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Development of variable microsatellite loci and range-wide characterization of nuclear genetic diversity in the important dryland shrub antelope bitterbrush (*Purshia tridentata*)

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ABSTRACT

Antelope bitterbrush (*Purshia tridentata* Pursh DC; Rosaceae) is an arid-land shrub that occupies an important ecological niche in various fire-dominated communities across much of the western United States. Because of its importance as a browse for large mammals and a food source for granivores, *P. tridentata* is frequently planted by Federal agencies in arid-land revegetation. We are currently analyzing the range-wide genetic diversity of this species as part of a larger effort to develop seed movement guidelines. In this study, we describe the development of eight novel nuclear microsatellite loci and characterize the amount and apportionment of range-wide nuclear genetic diversity. The eight microsatellite loci exhibited a high level of polymorphism (13–33 alleles per locus) and in general, observed levels of heterozygosity did not deviate form Hardy–Weinberg expectations. An initial screen of 196 individuals from 12 widely distributed populations revealed a moderate amount of genetic differentiation ($F_{ST} = 0.09$, $p < 0.001$). Moreover, these loci successfully produced PCR products in cross-species amplifications with two closely related *Purshia* species. These results demonstrate the utility of these markers and provide useful measures of neutral genetic diversity and population differentiation.

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1. Introduction

Among native plant species used in habitat restoration, antelope bitterbrush (*Purshia tridentata* Pursh DC; Rosaceae) is arguably one of the most important shrubs in the western United States (U.S.). The native range of this species encompasses ~840 million hectares of rangeland and dry forest between the Cascades/Sierra Nevada and the Rocky Mountains (Young and Clements, 2002). Across this Intermountain Region, *P. tridentata* exhibits remarkable adaptability, spanning an elevation range of 60 to over 3500 m, and a precipitation gradient ranging from less than 25 cm yr^{-1} to over 125 cm yr^{-1}. This drought-adapted shrub figures prominently in the ecology of the Intermountain Region; it is a key forage for large mammals (mule deer, elk, and pronghorn antelope; Nord, 1965; Kufeld, 1973; Kufeld et al., 1973; Stuth and Winward, 1977; Guenther et al., 1993), an important seed source for granivores (Vander Wall, 1994; Young and Clements, 2002), and an early season pollen and nectar source for a diversity of insects (Furniss, 1983). In addition to these important roles, *P. tridentata* is one of few Rosaceous species that fix nitrogen through symbiosis with the actinomycete *Frankia* (Bond, 1976; Dalton and Zobel, 1977), making it an important contributor to soil nitrogen in arid-landscapes.

Although *P. tridentata* is naturally distributed across some of the most fire-prone ecosystems in the Northwest U.S., it is usually consumed by fire and it shows a low frequency of root sprouting relative to fire-resistant species like *Manzanita* or *Ceanothus*. While post-fire sprouting ability in *P. tridentata* is generally low, it does appear variable and may have a genetic component; for example, young and very old *P. tridentata* (<5 years, and >40 years) have been reported to root sprout in the Upper Snake River basin of Idaho (Blaisdell and Mueggler, 1956), while bitterbrush from central Oregon apparently lacks this trait (Clark et al., 1982). Rather than investing resources in below-ground, fire-resistant lignotubers, *P. tridentata* is a prolific seed producer that relies on the caching activities of granivores for fire avoidance (West, 1968; Sherman and Chilcote, 1972; Clark et al., 1982; Vander Wall, 1994). Below-ground burial by rodents and insects protects seed from fires, in addition to providing the cool-moist environment necessary to break seed dormancy (Young and Evans, 1976). In a study of 11 burned sites, Nord (1965) found that seedling recruitment was far more important than re-sprouting, with seedlings accounting for up to 80% of all new plants. Despite its importance, post-burn re-establishment of *P. tridentata* from seed is a slow process; at some sites, *P. tridentata* can require 10 years to reach flowering age (Nord, 1965). During this establishment period, wildlife is attracted to tender *P. tridentata* sprouts, and damage from browsing animals is a major cause of stand decline (Young and Clements, 2002).

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