7 LIMITATIONS AND USE OF THE DATASET

The integrated surveys that form the basis for this dataset were originally designed to support planning for soil conservation on agricultural land. However as the studies identified fundamental differences between various types of land, their application has widened to include town and regional planning, forest management, water supply catchment protection and management, and the location of services such as waste treatment and disposal.

This chapter examines some of the applications of the dataset.

FORMS OF THE DATA

The Statewide Land Systems exist in both paper and digital form.

This report, including the tabular descriptions of the land systems and the accompanying maps at a scale of 1:500 000, form the paper version of the dataset. While the paper copy has the advantage of being readily accessible to a wide spectrum of potential users it has the serious disadvantage of not being readily amenable to manipulation or reformatting, either by aggregation of land systems, or by integration with other related datasets, to meet specific user needs.

In the light of these considerations, the dataset has been entered into the Department of Natural Resources and Environments' Geographic Information System (GIS). This system utilises ARC/INFO software running on SUN Workstations, however data can be exported in electronic form to virtually any other GIS. The data can also be reproduced as paper copy or on transparency suitable for reproduction in dye-line machines. Tabular information can be produced for common word-processing, database or spreadsheet packages.

The powers of the Geographic Information System include the ability to overlay other data to form combined datasets (for example, the system could be used to overlay information on land use to identify areas with critical combinations of land use and susceptibility to land degradation), the ability to rapidly calculate areas, and to subset or aggregate the data on any basis specified by the user (within the constraints of the data). The system can also be used to produce contemporary paper copy of subsets of the data for particular needs.

However, concomitant with the greater power of the system is the greater complexity. While basic operations can be performed by users with limited knowledge of either the system or the data, the more complex manipulations are best handled by experienced operators who are also familiar with the characteristics and limitations of the dataset (see below).

LIMITATIONS OF THE DATA

While many potential users of the dataset will already have particular expectations of how they may use the data, certain limitations need to be borne in mind if spurious or erroneous results are to be avoided. The major constraints are:

1. precision of boundaries

2. scale

3. quality and evenness of the base data

4. detail of land system descriptions

These constraints are discussed earlier in this chapter, not as an apology for the data, but rather to alert potential users to pitfalls well known to those familiar with the dataset.

It is the responsibility of the user to determine the level of detail and reliability that is required for their particular needs and to assess the suitability of this dataset for their purposes.

Precision of boundaries

Land systems are an interpretation of the landscape, integrating the independent variables of landform, geology and climate. However the interaction between these variables is never constant and decisions are made in the mapping process as to which are the critical variables at any one location, and which should be given precedence in determining the location of land system boundaries.

Frequently, the 'boundary' between two land systems is, in reality, quite indistinct and relies on identification of areas of most rapid change in the relevant parameters of landform, geology, soil and vegetation. The dictates of preparing a map require the delineation of a clear boundary between the two adjoining land systems and a single line is placed on the map. A different mapper may place the line differently. Neither line is necessarily 'wrong' or 'right' - what is important is that two quite distinct land types are separated, the user is able to make the distinction, and that the map is a reasonable representation of the landscape.

This imprecision is most clearly demonstrated by the use of mean annual rainfall - rainfall isohyets have, in some places, formed the boundary where the discriminant between two land systems is climate. This isohyet is generally located by interpolation between rainfall gauging points and may not adequately reflect orographic effects on local rainfall distribution. The boundary appears as a dashed line on printed maps in recognition of the imprecision of this boundary.

A consequence of this is the inbuilt 'error' in the determination of areas - comparisons based on area statements of relatively small land systems marked on a map may be quite erroneous because of marginally different standards in locating boundaries between or even within studies. These 'different' standards are entirely legitimate for the reasons outlined and do not necessarily invalidate the data. They merely require caution when dealing with small areas and/or small differences.

Scale

Any description of a complex entity must choose between scale of mapping and detail of description and definition. The amount of detail that can reasonably be recorded, transmitted and processed decreases with decreasing scale. Land is by most definitions a complex entity, and certain compromises have to be made to identify and present usable information.

Input scale has changed for many of the new studies making up this coverage. All the new studies put into the Statewide Land System have an scale of 1:100 000 although the intensity of study may vary and means that there are a larger number of polygons than at the 1:250 000 scale. It is envisaged that eventually a 1:100 000 scale statewide cover will be developed.

In the case of this dataset, the data is presented at a scale of 1:500 000/250 000, and the detail is directed towards the generation of state/regional perspectives rather than at the management unit level. Preparation of maps at these scales has placed limitations on both detail of the linework and the size of unit (land system) which could reasonable be represented on the map.

The thickness of the linework on the map has the potential to introduce errors. For example, a one centimetre square on a 1:250 000 scale map has an area on the ground of 625 ha. Placing a line of thickness 0.5 mm around that square and calculating the area of both the square and the linework results in an area of 756.25 ha - a 21% increase on the area of the square alone. However a ten centimetre square on the same map has an area of 62 500 ha, while the same square plus the line has an area of 62 525 ha - an increase of only 0.04%. Consequently, any strictly numerical analysis involving areas of land systems less than (say) 10 sq km must be viewed with some caution.

Small errors in the location of linework due to draughting alone can therefore distort the area of small land systems substantially due simply to scale considerations. The choice of boundary location by the mapper can likewise markedly affect the area of small land systems.

Enlargement of the map will not increase the accuracy or reliability of the data; it will introduce errors, and may even render the data quite misleading at the new scale (see also limitations due to detail).

Quality and evenness of the base data

Ideally, such a dataset would be built up from smaller units of consistent scale and detail. However, this is not the case for the Statewide Land Systems as information at a consistent scale is simply not available and is unlikely to ever become available at the most detailed level.

The base data available has been collected over a period of forty years. Obviously there have been significant developments in our understanding of land forming processes, in technology (such as satellite imagery) and in the availability of related base information (such as geologic and topographic maps). This has resulted in some changes to the intensity of mapping and in the detail collected, even within the land system mapping program - compare Gibbons and Downes (1964) and Aldrick *et al*.(1988, 1992).

Notwithstanding this, the power of the dataset is in its scope, integrating information to form a consistent format for the whole of the state, rather than in presenting precisely located site-specific data. It takes an uneven database and extracts a common, if limited, set of descriptors.

The links with the more detailed datasets have been retained through the inclusion of the Equivalent Land System entry in the data (see Chapter 4) allowing some users to accommodate the limited set of descriptors when they really need more information. This additional information can be retrieved from the original publications as required.

The result is a dataset that has varying degrees of reliability and detail across the state. The extent of field and laboratory investigations supporting the various datasets is shown in Figure 7.1. Where there was little site-specific information available, interpretations were made from the limited generalised information that was available. This was required for a significant proportion of the state (see Figure 4.2 and Table 4.6).

However, because of the limited information that comprises the dataset, this variability in the base data is considered to be of minor significance for most applications.

