



















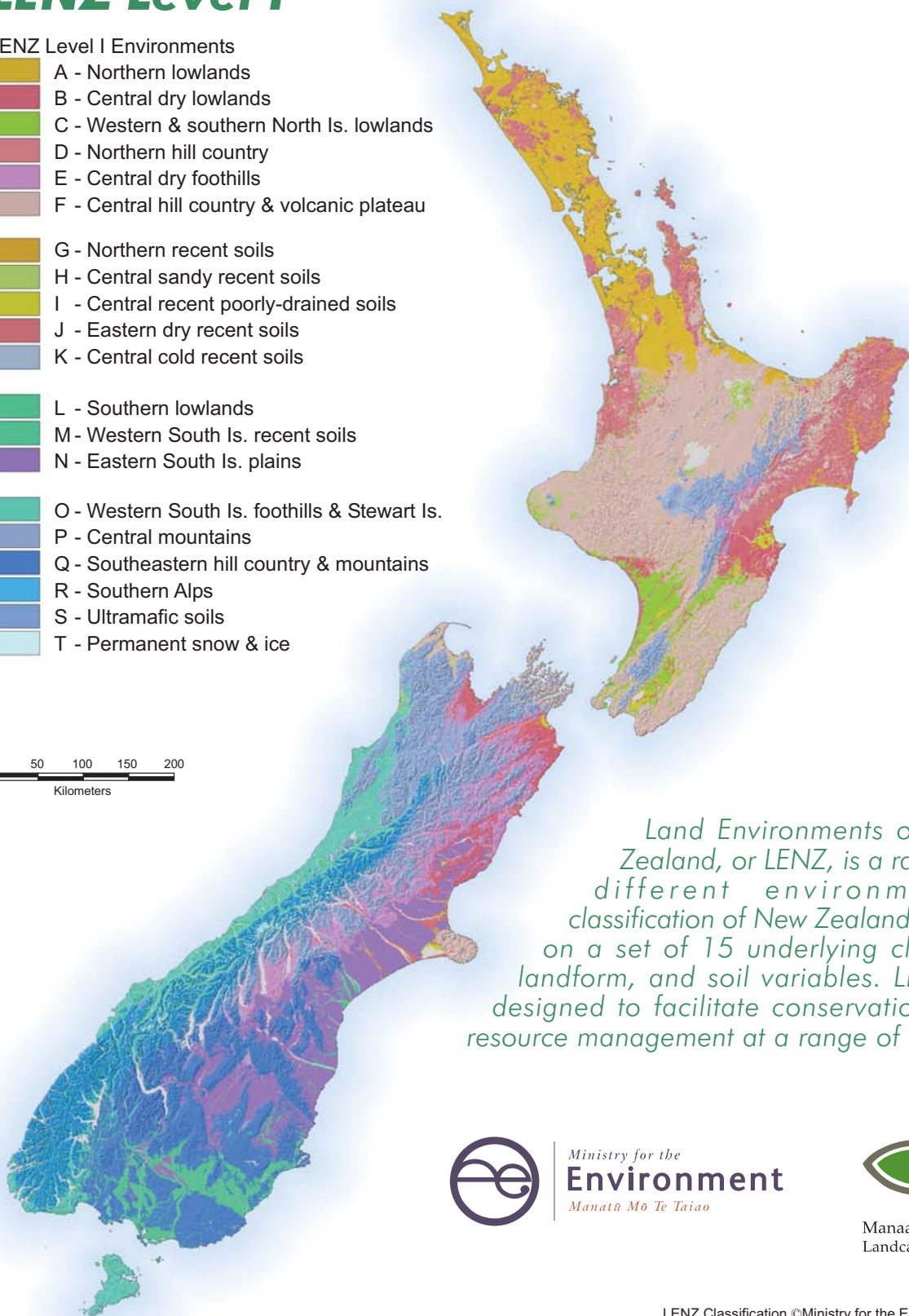
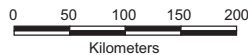




### LENZ Level I

#### LENZ Level I Environments

-  A - Northern lowlands
-  B - Central dry lowlands
-  C - Western & southern North Is. lowlands
-  D - Northern hill country
-  E - Central dry foothills
-  F - Central hill country & volcanic plateau
  
