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Windbreaks prove their worth

By Tim Negus, Co-ordinator, Landcare Technicians Training Scheme, Department of Agriculture, Narrogin

Strong winds in the south-west of Western Australia in April 1991 carted tonnes of top soil from stubbles, over-grazed pastures, and recently prepared cropping land. However, where there were windbreaks, downwind protection into the paddock was up to 10 to 20 times the height of the windbreaks.

On May 1, 1991, the author inspected farm land for damage from Narrogin to the Dongolocking area, to Harrismith, up the rabbit-proof fence to West Corrigin and back to Narrogin via Kweda. He found the extent of soil erosion varied, and that some tree species planted in windbreaks gave better protection than others.

Wind erosion damage

Severe wind erosion was not obvious south-east of Narrogin, mainly because of the excellent germination after 25 to 30 mm of rain on April 10, 1991.

From Harrismith northwards and particularly on sandy soils along the rabbit-proof fence, which divides the Shires of Wickepin and Kulin, damage was severe.

Topsoil was sorted to a depth of one to two centimetres on these soils. In topsoil 'sorting', strong winds selectively remove the fine, fertile clay and silt particles as dust, leaving coarse sand behind on the soil surface.

We can also assume that most of the light land in the wheatbelt probably suffered significant soil loss during the five-hour windstorm.

Some of this land also suffered erosion earlier in summer and did not produce a dense pasture germination after the opening rains. The soil was still unprotected when the windstorm struck.

TOP PHOTO: At several sites from Harrismith northward natural bush and planted windbreaks helped to reduce the erosion damage.

ABOVE: Several paddocks just north of Wickepin were eroded to a depth of one centimetre in the weeks before April 21.
The Perth Bureau of Meteorology said the gale-force winds that ripped through the South-West on April 21, 1991 were the most serious for farmers since Cyclone Alby struck on April 4, 1978. The winds, which blew from a low-pressure system - formerly Cyclone Fifi - followed a similar pattern to that of Cyclone Herbie in May 1988.

The April 1991 windstorms were a combination of events. Cyclone Marian was moving from the Northern Territory across Western Australia and parallel to the north-west coast. Earlier that week, Cyclone Fifi had formed near the Cocos Islands.

As the week progressed, Cyclones Marian and Fifi both moved down towards the coast. Cyclone Marian died and an extra tropical low-pressure system - formerly Cyclone Fifi - developed in front of Fifi. This low-pressure system produced the gale force winds. The low did not cross the coast, only coming within 100 km west of Cape Leeuwin.

Such storms are not uncommon at this time of the year. The weather was similar to a severe winter storm, but the dry conditions caused an extreme erosion hazard.

What the tour confirmed

Natural tree clumps and strips and properly designed and planted windbreaks can reduce soil erosion significantly during disastrous windstorms.

In the Wickepin and Corrigin shires, the protected area downwind of windbreaks, which varied in height from 10 to 15 m, was 100 to 200 m, or, on average, 10 to 20 times the height of the windbreaks.

River red gum, *Eucalyptus camaldulensis* and pinaster pine are suitable species for planting in windbreaks. These species retain branches close to the ground.

To be effective, windbreaks must be permanently fenced to prevent grazing and formation of wind tunnels.

In windbreaks of one and two rows, trees initially should be three metres apart to encourage an early closure of the canopies in a sideways direction, and hence good density. However, such a spacing compromises the long-term survival of the trees and the effectiveness of the windbreak.

It is better to keep at least a five-metre spacing, and add another line of trees. But remember, a single row of trees does not provide a truly effective windbreak.

### Botanical and common names of the trees mentioned

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
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<tbody>
<tr>
<td><em>Eucalyptus camaldulensis</em></td>
<td>River red gum</td>
</tr>
<tr>
<td><em>E. cladocalyx var. nana</em></td>
<td>Bushy or dwarf sugar gum</td>
</tr>
<tr>
<td><em>E. globulus</em></td>
<td>Tasmanian bluegum</td>
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<tr>
<td><em>E. gomphocephala</em></td>
<td>Tuart</td>
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<tr>
<td><em>E. leucoxylon subsp. megalocarpa 'rosea'</em></td>
<td>Red-flowered form of large fruited yellow gum</td>
</tr>
<tr>
<td><em>E. leucoxylon subsp. leucoxylon</em></td>
<td>Larger tree form of red-flowered yellow gum</td>
</tr>
<tr>
<td><em>E. longocornis</em></td>
<td>Red morrel</td>
</tr>
<tr>
<td><em>E. loxophleba</em></td>
<td>York gum</td>
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<tr>
<td><em>E. melanoxylon</em></td>
<td>Black morrel</td>
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<tr>
<td><em>E. oleosa</em></td>
<td>Great mallee, red mallee, oily mallee, glossy-leaved mallee</td>
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<tr>
<td><em>E. platypus var. heterophylla</em></td>
<td>Coastal moort</td>
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<td><em>E. wandoo</em></td>
<td>Wandoo</td>
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<td><em>Pinus pinaster</em></td>
<td>Pinaster pine</td>
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<td><em>Pinus radiata</em></td>
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<tr>
<td><em>Allocasuarina huegeliana</em></td>
<td>Rock sheoak</td>
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<tr>
<td><em>A. obesa</em></td>
<td>Salt sheoak</td>
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<tr>
<td><em>Acacia baileyana</em></td>
<td>Cootamundra wattle</td>
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<td><em>A. decurrens</em></td>
<td>Black wattle</td>
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<tr>
<td><em>A. podalyriifolia</em></td>
<td>Queensland silver wattle or Mount Morgan wattle</td>
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<tr>
<td><em>Chamaecytisus palensis</em></td>
<td>Tagasaste or tree lucerne</td>
</tr>
</tbody>
</table>
Windbreak