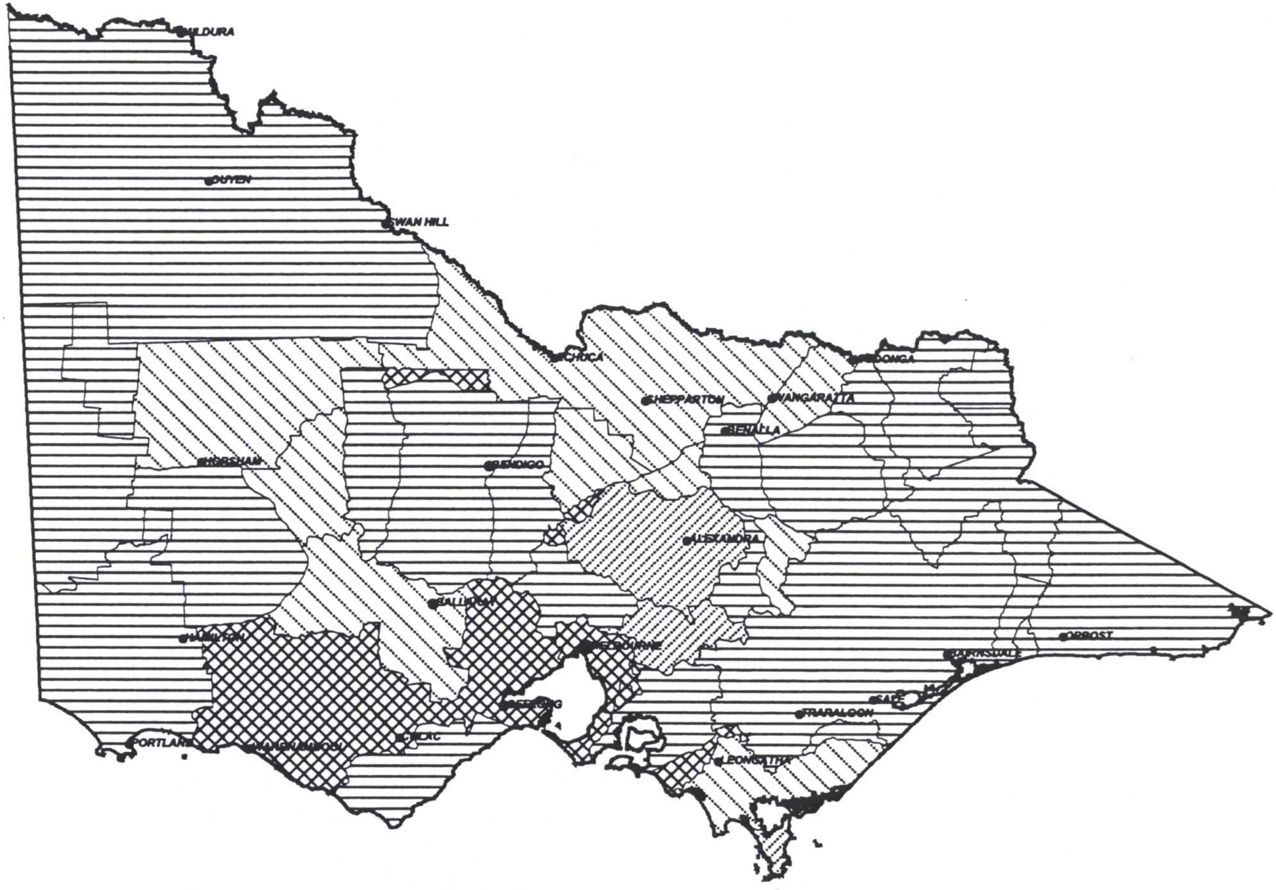


Figure 7.1 Quality of data sources

Surveys with detailed field work, areal photo-graphs, laboratory analysis of soils and published data; reports published by Soil Conservation Authority, Land Protection Division, or press.

Reconnaisance surveys mainly using areal photographs and maps with some field checking; maps and descriptions published in Land Conservation Council reports.

Detailed or reconnaisance surveys with mostly detailed field work but no laboratory analysis; internal reports of Soil Conservation Authority.

Additional mapping by J.N. Rowan and D.B Rees using maps and unpublished land systems data.

Detail of land system descriptions

Each land system is essentially treated as a point entity, ignoring the considerable variation known to exist inside the unit. This is a legitimate approach to presenting a broad picture of the land across the whole state whilst retaining the data in a usable form at a reasonable level of complexity.

AVAILABILITY OF THE DATASET

The dataset is available as paper copy and in the electronic form. While the paper version (this report) is available for sale and subsequent use by the purchaser, access to the electronic version may be restricted. However, the Department can assist potential users of the data determine their requirements and undertake data analyses as required, generally on a fee-for-service basis.

Enquires should be directed to:

Unit Leader, Land Evaluation and Management
Department of Natural Resources and Environment
Centre for Land Protection Research
BENDIGO Vic 3550

APPLICATIONS OF THE DATASET

A knowledge of the nature of the land in terms of its basic characteristics, the likely consequences of various alternative land uses or management systems, and the likely productive capability, is fundamental to any informed program of land use planning and management.

This dataset provides a basis for each of these sets of information. While it is limited in scale - many users require information at a more detailed scale - it provides a framework in which more detailed information can be assembled.

Scale: Resolution of the available information and product resolution.

It has already been noted that the quality of the data making up this statewide dataset varies even if the presentation scale is at 1:500 000 and 1:250 000. It should be noted that more recent information has been incorporated at a scale of 1:100 000, though even between these studies there are variations in the detail. This implies that the use of this information is limited to the scale of study and consequently the range of applications.

Single theme (thematic) maps can focus attention on a desired theme and can be used at a range of scales and at various resolutions. For example, the broadest geomorphic province can be used to acquaint people with the basic physiographic divisions of the State and linked with such a grouping with the rest of the country (Figure 3.1) and generate generalised datasets available for comparison (Table 7.1). For a more detailed view more information is available and able to be better portrayed at a finer scale, which starts to show the benefit of a hierarchical system of linked land information. The basic factors (building blocks) which make up this dataset can be presented separately such as landform (Figure 7.3) which may help people understand the land system concept a little better, as well as specific needs, for example, ease of access, areas of hard rock and areas of high biomass production.

Even the broad resolution data may be overlayed by different datasets to provide useful multilayered spatial datasets. For example, data such as municipalities, Catchment Management Areas, drainage basins and water supply catchments overlayed provide data on land resource abundance/rarity in different designated areas as well as targeting areas of interest which can have major time and economic savings. This is useful for national, regional and even local planning, often being a means to clarify the allocation of funds for development and/or environmental maintenance amongst competing demands. Thus differences and commonalties between areas can be evaluated including broad vegetation and soil types.

The information of susceptibility to various forms of degradation can be used as a set of thematic maps or combined to provide a more complex view of the land.

As implied above, other datasets can be overlayed to provide multilayered datasets for a range of policy, resource management and planning uses as well as the possibility of modelling at a broad scale (>1:250 000). Examples include areas capable of accepting effluent disposal with minimal off site effects, feedlot location, potential woodlot development and pipeline (or other network) routes.

The statewide dataset has also been modified from its physiographic base by taking land management/use into consideration to produce Resource Management Units (RMUs) which highlight where land management practices have altered the natural behaviour of the land to various degrees (Russell[1] pers. comm.). Examples of modified or specifically managed landscapes include urban, irrigation and (sub) alpine areas. This RMU approach is used for state and regional planning of designated areas and even as a sifting/stratifying mechanism for broad vegetation habitat types to assess habitat abundance.

The hierarchical nature of the RMU database is useful for similar reasons to the main land system database; more information at finer scales.

The full range of applications of the dataset has not been explored, however there are a number of classes of potential uses:

1. description of the land
2. relative susceptibilities to degradation
3. first approximation of potential productive capacity
4. assessment of performance/management requirements for specific needs
5. organisation of other land related data

Because the dataset is statewide in its coverage, it can be used to obtain full state perspectives. It can also be subset on any identified boundary (a municipality, river basin, proclaimed water supply catchment, national park, parish, etc.), or an area within a nominated distance of a linear feature (highway, river, etc.) or a point (a groundwater bore, dam, peak, etc.). Naturally, as the area of interest becomes smaller, more care is required in using the dataset because of the previously described limitations of scale and detail.

The following examples demonstrate some of the uses. Some maps have been prepared on a whole state basis as it is likely that there are existing users whose initial needs will be this statewide perspective. Other maps have been prepared as subsets of the data to demonstrate certain applications.

---

1 L. Russell (Senior Policy Officer, AFFA, Canberra). March 1996

DESCRIPTION OF THE LAND

The components of the land system codes and the entries for dominant soils and, to a lesser degree, native vegetation provide a basic description of the land. Individual land systems can be used to describe the land, or the land systems can be aggregated to provide descriptions with a lesser degree of specificity or detail.

Typical aggregations include mapping of the Geomorphic Units (Figure 7.2), the lithology (Figure 7.4) and landform (Figure 7.3) as ways of presenting general classifications of the land at a broad scale.

Table 7.1 Geomorphic units of Victoria.

