



Ministry for the
Environment
Manatū Mō Te Taiao

Environmental performance indicators

Technical Paper No. 10 Land

Land indicators for national environmental monitoring – Part 5: Land monitoring model.

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for the Environment by:
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April, 1997.

Signposts for sustainability

**LAND INDICATORS FOR NATIONAL ENVIRONMENTAL
MONITORING - PART 5:**

LAND MONITORING MODEL

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**Landcare Research Report LC9697/109
for
Ministry for the Environment**

April 1997

CONTEXT AND TERMS OF REFERENCE

This report is one of eight produced as part of a consultancy for the Ministry for the Environment. The consultancy consists of a review and policy analysis of current land monitoring for national environmental indicators and a prioritisation of land monitoring parameters and indicators which provides recommendations for a preliminary core set of land indicators. The consultancy is funded by the ‘Green Package’ National Environment Indicator Programme.

The terms of reference for this report (Part 5) are:

“Develop a model showing: (1) the current regional land monitoring approaches being used/proposed at present; (2) what an ideal land monitoring situation for sustainable land use might be; (3) the steps required to reach the ideal situation over time; and (4) include the identification of the research relationships and information requirements related to the monitoring and development of indicators. This task should include the linkages (integrated management requirements) between land and other media or issues for indicator development under the NEIP (in particular, water and biodiversity), and identify other research which may fit within the model (e.g. NSDB).”

CURRENT APPROACHES TO REGIONAL LAND MONITORING

The following discussion is based on the Taranaki and Otago approaches. These two approaches are similar, and an outline of the two is presented in Figure 1. Both approaches assess the degradation risk of the soil by matching the land use and its probable impact with the land’s inherent characteristics. From this match, the likely response of the soil to the land use was deduced.

One major difference between the two approaches is the level of detail used to categorise land use. The Taranaki approach uses broad land use classes, and although land management functions were taken into account, their use in the approach is merely implicit. In the Otago proposed method, however, the land management functions are explicit. Another difference is that the Taranaki approach goes only as far as risk assessment. It was decided that in order to assess policy, only changes to the proportion of land considered sustainable needed to be monitored. The Otago proposal, however, intends to extend assessment to include a more detailed examination of the performance of land uses by monitoring land management functions, and by sampling soil intactness and soil health at selected at-risk sites.

AN IDEAL MONITORING SYSTEM

1. General Criteria

An ideal monitoring system will be policy relevant, that is, a high correlation will exist between any changes to indicator values and those environmental outcomes which indicate progress towards policy goals. The system must also meet multiple objectives, allowing for national and local authority reporting, and should be relevant to other agencies wishing to compare progress with their strategic policies (for example, DOC and MAF).

The system must allow other sectors to build on the monitoring framework and should also allow them to meet their reporting requirements. If other sectors are able to use the framework, it is more likely to be accepted by national agencies and local government.

All aspects of the indicator programme will be subject to quality assurance.

2. Framework

An ideal monitoring system needs to be based on an agreed (by national agencies and local government) spatial framework which should be land/ecosystem focused. It should also allow the integration of all indicators from other NEIP media (air and water) and from other environmental issues (for example, biodiversity). The framework should be based on defined rules (it should be rule-based) to ensure consistency throughout New Zealand.

3. Approach

The approach should be based on risk assessment. Areas at risk of environmental degradation should be identified, allowing users to target resources and to reduce the probability of further adverse impacts of inappropriate land use and/or management. Thus, the framework should provide for all land uses, including conservation, production, and urban development.

The risk assessment approach will be able to provide a whole picture of New Zealand. That is, reporting will not be limited to high risk areas. Rather, information on risk and low risk areas will be compared to provide a balanced view of New Zealand's environmental state.

The risk assessment approach needs to be soundly based on scientific research.

4. Indicators

As well as risk assessment (or pressure) indicators, we recommend a "toolkit" of more issue-specific state indicators that can be applied to high risk areas. State indicators from the "toolkit" will need to be sampled across a risk gradient to not only provide analytical validity but to also assist in presenting the "whole picture", providing information on land not at risk. Further, the indicators in the "toolkit" must be simple and robust, policy relevant, easy to understand, analytically valid and cost effective (Ministry for the Environment, 1996).

5. Integration

A strong integration with other NEIP media and issues is needed. For example, when the land use risk assessment is completed, it may identify risks that impinge upon water quality or biodiversity. The framework and the reporting have to be flexible and robust enough to allow for easy integration.

