***Dryas octopetala* L.** white mountain avens
ROSACEAE

Synonyms: *Dradetum octopetalae* Keiner

Drawing source: USDA--FS Collection, Hunt Institute

General Description.—*Dryas octopetala* is commonly known as alpine dryad, mountain avens, or white mountain avens in areas where more than one Dryas species occur (Stace 1997, Kershaw and others 1998, Carter 1988). The epithet "dryad" and "dryas" is derived from the mythical oak-nymph, Dryas, because the shape of its leaves resembles that of an oak species (Gledhill 1992, Zwinger and Willard 1996). This prostrate, trailing perennial shrub is usually less than 30 cm tall, but can grow up to 50 cm, and commonly forms mats. The oval to oblong leaves are 5 to 25 cm long and the margins are coarsely round-toothed (crenate) and somewhat rolled under (Carter 1988, Kershaw and others 1998, Stace 1997). Typically the shrub is described as "evergreen" but has also been observed as "semi-deciduous," because it loses some of its foliage in winter (Williams and others 1986). The leaves are dark green, wrinkled and hairless on the upper side but densely white-hairy on the lower surface (Kershaw and others 1998). The stalk, midrib, and veins have yellowish-brown glands on the lower surface. Each flower has eight (sometimes nine or 10) egg-shaped white, rarely yellowish, petals and lance-shaped sepals. The flowers are 2 to 3 cm across and are solitary on hairy stalks that are 1 to 20 cm long. The seeds (achenes) are 2.5 to 4 mm long with a feathery plume (style) at the tip (Komarov 1941). The chromosome number is 18 (Stace 1997, Welsh and others 1993). The species tends to be heterogeneous throughout its range. The stature and organs of white mountain avens plants in North America and a part of the Western Arctic appear to have smaller dimensions than those in Russia and alpine Western Europe (Komarov 1941). At least four subspecies and several varieties of *Dryas octopetala* are recognized (Hitchcock and Cronquist 2001, Kartesz 1994): *Dryas octopetala* L. ssp. *alaskensis* (Porsild) Hultén, ssp. *hookeriana* (Juz.) Breit., ssp. *punctata* (Juz.) Hultén, and ssp. *octopetala* of which there are at least three varieties; namely var. *angustifolia* Hitch., var. *kamtschatica* (Juz.) Hultén, and var. *luteola* Hultén. Some other varieties are described in Kartesz (1994) and Komarov (1941).

Range.—White mountain avens is a circumpolar species occurring in arctic and alpine zones in Europe, Asia, and North America. In North America, it grows in sub-alpine and alpine tundra zones from Greenland, Labrador, and Alaska to the Cascade Mountains in Washington and Oregon and through the Rocky Mountains to Montana, Wyoming, and Colorado and west to high elevation sites in Utah and Idaho (Britton 1901, Hitchcock and Cronquist 2001, Welsh and others 1993, Kershaw and others 1998). It is found in Scandinavia, the British Isles, Ireland, and the Alps, Pyrenees, Carpathians and Dinarid Mountains of Europe (Praprotnik 1997, Ellenberg 1988). It also dominates the tundras of Novaya Zemlya, Wrangel Island, the Urals and mountin slopes in Siberia (Komárková 1979, Botch and Masing 1983).

Ecology.—Mountain avens is often the dominant or co-dominant species in areas where it occurs throughout its range. The elevation at which it grows is associated with latitude. Plants are found at 3,500 m to 3,965 m in Utah whereas they may occur at 100

m or less in northern parts of its range, such as Greenland (Borge Wills 1996, Welsh and others 1993). It typically grows above the timberline in sites with low snow cover on calcareous or basic soils (Dorn 2001, Dorn 1984, Komárková 1979, Ellenberg 1988, Stace 1997, Weber and Wittman 2001). It is not an indicator of calcareous sites *per se* as it is common on granitic substrates in the Colorado Rocky Mountains (Weber 1960). However, on this substrate calcium is likely available to the plants as a leachate (Weber and Wittman 2001). Mountain avens grows in dry meadows, rocky tundra, fellfields, and in relatively moist sites in fen lands. In Russia, it has been reported as a co-dominant in "frost mound bogs" that are essentially permanently frozen ridges, or mounds, that alternate with wet hollows (Botch and Masing 1983). In contrast, mountain avens and lichens are of primary importance on the dry upland meadows in the Alaskan Arctic and on the windswept fellfield slopes of the Rocky Mountains of Colorado U.S.A. (Komárková 1979, Langenheim 1962). These shrubs have an trellis-like growth habit clinging closely to rocks and stones and anchoring its roots in cracks or between stones. The radiation is so intense at high elevations that the temperature can rise to more than 65 ^{o}C where the ground is dark colored. In these locations the prostrate seedlings and young plants can be heat damaged (Ellenberg 1988). A mutualistic association exists between mountain avens and ectomycorrhizal fungi (Monson and others 2001). The most dominant fungus is *Cenococcum geophilum*, an ascomycete.

Reproduction.—White mountain avens reproduce by seed. Flowering is from June into August. The flowers always face the sun on calm, sunny days, and their parabolic shape directs the sun's heat on to the stigma, which can then become up to 3.5 ^{o}C warmer than the surrounding air temperature (Kershaw and others 1998). The warmer temperatures can attract insects and also speed pollen germination. Hybridization occurs between sympatric *Dryas* species (Komarov 1941). Seed is, at least in part, distributed by wind.

Growth and Management.—White mountain avens seeds have physiological dormancy but do not appear to require stratification for germination (Baskin and Baskin 2001). Forty-eight percent of freshly matured seeds germinated after 4 days in the light at 25°C (Baskin and Baskin 2001). However, in England seeds failed to germinate when sown outdoors in the autumn while seeds did geminate the following spring, suggesting that cold stratification lowers the temperature requirement for germination (Elkington 1971). The stems root easily and contribute to the rapid spread of plants. As part of studies on the consequences of global climate change, experiments have been made on the response of white mountain avens to elevated temperatures in the Colorado Rocky Mountains (Welker and others 2001). The results suggested that warmer, wetter conditions would initially lead to greater productivity (increased leaf mass and higher numbers of seed per ramet) although decomposition may be retarded, leading to a lower nutrient availability in subsequent years (Welker and others 2001). Under longer term conditions, a switch in the source-sink activity of the community occurred. Under current conditions the mountain avens community is a carbon sink of about 8 g CO^2-C m^{-2}. However, after 4 years of experimental warming, the community switched to a carbon source of almost 10 g CO^2-C m^{-2} per summer due primarily to an increase in the rate of respiration without a concomitant increase in photosynthesis (Welker and others 2001). This switch in source sink activity has been reported for *Dryas* and other communities in the Arctic (Welker and others 2001, Oechel and others 1993). This finding may be significant when considering the repercussions of increasing industrial "greenhouse gas" emissions

Benefits.—White mountain avens is a pioneer species and is important in stabilizing the thin soils on mountain slopes (Zwinger and Willard 1996, Ellenberg 1988). It spreads relatively rapidly and is popular in landscape rock gardens (Williams and others 1986). Several cultivated varieties, including hybrids, are available (Kershaw and others 1998). One hybrid, *xSuendermannii* Kellerer, between *Dryas octopetala* and *D. drummondii* is morphologically similar to *D. octopetala,* but the flowers are yellow in bud becoming white and nodding upon opening (Bailey and Bailey 1976). White mountain avens is an important food source for ptarmigian (Nelson 1992) and pikas (Martin and others 1951).

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