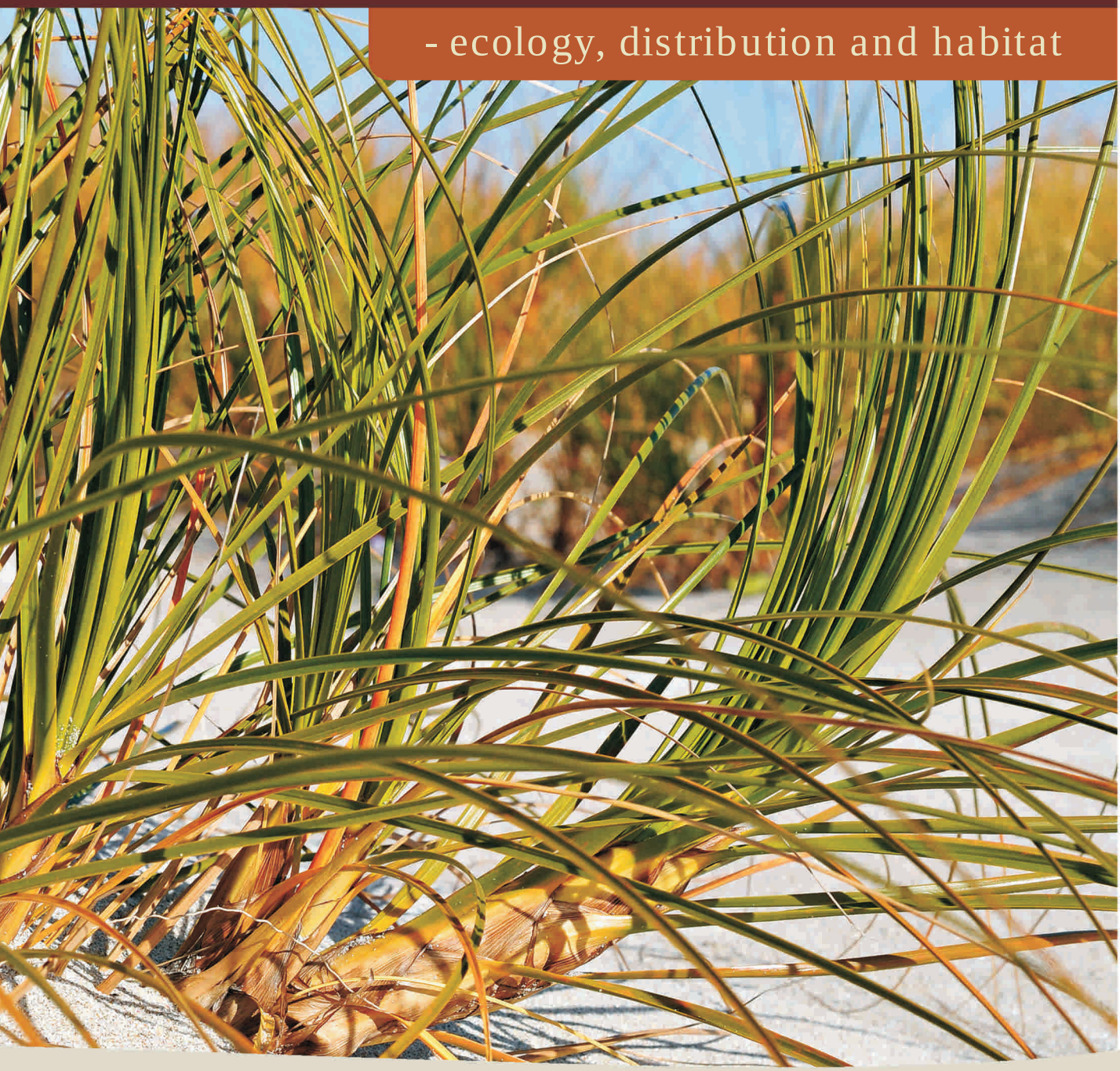
DUNE RESTORATION TRUST OF NEW ZEALAND

Technical Article No. 7.3

Pingao
Golden Sand Sedge
- ecology, distribution and habitat



Technical Handbook Section 7: Native vegetation on foredunes
7.3 Pingao - ecology, distribution and habitat

