Conservation and Recovery of Ione Endemic Plants: Mapping the Ione Plant Community

Final Report

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EXECUTIVE SUMMARY

This study determines the distribution of *Arctostaphylos myrtifolia* (Ione manzanita) and the associated *Eriogonum apricum* var. *apricum* (Ione buckwheat) and *Eriogonum apricum* var. *prostratum* (Irish Hill Buckwheat) within Amador and Calaveras counties. The information is represented as GIS coverages that allow for further geographic analysis, revisions and updates. *Arctostaphylos myrtifolia* is federally listed as threatened and listed as endangered in California. *Eriogonum apricum* var. *apricum* (Ione buckwheat) and *Eriogonum apricum* var. *prostratum* (Irish Hill buckwheat) are both listed federally and by the State of California as endangered. Pinpointing the distribution of these endemic species provides information for more effective planning and habitat conservation for their future recovery and survival.

An accuracy assessment of the GIS map of vegetation was performed to estimate the correctness of the mapped vegetation classification. Fifty random plots were located and surveyed within the study area. Surveyed plots were compared with their location on the map and the vegetation class assigned on the map was compared to that determined by ground survey.

Thirty survey plots were taken within the *A. myrtifolia* community using a releve method to obtain a clearer, more quantitative description of the community. An estimate of cover, species composition and abundance were recorded for each plot.

Additionally, there has been a considerable amount of *A. myrtifolia* dieback noted in the past few years. This study provides a quantitative and spatial measurement of how much dieback currently exists and investigates the causal agents for the decline. The pathogens involved are identified and the potential methods of management appropriate to improve the health and survival of the Ione chaparral are suggested.

Project Area

Although there is exposed Ione Formation found in other parts of California besides western Amador County, no Ione plant community associates have been recorded in these areas. The study area focuses on western Amador County where known populations exist. Initially the area of interest was defined by what had been recorded in the California Natural Diversity Database (CNDDB). After preliminary field observations and viewing aerial photography, the area was extended beyond the CNDDB record because other populations were found that had not been previously recorded. Two populations that had been recorded in Calaveras County are also surveyed. The final project area includes all known populations of the *Arctostaphylos myrtifolia* and is buffered by one hundred meters in every direction totaling 9534 hectares (23,558.19 acres).

The mapped project area is approximately 19.5 miles long, extending from Highway 16, paralleling the Sacramento County line to the Calaveras County border. The town of Ione and Highway 88 bisect the center of the project area. In addition to this core area, the project also surveyed two disjunct areas in Calaveras County: Valley Springs Peak, just north of the town of Valley Springs, and a section northeast of the town of San Andreas.

Vegetation Mapping of the Target Species

The distribution of Ione Manzanita

A current set of aerial photography, IKONOS satellite imagery, and ancillary data, such as soil and geologic information, CNDDB data, digital ortho quadrangles (DOQQs), Digital Raster Grids (DRGs), previous surveys and field surveys, were used to delineate polygons of Ione manzanita. Each polygon is attributed with the following:

1. Area in hectares (acres)
2. The percentage of dead foliage
3. Ocular estimate of Ione manzanita percent coverage
4. Associated Vegetation Community Classification

The *Arctostaphylos myrtifolia* distribution map provides a description of the plant communities in the project area using the Sawyer & Keeler-Wolf (1995) classification at the series level. The project area was broken into seventeen different types, including ten vegetation series. Although the *Arctostaphylos myrtifolia* distribution map includes the surrounding vegetation, the focus was on *A. myrtifolia*. Four hundred and eighty-four hectares (1196 acres) of *A. myrtifolia* were mapped, revealing five major population sites and a few smaller populations in a disjunct distribution running in a distinct northwest to southeast vein across the landscape.

The distribution of Ione buckwheat and Irish Hill buckwheat

Eriogonum apricum is such a small plant that it was impossible to see remotely, even with high resolution, multispectral imagery. The populations were typically very small, covering less than 50 meters of ground. Because of this, a GIS point layer instead of a polygon layer was used to represent the *E. apricum* distribution. *E. apricum* populations were identified and their locations were determined using a GPS. GPS coordinates were recorded every time an area of *E. apricum* was located. The *E. apricum* GIS layer includes attributes that identify the variation of *E. apricum* found at that point. Notes are also included to describe the populations, such as recently burned, or health appearance.

