

**Review of Soil and Land Resource Information Available
for the Marlborough District**

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Landcare Research Contract Report: LC0506/084

PREPARED FOR:
Marlborough District Council

DATE: March 2006



ISO 14001

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1. Introduction

Information on the land and soil resources of Marlborough region was collated by Landcare Research for the Marlborough District Council in March 2006. This report was prepared as part of the commitments for Envirolink small advice grant MLDC 7.

2. Objectives

- Review and document known sources of soil and land resource information available for the Marlborough District.
- Identify sources of unpublished material held by Landcare Research.
- Scope a number of projects to collate and deliver unpublished material to Marlborough District Council and the general public.

3. Method

The known published and unpublished map and data sources of soil and land resource information for the Marlborough District held by Landcare Research at Lincoln were reviewed and documented.

4. Results

The main sources of soil and land resource information for the Marlborough District are published and unpublished reports of the following government departments and local authority organisations and their successors:

- DSIR Soil Bureau
- DSIR Land Resources
- Ministry of Works and Development, Water and Soil Division
- Marlborough Catchment and Regional Water Board.

Since 1990 some of the nationally significant databases, e.g. New Zealand Land Resource Inventory (NZLRI) and the National Soils Database (NSD), have been the responsibility of the Crown research institute, Landcare Research.

4.1 Land resource inventory surveys

A number of land resource inventory surveys have been undertaken, primarily by the Marlborough Catchment and Regional Water Board (MCB); the Ministry of Works and

Development, Water and Soil Division, for the National Water and Soil Conservation Organisation; and Landcare Research, over all or parts of the district.

Few surveys undertaken by the MCB were published. They tend to be whole-catchment or part-catchment based, and lack the accompanying raw inventory data in printed or database form. Published reports include:

- Wairau mountain lands (Simpson 1980)
- Molesworth and Upper Clarence catchment land resource inventory (Sutherland 1988).

Unpublished reports include:

- Upper Waihopai Catchment control scheme (Sutherland 1987)
- The Wye Catchment Control Scheme comes of Age, (Anon 1982)
- A draft Marlborough Sounds Survey, (Sutherland 1986).

The latter is known only from a draft set of 1:50 000 scale maps with inventory codes, and a very rough draft 'Sounds LUC legend' held at Landcare Research, Lincoln. The soil codes used are similar to but differ from those used in the unpublished report and map @ 1:100 000, 'Soils of the Marlborough Sounds' (Laffan et al. 1987).

4.2 The New Zealand Land Resource Inventory (NZLRI)

New Zealand Land Resource Inventory is a national database of physical land resource information (NWASCO 1975-79, 1979). It has been widely applied in New Zealand to identify opportunities and constraints to land use and is contained in a GIS database. Two dates of NZLRI assessment are available for the Marlborough District, 1st Edn compiled in the mid-1970s and 2nd Edn compiled in the 1990s.

The NZLRI comprises two sets of data:

1. An inventory of five physical factors controlling land use:
 - rock type
 - soil unit
 - slope group
 - erosion type and severity
 - vegetation cover.
2. A derived assessment identifying the capacity of land for sustained agronomic production (land use capability), taking into account its productive potential, physical limitations, including climate, soil conservation needs and management requirements.

The inventory factors are defined in the following;

- Rock type – Lynn (1985 1st Edn), and Lynn & Crippen (1991 2nd Edn)
- Soil unit – see below
- Slope group – Soil Conservation and Rivers Control Council (1971)
- Erosion type and severity – Soil Conservation and Rivers Control Council (1971), Eyles (1985)
- Vegetation cover – Hunter & Blaschke (1986 1st Edn), and Page (1987 2nd Edn).

The NZLRI has a strong landform and slope bias. On flat to strongly rolling land, a heavy emphasis is given to soil parent material, soil depth, stoniness, and soil drainage, reflecting the agricultural heritage of the system. On moderately steep – to - steep terrain the emphasis is on erosion susceptibility and altitude-related climatic constraints to production.

The land use capability classification is a systematic arrangement of different kinds of land according to those properties that determine its capacity for sustained production, emphasising suitability for productive use, based on the land's physical limitations defined in the land resource inventory as well as climate and the effects of past land use (Hunter 1992).

Land use capability has the following structure. Land use capability *class* (LUC) is the general degree of limitation for productive use, *subclass* is the main kind of limitation, and *unit* groups together land that responds similarly to management.

