Impact of Large Ungulates in Restoration of Aspen Communities in a Southwestern Ponderosa Pine Ecosystem

Wayne D. Shepperd and M.L. Fairweather

Abstract — Experience has shown that in some areas of the Southwest, regenerating aspen suckers require fencing to protect them from browsing elk. In October, 1991 we removed the fence surrounding a 6.5 ha aspen sucker stand north of Flagstaff, Arizona to test whether the trees were large enough to be out of reach of the animals. The site had been fenced for five years following clearfelling of several clones that comprised the original stand. The regenerated stand averaged 50,000 stems/ha with dominant stems over 3 m in height. By October, 1992, most stems in one clone had been severely damaged by elk. Animals broke many stems to reach the terminal foliage, often infecting the residual stem with Cytospora canker. Monitoring will continue to determine if the remaining clones will be browsed in future years. It appears that fencing must remain in place indefinitely in this ecosystem, given the demand for browse associated with current high animal populations.

INTRODUCTION

Aspen is currently a minor component of most southwestern landscapes. Large, stable aspen communities similar to those on the plateaus of Colorado and Utah (Shepperd 1990) do not exist in the Southwest. Instead, most aspen stands are in advanced stages of succession to conifers. This is especially true in the ponderosa pine type on the Coconino and South Kaibab National Forests, where the only remaining aspen clones consist of a few small scattered groups of declining and damaged stems in a sea of pine. Aspen is approaching "threatened and endangered" status in these situations, since the few remaining aspen genotypes will be lost if the surviving stems die without re-sprouting. The long term survival of aspen in some southwestern landscapes may be in doubt.

Although an earlier study of techniques to regenerate aspen in this area reported success (Larson 1959), attempts to regenerate small clones in recent years have invariably failed, not from lack of initial suckering, but from subsequent sucker mortality. Two factors have contributed to this situation: the absence of frequent fire in southwestern ecosystems since European settlement (Covington and Moore 1991, Dieterich 1980) and extreme browsing pressure from large ungulates.

The impacts of long-term fire control measures upon vegetation succession in Southwestern ponderosa pine ecosystems has been well documented (Cooper 1960, 1961). Conifer understories have established under many aspen clones. Young conifers have grown into aspen canopies in many cases and are gradually crowding the aspen out.

Clearfelling isolated mixed conifer/aspen stands to re-establish aspen has not been successful in isolated clones. Fencing trials on both the Apache-Sitgreaves and Coconino NF's have verified that elk browse aspen suckers and have confirmed the need for elk-proof fencing to allow regenerating aspen suckers to establish and grow. Although there is no doubt that clearfelling and subsequent fencing will result in abundant stands of healthy aspen suckers (Schier et al. 1985, Shepperd and Engelby 1983), the question of when fencing can safely be removed remains. This study was designed to test if aspen regeneration can be certified as established if fencing is removed after five years. We had hoped that five-year-old aspen stems would be dense enough and tall enough to withstand animal browsing after fences were removed and not succumb to subsequent diseases introduced from animal wounds.
METHODS

The study site was located on the Peaks RD of the Coconino NF in the NE 1/4 of Sec 17, T24N, R6E in an area known as the Hochdeffer Aspens Regeneration Project. The 6.5-ha study area was one of several aspen stands that were clearfelled and fenced with 2 m hog-wire fencing in 1986. In 1990, a sample of ten 2.322-m² plots indicated that the area contained about 51,000 stems/ha with dominant stems averaging 2.5 m in height. No animal-related damage was evident inside the fence and no suckers survived outside the fence, although there was evidence that suckering had occurred.

In the fall of 1991 Forest Service crews removed fencing from the unit except for an exclosure at one end. Sixty 4.05-m² circular plots were then established in a uniformly stocked area in one genotype within the cut unit. Thirty of the plots were located in the area where fencing had been removed and 30 were inside the remaining fenced area. All plots were measured one year later, in September, 1992. Live aspen stems in each plot were examined for damage and tallied as undamaged, or assigned a damage code (based on the damage most likely to affect stem vigor). Dead stems were tallied by size class only.

