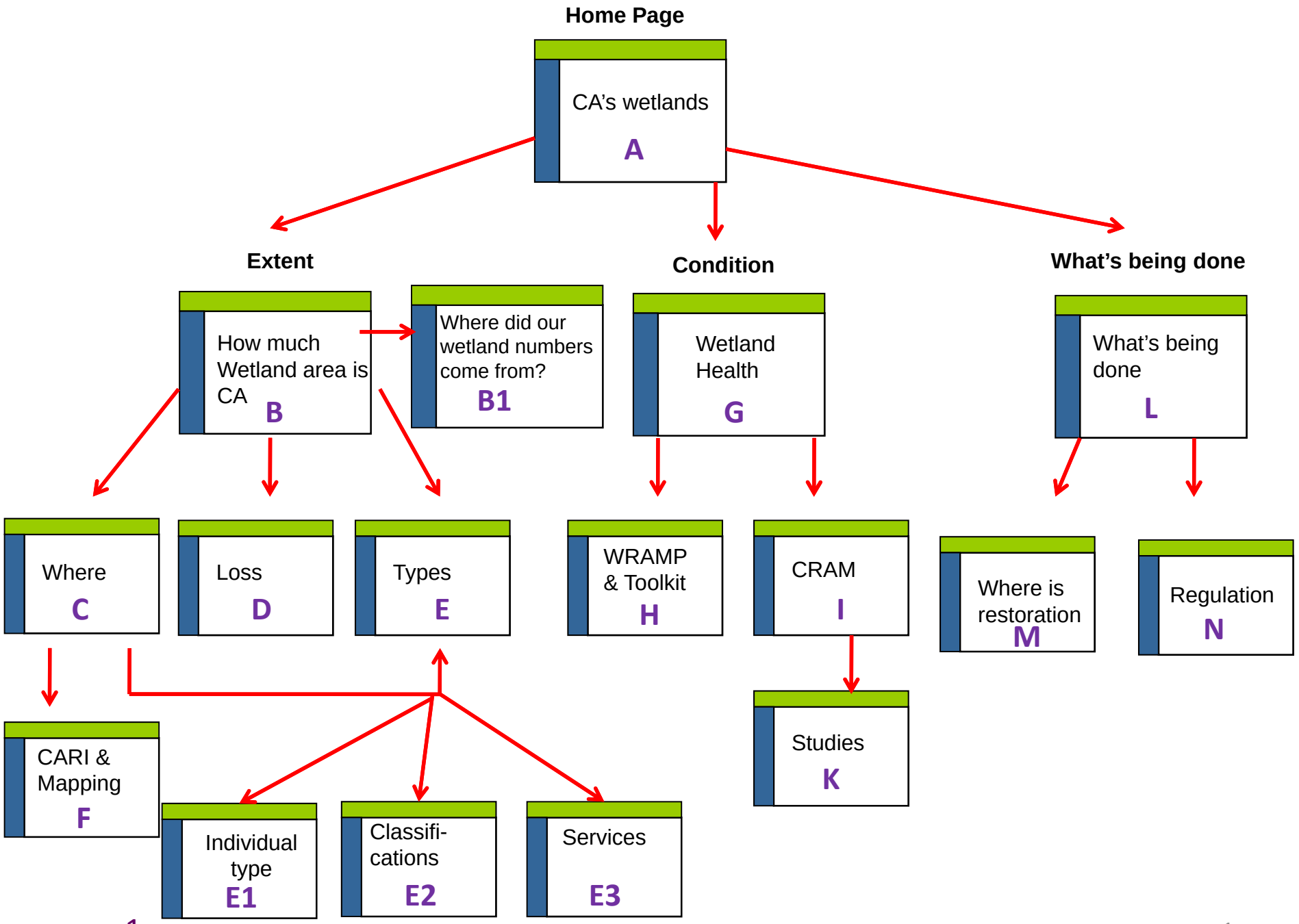
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Where are California's wetlands and how are they doing?

Vernal Pool at Mather Field, Sacramento County
At certain times of the year, vernal pools dot the landscape with colorful vegetation and unique wildlife.
(David Rosen , Wildside Photography)

Questions Answered

- What is the extent of our wetlands?
  - Where did our numbers come from?
  - Where are they?
  - How much have we lost?
  - What type are there?
  - How do we classify them?
  - What services do they provide?
  - What is the status of mapping?
- What is the condition of our wetlands?
  - How do we know how they're doing?
  - How do we assess wetland health?
  - What studies have documented wetland condition?
- What is being done for our wetlands?
  - What regulations protect them?
  - Where are wetlands being restored near me?

both aquatic and terrestrial characteristics. Wetlands form along the s of lakes, estuaries, and rivers, and in areas with high groundwater ace water, such as springs, wet meadows, ponds, and freshwater and They often go through wet and dry cycles, and therefore support a f life specially adapted to these conditions.

ide important habitat for birds, fish, and other wildlife. They support s, contribute to flood protection, groundwater recharge, shoreline d water filtration: all important ecosystem services.

ost more than 90% of its historical wetlands, and today, many lands are threatened. Wetlands continue to be drained for ed for development, or disturbed by modifications to the watershed r water diversions. Climate change poses a significant threat, as s today are dependent on artificial water delivery systems or high evels, and may be impacted by changing climatic conditions. Further, the coast face flooding from potential sea level rise.

e found in every region of California, but are not distributed evenly e. They are concentrated in the San Francisco Bay, Sacramento-San Joaquin River Delta, Central Valley, Sierra, Modoc Plateau, and along coastal areas and river valleys.

Because of their value and vulnerability, wetlands are protected by a series of special laws and permitting requirements. The following links contain more information about the health and distribution of California's wetlands.

← Collapsible sections on Questions Answered

2
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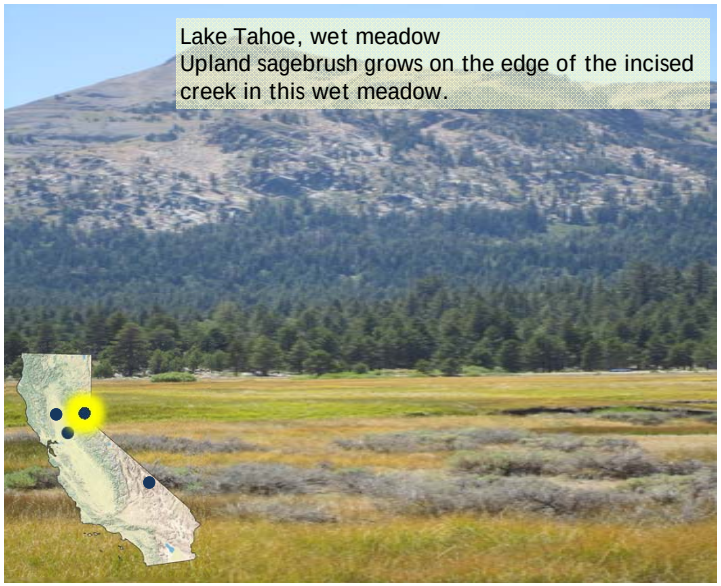
Interactive element

A.

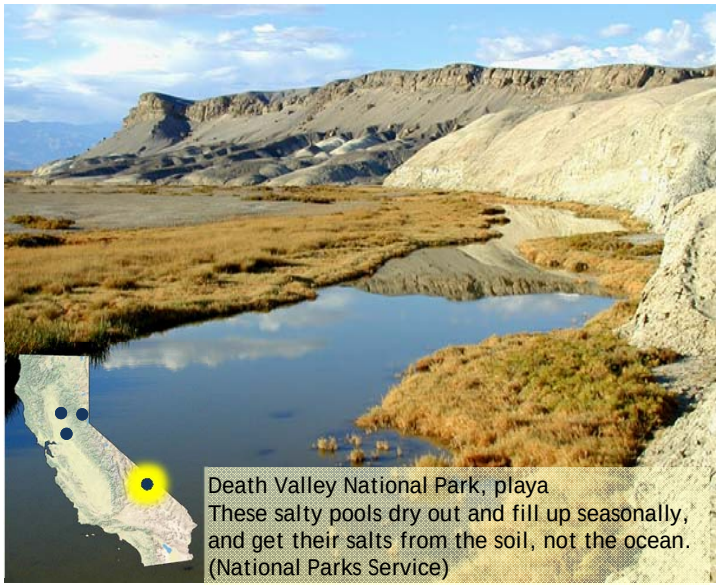
Vernal Pool at Mather Field, Sacramento County
At certain times of the year, vernal pools dot the landscape with colorful vegetation and unique wildlife.
(David Rosen , Wildside Photography)

Mather Field, Sacramento County, vernal pool
At certain times of the year, vernal pools dot the landscape with colorful vegetation and unique wildlife.
(David Rosen , Wildside Photography)

Georgiana Slough in the Sacramento-San Joaquin Delta
The estuarine wetlands of the Delta are an important stopping-point on the Pacific flyway for migrating birds.