The land use capability *class* is the broadest grouping in the capability classification. There are eight classes, with limitations to use increasing, and versatility of use decreasing, from classes 1 to 8. Classes 1 to 4 are arable with increasing limitations for arable use, whereas classes 5 to 8 are non-arable with increasing limitations and decreasing versatility to use, (Table 1).

Table 1 Land use capability class as recognised in the NZLRI.

| LUC class code | | Description |
|----------------|-----------------|--|
| 1 | Arable land | Land with virtually no limitations for arable use and suitable for cultivated crops, pasture or forestry. |
| 2 | | Land with slight limitations for arable use and suitable for cultivated crops, pasture or forestry. |
| 3 | | Land with moderate limitations for arable use, but suitable for cultivated crops, pasture or forestry. |
| 4 | | Land with severe limitations for arable use and suitable for occasional cropping, pasture or forestry. |
| 5 | Non-arable land | Highly producing land unsuitable for arable use, but with only slight limitations for pastoral or forestry use. |
| 6 | | Non-arable lands with moderate limitations for use under perennial vegetation such as pasture or forest. |
| 7 | | Non-arable lands with severe limitations for use under perennial vegetation such as pasture or forest. |
| 8 | | Land with very severe to extreme limitations or hazards that make it unsuitable for cropping, pasture or forestry use. |

Four land use capability *subclasses* are recognised, erosion, soil wetness, soil physical or chemical limitations and climate, (Table 2).

Table 2 Land use capability subclass descriptions.

| LUC subclass modifier | Description |
|-----------------------|--|
| e | Erosion susceptibility, deposition or the effects of past erosion damage limits production. |
| w | Soil wetness resulting from poor drainage or a high water table, or from frequent overflow from streams or coastal waters limits production. |
| s | Soil physical or chemical properties in the rooting zone such as shallowness, stoniness, low water holding capacity, low fertility (which is difficult to correct), salinity, or toxicity limits production. |
| c | Climate limitations such as coldness, frost frequency, and salt-laden onshore winds limit production. |

The land use capability *unit* groups together land that responds similarly to management and is adapted to growing the same kind of crops, pasture or forest species and have similar yields.

Accuracy of land resource evaluation systems, including land use capability assessment, are dependent on the quality of detailed soil information, agronomic records, and the knowledge of land's response to intensive management.

4.3 NZLRI coverage for the Marlborough District Council area.

Two dates of NZLRI assessment are available for the Marlborough District.

1st Edn NZLRI

- Fieldwork and compilation was undertaken between 1974 and 1977 (National Water and Soil Conservation Organisation 1975-79)
- Whole district coverage at a mapping and publication scale of 1:63 360
- Uses a South Island-wide land use capability extended legend of 220 units
- Delineated polygons tend to be large and generalised
- Depicts vegetation cover and erosion status of the 1970s.

2nd Edn NZLRI

- Fieldwork, evaluation and compilation was undertaken between 1989 and 1993, (Lynn 1996)
- Covers 62% of the district at a mapping and publication scale of 1:50 000
- Coverage includes the Wairau catchment, Molesworth Station, and coastal Marlborough including the Waima catchment. The balance of the Marlborough region, including the Marlborough Sounds, D'Urville Island, the Hossack catchment and parts of the Ouse catchment have only 1st Edn coverage
- Uses a region-specific land use capability extended legend (154 units) designed to provide coverage of the Marlborough and Kaikoura districts, including those areas not remapped due to budgetary constraints
- The land use capability units are structured to distinguish the major climatic-geomorphic and soil-forming environments present

- The regional legend has a hierarchical framework of increasing detail: environment, landform, rainfall, and a range of factors determined by the specific type of terrain under consideration (see table 3, Lynn 1996)
- Decision trees are included to identify and recognise the land use capability units distinguished
- Delineated polygons tend to be small and specific
- Depicts vegetation cover and erosion status of the early 1990s.

It is important to note that the land use capability (luc) unit numbers are NOT equivalent between editions. For example 2nd Edn regional legend luc unit 3e1 correlates closest to 1st Edn South Island-wide luc unit 3e5. These correlations are outlined in the summary tables that precede each land use capability class section of the regional legend (Lynn 1996).

