

*Atriplex confertifolia* (Torr. & Frém.) S. Wats.  
CHENOPODIACEAE

shadscale

Synonyms: *Obione confertifolia* Torr. & Fremont  
*Atriplex collina* Woot. & Standl.



Illustration source: USDA—Forest Service collection, Hunt Institute

**General Description.**—Shadscale is a compact spinescent shrub that is typically 15 to 120 cm tall and 30 to 170 cm wide. Branches are scruffy when young but become rigid, brittle, and spiny with age. Leaves are nearly circular to elliptic, oval, or oblong, 9 to 25 mm long and 4 to 20 mm wide (Blauer and others 1976). Flowers are imperfect. Staminate (male) flowers are arranged in glomerate inflorescences borne in leaf axils. Pistillate (female) flowers are enclosed by foliose bracts, 5 to 12 mm long, broadly ovate to almost round, united at the base, and have entire, free, somewhat spreading margins. Staminate flowers are small and inconspicuous. Populations may have biased sex ratios and can include monoecious as well as dioecious individuals (Freeman and McArthur 1984).

**Taxonomy.**—Shadscale includes several chromosome races ranging from diploid ( $2n = 2x = 18$ ) to decaploid ( $2n = 10x = 90$ ). Plant similarities and the paucity of close relatives suggest that these races are largely autopolyploid (Stutz and Sanderson 1983). Of all the races, tetraploids are most common (Sanderson and others 1990). Generally, polyploid populations occur in uniform stands at lower elevations and on valley floors while diploid forms occur on uplands in more diverse communities and are usually larger in stature (Sanderson and others 1990, Stutz and Sanderson 1983).

**Range.**—Shadscale is present throughout much of Western North America, from Montana in the north to Texas and Chihuahua in the south, and from North Dakota in the east to California and Oregon in the west (Stutz and Sanderson 1983). It usually grows at elevations from 460 to 2,100 m. Among the woody chenopods, it ranks next to fourwing saltbush [*Atriplex canescens* (Pursh) Nutt.] and winterfat [*Ceratoides lanata* (Pursh) J. T. Howell] in frequency and distribution.

**Ecology.**—Shadscale usually grows on fine-textured alkaline soils, although it can be found on coarser, sandier soils (Blaisdell and Holmgren 1984, McArthur and others 1978). It can occur in nearly pure stands, but also grows intermixed with many other shrubs, especially of the chenopod and sunflower families, and with junipers (*Juniperus* L.) and grasses. It tolerates alkali soils better than most of these associates (McArthur and others 1978). Relationships between microhabitat, synecology, and physiology have explained differences in distribution patterns within intermixed stands of shadscale and winterfat (Caldwell and others 1977, West and Gasto 1978). Shadscale grows slowly, has a relatively short life span and can be killed by drought or high water (Blaisdell and Holmgren 1984, McArthur and others 1978). High water can kill plants directly, lead to anaerobiosis, induce abiotic disease, or predispose plants to biotic pathogens, all of which may have contributed to die-offs over the past decades (Wallace and Nelson 1990). Shadscale typically grows in arid climates where mean

annual precipitation can range between 180 and 360 mm.

**Reproduction.**—Shadscale usually blooms during April and May. In isolated locations populations may bloom as early as January and as late as June. Utricles mature, in general about mid-October. Shadscale seeds are largely dormant after maturation but respond to cold treatment (chilling) through dry after-ripening (Meyer and others 1998). Chilling and leaching soluble inhibitors from seeds has been shown to increase germination (Garvin and others 1996). Interestingly, seeds from warm desert populations responded to chilling more and after-ripened quicker than those from cold deserts (Meyer and others 1998). Ecotypic germination variation is common in shadscale.

Shadscale spreads naturally through seed but is difficult to establish by artificial seeding (McArthur and others 1978, Monsen and Richardson 1984). Low seed fill often compounds seed dormancy and germination problems. Fall seeding is recommended because it reduces the effects of dormancy, and utricles are more likely to break down before spring. Seeds should remain between 6 and 13 mm of the soil surface to improve the likelihood of germination and establishment. Soil type and seedbed preparations should be considered prior to seeding. Seed should be planted at rates of 2.2 to 4.5 kg of pure live seed/ha and in separate rows from other seeded species. Seedlings grow slowly and compete poorly with herbs and aggressive grasses, particularly within the first 2 years. Diploid races from pinyon-juniper woodlands and big sagebrush communities establish more readily in biologically diverse communities than other races.

Shadscale has also been successfully transplanted when moisture conditions are right during spring or fall (Luke and Monsen 1984). Transplants can be from container or bare-root stock. Survival is usually poor unless care is taken during handling and planting. Young shrubs are particularly susceptible to overwatering. Transplanting is most successful if plants are dormant at the time of planting.

**Management.**—Despite its spiny nature, shadscale is grazed by livestock and game. Forage value is directly related to leaf persistence, which is a characteristic that varies by habitat. Many species prefer the nutritious seeds (USDA 1937). Livestock and wildlife tend to seek seed and leaf accumulations under parent shrubs after leaves and fruits have fallen in autumn. Grazing pressure can

reduce more palatable shrub species, such as budsage and blacksage, resulting in increased shadscale populations (Blaisdell and Holmgren 1984). Shadscale may be more effective in restoring and stabilizing salty areas than fourwing saltbush or other saltbushes because it is more salt tolerant (McArthur and others 1978). In large stands, shadscale should be managed rather than mechanically controlled. Managing for shadscale is easier than reducing shrub densities and seeding in new species because limited soil moisture and precipitation make it difficult to manipulate these plant communities (Bleak and others 1965). Aggressive annuals, such as cheatgrass, usually invade such areas if they are disturbed.