Lake Tahoe, wet meadow
Upland sagebrush grows on the edge of the incised creek in this wet meadow.



Death Valley National Park, playa
These salty pools dry out and fill up seasonally, and get their salts from the soil, not the ocean.
(National Parks Service)

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California's wetlands

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Code and host

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480x302 interactive element

Primary landing page

A.

Interactive element

- Very simple map with 4-6 specific locations highlighted. Upon a click, mouseover for any of the locations, an image appears of a wetland at that specific site. This could also be an automatic scroll through the pictures.

6
Interactive element detail

LW B.

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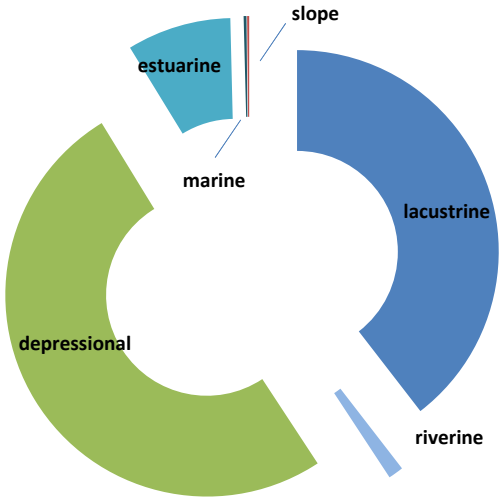
How much wetland area is there in California?



Wetland Type	Wetland Area (acres)
Depressional	2,156,700
Lacustrine	1,687,078
Estuarine	356,462
Riverine	51,957
Marine	9,560
Slope	7,008

According to the State of the State's Wetlands, there are approximately 2.9 million acres of wetlands in California today. Although vast, this represents only 10% of the estimated historical extent of wetlands. The numbers to the right are from a more recent estimate of modern wetlands that uses new data. This estimate sets the total to about 4.3 million acres of wetlands, which is about double the previous number, yet still only 20% of the historic wetland extent.

The wetlands present today include a diverse array of types. Wetlands that occur at the margins between the land and the ocean are known as estuarine wetlands, and those that are found on beaches and dunes overlooking the ocean are called marine wetlands. Riverine wetlands occur along the edges of streams and rivers, and include a range of wetland types, from vast forests to small streamside marshes. Other wetland types occur at the edges of lakes (lacustrine), in low points (depressional), and on hillsides (slope). Wetlands range from shallow ponds to springs, vernal pools, and willow swamps. Each wetland type supports a distinct group of species and performs important watershed functions such as sediment and water storage and filtration.

The majority of wetlands by area are depressions (e.g. freshwater marshes, ponds) and lakes. Together, these wetland types make up 90% of the total wetland extent. The remaining 10% are split between riverine, estuarine, and marine wetlands. Information and images about each of the major wetland types found in California can be found here.

Wetland extent in CA

What is the extent of our wetlands?
- Where did our numbers come from?
- Where are they?
- How much have we lost?
- What type are there?
- How do we classify them?
- What services do they provide?
- What is the status of mapping?

SFEI to provide size and resolution
numbers and graph to be updated
pending recalculation of NWI/NHD depressional to pull out slope

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How much wetland area is there in California?

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Water Board to code and host

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Waterboard code and host

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Add data gaps to legend B1.

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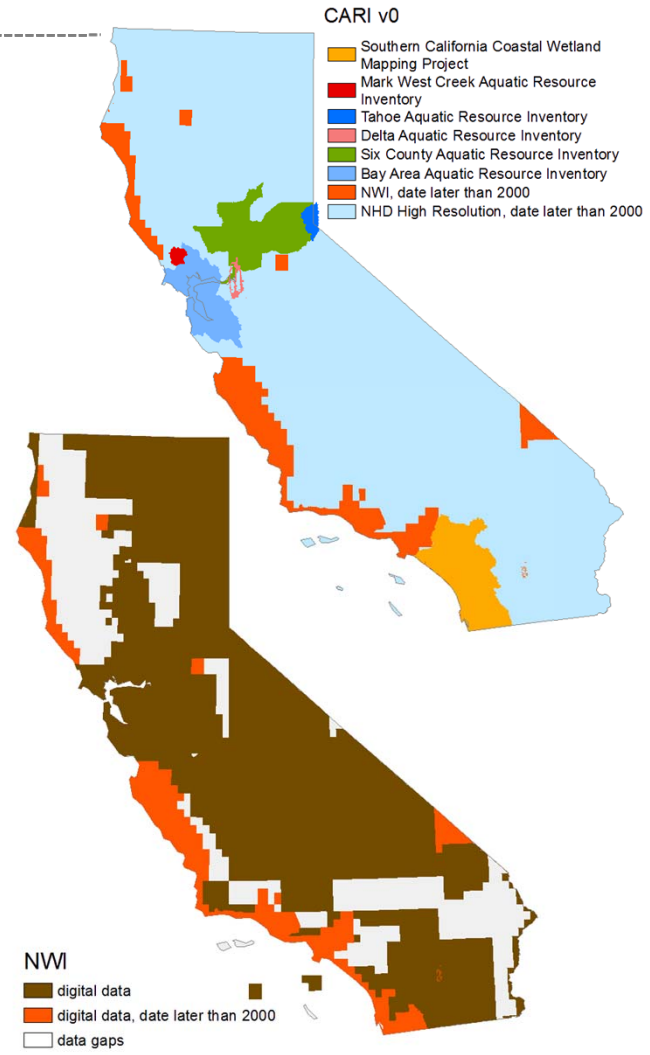
Where did our wetland numbers come from?

There are a number of approaches to estimating the total wetland acreage in California. Wetland extent can be determined via standardized, comprehensive mapping, aggregating acreages from multiple datasets together, summarizing a single statewide dataset, or from estimations based on extrapolation from random sampling of wetlands maps around the state. Each method is valuable and can compliment other methods, though none are perfect.

The estimate we present in "How much wetland area is there in California?" (4.3 million acres) was summarized from CARI v.0, a compilation of "best available" wetland datasets. By piecing together the National Hydrography Dataset (NHD), National Wetland Inventory (NWI), and high-resolution local datasets, CARI v.0 provides full coverage of wetland extent for the state. The dataset aggregation approach combines data with varying standards and quality. While it eliminates data gaps, meaningful comparisons between regions and wetland types become challenging.

Another recent summary of wetland extent in California reported a total of 2.9 million acres. The State of the State's Wetlands (SOSW) report used a single dataset summary approach to calculating total extent solely based on the NWI dataset. Although the NWI is comprehensive for areas it has mapped, there are still large gaps in its coverage. Some areas therefore become underrepresented, particularly the North Coast / Klamath and the Colorado and Mojave deserts.

As CARI continues to develop with the addition of higher resolution and more standardized local-scale datasets, the total acreage estimate of wetlands in California will change. Wetland managers are therefore discussing the "adoption" of a baseline wetland acreage that other analyses, including status and trends and net change, can be built upon. For now, the combination of NWI, NHD, and high-resolution local data, or CARI v.0, is the best approximation of wetland extent in California.



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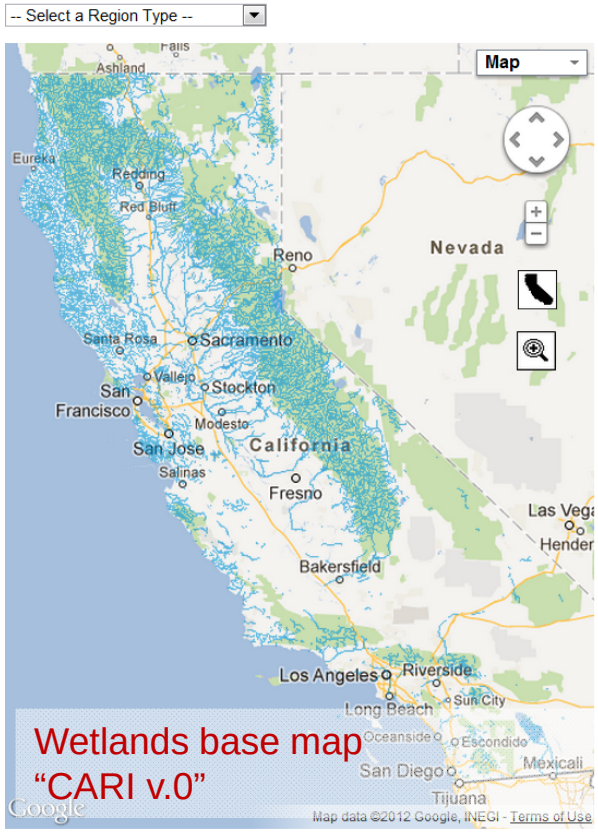
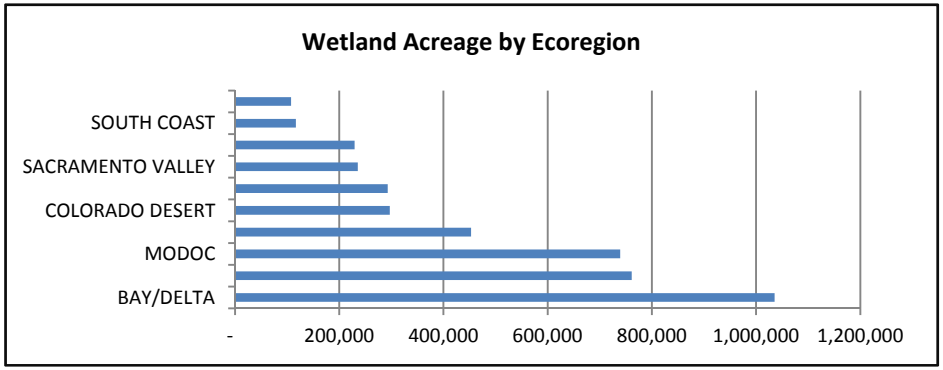
Where are California wetlands?



