Restoring Antelope Bitterbrush

Management guidelines for overcoming the challenges of establishing antelope bitterbrush after a wildfire.

By Charlie D. Clements and James A. Young

Antelope bitterbrush occurs from British Columbia to Montana, and south to New Mexico. This widespread distribution implies the importance of this shrub. In 1924, Arthur W. Sampson, one of the fathers of range management, reported that antelope bitterbrush is an important browse species to deer, elk, and antelope. Since then, its importance has been documented as a critical browse species for wintering mule deer herds and highly preferred by domestic livestock during late summer, fall, and winter months when herbaceous vegetation dries up and is low in digestible protein.

Destructive wildfires in 1999 burned more than 1.6 million acres of rangelands in the state of Nevada alone. These wildfires can be very destructive causing loss of life and or property, decreasing food and cover for wildlife and livestock, and aiding in the spread and dominance of invasive weeds.

The restoration or rehabilitation efforts that follow these fire storms are critical in suppressing these invasive weeds as well as providing food and cover for wildlife and livestock. The Nevada State Office of the Bureau of Land Management, USDI in coordination with other federal and state agencies aggressively approached these restoration or rehabilitation efforts following this destructive wildfire season by ordering over 4.3 million pounds of seed in 1999 to be seeded onto burned rangelands throughout Nevada using various seeding methods. Of this 4.3 million plus pounds, not a single pound of antelope bitterbrush seed was ordered.

Unfortunately, many resource managers do not include antelope bitterbrush in rangeland seedings because it has not demonstrated successful establishment following wildfires. Here, we outline the successful and less successful outcome of two evaluations to re-establish antelope bitterbrush following wildfires.

Case Study #1

An important antelope bitterbrush community located within the Doyle Wildlife Management Area, located in northeastern California, was destroyed by wildfire in 1987. This site is at an elevation of 4,260 feet, receives an average of 9.6 inches of precipitation annually and is a critical wintering area for the Doyle mule deer herd.

The natural seedling recruitment or resprouting of antelope bitterbrush was nearly absent following this fire. At the time the r0evegetation efforts were initiated, the habitat destroyed by wildfire was dominated by perennial buckwheat, skeleton weed, and cheatgrass with less than 10 antelope bitterbrush shrubs per acre. In contrast, the unburned habitat was dominated by antelope bitterbrush and big sagebrush with the antelope bitterbrush density at over 500 shrubs per acre.

In the fall of 1993 and 1994 we evaluated five methods of establishing antelope bitterbrush at this site:

1) a cased-hole punch seeder,
2) hand seeding to simulate rodent caches,
3) drill seeding with a no-till drill,
4) drill seeding with a half-sized rangeland drill, and
5) discing followed by seeding with a half-sized rangeland drill.

The cased-hole punch seeder tool (developed by Dr. Terrence Booth, Agricultural Research Service, USDA, Fort Collins, Colorado) was used by placing three antelope bitterbrush seeds inside a 1/2 inch wide by 2-1/2 inch deep circular plastic cylinder and pressing into the ground. The plastic coating is designed to deter predation by rodents. The cased-hole punch method planted antelope bitterbrush in 20 foot rows, 2 feet apart. A total of 100 cased-hole punchings were established on 10 rows. Antelope bitterbrush shrubs, recorded at the end of the second growing season, established in 82% of the cased-hole punch applications.

