Locoweed Population Cycles

Outbreaks occur in wet years and die-off in drought.

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Locoweed poisoning is the most wide spread poisonous plant problem on western rangelands. Species of *Astragalus* and *Oxytropis* occur in every major plant community. However, livestock poisoning is erratic, due to the cyclic nature of the locoweed populations.

Locoweeds have different survival strategies which allows perpetuation of the species through long-term climatic cycles and short-term weather conditions. Climate controls the establishment and growth of these plants by the amount and timing of precipitation. There are three main survival strategies:

1) Annual plants avoid drought by seed-dormancy through dry cycles, and germinate in years when sufficient moisture is available.
2) Biennial or short-lived perennial plants rely on both timely and adequate moisture for germination, growth, flowering, and seed set.
3) Long-lived perennial plants grow where moisture is more abundant and more regularly available. The plants flower and produce seed for many years following initial establishment, although they too may die out during extended droughts.

The seed bank in the soil supports these cycles. Seed of white locoweed ranged from 56 to 370 seeds/ft^2 in the top inch of the soil (8). The seeds have hard coats and remain viable for many years, thus providing an ecological advantage to exploit environmental conditions and maintain the "boom and bust" populations cycles.

Livestock poisonings follows these cycles, often in catastrophic proportions. Each of the strategies requires different management techniques.The objective of this article is to describe the population cycles of some important locoweed species.

Winter Annuals

Garbancillo is a winter annual in the southwest deserts of eastern Arizona, southern New Mexico, the Trans-Pecos area of Texas and northern Mexico. It grows only during years of high winter precipitation. It becomes a large robust plant and retains its succulence in this desert region, which enhances its palatability and likelihood to cause poisoning.

Emory milkvetch is a winter annual throughout much of the Rio Grande Valley of Texas and southern half of New Mexico. It contains both the locoweed toxin, swainsonine, and nitro toxins. In dry years, plants are small and scattered. When precipitation is timely and abundant, seeds germinate and plants grow profusely, often forming a veritable carpet on large areas of rangeland. Abundant precipitation fell in autumn 1974 causing unusually high rates of germination. There was adequate winter and spring moisture to continue growth, and densities were high throughout the region surrounding Roswell, N.M. in the spring 1975. Cattle death loss averaged 2-3%, and almost all the cows in the region were poisoned to some degree (14). Only sporadic incidences of poisoning problems have occurred since then.

The same survival strategy has been observed in other annual Astragalus species; e.g., *A. geyeri* in eastern Utah in 1957, and *A. nuttallianus* var. *micranthiformis* in 1997 (herbarium specimens BYU). In both of those instances, the plants were sufficiently abundant to appear as a stubble field, then died out the following year.

Biannual Or Short-Lived Perennial Semi-Desert Species

Spotted locoweed causes major livestock poisoning in northern Arizona and southern Utah. However, the poisoning problems are erratic and seem to be tied to its population cycles. Outbreaks occurred in 1983–85, 1991–93, and again in 1998 (4). Populations of spotted locoweed appear to require two successive wet years to establish. The first year, seeds germinate and establish, but are not very apparent. If sufficient moisture is available the second year, they grow rapidly and appear to dominate the plant community (Stan Welsh, personal observation).

Wahweap milkvetch occurs in pinyon/juniper and mixed desert shrub communities on gravely benches surrounding the Henry Mountains in southeast Utah. Population outbreaks occurred every six to eight years between 1946 and 1986. These outbreaks were associated with above-average fall and spring precipitation (Figure 1). Catastrophic losses occurred in those years when Wahweap milkvetch was abundant (7).