Every effort was made to identify as many *E. apricum* populations as possible, but only populations that were identified or noted by previous researchers, property managers, or other individuals were recorded. It is probable that there are *E. apricum* populations that are not identified on the map, such as those existing on inaccessible private property or those overlooked. Because the *E.*

apricum GIS layer is a dynamic layer, when more plants are located and recorded those coordinates can be added to the layer.

The *E. apricum* distribution map revealed seven major population centers. Five were *E. apricum v. apricum* and the other two were *E. apricum v. prostratum*. A population of *E. apricum v. apricum* was found between two populations of *E. apricum v. prostratum*. This species variation distribution generates questions regarding gene flow and exchange, plant dispersal, and speciation mechanisms. Not all of the populations were directly associated with the *A. myrtifolia* or the Ione formation. The range of *E. apricum,* spanning 12 miles, has a smaller extent than *A. myrtifolia* which extends across a distance of 19.5 miles.

Assessing Accuracy

An accuracy assessment of the *A. myrtifolia* and adjoining vegetation map was performed in order to determine its utility and limitations. Since all of the polygons could not be field checked due to time and budget constraints, a random sample of 50 sites were selected. The sample selection was limited to public and accessible private property that was located and surveyed within the study area. The dominant vegetation observed at surveyed plots on the ground was compared to the mapped vegetation class of the polygon containing the mapped survey plot. No formal accuracy assessment was conducted for the *E. apricum* map. The accuracy of the Ione manzanita designated on the map was approximately 70 percent. For overall accuracy of the entire map was approximately 70 percent. Some of the misclassification on the map was due to segmentation error of the mapping program, majority rule used for classification, minimum area required for classification or to the exclusiveness of the community classification criteria. Twenty seven percent of the plots were determined to be mislabeled, that is classified as a community entirely different than that which appeared on the map. The additional error was from the ground surveyed assessment plots that noted sample plots contain additional species, not originally designated in the remotely sensed data.

Releve Plots of *Arctostaphylos myrtifolia* community

Until this study, the *Arctostaphylos myrtifolia* plant community had not been quantitatively described thoroughly. This study examined 30 releve plots following the CNPS protocol with the goal of acquiring a set of data that quantitatively describes the entire community.

From the releve plots, elevation ranged from 74 to 156 meters with an average elevation of 114m. Slope averaged 10.72 degrees and ranged from 0 to 50 degrees. Aspect varied. Average percent cover by *Arctostaphylos myrtifolia* was estimated at 87 percent. Other species present in the releves included *Arctostaphylos viscida, Arctostaphylos manzanita, Arctostaphylos xhelleri, Eriogonum apricum, Adenostoma fasiculatum, Eriodycton californicum, Quercus wislizenii, Pinus sabiniana, Baccharis pilularis,* and unidentified mosses, lichen and grass species. At least one other species was found on the Ione manzanita plots in 97 percent of the plots, although those associated species typically occurred in small percentages. Total species within a releve ranged from pure *A. myrtifolia* to four different species within the defined plot. An average of three associated species per plot was observed within the releve plots.

Adjacent alliances surrounding the *A. myrtifolia* releves included the whiteleaf manzanita, interior live oak, chamise, mixed scrub, foothill pine and common manzanita series.

In the releve plots, health of the stand was assessed in terms of estimated percentage live vegetation. Average live vegetation was 87 percent. Noted impacts that may be threatening the plant community were included in the releve data. Of the 30 plots surveyed 47 percent were found to have some impact of dieback from disease or fungus. Ten percent had evidence of previous fire; thirty percent had other impacts such as mining, or road building in the area. Only 13 percent had no impacts noted.

The Health of *Arctostaphylos myrtifolia* Populations

Mapping Stand Health

Using remotely sensed imagery and field checking, the health of *A. myrtifolia* populations was evaluated and mapped. The percent of dead *A. myrtifolia* versus live foliage was analyzed and included in the map. Thirty percent of *A. myrtifolia* was found to have less than half live foliage, meaning it is in poor health. It should be noted that a large portion of this figure may be due to a wildfire in 2002 that caused a considerable amount of dead foliage.

