Old Man Saltbush

Atriplex nummularia

White, silver and grey foliaged plants are much sought after by those looking for decorative plants in hot, dry places with excessive sunlight. Light coloured foliage can result from hairs, scales or waxy surfaces; all have the potential to reflect more light than green leaves, reducing leaf surface temperatures and minimising water loss. These are essential features in extreme hot and dry conditions.

Old Man Saltbush, *Atriplex nummularia*, is an iconic, silver-foliaged shrub of arid and semi-arid regions of Australia. It is the largest species of Australian saltbush and in addition to its tolerance of high temperatures and dry environments, is common on saline, alkaline and limestone soils. Exceptionally deep tap roots enable Old Man Saltbush to tap water resources at considerable depth.

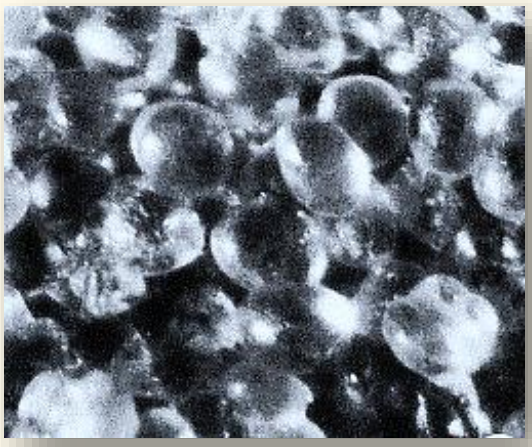
Distribution of *Atriplex nummularia*, Old Man Saltbush, in Australia. Modified from *Atlas of Living Australia*: https://bie.ala.org.au/species/https://id.biodiversity.org.au/taxon/apni/51299864

There are more than 250 species of *Atriplex* world-wide, about 50 species occurring in Australia. *Atriplex* was originally included in the plant family Chenopodiaceae, hence the distinctive blue, grey and white shrublands across vast areas of southern Australia were referred to as *Chenopod* shrublands. *Atriplex* and related arid zone 'chenopods' are now included in the *omnibus* plant family Amaranthaceae. Worldwide, 'chenopods' occur in arid and semi-arid regions, often on highly saline soils and

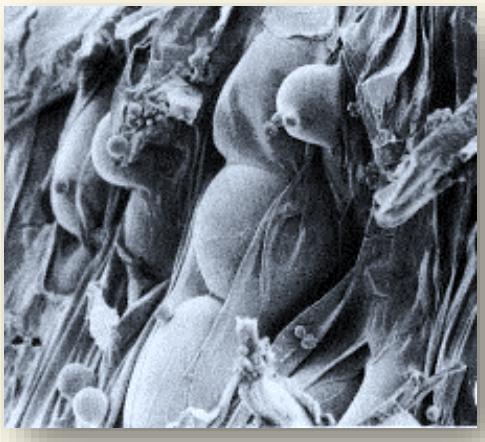
Old Man Salt Bush – undersurface of a leaf

characterised by low rates of transpiration, high water use efficiency and drought tolerance.

Plants that grow on saline soils (halophytes) have two strategies: they can either exclude salts or allow them to accumulate in large living cells. *Atriplex* species are referred to as *salt accumulators* because they store salt in specialised *trichomes* (hair cells that are also referred to as *vesiculate hairs*) present on the upper and lower surfaces of leaves. When leaves are quite young the *vesicles* burst and release salt, often after rain, covering the leaf with a mealy covering. Vesiculate hairs are comprised of a salt-filled *bladder* supported by a *stalk* that anchors the bladder to the leaf surface. Salt absorbed by roots is transported via conducting system to the epidermal cells of leaves and ultimately to the bladder cells, where salt is safely sequestered away from the leaf's metabolic machinery. The saturated salt levels in the bladders remind us of the effectiveness of this re-cycling mechanism that allows saltbush to thrive on the ancient seabeds of Central Australia.



SEM (Scanning electron microscopy) image of the surface of a leaf of *Atriplex nummularia* showing bladder cells of vesiculated hairs. From Uchiyama, 1987.



SEM image of the surface of *A. nummularia* stem showing intact and collapsed bladder cells. From: Uchiyama 1987

Old Man Saltbush is a useful plant in arid Australia. It has a very high protein content and is of considerable value as a fodder plant in saline and arid lands. The capacity to accumulate salts also makes Old Man Saltbush an ideal

species for *rehabilitation* of saline lands. Other uses include for erosion control, stabilisation of sand dunes, for windbreaks, shelter belts, hedges and firebreaks.

Old Man Saltbush fixes CO_2 in photosynthesis by a relatively unusual mechanism called *C4 photosynthesis*. This is a topic for another day but is relevant here because tissues from animals that have eaten 'C4 plants' have a combination of natural carbon isotopes that reflect their diet, including *Atriplex*. Remarkably, collagen-rich tissues have been extracted from the bones of fossil megafauna in South Australia, identifying a shift in diet in the past 45 thousand years from trees and shrubs (predominantly C3 plants) to browsing C4 'chenopods' such as *Atriplex* and C4 grasslands such as kangaroo grass as the continent became drier.

Gröcke D R. 1997. Distribution of C3 and C4 plants in the Late Pleistocene of South Australia recorded by isotope biogeochemistry of collagen in Megafauna. *Australian Journal of Botany* 45: 607-617. https://doi.org/10.1071/BT96040

Mozafar A, Goodin J R. 1970. Vesiculated hairs: A mechanism for salt tolerance in *Atriplex halimus* L. *Plant Physiology* 45(1): 62-65. https://doi.org/10.1104/pp.45.1.62

Sharma M L. 1982. Aspects of salinity and water relations of Australian chenopods. In: Sen D N, Rajpurohit K S (eds) *Contributions to the Ecology of Halophytes. Tasks for Vegetation Science,* Vol. 2. Springer, Dordrecht. https://doi/org/10.1007/978-94-009-8037-2_11

Uchiyama Y. 1987. *Salt Tolerance of Atriplex nummularia.* Tropical Agriculture Research Center, Ibaraki, Japan.

Wikipedia: https://en.wikipedia.org/wiki/Atriplex_nummularia

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Silvery white Old Man Saltbush, *Atriplex nummularia*, with scarlet Sturt's Desert Pea, *Swainsona formosa* in chenopod shrublands of South Australia. Photo: David Edgecombe

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