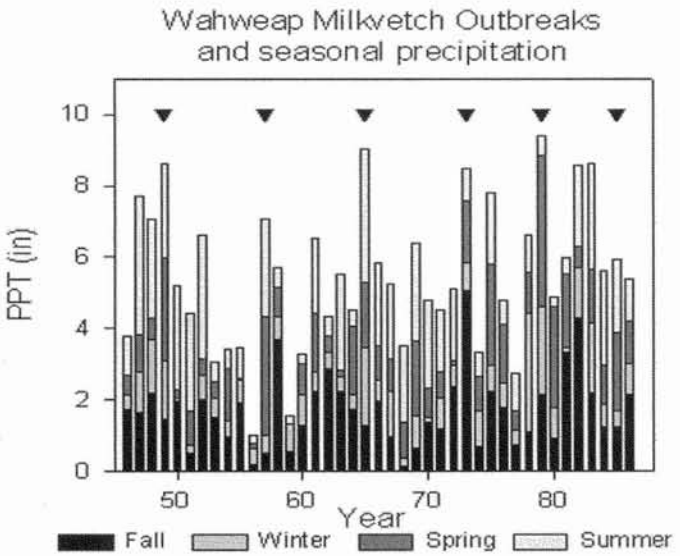

Figure 1. *Years in which outbreaks of Wahweap milkvetch occurred (g) and seasonal precipitation. Outbreaks occurred in years of high fall and spring precipitation. Data taken from Ralphs and Bagley (7).*

Green River milkvetch is a short-lived perennial forb that is occasionally abundant along the Green River corridor in southwest Wyoming, and eastern Utah. It grows on lightly alkaline soils derived from shales or sandstone, and is a component of the salt-desert shrub, mixed desert shrub, and pinyon/juniper plant communities. In years of abundance, it is the principal forb in these desert communities, appearing as dense as fields of alfalfa. Outbreaks of Green River milkvetch occurred in 1917–1918, 1957–58, and 1965–66, resulting in epidemics of poisoning (1). In the last outbreak in the Uinta Basin, 55% of a band of 1900 ewes died and most of the reminder of the band aborted. In another band, 45% aborted.

Crescent milkvetch is a short-lived perennial forb that occurs on sandy soils along the Green River corridor in eastern Utah. It is taxonomically and morphologically similar to Green River Milkvetch. It contains the locoweed toxin, swainsonine, and periodically has caused losses to sheep and cattle. A population outbreak occurred during the wet fall of 1994, but it died out during the dry summer and fall of 1995. A catastrophic loss of sheep occurred from grazing the remaining dead, dry stems: of 700 ewes, 340 aborted and 300 died.

Another crop of Crescent milkvetch germinated in the wet spring of 1996. Crescent milkvetch density was 2 plants/ft^2 on sand dunes and 0.5 plants/ft^2 on sandy-gravel soil. It did not occur on the heavier clay soils. In 1997, 95% of the plants on the gravely soil died and 65% of plants on the dunes site died. By 1998, all crescent milkvetch plants were dead. There were only widely scattered plants in 1999 and 2000, but a new crop germinated and established in the spring 2001 (Figure 2). Crescent milkvetch populations appear to establish during years of high fall and/or spring precipitation and die out in summer drought.

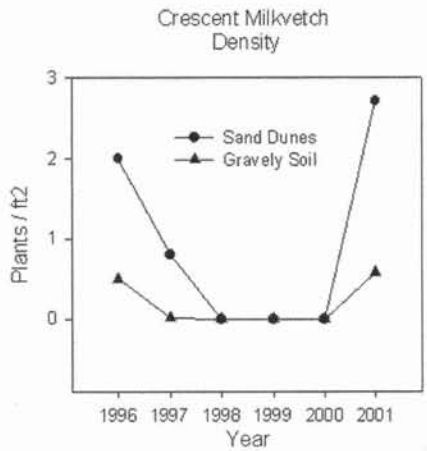

Figure 2. *Population cycle of Crescent milkvetch near Green River Utah.*

Woolly locoweed is a principal poisonous plant in western Kansas, the panhandle of Oklahoma, eastern New Mexico and west Texas. However, it rarely persists more than 2–3 years because of re-occurring droughts and from damage inflicted by the larvae of the 4-lined locoweed weevil (5). Standing crop of woolly locoweed averaged 170 lb/ac in a grazing trial at Gladstone, N.M. in 1991, but totally died out 2 years later (10).

Long-Lived Species

White locoweed is more persistent and less cyclic than the *Astragallus* locoweeds. It is also the most wide-spread locoweed. It grows on short grass prairies and eastern foothills of the Rocky Mountains from Montana to New Mexico, and on mountain grasslands in the Great Basin. Its preferred habitat is rocky soils (3), where its long tap root can access deep percolated water allowing it to survive drought, temperature and wind stress (9).