Code	Geomorphic Unit	Area (sq km)
1.1	Dissected uplands	53 422
1.2	Dissected plateau (Wellington Uplands)	4 284
1.3	High plains (Dargo, Bogong, etc.)	1 268
2.1	Dissected uplands (Midlands, etc.)	19 842
2.2	Prominent ridges (Grampians)	2 378
2.3	Dissected tablelands (Dundas Tablelands)	4 020
2.4	Dissected tablelands (Merino Tablelands)	838
3.1	Dissected fault block (Otway Range)	1 427
3.2	Moderately dissected fault block (Barrabool Hills)	83
3.3	Moderately dissected ridge (Mornington Peninsula)	977
3.4	Dissected fault block (South Gippsland Ranges)	3 824
3.5	Dissected outlier (Wilsons Promontory)	378
4.1	Present floodplain (Murray Valley)	3 407
4.2	Older alluvium (Shepparton)	21 620
5.1	Low calcareous dunes (Ouyen)	32 400
5.2	High siliceous dunes (Big Desert/Sunset)	11 865
6.1	Clay plains (Nhill)	10 950
6.2	Ridges and flats (Goroke)	4 263
6.3	Low siliceous dunes (Little Desert)	1 906
7.1	Undulating plains (Western District)	19 678
7.2	Stony undulating plains (Western District)	3 700
8.1	Ridges and flats (Follet)	4 665
8.2	Dissected plains (Port Campbell)	3 825
8.3	Sands and clay plains (Moorabbin)	614
8.4	Sands and terraces (Western Port)	370
8.5	Barrier complexes (Discovery Bay, Gippsland Lakes)	2 908
9.1	Present flood plain (Gippsland)	1 652
9.2	Intermediate terraces (Gippsland)	1 285
9.3	Higher terraces and fans (Gippsland)	7 664

Figure 7.2 Geomorphic regions of Victoria

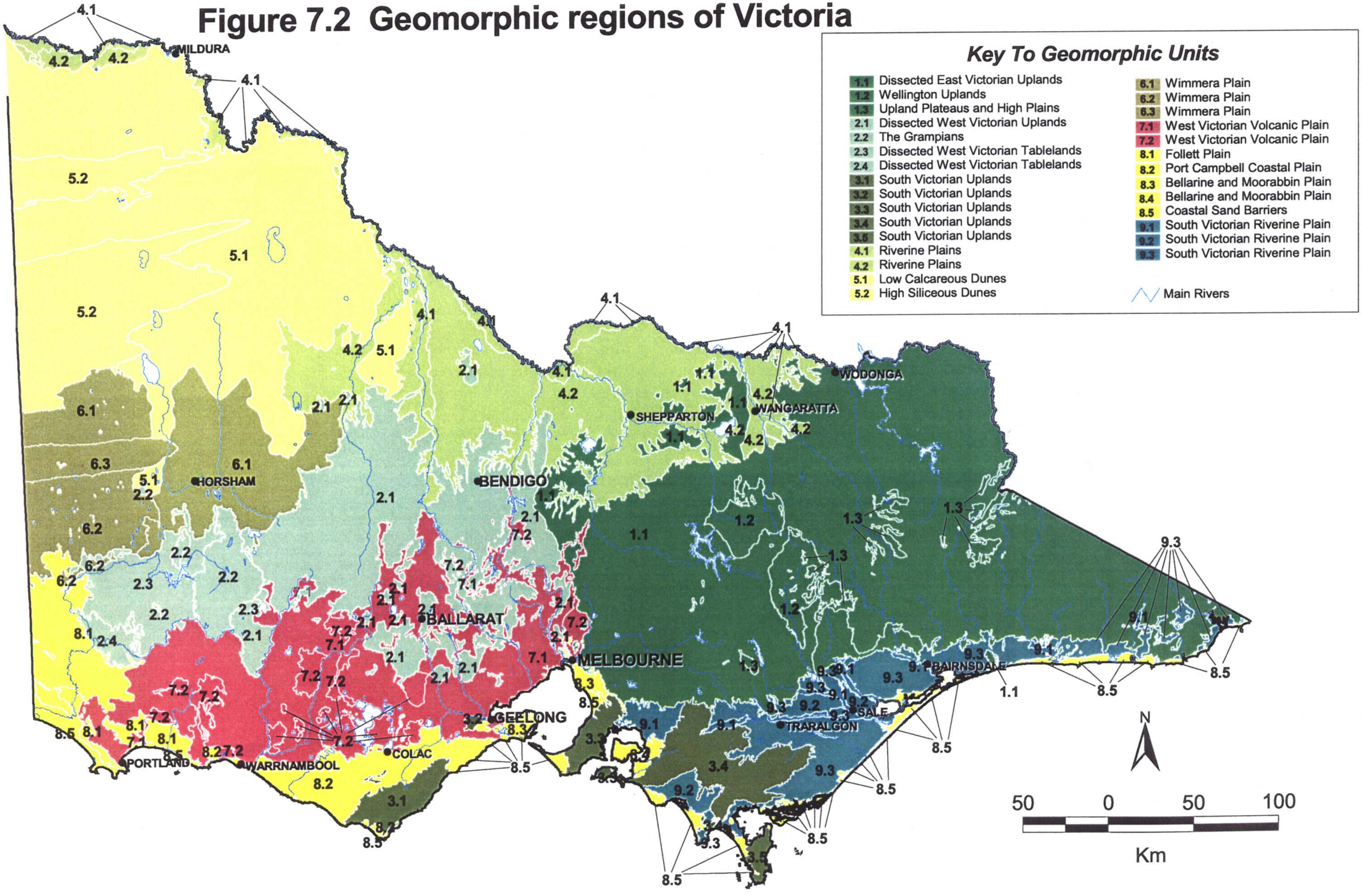


Table 7.2 Landforms of Victoria.

Landforms	Area (sq km)
Coastal (dune) Complex (PC)	4 758
Dune, other (Complex)	24 720
Present flood plain	7 688
Hill	17 862
Low hill	26 308
Mountain	32 405
Plain above flood level	72 474
Rise/Stranded beach ridge, usually trending NNW-SSE	9 456
Swamp, lunette/ water body complex	1 176