The natural recruitment of antelope bitterbrush is closely related to the seed caching activities of granivorous rodents. These rodents exhibit two types of caching: 1) they harvest seeds and bury them deep within their burrows, termed larder hoarding, and 2) they harvest seeds and cache them in shallow depressions throughout their home range, termed scatter hoarding. Scatter hoard caching has been found to be an important mechanism of dispersal and recruitment of antelope bit-

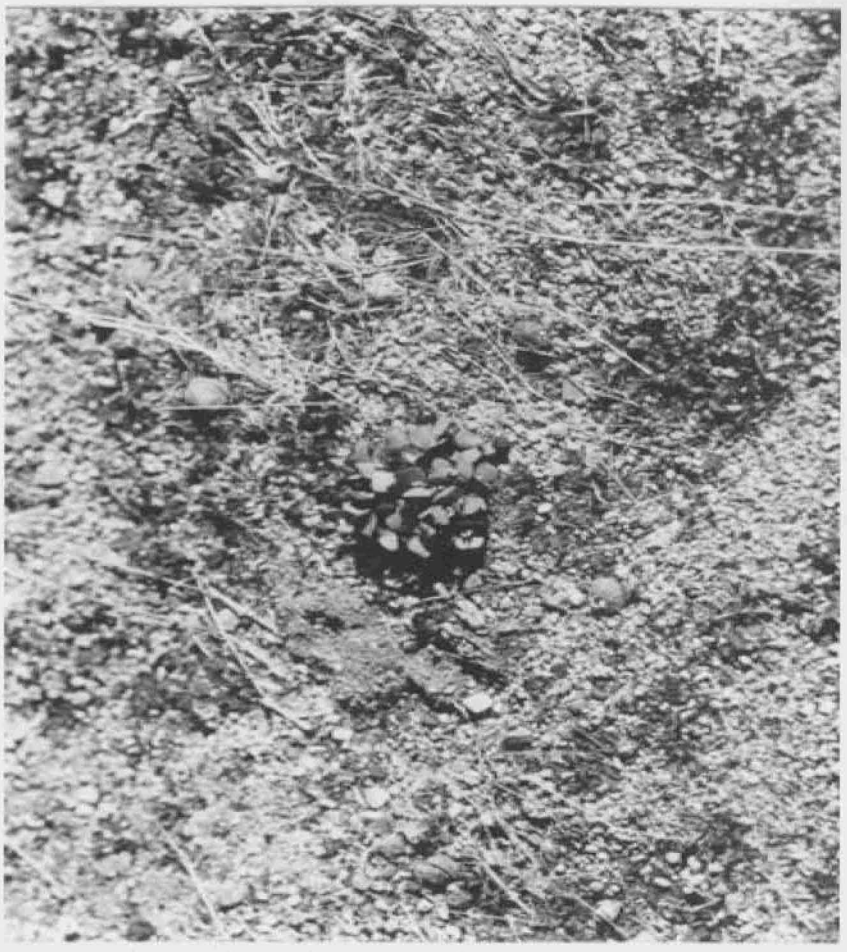

Figure 1. ***Antelope bitterbrush seedlings sprouting from a rodent cache.***

terbrush plants because seeds not recovered may germinate and sprout (Figure 1).

We hand seeded caches, 25 seeds per cache 1–2 inches in depth, simulating rodent caches 2 separate times. The first time we planted these caches the rodent population at the site dug up and removed the seeds from all 298 caches. On the second attempt, we placed 10 inch by 10 inch 1/2 inch mesh hardware cloth over the caches to protect the seed from the rodents. However, rodents still successfully robbed about 40% of the caches. In addition, following the initial sprouting and removal of the screens, 53% of the sprouted seedlings were destroyed through rodent grazing and digging activity. Overall, our hand caching efforts resulted in the establishment of 21 shrubs within this plot.

A no-till drill was used to limit soil disturbance and subsequently reduce cheatgrass proliferation. Antelope bitterbrush seed drilled at 3 pounds per acre rate successfully established 7,840 antelope bitterbrush shrubs per acre which appeared to be too dense for the site. Similar to the cased-hole punches, these young antelope bitterbrush shrubs were likely limiting each other by density dependent factors.

Antelope bitterbrush is most frequently seeded on rangelands with a rangeland drill. We used a half-size rangeland drill to seed antelope bitterbrush at 3 pounds per acre rate (Figure 2a). This method effectively established 2,505 antelope bitterbrush shrubs per acre (Figure 2b). Some areas appeared to be too dense therefore limiting the growth of smaller shrubs.