In spite of its stress-tolerant survival strategy, its populations appear to be affected by precipitation patterns. Marsh (2) observed the white locoweed was particularly abundant in wet years, but nearly disappeared in dry seasons. Following the great drought of the early 1950's, locoweed poisoning problems were severe in northeastern New Mexico in the wet years from 1954–1962. There was another short population outbreak from 1977 to 1979, and then a major extended outbreak from 1987 to 1996. There was a positive correlation between white locoweed density (6) and above average spring precipitation during this period (Figure 3).

Populations of white locoweed declined in New Mexico, Colorado and Utah during the droughts be-

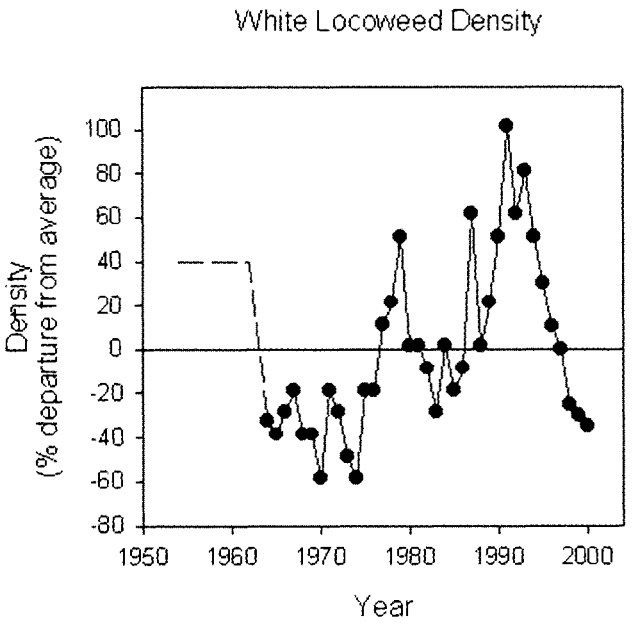

Figure 3. *Change in density of white locoweed associated with spring precipitation in north eastern New Mexico. Data taken from Purvines and Graham (6).*

