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FIRE EFFECTS ON SPINY HOPSAGE IN SOUTH CENTRAL WASHINGTON

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Grayia spinosa (spiny hopsage) is a dioecious, short-statured, multi-stemmed, summer deciduous shrub erratically distributed across the low-elevation Columbia River plain on the 1400-km\(^2\) U.S. Department of Energy's Hanford Site in south central Washington. The Columbia River plain differs from other rangeland habitats in Washington because it has not been grazed by livestock since 1943 and has served as a refugium for native plants and animals in a surrounding matrix of land devoted to cultivation agriculture and urbanization (Rickard and Rogers 1983, Gray and Rickard 1989).

Daubenmire (1970) studied steppe communities throughout eastern Washington and observed that burning was not a threat to hopsage because it readily sprouted. Rickard and McShane (1984), however, reported that hopsage growing with Sarcobatus vermiculatus (greasewood) did not respout after burning. It is important for rangeland managers to be able to predict the response of steppe shrubs to wildfires. Spiny hopsage is a browse species palatable to livestock, and hopsage plantings could be useful in rangeland restoration, especially if hopsage sprouts after burning. Managers of conservation areas may need to consider fire protection for hopsage communities as a way to sustain a measure of landscape biodiversity and wildlife habitat, especially when hopsage is easily killed by fire. Small, peripheral populations of otherwise widely distributed species such as hopsage can be reserves of genetic variability and are worthy of protection (Jones et al. 2001).

Six botanical study plots were established in 1986 and 1987 on the Columbia River plain adjacent to the Arid Lands Ecology (ALE) Reserve in south central Washington. This location had been selected as a possible location for a deep underground repository for highly radioactive waste (Rickard and Schuler 1989). Each plot was 50 x 50 m with the perimeter marked with steel posts at 5-m intervals. Shrub density was determined by counting all shrubs greater than 0.2 m tall in each plot. Shrub canopy cover was measured by line intercept, and herb cover by species was ocularly estimated along three 40-m transects systematically spaced in each plot using the canopy coverage method of vegetational analysis proposed by Daubenmire (1959).

The repository project was abandoned in 1988, but all plots remained undisturbed until a massive wildfire burned through the repository location and all of the adjacent 30,000-ha ALE Reserve on or about 1 July 2000. Each plot was resurveyed during spring and summer 2001 and spring 2002 with particular attention to sprouting of spiny hopsage.

Five of the 6 study plots supported hopsage shrubs in 1987 (Table 1). According to Rickard and Schuler (1989), the sparse herbaceous understory was dominated by Bromus tectorum (cheatgrass) and Poa secunda (Sandberg's bluegrass). Most of the combustible fuel in all study plots was wood. Hopsage was the only shrub species on 1 plot and it was subordinate to Artemisia tridentata (Wyoming big sagebrush) on the other plots. All hopsage shrubs on the study plots and surrounding areas were burned in July 2000 (Fig. 1). Only 1 hopsage shrub on plot 2H sprouted after the 2000 wildfire (Fig. 2). None of the hopsage shrubs on the other plots sprouted. One Purshia tridentata (bitterbrush) shrub escaped burning on plot 6S along with a few Ericameria nauseosa...
(gray rabbitbrush) shrubs (Table 1). We revisited all plots in March 2002 and there were no new hopsage sprouts, thus confirming the 2001 findings.

Fire frequency on the Columbia River plain is unknown. However, sagebrush shrubs on the study plots were known to be at least 50 years old (Rickard 1988). Hopsage phenology is synchronous with the annual cycle of precipitation and temperature. New hopsage leaves emerge in late February or early March, fruits (bracted utricles) mature in May and June, leaves drop in July and August with the onset of summer soil drought, and conspicuous overwintering buds develop. Hopsage is dormant in autumn and winter. Wildfires usually occur in July and August when steppe shrubs and herbs are most desiccated, air temperatures are at annual highs, and soil water is depleted (Rickard 1967). The fire sensitivity of hopsage following the 2000 wildfire may be exacerbated by slightly below normal precipitation as measured at the Hanford Site Meteorological Station. Normal October–June precipitation is 152 mm. The October–June precipitation was 141 mm in 1999–2000 and 149 mm in 2000–2001.

Typically, managers of conservation areas target a few selected utilitarian species for protection, but conservation biology must focus on understanding and conserving biological diversity (Temple 1997). In Washington State, *Centrocercus urophasianus* (Sage Grouse), *Amphispiza belli* (Sage Sparrow), *Oreoscoptes montanus* (Sage Thrasher), and *Lanius ludovicianus* (Loggerhead Shrike) are listed as steppe species of special concern by the Washington Department of Wildlife (1987), because they depend upon sagebrush as nesting habitat (Poole 1992, Fitzner 2000, Vander Haegen et al. 2000). Sagebrush is easily killed by burning. Efforts have been made to restore it to burned areas by planting tube-grown and barerooted seedlings (Durham 2000). Currently, there are no efforts to restore spiny hopsage to burn scars.

Spiny hopsage is a minor component of eastern Washington’s steppe rangeland communities and pure stands are scarce. Daubenmire (1970) observed that hopsage stands in eastern Washington seldom, if ever, established seedlings even though seeds readily germinated in laboratory tests. This matches our own field observations. In the absence of hopsage seedlings, young plants, and mortality of mature shrubs, it seems likely that there was little change in hopsage density between 1987 and 2000. Our observations on the Columbia River plain indicate that hopsage has the potential of being extirpated by repetitive burnings. Hopsage populations are widely distributed in arid interior valleys throughout the intermountain regions of the western United States, and the species as a whole is probably not under any immediate threat of extinction. However, small,
Fig. 1. Ground-level photographs of hopsage study plot 2H in June 1987, thirteen years before burning (upper), and in May 2001, eleven months after burning (lower).
isolated peripheral populations such as those in the Columbia River plain and ALE Reserve are threatened. As Washington's rangelands are steadily converted to agriculture and urban uses, fire threats to burn-sensitive species become more pronounced.

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