MALLEE CATCHMENT
TECHNICAL BULLETIN

Technical Bulletin # 24

Wind erosion susceptibility mapping

Left: Jim Rowan and David Rees provided valuable insights into the geomorphology of the Mallee and it's relation to wind erosion susceptibility. Photo: DPI.

At a glance

- This project has combined expert knowledge, wind erosion observations, climate and soil site data.
- Spatial relationships between landform components and the properties that underpin a component's inherent susceptibility to wind erosion have been described and mapped.
- The mapping will help the Mallee CMA predict where wind erosion may pose a threat to the region's natural assets.
- The new fine-scale mapping will provide input to: enhance the accuracy and precision of modelling; select sites for monitoring wind erosion with greater certainty; aid in the prioritisation of applications under incentive programs.

This technical bulletin provides a summary of the methodology and outcomes of the 'Mallee wind erosion susceptibility mapping' project.

The objective of this project was to map wind erosion susceptibility for the Mallee region at a resolution previously unavailable. This will aid the Mallee Catchment Management Authority (CMA) in delivering strategic outcomes geared to protect key assets.

Background

Wind erosion degrades the soil, reducing its capacity to sustain biodiversity and to support agricultural production. It can also have significant off-site impacts on infrastructure, air quality and respiratory health. The widespread light sandy soils of the Mallee, combined with low annual rainfall and strong winds, make the region the most wind erosion prone area of Victoria (Lorimer, 1985). Consequently, wind erosion is one of the most significant land degradation issues facing land and resource managers in this region.

The susceptibility of soil to erosion is dependent on its erodibility; its exposure to erosive winds; and on its moisture content. Soil erodibility refers to the

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inherent properties of the soil that make it susceptible to movement should they be unprotected from strong winds (e.g. when soil has been completely cleared or cultivated). These properties include: surface texture; organic matter content; and stability of soil aggregates. The most erodible soils are those with single grained structure and poor aggregate stability. Such soils commonly comprising a large proportion of fine sand particles. Many of the soils of the Mallee exhibit these traits and the annual climate is not conducive to production of large quantities of organic matter (MacEwan, 2005).

There is a recognised relationship between terrain and soil type. The recent production of landform component mapping from the '*Disaggregation of the Victorian Mallee Land Systems*' (Hopley and Clark, 2010) can therefore serve as a basis for predicting soil properties, such as surface texture, that determine its erodibility. The project used soil texture as the measure of erodibility and considered the frequency and direction of erodible winds (from south-west to westerly) to be consistent across the study area.

Rowan and Downes' (1963) mapping and description of land systems in the Victorian Mallee has provided an excellent source of information about the land, its capabilities and its susceptibilities. This information has been used by land and resource managers for nearly 50 years. The landform component mapping has provided an opportunity to improve the spatial scale of wind erosion susceptibility assessments across the region. The susceptibility maps will be used by the Mallee CMA to make spatially strategic decisions for investment in research, monitoring, protection, management and extension.

Method

Spatial relationships between landform components and properties that underpin a landform's inherent susceptibility to

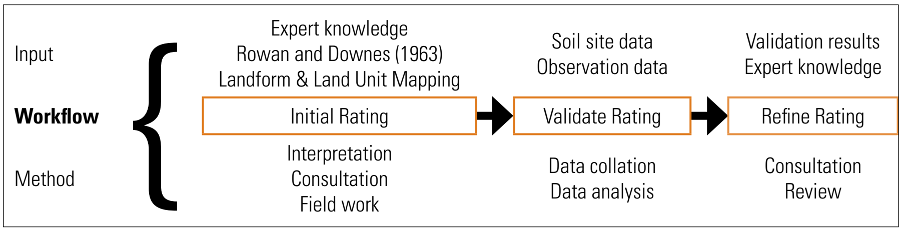


Figure 2: Workflow showing key steps for assigning wind erosion susceptibility to landform components.

wind erosion were developed from a combination of expert knowledge and environmental data.

