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Forage shrubs and grasses for revegetating saltland

H V. Runciman

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FORAGE SHRUBS AND GRASSES FOR REVEGETATING SALT LAND



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DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA



FORAGE SHRUBS AND GRASSES FOR REVEGETATING SALTLAND

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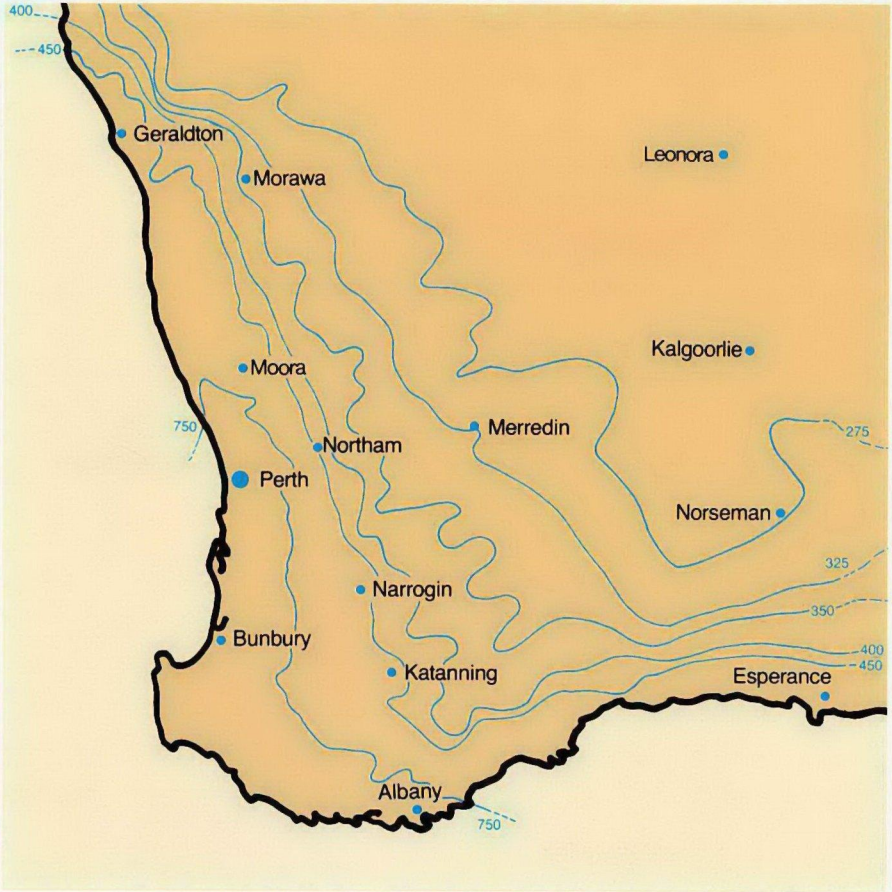
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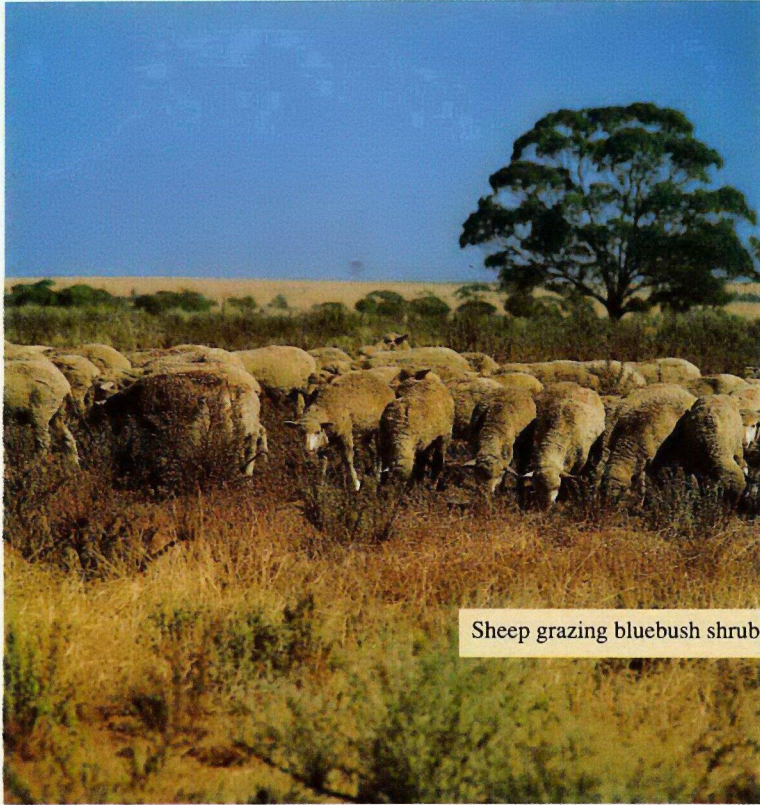
2nd printing, October 1991

The South-West agricultural area, with major towns



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Sheep grazing bluebush shrubs at Tammin

