by appropriate means, such as land use ordinances and development plan reviews. The local planning activity was in various stages of progress at the time this catalog was being prepared in the spring of 1979. Some communities were well advanced, others barely started. None had completed a plan and enforcement program acceptable to the California Coastal Commission. Therefore, it seemed possible to prepare a catalog that would be available in time to aid the planning process in the short run as well as to guide the implementation phase in the long run.

The value of an ecological source document to aid in the planning process was evident to us and to many local planners. For example, Pat Beck and Joseph O'Hagan with the San Luis Obispo Planning Department commented as follows: "A major problem facing the Local Coastal Program in development of resource protection techniques is the lack of technical information. The Coastal Act provides excellent guidance in the development of policies and principles, however, the ecological facts to support specific standards are lacking." Haywood Norton of Monterey stressed the value this way: "...if your catalog allows the Coastal process to be just a little less subjective your effort should be considered an overwhelming success."

Responding to such opinion, I persuaded my 10 graduate students in environmental planning to prepare a source document on ecological aspects of the 1976 Coastal Act as the second part of their comprehensive project, a thesis equivalent option for masters degree candidates at UCLA's School of Architecture and Urban Planning (the first part was a detailed study of the Ballona Wetlands in Los Angeles).

The encyclopedia format for the catalog was selected as the alternative which would best fit the needs of the readers and the circumstances of the student planning team. We hope the catalog in this form will serve a broad spectrum of interests: local planners, administrators, citizens, public officials and developers, among others. The Readers Guide explains

how to most rapidly find information on a particular subject and generally how to get the most out of the catalog.

We tried to respect the advice of many to keep the articles concise and simply worded and the format attractive. For example, Thomas A. Zanic, Principal Planner of the South Central Coast Regional Commission commented: "...I would advise that the text of the handbook be as simple as is possible and that the purpose and usability of the handbook be as clear as possible through the use of graphics, a 'user's guide' and so forth... the communication device needs to be clear and simple."

The research for the catalog and the preparation of the draft manuscript was done by the second-year masters students under faculty supervision. The students consulted with a variety of experts in the process of their research, sent drafts of each article to experts for technical review (see Authors and Reviewers section for names), and all finished manuscript was subjected to faculty review. Through this process it is hoped that most errors have been caught and that the copy has been made as relevant to local coastal planning issues as possible. The authors of the individual encyclopedia articles are listed in the Authors and Reviewers section.

We are grateful for the generous assistance of many colleagues on and off the UCLA campus, many of whom are credited inthe Authors and Reviewers section. We are particularly grateful for the guidance provided by the following: Erik Metz, the California Coastal Commission; Jens Sorenson, the California Sea Grant Program; Les Strnad, the Central Coast Regional Commission. Ruthann Corwin, my faculty colleague, assisted in numerous ways. Students Debra Loh and James Caudill volunteered many weeks of post-graduate time to manuscript improvement. Catherine Lochner served as copy editor-manager and Barbara Haynie and Toney Dixon typed most of the manuscript. Diane Mills provided administrative support. Thanks are due to Harvey M. Perloff, Dean, Peter Maris and David Conn of the School of Architecture and Urban Planning for their general support and to William K. Reilly, President of the Conservation Foundation for initiating the arrangement under which I served on the UCLA faculty.

John Clark
Los Angeles
July 27, 1979

Introduction to the Coastal Act

In November 1972, a public referendum called Proposition 20 was approved by the voters of California and the Nation's most comprehensive coastal planning and management program was underway. The new law created one statewide and six regional coastal commissions, with memberships divided about equally between local elected officials and "citizen commissioners" appointed by the governor and legislative leadership. The commissions were to have authority over almost all forms of development in a strip extending three miles seaward and 1,000 yards landward along the state's entire coastline. Proposed developments -- after they had secured the usual local government approvals -- had to obtain a permit from a regional commission. And, if a permit was granted, any person who had made objection before the regional body could appeal that decision to the state commission. Even public agencies' own development projects were not exempt from the law's provisions. The state highway department and local urban renewal agencies, like private developers, had to apply for permits for coastal projects. But while the permit process attracted the most public attention when the law was enacted, it was only a holding action. The commissions' concurrent task was to draw up a detailed plan for permanent protection of the coast, and to submit it to the 1976 session of the legislature, the coastal plan was submitted in January of 1976.

The legislature accepted the Coastal Plan's most important implementation principle more or less intact. For four years beginning in 1977, the coastal commissions would oversee the preparation of "local coastal programs" (LCP's) by local governments. The result will become part of each locality's body of land-use controls, incorporated in its land-use plan and zoning map. These LCP's are required to be in accordance with a 12-page list of coastal standards (a kind of summary version of major policies of the plan) and are subject to approval and possible revision by the commissions. Until a local coastal program is approved by the coastal commissions, the commissions retain their permit power. And even afterwards, citizens can ask a permanent state coastal commission to review local decisions on large or strategically located projects.

This joint state-local planning process is now under way. Fifty-three cities, fifteen counties, and four port districts fall within the boundaries of the coastal zone as defined in 1976, and each must prepare a local coastal program. The development of technical standards for achieving the requirements of the 1976 Coastal Act was not addressed during the 1973-1975 planning perion but rather was shifted to the future and thus left up to local governments. Thus, the California Coastal Commissions' planning program did not come to grips with underlying scientific issues but shifted them ahead to the implementation period which, in effect, transferred the search for data and concepts to local governments, which must formulate local coastal programs.

It is because no single collection of facts and concepts about California's coast and coastal program was available to local citizens and planners that

we launched the project that lead to this book while I was teaching at U.C.L.A. in winter and spring of 1979. It is an encyclopedia of facts, definitions, profiles, concepts, and other items of value to those dealing with the formulation and implementation of LCP's, Local Coastal Programs. As a special feature we have included at the end of each article, where appropriate, several examples of permit cases we believe to be particularly instructive. The staff reports and other material on these study cases may be obtained from the California Coastal Commission office in San Francisco by giving the citation to the case as listed. The resolution of contested permit actions sometimes provides good leads to local planning criteria and to implementation techniques.

A

AGRICULTURE

Although the economic and scenic values of coastal agricultural land have long been recognized, vast areas of productive cropland have been lost to urban development -- approximately eight percent in coastal counties in the last decade. State and national policies directed at reversing this trend must reckon with the real and potential conflicts between agricultural use and coastal water-based resources. Careless agricultural practices (e.g. poor soil management and indiscriminate use of pesticides) heighten these conflicts and lead to reduction in output from fisheries, shellfisheries, aquaculture, and other coastal industries. (1)

Agriculture is addressed in Sections 30241, 30242, and 30243 of the Coastal Act:

- The maximum amount of prime agricultural land shall be maintained in agricultural production.
- The conflicts between both prime and non-prime agricultural and urban land uses shall be minimized.
- Non-prime agricultural lands shall not be converted to non-agricultural use unless continued or renewed agricultural use is not feasible.
- The long-term productivity of both prime and non-prime agricultural soils shall be protected. (2)

Major coastal ecosystem disturbances in California include water pollution, alteration of the runoff water cycles, and loss of coastal wetlands. Sedimentation, nutrient enrichment, and inflow of toxic substances -- the principal pollutants -- are caused by soil fertilizers, animal wastes and biocides being carried into tidal waters. These eroded materials carry excess nutrients and toxic substances into estuaries, causing water turbidity and the sedimentation of streams and bays. Many bays and harbors have been seriously degraded by sedimentation, and some require continual dredging, at an annual cost to the nation of tens of millions of dollars. (1)

Disruption of the natural runoff pattern -- its quality, volume and rate of flow -- is caused by diking, drainage, irrigation works, and clearing of natural vegetation (see: Diking and Watersheds.) Under the terms of Section 30106 of the Coastal Act, the removal or harvesting of major vegetation for agricultural purposes is specifically exempt from the permit process. While this exemption is a major concern of several agencies in the coastal zone, owners of agricultural land currently may clear and grade the property without approval of the state or regional coastal commissions. (3)

In some instances, the change in land use has caused increased erosion, loss of wildlife habitat and lowering of the water table. For example, in the Elkhorn Slough area of the Central Coast Region, large areas of land were cleared of mature oak trees in order to be put into strawberry production. As a result, an additional 12 inches of sedimentation (per year) were recorded in the estuary; the loss of trees eliminated wildlife habitat and greatly increased the need for water on the property. (3,4)

Feedlots -- often located along streams and rivers that discharge into coastal waters -- have for years introduced animal wastes similar to untreated human wastes directly into sewage waters. (2)

Although many states now require permits for the use of pesticides, controlling their use is often complicated by the large number of chemicals in use. A 1970 study identified 78 frequently used pesticides in the California coastal zone. While general pesticide control mechanisms may exist at the state and Federal levels, special local needs and problems often require additional constraints. (2)

In addition to its value as a food-supply resource, agricultural use of land preserves the scenic and aesthetic values of open space in coastal areas and provides seasonal wildlife habitat (e.g. for birds of prey and small rodents). If agricultural management is effective in minimizing attendant coastal ecosystem disturbances, this use of the land is most desirable. Another advantage of coastal agriculture under proper control is the potential use of the higher parts of floodplains for range and cropland rather than housing. The property damage and loss of life that can occur from flooding in such areas are thus prevented (see: Floodlands.) (2)

During periods of high demand for agricultural products, the use of non-wetland coastal lowlands -- low-lying, soggy land above extremely high water -- for cropland or livestock is often encouraged. Drainage of these lowlands for agricultural purposes can seriously stress coastal ecosystems. (1) Artificial drainage within a coastal watershed alters a vital element of the coastal ecosystems -- the natural drainage system -- and requires careful control to ensure that the water-cleansing function of vegetation is preserved and the freshwater flow into the estuaries remains constant. In addition to altering water flow, land improvement projects are often accompanied by a large increase in "non-point-source" pollutants which increase both the inflow of nutrients and the biochemical oxygen demand (BOD). (3)

The Coastal Commission's decisions on agricultural issues show a strong commitment to preserving agricultural lands in the coastal zone. The Commission has denied numerous applications for land divsions because they involved the conversion of agricultural land to non-agricultural use in a manner inconsistent with Coastal Act policies.

The primary focus of both the Coastal Act and the California Coastal Plan is the preservation of agricultural lands in agricultural production. While not explicitly stated, it is implied that conflicts between agricultural impacts on coastal ecological resources should be minimized. In May of this year, the Coastal Commission approved the Coastal Conservancy's Arcata Marsh Enhancement Project. The project entailed the conversion of 10.4 acres of non-prime agricultural land to non-agricultural use. While this conversion parted from the spirit of Sections 30241 and 30242 of the Coastal Act, the Commission found, in this specific case, that the policies encouraging protection of marine resources and sensitive habitats were more protective of coastal resources than those limiting conversion of farmland. (Section 30007.5 of the Coastal Act states that in cases where a conflict arises between two or more policies of the Coastal Act, such conflicts shall be resolved in a manner which on balance is the more protective of significant coastal resources). (5) (See: Coastal Conservancy.) Therefore, although the Arcata project was not in conformance with the agricultural preservation policies of the Coastal Act, the Commission found that the project was more protective of coastal resources than the preservation of 10.4 acres of non-prime agricultural land.

The issues involving both prime and non-prime agricultural land differ according to whether the land is upland, transitional, or wetland:

- Upland: Agricultural use of upland areas is preferred to residential development provided that performance standards effectively protect water quality (e.g. prevent eutrophication, toxicity, and sedimentation).

- Transitional (buffer) area: Agricultural use of buffer areas (minimum 100 feet), which are established to protect sensitive environmental habitat areas from runoff, ecological disturbance and habitat disruption, is strongly discouraged. However, if the buffer area is prime agricultural land and the owner can guarantee that the water quality will not be degraded by agricultural practices, then agricultural use of the buffer area is often permitted. (See: Buffer Area.)

- Wetlands: Agricultural use of wetlands is unacceptable, virtually without exception and present agricultural use of a wetland is a non-conforming use. Whenever possible wetlands that have been converted to agricultural use are restored to their natural states.

cw

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 2. California Coastal Commission. July 12, 1978. "Draft Memo on Agricultural Policies." California Coastal Commission, San Francisco. 3. Assembly Office of Research. 1979. "An Assessment of the California Coastal Planning Process." Assembly Office of Research, Sacramento. 4. Personal communication with Thomas Dickert. School of Landscape Architecture and City Planning, University of California, Berkeley. 5. California Coastal Commission. 1979. "Staff

Recommendations: Coastal Conservancy Project #1 (Arcata Marsh Enhancement Project)." California Coastal Commission, San Francisco.

AMERICAN PEREGRINE FALCON

(See: Peregrine Falcon, American.)

AQUIFER

(See: Groundwater.)

AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE

Areas of Special Biological Significance (ASBS) are water areas designated by the California State Water Resources Control Board to afford special protection for marine species from thermal, sewage, and industrial discharges and urban runoff. "Point-source" discharges are prohibited and "non-point" sources are to be controlled to the extent practicable.

The Coastal Act requires that each ASBS be protected against significant disruption (Section 30204). The Coastal Commission has classified them as "environmentally sensitive habitat areas" in the "Local Coastal Program Manual." (1)

The designated ASBS are in ocean waters and may include or border ecological reserves, marine life refuges, kelp beds, marine reserve areas, reef reserves, national parks, natural seashores, islands, and other significant natural resource areas. A list of the ASBS and necessary controls is contained in the California State Water Resources Control Board document, "Areas of Special Biological Significance" (July 1976), (2) for use in local coastal planning.

dl

References: 1. California Coastal Commission. July 22, 1977. "Local Coastal Program Manual." 2. California State Water Resources Control Board. July 1976. "Areas of Special Biological Significance."

B

BAYS

(See: Estuaries.)

BEACHES

A beach may be defined as the unvegetated part of the shoreline formed of loose material, usually sand, that extends from the upper berm to the low-water mark. It is useful to understand the taxonomy of the beach in order to understand shoreline processes. The typical beachfront is composed of the following parts: (1)

Bar: An offshore ridge that is submerged permanently or at higher tides.

Trough: A natural channel running between an offshore bar and the beach or between offshore bars.

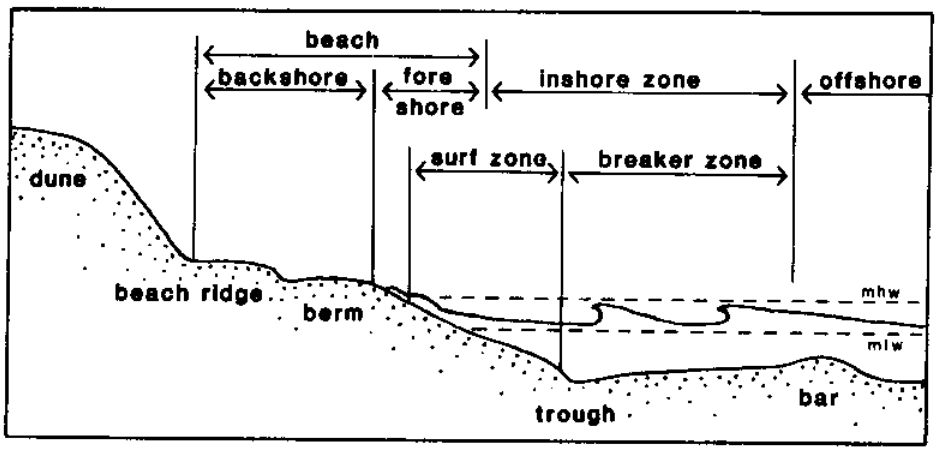
Foreshore (Forebeach): The part of the shore lying between the crest of the most seaward berm and the ordinary low water mark; it is ordinarily traversed by the uprush and backrush of the waves as the tides rise and fall.

Backshore (Backbeach): The part of the beach that is usually dry, that lies between the foreshore and the duneline, and that is acted upon by waves only during storm and exceptionally high water.

Berm: A wave-deposited ridge of sand on the backshore, that marks the upper limit of ordinary high tides and wave wash.

Beach Ridge: A more or less continuous mound of beach material behind the berm that has been heaped up by wave action during extreme highwater levels (if largely wind built, usually termed "dunes", and often vegetated).

Dunes: More or less continuous mounds of loose, wind-blown material, usually sand, behind the berm (often vegetated). The first layer dune is termed the "foredune", or the "frontal" or "primary" dune; those behind the frontal dune are called "secondary", "rear", or "back" dunes. Secondary dunes may be active or stabilized. An "active" dune is one that is mobile, or in the process of visibly gaining or losing sand.



The whole beachfront is a dynamic and integrated system. Dunes, berms, forebeach, and the shallow nearshore areas form a single interacting unit which must be considered holistically. To prevent serious erosion and storm damage the beachfront must be carefully managed.

Ecologically, the beachfront is a unique environment occupied by animals adapted to the high stress and constant motion of the beach sands: for example, crabs, clams, and other rapid-burrowing species. There are also many temporary residents, such as the grunion fish that comes to nest on the beach. Countless shorebirds feed at the water's edge and nest on the upper beach areas, the sand dunes, and the sand overwash areas behind the beach.

A survey of the nesting and breeding habits of local species that use the beach or dune is needed for the identification of specific nesting sites. Once identified, these critical habitat areas should be protected during the particular breeding and nesting seasons and regulations should be promulgated for keeping people out of these areas, as is practiced in England for tern protection.

The plant communities of the beachfront thrive on the continuing stress of natural disturbances, to which the grasses and other plant species living here are especially adapted. The vegetation plays a significant role in stabilizing the dune front, trapping and holding the sand blown up by the wind, and thereby allowing the dunes to build and stabilize.

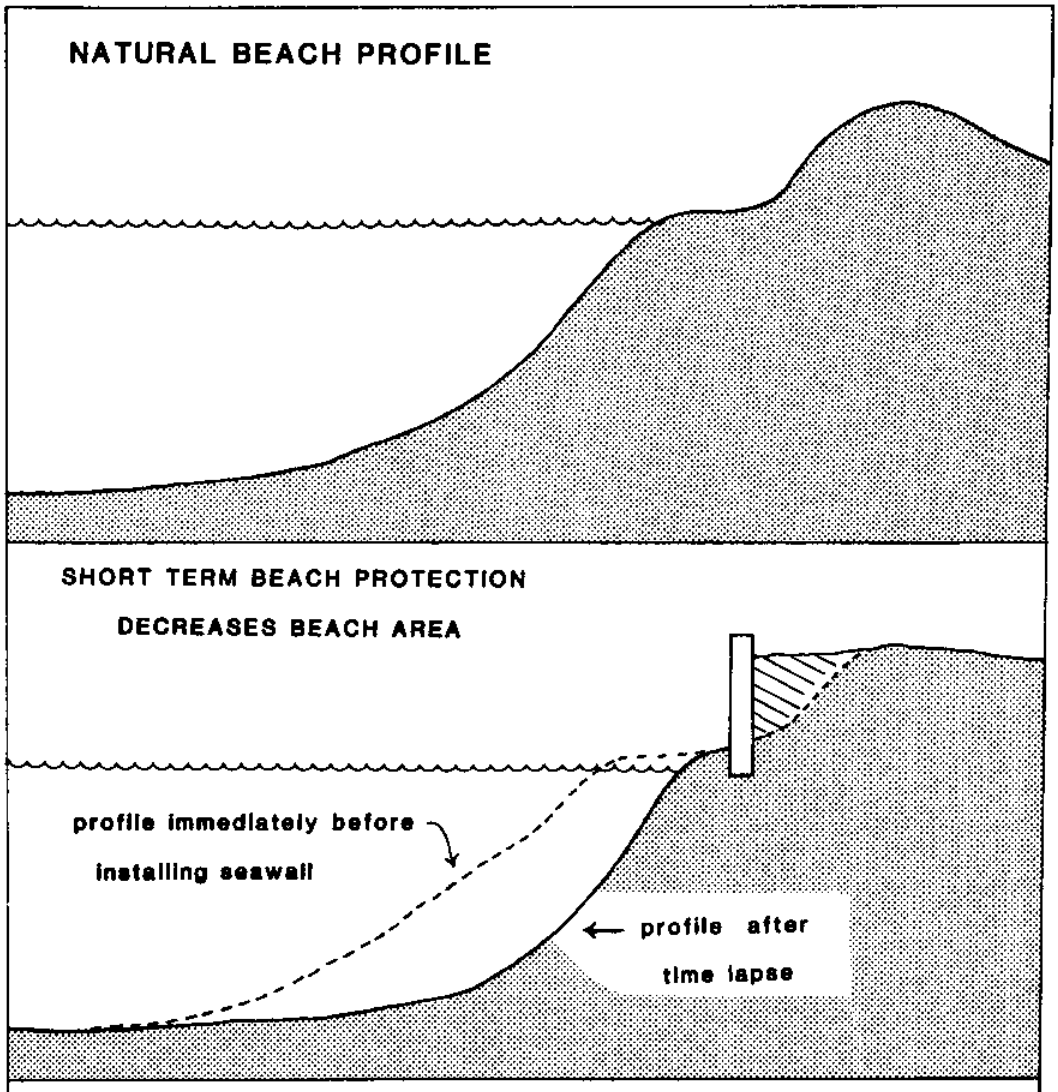
Effective beachfront management requires closely coordinated federal-state-local participation in the planning and implementation of programs which can be planned through the Local Coastal Program (LCP) process. The most urgent task facing many communities is the formulation of a comprehensive beachfront management plan as part of the LCP and the establishment of a regulatory program to enforce it.

(See also: Dunes.)
jw
References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 2. The Conservation Foundation. In press. Physical Management of Coastal Floodplains: Guidelines for Hazards and Ecosystems Management. The Conservation Foundation, Washington, D.C.

BEACHFRONT PROTECTION

Coastal planning interests will find it desirable to understand beachfront protection problems in responding to Section 30235 of the California Coastal Act which requires that the Local Coastal Program (LCP) include methods or means to minimize hazards from wave inundation and wave-related problems (i.e. shoreline and coastal bluff erosion). Wave hazard studies are needed to determine the effect of waves on the project site and the best location design. This will normally require professional consulting assistance. Such assistance for local projects is often available through the state or, particularly, through the U.S. Army Corps of Engineers. Damage due to beach erosion in California was approximately $10 million in 1965. The Water Resources Council projects the annual loss to be $15.7 million in 1980 and $29.7 million by 2000, unless large-scale preventive measures are taken. (1)

Many traditional short-term approaches to beach protection cause long-term adverse effects. To prevent such troubles it is necessary to thoroughly study the problems and prepare a comprehensive protection plan before structures are authorized. The goal for beach management is to maintain the "beach profile" (its surface slope) in its natural configuration. This can be done best by protecting both the processes that supply the beach with sand and the sources of the sand. Long-term



Maintaining the beach profile in its natural configuration prevents long-term adverse effects from beach protection measures.
Reference: Redrawn after O. Pilkey et al. 1975. How to Live with an Island. N.C. Dept. of Nat. and Econ. Resources. Raleigh, N.C.

stability is fostered by maintaining the storage capacity of each of the components of the beachfront system at the highest level; e.g., forebeach, berm, dune (see: Beaches). Bulkheads, seawalls, and groins may steepen the profile, destabilize the beach, and cause depletion of the sand.

There are two general solutions to beach erosion that should be considered together. First, permanent development should be placed well inland of the active part of the shore. Second, positive action should be taken both to prevent the loss of sand from any storage element and to prevent blocking the free transport of sand from any storage element into the active part of the system.

The placement of buildings can be controlled by a setback gauged for the particular circumstances of the beachfront involved. A setback line should be entirely landward of any active part of the beach or dune system. Moreover, the line should be far enough landward to allow for predictable recession of the beach and dune system. It is suggested that the beach and dune system be surveyed to establish a 50 to 70 year recession line -- the limit of expected recession and consequent landward movement in a 50 to 70 year period (the assumed "useful life" of a structure). Many states and some communities require setbacks or other constraints. For example, in Taxes the state controls beach use up to the line of vegetation. In North Carolina, South Carolina, and Georgia, state law encourages communities to protect dunes with setback lines. The state of Florida is gradually establishing individually surveyed setback lines for each coastal community, based on topography, erodability, storm size, wave runup, vegetation, and other technical data, including beach slope.

Beachfront protection schemes fall into three categories: structural protection, beach nourishment, and non-structural protection or beach management. The principal shore protection structures include seawalls, revetments, groins, breakwaters, jetties and bulkheads (see individual subject articles). There have been great disappointments and some successes with such structures. These structures are designed to stop the natural process of sand movement (littoral drift) by trapping or slowing it down. Thus a shortage of sand occurs downshore from the structure, often causing more rapid erosion. Besides being often ineffective, counter-productive, impermanent, and expensive, they establish a false sense of safety on the part of beachfront residents. Shore protection structures should be used for beach protection only as a last resort to protect property since structures that provide short-term solutions often cause or intensify long-term problems. If they are used to stabilize the backbeach, the reserve of sand may be reduced to a level no longer capable of replacing sand losses during severe storms. After storm waves remove the beach, sand erodes under and around structures. Often the structures are then bypassed and the beachfront shifts to a new equilibrium profile inland of them. Most structures placed on the beachfront reduce the amount of material available to the dynamic beach system. Breakwaters, seawalls, bulkheads, and revetments do not prevent

the loss of sand in front of the structure and in fact commonly accelerate the loss because they deflect wave forces downward into the beach.

Another solution to shoreline erosion that has received widespread application is beach nourishment. This solution requires pumping sand on the beach from the offshore bottom, an inlet or an estuary. It permits the natural process to continue but at great expense. (2) The cost of sand used for beach nourishment can range from about $1.50 to $2.00 per cubic yard for sand pumped by a dredge (1975 prices). A U.S. Army Corps of Engineers study (1973) estimated the initial cost for a 50-foot beachfront lot at around $20,000, with an additional $1000 to $2000 a year to maintain stability (North Carolina). (2) Often the supply of sand of suitable quality (type and size) is not readily available. The grain size generally must exceed 0.25 millimeter to remain on the beach (up to 0.4 millimeter may be required under certain unfavorable conditions). Since dunes, adjacent beaches, nearshore areas, and estuaries are generally considered off-limits for sand removal, the two appropriate sources of supply for beach nourishment are: (a) the open ocean or broad non-estuarine bays beyond a depth of about 40 feet (14 meters), or (b) around inlets or other areas of accretion, where the supply is constantly replenished by natural forces, particularly when navigational dredging is being done.

The best solutions to shoreline protection from a long-term viewpoint are ones that involve the least engineering intervention in the natural system. The key is proper management and regulation of land use and beachfront activities so that the capacity of the beach system to act as a buffer and to store sand and yield it to the areas that need replenishment is protected. The approach is not to go exclusively with either structural or nonstructural techniques but to achieve a balanced plan emphasizing the nonstructural. Although it might be simplest to let nature take its course, extensive areas of the coast are already occupied and must somehow be maintained safely until setbacks and other protective land use plans (natural protection) can be implemented. (2)

It is clear that both inlet deepening and inlet stabilizing projects affect the sand supply moving along the beachfront and that either can lead to a major imbalance of the beach system. Therefore inlet projects must also be considered in the context of a comprehensive long-term plan for stabilization and protection of the beach systems which involve both land controls and engineered projects. Extensive information must often be compiled on ocean currents and their effect on the littoral drift of sand.

A program of beach protection needs to reflect the following major principles:

- Structures: Structures should be used for beach protection only when compatible with a comprehensive beach protection program.

- Sand transport: Natural processes that transport sand to the beach should be maintained by not building structures that significantly divert littoral drift.

- Excavation: Sand should not be removed from any portion of the beach or from any adjacent undersea area that interacts with the beach.

- Inlets: Sand bypass systems should be provided when inlets are dredged and jetties installed; inlet dimensions should be optimum for release of storm waters accumulating in bays and other estuarine basins.

- Buildings: All new buildings should be located behind a setback line which accomodates the predicted long-term recession rate of the beachfront.

- Habitats: The beachfront nesting and breeding habitats should be protected during identified breeding and nesting seasons by temporary restriction of access.

jw

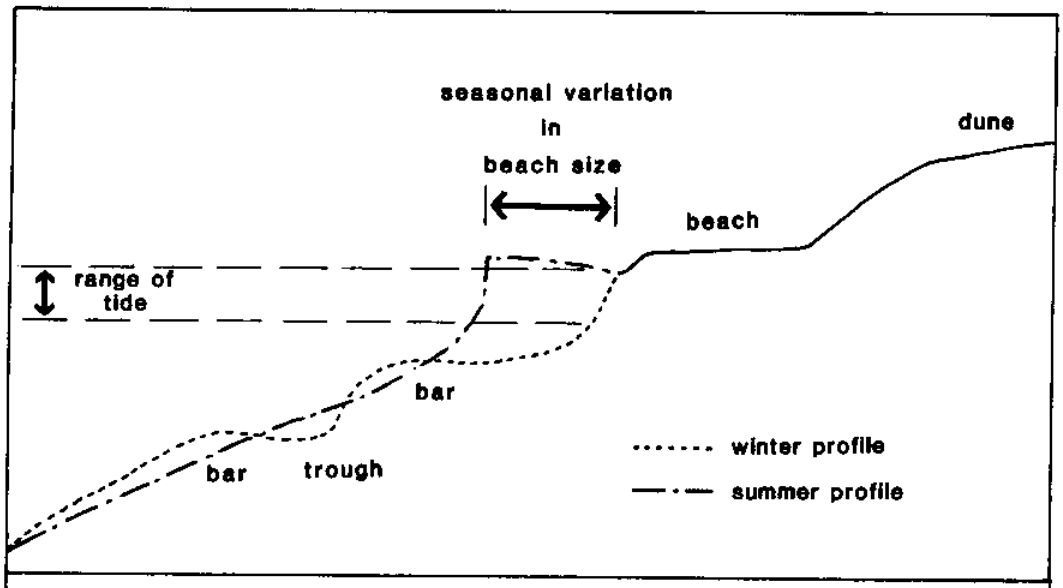
(See also: Beach, Beach Processes, Dunes.)

References: 1. Coastal Commission. 1975. California Coastal Plan. California Coastal Zone Conservation Commission. 2. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. (Particularly seearticles by J.M. Colonell, p. 571, and R. and P. Dolan, p. 577).

BEACH PROCESSES

The constant change and continual shifting of a beachfront in response to the forces of waves, winds and currents that act upon it are known as beach processes. Planners in beach communities will find it necessary to understand beach processes in order to implement Section 30235 of the Coastal Act.

While theposition of a beach remains generally constant, its profile often shifts markedly with the seasons. Mild summer waves add sand to the berm, (horizontal part of the beach formed by the deposits of material by waves) and prevailing onshore winds move it from the berm to the dunes. During winter storms the berm may be largely reclaimed by the ocean, at which time the dunes must erode to replenish the lost sand. The berm moderates these changes by providing a reservoir of sand available to either dunes or beach as needed. (1)



Distribution of sand along the beach and offshore bars varies with the season.
Reference: Stephen B. Olsen and Malcom J. Grant. 1973. Rhode Island's Barrier Beaches. Univ. of Rhode Island Kingston, R.I.

The berm-and-dune systems acts as a buffer to the force of storm seas. As the dune is attacked by storm waves, eroded material is carried out and deposited offshore where it alters t e beach's underwater configuration. Accumulating sand decreases the offshore beach slope (makes it more nearly horizontal), thereby presenting a broader bottom surface to storm wave action. This surface absorbs of dissipates, through friction, an increasingly large amount of destructive wave energy that would otherwise focus on the beach. (2)

In the optimum natural state there is enough sand storage capacity in the berm or adjacent dune to replace the sand lost from the beach to storms. Consequently, storm effects are usually temporary, with the dune or berm gradually building up again after the storm passes. However, when the total volume of sand held in storage is reduced, the ability of the beachfront to absorb the energy of storm waves is reduced. If the forces of a storm exceed the restorative capabilities of the beach, then extensive long-term erosion and alteration of the beach profile are likely results. (3)

Littoral drift is the movement of sand along a coast by wave-caused currents. It is a very important part of the beach process mainly because it is responsible for most shoreline problems. Either sand is being removed from where people want it to stay or it is being deposited where it is not wanted, or both. (4) Coastal cities are con-

stantly confronted with variations on the problems of how to keep sand moving along a shoreline and at the same time prevent the shore from eroding. If any new shoreline facilities are built that stop the flow of sand, there will be trouble both at the place where the sand stops and the place where it would have gone. (4)

Clearly any new harbors or structures that interrupt the sand flow require either a fixed pumping plant or a plan for bypassing the interruption. For example, at Port Hueneme, in Ventura County, a harbor was scooped in the flat coastal land and the entrance fenced with two parallel jettles, the westernmost of which stopped the sand. Periodically, as expected, it is necessary to dredge the sand from this trap and pass it onto the downdrift beaches. (4)

From December of 1977 through mid-March of 1978, a series of severe storms battered the California coast. The cost of damages throughout the state (inland and coastal) was $238,000,000. Along the coastline high waves and tides, accompanied by a storm surge, caused more than $18,000,000 in damage to coastal developments. In addition to the structural losses, millions of cubic yards of beach sand were washed out to sea. (5) The strong winds associated with the storms created a surge that increased sea level by as much as three feet. This allowed large waves to pass over offshore bars without breaking. The highest tides of the winter also occurred within the period of intense storm activity (January 8-9, 1978). (5)

Perhaps the most important characteristic of the winter of 1977-1978 was the persistence of storm attack. Atmospheric conditions allowed virtually every storm generated in the Pacific to hit California. In the beginning of the winter waves eroded the berm and reduced it protective value. Continued storm activity generated waves that overtopped the once-existing berms and damaged vulnerable coastal structures. (5)

Seadrift Beach in Marin County, Malibu Beach in Los Angeles County and Oceanside in San Diego County suffered extensive damage during the winter storm of 1977-1978. Homes at Seadrift Beach were plagued by high tides, pounding surf and breakers as high as twelve feet which eroded away as much as ninety feet (horizontal distance) of beaches. High tides and waves at Malibu caused more than $3,000,000 damage to private property (including damage to building foundations, decks, patios, windows, etc.). More than 140 lots along the Malibu coast were damaged. At Oceanside over 300,000 cubic yards of beach sand were washed away by the pounding surf. The south of jetty at Oceanside's municipal harbor lost thirty feet of its seaward end. (5)

Unfortunately, almost anything that attempts to stop erosion of a coast or retard the normal motion of sand along shore affects all property "downstream". Any remedial action that does not consider the effects on the downstream beaches only causes more problems. Thus, in addition

to considering the complex immediate problem of what action to take at any one place to keep the property owners happy, one must be careful that the solution does not create worse problems for neighbors downstream.

Although areas susceptible to wave attack may be unsuitable for permament habitation or structures, they may be very useful as a recreational resource, as recommended in a State Commission report. (5) Rather than allow a development that would require protective measures, periodic maintenance, and possible public subsidy (for repairs caused by wave damage), it may be more desirable to acquire (or publicly control the use of) areas subject to wave hazards. These areas could then be developed for public uses compatible with the constraints of the hazard. This possibility is in accordance with Coastal Act goals to maximize public access and recreational opportunities to and along the coastline (Section 30001.5(c)). (5)

This State Commission report also recommended that acquisition of developed hazard areas could be achieved by a relocation program or by amortization regulations. Undeveloped hazard areas could be obtained (or publicly managed) by outright purchase, less-than-fee acquisition, exclusive use zoning, preferential taxation, or transfer of development rights. These methods have been used with varying degrees of success. Any one method may be used exclusively or with a combination of other methods, and each may be supplemented with a payment of some compensation.
jw

For further reading on beach processes, the following documents may be helpful: Assessment and Atlas of Shoreline Erosion Along the California Coast, July 1977, and the Study of Beach Nourishment Along the Southern California Coastline, October 1977, both available from the California Resources Agency, Department of Boating and Waterways.

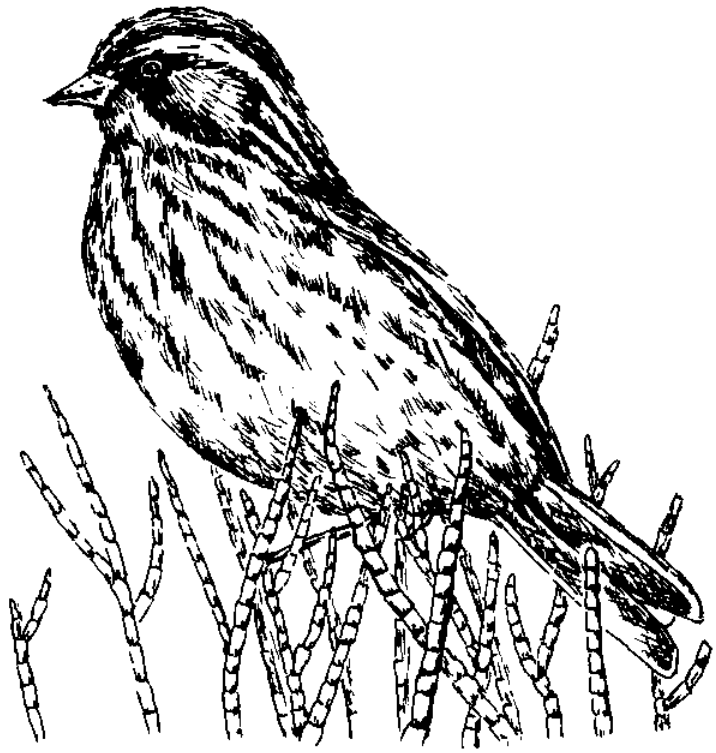
References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 2. Stephen B. Olsen and Malcolm J. Grant. 1973. Rhode Island's Barrier Beaches, Vol. I, Mar. Tech. Report No. 4, University of Rhode Island. 3. Conservation Foundation. In press. Physical Management of Coastal Floodplains: Guidelines for Hazards and Ecosystems Management. The Conservation Foundation, Washington, D.C. 5. Steve Howe. 1978. Wave Damage Along the California Coast, Winter 1977-1978, California Coastal Commission. 4. Willard Bascom. 1964. Waves and Beaches. Doubleday and Co., New York.

BELDING'S SAVANNAH SPARROW

Belding's Savannah Sparrow (Passerculus sandwichensis beldingi) is a subspecies of bird which is distinguishable from other savannah sparrows by its darker coloration, lack of distinct crown stripe, heavy streaking on the throat, breast, and sides, and by its distribution. Belding's Savannah Sparrow occurs as a resident in the tidal estuaries of Southern California and nothern Baja California, Mexico. It resides and nests in pickleweed salt marhes subject to tidal influence. A 1977 survey revealed 28 breeding sites in Southern California, from Santa Barbara County to San Diego County. Apprxoimately 1,610 breeding pairs were located in California in 1977.

There is no published work on the life history of Belding's Savannah Sparrow. However, Massey (1) relays information based on her own field studies for a five-year period. Males begin to establish territories in late December or early January. Courtship begins in February. The females are highly secretive whereas the males are quite visible. After the pair bond has been established, the female begins nest building in the latter half of March. Nests are made of pickleweed twigs on the ground or in low branches of fairly dense pickleweed. They are sometimes built in patches of alkali heath or in salt grass. They are usually built above the level penetrated by the high spring tides. The first eggs are laid in early April.(1)

Belding's forage in the pickleweed, on mudflats, on rock jetties, and occasionally on beaches. Their diet is apparently varied, with small marine invertebrates, insects, seeds, and growing tips of pickleweed all known to be eaten. (1)



During the nonbreeding season, the birds disperse in the daytime to feed, but many return to spend the night on their breeding territories, or in the vicinity.

The reduced numbers of Belding's Savannah Sparrows in California appears to be directly attributable to destruction of their habitat. The bird has been declared endangered by the California Department of Fish and Game. An appropriate management goal for local coastal planners, with regard to this bird, is to maintain existing viable saltmarsh habitat and to restore saltmarsh habitat, where necessary, through enhancement of tidal action and enlargement of upper littoral and maritime zones.

cwb

(See also: Birds, Endangered Species: California Policy.)

References: 1. B.W. Massey. 1977. "A Census of the Belding's Savannah Sparrow in California, 1977." California Department of Fish and Game, Nongame Wildlife Investigative Final Report, Project E-1-1, Job IV-1.2. 2. R.A. Bradley. 1973. "A Population Census of the Belding's Savannah Sparrow." In Western Bird Band. 48 (3), 40-43. 3. B.W. Massey. January 1979. The Belding's Savannah Sparrow. Prepared for U.S. Army Corps of Engineers, Los Angeles District. Submitted by the Southern California Ocean Studies Consortium of the California State University and Colleges, Contract No. DAC W09-78-C-0008, Work Order No. 6.

BIOLOGICALLY PRODUCTIVE WETLAND

A "biologically productive wetland" is a wetland where the rates of both primary and secondary productivity are high. Primary productivity refers to the quantity of organic material produced through photosynthesis. Secondary productivity refers to the quantity of organic material produced by organisms which do not photosynthesize.

Section 30233(3) of the California Coastal Act states that boating facilities may be developed in degraded wetlands if a "...substantial portion of the degraded wetland is restored and maintained as a biologically productive wetland..." (emphasis added). As there is no widely accepted definition of a "biologically productive wetland," one must presume that coastal wetlands in their natural state are a priori biologically productive (see Biological Productivity).

Wetland productivity depends heavily upon inputs of organic matter and nutrients. Wetland systems in turn export organic matter and nutrients to the ocean. Wetland systems are subject to cyclical change -- for example, flooding and drying out typically occur annually or every few years. Not only do productivity and food chain values change with these cycles, but the maintenance of these values over the long term seems to depend upon the continuation of such periodic pulsing.

Activities such as ditching, dredging, and changes in the water regime, topography, and vegetation types can have the effect of lowering the biological productivity of wetland areas.
db
(See also: Degraded Wetlands, Biological Productivity).

References: 1. John Clark and Judith Clark (eds.). 1979. Scientist's Report: The National Symposium on Wetlands. National Wetlands Technical Council, Washington, D.C.

BIOLOGICAL PRODUCTIVITY

Biological productivity refers to the "output" by a given ecosystem of natural products. Although the quality of production is very important, biological productivity is often determined by the rate of organic production (animals and plants) per unit of time. The processes of both primary and secondary production determine the rate of organic production. Primary production is essentially the quantity of plant material produced, and secondary productivity refers to the quantity (or) biomass of animals produced (see also: Primary Productivity and Secondary Productivity). Thus biological productivity has a specific scientific meaning, but it can also be used in the general sense of the proliferation of life in an ecosystem.

Recognizing that California's coastal areas are especially productive, the Coastal Act states that uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters (Section 30231), and that the appropriate biological productivity and quality of coastal waters, streams, wetlands, estuaries, and lakes be maintained and, where feasible, restored. Among other means, restoration may be achieved through minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams (Section 30231).

Biological productivity is determined by the abundance and diversity of organisms, availability and transfer of energy in the ecosystem, and the availability and uptake of nutrient elements. Under natural conditions, much of the nutrient and energy flow within a coastal ecosystem is in dynamic equilibrium. This equilibrium can be disturbed through many activities in the coastal zone, and the result can be a reduction in diversity and stability and a decrease in the number of organisms. (1)

It is assumed that the greater the diversity of species in a given ecosystem, the higher the efficiency will be. The result of greater diversity is often an increase in the yield of living organisms. Man's ability to use the natural ecosystem yield depends upon maintaining the diversity of the system, even though all of the biological production in a given ecosystem is often not of direct value to man. (1) This is to say

most simply that, like Noah and the Ark, the more species that are included, the more effective the system in serving society's goals. This is best accomplished by providing the greatest possible diversity of habitat types.

Coastal wetlands are generally highly productive. The biological productivity of wetlands depends heavily upon inputs of organic matter and nutrients that are suspended or dissolved in the water. Wetland systems receive these nutrients and in turn export organic matter and nutrients in later cycles. Most wetlands act as nutrient traps. Rapid release of these materials through activities such as ditching, and dredging can generally upset the coastal ecosystem (see: Dredge and Fill). (2)

Additionally, changes in the water regime (the extent and duration of wetland inundation) have an immediate and usually adverse effect on wetland productivity. Artificial stabilization of the water regime tends to reduce habitat, and thus species diversity, and hastens the loss of the wetland through succession to a terrestrial system.

Such measures as the rate of organic production per unit of time expressed as the amount (usually weight or mass per unit of area) produced per hour, day, year, etc., can be used to indicate the level of biological productivity in a given ecosystem (for example: grams/meter/year). Additionally, the quantity of organic material produced, as expressed as grams/meter or lb/acre, etc...may be used.(2)

Coastal wetlands, lagoons, estuaries, and other special marine and land habitat areas are highly productive and it is the planner's role to assure that human activities and developments do not lower the biological productivity of such areas.

The use of buffer areas surrounding areas of high biological productivity can often be an effective method for minimizing disturbance (see: Buffer Areas). In cases where such resources have already been degraded, the restoration of biological productivity may be in order (e.g. see Section 30233(e)(3) of the Coastal Act). The restoration of biological productivity refers to restoring degraded resource areas toward the original level of productivity by improving the habitat's physical form, its functions, and its diversity of plants and animals.

Such activities as filling, excavation, ditching, draining, and impounding of estuarine and wetland areas, release of pollutants such as sewage, thermal and chemical discharges, and the overharvesting of marine organisms all tend to lessen the biological productivity of coastal resource areas. (3) Because of the role which productive coastal areas play in providing man with food, economic opportunity, educational and scientific resources and recreation, the restoration of degraded resource areas should receive priority in planning.

In order to restore the biological productivity of a coastal area, one must know to the extent possible what the area was like originally, or one may compare the degraded resource with a similar area which is not degraded to establish goals and approaches. Once a baseline is established, restoration activities can commence. Depending upon the particular nature and location of the given resource, and the nature of the degradation, various restoration alternatives exist.

In wetlands and estuaries restoration may include the enhancement of tidal circulation and/or natural patterns of land runoff, reshaping of topography, revegetation, and the provision of a number of microhabitats to insure a high species diversity. In certain areas, wastewater discharges may be required to receive adequate treatment before release into coastal areas, and special measures can be taken to ensure that chemical and thermal discharges do not adversely affect the productivity of coastal resources. Better control over the harvesting of marine organisms may help to ensure that species type and diversity will be sustained at appropriate levels.

Local government agencies considering restoration activities should seek the advice of ecological experts, either State, Federal, or private consultants. The California Department of Fish and Game and the U.S. Fish and Wildlife Service should be able to provide helpful advice. No planner's guide currently exists on the subject of restoration of biological productivity; information occurs in diverse sources.

In addition, the California Coastal Conservancy can be contacted to see if funding assistance for local restoration is appropriate. The Conservancy is authorized to award 100% grants to public agencies for the restoration of degraded areas within the coastal zone. The Conservancy can also help support local planning studies, receive land gifts, establish buffer areas, and agree upon land-use tradeoffs with local governments. Under certain circumstances, the Conservancy may also undertake the physical restoration of an area. (See: Wetlands Restoration for an example of a major wetlands restoration project undertaken by the Conservancy.)

For a more detailed discussion of biological productivity, see Clark and Clark. (2) In addition, an intensive bibliography of pertinent material is in Coastal Marsh Productivity; A Bibliography, U.S. Fish and Wildlife Service Report No. FWS/OBS-77/3, October 1977.

db

References: 1. Bostwick H. Ketchum (ed.). 1972. The Water's Edge: Critical Problems of the Coastal Zone. MIT Press, Cambridge, Mass. 2. John Clark and Judith Clark (eds.). 1979. Scientists' Report: The National Symposium on Wetlands. National Wetlands Technical Council, Washington, D.C. 3. Conservation Foundation. In press. Physical Management of Coastal Floodplains: Guidelines for Hazards and Ecosystems Management. Federal Insurance Administration, Washington, D.C.

BIRDS

California estuaries and coastal wetlands are essential resting places, feeding areas, and wintering grounds for important segments of the migratory bird population of the Pacific Flyway.

Water-associated birds that visit or reside in California's bays and wetlands include:

- o Waterfowl: Black brant, American widgeon, mallard, pintail, green-winged teal, lesser scaup, greater scaup, bufflehead, surf scoter and three mergansers (common, hooded, red-breasted).

- o Shorebirds: Western sandpiper, marbled godwit, least sandpiper, sanderling, long-billed curlew, black-necked stilt, avocet, black-bellied plover and killdeer.

- o Seabirds: Gulls and terns.

- o Marshbirds: Great blue heron, snowy egret, great egret, American bittern.

There are some rare and endangered bird species that are migrants or residents of the coastal wetlands. Because of destruction of habitat, several species are on State and Federal endangered species lists. Destruction of saltmarsh habitat areas is a threat to the future existence of both marsh-obligate (dependent) birds and reduces the habitat of marsh-facultative (optional) birds.

The following birds found in coastal habitats have been declared endangered by the California Department of Fish and Game (DFG):

- California Brown Pelican (facultative)

- American Peregrine Falcon (facultative)

- California Clapper Rail (obligate)

- Light-Footed Clapper Rail (obligate)

- Belding's Savannah Sparrow (obligated)

- California Least Tern (facultative)

A brief description of each of these endangered species will be found by name in this report (see also: Endangered Species: Federal Act; Endangered Species: California Policy).

It is a policy of the Coastal Act to protect "environmentally sensitive habitat areas" (Section 30107.5) from "significant disruption" of habitat values (Section 30240). Such management practices as conservation zones and buffer areas protect habitats for birds and other wildlife. (See: Buffer Areas and Environmentally Sensitive Habitat Areas.)

An example of the habitat value for birds of California's coastal wetlands can be found at Ballona Wetlands, adjacent to Marina del Rey in Los Angeles County. Although reduced to a fraction of its original size by various human activities, the wetlands area provides habitat for over 100 species of birds. The principal use of the wetlands is by water-associated bird species which spend the winter or pass through during fall or spring migration. Ballona is one of the network of coastal wetlands that forms an integral part of the Pacific Flyway. A smaller number of species are permanent residents or summer visitors; some use the marsh for breeding. Two of the breeding subspecies of birds at Ballona. the California Least Tern and Belding's Savannah Sparrow, are on the endangered species list in California.

Coastal Commission policies support other state and Federal policies aimed at species protection. The common theme is that the key to success in the effort to preserve the species lies in the preservation of the natural ecosystems in which these animals exist. Therefore planners will find it necessary to delineate as "environmentally sensitive" all critical bird habitats, particularly those that support endangered species. This inventory would lead to zoning provisions and to the identification of areas that need to be acquired.

