

Effects of wildfire on high-quality shrub-steppe vegetation, Cleveland Natural Area Preserve, south-central Washington State.

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Cleveland Natural Area Preserve, located in eastern Klickitat County in the *Purshia tridentata*/*Festuca idahoensis* zone, protects high-quality examples of shrub-steppe plant communities. In 1998, a lightning-ignited wildfire burned virtually the entire site at moderate to high intensity. The burned area encompassed several pre-existing plots where baseline vegetation data had been gathered, providing an excellent opportunity to assess changes in the plant communities. While many past studies have documented the responses of shrub-steppe dominants such as shrub species and bunchgrasses, there is far less information about other plant species that are commonly found in shrub-steppe communities, particularly forbs. This study tracked the responses of all vascular species in burned examples of two different shrub-steppe plant communities: antelope bitterbrush/Idaho fescue (*Purshia tridentata*/*Festuca idahoensis*) and Douglas' buckwheat/Sandberg bluegrass (*Eriogonum douglasii*/*Poa secunda*). Frequency and cover data were collected from three vegetation plots annually from 1999-2002 and compared to pre-fire data.

In both communities, **native perennial grasses, shrubs, and subshrubs** generally decreased following fire. *Elymus elymoides* ssp. *hordeoides* was the only bunchgrass that increased. Of the shrubs and subshrubs, *Purshia tridentata* and *Eriogonum douglasii* were completely eliminated from the communities, while *Eriogonum heracleoides* resprouted and was present in substantial amounts beginning in the first year after the fire. **Native perennial forbs** increased substantially in both communities, although the increase appeared to be shorter-lived in the Douglas' buckwheat community than in the antelope bitterbrush community. A number of species, especially those with substantial underground storage parts such as *Lomatium* spp., *Calochortus macrocarpus*, and *Fritillaria pudica*, showed dramatic post-fire increases. *Achillea millefolium* also increased substantially, while *Trifolium macrocephalum* remained at or above pre-fire levels. *Balsamorhiza careyana* and *Antennaria dimorpha* were the only native perennial forbs that decreased notably. **Native annual forbs** initially decreased slightly and then increased in the antelope bitterbrush community, while they showed the inverse pattern in the Douglas' buckwheat community. Those showing the most dramatic increases were *Collinsia parviflora*, *Clarkia pulchella*, *Collomia grandiflora*, and *Montia spathulata*. *Epilobium paniculatum* and *Madia* spp. both increased substantially in the 2nd post-fire year, but then decreased in subsequent years. Three species of **introduced forbs** varied somewhat in their patterns. *Lactuca serriola* increased dramatically in the 2nd post-fire year, but then returned to pre-fire abundance or less. *Tragopogon dubius* increased in the 1st post-fire year and essentially remained at the new levels throughout the study period. *Holosteum umbellatum* appeared to be substantially reduced by the fire. **Introduced annual grasses**, dominated by *Ventenata dubia*, increased slightly in the antelope bitterbrush community but decreased substantially in the Douglas' buckwheat community. *Bromus tectorum*, which was present in small amounts in the antelope bitterbrush community, decreased in the 1st post-fire year but then increased in subsequent years.

In summary the two communities showed both similarities and differences in their overall vegetation trends. The antelope bitterbrush/Idaho fescue community appears to be shifting toward a community dominated by a single subshrub species, *Eriogonum heracleoides*, with greater importance of forbs and a somewhat reduced importance of perennial grasses. Introduced annual grasses have increased only slightly thus far. Re-establishment of a significant *Purshia tridentata* layer in this community will likely take decades. The Douglas' buckwheat/Sandberg bluegrass community also appears to be shifting toward more forbs and less perennial grass, but with essentially no shrub or subshrub cover and reduced introduced annual grass.

The response of introduced annual grasses was of particular interest for this site, since one of the primary criteria for establishing it as a Natural Area Preserve was its low cover of such species. The difference in the response of introduced annual grasses in the two communities may be explained by the difference in the degree of litter consumption in the communities. The antelope bitterbrush community in this study had a much greater accumulation of litter before the fire compared to the sparsely-vegetated Douglas' buckwheat community and only a portion of this litter layer was consumed. The seed bank of annual grasses, which is typically concentrated within the litter layer, may therefore have been only partially consumed in the antelope bitterbrush community, while much more of the seed were consumed in the Douglas' buckwheat community. In addition, small spots of high fire intensity where large bitterbrush shrubs burned may have created optimum seedbed sites for the annual grasses in the antelope bitterbrush community. Managers considering the use of prescribed fire for reducing annual grasses in similar communities may need to plan for multiple prescribed burns to progressively eliminate the litter layer and associated annual grass seed.