

Mountain Big Sagebrush Reestablishment Following Fire

Lori Ziegenhagen and Richard Miller

Introduction

It is a challenge for land managers to plan long-term fire management programs because there is a lack of information on natural sagebrush reestablishment and recovery rates. To better forecast natural post-fire recovery, we need to understand the variability of sagebrush reestablishment and develop predictive models for recovery timelines.

Experimental Protocol

This study examined mountain big sagebrush recovery on 16 large, uniform burns between 2 and 42 years old. These fires were located in mountain big sagebrush communities in southeast Oregon, northwest Nevada, and northeast California. Mountain big sagebrush is a subspecies of big sagebrush that, in this region, grows on higher elevation (>4,500 ft) sites with more than 12 inches of annual precipitation. We measured the percent canopy cover and shrub density on over 175 burned sites and aged 1,400 mountain big sagebrush to determine each shrub's year of establishment.

Results and Discussion

Rates of recovery for mountain big sagebrush canopy cover and density were highly variable, and reestablishment of seedlings following fire occurred in three phases. Live canopy cover of sagebrush increased approximately 3.5 times with each doubling of fire age. In other words, a 5-year-old burn with 2 percent canopy cover would have approximately 7 percent at 10 years and 24.5 percent at 20 years after

the fire. Similarly, sagebrush densities increased around 900 shrubs/acre with each doubling of fire age. These rates of increase are only estimates, and fire age explained about 36–57 percent of the variation we saw across the landscape. (For a detailed list of the recovery formulas, please refer to: L.L. Ziegenhagen. 2004 M.S. Thesis. Oregon State University, Corvallis).

Although these formulas suggested that mountain big sagebrush cover and density increased in smooth lines, recovery actually occurred in pulses. Our study suggested that on large, uniform burns, post-fire mountain big sagebrush reestablishment occurred in three phases (Fig. 1). Phase one is the opportunity for immediate shrub establishment from seed that survived the fire on

