'Umatilla' snow buckwheat for rangeland restoration in the interior Pacific Northwest

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Native plants are generally considered the best option for plant materials to restore productivity and diversity to degraded rangelands (McArthur 1988). It is difficult to find native plants capable of becoming established from seed in dense stands of introduced annual species such as cheatgrass. It has been easier to import species such as crested wheatgrass to restore perennial grasses on degraded rangelands. Although successful, such revegetation has not been without drawbacks. Establishment of large areas of a single plant species lowers vegetative diversity and may be aesthetically less desirable than a diverse community of native species. Monocultures also tend to have insect and disease problems that are less prevalent in plant communities with greater diversity.

Snow buckwheat (*Eriogonum niveum* Dougl. ex. Benth.) is a native pioneering species in big sagebrush antelope bitterbrush plant communities of the interior Pacific Northwest (Figure 1). Cover of snow buckwheat was measured by Tiedemann (1983) while studying the response of bitterbrush to fertilization in north central Washington. In these big sagebrush/bitterbrush habitats, snow buckwheat cover ranged from 3 to 18% and frequency from 25 to 100%. Cover of snow buckwheat on south aspects was more than twice as great as on west aspects suggesting a preference for arid sites. Prominence of snow buckwheat in cheatgrass dominated sites and on road cuts and fills indicates that the plant is a promising candidate for revegetation of harsh rangeland sites.

Fig. 1. *Snow buckwheat natural habitat near Wenatchee Wash.*

The potential of snow buckwheat for revegetation was documented by Tiedemann and Driver (1983) and Zamora and Leier (1993). In the study of Tiedemann and Driver (1983), snow buckwheat established well from locally collected seed that had been broadcast seeded into firelines in the late fall. By the fifth growing season, average number of plants ranged from 8,716 per acre at 1,378 ft elevation to 11,656 plants per acre at 2,788 ft elevation. Height and ground cover were greatest at the 1378 ft elevation site. The pioneering nature of snow buckwheat was evident from the fact that it established at the 1,378 ft elevation site in a year in which about half of the long-term average precipitation was received. There was also intense competition from annual mustard plants at this location.

Tiedemann and Driver (1983) also established baseline nutrient requirements for snow buckwheat. In a pot test (bioassay trial) using nitrogen (N), phosphorus (P), potassium (K), and sulfur (S), the plant responded only to nitrogen fertilization, even though the sites where it is found are notably low in both nitrogen and sulfur (Tiedemann 1983).

Snow buckwheat is browsed by wild ungulates on steep slopes adjacent to the Columbia River in north-central Washington. Burrell (1982) observed that snow buckwheat comprised a substantial proportion of mule deer diets in that area. Use by mule deer was especially heavy on south-facing slopes in late winter and early spring.

Characteristics of Snow Buckwheat.

Snow buckwheat is a low growing, much-branched evergreen halfshrub that grows throughout the interior Pacific Northwest and eastern to west-central Idaho in habitats ranging from sagebrush desert to ponderosa pine forest (Hitchcock et al. 1964) (Figure 2). Stature varies from prostrate and mat-forming to erect and up to about 20 inches tall. The plant is tufted from a loose woody caudex. Stems are pubescent, 11 to 15 inches tall, and