-  G - Northern recent soils
-  H - Central sandy recent soils
-  I - Central recent poorly-drained soils
-  J - Eastern dry recent soils
-  K - Central cold recent soils
  
-  L - Southern lowlands
-  M - Western South Is. recent soils
-  N - Eastern South Is. plains
  
-  O - Western South Is. foothills & Stewart Is.
-  P - Central mountains
-  Q - Southeastern hill country & mountains
-  R - Southern Alps
-  S - Ultramafic soils
-  T - Permanent snow & ice



*Land Environments of New Zealand, or LENZ, is a radically different environmental classification of New Zealand based on a set of 15 underlying climate, landform, and soil variables. LENZ is designed to facilitate conservation and resource management at a range of scales.*



Ministry for the  
**Environment**  
*Manatū Mō Te Taiao*



Manaaki Whenua  
Landcare Research

LENZ Classification ©Ministry for the Environment.  
LENZ Underlying Data ©Landcare Research NZ Ltd.

## Underlying Data Layers

### Climate

**Mean Annual Temperature** - strongly influences actual plant productivity.

**Mean Minimum Winter Temperature** - influences plant survival.

**Mean Annual Solar Radiation** - determines potential productivity.

**Minimum Winter Solar Radiation** - the lowest solar radiation input through the year.

**October Vapour Pressure Deficit** (air dryness) - controls evaporation from plants.

**Monthly Water Balance Ratio** - indicates average site 'wetness'.

**Annual Soil Water Deficit** - the extent of drought limitation on plants.

### Landform

**Slope** - major driver of drainage, soil rejuvenation and microclimate.

### Soils

**Drainage** - influences the oxygen availability in upper soil layers.

**Acid Soluble Phosphorous** - measures a key soil nutrient.

**Calcium** - both a nutrient and a determinant of soil weathering.

**Particle Size** - affects the rates of soil formation and nutrient release.

**Induration** - determine soil resistance to weathering.

**Age** - separates recent, fertile soils from older, less fertile soils.

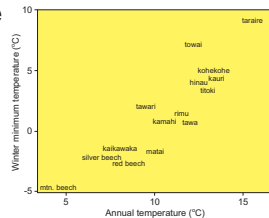
**Chemical Limitations to Plant Growth** - indicates presence of salinity or ultramafic substrates.

## Why LENZ?

1. Growth of ecosystem management as reflected in national legislation, government policy, and international agreements
2. Increase in monitoring and reporting requirements
3. Need for spatially explicit, quantitative tools including maps showing the distribution of areas with similar ecosystem character.

## LENZ Underlying Data Layers

LENZ Underlying Data Layers were chosen based on the results of a series of studies relating the distribution of New Zealand's major tree species to climate, landform, and soil variables. The selected variables showed the strongest relationship with observed tree distributions and have strong linkages with tree physiological growth processes.



### Climate

Climate layers came from mathematical techniques that estimate values for areas between points with known values. For LENZ, known values were long-term data from New Zealand Meteorological Service weather stations.

### Landform

The slope layer came from a 25 meter digital elevation model (DEM) generated from 1:50,000 topographic data sources.

### Soils

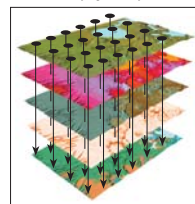
Soils layers came from the New Zealand Land Resource Inventory, which maps areas with similar land characteristics. Soils were grouped by parent material – the original surface rock or other material from which the soils formed – to estimate their fertility and weatherability.

## LENZ Classification

LENZ classifies New Zealand into environments with varying degrees of similarity using multivariate classification techniques. Whereas traditional ecosystem classifications generally rely on subjective synthesis of multiple information sources, multivariate classifications offer significant advantages because they are flexible, explicit, repeatable, and scalable.

At the heart of LENZ lies the concept of environmental distance. Environmental distance measures how "close" (similar) two areas are based on a given set of environmental variables. For LENZ, the set consisted of the 15 underlying data layers.

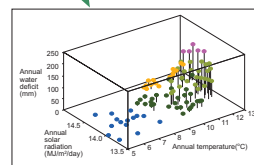
Step 1: For each 100-m grid point in New Zealand, determine the corresponding value of each of the 15 underlying data layers.