Since 1970 the State Department of Fish and Game has been acquiring important habitat areas. Examples are the state system of ecological reserves and the preservation of coastal wetlands such as Upper Newport Bay (Orange County) and Bair Island (San Francisco Bay). In addition, other state agencies, such as the Department of Parks and Recreation and Caltrans have been responsive to the needs of endangered wildlife. Federal agencies such as the U.S. Fish and Wildlife Service, U.S. Forest Service, National Park Service, Bureau of Reclamation, and Bureau of Land Management continue to make substantial contributions toward acquisition of habitat.

Contributions also have been made by county and city planning departments and local governments. An example is the preservation of the Palo Alto Marsh (the habitat for the salt marsh harvest mouse) by the City of Palo Alto through the Baylands Nature Interpretive Center.

Planners may wish to refer to the list that the California Natural Areas Coordinating Council has compiled of 2,300 natural areas. The National Audubon Society, the Nature Conservancy, and the National Wildlife Federation are among organizations prominent in habitat acquisition.
cwb

(See also: Endangered Species: Federal Act, Environmentally Sensitive Habitat Areas, Buffer Areas.)

References: 1. California Department of Fish and Game. 1978. At the Crossroads 1978: A Report on California's Endangered and Rare Fish and Wildlife. California Department of Fish and Game, Sacramento.
2. Arnold Small. 1974. The Birds of California. Macmillan Publishing Co., Inc. New York.

*Appeal No. 24-79 (Santa Barbara County Department of Transportation). The Commission granted a permit with conditions to the County of Santa Barbara Department of Transportation to replace approximately 2,000 ft. of roadway at West Main Street, Guadalupe Dunes, Santa Barbara County. At issue was the need to protect sensitive Least Tern habitat.

BREAKWATERS

A breakwater is a structure used to protect a coastal area from the effects of waves and wave energy. It is also used for the purpose of improving navigation. Breakwaters are covered under Section 30235 of the Coastal Act as a construction that "alters natural shoreline processes."

Breakwaters are classified as either offshore or shore-connected. Offshore breakwaters have no physical connection with the shoreline. Shore-connected breakwaters have one arm that extends to shore and acts more or less like a jetty in providing a total barrier to the movement of littoral drift. (1) Breakwaters are made of rubble, mound, composite, concrete-caisson, sheet-piling cell, crib or mobile. (1)

Breakwaters have both beneficial and detrimental effects on the shore. When placed on the updrift side of a navigation opening, a breakwater may impound sand and prevent it from entering the navigation channel. (It may afford shelter for a floating dredge that pumps the impounded material across the navigation opening back into the stream of sand moving along the shore.) An offshore breakwater stops wave action and creates a quiet water area behind it, which benefits navigation. However, in the absence of wave action to move the sand stream, sand is deposited and builds up the shore seaward toward the breakwater. The buildup actually serves as a barrier to littoral sand drift and deflects the sand stream seaward, depriving the downdrift beaches of sand. Offshore breakwaters are also expensive. Costs range from $200 to $500 per foot of shore protected. (2)

In Santa Monica, a breakwater was constructed parallel to the shore, several hundred yards out. The sand, it was hoped, would flow through the wide gap between the breakwater and shore. It did not. Once in protected water, where the driving force of the waves ceased, the sand deposited. The result is that the beach shoreward from the breakwater has widened and become an obstruction to the movement of sand, causing the downstream beach to erode. Thus Santa Monica must use a dredge to

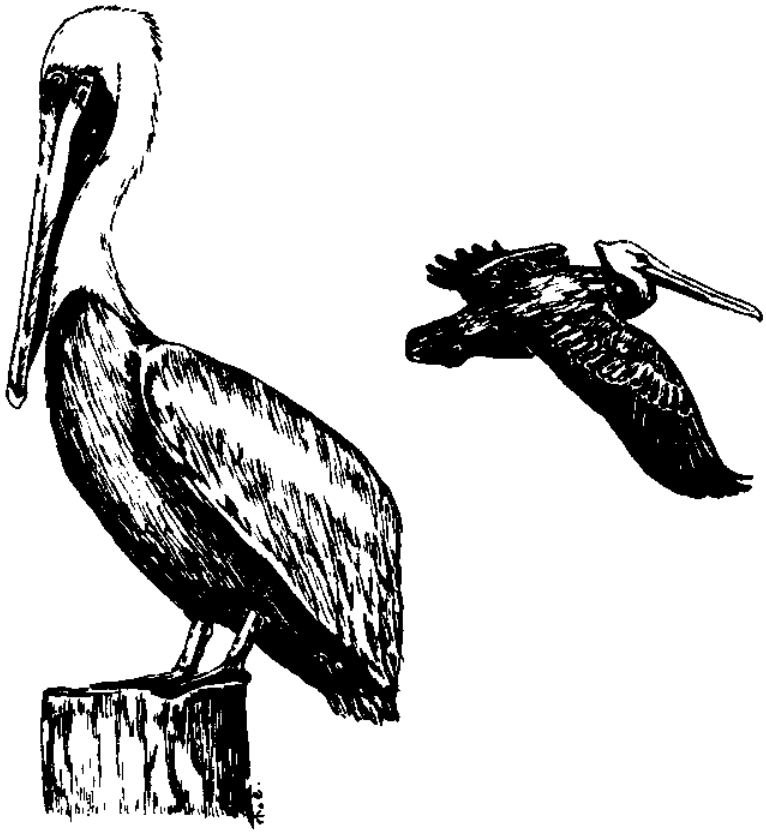
put the sand back into circulation within the littoral cell. (3)
jw
(See also: Groins, Jetties, Beachfront Protection.)

References: 1. Division of Wetlands. 1978. A Guide to the Coastal Wetlands Regulations. Department of Environmental Quality Engineering, Boston. 2. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 3. Willard Bascom. 1964. Waves and Beaches. Anchor Books, Doubleday and Company, Inc., New York.

BROWN PELICAN

The Brown Pelican is a large grayish-brown coastal bird with a long, pouched bill. It flies with its neck and head back on its shoulders, and with alternate wing flapping and sailing. Adults have white heads and necks, whereas immature birds are dark-headed.

This subspecies occurs on the Pacific Coast from Canada to Mexico. It nests on the California Channel Islands, on the coastal islands off Lower California and in the Gulf of California, Mexico.



The Brown Pelican has been declared endangered by the California Department of Fish and Game and by the U.S. Fish and Wildlife Service. A 1972 survey indicated that the total population approximated 100,000 birds with 20,000 pelicans frequenting California's coast from August through November. Breeding colonies were monitored at Anacapa Island and at Isla Coronado Norte in 1977. Productivity at both colonies declined from 1976, as did the number of nesting attempts. Seventy-six nests at Anacapa Island produced 39 young, while 263 nests at Isla Coronado Norte produced 213 young. There was little evidence of eggshell related problems (a problem of thinning shells caused by DDT and other pesticide residues; DDT is now banned). However, many incomplete nests were observed suggesting that "food stress" resulted in nest abandonment early in the season.

cwb

References: 1. California Department of Fish and Game. 1978. At the Crossroads 1978: A Report on California's Endangered and Rare Fish and Game. California Department of Fish and Game, Sacramento.

BUFFER AREAS

A coastal buffer area is a marginal strip of natural land which is used to separate developed areas from environmentally sensitive areas, often coastal wetlands or bays. Such buffer strips help to ensure that adjacent developed areas do not damage sensitive resource values; they vary in width depending upon local circumstances. They can be used to prevent pollution of watercourses and water bodies; as a protection against flood hazards; and as a physical, visual, or noise barrier.

The California Coastal Act recognizes the importance of buffer areas, stating (Section 30231) that:

> The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means ...maintaining natural vegetation buffer areas that protect riparian (waterside) habitats, and minimizing alteration of natural streams. (Emphasis added).

While riparian habitats and natural streams are specified in Section 30231, the intent of the Act is certainly to ensure that all sensitive resource areas, including wetland and estuarine areas, be protected through the use of buffer areas. Therefore, "riparian" should be interpreted in its widest sense so that it refers to special, water-influenced habitats adjacent to all water bodies and watercourses, rather than in its narrower definition which limits "riparian" just to freshwater situations.

The Coastal Act also declares that conflicts between agricultural and urban land uses should be minimized through the use of buffer areas (Section 30241(a)) and that new or expanded refineries or petrochemical facilities shall be permitted only if the facility is sited so as to provide a sufficient buffer area in order to minimize adverse impacts on surrounding property (Section 30263(5)).

In addition, the Coastal Conservancy Act requires that buffer areas, or resource protection zones (RPZ's), be designated around environmentally sensitive public beaches, parks, natural areas, and fish and wildlife preserves. After the Coastal Commission has considered the comments of local public agencies, it is supposed to adopt resource protection zones, recommend their inclusion in local coastal plans, and specify guidelines to aid local jurisdictions in bringing local plans and ordinances into conformity with the objectives of the resource protection zones. Once the Commission has adopted these protection zones, and when proposed private development within these zones will clearly damage resource values of the adjacent public areas, the Coastal Conservancy may award grants to any state agency for the acquisition of any interests in the lands, not including fee title or outright purchase. (1) The continuance of this program is in doubt, however, and it is possible that the Coastal Commission will not officially adopt the RPZ's and will instead leave the matter in the hands of local governments.

Habitat areas which require buffers are those 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 areas in which the habitat could be easily disturbed or degraded by human activities and developments. Such areas include "areas of special biological significance" as identified by the State Water Resources Control Board; rare and endangered species habitat as identified by the State Department of Fish and Game; and wetlands, lagoons, estuaries, and other special marine and land habitat areas. (1) The Control Commission has some permit experience with buffer areas.*

Flood hazard areas which may require buffers are river and stream basins and coastal areas, such as bays, esturaries, and lagoons,where occasional extreme high tides or combinations of high tides, winds, and floods in streams result in inundation of land areas. (2)

All watercourses and water bodies need protection with a buffer strip of natural vegetation of appropriate width. There is at this time no consensus among experts as to exact criteria for buffer zone boundaries used to protect habitat areas. Climate, shore slope, water depth, species type, sail type, sensitivity to disturbance and location of area all come into play. Since each habitat or sensitive area is in a sense unique, the buffer area necessary to protect the area will vary with existing conditions. Nevertheless, the following guidelines for wetland/esturine areas which resulted from a recent (May 1979) workshop of state wetlands experts should be helpful: (3)

> The widest and most conservative buffer zone should be established to assure protection of marsh resources. In no case shall a buffer zone be less than 100 feet from Extreme High Water (EHW), or 100 feet land-ward of the (edge of the wetland) plant community consisting of a 50% cover by halophytic vegetation (vegetation adapted for life in saturated and/or salty soils), whichever is greater. The buffer shall be based upon a thorough scientific study (vegetation mapping, wildlife censuses, wildlife habits and tolerance levels, etc...) of the habitat requirements of the species of wildlife using the area which are the most sensitive to human disturbance or habitat disruption.

Thus, the scientists are saying that each situation should be considered on its own merits, but a 100-foot standard is provided as a rule of thumb. This line would start at either: (a) the upper edge of the wetland transition zone mid-point where there are 50% wetland plants (halophytes) and 50% upland plants, or (b) the Extreme High Water mark as defined by the highest spring tides of the year.

Species behavior is one of the criteria which can be used to determine the additional required width of habitat buffers (beyond 100 feet). The buffer zone should be wide enough to ensure that the species types residing within are not adversely affected by human disturbances. Two areas with similar physical conditions may require widely divergent buffer areas if there is a difference in species type. For example, clapper rails are quite sensitive to disturbance and may be flushed if approached within several hundred yards. Least terns, on the other hand, can often be approached quite closely before they are distrubed. Therefore, a buffer area intended to protect a clapper rail habitat might have to be substantially larger than one intended to preserve a least tern habitat. To be successful, a buffer should be of adequate width to protect the most sensitive organism in a given habitat area from adverse disturbances.

Protection from flood hazards can also be a function of buffer areas. The lower, most dangerous part of the floodlands can be incorporated into such buffer areas.

Buffer boundaries used to protect watercourses and water bodies from runoff can be established in two ways. A boundary may be a fixed distance from the water's edge, or it may be a variable boundary which "floats", widening where necessary to include broader habitats within its protective shield. The fixed point zone is most easily delineated and administered, but may not fit the natural land-form. The weakness of the fixed type of boundary is that it may exclude such adjacent sensitive areas as scrub and woodlands where development could have a particularly adverse impact on wildlife or water quality. (2)

A "variable boundary" has the advantage of flexibility, but successful administration requires careful survey and evaluation of all areas that might be included. For small communities with limited assessment

capability, a combination of fixed and variable boundaries might prove effective. The boundary could remain fixed (in width) except in places where proposed developments (or sensitive "upland" habitat) might abut it. Then a special environmental evaluation of those areas would determine whether the buffer should be extended to protect them. (2)

One expert explains that stream buffer zones often extend from the stream bank to a landward point 50 to 200 feet away. The area within the zone is retained in its natural condition, and every attempt should be made to preserve or enhance the vegetative cover of the buffer. (2)

Buffers comprised of a variety of shrubs, open space, and tall trees can be particularly useful in visual and noise buffering, in protecting wildlife habitat, and in regulating runoff. Grasses, sedges, and woody shrubs with dense fibrous root systems are particularly effective in trapping harmful pollutants and slowing the flow of runoff resulting from construction projects and agriculture. (4)

We advise that professional help be sought in the delineation of most buffer areas, either from the Department of Fish and Game, the U.S. Fish and Wildlife Service, local universities, or private consulting firms.
db
(See also: Riparian habitats)

References: 1. State Coastal Conservancy. Memo November 9, 1978. Conservancy Wetlands Program. State Coastal Conservancy, Oakland, CA. 2. Conservation Foundation. (In press). Coastal Environmental Management. Federal Insurance Administration. Washington, D.C. 3. Wetlands Workshop, Santa Barbara. (In press). May 24-25, 1969, at University of California.
4. Elizabeth N. Layne. 1976. The Natural Environment: A Dimension of Development. National Audubon Society, Office of International Affairs, Washington, D.C. 5. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

* Appeal No. 373-77. Commission granted a permit with conditions concerning buffer strip, setback and density, esplanade improvement, drainage plans and buffer dedication, to J.B. Graner for 6 townhouses on 5 contiguous lots at 4000 Pacific Avenue, Venice, City and County of Los Angeles.

BULKHEAD

(See: Seawall.)

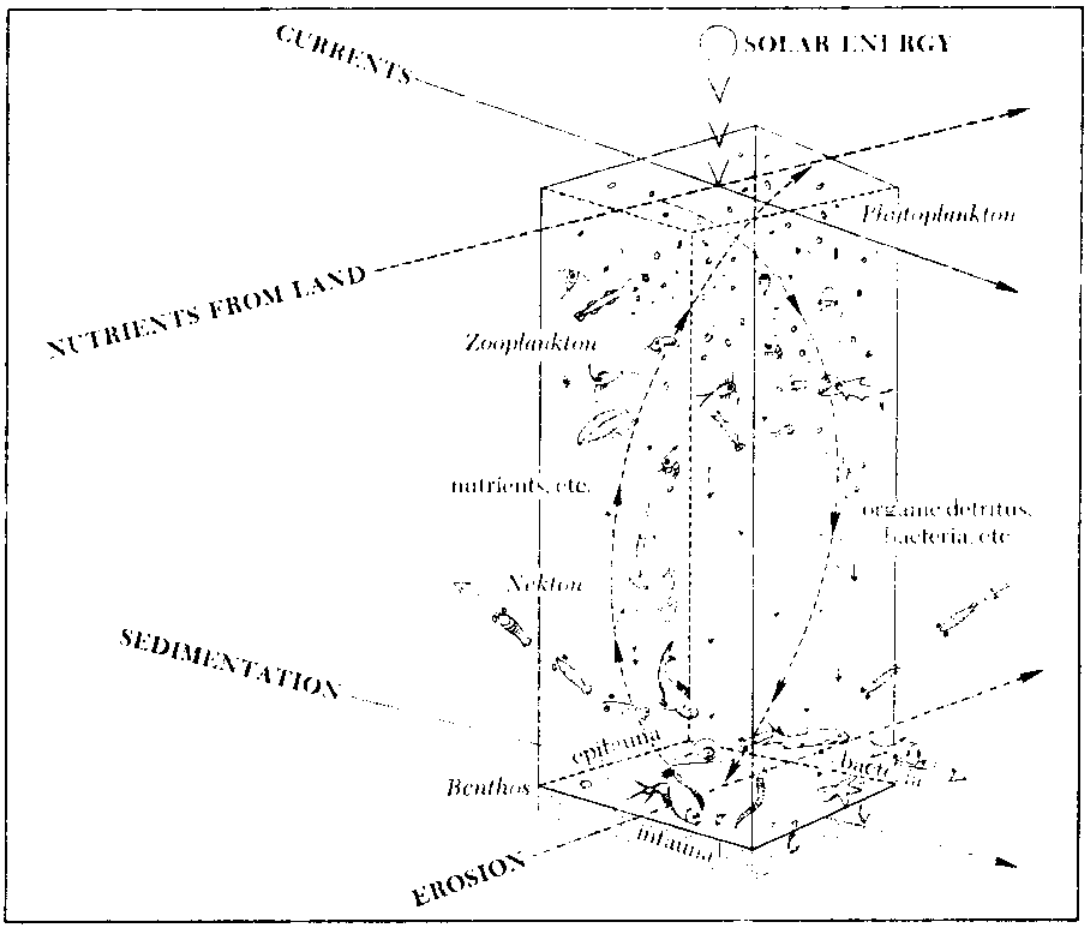
C

CALIFORNIA CLAPPER RAIL

(See: Clapper Rail, California.)

CARRYING CAPACITY

Carrying capacity is the amount of life that can be supported by a given area of a specified habitat. Most narrowly, it is the number of individuals of a particular species. In a wider sense, carrying capacity expresses the amount of life that an ecosystem can support. The term always refers to the potential number of species or biomass. Carrying capacity is the upper threshold imposed on the biota by existing environmental limits, such as the availability of food, space or breeding sites, or by disease or predator cycles, temperature, sunlight or salinity. (1)



Factors affecting the carrying capacity of the marine habitat are shown in this idealized prism.
Reference: Joel Hedgpath, ed. 1968. Between Pacific Tides. Stanford Univ. Press. Stanford, Calif.

Carrying capacity is related to the Coastal Act in Section 30231 which calls for the maintenance and,where feasible, restoration of the biological productivity and the quality of coastal waters...appropriate to maintain optimum populations...." Although a population at carrying capacity is not necessarily an "optimum population" (for example, sea urchins), an "optimum population" generally cannot exceed the carrying capacity of an ecosystem for any length of time.

Carrying capacity analysis, as a planning tool, studies the effects of development -- amount, type, location, quality -- on the natural and man-made environment in order to identify critical thresholds beyond which public health, safety or welfare will be threatened by serious environmental problems. It thus provides a framework for analyzing resources, considers the impacts of growth on them, and determines the implications for planning. (2)

Carrying capacity analysis may be applied in a number of ways:

- Land use controls based on carrying capacity restrict development in particular fragile or important resource areas, like wetlands. The purpose of these development regulations is to minimize adverse environmental impacts such as erosion or water pollution. The underlying theme of this approach is that the natural environment has a limited ability to withstand different types or intensities of use. Studies which form the basis for land use decisions are often called land capability studies and refer to the capacity of different areas to absorb development. For example, a carrying capacity survey was conducted for Half Moon Bay in San Mateo County. (3)

- Environmental performance standards are also based on carrying capacity. They acknowledge the importance of natural processes and limit the effects of development on them. Rather than regulate density or intensity of use, they regulate the effects of development, which, if uncontrolled, could lead to serious environmental damage. The Sanibel Report (4) shows how a natural resource inventory was used to divide a fragile barrier island into ecological zones. The tolerance of each zone to development types and densities was studied, and performance standards were developed to minimize environmental impact in each.

- Threshold studies are based upon the notion that a community or region can only absorb a certain number of people before the natural environment's capacity is exceeded and degradation results. Theoretically, population thresholds at which problems will occur, in either the environmental or man-made systems, can be pinpointed as a result of these studies. One of the most straightforward examples of the use of environmental constraints to define population thresholds is the "Current Planning Capacity" approach, developed at Rutgers University for the New Jersey Department of Community Affairs. (5) The study defines water quality, water supply and air quality as the constraints that most limit population growth. The maximum population that can be accommodated in a given area under existing

provisions for water supply, wastewater treatment, etc., is equal to the lowest or most restrictive of the estimates derived from determining the carrying capacity of each of these systems.

Ecologically, the determination of carrying capacity requires the identification and quantification of the multiple effects of many factors that govern the ecosystem (the coastal waters ecosystem in the present case). The factors which limit the carrying capacity of the ecosystem in major ways must be known and their multiple effects estimated.

Limiting factors are those elements which influence the carrying capacity of coastal ecosystems, such as water circulation or the supply of critical nutrients in water. Because these factors are altered by development, usually adversely, carrying capacity can be markedly reduced by poorly planned and uncontrolled land and water uses. A community conservation program is most effective if it anticipates limits to development based upon the limits of the natural systems to absorb human-caused impacts. Only then can the system's natural carrying capacity -- its capacity to provide resource benefits -- be enhanced.

The major limiting factors influencing carrying capacity and pertinent management principles in the coastal zone are as follows:

- Water circulation provides numerous benefits: transport of nutrients, cleansing of wastes and pollutants, controlling of salinity, mixing of water and transport of suspended shellfish and fish larvae. An important management principle for local coastal planners is to avoid any interference with water circulation in coastal ecosystems. For example, road systems and bridges should be designed and located to avoid impinging on vital habitat areas or interfering with surface water or groundwater flow.

- Chemicals in coastal waters fall into two categories, nutrients and trace metals. Nutrients added to the system by natural processes provide the driving force for primary productivity. Primary productivity of coastal waters is normally limited by the amount of available nitrogen. An excessive supply of nitrogen caused by septic tank leaching, urban land runoff, discharge of sewage and industrial wastes, etc., leads to degraded water quality and an unbalanced mix of natural species. Thus, local coastal planners can presume that any discharge of nitrogenous compounds into confined coastal waters will have adverse effects.

- Salinity of coastal waters reflects a complex mixture of dissolved salts, the most abundant being the common salt sodium chloride. Salinity throughout the coastal ecosystem fluctuates with the amount of dilution by precipitation, land drainage, and river inflow. Some coastal species can tolerate a wide range of salinity, whereas others require a narrow range to live and reproduce successfully. Activities of man, such as dredge and fill projects, can alter salinity patterns considerably.

- o Dissolved gases are important to all species. Of the various gases dissolved in coastal waters, oxygen is the most important. Ample supplies of dissolved oxygen, largely produced by plants, are required for efficient ecosystem function. Oxygen may decrease to unhealthy levels when sewage and other organic waste materials with high biochemical oxygen demand (BOD) pollute coastal waters and induce high bacterial action. These bacteria multiply rapidly, thereby depleting the water of oxygen faster than it can be replaced. In order to maintain an optimum oxygen environment, local coastal planners should presume that any significant reduction in the natural concentration of oxygen is adverse and should be avoided.

- 0 Temperature exerts a major influence on the coastal ecosystem. Many functions of aquatic animal life are temperature controlled -- migration, spawning, feeding efficiency, swimming speed, embryological development, an basic metabolic rate (which doubles with each increase of 10°C or 18°F). The naturally balanced temperature regime provides for optimum ecosystem function. The management principle is therefore to avoid interference with the naturally occurring water temperature pattern. An increase in ambient water temperature from a power plant cooling system discharge is particularly critical in enclosed waters-- estuaries, bays, lagoons and tidal rivers -- because of the high productivity and diversity of life they support.

- o Sunlight is the basic driving force of the ecosystem. It is the energy source for plants which are the basis of the food chain. Sunlight, therefore, must be able to penetrate the water to a considerable depth so as to foster the growth of rooted plants and the phytoplankton that float beneath the surface. Turbidity from suspended silt or from a concentration of algal organisms reduces carrying capacity in coastal waters. Therefore, the management principle is to avoid actions which will interfere with light penetration either through increased turbidity or through phytoplankton "blooms."

One example of carrying capacity application is runoff control. It is possible and reasonable to prevent overloading the carrying capacity of the natural drainage system. (3) With information from the U.S. Soil Conservation Service, one can estimate the runoff from a specific area under natural conditions. Using this information, local planners can suggest performance standards for any specific area subject to development. A report entitled Water Resources Protection Measures in Land Development: A Handbook, identifies a dozen ways to control increases in runoff due to development, ranging from roof retention to porous pavement. (4)

Many planners using the carrying capacity approach have been disappointed that it does not provide a technical solution to the complex political-legal-administrative-ethical-economic problem set involved with growth management. Its purpose should be to illuminate the normal decision-making process, not to replace it with a quantitative methodology. The limiting factors discussed above which control ecosystem capacity are strongly influenced by land uses and development activities in the up-

lands adjacent to coastal water basins, in the transitional edge zones and intertidal areas, as well as within the basins. Managing for best development practices in order to optimize carrying capacity is discussed in the book Coastal Ecosystem Management. The system advocated there will provide only a general framework for management. Quantitative details would have to be supplied by ecological specialists.
cwb
(See also: Functional Capacity of Wetlands.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 2. Devon M. Schneider, David R. Godschalk and Norman Axler. 1978. The Carrying Capacity Concept as a Planning Tool. American Planning Association, Planning Advisory Service Report No. 338, Chicago, Illinois. 3. Thomas Dickert, et al. 1976. Collaborative Land-Use Planning for the Coastal Zone: Volume II, Half Moon Bay Case Study. Institute of Urban and Regional Development, University of California, Berkeley. 4. John Clark. 1976. The Sanibel Report: Formulation of a Comprehensive Plan Based on Natural Systems. The Conservation Foundation, Washington, D.C. 5. George H. Nieswand and Peter J. Pizor. 1977. Current Planning Capacity: A Practical Carrying Capacity Approach to Land-Use Planning. Extension Bulletin 413, Rutgers University. 6. Conservation Foundation. In press. Coastal Environmental Management. Federal Insurance Administration, Washington, D.C.

CHANNELIZATION

Channelization is the process of making channels. As it is used here, it applies to rivers, not harbors and bays. Channels are built primarily for flood control and navigation in coastal parts of rivers. The U.S. Army Corps of Engineers is largely responsible for the channelization of the Los Angeles and other rivers. Because the Corps' channels are primarily storm water conveyances, many of them are concrete-lined. On the other hand, most navigation channels are improved natural waterways, have natural bottoms, and require periodic dredging.

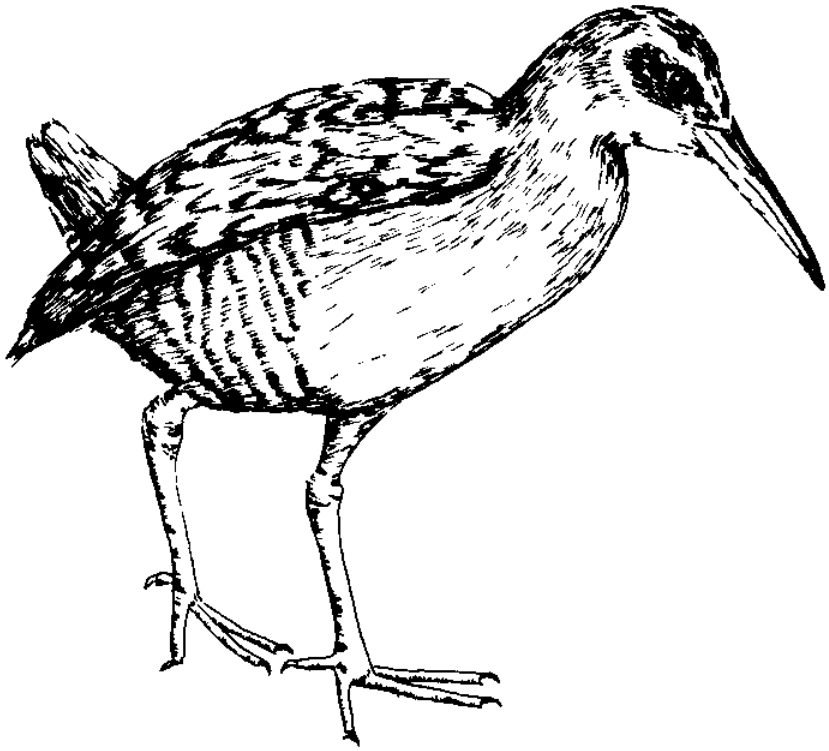
The Coastal Act (Section 30236) states that channelizations, dams or other substantial alterations of rivers and streams shall incorporate the best mitigation measures feasible, and be limited to: a) necessary water supply projects, b) flood control projects where no other method is feasible, or c) development of fish and wildlife habitat. The restrictive nature of these policies is due to the fact that channelization often adversely alters the natural river environment. *
cw
(See also: Rivers and Streams.)

References: 1. Oliver S. Owen. 1975. Natural Resource Conservation: An Ecological Approach. 2nd Ed. Macmillan Publishing Company, New York. 2. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

* Appeal No. 85-77. Commission denied a permit to Erskine-Johns Co. for an industrial building and for storage of flammable materials on east side of Roselle St. at Dunhill St., Pacific Sorrento Industrial Park, City of San Diego. At issue were the flood and geologic hazards, stream channelization, and protection of Los Penasquitos Lagoon and riparian area.

CLAPPER RAIL, CALIFORNIA

This is a long-billed, brown bird with a tawny colored breast, striped sides, and a short upturned tail with a white underside. Largest of California's rails, about the size of a coot, this secretive bird is seldom seen far from salt marshes.



This rail is highly specialized and apparently incapable of adapting to environmental change. Major populations occur in salt marshes bordering South San Francisco Bay and the Napa Marshes. Smaller populations exist in San Pablo Bay and Elkhorn Slough. Populations appear to fluctuate tremendously from year to year in certain habitats. Marsh reclamation as well as industrial pollution and the introduced old-world rat are threatening its existence. However, with the recent establishment of the San Francisco Bay National Wildlife Refuge Complex and preservation of key habitat areas, the status of this rail is less tenuous.
cwb
(See also: Birds.)

References: 1. California Department of Fish and Game. 1978. At the Crossroads 1978: A Report on California's Endangered and Rare Fish and Wildlife. California Department of Fish and Game, Sacramento.

CLAPPER RAIL, LIGHT-FOOTED

The Light-Footed Clapper Rail (Rallus longirostrus levipes) is a subspecies of bird, slightly smaller and darker than the California Clapper Rail. It is the only clapper rail found in southern California coastal salt marshes. (See: California Clapper Rail.)

The Light-Footed Clapper Rail ranges from Goleta Slough, Santa Barbara County, south to San Quintin Bay, Baja California. Planned developments at Tijuana Estuary, South San Diego Bay, Los Penasquitos Lagoon and other southern California marshes threaten its survival. Upper Newport Bay and Tijuana Estuary support the largest populations, each with a few dozen birds. Total population in California is estimated to be 250 birds.

The reduction in number of Light-Footed Clapper Rails in California appears to be directly attributable to destruction of their habitat. The bird has been declared endangered by the California Department of Fish and Game and by the U.S. Fish and Wildlife Service. A highly secretive bird this rail prefers thick stands of Spartina grass found in the lower littoral zone of salt marshes.

An appropriate management goal for local planners, with regard to this bird, is to maintain and protect the existing rail habitat and to restore additional saltmarsh habitat through appropriate measures, such as enhancement of tidal action and creation of lower littoral zones.
cwb
(See also: Birds, Endangered Species: Federal Act, Endangered Species: California Policy.)

References: 1. California Department of Fish and Game. 1978. At the Crossroads 1978: A Report on California's Endangered and Rare Fish and Wildlife. California Department of Fish and Game, Sacramento. 2. S.R. Wilbur. 1974. "The Status of the Light-Footed Clapper Rail." In, American Birds. Vol. 28, pp. 868-870.

CLEAN WATER ACT

(See: Section 404: U.S. Clean Water Act.)

COASTAL CONSERVANCY

The most promising source of assistance in California coastal problem-solving today is the Coastal Conservancy,which has authority, upon approval by the Coastal Commission, to buy land, to support planning studies, to physically restore wetlands, to receive land gifts, to establish buffer areas, and to agree on land use tradeoffs with local governments.

The California State Coastal Conservancy was established by the legislature in 1976 for the purpose of protecting coastal resources through land acquisition and other mechanisms when regulation appears infeasible. As an entity within the Resources Agency, the Coastal Conservancy consists of the Chairman of the State Coastal Commission, the Secretary of the Resources Agency, the Director of Finance, and two members of the public appointed by the Governor. The Coastal Conservancy staff also works closely with the staffs of the Coastal Commission and the Real Estate Services Division of the Department of General Services. The Division has the authority to lease, rent, sell or exchange acquired lands. It may also apply for and accept Federal grants, receive donations, gifts, rents and any other public or private financial support.

The enabling legislation for the Coastal Conservancy is the Coastal Conservancy Act (Division 21 of the Public Resources Code), which was enacted by the legislature in order to serve as an implementation tool for the resource protection policies of the Coastal Act. Coastal Act policies which could be implemented through Coastal Conservancy action include wetland restoration, designation of buffer zones around sensitive habitats, preservation of agricultural lands and important coastal resources, and provision of public access. All Coastal Conservancy undertakings must be consistent with the Coastal Act and with any development guidelines adopted by the Coastal Commission.

The Conservancy has five principal program areas:

- Preservation of agricultural land in the coastal zone.
- Creation of Coastal accessways.
- Coastal restoration (repackaging land parcels and redesigning development in areas where poor land use patterns are adversely affecting the coastal environment).
- Coastal resource enhancement (e.g., marsh restoration).
- Site reservation (holding key coastal resource lands for a period of up to ten years to reserve them for later acquisition by a state or local public agency).

The Coastal Conservancy has selected projects which could serve as models in almost all of its program areas. The most developed programs are the resource enhancement and coastal restoration programs.

Resource enhancement: Resource enhancement grants may be awarded to local and state public agencies for the purpose of restoring coastal resources, such as degraded wetlands. Coastal resource enhancement projects are defined as "actions...necessary to restore, as nearly as possible, degraded natural areas to their original condition or to enhance resource values in the Coastal Zone." (1) Such areas may have suffered a loss of natural or scenic values because of indiscriminate dredging or filling, improper location of improvements, or incompatible land uses. The Conservancy grants may be used to improve resource management by funding up to the total cost of assembling parcels of land within a designated coastal resource enhancement area, relocating improperly designed improvements, and making other corrective measures, which could enhance the natural or scenic character of the area. Conservancy monies can also be used to fund up to 40% of the cost of acquiring any land as a part of a coastal resource enhancement project. In cases where the local agency is unwilling to unable to undertake a project, the Conservancy itself may do so.

The state or local agency applying for the grant must prepare a resource enhancement plan. The Conservancy may provide up to $50,000 of the cost of preparing this plan. The plan must be consistent with the city or county Local Coastal Program (LCP) and approved by the Coastal Commission. In the interim before the final LCP's are adopted, the project must be consistent with the Work Program or Issue Identification document. The Conservancy need not be specifically mentioned in any of these documents, but there must be a reference to the project site or to the type of site in general which indicates that a higher level of government action is needed. (2)

The specific types of problems that the Conservancy may be able to resolve include: (2)

- The lack of an adequate water supply for freshwater marshes during dry months.
- The lack of adequate tidal flushing and resulting stagnation in lagoons and saltwater marshes.
- Sedimentation due to erosion by runoff.
- Pollution from contaminants carried by urban runoff.
- The lack of adequate habitat to accommodate those species which have used or would use the wetland.
- Mosquito control.
- Control of human carelessness and vandalism.

These goals may be accomplished through undertaking the following types of activities:

- o Water management, including the construction of dikes or gates, or securing a dependable water supply.

- o Lagoon mouth opening.

- o Habitat enhancement and planting,which could include the construction of potholes and islands.

- o Mosquito control, including one-time expenditures such as bank grading or the introduction of mosquito fish.

- O The construction of interpretive or educational facilities.

The first Coastal Conservancy project is a resource enhancement project for the Arcata Marsh in Humboldt County. At the request of the City of Arcata, the Conservancy has developed a plan for the city to acquire the marshland and to restore it as a freshwater marsh. The plan provides for the development of a public picnic area and a recreational lake. In selecting the project, the Coastal Conservancy used the following criteria:

- o Urgency: Existence of adverse development pressures, speculation or taxation rates may necessitate immediate Conservancy support to maintain the coastal resource involved.

- o Need: Absence of any means, except Conservancy action, to resolve the existing or potential problems.

- o Significance: Uniqueness, rarity, or irreplaceability of the site and the value of accompanying resources.

- o Cooperation: Extent to which the cooperation of the landowners, and public, private, and non-profit groups contributes to achieving the project's goals.

- o Additional Support: Extent to which the project is or can be supported by the current land-use planning or development programs of other governmental entities.

- o Completeness: Inclusion in the proposal of all planning and design elements necessary to ensure a completed project consistent with the Conservancy's objectives.

- o Model: Usefulness of the project as a model for other Conservancy projects or for similar projects undertaken by individuals, non-profit organizations, or private developers.

- o Financial Return: Potential for return of funds to the Conservancy after completion of a coastal restoration project (to include the sale or lease of restored land for the purpose of development.

- o Scope: Ability of the project to address and resolve impacts of greater than local concern; extent to which it makes the coast more accessible by restoring and enhancing access to the handicapped and persons of all age and income groups; and extent to which it addresses a multiplicity of Coastal Conservancy goals.

- o Management: Applicant's ability to provide sound fiscal management for the project and effective implementation of Conservancy assistance. (3)

In finding that the project was in conformance with the Coastal Act, the Coastal Commission determined that all portions of the project site were once wetlands, although some of it had been degraded through use as a sanitary landfill and by nearby logging activities.
The Commission tested the project with all of the applicable Coastal Act policies regarding wetlands. The Commission supported the project primarily on the basis that wetland restoration was a resource-dependent activity and that it would benefit wildlife habitat. The Coastal Conservancy has also embarked upon a resource enhancement project in the San Dieguito Lagoon and on the Aliso site southeast of Laguna Beach.(4)

Coastal restoration: Coastal restoration grants may be awarded to local public agencies for the enhancement of areas in the coastal zone where improperly designed development has resulted in scattered ownerships, poor lot layout, inadequate park and open space, incompatible land uses, or other conditions adversely affecting the coastal environment. The grants may be used for the assembly and redesign of parcels and the installation of public improvements. For example, where a development proposal might encroach on an adjacent wetland resource, the Conservancy couldsite compatible development on high adjacent dry land. Protection of the wetlands could be provided through many of the same means as used in an enhancement program. The design potential of proposed restoration projects will be an important criterion for conservancy evaluation. The projects must be innovative in integrating man-made features into the natural coastal environment.

The Conservancy will fund up to the total cost of enhancing a designated coastal restoration area, including the acquisition of the land. As in the resource enhancement program area, the applying local agency must prepare a plan that is consistent with the Coastal Act and with Commission policies.

Another Conservancy project is the Whiskey Shoals coastal subdivision restoration plan, which would redesign a poorly laid out housing development in such a way as to take advantage of the area's scenic viewshed. The plan calls for lot consolidation and reduction of the number of housing units. Other projects include the El Nido lot consolidation project and urban waterfront restoration projects at Seal Beach and at Stern's Wharf in Santa Barbara.

Because of the level of funding available to the Coastal Conservancy, the thrust of Conservancy programs will be to assist local governments in rehabilitating and enhancing areas that are to be acquired and managed locally. The Conservancy encourages the applying local government to provide an amount of funding equal to the amount of the Conservancy grant. The amount of Conservancy funding is determined by total amounts of funding available for the program area, alternative fiscal resources of the applicant, as well as other criteria that the Conservancy has established to determine project eligibility and priority.

Reservation of coastal resources: The Coastal Conservancy's reservation program enables it to purchase and reserve key coastal lands that would otherwise be lost to public use, until such time as another public agency can purchase and maintain them for public use. To be eligible, these lands must have recreational, fish and wildlife habitat, historical or scientific values needed to meet the policies and objectives of the Coastal Act, or they must be identified in a certified Local Coastal Program (or a Coastal Commission approved Work Program or Issue Identification document) as having such values. While these lands are being reserved, specific restoration or management arrangements can be developed. The Conservancy's first project in this program area involves the purchase of key parcels along Trinidad Bay in Humboldt County. This site has improtant scenic and archaeological value. The site was selected from many other possible candidates for acquisition because it was threatened by encroaching development and because its history of permit applications and denials had created a severe hardship for the owner. (5)

Public access: To ensure the public's access to and enjoyment of the coast, the Conservancy is empowered to grant funds to the California Department of Parks and Recreation, or to local agencies, for up to the total cost of acquiring, developing and maintaining coastal accessways. In cases in which grants are awarded to local agencies, it must be determined that the accessways are required to serve more than local needs. Under this program, the Conservancy has developed a project for the establishment of a three-mile long trail from Highway 101 north of San Francisco to the coast. This trail will be designed to accommodate pedestrians, bicyclists and horses. The Conservancy is providing half the purchase price, which will be matched by funds from Caltrans' Abandoned Railway Account. (5)

Resource protection zones: (See: Resource Protection Zones.)

Preservation of agricultural land: The focus of the Coastal Conservancy's agricultural land preservation program is to provide the impetus for other public agencies to innovatively protect agricultural lands threatened with urban and suburban development. The Conservancy hopes to serve as a model for agricultural preservation efforts by testing different combinations of methods for handling particular preservation problems, such as providing of buffers in urban fringe areas, implementing mixed use projects, consolidating fragmented holdings into more efficient parcels, restoring idle lands to production and aiding smaller farms in maintaining economic viability. The Conservancy is authorized to acquire

fee title, development rights, easements, options to purchase (up to $100,000), or other interests in coastal zone agricultural land. The Conservancy can also improve or develop such lands where required and lease lands it acquires. The Conservancy must return land to private use or ownership with appropriate use restrictions for agricultural preservation. Income generated from sale or lease of lands can be used in other Conservancy preservation activities and projects. (6) (See: Agriculture.)

The Conservancy has proposed the purchase of 146 acres of prime agricultural land in the Morro Valley, adjacent to the City of Morro Bay. The land is to provide a buffer zone for agricultural uses and later be resold under provisions restricting all but agricultural uses. Another 92 acres of farmland would probably be preserved by trading equivalent agricultural acreage in the 146 acre parcel for the development rights to the 92 acre parcel. (5)
dl
(See also: Resource Protection Zones, Agriculture, Buffer Zones.)

References: 1. California Coastal Conservancy Act of 1976. California Public Resources Code, Division 21, Sections 3100 et seq. Also cited as Chapter 1441 of the California Statutes of 1976. 2. State Coastal Conservancy. November 9, 1978. "Conservancy Wetlands Program." California Coastal Conservancy, Oakland, Ca. 3. State Coastal Conservancy. January 12, 1978. "State Coastal Conservancy Guidelines and Criteria for Grants to Local Public Agencies for Coastal Restoration Projects, and for Coastal Resource Enhancement Projects." California Coastal Conservancy, Oakland, Ca. 4. Staff Recommendation. March 7, 1979. "Coastal Conservancy Project #1 (Arcata Marsh Enhancement Project)." California Coastal Commission, San Francisco. 5. State Coastal Conservancy. April, 1979. "Activities Report 1978-1979." California Coastal Conservancy, Oakland, Ca. 6. State Coastal Conservancy. October 30, 1978. "The State Coastal Conservancy's Role in Agricultural Preservation." California Coastal Conservancy, Oakland, Ca.

COASTAL-DEPENDENT USES

Certain land uses, by their very nature, require a site within the coastal zone to be able to operate. These land uses are commonly called "coastal-dependent" uses. Coastal-dependent uses fall into two categories. the first category includes uses that are absolutely dependent on a site at the shoreline because they require direct contact with the ocean. marinas and petroleum tanker terminals are examples of uses in this category. The second category is for uses that must locate in the coastal zone, but not necessarily on the shoreline. A seawater-cooled power plant would fall into this category because the cooling water could be pumped a shore distance inland without impairing plant operation.

One of the basic goals of the California Coastal Act of 1976 is to give priority to coastal-dependent development over other development within the coastal zone (Section 30001.5 (d)). A major inquiry made on a coastal permit application by the Coastal Commission or by a local jurisdiction with an approved Local Coastal Program (LCP) is whether the proposed development is coastal-dependent. In addition, a federal dredging permit will not be granted by the Army Corps of Engineers unless the dredging or filling is for a "water-dependent" use, which is basically the same concept as coastal-dependent use.

The Coastal Act defines as coastal-dependent any land use requiring a site on or next to the ocean for the project to be able to function at all (Section 30101). While such uses have priority over other development in the coastal zone, they are not exempted from the provisions of Chapter 3 of the Act, with one exception. Coastal-dependent industrial development is exempted from the provisions of the Coastal Act if a permit denial would adversely affect the public welfare (Section 30260). Coastal-dependent development is encouraged by Section 30250 of the Act to locate within or adjacent to existing developed sites, if feasible. Coastal-dependent uses are restricted in wetlands by Section 30233.

The Coastal Act contains few provisions for resolving conflicts between incompatible coastal-dependent uses. Section 30222 grants agriculture and coastal-dependent industry priority over visitor-serving facilities. Section 30262 (b) gives oil and gas extraction priority over oil and gas processing facilities. The Coastal Act also provides a general policy for resolving conflicts among provisions of the Act. Section 30007.5 says that conflicts should be resolved in a manner which is the most protective of coastal resources.

The major issue to be resolved when interpreting the above policies is to determine what constitutes a coastal-dependent use. Local jurisdictions are responsible for initial interpretation of Coastal Act policies, subject to review by the Coastal Commission. Local planners can get help in identifying coastal-dependent uses from careful study of uses specifically permitted by the Coastal Act, Coastal Commission comments on other LCP submittals, and Coastal Commission permit decisions.*

Marinas and boating facilities for recreation and commercial fishing, as well as major port facilities are obviously dependent on the presence of the sea. Such facilities include dry-storage areas, boat ramps, berth space, turning basins, access channels, boat works and shipyards, plus cargo loading, fueling, and other support facilities. (1) Shoreline sites are needed for these uses.

Coastal-dependent industrial uses consist mainly of fishing and energy related development. (1) Such uses include canneries, aquaculture, kelp harvesting and processing, and energy facilities (listed in Chapter 3, Article 7 of the Act). Some of these industries require the marine environment and a shoreline site for their production processes, (for example fishing, aquaculture and kelp harvesting). Others require raw materials

extracted from the sea or transported by ship and cannot be feasibly transported to an inland site for processing (for example, seafood canneries, liquified natural gas gasification plants).

Agriculture and mineral extraction, though not dependent on the coast per se, are considered coastal-dependent because the soil or mineral deposits found in the coastal zone cannot be moved elsewhere, but must be used or mined where they are found. These uses are coast land dependent. If agriculture or mineral resources are found in the coastal zone, their associated production facilities (e.g., drilling platforms) must also be located in the coastal zone and are thus considered coastal-dependent. (2)

Very few appeals of Coastal Commission permit decisions involve the uses just described. The Commission has had a great deal of trouble with permit applications for residential or commercial uses that claim the project is "coastal-related," a term not mentioned in the Coastal Act. Applicants base this "coastal-related" argument on the contention that the economic viability of the project is derived from its proximity to the coast. Examples include restaurants, motels, and condominium developments intended to take advantage of ocean views. The Coastal Commission has consistently rejected this argument. The Commission has found that enhanced economic value is not sufficient ground to claim that this type of development is totally reliant on the sea since successful residential and commercial development occurs inland from the coast as well. (3)
The only type of commercial development explicitly permitted by the Coastal Act is visitor-serving development. Visitor-serving facilities include motels, campgrounds, restaurants, shopping and amusement areas specifically intended to serve visitors to the coast, especially in areas where sufficient facilities do not currently exist. (1) Visitor-serving facilities have lower permit priority than coastal-dependent uses. In general, development that is not coastal dependent is permitted only if it does not conflict with a proposed coastal-dependent use and is consistent with all other provisions of the Coastal Act. (3)

In addition to identifying coastal dependent uses, local planners must be able to resolve conflicts among incompatible coastal-dependent uses. For example, should an oil refinery be allowed to replace a commercial fishing facility? There are few specific provisions in the Coastal Act for resolving such conflicts which require case-by-case analysis. No Coastal Commission permit decisions have yet involved this issue, so case histories are not available as guides. However, the permit review section of the Coastal Commission has unofficially indicated that it would resolve such a conflict by ranking development based on degree of dependence on the coast or a particular site. (3) For example, aquaculture, fishing, marinas and ports might be considered more dependent on a coastal site than an oil refinery. Agriculture and mineral extraction are more dependent on a particular site than other coastal-dependent industrial development. Visitor-serving facilities, followed by general industrial, residential and commercial uses,have the lowest priority.
bh

References: 1. California Coastal Zone Conservation Commissions. 1975. California Coastal Plan. Sacramento, California. 2. South Central Regional Commission. March 12, 1979. "Comments on County of Santa Barbara and City of Carpenteria draft land use plans." California Coastal Commission. San Francisco. 3. California Coastal Commission. June 7, 1979. Informal communication with Tom Mikkelsen, Coastal Commission Permit Section.

* Appeal No. 139-78. Commission denied a permit to the Old Santa Barbara Pier Co. and City of Santa Barbara to rehabilitate and develop Stearn's Wharf, Santa Barbara County. At issue were traffic, parking, access to the waterfront, intensity of development and coastal dependency along with preemption of planning to be done in the LCP.

Appeal No. 251-78. Commission granted permit with conditions concerning access and housing to the Bank of Newport to demolish motel, convert apartments to condominiums, construct a bank, office structure, six drive-through kiosks, and parking facilities, and divide related parcels of land at Corona del Mar, Orange County.

Appeal No. 342-78. Commission denied permit to San Dollar Development Co. to divide 6.7 acres into 9 lots, grade site and construct industrial subdivision improvements; Huntington Beach, Orange County.