Figure 7.3 Landforms of Victoria

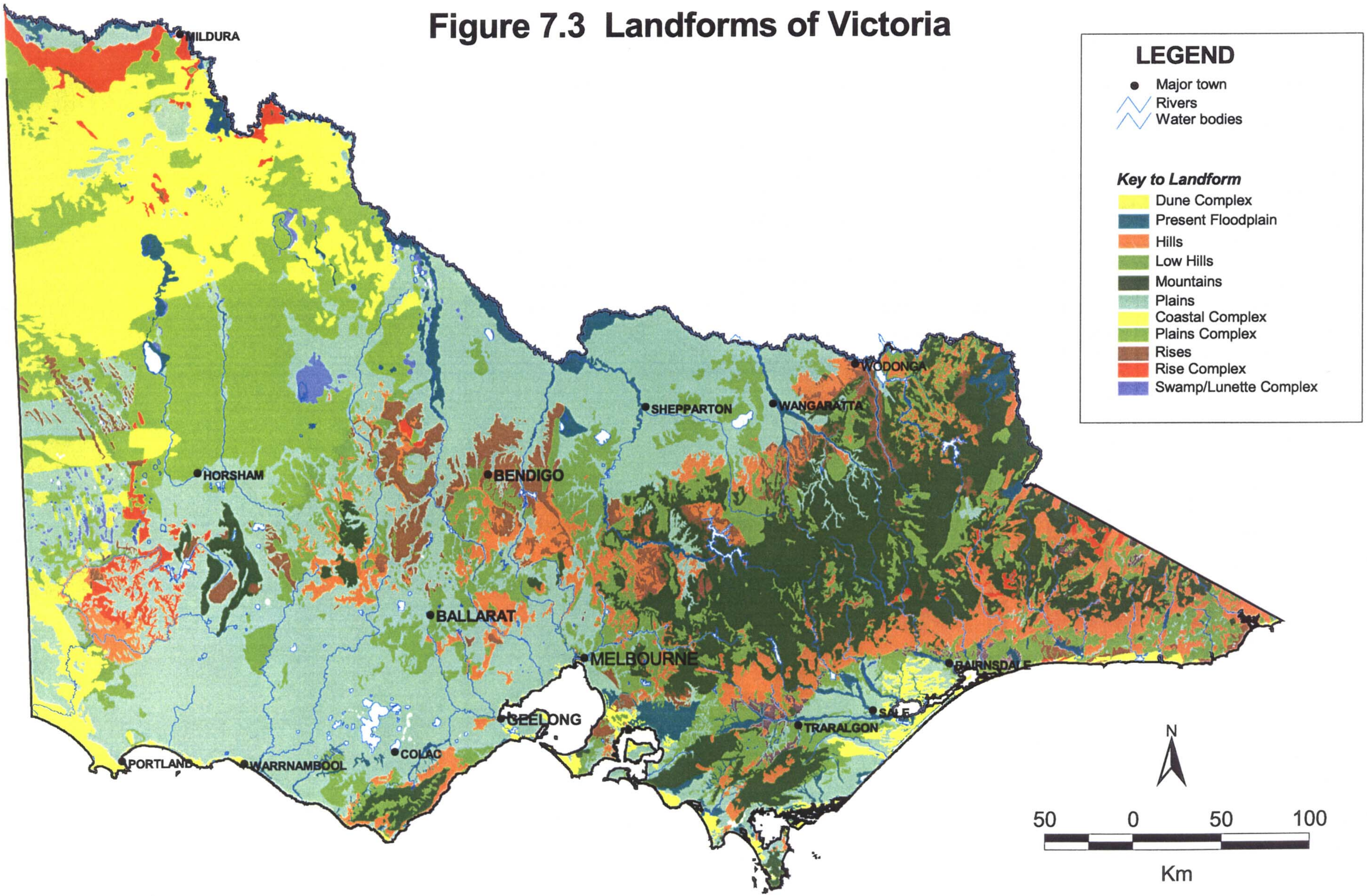
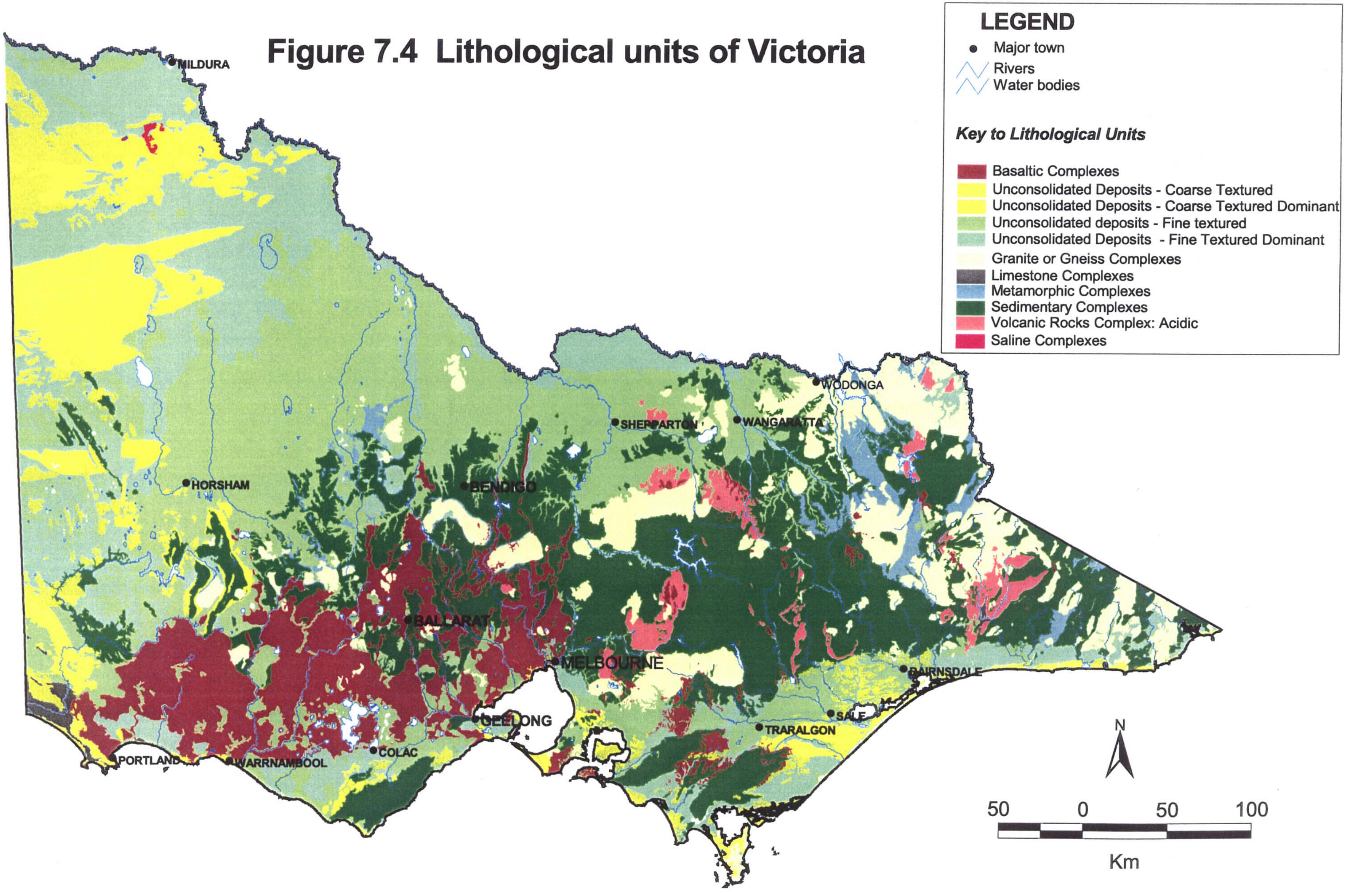


Table 7.3 Lithological units of Victoria.

Lithology	Area (sq km)
Coarse textured unconsolidated deposits	25281
Fine textured unconsolidated deposits	99073
Granites or gneisses	18081
Limestone	811
Sedimentary rocks	51259
Metamorphic rocks	4223
Volcanic rocks: Acidic	3841
Volcanic rocks: Basic	22883
Salina, fine textured deposits	120

Figure 7.4 Lithological units of Victoria



ASSESSMENT OF RELATIVE SUSCEPTIBILITIES TO DEGRADATION

As previously described, the dataset contains estimates of the inherent susceptibility of the land to seven forms of land degradation. As also noted, the assessments have been made independent of land use. Consequently, in using the information, consideration has to be given to the influence of the different land uses anticipated in the area of interest.

Figures 7.5, 7.6, 7.7, 7.8, 7.9, 7.10 and 7.11 present state-wide views of the relative susceptibilities to each of these seven forms of land degradation.

Figure 7.5 Susceptibility to compaction

Key to Susceptibility Classes		Area (sq km)	Percentage Area
	Nil	312	0.1
	Low	73 454	32.6
	Moderate	80 397	35.7
	High	71 358	31.6