Wetlands occur in every region of California, from the high Sierras to the deserts of the southwest, and form wherever water collects. They can vary from location to location and are found along streams (riverine), in low points with slow drainage (depressional), at the confluence of fresh and tidal waters (estuarine), along the coast (marine), at the edges of lakes (lacustrine), and around springs (slope).

Overall wetland area is constantly changing due to both natural and human-caused factors. Natural events such as floods, fires, earthquakes and short- and long-term climate change can affect the extent and distribution of wetlands. Wetland losses can occur due to a variety of agriculture, development, and infrastructure activities. Often, these losses are offset by wetland protection and restoration.

Monitoring changes in wetland extent and distribution is critical to effective wetland protection and management. Regular mapping and tracking of restoration activities help environmental managers track change and prioritize locations and types of management actions. The most cost-effective way to map wetlands is using aerial imagery or remote sensing. Interpretation of the images is complex and uncertainties arise from image quality, age and time of year the image was taken, image variability because of climatic conditions, and even the level of experience of the person interpreting the image. Although no maps are perfect, they are immensely helpful for wetlands management. There is currently no comprehensive state wetlands map, and mapping efforts to update existing data are ongoing throughout the state .



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Where are California wetlands?

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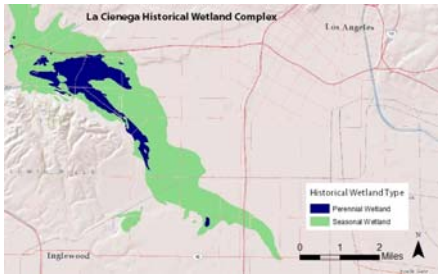
How much wetland area has California lost?

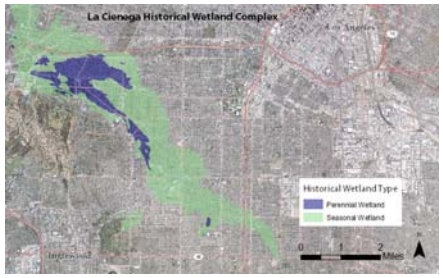
Estimates of total historical wetland loss vary for California. Some regional studies have reported loss rates up to 90% in the state. Some wetland types, such as vernal pools, riparian habitat, and coastal wetlands, have experienced disproportionately higher rates of loss. For example, an estimated 7 million acres of vernal pools existed at the time of initial Spanish exploration, of which less than 13% remains today.

Many types of land use activities can cause wetland degradation, destruction, or modification. Agricultural drainage, dewatering from groundwater withdrawals and construction of roads and rail have accounted for much of the historical wetland loss. In more recent times, urban development, infrastructure, pollution, and invasive species have contributed to wetland loss.

An understanding of historical wetland patterns and loss can help managers understand how landscapes change over time, and how natural wetlands functioned as part of larger systems. Studies done in Southern California, the San Francisco Bay, and the Sacramento-San Joaquin Delta highlight the differing degrees of impact in different regions of the state. In the Delta, perennial marshland has been particularly impacted - only 3% of historical freshwater emergent wetland remains today. In the San Francisco Bay, only 15% of historical estuarine wetlands remain. Studies in several southern California watersheds indicate between 75 and 85% of historical wetlands have been lost.

Cienega wetland complex – urbanization in Los Angeles



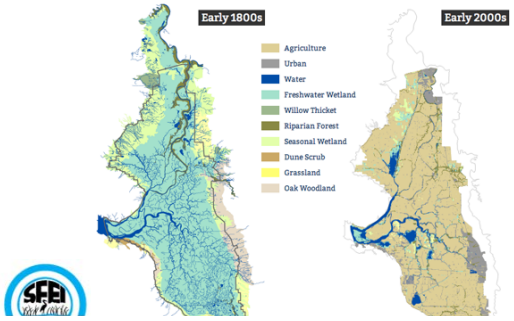


Spanish for "The Marsh", the La Cienega wetland complex once spanned over 7000 acres and extended from present-day Hollywood to Inglewood. These former wetlands have been engulfed by the vast urbanized expanse of the Los Angeles metropolitan area. The transformation of wetlands into urban landscapes is not a phenomenon limited to Los Angeles; similar examples can be found in urban areas across the state.

The Sacramento-San Joaquin Delta – agriculture and flood protection

Until the mid-1800's, the entirety of the Sacramento-San Joaquin Delta was a complex network of channels and wetlands . The historical marshes of the Delta were maintained by periodic flooding and nourished by sediments carried in by floodwaters.

Beginning around 1850, reclamation efforts began to transform the many islands of the Delta into farmland. Levees were built around the islands and the water was pumped out, allowing the fertile peat soils beneath to be farmed. In the early years, levees to protect the land from flooding were constructed by hand. By the 1870's, steam-powered dredges were digging new channels throughout the Delta and constructing large levees with the moved earth. This process led to the transformation of the expansive Delta wetland into one of California's core agricultural regions. By the mid-1920's, virtually the entire Delta had been converted into farmland.



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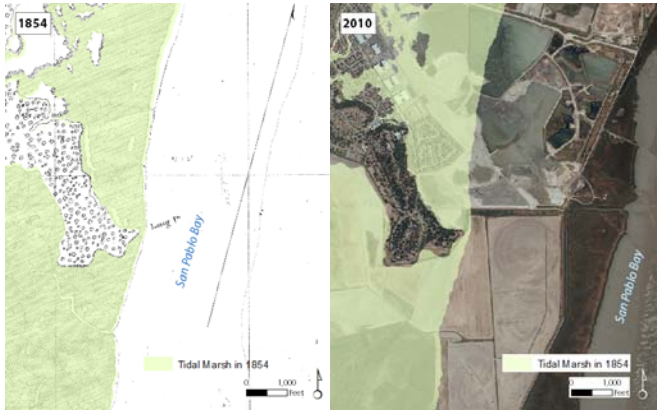
How much wetland area has California lost?

San Pablo Bay – mining and diking

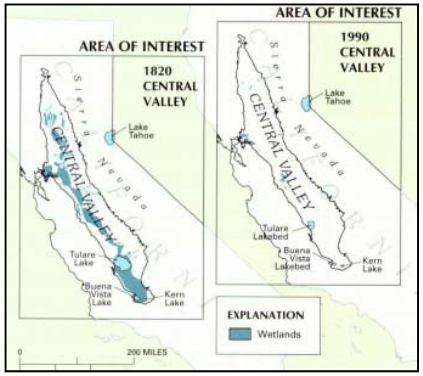


The diked former marshes along the shores of San Pablo Bay provide an interesting example of how distant land uses can affect wetlands downstream. These two maps show the western margins of San Pablo Bay in Marin County. Two factors explain this loss of wetlands. By the mid-1850s, hundreds of miles away in the foothills of the Sierra Nevada, hydraulic gold mining operations had begun. Water cannons obliterated hillsides in order to recover the gold deposits within. The byproducts of these operations were massive amounts of mining debris which made their way into tributaries feeding the Sacramento River and, ultimately, into San Pablo Bay and beyond. Debris deposits blanketed the margins of San Pablo Bay in a swath about a mile wide and three feet thick. The second factor was the successive rows of dikes that were built across the tidal marshes during the late 1800's. Today, these diked former marshes host a number of land uses including cattle grazing, agriculture, and sewage treatment. On the bay side of the dikes, new tidal marshes have begun to grow, and the present shoreline lies about a mile east of the 1854 shoreline.

Changes in wetland extent can be expected with continued land use development and climate change. The State has been working to minimize loss from ongoing development (see Wetland Protection) and has stepped up efforts to conserve and restore existing wetlands (see Efforts to Improve Wetlands).

The Central Valley – floodplains into farmland

California's Central Valley, which now produces nearly 25% of the nation's table food on only 1% of its farmland, was once an extensive network of wetlands. Tulare Lake once had a surface area of about four times that of Lake Tahoe, while Buena Vista and Kern Lakes once held runoff from the Sierra Nevada. Expansive forests of willow, sycamore, oak, elder, poplar, and alder lined the rivers and streams that flowed into the Central Valley, and wetland grasses and tules covered the valley floors and prairies. Farmers began diking and draining the floodplains for agriculture in the mid-1800's, and by the 1920's about 70 percent of the original wetlands had been hydrologically modified. Nearly 4 million of the 13 million acres of the Central Valley is estimated to have been wetland before this expansive land change.