Keeping our Dunes ALIVE

INTRODUCTION

Pingao (*Ficinia spiralis*) is a native sand-binding plant found growing on or near coastal foredunes throughout New Zealand. Pingao once would have been found on almost every beach and mobile foredune throughout New Zealand but it is now only found as remnant populations or where active replanting programmes have occurred. This article provides a description of pingao and its ecology, and a summary of its natural distribution and its current status as a sand binder along our sandy coastline in New Zealand.

PLANT DESCRIPTION

Pingao, also known as golden sand sedge, is a tussock-like perennial plant 30-90 cm tall found on active sand dunes in New Zealand dunelands. The leaves are narrow (2-5 mm wide) and occur in tufts. They are stiff, curled and saw-edged, some of which helps to minimise moisture loss in the harsh coastal environment. The foliage is a brilliant green which turns to a golden yellow or fiery orange as leaves age and dry out.

Most plants are borne on long, thick, rope-like rhizomes which run out across the sand surface before become buried by drifting sand. Some southern South Island populations produce dense tussock-like plants without extensive rhizomes. An extensive fine root system assists in binding sand and sourcing water. Vegetative reproduction by rooting from partially-buried rhizomes is the main means of plant spread.

Thick rope-like rhizomes of pingao exposed by wind erosion.

FLOWERS AND SEEDING

In spring, the dark brown spiral flowerheads appear, borne on stems up to 90 cm tall. The small flowers are arranged on a flowerhead in a spiral pattern (hence the name *Ficinia spiralis*).

Pingao seeds appear from early summer and are 3-5 mm long (size of a matchhead), ovoid shiny black nuts which develop in 15-30 cm long seedheads. Like the flowers, the seed is arranged in a spiral pattern.

Vigorous colonies of pingao usually produce large numbers of seedheads. Seed ripens from December to February depending on location – maturity is reached later in more southern cooler latitudes.

Flowerheads of pingao can be up to 30 cm long. Individual flowers are arranged in a spiral pattern.

The dark brown seedhead of pingao containing ripe seed.

Wind is the primary mechanism of dispersal over short distances, whereas transportation via seawater allows greater dispersal over longer distances (Department of Conservation, 1992). Pingao seeds may have a dormancy period although the length of time seed may remain viable in sand dunes is not known.

Natural regeneration from seed has not often been observed, even though copious seed is usually produced. When present, seedlings are generally confined to depressions in the dunes where the sand is more moist.

DISTRIBUTION

Pingao is endemic – found only in New Zealand. It occurs from Northland to Rakiura (Stewart Island) and the Chatham Islands. It is a distinctive plant on the coastal sand dunes, its bright-coloured foliage often contrasting with the silvery grey colour of spinifex (*Spinifex sericeus*), with which it is frequently associated with in the North Island and upper South Island. In the more southern parts of New Zealand, spinifex is absent and pingao can be the dominant sand-binder where it is often referred to as pikao. Before European settlement, pingao was widespread in both the North and South Islands (Cockayne, 1911). Today most populations are small and distribution is infrequent due to a range of factors related to settlement (Courtney, 1984). These include browsing by introduced animals such as rabbits, grazing by domestic stock, competition with the exotic sand-binder marram grass (*Ammophila arenaria*) (Wardle, 1991), recreational and residential development on dunes, sand mining (Partridge, 1992), and harvesting of leaves for weaving. In some districts there is now virtually no pingao on sand dunes.

Browsing by rabbits is but one of a range of human-induced factors that has reduced the distribution and frequency of pingao throughout the country.

The demise of pingao - *an example from Otago*

The decline of pingao illuminated on the Department of Conservation's website (www.doc.govt.nz/publications/conservation/nativeplants/pikao) in just one of our regions, Otago, highlights the bad practices on coastal land, including fire, and the desirability of coastal land for agricultural and forestry purposes.