Discing followed by seeding with a half-sized rangeland drill at a 3 pounds per acre rate established the fewest antelope bitterbrush shrubs, 160 per acre. We attribute this low establishment to increases in cheatgrass following the discing disturbance, which appeared to reduce the establishment of antelope bitterbrush seedlings.

Case Study #2

A 1996 wildfire burned a mountain brush community known as the Sand Hills area, north of Reno, Nevada. This site is at 5,930 feet in elevation, receives an average of 12.3 inches of precipitation annually and is critical winter range for the Truckee Interstate mule deer herd. Prior to the wildfire this site was dominated by mountain big sagebrush and Sandberg bluegrass with an antelope bitterbrush population of 27 shrubs per acre.

Following the wildfire an average of seven antelope bitterbrush shrubs were found per acre and Sandberg bluegrass and green rabbitbrush dominated the site. In addition, we noticed that the cheatgrass density increased following the wildfire.

Table 1. Antelope bitterbrush shrub establishment following respected methods.

Case Study#1 Method	**Shrubs/Acre**
Cased-hole Punch Seeder	8,930
Hand Seeding	508
No-Till Drill	7,840
Rangeland Drill	2,505
Disc, Fallow, Drill	160
Case Study #2 Method	**Shrubs/Acre**
Rangeland Drill, Cleaned Seed	2,275
Rangeland Drill, Uncleaned Seed	766
Drilled Bitterbrush, Crested Wheatgrass	1,452/17,967
Drilled Bitterbrush, Crested, Forage Kochia	1,556/15,145/0

Figure 2a and 2b. ***Rangeland drilling of antelope bitterbrush in 1993 (2a) and the retake in 2000 (2b).***

In the fall of 1997 using a half-sized rangeland drill, we seeded antelope bitterbrush using 4 different methods:

1) cleaned antelope bitterbruh seed at a rate of 3 pounds per acre,
2) uncleaned antelope bitterbrush seed at a rate of 3 pounds per acre,
3) cleaned antelope bitterbrush at 2 pounds per acre rate, crested wheatgrass at 4 pounds per acre rate, and
4) cleaned antelope bitterbrush at 2 pounds per acre rate, crested wheatgrass at 4 pounds per acre rate, and 'Immigrant' forage kochia at 0.75 pound per acre rate.

Seeding of uncleaned antelope bitterbrush seed was experimented with to see what type of results could be attained, while at the same time decreasing the cost of the seed by not having to go through the cleaning process. In addition to the drill seedings, 25 antelope bitterbrush seedlings in quart sized containers were transplanted at 3 foot spacings in the spring of 1998, and monitored monthly for mortality.

The seeding of cleaned antelope bitterbrush seed established 2,275 shrubs per acre. However, these plants have grown very slowly and few exceed a foot in height after 3 years. The seeding of uncleaned antelope bitterbrush seed resulted in the establishment of 766 shrubs per acre. The mixture of cleaned antelope bitterbrush and crested wheatgrass successfully established 1,452 bitterbrush shrubs and 17,967 crested wheatgrass plants per acre. The mixture of cleaned antelope bitterbrush , crested wheatgrass and 'Immigrant' forage kochia resulted in the establishment 1,556 bitterbrush shrubs, 15,145 crested wheatgrass plants and 0 kochia plants.

Following the first summer, only two antelope bitterbrush transplants were recorded as dead, but by the end of the second summer all but four transplants had been recorded as dead. To date these four transplants are alive and well. This result is comparative to past experiences in regards to transplanting antelope bitterbrush seedlings that we have experimented with.

