REVIEW OF COMMUNITY-BASED MONITORING GUIDES FOR RESTORATION OF COASTAL SITES

David Bergin

Community-based monitoring at Rarawa Beach, Far North, Northland

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REPORT INFORMATION SHEET

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AUTHORS	DAVID BERGIN, SCION
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EXECUTIVE SUMMARY

The Northland Regional Council and Community Coast Care group are involved at many Northland beaches in restoring natural dune form and function. This often involves investing substantial effort and resources in restoration of the indigenous biodiversity through planting and management of appropriate plant species. In contrast to restoration initiatives in many other ecosystems, there are no guidelines on how to monitor the success of coastal sand dune restoration programmes.

We reviewed monitoring guidelines used by community groups in other ecosystems that may be relevant to developing community-based monitoring systems for coastal dune restoration. We also held field-based workshops with representatives of selected Coast Care groups at three Northland sites to review current monitoring practices and to determine their interests in and needs for a community-based monitoring system for coastal sand dunes. The aim is to provide the Northland Regional Council with information for the development of guidelines for Coast Care groups in their region to effectively monitor the performance of their restoration programmes that will see more successful restoration and management outcomes in Northland.

We reviewed monitoring toolkits and guides used in wetlands and estuaries, and along coasts and riparian areas that have developed for use in New Zealand by local authorities, Trusts and other community/interest groups. The focus was on those kits that monitored vegetation cover, although many included substrate and fauna.

Most of the monitoring guides and systems reviewed, whether aimed at the professional or community user, included similar elements essential for effective collection of monitoring data that can be used in the development of a community-based monitoring system for coastal sand dunes in Northland and elsewhere in New Zealand. These include:

- the use of aerial photographs to map vegetation cover;
- use of a history or site sheet to record site characteristics and any management undertaken;
- use of photopoints to monitor change over time;
- basic methods for recording any invasive weed and pest animal presence, and;
- simple methods for estimating vegetation cover by species and density across the coastal gradient from foredunes to backdunes.

Feedback from community members during field-based workshops indicated that many involved in Coast Care groups are already very busy with restoration activities such as planting and weed control progammes. While time and resources are limited for commuities to be involved in monitoring of dunes, there is overwhelming support for some monitoring of coastal dune condition and restoration activities. Most are keen to be involved in implementing and contributing to a rapid basic monitoring system designed for use by community groups. The resounding message from community representatives already involved in coast care is that a community-based monitoring system has to be rapid, practical and easy to use.

Review of community-based monitoring guides for restoration of coastal sites

David Bergin
Scion, Private Bag 3020, Rotorua

2013

Introduction

We undertook a review of monitoring guides relevant to restoraton of coastal sites as part of an Envirolink project for the Northland Regional Council (Regional Council Advice No. 1254-NLRC157).

Coastal dune systems in New Zealand are classified as the most endangered of our natural ecosystems. The major issues of animal pests, grazing, invasive weeds, and development severely impact on the natural form and function of coastal dunes throughout the country. Most of the 3200 km of coastline in Norhland is sandy beaches, many with extensive sand dune complexes and virtually all highly modified by human influence.

As in other regions, local community groups are involved in many Northland beaches in restoring natural dune form and function in collaboration with agencies including the Northland Regional Council (NRC) and the Department of Conservation (DOC). This often involves substantial effort and resources in restoration of the indigenous biodiversity through planting and management of appropriate plant species. In contrast to restoration initiatives in many other ecosystems, there are no guidelines on how to monitor the success of restoration programmes on coastal sand dunes.

This project reviews monitoring guidelines used by community groups in other ecosystems both nationally and internationally that may be relevant to developing community-based monitoring systems for coastal dune restoration. The aim is to provide the NRC with information for the development of guidelines for Coast Care groups in their region to effectively monitor the performance of their restoration programmes.

Background

Monitoring can be defined as assessing the progress or state of something over a period of time. This requires establishing a 'baseline' against which to measure change over time using standardised methods and protocols that can be repeated at defined intervals. This will provide a record of trends as well as indicate any significant changes that may be occurring in the ecosystem. It may also identify causes of change. Monitoring includes field reconnaissance and survey, collection of data, and analysing the results to compare changes over time.