CONSERVATION AREAS

"Conservation areas" and "conservation buffers" are general terms for areas reserved to protect natural resources. The Local Coastal Program Manual calls for the "designation of conservation areas and conservation buffers where necessary to protect riparian habitats and coastal resource areas." (1)

As an example of conservation buffers, coastal jurisdictions have designated riparian habitats using river and stream locations on U.S.G.S. quad sheet maps. The current practice in the Santa Monica Mountains region of Los Angeles County is to prohibit development within 100 feet of riparian habitats. If that would preclude development of a lot, then the buffer area is reduced to 50 feet.

(See also: Buffer Areas, Riparian Habitats.)

References: 1. California Coastal Commission. July 22, 1977. Local Coastal Program Manual. San Francisco.

CONSERVATION BUFFERS

(See: Buffer Areas.)

CONSTRUCTION

(See: Dredge and Fill.)

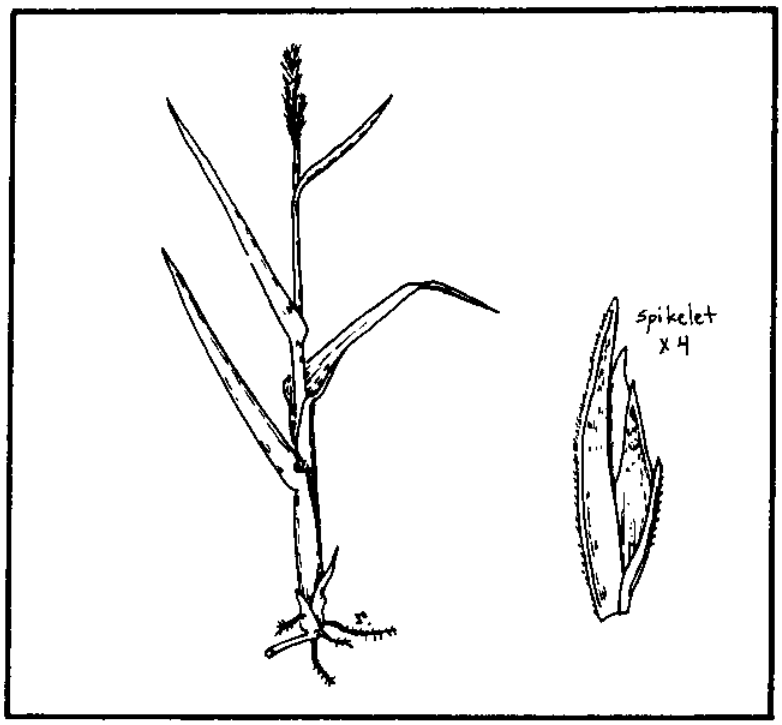
CORDGRASS

Perennial cordgrass (Spartina foliosa) is the dominant plant of the lower littoral zone (roughly between Mean Lower Low Water and Mean Lower High Water) of the saltmarsh community. Cordgrass primarily colonizes the peripheral mudflats. It functions as an effective sediment trap and is therefore an important agent in marsh formation and expansion.

Cordgrass is one of the world's most productive plants, producing 5 to 10 times as much nutrient material and oxygen per acre as wheat. Decomposition of cordgrass results in the formation of detritus and thereby contributes to detrital enrichment of the estuarine environment. Cordgrass is a member of the halophytes -- the small number of plants which can tolerate soils of high salt content.

Cordgrass is an essential habitat for some saltmarsh animal species, such as the endangered Light-Footed Clapper Rail found in Southern California. Destruction of habitat seems to be the main reason for the rail's diminished numbers. Many Southern California salt marshes lack the lower littoral zone where cordgrass grows. Consequently, restoration or enhancement of tidal flow and restoration of the lower littoral zone are ways of providing additional habitat for saltmarsh-adapted endangered species.
cwb

References: John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.



D

DEGRADATION OF MARINE RESOURCES AND WATER QUALITY

Degradation of marine resources and water quality occurs when either resources or the carrying capacity of habitats is significantly reduced because of the impacts of human activity. Degradation of water quality may be indicated by an unnatural decrease in the abundance of certain species or in the natural diversity of a coastal ecosystem. It is important to understand that a state of degradation does not imply that the water is absolutely unproductive or the resource is absolutely depleted. "Degraded" describes a relative degree of reduction of value and requires a modifier (e.g., 50% loss of kelp beds, economically extinct species, etc.)

Section 30231 of the Coastal Act calls for marine resources, biological productivity, and coastal water quality to be "maintained, enhanced, and, where feasible, restored" and thereby protected from degradation. Section 30231 lists a number of management principles to prevent or minimize degradation of marine resources and water quality.

Since prevention is preferred over cure, an appropriate management framework to prevent future degradation of marine resources and water quality (and thus the need for restoration of these coastal resources) is most desirable (see: Ecological Resources Management).

Prescribing cures for all the varieties of degraded resources and water quality is beyond the scope of this handbook. Degradation is the converse of protection and enhancement, subjects covered in detail elsewhere in this report. Some tools of restoration may be restocking or restoration of land form. Restoration requires public expenditure and as such is a capital expense item in the budget rather than a regulatory matter such as a land use control. Since additions to the local budget are not currently popular in California, state or federal funding will be necessary for much of the needed restoration of degraded resources and waters.
cwb

References: 1. The Conservation Foundation. In press. Coastal Environmental Management. Federal Insurance Administration, Washington, D.C. 2. Bruce Jones. 1978. "Watershed management: The Next Environmental Crusade." In, Cry California. Summer, 1978. 3. John Clark and Judith Clark, Eds. 1979. Scientists' Report, National Symposium on Wetlands. National Wetlands Technical Council, Washington, D.C.

DEGRADED WETLANDS

A degraded coastal wetland is a wetland habitat in which the physical components and biological functions have been deleteriously altered to the extent that its ecological viability is significantly impaired (e.g., its carrying capacity is reduced by 10% or more). (1) Human intervention is usually necessary to restore degraded wetland habitats to their full ecological viability. (See: Wetlands Restoration.)

Basically, "degraded" means lowered (in quality or quantity of output) as distinct from "disturbed" which means changed (usually adversely so). It should be made clear that degradation is a relative condition, not an absolute state; thus a wetland may be "significantly" degraded, "highly" degraded, or "moderately" degraded -- some modifier is necessary. If the wetland system as a whole is providing typical wetlands products or values, but at a clearly reduced level, it may be termed "significantly degraded." If the system is providing little or no products or values, it may be termed "substantially degraded." Theoretically, any wetland is restorable (see: Wetlands Restoration). The test is one of practicability, not possibility.

Some of the preliminary causes of wetland degradation are filling, excavating, ditching, draining, impounding, diking, bulkheading, roadway construction and pollution. The filling in and disposal of spoil on wetlands areas changes the elevation, thereby affecting tidal inundation and circulation patterns.

The excavation of drainage ditches in wetlands is often quite damaging ecologically. In addition, ditches often collect runoff pollutants that contaminate estuarine waters. The construction of levees and dikes for mosquito control, flood control, or conversion of land to agricultural or residential purposes often leads to total loss of the habitat under and along the embankments and tends to diminish or even destroy the wetlands within the diked areas. Ditching is often accompanied by water pollution and interruption of water movement and circulation. Roadway construction physically replaces wetlands with the roadbed and the spoil dredged out for the roadbed construction. Additionally, roads can disrupt normal circulation patterns, including both tidal and land drainage. (2)

Pollutants such as industrial effluents, sewage, agricultural runoff and sediment are detrimental to wetlands communities. However, pollution is often passively reversible (by source abatement) while much physical alteration is not. (2)

A degraded wetland can often be visually identified by various characteristics such as low diversity of animals and plants, altered or compacted soils, and channels and lagoons which have obviously been dredged or blocked or have had their water clouded by sediments. Also, physical evidence of degradation, such as fill, excavations, ditches or dikes, may be ovbious.

An example of a significantly to substantially degraded but mostly restorable wetlands area is the Ballona Wetlands, located in Los Angeles County. Originally, about 2,100 acres of wetlands, lagoons and shallows covered the area, but urban development has converted a good deal of this land to other uses, much of it irretrievably. Currently, about 515 acres are either actual wetlands or are vacant land that once was wetlands and could probably be so again given a large-scale commitment to restoration. About 120 acres are existing vigorous wetlands, 180 acres are easily restorable, and 215 acres are more difficult to restore. (3)

In this case, the primary causes of degradation have been the deprivation of tidal flushing caused by the placement of a flood control channel through the area and resultant diking, berming, filling and road building. It appears that the removal of "flap gates" from the culverts (or the construction of larger channels connecting the wetlands to the ocean), as well as simple grading and reshaping of the wetland surface, improving the water flow, and providing edge-zone buffers would restore much of the remaining Ballona wetlands to a near-natural level of functioning, especially if an enlarged tidal entrance were constructed. (3)

A good example of the restoration of a degraded wetland is Arcata Marsh Enhancement Project #1 in Humboldt County. (See: Coastal Conservancy.) We know of no guidelines or references available to planners that would be helpful in determining whether or not a given wetland is degraded. (See: Wetlands Restoration.) While the planner can by visual inspection often make a preliminary judgement whether a specified wetland area is degraded, a definite opinion should be obtained from an agency or private expert. Scientific and engineering expertise will be needed when formulating a wetlands restoration program.

The subject of degraded wetlands is addressed in the Coastal Act principally in relation to boating facilities; for example, Section 30411 states that the California Department of Fish and Game (DFG) "...may study degraded wetlands and identify those that can most feasibly be restored in conjunction with development of a boating facility...." The basic theme of state policies is that wetlands restoration should be accomplished to the fullest extent possible by means that do not pre-empt wetlands. Only if restoration cannot be accomplished by any other means is wetlands preemption for a marina considered to be permissible. Otherwise, state policy directs marina projects into: a) natural harbors, b) offshore freshwater-protected sites, or c) excavated "dry land" harbors.

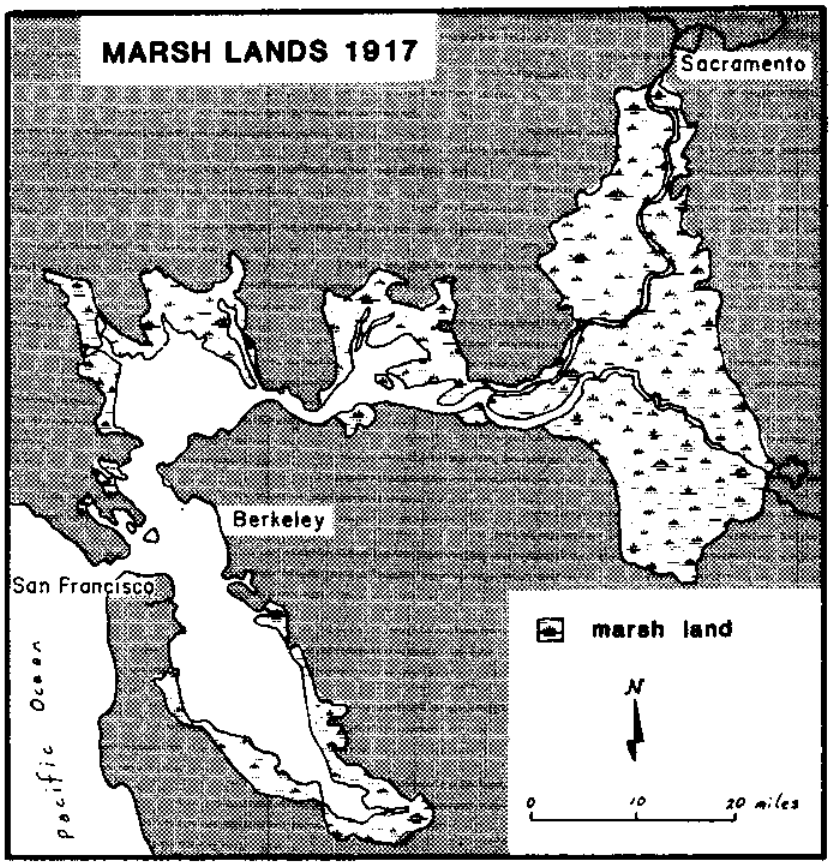
The California Department of Fish and Game (DFG) is expected to ascertain the state of degradation of certain wetland areas under Section 30411 (b) of the Coastal Act by considering:

- Whether the wetland is so severely degraded that it is not capable of recovering...without major restoration activities.

- Whether a substantial portion of the degraded wetland, but in no event less than 75 percent, can be restored...in conjunction with a boating facilities project.

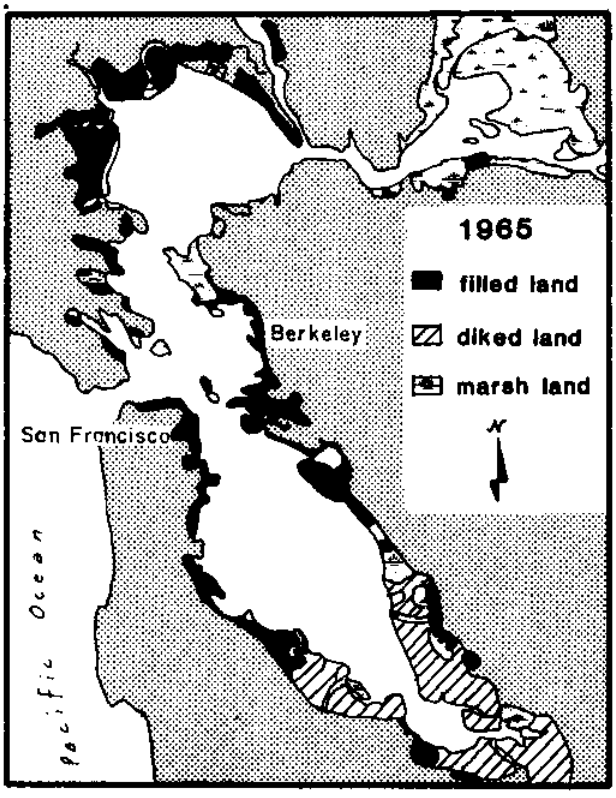
- Whether restoration of the wetland's natural values...can most feasibly be achieved and maintained in conjunction with a boating facility or whether there are other feasible ways to achieve such values.

Also, Section 30233 (a) states that diking, filling, or dredging shall be permitted for boating facilities where there is no feasible alternative and a "substantial portion of the degraded wetland is restored and maintained as a biologically productive wetland."



The map above shows San Francisco Bay in 1917 before diking and filling while the map below shows the Bay in 1965 after extensive degradation had occurred.

Reference: Hedgepath. 1977. San Francisco Bay: The Wetlands Besieged in National Wetland Protection Symposium. U.S. Fish and Wildlife Service.



The DFG may or may not be able to help local coastal planners on general planning matters. Normally, the DFG will not participate in a decision until a permit for wetlands development has been applied for; however, when a specific planning issue arises and they are asked for advice, they will usually be able to assist. Then, the Department routinely works cooperatively with the Coastal Commission or federal agency in determining a given wetlands state of degradation. In the absence of an application for a specific development permit application, the situation is less certain. The DFG does routinely review and comment on Local Coastal Programs.
db
(See also: Wetlands of the Coast, Wetlands Restoration, Buffer Areas.)

References: 1. John Clark and W. Brownell. 1973. Electric Power Plants in the Coastal Zone Environmental Issues. American Littoral Society, Special Publication No. 7, Highlands, New Jersey. 2. The Conservation Foundation. In press. Coastal Environmental Management. Federal Insurance Administration Washington, D.C. 3. John Clark, et.al. 1979. Ballona Wetlands Study. Prepared by the UCLA Urban Planning Program, Department of Architecture and Urban Planning, University of California, Los Angeles.

DETRITUS

Detritus consists of small particles of dead organic matter in varying stages of decomposition. Detritus forms the basis of the detritus food chain which transfers energy from dead organic matter into microorganisms and on to subsequent consumers.
cwb
(See also: Food Chain.)

DIKING

A dike is a berm or bank of earth constructed of soil or aggregate to form a barrier, usually to confine a water body. The California Coastal Act (Section 30233(a) and 8(c)) states that diking of open coastal waters, wetlands, estuaries and lakes shall be permitted in situations where there is no feasible alternative which is less environmentally damaging, where mitigation measures have been provided to minimize adverse environmental effects, and where diking in existing estuaries and wetlands maintains or enhances the functional capacity of the wetland or estuary.

The purpose of dikes is to control water flow; they can be used to keep water out or in. In either case, dikes obstruct the continuity of water flow, blocking the passage of fish to the marsh, the flow of nutrients to the estuary, and the general circulation of water. (1) Dikes can be used to control water in agriculture and mosquito abatement and to hold fill in marsh conversion. The use of dikes for water control includes: a) impoundments, where marshes are surrounded with dikes to control the water level, b) open-marsh water management, where a connected system of pools and open channels is developed to provide habitats for mosquito-eating fish and to give them access to all temporary standing water areas, c) flood control for agricultural or community protection, (1) and d) channel containment.

The diking of coastal wetlands and estuaries can cause significant adverse environmental effects. In the Ballona Wetlands (South Coast Region), for example, dikes restricting tidal flow have seriously degraded and impaired the wetland's natural processes. Similarly, in the Elkhorn Slough (Central Coast Region), a dike (railroad grade) has cut off or greatly restricted tidal exchange and, in one instance, converted a portion of a natural marsh to a pasture. (2)

Because dikes impair the water regimes of wetlands and estuaries, they should be discouraged in new construction and removed in restoration projects. Exceptions will be necessary only when restoration projects require diking to rectify an existing irreversible adverse situation.
cw
(See also: Dredge and Fill.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley and Sons. New York. 2. Madrone Associates. 1979. "Preacquisition Planning Study Elkhorn Slough." (Review Draft.)

DISSOLVED OXYGEN

Dissolved osygen is a critical limiting factor in the productivity of water environments. (1) "Molecular" oxygen, on which life depends, exists only in the atmosphere or dissolved in water. (2) Dissolved oxygen enters the water either by transfer from the atmosphere or by the photosynthesis of aquatic plant life. Water runoff from the land, which carries a great amount of organic material and nutrients, can cause eutrophication of water bodies, a condition in which the dissolved O_2 content of the water becomes unstable and depleted (see: Carrying Capacity).
jt
References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 2. Raymond F. Dasmann. 1972. Environmental Conservation. John Wiley & Sons, New York.

DIVERSITY

Diversity refers to the variety and number of species present in a given ecosystem. It is generally assumed that high species diversity indicates a better ecosystem balance and provides for greater resilience to catastrophic events. Conversely, a low species diversity may indicate a system which has been stressed, (for example, by pollution) or which is artificially controlled (such as farmland).

Professional ecologists often use the species diversity index as a measure of the condition of an ecosystem. The diversity index is calculated as the ratio between the total number of species in a given ecosystem and some rating of the relative importance of individual species (such as population, biomass or productivity). Such indices often provide a good method

of detecting the presence of disturbances, such as pollution, and of evaluating the quality and condition of coastal ecosystems.

Planners and non-professional ecologists may use the term "diversity" in a more general, often qualitative sense, when discussing the condition of natural systems and habitats.

The Coastal Act states that "The biological productivity and the quality of coastal waters, streams, wetlands, estuaries and lakes...shall be maintained and, where feasible, restored..." (Section 30231). Diversity measures can be useful in assessing overall ecosystem health and, therefore, in determining where special protection of marine resources is needed.

db

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons. New York.

DRAINAGE

(See: Runoff.)

DREDGE AND FILL

Dredging (the excavation of bottom material) and filling (the artificial elevation of land by the deposition of soil or other material) is done extensively in the coastal zone. Dredging may be performed to create and maintain canals, navigation channels, turning basins, harbors and marinas, as well as to lay pipeline and to obtain a source of material for fill or construction. Filling relates to the deposition of dredged or other materials, either for the specific purpose of creating real estate or for disposal of the by-product (dredge spoil) produced during dredging.(1)

The greatest ecological impacts of dredging and filling are: a) conversion of landforms and water bodies, such as wetlands and estuaries, from natural,biologically productive areas to artificial, non-productive areas, b) siltation and water turbidity, and c) alteration of the natural circulation of estuaries.

The California Coastal Act addresses this problem in Section 30233 (a) which states "The diking, filling or dredging of open coastal waters, wetlands, estuaries and lakes shall be permitted...where there is no feasible less environmentally damaging alternative..." (emphasis added). In addition, the section also requires adequate mitigation measures to be implemented and states that only certain types of development can take place in the mentioned areas.

Dredge and fill operations adversely affect the coastal ecosystem in a variety of ways. Among the potential effects of dredging are the following: a) adding to water turbidity, siltation and pollution, b) lowering the dissolved oxygen, and c) creating short-and long-term changes in water currents, circulation, mixing, flushing and salinity. Submerged bottoms and coastal wetlands and tidelands, along with their associated organisms, are often obliterated by dredging. (1) Dredging also produces spoil, which must be disposed of on some other natural habitat. Filling requires some area to be dredged for a source of fill material. Such operations cause a two-fold destruction of habitat that extends beyond the area of primary concern. (1)

In addition to the direct loss of habitat which accompanies dredge and fill, the removal, transportation and deposition of sediment creates and disperses large quantities of silt and debris into coastal waters Suspended silt in high concentrations creates a number of adverse environmental impacts. As it settles, it physically smothers bottom dwelling plants and animals. (1) Turbidity is also increased, which decreases light penetration into the waterand reduces photosynthesis. (1)

In addition to the biological impacts of dredge and fill operations, filled lands may be a potential geological hazard because of the unstable nature of filled areas. If a filled area happens to be within the range of an earthquake, ground-shaking effects of such an occurrence could cause liquefaction to occur, which in turn could cause the soil to be incapable of supporting structures. (2)

The U.S. Army Corps of Engineers has responsibility for control of dredging and filling in coastal areas under Section 10 of the U.S. River and Harbor Act of 1899 which requires a permit for any alteration within navigable waters of the United States. Under Section 404 of the Clean Water Act of 1977, the Corps was directed to give stricter attention to preventing adverse impacts from dredging and filling, especially in wetlands and estuaries. As a result, any filling or excavation of any wetland (not just "navigable waters") requires a Corps permit. (See: Wetlands Policy: Federal, and Wetlands Policy: State.)

Dredging and filling has been a major factor in the destruction of much of the wetlands and related areas in California. Of the original 197,000 acres of marshes, mudflats, bays, lagoons, sloughs and estuaries (excluding San Francisco Bay) over 52% have been destroyed by dredging and filling. Of California's remaining estuaries and wetlands, 62% (1975) have been subjected to severe damage and 19 percent have received moderate damage. In Southern California, 75 percent of the coastal estuaries and wetlands have been destroyed or severely altered by man since 1900. (3)

Planners will have to address dredging and filling in two major contexts: a) the effects of the dredging operations that produce the fill material and b) the effects of the actual filling and obliteration of wetlands and tidal flats. All potential coastal developments must be reviewed to see whether they will induce any major dredging or filling activities.

Before planning any type of dredging activity, it is necessary to contact the state dredging authority or the district office of the Corps of Engineers. Federal regulations contain stringent guidelines for dredging projects that provide for the issuance of public notice and for public comments on economics, navigation, conservation, aesthetics, historic value, fish and wildlife values, flood damage prevention, recreation, land use, water supply, water quality and general environmental concerns.

The selection of disposal sites for dredge spoil is governed by guidelines developed by the administrator of the Environmental Protection Agency (EPA) in conjunction with the Secretary of the Army. Section 103 of the Federal Ocean Dumping Act (1972) authorizes the Secretary of the Army to issue, after notice and opportunity for public hearing, permits for the transportation of dredged materials for dumping into ocean waters. Furthermore, under both the Federal Clean Water Act and the Ocean Dumping Act, the administrator of EPA can prohibit or restrict the use of any defined area as a disposal site whenever he finds, after notice and opportunity for public hearing, that the discharge of such materials into such areas will have an unacceptably adverse effect on municipal water supplies, shellfish beds, fishery areas, or wildlife and recreational areas. Furthermore, in evaluating permits for transporting dredged material for dumping into ocean waters, the Corps of Engineers will specify the dumping site using the recommendations of the EPA. (4)

Local coastal planning needs to consider three important aspects of dredge and fill operations.

- o Spoil disposal sites: The Corps of Engineers requires local communities to provide areas for disposal of excavated material. The safest sites for this purpose are upland areas or deep ocean sites. (3) With proper ecological safeguards certain dredge spoils can be used to build marshlands. (3)

- o Constraints on disposal: Section 30233 of the Coastal Act requires certain constraints and mitigation measures to minimize adverse environmental effects of dredge spoils disposal.

- o Constraints on location of marinas or boating facilities: Consideration and designation of proper spoil disposal sites is necessary when planning for the construction of marinas and boating facilities.

Dredge and fill problems can be avoided for the most part through careful planning and attention to the natural processes at work in coastal ecosystems and to the probable effects of dredging. The first approach in planning is to search for alternative solutions that eliminate the need for channels and save money. Projects that are essential to the public and for which there are no alternative solutions need to be minimized in extent, designed with care, and built under stringent environmental controls. (4)

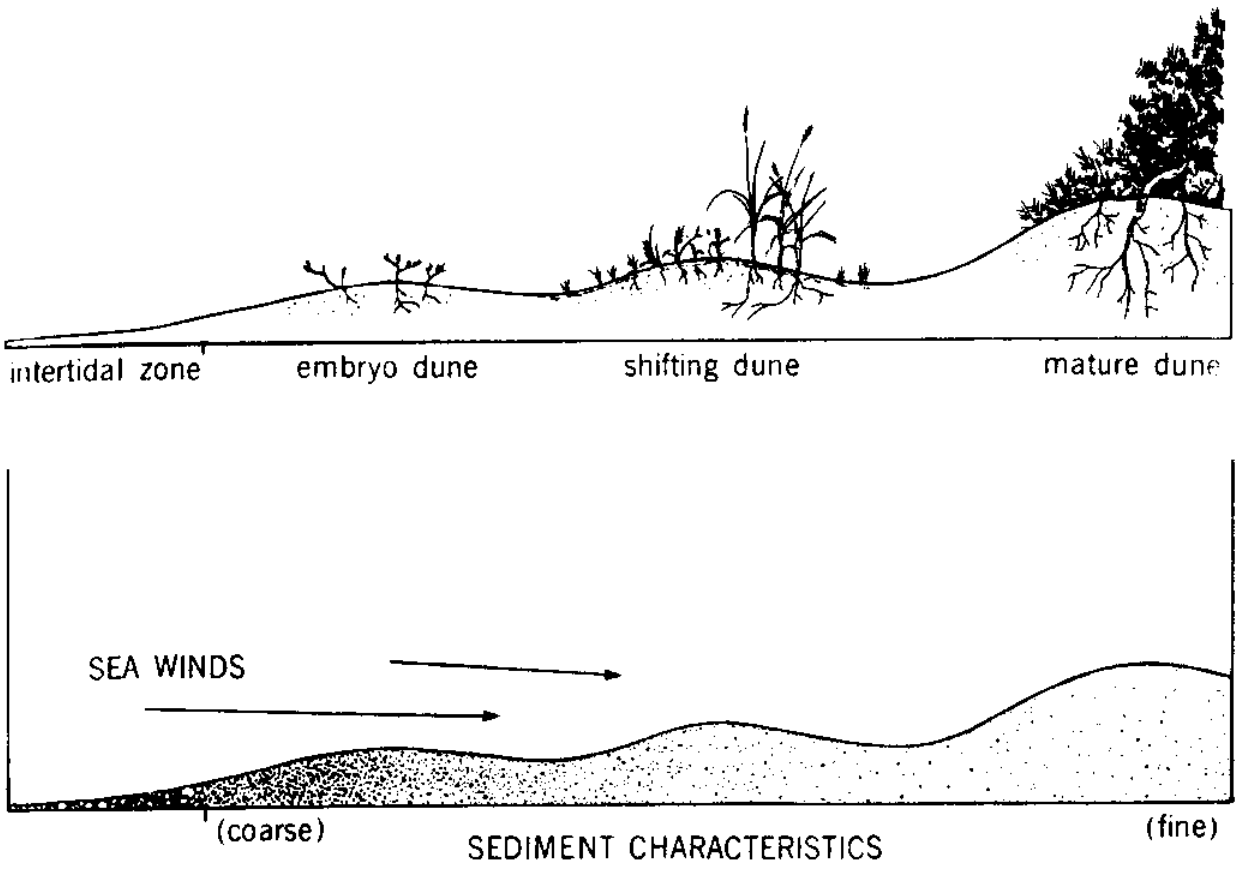
An example of a "feasible less environmentally damaging" alternative to a marina built in wetlands could be any of the following: (a) excavation of the marina at a non-wetland (dry land) site, (b) expansion into an existing natural harbor, (c) creation of the berth space with breakwaters off the ocean beach, (d) utilization of dry storage areas for boats where only a launch and haulout facility is necessary.
jw
(See also: Section 404: U.S. Clean Water Act Section 10 and River and Harbor Act.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley and Sons, New York. 2. United States Geological Survey. 1974. Seismic Hazards and Land Use Planning. USGS Circular 690. U.S. Government Printing Office, Washington, D.C. 3. California Coastal Zone Conservation Commissions. 1975. California Coastal Plan. State of California, Sacramento. 4. Dr. Edward T. LaRoe. 1977. "Dredging-Ecological Impacts." In John Clark. Coastal Ecosystem Management. John Wiley and Sons, New York.

DUNES

Coastal dunes are mounds of sand lying landward of the backshore and are formed by the action of the wind. There are two primary functions served by dunes. One is to foster long-term beachfront stability by providing a storage area for sand to replace that which is eroded by waves or blown away by wind; the second is to prevent inland flooding by serving as a barrier to the run-up of storm waves. Dunes are designated as "environmentally sensitive habitat areas" by the California Coastal Act (Section 30240 (a)) and have been protected in permit actions.

Dunes are waves of windblown sand, the height and movement of which are determined by the available quantity of sand and by the direction and intensity of the wind. The "self-healing" and mobile character of the dune surface makes it an excellent structure to absorb wave energy. The sand eroded by storm waves is deposited on the offshore portion of the beach. The extra sand builds up a parallel ridge, or bar, that lies submerged below the low water mark. This augmented bar causes subsequent storm waves to break and thus weakens their erosive capability. After a storm has passed the berm is rebuilt and the dune is restored with new beach sand carried by the wind. Dune sand is supplied by beach berms. The berm moderates winter sand losses by providing a reservoir of sand available to either dunes or beach as needed. During storms most or all of the berm may be removed by waves, at which time the dunes slump onto the beach to replenish the lost sand. Very strong storm forces may succeed in removing the primary dunes, whereupon the secondary dune becomes a wave barrier.



With time, the chemical and physical characteristics of the dune change. Foreshore dunes are made up of coarse-grained, loose, salty, slightly alkaline, and nutritionally poor sediments. As the dunes age, decomposing plants increase the humus content and the soil becomes acidic; the water-holding capacity also increases.
Reference: Thomas Carefoot. 1977. Pacific Seashores. Univ. of Washington Press. Seattle.

Dunes are greatly influenced by the presence or absence of vegetation. Most dune plants (the most common being an introduced European beach grass, Ammophila arenaria) are rapid growers and spread by forming runners or underground root systems. The vegetation plays a significant role in stabilizing the dune front, trapping and holding the sand blown up by the wind, and thereby allowing the dunes to build and stabilize. This fragile network of vegetation on active dunes is adapted to withstanding the continuing stress of wind and sand, but not to withstanding human disturbance. When the mantle of vegetation is broken, dune movement is accelerated to a point where plant growth cannot keep pace with the shifting sand. The result is a chain reaction which leads to erosion and loss of the active frontal dune. (1)

Behind the active dunes are the secondary (or stable) dunes, typically characterized by heavier vegetation -- perennial shrubs, trees, and vines. When storms periodically remove the active dunes, the more stable dunes absorb the brunt of the physical forces. When both active and stable dunes are destroyed by man, there is nothing left to stabilize the remaining drifting sand but man himself. (2)

The great development pressure on dunes and sandy shorefronts often creates a difficult land use dilemma. Although these are highly sought-after locations for homes and visitor facilities, they are at the same time environmentally sensitive, and any alteration of them may set off a chain of events creating large-scale problems.

Dunes and beaches require protective management and should be identified and classified for this purpose (see: Beaches, Beachfront Protection). The dune system to be designated as a vital area for protection should always include the frontal dune and other active dunes. Basically it should be defined as extending from the "toe" of the frontal dune or beach ridge -- the place where significant vegetation begins to the back side of the most inland active dune. (1) Vegetation must be kept intact, and all traffic, even foot traffic, should be strictly controlled or prohibited altogether -- off-road vehicles (dune buggies, dirt bikes, etc.) are very destructive of dunes. Bridges should be provided for all dune crossing. Holding the beachfront in place by building protective structures as substitutes for dunes involves tremendous expense and is usually not permanently successful. Further more, dunes loosened by vegetation disturbance can migrate landward, rolling over the adjacent land behind them.

Texas has implemented a statute for the protection of dunes and beaches of the Texas coast that states:

> Where a dune protection line has been established, it shall be unlawful for any person or association of persons, corporate or otherwise, to: (1) excavate, remove, or relocate any sand dune or any portion thereof located seaward of such dune protection line so as to reduce the sand dune...(2) kill, destroy, or remove in any manner any vegetation growing on any sand dune seaward of the dune protection line, without making provision for the stabilization of such dune...without first having obtained a permit...(c) in any county where a dune protection line has been established, it shall be unlawful for any person to operate a recreational vehicle on any sand dune seaward of the dune protection line.

In summary, dunes are enormously valuable and fragile. They should not be altered in any way. Dunes should be set aside for preservation and encompassed by as broad a buffer area as necessary to allow for their movement and to protect them and the larger system of which they are an integral part. Roads, buildings, utilities, and other permanent structures should be prohibited in the frontal dune area. The mining of dunes for sand should be completely banned. Traffic over dunes should be limited to designated crossings. Damaged dunes should be restored.

Two inexpensive and effective methods to restore dunes and protect beachfronts are simple structures, such as snow fences, and revegetation programs. Such means enable individual property owners or community groups to build and rehabilitate sand dunes. Replacement dunes should be built above the high-tide line and on slopes that face the ocean. In some areas, in less than a year, dunes 4 feet high or more may be built through the use of fencing, whereas in other places this amount of growth may take several years. The rate depends on the forces of wind that carry the sand onto the dunes and on the availability of sand capable of being eroded and transported by the wind. After dunes are restored they should be stabilized by vegetation to prevent them from being blown away.
jw
(See also: Beaches, Beachfront Protection, Beach Processes.)

References: 1. D. Frankenberg, L.R. Pomeroy, L. Bahr, and J. Richardson. 1971. "Coastal Ecology and Recreational Development." In, C.D. Clement, ed The Georgia Coast: Issues and Options for Recreation. The Conservation Foundation, Washington, D.C. 2. R.A. Bagnold. 1963. "Beach and Near-Shore Processes: I-Mechanics of Marine Sedimentation," pp. 507-524. In, M.N. Hill, ed. The Sea; Ideas and Observations on Progress in the Study of the Seas: vol. 3 -- The earth beneath the sea. John Wiley & Sons, New York. 3. Texas Coastal and Marine Council, n.d. Texas Coastal Legislation, Austin, Texas.

* Appeal No. 41-78. Commission granted a permit with conditions concerning dune survey and restoration, project alignment, riverbed excavation and disposal sites to Union Oil Company for 22,500 ft. long natural gas pipelines in the vicinity of Santa Maria River and Guadalupe Dunes, Santa Barbara and San Luis Obispo Counties.

Appeal No. 109-78. Commission granted a permit with conditions to Alfred Silver concerning submission of revised plans and protection of natural resources for single-family homes, east of Sunset Drive in Asilomar Dunes area of Monterey County.

Appeal No. 115-77. Commission denied a permit to Rosemary Canfield for single-family home, 484 Asilomar Blvd., Pacific Grove, Monterey County. An issue was protection of dune habitat.

E

EASEMENTS

Generally, an easement is a non-possessory interest in land which either grants specific uses or restricts the manner in which the land may be developed. Such an easement can be required through various transactions, such as donation or purchase, and generally falls into two categories--affirmative and negative.

- An affirmative easement enables the easement holder to make certain uses of another person's property. Affirmative easements which may be transferred to public ownership include hunting, fishing, and beach access rights.

- A negative easement enables the easement holder to limit the use a landowner may make of his or her property. A negative easement is equivalent to purchasing development rights. Conservation, scenic and wetland easements are valuable tools for open space resource protection and coastal recreational management.

  a) Conservation Easement: prohibits development in an effort to reserve natural resources for future use

  b) Scenic Easement: limits construction prohibits dumping, billboards, etc.

  c) Wetland Easement: prevents drainage, fill, and development in wetland areas. (1)

However, there is another type of easement -- the public trust -- which is possessory. The State of California (State Lands Commission) retains through sovereignty, public trust easements restricting use of all California tidal and submerged lands except for commerce, navigation, and fisheries. (However, the State's jurisdiction over those lands in private ownership as a result of pre-statehood Mexican land grants is open to question -- the courts have yet to settle this issue.) The California Supreme Court's ruling in Marks v. Whitney expanded the proper public uses to which trust lands may be committed. According to the court:

> The public lands to which tidelands are subject are sufficiently flexible to encompass changing public needs...There is a growing public recognition that one of the most important public uses of tidelands - a use encompassed within the tidelands - is the preservation of those lands in their natural state, so that they may serve as ecological units of 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. It is not necessary to here define precisely all the public uses which encumber tidelands. (3)

Public trust easements can be granted for conservation purposes; for example, the State Lands Commission recently exercised the public trust to prevent environmentally damaging development in the mudflats of southern Morro Bay. (2) In some instances, the California Legislature has granted state-owned tidelands (which carry the trust) to local agencies; for example, the Ports of Los Angeles and Long Beach are the trust-administrators in their jurisdictions. (2)

In cases where the State sold tidal and submerged lands, the court has closely ruled that the land continued to be burdened with the public trust. As a result, the State Lands Commission can restrict the private owners' use of the land. (2)

Several of the resource protection and beach access policies of the Coastal Act could be implemented by the acquistion of easements. For example, Section 30240 states that "environmentally sensitive habitat areas" shall be protected against any "significant disruption" of habitat values and that only uses dependent on such resources shall be allowed within such areas. While State police power may be sufficient to implement this policy, acquiring conservation easements in any environmentally sensitive habitat area could potentially cause less of a hardship to the affected landowner. There is no doubt that acquiring easements is less expensive than fee simple acquisition, especially in the coastal zone.

Furthermore, implementation of those Coastal Act policies restricting the use of submerged lands (e.g. lagoons, wetlands, estuaries, etc.) is clearly made simpler by the State's retention of public trust easements in these areas (except in those situations where the State's jurisdiction is in question because of pre-statehood Mexican land grants).

While acquiring easements can be less expensive than fee simple acquisition, the longer the term of the easement, the higher the cost. Similarly, the longer the easement is sought by a political entity, the less willing the landowner may be to grant it. (1)

The Coastal Act does not enable the Coastal Commission to acquire or hold easements. However, the Commission can and occasionally does require an easement as a condition to granting a permit. (4) A separate state agency, such as the Coastal Conservancy, can acquire and hold easements. However, the Conservancy's legislation limits this holding period to ten years from the time of acquistion (Section 31354).

The previous discussion does not pertain to implied dedication easements acquired through prescriptive use. For further discussion on this issue see Implied Dedication and Prescriptive Rights Manual Relating to California Coastal Commission Matters, State of California, Office of the Attorney General.
cw

References: 1. Robert B. Ditton and Mark Stephens. 1976. Coastal Recreation: A Handbook for Planners and Managers, U.S. Environmental Protection Agency, Washington, D.C. 2. Bud Uzes. State Lands Commission, Sacramento, California, personal communication. 3. Alexis Strauss. June 1979. "Land Ownership and Use," Ballona Wetlands Study, UCLA Environmental Planning Team, Department of Architecture and Urban Planning, UCLA. 4. Jim McGrath, Permits Section, State Coastal Commission, personal communication.

ECOLOGICAL EFFECTS

An ecological effect is the reaction of an ecosystem to a disturbance such as oxygen depletion, turbidity, or siltation, which leads to an alteration of the ecological balance of the system. For example, modification of land area entails a high potential for adverse ecological effects upon estuarine systems through increasing the flow of eroded soils, fertilizers, and nutrients into them. Ecological effects can often set off a chain of events which result in environmental impacts.

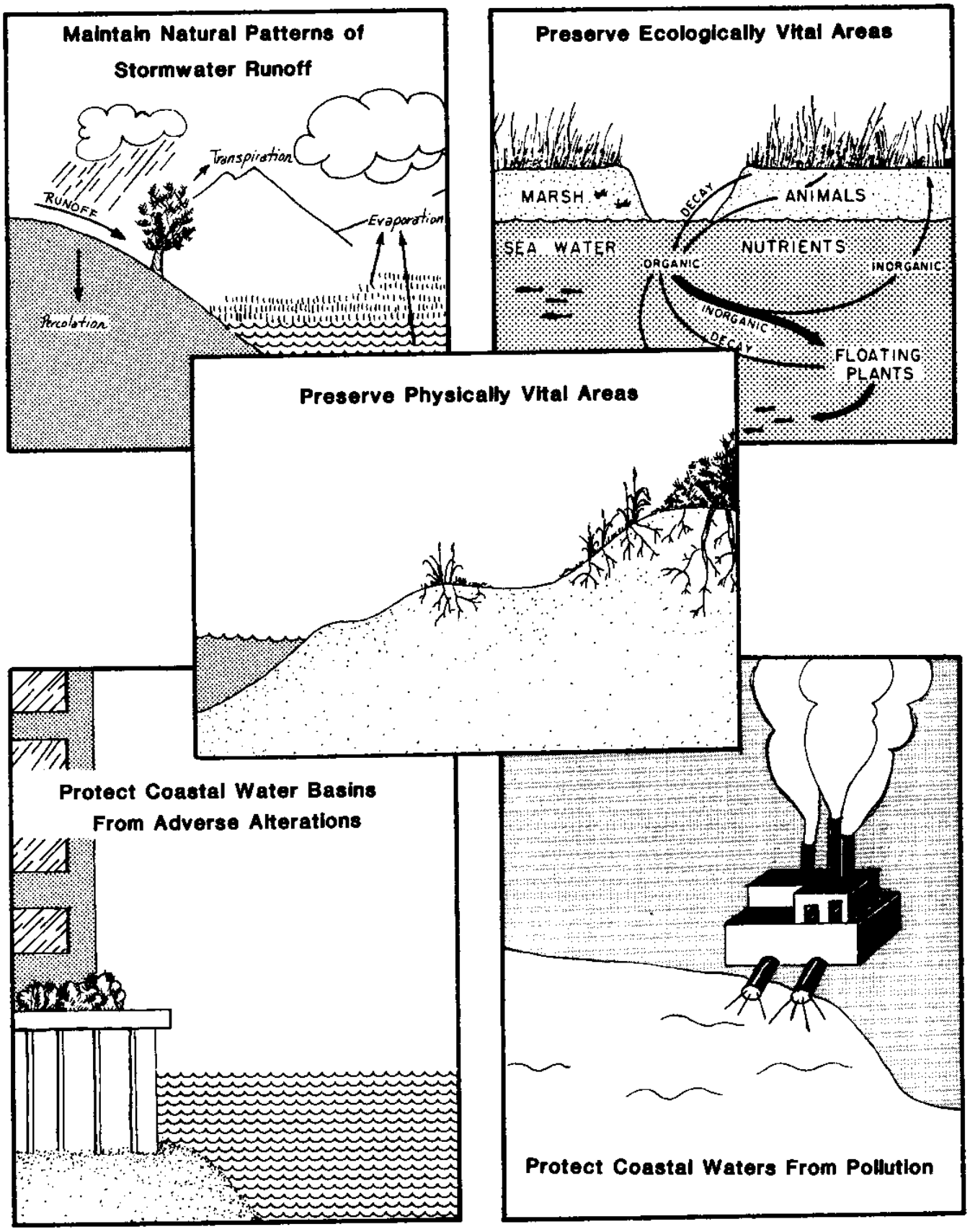
db

References: 1. Biological Services Program. March 1978. Environmental Services Programs -- Volume III: Effects on Living Resources and Habitats. U.S. Fish and Wildlife Service, U.S. Department of the Interior. 2. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

ECOLOGICAL RESOURCES MANAGEMENT

The following principles provide a framework for management to achieve maximum carrying capacity and prevent degradation of marine resources and water quality. If these five management principles are adopted, a high level of coastal ecosystem function should be attained. Experience to date with local planning shows clearly that the Local Coastal Program (LCP) must begin with the water, determine water requirements, and then adjust land uses accordingly. Many planners state this as their aim, but no plan will succeed unless it is based on a foundation of ecological principles. Ecological protection must control land use, not vice versa. Determining the amount of ecological protection by the amount of land use control that is easy to achieve will not work.

- Manage coastal watersheds to minimize alteration of natural patterns of stormwater runoff. Watersheds are crucial to water quality and marine resource protection because they retain stormwater and regulate its quality and rate of flow. The quality of the water that runs off the uplands is a function of the amount of sediment, nutrients, minerals, organic matter, and other substances dissolved or suspended in the water (see: Watersheds). Uncontrolled clearing, hydrologic alteration, and development activity in the uplands is a potential source of damage to coastal ecosystems and a threat to life and property. Ideally, watersheds are addressed under regional management which encompasses the entire geographical area



Management Guidelines for Preserving Estuarine Resources. (See text).

of the watershed. Major watershed management needs are a) the conservation of soil, b) protection of natural hydrologic systems, and c) control of land application of chemicals. These watershed management principles can be implemented in connection with regular land use programs if the watershed lies beyond the designated coastal zone. A case in point is the urgent need for appropriate management techniques to be applied in the watershed of Elkhorn Slough. This area is facing a serious siltation problem which results in degradation of water quality and wildlife habitat.

- Preserve ecologically vital areas, such as kelp beds, wetlands, and edgezones. These areas are supercritical areas, often found inside a generally critical area. For example, kelp beds are especially important components of the waters of rocky Pacific shores. Kelp beds break the force of the sea and provide strips of less turbulent water between themselves and the shore. They provide food and a favorable habitat for many fish, as well as sheltered nursery areas for their young. Wetlands are a vital component of the coastal environment, for both ecological and flood-protection reasons. In addition to providing critical habitats for birds and marine life, wetlands are important sites for mineralizing organic matter and form the basis of the coastal food chains. Wetlands also remove pollutants, slow floodwaters, break waves, and stabilize shorelines. Diking, dredging, and filling destroy wetland habitat, and interfere with water circulation. Edge-zones include natural transition areas (ecotones) at the boundary between land and water (at the extreme high water mark). They are natural buffers and provide important habitat, slow stormwater, stabilize the shore, and cleanse runoff. Edge-zones include special habitats along estuarine/wetlands systems at the inner edge of the wetlands and are synonomous with riparian zones. It is essential that all ecologically vital areas be identified and designated for protection in the coastal planning process.

- Preserve the integrity of protective natural land forms such as sand dunes, beaches, banks and bluffs. Dunelands, the area immediately adjacent to ocean beaches, require protection so they may continue to provide capacity to store and yield sand to protect beaches and shorelands from waves and rushing water in major storms. Dunelands also provide valuable habitat for certain wildlife species (see: Dunes). Major management needs include setbacks, construction standards, excavation prevention, and traffic control. But dune management must be keyed to a comprehensive beach management program (see: Beachfront Protection). Banks and bluffs are areas where geologic instability and water-related erosion contribute to hazardous development conditions. Major management needs are construction setbacks and controls on factors that contribute to erosion and slides, such as water seepage and face or toe alteration.

- Protect the configuration of coastal water basins against adverse alteration. Tidal forces and the characteristics of coastal basin floors strongly influence the carrying capacity of coastal ecosystems. Water circulation prevents stagnation, provides for nutrient exchange, and allows for the entrance and exit of aquatic organisms. Management needs include controls on dredging and construction projects that would detrimentally alter basin floors or inlets or would adversely affect currents or tidal flushing in coastal basins (see: Dredging and Filling).

- Protect coastal waters from pollution. This requires controlling pollution from watershed runoff, from industrial and domestic wastes, and from dredging in coastal water basins. However, since Federal and State regulations are usually preemptive, it will be necessary to a) explore all federal, state, regional and special district authorities as to their potential to provide for local water quality needs, b) determine what part of local water quality needs will not be met by these programs, and c) formulate a local water quality program to meet these residual local needs (coordinated closely with state and Federal programs).

(See also: Restoration of Water Quality, Watersheds.)

References: 1. The Conservation Foundation. In press. Coastal Environmental Management. Federal Insurance Administration, Washington, D.C. 2. Bruce Jones. 1978. "Watershed Management: The Next Environmental Crusade." In, Cry California, Summer, 1978. 3. John Clark and Judith Clark (Eds.) 1979. Scientists' Report, National Symposium on Wetlands. National Wetlands Technical Council, Washington, D.C.

ECOTONE

An ecotone is the transition zone, or border area, between two different ecological communities. An ecotone combines the characteristics of the two communities it separates and often has an unusually high abundance and diversity of life. The ecotone thus serves a uniquely beneficial function to the ecosystem.

cwb

(See also: Transition Zones.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

ENDANGERED SPECIES: CALIFORNIA POLICY

The State of California is vested with the authority to protect rare and endangered animal and plant species through the Endangered Species (Chapter 1.5, Section 2050 et seq.) and the Native Plant Protection (Chapter 10, Section 1904 et seq.) provisions of the Fish and Game Code. An endangered animal is defined by the code as "an animal of a species or subspecies of birds, mammals, fish, amphibia, or reptile, the prospects of survival and reproduction of which are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition or disease." A rare animal is defined as "an animal of a species or subspecies of birds, mammals, fish, amphibia, or reptiles that, although not presently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment worsens." A native plant is defined as a "plant growing in a wild uncultivated state which is normally found native to the plant life of this state."

The state's Endangered Species policies express public concern over California's endangered wildlife, give authority to the Fish and Game Commission to deem what animals in California are rare and endangered, and prohibit the importation, taking, possession, and sale of rare and endangered species. The Native Plant Protection provision authorizes the Fish and Game Commission to identify rare and endangered native plant species and to regulate their taking, possession, propagation, transportation, exportation or sale. Although the native plant provision calls for the preservation, protection and enhancement of native plant habitat, which is "critical to their continued survival," the protection of animal species habitat is not specified. Any loss of habitat adversely affects the well-being of a species and can threaten its survival.