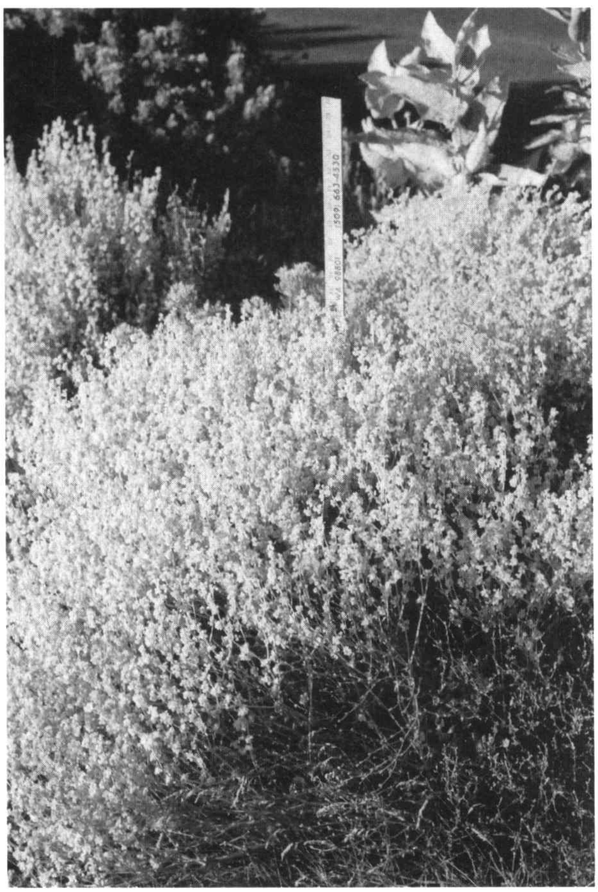

Fig. 2. *Snow buckwheat is a low growing, much-branched evergreen halfshrub.*

branched 2 to 3 times. Basal leaves are numerous with petioles 0.3 to 1.5 inches in length. Overwintering, evergreen leaves are small and highly pubescent, formed at each shoot apex in late summer and fall (Delany 1986). Early in the spring, shoots begin to elongate and new leaves arise alternately. Fully formed summer leaves are 1 to 3 inches long, elliptic or ovate, obtuse, and white wooly pubescent on each side. By mid- to late spring, inflorescences arise and begin to elongate. The majority of a plant's shoots bear an inflorescence. Flowering occurs in late summer and fall. Flowers are white when in full bloom, turning pink, then brown as ripening occurs. They are small, perfect, pedicelled, and clustered 3 to 13 per involucre. Inflorescences originate from vegetative shoots across the entire crown and are exerted 4 to 12 inches above basal leaves. According to Delany (1986), snow buckwheat appears to be insect pollinated during a very short flowering season. She found a variety of insect orders on snow buckwheat flowers: Hemiptera, Lepidoptera, Diptera, and Hymenoptera. Flowers remain receptive to pollination for 2 to 3 weeks. Insect pollination suggests that the plant is primarily outcrossing. Fruit is an achene 0.01 to 0.02 inches long, smooth, and angled with reticulate texture on the upper part. Achenes (seeds) shatter from flowers readily at maturity.

In natural habitats, the plant produces 0.02 to 1.0 ounce of seed per plant (Delany 1986). Numbers of seed per lb range from 585,400 to 616,740 (Tiedemann and Driver 1983). Seed germination ranged from 42 to 72% in 65 to 70 day trials (Delany 1986, Tiedemann and Driver 1983, Kelley 1984). Seed germination occurred erratically during the 65 to 70 day incubation periods.

Delany (1986) studied phenology and variation of plant characteristics among 5 populations of snow buckwheat in north-central Washington and the Columbia Basin. She observed significant variation among populations for late spring phenology, fall flowering phenology, plant diameter, seed germination, foliar crude protein content, and leaf size. The only characteristic that did not vary among populations was seed size. There was also 1.5 to 2 times more variation among plants within a population than among populations for all characteristics studied.

Delany's measurements of foliar crude protein in 5 native populations indicated spring levels as high as 18% with a decline to as low as 6.5% in fall. We charted average crude protein for 3 native populations in north-central Washington across 1 growing season (Figure 3). At each of the 3 locations, a compsite sample of 10 plants was collected. Samples were separated into new leaves, new stems, old leaves, and old stems. Crude protein was generally highest in the new leaves and lowest in the old stems. In new leaves, highest crude protein levels (11.5%) occurred from March into early June. This was followed by a continuous decline to less than 5% by December. In new stems, crude protein was greatest in early May (9.5%). Levels declined rapidly to about 3% by mid December. Crude protein contents of old leaves and old stems were relatively constant over the entire sample period. Mid-winter (Dec. 18) crude protein levels (< 5% for all plant parts) are at the lower end of the range reported by Welch (1989) for a variety of shrubs in late winter.