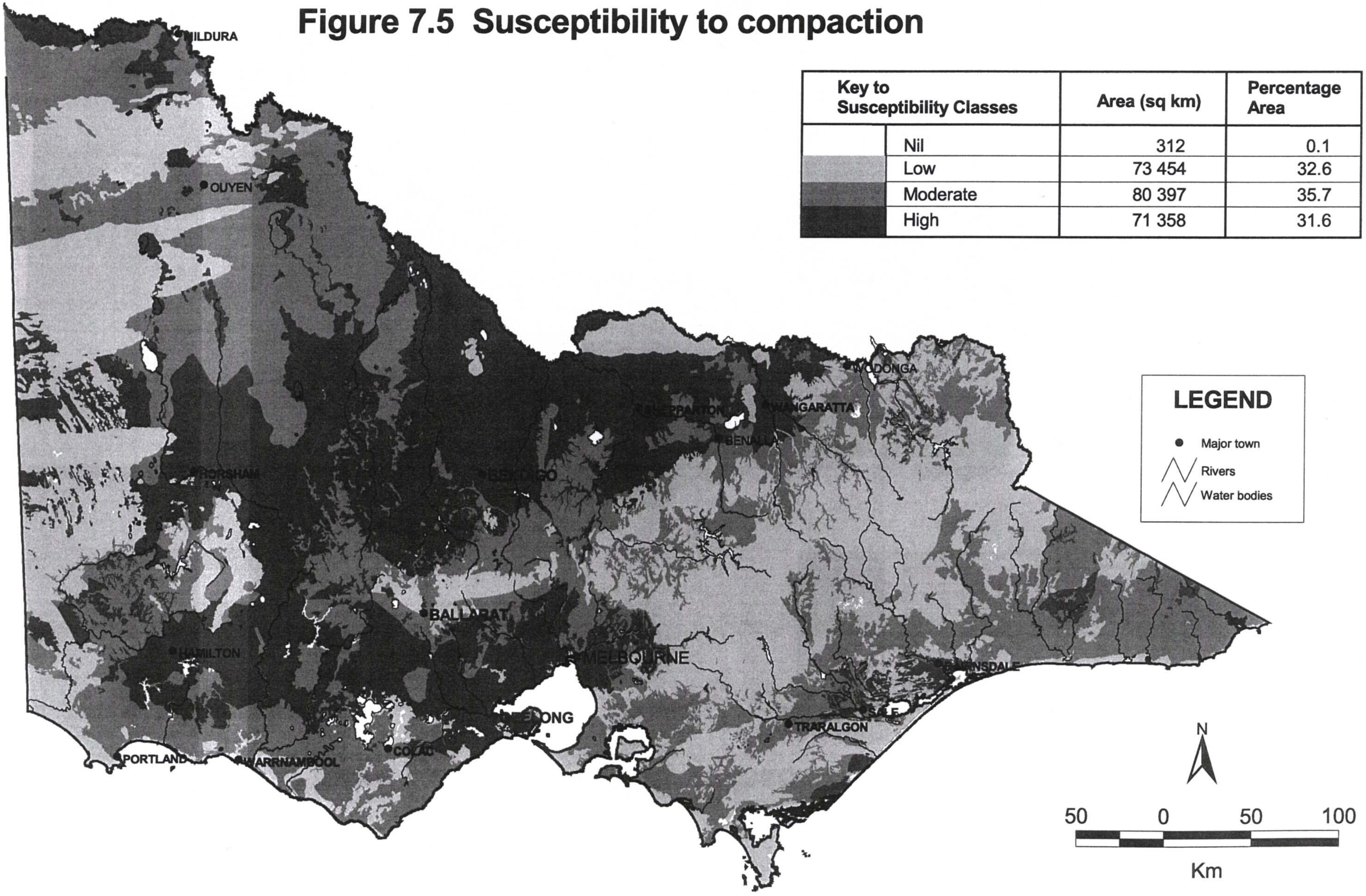
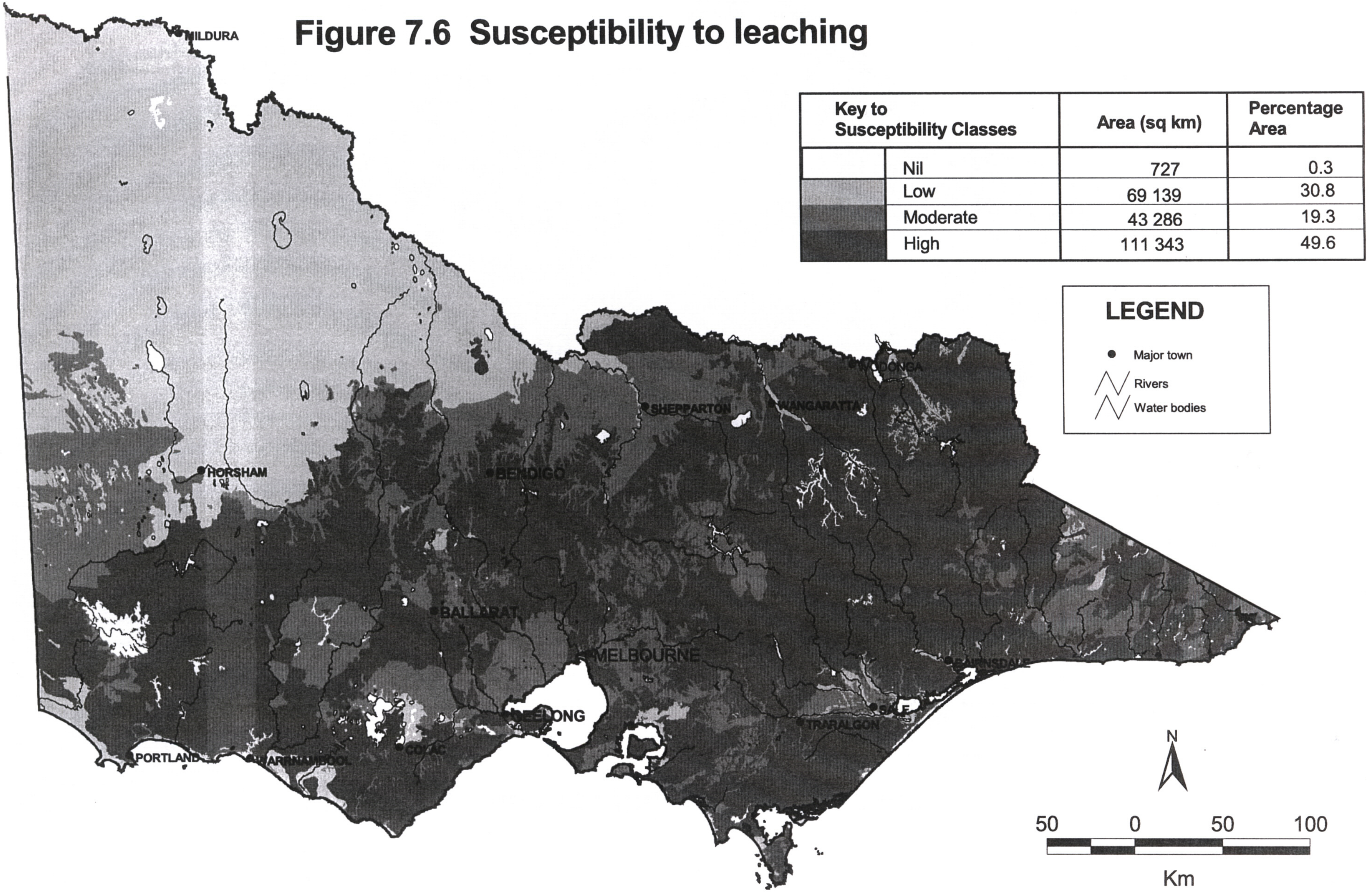
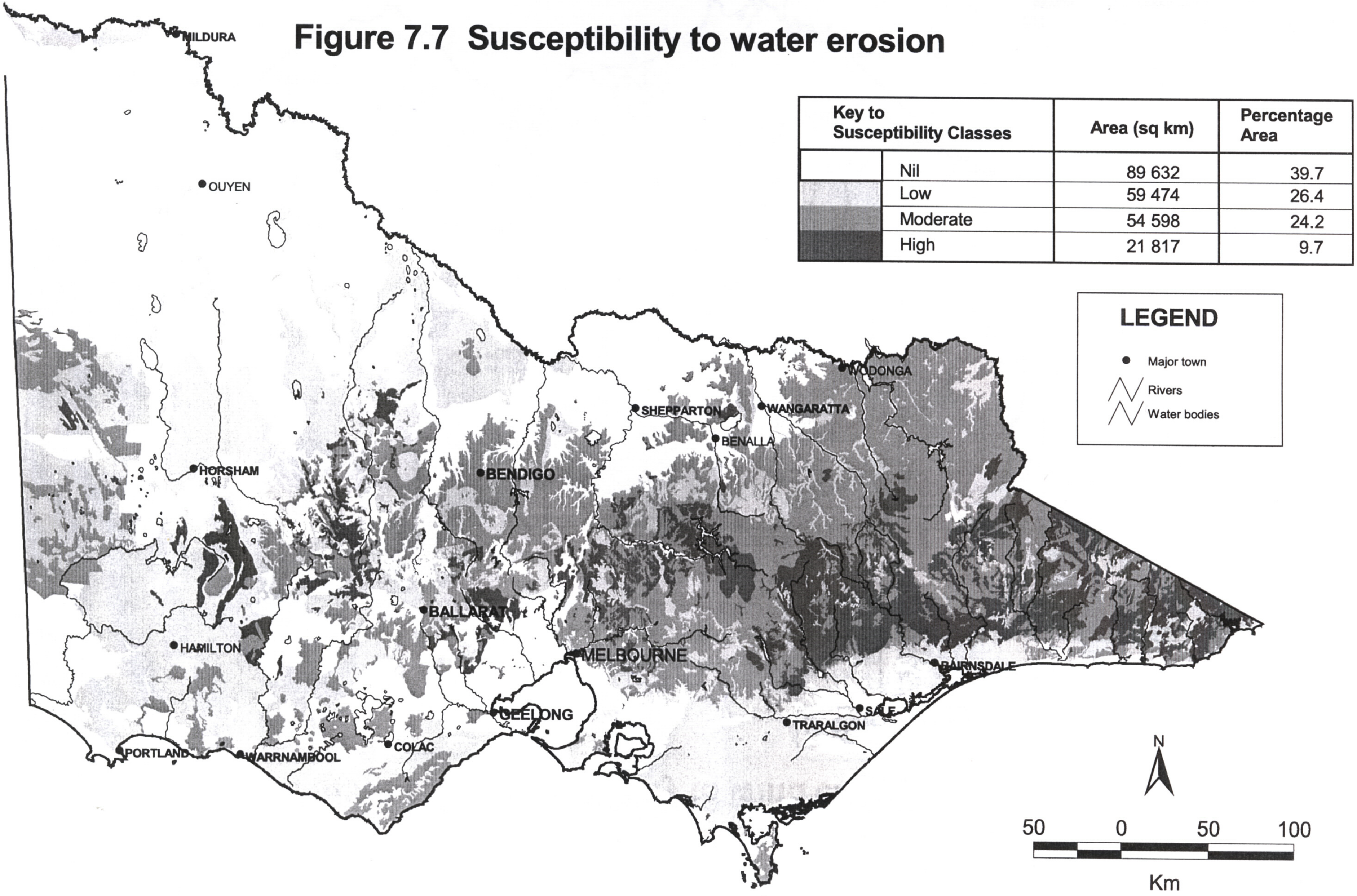


