Kearney's Buckwheat *Eriogonum nummulare*

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INTRODUCTION

The *Eriogonum* are a highly complex group of plants in a genus of about 250 species of shrubs, subshrubs, and herbs largely from western North America (Reveal 2005). These distinctive plants often have unique associations with endemic animals. One such case that has received much interest involves Kearney's Buckwheat, (*Eriogonum nummulare* M. E. Jones) (Fig. 1) a long-lived, perennial shrub with numerous branches, that occurs in scattered sandy locations in several western States and an endemic butterfly, the Sand Mountain blue butterfly (*Euphilotes pallescens arenamontana*) (Fig 2). Although the petition to list this butterfly as threatened or endangered was denied in 2007 there is still concern over habitat loss for this species. The butterfly is known only from Sand Mountain (Fig. 3), Churchill County, Nevada, where it is dependent on its host plant, Kearney's buckwheat. In 2006 a conservation plan was agreed upon with several interested groups. The purpose of this Conservation Plan was to provide long term protection for the Sand Mountain blue butterfly and its habitat, particularly, its host plant, Kearney's buckwheat (Eriogonum nummulare) and to minimize disturbances from off road vehicles. Other components of the Conservation Plan are to initiate research on the population dynamics of the Kearney's buckwheat including propagation and revegetation research.
Unfortunately very little research has been done on the seed production, viability and propagation or restoration potential of this plant. We examined these unknown potentials.

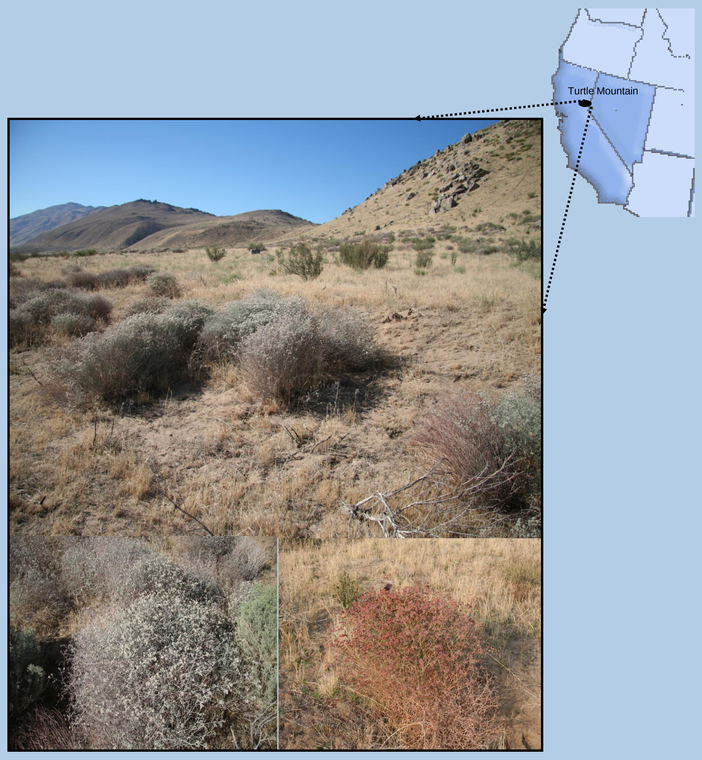

Figure 1. Mature Kearny Buckwheat plants at Turtle Mountain, Doyle CA.

Study Site & Methods

Because of restrictions and lack of access at Sand Mountain we monitored a population of Kearny's buckwheat plants at Turtle Mountain in Doyle CA about 80 miles northwest of Sand Mountain. This site, similar to Sand Mountain, occurs in an off highway vehicle (OHV) area the Fort Sage OHV area. However the plants at this site are robust and exhibit muti-aged stands with high recruitment rates. We have not observed this at Sand Mountain, though we have not been to every Kearney's buckwheat community there. At Turtle Mountain we collected seed over the entire seed ripening period, as well as monitored seedling emergence, leafing out, flowering and seed ripening dates. We also performed germination tests, propagation studies, transplant and direct seeding research.