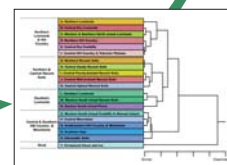
Step 4: Map the locations of all environments nationally.



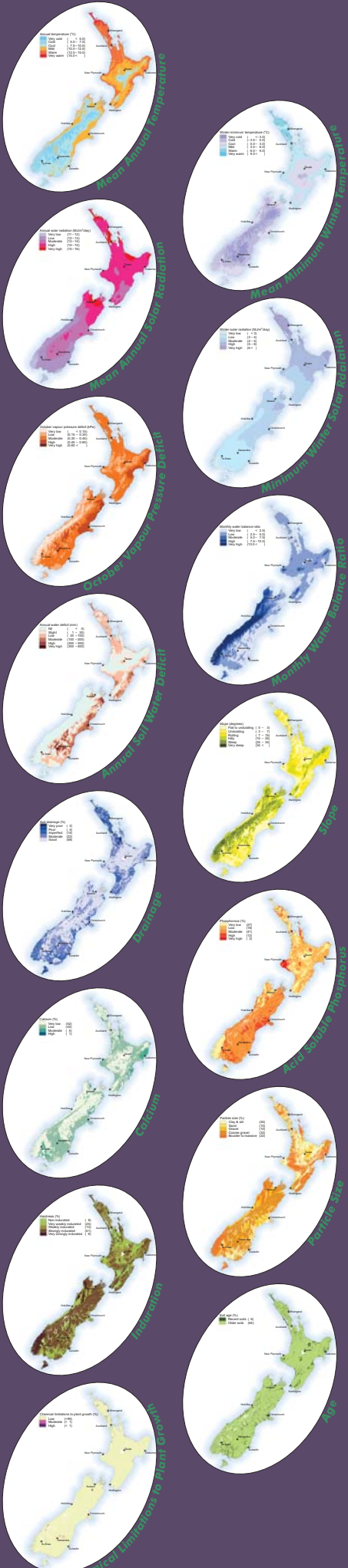
## Classification Process



Step 2: Group all points based on their similarity ("distance") in environmental space.



Step 3: Determine similarity between environments to create a classification hierarchy.

