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# Genecology of *Holodiscus discolor* (Rosaceae) in the Pacific Northwest, U.S.A.

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## Abstract

An important goal for land managers is the incorporation of appropriate (e.g., locally adapted and genetically diverse) plant materials in restoration and revegetation activities. To identify these materials, researchers need to characterize the variability in essential traits in natural populations and determine how they are related to environmental conditions. This common garden study was implemented to characterize the variability in growth and phenological traits relative to climatic and geographic variables of 39 *Holodiscus discolor* (Pursh) Maxim. accessions from locations throughout the Pacific Northwest, U.S.A. Principal component analysis of 12 growth and phenological traits explained 48.2% of the observed vari-

ability in the first principal component (PC-1). With multiple regressions, PC-1 was compared to environmental values at each source location. Regression analysis identified a four-variable model containing elevation, minimum January temperature, maximum October temperature, and February precipitation that explained 86% of the variability in PC-1 ( $r^2 = 0.86$ ,  $p < 0.0001$ ). Spatial analysis using this regression model identified patterns of genetic diversity within the Pacific Northwest that can help guide germplasm selection (i.e., seed collections) for restoration and revegetation activities.

**Key words:** common garden, genecology, germplasm, *Holodiscus discolor*, Oceanspray.

## Introduction

In recent years, land managers have increasingly focused attention on the use of native plant species in habitat restoration and land reclamation activities (Booth & Jones 2001; Hufford & Mazer 2003). Moreover, management agencies have been striving to use locally adapted materials rather than commercially produced cultivars of native species, especially if the cultivars are seen as highly bred or from a genetically narrow base (Lesica & Allendorf 1999; Hufford & Mazer 2003; Rogers & Montalvo 2004). Unfortunately, formal guidelines on how to develop locally adapted releases for a given species in the wild do not exist for many native plant species (Johnson et al. 2004). To identify plant movement guidelines (e.g., seed zones), researchers first need to quantify the phenotypic genetic variation found in a species within a geographic region of interest (e.g., species range, management area; Hufford & Mazer 2003; Johnson et al. 2004). Patterns of genetic variation vary by species (i.e., generalist vs. spe-

cialist) and by region; consequently, plant movement guidelines are determined on a species-by-species basis. Historically, this approach was developed for forest tree species (Campbell & Sorensen 1978; Rehfeldt 1978; Johnson et al. 2004) and has more recently been successfully applied on nontimber native plant species (Erickson et al. 2004; Doede 2005).

One important restoration species, Oceanspray (*Holodiscus discolor* (Pursh) Maxim.), is a multistemmed rosaceous shrub that is distributed throughout the Pacific Northwest from British Columbia, Canada, to southwestern California, U.S.A. This showy understory shrub is dominant in many forest communities at elevations from sea level to approximately 2,500 m. *Holodiscus discolor* is a tetraploid ( $2X = n = 18$ ; Goldblatt 1979; McArthur & Sanderson 1985; Antieau 1986), and there are no published accounts of population-level ploidy variation. Moreover, given the significant partitioning of phenotypic variation among locations observed in this study (see below), variation in ploidy may not be common in *H. discolor* in the Pacific Northwest; however, additional studies would be needed to confirm this. Preliminary common garden results indicate that there is substantial genetic variation in characters such as growth habit, growth rate, leaf morphology, and flower abundance (Flessner et al. 1992). *Holodiscus discolor* can readily occupy a broad range of habitat types, grows vigorously, and is an important browse for large game animals (e.g., deer, elk; Flessner et al. 1992). Given these characteristics, *H. discolor* is used in a variety of small-scale revegetation projects

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