The Coastal Act strongly supports the protection of rare and endangered species habitat (Section 30204, Article 5) by calling for the protection of "environmentally sensitive areas" against any "significant disruption" of habitat values. "Environmentally sensitive areas" are defined to include rare and endangered species habitat identified by the State Department of Fish and Game (DFG). (1) It is also the Commission's policy to protect native plant communities against disruption as habitat for vertebrate and invertebrate wildlife. (2)

The DFG designates a species as endangered if the answer is "yes" to any of the following questions: (3)

- Does the mortality rate consistently exceed the birth rate?
- Is it incapable of adapting to environmental change?
- Is its habitat threatened by destruction or serious disturbance?
- Is its survival threatened by the unwanted introduction of other species through predation, competition, or disease?
- Does environmental pollution threaten its survival?

Species	Distribution	Breeding Season	Estimated California Population	Status Trend	Migratory	Age at Maturity	Nest or Breeding Data	Number of Nesting or Breeding Sites in California
California Least Tern *(Sterna albifrons browni)* (3, 4, 5, 20, 21)	San Francisco Bay to Mexico (breeding). Formerly nested on Santa Barbara and Carpinteria beaches, recently near mouth of Santa Clara and Santa Ynez Rivers.	Apr - Sept	1200	Endangered: stable	Yes – south in winter Oct - Mar	5 yrs. ±	Mud flat, bare sand - gravel area (colonial)	25±
Light-footed Clapper Rail *(Rallus longirostris levipes)* (12, 20, 21)	Goleta Slough south to San Quintin Bay, Baja. Reported at Goleta Slough and Pt. Mugu. Formerly Carpinteria Slough.	Feb: Courtship Mar: Nesting June: Eggs	250	Endangered	No	Ca. 2 yrs. spring after hatching	Nest in clumps of *Salicornia.* (solitary)	13±
California Black Rail *(Laterallus jamaicensis coturniculus)* (1, 2, 20, 21)	Salt marshes from Tomales Bay south to Baja, Mexico. Early records: Hueneme and Santa Barbara. McGrath State Parks, Ventura County, 1971.	April - May		Rare (State)	Some (late summer and fall)	Ca. 2 yrs.	Cupped nest in reeds on ground or elevated above high tide line.	
Belding's Savannah Sparrow *(Lasserculus sandwichensis beldingi* (15, 20, 22)	Goleta Slough south to Imperial Beach in San Diego Co. Goleta, Devereaux, Carpinteria Sloughs.		2200	Endangered: (State listing)	No			11
Island Fox *(Urocyon littoralis)* (7, 20)	All Channel Islands except Anacapa and Santa Barbara	Feb - May		Rare (State): stable	No	2 yrs. ±	Use any available structure for den	
California Brown Pelican *(Pelecanus occidentalis californicus)* (8, 9, 11)	Statewide along coast. Breeding only on Anacapa Island and Scorpion Rock off Santa Cruz Island	Feb - Aug	1500± in Calif.	Endangered: increase	Yes – North after breeding		Sticks on ground or *Coreopsis.* (colonial)	3±; only breeding sites in State
American Peregrine Falcon *(Falco peregrinus anatum)* (1, 10, 21, 24)	13 territories along coastal Calif. between Oregon and Mexico: formerly nested on Santa Cruz Island,		30± (16 adults)	Endangered: decline	Yes	2 yrs.	Scrape on ledge high on cliffs or rocks (solitary)	8+

A rare designation is given if the answer is "yes" to any of the following questions: (3)

- Is it confined to a relatively small and specialized habitat, and is it incapable of adapting to different environmental conditions?
- Although found in other parts of the world, is it nowhere abundant?
- Is it so limited that any appreciable reduction in range, numbers or habitat would cause it to become endangered?
- If current management and protection programs were diminished in any way, would it become endangered?

Endangered and rare animal species that are found in the California coastal environment include the California Least Tern, the Belding's Savannah Sparrow, the Light-Footed Clapper Rail, the California Clapper Rail, the California Brown Pelican, the American Peregrine Falcon, the Island Fox, and the California Black Rail (see articles in this report listed by names of individual species).

The DFG is also empowered to manage and protect federally listed endangered and threatened (the Federal term for "rare") wildlife in accordance with the 1976 cooperative Agreement between the DFG and the U.S. Fish and Wildlife Service. This agreement also enables the DFG to receive Federal grant-in-aid funds on a two-thirds/one-third Federal/state matching basis for program management and critical habitat acquisition.

Although the DFG comments on state projects regarding the protection of Federal and state-listed endangered, rare, and threatened species, the DFG does not have the power to halt projects that have the potential to adversely affect their habitats. In its advisory role, however, the DFG has usually taken a protectionist stance on endangered species habitat. The DFG has played its most crucial role in protecting rare and endangered species and preserving important natural ecosystems by acquiring critical habitat. Examples have been the system of ecological reserves throughout the state and the preservation of coastal wetlands, such as upper Newport Bay and Bolsa Chica Marsh in Southern California and Bair Island and other tidal marshlands in the San Francisco Bay area. Much of this has been accomplished through funds provided by the state Environmental Protection Act and special appropriations from the Legislature. (3)

Local governments can protect rare and endangered species habitat by designating these habitats as exempt from all but the most limited, non-altering types of uses. For example, Los Angeles County has proposed a "Significant Ecological Areas/Habitat Management" designation which encompasses rare and endangered species habitat in the Ballona Creek Wetlands.

These areas are to be preserved in "as viable and natural condition as possible.... The following activities are considered compatible by definition: regulated scientific study, passive recreation...limited picknicking, riding and hiking, and overnight camping. A range of additional uses may also be compatible...pending compliance with...design criteria..." (4) For technical assistance in identifying rare and endangered species habitat, local planners should contact the Endangered Species Program of the DFG.

A report entitled "At the Crossroads: A Report on California's Endangered and Rare Fish and Wildlife" is helpful. (The latest edition of this report is dated 1978 and is available for purchase from the Office of Procurement, Publications Section, General Services, P.O. Box 1015, North Highland, California 95660). The list of Animals of California Declared to be Rare or Endangered is also published in the California Administrative Code, Title 14, Section 670.5. The list of Plants of California Declared to be Endangered or Rare is contained in Title 14, Section 670.2. The California Native Plant Society has issued a report listing endangered plants in California entitled "Special Bulletin No. 1, Inventory of Rare and Endangered Vascular Plants of California." (This publication has been used by the Coastal Commission in identifying endangered native plant species, pursuant to Section 30204 of the Coastal Act). (1)
dl
(See also: Endangered Species: Federal Act.)

References: 1. California Coastal Commission. 1977. Local Coastal Program Manual. Sacramento, California. 2. California Coastal Commission. "Vegetation Management Report." March 1, 1979. 3. California Department of Fish and Game. 1978. At the Crossroads 1978: A Report on California's Endangered and Rare Fish and Wildlife. California Department of Fish and Game, Sacramento, California. 4. Department of Regional Planning. March, 1979. "Proposed General Plan and Final Environmental Impact Report, Summary." Los Angeles County.

ENDANGERED SPECIES: FEDERAL ACT

Endangered species are those species in danger of extinction through all or a portion of their range. Threatened species are those species likely to become endangered within the forseeable future throughout all or a portion of their range. The Federal Endangered Species Act (P.L. 93-205, as amended by P.L. 94-32 (1976), P.L. 94-359 (1976), and P.L. 95-632 (1978)) provides protection for endangered and threatened animal and plant species by regulating the taking and capture of all endangered and threatened animals listed as well as the interstate and foreign commerce of both animals and plants. The Act is administered by the U.S. Fish and Wildlife Service (FWS) through the Service's Endangered Species Office. (The National Marine Fisheries Service has a minor role.) Although there is no federal prohibition under the Act against the taking of endangered and threatened plants, the California Department of Fish and Game (DFG) regulates such taking in California.

Section 30240 of the California Coastal Act calls for the protection of environmentally sensitive habitat areas against significant disruption. As defined in the Local Coastal Program Manual (July 22, 1977), environmentally sensitive habitat areas include those occupied by rare and endangered species identified by the DFG. Most California-listed endangered and rare species also appear on the Federal list. ("Rare" is equivalent to the Federal term "threatened.") Conversely, the DFG is empowered to protect federally listed species by a Cooperative Agreement between DFG and FWS. *

Section 7 of the Federal Endangered Species Act requires that all Federal agencies ensure that their actions do not jeopardize the continued existence of endangered or threatened species, or result in the adverse modification of critical habitats. However, the Endangered Species Act of 1973 does not define what constitutes a jeopardization of the existence of a listed species or its habitat. Furthermore, until 1978, the Act did not define the term "critical habitats." The FWS, however, had defined critical habitat as the:

> area of land, water, and airspace required for the normal needs and survival of the species. These needs include space for growth, movements, and behavior; food and water; sites for breeding and rearing of offspring, cover or shelter; and other biological or physical requirements. Determination of a critical habitat may include consideration of certain biological, physical or human elements of a species' environment if -- but only if -- the element is required for the continued survival or reasonable recovery of the species. (1)

Under this definition the Service sometimes included former habitat areas. (2)

The Endangered Species Act Amendments of 1978 defined critical habitat to include:

> ...the specific areas within the geographical area occupied by the species at the time it is listed...on which are found those physical or biological features essential to the conservation of the species (and) specific areas outside the geographical area...upon a determination by the Secretary that such areas are essential for the conservation of the species. (1)

Under the 1978 Amendments, designation of critical habitats is mandated when a species is listed as endangered or threatened. In determining critical habitats, the Secretary of Interior is directed to consider the economic impacts of specifying them as such. Areas of critical habitat can be excluded if it is determined that the benefits of exclusion outweigh the benefits of designation as a critical habitat, unless such action could lead to the extinction of the species. The Amendments provide a formal mechan-

ism for granting exemptions in cases where: a) there are no reasonable alternatives to the agency action, b) the benefits of Federal Action outweigh the benefits of alternative actions consistent with conserving the species or its critical habitat, and c) the action is of regional or national significance.

The Fish and Wildlife Service has taken the position that critical habitat in no way

> ...places an iron curtain around a particular area, that is, it does not create a wilderness area, inviolable sanctuary or sealed-off refuge....there are many types of existing land uses that are compatible with the continued survival of the species and maintenance of the quality of their habitats. (1)

The authority of the FWS ot override the actions of other Federal agencies will ultimately have to be determined by the courts. Based on past judicial history, it appears that in cases where the Secretary establishes that the proposed action will violate Section 7, and the consulting agency is unable to produce any overriding rebuttal evidence, the courts will give great deference to the Secretary's judgment. Where the FWS does not take a firm position on whether or not the proposed action will jeopardize an endangered species habitat, the courts are not likely to find a violation of Section 7. For example, in Sierra Club vs. Friehlke, the Secretary never asserted that construction of the proposed project would jeopardize an endangered species, but simply asked for a moratorium on construction pending further study. As a result, the district court found no violation of Section 7 and the Court of Appeals upheld this decision. (3)

The principle that the expert opinion of a wildlife agency will be presumed to be valid until overriden by contrary evidence should provide for the effective administration of Section 7.

The United State List of Endangered Fauna and the United States List of Threatened Fauna are amended at irregular intervals in the Federal Register. Some of the coastal-associated animal species found on both the federal and California endangered species lists include the California Least Tern, the Light-Footed Clapper Rail, the California Clapper Rail, the American Peregrine Falcon, the California Brown Pelican, the Morro Bay Kangaroo Rat, the Santa Cruz Long-Toed Salamander, the Unarmored Threespine Stickleback, the Salt Marsh Harvest Mouse, the Bald Eagle and the San Francisco Garter Snake. Among these species, critical habitat has been delineated for the American Peregrine Falcon and the Morro Bay Kangaroo Rat (Federal Register, Volume 42, No. 155, August 11, 1977). Critical habitat has been proposed for the Santa Cruz Long-Toed Salamander in Volume 43, No. 121, June 22, 1978. Critical habitats have been proposed for the California Least Tern and the Light Footed Clapper Rail by their respective Recovery Teams. (2)
dl
(See also: Endangered Species: California Policy.)

References: 1. U.S. Fish and Wildlife Service, Endangered Species Technical Bulletins: August 1976, Vol. 1, No. 2; October 1977, Vol. II, No. 10; October 1978, Vol. III, No. 10; December 1978, Vol. III, No. 12. U.S Department of Interior, Washington, D.C. 2. Personal communication with M.C. Freel, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, May 25 and May 31, 1979. 3. Council on Environmental Quality. 1977. The Evolution of National Wildlife Law. CEQ, Washington, D,C.

* Appeal No. 118-77. Commission denied a permit to Everett and Joe Otto for 2-story, single-family home and removal of 4 trees on Lona Prieta Dr., Aptos-Rio del Mar, Santa Cruz County. At issue was the need to protect habitat of an endangered species.

Appeal No. 24-79 (Santa Barbara County Department of Transportation). The Commission granted a permit with conditions to the County of Santa Barbara Department of Transportation to replace approximately 2,000 ft. of roadway at West Main Street, Guadalupe Dunes, Santa Barbara County. At issue was the need to protect sensitive Least Tern habitat.

ENERGY DEVELOPMENT

The development of energy resources in the coastal zone often triggers significant environmental impacts. While energy development is largely controlled by state and Federal agencies, local coastal planners need to be aware of the issues. Therefore, the following definitions are provided:

Thermal Electric Generating Plants

These are power plants producing electricity by the combustion of fuels such as oil, natural gas, or coal.

New Hazardous Industrial Development

Hazardous industrial development refers to the development of facilities such as LNG terminals which involve a risk to human life, or to the development of facilities such as refineries and power plants which may cause significant air and water pollution and other environmental problems. The California Coastal Act (1) calls for the location of new hazardous industrial development away from existing developed areas when possible.

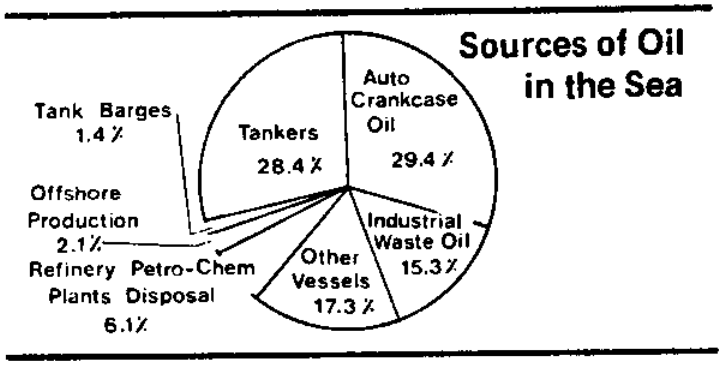
Oil and Gas Development

In the coastal zone, oil and gas development is usually achieved through offshore drilling operations accompanied by tanker facilities, pipelines, and onshore processing and storage complexes. The California Coastal Act encourages the development or expansion of oil and gas facilities within existing sites and favors consolidation of facilities for

use by several companies. Development of oil and gas resources may involve the following:

- Offshore Petroleum and Gas Development: This refers to oil and gas drilling and pumping operations on the Outer Continental Shelf. The Outer Continental Shelf (OCS) extends from three miles offshore to as far as its resources can be commercially exploited. OCS operations are supervised and regulated by the Department of Interior's Bureau of Land Management.

- Oil Spills: Oil enters the sea from several sources, including deballasting of tankers, bilge pumping, ship accidents, vessel and ship yard operation, sewage effluents, oil well accidents fallout from air pollution, and natural seepage. The Clean Water Act of 1977 prohibits any oil discharge in "harmful quantities", with violators subject to civil penalties of up to $5000 assessed by the Coast Guard. As a practical matter, "harmful quantities" occur with an oil discharge of approximately 50 gallons or more per square mile. The U.S. Coast Guard coordinates most oil spill clean-up operations.



The California Coast Act calls for tanker facilities that are designed to minimize the total volume of oil spilled by means of industry use of the best available oil spill and emission control technology and tanker berth arrangements that will minimize ramming and other accidents. The Act encourages the use of existing and new tanker facilities by several companies in order to reduce duplication and diminish the potential for a series of individual spills. For example, the Getty-Gaviota processing and storage complex near Santa Barbara is used by Getty, Chevron, ARCO and Douglas Oil. It has been the policy of the Coastal Commission to favor, whenever possible, the use of pipelines rather than tankers for oil transport because increases in tanker traffic result in an increased probability of navigation accidents and spills and higher emissions of air pollutants.

- Containment and Recovery Equipment: The most frequently used containment and recovery equipment consists of containment booms and oil skimming devices. Oil spill cleanup procedures have improved substantially since the Santa Barbara spill in 1969, but if a spill occurs in other than ideal conditions, (daylight, calm seas, proximity containment and recovery equipment), the success and cost effectiveness of the cleanup operations remain an open question.

- Fouled Ballast Water: After unloading an oil cargo, the tanker's empty oil compartments are filled with ballast water to maintain a stable weight. Upon departure from the dock, the tanks are cleaned and filled with clear ballast water, and the dirty or fouled ballast water containing oil residue may be pumped overboard, causing an oil discharge.

- Liquefield Natural Gas (LNG) Terminal: A regasification plant and terminal receives LNG from a specialized tanker, heats and vaporizes it and then sends the gas to a natural gas pipeline distribution system. The California Coastal Act specifies that only one LNG terminal shall be permitted in the coastal zone until engineering and operational practices can eliminate any significant risk to human life. Until these risks are overcome, the terminal shall be built only at a site remote from human population concentrations. The California Public Utilities Commission is primarily responsible for LNG terminal siting decisions.

- Producing Wells: These are wells that are currently producing oil and gas. Offshore oil production is regulated by the U.S. Department of the Interior's Bureau of Land Management and the State Land Commission's Division of Oil and Gas.

- Subsea Completions: This is an oil or gas production well in which much of the drilling structure is located near the ocean bottom, rather than on a platform. Subsea completions are sometimes used when drilling platforms or islands would substantially degrade coastal visual qualities.

- Oilfield Brine: Oilfield brine is the sea water associated with the crude oil in the oilfield. A waste material with negligible value, it is separated from the crude during the production drilling process. It usually contains oil residues and some heavy metals, making it incompatible with ordinary sea water. Environmentally safe disposal of the brine can be a problem, with the Coastal Act requiring reinjection into oil producing zones.

- Oil Producing Zones: Oil producing zones are the areas immediately surrounding the oil well and platform structure. The Coastal Act requires that oilfield brines be reinjected into the oil producing zones (primarily the well's outer casing) in order to prevent an oil discharge from ocean disposal.

- Petroleum Odors: Petroleum odors are primarily hydrocarbon vapors which are emitted during drilling and tanker operations.

- Refineries: Refineries convert crude oil into useful petroleum products such as gasoline, fuel oil, and residual oil which is used by electric utilities. A refinery uses a series of processing units that separate crude oil by fractionation (distillation), convert it to other more valuable hydrocarbon compounds, treat it to remove undesirable constitutents, and then blend basic stocks into desirable end products.

- Petrochemical Facilities: Petrochemicals are chemicals drived from refined petroleum products (e.g. naptha) and natural gas liquids. Petrochemical facilities are manufacturing complexes which produce industrial organic chemicals, which are then used to produce synthetic fibers and plastics, rubber, lubricants, and hundreds of other oil-based items. A petrochemical plant has a "refinery look" to it. There are tanks, pipes, stacks, and metal buildings.

- Once Through Cooling: Once through cooling refers to the need for cooling water to reduce the heat generated during manufacturing operations in refineries and petrochemical facilities. The California Coastal Act calls for the use of air cooling as much as possible to reduce water quality problems and the overall consumption of water.

- Treated Waste Waters From In-plant Processes: This refers to the recycling after treatment of water used in the plant or refinery's manufacturing processes. The treated recycled water would be used as a substitute for outside sources such as fresh or salt water.

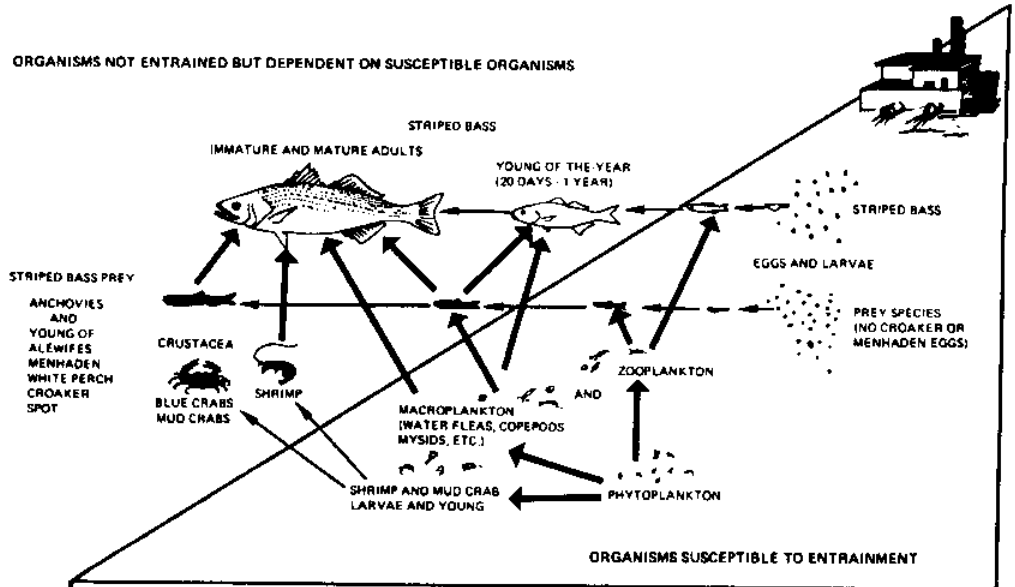
bh

(See also: Coastal Dependent Uses.)

References: 1. California Coastal Act of 1976. 2. California Coastal Commission Biennial Report 1977-78, California Coastal Commission, San Francisco. 3. John Clark, Charles Terrell and Jeffrey Zinn. March 1978. Environmental Planning for Offshore Oil and Gas, Vol. I: Recovery Technology, U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 4. California Office of Planning and Research. October 1977. "Offshore Oil and Gas Development: Southern California." Sacramento, California.

ENTRAINMENT

Entrainment is the capture and inclusion of organisms in the cooling water of power plants. The Coastal Act (Section 30231) states that the adverse effects of entrainment shall be minimized where feasible. Although the scientific and engineering expertise exist to design power plants with once-through cooling systems which minimize the total number of organisms killed by entrainment, this is often not done.



An illustration of organisms susceptible to entrainment and other organisms dependent on susceptible organisms. Reference: State of Maryland. Record of the Maryland Power Plant Siting Act. Volume I.

Paradoxically, the two major remedies for entrainment at existing plants are in conflict. On the one hand, thermal and chemical mortality of "entrained" aquatic life may be reduced by <u>increasing</u> the pumping rate of cooling water and thereby lowering the temperature and chemical content of the effluent water. On the other hand, the physical buffering and abrasion that aquatic organisms suffer during passage through the plumbing of water cooling systems may be reduced by <u>decreasing</u> the pumping rate. (1)

Clearly, there is no simple solution to the problem for plants already built and the objective cannot be the complete elimination of organism mortality -- many will die under the best of design and operational compromises. Instead, given that the observed death rates range from 1% to 100% for various organisms under varying arrangements, there is considerable scope for balancing and fine-tuning plant components and operational rates. (1)

The way out of the dilemma is straightforward for power plants of the future: a) Do not permit power plant construction in or adjacent to sensitive aquatic resource areas such as estuaries, wetlands, and small bays, b) Locate plants with open cycle cooling on deep ocean coasts away from vital areas where critical ecologic functions could be disrupted, and c) Require closed-cycle cooling systems (cooling towers and ponds) for those plants built in open water areas where there is concern for disruption of ecologic functions. (2)

Although the California Energy Commission exercises power plant siting authority within the coastal zone, the Coastal Act requires that the Coastal Commission participate in the proceedings and review that proposed site. Coastal Commission participation in the power plant siting process enables it to identify any potential adverse environmental effects on fish and wildlife and their habitats. As a result, the Commission is in a position to anticipate problems and suggest remedies for entrainment.
cw

References: 1. J.R. Shubel and Barton C. Marcy, Jr., Eds. 1979. Power Plant Entrainment: A Biological Assessment. Academic Press, Inc. (permission required) 2. J.R. Clark and W. Brownell. 1973. Electric Power Plants in the Coastal Zone: Environmental Issues. American Littoral Society, Special Publication No. 7, Highlands, New Jersey.

ENVIRONMENTAL IMPACT

An environmental impact is an environmental change that affects human needs. Human needs lead to specific activities or projects, some of which lead to environmental disturbances. Environmental disturbances, set off a chain of ecological effects. If these effects degrade the ecosystem, they then cause an environmental impact that detracts from the satisfaction of human needs. Impact terms are defined below: (1)

- Program: A broad initiative taken to fulfill some human need or needs (housing, agriculture, recreation).
- Project: One specific action taken under a program (housing subdivision, new farm, park).
- Construction activity: An individual process involved in the construction of a project facility (has mostly short-term effects).
- Operations activity: An individual process in the continuing operation of a project (has long-term effects).
- Environmental disturbance: A perturbation; an alteration that disrupts an ecosystem.
- Ecological effect: A reaction of an ecosystem to a disturbance.

- Environmental impact: An environmental change that affects the fulfillment of a human need (adverse impacts lead to social detriment and interference with the fulfillment of other needs).

- Human needs: The state of tension between what society has and what society wishes to have.

The Coastal Act (Section 30233(a)) states that diking, filling, or dredging of open coastal waters, wetlands, estuaries and lakes shall be permitted where feasible mitigation measures have been provided to minimize adverse environmental effects. Section 30263(a) states that new or expanded refineries or petrochemical facilities shall be permitted if, among other things, adverse environmental effects are mitigated to the maximum extent feasible. Therefore, actions which have the above-cited effects are required to provide mitigation measures which will minimize the substantial negative impacts associated with the projects. The State Environmental Impact Review (EIR) guidelines list the following broad categories of adverse impacts: (2)

- Substantially affect a rare or endangered species of animal or plant, or the habitat of the species.

- Interfere substantially with the movement of any resident or migratory fish or wildlife species.

- Substantially diminish habitat for fish, wildlife or plants.

- Substantially degrade water quality.

- Contaminate a public water supply.

- Substantially degrade or deplete ground water resources.

- Interfere substantially with ground water recharge.

- Cause substantial flooding, erosion or siltation.

- Violate any ambient air-quality standard, contribute substantially to an existing or projected air quality violation (or expose sensitive receptors to substantial pollutant concentrations).

- Conflict with the adopted environmental plans and goals of the community in which the action occurs.

- Have a substantial, demonstrable negative aesthetic effect.

Thinking in terms of environmental impact is the general theme of the Local Coastal Planning process. Planners are encouraged to regulate various coastal activities and projects so as to prevent, to the extent possible, a chain of events leading to an environmental impact. Where such activities have already created environmental disturbances in sensi-

tive coastal resource areas, planners are encouraged to try to restore the resource or to minimize the disturbance so as to prevent environmental impacts.
db
References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 2. "State EIR Guidelines," Title 14, California Administrative Code, Division 6, Secretary of Resources.

ENVIRONMENTALLY SENSITIVE HABITAT AREAS

Environmentally sensitive habitat areas (also called environmentally sensitive areas or ESA's) are areas that are of such importance to the functioning of the coastal ecosystem that they must be preserved intact by disallowing uses that would alter them significantly.

Section 30204 of the California Coastal Act provides that environmentally sensitive habitat areas be protected against significant disruption. ESA's have been defined as: (1)

> 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 (Coastal Act Section 30107.5), including: areas of special biological significance as identified by the State Water Resources Control Board; rare and endangered species habitat identified by the State Department of Fish and Game; all coastal wetlands and lagoons; all marine, wildlife, and education and research reserves; nearshore reefs; tidepools; sea caves; islets and offshore rocks; kelp beds; indigenous dune plant habitats; and wilderness and primitive areas.

(See: Areas of Special Biological Significance, Birds, Dunes, Estuaries, Freshwater Wetlands, Kelp Beds, Riparian Habitats, Tidepools, Wetlands of the Coast.)

Uses dependent on such resources have been defined to include nature education and research, hunting, fishing, and aquaculture. (1) "Significant disruption" results from any activity which interferes with the functional value of the habitat area (such as carrying capacity reduced by 10% or more) or causes a reduction in species diversity.

Environmentally sensitive habitat areas are significant to the survival and well-being of certain species, to the functioning of the coastal ecosystem, and to the maintenance of optimum carrying capacity. These areas are easily degraded by human activities and uses. The importance of individual ESA's to the coastal ecosystem and an assessment of their sensitivity to disturbances are described under the appropriate habitat area headings elsewhere in this handbook.

In order to ensure the protection of ESA's, they should be identified, evaluated, and mapped early in the local coastal planning program. (Monterey County has compiled an extensive bibliography of technical information sources on marine resources and implementation measures for protecting ESA's, which may be obtained by contacting the Coastal Planner for Monterey County.) Detailed technical studies may be needed to set the boundaries of these habitat areas. It is important that the definition of these resources not be too limited because in many cases, such as with wetlands, boundary considerations are crucial to the protection of the area. (2) Where an official definition exists (such as the federal definition of wetlands), this designation should be utilized.

All but the most limited non-altering types of uses can significantly disrupt ESA's. Activities that would severely disturb these areas include draining, dredging, or filling. Pollution and external sources of disruption can also degrade the values of these areas. The designation of broad buffer areas around ESA's will minimize disruption from accepted adjacent land uses. (3)

Specific provisions for protecting certain ESA's are contained within the Coastal Act (such as for wetlands protection, as provided for in Sections 30231, 30233, and 30240). The Coastal Commission staffs have also formulated unofficial criteria for development in certain ESA's. (See: Wetlands Policy: State, Riparian Habitats.) Local coastal planners can gain some insight into Commission interpretation of these provisions, before their local coastal plans are submitted to the Commission, by reviewing Commission decisions on permit applications in ESA's.* Although the Commission has sometimes provided for the preservation of certain pocket sensitive habitats, Commission decisions indicate that blanket prohibition of development in ESA's is not necessary. The Commission has generally permitted development in or adjacent to ESA's when mitigation measures were available to prevent adverse impacts in the habitat areas. Protection of ESA's is also often provided for by attaching conditions to permits. Frequently imposed permit conditions include buffer dedication, deed restrictions, revegetation, and other site and design requirements.

The Coastal Commission has approved developments not dependent on the resources in ESA's in cases where there was no feasible alternative that would preserve the site (such as public acquisition) and where removal of any specialized biotic communities could be avoided. For example, a single family residence was permitted in a native Monterey cypress forest (a non-endangered species, but very restricted in its coverage) in Monterey County, with the following conditions: (4)

- The residence was to be sited where no removal of cypress trees would be necessary.
- Disruption of existing ground cover was to be minimized.

- o A deed restriction was required to restrict future development or subdivision of the property and prohibit future removal of the cypress trees. Future use of the property for scientific or educational purposes was to be allowed.

A single family dwelling was also permitted in a coastal sand dune area in Monterey County on which an endangered plant species grew. The development was approved on the basis that it had mitigated against significant disruption of the dune habitat through restrictions on grading, ground cover removal and future uses. Also, the permit applicant was required to retain a licensed landscape contractor experienced in propagation of endangered local dune flora in order to reestablish native dune plant cover on the site. (4)

In addition to determining the measures needed to protect environmentally sensitive habitat areas, local governments also need to design regulatory programs for implementing these measures. Acquisition of environmentally sensitive habitat areas is often difficult to accomplish. Although these habitat areas do not bring high prices if stripped of development rights, local communities often find themselves paying development prices when acquiring them for preservation purposes. In certain cases, the price of the area that needs to be acquired in order to adequately protect the habitat (which may encompass an entire watershed) may be overwhelming.

However, there are other options for preserving environmentally sensitive habitat areas that local governments may pursue:

- o Zoning ordinances may be established which define a special district or an overlay district. These ordinances identify a list of permitted uses, prohibited acts, and special use procedures. The special use procedures usually employ a review board to evaluate individual permits based on specified environmental performance standards.

- o Conservation or open space easements limit the uses that landowners can provide on their lands. However, the valuation of their land is adjusted accordingly for the purposes of real estate taxation.

- o Cluster zoning or planned unit developments may be arranged allowing the developer to build at higher densities in less sensitive areas in conjunction with provisions for open space.

- o Density transfers allow landowners to shift their development rights from one part of their land to another. Density transfers are similar to development rights transfers except that they are not sold on an open market.

- o The California Coastal Conservancy provides funds to local governments for enhancement, restoration, and acquisition of sensitive coastal resources.

Various jurisdictions throughout California have designated ESA's. In many cases, these areas coincide with the "Special Land Habitat" designation of the Plan Maps contained in the 1975 California Coastal Plan. For example, Los Angeles County has identified "Sensitive Ecological Areas" (SEA's) in their new countywide Comprehensive Plan. These areas are to be provided special protection through regulatory means, such as:

> ...county and city land use regulations, density transfers, open space easements, deed restrictions, private land gifts and public acquisitions. The specific protective mechanism recommended for each SEA requires individual consideration based upon the nature of the specific resource value, land suitability, the degree of threat from urbanization, location within or adjacent to committed open space, and jurisdictional responsibility.

The Ballona Wetlands of Los Angeles County have been designated SEA No. 29. The Regional Commission staffs should be contacted for information regarding specific ESA designations and protective mechanisms.
dl
(See also: Buffer Areas.)

References: 1. California Coastal Commission. 1977. Local Coastal Program Manual. California Coastal Commission, San Francisco. 2. Charles Thurow, William Toner and Duncan Erley. 1977. Performance Controls for Sensitive Lands. Planning Advisory Service Reports 307,308. American Society of Planning Officials, Chicago. 3. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 4. California Coastal Commission. March 1, 1979. "Vegetation Management Report." California Coastal Commission, San Francisco. 5. Los Angeles County. May 1979. "Proposed General Plan, Summary." Section: Sensitive Ecological Areas/ Coastal Zone.

* Application No. 338-76. Commission denied a permit for a single-family home adjacent to Hunters Lagoon, Mendocino County. At issue was the effect of such development on the sensitive wildlife habitat of this important coastal lagoon.

Appeal No. 332-77. Commission first denied then approved a permit to Brizard Co., and Arcata Little League and Babe Ruth League, Inc., for division of 5.75-acre parcel from larger parcel and construction of baseball park, City of Arcata, Humboldt County. At issue were the protection of sensitive wildlife habitats, concentration of development and prejudicing of the Local Coastal Program.

Appeal No. 367-77. Commission denied permit for division of a 90-acre parcel into 3 parcels of 30 acres between Cameron Rd. and south bank of Navarro River, Mendocino County. At issue were the need to concentrate development, protection of timberlands, protection of sensitive habitat and possible public recreation values.

Appeal No. 158-78. Commission granted a permit with conditions for two houses on four acres south of Malibu Lake, Malibu, Los Angeles County. The Commission also recognized two additional transferable development privileges. At issue was the need to protect sensitive habitat and limit buildout of the small-lot subdivisions in the Santa Monica Mountains.

EROSION

(See: Soil Erosion.)

ESTUARIES

An estuary is a confined coastal water body with an open connection to the sea and a measurable quantity of salt in its waters. A bay is a large estuary with a relatively high degree of flushing. A lagoon is a relatively shallow estuary with restricted exchange with the sea and no significant freshwater inflow. In California the term wetland is often used to mean a whole lagoon-type estuary, which causes considerable confusion because wetlands are normally defined to include only the transitional, intertidal parts of the estuary. Of course, the channels, creeks and small water bodies that are enclosed within the wetlands are included in the definition. The question then becomes how large does the open water component have to be to qualify as an estuary. A handy rule of thumb in determining whether a body of water is a wetland or an estuary is to separate them on the basis of 50 percent water at mean low tide. That is, a system with more than 50% open water (outside the marsh) is an estuary, one with less than 50% is a wetland.

Estuarine waters are the richest part of the coastal zone. The exceptional natural value of the estuary derives from a combination of physical properties (e.g. confinement, shallowness, water circulation, nutrient storage/recycling) that combine to form a uniquely valuable ecosystem. Estuarine waters are also the most vulnerable to disturbance from uncontrolled activities that pollute the waters and reduce the carrying capacity of coastal ecosystems. The most vulnerable are the smallest, most confined, least flushed estuaries.

The protection of estuaries is called for in Section 30231 of the California Coastal Act. * Estuaries and lagoons are included in the "sensitive coastal resource areas" found in Section 30116 of the Coastal Act. Section 30502 calls for the Coastal Commission to "designate sensitive coastal resource areas" within the coastal zone. The Local Coastal Program Manual issued by the California Coastal Commission lists actions to be taken by local governments for the protection of wetlands and estuaries: a) designation of compatible uses in wetlands, estuaries and adjacent areas and b) provision of setbacks from wetlands and estuaries.

Both direct measures, such as buffer areas, and indirect methods, such as reducing disturbance to vegetation or installing on-site drainage for runoff disposal, may be used to minimize pollution and sedimentation of estuarine waters. Pollution from septic tanks and other sources must be tightly controlled. **

The following is a management framework for the protection of estuarine waters -- if these five elements are addressed appropriately, estuarine ecosystems should be well protected (see also: Ecological Resources Management):

- o Manage coastal watersheds for least alteration of natural patterns of stormwater runoff.

- o Preserve ecologically vital areas, such as dunes, wetlands, and edge-zones.

- o Preserve physically vital areas, such as dunes, beaches, erodible banks and bluffs.

- o Protect the configuation of coastal water basins against adverse alterations.

- o Protect coastal waters from pollution.

cwb

References: 1. California Coastal Commission. March 1, 1979. "Vegetation Management Report." California Coastal Commission, San Francisco. 2. California Coastal Commission. 1977. Local Coastal Program Manual. California Coastal Commission, Sacramento. 3. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 4. Charles Thurow, et al. 1977. Performance Controls for Sensitive Lands: A Practical Guide for Local Administration. Planning Advisory Service Reports 307, 308. American Society of Planning Officials, Chicago.

* Appeal No. 32-77. Commission denied a permit for 2-story multipurpose industrial building on site south of San Dieguito Lagoon, City of Del Mar, San Diego County. One item at issue was adverse impacts on the lagoon.

Appeal No. 507-77. Commission denied a permit for 1- and 2-story commercial building on Jimmy Durante Blvd. between the AT&SF railroad and Jimmy Durante Blvd., Del Mar, San Diego County. At issue were flood hazard, lagoon enhancement and traffic.

** Appeal No. 276-76. Commission granted permit with conditions relating to septic tank systems, drainage and other matters for single-family home, Malibu, Los Angeles County.

ESTUARINE SANCTUARIES

Estuarine sanctuaries are natural estuarine areas that may be acquired, developed, and managed by coastal states for educational and research uses, under the Coastal Zone Management Act of 1972. (1) Federal grants are provided to coastal states on a 50-50 matching basis for such purposes. According to the "biogeographic" classification system devised by the Office of Coastal Zone Management for selection of estuarine sanctuaries, California is able to nominate only one sanctuary. Elkhorn

Slough in Monterey County has already been selected as California's candidate estuarine sanctuary. (2) Additional sanctuaries could be considered in the future once all eleven federal regions have established sanctuary programs. dl

(See also: Marine Sanctuaries.)

References: 1. Memorandum from Joseph E. Bodovitz, Executive Director, California Coastal Commission to Interested parties on "Preliminary Staff Report on the Nomination of a Federal Estuarine Sanctuary in California." November 14, 1977. 2. "Draft Environmental Impact Statement, Elkhorn Slough Estuarine Sanctuary." National Oceanic and Atmospheric Administration, Office of Coastal Zone Management; and California Department of Fish and Game.

F

FILLING

(See: Dredge and Fill.)

FLOOD HAZARD

Flood hazard describes the condition that occurs when life and property may be subjected to damage from flooding. This occurs when development takes place in floodplains (areas that are subjected to periodic flooding, from either river overflow or storm surges from the sea).
jc
(See also: Floodplains.)

References: 1. Conrad D. Blue. 1967. Flood Information for Flood-Plain Planning. United States Geological Survey Circular 539, Washington, D.C.

FLOODPLAINS

Floodplains refer to areas that are subjected to periodic flooding. Floodlands are the part of the floodplain above the water, wetlands, and beaches.

The Coastal Act deals with floodplains in Section 30236 which states that "channelization, dams, or other substantial alterations of rivers and streams shall be limited to flood control projects where no other method for protecting existing structures in the floodplain is feasible and where such protection is necessary for public safety or to protect existing development." Section 30253 states that "new development shall minimize risks to life and property in areas of high geologic, flood and fire hazards. The flood issue has been raised many times in permit considerations under the Coastal Act. *

In addition to the Coastal Act, various programs have been developed on both the state and Federal levels that strive to ensure adequate consideration of floodplains in the planning process. At the state level, the Cobey-Alquist Floodplain Management Act requires the establishment of floodplain regulations as a condition of state contribution toward the cost of lands, easements and rights of way for local flood control projects. (1) Under the Federal Flood Disaster Protection Act of 1973 (PL 93-234), the flood insurance program of the Department of Housing and Urban Development (HUD) has developed programs to encourage local governments to restrict uses in identified flood hazard areas (see: National Flood Insurance Program).

Because of the ever-present hazards of flooding, coastal floodplain regulations generally require that structures be elevated (or otherwise protected) to a defined regulatory flood protection elevation (usually the 100-year flood level). There is no coastal hazard area comparable to

the "riverine floodway" which must be maintained entirely free of obstruction to pass flood flows from upstream to downstream areas. However, some coastal communities impose severe development restrictions upon coastal dunes since they act to blunt the force of wind and waves and thus minimize property damage behind the dune line. (2)

Regulations pertaining to both riverine and coastal flood problems are needed, including, in certain instances, riverine floodway and flood fringe districts and high hazard zones. The principal floodplain regulatory tools at the local level include zoning, subdivision controls, building codes, encroachment regulation, and special codes (e.g., sanitary codes). The principal state level regulations include permits, water obstruction laws, floodway encroachment regulation, zoning subdivision regulations and state building codes. The constraints necessary for sound management may influence the siting, density, design and construction of residential, commercial, and industrial facilities.

California courts have generally upheld restrictive regulations for coastal floodplains. For example, in McCarthy vs. City of Manhattan Beach (3) a court upheld a beach recreation zone prohibiting apartments in a coastal storm damage area, despite a showing that little or no economic use was possible for the zoned land. (4) However, there have been problems in carrying out such regulations.

The extent and precise definition of a floodplain depends on the purposes of the floodplain designation. Different local, state, and Federal agencies identify a floodplain with regard to a specific management or regulatory program. For general coastal zone management purposes, the upper edge of the coastal floodplain is the 100-year mark: that point on land which represents the farthest inland extension of floodwaters expected to occur once in 100 years. The 100-year flood is also referred to as the 100-year frequency flood; the one percent chance flood (i.e., has one chance in 100 of being equalled or exceeded in any given year); or is said to have a 100-year recurrence interval.(5) It is often useful to locate boundaries of other "statistical" floodplains. The 10-year and 25-year marks aid in designating buffer areas and in excluding or controlling certain uses.

The lower boundary of the official floodplain is often ambiguous and undefined, ending with wetlands or extending into the waters. For clarity and administrative simplicity, it is useful to sharply define a lower boundary which separates the floodplain from the wetlands and to use the term floodland for the designated zone. This lower boundary is the annual flood mark (Extreme High Water for coast, Ordinary High Water for inland) which is also the upper boundary of wetlands and beaches. This boundary is determined by vegetation indicators for wetlands and by berms and wrack line (wave debris) positions on beaches. has been mentioned the upper boundary is variable depending upon the administrative purpose of the floodland designation. The floodlands then incorporate all lands above the annual highmark up to the upper (administrative) limit (100-year, etc.).

Coastal floodland terrain is essentially terrestrial and is ecologically analogous to coastal watersheds. In the lowest areas, the floodplains may contain unique plant communities that require special management, such as in riparian zones. Other natural factors that require special attention are the high water table and soils. Coastal floodlands, particularly the lower, wetter parts, may also be exceptionally valuable in their roles as edge zones or ecotones (transition zones between two different ecological communities). The narrow zone that lies between wetlands and uplands (6) is especially valuable habitat.

Many communities located at the mouths of rivers are subject to both riverine and coastal flooding. When the marginal floodlands directly adjacent to water bodies are graded, cleared, filled and built upon, the result is a reduction in retention capacities that increases potential flood elevations. (See: Watersheds.)

The key point is that floodland management is required for both protection of life and property and conservation of coastal and riparian ecosystems. Floodlands provide: exceptional habitat (and buffer), purification of overland waterflow, edge stabilization, and flood water storage.
jc
(See also: National Flood Insurance Program.)

References: 1. United States Water Resources Council. 1972. Regulation of Flood Hazard Areas to Reduce Flood Losses. Vol. I. U.S. Government Printing Office, Washington, D.C. 2. California Coastal Commission. 1977. Local Coastal Program Manual. California Coastal Commission, Sacramento, California. 3. United States Water Resources Council. 1972. Flood Hazard Evaluation Guidelines. U.S. Government Printing Office, Washington, D.C. 4. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 5. California Coastal Act of 1976. California Public Resources Code, Division 20, Sections 30000 et seq. Also cited as Chapters 1330, 1331, and 1440 of the California Statutes of 1976. 6. California Coastal Zone Conservation Commissions. 1975. California Coastal Plan. Sacramento, California.

* Appeal No. 85-77. Commission denied a permit to Erskine-Johns Co. for industrial building and storage of flammable materials at Pacific Sorrento Industrial Park, City of San Diego. At issue were the flood and geologic hazards, stream channelization, and protection of Los Penasquitos Lagoon and riparian area.

Appeal No. 433-78. The Commission denied a permit to The Wyer Co. for 68 condominium units, west side of Carmel Valley Road, between Del Mar Scenic Parkway and Del Mar City limits, San Diego, San Diego County. At issue were flooding problems along with wetlands protection, traffic and public access, and reservation for commercial recreation.

FLUID EXTRACTION AND SUBSIDENCE

Fluid extraction, as used in connection with the Coastal Act, refers to the removal of onshore and offshore oil and natural gas from the earth. The Coastal Act (Section 30262) states that oil and gas development shall be permitted if, with respect to new facilities, all oilfield brines are reinjected into oil-producing zones (a few exceptions are cited). The Act further states that, where appropriate, monitoring programs to record land surface and near shore ocean floor movements shall be initiated in locations of new large-scale fluid extraction on land or near shore. The Coastal Act's objectives regarding fluid extraction are more oriented toward the prevention of subsidence than the protection of ecological resources.

Subsidence can cause extensive structural damage; oil wells fifty years old and older are a particular worry. For example, subsidence due to withdrawal of oil from the Wilmington field in Long Beach, California, has caused close to $100 million in damages. From 1928 to 1968, one area sank, more or less symmetrically, with a subsidence of 29 feet at the center. Damage to wells, pipelines, transportation facilities, harbor installations and other industrial facilities resulted. (1)

In many oil fields, the wells produce a mixture of oil and salt water (brine). In California, for instance, roughly 2.5 barrels (42-gallon capacity) of salt water are produced for every barrel of oil. Once the oil and brine are separated, the latter is essentially waste-water requiring disposal. Because of its high salinity, brine must be disposed of safely, away from ground water sources used for drinking, irrigation, etc. Consequently, the waste-water is often pumped (re-injected) into abandoned wells. Re-injection serves several purposes: waste-water disposal, repressurization of the oil reservoir, and the prevention of subsidence. (1)

There are several subsidence monitoring programs underway in the coastal zone. The individual operators, the Division of Oil and Gas, the U.S. Geological Survey, and the State Lands Commission all conduct monitoring programs of present fluid extraction facilities. Onshore indications of subsidence include cracked walls, pavements and foundations and sticking windows and doors. When these indicators occur consistently, and it can be shown that subsidence due to fluid extraction is the cause, the State of California's offshore oil and gas leasing program stipulates that the State Lands Commission can cease operation at any facility (within its jurisdiction) responsible for the subsidence. (2)

Information concerning the natural resource base is required in sufficient detail to allow planners to assess the effects of oil extraction operations, storage yards, etc. (3) A geologist reviewing a potential oil extraction site must consider, first, the quality of the consolidated sediments above the site. (1) Secondly, a three-dimensional geologic and hydrodynamic analysis is required to locate a formation with

sufficient porosity and permeability to receive the waste fluids and to predict where the fluids will go when they enter the disposal reservoir. (1) Finally, a monitoring program to evaluate the impacts of these operations is required both to check the predictions of the environmental impact assessment and to remedy situations where adverse impacts have occured.
cw
(See also: Energy Development.)

References: 1. Peter Flawn. 1970. Environmental Geology: Conservation Land-Use Planning and Resource Management. Harper & Row, 1970. 2. Bob Paul, State Lands Commission, personal communication. 3. J.R. Clark. 1977. Coastal Ecosystem Management, John Wiley & Sons, New York.