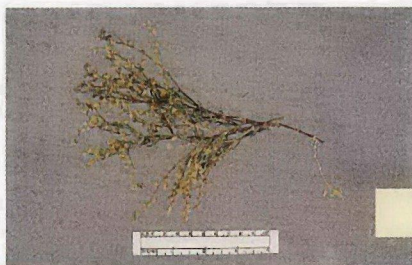
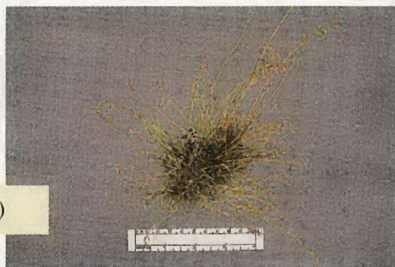
Salt tolerant shrubs and grasses are used for forage production from salt-affected farmland. This Bulletin is designed to assist in recognition of the important species in Western Australia and to provide information on their use. The species listed have more forage value than some natural indicators and colonizers of saltland, such as Mediterranean barley grass (*Hordeum geniculatum*), ice plant (*Mesembryanthemum* spp.), mallee lovegrass (*Eragrostis dielsii*), salt spurry (*Spergularia* spp.), curly ryegrass (*Parapholis incurva*) and beard grass (*Polypogon monspeliensis*). Some of the plants are also useful for rehabilitating degraded rangeland and mine dumps in arid areas.

The plants featured are known as halophytes (salt plants). Although they are highly salt tolerant in the adult growth stage, many are less salt tolerant during germination and establishment. They vary greatly in their tolerance to waterlogging, ranging from salt water couch, which will thrive in standing water, to small-leaved bluebush, which is killed by a few weeks of waterlogging in winter. The damage to the mature plant caused by waterlogging depends on the depth and duration of waterlogging, and on the weather. Most species are adversely affected by waterlogging during the germination and establishment phase, especially when the soil contains high levels of salt.

Adaptation of these species to any given site is governed by rainfall, and by the severity of salinity and waterlogging at the site. If the site is ungrazed, the level of salinity and waterlogging may be gauged from the type of annual plants which grow there. The adaptation of salt tolerant forage plants to particular soil conditions is discussed in other Department of Agriculture publications. See Further Reading on page 35.

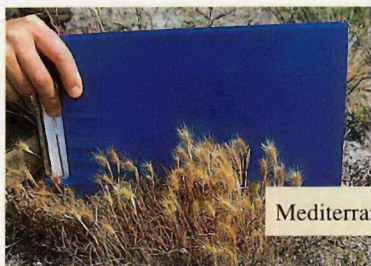
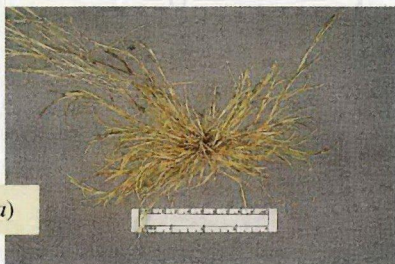
Some annual plants which indicate salty soils

Mallee lovegrass (*Eragrostis dielsii*)



Salt spurry (*Spergularia* spp.)

Curly ryegrass (*Parapholis incurva*)



Mediterranean barley grass (*Hordeum geniculatum*)

The descriptions in this Bulletin are based on common forms of these species. It should be noted, though, that there is marked variation within the species of saltbush (*Atriplex*) and puccinellia. Sizes given are usually for ungrazed plants. The male and female flowers in some saltbush species are on the same plant (that is, they are monoecious) whereas in others they are on separate plants (dioecious).

Although the salt tolerant shrubs described are usually less palatable to sheep than many herbaceous pasture plants, they are grazed heavily when the herbaceous plants are absent. Most species provide good nutrition. Sheep grazing salt tolerant forage shrubs must have access to good quality drinking water because of the shrubs' high salt levels.

The more easily established saltbush species may be sown using specialized seeding techniques, provided the site is suitable and the season favourable. Broadcast sowing on to cultivated ground, while cheaper, is a less successful alternative. A more reliable but more expensive option is to transplant young plants derived from cuttings or seedlings.

Establishment methods are described more fully in Department of Agriculture Farmnotes listed on page 35 of this Bulletin. Most species require protection from grazing for at least two summers after planting.

A glossary of some terms used in this Bulletin is on page 39.



Whole creeping saltbush



Creeping saltbush has red fruits

CREEPING SALTBUSH

Atriplex semibaccata

Common in fine textured, non-saline to moderately saline soils near salt lakes and in woodland. Native to the Western Australian wheatbelt, it often colonizes bare soil on dam banks and road verges in areas receiving 275 to 400 mm average annual rainfall.

Occurrence

Perennial shrub with prostrate habit. The dark green leaves are thin, narrow and less than 1.5 cm long. Monoecious. Male and female flowers are in small clusters in leaf axils. Fruits, produced in summer, are red, diamond-shaped, succulent, and 2 to 5 mm wide. They are often collected by ants.

Description

Since creeping saltbush is palatable and easily eaten out by sheep, the stand must be carefully managed. It is introduced easily on most sites by seeding. Individual bushes are short-lived, but seedlings establish naturally. Seeds are most readily harvested in late summer by shaking the bushes and sweeping the seeds from the ground.