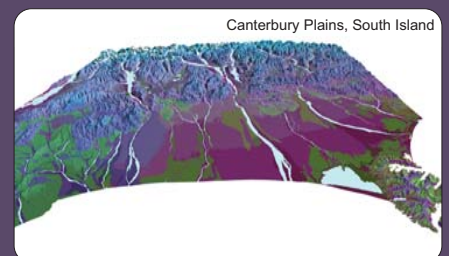
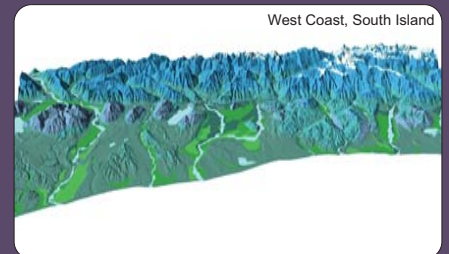
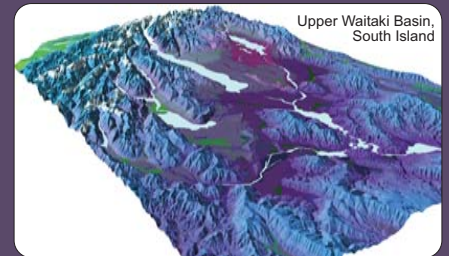
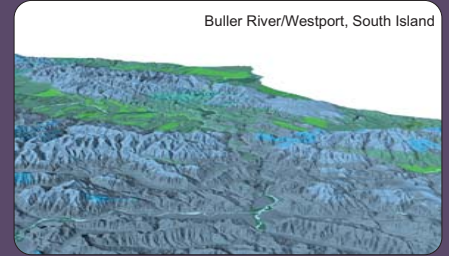
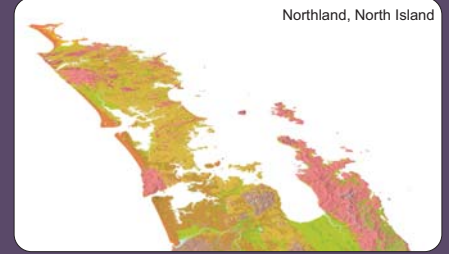
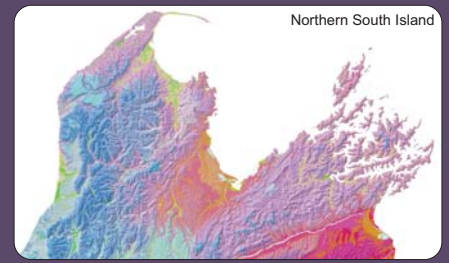
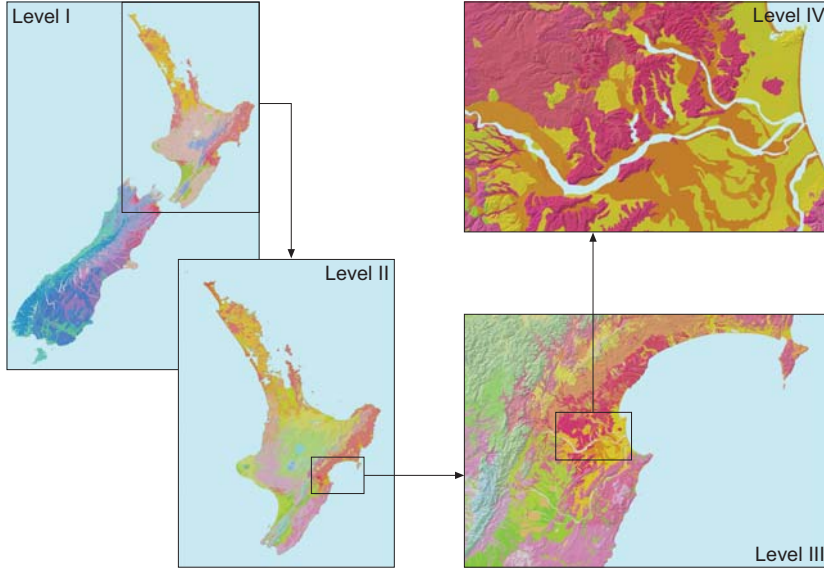




# LENZ Hierarchy

LENZ consists of four levels of classification (I to IV) for description and mapping at various levels of detail and geographic scales. A standard set of classification levels promotes a common framework for activities such as environmental reporting and maximises the ability to compare or combine results from different studies.

| Level | Number of Environments | Grid Resolution | Suggested Map Scale | Suggested Geographical Extent |
|-------|------------------------|-----------------|---------------------|-------------------------------|
| I     | 20                     | 100m            | 1: 2–5,000,000      | National                      |
| II    | 100                    | 100m            | c. 1: 1,000,000     | National–Regional             |
| III   | 200                    | 25m             | c. 1: 250,000       | Regional                      |
| IV    | 500                    | 25m             | Down to 1: 50,000   | Regional–District             |



# LENZ Applications

The environmental factors that influence the distribution of native flora and fauna also influence human uses of the landscape. Therefore LENZ has applications for a broad range of issues including:

- Biodiversity conservation
- Ecological restoration
- Biosecurity
- Risk management
- Public Health
- Economic development

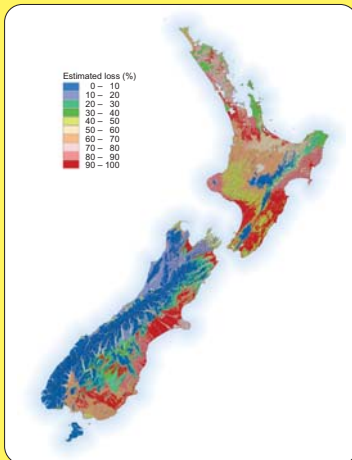
## Biodiversity Conservation

**Objective:** Estimate the extent of indigenous ecosystem loss across New Zealand.

**Approach:** Compare a reconstruction of New Zealand's likely pre-human vegetation cover with current land cover to determine percentage loss of indigenous ecosystems by Level II environments.

