The F.O.R.C.E.

The Future Of Redwood Creek Environment

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Introduction

The Redwood Creek watershed is located in Marin County, California. The creek runs through an enormous redwood forest and is at the crux of several conservation efforts.

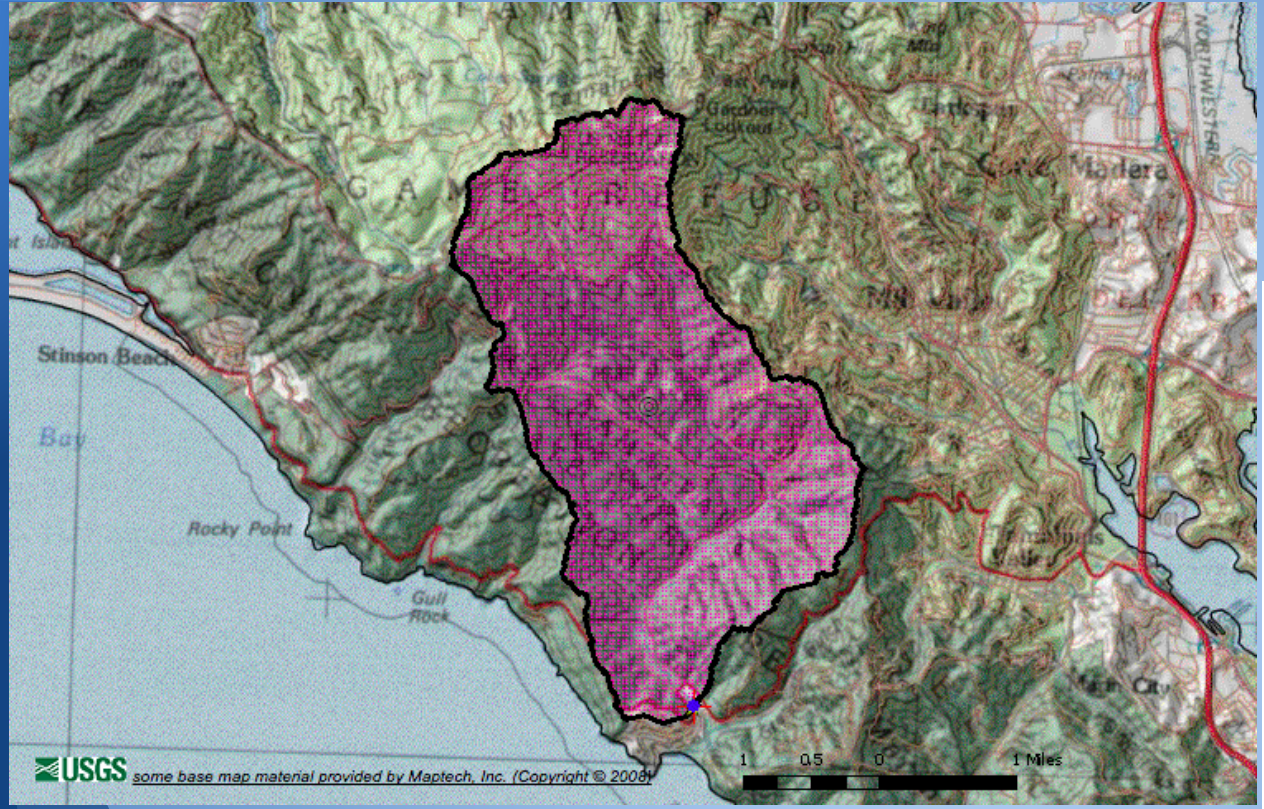
Mission Statement

The F.O.R.C.E.'s goal is to reduce turbidity by 10%, increase the dissolved oxygen content to 5 mg/L, restore the function of the floodplain, and increase the Coho salmon population by 20% by the year 2030 in the Redwood Creek, Marin County.

We also hope to engage the community in an educational program for the watershed by 2020.

Watershed Characterization

- Drainage area: 7.3 sq. miles
- Redwood Creek Length: 4.7 miles
- Potential Habitat: 6.8 miles of streams
- Vegetation: 31% Coniferous, 32% Shrubland, 18% Riparian,12% Grassland
- Source: Mount Tamalpais
- Discharge: Pacific Ocean at Muir Beach
- Main Tributaries: Bootjack, Fern, Kent Canyon, Rattlesnake and Spike Buck Creeks