NRC provides substantial commitment and resources to dune restoration and management programmes throughout their region. Their focus is working with local communities to improve natural dune form and function and to enhance indigenous biodiversity. The council currently support 30 Coast Care groups in Northland who are

actively involved in dune restoration and management such as planting, weed and animal pest control (/www.nrc.govt.nz/environment/coast/take-action/coastcare. NRC undertakes some monitoring in collaboration with Coast Care groups, including regular site visits and recording selected aspects of restoration programmes. However, there is no consistent approach for detailed monitoring of a range of key indicators of success such as survival by species and sites for planting programmes, influence of management initiatives on natural regeneration, and the effectiveness of weed and animal pest control. Similarly, there are no consistent dune-specific monitoring methods for coastal restoration programmes nationwide.

Councils are increasingly constrained in providing resources into environmental programmes, including comprehensive monitoring of projects. Meanwhile, local communities are requesting greater involvement in contributing to environmental outcomes including the ability to assist in monitoring the relative success of this work. This project will provide the platform for developing a set of guidelines for a consistent community-based monitoring of sand dune initiatives in Northland. This will allow Coast Care groups to learn directly from their monitoring programmes and have the opportunity to implement changes to improve future outcomes.

A robust practical monitoring system has the potential to provide the council with a standardised quantifiable measure of the success or otherwise of each restoration and management programme by site and by Coast Care group. This provides an audit of resources measured against objectives and outcomes for each project and site.

The council then has the opportunity to use the information gained from a monitoring programme to:

- allocate resources to those areas and practices where the aims and aspirations of local community groups in partnership with the council are being met in terms of tangible outcomes, e.g., greater survival of planted natives; and
- use the most successful programmes to demonstrate to other community groups how to improve restoration and management outcomes and the benefits of using community-based monitoring to measure relative success and make improvements to practices in the future.

Methods

Collation of existing monitoring information – A search of the literature for existing community-based monitoring guides that have been developed and used for restoration and management across a range of ecosystem types in New Zealand was undertaken. This included wetland monitoring systems, riparian monitoring toolkits, and forestry monitoring options. An international literature search for monitoring systems used by local communities focussed on coastal sand dunes.

Relevance to coastal site monitoring – The searches included collating any relevant monitoring information associated with assessing cross-sectional profiles, vegetation cover, weeds and animal pests, quantifying the success and failure of restoration projects, and assessing the influence of human use on beaches and dunes including the effect of development. Monitoring methods and systems were then evaluated for relevance to setting up community-based monitoring guides for restoration and management programmes on coastal sand dunes in Northland and implications for other regions in New Zealand.

Community workshops – Three field-based workshops were held with Coast Care groups and supporting agency staff to determine local issues and requirements for

developing practical community-based monitoring systems. Two sites were located on the east coast of Northland and one on the west coast to cover the likely range of sites and issues.

Each site was visited twice to collate information from participants on their community needs for a monitoring system and then to discuss possible monitoring options and their suitability for Coast Care groups to implement and meet their requirements. Testing of selected monitoring options was undertaken at two of the sites with participating Coast Care group members in collaboration with NRC and Department of Conservation staff.

Existing monitoring initiatives carried out by these groups and other Coast Care and coastal community groups in Northland were also collated.

Monitoring options – Likely options for developing monitoring guidelines for community-based restoration and management of coastal sand dunes for Northland were summarised. These can be evaluated by the Northland Regional Council to develop a region-wide guide to monitoring and support site-specific requirements of local Coast Care groups.

This review will assist the NRC in the next step which involves the production of guidelines on community-based guidelines for monitoring the condition and health of sand dunes and for monitoring the performance of restoration programmes.

Collation of existing monitoring information

Scope of this review
A number of monitoring toolkits, handbooks and guidelines have been selected for this review, which may be useful in developing a community-based monitoring method for sand dunes. This reveiw focusses mostly on monitoring of vegetation cover, although some guides that include some aspects of monitoring site factors such as substrate type and moisture levels are considered. The importance of including fauna, both indigenous and exotic, in monitoring of ecosystems and restoration programmes is acknowledged.