FLUSHING RATE

Flushing rate refers to the time needed for the water in a water body to be replaced by new water. A natural rate of flushing is mandatory in wetlands and marinas to prevent water stagnation and to ensure a natural and productive water circulation pattern. (see Water Circulation.)
jc

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

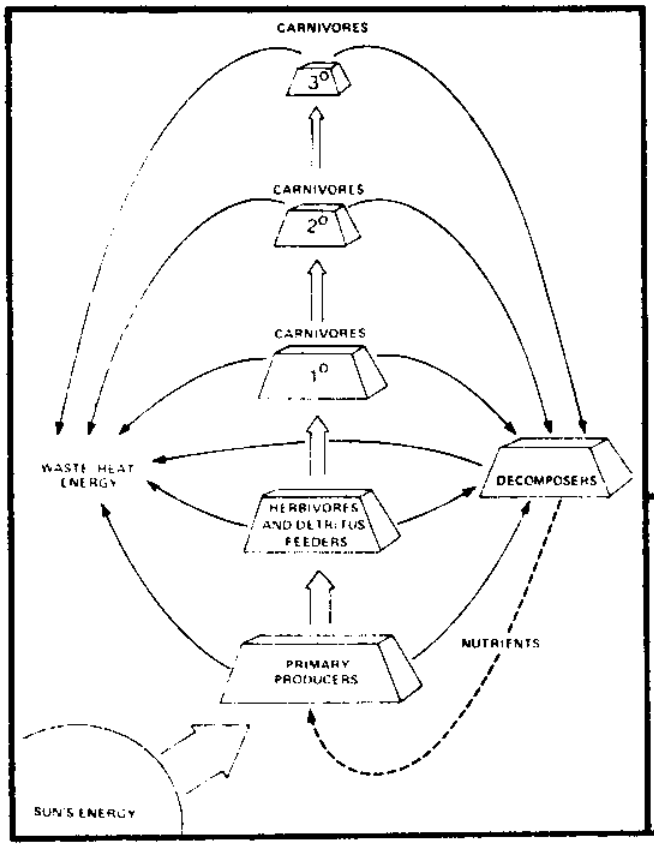
FOOD CHAIN

The term food chain refers to the step-by-step transfer of energy from sunlight, which is captured by plants and converted to food, to plants (primary productivity) to increasingly higher forms of animals (secondary productivity).
Section 30230 of the Coastal Act calls for the sustenance of the biological productivity of coastal waters. Biological productivity, which is a function of both primary and secondary productivity and is thus directly related to the food chain concept (or energy pyramid concept).

The transfer of food energy up the food chain involves several components: (1)

- Producers (green plants).
- Consumers (plant-eating animals, also called herbivores).
- Predators (animals that prey on the consumers, carnivores).
- Superpredators (animals that prey on smaller predators, top carnivores).
- Decomposers (microbes, e.g., bacteria, fungi, etc., that mineralize organic matter back to basic materials).

Each of these steps is called a trophic level.



A simplified energy pyramid showing the flow of energy through a food chain.
Reference: Thomas Carefoot. 1977. Pacific Seashores. Univ. of Washington Press. Seattle.

An energy pyramid points out an important phenomenon of food chains: energy transfer along the food chain is inefficient. The amount of biomass necessary to support the next higher trophic level increases by a power of 10. Consequently, most terrestrial food chains have only three or four links. In the clover-grasshopper-frog-snake-hawk food chain, which operates in wet meadows, the hawk uses only 0.0001 percent of the incident solar energy. Some marine food chains leading from algae to tuna might be so long that 100,000 pounds of algae would be required to produce a single pound of tuna. These food chain relationships have important implications for activities that interfere with the links of the food chain, especially with the producers. For example, disturbances to wetland plants, that in turn supply detritus (decayed organic matter -- the basis of the coastal ecosystem's food chain) will be harmful to coastal ecosystems.

cwb

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 2. Oliver Owen. 1975. Natural Resource Conservation: An Ecological Approach. Macmillan Publishing Co., Inc. New York.

FRAGILE COASTAL RESOURCES

Fragile coastal resources are those natural resources which are easily disrupted or destroyed by human interference -- particularly if such interference affects the areas which support them. Fragile coastal resources include, but are not limited to, specific "natural resource areas." (See: Natural Resource Areas.)

The Coastal Act (Section 30212) states that public access from the nearest public roadway to the shoreline and along the coast shall be provided in new development projects except where it is inconsistent with public safety or the protection of fragile coastal resources. Coastal resources specifically sensitive to human interference and overuse include wetlands, estuaries, dunes, primitive areas, and tidepools.

The entire Coastal Act is specifically intended to protect coastal resources. However, because of its varying objectives, some policies conflict (e.g. agricultural preservation, and protection of wetlands or "environmentally sensitive habitat areas)". When such conflicts occur, Section 30007.5 states that the conflict shall be resolved in a manner which on balance is the more protective of significant coastal resources.

The planning framework for coastal management of fragile resources requires a system of classification and evaluation that embraces both large areas of environmental sensitivity -- areas of concern -- as well as the smaller areas of concentrated ecological value--the vital areas.

Areas of Concern

The Federal Coastal Zone Management Act uses the term "areas of particular concern" to embrace areas requiring special management. The guidelines for the Federal Coastal Zone Program list the following representative factors as those to be taken into account when designating "areas of particular concern" as required by the Act:

- Areas of unique, scarce, fragile or vulnerable natural habitat, physical feature, historical significance, cultural value, and scenic importance.
- Areas of high natural productivity or essential habitat for living resources, including fish, wildlife, and the various trophic levels in the food web critical to their well-being.
- Areas of substantial recreational value and/or opportunity.
- Areas where developments and facilities are dependent on the utilization of, or access to, coastal waters.
- Areas of unique geologic or topographic significance to industrial or commercial development.
- Areas of urban concentration where shoreline utilization and water uses are highly competitive.
- Areas of significant hazard if developed, because of storms, slides, floods, erosion, settlement, etc. (1)

Vital Areas

The vital areas of concern will most often be fixed ecosystem features of a tangible physical character, such as coral reefs, submerged oyster beds, or cordgrass marshes, that remain essentially constant in location. These fixed vital areas can be readily located, surveyed and mapped by professional biologists, geographers, etc. However, there are other vital areas that are transient features of the water mass. Transient vital areas are most often water masses of special ecological value that shift position with wind, tide, or river inflow. The services of a professional ecologist will normally be required to provide boundaries for sufficient accuracy to serve regulatory needs. (1)

Three types of vital areas can be delineated; a) vital habitat areas which chiefly provide general living space for particular species -- e.g. coral reefs, kelp and shellfish beds, lower wetlands; b) vital productivity areas which chiefly supply nutrients to the system -- e.g. tideflats, high marsh; and, c) vital structural areas which physically protect the ecosystem through their structure -- e.g. sand dunes, coral reefs, wetlands. (1)

There are several development control strategies for protecting fragile coastal resources within these areas: zoning, performance standards, and various other techniques.
cw
(See also: Environmentally Sensitive Habitat Areas, Natural Resource Areas.)

Reference: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

FRESHWATER WETLANDS

Freshwater wetlands are scarce and precious in the California coastal zone. They are officially defined to include all vegetated areas with saturated soils that are permanently flooded or flooded with fresh water long enough each year to support communities (two or more species) of water dependent plants (see: Wetlands Policy: Federal). They include marshes, swamps, strands, bogs, vernal ponds, and all similar natural elements. They are not to be confused with the riparian zones which lie above them. They often lie adjacent to saltwater wetlands, sometimes grading almost imperceptibly into the tidal zone as the plants shift gradually from freshwater hydrophytes to saltwater halophytes. Such freshwater wetlands are an extremely important part of the coastal ecosystem.

Since most planners may not have such detailed scientific baseline data, they can make an initial "eyeball" determination of the probable level of wetland carrying capacity from visual evidence using the general categories found below:

- Hydrology: The hydrology of a wetland is a function of tidal flow and freshwater input. Tidal currents not only deliver nutrients and oxygen to the biota, but also remove wastes or assimilate them into the ecosystem. Salinity differences between incoming freshwater and ocean water create a turbulence which mixes the nutrients, diffuses them and makes them more valuable.

High capacity:	The tide and freshwater sources flow freely.
Low capacity:	Dikes, berms, and flood control channels interfere with wetland water circulation.
Strategy:	Do not permit activities which obstruct wetland water circulation.

- Topography: The intertidal slope is the key feature to wetland structure. The more gradual the slope, the greater the area of exposure/submergence.

High capacity:	Gradual slopes allow for greater vegetative diversity.
Low capacity:	Abrupt slopes, often from dredging and filling, result in lower vegetative diversity.
Strategy:	Do not permit activities which modify wetland topography.

- Vegetation Types/Habitat Diversity: Interaction of tidal range, elevation, topography and salinity determine plant species and vertical zonation. The greater the vegetative diversity, the greater the habitat diversity and the greater the biotic diversity of the wetland.

High capacity:	Maintenance of the natural diversity of the wetland allows for maximum species diversity.
Low capacity:	Actions which reduce vegetative and habitat diversity, such as dredging and filling, create conditions which reduce species diversity.
Strategy:	Do not allow activities which reduce vegetative and habitat diversity.

cwb
(See also: Wetlands of the Coast, Buffer Areas, Riparian Habitats.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 2. Conservation Foundation. In press. Coastal Environmental Management. Federal Insurance Administration, Washington, D.C. 3. James Schuler, California Department of Fish and Game, Long Beach, California. Personal communication, June 28, 1979.

FUNCTIONAL CAPACITY OF WETLANDS

The functional capacity of a wetland is its capability to reach a high level of carrying capacity in terms of the number and types of species it is able to support and its capability to provide for water conditioning, nutrient export, and hydrologic functions (see: Carrying Capacity). The following discussion incorporates the concepts of the 1975 California Coastal Plan (1) in Policy 15a and recent unofficial material from the State Commission (2) and is expanded in definition to cover hydrologic and nutrient export functions. The term "functional capacity of wetland" appears in the Coastal Act in Section 30233(c):

> In addition to the other provisions of this section, diking, filling, or dredging in existing estuaries and wetlands shall maintain or enhance the functional capacity of the wetland or estuary. (Emphasis added.)

The carrying capacity of a wetland can be markedly reduced by human disturbances which tend to simplify the ecosystem by creating conditions unfavorable to certain plants and animals. Excess nutrients and siltation can give an advantage to one plant species over another, resulting in an imbalance.

In looking for ways to determine the "functional capacity" of a wetland, what is really being sought is a measure of the wetland's functional health. Function is the process; capacity is the product. Optimum functioning, and thus highest and best carrying capacity of the wetland system as a whole, would occur at the "natural" state of the wetland as determined by climate, soil, hydrology, and topography in the absence of human disturbance. This state of perfection rarely occurs in the coast today and would also be hard to obtain through restoration in most cases. Thus, it may be necessary to settle for a little less in restoration or protective management -- a good target would be 90% of the original, optimum carrying capacity. It is important, in determining either the present or the potential carrying capacity of a wetland, to use a combination of indicators of the condition of such a complex system. Species composition, species diversity, and species abundance, along with primary and secondary productivity, are all indicators of carrying capacity.

Freshwater wetlands function to: (1)

- Absorb, convert, store basic nutrients and supply them to the local food chain and to coastal ecosystems downstream.
- Purify the water of contaminants.
- Act as aquifer recharge, flood storage and retention areas.
- Provide exceptional habitat and food for wildlife.
- Bind the soil to provide stability.
- Provide scenic and other amenity values.

The Coastal Act (Section 30231) calls for the protection of wetlands, which includes freshwater marshes. Section 30233 specifies requirements for wetlands development.

In order to protect the beneficial functions of wetlands, local coastal planners should discourage the following activities in freshwater wetlands: (2)

- Filling, excavation, or other surface alteration.
- Land clearing, grading, or removal of natural vegetation.
- Establishment of solid-fill roads, causeways, or other structures that would obstruct water flow.
- Drainage or impoundment programs which interfere with the natural water regime.

Non-Altering types of uses such as passive recreation can be compatible with the function of the wetland, if properly designed and managed.

The conservation of freshwater wetlands follows the same principles as for saltwater wetlands (see: Wetlands of the Coast).

The U.S. Fish and Wildlife Service Wetlands Classification is being prepared for the entire California coast, using a very broad definition of wetlands, including seasonal wetlands. A set of maps consisting of U.S.G.S. maps and overlays identifying all wetlands in Los Angeles County and San Luis Obispo County is available from the California Department of Fish and Game, Long Beach. (3) Maps for other coastal counties will be available in the future. Contact the nearest U.S. Fish and Wildlife Service Office or California Department of Fish and Game for further information.

Malibu Lagoon provides an example of a wetland whose functions and carrying capacity were reduced by disturbances leading to habitat modification. (3) Within the past few decades, there has been a marked reduction in the species and numbers of birds occurring at Malibu Lagoon. Aerial photographs taken of the lagoon during the 1930's show the existence of a large Salicornia marsh and several outlying freshwater ponds. It is virtually certain that the now endangered Light-Footed Clapper Rail and Belding's Savannah Sparrow occurred as breeding residents of the marsh. These species are now gone. In addition to the loss of certain breeding species, there has been a reduction in the actual numbers of birds, especially migratory and wintering shorebirds, found in the area. Most of the losses in avian biomass can be attributed to an increase in human disturbance and an overall reduction of suitable habitat for waterbirds.

The principal deleterious habitat modification at Malibu Lagoon has involved the virtual destruction of the original Salicornia marsh and associated wetlands. This occurred chiefly as the result of fill being placed onto the marsh by the state highway department, thus raising the marsh area to a level where it was no longer influenced by tidal conditions. Consequently, marsh functions were completely disrupted and the carrying capacity or "functional capacity" fell to a low level.
cwb
(See also: Carrying Capacity, Biologically Productive Wetland, Wetlans Restoration.)

References: 1. California Coastal Zone Conservation Commissions. 1975. California Coastal Plan. Sacramento, California. 2. California Coastal Commission. April 11, 1979. Wetland Policy Planning and Permit Guidelines. (Draft) California Coastal Commission, San Francisco. 3. Lloyd F. Kiff. 1979. "Preliminary Report on the Birds of Malibu Lagoon, L.A. County." Western Foundation of Invertebrate Zoology, Los Angeles. 4. John Clark and Judith Clark, (Eds.). 1979. Scientists' Report, National Symposium on Wetlands. National Wetlands Technical Council, Washington, D.C. 5. Charles Thurow, et al. 1977. Performance Controls for Sensitive Lands: A Practical Guide for Local Administration. American Society of Planning Officials, Chicago, Illinois.

G

GROINS

A groin is a storage dam for sand -- a structure built at right angles to the beach to interrupt longshore sand movement (littoral drift) and to trap sand in order to stabilize or widen a beach. Groins are usually a few feet high and a hundred feet long and are constructed of timber, steel, concrete, or rock. Groins are covered under Section 30235 of the California Coastal Act as a construction that "alters natural shoreline processes."

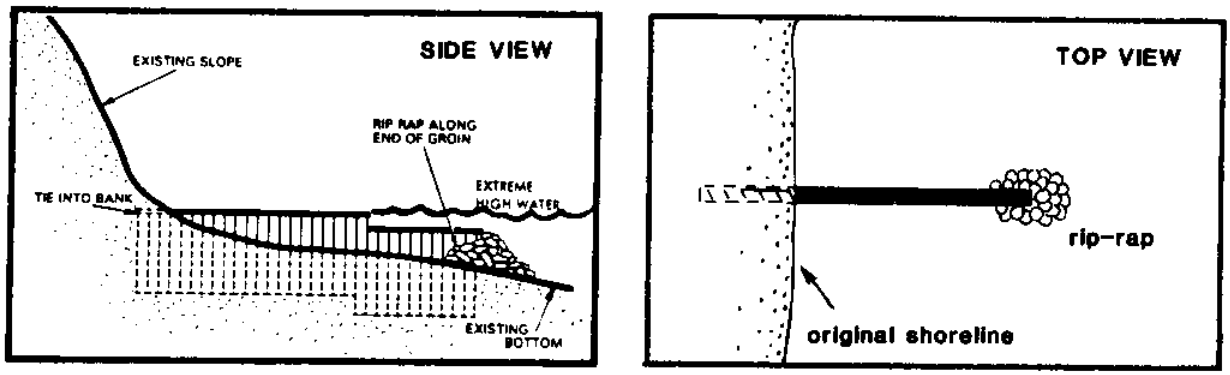
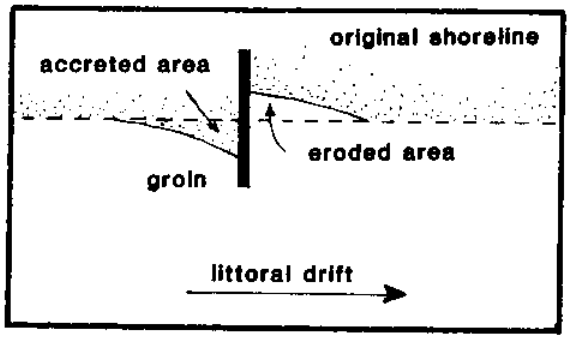
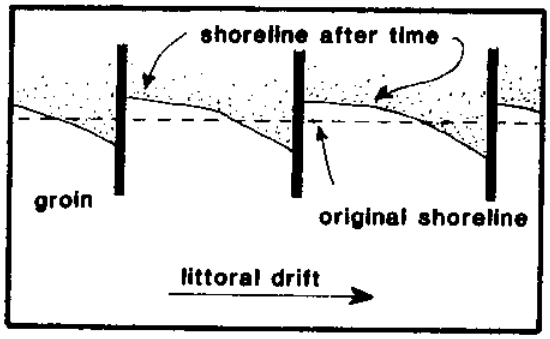


Illustration of a Typical Groin

The trapping of sand by a groin is done at the expense of the adjacent downdrift shore. Groins are effective only when a) there is a significant volume of littoral drift, b) the drift carries coarse materials (greater than 0.2 mm), and c) the beach downstream from the groin can be sacrificed (the sand gained at one place is denied to another). A row of parallel groins tends to force the littoral drift of sand offshore because much of the sand moves from tip to tip of the groins instead of moving along close to the beach, thereby causing sand starvation of the whole length of the beach. (1)



Effect of a Single Groin on Sand



Effect of a Series of Groins on Sand

Reference: U.S. Army Corps of Engineers.

Groin fields cost about $100 to $350 per foot ($330 to $1150 per meter) of shore protected, depending on such factors as exposure to wave action, range of tide, and accessibility of building materials. Beach fill required to prevent adverse effects on downdrift shores adds to the cost. (1)
jw
(See also: Jetties, Breakwaters, Beachfront Protection.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

GROUNDWATER

Groundwater is water that is confined to subsurface rock and soil layers. The top of this subsurface water is the water table.

Section 30231 of the Coastal Act states "...biological productivity and...human health shall be maintained and where feasible, restored through, among other means,...preventing depletion of groundwater supplies..." Aquifers have been protected by denials and modifications of permits for coastal development.

In addition to the Coastal Act, the Federal Water Pollution Control Act and the Safe Drinking Water Act of 1974 deal with groundwater. Section 208 of the Federal Water Pollution Control Act authorizes the EPA to designate agencies to prepare regional water quality management programs. The protection of groundwater from both man-made pollutants and seawater intrusion are prime considerations of these programs.

Groundwater resources are under growing pressure from coastal communities as shoreland aquifers are increasingly pumped for industrial and domestic water use. In certain areas of California, particularly southern California, the groundwater aquifer has been overpumped and contaminated by saltwater intrusion. Some coastal areas are close to running out of uncontaminated groundwater because of saltwater intrusion. With as little as two percent contamination by salt water, a drinking water supply is classified as unfit according to federal potable water standards. The solution to protecting groundwater is a sound and comprehensive management plan. A total management program provides for groundwater, surface water, and reused water to be utilized in a coordinated plan.
jc
(See also: Saltwater Intrusion, Water Table.)

* Appeal No. 375-77. Commission denied a permit to the Miramar Hotel to drill a back-up well, Montecito, Santa Barbara County. At issue was the integrity of the coastal aquifer and the impact on coastal resources served by this aquifer.

Appeal No. 124-77. Commission denied permit to Mututal Savings and Loan Association to drill 2 wells in Santa Barbara County. At issue was the need for further assessment of and planning for water resources in the area.

H-J

HARBORS

(See: Marinas.)

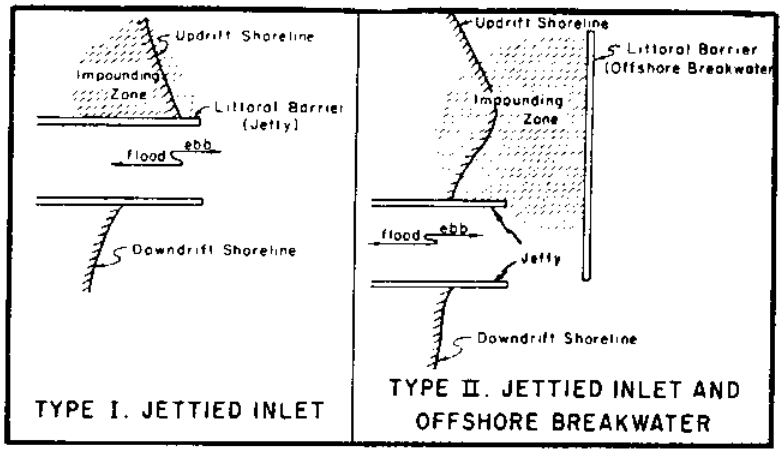
HEADLANDS

(See: Natural Landforms.)

JETTIES

Jetties are structures developed to modify or control sand movement. They are built perpendicular to the shore and are constructed of steel, concrete, or rock, depending on foundation conditions, wave climate, and economic considerations. Jetties are covered under Section 30235 of the California Coastal Act as a structure that "alters natural shoreline processes."

Jetties are generally employed at inlets in connection with navigation improvements. When sand, transported along the coast by waves and currents, arrives at an inlet, it flows inward on the flood tide to form an inner bar, and outward on the ebb tide to form an outer bar. Both formations can impede navigation and must be controlled to maintain an adequate navigation channel. Jetties aid navigation by reducing the movement of sand into the channel, by stabilizing the location of the channel, and by shielding vessels from waves. To be of maximum aid in maintaining the channel, the jetty must be high enough to completely obstruct the sand stream. The jetty is similar to the "groin" in that it dams the sand stream (see: Groins). However, jetties are often larger than groins since they typically extend from the shoreline seaward to a depth equivalent to the channel depth desired for navigation purposes.



Reference: U.S. Army Corps of Engineers.

Jetties can result in erosion on the downdrift side of the structure. As sand is impounded on the updrift side of the jetty, the supply of sand to the shore downdrift from the inlet is reduced. To eliminate undesirable erosion, some projects provide for dredging the sand impounded by the updrift jetty and pumping it through a pipeline to the eroding beach. This ensures an uninterrupted flow of sand along the shore to nourish the downdrift beach and also prevents shoaling of the entrance channel.

At Port Hueneme in Ventura County, a harbor has been scooped out in the flat coastal land and the entrance fenced with two parallel jetties, the westernmost of which stopped the sand. Periodically, as expected, it has been necessary to dredge the sand from this trap and to deposit it on the downdrift beaches.

jw

(See also: Breakwaters, Beachfront Protection, Groins.)

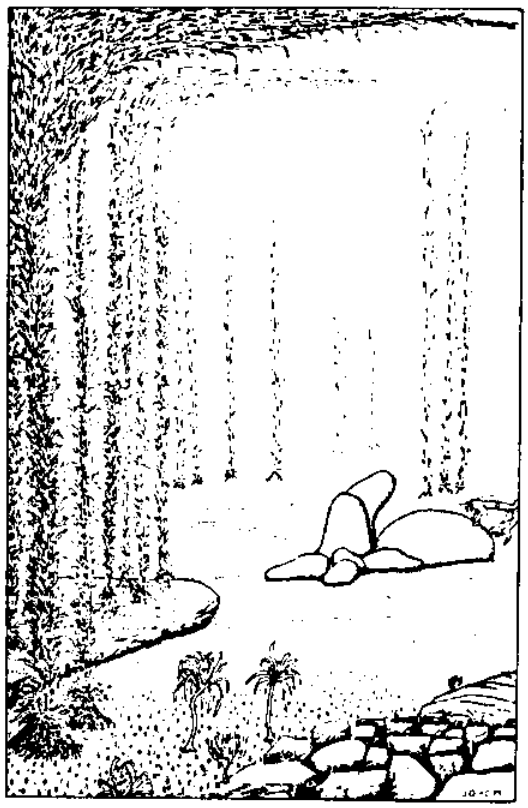
References: 1. Dennis W. Berg. "Beachfront Protection." In, John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

K

KELP BEDS

The term "kelp beds" designates aggregations of certain large brown seaweeds, which achieve such great densities that they form "mats" on the sea surface. The term "kelp forest" describes the ecological structure of the kelp community since it is comparable to a terrestrial forest. The dominant plant in kelp forests along the California coast is Macrocystic pyrifera, commonly known as the giant kelp. Kelp forests are found along the Central and southern California coast primarily over rocky habitat, at depths typically less than 100 feet and where water quality permits the algae to survive. Forests may also be found over the sandy substrate in the Santa Barbara area. Kelp usually develops best where there is protection from heavy wave surge. (1) In southern California, the gently sloping continental shelf, protective offshore islands, and upwelling processes provide optimal conditions for the growth of kelp. (2)

The protection of kelp beds is provided for under Section 30204 of the California Coastal Act which calls for the protection of environmentally sensitive habitat areas. The Local Coastal Program Manual (July 22, 1977) defines environmentally sensitive habitat areas to include kelp beds. Sections 30230 and 30231 of the Coastal Act also provide protection for kelp beds by requiring the maintenance of marine resources and the biological productivity of coastal waters.



Kelp bed.
Reference: Dept. of Fish and Game. 1968. Utilization of Kelpbed Resources in Southern California. Sacremento, Calif.

Kelp forests are among the most productive biological systems in the world, offering refuge for fish, crustaceans, and molluses, and acting as a nursery area for larval and juvenile fish. Over 120 species of fish can be found in the southern California kelp forests, many of which support well-developed sport and commercial fishing industries (2). Kelp also provides food and habitat for numerous prey species, which are in turn, an important food source for consumers such as crustaceans and fish.

An important industry has been formed based on kelp harvesting off the California coast. One of the major products of this industry is algin, which is widely used in the preparation of food, drugs, cosmetics, building materials, and fertilizers. The harvesting of kelp is regulated by the State Department of Fish and Game. Harvesters are not allowed to cut kelp at a depth of more than four feet below the surface of the water. (3) Whether overharvesting of kelp is occurring is a controversial topic. Although current annual kelp harvest in California is 160,000 wet tons, Macrocystis is known to be capable of extremely rapid growth under favorable conditions.

Human-related activities that disturb kelp plants include pollution from ocean discharges of both domestic and industrial wastes, sedimentation from dredging and construction, and thermal waste discharges. Sewage discharges result in the accumulation of fine organic sediments which can change the amount of light available for photosynthesis and smother juvenile bottom dwelling plants and animals. Some organic materials in sewage also favor the nourishment of sea urchins. Los Angeles County discharges sewage at White Point which changes the quantity and quality of light available for photosynthesis and causes sedimentation which smothers gametophytestages of kelp plants. Local over-harvesting of species, such as lobster and sheepshead, which feed upon urchins, and abalone,which competes with urchins for food and habitat, further upsets the balance and encourages growth of excessive numbers of sea urchins which overgraze the kelp. Thermal discharges (from electrical power plants, for example) that result in ocean temperatures above 20°C can also threaten kelp in local areas. Together, these disturbances have acted to reduce Southern California's kelp forest from approximately 100 square miles to 1/2 to 3/4 the original size. The Palos Verdes kelp forest completely disappeared by 1967 because of the combined influences of several factors. However, successful kelp restoration programs have restored much of the damaged kelp forest community at Palos Verdes and in San Diego.

The protection and management of offshore "environmentally sensitive habitat areas" are much more complex than for shorelands and more remote for local planning. Kelp harvests, sewage, and power plants are largely controlled by the state. The California Water Resources Control Board has designated "areas of special biological significance", which are offshore areas in which the discharge of elevated temperature waters as well as point and non-point sources of pollution are prohibited. Many of the designated areas are within or adjacent to kelp beds.

The Coastal Commission's regulatory program has provided protection to marine flora, particularly kelp beds. In general, the Commission has approved development with the potential to affect marine resources if mitigation measures were available to minimize habitat degradation. The Commission has also afforded more protection to unique marine resource areas which were particularly diverse and productive. The Commission has identified kelp beds as one of thirteen categories of marine resources to be protected from the intakes and discharges of thermal power plants. In view of this designation, the Commission has identified sites where a) no power facility should be sited and b) where a facility could be sited but the construction of ancillary facilities, such as cooling water conduits, would require Coastal Commission approval. The second designation would protect kelp beds by locating conduits so that intakes and discharges are seaward of kelp beds. (4) Accordingly, local planners will need to anticipate the Commission's policies and respond to them in local plans.

dl

(See also: Biological Productivity, Environmentally Sensitive Habitat Areas.)

References: 1. Rimmon C. Fay. 1973. Southern California's Deteriorating Marine Environment. Center for California Public Affairs, Claremont, California. 2. California Department of Fish and Game. 1968. "Utilization of Kelp-bed Resources in Southern California." Fish Bulletin 139, Department of Fish and Game, Sacramento, California. 3. California Administrative Code, Title 14, Section 165, et seq. 4. California Coastal Commission. 1979. "Vegetation Management Report," California Coastal Commission, San Francisco. 5. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

L

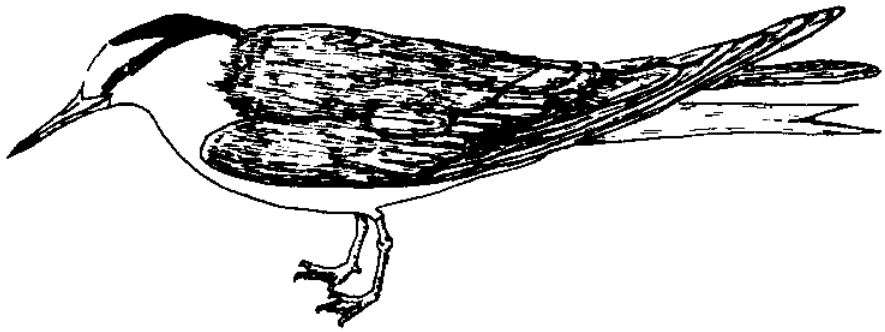
LAGOONS

(See: Estuaries.)

LEAST TERN

Smallest of the North American terns, the California Least Tern (Sterna albifrons browni) is recognized by its white body, gray wings, black outer flight feathers, black-capped head and black-tipped yellow bill.

This migratory bird occurs from April to September along the Pacific coast from San Francisco Bay to southern Baja California; breeding colonies are distributed irregularly along the coast. The wintering area is not known but probably includes the coastal areas of Mexico or northern South America.



The Least Tern is listed as an endangered species by both the state and federal governments because of continuing destruction of the few remaining feeding and nesting habitats and because of human disturbance and animal predation. It has been addressed in actions of the Coastal Commissions.* Nesting colonies require flat areas lacking in vegetation, loose substrate, freedom from disturbance and proximity to an estuary with a good supply of small fish. About 29 colonies nested in California in 1977. Statewide breeding population was approximately 624 pairs in 1973, 582 pairs in 1974, 600 pairs in 1975, 664 pairs in 1976, and 775 pairs in 1977. About 60 percent of nesting occurs in San Diego County.

A California Least Tern Recovery Team (largely voluntary) has been established by the U.S. Fish and Wildlife Service. The team's plan is to direct protection and management efforts needed to restore and maintain the breeding population of the California Least Tern at a secure level. Although the California Least Tern Plan has not yet been formally adopted, it currently recommends that the California breeding population be increased to at least 1200 pairs to enhance population stability. These pairs should be distributed among colonies in at least 20 coastal wetlands throughout their breeding range.

- The availability and security of breeding habitat appears to be the key limiting factor. There is a need to protect and manage existing nesting areas and to restore or create additional sites.

- The availability of feeding areas is also very important as Least Tern colonies need dependable supplies of small fish. In some wetland areas, restoration is essential to improve the tern's food supply.

- Successful nesting appears to be independent of colony size, and some large colonies have shown considerable fluctuations in breeding success from year to year. Consequently, it is important to protect even the smallest nesting site.

(See also: Birds, Endangered Species: Federal Act; Endangered Species: California Policy.)

References: 1. California Department of Fish and Game. 1978. At the Crossroads 1978: A Report on California's Endangered and Rare Fish and Wildlife. Office of Procurement, Publication Section, North Highlands, California. 2. S.R. Wilbur. 1974. The Literature of the California Least Tern. U.S. Fish and Wildlife Special Science Report 175. Washington, D.C. 3. Ralph Hoffman. 1927. Birds of the Pacific States. Houghton Mifflin Company, New York. 4. B.W. Massey. 1974. "Breeding Biology of the California Least Tern." Proc. Limn. Soc. N.Y., 72: 1-24. 5. B.W. Massey and J.L. Atwood. 1978. "Plumages of the Least Tern." Bird Banding, 49: 360-371.

* Appeal No. 24-79 (Santa Barbara County Department of Transportation.) The Commission granted a permit with conditions to the County of Santa Barbara Department of Transportation to replace approximately 2,000 ft. of roadway at West Main Street, Guadalupe Dunes, Santa Barbara County. At issue was the need to protect sensitive Least Tern habitat.

LIGHT-FOOTED CLAPPER RAIL

(See: Clapper Rail, Light-Footed.)

LIQUEFACTION

Liquefaction is the transformation of soil from a solid to a fluid state, usually caused by a sudden shock or strain (such as an earthquake) which results in a sudden loss of strength in a "saturated cohesionless soil". This subject is addressed by the Coastal Act in Section 30253 which states a policy to minimize risks to life and property in areas of geologic hazard.

Ground shaking can cause sandy, loose sediment with high water content to loose internal shear strength momentarily, in effect causing them to "liquify". Areas of young alluvial deposits and a high groundwater table, such as old floodplains, deltas, estuaries, marshes and lakes, are especially susceptible to this type of ground failure. Structures on such soils can sink, tilt and even topple. (1) If the liquified layer is near the surface, the effects are much like that of quicksand on any structure located on it. If the layer is in the subsurface, it may provide a sliding surface for the material above it. Liquefaction typically occurs in areas where the groundwater is less than 30 feet from the surface and where the soils are composed of poorly consolidated fine to medium sand. In addition to the necessary soil conditions, the ground acceleration and duration of the earthquake must also be of sufficient level to bring on liquefaction. (2)

Liquefaction is an important factor in coastal zone planning in California. Due to pressures from urban growth, large areas of wetlands have been filled in to provide "new land" for development. Filled land, especially in areas that are adjacent to a water body, are highly susceptible to liquefaction. Moreover, wetlands are not only poor building sites, they are critical ecological resources that should be protected. (See: Wetlands of the Coast.)

References: 1. Staff, South Coast Regional Commission. 1974. The Geology Element for the South Coast Region. South Coast Regional Commission, Long Beach, California. 2. Envicom Corporation. 1975. Seismic Safety Element. City of Santa Monica General Plan, Santa Monica, California.

LITTORAL DRIFT

(See: Beach Processes.)

M

MARINAS

Marinas are waterfront facilities constructed primarily for recreational boating. Section 30224 of the Coastal Act calls for the provision of new boating facilities; Section 30234 calls for the protection of boating facilities; and Section 30255 gives coastal-dependent developments priority over other developments. Therefore, boating facilities (marinas) should be addressed by local governments.

The influence that a marina may have on surrounding development is illustrated, in the extreme, by Marina Del Rey in Los Angeles, California, now one of the largest marinas in the world. Originally, the marina area was 1513 acres of saltmarsh, farm and residential land. At first, the marina was designed to serve recreational boating interests. The land use scheme was changed however, to incorporate a high-density residential development because of the county's need to pay back revenue bonds that boat-slip rental fees alone could not cover. By 1971 this "recreational boating facility" contained 4500 apartment units, plus supporting restaurants and shopping areas, with a value exceeding $105 million. (These figures have more than doubled since then.) As a result, greatly expanded public utilities were required. (1)

Potential damage to the coastal ecosystem from marina development may include contamination of surface water and groundwater from inefficient sewage treatment procedures, interruption of groundwater recharge, and saltwater intrusion, water pollution from surface runoff and boats, erosion and sedimentation resulting from failure to properly revegetate or drain cleared surfaces, and loss of vital habitat areas. (1)

Marinas in tidal creeks or estuarine water bodies with restricted natural flushing rates are particularly troublesome environmentally, because the water body is unable to rid itself of marina-source contaminants, including heavy metals. In addition, breakwaters, jetties, and other structures required to protect the marina from wave action may interfere with tides and currents, further reducing the flushing rate and thus creating stagnant sinks for pollutants. All such alterations have the potential for serious degradation of the quality of coastal waters. (1)

Locating marinas as much as possible in places that provide natural protection, strong currents and a rapid "turnover time," greatly minimizes environmental impact by preventing stagnant water and the accumulation of pollutants. Generally, turnover time can be defined as the number of days or hours required for tidal action or river flow to replace the water of a bay or tributary with new water from another source. Only if good tidal flushing is maintained will water quality remain high. This requirement would mean that many small tributaries and confined stagnant

water areas should be off-limits for marina sites. (1)

When considering tributaries of larger bays for marina locations, the flushing time of the tributary, as well as that of the main bay to which it is attached, must be used in the calculation of flushing time. In the absence of specific information to the contrary, a maximum turnover time of 2 to 4 days should be safe as a design criterion. Normally, a period of more than 10 days should be considered an unacceptable turnover time. (1)

When a marina site requires excavation for utilities, building foundations, fill, or canals, the potential for erosion and sedimentation in nearby waters is increased. Increased stream flow resulting from rainwater runoff from cleared and surfaced areas causes erosion, sedimentation, downstream flooding, and the introduction of high nutrient loads into estuarine waters. (1)

Implementation of Section 30240 of the Coastal Act requires that local governments address the problems associated with development in "environmentally sensitive habitat areas." Since most marina projects involve wetlands, flats, grassbeds and so forth great care must be taken in the location, design, and construction of these facilities.*

Ancillary marina facilities, such as parking areas, boat storage areas, housing, and repair yards, can safely be situated above wetlands and, where possible, out of the coastal floodplains so as to displace the effects of surfacing, clearing, and the runoff pollution potential to less sensitive areas. An internalized drainage system to collect and store water runoff and other liquid waste may be needed.

Construction on the waterfront, such as docks, piers, and walkways, if done on elevated pilings rather than on landfill, will allow the water to freely pass under the structure, thereby preventing stagnation. Marina space should be allocated so that larger boats with deeper draft are kept in deeper water while smaller boats can be located closer to the shoreline in shallow water. This is because larger boats create higher waves that erode the shoreline and destroy coastal habitat.
jw
(See also: Dredge and Fill.)

Reference: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

* Application No. 362-76. Commission denied a permit to the Port San Luis Harbor District for 7-acre landfill, 410 boat slips, 500 moorings, shore facilities, floating fuel dock and pumpout station, Port San Luis Harbor, Avila Beach, San Luis Obispo County.

* Appeal No. 355-78. Commission granted a permit with conditions to Glorietta Bay Marina to expand marina for approximately 50 additional boat slips, Glorietta Bay, Coronado, San Diego County.

MARINE SANCTUARIES

Marine sanctuaries are ocean water areas that are set aside under the Marine Protection, Research, and Sanctuaries Act of 1972, for the purpose of preserving or restoring their conservation, recreation, ecological, or aesthetic values. Marine sanctuaries may be designated by the Office of Coastal Zone Management (OCZM) with the approval of the Secretary of Commerce and the governor of the state in which the sanctuary is nominated. Marine sanctuaries can exist as far seaward as the outer edge of the continental shelf and in coastal waters where the tide ebbs and flows. Thus, the designation offers protection in both federal and state waters.

Marine sanctuaries are designated to preserve distinctive marine resources in areas where potential conflicts between conservation and human use require comprehensive, geographically-oriented planning and protective mechanisms not otherwise available. After a marine sanctuary has been established, regulations are issued to control all activities within the area to the extent that they threaten the distinctive characteristics that originally prompted designation. (1)

The marine sanctuaries program enables local governments to become closely involved with the designation and management of such areas. Any individual, organization, or governmental body can nominate an area for consideration as a marine sanctuary.

The Act permits the responsibility for sanctuary management to be delegated or shared with non-federal organizations, such as local or state governments or universities, with the provision of full federal funding (when funding is necessary). In the two marine sanctuaries which now exist (the Monitor marine sanctuary in North Carolina and the Key Largo Reef in Florida), the states have central management roles. However, local governments are participating in the planning and management of these marine sanctuaries. (2)

In California, three possible sites are being considered for designation as marine sanctuaries: Point Reyes-Farallones, Monterey Bay, and the Santa Barbara Channel Islands offshore areas. The Coastal Commission has advised the OCZM to prepare Draft Environmental Impact Statements for each area, which will provide the necessary information to allow the Coastal Commission and the public to assess the potential benefits of the proposals. Hearings and opportunities for consultation will be provided to allow federal, state, and local agencies and interested organizations and individuals to comment on these proposals. For a schedule of the review procedures, the State Coastal Commission should be contacted.
dl

(See also: Estuarine Sanctuaries.)

References: 1. Office of Coastal Zone Management. December 1978. "Issue Paper on Possible California Marine Sanctuary Sites: Monterey Bay, Point Reyes/Farallon Islands, the Northern Channel Islands, and Santa Barbara Island." National Oceanic and Atmospheric Administration, Washington, D.C. 2. Center for Natural Areas. April 11, 1977. "An Assessment of the Need for a National Marine Sanctuaries Program." Center for Natural Areas, Washington, D.C.

MARINE TERRACES

(See: Natural Landforms.)

MARSHES

(See: Salt Marshes.)

MITIGATION

Section 30233(a) of the Coastal Act states that "diking, filling, or dredging of open coastal waters, wetlands, estuaries, and lakes shall be permitted..." under specific circumstances and where feasible "mitigation measures have been provided to minimize adverse environmental effects..." (emphasis added). Section 30233(a)8(c) further states that "diking, filling, or dredging in existing estuaries and wetlands shall maintain or enhance the functional capacity of the wetland or estuary." Section 30236 of the Coastal Act states that "channelizations, dams or other substantial alterations of rivers and streams shall incorporate the best mitigation measures feasible."

Mitigation measures as used in the above policy statement could conceivably be those preservation or restoration measures which maintain or enhance the functional capacity of the wetland or estuary (coastal waters or lakes) to be altered. The functional capacity of a natural area is determined by its carrying capacity, i.e. the ultimate constraints imposed on the biota by existing environmental limits, such as the availability of food, space, or breeding sites, or by disease or predator cycles, temperature, sunlight, or salinity. The carrying capacity of a system can be markedly reduced by human-made disturbances that reduce available energy supplies or interfere with energy utilization. (1) Therefore, mitigation measures could include actions (or inactions) which preserve the carrying capacity of an area that has been degraded by previous alteration. (See: Wetlands Restoration, Rivers and Streams.)

The term "mitigation" is used in many different, and often conflicting or ambiguous ways. This is because it is an "umbrella" term which covers so broad a field as to be open to nearly unlimited interpretation. Yet one can narrow the subject down by the use of appropriate terminology such as the following:

- Enhancement is a form of mitigation that implies improvement of an ecosystem; for example, improving water circulation, plant growth, or a species habitat.

- Minimization (or reduction) of impact is a form of mitigation that implies unavoidable ecological damage from some development activity and seeks to reduce it to the minimum; for example, preventing the spread of silt in dredging, not bulldozing during breeding time to avoid disturbing an adjacent eagle nest, or reducing entrainment by a power plant.

- Compensation is a quid pro quo form of mitigation that implies the tradeoff of an unavoidable ecological loss for an ecological improvement; for example, the enhancement and dedication of a piece of upland game habitat as a tradeoff for some riparian habitat lost to a reservoir.

- Replacement is a quid pro quo form of mitigation whereby the lost function is replaced with an identical function.

- Indemnification is a quid pro quo form of mitigation that implies a monetary recompense for loss of ecological resources; for example, the payment of money to a public agency for damages to a wetland converted to housing sites.

Restoration is a secondary term. It might apply to a required enhancement-mitigation, to a desirable public project, or to a specific court-imposed penalty required for an illegal (non-permitted) or irregular project.

The preferred form of mitigation is on-site mitigation which permits historic natural systems to continue to function. That is to say, all damage caused by a project should be mitigated within the site area where the damage occurs. The preferred mode of mitigation is direct rather than substitute. That is, the same functions are to be directly restored, replaced, or compensated for if lost. Thus, if a wetland is to be preempted, all wetland functions are to be replaced, on site, by duplicate wetland -- (it would be nearly impossible to replace wetland with a combination of artificial subsitutes). However, an appropriate waste detention system might be a successful indirect replacement of drainage control for a loss of natural vegetation in an upland development area.

Usually, the developer and the public will best be served by the use of "performance standards" to formulate the mitigation requirements. In this approach, the exact properties and characteristics of the natural system that must remain after development are defined. Accordingly, the developer is allowed to proceed with the project if he can show proof that the natural system will still "perform" according to prescribed "standards." In this way, the developer is free to devise methods to accomplish the project without causing public harm. A performance standard might be the quantity of ducks a pond shall produce, the quality of water that passes from a parcel of land, or the amount of water current flowing through an estuary.

jt

Reference: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

MOSQUITO CONTROL

Saltmarshes above Mean High Water (MHW) may be potential mosquito breeding areas. Methods which have been used to control mosquitoes include partial draining of saltmarshes with grid-pattern ditching and channeling, application of petroleum and chlorinated hydrocarbons (pesticides), and the hydraulic filling of marshlands. However, all three of these methods have proven to be destructive to the marsh ecosystems where they have been applied. Indiscriminate ditching disrupts and damages marshes. application of pesticides has been harmful to the ecosystem and mosquitoes often exhibit increased resistence to pesticides, and the filling of marshes exterminates the habitat.

A current and well-tested method (in east coast states) which eliminates the problems of these methods is called "open marsh water management." The aim of this control technique is to provide channels to connect mosquito-breeding depressions to tidewater or to pools. The ditching of saltmarshes has often been done in a manner harmful to their resident biota. However, with open marsh water management, channels are dug only where needed to connect mosquito-breeding depressions to tidewater and temporary ponds, while permanent ponds and pools are saved. Since salt marsh mosquitoes cannot breed under conditions of daily tidal flooding, the connection of depressions and ponds through selective ditching, eliminates them. Open water marsh management effectively controls mosquito breeding without harming the vegetation, while increasing the populations of many important marsh organisms. It has the great advantage of maximizing the effectiveness of mosquito-eating minnows (Fundulus Cyprinodon, Gambusia, and so forth) and facilitating the transport of all life-forms and nutrients between marsh and estuary. The disadvantage of this control technique is a higher cost in the short run than pesticide use. However, the long-term benefits normally outweigh the initial cost factor.

The water management approach has been recommended for California by the Coastal Region of the California Mosquito and Vector Control Association (CMUCA). It gives the following list of recommendations for use by

planning agencies to prevent the production of mosquitoes in marsh restoration projects: (3)

- o Conduct a topographical engineering survey to delineate depressions that would trap and hold tidal waters. The survey would also dictate proper emplacement of permanent ditches and drainage structures.

- o Establish a recirculation drainage system by constructing sloughs, ditches and connecting ditches to all depressions that might trap or hold standing water. These would provide access for predator fish (see also Reference 4).

- o Disk or harrow all cracked ground caused by shrinkage and subsidence prior to the breaching of levees.

- o Construct inboard levees or upgrade existing inboard levees as necessary to withstand wind-driven high tides. (These inboard levees would become outboard levees once the outboard levee is breached.)

- o Plan and fund a long-term maintenance program on the marsh. The maintenance should include:

  a) Dredging and cleaning of sloughs, ditches and connecting ditches to provide adequate water circulation.

  b) Disking of cracked ground as needed.

  c) Maintenance of levees as needed.

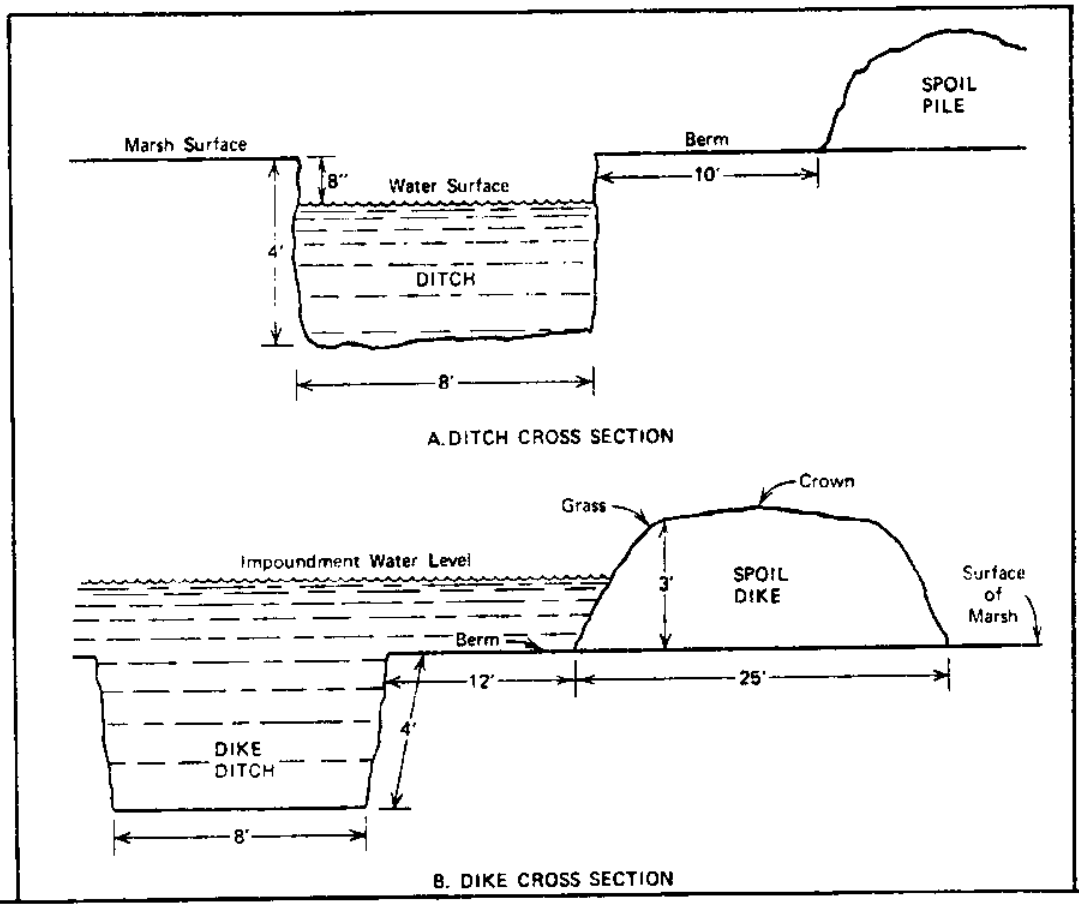
  d) Construction of small ditches as necessary to enhance water circulation.

  e) Maintenance and repair of water control structures.