Determine the Pathogens and/or Agents involved in Ione Manzanita Dieback

An additional task of this study identifies and researches the pathogens associated with large events of dieback throughout the populations. Using a variety of plant disease diagnostic techniques, pathogens associated with plant decline were identified. At least two unidentified species of *Fusicoccum* have been found to affect the health of *A. myrtifolia* and *A. viscida* in the Ione area. *Fusicoccum sp*. may contribute to *A. myrtifolia* dieback and possibly even mortality. Symptoms associated with this pathogen tend to be found scattered throughout affected stands.

Most importantly, a second disease, *Phytophthora cinnamomi*, newly identified and documented in this study, was found to cause root and crown rot that typically lead to large mortality centers of *A. myrtifolia* and *A. viscida*. Infected plants desiccate rapidly at the onset of hot weather. *P. cinnamomi* was isolated from plants at two different locations and was also found in the soils collected from one of the two sites. Greenhouse tests confirmed pathogenicity of *P. cinnamomi* isolates to *A. myrtifolia*.

Phytophthora cinnamomi crown and root rot is a very serious crisis for *A. myrtifolia* and has the potential to eliminate entire populations of the manzanita. Because *P. cinnamomi* can persist in soils for undetermined amounts of time, infected areas may create long-term or permanent loss of habitat.

Recommendations

Based on the above research, the following management recommendations have been made.

<u>Preserve Habitat</u>**:** The most important step in conserving the Ione plant community is to preserve habitat. Because it is not known how interdependent these disjunct populations are, it will be necessary to preserve as many of them as possible until more is understood about these relationships. Critical habitat needs to be identified with special consideration to the health of the populations, particularly relative to disease potential. Over ninety-six percent of the *A. myrtifolia* exists on private land. Mining activities currently occupy a large portion of *A. myrtifolia* habitat. Partnerships with mining interests could be an excellent source for habitat reclamation and possible reestablishment of populations.

<u>Contain *Phytophthora cinnamomi* Disease</u>: Minimizing the impact of *Phytophthora cinnamomi* is vital to the conservation of *A. myrtifolia*. The recommended management strategies to accomplish this are to prevent the spread of the pathogen to uncontaminated stands, stop the spread in existing mortality centers, and rehabilitate areas that have been completely infested, if possible. Soil borne pathogens such as *Phytophthora cinnamomi* are spread by moving infested soils. Generally root infections occur during wet seasons when soils are saturated. Soil transportation through mechanisms such as vehicles, OHVs, walking through an infected area, mining and soil operations should be restricted in *A. myrtifolia* populations, particularly during wet seasons. Care needs to be taken not to introduce new infestation of *Phytophthora cinnamomi* from outside sources.

<u>Involve Local Landowners and Citizens:</u> Local citizens, landowners and local government need to be included in Ione plant community conservation. Currently, Amador County does not emphasize environmental support or planning, but local meetings, public awareness, and educational campaigns could assist in shifting attitudes towards a pride for this precious resource. Local involvement will facilitate a more holistic, adaptive approach to Ione plant community management.

<u>Continue research</u>**:** The current scientific literature involving the two species of concern in this research is brief and incomplete. Proper management of the Ione plant community will require a better understanding of its biology and a long term monitoring program such as the Inventory, Monitoring and Assessment Program (IMAP).

Additionally, understanding how both species of interest react to fire, restoration, or reclamation efforts may improve and increase options for their recovery.

CONCLUSION

Efforts towards mapping *Arctostaphylos myrtifolia* and *Eriogonum apricum* yielded excellent distribution maps that reveal vital statistics of the two species. A map of the associated vegetation has added information about the plant associations surrounding the Ione plant community. Health analysis mapping efforts support studies of the two pathogens that are causing large amounts of dieback throughout the *Arctostaphylos myrtifolia* stands.

An accuracy assessment found that *A. myrtifolia* populations were mostly correctly labeled. Although remote spectral analysis provided a good initial mapping effort, achieving appropriate accuracy was not possible without further supervision, hands on adjustment, and ground surveys. This was particularly evident in differentiating chamise from Ione manzanita. Although remotely sensed imagery allows for a faster evaluation, the necessity for on the ground evaluation continues to be crucial in mapping these rare populations. The study also provides the first extensive quantitative examination of the Ione manzanita plant community using thirty releve plots.

By researching this rare endemic plant community we are better able to understand its distribution and the characteristics of the community, and make recommendations for future studies and proper management. Immediate management, research, protection and continuous monitoring will play a crucial role in maintaining stable populations into the future.