Small Aspen Stand Dynamics in the Elkhorn Mountains, Montana

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BACKGROUND: The Slim Sam aspen restoration project was initiated in 1999. The objectives of the project were 1) to inventory and establish baseline information on all aspen stands in the Slim Sam basin; 2) to determine limiting factors relative to health and regeneration for each stand; 3) to prescribe treatment based on those limitations; and 4) to monitor the results, in terms of effectiveness and cost, of each treatment type for use in future aspen restoration projects on the Helena National Forest.

Aspen is a minor, but ecologically important, vegetative component in the Elkhorn Mountains of southwest Montana. The Slim Sam basin has rolling topography dominated by semi-arid bunchgrass rangeland with various degrees of colonization by Douglas fir, limber pine, and juniper. There are three main drainages that include Aldrich Gulch, Slim Sam Creek, and Norris Gulch. Only Slim Sam Creek is perennial, but small isolated aspen stands occupy all three drainages.

The Elkhorn Mountains are managed as a "Wildlife Management Unit" with an emphasis on big game habitats. The Slim Sam basin is within the core winter range for the South Crow elk herd – about 500 animals – that use the area from December through May. There are also moose, mule deer, and bighorn sheep in the basin.

The Slim Sam basin is within the South Crow Grazing Allotment, which provides forage for about 484 cow calf pairs from June 10- October 15. Most of the aspen stands were within the "Spring Pasture" of the allotment, which operates as a 3-pasture deferred rotation system. Cattle graze the Spring Pasture either first or second in the deferred rotation system.

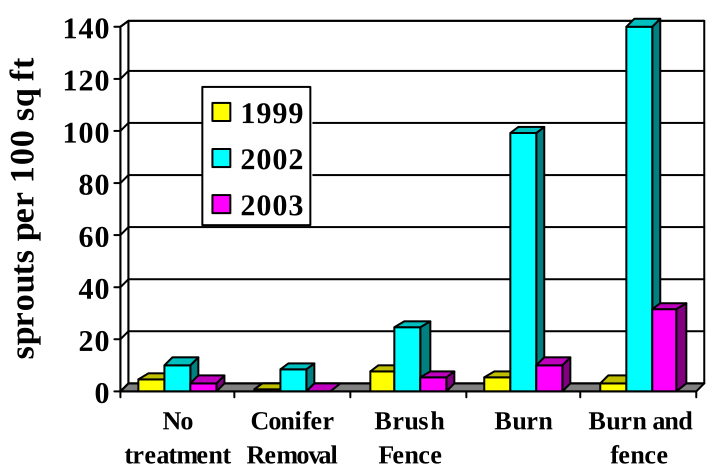
METHODS: The initial inventory included 20 separate aspen stands, ranging from under 1-acre to about 5 acres in size. Baseline inventory information was collected using an inventory form and establishing pre-treatment density of aspen sprouts on a 100 square foot belt transect. Each aspen stand had from 1-3 transects running parallel to the drainage pattern. Ground cover was also established using a 50 foot point count method as well as 5 cover microplots spaced at 12, 24, 36, 48 and 60 feet along the density belt.

Two of the original 20 stands were not included in the study because they lacked enough live aspen to support restoration treatments (Sheppard 1993). Two stands were left untreated because they were sprouting on their own and were not colonized by conifers. Limiting factors in other stands included grazing impacts, age and lack of disturbance, and hydrologic change (the drainage severely down cut following a thunderstorm event in 1997).

In 5 stands, conifers within the aspen were removed and used to create a "slash" barrier around the perimeter of the stand. Barriers were generally about 3-4 feet high and 2-3 feet wide. In 3 stands, conifers were removed but no barrier constructed. In 5 stands, conifers were slashed and the aspen burned in the spring of 2002; game-proof fences were constructed that summer and fall. In one stand, both conifer and aspen were slashed prior to burning and fencing. Lastly, 2 stands were burned but not fenced.