- Photo 1: Natural bush strip of sheoaks 10 m high along fence. The protected area was 100 m downwind.

- Photos 2, 3: Planted windbreaks on a trial area north-west of Corrigin. This area was planted in 1982 to test combinations of various tree and shrub species in windbreaks of two-rows of trees.

The paddock had eroded extremely badly in 1980. The windbreaks, which are now six to eight metres high, helped to control erosion during the April 1991 windstorm.

Among the best combinations of species were two rows of Pinaster pine (eight metres high) [Photo 2] and a two-row windbreak of Eucalyptus leucoxylon var. rosea and coastal moort (seven metres high) [Photo 3].

- Photo 4. Single rows of tuart (six metres high) and tagasaste (three metres high) also helped to reduce erosion.

- Photos 5, 6: Several wattles were tested in this trial. Cootamundra wattle and black wattle both have a very upright growth habit with light foliage and seem ineffective as trees for windbreaks. The Queensland silver wattle was three metres high.

The acacias, by themselves, may not be suitable as windbreak trees, but they may be more useful when combined with other tree species.
Queensland silver wattle is a fast-growing tree that appears more dense than other acacias, but it tends to open up and break up after five to 10 years.

- Photo 7. The electric fence around one of the windbreaks had broken down and sheep had severely grazed the lower parts of the trees.

Erosion was severe for 25 m downwind of this plantation because of the wind tunnel effect under the trees. Permanent fencing of windbreaks is essential.

The trees in this planting were five metres apart, and after nine years there are still gaps between several of them. Gaps in a line of trees do not matter where there are several lines, provided there are no gaps in the windbreak.

- Photo 8: One combination that may be effective is bushy or dwarf sugar gum and coastal moort.

The sugar gums are now between five and ten metres high, but the row of coastal moorts is stunted and some trees are dead. Coastal moorts do not grow well when shaded.

- Natural bush block of morrel and sheoak 20 m high. A protected area extended 200 m downwind from the bush.

- Natural bush in road reserve. An excellent windbreak of sheoaks about 10 m high. There was no protection as the strip ran almost due north-west, the direction of the wind storm. Soil eroded up to the base of the trees.
Other observations

• Photo 1. River red gum planted in single rows. Trees, now 10 m high, are spaced 10 m apart and the plantation has a double fence. The trees have branches low to the ground and have formed a good windbreak with a good permeability of 50 to 60 per cent.

• Photo 2. Direct sown river red gum and sheoaks on very light soils. Allocasuarina huegeliana and A. obesa are the dominant species. The trees are 2 m high and the windbreak is 16 m wide.

• Photo 3. Windbreak of five rows. The trees, and their location within the planting, are: Tasmanian bluegum in the centre, and York gum, wandoo and coastal moort along the outer rows. The trees are about four metres high and planted in a three metre by three metre spacing. The windbreak is very dense.
of windbreak designs

- Photo 4. Direct-sown tagasaste. Trees are 2.5 to 3 m high and the windbreak is 20 m wide. The planting is very dense, with little permeability. Low permeability forces all the wind over the trees and can cause turbulence on the leeward side.

- Photo 5. Radiata pines in single rows. Pines are 11 m high and 5 m apart. There are no gaps in the planting, except under the trees as a result of grazing. Trees that are double-fenced have thicker and better growth in the base of the windbreak.

- Photo 6. Tasmanian bluegum in single rows. Trees are 11 m high and 10 m apart. There are four-metre gaps between well grown trees at this spacing.

The trees were planted on sandy-gravel east of Wickepin soon after Cyclone Albie struck in April 1978.

A single row of trees is not a highly effective windbreak because loss of individual trees causes a gap. 

Photo 5. Radiata pine.

Photo 6. Single rows of Tasmanian bluegum.