Figure 7.6 Susceptibility to leaching



Key to Susceptibility Classes		Area (sq km)	Percentage Area
	Nil	727	0.3
	Low	69 139	30.8
	Moderate	43 286	19.3
	High	111 343	49.6

Figure 7.7 Susceptibility to water erosion



Key to Susceptibility Classes	Area (sq km)	Percentage Area
Nil	89 632	39.7
Low	59 474	26.4
Moderate	54 598	24.2
High	21 817	9.7

Figure 7.8 Susceptibility to wind erosion

Key to Susceptibility Classes	Area (sq km)	Percentage Area
Nil	140 483	62.3
Low	39 477	17.5
Moderate	23 298	10.3
High	22 264	9.9

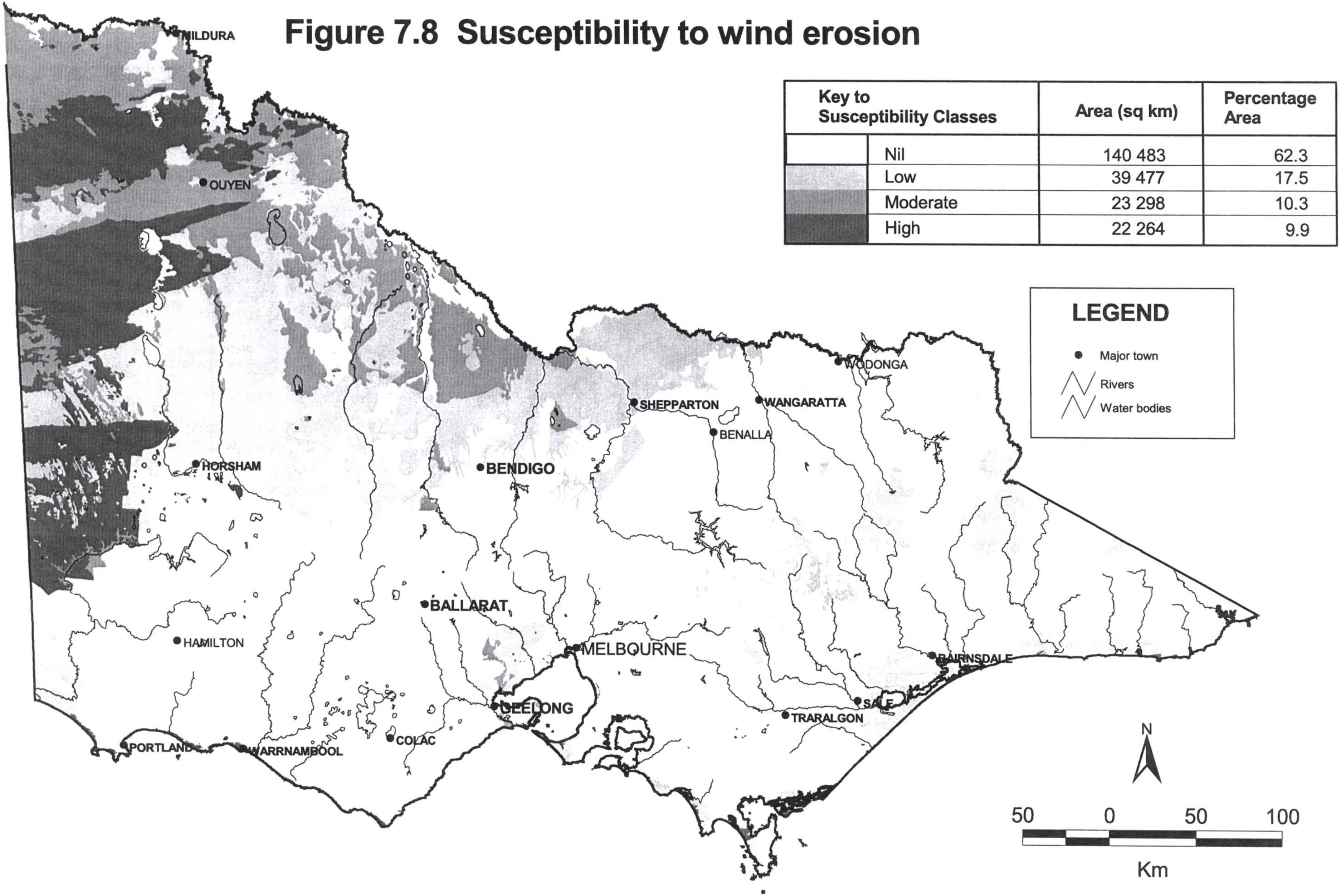


Figure 7.9 Susceptibility to waterlogging

Key to Susceptibility Classes		Area (sq km)	Percentage Area
	Nil	186 767	82.8
	Low	32 804	14.5
	Moderate	3 971	1.8
	High	1 978	0.9