Examples of bad practices on coastal land can be traced back to 1880s in the Otago region in Murray Thomas's work "A Pakeha's Recollections" (Thomas, 1944).

Here he describes how:

"to relieve the monotony of waiting (for frost fish to strand on the beach) and at the same time cater for their comfort, the boys used to set fire to the native grass, and night saw patches of sandhills ablaze".

Consequently he noted that areas of dune that were now devoid of vegetation were blowing out, causing sand to drift over the productive land where people had settled with no signs of regeneration of the vegetation. Subsequently, Thomas introduced the yellow tree (*Lupinus arboreus*) after other methods such as shrub fences failed to halt the drifting sand. The success of this revegetation then lead to the fervent sowing of marram grass and lupin around the Otago region, with the resultant dune reformation proclaimed to be a "most gratifying" outcome.

HABITAT

A dynamic landscape

Vigorous stands of pingao are found only where there is sand movement, typically on the seaward face of coastal foredunes and sometimes extending to active rear dunes. Wind-blown sand is readily trapped around its stems and leaves and hence it is very effective in contributing to dune building. Pingao only partially traps sand as a result of the density of its foliage and the plants morphology creating active sand dunes which allows a degree of sand movement.

The typical open habitat of a pingao-dominated foredune where the open foliage allows continual sand movement amongst plants.

Planting trials indicate that growth of young pingao is stimulated by moderate rates of sand accumulation in the order of 10-20 cm a year (Bergin and Kimberley, 1999). On the exposed west coast of the North Island, large well-established plants in natural colonies have been found to withstand inundations of 70 cm annually. Pingao may be present on rear dunes, but growth slows as sand movement declines.

Because active sand dunes allow some sand movement, they create a more dynamic environment. Pingao-dominated dune systems change constantly with sand accretion (build up) and erosion, while retaining diversity by constant creation of various ecological niches at different stages of succession. A pingao-dominated undulating dune system creates an ideal environment for other coastal species to colonise and these areas will often support diverse communities. This is particularly the case landward with reduced exposure to salt spray and wind.

Although moderate sand movement promotes growth of pingao, excessive accumulation or erosion causes dieback. Day-to-day wind conditions can therefore be critical for plant survival and growth. Even well-established stands can be excavated by high persistent winds and may die back completely leaving exposed rhizomes and roots.