RESULTS: The results of the density transects are based on the number of live aspen sprouts (Figure 1). The sample sizes (transects) are as follows: no treatment n=4; remove conifers n= 4; brush fence n=7; fire only n= 5; fire and fence n=9. Based on (MANOVA; <0.05) live aspen sprouts in pre-treatment stands were not significantly different. In year 1, stands that were burned (fenced or not) had significantly more aspen sprouts then all other treatments. In year 2, those stands that were burned and fenced stands were had significantly more aspen sprouts compared to stands with brush fences.

Figure 1.



Results from the point cover transect showed that in burned stands, compared to unburned stands, there is one year where bare soil increases and the stand is susceptible to weedy species; this recovery takes place by year 2 and is more pronounced in fenced stands (Figure 2).

Cover and frequency of aspen sprouts were significantly different by treatment type (MANOVA; $P<0.05$), and cover of aspen sprouts was significantly different among years (Figure 3).

Figure 2.

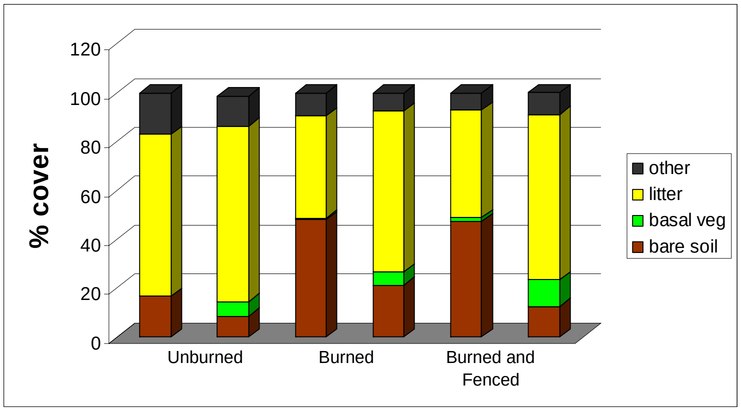
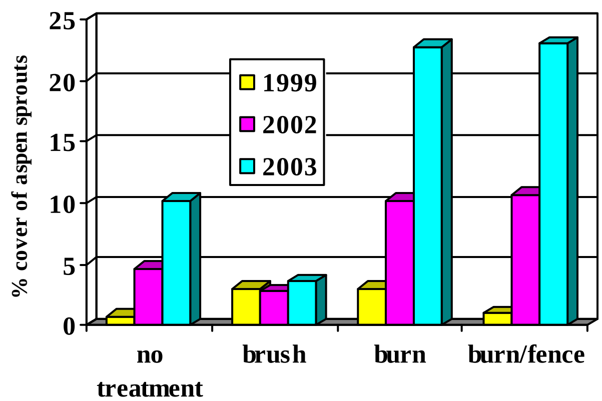


Figure 3.



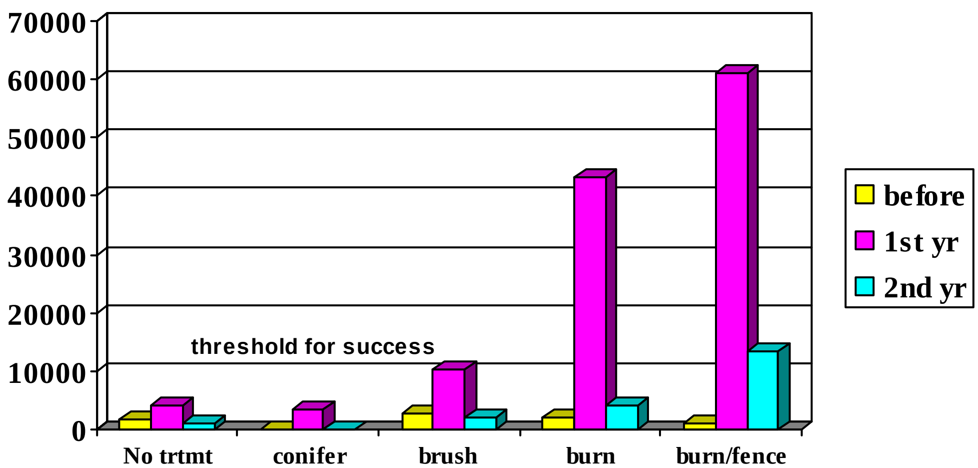
DISCUSSION: Each aspen stand had its own history and sprouting responses even within a treatment were variable. However, the following trends were evident:

- Sprout densities increased in 2002 in all treatment types.
- Sprouting increased dramatically in stands treated with fire.
- Sprout densities in 2003 declined in all treatments, but stayed the highest in the fenced stands.
- Canopy cover of aspen sprouts increased over time in all treatments except for the aspen stands with brush fences.
- Burning increases the amount of bare soil the first year.
- Dead and damaged sprout densities (Year 2) were highest in the brush fenced stands and lowest in the burned stands.

This area, like much of the west, has been in a severe drought for several years. The response we saw in all treatment types in 2002 was probably a function of an increase in May/June moisture, relative to previous years, which stimulated sprouting. Aspen are apparently sensitive to soil moisture, with too much or too little soil moisture resulting in regeneration failures (Jacobi 1996).

Research has shown that at least 5,000 stems per acre and better 10,000 following treatment to insure successful regeneration due to self thinning of the clone (nutrients and growing space) (Sheppard 1993). In this study, by the 2nd year after treatment, only the stands that were burned had sufficient sprouts to sustain a new clone (Figure 4). In the absence of protection from browsing, however, the burned sites could deteriorate quickly (Bartos et al. 1994). Kay and Bartos (2000) found that aspen within total-exclusion (livestock and wildlife) fences successfully regenerated and developed multi-aged stems without the influence of fire. Browsing kills aspen sprouts indirectly, through pathogens such as sooty bark canker and cytospora (Krebill 1972). Although these cankers are normally present, they may increase to lethal levels due to increased stress from browsing (Jacobi and Sheppard 1991).

Figure 4.



Ripple and Larsen (2001) found that woody debris protected aspen regeneration from browsing. In this study, in aspen stands where conifers were removed, sprouting was stimulated; however, removing conifers also facilitated ungulate access to those sprouts. In several situations, domestic livestock broke through the brush fences, couldn't easily get out, and grazed heavily within the fenced area. This was reflected by the low "aspen sprout cover" in this type of treatment (Figure 3).

The behavior of ungulates in relation to aspen was influenced by the time of year and the overall climate pattern. Generally, when livestock were in the Spring

Pasture early in the rotation, they grazed preferentially on green grass and impacted aspen only incidentally while traveling to and from water. However, in 2003, drought effects in this watershed were very pronounced and both cattle and wild ungulates spent considerable time in cooler microsites, which included the aspen stands that were accessible to them.

COST EFFECTIVENESS: Treatment costs were averaged and compared among treatment types in this study. Inventory and Monitoring averaged about 300$ per stand regardless of treatment type. The brush fences averaged about 2,000$ per stand including maintenance work in the second year to bolster the places cows had penetrated. The prescribed burning (including unit preparation) cost about 1,500$ per stand. Stands that were burned and fenced cost about 4,700$.

FENCING CONSIDERATIONS: Both metal and mesh fencing materials were used in this study. Mesh fencing is much lighter then metal and was used to fence stands that were not accessible by road. Constructing fence in the Slim Sam Basin was difficult due to rocky shallow soils and uneven terrain. Many of the fences had to be pinned to the ground to keep deer from crawling under the fence. Also, fences had to be examined and maintained annually. In this study, a cow moose died within an exclosure after crashing through and destroying a large section of mesh fence.

CONCLUSIONS:

- Sprouting occurs naturally under the right conditions, but sprouts may quickly disappear if not protected
- Burning and wildlife fencing produced the best overall results; burning introduces the chance for weeds
- Total exclusion fencing is expensive and can be logistically difficult, but may be necessary to sustain aspen in grazed landscapes.

LITERATURE CITED:

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