RESULTS

In September, 1992, the fenced exclosure contained an average stocking of 50,000 live stems/ha while the adjoining area, where fencing had been removed one year earlier, contained only 30,000 live stems/ha (fig. 1). The greatest differences in live stem numbers occurred in size classes from 0.45 m in height to 2.5 cm diameter breast height (dbh) (fig. 2). Although this was a significant difference (p = 0.05) in overall live stem density (fig. 1), the data belies the serious browsing damage suffered by many surviving stems outside the fence. Nearly all stems less than 0.45 m in height were browsed, as were nearly half of the surviving mid-size classes (fig. 3).

Surprisingly, about 60% of large dominant stems (> 2.5 cm dbh) were also browsed. Many larger stems were stripped of lower branches, or were broken completely off by the elk (fig. 4). In addition, most of the severely wounded stems were infected with Cytospora canker [Cytospora chrysosperma (Pers.)] (fig. 5). Elk browsing was also manifested by a significant (p = 0.05) reduction in the average height of dominant stems in the unfenced, heavily browsed area. Dominant stem heights averaged 3.47 m inside the fence in 1992, but only 2.67 m outside the fence (fig. 6).
Figure 4. — Effect of elk browsing in a six-year-old aspen population, one year after fence removal. Note the distinctive browse line in the background and the stems broken by elk to access upper foliage.

Figure 5. — Fruiting bodies of *Cytospora chrysosperma* canker. Many broken stems were infected with this disease.

Figure 6. — Ninety-five percent Tukey HSD intervals comparing the height of dominant stems in unfenced and fenced treatments a year after fence removal.
DISCUSSION

It is clear from the striking change in appearance of the previously fenced area a year after fence removal that elk severely impacted the health and vigor of this five-year-old aspen sucker population. A sea of dense, vigorous aspen suckers was reduced to a scattering of severely damaged stems in the most severely affected area (fig. 4). The high percentage of large dominant stems that were browsed by elk (fig. 3) is disturbing. Most of these stems must survive intact if a new generation of aspen is to survive and prosper. Heavy browsing, destruction of terminal leaders, and canker infections in the largest stems only forecast regeneration failure. As long as elk go to these extremes to reach live leaves, aspen stems will have to be much larger to resist breakage and foliage browsing. Ten, or perhaps 15 years of continued fencing protection may be necessary.

One encouraging factor is that not all genotypes in the study area were heavily browsed the first year after fence removal. Ironically, the clone where the plots were located received most of the damage. This suggests that elk have exhibited a genotypic taste preference for the foliage of one aspen clone over others in the study area. If so, there may be compounds present in the foliage of the other clones in the area that discourage herbivory. Remeasurement in future years should determine if this effect is permanent, or if the elk will browse less tasty genotypes once the preferred clone is depleted.

The existence of a genotype over a hectare in size that is highly preferred by elk indicates that browsing intensities observed here were not likely to have occurred in the past. This suggests that there is either a lot less aspen, or a lot more elk in the landscape today than in the past. Both cases are likely to be true.

Fire suppression has resulted in a reduction of openings within southwestern ponderosa pine forests (Cooper 1960,1961; Covington and Moore 1991). Accompanying the increased density of ponderosa pine has been a reduction in the light and fire-disturbance regimes favorable to the regeneration of aspen (Schier et al. 1985; Shepperd and Engelby 1983). This trend has also reduced other forage available to browsing animals and further exacerbated the impacts of elk upon regenerating aspen in this area.

This study has clearly demonstrated that fences will have to remain around aspen regeneration in this southwestern ponderosa pine ecosystem longer than five years to guarantee survival of genotypes that are preferred by elk. The severity and pattern of elk browsing observed here are indicate a larger underlying ecosystem problem. Restoring aspen may ultimately require reduced elk populations as well as altering forest conditions within the landscape to support remaining animals and favor aspen establishment. Otherwise, some aspen genotypes in this area may have to exist like other endangered species — behind zoo-like fences.

LITERATURE CITED