Use



Grey saltbush



Seeds



Close up of grey saltbush

GREY SALTBUSH

Atriplex cinerea

An Australian species which grows on coastal dunes in southern and south-eastern Australia.

Occurrence

Perennial shrub, which in Western Australia has a prostrate, self-layering growth habit. Can grow up to 6 to 8 m in diameter and 0.5 m high. Leaves to 2 cm long, grey-green, with a sheen on the upper and lower surfaces. Ecotypes in southern and eastern Australia tend to be larger leaved, greyer and more upright. Dioecious or monoecious. Male flowers in dense clusters on the ends of branches; female flowers in clusters in leaf axils of upper parts of branches. Fruits are hard, 2 to 6 mm long and wide, roughly triangular and contain a single seed. Seed ripens in late summer.

Description

Grey saltbush is a productive shrub which grows well on saline seepages in areas receiving more than 350 mm average annual rainfall in the wheatbelt and in mixed farming areas. It tolerates moderate waterlogging. It is important to obtain a suitable ecotype; for example, the Rottnest Island ecotype is not palatable and therefore would be suited for areas which won't be grazed. The ecotype from Geraldton is palatable, and recovers well from grazing.

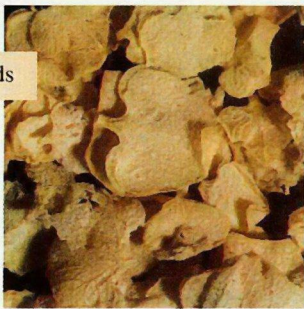
Use

Sown seeds take several weeks to germinate, but establishment from seed is possible. Cuttings strike readily.

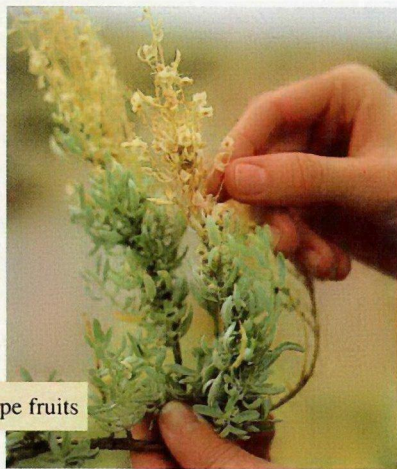
Marsh saltbush with ripe female fruits



Seeds



Close-up of a female bush with ripe fruits



MARSH SALTBUSH

Atriplex paludosa

Occurs naturally on saline, coastal marshes in southern Australia, and inland south-western Australia.

Occurrence

Perennial shrub, up to 1 m high and wide. Growth habit is usually semi-prostrate and self-layering, but sometimes erect. Leaves oval to circular, tending to be cupped upwards; green on the upper surface, silvery beneath. Leaves 1 to 2 cm long, 2 to 10 mm wide. Predominantly dioecious. Male flowers in discontinuous compact clusters on the ends of branches; female flowers on branched inflorescences, about 15 cm long. Fruits are flat and papery, circular to triangular, 7 to 12 mm long and wide, and contain a single seed. Seed usually ripens in summer.

Description

The species grows well on salt-affected land in the 300 to 500 mm average annual rainfall zone which is not subject to waterlogging. Plants spread naturally by wind-blown seed if protected from grazing.

Use

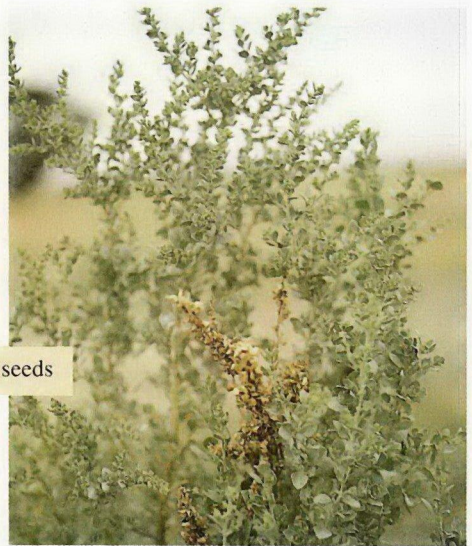
The bushes are palatable to sheep and are killed by heavy grazing.



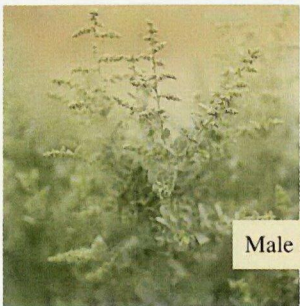
Whole old man saltbush



Seeds



Female flowers, ripe seeds



Male flowers

OLD MAN SALTBUSH

Atriplex nummularia

Native to the semi-arid and arid zone of southern and central Australia.

Occurrence

Old man saltbush is a long-lived, highly drought and salt tolerant shrub. It has an upright habit and may grow up to 1.5 m high and wide. Leaves are grey-green, 2 to 4 cm long, and irregularly shaped. Predominantly dioecious. Male flowers are in dense clusters and female flowers are in 20 cm long bunches on the ends of branches. Fruits are fan-shaped to nearly round, and woody towards the base, up to 6 mm across. They ripen by late summer.