**Methods:** 1) Assign likely pre-human land cover to LENZ Level II environments.  
2) Analyse changes in the extent of indigenous land cover by comparing likely pre-human cover with current land cover database by LENZ Level II environment.

**Output:** Map describing percentage loss of indigenous land cover by LENZ Level II environment.



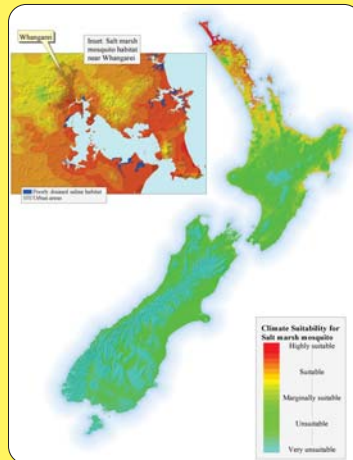
## Public Health

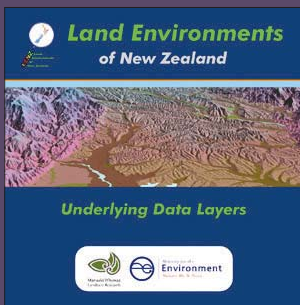
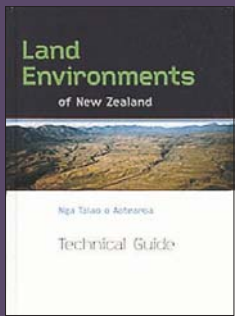
**Objective:** Develop surveillance priorities to monitor pest species

**Approach:** Combine knowledge of the environmental relations of pest species (the southern saltmarsh mosquito) with climate and soil variables to determine likely breeding areas.

**Methods:** 1) Use population growth model with monthly temperature estimates to analyse geographic variation in climatic suitability for the southern saltmarsh mosquito;  
2) Combine layer describing climatic suitability with layers identifying poorly drained and/or saline soils for locations of suitable breeding habitat.

**Output:** Map showing suitable breeding areas for the southern saltmarsh mosquito.





## LENZ System

### Land Environments of New Zealand - Nga Taiao o Aotearoa

John Leathwick, Gareth Wilson, Daniel Rutledge, Fraser Morgan, Kirsty Johnson, Malcolm McLeod, Russell Kirkpatrick.

- Contents
  - What is LENZ?
  - Why LENZ?
  - Environmental drivers of biological patterns
  - Defining and mapping the LENZ classification
  - Land Environments of New Zealand Levels I and II
  - LENZ Case studies
- LENZ Level II Posters (1:1,000,000) for North and South Islands
- Cost: \$49.99 from Manaaki Whenua Press

### Land Environments of New Zealand Technical Guide

John Leathwick, Fraser Morgan, Gareth Wilson, Daniel Rutledge, Malcolm McLeod, Kirsty Johnson.

- Contents
  - Introduction
  - The Underlying Data Layers
  - Creation of LENZ
  - The LENZ Environments Levels II – IV
  - Using LENZ
  - Endnotes
- Cost: Free from MfE

### Land Environments of New Zealand Underlying Data Layers

- ESRI Grid Layers
  - LENZ Level I (100m & 25m)
  - LENZ Level II (100m & 25m)
  - LENZ Level III (100m & 25m)
  - LENZ Level IV (100m & 25m)
- Metadata files
- ArcView Legends
- ArcGIS Layers
- Cost: - Public Good - \$350
  - Commercial - \$1500 + royalties/profit sharing (\$1250 as set)

### Land Environments of New Zealand Classification Layers

- ESRI Grid Layers
  - 7 Climate Layers (100m & 25m)
  - 1 Landform Layer (100m & 25m)
  - 7 Soils Layers (100m & 25m)
- Metadata files
- Cost: - Public Good - \$350
  - Commercial - \$1500 + royalties/profit sharing (\$1250 as set)

## LENZ Website

The website provides general information about LENZ, case studies, and news about on-going development and enhancement of LENZ. It also provides a facility for on-line orders for the LENZ data CDs and has links to Manaaki Whenua Press for ordering the LENZ book.

The website also has a secure members-only area where licenced organisations can download patches, updates, and other important changes.