Selection of 'Umatilla'.

Selection was made after field trials of three geographically diverse accessions, U-4, U-6, and U-10. Locations of collection were: U-4 south of Moses Lake, Wash.; U-6 from the Entiat Valley near the confluence of the Entiat and Columbia Rivers in central Washington; and U-10 from Juniper Canyon in Umatilla County, Ore. Accessions were outplanted as container-grown stock at wildland sites south of Moses Lake, Wash, near Entiat, Wash., near Moro, Ore., and at the Boise Shrub Garden near Boise, Id. Seed increase fields of the 3 accessions were also established by the Pullman Plant Materials Center (PMC) at Central Ferry and Lind, Wash. Accession U-10 was selected for release on the basis of performance at these locations. Accession U-10 demonstrated greater vigor and was

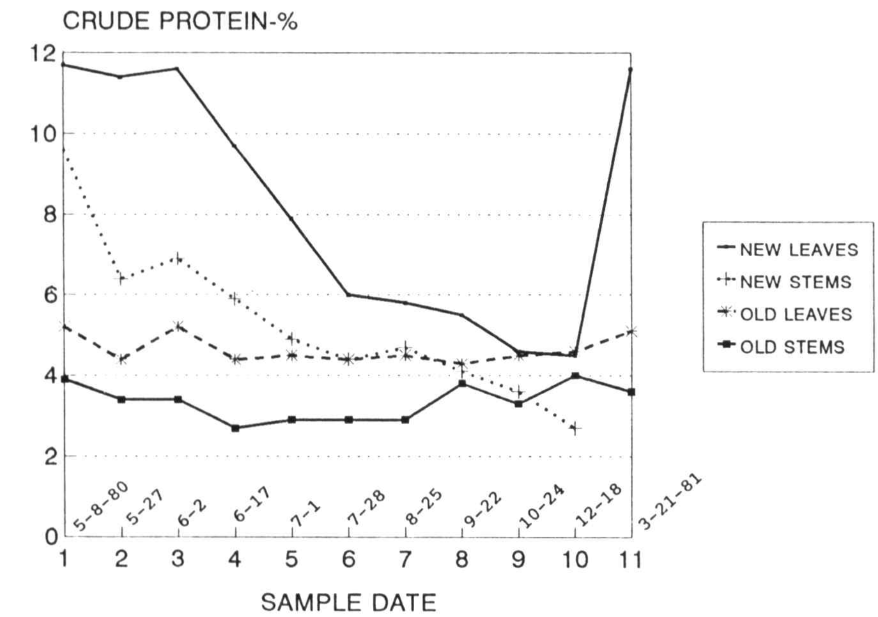

Fig. 3. *Average seasonal crude protein trends in snow buckwheat in 3 native populations in north central Washington.*

more robust than the other 2 accessions with greater plant height and width and greater numbers of seedheads. It was not surprising that the accession with the greatest crown spread produced the most seedheads. Delany (1986) observed a direct correlation between plant width and seed production.

In November, 1990, USDA Agricultural Research Service assigned Plant Introduction (PI) number 537595 to 'Umatilla' snow buckwheat. The cultivar was identified as *Eriogonum niveum* by the Washington State University Herbarium, Oregon State University, and the USDA Soil Conservation Service (now Natural Resources Conservation Service) National PMC. The name 'Umatilla' was cleared for release by the U.S. Department of Commerce Patent and Trademark Office in Oct., 1990. 'Umatilla' snow buckwheat (accession U-10) was released in 1991 for public use by the USDA SCS (now NRCS) and Forest Service, Washington State University, Washington Department of Wildlife, and Oregon State University as a selected cultivar for rangeland seeding, wildlife habitat improvement, and critical area plantings.

Areas of Adaptation.

