

# Big Sagebrush Seed Bank Densities Following Wildfires

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## Introduction

Big sagebrush (*Artemisia* spp.) is a critical shrub to many wildlife species including sage grouse (*Centrocercus urophasianus*), mule deer (*Odocoileus hemionus*), and pygmy rabbit (*Brachylagus idahoensis*) (Fig. 1). Big sagebrush is killed by wildfires and big sagebrush seed is generally short-lived and do not survive wildfires (Young and Evans 1989). In recent years, various land managers have reported to us that they have been informed that big sagebrush does build persistent seed banks and that these seed banks may have the potential to re-establish big sagebrush following wildfires. This is important as big sagebrush is a common species purchased and seeded in restoration efforts. Young and Evans (1989) also reported that when conducting bioassay and germination tests of over 1,000 surface soil samples from burned habitats that no big sagebrush emerged. The return of big sagebrush to a community following wildfires can be a very slow process. With the increase in wildfire frequency throughout the Intermountain West from cheatgrass (*Bromus tectorum*) fueled wildfires, many habitats have been converted to cheatgrass dominance with no sight of shrub return, especially big sagebrush (Fig. 2).



Figure 1. Big sage brush is very important to many wildlife species, such as mule deer which are the only declining big game species in North America.



Figure 2. The loss of big sagebrush on millions of hectares Intermountain West rangelands is increasing at an alarming rate. The conversion of these once big sagebrush/bunchgrass communities to cheatgrass dominance assures that active and innovative methods are needed to get big sagebrush back into these communities.



Figure 3. Empire 2006 wildfire south edge. No evidence of Wyoming big sagebrush seed bank activity and very little success seeding this site. We continue to follow any shrub return at this site.



Figure 4. Mountain big sagebrush seedlings at the Sand Hills site that recorded an active seed bank. These seedlings are at the 10m distance from an unseeded plot.

## Methods

In the summer of 1996 we selected two areas in northwestern Nevada that burned in wildfires to test any possible seed bank potential of big sagebrush (Fig. 3). The first site, Empire Fire, is located 120 km north of Reno, NV and is a degraded Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) habitat with an understory dominated by cheatgrass, with a sparse density of bluegrass (*Poa secunda*), squirreltail (*Elymus elymoides*), and Indian ricegrass (*Achnatherum hymenoides*). The second site, Sand Hills Fire, is located 10 km north of Reno, NV and is a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community in good to excellent ecological condition. Other dominant shrubs at this site are antelope bitterbrush (*Purshia tridenata*) and Golden Currant (*Ribes aureum*). Sandberg bluegrass (*Poa secunda* formerly *sanbergii*) dominates the understory. Following the wildfires that took place in these two habitats we established 54 paired 3m x 3m plots at each site at the north and south end of the burned habitat. Nine paired plots were established at 1m from the unburned fires edge and again at the 10m and 30m distance (9 x 3 = 27 paired plots x 2 directions = 54). At each paired plot, one plot was seeded (45g/ha rate) to the occurring big sagebrush species for that site. The other plot was bioassayed (surface soil collected) and brought back to the greenhouse for germination tests, 5 bioassay tests per plot were conducted. Bioassay tests ran in the greenhouse environment for 14 weeks (included nitrogen enrichment and gibberellic acid treatments to break dormancy). Big sagebrush emergence was recorded in these bioassay tests weekly, while the paired seeded plots were recorded weekly from April 2007 through May 2007.

## Results and Discussion

We found no evidence from our bioassay tests nor in the unseeded paired field plots that Wyoming big sagebrush has an active seed bank following wildfire at the Empire site as we recorded no emergence of Wyoming big sagebrush. We experienced very poor success in our seeded plots as 3 out of the 54 plots recorded Wyoming big sagebrush recruitment, averaging less than one per plot.

The mountain big sagebrush plots at the Sand Hills site did however yield results that suggest that mountain big sagebrush has an active seed bank (Fig. 4). The south edge of the wildfire yielded 6.7 emerging big sagebrush seedlings in the plots at 10m and 1.8 in the plots at 1m and 30m. The north edge recorded an active seed bank at the 1m plots, at 1.8/plot. Seven of the 54 seeded plots recorded recruitment of big sagebrush which average 1.3/plot.

Wyoming big sagebrush sites are more xeric and have less site potential. The difficulty in restoring or revegetating these xeric sites following wildfires is well documented. Once these sites burn, if there is not an active and successful weed control and restoration/revegetation plan implemented these sites are often converted to cheatgrass dominance. Mountain big sagebrush communities on the other hand have much more site potential and therefore experience a greater potential to re-establish on their own. In the Sand Hills area, a variety of past wildfire events have indeed come back to desired mountain big sagebrush densities on their own. The question though is, are resource managers willing to allow this process to take hold on its own even though it may be 20+ years for this event to unfold, or are they more apt to seed the site in an effort to speed up this process. Does this effort in fact speed up this process? Plots that we have established in other mountain big sagebrush communities often yield shrub densities 73% lower than unburned islands 15 years after the wildfire, not significantly different than those habitats that were not seeded with big sagebrush species.