- o Additional benefits would be realized by the emplacement of water control structures in the outboard levee as an alternative to breaching the levee. By controlling tidal waters in this manner, emergency control of mosquitoes could easily be applied and maintenance of the recirculation system would be more easily accomplished. Wetland management in general would also be significantly enhanced.

- o Secure appropriate permits before the outboard levee is breached. The outboard levee systems should be maintained until the project has been approved by all concerned agencies including the local mosquito or vector control agency. (Concerned agencies may include: U.S. Corps of Engineers, San Francisco Bay Conservation and Development Commission, San Francisco Regional Water Quality Control Board, California State Lands Commission, California Department of Health, California Department of Fish and Game, California Reclamation Board, California State Coastal Commission, local planning agencies and others.)

db



Schematic ditch, dike, and impoundment cross sections for mosquito control. Reference: D. Boseman. 1974. Impoundment. In R.C. Axtell (Ed.) Training Manual for Mosquito and Biting Fly Control in Coastal Areas. Univ. of North Carolina Sea Grant Program. Raleigh, NC.

Note: Further details can be obtained by contacting the local mosquito or vector control agency or by contacting the CMVCA (707-425-5768).

References: 1. Maurice Provost. "Mosquito Control," in Coastal Ecosystems Management. 1977. John Clark (ed.), Washington, D.C. 2. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, Inc., New York. 3. Information provided by Fred Roberts of the Alameda County Mosquito Abatement District, Oakland, California. 4. Fred Roberts. 1977. Salt Marsh Restoration in Alameda County and its Impact on Mosquito Control. Proceedings and papers of the Forty-fifth Annual Conference of the California Mosquito and Vector Control Association, Inc.

MUDFLATS

(See: Tideflats.)

N

NATIONAL FLOOD INSURANCE PROGRAM

This federal assistance program was authorized by the National Flood Insurance Act of 1968 and amended by the Disaster Protection Act of 1973. The National Flood Insurance Program (NFIP) encourages local governments to limit development and potential damage in flood plains, and to study flood hazards. The NFIP superceded the Federal Flood Insurance Act of 1956. It specifically prohibits new federal flood insurance coverage for an area unless the appropriate public agency has adopted land-use control measures, with enforcement provisions, which met federal land management and use criteria restricting or discouraging land development and occupancy in flood-prone areas. These Federal criteria are established by the Federal Emergency Management Agency (FEMA). They limit the development of land exposed to flood damage, guide proposed construction away from flood-prone areas, assist in reducing flood-caused damage, and improve the long-range management and use of flood prone areas.
areas.

Unfortunately, this voluntary program has enforced effective flood-plain management only in communities responsive to land-use controls. The program provides minimum management standards for areas subject to flooding and erosion, but lacks effective implementation measures. Conversely, the Federal coastal zone management policy supports state planning, but establishes no standards. If these two pieces of legislation were better coordinated, more effective mitigation of coastal hazard and resource losses would occur. The NFIP is a weak planning process, lacking technical substance; it highlights the need for a unified national policy for the management of coastal hazards.

The NFIP and Coastal Zone Management Act (CZMA) have a common interest in coastal areas, but different responsibilities. The CZMA is oriented to the protection of natural resource areas, and the NFIP is oriented to the protection of life and property. Federal flood regulations call for setbacks, building elevation above designated heights, and other protective measures. Local compliance is voluntary, but applicants for Federal financial assistance to buy or develop flood-prone property must purchase flood insurance. Title VII of the Housing Act of 1977 lifted the restrictions on the provision of Federal assistance by federally regulated financial institutions in flood-prone areas not participating in the NFIP. Such communities are ineligible for disaster relief. Direct Federal assistance to non-participating communities is not allowed; communities recieving direct Federal financing of a project are required to buy flood insurance.

The NFIP was substantially strengthened by the Flood Disaster Protection Act of 1973. Its purpose was to provide flood insurance to property owners in coastal and riverine areas which are subject to floods, coastal storms, mudslides, or sudden erosion. The insurance is subsidized by the Federal government and available at low rates through private borkers under contract with the Flood Insurance Administration of HUD, or directly from the FIA. This insurance satisfies the requirements of the NFIP.

The Coastal Act (Section 30253) refers to new development in areas of geologic, flood and fire hazards in terms of minimizing risks to life and property in such areas. The land-use plan of a Local Coastal Program (LCP) must designate appropriate land-use categories for areas subject to flood, fire and geologic hazards. The actual designation of the areas subject to flooding is perhaps the most controversial aspect of the State and Federal programs, as it can be construed as limiting development to areas that ostensibly seem "safe". On the other hand, the mitigation criteria of floodplain regulations are often narrow in scope, offering inadequate protection of resource values.

Since approximately 16,000 communities participate in the Federal Insurance program, the problem of monitoring and enforcing the regulations with a relatively small staff is obvious. Agency personnel are hampered by the lack of the best available data, maps, and specific information. Until key issues regarding mapping of flood zones are resolved, and until all communities are required to participate, the enforcement and improvement of defined federal performance standards cannot be effective.
as
(See also: Floodplains, Flood Hazards.)

References: 1. R.H. Platt. 1978. "Coastal Hazards and National Policy." In Journal of the American Institute of Planning, April, 1978.

NATURAL LANDFORMS

Landforms are the natural features of the earth's surface, such as hills, valleys, beaches, etc. At the broadest level, the following nine types of landforms have been found to encompass most conditions along the coast:

- Beaches - that may be narrow to broad sand, shingle, cobble, or rock with a wide degree of vegetation ranging from none to thick grasses.

- Sand dunes - that vary greatly in height and in the degree of vegetation they support, such as Murray Dunes, Monterey Bay Dunes, and Salmon Creek Beach.

- Coastal bluffs - that are the angular, irregular coastal edges of marine terraces rising at least ten feet above sea level, such as Point St. George, Santa Cruz North Coast, and Goleta Point.

- Headlands - that usually fall steeply into the sea along a jagged angular, irregular shoreline, such as Big Sur, Cape Vizcaino, and the Golden Gate Headlands.

- Wetlands and Estuaries - that encompass bays, lagoons, inlets, and their surrounding wetlands, such as Bolinas Lagoon, San Dieguito, and Pescadero Lagoon.

- Islands - ranging from large rocks to the expensive Channel Islands, such as Indian Island, Farallon Islands, and Santa Catalina Island.

- Hillsides and canyons - that are usually steep and rugged and include rare vegetation, small-scale features, abundant wildlife, and outstanding visual features, such as Bixby Canyon, Los Trancos Canyon, and the San Clemente Hillsides.

- Upland terraces and plains - that are generally broad, flat coastal lands stretching inland from the sea to the coastal mountains, such as much of the Mendocino Coast, San Mateo coastline, and the Irvine Properties.

- Rivers and streams - that are the upland portion of estuaries, that are connected to the sea and that are often meandering, broad open areas shaped by paralleling hills, such as the Smith, Tijuana, and Russian Rivers. (1)

The Coastal Act (Section 30251) states that permitted development shall minimize the alteration of natural landforms.* Section 30253(2) states, more specifically, that the construct ion of protective devices that would substantially alter natural landforms along bluffs and cliffs shall be prohibited. Each coastal jursidiction's Local Coastal Poogram (LCP) will provide an inventory of the area's natural landforms and specify policies for their protection.
CW
(See also: Fragile Coastal Resources, Natural Resource Areas.)

References: 1. California Coastal Zone Conservation Commission. 1975. California Coastal Plan. State of California, Sacramento.

* Appeal No. 509-77. Commission denied a permit to Bel Mar Estates, to divide 531 acres into 174 residential lots near Tuna Canyon, Malibu, Los Angeles County. One issue was natural landforms protection.

NATURAL RESOURCE AREAS

Natural resource areas are areas on or near the coast (or enhanced by a coastal location) which support coastal resources of value for ecological, recreational, cultural, aesthetic, or economic purposes. Coastal natural resource areas include, but are not limited to, the following: (1)

Coastal waters (estuaries, bays, lagoons, sloughs, etc.)

Beaches and dunes

Islets and offshore rocks

Natural habitat areas

Open space areas

Primitive areas

Rivers and streams

Bluffs

Freshwater and saltwater wetlands

Kelp beds

Endangered species habitats

Highly scenic areas

Tidepools

Watersheds

The Coastal Act (Section 30210) states that maximum access to the coast shall be provided for all people consistent with public safety needs and the need to protect natural resource areas from overuse.

Natural resource areas are vulnerable to public overuse, poor development, and agricultural practices which substantially alter and perhaps destory their natural resource values. Some resource areas are more sensitive than others to human inteference. (See: Fragile Coastal Resources.)

The numerous protection policies of the Coastal Act are intended to protect these natural resources. In fact, Section 30007.5 of the Act states specifically that when conflicts occur between two or more policies of the Act, such conflicts shall be resolved in a manner which on balance is the most protective of significant coastal resources. (See: Agriculture for a case-study involving such a conflict.) One strategy for identifying "significant coastal resources" is a natural systems survey. (2)

Natural systems surveys (soil and water surveys and surveys of the biota of both the shoreland and the coastal basin subsystems, for example), are conducted and utilized to assist in establishing carrying capacity limits of natural systems and to reveal points of vulnerability of the ecosystem to adverse impacts of various kinds. This information can then be used to identify ecologically vital areas and to establish a general strategy for management. It will also suggest the particular land use control measures (such as designation of exempt vital areas) or performance standards (such as those requiring dredging limitations) needed to protect the ecosystem and to optimize its carrying capacity. (2)

CW

References: 1. California Coastal Zone Conservation Commissions. 1975. California Coastal Plan. State of California, Sacramento. 2. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

NUTRIENTS

The nutrient cycle (also called the mineral cycle or biogeochemical cycle) refers to the circulation of chemical elements such as nitrogen, carbon, and phophorous in specific pathways from the abiotic portions of the environment into the organic components of the flora and fauna and then back again into abiotic forms.

Wetland areas generally serve as the vehicle for the collection and storage of mineral nutrients washed down from shoreland watersheds. The nutrients may be partially used and recycled within the wetland system, but they are ultimately transported into coastal waters to provide basic nutrients for the food chain of coastal waters ecosystem (see: Food Chain).

Nutrient balance is a key in maintaining a healthy ecosystem. Disturbances which decrease the supply of natural nutrients to the wetland plants that in turn supply detritus are harmful to the coastal ecosystem. Conversely, an ecosystem can become unbalanced by an excessive supply of nutrients washed down from shoreland watersheds because of septic tank leaching or discharge of sewage effluent, industrial organic wastes, contaminated runoff water, and so forth. An excessive supply of nutrients leads to eutrophication, an unbalancing of the natural species mix of the ecosystem and to general degradation of water quality.

Since Local Coastal Programs are required to contain policies which support the biological productivity of coastal waters, planning actions taken to insure a proper nutrient balance in coastal waters are important.

Maintenance of nutrient sources can be accomplished through controls on watershed alteration which help to preserve or restore the natural quality, volume, and rate of flow of runoff. Excessive nutrient loads can be controlled through appropriate development controls for watersheds which help prevent harmful runoff and actions taken to prevent septic tank leaching and sewage discharges.

db

References: 1. The Conservation Foundation. In press. Coastal Environmental Management. Federal Insurance Administration, Washington, D.C.
2. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

O

OFFSHORE OIL DRILLING

(See: Energy Development.)

OPTIMUM POPULATIONS

Optimum populations are the levels of plant and animal populations which meet human criteria of the highest and best populations. "Optimum populations" are social, administrative, and political constructs. Ecologically, one would define optimum populations as those which occur under a set of natural physical and biological conditions which maintain species diversity (the number of species present and the relative proportions of those species) and best ensure the self-sustained continuance of the habitat. (1) Optimum populations, then, refer to the interplay of the species' potential rates of population increase and those forces which cause death or reduce reproduction rates within each species. The optimum level for each population is only theoretically quantifiable because both habitat and population variables are always changing.

The concept "optimum populations" is defined as follows in the California Coastal Act: "...to maintain optimum populations of marine organisms, the productivity and quality of coastal water, streams and wetlands shall be maintained" (Section 30231). (Emphasis added).

Policies and implementing measures of the Local Coastal Program (LCP) can incorporate the concept of optimum populations as a goal or policy provision by which to assess the effectiveness of various measures in protecting coastal habitats. The indicators of a condition of optimum population in a habitat area include: a) no irregular, rapid population growths or die-offs of any species; and b) sufficient food resources for the species.

In a degraded coastal habitat, where populations are small or unbalanced, the causes may be traceable to some human activity which has raised the mortality rate or reduced the reproductive rate of one or more species. Policies and implementing actions of the LCP can be designed to substantially alleviate these degraded conditions, once they are identified. However, professional evaluation by a biologist will probably be necessary in order to devise effective and appropriate development controls and other regulations. These controls could be stated as performance standards which protect the conditions necessary to attain an optimum population.

(See also: Biological Productivity, Carrying Capacity.)

References: 1. Eric Metz, unpublished report. 1979. "Development Guidelines," State Coastal Commission, San Francisco. 2. Raymond F. Dasmann. 1972. Environmental Conservation. John Wiley & Sons, Inc., New York.

P

PATENTED TIDELANDS

A patent is a deed from a sovereign body, such as a state, to convey public lands into private ownership. In California, tidelands are those lands lying between the mean low water (MLW) and mean high water (MHW) levels.

In 1850 the federal government gave California title to all tidal and submerged lands not conveyed to private ownership by Mexican land grants. Since that time, the Federal government has confirmed by patent the then-existing Mexican land grants, many of which included coastal lands. Laws passed by the State of California in the 1850's and 1860's authorized surveys and patents for tidelands. Thus, the State owns all tidelands except where sold or conveyed to private ownership. The State has retained a public trust easement for commerce, navigation and fisheries in all tidelands.

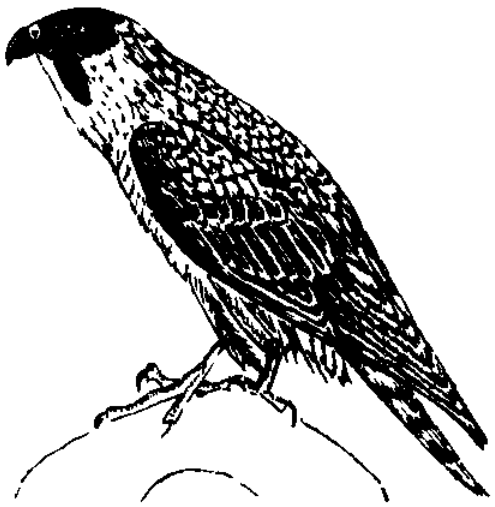
The legal boundary between State and private lands in situations where tidelands have been modified (e.g., filled) is the "ordinary" high water mark (generally considered MHW). Where this level has been affected by man-made alteration, the last-known natural mean high tide level is determined by the State.

Current litigation regarding patented tidelands in Los Angeles County illustrates the confusion regarding a private title which includes tidelands. In City of Los Angeles v. E. F. Carmen Riles, the Superior Court ruled that the waters of the Ballona Lagoon (considered to be under private ownership) were subject to a public trust easement for commerce, navigation and fisheries to the line of mean high tide. This case is under appeal. The precedent for this case was established by the California Supreme Court ruling in Marks v. Whitney (1971), which emphasized the existence of public trust rights regarding tidelands as well as the proper public uses to which tidelands may be committed.

The private owner of land burdened with a public trust easement may develop the land in a manner consistent with the public trust (see: Tidelands Jurisdiction for details).

Note: Questions regarding the status of patented tidelands can be directed to the State Lands Commission, which has jurisdiction and authority over tidelands, submerged lands, and other State lands.
as
(See also: Tidal Functions, Tidelands Jurisdiction.)

References: 1. Dan Gorfain. State Lands Commission. Personal communication. 2. Nancy Saggese, California Attorney General's Office. Personal communication. 3. Marks v. Whitney, 6 Cal 3d 251 98 Cal. Report 790, 491 P.2d 374 (1971).



PEREGRINE FALCON, AMERICAN

Commonly called the duck hawk, the American Peregrine Falcon (Falco peregrinus anatum) is a medium sized blue-gray hawk with long pointed wings. It is distinguished from other falcons by its black cap and black cheek patches. The prairie falcon is much browner and has a streaked breast.

The American peregrine, extinct as a breeding race east of the Rocky Mountains, breeds in California along the coast and in higher mountains inland. The bird has been declared endangered by the California Department of Fish and Game (DFG) and by the Secretary of Interior. Food chain contamination by persistent pesticides and other contaminants, illegal taking by falconers, human disturbance and occasional shooting are contributing to its decline. In the 1940's, the breeding bird population was 100 pairs. By 1970 this population had declined to 10 birds, of which 2 pairs produced 4 young. In 1975, encouragingly, 8 pairs were found, 6 of which fledged 14 young.

Management actions recommended by the California DFG include:

- Acquaint the public with the plight of the American peregrine falcon and the added protection needed to assure survival.

- Protect active nest sites through acquistion, easement, or memoranda of understanding with landowners.

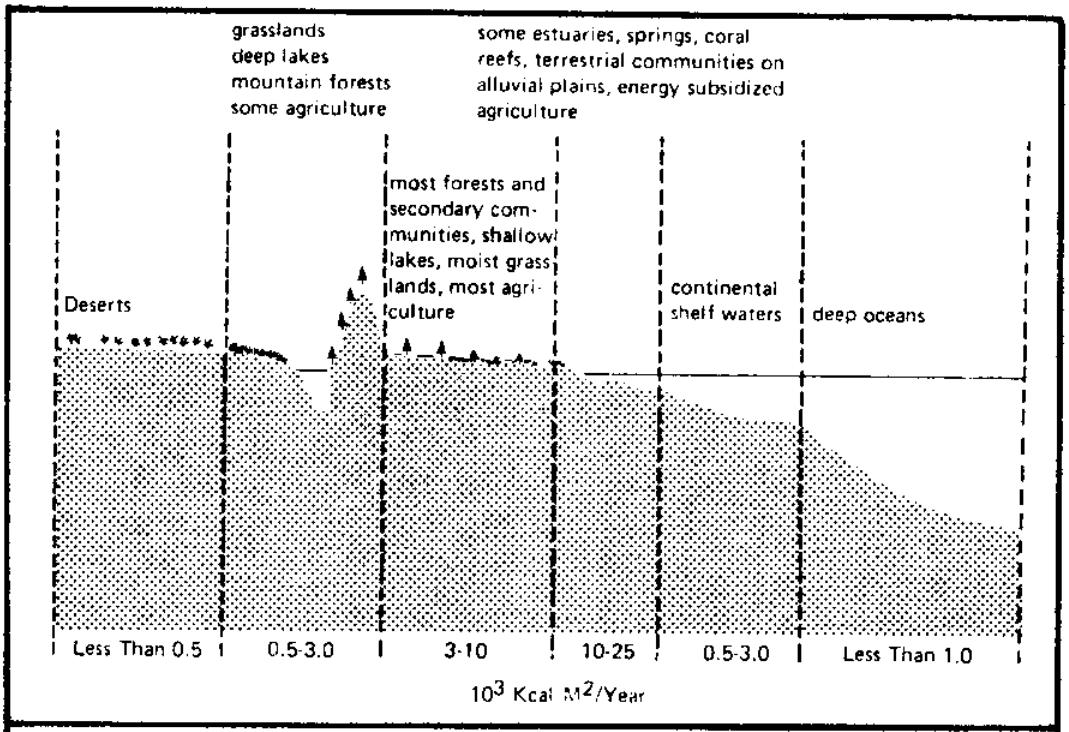
cwb

(See also: Endangered Species: California Policy.)

References: 1. California Department of Fish and Game. 1978. At the Crossroads 1978: A Report on California's Endangered and Rare Fish and Wildlife. California Department of Fish and Game, Sacramento.

PRIMARY PRODUCTIVITY

The concept of primary productivity refers to the capacity of a given ecosystem to produce basic plant material. Technically, primary productivity is the amount of energy converted from light, basic nutrients, and carbon dioxide into plant tissues, within a unit area during a unit of time. Measures may be expressed, for example, in the form of the grams of carbon fixed per square meter per day, or by calories produced per square meter per year, etc. Estuarine water bodies are generally highly productive, often producing three times as much as agricultural land.



The world distribution of primary productivity in terms of annual gross production (in thousands of kilocalories per square meter) of major ecosystem types. Reference: E.P. Odum. 1971. Fundamentals of Ecology. W.B. Saunders Co. Philadelphia.

Primary production forms the base of the food chain, with all successive levels ultimately dependent upon such production. Food chain structure is often diagrammed in the form of an ecological pyramid. Primary productivity, along with secondary productivity (the quantity of organic material produced by organisms which do not photosynthesize), constitute the biological productivity of an ecosystem.

The importance of productivity is recognized in the California Coastal Act, where it states in Section 30231 that: "the biological productivity

and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored..."

Productivity measures are often useful in diagnosing the condition of an ecosystem since they indicate the potential capacity to support life. Primary productivity measures are often used as a guage for the level of total biological productivity of a system. The growth rates of coastal plants such as algae, seaweed, and marsh grasses can help to provide an index of the biotic potential or carrying capacity of an ecosystem. (See: Carrying Capacity.)

It is possible to receive some idea of the level of primary productivity in a given natural area by visually inspecting the quality of the vegetation. A fairly lush area is likely to be more highly productive than an area where vegetation is stressed or has disappeared. A relative indication of the productivity of an area may be ascertained by measuring its standing crop, or the actual number (or mass) of the plant species present in an area at any one time. Measures of standing crop should be taken during times of the year when vegetation in the area to be measured is the most lush; otherwise an unreliable assessment could be made.

db

References: 1. Thomas Emmel. 1973. An Introduction to Ecology and Population Biology, W.W. Norton and Company.
2. Ingrid Waldron and Robert E. Ricklefs. 1973. Environmental Population: Problems and Solutions. Holt, Rinehart, and Winston. 3. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

PUBLIC TRUST

(See: Tidelands Jurisdictions.)

R

RECREATIONAL BOATING

The Coastal Act (Section 30244) states that increased recreational boating use of coastal waters shall be encouraged by: a) developing dry storage areas and increasing public launching facilities and berthing space in existing harbors; b) providing harbors of refuge; and, c) providing new boating facilities in natural harbors, new protected water areas, and in areas dredged from dry land. Relevant terms are provided below. (For a discussion of planning problems see: Marinas.)

- o Dry storage areas - public facilities for launching trailerable boats into the water (distinct from private facilities, such as yacht clubs).
- o Berthing space - a boat slip, essentially a parking space for a boat.
- o Harbor of refuge - any place of shelter or anchorage, natural or artificial, which is readily accessible and which offers safe shelter or anchorage to light draft vessels. (1)
- o Natural harbors - sheltered areas in the open waters of bays, estuaries, and coves. (2)
- o New protected water areas - areas created by the dredging of existing low level dry lands or by the placement of wave barriers that are in conformance with other Coastal Act policies. (2)

cw

References: 1. U.S. Army Corps of Engineers. 1949. "Preliminary Examination Report on Harbors for Light Draft Vessels, Northern California Coast." 2. California Coastal Zone Conservation Commission, 1975. California Coastal Plan. California Coastal Commission, Sacramento, and Mike Dadasovich, State Coastal Commission.

RESOURCE PROTECTION ZONES

Resource protection zones (RPZ's) are buffer areas which surround and protect the sensitive resource values of public areas -- beaches, parks, natural areas, and fish and wildlife preserves -- in the coastal zone.

The establishment of resource protection zones is mandated by the Coastal Conservancy Act of 1976 -- not the California Coastal Act of 1976. However, the policies of Chapter 3 of the Coastal Act are the criteria for determining where RPZs are necessary (the same policies that the Coastal Commission uses to determine whether or not proposed developments would be compatible with coastal zone resources). Also, the implementation measures necessary to control or mitigate development in RPZs will be a part of each participating jurisdiction's local coastal program. The types of land uses and resources protection measures required by RPZs may or may not be different than those required for local programs by Coastal Act policies. (1)

Resource protection zones have limited purposes: they are designed only to protect resources under public ownership or control (as of January 1, 1979) from adverse effects of nearby private development. Specifically, Section 31300 of the Coastal Conservancy Act of 1976 states:

> It is the intent of the Legislature to establish buffer areas, to be known as resource protection zones, surrounding public beaches, parks, natural areas, and fish and wildlife preserves in the coastal zone. The purpose of such zones shall be to ensure that the character and intensity of private development surrounding any such areas and preserves is generally compatible with and does not adversely impact sensitive resource values within such public areas and preserves.

Adopting resource protection zones is not, however, simply a mechanism for reinforcing Coastal Act policies. A second and equally important purpose of designating resource protection zones is to involve state agencies with local coastal planners in implementing Coastal Act policies; the Conservancy statute provides for state agencies to propose resource protection zones and for local agencies with jurisdiction over the land to review the proposals. The participating state agencies are the Department of Parks and Recreation, the Department of Fish and Game, and the University of California, through its Natural Land and Water Reserve System (NLWRS). (1)

The Coastal Conservancy has a specific role in the use of its authorities to provide equity. Specifically,

> When private development of lands within an adopted resource protection zone will clearly decrease resource values within an adjacent public area, and where exercise of the police power to protect such resource values would be unreasonable, a state agency, may, through purchase, dedication, or other means, acquire development rights scenic easements, or other interests, not including fee title, in private lands in resource protection zones.

The state agencies participating in the RPZ program had submitted resource protection zone proposals to the Coastal Commission by January 1, 1979. The agencies identified coastal resource areas under their control and defined necessary buffer areas based on the types of recources to be protected and the possible adverse effects of uncontrolled development within the resource protection zone. The Coastal Commission referred the proposals to those local agencies with jurisdiction over the proposed zones

(February 23, 1979).

The final step in the RPZ planning process is anticipated to be zone adoption by the Commission and preparation of guidelines for local agencies. However, this function may be modified by pending legislation which would

change the RPZ requirements within the Conservancy Act. The Conservancy statute mandating RPZ designations does not provide implementing measures stronger than those already provided by the Coastal Act.
cw
(Note: In 1980, the RPZ program was discontinued.)

References: 1. Memo from Michael Fischer, State Coastal Commission, to Planning Directors of City and County Governments and Affected Special Districts, February 23, 1979. 2. Anne Herzenberg, RPZ Coordinator, State Coastal Commission.

RESTORATION OF MARINE RESOURCES

The restoration of marine resources refers to attempts to restore natural marine resources to as near their original productive state as possible. The Coastal Act (Section 30230) states that "Marine resources shall be maintained, enhanced, and,where feasible, restored." In addition, Section 30231 states that "The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored...." In the context of the Coastal Act, marine resources are taken to mean tangible natural resources of direct economic value, such as kelp beds and fisheries. The Coastal Act further states that in deciding permit matters when the protection of natural resources is at issue, the permit decision must be made so that on balance the natural resources are protected.

Activities such as filling, excavation, ditching, draining, and the impounding of estuarine and wetland areas; release of pollutants such as sewage, sediment, thermal and chemical discharges; and the overharvesting of marine organisms tend to alter the productivity and therefore the value of marine resources.

Note: Planners can check with the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA) to obtain information on national fisheries programs being developed. The California Department of Fish and Game can provide information on State sport fishing management activities.
db
(See also: Wetlands Restoration and Restoration of Water Quality.)

References: 1. California Coastal Zone Conservation Commission. 1975. California Coastal Plan. California Coastal Commission, San Francisco.

RESTORATION OF WATER QUALITY

The restoration of water quality refers to the attempt to restore water resources to as near a natural state as possible. Once the flow of pollution is halted, water quality will usually, in time, restore itself.

The Coastal Act refers to the restoration of water quality in Section 30231, where it states, "...the quality of coastal waters, streams, wetlands, estuaries, and lakes...shall be maintained and, where feasible, restored..."

Section 30412 clarifies the Coastal Commission's role with regard to water quality. It states: a) that the State Water Resources Control Board (SWRCB), and the California Regional Water Quality Control Board (RWQCB) are the state agencies having primary responsibility for the coordination and control of water quality; and b) that the Coastal Commission will not adopt conditions or take actions which will conflict with any determination by the SWRCB or any of the Regional Boards in matters relating to water quality.

Water quality management programs of the State and Regional Boards are based upon the requirements in the 1972 Federal Water Pollution Control Act and its amendments. The boards administer the discharge permits in accordance with state and Federal regulations and prepare required basinwide and specific area wastewater discharge plans and programs. In addition, they administer Federal grants for the upgrading of treatment facilities and they designate critical areas. (See: Areas of Special Biological Significance.)

The concept of "Areas of Special Biological Significance" (ASBS), recognizes that certain biological communities, because of their value or fragility, deserve special protection consisting of preservation and maintenance of natural water quality conditions, to the extent possible. Once the State Board designates an ASBS, it then takes actions to prohibit discharges of thermal sewage, industrial process wastes, and discharges from non-profit sources (including storm water runoff, silt, and urban runoff) into the area. (1)

Another relevant program is the National Pollution Discharge Elimination System (NPDES), which requires that industrial, municipal, and other point source discharges obtain permits for the discharge of wastes or process waters into the navigable waters of the U.S.

Water discharges such as disposal of sewage, the release of sediment, or thermal and toxic chemical discharges all have the potential for seriously degrading coastal water quality. Currently, at least 130 waste disposal outfalls annually discharge 444 billion gallons (1.36 million acre-feet) of domestic and industrial sewage into California's wetlands, estuaries, and coastal waters. (2) These discharges receive varying degrees of treatment.

Enclosed bodies of water such as lagoons, estuaries, and bays are vulnerable to degradation as a result of water pollution because of restricted circulation and flushing. Many wastes are organic products which are mineralized in the ocean and may be recycled by living organisms. However, when large amounts of such wastes are discharged into enclosed bodies of water, fish kills, algal blooms, stagnation, foul odors, and smothering of bottom dwelling organisms can result.

Thermal pollution and entrainment by power plants disrupt ecosystem health by killing organisms, changing the reproduction and migration patterns of aquatic species and degrading the ecological quality of water bodies.

Sedimentation degrades water quality and ecosystem health through increasing turbidity and silt loads, and the discharge of chemicals can often cause damage and death to aquatic organisms near outfalls. Some chemicals, such as clorinated hydrocarbons (e.g., PCB's) can accumulate and build up in food chains, having disastrous effects, such as killing sensitive species, inhibiting reproduction, and making them inedible for humans.

Water quality restoration measures include providing for sewage treatment that produces a product compatible with the environment, phasing out discharges into enclosed bays and estuaries, reclaiming wastewater, regulating waste discharges from vessels, limiting thermal discharges in areas where ecosystem health will be adversely affected, prohibiting toxic and harmful discharges into areas of biological importance, and improving the monitoring of discharges.

The concept of "restoration" needs to be distinguished from that of "abatement." In the case of a degraded habitat area, restoration and abatement are complementary activities: once abatement of the damaging activities is accomplished, restoration measures are often necessary to bring the habitat values as near as possible to those which once existed. With water pollution, abatement and restoration are often synonomous -- once the harmful activity has been stopped, water quality is often restored merely by removing the pollutants.

There are many things that local planners can do about the subject of water quality restoration in addition to meeting existing Federal and State regulations. Local planners may establish buffer areas about sensitive bodies of water. They may plan for compatible uses to be developed adjacent to bodies of water. Ordinances and land development practices to control and minimize siltation are very important to protect both water quality and the existence of coastal bodies of water themselves. Developments which will be energy-efficient and can utilize reclaimed water must be encouraged, including the establishment of areas of urban forests and agriculture. Developments which are coastal related and coastal dependent must be permitted on the shoreline while those not so dependent or related are sited elsewhere. The most stringent enforcement is necessary for estuaries, lagoons, bays, and wetlands.

Regarding State and Federal water quality restoration activities, either SWRCB or one of its Regional Boards can provide information. In addition, the State Board's Ocean Waters and Thermal Plans may be useful. The Ocean Plan sets waste discharge requirements to protect beneficial uses of coastal waters, including the maintenance of marine life. The Thermal Plan places restrictions on existing and new thermal discharges, and the Bay and Estuaries Policy limits the discharge of municipal wastewaters and industrial process waters into enclosed water bodies.

db

(See also: Restoration of Marine Resources, Water Quality, and Sewage Effluent.)

References: 1. California State Water Resources Control Board. July 1976. Areas of Special Biological Significance. 2. California Coastal Zone Conservation Commission. December 1975. California Coastal Plan. California Coastal Commission, Sacramento. 3. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, Inc., New York.

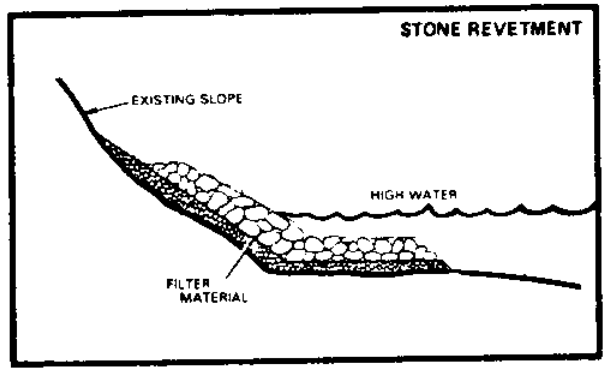
REVETMENTS

A revetment armors the slope face of a dune or bluff with one or more layers of rock or concrete. Revetments are covered under Section 30235 of the Coastal Act of a construction that "alters natural shoreline processes." A revetment dissipates wave energy with less adverse effect on the beach than occurs with a vertical seawall. Revetments usually cost about $75 to $150 per foot ($250 to $500 per meter) (1973 dollars) of shore protected, depending on strength needed, total length, and proximity to sources of construction material. (1)

jw

(See also: Beaches, Beach Processes.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, Inc., New York.



Reference: U.S. Army Corps of Engineers.

RIPARIAN HABITATS

A riparian habitat is an important ecological zone that is found along watercourses above the ordinary high water mark. It is visible and easily differentiated from other upland habitat by characteristic vegetation. "Riparian" is defined as pertaining to or living on the banks of a river, lake, or other body of water. Habitat is defined as the environment in which a species or a community of species live. For present purposes, riparian must be interpreted in its fullest sense -- referring to all water-influenced habitats, including saltwater ones, adjacent to all water bodies and watercourses rather than just to freshwater situations (which is contrary to the intent of the Coastal Act).

The Coastal Act recognizes that riparian vegetation is a significant coastal resource and seeks to protect it from adverse disruption. Section 30231 calls for the protection of biological productivity and water quality by "maintaining natural vegetation buffer areas that protect riparian habitats." Section 30240 calls for the protection of environmentally sensitive habitats and adjacent areas.

The riparian vegetation of California's coastal zone, rivers and streams forms a readily recognizable plant community. Native trees such as willow (Salix spp.), alder (Alnus spp.), maple (Acer spp.), cottonwood (Populus spp.) and sycamore (Platanus racemosa) are typically found growing by streams along with their associated understory plants. The partial or sometimes full tree canopy of foliage as well as the binding of streamside soil by tree and understory plant roots provides physical and biological protection for streams. Canopy shading regulates water temperature to provide a suitable regime for resident fishes, amphibians, invertebrates, and aquatic plants; shading also reduces water evaporation. Freshwater riparian vegetation reduces streamside erosion and silt deposition into the stream and stabilizes stream banks. Freshwater riparian vegetation also serves as an important habitat for terrestrial animals. In and near a stream, a diverse fauna secures food, cover and nesting sites.

Depending on the amount of intended development in a riverside area, additional buffer area width must be provided to offset the progressive effects of runoff contamination, as well as the unbalancing of the rate and periodicity of runoff associated with increasing development (see: Buffer Areas). This leads to a basic management goal: the higher the degree of development, the greater is the need to provide vegetative buffer areas along riverways. (1)

In the Coastal Act, riparian appears to be applied to the habitat at the edges of estuaries (saltwater basins and wetlands) as well as freshwater courses. The Coastal Commission staff has developed "Model Land Use Policies, Draft Guidelines for Wetlands" which calls for "a buffer strip, a minimum of 100 feet in width,(which) shall be established along the periphery of all wetlands and maintained in a natural condition." This

would be the riparian habitat zone, or part of it, in most cases. In addition, "a critical wetland protection area shall be established and shall include the wetland or estuary, including any...coastal watercourse or natural drainageway; and those upland areas recommended by the Department of Fish and Game which are adjacent to a coastal watercourse or floodplain which have been determined to be essential to preserving the habitat." (2)

The Coastal Commission has informally defined a minimum buffer strip for a stream environment at least 100 feet from the normal high water mark or stream bank and has considered site and construction restrictions as follows: (3)*

- No structures shall be allowed within minimum buffer strip.
- If parcel lies partially or entirely inside buffer, the disturbance must occur on "best site" available (having the least impact on the maintenance of the biological and physical integrity of the stream environment and on its capacity to endure a 100-year flood without increased damage to the natural or human environment).
- No structure shall interrupt flow of groundwater.
- Removal of vegetation, compaction of soil, and grading shall be minimized.
- Appropriate "best management practices," such as temporary and permanent runoff management facilities, soil stabilization techniques, and revegetation shall be implemented as mitigation measures.

The Regional Commissions have also informally used several criteria to determine adequate setbacks from riparian areas. (4)

- The North Coast Regional Commission generally uses the setback standards of the regional water quality control ordinances.
- The Central Coast Regional Commission, when considering a permit in Santa Cruz County, was guided by the standards of the County Watershed Management office.
- The South Central Coast Regional Interpretive Guidelines advise that four creeks in the area should be maintained as natural watercourses and makes provisions for setbacks:

  > Setbacks should be sufficient to leave the watercourse and the adjacent banks and streamside vegetation in their natural states. Setbacks... should be adequate to allow no removal of...riparian...vegetation and no grading that would cause direct erosion into the creek.

- More specific are the guidelines adopted by the South Coast Regional Commission.

> A minimum 50-foot buffer strip (measured from the outer limit of riparian vegetation; or if the waters are estuarine, a minimum estuarine vegetation) shall be required in new development to protect the habitat value of riparian area where the opportunity exists.

As an example of the Coastal Commission's action with regard to riparian habitats, the Commission voted to protect not only the riparian vegetation but also the lagoon of which the stream is a tributary. (4)

> A permit appeal from San Diego County* proposed an industrial structure to be constructed within the riparian corridor of a stream that ultimately drained into a coastal lagoon. The State Commission denied the permit. Among its findings were that some riparian habitat would be directly eliminated. Furthermore, because other development likely would follow the proposed development which was to be located in a floodplain, the construction of additional flood control facilities probably would ensue. These, in turn, would eliminate more riparian habitat and further increase siltation in the lagoon.

Thus the above included both the classic streamside riparian zone plus the Commission's extension of the riparian concept to estuaries.

In conclusion, there are three phases to addressing the protection of riparian habitats. First, the planner conducts a natural resource inventory of the jurisdiction. The work of a number of agencies can provide pertinent information:

- State Water Resources Control Board identification of "Areas of Special Biological Significance."
- State Department of Fish and Game identification of rare and endangered species habitat.
- U.S. Army Corps of Engineers Floodplains Management Section identification of flood hazard areas requiring buffer areas.
- The Soil Conservation Service provision of soil survey maps is useful in determining the likelihood and degree of sedimentation.
- U.S. Fish and Wildlife Service information on wildlife use of streams.

Second, the planner designates areas to be protected, primarily through the use of buffer zones. Third, the planner sets standards so that the quality of the water will not be degraded by erosion, sedimentation or pollution. Both on-site and off-site controls can be used.
cwb
(See also: Buffer Areas.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, Inc., New York. 2. California Coastal Commission. 1979. "Model Land Use Policies, Draft Guidelines for Wetlands." 3. California Coastal Commission. July 19, 1978. Draft Model Ordinances (dealing with 1) steep slope and water protection regulations, 2) ag. exclusive zoning, and 3) shoreline development regulations. 4. California Coastal Commission, March 1, 1979. Vegetation Management Report. 5. Charles Thurow, et al. 1975. Performance Controls for Sensitive Lands: A Practical Guide to Local Administration. ASPO, Chicago, Illinois. 6. Personal communication from Eric Metz, the California Coastal Commission, May, 1979.

* Appeal No. 85-77. Commission denied a permit to Erskine-Johns Co. for industrial building and storage for flammable materials. Pacific Sorrento Industrial Park, City of San Diego. At issue were the flood and geologic hazards, stream channelization, and protection of Los Penasquitos Lagoon and riparian area.

RIVER AND HARBOR ACT

(See: Section 10: U.S. River and Harbor Act.)

RIVERS AND STREAMS

The Coastal Act provides for the protection of the quality and biological productivity of all coastal waters, including tributary streams within the designated Coastal Zone. The Act calls for minimizing the alteration of natural streams and maintaining natural vegetative buffer areas to protect riparian habitats.* (See: Riparian Habitats.) Water quality of streams is also addressed through the Coastal Act.**

Section 30236 of the Coastal Act states that "substantial alterations of rivers and streams" should incorporate the best mitigation features feasible. Substantial alteration of rivers and streams consists of the significant disruption of the natural systems of water drainage and stream flow (such as by channelization, impoundment or removal of marginal vegetation). Section 30236 specifies the particular circumstances under which substantial alteration, with mitigation, is permitted:

- Necessary water supply projects;

- o Flood control projects necessary for public safety where no other feasible alternative is available;

- o Improvement of fish and wildlife habitat.

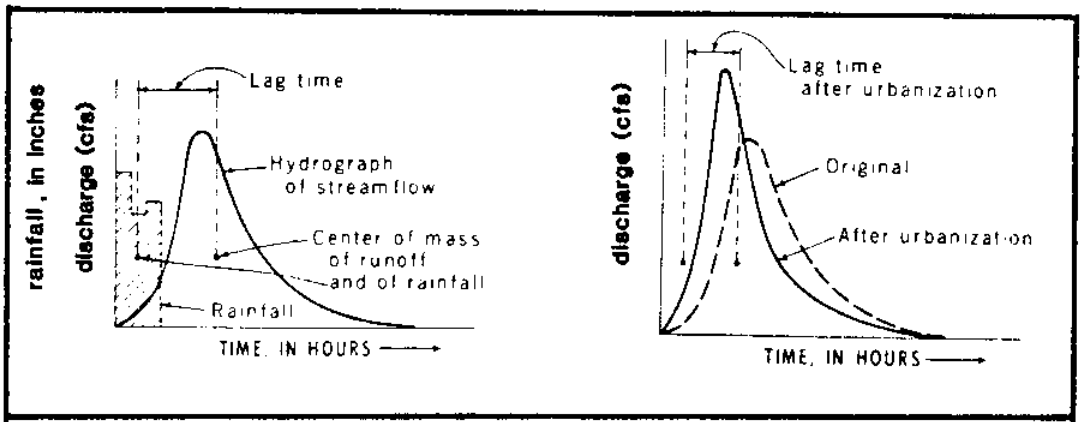
In addition to the Coastal Act, the Department of Fish and Game (DFG) also deals with alteration of rivers and streams. Development that will a) divert or obstruct the natural flow of, or b) change the bed, channel, or bank of, or c) use material from any riparian area, stream, or lake is required to comply with a Fish and Game Agreement pursuant to Sections 1601, 1602 or 1603 of the California Fish and Game Code. Where a fish or wildlife resource may be substantially degraded by development, the DFG proposes reasonable modifications in the proposed construction that would allow for the protection and continuance of the resource.

Regulatory activities for the protection of rivers and streams can be divided into two main categories:

- o Site-specific regulations, such as development of buffer areas and land use control within the stream corridor and the land immediately adjacent to it. (See Buffer Areas.)

- o Non-site-specific regulations, such as land use control in the larger watershed. Erosion and sedimentation control ordinances are the most common form of these controls. (See Watershed and Runoff.)

An appropriate management goal for local coastal planners is to maintain the natural system of water drainage and stream flow in coastal watersheds and to avoid substantial alterations of rivers and streams, such as channelization, impoundment, and removal of riparian vegetation.



Hydrographs of streamflow relating runoff to rainfall in urbanized and natural situations.
Reference: Luna Leopold. 1968. Hydrology for Urban Land Planning. U.S. Geological Survey. Washington, D.C.

Stream channelization adversely influences the natural stormwater retention function of the hydrologic system. In a natural water course, high flow volumes in the stream bed may be reduced by the storage of flood water in floodlands and wetlands. These stormwater retention benefits may be lost if the system is altered by drainage of wetlands, construction of levees or dikes, channelization or straightening of streams, or removal of marginal vegetation. (See Watersheds.)

Upstream impoundment adversely influences downstream wetland environments in numerous ways. Among the adverse effects are the following: (1)

- o Floodplain wetlands - reduced recharge, reduced restocking, and reduced sediment enrichment.
- o Streams - reduced flow rates (especially peak flows), reduced flushing (hence increased sedimentation) and reduced enrichment by leaf litter from the floodplain.
- o Estuaries - reduced flushing, increased shoaling, increased salinity, sharpening of salinity gradients, reduced nutrient inflow, increased invasion of marine species.
- o Nearshore coastal areas - reduced beach nourishment and increased beach erosion.

The Local Coastal Program Manual contains general guidelines suggesting both on-site and off-site controls for the protection of rivers and streams. The Manual recommends the designation of conservation areas and conservation buffers in the land use plan where necessary to protect "riparian habitats" and "coastal resource areas." (See Riparian Habitats for case studies involving protection of rivers and streams.)

While the local planning goal must be to provide complete protection for rivers and streams, in some cases alteration may be unavoidable. When one of the three situations in which substantial alteration with mitigation is permitted under Section 30236 arises, the following mitigation principles might be used:

Minimization of impacts from channelization. (2)

- o Create channels only where necessary, avoiding areas of high environmental value.
- o In channelized areas, provide for the maintenance of wetland habitat diversity.

- o Maintain all bypassed stream meanders as wildlife habitat.

Mitigation of impacts from dams: (2)

- o Avoid placing dams in localities where they will impact prime wetland habitat.

- o Incorporate fish and wildlife protective devices into the design of dams.

- o Design the water management program to perserve existing water quality, volume and rate of flow.

Mitigation of slope and vegetation disturbance from construction:

- o Revegetate disturbed sites with native plants, but only after slopes have been made stable.

- o Use temporary soil stabilization techniques during construction activities.

- o Stabilize the slope permanently. Correct oversteepened slopes (slopes greater than 50 percent) and stabilize slopes with long uninterrupted faces.

cwb

(See also: Riparian Habitats, Buffer Areas, Flood Plains.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 2. Joachim Tourbier and Richard Westmacott. 1974. Water Resources Protection Measures in Land Development: A Handbook. University of Delaware Water Resources Center, Newark, Delaware. 3. Conservation Foundation. In press. Coastal Environmental Management. Federal Insurance Administration, Washington, D.C. 4. California Coastal Commission. Mar. 1, 1979. Vegetative Management Report. California Coastal Commission, San Francisco. 5. Charles Thurow, et al. 1977. Performance Controls for Sensitive Lands: A Practical Guide for Local Administration. ASPO, Chicago. 6. Rezneat M. Darnell. Nov. 1978. "Minimization of Construction Impacts on Wetlands: Dredge and Fill, Dams, Dikes, and Channelization." In, National Wetland Protection Symposium. June 6-8, 1977. (FWS/OBS - 78/97). Reston, Virginia. 7. California Coastal Commission. July 19, 1978. First Drafts of Model Ordinances (dealing with ... steep slope and watershed protection regulations). 8. Allen Carroll. Developer's Handbook. State of Connecticut Dept. of Environmental Protection, Coastal Area Mgmt. Program, Hartford, Conn.

R

* Appeal No. 482-78 (County of San Luis Obispo). Commission granted permit with conditions concerning habitat protection and sediment control to County of San Luis Obispo for rip-rap bank protection along Los Osos Creek, San Luis Obispo County. At issue was the need for mitigation of a streambank stabilization project.

** Appeal No. 396-78 (Timothy). The Commission granted a permit with conditions to Ellen & Arthur Timothy for a single-family home, Salmon Creek subdivision, Sonoma County. The permit was subject to conditions concerning height, extent of deck, water use, septic system, and removal of trailer. At issue was the impact of the development on water quality of Salmon Creek.

Appeal No. 62-79 (Schneider). The Commission denied a permit to Stewart Schneider to divide two 12-acre parcels into thirteen 1-acre parcels, three 2-acre parcels, and one 4-acre parcel, east of Highway 101, approximately 3 miles north of Crescent City, Del Norte County. One issue was potential water quality impacts on Jordan Creek from septic tank leading.

RUNOFF

Runoff is that part of precipitation that flows directly off the land. Stormwater runoff is a major source of water quality, erosion, and sedimentation problems. (1) The California Coastal Act specifically addresses runoff in Section 30231, which states,"The biological productivity and the quality of coastal water.... shall be maintained.... and where feasible, restored through controlling runoff...". (2) The Coastal commissions have been very restrictive of development which would adversely affect runoff.*

In less developed coastal areas, stormwater washes soil and sediment into surface and ocean waters, causing increased levels of turbidity and eutrophication, and threatening the high productivity of estuaries and wetlands. In urban coastal areas runoff carries with it the pollutants from surfaces over which it runs, including oil, litter, chemicals, nutrients and biological wastes.