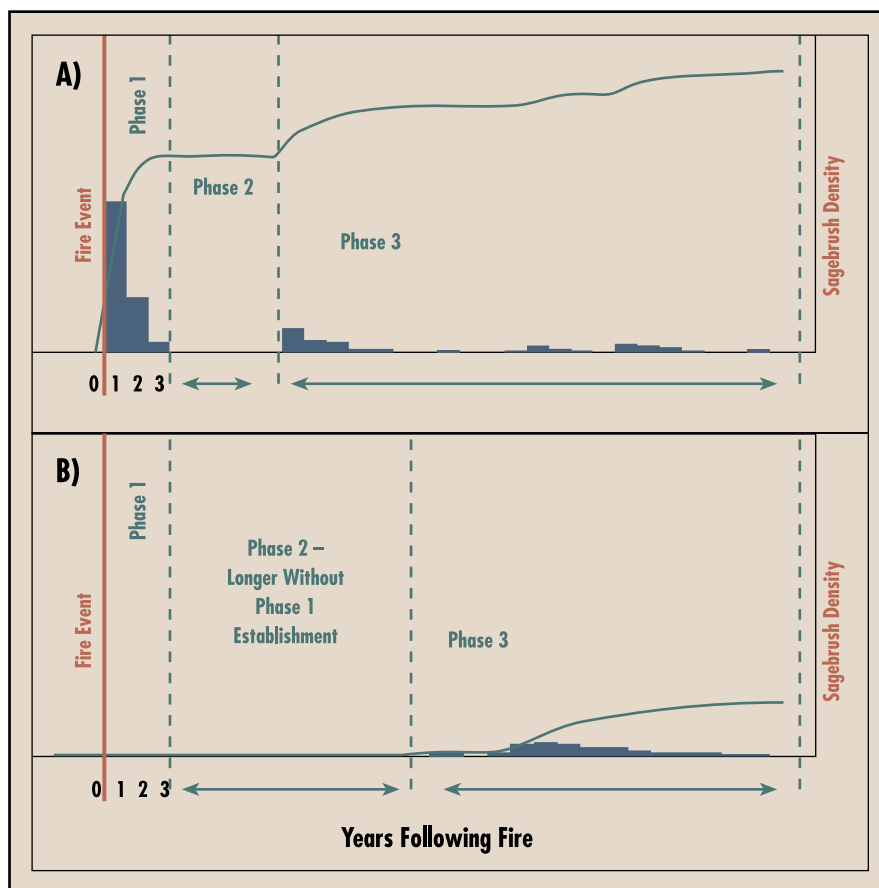


Figure 1. The three phases of shrub reestablishment following fire: A) an example fire with large initial establishment from soil seed pools, and B) an example that was missing establishment in Phase One. Fire B relied upon unburned communities for shrub reestablishment. The red vertical line represents the year of the fire. Dashed vertical green lines separate post-fire establishment phases. Gray bars represent the percent of the total sagebrush to establish each year following the fire. The solid line is a running total of sagebrush established. Years are in “crop years” (Oct.–Sept.).

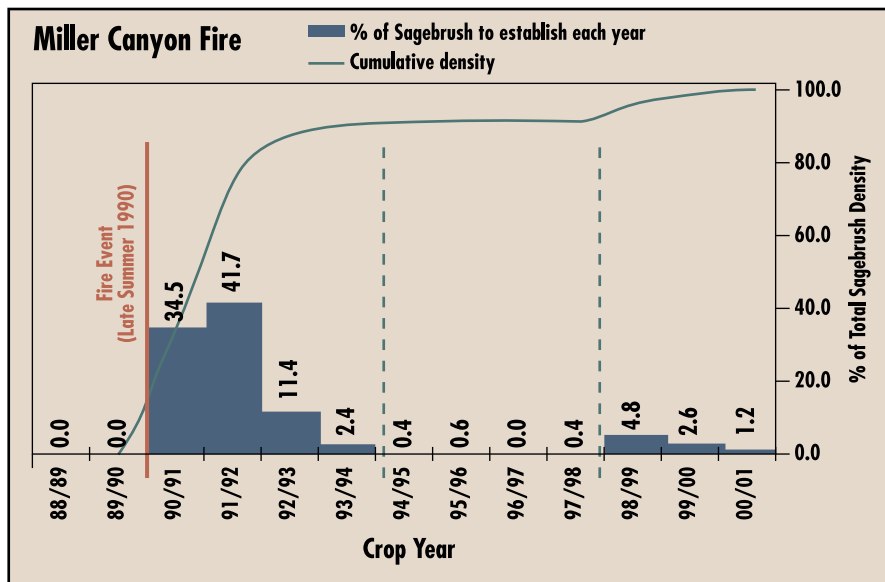


Figure 2. Example of the Three Phases of Shrub Reestablishment on Miller Canyon, a burn located near Burns, Oregon. The red vertical line represents the year of the fire. The dashed vertical green lines separate post-fire establishment phases and the grey bars represent the percent of the total sagebrush on Miller Canyon that established each year following the fire. The solid green line is a running total of sagebrush establishment as it approaches the total. In 2000/01 sagebrush density was approximately 1,700 shrubs/acre. Years are in “crop years” (Oct.–Sept.).

the soil surface (soil seed pools). Phase two is a lull in shrub establishment and phase three begins when newly established shrubs are mature enough to produce new seed. The Miller Canyon Fire near Burns, Oregon (Fig. 2), illustrates these three phases of reestablishment. The length of phase two is determined greatly by the success or failure of soil seed pools to establish seedlings during phase one. Without successful establishment during phase one, phase three begins only after sagebrush seed from adjacent unburned communities migrates into the interior of these large burns. Mountain big sagebrush seed dispersal is limited to only a few yards from the parent plant and migration across a landscape is a slow process.

Management Implications

Many fire-management programs require a target canopy cover across a given landscape and a given acreage to be burned every year.

In our study region, mountain big sagebrush required, on average, 36 years after a fire to acquire a canopy cover of 25 percent. However, more importantly, the range of time needed for this recovery to occur was 25–57 years. Although recovery rates were highly variable, results did emphasize the importance of soil seed pools in establishing mountain big sagebrush during the years immediately following a fire. Higher densities at the end of phase one of post-fire establishment would lead to a faster recovery rate in following years. If shrub densities after 2–4 years were below target level, predictions of the recovery timeline should be lengthened and the timing of future burning projects across the landscape reevaluated. Furthermore, the availability and size of soil seed pools (the size of the previous fall’s seed crop) should be considered when planning a proper time to burn mountain big sagebrush sites.