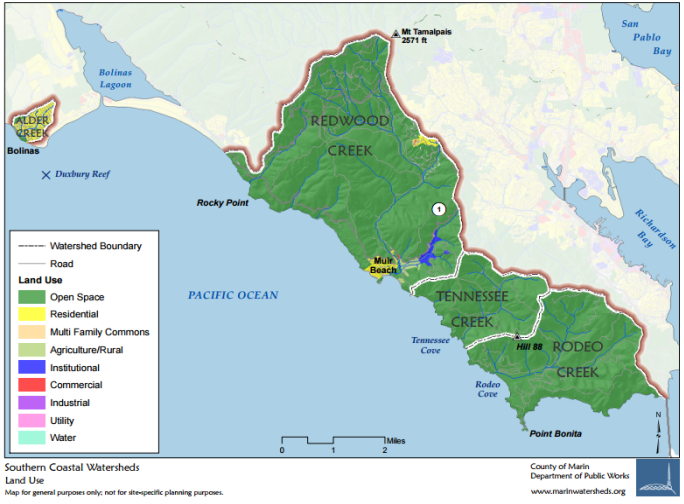
Parameter	Value
Area, in square miles	7.3
Mean annual precipitation, in inches	44.7
Average maximum January temperature, in degrees Fahrenheit	54.6
Average minimum January temperature, in degrees Fahrenheit	41.3
Maximum elevation, in feet	2583
Minimum elevation, in feet	13
Relief, in feet	2570
Elevation at outlet, in feet	25
Average basin elevation, in feet	834
Relative relief - Basin relief divided by basin perimeter, in feet per mile	157
High Elevation Index - Percent of area above 6000 feet	0
Altitude Index, in thousands of feet. Estimated as 0.00083 times mean basin elevation.	0.69
Mean basin slope computed from 30 m DEM, in percent	34.6
Percentage of basin covered by forest	48
Percent of area covered by lakes and ponds	0
Percentage of impervious area determined from NLCD 2001 imperviousness dataset	0.9
X coordinate of the centroid, in map coordinates	-2285437.2
Y coordinate of the centroid, in map coordinates	1972944.7
Latitude of the outlet, NAD83	37.86471
X coordinate of the outlet, in map coordinates	-2285820.0
Y coordinate of the outlet, in map coordinates	1969380.0
Basin perimeter, in miles	16.3
Distance in miles from basin centroid to the coast	1.78
Length of the longest flow path in meters	9821
Elevation relief in meters	783

Land and Water Use

- 95% of land is in public ownership; 5% is in private ownership
- Three private communities occupy a small portion:
  - Green Gulch Farm, Muir Woods Park, Muir Beach Community
- Dominant Land Use: Recreational
- Within the watershed boundaries:
  - Mt. Tamalpais State Park, National Park Service Lands: Muir Woods National Monument, portions of Golden Gate Recreational Area
- Variety of habitat types:
  - coastal chaparral, grasslands, old-growth redwood forest, mixed hardwood forest, seasonal wetlands, riparian wetlands

Southern Coastal Watersheds
Imperviousness
Map for general purposes only; not for site-specific planning purposes.

County of Marin
Department of Public Works
www.marinwatersheds.org



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Land Use
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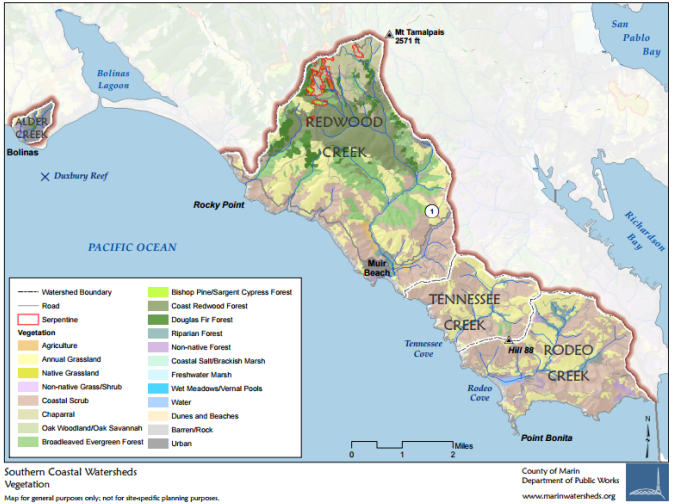

Southern Coastal Watersheds
Vegetation
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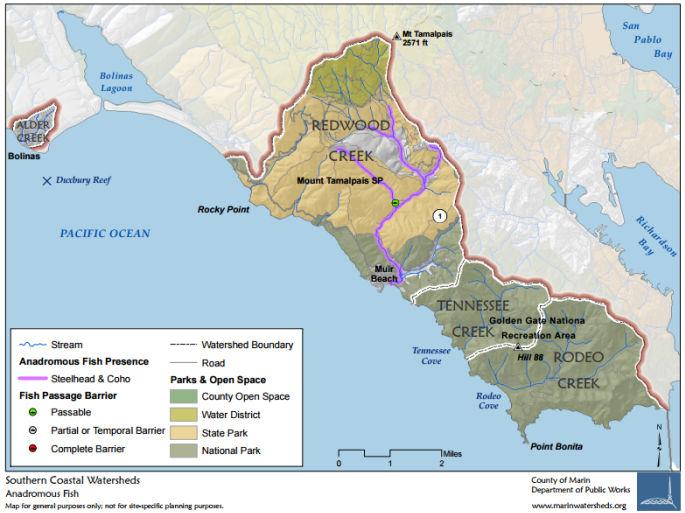