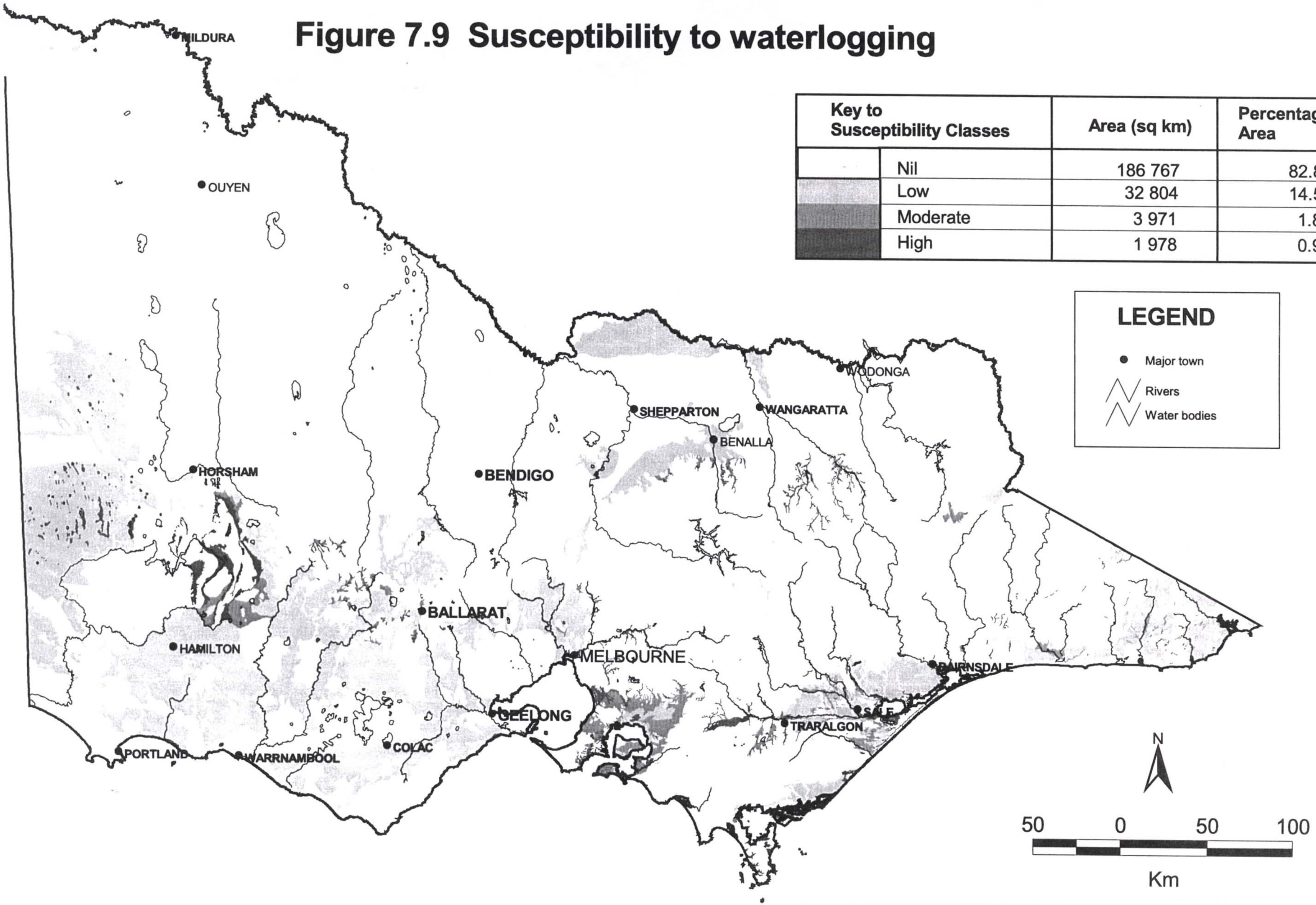


Figure 7.10 Susceptibility to salting

Key to Susceptibility Classes		Area (sq km)	Percentage Area
	Nil	59 105	26.2
	Low	78 850	35.0
	Moderate	79 406	35.2
	High	8 160	3.6

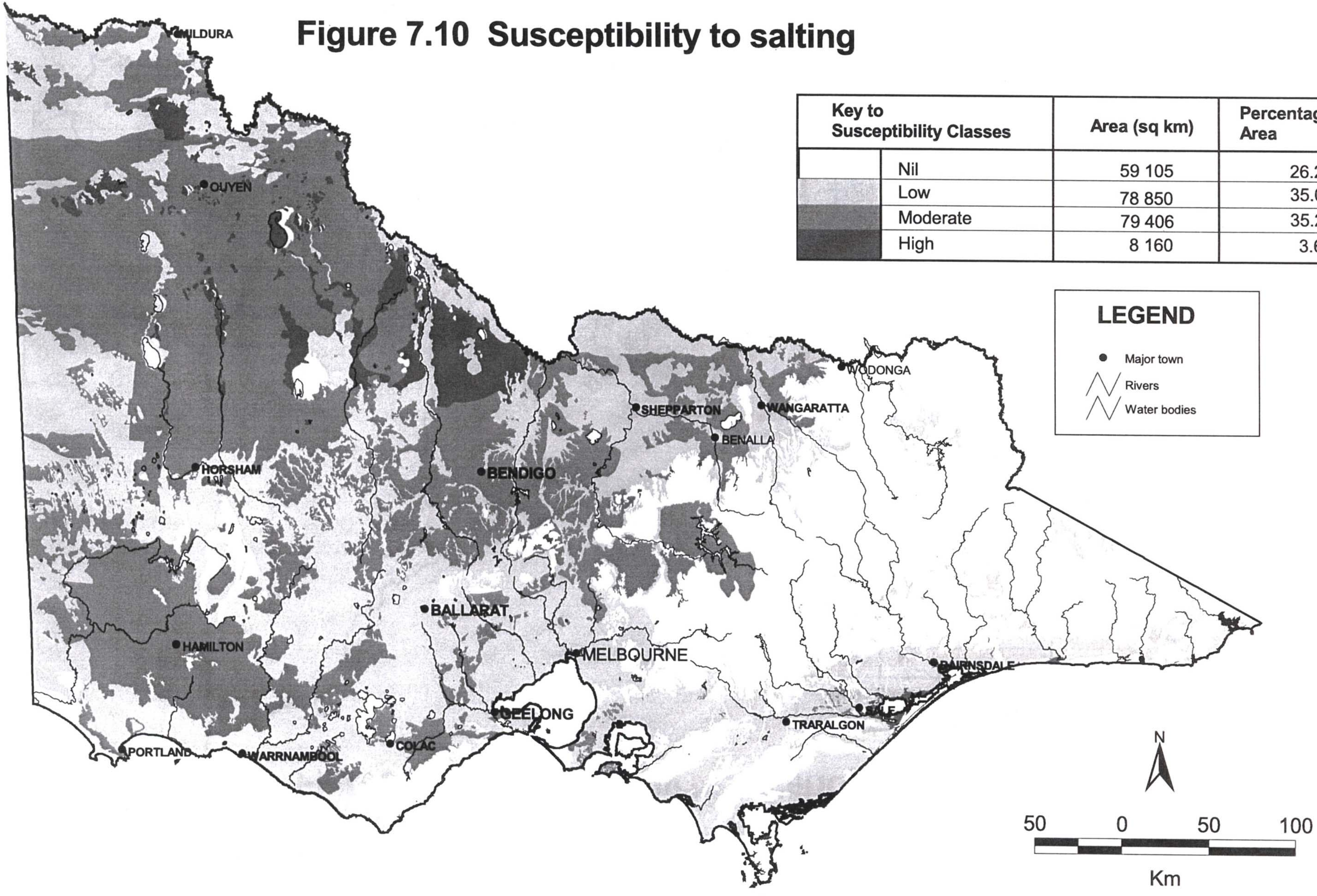
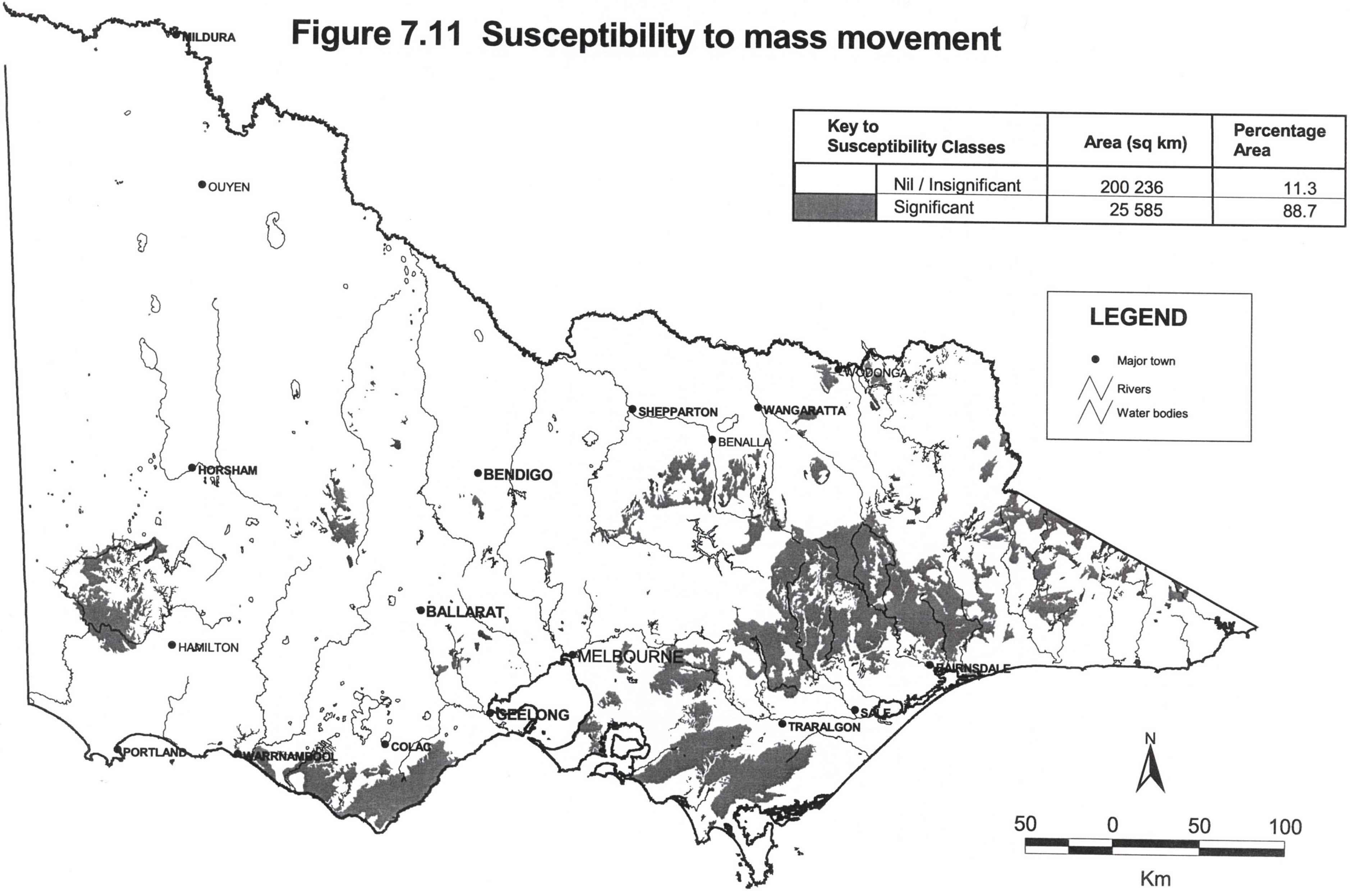