Comparing species

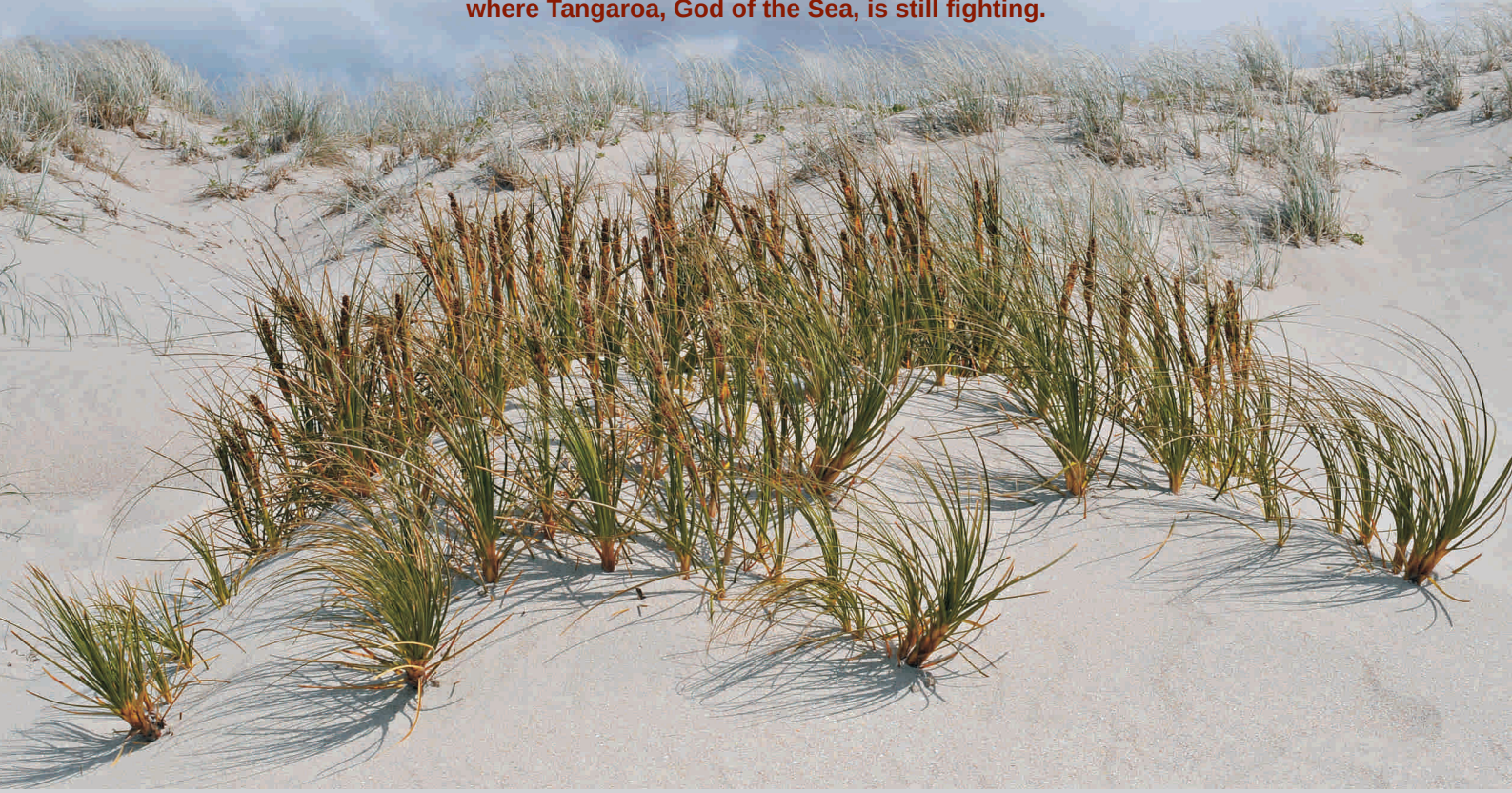
In a review of the ecology and role of marram grass in New Zealand, Gadgil (2006) summaries various studies comparing marram grass with the native sand binders pingao and spinifex including tolerance of salt water, influence on dune shape, wind effects and sand trapping, and competitive effects. In a study of dunes on the Manawatu coast, Esler (1978) found that pingao was associated with lower, more gently sloping foredunes than was spinifex or marram grass. The steepest dunes had a marram grass cover. Pingao was less resistant to sand removal than the other sand binders, and persistent rhizomes of exposed sites were a feature of eroding dunes.

Pingao colonies are most vigorous on mobile sand dunes.

Although pingao is an efficient sand collector, it is a less-effective sand binder than either marram grass or spinifex because it grows more slowly (Holland, 1981) and is more sensitive to erosion of sand around roots and buried rhizomes (Esler, 1970). While Hilton et al. (2005), have shown that pingao cannot co-exist with marram grass in active dune sites, Partridge (1995) has described circumstances under which marram grass does not constitute a threat to pingao. In southern regions of New Zealand, competition with marram grass is considered by the Department of Conservation and the Pikao Recovery Group as one of the greatest threats to pingao (refer to www.doc.govt.nz/publications/conservation/native plants/pikao). They suggest marram grass excludes pingao in two ways. Firstly, due to marram's superior sand trapping abilities it is able to deprive pingao of sand causing it to go moribund. Secondly, because marram grows quickly, developing extensive root and rhizome systems it is able to outcompete pingao for moisture, resulting in desiccation, slowing its growth and resulting in burial and death.