Description

Old man saltbush grows well on moderately saline soils in the wheatbelt, and on mine dumps at Kalgoorlie, but it is relatively sensitive to waterlogging. It recovers from grazing but branches are brittle and may get trampled. It may be grown where annual rainfall ranges from about 175 to 400 mm. Old man saltbush is less palatable than other saltbushes and bluebush.

Use

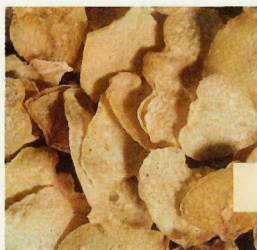
The species does not readily self-sow. Before sowing, fruits should be washed under running water for two to four hours to leach materials which inhibit germination.



Male flowers



Whole "Pintharuka" saltbush



Seeds

“*PINTHARUKA*” SALTBUSSH

Atriplex spp.

This, as yet unnamed type, has only recently been recognized. It is found north of Morawa.

Occurrence

This bush is similar in shape and colour to silver saltbush, but tends to grow much larger. It can spread to up to 8 m across.

Description

Leaves are up to 3 cm long; stems are woody and erect. It appears to be dioecious. Fruit are flat and papery, up to 1.2 cm across. Seed ripens in November to December.

This saltbush is fast growing and readily establishes from seed. It has grown well on saline land in the central wheatbelt, and on mine dumps at Kalgoorlie. It has been grown in areas where average annual rainfall ranges from 200 to 400 mm.

Use

The bush recovers poorly from simulated grazing but has not been tested under grazing. The bush is not highly palatable to sheep. Its main value may be for revegetation where grazing is not required.



Puccinellia



Seeds

PUCCINELLIA

Puccinellia ciliata

Originally from the west coast of Turkey.

Occurrence

Puccinellia is a perennial grass which forms a tussock up to 40 cm high and wide. The long thin leaves and seed heads radiate out from the centre of the tussock. The plants grow in winter and are dormant over summer. It is monoecious. Flowers are formed in September and seed is ripe by December.

Description

This species is tolerant of saline and waterlogged conditions. It may be grown on salt-affected soils which are too wet during winter for bluebush, but too dry in summer for salt water couch. It is well suited to bare saline areas and sites carrying Mediterranean barley grass (*Hordeum geniculatum*) where the annual average rainfall is more than 350 mm. Weeds must be controlled for good establishment. The grass is palatable and recovers well from grazing.

Use

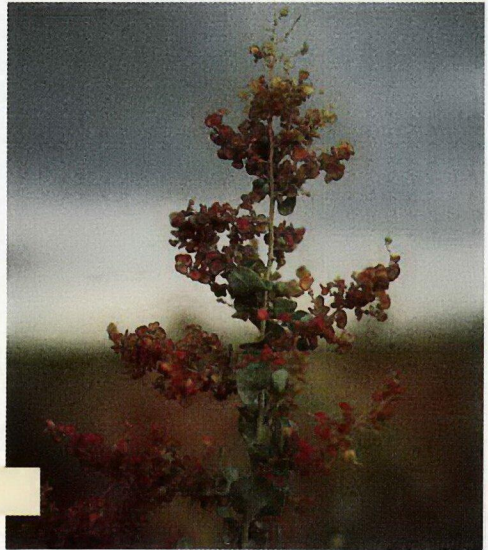
It is easily introduced by seeding on to cultivated ground, but it must be protected from grazing for the first year. The stand should be moderately grazed in the second year, and thereafter managed to maintain a healthy stand.



Whole quail brush



Seeds



Female flowers

QUAIL BRUSH

Atriplex lentiformis

The quail brush grown in Western Australia originally came from the hot arid deserts of southern California and Arizona, U.S.A.

Occurrence

Perennial shrub with open, upright structure. It grows fast, up to 2.5 m in height and width. The silvery blue-green leaves are about 2 cm long. It is dioecious. Male flowers are in small clusters on ends of bunches. Female flowers, which often turn pink before ripening, hang in dense bunches. Fruits are flat and round, 2 to 5 mm in diameter. Seed ripens by about April-May.

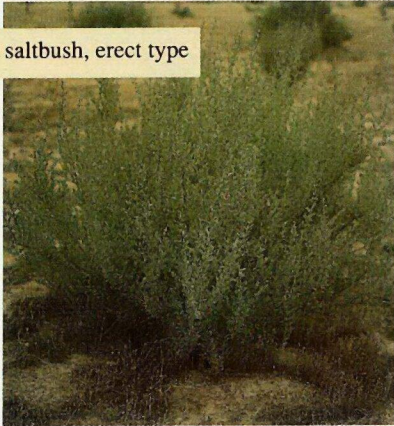
Description

The species grows particularly well on salt-affected land in the warmer parts of the northern wheatbelt where it has self-sown. It is being grown in areas receiving an average annual rainfall of 300 to 450 mm.