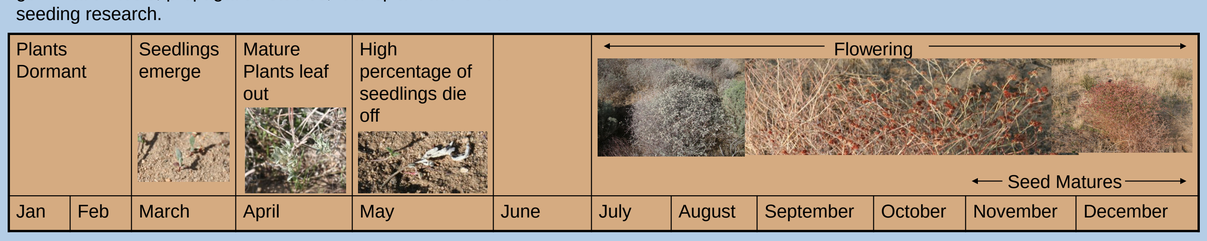

Figure 2. Sand Mountain Blue Butterfly

Germination

Based on germination tests, germination of Kearny's buckwheat can occur over a wide range of temperatures from 0C to 40C (Table 1). Less than 20% occurs at both ends of those extremes with a maximum germination rate of about 55% occurring with nighttime daytime temperature fluctuations of 5C and 35C. In general, higher germination rates occur with greater fluctuating night and day temperatures where as a constant temperature resulted in lower germination rates. It is important to stress that germination is not completely limited though. An interesting observation during testing was that if the inflorescences were not completely removed from the seed they would mold and zero germination occurred (Fig 7).

Table 1. Germination percent of Kearny buckwheat seeds incubated at 55 constant or alternating temperatures (8 hour/16 hour cycle). Seeds collected at Turtle Mountain, Doyle, CA 2006.

Percent Germination

Cold period Temperature C \ Warm period temperature C	0	2	5	10	15	20	25	30	35	40
	%									
0	9	26	17	27	29	27	19	17	54	46
2	15	23	22	33	39	32	25	35	25	
5	13	23	28	27	29	46	55	29		
10	24	33	24	33	33	45	23			
15	20	31	20	40	49	28				
20	40	27	36	35	39					
25	19	15	21	42						
30	12	15	8							
35	4	17								
40	16									

Figure 7 . Germination trays with clean seed (left) germinating and (right) seed without the inflorescence husk removed, which molded and did not germinate

Propagation

Growing seedlings for transplant is somewhat difficult, as the plant does not do well after transplanting. Using a sandy mix with just enough organic material to hold moisture is best. **Drainage and dry conditions is a must**. Seedling die off from too moist conditions is the main reason for lack of seedling propagation success. Before a robust seedling forms, seedlings are very susceptible to transplanting stress. Maintaining these considerably dry but not too dry conditions is not common practice in most commercial nurseries. However, under proper conditions seedlings will grow relatively fast and can even flower the first year, though rare (1/100+ plants) (Fig 8). Propagation by rooting stems is also not a practical restoration method. While the stems readily leaf out and maintain leaves for long periods of time, they do not develop roots. We have transplanted several dozen plants into the field with zero success. Part of the difficulty is that the soil medium (mostly sand) does not adhere to the root system (mainly one tap root) when removing the plant from the pot. We are currently providing the BLM with 500 plants grown inside pots with a biodegradable liner to hold the soil in contact with the roots at transplant time. We will monitor the success of these plants.

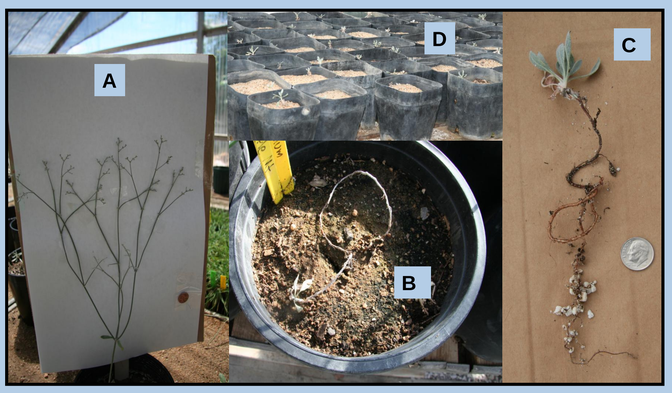

Figure 8 . Nursery grown plants. A: Six month old plant that grew rapidly and flowered (penny as a reference, bottom right). B: Two year old plant that remained small with a long thin stem. C: Root system of a one year old plant. D: One year old plants ready for transplant.