Landform component susceptibility

The approach taken in this project is designed to validate and supplement Rowan and Downes' (1963) original wind erosion hazard ratings based on the refined landform component and regional unit mapping. The steps involved are summarised in Figure 2.

Step 1 Initial rating

Jim Rowan (retired geomorphologist and author of the original land systems of the Mallee) and David Rees (DPI soil scientist) helped interpret and refine the original descriptions based on the landform component mapping. This included the stratification of some landform component types into homogenous 'susceptibility regions'. It also involved the assessment of mapped landform components not previously described (e.g. the ridge lunettes and former lake beds).

Step 2 Validation

Validation involved two activities: collation and analysis of soil site texture data, and analysis of soil erosion observational data. Soil texture data from nine previous studies, totalling 572 soil sites, conducted within the Mallee CMA region were collated. Only sites with surface texture and landform information were used in the analysis. Soil texture classes were assigned to wind erosion susceptibility classes (Table 1). An average susceptibility classification value was calculated for each specific landform component.

Analysis of erosion observation data

Table 1: Soil texture groups assigned to susceptibility classes.

Soil Surface Texture Group	Susceptibility Rating	Susceptibility Class
Fine-medium sand	Very high	5
Loamy sands, sandy loams	High	4
Loams, coarse sands	Moderate	3
Clay loams	Low	2
Clays	Very low	1

entailed a visual assessment of the effects of wind erosion captured in aerial photographs recorded immediately after a wind erosion event in March 2003. Samples, comprising 80 randomly selected points within each stratified landform component group, were assessed for both the level of ground cover present and the level of erosion observed. The two measures were combined to produce a weighted erosion value that emphasised incidences of erosion where ground cover was heavier (Table 2 next page). The results were averaged for each landform group.

Step 3 Refinement

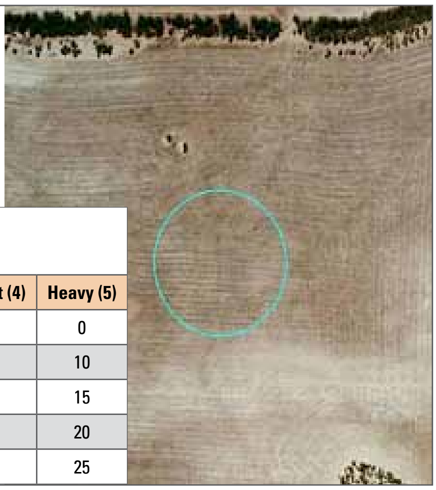
Results from the two validation exercises were compared against the initial ratings and where differences from either assessment, greater than the equivalent of one susceptibility classification level, were recognised, further investigation involving consultation with regional experts was undertaken. In some instances the initial classification was modified.

Regional map unit (RMU) susceptibility

RMUs delineate areas of repeating landform patterns. A total of 40 RMUs

Table 2: Weighted erosion values based on assessments of paddock ground cover and observed erosion. The blue circle delineates the area assessed for wind erosion within the photograph.

	Vegetation cover				
Erosion	**Bare (1)**	**Slight (2)**	**Mod (3)**	**Prominent (4)**	**Heavy (5)**
Nil (1)	0	0	0	0	0
Low (2)	2	4	6	8	10
Moderate (3)	3	6	9	12	15
High (4)	4	8	12	16	20
Very high (5)	5	10	15	20	25



have been defined across all land systems of the Mallee, including areas of public land. They represent mapping at a nominal scale of 1:250,000. The new RMUs are linked to their parent land system through an alpha-numeric naming convention with the letter indicating the 'parent' land system from which the unit has primarily been derived (e.g. CM4 = Central Mallee unit #4).