Figure 7.11 Susceptibility to mass movement



Key to Susceptibility Classes		Area (sq km)	Percentage Area
	Nil / Insignificant	200 236	11.3
	Significant	25 585	88.7

FIRST APPROXIMATION OF POTENTIAL PRODUCTIVE CAPACITY

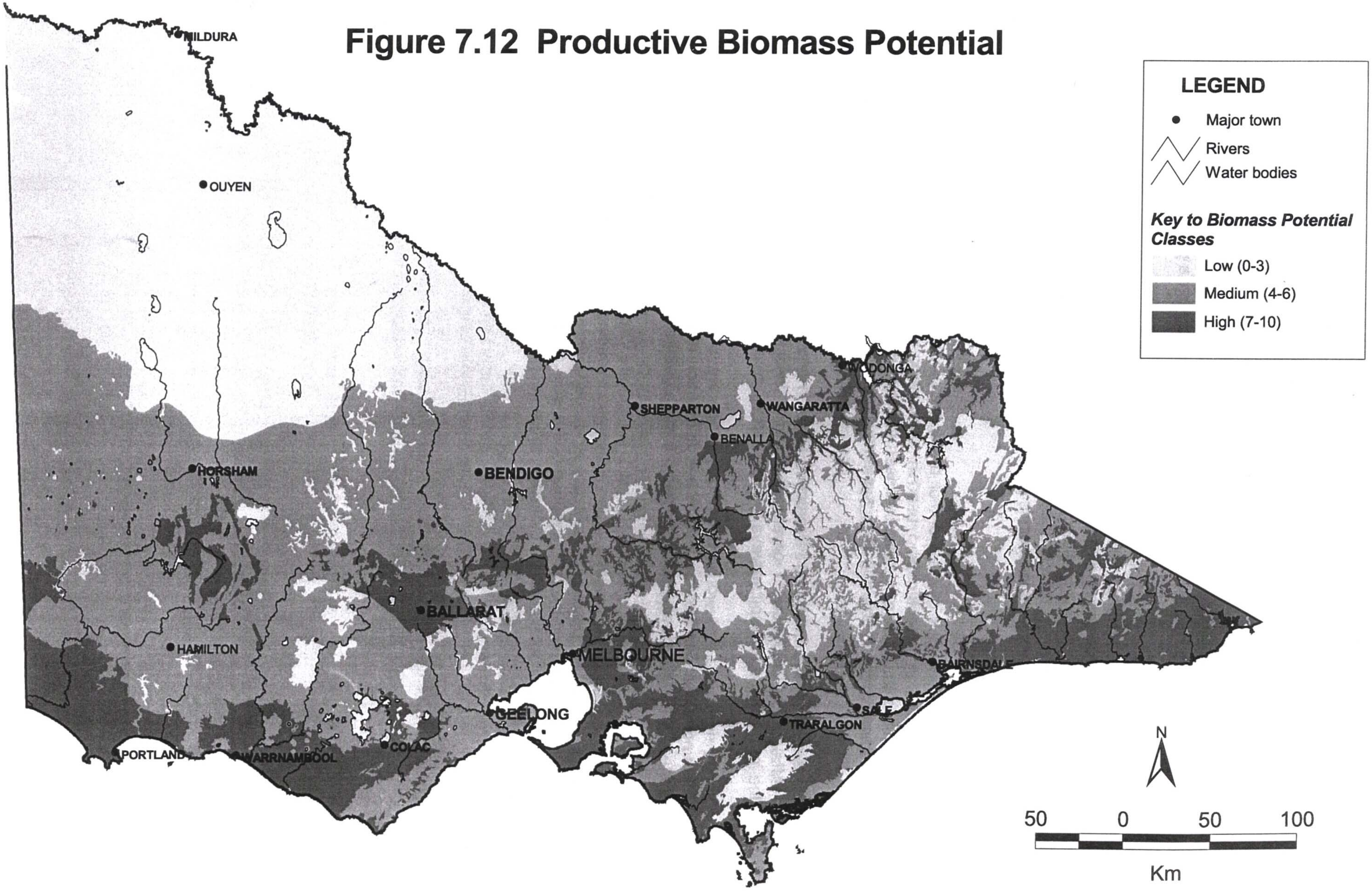
As described previously, the dataset includes a systematic prediction (based on land characteristics) of the potential productive capacity of the land. This is, by necessity, quite general and refers more to the ability of the land to produce vegetative matter rather than any specific crop. **The information is intended for comparative purposes only across relatively broad areas of Victoria, and should not be used as a basis for advice on the worth of any land for a specific use.** The assessments rapidly decrease in value as the area under consideration decreases, and more specific assessments of productive capacity based on different criteria become appropriate.

Figure 7.12 and Table 7.4 present a statewide perspective of potential productive capacity. Such information has application to the direction of resources to areas where higher quality agricultural land is being threatened by land degradation (i.e. where the returns from investment will be greatest), to comparing relative productive capacities of land under threat of change to another land use and similar planning exercises. Clearly, this information will only be a starting point for such judgements, but it does provide a consistent base that has not previously been available.

Table 7.4 Potential Productive Capacity of Victoria.

	Productive Capacity score	Area (sq km)	Percentage Area
High	10	-	-
	9	5 583	2.5
	8	1 649	0.7
	7	34 576	15.2
Medium	6	40 183	17.7
	5	30 093	13.2
	4	35 502	15.2
Low	3	58 804	25.8
	2	17 288	7.6
	1	392	0.2
	0	3 344	1.5

Figure 7.12 Productive Biomass Potential



ASSESSMENT OF PERFORMANCE/MANAGEMENT REQUIREMENTS FOR SPECIFIC PROPOSALS

As previously mentioned, the data could be subset to meet specific user needs. One such need may be an examination of land types and risks of erosion following land disturbance along an alignment - such as the prospective route for a pipeline.

This information highlights particular land systems that are likely to require a high level of management if the disturbance of the land is not to significantly increase the risk of soil erosion and subsequent damage to downstream water resources. It does not provide all the information required due to scale and detail limitations, drainage lines will always need special management, and drainage lines occur in virtually all land systems in the area and will always require site-specific planning.

ACKNOWLEDGEMENTS

This report is a synthesis of the work of many people. The first acknowledgement is made to the late Jeff Jenkin who used his knowledge of Victoria's lands to define geomorphic units that, being genetically based and mapped at various scales, provide an excellent framework for ordering land systems according to processes that affect land use.

Soil Conservation Authority, Land Protection Division and Department of Agriculture and Rural Affairs (and subsequent organisations and divisions) staff who carried out the detailed land studies and soil surveys are listed in the references.

The earlier editions of this work had many contributors and are thanked for their efforts. Bryan Young worked on and supervised the distribution of the 1975 Land Systems Map of Victoria. Lynne Matthews helped to map the more detailed Mallee land systems.

Centre for Land Protection Research and Agriculture Victoria staff members, Keith Reynard (GIS, database, outline), John Williamson (outline and editing), Mark Imhof (outline), Grant Boyle (report compilation) and Kath Ferrari (word processing, report compilation) have had input into this edition of the work. Jim Rowan is acknowledged for his continuing input into this work despite retirement from the public service. Leisa Macartney is thanked for her editorial role.