**Benefits.**—Shadscale is a genetically and morphologically diverse native shrub that occupies a considerable range throughout the West. It provides soil cover, habitat for birds, and forage for domestic livestock and wildlife. Some small passerine birds, such as horned lark (*Eremophila alpestris*), Brewer's sparrow (*Spizella breweri*), and sage thrashers (*Oreoscoptes montanus*) nest in shadscale stands (Medin 1990). Healthy stands also reduce the proliferation of exotic, undesirable annuals. In addition, seeds were historically ground into flour by Native-Americans for bread (Stubbendieck and others 1997).

## References

- Blaisdell, J.P. and R.C. Holmgren. 1984. Managing Intermountain rangelands-salt-desert shrub ranges. General Technical Report INT-163. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. 52 p.
- Blauer, A.C., A.P. Plummer, E.D. McArthur, R. Stevens, and B.C. Giunta. 1976. Characteristics and hybridization of important Intermountain shrubs. II. Chenopod family. Research Paper INT-177. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. 42 p.
- Bleak, A.T., N.C. Frischknecht, A.P. Plummer, and R.E. Eckert, Jr. 1965. Problems in artificial and natural revegetation of the arid shadscale vegetation zone of Utah and Nevada. *Journal of Range Management*. 18: 59-65.
- Caldwell, M.M., R.S. White, R.T. Moore, and L.B. Camp. 1977. Carbon balance, productivity, and water use by cold desert shrub communities

- dominated by C<sub>3</sub> and C<sub>4</sub> species. *Oecologia*. 29: 275-300.
- Freeman, D. C. and E.D. McArthur. 1984. The relative influences of mortality nonflowering, and sex change on the sex ratios of six *Atriplex* species. *Botanical Gazette* 145: 385-394.
- Garvin, S.C., S. E. Meyer, and S. L. Carlson. 1996. Seed germination studies in *Atriplex confertifolia* (Torr. & Frem.) Wats. In: J.R. Barrow, E.D. McArthur, R.E. Sosebee, and R.J. Tausch, comps. Proceedings: shrubland ecosystem dynamics in a changing environment. 1995 May 23-25; Las Cruces, NM. General Technical Report INT-GTR-338. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT. p. 165-169.
- Luke, F. and S.B. Monsen. 1984. Methods and costs for establishing shrubs on mined lands in southwestern Wyoming. In: A.R. Tiedemann, E.D. McArthur, H.C. Stutz, R. Stevens, and K.L. Johnson, comps. Proceedings-symposium on the biology of *Atriplex* and related chenopods, 1983 May 2-6; Provo, UT. Gen. Tech. Rep. INT-172. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. p. 286-292.
- McArthur, E.D., A.P. Plummer, and J.N. Davis. 1978. Rehabilitation of game range in the salt desert. In: K.L. Johnson, ed. Wyoming shrublands: proceedings 7th Wyoming shrub ecology workshop; 1978 May 31-June 1; Rock Springs, WY. University of Wyoming, Division of Range Management, Laramie, WY. p. 23-50.
- Medin, D.E. 1990. Birds of a shadscale (*Atriplex confertifolia*) habitat in east central Nevada. *Great Basin Naturalist* 50: 295-298.
- Meyer, S.E., S.L. Carlson, and S.C. Garvin. 1998. Seed germination regulation and field seed bank carryover in shadscale (*Atriplex confertifolia*: Chenopodiaceae). *Journal of Arid Environments* 38: 255-267.
- Monsen, S.B. and B.Z. Richardson. 1984. Seeding shrubs with herbs on a semiarid mine site with and without topsoil. In: A.R. Tiedemann, E.D. McArthur, H.C. Stutz, R. Stevens, and K.L. Johnson, comps. Proceedings: Symposium on the biology of *Atriplex* and related chenopods, 1983 May 2-6; Provo, UT. Gen. Tech. Rep. INT-172. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. p. 298-305.
- Sanderson, S.C., H.C. Stutz, and E.D. McArthur 1990. Geographic differentiation in *Atriplex confertifolia*. *American Journal of Botany* 77: 490-498.
- Stubbendieck, J., S.L. Hatch, and C.H. Butterfield 1997. *North American Range Plants*. Fifth Edition. University of Nebraska Press, Lincoln, NB. 305 p.
- Stutz, H.C. and S.C. Sanderson. 1983. Evolutionary studies of *Atriplex*: chromosome races of *A. confertifolia* (shadscale). *American Journal of Botany* 70: 1536-1547.
- U.S. Department of Agriculture, Forest Service. 1937. *Range Plant Handbook*. U.S. Government Printing Office, Washington, DC. 816 p.
- Wallace, A. and D.L. Nelson. 1990. Wildland shrub dieoffs following excessively wet periods: a synthesis. In: E.D. McArthur, E.M. Romney, S.D. Smith, and P.T. Tueller, comps. Proceedings: Symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5-7; Las Vegas NV. General Technical Report INT-276. Ogden, UT. U.S. Department of Agriculture, Forest Service, Intermountain Research Station. p. 84-90.
- West, N.E. and J. Gasto. 1978. Phenology of the aerial portions of shadscale and winterfat in Curlew Valley, Utah. *Journal of Range Management*. 31: 43-45.
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