6. Reporting

The reporting module of the ideal monitoring system must enable all stakeholders to extract accurate, timely and useful environmental information. It must provide easy data access to stakeholders based anywhere in New Zealand, regardless of their computer platforms. All aspects of the indicator programme will be subject to quality assurance.

STEPS REQUIRED TO ACHIEVE THE IDEAL

The following steps are needed to develop an ideal national monitoring indicator system. Table 1 outlines a five stage timeline and indicates periods of major activity.

1. Reach an agreement on the spatial classification of land and on how the classes should be recognised and mapped.
2. Reach an agreement on the classification of land use and land management functions and on how these should be recognised and mapped.
3. Ensure wide stakeholder participation and consultation to encourage cooperation and encourage ownership of the monitoring system.
4. Choose an initial set of indicators on the understanding that these indicators will evolve and others will be developed.
5. Test the proposed system in two pilot areas of contrasting terrain, one in the North Island and one in the South Island.
6. Review the results of the pilot studies and investigate the feasibility of applying the same methods for the whole of New Zealand. During the review, particular attention needs to be given to national information requirements, to the possible economies of scale and to how the monitoring effort could be apportioned amongst national and regional agencies.
7. Integrate the evolving system with systems being developed for other NEIP media and issues.
8. Identify research gaps and establish research funding arrangements.
9. Establish information systems, including quality assurance and reporting procedures.
10. Develop a monitoring “toolkit” of state indicators that will ensure maintenance of national standards and protocols.

Table 1. Showing periods of major activity for each step required to reach an ideal environmental monitoring system

Steps	Five Stage Timeline			
1. Land classification				
2. Land use/management functions				
3. Stakeholder participation				

4. Initial set of indicators					
5. Pilot test proposed system					
6. Review pilot, extend for NZ					
7. Merge NEIP media and issues					
8. Research gaps and funding					
9. Information systems, QA					
10. Develop "toolkit" indicators					

RESEARCH RELATIONSHIPS AND INFORMATION REQUIREMENTS

1. Soil health

Soil health indicators which will help develop operational methods for sampling, analysing and interpreting results need to be trailed. Pressure-status relationships need to be established.

2. Erosion

Indicators are needed to monitor the extent and location of water and surface erosion, particularly in the South Island. The Cs-137 technique (Basher *et. al* 1995) should be developed and its usefulness as an operational tool for flat and rolling land tested.

3. International linkage

The distinctive character of New Zealand soils and their environment needs to be recognised, and the relevance of New Zealand's soils characteristics to international standards needs to be investigated. International links in indicator research and development need to be developed and maintained.

4. National spatial databases

National spatial databases need to be created for erosion, vegetation, land type, land use class, and soil resistance and resilience. We envisage that data from a number of existing databases, including AGRIBASE, the Land Cover Database (LCDB), the National Soils Database (NSD) and the NZLRI, could be contributed. The incorporation of or linkage to regional land resource inventory databases should be investigated. Although new data will be required, some research into the development of transfer functions may make best use of existing data.

5. National soils database

National coverage is patchy in terms of the geographic spread of data, the soil types represented and the properties that have been analysed. A gap analysis is required, so that sampling and analysis efforts can focus on making the NSD more robust. Further, the database needs to be made more accessible.

6. Risk assessment

To improve risk assessment, relationships between land management pressure and soil status need to be understood in terms of intactness and soil health. A range of land management functions and soil types need to be assessed. Many of these relationships are already familiar to experienced land managers, but quantification and validation is needed so that the soil resistance and resilience relationships can be confidently extended to other regions.

7. Information management

Information management of, and access to, regional and national databases need to be improved and standardised. The Internet should be used. Techniques for presenting information in acceptable and easily understood formats should also be developed.

8. Policy linkage

Links need to be established between science funding agencies and policy agencies.

9. Long term sites

In order to detect natural change, a commitment to establishing and maintaining long term monitored benchmark sites which are representative of major ecosystems is needed.

10. Inter-media and issue relationships.

Relationships between soils and a number of other ecosystem components need to be explored. Priority should be given to soil - water relationships (relationships between soil and water qualities) and soil - biodiversity relationships (spatial aspects of biodiversity, the diversity of soil fauna and microfauna and the contribution of soils to habitat diversity). The linkage between soil intactness and soil health and the social and economic goals of sustainability need to be strengthened.

