Serpentine Prairie Restoration Project, Redwood Regional Park: 2008-2013

The Serpentine Prairie Restoration Project was initiated in 2008 to restore native serpentine flora and monitor the population of Presidio clarkia (*Clarkia franciscana*), a federal and state-endangered annual forb. The study site is appropriately named the Serpentine Prairie, an area within Redwood Regional Park, which is owned and managed by the East Bay Regional Park District (EBRPD). The ecological setting of this project is the Oakland Hills, near Redwood Peak. The Serpentine Prairie restoration project offers insights to the management of the Prairie and clarkia. We offer six conclusions to guide effective management in the future.

Figure 1: Clarkia franciscana in full flower

Tree removal creates habitat

Tree removal has shown to be the most effective technique for creating more clarkia habitat. Clarkia has responded favorably in tree removal areas, increasing clarkia numbers nearly 100-fold without actively reseeding the area. The disturbance from tree and duff removal produces bare ground, which may stimulate clarkia germination. Clearing trees established on serpentine substrate is an effective restoration tool.

Figure 2: Note EBRPD tree removal efforts in the prairie creating new habitat for prairie flora

Weather affects clarkia survivorship

Weather variability affects the local population size and distribution of clarkia, which can change dramatically on an annual basis. Areas that may be replete with clarkia in one year may have only a few individuals the following year. In general, years with higher spring precipitation also had higher clarkia populations at the time of survey. Although the spring precipitation was above average in 2011-2012, clarkia still declined. Another very dry year followed in 2012-2013 when spring precipitation was at record lows. Both total and spring rainfall need to be considered when predicting annual clarkia survivorship indicating the clarkia may be impacted by periods of extended drought. Anecdotally, we observed high levels of germination in the winter of 2012, but with extended drought in 2013, few of those plants reached maturity and reproduced. Active reseeding efforts should consider supplemental irrigation as a stop-gap measured for extended dry periods.

Clarkia seed dispersal has benefits

Survivorship from seed dispersed varies greatly from year to year. In the first year of seed translocation, all three sites seeded produced plants with survivorship varying from 13 to 39%. We report varying results from the following years. In

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2013 we observed directed seeded plots with a northern aspect had both great germination and many plants reaching reproduction. We believe that direct seeding efficacy is closely linked to weather and seed should be distributed to both cool, warm and slopes receiving moderate insolation.

Spring mowing maintains clarkia habitat

Occupied clarkia habitat requires management to prevent overgrowth of non-native annual grasses and thatch. Spring mowing has emerged as an effective tool for annual management of native serpentine flora. Three successive years of spring mowing provide benefits of increased bare ground, decreased thatch, decreased non-native annual grass, and increased annual forbs. The third successive year of treatment does not appreciably improve habitat conditions. Unfortunately, even one rest year can negate years of mowing, as observed in 2012. In 2013 we reinitiated mowing on the rested plots and found an increase in native cover from 18% to 32%.

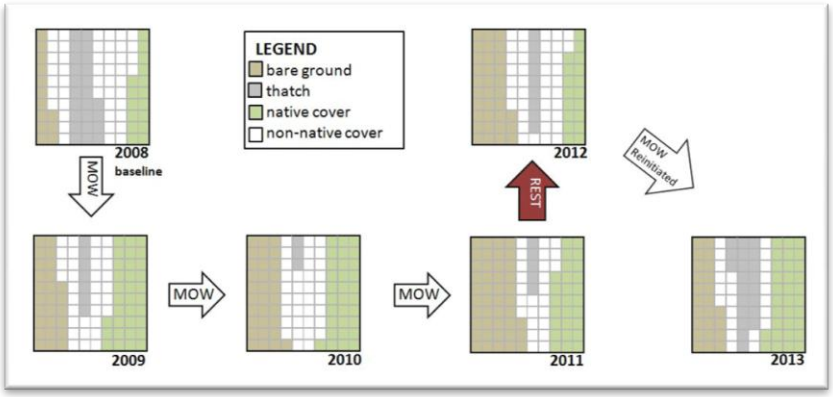

Figure 3: Diagram showing the change in cover for experiment spring mow plots

Appropriate disturbance benefits clarkia

Clarkia has been observed in areas with disturbance. Tree removal plots and accidental scrape areas often are areas where new patches of clarkia are located. Tree removal completed in tandem with reduction of soil surface organic matter from the trees, seems to create fertile patches for passive clarkia establishment from existing seed bank.

Initial conversations with agency officials about the restoration of the prairie cautioned mowing could impact the population. Our results show that clarkia survived in mow plots after an appropriately timed mow treatment in spring. Additionally, our 2011 in Hunt Field mow accidently cut 20 clarkia individuals. Those individuals were flagged and tracked through the year, wherein we observed many of these cut plants flowering, and in some cases, flowering vigorously with multiple inflorescence stalks.

Anecdotally, we have also observed clarkia germinating on bare ground that was recently disturbed by gophers. The recently turned soils is often free of any plants other than clarkia. This indicates less competition for these clarkia individuals. We have observed these plants also flower vigorously, forming large seed capsules.

Enclosure effects are not evident

No notable differences in vegetation composition were observed between the enclosed plots and the non-enclosed plots through 3 years of study. We expected that thatch might increase and bare ground decrease in the enclosure area because of the reduced foot traffic. In fact, pocket gophers were found to be very active and regularly create surface soil disturbance. This native rodent may be critical in helping maintain bare areas and exposing formerly buried seeds.

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