4.4 Soil map coverage of the Marlborough District

The Department of Scientific and Industrial Research and its divisions undertook soil research in the Marlborough District from the 1930s. Published soil mapping on the lowlands dates from 1939, and regional and part-regional coverage from 1945. Soil mapping is also a component of the NZLRI inventory.

The National Soils Database (Wilde 2006) contains information on soil physical and chemical analyses undertaken as part of mapping programmes in the Marlborough region and similar soils sampled in Canterbury. Some specialist reports are also, available e.g. Watt & Vincent (1991).

4.5 Soil maps

The 1939 Wairau Plains report and map at 1:63 360 (Harris & Birrell 1939) covers an area from the Wye River to the Blenheim–Picton Railway on the south side of the Wairau River, to the Taylor River west of Blenheim, and New Renwick Road to the south. The lower end of the Fairhall, Hawkesbury and Waihopai valleys are included. This survey was undertaken as part of an irrigation feasibility study.

Significant parts of the inland high country were mapped at 1:500 000 in Gibbs et al. (1945). The Awatere, Kaikoura, and part of the Marlborough county were mapped at 1:250 000 by Gibbs & Beggs (1953).

Whole-district coverage was achieved with the general survey of the soils of the South Island, (New Zealand Soil Bureau 1968), at a mapping scale of 1:250 000. Little additional fieldwork was undertaken in the Marlborough region for this publication. Heavy reliance was placed on the previous published work, although the accompanying extended legend documents the soil mapping units used to a consistent standard.

Laffan & Vincent's (1990) 'Soils of the Blenheim–Renwick District' and accompanying map at 1:50 000 is the only other published soil map in the district. It covers the area south of the Wairau River between SH6 and SH1 and includes the Fairhall and Hawkesbury valleys.

A detailed, uncorrelated and rationalised draft soil map at 1:15 000 for the Lower Awatere Valley is on file with Landcare Research (Campbell 1987 unpublished). There is an urgent need to collate and publicly release this spatial information and soil characterisation in both

this area and the Wairau Plains detailed window (Laffan & Vincent 1990), at publication standard.

4.6 Soil information as a component of the NZLRI inventory

The soil data incorporated in the 1st Edn is based on soil units defined in New Zealand Soil Bureau (1968). The defined soil sets were interpreted and applied to the landscape in a refined and systematic way. However, only limited ground resurvey was undertaken.

The 2nd Edn NZLRI used the most recently published data, rationalised to the 1:50 000 mapping scale. The default information for the Marlborough region was a consistent interpretation or reinterpretation of the soil sets defined in the 4-mile survey in New Zealand Soil Bureau (1968). The soil sets have been applied to a more detailed and rigorously delineated landscape. This was made possible by the availability of improved topographic maps, intensive aerial photo interpretation, and significant ground resurvey in representative areas. There has been significant reinterpretation of the distribution of soil sets in inland Marlborough, especially on Molesworth and in the Upper Awatere Valley.

Detailed soil mapping was incorporated where available. In the Wairau Valley Laffan & Vincent's (1990) 1:50 000 scale Blenheim–Renwick District mapping is incorporated with units displaying reference code prefix 'x'. In the Lower Awatere Valley the unpublished 1:15 000 scale soil map (Campbell 1987) was simplified and an aggregated version of this detailed map was incorporated with reference code prefix 'y'.

4.7 Soil-based scientific papers

Few soil-based papers have been published from the Marlborough area in recent times. Most describe the relationships between soil fertility and vegetation pattern or soil suitability for exotic forestry.

A number of soil studies have been undertaken on the inland steeplands (Lynn & Basher 1994; Rose et al. 1998; Lynn et al. 2002), and the Marlborough Sounds (Laffan & Daly 1985; Laffan et al. 1985; Laffan et al. 1986; Walls & Laffan 1986).

Soil–landscape relationships are discussed for some islands in the Sounds, e.g. Webb & Atkinson (1982), Ward (1961). An incomplete list of additional soil papers is given in the soil bibliography.

5. Recommendations

- To improve compliance and consent decisions by council, and to improve management decisions by landholders and researchers, access to the unpublished detailed soil spatial and profile characterisation data needs to be improved.
- A series of projects should be undertaken to correlate, rationalise and compile the Lower Awatere Valley soil map to publication standard, and to establish and implement a soil fact sheet generator and database parameters for the Lower Awatere Valley and Wairau Valley, soils compatible with S-map (Hewitt 2004).
- Envirolink funding should be sought to accomplish these three tasks.

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