

Herbaceous re-growth in the spring following fire in mountain big sage



# EFFECTS OF SURROUNDING VEGETATION AND SOIL MOISTURE ON POST-FIRE SAGEBRUSH SEEDLING ESTABLISHMENT IN SAGEBRUSH STEPPE

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An emergent sagebrush seedling in herbaceous cover

## Introduction:

•Despite the importance of fire to sagebrush steppe, patterns and mechanisms of plant community succession following fire are not well understood for this ecosystem.

•The objective of this research was to determine how interactions with surrounding vegetation might affect the establishment of sagebrush seedlings after fire.

•A better understanding of sagebrush recruitment could help guide management decisions regarding prescribed fires and subsequent grazing, seeding, and/or herbicide practices.

## Research Questions:

How is sagebrush seedlings establishment affected by surrounding vegetation and how are these effects modulated by the following?

- The identity and proximity of surrounding vegetation
- Time since burning
- Water availability

## Research Approach:

•All research was conducted during the summer of 2003 at the U.S. Sheep Experiment Station, Dubois, ID, in a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community near 6000 ft elevation.

•A stratified random design was used to sample sagebrush seedlings and random field points on sites burned 1, 4, 5 and 8 years prior to the summer of 2003.

•The sum of distances to nearest shrub and herb (grass or forb) in each of 4 cardinal directions was determined for each sagebrush seedling and random point.

•Soil volumetric water content (VWC) was measured under and around each sagebrush seedling using a Hydrosense hand-held soil moisture probe.

•Biomass was measured for sagebrush seedlings growing at different distances to surrounding vegetation in the 2002 burn area. Half of the seedlings received supplemental waterings.

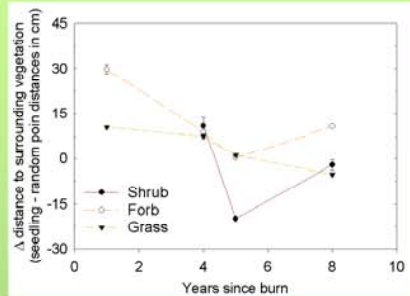


Fig 1. Differences ( $\Delta$ ) in mean sum distance to surrounding vegetation for sagebrush seedlings compared to random points, for each burn year. There were no shrubs present in the 2002 burn. Positive values indicate seedlings were further from vegetation than random points. N= 10-89

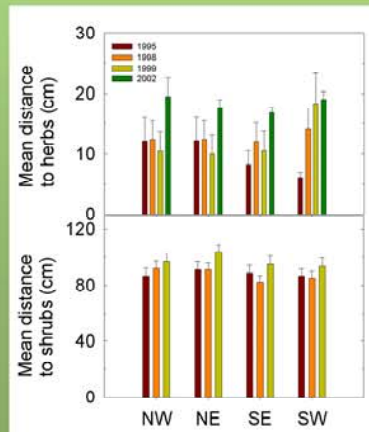


Fig 2. Distance from sagebrush seedlings to surrounding vegetation for seedlings in sites with different time since fire. N = 51-97

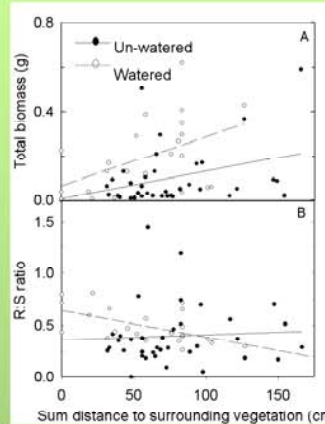


Fig 3. Total biomass and root:shoot ratios of 1<sup>st</sup>-year sagebrush seedlings, in relation to their distance to surrounding vegetation. Data are from the 2002 burn area. Biomass, un-watered:  $R^2 = 0.1202$ ,  $p=0.0355$ ; biomass, watered  $R^2 = 0.2310$ ;  $p=0.0203$ . R:S, un-watered  $R^2 = 0.0040$   $p=0.7105$ ; R:S, watered  $R^2 = 0.3271$ ,  $p=0.0044$ .

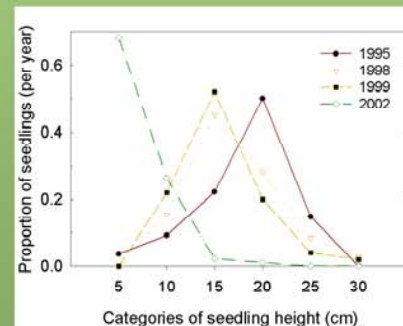


Fig 4. Frequency distribution of heights of sagebrush seedlings found on sites with different time since fire. Seedling height categories are binned groups of 5 cm increments; the upper values are shown as x-axis values. N= 50-89

## Major Findings:

•Sagebrush seedlings were always further from surrounding vegetation than random points in the two most recent burn years, and when the surrounding vegetation was forbs (Fig 1).

•Seedlings did not prefer any particular cardinal orientation to adjacent vegetation. There were no significant differences within years for herbs or shrubs (Fig 2).

•Total biomass of seedlings increased with greater distance from surrounding vegetation (Fig 3A). Supplemental watering increased this effect. R:S ratios of seedlings decreased with greater distance from surrounding vegetation only in watered plots (Fig 3B).

•Seedlings <5 cm height were found primarily only in the 2002 burn (Fig 4).

•Mean volumetric water content was  $13.1 \pm 0.2\%$  under sagebrush seedlings  $12.9 \pm 0.3\%$  on bare ground and  $12.1 \pm 0.3\%$  under grasses.

## Conclusions and Implications:

•Seedlings of mountain big sagebrush establishing after fire are likely negatively affected (i.e. competitively excluded) by surrounding vegetation, particularly forbs compared to grasses or older sagebrush.

•Belowground interactions appear to have a larger effect than aboveground interactions on spatial patterns of sagebrush seedling establishment. Water appears to be a major factor in these interactions, and greater water availability may exacerbate, instead of minimize, competitive interactions.

•Sagebrush seedling establishment may occur in isolated events immediately after disturbances such as fire, as opposed to gradually throughout post-burn years. Sagebrush seedlings may therefore require disturbances such as fire to open spaces necessary for successful establishment.

•Non-native forbs that are successful in colonizing recent burns might also be exceptional in their ability to inhibit establishment of new sagebrush seedlings.



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