From Forest Nursery Notes, Summer 2007

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Seed Shatter Dates of Antelope Bitterbrush in Oregon

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Abstract

Seed shatter dates for antelope bitterbrush (*Purshia tridentata* [Pursh] DC) were estimated from collections at 192 sites in Oregon and surrounding states. Shatter date was strongly correlated to elevation ($r = 0.74$) and an equation that included elevation, latitude, longitude, and longitude squared explained 79% of the variation in seed shatter dates. In general, earlier shatter dates were associated with more southerly latitudes, easterly longitudes, and lower elevations. Examination of climatic data confirmed the expectation that earlier shatter dates were associated with warmer sites. This information can assist those needing to schedule seed collection activities at multiple locations.

Resumen

Se estimaron las fechas de liberación de la semilla del "Antelope bitterbrush" (*Purshia tridentata* [Pursh] DC) de colecciones de 192 sitios de Oregon y los estados circunvecinos. La fecha de liberación estuvo fuertemente correlacionada con la elevación ($r = 0.74$) y una ecuación que incluyó la elevación, latitud, longitud y longitud cuadrada explicó 79% de la variación de las fechas de liberación de la semilla. En general las fechas más tempranas estuvieron asociadas con las latitudes más al sur y las longitudes más al este y bajas elevaciones. El examen de los datos climáticos confirmaron la expectativa de que fechas tempranas de liberación de semilla estaban asociadas a sitios más calientes. Esta información puede asistir a aquellas personas que necesitan programar actividades de colecta de semilla en localidades múltiples.

Key Words: *Purshia tridentata*, seed collection, seed maturation

INTRODUCTION

Antelope bitterbrush (*Purshia tridentata* [Pursh] DC) is an important shrub used in landscape restoration in the western United States. This shrub is an important component of the Intermountain Zone and is a key forage plant 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) and a seed source for granivores (Vander Wall 1994; Young and Clements 2002). Most seed for restoration is obtained from wildland collections. These collections must be appropriately timed because seed shatter for bitterbrush stands occurs over a period of a very few days following seed maturation (Nord 1965; Shaw and Monsen 2004). If collectors arrive too early, the seed cannot be easily removed from the plants and if they arrive too late, the seed is already on the ground.

Phenology, in general, is tied to the heat units accumulated over the season (see reviews by Wang 1960 and Wielgolaski 1999) and seed shatter date would logically follow the same model. Shelford (1930) pointed out that Réaumur (1735) was one of the first to note that one could predict a phenological stage better with heat sums than with calendar days. Predicting seed shatter dates by summing heat units for each potential collection site is impractical in practice. Another complicating factor is that seed sources of the same species can differ in the heat sums required for particular phenological stages (e.g., Campbell 1974; Frank et al. 1985). Common garden studies in forest trees have demonstrated that these population differences also tend to be associated with the climate from where the population is collected (e.g., Rehfeldt et al. 1999; St. Clair et al. 2005). Because geography (latitude, longitude, and elevation) is closely related to temperature (e.g., Rehfeldt et al. 1999), these variables could be used as surrogates for heat sums.

Nord (1965) used elevation and latitude of collection site to predict seed shatter dates for 29 locations in California with reasonable accuracy ($R^2 = 0.74$). Alderfer (1976) also found a strong association between elevation and seed shatter date for 18 locations in Oregon, but found that the ripening dates predicted by Nord's equation were not suitable for the Oregon locations.

In 2002, a major collection effort was made, predominantly in Oregon, but also in surrounding states, to obtain bitterbrush populations for a genecology study. The objective was to make collections at many locations throughout the range of the species and plant them in a common garden (see Johnson et al. 2004 for a general description). Most collections were of single plants, but a subset were multiple-plant collections. Seed shatter dates varied widely among locations and seemed to be associated with physiographic variables. The objective of this paper was to use the collection information to develop an equation to predict seed shatter dates in Oregon based on elevation, latitude, and longitude. Such information would

Research was funded in part by a grant from the Cooperative State Research, Education, and Extension Service, Managed Ecosystems Program.

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Manuscript received 5 January 2006; manuscript accepted 18 August 2006.