Recognizing the major impacts that runoff and erosion have in terms of water quality, Section 208 of the Federal Water Pollution Control Act has made an effort to deal with the problem by requiring adequate planning in regional water quality management plans. More specifically, Section 208 requires preparation of water quality management plans by (a) area-wide water quality management planning agencies in areas specially designated because they have "substantial water quality control problems" as a result of "urban-industrial concentration or other factors" and (b) by state water quality management planning agencies in those areas of the state which have not been designated. (3)

Public management of non-point sources is often used in conjunction with direct regulation. A municipal street sweeping program, for example, will serve to reduce the pollution level on surfaces over which stormwaters run. Or a local government may construct and maintain stormwater retention facilities for part of a community. (3)

Incentives and penalties are a third alternative designed to check stormwater pollution at an early non-point phase. For example, a developer might be permitted to exceed normal zoning densities on some parts of his site if he dedicates other parts as open space for stormwater rentention. Or effluent charges might be imposed on a development in proportion to the rates of runoff from its site. (3)

Regardless of the management method chosen, runoff is to be approached on an area-wide basis whenever possible. In this way the drainage and pollution problems of an entire watershed can be addressed at once. Runoff control on a site-by-site basis leads to a proliferation of small detention facilities which may be dangerous in a heavy storm, since stormwater is likely to be released from them in greater total volume and over shorter time than that released from a single, larger, well-planned facility. (3)

The key elements of the Section 208 planning program are its requirement that every plan be capable of implementation and its ability to identify the control techniques (permits, incentives, performance standards, etc.) that are the most effective in the area considered. Another key is that it focuses on the control of runoff, sedimentation and erosion, not by major capital projects, but through preventive approaches that rely greatly on land use planning, regulation, and intensive coordination with other Federal, state and local agencies dealing with water quality. For example, in southern California the Southern California Association of Governments (SCAG) has responsibility for "208" planning. In planning for runoff and erosion controls, SCAG has coordinated its activities with many other agencies on the federal, state and local levels, including the Army Corps of Engineers, Soil Conservation Service and the California Department of Water Resources. On the local level, SCAG works with flood control districts, water conservation districts, irrigation districts, etc. (4)

The three most often used strategies for the control of runoff are (a) direct regulation; (b) public management of nonpoint source controls; and (c) the use of incentives or surcharges.

Direct regulation is usually the most frequently employed strategy. Under this approach, developers or subdividers are required to submit plans for minimizing runoff from their sites through acceptable control practices, which may be specified in regulations or in engineering guidelines; or the developer may have to present a plan that meets certain environmental performance standards, such as limiting the rate of runoff or erosion from the developed site. In either case, the control plans must be approved and a permit must be secured by a zoning

or subdivision review agency before development can proceed. (3)

Runoff policies of the local coastal program need to be based on a thorough analysis of the watershed's ecological conditions. Performance standards can then be devised setting the conditions required for coastal development. These performance standards could take the form of qualitative statements; for example, "runoff from a new development shall not exceed the natural runoff of the development site." Runoff standards could also be set as quantifiable measures, i.e., runoff from the completed project shall not exceed X acre-feet/acre/year (the average runoff rate caculated for the entire watershed).

The runoff performance standards can be developed with the assistance of the U.S. Soil Conservation Service and/or the State Department of Water Resources. The runoff standards developed could then be implemented as provisions of the zoning ordinance or as special regulations applying to all land within the watershed. In addition, standards for vegetation removal, impervious surfacing and other development processes need to be addressed to control the rate of runoff.

jc

(See also: Soil Erosion.)

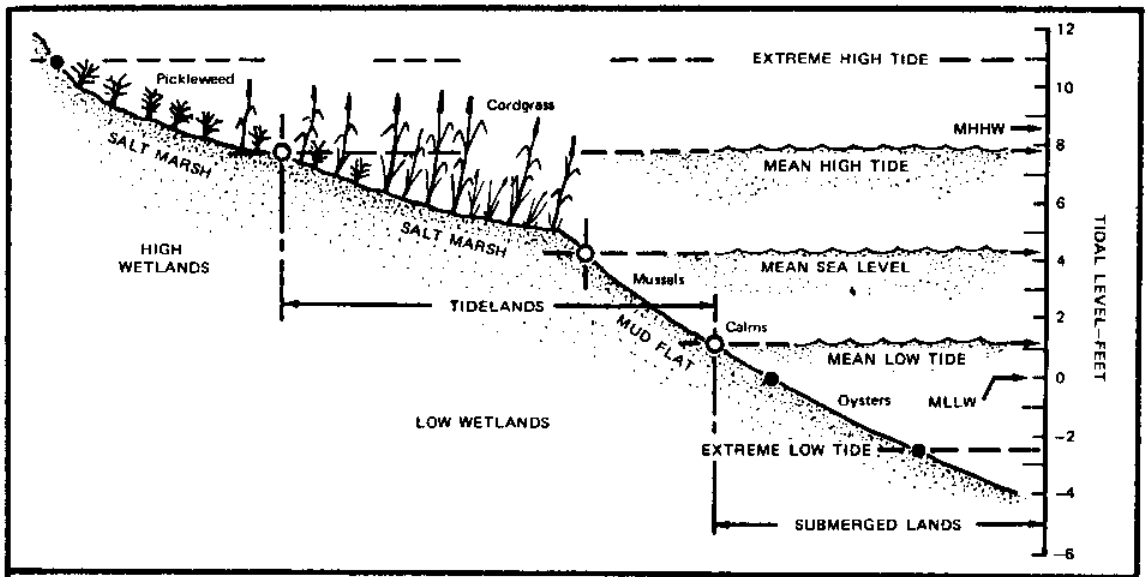
References: 1. John Clark. 1977. Coastal Ecosystems Management. John Wiley & Sons, Inc., New York. 2. California Coastal Act of 1976. California Public Resources Code, Division 20, Section 30000 et seq. Also cited as Chapters 1330, 1331 and 1440 of the California Statute of 1976. 3. U.S. Environmental Protection Agency, 1977. Legal and Institutional Approaches to Water Quality Management Planning and Implementation. U.S. Environmental Protection Agency, Washington, D.C. 4. Southern California Association of Governments, 1978. "208" Areawide Waste Treatment Management Plan. Southern California Association of Governments, Los Angeles.

* Appeal No. 246-78. Commission granted permit with conditions to Pitsch Associates for single-family home, Malibu, Los Angeles County. At issue were sensitive habitat areas, increased runoff and erosion, geologic hazard, access, visual impact, and buildout of the small-lot subdivisions in the Santa Monica Mountains.

Appeal No. 321-78. Commission denied permit to Melvin M. Metcalfe for single-family home with detached garage, Topanga, Los Angeles County. Issues were sensitive habitat areas, increased runoff and erosion, geologic hazard, access, visual impact, and buildout of the small-lot subdivisions in the Santa Monica Mountains.

SALT MARSHES

Salt marshes are coastal wetlands subject to periodic flooding by brackish or salty water and vegetated with salt-tolerant plant communities. Salt marshes are therefore a subset of coastal wetlands in the context of the 1976 Coastal Act (which includes both salt and freshwater areas). Coastal salt marshes are wetlands fringing the land-water interface of the tidal marsh-estuarine ecosystem, which is recognized as one of the most biologically productive of the world. (1)



Profile of a California Salt Marsh.
Reference: Harold B. Goldman. 1973. Hayward Shoreline Environmental Analysis. Shoreline Planning Agency. Hayward, Calif.

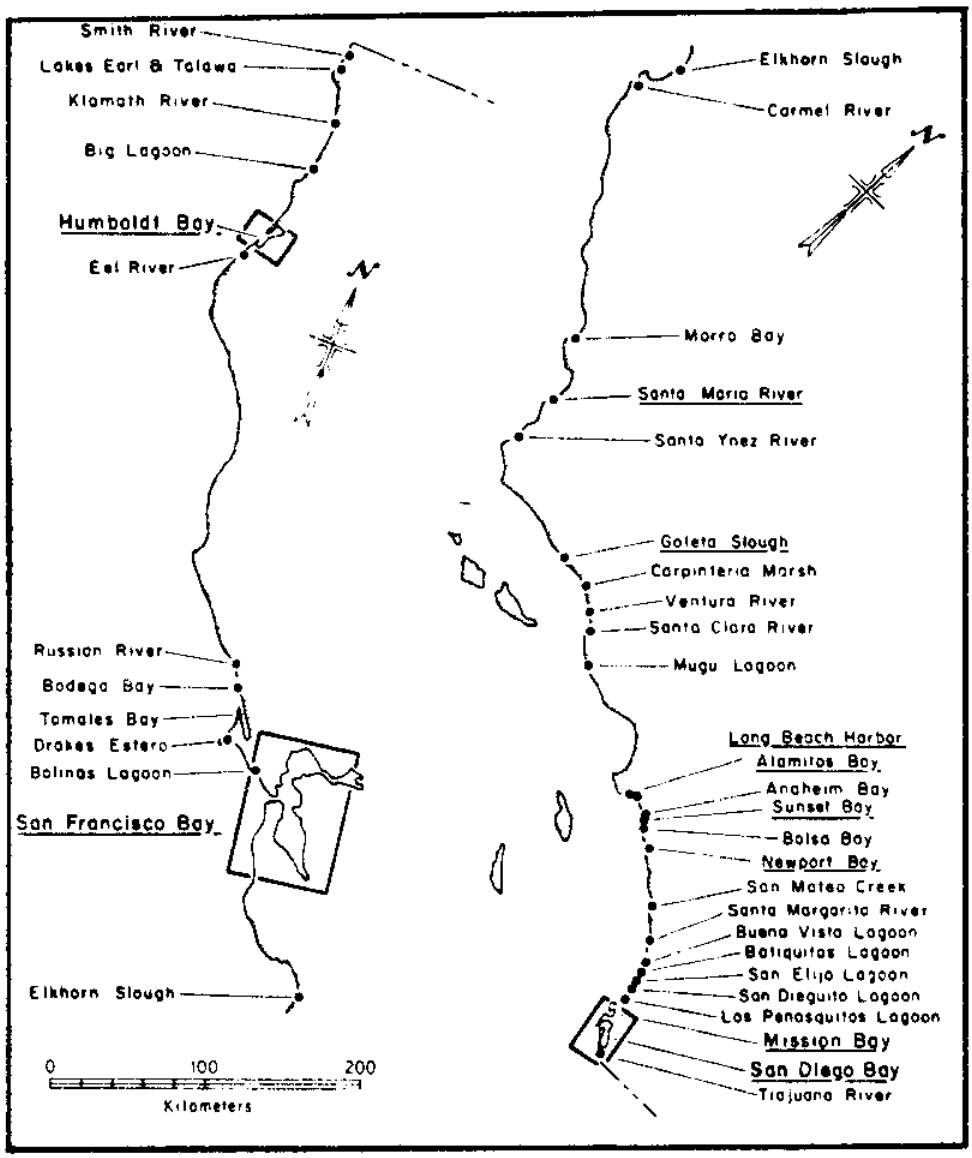
Saltwater marshes, like all aquatic habitats, are sensitive to human disruption. Saltwater marshes are included in the Coastal Act's definition of wetlands; Section 30231 calls for the protection of wetlands.

Salt marsh communities are exemplified by a vertical zonation which reflects species' tolerance of saline conditions as well as frequency and duration of saltwater submersion. Salt marshes perform important ecological functions. Upper portions of salt marshes (between the normal highest tide mark and mean high water mark) regulate the flow of runoff waters, cleanse them of contaminants, intermittently export nutrients to the food chain, slow storm surge, provide habitat, stabilize soils, and offer open space/scenic benefits. Lower salt marshes (between mean high and mean low water marks) store nutrients and convert them to detritus (the key to the food chain of coastal ecosystems). Salt marsh vegetation removes toxic materials, excess nutrients, and sediment. The vegetation also slows storm surge, stabilizes the shoreline, and prevents erosion. Salt marshes and tidal creeks provide nurseries, other exceptional habitat, and scenic/open space benefits.

cwb

(See also: Wetlands of the Coast Tideflats.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, Inc., New York. 2. The Conservation Foundation. In press. Coastal Environmental Management. Federal Insurance Administration, Washington, D.C. 3. Elna Bakker. 1971. An Island Called California: An Ecological Introduction to its Natural Communities. University of California Press, Berkeley.



California coastal salt marshes. Underlined sites have suffered significant declines in salt marsh acreage.
Reference: M. Barbour and J. Major. 1977. Terrestrial Vegetation of California. John Wiley & Sons. New York.

SALT WATER INTRUSION

Saltwater intrusion is the advance of salt water into aquifers that previously contained fresh water. This is a frequent occurrence in coastal areas where the aquifer crops out on the ocean floor and overpumping and/or insufficient recharge has depleted the groundwater in the area.
jc
(See also: Groundwater.)

Reference: 1. Grant Kimmel and John Vecchioli. 1977. "Groundwater." In, John Clark. Coastal Ecosystem Management. John Wiley & Sons, Inc., New York.

SAND DUNES

(See: Dunes.)

SAND FLATS

(See: Tideflats.)

SCENIC AND VISUAL QUALITIES

The scenic and visual qualities discussed here are those of natural origin for which the California coast is so renowned. Beaches, dunes, bluffs, headlands, mountains, wetlands, and estuaries are but a few examples.

The Coastal Act (Section 30251) states that the scenic and visual qualities of coastal areas shall be protected. Permitted development shall protect views to and along the ocean and scenic coastal areas, minimize alternation of natural landforms, be compatible with surrounding areas, and, where feasible, restore and enhance visual quality in visually degraded areas. The emphasis is on the protection of ocean and coastal views as they are seen from public areas -- highways, roads, beaches, parks, coastal trails and accessways, vista points, coastal streams and waters used for recreational purposes, and other public preserves -- rather than the protection of coastal views as they are seen from private residences where no public vistas are involved. (1)*

A number of methods have been developed for conducting aesthetic resources inventories but objective measures of beauty are difficult to develop. Beauty is basically a subjective response of the viewer to the environment. Non-visual elements, such as odors and noise, enter into the viewer's perception of the visual environment. Still, objectiveness must be the planner's goal if any type of aesthetic resources inventory is to be useful. The following visual attributes could be addressed with some type of weighted scale. (2)

- Vividness or visual distinctiveness

  Topographic expression
  Shoreline complexity
  Landmarks
  Vegetative pattern diversity
  Waterform expression
  Wildlife visibility
  Manmade elements
  Human dynamics

- Intactness, or visual integrity; absence of intrusions

  Level of development
  Human intrusion (litter, overcrowding, wear and tear)
  Encroachment (eyesores, deficits)

- Unity or visual harmony

  Pictorial composition
  Harmony between manmade and natural landscape

- Cultural or historic significance

  Scarcity (uniqueness)
  Fragility
  Historical value
  Educational value
  Threat of loss

The ecologic connection derives from the dictum "Natural beauty rises from natural function." That is to say, a natural landform that is part of a well-functioning ecosystem will be more appealing than one that is part of a stressed and crippled one. In this way the two values -- aesthetic and ecologic -- are reinforcing, and an effort to protect the one will help protect the other. For example, a healthy and natural salt marsh may be a scenic delight, while a defaced and polluted one may be a scene of ugliness. (3) Since the visual resources of the coast encompass the entire coastal viewshed, they include not only views of the ocean and coastline but of natural landforms, vegetation, and other scenic areas in the coastal zone, both oceanfront and inland. (4) Good ecologic management is a requisite for the protection of these scenic and visual qualities.

CW

References: 1. State Coastal Commission. October 31, 1978. "Statewide Interpretive Guidelines" State Coastal Commission, San Francisco. 2. City of Coronado. No date. Background Report on Visual Resources and Special Communities. Coronado, California. 3. J. R. Clark. 1977. Coastal Ecosystem Management, John Wiley & Sons, Inc., New York. 4. Personal Communication. Wendy Brewer, Local Coastal Program Coordinator, State Coastal Commission.

* Appeal No. 304-78. Commission denied permit for single-family home, Upper Zuma Canyon, Malibu. At issue was visual impact, along with sensitive habitat areas, increased runoff and erosion, and other matters.

Appeal No. 233-78. Commission denied permit for a development of 106 single-family homes on 57.2 acres, Leucadia, San Diego County. One issue was scenic and visual qualities.

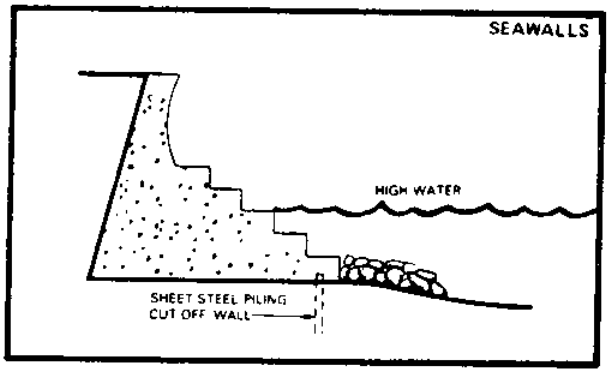
Appeal No. 449-78. Commission granted permit with conditions for single-family home, detached garage, tramway, septic system, and tree removal, Big Sur. At issue were the visual impacts of development within the Big Sur area.

SEAWALL

A seawall (beachfront bulkhead) is a solid barricade built parallel to the shoreline to protect the shore and to prevent inland flooding. Seawalls are covered under Section 30235 of the Coastal Act as a construction that "alters natural shoreline processes." In the permit program the Coastline Commissions have been quite restrictive on seawalls.*

Extensive seawalls have been built as public works projects, principally in Massachusetts, Florida, Mississippi, Texas, and California. Seawall costs usually begin at around $200 per foot ($660 per meter) and may range considerably above $500 per foot (1973 dollars) for the heaviest structures built at a distance from the sources of materials. (1)

Seawalls are usually suitable only for special situations, since they often compound shore erosion problems. Unfortunately, seawalls (including bulkheads and revetments) commonly accelerate the loss of sand as the wall deflects the wave forces downward into the beach deposit. This causes the sand to erode away seaward of the footing; the beach may lower or disappear. Often the seawall is undermined and collapses. (1)



Reference: U.S. Army Corps of Engineers.

jw

(See also: Beaches, Beachfront Protection, Beach Processes.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, Inc., New York.

* Appeal No. 2-79 (Isla Vista Seawall). Commission granted permit with conditions concerning construction of seawall and blufftop drainage for 125-ft. armored rock seawall, Isla Vista, Santa Barbara County. At issue was seawall construction, public access, and protection of low- and moderate-cost housing.

Appeal No. 421-78 (Olympian Hotel). The Commission granted a permit for two-story single-family home in Malibu, with conditions concerning seaward extent of bulkhead structure and drainage pipe, fill materials, access to and along the beach, and other matters.

Appeal No. 225-78. Commission granted a permit with conditions concerning design, drainage landscaping and access for seawall and crib wall Pismo Beach, San Luis Obispo County.

SECONDARY PRODUCTIVITY

Secondary productivity refers to the quantity of organic material produced by organisms that do not photosynthesize. This includes the production of all animals, as well as most bacteria and fungi. All organisms above the level of primary producers are included in secondary productivity.

(See also: Primary Productivity, Biological Productivity.)

References: 1. John Clark and Judith Clark, (Eds.). 1979. Scientists Report: National Symposium on Wetlands, National Wetlands Technical Council, Washington, D.C. 2. Thomas C. Emmel. 1973. An Introduction to Ecology and Population Biology. W. W. Norton and Co., New York. (need permission).

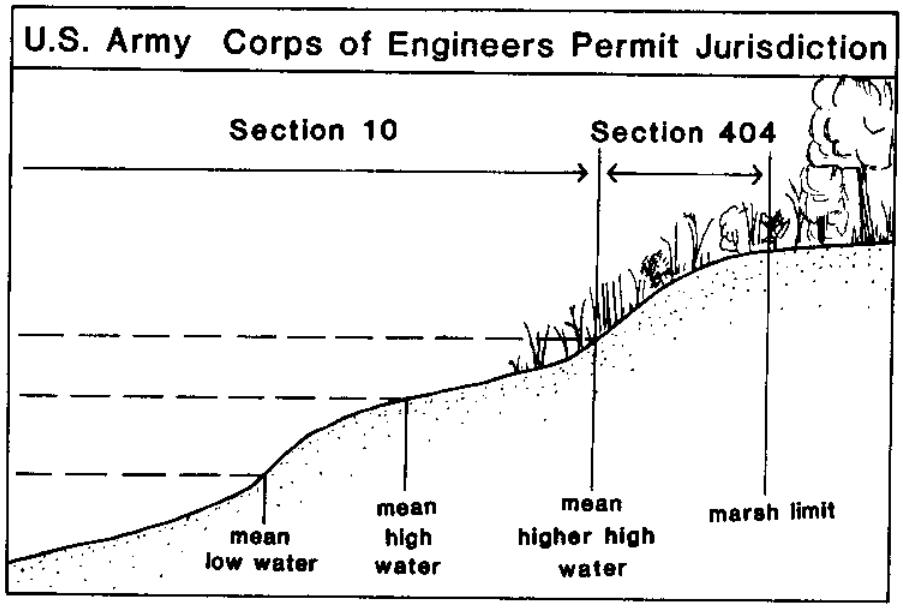
SECTION 10: RIVER AND HARBOR ACT

Section 10 of the River and Harbor Act of 1899 prohibits the unauthorized obstruction or alteration of any navigable waters of the United States. (1) It is unlawful to build over, excavate, fill or otherwise modify any navigable water without approval from the Army Corps of Engineers.

The Army Corps of Engineers regulatory authority extends throughout the coastal zone by means of this Act, the Clean Water Act, and other legislation. Local and state jurisdictions must be aware of the scope of Federal regulatory authority in the coastal zone, and the requisite permits for activities and structures. Federal authority can override state and local jurisdictions, even if all other permits have been obtained.

The California Coastal Act limits filling, dredging, and diking activities to eight general categories in Section 30233, as long as no feasible less environmentally damaging alternative exists and feasible mitigation measures are used to minimize the adverse environmental effects of the project. Section 30233 of the Coastal Act permits the construction of breakwaters, revetments, groins, etc. for both coastal-dependent uses and the protection of existing beaches and structures.

Sections 30233 and 30235 pertain to activities and structures regulated by the River and Harbor Act. Many projects in (and sometimes, beyond) the coastal zone will require Section 10 permits from the Corps.



There are four types of Section 10 permits:

- Individual permits are issued on a case-by-case basis, depending upon the evaluation of the Corps district staff.

- Letters of permission represent an abbreviated review by the district's staff; this permit is followed by an individual permit.

- General permits are issued for proposed minor work which will have a minimal individual and cumulative effect upon the environment.

- Nationwide permits are issued for specific activities which have a minimal impact upon the environment, and for which individual permit applications are not required. These specific activities include the placement of navigational aids (e.g., buoys), scientific testing gauges, marine harvesting devices (e.g., nets, pots), etc.

Applicants needing a Section 10 permit may find the proposed action has already been permitted by a general or nationwide permit. For this reason, it is essential to check with the Corps district prior to preparing an application.

In 1974, the Corps published new regulations to guide the evaluation of Section 10 permits. In assessing a proposed project, the Corps considers the following factors:

- The impact of the project on the public interest; impacts include conservation, economics, ecology, aethetics, historic values, fish and wildlife values, land-use classification, navigation, recreation, water supply, water quality, public needs and flood damage prevention.

- The balance between the anticipated benefits and the reasonably foreseeable damages caused by the proposed project.

Four specific criteria are considered for each permit:

- The public and private need for the proposed structures or work.

- The desirability of using alternative locations or methods.

- The extent and permanence of beneficial and detrimental effects of the proposal.

- The cumulative effects of the proposal, in relation to other activities in the area.

Predicting the outcome of individual permit decisions is difficult, as individual Corps district offices vary in their consideration of the breadth and depth of environmental impacts. Since applications are submitted at the district level, the initial decisions are made at this level. Despite the decentralized character of this permit program, all offices do follow the same standards. The critical need is for vigorous enforcement of the Act and the prosecution of violations. Currently, financial penalties seem ineffective because of the low fines imposed. The requirements of Section 10 regarding restoration may be a more formidable threat, if imposed. Although private parties have brought actions against violators of the Act, the primary responsibility is that of the government. Potential violations at the state and local level can best be investigated with the assistance of the Corps.
as
(See also: Wetlands Policy: Federal.)

References: 1. Neil J. Barker. 1976. "Sections 9 and 10 of the River and Harbor Act of 1899." In Ecology Law Quarterly, Vol. 6, No. 1.
2. Lance Wood and John Hill, Jr. 1978. "Wetlands Protection: The Regulatory Role of the U.S. Army Corps of Engineers." In Coastal Zone Management Journal, Vol. 4, No. 4.

SECTION 404: U.S. CLEAN WATER ACT

Section 404 of the Federal Water Pollution Control Act Amendments of 1972 asserts Federal regulatory authority over the discharge of dredge or fill material into all U.S. waters. The Army Corps of Engineers may issue or deny permits for a specified disposal site after the permit review process is completed. The disposal sites are determined by Environmental Protection Agency (EPA) and Corps guidelines; the EPA may prohibit or restrict use of disposal sites if adverse effects upon municipal water supplies, shellfish beds, fisheries, wildlife or recreation will result.

Section 404 strengthened Federal authority in controlling water quality problems through its relationship to interstate commerce. A 1974 Federal court ruling linked water pollution with interstate commerce, as all waters are part of interrelated ecosystems (which include navigable waters and water-related commerce). It is important to be aware of Federal regulatory authority through both this permit program and that of the River and Harbor Act. Many kinds of development in the coastal zone will require multiple Federal permits in addition to those of state and local agencies.

The Army Corps of Engineers is usually the lead agency for Section 404 permits, although the EPA has ultimate permit authority. The Corps and the EPA receive technical assistance from the National Marine Fisheries Service (NMFS) and the Fish and Wildlife Service (FWS), through the Fish and Wildlife Coordination Act. Other Federal agencies consulted during the permit review process include the State Department of Fish and Game, the Heritage Conservation and Recreation Service, the National Park

Service and several others.

The Corps permit review process incorporates the following criteria into the evaluation of an application:

- o A public interest review to determine:
  - The public and private need;
  - The desirability of alternate locations and methods;
  - The extent and permanence of beneficial/detrimental effects;
  - The impact of the individual application with regard to the cumulative effect in the area.
- o The effect upon wetlands, incorporating review by the Fish and Wildlife Service, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Soil Conservation Service and others.
- o The effect upon fish and wildlife, involving the Fish and Wildlife Coordination Act.
- o The effect upon water quality, subject to EPA conditions. All proposals must be consistent with Federal water quality regulations.
- o The effect upon historic, scenic and recreational sites.
- o The effect upon the limits of the territorial sea, with regard to Federal and state interests.
- o The interference with adjacent property or water resource projects, with regard to upstream, downstream and nuisance effects.
- o The effect upon the coastal zone, with regard to existing state and Federal regulations.
- o The effect upon marine sanctuaries, requiring review (and certification, if applicable) by the Department of Commerce.
- o The effect upon floodplains, including the impacts upon individual safety, property and the beneficial value of floodplains.

Much of the site-specific information required for permit review may not be available to the Corps district office. Some effects, such as the cumulative effect of an individual project, may be almost impossible to ascertain. The problem of forecasting, problems of data-gathering, and the lack of pertinent maps and other information make the permit review process a difficult task. In addition, the problem of detecting violations is great. There is a need for better state/Federal coordination, and for effective follow-up to detect and prosecute violators.

In all cases, the best place to begin is with the Corps district office. The applicant may find his proposal is in an exempted category, obviating the need for the complete application process (numerous activities, such as normal farming and ranching are not subject to 404 regulations).
as
References: 1. Federal Register. July 19, 1977. "Regulatory Programs of the Army Corps of Engineers." 2. Forester Einarsen, U.S. Army Corps of Engineers. 3. M. Freel, U.S. Fish and Wildlife Service.

SEDIMENTATION

(See: Soil Erosion.)

SEPTIC TANK

(See: Estuaries.)

SEWAGE EFFLUENT

Protection of environmental quality and sensitive habitat areas in coastal wetlands, particularly estuaries and confined lagoons, is of major concern. (1) The key items relating to effluent disposal are the quality and placement of the effluent and the method of disposal.

The Coastal Act's major discussion of sewage treatment is found in Section 30412. The State Water Resources Control Board and its subsidiary Regional Water Quality Control Boards are the state agencies with primary responsibility for the coordination and control of water quality. The State and Regional Boards work closely with the federal Environmental Protection Agency (EPA) on water quality protection. The Coastal Act places responsibility on the Coastal Commission for assuring that any new developments permitted in the coastal zone will not violate state and Federal water quality standards.* Effluent discharge in shallower ocean areas or bays is the subject of considerable controvers y. One opinion in the science community holds that only primary treatment is necessary because the high concentration of nutrients is beneficial to the food chain of fish and other marine organisms. The other opinion holds that at a minimum, secondary treatment is necessary to maintain an acceptable ecological balance and that the effluent should be detoxified at the domestic, commercial or industrial source. EPA regulatory policies normally reflect this second view.

Primary treatment is environmentally unacceptable in most circumstances, and toxics and nutrients should be removed before the effluent is discharged into enclosed bodies of water. It appears that properly designed and controlled ocean discharge is feasible, as long as second-

ary treatment takes place and minimal concentrations of toxic substances are discharged. The principal advantage of the ocean as a disposal site is a reduction of costs, compared to the costs of secondary or tertiary treatment required for disposal in wetlands, estuaries or lagoons. Critical factors for a decision are the mass load of toxins, protection of public health, and the biological significance of the circulation and mixing features of the particular location.

Sewage effluent disposal in shallow, confined water areas is prohibited. Estuaries, wetlands, and coastal rivers are not acceptable locations for effluent unless it is the product of very advanced treatment and firm performance standards are set. The "Scientists' Report" of the National Symposium on Wetlands contains a discussion regarding disposal in large wetlands that has some relevance to the smaller wetlands typically found in California:

- The main factors determining the capacity of a wetland for waste treatment are hydraulic features (the water regime) and sediment characteristics -- whether the sediment is clay or sand, and how much organic matter is present.

- Flushing rate (turnover time) is a crucial item to consider in evaluating the ability of a wetland to remove any pollutant from the water.

- Vegetation is important for waste assimilation and for maintaining appropriate sediment conditions.

- Wetlands can take up heavy metals and other pollutant compounds as a result of absorbtion by vegetation, but the cumulative effects are poorly understood, with few conclusive results at this time. The report concludes that disposal of effluents in wetlands may be possible without environmental damage but that it must be done with extreme care.

Septic tanks, too, must be designed, located, and operated with care in coastal areas.**
ea

References: 1. John Clark. 1977. Coastal Ecosystem Management, John Wiley & Sons, Inc., New York. 2. John Clark and Judith Clark, (Eds.) 1979. Scientists Report: The National Symposium on Wetlands, National Wetlands Technical Council, Washington, D.C.

* Appeal No. 285-77. Commission denied permit for 187 single-family homes on 38.3 acres, Highway 5, San Diego. At issue were sewage treatment, plant siting and other matters.

Application No. 307-76. Commission denied a permit for 22-unit, 6-story condominium with subterranean parking, swimming pool, detached jacuzzi and sauna, Redondo Beach. At issue were sewage capacity, transportation, and the density of development.

** Appeal No. 351-77. Commission granted permit with conditions concerning lot consolidation, erosion, and the meeting of Santa Cruz County water and sanitation standards, for a single-family home with well, storage tank, and septic system, Santa Cruz County.

** Appeal No. 183-77. Commission denied permit for a single-family home, well, and septic system, Inverness Park, Marin County. At issue were septic tanks, fire hazard and water supply.

SOIL EROSION

Soil erosion is the removal and loss of soil by the action of water, ice, gravity or wind. (1) The California Coastal Act deals with erosion and sedimentation in Section 30231 and section 30234.

Section 30231 states, "The biological productivity and the quality of coastal waters, streams, wetlands, estuaries and lakes appropriate to maintain optimum populations of marine organisms... shall be maintained, and,where feasible, restored through... controlling runoff and... minimizing alteration of natural streams" (emphasis added). (2) Section 30234, states, "...the long-term productivity of soils and timberlands shall be protected...". (2)

Section 208 of the Federal Water Pollution Control Act also addresses erosion and its attendant problems by authorizing the Environmental Protection Agency (EPA) to designate agencies to prepare regional water quality management programs in which the management of erosion and sedimentation are prime considerations. (3)

Soil erosion and sedimentation controls are necessary to the continued viability of the coastal ecosystem. The problem of soil erosion is a complex and multifacted problem, requiring sound management and planning techniques dealing with the whole spectrum of ecosystem management. The Coastal Commissions are very restrictive on erosion control in the permit program.*

In general, the erosion process includes both the detachment and transport of soil particles. Sedimentation is the settling out of soil particles which are transported by water. Sedimentation occurs when the velocity of water in which soil particles are suspended is slowed for a sufficient period of time to allow the particles to settle out of suspension in the water column. Uncontrolled erosion can critically damage valuable watershed and wildlife habitat areas; sedimentation can pollute and silt-up a natural water course.

The potential of an area to erode is determined principally by a) the characteristics of its soil, 2) its vegetative cover, 3) its topography and d) its climate.

- Soil characteristics: The erodability of a soil depends on four factors: a) average particle size and gradation, b) percentage of organic content, c) soil structure, and d) soil permeability (the ease by which water passes through the soil). Soil which contains high amounts of silt and very fine sand is generally the most erodable. The erodability of these soils is decreased as the percentage of clay and/or organic matter increases. Well-drained and well-graded gravels and gravel-sand mixtures with little or no silt are the least erodible soils.

- Vegetative cover: Vegetation plays an important part in controlling erosion in several ways. It shields the soil surface from the impact of falling rain, slows the velocity of runoff, maintains the soil's capacity to absorb water, and holds soil particles in place.

- Topography: The size and shape of a watershed influences the amount and rate of runoff. Slope gradient determines the velocity and volume of runoff and erosion. Generally, the steeper the gradient, the greater the chance that serious erosion will occur.

- Climate: The frequency, intensity and duration of rainfall are factors that determine the amount of runoff produced. Where storms are frequent, intense, and of a long duration, the risks of erosion are high.

Erosion control measures serve to: a) divert runoff from exposed soils and other vulnerable areas, b) safely convey runoff, either in subsurface or enclosed drainage systems or by ensuring that all surface channels and outlet points are adequately drained, c) stabilize exposed surface areas and d) control the volume and velocity of runoff discharge. (4)

Sedimentation control measures serve to: a) detain runoff for a period of time to allow soil particles which are in suspension to settle out, b) filter runoff as it flows and c) intercept runoff containing sediment.

In summary, the basic erosion and sedimentation controls are:

- Keep disturbed areas small.

- Stabilize and protect disturbed areas as soon as possible.

- Keep storm water runoff velocities low.

- Protect disturbed areas from storm water runoff.

- Retain sediment within the site.

In California, erosion and sedimentation are serious problems for all coastal areas, particularly in areas where development has occurred on cliffs and bluffs. Low lying coastal lands such as wetlands and estuaries are also severely impacted. The major cause of erosion and sedimentation are poorly planned developments and inadequate erosion and sedimentation controls during construction activities. These can result in extremely severe erosion and sedimentation which can cause substantial adverse impact on water quality. These impacts, which include high levels of suspended sediment, turbidity, sediment deposition, and the destruction of aquatic life and riparian habitats, can be avoided if the land is properly used and managed.

In California, erosion and sediment-related water quality problems occur in many areas of the region. Receiving waters of particular concern include perennial streams, lakes and reservoirs, bays, estuaries and wetlands, harbors and marinas, coastal marine areas of special biological significance, and marine life refuges. (3) Examples in southern California include Upper Newport Bay Ecological Reserve, Bolsa Chica Bay and Wetlands, and Malibu Lagoon.

Poorly planned, constructed and maintained developments have occurred in the region and have contributed to water quality problems. For certain receiving waters, additional erosion and sediment control protection is necessary. Upper Newport Bay is severely impacted by sedimentation. A large portion of the tidal prism of the bay's ecological reserve has been destroyed through accelerated sedimentation processes caused by various construction and watershed activities. Malibu Lagoon has been heavily disturbed through spoil disposal from past highway construction activities. Many harbors and marinas that act as sediment traps are impacted. Perennial streams in mountains and foothill areas may be severely affected by adverse amounts of sediment. Big Bear Lake suffers from excessive nutrient levels, which support extensive growths of aquatic vegetation, which in turn impair its recreational potential. Construction activities appear to be a significant source of sediment and nutrients in the lake.

Local planning efforts, in order to control erosion and sediment problems, need to be directed towards strengthening local ordinances concerning the regulation of development and construction activities and towards improving coordination with other local, regional state and Federal agencies that are concerned with erosion problems.

- Local Ordinances: Local ordinances often do not provide for adequate control of erosion and sediment-related impacts. Most local governments utilize the Uniform Building Code (or variations thereof) for regulating grading and construction activities. The erosion and sediment control provisions of the UBC are not entirely adequate for water quality purposes. Additional measures and improved inspection techniques are necessary. (4)

- o Coordination: Increased coordination among adjacent communities could help prevent projects in one jurisdiction from having a negative impact on another. Also, increased coordination with state resource agencies can provide the local planner with knowledge and expertise in the area of erosion control. For example, Resource Conservation Districts (RCD's) have the capability to help plan, review and implement erosion and sediment control programs.

RCD's are legal subdivisions of state government, responsible under state law for conservation work within their boundaries. Resource conservation plans, including erosion control plans, are prepared by the RCD's through cooperation agreements. While some districts may have their own technicians, they also rely on personnel from various state and Federal agencies such as the Soil Conservation Service. In addition, some state agencies have broad regulatory powers that could be of great assistance to the local planner. The California Regional Water Quality Control Boards have adequate regulatory power over construction activities in order to protect water quality. The State through its State Water Resources Control Boards has primary regulatory authority over the water resources of the State. Under State law, one of the regulatory mechanisms available to these Boards is the establishment of waste discharge requirements. In addition to other types of pollutants, waste has also been defined to include "waste from construction activities." This has been interpreted in court to include eroded sediments resulting from inadequate construction methods.

jc

(See also: Runoff, Watersheds, Floodplains, Restoration of Water quality.)

References: 1. John Clark. 1977. Coastal Ecosystem Management, John Wiley & Sons, Inc., New York. 2. California Coastal Act of 1976. 3. Southern California Association of Governments. 1978. Draft Areawide Waste Treatment Management Plan. Southern California Association of Governments, Los Angeles. 4. Department of Natural Resources. 1975. Soil Erosion and Sedimentation Control Guidebook. State of Michigan. 5. Ronald W. Tank. 1976. Focus on Environmental Geology. Oxford University Press, New York.

* Appeal No. 111-78. Commission granted a permit with conditions concerning drainage plans and erosion, for a single-family home, Capistrano Beach, Orange County.

Appeal No. 209-78. Commission granted a permit with conditions concerning restrictions on future development and construction to divide 38.8 acres into four lots and extend San Dieguito Drive, San Diego County.

Appeal No. 304-78. Commission denied single-family home, Upper Zuma Canyon, Malibu. At issue was increased runoff and erosion, geologic hazard, access, sensitive habitat areas and visual impact.

SPECIAL ECONOMIC SIGNIFICANCE

Section 30230 of the Coastal Act, dealing with protection of marine resources, requires that areas and species of special economic significance be given special protection. A suggested determination of "special economic significance" is to see if either of the following criteria can be responded to affirmatively:

- Is the marine resource unique or limited in supply (e.g., abalone or salmon)?
- Is the community's economy dependent on the utilization of the marine resource (e.g., the fishing fleets in Noyo and Crescent City)?

An area or species may also be of special economic significance if it is a vital portion of the life cycle or food chain of another species being utilized commercially. Examples of economically significant areas include feeding and spawning grounds. Small schooling fish, which are eaten by more valuable fish such as yellowtail, are an example of an economically significant species.

Marine resources of "special economic significance" may have regional or state significance. The economic base of some regions may be supported primarily by the utilization of a particular marine resource, such as shellfish. Protection of deep sea fishing is important to the entire state economy.
bh

STREAMS

(See: Rivers and Streams.)

SUBMERGED VEGETATION

Submerged grass beds are a vital component of coastal ecosystems. Eelgrass is the predominant species of sea grass in estuaries of temperate latitudes, including most of the Pacific Coast. Grass beds supply food to grazing animals and detrital nuturients to the water. They also stabilize bottom sediments and provide nursery areas for young fish and other aquatic life forms.

Estuarine grass beds are vulnerable to turbidity, which screens out light necessary for grass growth. Fine sediments (mud) can prevent the grasses from anchoring by creating unstable bottom conditions. Boat traffic, heated power plant effluent, sewage disposal and other activities can also result in such adverse effects.

Management and protection for offshore coastal habitats are more complex than for shorelands. They are also more remote from local planning processes (e.g., sewage and power plant discharges are largely controlled by the state). To protect submerged grass beds it is not enough that development be concentrated in drier land areas; appropriate design and site controls must be applied to prevent deteriorating water quality. In this connection it may be necessary to solicit expert advice from state or Federal agency technicians or private consultants.

cwb

SUBSIDENCE

(See: Fluid Extraction and Subsidence.)

T

TIDAL FUNCTIONS

Tidal functions include the physical and related biological and chemical forces that tides exert on the interface of land and sea. The natural, unaltered tidal cycle plays a crucial role in the proper functioning of the coastal ecosystem. The California Coastal Act addresses the need for maintaining a naturally functioning system in Sections 30230 and 30233.

Section 30230 states that "Marine resources shall be maintained, enhanced, and,where feasible, restored.... Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy population of all species of marine organisms...."

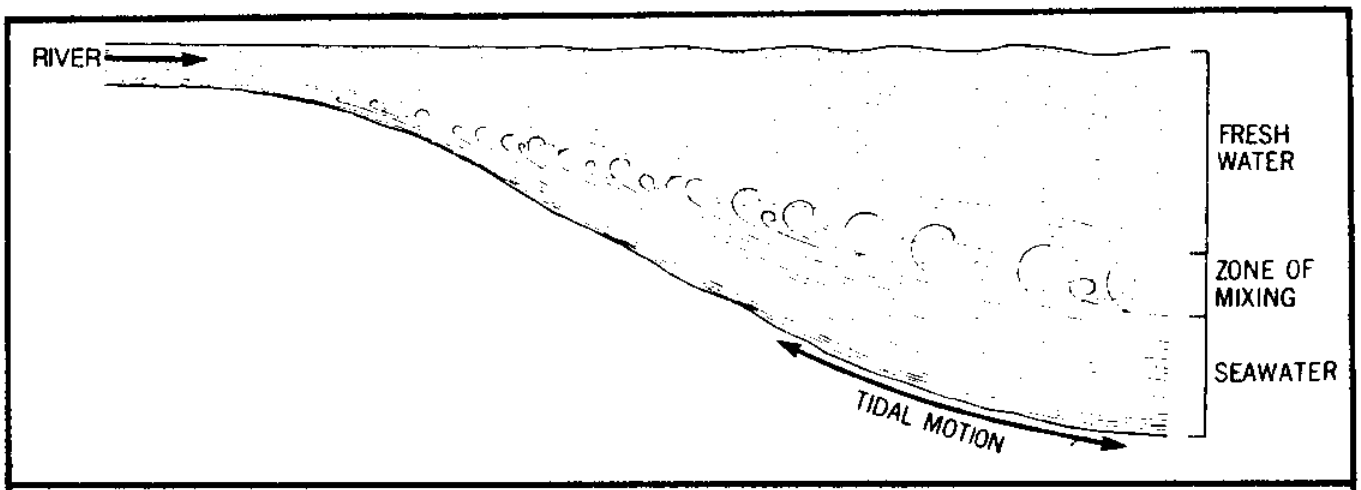
Section 30233 states that "diking, filling and dredging (which would significantly alter the effects of tidal action in the area) will be permitted only if there is no feasible less environmentally damaging alternative" (emphasis added). If such alteration is necessary, certain mitigation measures must be incorporated.

To fulfill these policies, it is necessary to protect and enhance tidal flow. For coastal management purposes, tidal functions are important for two reasons: a) tidal action is essential to the proper functioning of coastal estuaries and wetlands; and b) the determination of tidal boundaries is necessary for the delineation of the extent of tidal influence and for the determination of wetlands boundaries and tidelands ownership.

Coastal estuaries and wetlands are highly productive. Coastal estuaries (which include the mouths of rivers, lagoons, and bays) and wetlands (made up of tidal marshes and mudflats) are a vital part of the coastal water ecosystem. Both estuaries and wetlands owe their high productivity to the effects of tidal action. (1)

Estuaries: Incoming saltwater (high tide) interacts with the outflowing freshwater from rivers to create a "mixing zone" in larger estuaries, the zone of transition from salt to freshwater. The mixing zone results from the intrusion of heavier saltwater from the ocean under the less saline and lighter outflow of fresh water from rivers. (2) Under favorable conditions, the two layers move at sufficient speeds to provide good circulation throughout much of the estuary. The strength of the flow governs the position of the salt front (the boundary between ocean and river water) and thus the location of the most abundant population of fish and microorganisms which prosper in the area of salinity transition. (2)

Saltwater Wetlands: The ebb and flow of the ocean tides create and energize the salt marsh. Tides import nutrients and floating life forms into the marsh and export organic detritus (fragments of organic matter important to the food chain of coastal ecosystems). They also dilute the concentration of toxic materials and excess nutrients and sediments and flush them out of the estuary. Deprived of tidal action, salt marshes and estuaries rapidly become stagnant and polluted and their productivity declines.



In an estuary, a mixing zone is created by incoming saltwater from high tide interacting with freshwater from rivers.
Reference: Thomas Carefoot. 1977. Pacific Seashores. Univ. of Washington Press. Seattle.

Tidal Glossary: Tidal heights serve as reference points for the extent of tidal influence (for the designation of boundaries of upper and lower wetlands for example) and for legal, administrative and planning purposes (i.e., land ownership, tidelands jurisdictions, etc.).

The following is a glossary of tidal height terminology (2) from the highest to the lowest height. While this terminology is the most frequently used, there are certain additional terms that are coming increasingly into use.

- Statistical Storm (S.S.): The level reached during the maximum storm surge expected in a specified number of years (for example, the 5-year, 25-year or 100-year storm surge).

- Extreme High Water (E.H.W.): The 19-year average level of the maximum storm surge for each one year period.

- Mean High Water, Spring (M.H.W.S.): The 19-year average height of high water running on spring tides (average during new and full moon days and the 2 days following each.)

- Mean Extreme Tide (M.E.T.): The average of each of the biweekly highest spring tides throughout the year.

- Mean Higher High Water (M.H.H.W.): The 19-year average of all the daily higher high tides.

- o Mean High Water (M.H.W.): The 19-year average height of high water.

- o Mean Sea Level (M.S.L.): The 19-year average of hourly water height (not the same as fixed geodetic MSL reference point).

- o Mean Tide Level (M.T.L.): The plane midway between MHW and MLW (usually within a few hundredths foot of MSL). Also referred to as HTL (Half tide level).

- o Mean Lower Low Water (M.L.L.W.): The 19-year average of all the daily lower low tides.

- o Mean Low Water, Spring (M.L.W.S.): The 19-year average height of low water running on spring tides (average during new and full moon days and the 2 days following each).

- o Spring Tides: The tidal cycle when the range between high and low tides (or higher high and lower low) is the greatest, that is during times of the full and new moon.

- o Neap Tides: The tidal cycle when the range between high and low tides (or higher high and lower low) is at its minimum, that is, when the moon is in its first and third quarters. (2)*

jc

(See also: Tidelands Jurisdiction, Patented Tidelands).

References: 1. California Coastal Zone Conservation Commissions. 1975. California Coastal Plan, Sacramento, California. 2. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, Inc., New York.

*Note: The tidemark definitions used above are based upon information from the National Ocean Suevey Supplemented by usages of other federal and state agencies. For example, the State of California may observe fine distinctions among the levels of mean high water, mean high tide, and the ordinary high-water mark.

TIDEFLATS

Tideflats are unvegetated expanses of mud (mudflats) or sand (sandflats) found in the intertidal zone.

Section 30203 of the California Coastal Act calls for the protection of wetlands, which are defined to include mudflats. Coastal wetlands are normally vegetated with grasses and herbs to the low-tide mark, below which they extend into tideflats. Although tideflats are typically found in the low-tide zone, they may extend above the low-tide mark where there is heavy tidal scouring, surface depressions or other unfavorable conditions. Tideflats are often rich sources of basic nutrients for the ecosystem and serve as feeding areas for fish at high tide and birds at low tide. In many estuaries they produce a high yield of shellfish or of

baitworms for fishermen. Tideflats are particularly important as energy storage elements of the estuarine ecosystem. They catch departing dissolved chemical nutrients and hold them until the returning tide sweeps them back into the marsh area. Without tideflats, these vital nutrients would eventually be depleted.

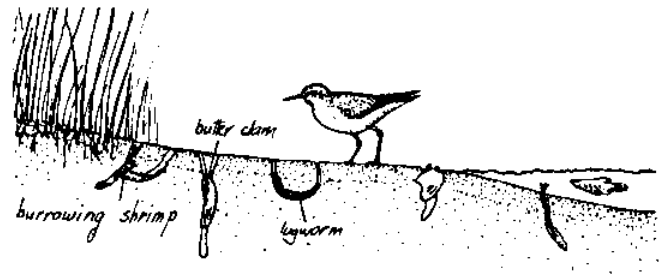
Changes in existing current flows, sedimentation, and the deposition of dredge spoil have adverse effects on tideflats; industrial pollutants, heated effluents and sewage are also detrimental to tideflat communities.

The planner's approach is to include tideflats as "sensitive environmental areas" to be protected in the same way as wetlands. One dilemma is the tideflat that is expanding through sedimentation from upland erosion at the expense of the estuary or wetland. Here, erosion controls in the watershed -- sometimes combined with corrective dredging to solve the present problem -- should do the trick.

cwb

(See also: Salt Marshes, Wetlands of the Coast.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, Inc., New York.



Tideflats are unvegetated sandy or muddy areas exposed at low tide. Despite their barren appearance, they support large animal populations. Worms, crabs, and clams feed at high tide, and retreat into burrows as the tide recedes. High tide also brings juvenile and even adult fish, which graze on the exposed food supply. Millions of microorganisms in the tideflats serve as natural filters for cleaning polluted water.

TIDELANDS JURISDICTION

Tidelands are the lands lying inland of the mean low water mark that are subject to the ebb and flow of the tides. Seaward of mean low water are the submerged lands. In California, the State Lands Commission and the Coastal Commission are the principal State agencies with jurisdiction over tidelands. A variety of Federal agencies also have mandated responsibilities for tidelands.

- State: Section 30416 of the Coastal Act acknowledges the responsibility of the State Lands Commission to manage all State lands, including tidal and submerged lands. The tate owns the tidelands in fee simple, from the line of mean high tide seaward. California received title to all ungranted tidelands from the Federal government when it received statehood in 1850. During the 1850's and 1860's, the State legislature authorized the surveying and patenting of lands for purposes of conveying lands, including tidelands, into private ownership. However, the State has retained a public trust easement for commerce, navigation and fisheries, which generally extends to the line of mean high tide. Litigation such as Marks vs. Whitney (1971) and City of Los Angeles vs. E. F. Carmen-Riles (under appeal) has dealt with this issue and supports the existence of these rights.

