

Salt Pans

The last fragments



Salt pans, Chapman Road Scientific Reserve.
Mike Thorsen

Quickfacts

Found only in the driest areas of Central Otago and the Waitaki Valley.

Swamped by weeds and only tiny fragments remain.

A Nationally Critical endangered habitat home to a number of endangered plants and insects.

Salt

A very rare habitat exists in the driest areas of Central Otago and the Waitaki Valley, here the lack of rainfall allows salt pans to form in some places. The landforms of Central Otago are some of the oldest in New Zealand and have been present since the Late Cretaceous period (70 million years ago), and salts from the weathering of the old schist rocks have accumulated over centuries to create white bare salty patches. Salt is an alkaline and toxic to most plants, and only specially-adapted plants can live in salty environments. These plants are known as 'halophytes'. Fifteen native halophyte plants inhabit New Zealand's salt pans. Two of these species are not found elsewhere, whereas the others have somehow colonised these inland habitats from the coast that is at least 90 km away. The two species that are found only in salt pans, salt pan cress and pygmy salt grass, have evolved to the degree that they do not inhabit other habitats. A puzzle exists for the other halophyte species that also occur in coastal sites - is the distance between the coastal and salt pan populations preventing interbreeding and, if so, are the salt pan populations evolving into a distinct new form?





Salt pan is used here as a general term and can take the form of a salt meander channel, salt plain, salt knoll, or salt apron in addition to a salt pan (a hollow). Salt pans once extended over large areas of Central Otago and near Otematata in the Waitaki Valley. Since the 1970's, when 40,000 ha of salt pans were mapped, over 99% of the salt pans have been obliterated by mining during the Otago gold rush (which ironically also created some salt pan areas), cultivation and irrigation for pasture or crops, and excavation of clays. Now only 100 ha of salt pan remains and much of this has been degraded through invasion by weeds: consequently this habitat type is classified as 'Nationally Critical'. Salt-tolerant weeds, particularly buckshorn plantain *Plantago coronopus*, Mediterranean barley grass *Critesion hystrix* and exotic salt grasses (*Puccinellia* species) are slowly colonising large areas of the remaining salt pans, forming dense patches where few other species can grow, and increasing the soil fertility which facilitates further weed invasions.

Life in salt pans

Salt pans are home to unique assemblies of plants and insects, some of which only occur on salt pans, and some of which are highly endangered.

Salt pan cress *Lepidium kirkii* (as its name implies) only occurs in the salt pans of Central Otago. Its lifestyle is finely-tuned to one of the harshest environments in New Zealand, and it is very different from the other native New Zealand cresses. The sites where it lives are constantly subjected to extremes of heat and aridity: in winter the ground freezes and in summer it is baked dry by the sun. There is a short period between winter and summer where conditions are just right for salt pan cress to sprout new leaves from the winter-dormant root, to flower, and to spread its seed. The flowering branches continue to grow as long as there is sufficient moisture in the soil, before withering once the soil is baked dry in summer. The root then survives through the dry summer and freezing winter to resprout again the next spring. Salt pan cress is now very endangered and is classified as 'Nationally Critical'. Small populations survive at only five sites (mainly salt knolls), and if all these plants were combined, they would fit onto the floor of a standard-sized living room. Competition with weeds, loss of habitat, fungal infections and lack of seed dispersal are all serious threats to the survival of salt pan cress. Luckily, salt pan cress is rarely eaten by farm animals (possibly because it is very hard to see!) or insects.

Pygmy saltgrass *Puccinellia raroflorens* is nearly New Zealand's smallest grass, growing to just 4.5cm tall. It only occurs in Central Otago salt pans (with one unusual record from a Stewart Island salt marsh), where it grows as brownish patches up to 2 m wide

on flat areas of salt pans which are wet in winter. Its scientific name *raroflorens* means “rarely flowering” as it only flowers when conditions are right. While the area occupied by pygmy salt grass is large (relative to other salt pan inhabiting species), there are probably less than 1,000 individual plants left, and the species is classified as ‘Nationally Critical’. The main threat to pygmy saltgrass is loss of habitat, as few weeds can survive in its habitat and it is not often eaten by animals.

New Zealand celery *Apium prostratum*, remuremu *Selliera radicans* and Buchanan’s orache *Atriplex buchananii* are three of the species that are found both in salt pans and on the coast. New Zealand celery plants growing on salt pans have physical differences from those growing on the coast, but the appearance of this species varies, and so further research on these differences is needed. Likewise the plants of remuremu and Buchanan’s orache need critical comparison with their coastal cousins. Buchanan’s orache is an annual sprawling herb, with distinctive rounded greyish-green leaves (some plants are greenish, some grey). While still common in some salt pans, overall numbers are decreasing and it is classified as ‘Nationally Vulnerable’.

There are other endangered species that grow in other habitats in addition to salt pans. Examples of those that inhabit salt pans include important populations of plants such as the ‘Nationally Vulnerable’ pygmy forget-me-not *Myosotis brevis* and the ‘Nationally Endangered’ New Zealand mousetail *Myosurus minimus* ssp. *novae-zelandiae*.