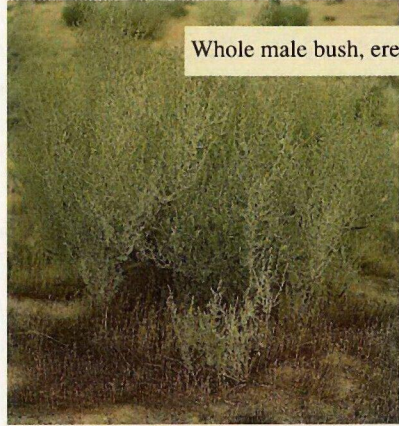
Use

The bush is rather erect and woody, but sheep graze it readily. It can be grown to provide shelter for stock. The species is not as long-lived as most other saltbushes listed in this Bulletin, but seedlings establish naturally after autumn grazing.

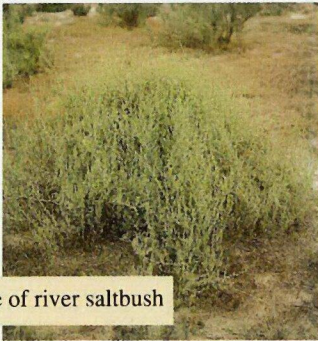
River saltbush, erect type



Whole male bush, erect type



Prostrate type of river saltbush



Male bush in flower, showing stamens



Seeds



RIVER SALTBUSH

Atriplex amnicola

Occurs naturally in the flood plains of the Gascoyne and Murchison Rivers, and as far east as Leonora.

Occurrence

Perennial shrub whose growth habit varies from prostrate to erect. Branches of the prostrate types form roots where they rest on the ground. Bushes are usually 1 m across and 1 m high, but larger ecotypes may reach 4 m across and 2.5 m high. There is a large variation in leaf size and shape, and leafiness and fruit shape, within the species. Leaves are often elongated and spear-shaped, but can be oblong with rounded ends, 1 to 3 cm long. Predominantly dioecious. Male flowers are in dense clusters on the ends of branches, female flowers in leaf axils and in short clusters on the ends of branches. Fruits may be woody or more papery, 2 to 6 mm across, roughly triangular or spherical in shape. Seed is usually harvested in summer. Flowering time is variable, depending upon seasonal conditions.

Description

The species is salt tolerant and fairly drought tolerant. Once mature, it tolerates waterlogging well; it will survive several weeks of flooding in winter.

Use

River saltbush strikes readily from cuttings. It has been difficult to establish by direct seeding, but two more easily established lines, Rivermor and Meeberrie, have been selected. Establishment of some ecotypes may be improved by washing the seed, as suggested for old man saltbush.

Ripe seeds can be hand-stripped from branches or collected from the ground after bushes have been shaken to dislodge seed.

River saltbush is a particularly good forage for sheep. It is one of the most palatable of the saltbushes listed in this Bulletin, and recovers well from grazing. River saltbush stands have supported 16 dry sheep equivalents per hectare over autumn. Leaf and small stem material contain 10 per cent crude protein and 13 per cent crude fibre.



Salt water couch and spiny rush, *Juncus actus*

SALT WATER COUCH

Paspalum vaginatum

Grows on the west coast of South Africa, where it survives regular inundation of sea water.

It also grows on the east coast of Australia, and on the North Island of New Zealand.

Occurrence

Salt water couch is a prostrate, stoloniferous perennial grass which grows actively during spring and summer.

Description

The seed heads characteristically have two branches. The grass flowers in summer, but sets negligible amounts of seed.

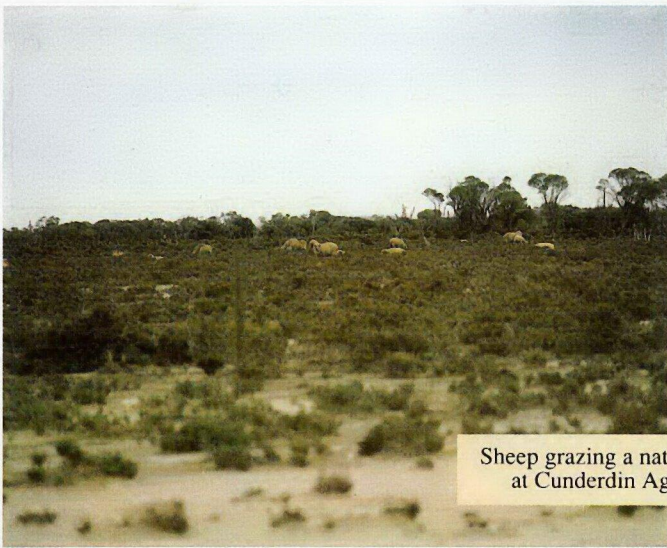
Salt water couch requires plentiful moisture during summer, and is best suited to saline seepages that are wet in summer. It is very tolerant of waterlogging. It can be propagated by transplanting runners, usually in spring. Once established, it may be grazed.

Use

A ground cover of salt water couch can control erosion of salty seepages and gullies.



Samphire



Sheep grazing a natural samphire stand
at Cunderdin Agricultural School

SAMPHIRE

Halosarcia spp.

Samphire is a common name for native species of *Halosarcia* which grow along drainage lines and the margins of saline lakes in pastoral and agricultural areas of Australia.

