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Lupinus nipomensis Seedbank Study

June 27, 2013

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Funded by: Cheadle Center of Biodiversity and Ecological Restoration (CCBER) with USFWS support and UC Santa Barbara Associated Students Coastal Fund

INTRODUCTION & BACKGROUND

The purpose of this seed bank study is to determine the contents of the seedbank of the Nipomo-Guadalupe dune complex located near San Luis Obispo. This dune complex is of interest because it is the home to a federally endangered plant species, *Lupinus nipomensis* (**LUNI)**, which has a population of only 100-1800 plants varying annually depending on winter rainfall [1]. Understanding the seed bank is valuable because it can shed light on the invisible reproductive capacity of both the rare plant and the invasive competitors to that plant.

This species is in dire shape because it is impacted by so many different factors. Other than direct loss of habitat, one of the main threats to the species is competition from invasive plant species. Of particular concern is *Ehrharta calycina* (**EHCA**), which is taking over the inhabitable space of LUNI and perhaps even altering the soil it grows in. Another factor that could be a result of its decline are the numerous burrowing rodents in the area disturbing and destroying plant roots [1].

In this study, soil samples were collected from soil adjacent to existing populations of Nipomo lupine found in the Nipomo-Guadalupe dune complex. Sites include all the existing populations where Lupine were recently seen (Occ 1: Jack's Lake, Walter's Valley; Occ 8 a hilly area with grass; Occ 2, a grazed area; Occ 4, Occ 9) . Soils were first sieved to count the seeds of Nipomo Lupine in each sample and then the soil was re-mixed and placed over a base of potting soil in flats and watered regularly. The goal of first sieving the soil was to count lupine seeds present to assess this simple method of counting lupine seeds (compared to growing out the seedbank) and to see directly how many seeds would be detected and what percentage would germinate. The seed count, thus, was then compared against the number of LUNI that actually germinated when those samples were grown out in the greenhouse. It was expected that not every seed found would germinate due to the fact that it could be a dead seed or that it had not gone through the necessary environmental cues to germinate. This latter option is highly probable since seeds in the lupine family generally require disturbance for germination.

As a part of this study, other species germination rates were also recorded in order to better understand what plants are prominent in the ecosystem and may be affecting the growth, germination or survival of LUNI population.

Figure 1: Soil samples were collected and stored in plastic Ziploc and left open in order to dry.

METHODS

A total of 21 soil samples were collected by CCBER staff at the Nipomo-Guadalupe dune complex.

Figure 2: Two sieve sizes were used in order to more efficiently strain out the Nipomo seed. Sieve #10 and #18

There are a total of 7 sites, with 3 samples collected from each site, 5 of the sites were set up first and the final 2 sites were started a couple of weeks after. Soil samples were collected and stored in plastic sandwich bags and left open to dry (Figure 1).

The soil samples were then all put through a sieve system consisting of a 0.0787 inch sieve falling into a 0.0390 inch sieve (Figure 2). This was done to first filter out large particles such as twigs and large root matter and then to filter out even smaller particles including the *Lupinus nipomensis* seed. After the sample passed through the second sieve, it was put under a dissecting microscope to more accurately search for the seed and was compared against a reference Nipomo lupine seed (Figure 3).

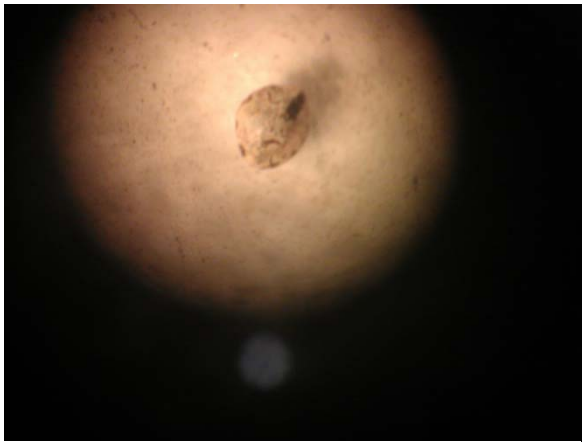

Figure 3: Shows the LUNI seed found under a dissecting microscope

Figure 4. Flats set up at the greenhouse with custom made soil mixture.

After each sample was carefully examined each sample was placed back into its respective storage bag. Shortly after, the soil samples were spread into plant starter

flats in order to attempt to grow out seeds in each sample. The flats were composed of approximately 30% perlite on the bottom layer, 70% of Sunshine potting mix #4 (mostly silty soil with organic material) and then the actual soil sample was spread out on top of this mixture.

The flats were placed on a table in a greenhouse which had automatic sprinkler systems which misted the flats 20 seconds at a time every hour. The condition in the greenhouse was usually warm and humid with a temperature range of 48°F-84°F. The samples were allowed to grow for about 6 months and plants were identified as they germinated if possible.