Southern Coastal Watersheds
Anadromous Fish
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F
Pelican Inn
Pacific Way
Pacific Way Bridge
Levee Road
Highway 1
Green Gulch Tributary
Redwood Creek
Tributary
Parking Lot
Tidal Lagoon
Coastal Fire Road
Feet
0 50 100 200 300

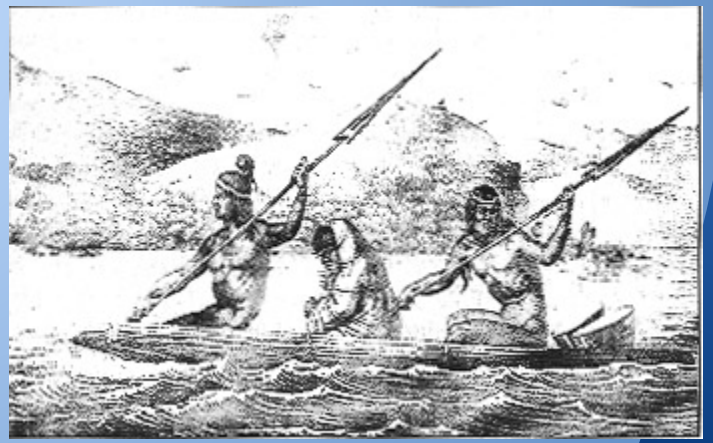

Redwood Creek Watershed
Mill Valley
San Francisco

History of the Watershed

- Before European colonization, primarily agricultural land inhabited by a local tribe

- After European colonization, the area attracted many farmers and construction along the creek took place. It has become a major tourist attraction in the area.
  - Unnaturally straight stream
  - Poor flow
  - Loss of riparian vegetation
  - Weak habitats for salmon and trout
  - Invasive plants and animals
  - Increased flooding

- Currently primarily used for recreation



Governance Organizations

- Marin Municipal Water District
- National Park Service
- California Department of Fish and Wildlife

Problems

Problem	Description
1. Aquatic and Riparian Habitat Quality	Coho salmon are state and federally listed as endangered. Steelhead trout and California red-legged frogs threatened. Abundant invasive species present.
2. Sediment Impairment and Flood Control	Construction features in recent years have confined the creek flow and influenced sediment transport. A visitor parking lot and footbridge are currently located in the center of the floodplain, which eliminates the function of the floodplain.

This is an image in the Redwood Creek in Muir Woods National Monument. It shows an excellent example of what we would like the entire creek to be like. It is an ideal habitat for salmon.

This is an image of the current condition of the Redwood Creek Watershed. Improving the estuaries would provide a nurturing habitat for fish prior to their journey out to the ocean.

Solutions

Problem	Solution	Solution
1	Habitat-based action: Implement restoration designs specific to coho salmon and steelhead trout habitats (side channels, large woody debris, removal of in-stream fish barriers)	Population-based action: Captive rearing is a temporary measure to mature infant salmon. Once mature, they will be released.

Solutions

Problem	Solution	Solution	Solution
2	Removal of visitor parking lot and undersized footbridge that consume the floodplain. Implementation of a new footbridge that will cross creek and floodplain. Addition of parking lot located outside of floodplain.	Implement an elevated emergency access road and hiking trail with a sloped drainage area on either sides to deal with flooding during winter rains.	Install erosion control techniques: use rice straw wattles to create contours on banks that direct water flow into creek and reduce downslope sediment delivery. Add vegetation to sloped drainage area in an effort produces roots and adds integrity to the soil preventing future erosion.

New access road and hiking trail. Elevation and drainage areas keep road from flooding

Reestablishing roots secures soils and reduces erosion.
The contours create a pathway that leads rainfall to creek. This will restore the capacity of the creek and help with the productivity of the creek habitat.

Community Outreach Solution

Implement an educational hiking trail around key components of the watershed, highlighting the importance of watershed and the restoration efforts taking place.

Some interactive educational hiking posts include:

- Information about the Coho salmon and their extinction
- Invasive species along the creek
- Heavy erosion spots
- Current restoration efforts

There is already a coastal trail in place near Muir beach so we hope to add these posts along that trail. There is also many trails within the Muir Woods National Monument.

Conclusion

- Reducing turbidity and increasing dissolved oxygen content will improve overall creek water quality.
- Restoring the function of the floodplain will decrease erosion on the banks of the creek.
- Habitat-based solution will increase the population of coho salmon in the creek by 20 % by the year 2030

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