Text and graphic adapted from "Technical Aspects of Wetlands History of Wetlands in the Conterminous United States" By Thomas E. Dahl and Gregory J. Allord, U.S. Geological Survey Water-Supply Paper 2425

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How much wetland habitat has California lost?

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As a user rolls over a type, text will appear with a link to a separate type page. Text should read "More about *depressional* wetlands." Images will slide on mouseover, then the user can click on expanded image to go to the individual type page.

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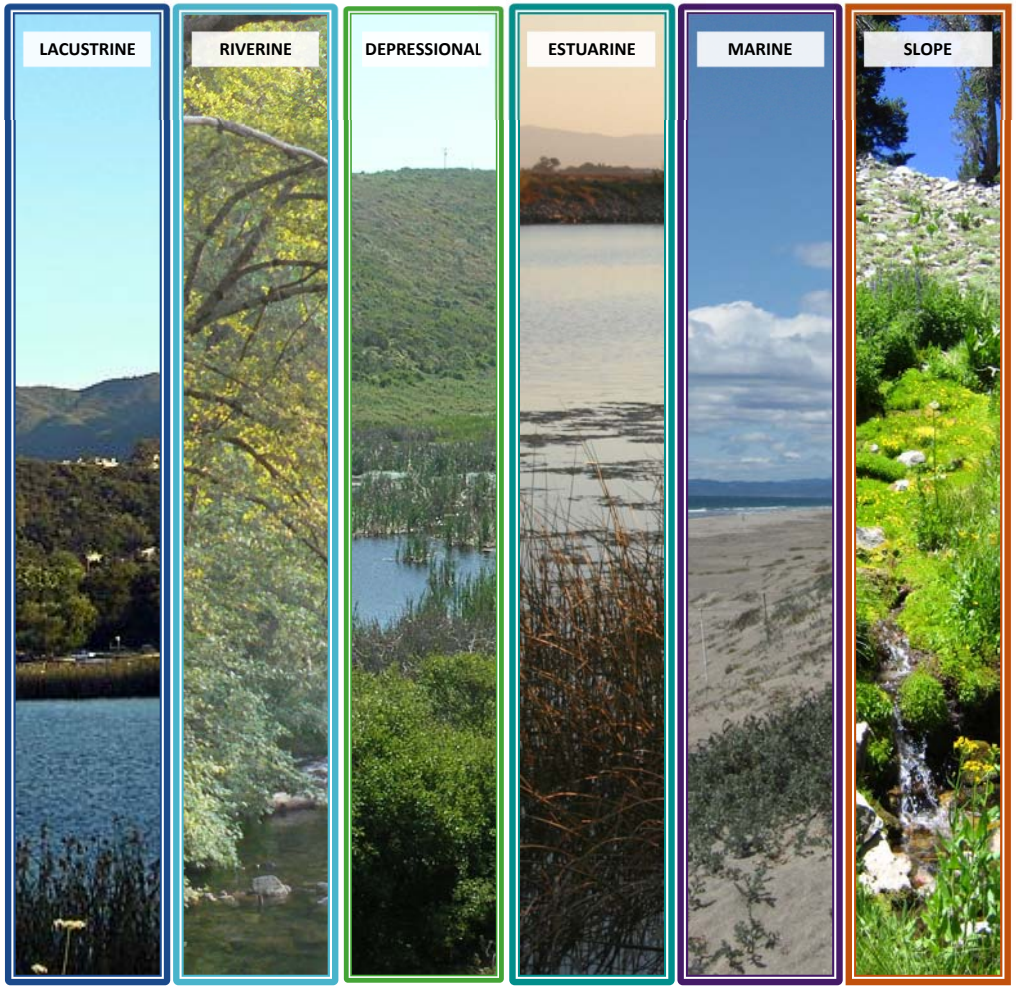
What types of wetlands can be found in California?



California has a great diversity of wetlands. Different types of wetlands can provide different functions and services. This is also true for the same kinds of wetlands in different regions or environmental settings. Different wetland types also provide different services and support diverse wildlife, such as water birds, birds of prey, otters, bears, deer, and a wealth of fish species. Wetland management strategies must, therefore, be customized based on wetland type and location. California has recently adopted a wetland classification system to help guide wetland management.

The broad categories used to classify California's wetlands are lacustrine (wetlands associated ted with lakes and reservoirs), riverine (wetlands associated with rivers and streams), depressional (shallow wetlands confined to topographic basins or hollows), estuarine (wetlands associated with estuaries), marine (wetlands along the coast), and slope (wetlands that depend on groundwater but are not confined to topographic basins). A number of factors distinguish these types, but the most important are the sources of the water supporting the wetland, the depth of water in the wetland, and its environmental setting.

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What types of wetlands can be found in California?

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Image stacker (if feasible)
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Image stacker code
http://demo.superdit.com/jquery/sliding_stacked/
The code for it can be found here: http://superdit.com/2011/05/14/sliding-stacked-images-with-jquery/

We recommend changing relative proportions of left and right side of the page (vs. typical portal map vs. text widths) to give more width to the images on the left hand side.

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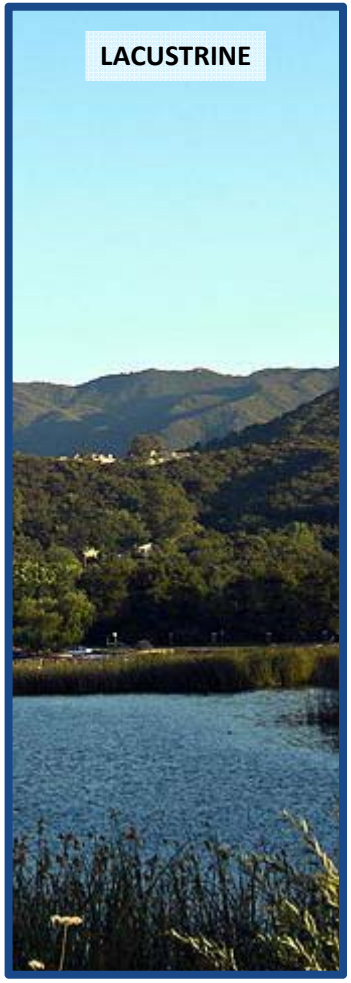
What is a lacustrine wetland?



Lake Sherwood in Santa Monica Mountains

Lacustrine wetlands are less than 2 m deep, and can be any size. They exist along the margins of lakes and reservoirs, which are non-tidal water bodies at least 2 m (6 ft) deep during the growing season and at least 8 ha (20 ac) large. These wetlands can be temporarily inundated by deeper water if the inundation does not persist throughout most of the growing season.

Link back to types main page

lacustrine

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What is a lacustrine wetland

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What is a riverine wetland?

Yosemite National Park

Riverine wetlands depend on the flow of water conveyed by natural or artificial channels, including rivers, streams, ditches, and canals. They can form on floodplains, river terraces, and along channel beds, especially where the flows are seasonal or episodic. Very broad floodplains can contain wetlands that resemble depressional wetlands because they are confined to topographic depressions or hollows, but are classified as riverine because they depend on riverine flooding.

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What is a depressional wetland?

Sunset State Beach, near Santa Cruz

Depressional wetlands are confined to topographic basins or hollows that are either too small or too shallow to form lakes or reservoirs. This is a very large category of wetlands that includes vernal pools and natural as well as artificial ponds. There is no minimum or maximum size for depressional wetlands. They often depend on multiple water sources, including local runoff, groundwater, and direct precipitation. Their waters can be saline, alkaline, or fresh.

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What is an estuarine wetland?

Georgiana Slough in the Sacramento-San Joaquin Delta

Estuarine wetlands form along the tidal reaches of rivers and streams, and along the margins of estuarine bays and straits. They depend on regular tidal flooding, although the timing and degree of tidal flooding might be managed with tide gates, weirs, and other water control structures. Common names for estuarine wetlands include tidal flats, tidal marshes, and salt marshes. Depending on the mixture of freshwater and saltwater that floods an estuarine wetland, it might be fresh, brackish, or saline.

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What is a marine wetland?

Moss Landing

Marine wetlands occur along the outer coast of California. They depend on regular tidal action, ocean waves, or frequent ocean spray. The plants that inhabit marine wetlands are salt-tolerant. In contrast with estuarine wetlands, marine wetlands are minimally influenced by the freshwater from rivers or streams.

Eelgrass beds are one particularly important kind of marine wetland. They occur in the lower limits of the intertidal zone, where they function as nurseries for a variety of marine fishes, as well as feeding areas for fish, birds, seals and other marine mammals. Eelgrass beds are subject to special protection in California.

MJW1

Slide 22

MJW1 Note that this link should navigate within the regulation page directly to the text on Eelgrass
Meredith, 10/19/2012

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What is a slope wetland?