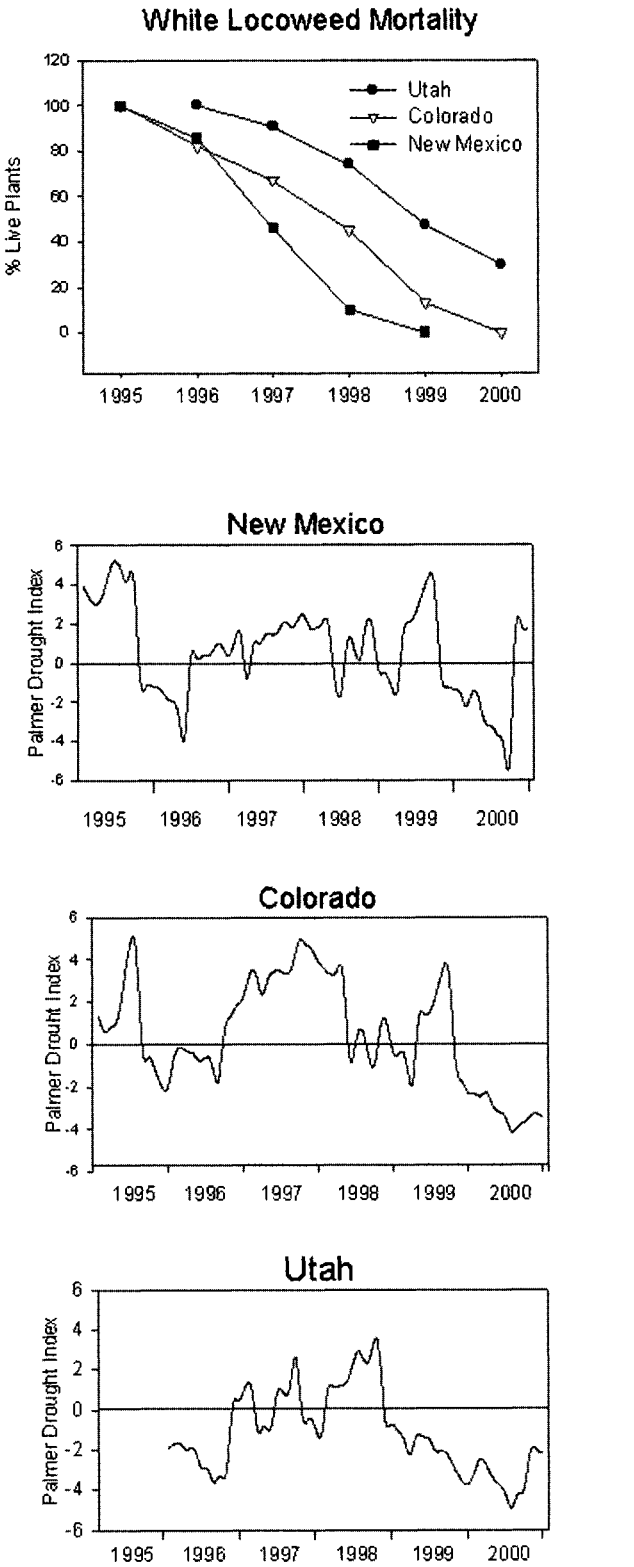

Figure 4. *Mortality of white locoweed on the Raft River Mountain in northwest Utah, eastern foothills of the Rocky Mountains in Colorado, and short-grass prairie in northeast New Mexico; and the Palmer drought index at each location (negative numbers refer to increasing drought, positive numbers are increasing moisture). Data taken from Ralphs et al. (11).*

Side Bar - Scientific Names

Winter Annuals
- Garbancillo (*Astragalus wootoni*)
- Emory milkvetch (*A. emoryanus* var. *emoryanus*)
- *A. geyeri*
- *A. nuttallianus* var. *micranthiformis*

Biannual or short-lived Perennials
- Spotted locoweed (*A. lentiginosus* var *diphysus*)
- Wahweap milkvetch (*A. lentiginosus* var. *wahweapensis*)
- Crescent milkvetch (*A. amphioxys*)
- Woolly locoweed (*A. mollissimus* var. *mollissimus*)

Long-lived Perennials
- White locoweed (*Oxytropis sericea*)

tween 1996 and 2000 (Figure 4). Vigor of large white locoweed plants in New Mexico declined during the severe winter and early spring drought in 1996, and most of the plants died during the successive years in 1997 and 1998. In Colorado, a large number of plants died in the moderate drought in 1998 and early 1999. Almost all of the plants in the region died in the 2000 drought. The mountain site at Utah had above average precipitation in 1997 and 1998, but mortality increased as total precipitation declined during the drought of 1999 and 2000. There was no establishment of new white locoweed plants during this six year study at any of the three locations (11).

Management Recommendations

Locoweed populations cycle, particularly in arid and semi-arid rangelands. Welsh (13) suggests they germinate following late summer or autumn rains, remain green over winter, then grow quickly and flower in the spring. These plants may continue to grow, flower, and produce seeds for one to two years until the next drought occurs and the population dies back.

Management decisions to graze infested areas are based on the risk of poisoning, which is dependent on the density and availability of the poisonous plant. Ranchers should anticipate outbreaks of annual and short-lived perennial locoweeds in wet years. If outbreaks materialize, they should move their livestock to other areas or non-infested sites to prevent poisoning. Caution should be used to avoid grazing the old dead stalks following die-off, since the toxin level remains high in the dead stalks.

For the long-lived species where high densities persist for several years, management strategies should be devised to avoid the critical period when the locoweed is relatively more palatable than associated forages. Poisoning from white locoweed on shortgrass prairies usually occurs in the spring and fall when it is green and growing, and relatively more palatable than dormant warm season grasses (12). Livestock should be moved to non-infested sites during these periods. During the summer, abundant green grass is more palatable than the mature locoweeds.

Populations of white locoweed will also decline during extended dry periods, but ranchers should not forget about its threat, since it will surely come back during the next wet cycle.

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