Assessing aspen regeneration in East-Central Arizona

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Introduction
Quaking aspen (Populus tremuloides) is not regenerating sufficiently after disturbance across much of Arizona and elk (Cervus elaphus) herbivory has been implicated as a major cause for the failure. Ripple et al. (2001) hypothesized that the presence of wolves may impact elk feeding behavior enough to reduce negative impacts elk have on regenerating aspen. In 1998, Mexican Gray Wolves (Canis lupus baileyi) were reintroduced into Arizona, and in 2003 and 2004, a series of wildfires burned ~33.2575r. in a mixed conifer stands within the wolf reintroduction area. This presents an opportunity to monitor aspen regeneration in this area and test Ripple’s hypothesis. In high severely burned aspen stands, high and low-wolf-use areas were identified, and aspen regeneration was measured. The objectives of this study were to determine (1) if aspen stands in high-wolf-use areas had more growth than aspen stands in low-wolf-use area and (2) to monitor aspen growth in regenerating aspen stands in high-wolf-use areas.

Methods

Objective one
• Areas burned in two adjacent fires, the Steeple and Thomas fires (both burned in 2003), were stratified into areas of high and low wolf-use.
• Annual wolf home-range maps created by US Fish and Game were used to determine wolf-use delineations.
• High-burn severity burned aspen stands from the high and low-wolf-use areas were randomly selected and sampled (n=9).
• Response variables were measured on 16 randomly placed 1 m² plots and included suckers per hectare, mean sucker height, and forks per sucker.
• Estimate of biomass (tonnes ha⁻¹) were obtained by transforming height data with a power curve (adj. R² = 0.95) based on data obtained from Hall et al. 1996.

Objective two
• Four stands in the high-wolf-use area (KP fire) were randomly selected and sampled in two consecutive years.
• Response variables, suckers per hectare and mean sucker height, were measured on 16 randomly placed 1 m² plots.
• Height measurements were transformed into biomass and analysis was done with paired (before and after) t-tests

Figure 1. Comparison of (A) aspen biomass (ordinate of dry weight), (B) forks per sucker, and (C) suckers per hectare in areas of low and high-wolf-use areas in east-central Arizona in 2007. Bars represent mean ± standard error.

Results
• Aspen in low wolf-use areas had more biomass (n ~ 9, T = -1.4, P = 0.18) and forks per sucker (n ~ 9, T = -0.8, P = 0.40) but fewer suckers per hectare (n ~ 9, T = -1.7, P = 0.10) than aspen in high-wolf-use areas (Figure 1A,B,C), although these relationships were not significant.
• Aspen biomass increased between summer 2006 and summer 2007 in the high wolf-use area within the KP fire (Paired t-test; df = 3, T = -3.4, P = 0.04)(see Table 1).
• Average sucker height increased between 2006 and 2007 in the high wolf-use area within the KP fire (mean: 2006 = 96.7 cm, 2007 = 164.2 cm. Paired t-test; df = 3, T = -6.9, P < 0.01).
• There were fewer suckers per ha in 2007 (50,156/ha) than in 2006 (75,000/ha) but the difference was not statistically significant (df = 3, T = 1.4, P = 0.26).

Discussion
• Sucker densities found were high (~50,000/ha) and similar to high suckers densities found in clearcut stands in the west (see Crouch 1983, Bartos and Muegge 1982).
• Average height in our study area after three years of growth was 1.6 m and many suckers exceeded two meters. Young aspen trees typically grow 0.9 to 1.8 m the first two years and from 2.7 to 4.5 m in five years (Shepperd 1993, Miller 1996).
• It appears that in these recently disturbed areas aspen is growing well. However, since elk browsing pressure is continuous, further monitoring is essential to determine the success or failure of a given area over time.
• Because of high variation in growth among aspen stands, we were not able to detect any difference in aspen growth due to the presence of Mexican Gray Wolves and their impact on elk foraging behavior.
• Spatial analysis could be conducted to help better understand what factors may be important in aspen regeneration in this area. Monitoring elk activity with radial collars, however, may be required to assess wolf-ek interactions.

Table 1. Biomass measurements and net biomass gain for regenerating aspen stands in high-wolf-use areas east central Arizona.

<table>
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<th>Stand No.</th>
<th>Stand Age*</th>
<th>Dry weight (tonnes ha⁻¹)</th>
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<th>2007</th>
<th>Net Gain*</th>
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* Years between fires and 2007 measurements.

Notes

References

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