Occurrence

Perennial shrub, with either a spreading or more erect habit. Grows up to 1 m high.

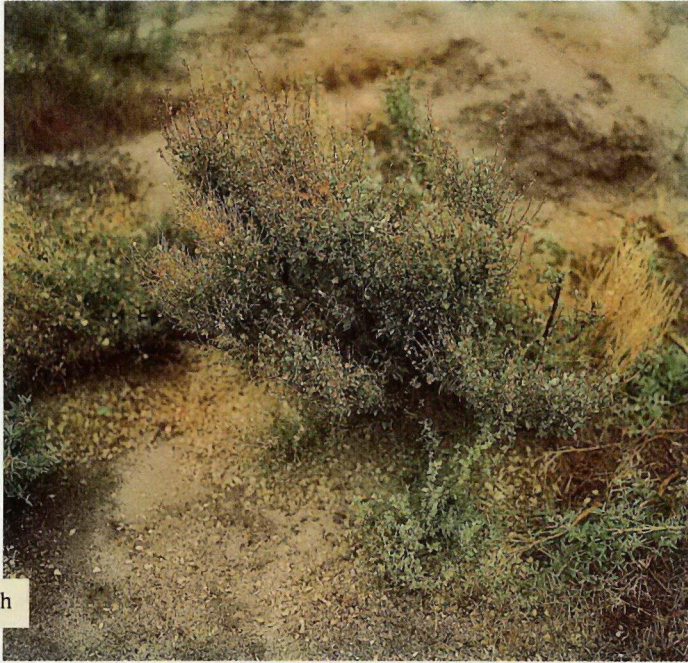
Description

Branches are made up of succulent, hairless segments, varying in colour from green to red-purple. Flowers and seeds are located between the fleshy segments and are not obvious. The seed is small (less than 1 mm in diameter) and may be brown or black, depending on the species. Seeds mature in late summer but the fleshy seed heads may not dry off until late autumn.

Samphire species are highly tolerant to salt and waterlogging and are well suited to the worst affected saltland in the wheatbelt. They survive moderate grazing. Samphire shrubs contain up to 20 per cent protein, but also 9 to 24 per cent salt (sodium chloride). They must therefore be grazed in conjunction with other feed such as crop stubble or dry annuals. Sheep must have access to fresh water. When grazed in this way, samphire has supported 0.5 to 0.8 dry sheep equivalents per hectare during autumn.

Use

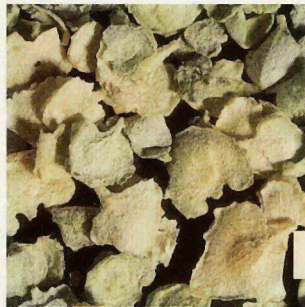
Green mature seed heads may be harvested in late summer and dried to give good quality seeds. To sow, broadcast samphire seed on to scarified ground before the first autumn rains. Samphire spreads rapidly over a site when protected from grazing.



Silver saltbush



Unripe female fruits



Seeds

SILVER SALTBUSH

Atriplex bunburyana

Naturally common in the agricultural and pastoral districts of Western Australia, where it grows on the margins of saline lakes and along drainage lines. Also occurs along the coast.

Occurrence

Perennial shrub, reaching 1 m high. In the wheatbelt its growth habit is erect, but in the Pilbara it assumes a more open and loosely spreading habit. Leaves narrowly oval-shaped, covered with bluish scale, 5 to 20 mm long. Predominantly dioecious. Male flowers in clusters at end of branches, female flowers occurring along ends of branches. Seed ripens usually by late December, but the timing depends on the weather. Fruits flat, thin and papery, somewhat heart-shaped, to 8 mm long and 12 mm wide, containing a single seed.

Description

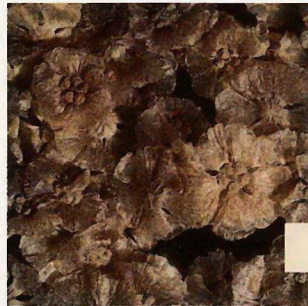
Silver saltbush is less tolerant of water-logging than the other saltbushes listed in this Bulletin. It is also less palatable to sheep, less productive than other saltbushes, and does not recover well from grazing.

Use

It self-sows readily if protected from grazing. Seed is short-lived and therefore should be used within a year of harvest.



Bluebush with flowers visible



Seeds

Bluebush

SMALL-LEAVED BLUEBUSH

Maireana brevifolia

Native to non-saline and mildly saline areas in southern Australia receiving 250 to 400 mm average annual rainfall. Common in the Western Australian wheatbelt.

Occurrence

Perennial shrub, usually 1 m high and 1 m wide. The dark bluish-green leaves are short and fleshy, 2 to 5 mm long. Upright to semi-erect habit. Monoecious. Flowering from late November to July. Flowers are bisexual and are borne in leaf axils. Seed ripens most profusely in February and March.