Lake Tahoe

Slope wetlands form because of high groundwater outside of a closed topographic depression. Precipitation is often a secondary contributing source of water. They can form on flat areas as well as on slopes. They lose water primarily by subsurface flow and by evapotranspiration. Groundwater can sometimes enter and leave slope wetlands in channels, but channels do not convey water through slope wetlands. They are often adjacent to other kinds of aquatic areas, such as rivers and lakes, or other kinds of wetlands.

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What services do our wetlands provide?

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How do we classify wetlands in California?

The California Aquatic Resource Classification System or CARCS is used to classify wetlands in the California Aquatic Resource Inventory (CARI). Wetland managers and scientists from across the state developed CARCS to support effort to track changes in the diversity, distribution, abundance, and condition of wetlands throughout the state. CARCS is based on existing federal classification systems that have been tailored to fit the needs of California. CARCS recognizes 6 classes of wetlands among 2 major categories. CARCS allows wetlands to be further classified based on their landscape connection, naturalness, vegetation, hydrology, and substrate. CARCS can be translated into federal and regional classification systems. For more information on the development of CARCS and wetland definitions visit the CARI info page.

The first step in CARCS is to digitize the feature using remotely sensed imagery (ex. aerial or satellite photos) and ancillary data (ex. slope, soil) and decide which major category and class it belongs to. Landscape connection (position in landscape relative to other areas) designation is highly recommended if discernible from the data sources.

REQUIRED CLASSIFICATION OBTAINED THROUGH REMOTE SENSING			
HYDROGEOMORPHOLOGY		LANDSCAPE CONNECTION	
MAJOR CATEGORY	CLASS	TYPE	SUBTYPE
Non-wetland Open Water	LACUSTRINE	Same as Associated Wetland	
	RIVERINE		
	ESTUARINE		
	MARINE	Intertidal	Cove Embayment Exposed Shoreline
		Subtidal	Cove Embayment Exposed Shoreline
Wetlands	DEPRESSIONAL	Floodplain	Defined outlet Undefined outlet
		Non-floodplain	Defined outlet Undefined outlet
	LACUSTRINE	Structural Basin Topographic Plain	
	SLOPE	Hillslopes Break in slope Topographic Plain	
	RIVERINE	High-gradient	
		Low-gradient	Confined

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How do we classify wetlands in California?

The next step is to collect more specific information on land use and vegetation characteristics. This data is recommended, but not required as it may be difficult to discern from the imagery or other data.

REMOTE SENSING, RECOMMENDED			
ANTHROPOGENIC INFLUENCE			VEGETATION MODIFIER
WHOLE SYSTEM			Non-vegetated
Modified			Forested
Remnant			Scrub-shrub
WATER SOURCE/HYDROPERIOD			Herbaceous
Agricultural Runoff	Diked	Infiltration	Emergent
Constrained/ Impounded	Ditched/Drained	Stormwater Control	Floating
	Diverted	Urban Runoff	Submerged
SUBSTRATE AND BANK			Algal
Armored	Filled / Graded	Marine Control Structures	
Excavated	Realigned		
AGRICULTURE OR OTHER USE			
Aquaculture	Orchards	Recreation	
Flooded Agriculture	Ranchland	Row or Sown Agriculture	
	Rangeland		
Flood Irrigation	Harbors / Marinas / Ports	Silviculture	

The final step is to collect, if possible, hydrology and substrate data that help further characterize the wetland. These data are also difficult to interpret based on the imagery, though indicators can be used and can sometimes be found in other data sources. If these resources are not available, field methods are likely necessary.

FIELD-BASED, RECOMMENDED	
HYDROLOGY MODIFIERS	SUBSTRATE MODIFIER
TIDAL	*RIVERINE OR FLOW-THROUGH*
Regularly tidal	Labile
Seasonally tidal	Transitional
Irregularly tida	Consolidated
FLOWING	*LENTIC OR CLOSED-BASIN*
Perennially flowing	Unconsolidated
Seasonally flowing	Rock Bottom
Ephemera	
INUNDATION	*MARINE*
Perennially flooded	Rock
Seasonally flooded	Coarse Unconsolidated
Temporarily flooded	Fine Unconsolidated
	Faunal Reef

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What services do our wetlands provide?

We also talk about wetland types to distinguish between the services that each can provide to us. The California Aquatic Resource Classification System (CARCS) provides information about the likely functions or services of different wetlands. Tidal wetlands (estuarine, marine) serve to stabilize shorelines by binding the soils along the shoreline together with strong systems of plant roots. They also provide storm protection by creating a natural barrier to the elements and shielding coastal communities. Wetland vegetation works as a sediment trap and locks up nutrients and contaminants, thereby preventing concentration downstream that can result in algal blooms or human health hazards. Riverine and lacustrine wetlands help stabilize channel banks and lake shores, and help reduce flood hazards through the storage of flood flows during extreme weather events.

Photo courtesy of Shannon Morrow/ Feather River Land Trust

Depressional wetlands are especially important for recharging groundwater aquifers. Many kinds of wetlands act as natural water purifiers, filtering and sequestering sediment and pollutants. Two-thirds or more of all the fish and most of the shellfish we consume are dependent on coastal wetlands, and products that are harvested from wetlands include medicinal plants and rice. Many of these agricultural areas also serve as habitat for wildlife.

Wetlands , which host thriving communities of plants and animals, also provide great recreational, aesthetic, and cultural value to local residents who like to hike, hunt, fish, birdwatch, and photograph wildlife. It's estimated that the annual economic value of wetlands statewide in California is between $6.3 and $22.9 billion. Wetlands must be managed well both now and in the future, or we risk losing all these essential services. This will be challenging since wetlands are among the most vulnerable ecosystems to climate change on Earth according to the International Panel on Climate Change (IPCC).

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How do we classify wetlands in California?

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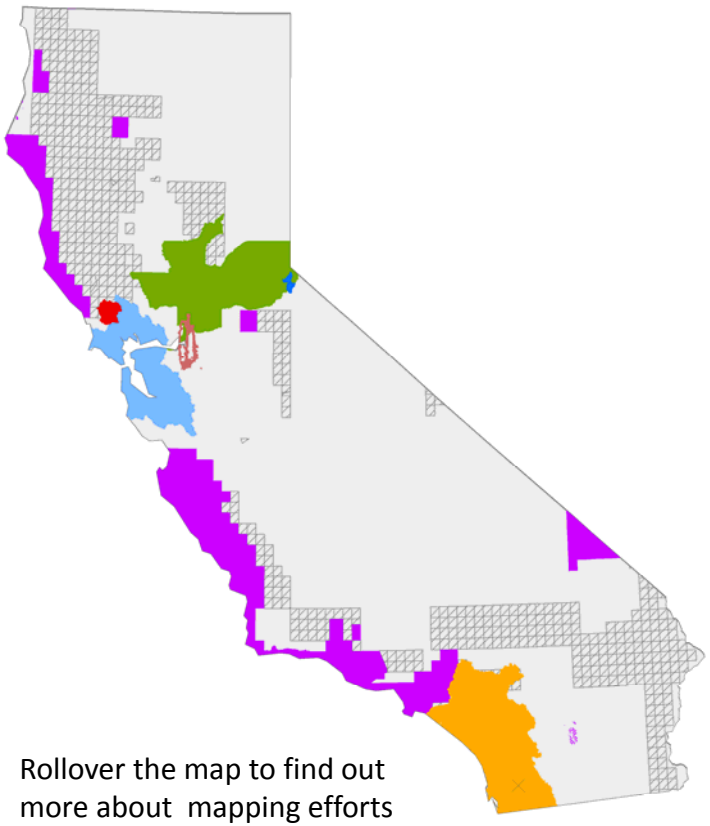
What is the status of mapping California wetlands?



Rollover the map to find out more about mapping efforts around the state.

Contemporary wetland mapping in California dates back to the 1940's when the U.S. Geological Survey (USGS) produced topographic maps that included streams, marshes, lakes and ponds. These have been amalgamated to become the National Hydrography Dataset (NHD). Since 1974, the U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI) program has mapped the country's wetlands on a regular cycle. Between these two efforts, California has digital wetland maps for about 75% of the State— - almost 123,000 square miles. However, much of the mapping has not been updated since the 1980s. Agencies, municipalities, and researchers use these maps every day for wetland protection and research.

Despite ongoing mapping efforts, there are still portions of the State which are significantly under-mapped or not in a GIS-compatible format – particularly with respect to wetlands that are more subtle in the landscape. In other areas more detailed maps are becoming available. This means that wetland maps for different parts of the state vary in terms of when they were created, level of detail, mapping methodology, and data formats. The end result is that available maps do not conform to a uniform standard nor can be used to assess wetland extent consistently around the state.

