



The Revegetation and Restoration of Coastal Sage Scrub in the Palos Verdes Peninsula, California



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Palos Verdes Peninsula Parcels



Introduction

The section of the Palos Verdes Peninsula, commonly known as Portuguese Bend, is dominated by an active landslide. The dominant plant community is the coastal sage scrub (CSS), a threatened habitat in Southern California. This plant community is a crucial component for the survival of the endangered species called the California Gnatcatcher (*polioptila californica*) (Dalkey, 2008).

On the Palos Verdes Peninsula, threats include: development, habitat fragmentation, and invasion by non-native plant species. For that reason, in 1988, the Palos Verdes Peninsula Land Conservancy (PVPLC) was established to address and preserve the undeveloped land. Not only has the PVPLC contributed to the preservation and revegetation of CSS, but other groups such as the city of Rancho Palos Verdes, too, aids this cause.

The non-native species crowding out the CSS were brought to California by European settlers who brought European plants (Dr. Laris, 2008). In the 20th century, Japanese farmers plowed the land in which we now call the city of Rancho Palos Verdes. Another type of natural disturbance that should be noted are the various fires that occurred across this estate ("Hiromitsu).

In this project, we are trying to learn about the dynamics of coastal sage scrub. If the land was once plowed, would the non-native invasive plants dominate the location forever? Or would coastal sage scrub find a way to win back its native land? If and when coastal sage scrub finds a way to grow in the mix of things, will it succeed in staying alive or will the non-native invasive plants eventually destroy the threatened habitat of CSS? From the CSS community, is lemonade berry (*Rhus integrifolia*) also an invasive species? Can lemonade berry be one of the causes for the decreasing diversity within CSS?



Figure 1: Comparison of size between lemonade berry (*Rhus integrifolia*) and human legs. Shown CSS is 64 ft. long.



Figure 2: Mixture of coastal sage scrub and non-native invasive plants in Ocean Trails.

Methods

1) Lab: Satellite imagery was used to assess the dynamics of coastal sage scrub in the Forrestral terrace. The rate at which California Sage Scrub grows was analyzed and the places and ways in which it expands or contracts were identified. Several historic images of the Palos Verdes Peninsula focused on the parcel of Ocean Trails were studied to learn about the history of the land.

1) Field: ArcGIS was used to obtain coordinates and GPS was utilized to locate them in the field. The size of various lemonade berry bushes (*Rhus integrifolia*) were calculated with a measuring tape. Also, GPS tracking systems were used to locate a single plant on a satellite image. Walking transects through the parcels were used to determine the percent cover of coastal sage scrub and non-native invasive plants. Restored areas were visually analyzed and surveyed for CSS.



Figure 3: Jin Young Choi (Peter) and fellow colleague used to locate a single plant on a satellite image. Walking transects through the parcels were used to determine the percent cover of coastal sage scrub and non-native invasive plants. Restored areas were visually analyzed and surveyed for CSS.

Study Area

Two separate areas were chosen: Forrestral and Ocean Trails. The Forrestral terrace acted as the control site. The upper portion of this parcel has never been affected by human interference and is a pristine location of coastal sage scrub. The disturbance in this area included: a fire in 1939 and in 1984, and a historic quarry. Ocean Trails, on the other hand, was farmed several times throughout the 20th century and was mostly populated by non-native exotic grasses. There are no records of fires ever disturbing this parcel.

Forrestral Control Site 2007



Ocean Trails Restoration Site 2006

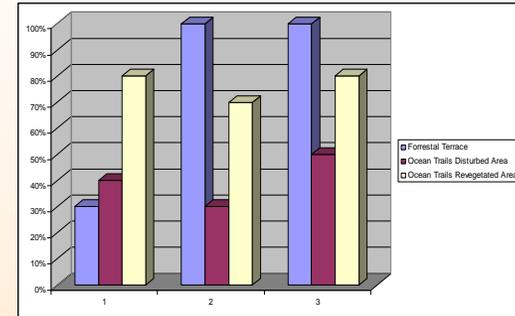


Results

Forrestral, as expected, was a pristine matrix of species comprising coastal sage scrub habitat. However, on the lower part, where there was human disturbance, there is still a remnant of the non-native invasive plant species. The disturbed land was then planned to be revegetated and is now being restored back to its natural stage. For that reason, not all of the lower part of Forrestral is full of coastal sage scrub; from three transects on this location, we concluded that about 75% of the land is occupied by native plant species.

Ocean Trails was different from any other parcel we visited. The restored parts of Ocean Trails look beautiful since they had a huge variety of CSS species. Unlike Forrestral, lemonade berry (*Rhus integrifolia*) is not the dominating plant in Ocean Trails. Nonetheless, the undisturbed area in this parcel is dominated by *Rhus integrifolia*. On the plowed part, there seems to be a good mixture between CSS and the non-native invasive plant species. According to three transects made through this location, about 40% of the land is covered by the native coastal sage scrub. That means that even without human interference, CSS is able to grow in between the non-native invasive plant species.

Percent Cover of Coastal Sage Scrub in Study Areas



Discussion

Our first location, Forrestral, demonstrates several things. First, land that was never disturbed by humans will always be a great habitat for its native plants. However, if coastal sage scrub is left alone for a long period of time, lemonade berry arguably appears to overgrow native species. At first look, lemonade berry seems like a big shrub; when analyzed carefully, it is too big of a shrub. This species seems to overcrowd the nearby plants, and at times, even outcompete them. There were many occasions where lemonade berry was growing on top of prickly pear (*Feeniculum vulgare*), purple sage (*Salvia leucophylla*), and sage brush (*Artemisia californica*). Also, when examined on satellite imagery, the amount of lemonade berry on a hillside increases tremendously over time. With those observations, the initial assessment is that *Rhus integrifolia* is an invasive native species. Despite its ability to survive and dominate, one way to inhibit its growth is through the occurrence of fires, which simultaneously creates conditions for the establishment of CSS ("The Coastal").

The second conclusion derived from this location is that land altered by humans will never return to its natural state; the only way to bring back the threatened habitat is by restoring the site. For instance, the lower portion of Forrestral was once a quarry and was affected by human intervention. Since then, the native CSS was not able to naturally develop on that land and the non-native invasive species began to dominate. After 80 years, geoscientists had to travel to this parcel and restore it back to its original status where the dominating species are juvenile CSS plants. Likewise, Ocean Trails has a restoration site. Nevertheless, the CSS in this location was planted in the late 1990's and is past its juvenile stages. Thus, this Ocean Trails restoration site can work as an example for future groundskeepers to realize that disturbed land can actually sustain its native plants after being restored.

Though CSS, in most viewed cases, was not able to develop in the mix of the non-native invasive plants, the Ocean Trails parcel proved otherwise. On the part where non-native invasives are dominant and restoration has not occurred, transects demonstrate that there is still a healthy amount of CSS. Hence, it may imply that the close location to the sea and the associated fog may aid CSS fight against the non-native plants; other locations further away from the sea did not display such characteristics. Only Ocean Trails, a parcel merely 100 yards away from the ocean, shows that CSS can actually live and share its habitat with the non-native invasive plant species.

All in all, this project sets up the stage for future projects to continue study on the Palos Verdes Peninsula. Future researchers can keep track of the progress of the restored Coastal Sage Scrub and if everything appears to look healthy, we can conclude that disturbed land is completely suitable for restoration.

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