REFERENCES

- Basher, L.; Matthews, K.M. and Zhi, L. 1995: Surface erosion assessment in the Canterbury downlands using ¹³⁷Cs distribution. *Australian Journal of Soil Research* 33: 787-803.
- Eyles, G.O. 1992: The New Zealand Land Use Capability system - techniques and applications. *In: Hamilton, G.J.; Howes, K.M.; Attwater, R. eds. Proceedings of the 5th Australian Soil Conservation Conference Vol. 2. Land Capability Assessment Workshop.*
- Ministry for the Environment: National environmental indicators: building a framework for a core set. Ministry for the Environment, January 1996.

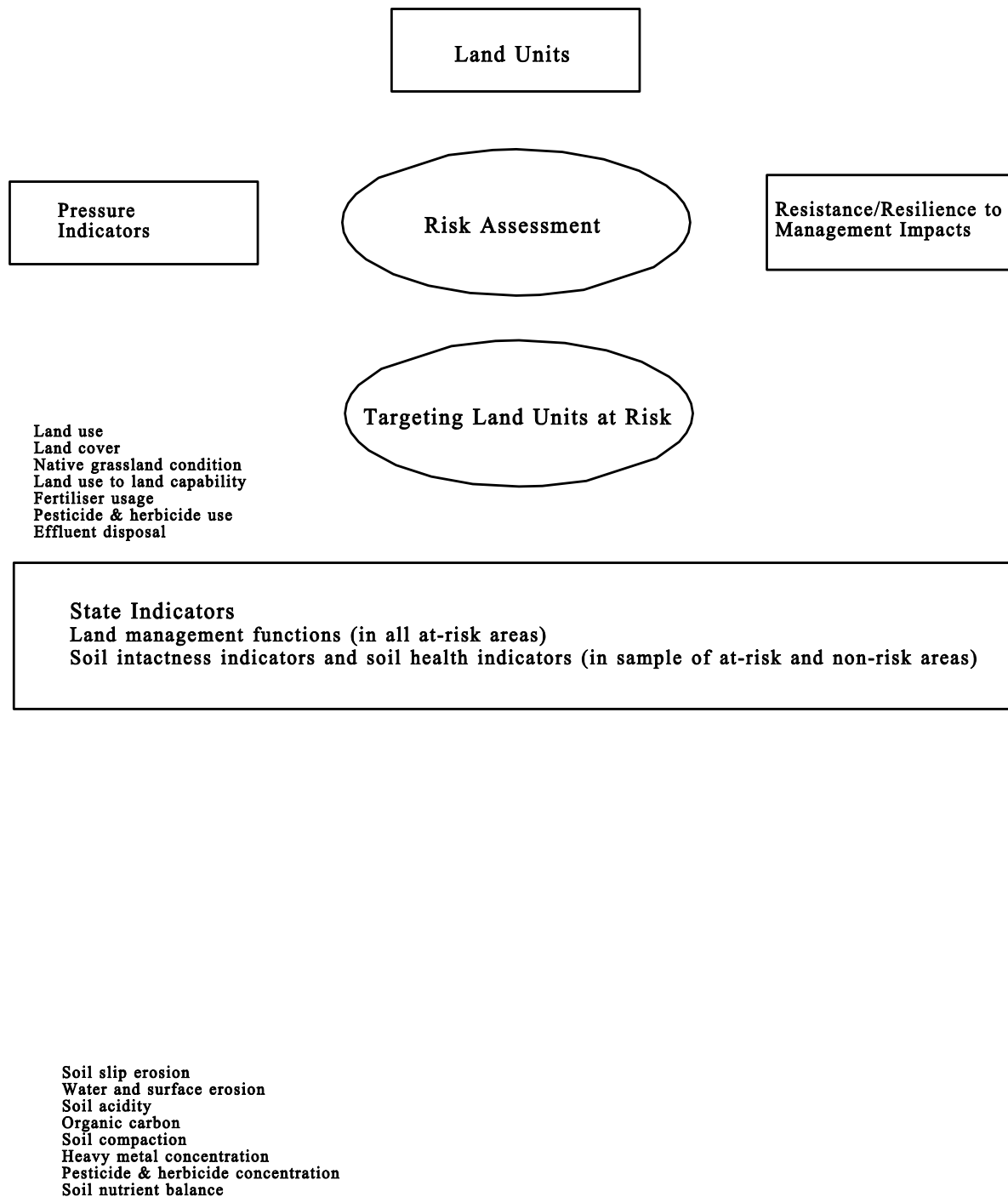


Figure 1. Risk assessment approach to environmental monitoring.