Description

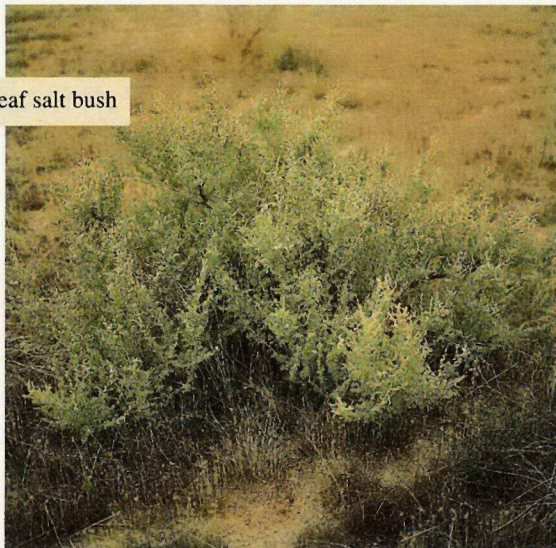
Grows on well drained, marginally to moderately saline soils, and particularly those soils which previously carried morrel (*Eucalyptus longicornis*) and Kondinin blackbutt (*E. kondininensis*). Will not tolerate flooding or waterlogging for more than a few days.

Use

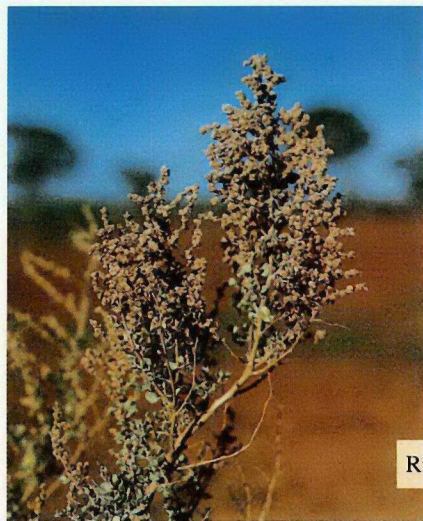
Bluebush provides good grazing (young bluebush shoots contain up to 26 per cent crude protein) and recovers well from it. Farmers in many wheatbelt districts regularly graze sheep on bluebush in summer to late autumn, in conjunction with pasture or stubble. This strategy avoids poisoning by the 9 to 12 per cent oxalate contained in the leaves. Hungry sheep should not be introduced to bluebush unless adequate other feed is available.

If there is a nearby stand of bluebush, fencing and protecting an adjacent area for two to three years will lead to colonization. Bluebush can be readily introduced into a suitable area by sowing with a specialized seeder such as the "Mallen" Niche Seeder or, less reliably, by spreading seed onto cultivated soil. Only recently collected seed should be sown because seed loses viability within a year of being collected.

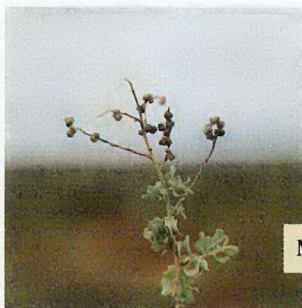
Male wavy leaf salt bush



Seeds



Ripe female fruits



Male flowers

WAVY LEAF SALTBUSH

Atriplex undulata

The wavy leaf saltbush now growing in Western Australia originally came from the semi-arid rangelands of central Argentina.

Perennial shrub, reaching 1 m high and 2 m across. This shrub has upright erect stems as well as low spreading stems. The stems growing along the ground form roots. As the name suggests, the leaves are crinkly or wavy, and are 0.5 to 1.5 cm long. Dioecious. Male and female flowers occur in clusters on the ends of branches. Fruits are soft and rounded, from 1 to 3 mm in diameter, and contain a single seed. Seed ripens about April to May.

Wavy leaf saltbush grows well on salt-affected soils in the wheatbelt. It is not as tolerant to waterlogging as river saltbush, but is more so than marsh saltbush.

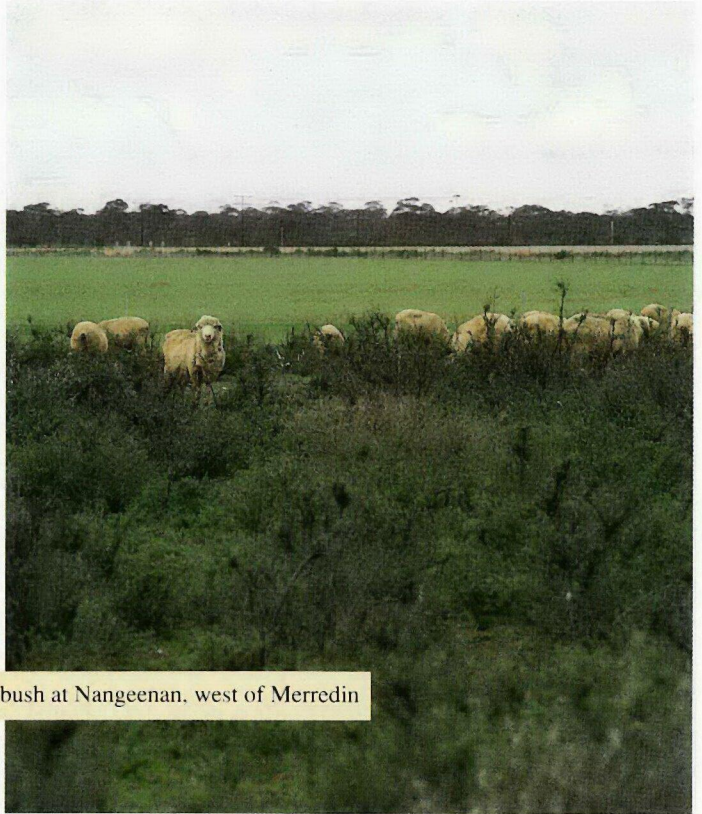
Wavy leaf saltbush recovers well from grazing. Stands have supported eight dry sheep equivalents per hectare over autumn.