As State ownership extends to mean high water, this line is considered the legal boundary between State and private ownership. In areas where the tidelands have been modified (e.g., dredged, filled), the last-known natural extent of the ordinary high water mark is the boundary between State and private ownership.

When an application is submitted to the Coastal Commission for a tidelands area, the applicant must have State Lands Commission certification that: a) the State has no interest in the land, or b) the State does have an interest in the land, and the applicant meets formal conditions specified by the State Lands Commission permit, or c) State interest in the land is undefined and a permit is not currently required, but the State reserves the right to require a permit in the future should its interest be established. This certification process was formalized after passage of the Coastal Act in 1976.

The Coastal Commission will generally reject applications for development seaward of mean higher high water within the State's jurisdiction. (1) The Coastal Commission staff is very careful not to preclude the existence of State ownership or interest in the land.*

The state Lands Commission has full authority to administer, manage, sell or lease the public lands owned by the State including tidal, swamp and overflowed lands. According to Section 30416 of the Coastal Act, State Lands Commission review of all Local Coastal Programs affecting state lands is required before certification.

The Department of Fish and Game enforces State laws for the protection of wildlife habitat, including those in wetlands. The Department also manages ecological reserves and acquires and maintains wetland habitat. Some of these contain tidelands.

- o Federal: The Army Corps of Engineers has jurisdiction over dredging, filling and other development activities in all tidelands (See Wetlands Federal Policy.) The Corps' permit authority extends to the surface and beds of all waters subject to tidal action. On the Pacific Coast, the boundary of Corps jurisdiction is the "mean higher high water" line (MHHW). (2) (See: Tidal Functions.)

The U.S. Fish and Wildlife Service's (FWS) Office of Endangered Species becomes involved in tidelands with the Corps through the Fish and Wildlife Coordination Act. The Fish and Wildlife Service's national mandate also includes the Migratory Bird Act, the Endangered Species Act, habitat issues, and public trust lands. This agency has the authority to comment on any proposal, but federal involvement in some important issues is limited by staff availability, time and expertise. In addition, FWS has a management program to reduce wetland degradation through the Fish and Wildlife Coordination Act as well as a wetlands acquisition program for the National Wildlife Refuge System.

The Migratory Bird Conservation Commission passes judgment upon areas recommended for acquisition by the Department of the Interior and sets a limit upon the purchase price.

- o Private: The determination of private ownership rights depends upon the nature of the patent, the historic extent of the tidelands, and/or the navigability of the waterway. All sovereign rights to the beds of navigable waters are held by the State in fee, subject to an easement for commerce, navigation and fisheries. In California, although some lands have been transferred to private ownership, artificial changes such as filling or dredging do not change the property boundaries as originally deeded by the State (usually bounded by mean high water). Thus, littoral boundaries between State and private ownership remain unchanged from the last natural location of the shoreline.

Where the fee has been sold, the state retains a public trust easement, and a private landowner with tidelands property is burdened by this easement. The landowner may not develop the land for strictly private uses (e.g., for private residential use); this would not be consistent with the trust. Public-oriented uses (e.g., hotel, restaurant) generally would be permitted.

As well as can be determined, the tidelands may be freed of the public trust easement by two means:

- o Legislative enactment by the State

- Contract with the State Lands Commission, whereby the State is compensated with the equivalent or greater in land, resources, or monetary terms. This is uncommon and tends to apply to situations of land exchange.

Regardless of tidelands ownership issues, no development of a wetland can occur without a Federal permit, even if all other State and local permits have been obtained. This applies fully to public or private tidelands of all kinds. The Federal authority through the Corps/E.P.A. permit process overrides State and local authority over tidelands.
cwb
(See also: Patented Tidelands. Sections 10 and 404.)

References: 1. Personal communication with Eric Mete, California Coastal Commission. 2. 33 Code of Federal Regulations. Section 209 et seq. 3. . 1969. Boundary Control and Legal Principles. John Wiley & Sons, Inc., New York. 4. Personal communication with Dan Gorfain, State Lands Commission. 5. Personal communication with Nancy Saggere, Attorney General's office. 6. Bradford W. Wyche. "Tidelands and the Public Trust." 1976. In, Ecology Law Quarterly. Vol. 6, No. 1.

* Appeal No. 32-77. Commission denied a permit for 2-story multipurpose industrial building at San Dieguito Lagoon, San Diego County. One issue was the possibility of existing public trust.

TIDEPOOLS

Tidepools can be found in the intertidal zone on rocky shores wherever there is a natural basin or crevice that contains water when the tide ebbs. Tidepools retain enough water to sustain marine life while other portions of the intertidal zone about them are exposed to air by the ebbing of the tide.

The Coastal Act calls for the protection of tidepools under the environmentally sensitive habitat areas provision (Section 30204). The Local Coastal Program Manual (July 22, 1977) defines environmentally sensitive areas to include tidepools.

Tidepools serve as a habitat for a multitide of animals. Their rocky surfaces provide walls, crevices, holes, ledges, and caves to offer a greater variety of niches than is found on flat sandy bottoms.

The tidal margins of rocky shores in which tidepools occur can be divided into zones according to their degree of exposure to water: (1)

- The spray zone is subjected to saltwater spray, but infrequently to solid water.

- The high-tide zone is usually exposed to the air except during high tides.

- The mid-tide zone is exposed at least once a day.

- The low-tide zone is exposed only during the lowest tides.

The biota that can be found in each of these zones have adapted to varying conditions of exposure to saltwater and air. The inhabitants of the spray zone include diatoms and diatom grazers such as periwinkles and limpets, as well as barnacles and other organisms that can tolerate a relatively wide range of physical and chemical conditions in their environment. The variety of life forms in the middle zones increases significantly to include such organisms as snails, mussels, chitons, barnacles, sea anemones, algae, worms, crabs, shrimp, clams, isopods, and amphipods. The diversity of life forms is greatest in the low-tide zone.

Thermal and chemical waste discharges from urban land activities can disrupt the tidepool habitat. However, the greatest damage to tidepools probably results from recreational use of the tidepools, as rocks are overturned exposing organisms to light, dessication, and predation. Organisms living on the rocks are crushed. People who trample over the rocks and through the tidepools are also contributing to tidepool destruction. (2) Tidepools can be afforded some protection from such use with a simple ordinance requiring that signs be posted prohibiting the taking, harming, or disruption of the biota. Disruption may also be minimized by locating points of public access to the beach as far as possible from the tidepools. (2) Furthermore, the local plan could specify non-acceptable uses on adjacent lands to ensure protection.

The State Department of Fish and Game can play a strong role in tidepool protection by establishing ecological reserves which provide protection for specialized aquatic and terrestrial habitat by prohibiting the disruption to these habitats. For example, an invertebrate ecological reserve has been established at Pismo Beach.

dl

References: 1. University of California, Division of Agricultural Services. 1979. "Ecology of the Intertidal Zone. 2. Rimmon C. Fay. 1973. Southern California's Deteriorating Marine Environment. Center for California Public Affairs. Claremont, California.

TRANSFER OF DEVELOPMENT RIGHTS (TDR)

A development right is one of the numerous rights included in the ownership of real estate; mineral rights, air rights and easements are other examples of such ownership rights. A development right permits the owner to build upon or develop his or her land. Rights of ownership in land may be separated from each other and regulated by government or sold by the owner and transferred separately. In transfer of development rights (TDR), the right to develop a parcel of land is treated as a marketable item. The development rights can then be sold to another party and transferred to a different parcel of land, thereby adding to the development density of the receiving parcel. Generally, TDR attempts to achieve preservation of private property in the public interest without the expenditure of public funds for land acquisition. (1)

The Coastal Act (Section 30250(a)) states that new development shall be located within, contiguous with, or in close proximity to existing developed areas able to accommodate it. The basic purpose of this section of the Act is to concentrate new development by promoting infill of existing urban centers on the coast, thereby limiting sprawl and providing for orderly, planned expansion of developed areas. (2) A TDR program is one means of accomplishing these objectives.

TDR's have attracted widespread national attention as a means of concentrating development and preserving historic handmarks, agricultural land, and other open space lands. Under this program, landowners are compensated for restrictions on the development of their land with an entitlement to transfer unused development rights to other locations that are designated as suitable for higher density use. Because of the compensation factor, TDR programs, like preferential taxation (see Agriculture), have realized a moderate degree of political feasibility as a land use control device. Consequently, many states, counties and local jurisdictions are currently considering implementation of this type of program. (2)

Implementation of a TDR program requires the following steps:

- Identification of the appropriate TDR areas from which development rights can be transferred and specification of the total number of TDR's to be issued.

- Designation of appropriate transfer districts. Careful planning must be exercised in this phase of the program to set aside high density districts with development potential which are also compatible with the community's overall plan.

- Formation of a market or exchange process through which transfer can be bought or sold. Alternatives could include establishing a private market subject to government regulation or a government agency such as a development rights bank which would operate in conjunction with the private market. (3)

In 1976, the Town of Eden, New York, adopted a voluntary townwide TDR system aimed primarily at preserving the jurisdiction's agricultural lands. Eden is located 20 miles south of the Niagara Falls-Buffalo area and its agricultural lands surround the highway route most accessible for suburban development.

Active lobbying by a local conservation group combined with strong public support led to the incorporation of the TDR program in the town's comprehensive zoning ordinance. The ordinance's specific intent is the protection of the town's scenic rural features and the preservation of agricultural lands.

The TDR program's major points include the following. The transfer areas are delineated in the ordinance as conservation and agricultural districts. The three development districts are differentiated on the basis of location, prospective utility service and density of development. These are, in order of increasing density, rural residential, suburban residential, and hamlet (incorporated town or village) residential.

The incentives for participating in the TDR program include: a) the economic benefits derived from selling the development rights and still maintaining ownership and all other rights to the land (e.g., farming, forestry, some recreational uses, and other open space use); b) reduced taxes due to decreased property assessment as a result of selling the development rights to the land; and c) increased profits for the purchaser of the development rights because the additional rights lower the project's per unit development costs. (4)

Because Eden's TDR system is one of the few in existence in the country, and because it is still relatively new, it is too early to judge its success. However, it is certainly a valuable case study for a jurisdiction considering implementing a similar program.

The South Coast Regional Coastal Commission is presently considering implementing a voluntary pilot transfer of development credits (TDC) program in the Malibu-Santa Monica Mountain coastal zone. A transfer of development credit differs from TDR in that the development "rights" are not separable from the land. The developer, in effect, transfers density units from the sending parcel of this land to the receiving parcel; there is no purchase of the development rights involved. (5) Once the developer has transferred the density credits from the sending parcel, he or she can then record a deed restriction preventing development on the parcel, record an offer to dedicate an Open Space or Scenic Easement, or work out an arrangement with the local jurisdiction in which the parcel is located. (5)

The specific goals of the Malibu-Santa Monica Mountain pilot TDC program are to:

- o Mitigate the adverse effects of land divisions approved prior to certification of a Local Coastal Program. This resolves the difficult issues relating to intensification of development in the Malibu-Santa Monica Mountain coastal zone.

- o Reduce the number of existing lots of inappropriately small size in some of the small lot subdivisions in the Santa Monica Mountains, thereby reducing the adverse cumulative effects of such development.

- o Encourage residential use of land which can be best developed for those uses consistent with the policies of the Coastal Act. (6)

The TDC program must be in compliance with local zoning regulations and will be carefully monitored by the Coastal Commission legal staff.

While TDR has been lauded as the new key to implementing effective growth management policies, it has actually been implemented in very few cases. While the reasons for this lack of application are many, the primary one is the program's expense. The major drawback to the development rights purchase program is that it requires large capital outlays to finance as much as 80 percent of the full value of the land. In the coastal zone, where land is especially valuable, the capital outlays would be tremendous. Also, developers often want to build on the coast (where their profits will be higher) rather than in an inland urban area.

Overall, the advantages of a TDR program can be summarized by its moderate political feasibility and by its potential for facilitating local government's task of concentrating development, preserving natural resource areas, and maintaining agricultural preserve areas under pressure to develop. However, like preferential taxation and zoning, a successful TDR program necessitates a strong commitment from local government officials to the goals of the Coastal Act policies. (3)

If the TDC pilot program is implemented in the Malibu-Santa Monica Mountain coastal zone, it will be interesting to see how effective it accomplishes its goals. If it is successful, it could very likely join the Eden example as a model after which coastal jurisdictions could fashion their own TDC or TDR programs. Information is available from the legal office of the State Coastal Commission.

CW

References: 1. B. Budd Chavooshian and Thomas Norman. July, 1975. "Transfer of Development Rights: A New Concept in Land-Use Management." In, The Appraisal Journal. 2. California Coastal Commission. October 31, 1978. "State Interpretive Guidelines." State Coastal Commission, San Francisco. 3. Thomas E. Dickinson, Project Director. January, 1977. Analysis of Agriculture on the Oxford Plain and the Urban/Rural Interface, California Coastal Commission, South Central Coast Region. 4. Manuel S. Emanuel. March, 1977. "Rural Town of Eden uses TDR to save Agricultural Land." In, Practicing Planner.

5. March, 1977. "TDR: What's Happening Now," in Practicing Planner.
6. South Coast Regional Commission. February 16, 1979. "Draft South Coast Regional Commission." February 16, 1979.

TRANSITION ZONES

Transition zones include any number of recognized transitions between land and water environments, such as riparian habitats, wetlands, edge-zones, and ecotones; by implication this includes any area lying between permanently submerged water areas and permanently dry upland areas.
db
(See also: Buffer Areas.)

TSUNAMI

Tsunamis are sea waves produced by any large-scale seismic disturbance of the ocean floor such as submarine earthquake, landslide, or volcanic eruption. This subject is addressed indirectly by the Coastal Act in Section 30253, which states that risks to life and property in areas of high geologic and flood hazard should be minimized. The principal flood hazard of the California coast is the tsunami.

The destructive power of tsunamis is due to the fact that they travel at velocities approaching 400 miles per hour. While they are generally imperceptible in the open sea, tsunamis have been recorded that crested to heights of more than 100 feet before slamming into shore. These great heights are rare and depend on several factors such as offshore topography, tide phase, and coastline orientation and configuration. Hazardous tsunamis may occur along the coastline of the study area as the result of both submarine faulting at great distance and local off-shore faulting.

Earth faulting is the most common source of tsunamis along the California coast. Typical source areas are the great submarine trenches off Chile and Alaska. The latter was the source area for the tsunami that struck Crescent City in 1964 with 13 foot waves claiming 11 lives and causing over 11 million dollars in damages.

Movement along faults in the offshore areas of California is also a potential sources of tsunamis. The Seismic Sea-Wave Warning System administered by the National Ocean Survey (N.O.S.) detects incoming tsunamis and supplies the endangered localities with the expected arrival times of waves. The warning times vary with distance from the source, but for most tsunamis approaching the coast, several hours are available to evacuate citizens and to make emergency preparations.

According to a State Coastal Commission report, tsunami runup studies indicate that runups from a "100-year tsunami" range from 5.4 feet (at Malibu) to 11.7 feet (at Seacliff Beach, Santa Cruz County). (1) The report further states that "due to these variations and the episodic nature of ocean storms and related erosion, detailed studies are needed prior to approval of any proposed development that may be subject to damaging wave conditions...The results of the wave study will aid in determining the best location and design (i.e. elevation, setback, type of foundation, etc.) for the proposed development, if the

development is to be allowed at all." (1) If a planner deduces that his community is susceptible to high tsunami runups, appropriate setback requirements and elevation constraints are important.

Runup information may be available from N.O.S. or the Federal Emergency Management Administration.

jw

(See also: Flood Hazard.)

References: 1. Steve Howe. 1978. Wave Damage Along the California Coast. California Coastal Commission. 2. Envicom Corporation. 1975. Seismic Safety Element. City of Santa Monica General Plan.

VITAL AREAS

Vital areas are physical elements of the coastal ecosystem that are essential to the survival and well-being of certain species, to the functioning of the entire ecosystem, and to the maintenance of optimum carrying capacity. Human-induced impacts that disturb vital areas are particularly damaging to the functioning of the coastal ecosystem. (1)

The protection of vital areas is provided for under Section 30240 of the Coastal Act, which calls for the protection of environmentally sensitive areas.

Three types of vital areas can be identified. "Vital habitat areas" provide general living space for particular species (such as kelp beds, grass beds, breeding areas, nursery areas, etc.). "Vital productivity areas" supply nutrients to the system (such as lower wetlands, upper wetlands, tideflats, etc.). "Vital structure areas" physically protect the ecosystem through their structure (such as sand dunes, wetlands, etc.) (1)

In order to provide maximum protection of vital areas, an inventory of vital areas should be accomplished early in the local coastal planning program. These areas can be identified, evaluated, and mapped for special protection. Provisions can be established so that lands adjacent to vital areas are protected and only limited types of non-altering uses are allowed within vital areas.

(See also: Environmentally Sensitive Habitat Areas.)

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York.

T

V

WATER CIRCULATION

Water circulation refers to the natural movement of coastal waters induced by wind, tide, currents or river inflow. (1) Water movement along the beach greatly affects beach erosion, and a natural circulation regime is essential for the ecological viability of the coastal area. Water circulation is addressed in Section 30235 of the Coastal Act, "...construction that alters natural shoreline processes shall be permitted when required...when designed to eliminate or mitigate adverse impacts on local shoreline sand supply. Existing marine structures causing water stagnation, contributing to pollution problems and fishkills should be phased out or upgraded where feasible." (2)

The circulation of water through an estuary is a key ecological factor. Water motion transports nutrients, propels plankton, spreads the planktonic larvae of fish and shellfish, flushes wastes from animal and plant life, clears the system of pollutants, controls salinity, shifts sediment, mixes water, and does many other things as well. Circulation strongly influences the abundance and the patterns of distribution of life in the coastal water basin, particularly the estuarine basin. Thus the entire dynamic balance of the estuary revolves around, and is strongly dependent on circulation. (1)

Water movement in estuaries is strongly influenced by the configuration of the estuarine basin. (3) The estuarine system includes the water basin and the marginal areas found around the edge of the basin that are seasonally flooded by storms or tides. Water basins may be embayments bays, lagoons, salt ponds or tidal rivers. The fringing marginal area includes the tideflats, mudflats and the saltmarsh wetlands, back to the limit of annual spring flooding, where the floodplain part of the shoreland starts.

Each of four major basin types in California has a different pattern of water circulation: (3)

- Tidal river: A tidal river is the lower reach of a river that enters the sea, often via a transition water body or basin. The coastal segment of the river extends as far upstream as there is significant salt content in the water. Tidal rivers are usually well flushed by the combined but opposite actions of fresh water outflow and tidal inflow.

- Bay: Larger, semi-enclosed coastal water bodies are bays. Bays usually have large openings to the sea that result in a strong tidal flow. They are also well flushed through strong tidal exchange and often receive considerable additional circulation from freshwater flow.

W

- o Embayment: Confined coastal water bodies with narrow restricted inlets and significant freshwater inflow are embayments. Usually they have narrower inlets than bays and are generally shallower and smaller. Embayments usually have less tidal action than bays, and water circulation may be poor, resulting in a poor rate of flushing, unless the freshwater inflow is particularly strong.

- o Lagoon: Confined coastal water bodies with restricted inlets to the sea and with little freshwater inflow are termed lagoons. They tend to have sluggish water circulation and are especially vulnerable to pollution. Thus, their carrying capacities have often been severely reduced by human development around their shores. (1)

  Note: "Wetlands" are not considered as a type of coastal water basin; they are considered as occurring within one of the above types of basin.

The primary management goal for coastal waters is to keep the circulation patterns in as natural a state as possible. Such projects as bridges, spoil piles, deep channels and landfills can significantly affect circulation patterns. Consequently, a fundamental goal of estuarine ecosystem management is to avoid any reduction or blockage of water flow to an estuarine water basin. Uncontrolled development in estuarine watersheds creates adverse effects by reducing: a) the capability of the land to store and regulate the release of rainwater from the watershed, and b) its capability to cleanse itself of sediments, nutrients and other contaminants. The total volume of fresh water reaching coastal waters may also be altered as land is covered with impervious surfaces. Installation of storm drain systems also has a negative impact on flow patterns and prevents recharge of groundwater aquifers. Clearing and grading land have the same effect. (1)

Of particular importance in coastal water circulation is the flow of fresh water because of its effect on the productivity, stability and general health of the coastal ecosystem. Maintaining the original natural rhythms or pattern of seasonal flow is generally beneficial to the ecosystem. Also related to the volume of inflow are the amounts of pollution, sediment, nutrients, minerals, organic matter and other substances dissolved or suspended in the water and carried down into the estuary, all of which affect the general function and the carrying capacity of coastal waters ecosystems.

jt

References: 1. John Clark. 1977. Coastal Ecosystem Management. John Wiley & Sons, New York. 2. California Coastal Act of 1976. California Public Resources Code, Division 20, Sections 30000 et seq. Also cited as Chapters 1330, 1331, and 1440 of the California Statutes of 1976. 3. Francis Shepard. 1973. Submarine Geology. Third Edition, Harper and Row, New York. 4. California Coastal Zone Conservation Commissions. 1975. California Coastal Plan. State of California, Sacramento.

WATERFOWL

(See: Birds.)

WATER QUALITY

(See: Restoration of Water Quality.)

WETLANDS OF THE COAST

Coastal wetlands, in the context of the Coastal Act, include both salt and freshwater areas. Saltwater wetlands, such as saltmarshes and brackish marshes, are areas subject to saline and/or tidal influences. Freshwater wetlands are areas where the water table stands near or above the land surface for at least part of the year.

In the Coastal Act, wetlands are recognized as endangered marine resources which should be protected from adverse alterations. Section 30231 states that the biological productivity of wetlands and other coastal water areas should be "...maintained and, where feasible, restored...." Accordingly, local coastal plans "should contain consistent policies that will support maintenance and enhancement of marine resources, biologically and economically significant areas, and the quality of coastal waters," (1) including wetland areas. The Coastal Commissions have been very protective of wetlands in the permit program.*

Because of the great importance of wetlands to coastal ecosystems, the high level of concern given to them by the Coastal Commission, and the usual resistence of landowners to their preservation, it is necessary to have as precise a definition as possible. In the most usual sense, wetlands are tidal or freshwater-flooded or saturated areas which have special, water-oriented plants growing in them. It is essential to realize that the term, "wetlands," does not include areas that are permanently submerged, except by specific reference. This exception often seems to apply to coastal areas of California, since the whole of a small lagoon-type estuary is often called a wetland, thereby including both tidal and sub-tidal areas and all the waters.

The Army Corps of Engineers uses the narrow definition of wetlands in its permit program under Section 404 of the Federal Water Pollution Control Act Amendments of 1972. (See: Wetlands Policy: Federal.)

> ...those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas....(2)

The term "saturated" is the key word in this definition.

The U.S. Fish and Wildlife Service (FWS) uses a broader definition of wetlands in permit review under the Fish and Wildlife Coordination Act:

> ...land where the water table is at, near or above the land surface long enough to do either of the following: a) promote the formation of soils that are saturated with water at or near the surface and are deficient of oxygen long enough during the growing season to result in solid properties that reflect dominant wetness characteristics near the soil surface (within 10"); or b) support the growth of plants which grow in water or in wet habitats. The upland limit of wetland is designated as: 1) the boundary between land which is capable of supporting plants which grow in water or wet habitats and land which is only capable of supporting plants which grow in habitats of an intermediate degree of wetness or in dry habitats; 2) the boundary between soil that is saturated with water at or near the surface and exhibits dominant wetness characteristics, and those soils which are not saturated and do not exhibit dominant wetness characteristics. (3)

This definition expands the definition of wetlands from inundated, saturated areas to include permanently submerged and aquatic forms of habitats.

The State of California's definition of a wetland, under Section 30121 of the Coastal Act, states that:

> "Wetland" means lands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, and fens.

In certain wetland situations, vegetation is lacking and soils are poorly developed or absent as a result of frequent and drastic fluctuations of surface-water levels, wave action, water flow, turbidity, or high concentrations of salts or other substances in the water or substrate. Such wetlands can be recognized by the presence of surface water or saturated substrates at some time during each year and their location within, or adjacent to, vegetated wetlands or deep water habitats. In this case, the limits of a wetland may be defined as the boundary between land that is flooded or saturated at some time during years of normal precipitation and land that is not. This would therefore include such formations as tideflats and salt pannes.

In addition, the FWS states that wetlands and tilled lands are not necessary mutually exclusive. It may be possible that during dry periods, land which meets the previous FWS definition may be farmed, but if not tilled or planted, will support wetland type vegetation. This would

mean that local conditions should be examined when evaluating wetland-type areas, as some areas may not be year-round wetlands but may have seasonal wetland value.
db
(See also: Degraded Wetlands, Wetlands Restoration.)

References: 1. California Coastal Commission. 1977. Local Coastal Program Manual, Sacramento. 2. U.S. Army Corps of Engineers. 1977. "Regulatory Programs of the Corps of Engineers." Federal Register, Vol. 42, No. 138, Tuesday, July 19, 1977. 3. U.S. Fish and Wildlife Service. 1977. Classification of Wetlands and Deepwater Habitats of the United States (An Operational Draft). FWS, Department of Interior, Washington, D.C. 4. Conservation Foundation. In press. Coastal Environmental Management. Federal Insurance Administration, Washington, D.C.

* Appeal No. 437-77. The Commission denied a permit to divide 10.9 acres into 2 parcels of 9.9 acres and 1 acre, City of Eureka, Humboldt County. At issue was the need to protect coastal wetlands.

Appeal No. 328-78. Commission granted permit with conditions concerning wetland protection and slope stabilization for office/shop building, City of Carlsbad, San Diego County.

Appeal No. 433-78. The Commission denied a permit for 68 condominium units, San Diego County. At issue were wetlands protection, traffic and public access, and reservation for commercial recreation.

WETLANDS POLICY: STATE

The California Coastal Act of 1976 specifically provides for the protection of wetlands. The state interest in wetlands protection is also exercised through the permit power of the administrative bodies within the State Resources Agency. Local land use decisions are influenced because development requires state as well as local permits.

The Coastal Commission, pursuant to the policies of the Coastal Act, provides for the protection of wetlands (through the state permit process) until the local coastal programs (LCP's) are approved. The state Assembly Office of Research reports that the State Coastal Commission has adopted statewide LCP priorities to guide local jurisdictions in focusing their programs on the most important issues. (1) Protection of natural resources, including wetlands, is given priority second only to planning for undeveloped urban land facing heavy development pressure.

Sections 30231 and 30240 of the Coastal Act state that the quality and productivity of wetlands should be maintained and, where feasible, restored. Development adjacent to wetlands should be sited in a manner that protects the wetland from disruption of its habitat values. Section 30233 permits diking, dredging, or filling of a wetland only for

specified coastal-dependent uses which have no feasible alternative and which include all feasible mitigation measures. The Coastal Act also adds Section 13142.5 to the Water Code, requiring that waste-water discharged into wetlands be of a quality that protects existing beneficial uses and, where feasible, restores past beneficial uses of the wetlands. The Coastal Commissions are very protective of wetlands in their permit programs.*

The State Coastal Commission has indicated that the Commission staff follows certain unofficial wetlands development criteria when reviewing LCP submittals. These review criteria are protective of wetlands. They represent the contents of what the Coastal Commission's staff feels is an adequate wetlands section of an LCP. However, since these guidelines are unofficial, they are not applied in every case and the Coastal Commission is not bound to accept all staff recommendations based on these criteria.

Based on these unofficial guidelines, Commission staff recommends the following:

- Diking, dredging, and filling of wetlands should be prohibited, except for the special conditions described in Section 30233 of the Coastal Act. Conditions for granting a dredging permit may include: a) prohibition of construction activity in wildlife breeding and nursery areas and during migration and breeding periods; b) limiting of construction activity to the smallest possible area; c) inclusion of measures such as silt curtains and weirs in projects designed to protect water quality; and d) deposition of dredge spoils in the littoral dirft, away from areas subject to tidal influence or where public access would be impaired. Sandbars may be dredged to maintain tidal flow in a wetland.

- Permanent structures should be banned within a wetland except for structures designed to enhance the natural resource values of the wetlands (e.g. interpretive facilities). Recreational use of wetlands can be enhanced by the installation of light-duty, pile-supported structures such as blinds, catwalks, and piers. Any such structure should be above the 10-year flood level and cover no more than 0.5 percent of the wetland surface. Any area disrupted during installation of these facilities would be restored to its natural condition. Residential development or other operations with which domestic pets are associated should not be located next to wetlands. Where existing developments are causing animal problems, suggested controls include fencing or other physical boundaries which protect the wetland. Septic tanks installed adjacent to wetlands must strictly conform to design and performance standards set by the Regional Water Quality Control Board.

- All construction in or adjacent to a wetland should be limited to a period which will minimize disruption of fish and wildlife, particularly breeding birds, as determined by the State Department of

Fish and Game (DFG). A 100-foot buffer strip, maintained in its natural condition, is suggested along the periphery of all wetlands. (2)

- Agricultural lands that qualify as seasonal wetlands should be limited to agricultural use or other open space uses that preserve wetland functions. Filling or diking of wetlands to bring land that has not been in agricultural use into production should be prohibited.

- Development should take place in increments that can be completed in a single construction season. Erosion and sediment control measures should be coordinated with the sequence of grading and construction operations. Open faces, grades, and cuts should be covered with vegetation as soon as possible. The relase rate of storm water from all developments in a wetland is suggested not to exceed the natural storm runoff rate. Extensive grading and erosion ordinances are recommended, which set strict standards for grading and construction practices. Accompanying manuals would delineate formulas and procedures to be followed in the preparation of grading and construction plans.

- All developments and zoning are expected to comply with guidelines and critical habitat designations of the Federal Endangered Species Act. Development is not to interfere with endangered and rare plants and animals designated by the state. (3)

The State Resources Agency is charged with state natural resources policy coordination. It has a basic wetlands policy which states that the agency, its departments, board, and commissions will not authorize or grant permits to projects that harm or destroy coastal, estuarine, or inland wetlands. Exceptions to this policy may be granted provided that the projects are water-dependent, have no feasible alternative, do not adversely affect the public trust, and provide adequate mitigation. This policy is strengthened by its interrelation with the Coastal Act and Federal wetland conservation programs.

The Department of Fish and Game (DFG), by authority of the Coastal Act, has the responsibility for identifying wetlands and determining the restorability of degraded wetlands (Section 30233(a),(8)(c) and 30411(b)). These designations are made on a case-by-case basis upon Coastal Commission request. When DFG receives a formal request from the Coastal Commission, its coastal resources staff studies specific wetlands as to the degree of degradation and restoration potential. DFG findings must be incorporated into the Commission's permit decision and project mitigation measures. DFG also reviews Section 404 permit applications at the request of the Army Corps of Engineers. By informal agreement, the Corps will not grant a Section 404 permit unless the application has been reviewed and approved by DFG. The Corps has also agreed to impose any permit conditions recommended by DFG that do not conflict with Federal policy.

DFG has three basic criteria, which guide its recommendations regarding wetlands acquisition, protection, and restoration:

- Protect the habitat of rare and endangered plant and animal species. Areas that can feasibly be enhanced to induce the return of such species should also be protected.

- Wetland boundaries must be clearly identifiable and include a sufficient buffer area for protection from outside influences.

- A diversity of habitat types sufficient to allow long-term functioning of the established ecosystem must be preserved.

Section 1601 of the Fish and Game Codes also gives regulatory power over wetlands to the DFG. The Department's wardens have the authority to protect wetlands through fines and other regulatory actions. However, the awareness and enforcement system behind the program is weak.

The California Coastal Conservancy was established to preserve coastal resources in areas where regulation alone is inadequate, areas which require instead restoration, buffer zones, land acquisition, or other alternatives. The Conservancy's primary role in wetlands protection is to assist local governments in enhancing, rehabilitating, managing, and, to a lesser extent, acquiring those degraded wetlands not under state or Federal ownership or investigation for purchase. In an unofficial statement, the Conservancy indicated that it intends to address the problems of water supply, tidal flushing, sedimentation, habitat destruction, pollution from urban runoff, mosquito control, and vandalism in its wetlands projects.

Local governments have the responsibility of initial interpretation of the wetlands policies in the Coastal Act. The Coastal Commission has maintained a generally reactive role, reviewing LCP's and commenting on their adequacy -- there is no formal in-progress review procedure. (2) Local planners are thus faced with the difficulty of predicting how the Commission will interpret Coastal Act wetlands policies and what implementation measures are likely to be approved in plan certification.

Local planners can gain some insight into Commission interpretation of Coastal Act provisions, before their LCP's are submitted to the Commission, by reviewing Commission decisions on permit applications in wetlands. Most Commission permit decisions reflect a strict adherence to the requirements of Section 30233. However, Commission decisions indicate that blanket prohibition of wetlands development is not necessary. Section 30233 is often enforced by attaching conditions to permits. Frequently imposed permit conditions include buffer dedication, drainage enhancement, deed restrictions, and protection, stabilization, and restoration of wetlands and lagoons. Grounds for permit denials have included flood hazards, irreparable damage to sensitive habitats, destruction of scenic qualities, and general need to preserve coastal wetlands.

The DFG might be consulted by local jurisdictions at an early stage in LCP preparation. Local planners need to be aware of whether a wetland in their jurisdiction is on the DFG list of acquisition priorities or is being considered for such designation. For stressed wetlands, local planners can request from DFG an indication of when and how official determination of degradation and restoration potential will be made. Local planners may want to coordinate preliminary DFG studies with preliminary studies made by the Army Corps of Engineers. This would encourage early state-Federal communication and cooperation regarding a specific area.

The Coastal Conservancy is a promising source of financial and technical assistance to local governments for wetlands conservation. Local planners could contact the Conservancy and arrange for a staff member to inspect the wetland, explain the various Conservancy programs and discuss the likelihood of obtaining assistance.
ea
(See also: Wetland Policy: Federal, Wetland of the Coast, Wetlands Restoration.)

References: 1. California Coastal Commission. 1979. Informal communication with Eric Metz, Coastal Commission Wetlands Coordinator, May 1979. 2. California Assembly Office of Research. 1979. "An Assessment of the California Coastal Planning Process". Sacramento, California. 3. California Resources Agency. 1977. "Basic Wetlands Protection Policy," The Resources Agency, Sacramento, California.

* Appeal No. 433-78. The Commission denied a permit for 68 condominium units, San Diego County. At issue were wetlands protection and other issues.

WETLANDS POLICY: FEDERAL

Federal authority, primarily through the Army Corps of Engineers permit system, overrides state and local authority in most wetlands areas. No alteration of a wetland that involves filling or excavation can occur without a Federal permit, even if all other state and local permits have been obtained. It is of utmost importance that a local jurisdiction be aware of the area over which Federal authority is defined and regulatory powers vested and how they relate to local coastal planning.

Federal regulatory authority over coastal waters stems mostly from Section 10 of the River and Harbor Act of 1899, which applies to navigable waters, and Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (The Clean Water Act) which applies to all waters of the United States. Wetlands development in most cases is controlled by the provisions of Section 404 because wetlands are not commonly defined as navigable waters. Section 404 was enacted as part of the congressional assertion of authority over interstate commerce in order to control threats to U.S. water quality.

The Army Corps of Engineers is the lead agency responsible for Section 404 permits, although the Environmental Protection Agency (EPA) is given final permit authority under Section 404 because it must approve areas for deposit of fill or dredge spoil. (1)

The Corps and EPA receive assistance from the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) through the Fish and Wildlife Coordination Act. This act requires that each Federal agency proposing to modify water bodies submit its plans to both FWS and NMFS and full consideration must be given to their recommendations. In this capacity, the FWS works particularly closely with the Corps on their permit process. While it is not mandated that FWS recommendations be required as a condition for the issuance of a permit, the Departments of Army and the Interior have formally agreed that no permit can be issued by any Corps field office over FWS objections. This can only be done at the Washington, D.C. level after consultation between the Army and the Department of Interior (parent agency of FWS). If the proposed work in navigable waters involves the alteration or destruction of valuable wetlands areas, the FWS subjects an application for a federal permit to three tests. The applicant is required to show that:

- The proposal is water-related or water-dependent.
- There are no alternate upland sites available.
- There is an overall public need for the proposal. (2)

FWS has identified residential and commercial development, factories, parking lots, roads and highways, spoil and dump sites, waste treatment lagoons, and small boat storage sites as unacceptable in wetlands. (1)

Formal Corps wetlands policy is expressed in permit review regulations issued by the Corps in July 1977. (3) Wetlands alteration or destruction is discouraged by the Corps as contrary to the public interest. The public interest with respect to any given wetland area can be defined in terms of valuable natural functions provided by wetlands, including:

- Wetlands which serve important natural biological functions, including food chain production, general habitat, and nesting, spawning, rearing, and resting sites for aquatic or land species.
- Wetlands set aside for study of the aquatic environment or as sanctuaries or refuges.
- Wetlands in which destruction or alteration would detrimentally affect natural drainage characteristics, sedimentation patterns, salinity distribution, flushing characteristics, current patterns, or other environmental characteristics.

- Wetlands which are significant in shielding other areas from wave action, erosion, or storm damage. Such wetlands are often associated with barrier beaches, islands, reefs and bars.

- Wetlands which serve as valuable storage areas for storm and flood waters.

- Wetlands which are major groundwater recharge areas.

- Wetlands which through natural water filtration processes serve to purify water.

Corps policy also places emphasis on evaluating the cumulative effects of piecemeal wetlands alteration. Finally, the Corps may deny any permit unless the applicant demonstrates that the project is in the public interest and that the benefits from alteration outweigh the damage to the wetland. The burden of proof is on the permit applicant, making this policy highly restrictive to wetland alteration.

The EPA has a wetlands policy calling for protection of all wetlands from abuse and destruction from point source (e.g. sewage outfall lines) or nonpoint source (e.g. runoff) water discharges. When combined with the policies and regulatory responsibilities administered by the EPA under the 1972 Federal Clean Water Act, this statement calls for the EPA to minimize alteration in the quality or quantity of natural water inflow and withdrawals, to protect wetlands from adverse dredging and filling practices, siltation, or the addition of toxic materials arising from nonpoint source wastes and construction activities, and to prevent violations of applicable water quality standards. (4)

There is also a Presidential wetlands protection policy (Executive Order 11990) which applies to all Federal agencies. (5) It reinforces Section 404, with specific policies to guide Federal construction projects. This order does not apply to the issuance of permits by Federal agencies to private parties for activities involving wetlands on non-Federal property. The Army Corps of Engineers' Section 404 permit process is independent of this order.

Past actions show that the Corps adheres fairly strictly to its wetlands policies. Permit applicants must make a compelling argument that the public interest is better served by altering the wetland at the expense of the valuable natural wetland functions identified by the Corps. The courts have consistently upheld permit denial on applications that the Corps felt did not meet the water dependency, alternatives, public interest and mitigation measures tests of Section 404.

The protectionist stance of the Corps is strongest when the area in question is a healthy, viable, relatively pristine wetland. The natural functions of most California wetlands have been impaired or lost. The Corps may become more inclined to grant a wetlands permit because of the apparently reduced value of the surviving wetland and the cost of

restoration. There is no set of criteria that can identify the threshold below which the natural values are overridden by the public values of development. The Corps must rely on case-by-case ad hoc review.

Because the Federal government has the ultimate authority and permit power over wetlands, local jursidictions need to determine what particular wetland types the Corps is likely to extend its jurisdiction over and the type of development (if any) that the Corps is likely to allow. Predicting decisions which the Corps may make in the future is one of the greatest difficulties facing local coastal planners. The Corps is not required to take any specific position regarding wetland use until a permit application is filed. However, it can conduct environmental surveys and informally comment on its area of jurisdiction and its policies. A local jurisdiction containing an area that may fit the Federal definition of a wetland might consider contacting the appropriate district office of the Corps for advice on the extent of Corps jursidiction and an informal review of Corps policies on wetland alteration.
ea
(See also: Dredging and Filling, Section 404: U.S. Clean Water Act, Section 10: River and Harbor Act.)

References: 1. John R. Hill, Jr. and Lance D. Wood. 1978. "Wetlands Protection: The Regulatory Role of the U.S. Army Corps of Engineers." In Coastal Zone Management Journal, Vol. 4, No. 4. 2. James D. Brown. undated. "Department of the Army Permits, Fish and Wildlife Service Perspective," Prepared by Fish and Wildlife Service, Division of Ecological Services, Washington, D.C. 3. Army Corps of Engineers. 1977. Permit Regulations, Section 320.4. "General Policies for Evaluating Permit Applications, B. Effect on Wetlands." July 19, 1977. 4. Environmental Protection Agency. 1973. "Wetlands Policy -- U.S. Environmental Protection Agency." In Federal Register, Vol. 38, No. 84, May 2, 1973. 5. Executive Order 11990. 1977. "Protection of Wetlands." In Federal Register, Vol. 42, No. 101, May 24, 1977. 6. Fish and Wildlife Service. 1975. Federal Register, Vol. 40, No. 231, Part IV, December 1, 1975.

WETLANDS RESTORATION

Wetlands restoration refers to appropriate actions necessary to rehabilitate altered and damaged elements of a marsh ecosystem to their natural condition. Restoration can be achieved through measures that increase the productivity, the habitat and the general ecological value of the area, raising the carrying capacity of the wetland (see: Carrying Capacity).

Since restoration entails the attempt to put a wetland resource into its original condition as nearly as possible, a baseline is needed on which to model restoration actions. This can be accomplished either through researching the past record of the area to find out what the natural conditions were in historic times or through comparing the wetland with other wetlands in similar areas which are still in a relatively pristine

state.

The California Coastal Act recognizes the value of restoring degraded wetlands and in some circumstances requires that restoration be included in development plans.* Section 30231 of the Coastal Act states that:

> Marine resources shall be maintained, enhanced, and, where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance.

This includes wetlands. Further, the Act states in Section 30231 that:

> The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored...

In addition, the Act, in Section 30411, declares that the Department of Fish and Game may study degraded wetlands and identify those which can most feasibly be restored in conjunction with development of a boating facility, as provided for in Section 30233. Any such study by the Department must include consideration of:

- Whether the wetland is so severely degraded and its natural processes so substantially impaired that it is not capable of recovering and maintaining a high level of biological productivity without major restoration activities.

- Whether a substantial portion of the degraded wetland, but in no event less than 75 percent, can be restored and maintained as a highly productive wetland in conjunction with a boating facilities project.

- Whether restoration of the wetland's natural values, including its biological productivity and wildlife habitat features, can most feasibly be achieved and maintained in conjunction with a boating facility or whether there are other feasible ways to achieve such values.

The California Coastal Conservancy can implement programs of wetlands restoration and resource enhancement in the coastal zone that are in conformance with the policies and guidelines of the Coastal Act. The Coastal Conservancy has no formal wetlands policy, but a staff document of November 9, 1978 discussed some Conservancy objectives:

> The Conservancy's primary role in its wetlands projects will be to assist local governments in enhancing, rehabilitating, managing, and to a lesser extent, acquiring those degraded wetlands not under state or federal ownership or investigation for purchase.

Therefore, it is strongly recommended that local planners contact the Conservancy for advice on the potential for restoring and buffering specific wetland areas (see: Buffer Areas). The Conservancy may award grants to local public agencies for the restoration of areas that are adversely affecting the coastal environment. Grants may also be obtained for acquisition of adjacent buffer areas and for coastal access and open space lands within the restoration area. The Conservancy can also help support local planning studies, receive land gifts, and agree on land use tradeoffs with local governments. Under certain circumstances, the Conservancy may actually undertake the physical restoration of areas.

An example of Coastal Conservancy action in the restoration of wetlands is the Arcata Marsh Enhancement Project #1, located in Humboldt County. A degraded wetland area south of the City of Arcata is to be restored by a program consisting of: (1)

- The enhancement of wetland habitat through the construction of three marsh areas to be created by the removal of fill, the placement of dikes, and the diversion of water from the Jolly Giant Creek and Janes Creek to provide a freshwater source for the marshes.

- Dredging and grading of an existing basin to form a lake that is able to support recreational fishing and that contains loafing islands for water fowl.

- Construction of a public use facility which includes nature interpretive facilities and a picnic area.

- The construction of ponds for aquaculture and fish imprinting.

The restoration of ecological functions may also be required for wetlands alteration as a form of mitigation by the Army Corps of Engineers, which has permit authority over all wetlands in the United States (see: Wetlands Policy: Federal and Wetlands Policy: State).

Restoration can be accomplished through design criteria covering the following principal objectives discussed briefly below: (2)

- Tidal flushing: This is often the most important factor in coastal saltmarsh wetlands. Tidal flushing energizes the entire saltmarsh system. The degree of tidal inundation and tidal height determines the distribution and condition of vegetation over a wetland area, which in turn affects the distribution of wildlife and the general functioning of the wetlands. Therefore, a major restoration goal for saltmarsh systems would be to provide for adequate tidal

flushing.

- Topography: The intertidal slope (or angle of repose) of marsh sediments and mudflats is a key feature in the functioning of a saltmarsh wetland. The more gradual the slope, the greater the area of exposure/submergence during the tidal cycle. Thus, a gradually sloping surface between low and high water is preferred over a steep bank, particularly if cordgrass is present. The upper surface of the marsh should not have isolated basins or flats that are not tidally formed because they often become stagnant, breed mosquitoes, or become dry salt flats. Care should therefore be taken to insure that the topography of the restored areas is proper.

- Soil types: The water-holding quality of marsh sediments is an important factor which controls the distribution of marsh plant species. Since the water requirements of many species of wetlands vegetation are critical, the function of soil type in retaining water is an important factor in maintaining vegetation viability. Care should be taken to ensure that the proper soil types are used for wetlands restoration activities.

- Vegetation types: The interaction of such factors as tidal range, elevation, topography, and salinity determines the species of plants present and influences the nature of the natural zonation of plants across the profile of a wetland. Any attempt towards restoration should respect this natural zonation.

- Habitat diversity: Habitat diversity is directly related to biotic diversity: the greater the habitat/diversity in an ecosystem, the greater the biotic diversity. Since a high biotic diversity is assumed to lead to better ecosystem balance and provides for greater resilience to catastrophic events, improving the biotic diversity of a wetlands should also be a restoration objective.

- Provision for needs of animal species: Various wetland-dependent animal species have different needs and requirements. Careful provision should be made to provide for these in restoration attempts. In addition, a restoration objective may be to re-introduce species that previously existed, but have left the area because of disturbance. Careful study of the habitat requirements of these species, particularly endangered species, should be made in order to provide adequately for their needs.

Wetlands will be in different stages of restorability, depending upon the degree of alteration which has occurred. Some areas may be restored effectively merely through the provision of better ocean access and/or the construction of a few channels to enhance tidal circulation. Other wetland areas may require more extensive actions such as regrading and reshaping areas which have been filled, excavated, and otherwise altered; or the entire area may require extensive work. In some cases, the replanting of appropriate wetlands vegetation may be required, as well

as the implementation of erosion and sedimentation control procedures throughout the construction phase.

It is suggested that local planners considering wetlands restoration needs, in the context of the local coastal planning process, assess, before-hand, the feasibility of such action, given the nature of the area under consideration. Professional scientific help may be required in the form of general consulting during the planning process, with a fuller study needed when implementation is considered. Possible sources of such help include the Department of Fish and Game (DFG), the U.S. Fish and Wildlife Service (FWS) and local universities.

Where restoration of a given wetland area is constrained by economic considerations, phased enhancement is possible. Accordingly, activities such as the re-establishment of better tidal circulation and/or regrading could be accomplished as a first stage. Improved channels, culverts, berms, or specific wildlife habitats could be added as funding becomes available.

Once a wetland is restored, the provision of an adequate buffer area to protect the resource values of the area is suggested. (See: Buffer Areas.)

Local government agencies can contact the California Coastal Conservancy for professional assistance in restoration projects. Additionally, the DFG can be of assistance in determining the degree to which a particular wetland is degraded, and the need for and feasibility of its restoration. Often the DFG itself will restore a wetland. An example of a current DFG wetlands restoration project is the Bolsa Chica wetlands area in Orange County. The wetland has been degraded through dredging, diking, filling, oil drilling, road building, and adjacent development. Restoration activities include construction of a new tidegate system across the entrance of the main channel into Bolsa Bay, a peripheral dike system, and visitor walkways to accommodate passive recreational demand. (3)

Wetlands restoration activities should be carefully considered and planned out, and ample consideration given to project effects upon the existing ecosystem.

db

(See also: Degraded Wetlands, Buffer Areas, Wetland of the Coast.)

References: 1. California Coastal Commission. May 7, 1979. Staff Recommendation for Coastal Conservancy Project #1 (Arcata Marsh Enhancement Project). California Coastal Commission, San Francisco. 2. Environmental Planning Team. May 15, 1979. Ballona Wetlands Study (Draft). Urban Planning Program, School of Architecture and Urban Planning, UCLA. 3. EDAW Inc., Environmental Planners. November 1978. Draft Report to the Bolsa Chica Study Group. 4. Ecological Services. May 1979. Bolsa Chica. U.S. Fish and Wildlife Service, Laguna Niguel, California.

* Appeal No. 25-78. Commission granted a permit with conditions concerning wetland restoration to the State Department of Parks and Recreation for group and bicycle campground, and day-use parking area, in Emma Wood State Beach, Ventura County.

AMERICAN LITTORAL SOCIETY

The Littoral Society is a non-profit public interest organization made up of members interested in the well-being of the sea, especially the sea close to land.

This Special Publication No. 10 is another effort of the Littoral Society to cultivate an interest in the study and conservation of coastal and marine life. Other special publications deal with power plant siting, fish habits and conservation, coastal management, and so forth.

Regular Society publications include "Underwater Naturalist", a quarterly magazine covering coastal marine life, and newsletters which concentrate on environmental issues. In addition, the Society sponsors field trips, seminars, and the world's largest volunteer fish tagging program.

All Littoral Society activities serve its members and all are supported by membership dues ($15 annually). For information about the Society or for a membership application, please write to Society headquarters:

AMERICAN LITTORAL SOCIETY
SANDY HOOK
HIGHLANDS, NEW JERSEY
07732