Poster #

Comparison of an Endangered Species' Seed Bank Before and After Ungulate Removal

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Abstract

The purpose of this study was to assess the impact of the removal of ungulates on the soil seed bank of the endemic Santa Rosa Island manzanita (*Arctostaphylos confertiflora). A. confertiflora* was trampled and browsed by non-native ungulates between the years 1850 and 2011 which reduced its ability to produce seeds.This species is an obligate seeder, meaning that sprouting from seeds in the soil is its only method of reproduction. Due in part to the lack of its soil seed bank, this species was federally listed as endangered by the US Fish and Wildlife Service in 1997. In order to assess the trend in its seed bank density, researchers compared its density in 2004 to its density in 2018. There are three stands of of *A. confertiflora* on the island, and this study collected data on the seed banks in each location. The overall methodology for surveying the seed bank was by selecting sixteen random plants in each stand and collecting 12 soil samples under the canopy of each one, which were sieved to count the number of seeds. The number of seeds was extrapolated to determine the number of seeds per square meter (seeds/m^2) of soil surface sampled. The data set examined for this poster focuses on only one of the three stands; data on the other two stands have yet to be examined. This pilot data set found a 213% increase in number of seeds/m^2 in the stand from 2004 to 2018, although results were not statistically significant at the 95% confidence level (Mann-Whitney U=. A Mann-Whitney U test found that the 2018 seed bank at Telephone Road did not have a significantly higher number of seeds than the 2004 seed bank (U=88.5, p=0.13). These data can be used by agency scientists to evaluate status and plan further management for *A. confertiflora* conservation and recovery.

Study Sites

Santa Rosa Island manzanita is found in three isolated populations located in the three largest chaparral stands on Santa Rosa Island, California. The three populations include South Point chaparral, Sierra Pablo chaparral, and Black Mountain chaparral (Figure 1). Chaparral's dominant species are island chamise (*Adenostoma fasciculatum* var. *prostratum*) and island scrub oak (*Quercus pacifica*). There are two other subspecies of island manzanita that coexist with with *Arctostaphylos confertiflora* which are *Arctostaphylos tomentosa* ssp. *insulicola* and *A. tomentosa* ssp. *subcordata.* Both of these approach co-dominant status with *Arctostaphylos confertiflora* in the Black Mountain chaparral (Figure 2).

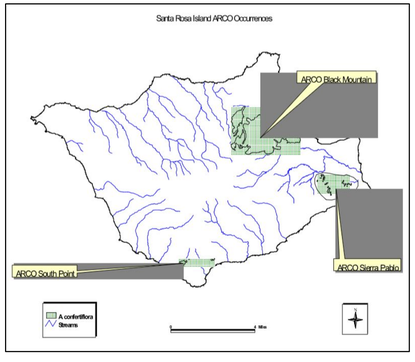

Figure 1. Distribution of Santa Rosa Island manzanita (*Arctostaphylos confertiflora)* on Santa Rosa Island, California. Source: NPS.

Figure 2. Remains of the exclosure fence at the Black Mountain chaparral. The dominant shrub pictured is *Adenostoma fasciculatum* var. *prostratum.*

Methods

1. At each site, 16 plants were randomly selected using a 50-meter tape and random digits (Figure 3).
2. At each plant, preliminary environment data were collected, including slope steepness, slope aspect, percentage of the plant's canopy touching other species and what species it was touching, composition of the ground below the canopy, and the length, width, and height of the plant. (Figure 4).
3. Twelve soil samples were collected from under each plant's canopy with a 2.5 cm diameter soil probe inserted 11.0-13.0 cm into the ground (Figure 5) and sieved to extract seeds (Figure 6).
4. Seeds with holes or cracks in them were classified as damaged, the others were classified as potentially viable. Numbers of viable seeds were extrapolated to determine the number of undamaged seeds per square meter of soil surface sampled under each plant.
5. Data were analyzed for differences in mean seed density across the site using a Mann-Whitney U test to determine statistical significance at the 95% confidence interval.

Figure 3. The transect bisects the study area to randomly select plants.

Figure 4. Plant dimensions are taken as part of preliminary data collection.

Figure 5. Samples were taken using a coring device.

Figure 6. A total of 1,152 samples were sieved separately to extract the seeds.

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Results

The total number of viable seeds found in the 2004 exclosure area was 20, and the total in the control area was 61 for a combined total of 81 seeds found in 2004. The total number of viable seeds found in the 2018 exclosure area was 102, and the total in the control area was 79 for a combined total of 181 seeds found in 2018. This information is summarized in Figure 7. When these numbers are extrapolated to estimate the number of seeds/m^2 in each year, the stand in 2004 was estimated to have 1,568 seeds/m^2; this number increased to 3,347 seeds/m^2 in 2018, as shown in Figure 8. This means that the density of the seed bank has increased by 213% between 2004 and 2018. The 213% increase in density from the Telephone Road stand proved to be statistically insignificant ($p>0.05$). A larger sample size is warranted to obtain more confidence in the conclusion.

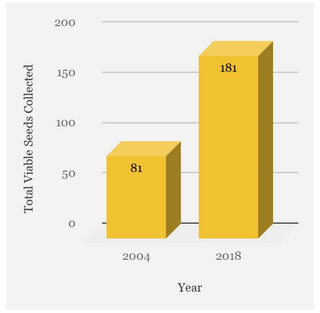

Figure 7. A comparison of the total number of seeds found from sieving samples from all 16 plants in 2004 and 2018. This data combines the totals found in the exclosure and control areas to show a general increasing trend.

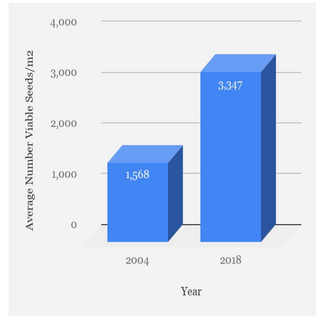

Figure 8. A comparison of the number of seeds per square meter of ground in each stand. This was found by using the numbers from Figure 2 extrapolating them out using the surface area of samples that were taken.

Next Steps

To enhance the validity of the findings in this pilot project, additional steps are recommended. The viability of seeds should be examined more thoroughly because although the shell might look intact from the outside, the embryo inside could be unviable. In the 2004 study, a large portion of seeds that looked intact from the outside did not contain a viable embryo, and therefore weren't actually part of the seed bank. It is likely that some of the seeds that were counted as viable from visual inspection aren't actually viable, so they should be tested for viability in a lab. In addition, all three stands should be analyzed to obtain an estimate of the seed density across all three chaparral stands. Finally, seed density should be calculated also as the number of seeds per unit volume of soil sampled beneath each canopy, as the volume sampled varies slight with depth to bedrock at each plant. Continued monitoring of this plant is imperative in order to fully assess its recovery after the removal of ungulates, as well as assess any other potential threats.