Seedling emergence

In early March seedlings emerge (Fig 4) mostly under mature plants before the mature plants leaf out. Seedlings are numerous and dense at this stage. By April the mature plants leaf out and seedling die off begins. By May and into June most seedlings occurring under mature plants die. The few surviving seedlings occur near mature plants but not under the canopy of parent plants.

Figure 4 . Seedling emergence

Figure 3. Sand mountain, below an active weekend with up to 5,000 people. Right, a sign warning riders of the consequences of straying from the designated areas.

Seeding

We seeded numerous five meter transects under varying conditions including surface seeding, differing depths, furrows, and cleaned or unclean seeds. We used six grams of unclean seeds or 300 clean seeds per five meter transect. Unfortunately no seedling emergence was observed for any of the treatments. This indicates a higher seeding rate may be required even though the seeds are viable. One interesting observation was the high degree of rodent activity at the site and seed predation on the seeded transects (Fig 9). This likely contributed to the lack of seedling emergence. In the fall of 2007 we seeded a small plot (3/4 acre) near Turtle Mountain at three increasing seed rates using a no-till experimental drill. We will monitor the success of this effort in 2008

Figure 9. An active rodent hole, a cache of Kearney's buckwheat seeds that germinated and the drill used to seed a ¾ acre plot in 2007.

Flowering and Seed Collecting

Flowering (Fig 5) begins in mid summer usually by July and continues into the winter months well into December. Seed ripening however occurs over a shorter period of time usually during November. When ripe, the flowers fall right off the plant. Timing of seed collecting is critical, likely due to flowering into winter months, when temperatures may decrease seed set. We found that the first possible chance to collect ripe seed provides the most seeds per gram. Seed collections made later during this period provided much less seed. Older decadent plants provided less seed, about a tenth as much as younger plants, which demonstrates the importance of maintaining a multiage community. With proper timing about 100 seeds can be obtained from 1 gram of inflorescences. It is important however to stress that these results were obtained from observing the population at Turtle Mountain and are only a general guideline as each habitat will likely have site specific differences. Figure 6 demonstrates the amount of plant material (one paper bag), required to obtain about 3,500 good clean seeds with 1 gram of threshed inflorescences providing about 100 seeds. This is important to consider when planning any direct seeding effort. At a typical seeding rate of 25 seeds per foot (which we have found to be too low for success) about 1 million seeds would be required to seed 1 acre. Which means 311 bags (typical paper grocery bag) of plant material would have to be collected to seed 1 acre. This becomes labor intensive and completely infeasible if the seed can *ONLY* be collected from the endangered plant community to which it is to be reseeded.

Figure 5. Kearny's Buckwheat flowering, flowers start out white-yellow (left) and then turn bright red-orange as they mature (right).

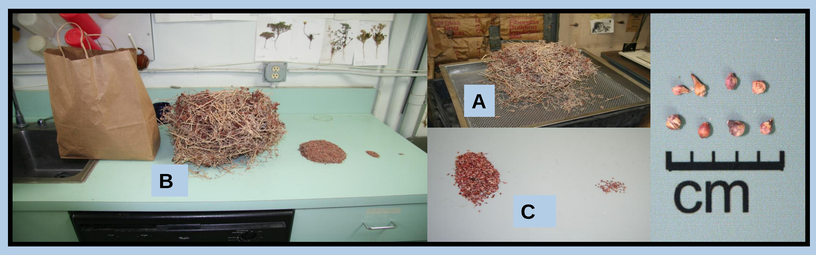

Figure 6. Seed processing **A:** unprocessed material on a threshing screen, **B:** various stages of processed seeds going from 1 bag of plant material to a rough filter removing stems to a cleaner pile of threshed inflorescences to completely cleaned seed, **C:** 1 gram of threshed inflorescences (left) and 100 clean seeds obtained from the 1 gram (right).

CONCLUSION

In conclusion, Kearny's buckwheat produces plentiful viable seed that could be potentially used for restoration or habitat enhancement efforts with proper propagation and seeding techniques. These methods if successful could be used for propagating other arid environment plants. Restoration by direct seeding may also be employed with concern to seeding rates, adjustments for small seed size and cautions for seed predation.

It is not likely that the attention and controversy over this beautiful and mysterious plant as well as the butterfly will disappear anytime soon. Hopefully, increasing our ability to understand and protect this plant will alleviate some of the tension between groups and allow everyone to realize we all want the same goal, a sustainable and functional habitat that everyone can enjoy