Successfully Establishing Antelope Bitterbrush

Antelope bitterbrush is an important rangeland shrub for wildlife and livestock browse and should be used in restoration or rehabilitation activities. The lack of success in antelope bitterbrush restoration has clouded many resource managers views towards using this species in these efforts. The failure to not seed antelope bitterbrush on rangelands following wildfires contributes to the decline of this once dominant and important shrub. Antelope bitterbrush decline ultimately reduces plant species diversity and forage and cover for wildlife. Our case studies showcase the potential success of re-establishing antelope bitterbrush on rangelands degraded by wildfires.

If the habitat is not too steep and rocky, the placing of antelope bitterbrush seed into the ground with the use of a no-till or rangeland drill can yield very favorable results. We seeded at a rate of 3 pounds per acre, which is the placement of over 50,000 seeds per acre (about 16,800 antelope bitterbrush seeds per pound) and experienced antelope bitterbrush densities that were actually too high and limited their own growth and productivity.

Economic feasibility should be considered in success-

fully establishing antelope bitterbrush. Drill seeding on gentle slopes lacking rocks is much more economically feasible than transplanting seedlings. Establishing the number of antelope bitterbrush seedlings in case study #1 costs $54.00 per acre plus labor. In contrast, to transplant the number of seedlings needed to achieve similar results to the rangeland drill in case study #2 would cost over $15,000 per acre. However, if a rangeland drill cannot navigate on a site, a volunteer program using the cased-hole punch method may be an effective alternative.

Many antelope bitterbrush habitats that burn are infested with the very aggressive annual invasive weed cheatgrass. The factor that most limits the establishment of antelope bitterbrush seedlings is competition for moisture from cheatgrass. If a big sagebrush/cheatgrass community burns with a good density of sagebrush present, the woody sagebrush will provide sufficient fuel to raise burn temperatures high enough for a long enough period to kill many of the cheatgrass seeds. After such a fire is an excellent time to seed antelope bitterbrush.

Repeated wildfires that eliminate most of the woody plant material and result in burning of cheatgrass fuel only, do not significantly reduce the cheatgrass seed banks. Seeding into these seedbeds is often futile using any perennial species. Some form of weed control is required before antelope bitterbrush can be established. The un-germinated seeds of cheatgrass in the seed bank are safe from attack except for tillage from a mold-board plow which turns over the seedbed resulting in burial of the seeds too deep to emerge. Such tillage is not feasible on many wildland sites because of rocks, rough surface topography, and the cost.

Disc tillage after the cheatgrass has emerged can effectively reduce the cheatgrass seed bank, but spring seeding of antelope bitterbrush is not feasible because of the chilling requirements to break dormancy. Tillage after cheatgrass emergence to create a summer fallow can be an excellent way to prepare a seedbed with reduced competition. However, fallowing may increase available soil nitrogen and promote cheatgrass germination and growth.

Planting antelope bitterbrush with perennial grasses may actively suppress cheatgrass without hindering antelope bitterbrush establishment. Mixing antelope bitterbrush and crested wheatgrass established 1,500 antelope bitterbrush shrubs per acre while at the same time providing a perennial grass to aid in cheatgrass suppression.

Our findings are similar to others that have worked on antelope bitterbrush restoration. Frank Hall, a wildlife biologist with the California Department of Fish and Game, points out many successful antelope bitterbrush restoration efforts in northeastern California and the methods that were most successful. Among those was seeding antelope bitterbrush over transplanting antelope bitterbrush seedlings. Also more success was experienced on sites that were drill seeded the fall following the wildfire as well as seeding sites that formerly had antelope bitterbrush present versus those sites that did not.

This is important because antelope bitterbrush plants are known to fix nitrogen through a symbiotic relationship with the microorganism, *Frankia*, that allows nodules to form on the roots to perform this nitrogen fixation. Sites absent of antelope bitterbrush would most likely be absent of this microorganism as well. That is why it is important to understand that antelope bitterbrush is not going to be a restoration or rehabilitation candidate for every burned habitat, but that by being familiar with the habitat and using the best methods available, success can be experienced.

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