This project has undertaken some refinement of the RMU mapping, originally developed as landform units during the land system disaggregation work, and has sought to align them with the Victorian Geomorphological Framework (GMF), a hierarchical classification of landforms and landscapes for the whole of the state (DPI, 2007).

The percentage area of landform components contained within each RMU and a weighted value related to the components' susceptibility classification was used to calculate an overall susceptibility score for each RMU.

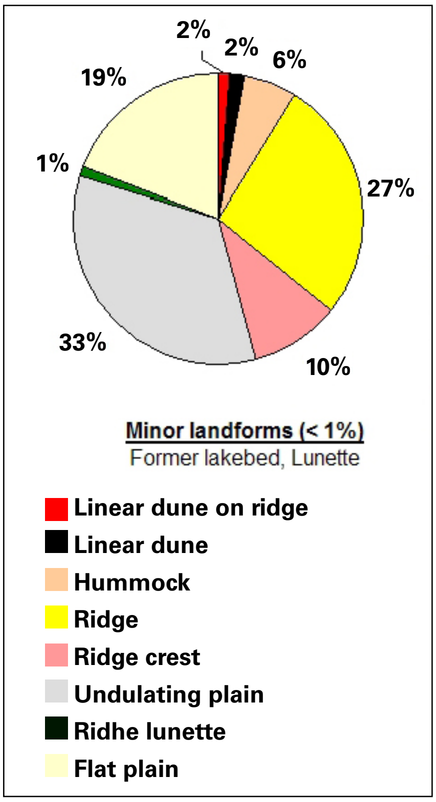
Results

Wind erosion susceptibility classifications have been assigned to each landform component. Some landform components were assigned a classification range if they exhibited internally different soil and wind exposure combinations. Upper westerly slopes of hummocks, for example, were considered more susceptible than their lower easterly slopes. Table 3 shows the highest susceptibility classification assigned to each landform component.

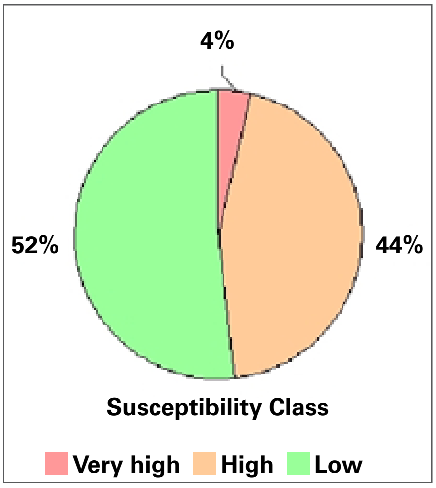
Descriptions of the RMU, including susceptibility rankings, can be found in the project report. Figure 3 illustrates the proportion of landforms within the Hopetoun unit and the corresponding wind erosion susceptibility class distribution. The susceptibility scores developed for each RMU allowed the units to be ranked according to wind erosion

Table 3: Landform component susceptibility classifications (by Regional Map Unit).

Landform Component	RMU's	Overall Susceptibility
Linear east-west dune, Desert Dune, Copi island	All	Very high
Hummocks and local ridges, Strandline ridges, Lunettes, Ridge lunettes	All	High
Undulating plains	CM2, Berrook, Big Desert	
Raak plain	All	Moderate
Terraced plains (upper and lower)	Millewa 2	
Scarp	All	
Flood plains	NC	
Low plains	CM, Millewa	
Undulating and Flat plains	CM, Tempy, Millewa, BB2, BB3	
Terraced plains (upper and lower)	CM9	Low
Former lakebed	All	
Low plains	All other	
Flood plains	MRFP and TC	
Undulating and Flat plains	Hopetoun, BB1, Culgoa, TC	
Channels and Lakes	All	Very low
Undulating and Flat plains	Wycheproof	



Above and below Figure 3: The landform and susceptibility class distribution for the Hopetoun land unit.



susceptibility. Figure 4 shows the Mallee RMUs mapped according to wind erosion susceptibility ranking.