Wetland managers, agency staff, and scientists have recognized the need for a consistent statewide map of wetlands and streams. They are now partnering to develop the California Aquatic Resource Inventory, or CARI. This team has drafted a standard methodology and classification system which can now be used to build the statewide map. Initially, the CARI Geographic Information System (GIS) dataset will consist of a compilation of maps from multiple sources to produce a statewide map with a common classification method. This map will be the basis for further updates as outdated information is replaced with new maps that conform to the CARI standards.

Ultimately, CARI will be integrated nationally through partnerships with USGS and USFWS. The CARI team is working towards a seamless integration into the NWI and NHD so that national maps include the more detailed and comprehensive data found in CARI.

If you are interested in getting more information about CARI or contributing information for an under-mapped region, or simply want more information about CARI, please email CARImapping@sfei.org.

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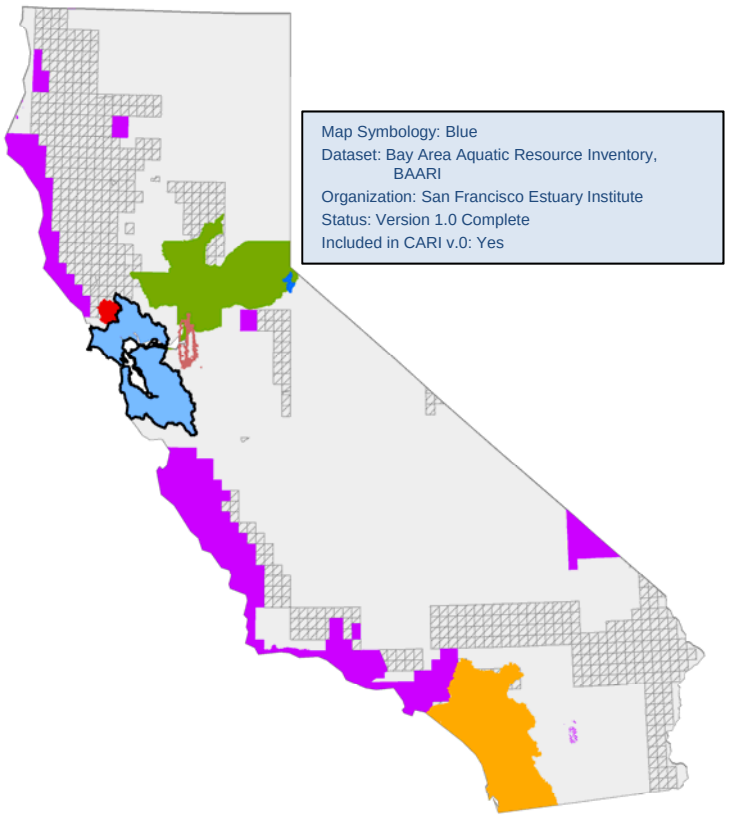

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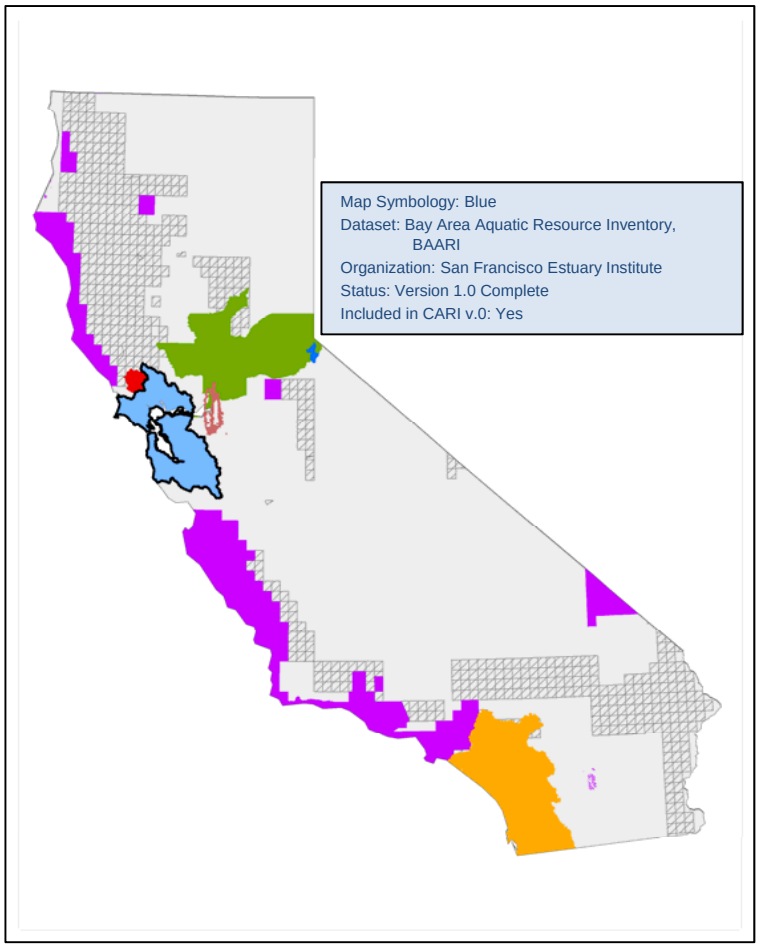

When the user mouses over one of the areas where there is a mapping effort is underway, there could be either a popup box with details about the mapping effort or a bit of text under the map that explains the effort.

Map Symbology: Purple
Dataset: National Wetland Inventory <12 years old
Organization: US Fish and Wildlife Service
Status: Complete, Acquired 2011
Included in CARI v.0: Yes

Map Symbology: Gray
Dataset: National Wetland Inventory >12 years old
Organization: US Fish and Wildlife Service
Status: Complete, Acquired 2011
Included in CARI v.0: Yes

Map Symbology: Blue
Dataset: Bay Area Aquatic Resource Inventory, BAARI
Organization: San Francisco Estuary Institute
Status: Version 1.0 Complete, 2011
Included in CARI v.0: Yes

Map Symbology: Grey hashing
Dataset: National Hydrography Dataset 1:24k
Organization: USGS
Status: Complete with on-going local updates, Acquired 2011
Included in CARI v.0: Yes

Map Symbology: Yellow
Dataset: Tahoe Aquatic Resource Inventory, TARI
Organization: California Tahoe Conservancy
Status: Version 1.0 Complete, 2012
Included in CARI v.0: Yes

Map Symbology: Pink
Dataset: Delta Aquatic Resource Inventory, DARI
Organization: Department of Water Resources
Status: In progress
Estimated completion date: December 2013
Included in CARI v.0: No

Map Symbology: Green
Dataset: Six County Aquatic Resource Inventory
Organization: US Army Corps of Engineers, Sacramento Division
Status: Complete, 2010
Included in CARI: Yes

Map Symbology: Red
Dataset: Mark West Creek Aquatic Resource Inventory
Organization: San Francisco Estuary Institute
Status: Planned
Estimated completion date: ~March. 2013
Included in CARI: N

Map Symbology: Orange
Dataset: Southern California Wetland Mapping Project
Organization: CSU Northridge and Southern California Coastal Wetland Research Project
Status: In progress
Estimated completion date: December 2012
Included in CARI: No

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What is the status of mapping California wetlands?

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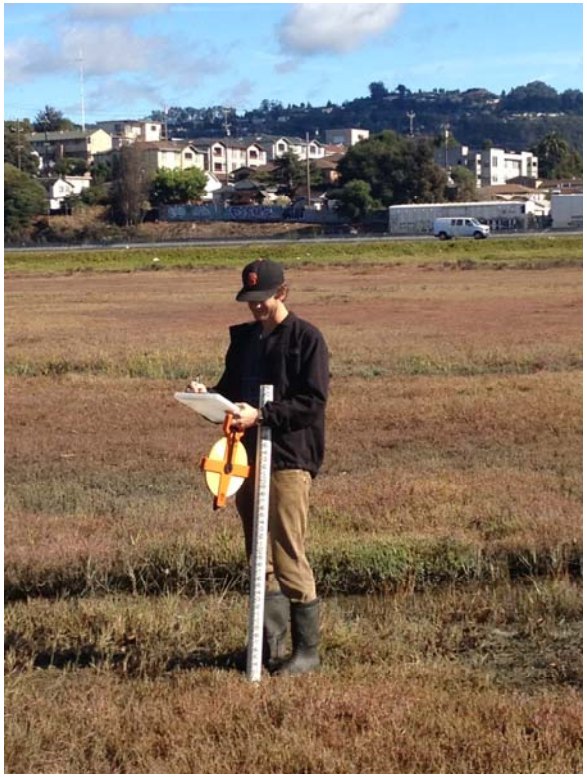
What is wetland health?

Knowing how many wetlands we have is critical, but it is not the entire story. Effective protection and management decisions also require that we know something about the condition, or health, of wetlands. A healthy wetland can be defined as one that provides the needed levels of natural functions, goods, and services. The biological diversity of a wetland (number of species present) is often considered a proxy for its ability to persist over time, and can be used as another measure of health.