THE EYEBROWS OF TANE

The eyebrows of Tāne Mahuta, God of the Forest, growing on the coastal dunes where Tangaroa, God of the Sea, is still fighting.



One version of the story of pingao relates to the beginning of time when Tangaroa, God of the Sea was jealous of his brother Tāne Mahuta, God of the Forest, who had been successful in separating Ranganui, the Sky Father, from Papa-tu-a-nuku, the Earth Mother. Tāne Mahuta wanted to end the conflict and so as a sign of peace he plucked out his eyebrows and gave them to Tangaroa. Tangaroa did not want to forgive Tāne and so he threw the eyebrows back on to the shore where they grow today as the pingao - the golden sand sedge at the boundary between forest and sea. And here Tangaroa is still fighting amongst the domains of Tāne Mahuta (Herbert and Oliphant, 1991).

REFERENCES

Bergin, D.O.; Kimberley, M.O. 1999: Rehabilitation of coastal foredunes in New Zealand using indigenous sand-binding species. *Department of Conservation, Science for Conservation Series No. 122*: 52p.

Cockayne, L. 1911: *Report of the dune areas of New Zealand plants, their geology, botany and reclamation.* Parliamentary Paper C 13. Department of Lands. Wellington, New Zealand. 76p.

Courtney, S. 1984: Our disappearing natural duneland. *Journal of the Royal Forest and Bird Society 15* (3): 2-5.

Department of Conservation 1992: *Pingao Recovery Plan*. Otago Conservancy 1993-1998. Department of Conservation, Dunedin.

Esler, A.E. 1970: Manawatu sand dune vegetation. *Proceedings of the New Zealand Ecological Society* 64: 304-314.

Esler, A. E.1978: *Botany of the Manawatu District*. Government Printer, Wellington, New Zealand. 206p.

Gadgil, R.L. 2006: Marram grass friend or foe? A review of the use of *Ammophila arenaria* on New Zealand sand dunes. *New Zealand Forest Research Institute Limited, Rotorua. Coastal Dune Vegetation Network Bulletin No. 5.*

Herbert, A.; Oliphant, J. 1991: *Pingao: the golden sand sedge.* Nga Puna Waihanga, Rotorua. 32p.

Hilton, M.; Duncan, M.; Jul, A. 2005: Processes of *Ammophila arenaria* (marram grass) invasion and indigenous species displacement, Stewart Island, New Zealand. *Journal of Coastal Research 21*: 175-185.

Holland, L.D. 1981: Plants and sand dune development, *Ammophila arenaria* vs *Desmoschoenus spiralis* on Kaitorete Barrier, Canterbury. M.Sc. Thesis, University of Canterbury, New Zealand.

Partridge, T.R. 1992: The sand dune and beach vegetation inventory on New Zealand. I. North Island. *Department of Scientific and Industrial Research Land Resources, Christchurch, Scientific Report No. 15*: 253p.

Partridge, T.R. 1995: Interaction between pingao and marram on sand dunes. *Department of Conservation Science for Conservation Series No. 3*: 27p.

Thomas, M. G. 1944: *A Pakeha's recollections. The reminicences of Murray Gladstone Thomas.* Extracts relating to early Dunedin. Eccles, A. (ed). A.H. & A. W. Reed.

Wardle, P. 1991: *Vegetation of New Zealand*. Cambridge University Press. 672p.

Author: David Bergin, Environmental Restoration Ltd

Dune Restoration Trust of New Zealand
Email: info@dunestrust.org.nz
www.dunestrust.org.nz

Ministry for the Environment
Manatū Mō Te Taiao
Sustainable Management Fund

The Ministry for the Environment does not necessarily endorse or support the content of the publication in any way.

2011 ISSN 2230-6919
Printed by Scion Digital Print Centre, Rotorua

The mission of the Dunes Trust is:

"To see the majority of New Zealand dunes restored and sustainably managed using indigenous species by 2050".