Implications

The wind erosion susceptibility maps produced by the project will:

- enable natural resource management agencies, such as the Mallee CMA, to monitor and assess wind erosion threats with greater certainty and focus by combining susceptibility with seasonal vegetation cover to identify areas under threat of wind erosion;
- facilitate the prioritisation of applications under incentive programs;
- provide land owners and the farming industry with terrain and wind erosion information at the paddock and landscape scales that correlates with production capabilities and land degradation risks;
- help the industry make decisions about how to best manage soils through appropriate land use and land management, while maximising potential productivity;
- support whole farm planning programs such as Environmental Management Action Planning (EMAP);
- assist all levels of government in planning and policy decisions to effectively address wind erosion in the Mallee.

Acknowledgements

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The Mallee CMA and the DPI project team thank retired geomorphologist Jim Rowan for sharing his immense knowledge of the geomorphology and soils of the Mallee area.

Further Information

The information for this bulletin has been taken from "*Assigning wind erosion susceptibility to Mallee landforms and land units*". A copy of the full report can be downloaded from the Mallee CMA website: **www.malleecma.vic.gov.au**

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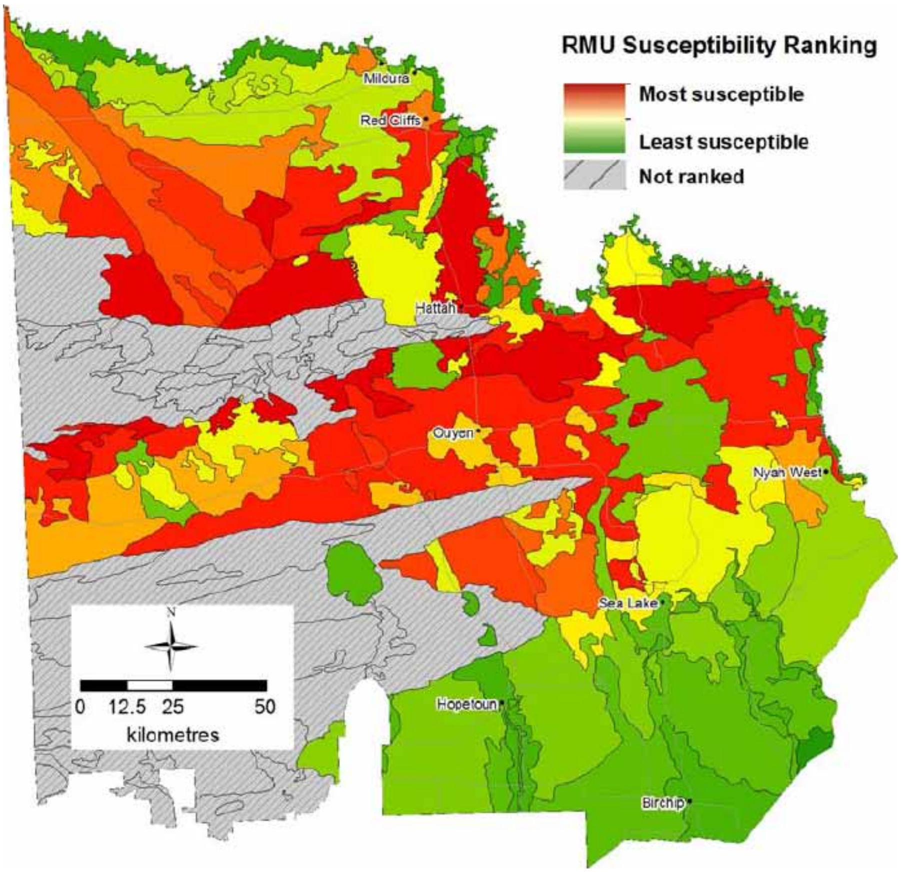

Figure 4: Regional Management Unit wind erosion susceptibility ranking.

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