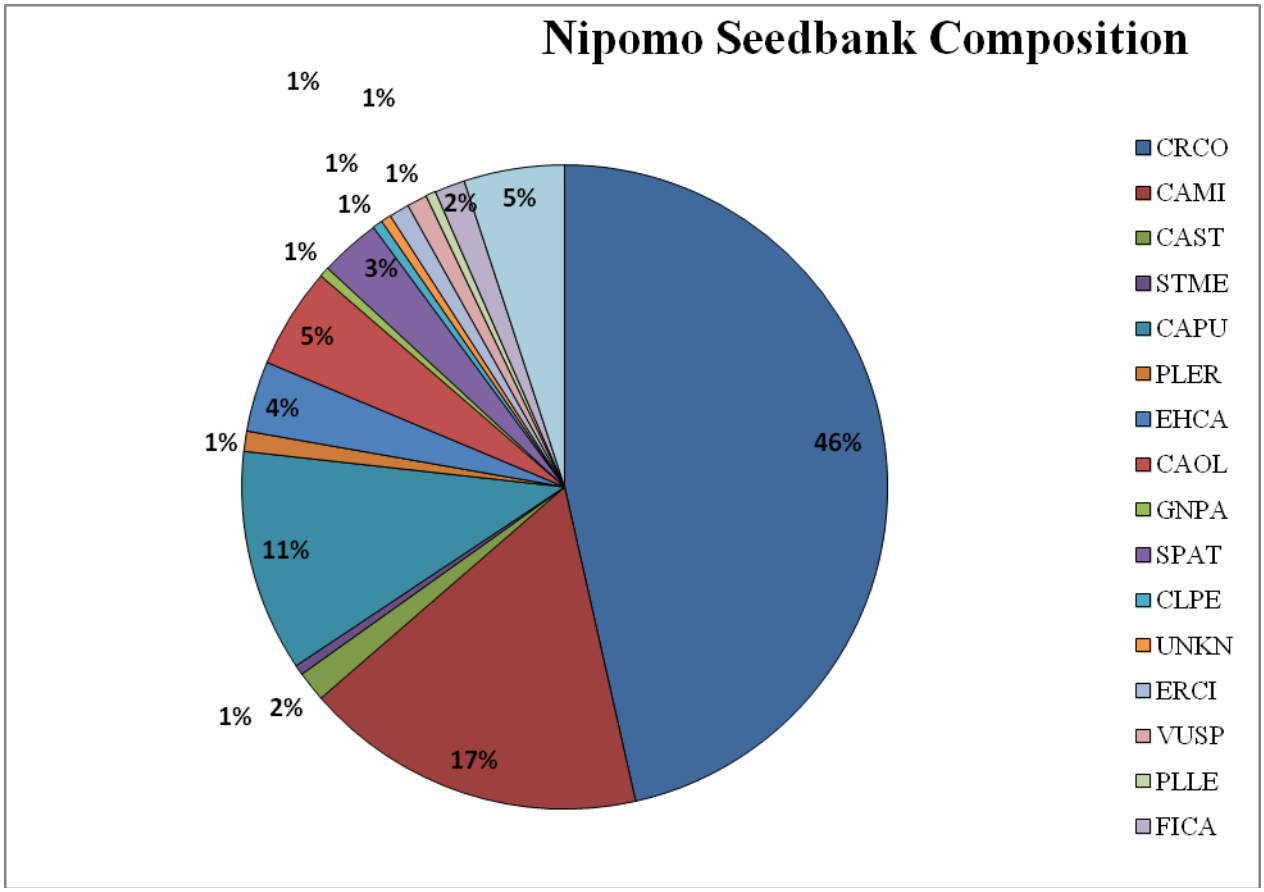

Figure 2: Shows the species composition data for the Nipomo dune complex. This count only takes into account plants that germinated.

RESULTS

After sieving was completed, there were just two LUNI seeds found one each from two separate sites creating a total of 2/21 samples. After putting these seeds back into their respective samples and after they were planted, it was found that none of the LUNI seeds actually germinated. However, a variety of other plant species were found; most of which were native with a few non-natives (Table 1). A compilation of the data was completed to illustrate the percentages of the species in the Nipomo dune complex seed bank (Figure 5). One fact to

point out is that not even EHCA, the acknowledged key competitor of LUNI was found in great abundance (4%). Instead the area was dominated primarily by natives: *Crassula connata* (CRCO, 46%) and *Camissonopsiis micrantha* (CAMI/ 17%).

Table 1: A complete list of the plants that germinated in the seedbank study. The table also displays abbreviations used for other figures. Also it includes native and nonnative information. One plant species was unidentifiable.

Species	Abbreviation	Native/Nonnative	# Germinated	% Germinated
Crassula connata	CRCO	Native	92	46.5%
Camissoniopsis micrantha	CAMI	Native	34	17.2%
Camissonia strigulosa	CAST	Native	3	1.5%
Stellaria media	STME	Nonnative	1	0.5%
Camissonia pusilla	CAPU	Native	22	11.1%
Plantago Erecta	PLER	Native	2	1.0%
Ehrharta calycina	EHCA	Nonnative (INVASIVE)	7	3.5%
Cardamine olgiosperma	CAOL	Native	10	5.1%
Gnaphalium palustre	GNPA	Native	1	0.5%
Spergularia atrosperma	SPAT	Native	6	3.0%
Claytonia perfoliata	CLPE	Native	1	0.5%
Erodium cicutarium	ERCI	Nonnative (INVASIVE)	2	1.0%
Vulpia spp.	VUSP	Nonnative	2	1.0%
Plagiobothrys leptocladus	PLLE	Native	1	0.5%
Filago californica	FICA	Native	3	1.5%
Acmispon strigosus	ACST	Native	10	5.1%

DISCUSSION

Overall out of the two LUNI seeds found, none germinated. There are various reasons this could be true due to the artificial environment or just because the seeds weren't ready to germinate or were dead. Seeds may need scarification of some sort or disturbance to germinate since they seem to occur in old road ruts and cattle-grazed areas that may not have occurred in the green house despite sufficient water. In addition, the warm conditions in the greenhouse may have been sufficiently different from the cooler dune environment to not induce germination in the seeds. Another possible reason discussed with CCBER is because legumes generally have a symbiotic relationship with bacteria on their root nodules that complete certain necessary functions. It is possible that this bacteria is also very rare in the soil and in using soil not directly from the site could be affecting the germination and growth rates of these LUNI plants.

REFERENCES

[1] Lupinus Nipomensis 2010. Center for Plant Conservation Collection Plant Profile. Missouri Botanical Garden.