Well-drained silt-loam to sandy soils of the interior Pacific Northwest and western Intermountain areas from basin big sagebrush to ponderosa pine habitats in precipitation ranges from 6 to 18 inches. Hitchcock et al. (1964) indicate that it occurs on heavy soils, but our observations suggest that snow buckwheat is best adapted to well-drained soils. Snow buckwheat was found to inhabit the widest range of soil conditions of 6 *Eriogonum* species adapted to harsh, arid sites studied by Zamora (1994). The plant is an excellent ornamental and provides blooms at a time when most other plants have finished flowering (Figure 4). Irrigation causes the plants to become leggy and break apart at the woody caudex after 3 or more years of growth. It is best suited to ornamental settings that receive little or no supplemental moisture.

At the outplanting sites where snow buckwheat was studied prior to release, it was observed to spread readily by seed from established plants. This attribute helps assure natural regeneration and recruitment of snow buckwheat.

Suitability for Wildlife Forage.

Persistent, evergreen foliage is one of the most desirable attributes of the plant for wildlife forage. At low elevation sites on the mule deer winter range, it provides a substantial part of early spring diets of mule deer (Burrell 1982). In mid-March, snow buckwheat comprised a greater proportion of mule deer diets than bitterbrush and arrowleaf balsamroot. Overwintering leaves (about 5% crude protein) and newly emergent leaves in March (about 11% crude protein) both contribute to the suitability of the plant for forage. Although 11% crude protein is only mid-range for a variety of forage plants, (Welch 1989), this is one of the first plants to emerge in the early spring. This may be the reason it makes up a large part of early spring mule deer diets. To assess the nutritive value of late fall foliage, we measured in-vitro digestibility of leaves of 10 accessions growing at Pullman Wash. Foliage was collected the last week in October. In-vitro digestibility ranged from 31 to 43% for these 10 accessions. Digestibility of snow buckwheat exceeds that for bitterbrush, (23.5%) in the winter (Welch 1989) but is not as high as that for big sagebrush (55.6%).

Information for Potential Growers.

Breeder and foundation seed and plants are maintained by the Pullman Plant Materials Center, Pullman, Wash. Seed should be sown in fall with a nitrogen starter fertilizer to provide 50 lb/acre of elemental nitrogen (N). Fall seeding is recommended to take advantage of natural wet chilling (stratification) of the seed through the winter. Germination tests at the Pullman PMC showed that a short (15–20 day) period of stratification may shorten the germination period and improve total germination. The Pullman PMC tested seed production for 24, 36, and 48 inch row spacings. The 24 inch spacing produced 33 to 200 % more seed on a per acre basis than the other two spacings (Kelley 1988).

Seed should be collected when the majority of petals have dried to a light

Fig. 4. *Snow buckwheat is an attractive plant in ornamental settings. It blooms late in the summer when few plants are flowering.*

brown color. This is usually the last week in October or first week in November in central and southern Wash. Hand harvesting has proved to be the best method for collecting snow buckwheat seed. Seed shatters very easily upon the slightest plant movement and may present problems for commercial harvesting (Kelley 1988). Threshing may be best achieved with a miniature hammermill operating at 600 to 900 rpm. Vigorous threshing may damage the seed coat and result in reduced seed longevity (personal communication with Mr. Mark Stannard, Pullman, PMC). Cleaning of threshed seed can be perfomed with a small office clipper.

'Umatilla' was one of three accessions tested by the NRCS at Central Ferry that produced over 100 lb/acre of seed (Kelley 1988). 'Umatilla' has produced up to 275 lb/acre of cleaned seed at seed increase fields of the NRCS at Central Ferry, and Lind Wash. Providing pollinators at flowering may improve seed production. Attraction of snow buckwheat for pollinators may provide opportunities for honey producers at a time when little else is flowering.

Latest results from the Pullman PMC indicate that longevity of seed from 'Umatilla' is below expectations. They are presently studying the best ways to harvest, clean, and store snow buckwheat seed.

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