There are four moth species that are only found at salt pan sites: *Paranotoreas fulva*, *Loxostege* sp. “salt pan”, *Scythris triatma* and *Kiwaia thyraula*. Both *Paranotoreas fulva* and *Loxostege* sp. “salt pan” are endangered and classified as ‘Relict’.

Caring for salt pans

A few salt pan sites are legally protected in covenants, Scientific Reserves, or Conservation Areas, and several landowners are protective of salt pans occurring on their properties. Several salt pans are listed as Regionally Significant Wetlands by the Otago Regional Council, and as Areas of Significant Indigenous Vegetation and Habitats of Indigenous Fauna and Wetlands by the Central Otago District Council (CODC), and are protected from further disturbance under the CODC’s District Plan. The Department of Conservation has, until recently, been monitoring the populations of salt pan cress at several sites. It has also undertaken herbicide trials to test which can be used safely in areas occupied by salt pan cress and the other endangered salt pan plants. This work showed that the herbicides Versatil and 24-DB can be used to kill the buckshorn plantain weed in salt pan cress sites without killing the native plants, if applied at a very specific concentration. A trial was also conducted that involved spreading salt pan

cross seed which was successful at producing more salt pan cress seedlings.

What next?

The threats to the survival of salt pans are:

1. Cultivation and irrigation as part of farm developments.
2. Excavation of salt pans for their clays.
3. Invasion by weeds swamping the bare ground needed by the endangered plants.

Successfully protecting salt pans from these threats must be achieved in order for a conservation programme to succeed. Ideally, this should be done by:

1. Removing weeds from salt pans inhabited by endangered plants or good examples of salt pan soils.

Removing weeds will allow the native plants to flourish. This removal needs to be done carefully in order to avoid damage to endangered plants or native plant communities. Currently, using Versatil and 24-DB removes many broadleaf weeds, particularly buckshorn plantain, without damaging native plants. The grass-specific herbicide Gallant® could also be trialled to kill grasses in areas where pygmy salt grass does not occur. A broad spectrum herbicide such as Roundup® can be used to kill weeds over large areas where there are very few native plants. The weed control programme at each site would need to be staged by initially removing the bulk of weeds over the first two years, and spot spraying of troublesome patches over the following three years. The weed-free areas would then be maintained through annual spraying of any new weed encroachment.

A weed control programme at five sites for ten years is likely to cost \$90,100.

2. Creating larger populations of the salt pan cress.

Most populations of native salt pan plants would increase unaided once weeds were removed from the salt pan sites, if they are already present. However, the seeds of salt pan cress (and possibly other salt pan plants) do not disperse far from its parent, and will require assistance by sowing the seed to recolonise new sites. Cultivated plants produce large numbers of seeds, and so captive colonies from each population of salt pan cress should be formed, harvested and the seed broadcast over suitable bare areas at the sites whence it originated.

Cultivating salt pan cress and harvesting and broadcasting its seed over ten years is

likely to cost \$258,200, of which \$240,000 is the cost of labour which would likely be donated by the plant breeders. The \$18,200 remainder is for purchasing cultivation materials and broadcasting seed over salt pans.

More information

- Website: New Zealand Plant Conservation Network – salt pan fact sheet. [Link](#)
- Website: Landcare Research - salt pan fact sheet. [Link](#)
- Website: Otago Regional Council – register of significant wetlands/Central Otago. [Link](#)
- Report: Ecosystem-based conservation strategy for Central Otago's saline patches. By J.G. Rogers, A.E. Hewitt, J.B. Wilson. Science for Conservation, No. 166. Department of Conservation, Wellington. 2000. [Link](#)
- Strategic document: Inland *Lepidium* recovery plan: 2000-2010. By R.B. Allen. Threatened Species Recovery Plan No. 32. Department of Conservation, Wellington. [PDF](#)
- Report: Guidelines for conservation of salt pans in Central Otago. By R.B. Allen & P.D. McIntosh. Science for Conservation, No. 49. Department of Conservation, Wellington. 1997. [PDF](#)
- Book: Wild Central: discovering the natural history of Central Otago. By N. Peat. Otago University Press, Dunedin, 1999.
- Scientific paper: The distribution of plants in relation to pH and salinity on inland saline/alkaline soils in Central Otago, New Zealand. By R.B. Allen, P.D. McIntosh, J.B. Wilson. New Zealand Journal of Botany vol. 35, pages 517-523, 1997. [PDF](#)
- Report: Register of saline soil sites in North and Central Otago (two volumes). By P.D. McIntosh, F.G. Beecroft & B.H. Patrick. Technical DN5, Division of Land and Soil Sciences, DSIR, 1990.



Photos



Weed infested salt pan. Mike Thorsen, DOC



Lepidium kirkii plant. Mike Thorsen, DOC



Pygmy salt grass. Mike Thorsen



Monitoring salt pan cress. Mike Thorsen, DOC

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