It establishes readily when sown using the "Mallen" Niche Seeder. Seedlings sprout in large numbers in established stands after autumn grazing.

Occurrence

Description

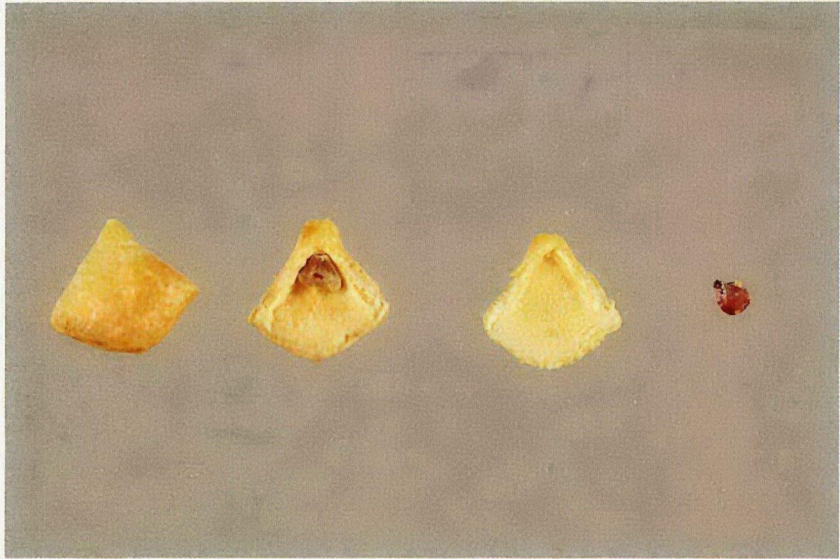
Use



Sheep grazing bluebush at Nangeenan, west of Merredin

FURTHER READING

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Bracts and seed of river saltbush (*Atriplex amnicola*), left to right-
Intact fruit.

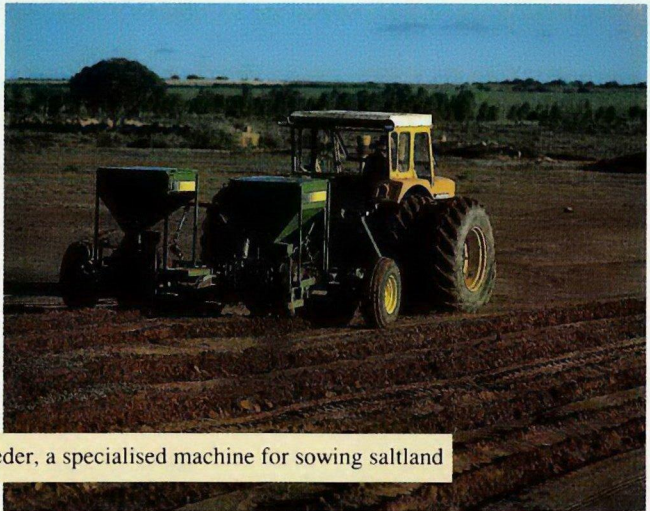
Fruit containing seed but with one bract removed.

Empty bract removed from fruit. Both bracts are empty if fruit is unfilled.

Seed removed from fruit.

SCIENTIFIC AND COMMON NAMES

Scientific name	Common name
<i>Atriplex amnicola</i>	river saltbush
<i>Atriplex bunburyana</i>	silver saltbush
<i>Atriplex cinerea</i>	grey saltbush
<i>Atriplex lentiformis</i>	quail brush
<i>Atriplex nummularia</i>	old man saltbush
<i>Atriplex paludosa</i>	marsh saltbush
<i>Atriplex semibaccata</i>	creeping saltbush
<i>Atriplex undulata</i>	wavy leaf saltbush
<i>Atriplex</i> species (Pintharuka)	“Pintharuka” saltbush
<i>Halosarcia</i> species	samphires
<i>Maireana brevifolia</i>	small-leaved bluebush
<i>Paspalum vaginatum</i>	salt water couch
<i>Puccinellia ciliata</i>	puccinellia



“Mallen” Niche Seeder, a specialised machine for sowing saltland

GLOSSARY

Dioecious	having male and female flowers on separate bushes
Ecotype	a variant within a species that is adapted to conditions at a particular place
Inflorescence	flowering shoot
Leaf axil	position where the leaf joins the stem
Monoecious	having male and female flowers on the same bush
Prostrate	grows along the ground
Stoloniferous	with underground stems that send up shoots
Succulent	thickened and fleshy