Coyote Ceanothus Mitigation Project, Summary for 2022

Annual planting of Coyote ceanothus, or *Ceanothus ferrisiae* (CEFE), at the mitigation site continues. By 2021 the four original test plots, or habitat types, at the site (Chaparral Edge, Pine, Lower Sage, and Upper Sage) had reached capacity and all additional plant installation is now focused in the larger mitigation site, dominated by serpentine grassland which surrounds the original test plots. In late November 2022, 200 new container plants were installed, and in mid-December an additional 60 basins were directed seeded, for a total installation of 260 new planting basins this winter. This brings the current total of created and planted basins at the population creation site to approximately 1500. (Note that this does not indicate the current number of surviving CEFE at the site, due to some mortality and the design of direct seeded basins often having multiple surviving individuals). Monitoring is conducted annually in June, of all planted basins. Monitoring metrics include recruitment, survivorship, plant height and vigor, and evidence of flowering and seed production.

Monitoring Results

Statistical analysis of the 2022 monitoring data focused on the following questions: 1). How survival rates change over time based on planting and habitat type; 2). Whether the different planting methods and habitat types significantly affect plant growth (height, health and vigor [plant "condition"], flowering and fruiting rate).

Results for 2022 indicate that container plants maintained high survival rates over time (85% survival six years after planting across all habitat types), and there wasn't much difference in survival rates in different habitat types over time. In contrast, direct seeded plants exhibited the opposite pattern, with a much lower average survival rate (43% six years after planting). There was a significant difference between habitat types over time for direct seeded plants, ranging from a low of 8% survival rate in Year 6 in the Lower Sage test plot, to a high of 85% survival rate in the Pine test plot.

The oldest plants are those that were direct seeded in 2015. Those plants had a 55% survival rate in the Chaparral Edge plot, an 8% survival rate in Lower Sage, and a 43% survival rate in Upper Sage, seven years after planting (the Pine plot wasn't planted until 2016). The low survival rate for direct seeded plants in Lower Sage is due to intense herbivory and mortality of young seedlings in the plot in the first several years after planting, and its proximity to Ca sagebrush, which likely provides cover to small mammals. The high survival rates seen in the Pine plot were similar to other results seen this year and consistently across years- plants in the Pine plot have done better than in other plots, whether direct seeded or installed by container. While there are only two years of data for direct seeded plants and three years of data for the container installed plants in the serpentine grassland area, survival of both types of plantings are high and appear similar to results in the Pine plot.

Average condition scores were high across all years for both direct seeded and container installed plants (2.90 for container plants and 2.58 for direct seeded plants, six years after planting), with not a lot of difference seen among habitat types. A condition score of 3 is "excellent", and a condition score

of 2 is “good” in the health and vigor rating system developed for this project. Condition scores increased slightly over time as plants matured, which is to be expected as plants become established.

Flowering and fruiting rates also increased over time as plants matured, with 2022 showing the highest rates regardless of planting method or habitat type, though fruit production was slightly down in 2022 from the previous year. Container plants had higher rates of flowering and fruiting than direct seeded plants (91% of container plants flowered and 76% produced fruit six years after planting, while for direct seeded plants 62% flowered and 46% produced fruit six years after planting). As is seen with all the monitoring metrics, direct seeded plants are likely still “catching up” in maturity while container installed plants continue to exhibit an edge after their start in the nursery prior to outplanting.

Year 2022 represented the final year of scheduled planting of CEFE in the introduction site, which began in 2015 and has occurred annually since then. Annual planting has allowed the site to develop structural complexity and phenological diversity due to different age classes of plants, mimicking natural recruitment seen in native populations. The use of different seed collection lots from the Anderson Dam occurrence for the annual planting has been designed to increase genetic diversity and microsite suitability.

At approximately 1500 basins, assuming some level of mortality, this is the appropriate size of the planted population of CEFE at the introduction site. At this point we are pausing the annual planting activity to see what kind of natural recruitment may occur, which would transition the introduction site to a self-sustaining population of Coyote ceanothus. It is estimated that there will be an additional 2-3 years of irrigation, and that ongoing site maintenance will be needed to control weeds and monitor the effects of herbivory.

In future years, an assessment will be made as to whether any additional planting should be performed. Regular monitoring will continue in order to evaluate if the seeds which are naturally produced in the population lead to recruitment and a self-sustaining population, as well as to ensure that the created population remains healthy. At some point in the future, prescribed burns may be necessary to stimulate natural recruitment and maintain the population.