***Atriplex canescens* (Pursh) Nutt.** fourwing saltbush
CHENOPODIACEAE

Synonyms: *Calligonum canescens* Pursh

Illustration source: USDA—Forest Service collection, Hunt Institute

General Description.—Fourwing saltbush, also known as costilla de vaca and chamizo, is an upright shrub between 10 and 200 cm tall. Stature varies with site conditions and genotype. Branches arise freely from the base and are brittle and hard at maturity. Young branches and leaves are covered with inflated or collapsed bladder hairs that create a scurfy, grey-green appearance. Leaves are evergreen, linear to oblanceolate or spatutulate, usually 1 to 4 cm long and 0.1 to 1.0 cm wide. The species is usually dioecious, although some are monoecious or trioecious. Pistillate (female) flowers are small and inconspicuous. A pair of small bracts united along their edges encloses each pistil. Each of these bracts has two ridges down the face that expand into "wings," giving the utricle (fruit) four "wings" at maturity. Staminate (male) flowers are small, yellow to red to brown, and borne in glomerules 2 to 3 mm wide (Blauer and others 1976). Sexual expression varies between populations and with ploidy level. Diploids are usually monoecious, with a few exceptions. At higher ploidy levels (tetraploids and hexaploids), fourwing saltbush is trioecious (three sexual states). In the trioecious condition, some plants are consistently female and others are consistently male and some are able to switch during stressful conditions from the less physiologically taxing female state to the male state (McArthur 1977, McArthur and others 1992). Gender differences appear to be adaptive and allow for greater species radiation (Freeman and others 1993).

Taxonomy.—Fourwing saltbush is composed of a number of polyploid races with a base chromosome number of x = 9 (Sanderson and Stutz 1994, 2001). Many have been named as varieties. It appears that many of these are autopolyploids (Stutz 1978). The common form of fourwing saltbush in the Intermountain region (race *Occidentalis)* is tetraploid (Sanderson and Stutz 2001). Of the several distinct diploids the most widespread are race *Angustifolia* of the Chihuahuan Desert and race *Linearis* of the Sonoran Desert. Hexaploids are also generally southern in distribution (Nevada, New Mexico and Mexico) (Sanderson and Stutz 2001). Polyploids higher than 6x (up to 20x) are usually restricted endemics (Sanderson and Stutz 2001).

The North American perennial saltbushes form a group of related species. Fourwing saltbush apparently hybridizes, at least to some extent, with all of these species (Blauer and others 1976, Stutz 1978).

Range.—Fourwing saltbush is a widespread shrub throughout much of Western North America. It grows from the Great Plains to the Pacific Coast and from Canada to Mexico at elevations ranging from below sea level to 2,400 m. Fourwing saltbush has been planted in various parts of Eurasia and Australia but naturalization has not been documented.

Ecology.—Fourwing saltbush is adapted to desert climates. Mean annual precipitation within its distribution usually ranges between 150 and 400

mm. It grows on deep, usually halophytic, well-drained sandy soils, gravelly washes, mesas, ridges, and slopes. Soil salts enhance growth of fourwing saltbush by increasing days to wilting, organic matter production, water use efficiency, and ability to extract water by means of osmotic adjustments (Glenn and Brown 1998). It often grows intermixed with a wide variety of shrubs, grasses and forbs.

Reproduction.—Flowering generally occurs between May and September (Blauer and others 1976). This period can vary, however, with genotype and location. Flowers are wind pollinated, and seed matures in October. Most wildland stands of fourwing saltbush produce abundant seed 3 out of every 5 years.

Seed fill in high quality lots may only reach 50 percent, although rates of 40 percent or lower are generally considered substandard (Meyer 2003). Like many species of saltbush, *Atriplex canescens* exhibits high levels of dormancy controlled by multiple and complex mechanisms (Meyer 2003). Woody bracts inhibit germination mechanically and also contain water-soluble substances, salt and perhaps saponin, which inhibit germination (Clor and others 1989). Seed normally requires 20 to 30 days of stratification to assure uniform germination. There are about 120,000 cleaned, dewinged seeds (utricles)/kg (Blauer and others 1976).

Artificial seeding should take place during the fall or winter unless spring frosts threaten seedling survival. Fall and winter seeding promotes seed stratification and overall germinability. When sown, seeds should remain within the top 1.25 cm of soil. Broadcast seeding followed by chaining has produced excellent stands. Shrubs can also be established using drills alone or in separate rows among other species. Care should be taken to keep herbs from displacing fourwing saltbush seedlings. Seedlings grow vigorously and quickly produce a dense canopy although interspecific competition can reduce stand densities.

Shrubs can also be grown from nursery stock, container stock, or by stem cuttings (Shaw and Monsen 1984). Rooted stem cuttings have been used successfully to establish shrub seed orchards with desirable traits (McArthur and others 1978, 1992). Some populations reproduce asexually through root sprouting (Barrow 1997).

Management.—Fourwing saltbush is a valuable forage shrub because it is abundant, palatable, provides large quantities of forage, is nutritious, and grows rapidly (Cibils 1998, McArthur and others 1983, Peterson and others 1987). Leaves, stems, and fruits provide browse throughout the year. Winter protein content has been shown to vary between accessions (Welch and Monsen 1981). Relative saponin concentrations may affect palatability. In mixed species communities, herbage production of fourwing saltbush and forbs remains quite high. Fourwing saltbush is a facultative selenium absorber, making it mildly poisonous to browsing animals in selenium-rich soils (Davis 1972).

When propagating fourwing saltbush, it is important to select ecotypes that are adapted to the site. If possible, seed should be from a source with a similar climate unless the strain being planted is known to have a broad ecological range. Climatic and biological factors may affect plant persistence. Plants established from southern seed sources have not persisted in colder northern areas. However, seed collected from colder areas have done well at warmer sites (McArthur and others 1983, Plummer and others 1966).

Benefits.—Fourwing saltbush is a valuable plant that provides livestock and wildlife habitat and food. It has been widely and successfully used in revegetation and restoration projects including soil stabilization (Blauer and others 1976, Plummer and others 1966). Its ability to adapt and to hybridize with other woody *Atriplex* can facilitate *in situ* selection during revegetation (Stutz 1982).

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