Poor wetland health is typically the result of human stressors, such as changes to water inputs, introduction of invasive species, pollution, climate change, or fragmentation. In particular, slight changes to water inputs can have large impacts on wetlands, particularly on seasonal wetlands that depend heavily on the arrival of seasonal water flows. Water inputs can change as a result of reservoirs, diversions, and levees, groundwater pumping and irrigation activities, and through altered climate regimes in the future.



Wetland health in CA

What is the condition of our wetlands?
- How do we know how they're doing?
- How do we assess wetland health?
- What studies have documented wetland condition?

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What is wetland health?

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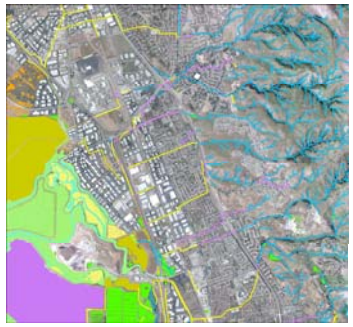
How do we know how California's wetlands are doing?

Comprehensive assessments of wetland health in California are challenging because standardized tools to evaluate the diversity of wetland types have never existed. The WRAMP (Wetland and Riparian Area Assessment Plan) was launched in 2010 to create standardized assessments of wetlands throughout California. WRAMP seeks to create a consistent approach to wetland classification, mapping, and monitoring that will allow for statewide assessments of wetland extent and condition.

What is the WRAMP toolkit

California's WRAMP Toolkit consists of standardized mapping and assessment methods that provide a comprehensive assessment of wetland extent and ecological integrity for the wetland within the context of the surrounding watershed. Assessments are conducted at three levels:

Landscape Assessment (Level 1)



uses remote sensing data and field surveys to inventory wetlands. Maps in the California Aquatic Resources Inventory and the National Wetlands Inventory are examples of Level 1 assessments.

Rapid Assessment (Level 2)

uses visible field diagnostics and existing data to assess conditions. CRAM is an example of a Level 2 assessment method.

Intensive Site Assessment (Level 3)

provides quantitative field data to assess condition more precisely. Plant and animal population surveys and soil studies are Level 3 assessments.

How is the toolkit used?

The toolkit is used differently based on the question asked about condition. For instance, in some cases it is important to characterize overall wetland condition within a landscape, watershed, or region, while in other situations a more localized assessment of the health of an individual restoration project is needed. Some management questions require more specific studies to test hypotheses about the causes of habitat conditions in order to inform management actions. Level 3 assessments meet this need and can be used to calibrate and validate Level 1 and Level 2 methods. Resource managers with responsibility for wetland regulation or management can use the WRAMP tools in the context of their own

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We will display CRAM scores by septile based on three colors, but we will not categorize scores as good, bad, etc.

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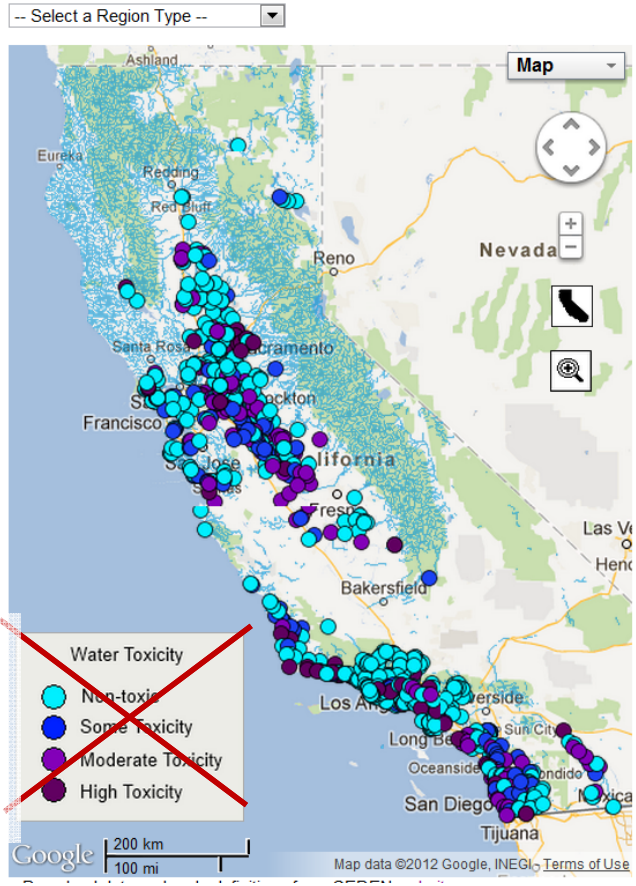
How do we use CRAM for Wetlands Health Assessment?



One way to measure the overall health of streams in California is to perform assessments using the California Rapid Assessment Method (CRAM). CRAM is a field-based diagnostic tool that, when used as directed, provides rapid, repeatable, and numeric assessment of the overall condition of a wetland.

CRAM assesses four overarching attributes of wetland condition: Buffer and Landscape Context, Hydrologic Regime, Physical Structure, and Biotic Structure Each attribute is related to several attribute-specific metrics and submetrics that are evaluated in the field for a prescribed assessment area. The attribute scores are averaged to produce an overall index score. Attribute and index scores range from 25 (lowest possible) to a maximum of 100. In the context of CRAM, condition is evaluated based on observations made at the time of the assessment. Higher scores represent better condition and infer a higher potential to provide the functions and services expected for the wetland site being assessed.

Preliminary studies using CRAM have found that an estimated 60% of the state's remaining riverine wetland habitat is in "good" or "very good" health. In 2007, 85% of the 44,000 acres of remaining salt marsh in California were found to be in "good" or "very good" condition. Human impacts to salt marshes increase moving from north to south along the coast because of increased urbanization, and as a result, salt marsh health is highest in the north and lowest in the south. Efforts are currently underway to recover many of the States previously damaged wetlands e (e.g. South Bay Salt Ponds, Malibu Lagoon, etc.), but much more work remains.

The data displayed here represent many wetlands studies around the state including the State of the State's Wetlands, the Perennial Streams Assessment of the Surface Water Ambient Monitoring Program (SWAMP) program, Use of CRAM to get a holistic assessment of wetland condition, in conjunction with probabilistic survey designs allows for a broader perspective on wetland condition. Although rapid methods like CRAM provide a cost-effective means for basic assessment of overall wetland health, they are just one element of a comprehensive regional monitoring program. In most cases, CRAM will need to be used in conjunction with more intensive methods, rather than as a stand-alone tool, to support management decisions.

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– If we provide access to more detail about an assessment, we will provide a link to the cramwetlands.org data display with an explanation that they're leaving the site.

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What studies have documented wetland condition?

The health of wetlands at of stream and creek margins is a major determinant of the health of California's streams and rivers. Riverine wetlands can stabilize banks, control water temperature, and help to reduce contaminant flow into streams. Therefore any effort to determine the health of California's streams and rivers and answer the question of how many are in good, fair, or poor condition, requires consideration of adjacent riparian wetlands. Because California assesses the condition of its waters biennially, it is conducting a statewide assessment of perennial streams (streams that flow year round).

This Perennial Streams Assessment (PSA) program is a probabilistic monitoring program that assesses selected water quality measures plus the biological and physical habitat conditions in perennial streams. Probability surveys are statistical surveys (like political polls) that allow us to estimate the characteristics of a large population (in this case perennial streams) with relatively small sampling effort. This allows us to produce objective estimates of resource extent and condition with known statistical precision Probability surveys provide an unbiased picture of the overall distribution as well as context for interpreting site-specific monitoring data. Probability surveys are widely adopted by many states and Federal agencies and used for many different types of aquatic resources, including lakes, coastal estuaries, as well as rivers and streams.

The main tool for statewide assessment of perennial streams is bioassessment. Bioassessment is the use of resident aquatic biota, such as benthic macroinvertebates and algae, as direct indicators of the biological integrity of water bodies. However, the California Rapid Assessment Method (CRAM) is another tool being used by this program to provide a "snapshot" of the ecological condition of perennial streams (similar to a yearly checkup at the physician). The integration of rapid assessment methods, like CRAM, with probabilistic survey designs provides a cost-effective means to make unbiased estimates of wetland condition across large geographic areas.

Much more information about the health of California's streams and rivers can be found on the Healthy Streams Portal.

**Add hover text for bioassessment: Bioassessment is the characterization of environmental conditions through the observation of biological communities of organisms.

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What is being done to protect California's wetlands?

California's unique and vulnerable wetlands are often impacted adversely by human use, and are therefore protected by a combination of regulations, incentives, and grant-funded restoration programs.

Regulation

The primary regulatory tool for protecting wetlands in the United States is Section 404 of the Clean Water Act (CWA). This law requires that a project that includes changes in land use which might affect wetlands must file for a permit. These permits require the avoidance of all significant negative impacts to the aquatic environment, including the impacted wetlands. If impacts cannot be avoided, then they must be minimized to reduce degradation to the system. Unavoidable impacts must be compensated through creation or restoration of other wetland areas in support of the federal and state no net-loss policies. The Wetland and Riparian Area Protection Policy (WRAPP) currently under development in California will provide a State analogue to the Federal program for those areas or circumstances beyond the jurisdiction of the Federal Clean Water Act. Activities that affect coastal wetlands are also subject to regulation by the California Coastal Commission under the California Coastal Act and the Federal Coastal Zone Management Act. In California, no single agency has authority over all aquatic resources. Regulation and management of wetlands and streams falls under the authority of six state and federal agencies leading to a complex and varied regulatory structure.

Incentives

Incentives such as conservation easements encourage landowners to protect wetlands. Through easements, landowners agree to leave a portion of their land permanently undeveloped, and in exchange receive tax incentives from the federal and state government. Federal, state, and local agencies work with landowners to set up easements. For instance, the National Resources Conservation Service (NRCS) in California received $30 million for its Wetlands Reserve Program for 2012. – CA Department of Fish and Game (DFG) , US Fish and Wildlife Service (USFWS) and even counties also have easement programs. Many NGOs collaborate on easement efforts and raise funds to secure property for easements—The Nature Conservancy, Ducks Unlimited etc. Also see "Restoration" below for more information about joint ventures and their role in incentivizing wetland conservation.

Who protects California's wetlands?

There are many agencies which work to protect California's wetlands. Explore the websites of State agencies who have a role in wetland protection and management.

- Federal and State Regulatory Agencies
  - US Army Corps of Engineers
  - US Environmental Protection Agency
  - California Department of Fish and Game
  - State Water Resources Control Board
  - California Coastal Commission
  - San Francisco Bay Conservation and Development Commission
  - State and Regional Water Quality Control Boards
  - National Oceanic and Atmospheric Administration
- Federal and State Resource Agencies and Other Groups
  - US Fish and Wildlife Service
  - Coastal Conservancy
  - National Resource Conservation Service
  - Resource Conservation Districts
  - Southern California Wetland Recovery Project
  - Central Valley Joint Venture
  - Pacific Coastal Joint Venture
  - San Francisco Bay Joint Venture
  - Sonoran Joint Venture
  - Baldwin Hills Conservancy
  - California Tahoe Conservancy
  - Coachella Valley Mountains Conservancy
  - San Diego River Conservancy
  - San Gabriel & Lower Los Angeles Rivers & Mountains Conservancy
  - San Joaquin River Conservancy
  - Santa Monica Mountains Conservancy
  - Sierra Nevada Conservancy
  - Nature Conservancy

Is your agency not listed here? Please send your information to trackermaster.

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Restoration

Also critical to the success of these efforts are voluntary and/or grant funded restoration programs, which account for the vast majority of increases in wetland acreage. Local, state, and federal agencies, in partnership with conservation groups and private landowners, have worked together to develop and increase the capacity for voluntary wetland conservation. Much of this work has been accomplished through the California Coastal Conservancy and the State Lands Commission along with California's six habitat-based joint ventures. Joint ventures are public/private partnerships that work entirely through voluntary efforts. Businesses, NGOs, state, regional and federal all participate in these partnerships to protect and enhance wetlands.
Public investment in wetland protection and restoration since 1998 has been facilitated by at least five voter-approved bond measures helping to strengthen the state's aquatic resources. Proceeds from these bond measures have been combined with other state resources to support the acquisition, protection, and restoration of wetlands across the state. Click here to see a map of restoration projects.

Photo courtesy of Mike Denega

In addition to larger statewide or regional efforts, there are a number of actions that individuals can take to protect wetlands. We can educate ourselves about the watersheds we live in and how they relate to the local wetlands and the plants and animals that live there, and in particular, about how pollution on land can wash into wetlands and contaminate them. The best way to understand wetlands is to visit them. The National Wildlife Refuge system provides access to many types of wetlands throughout the state . **Find a refuge near you!** Individuals can also participate in public efforts such as Coastal Cleanup Day that encourage the public to take ownership of their local wetlands.

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Sidebar code and links can be found here: https://gist.github.com/3919963.js?file=sidebar.html

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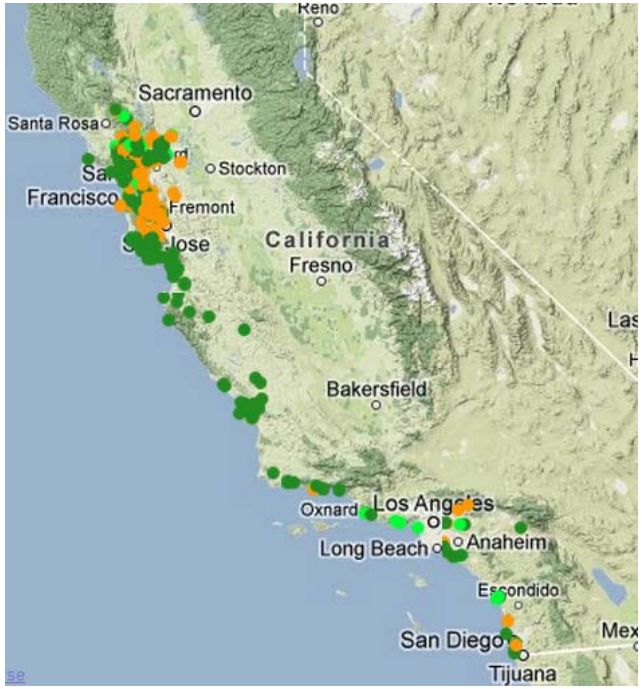
Where are wetlands being restored near me?



Restoration

California has made substantial progress over the last ten years in identifying, acquiring, restoring and enhancing thousands of acres of wetlands. From large scale restoration such as the South Bay Salt Pond Restoration Project to tiny vernal pool restoration projects, these efforts continue to stem the tide of wetland loss. The map on this page shows wetland restoration and improvement projects.

Many details about project are available through the California EcoAtlas. EcoAtlas files may include permit details, contact information, habitat plans, and monitoring reports.

Projects
No color code for project status

Project popup includes
Project name
Project acreage
Project organization

Needs marquis zoom search tool

Project locations page

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What regulations protect wetlands?

Clean Water Act – Section 404 (More)

The U.S. Army Corps of Engineers (USACE) regulates the discharge of dredged or fill materials into waters of the United States. Wetlands constitute a subset of "waters" that are under USACE jurisdiction. There are different types of Section 404 permits. General permits are established a priori for activities that are similar in nature and which have minimal impacts, and are issued for up to 5 years duration. There are three types of general permits; nationwide permits (issued by the USACE headquarters); regional general permits issued by the USACE district or division offices; and state programmatic general permits (issued by the USACE district or division offices). Activities that do not qualify for authorization under a general permit must be authorized through the USACE individual permit process which involves a public notice and comment as well as environmental analysis. Typically, the USACE permit review process seeks to avoid and minimize impacts to waters of the United States (i.e., aquatic resources, including wetlands), and where total avoidance is not practicable, compensatory mitigation is required. USACE regulators also ensure compliance with issued permits and permit conditions, and conducts enforcement activities (in partnership with EPA) when discharges of dredged or fill material occur without the necessary permits.

State 401 Certification (More)

Section 401 of the Clean Water Act allows states to certify that federal 404 permits do not violate State water quality standards. In California, these certifications are typically issued by the Regional Water Quality Control Boards. (some certifications pertaining to water rights and multiregional projects are administered by the State Water Board), and also serve as Waste Discharge Requirements (WDRs) under the State's Porter-Cologne Water Quality Control Act (see below).

The United States government has set an overarching goal to prevent the loss of wetlands in the U.S. Agencies work to improve, restore, create, and protect wetlands through a "no net loss" approach. The no net loss goal was recommended by the National Wetlands Policy Forum in 1987 and adopted in 1989. No Net Loss goals influence permitting California's water board, the Army Corps of Engineers, and other agencies responsible for wetlands protection.

Clean Water Act - National Pollutant Discharge Elimination System

Under the auspices of the U.S. Environmental Protection Agency (EPA), the State Board and nine Regional Boards also have the responsibility of granting permits, commonly known as NPDES permits, for certain point-source discharges.

Rivers and Harbors Act- Section 10

USACE regulates any work or structures in or affecting the course location, condition, or capacity of navigable waters. Typical structures which require Section 10 permits include piers, boat docks or ramps, wharfs, dolphins, weirs, booms, breakwaters, bulkheads and jetties. Work that would typically require Section 10 permits include dredging, beach nourishment, and geotechnical surveys. Tidal wetlands fall under both the River and Harbors Act Section 10 and Clean Water Act Section 404 jurisdiction.

Executive Order 11990 Wetland Protection (View)

Executive Order 11990 (1977) requires Federal agencies and responsible entities to avoid an undertaking or provide financial assistance for new construction located within wetlands, unless a finding is made that there is no practicable alternative to such construction.

Porter-Cologne Water Quality Control Act. (More)

Water quality in California is governed by the Porter-Cologne Water Quality Control Act. This law assigns overall responsibility for water rights and water quality protection to the State Water Resource Control Board and directs the nine Regional Water Quality Control Boards to develop and enforce water quality

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