A wide range of monitoring systems and approaches is used across different ecosystems in New Zealand, some of them developed on the basis of international literature on monitoring design. A brief literature search of international monitoring guides did not indicate many relevant sources that would add to that currently used in New Zealand. Consequently, this review has focussed on New Zealand examples of monitoring systems including those used in wetlands, sand dunes, estuaries and riparian areas. The review also focussed on short-stature vegetation so excluded forest monitoring methods, although the principles and methods of monitoring used in forests are similar to those for wetlands and riparian areas.

Several well-established monitoring systems have been reviewed with a focus on assessing vegetation cover and condition, monitoring change in vegetation over time, quantifying factors influencing vegetation cover, and monitoring restoration initiatives. A brief evaluation of these and relevance to monitoring on sand dunes is provided in the next section.

The scope and objectives of the selected monitoring systems are listed below (in no particular order). Comments on each of the monitoring systems is provided mostly in relation to relevance for developing community-based monitoring guidelines for coastal sand dunes. Further detail is provided in the Appendix.

1. WETLAND MONITORING HANDBOOK

Title: Handbook for monitoring wetland condition. Co-ordinated monitoring of New Zealand wetlands
Authors: Beverley R. Clarkson; Brian K. Sorrell; Paula N. Reeves; Paul D. Champion; Trevor R. Partridge; Bruce D. Clarkson
Date: June 2003, revised October 2004
Source:
http://www.landcareresearch.co.nz/publications/researchpubs/handbook_wetland_condition.pdf

Scope and objectives
This handbook describes a set of science-based indicators that have been developed to monitor the condition of New Zealand estuarine and palustrine wetlands. It has been designed for managers, landowners, community groups and anyone else with a need to monitor the condition of wetlands.

The handbook specifically covers:

- The approach and process involved in developing the indicators.
- A detailed description of each indicator and how to assign a value and tally
- scores to analyse the results.
- How the indicators can be used to answer a range of monitoring questions.
- How the science-based indicators relate to the other objectives and products of the Co-ordinated Monitoring of New Zealand Wetlands Project

Further details on this wetland monitoring handbook is provided in Appendix 1.

Comments

- A comprehensive guide to monitoring wetland ecosystems covering a range of factors including vegetation, substrate and water, and including the use of indicators to determine habitat condition and monitor change.
- Monitoring system is based on sound principles such as the use of indicators following international trends and trials in different wetlands throughout New Zealand.
- Focus is on collecting quantitative data using standard vegetation plots, although there are other aspects involving subjective and observational methods.
- While the handbook indicates it is for managers, landowners and community groups to use, some components are likely to require considerable commitment for communities to utilise.
- Useful source in the development of a coastal dune monitoring system to ensure methods are based on scientific principles.

2. STREAM HEALTH MONITORING AND ASSESSMENT KIT (SHMAK)

Title: Stream health monitoring and assessment kit
Authors: Developed by the National Institute of Water and Atmospheric Research (NIWA) in partnership with Federated Farmers of New Zealand.
Date: June 2003, revised October 2004
Source: http://www.niwa.co.nz/our-science/freshwater/tools/shmak

Scope and objectives
The New Zealand Stream Health Monitoring and Assessment Kit (SHMAK) has been designed for use by farming families and others in New Zealand to monitor the health of the streams that flow across their land. The methodology is also appropriate for

community groups, Fish and Game officers, regional council field officers, or anyone wishing to obtain a general indication of the ecological health of rural streams.

The data collected using this kit fall into three categories:

- biological data – based on common and easily recognised "indicator organisms" which are known to be characteristic of certain stream health conditions;
- data about the stream habitat – measurements and observations of conditions at a monitoring site;
- land-use and farm management data which are required for interpretation of the stream assessment result, and cover both the area immediately upstream of the site and the whole stream catchment.

Comments

- A comprehensive practical kit widely used as a monitoring system by community groups over many years.
- Comprises collection of both descriptive such as a site register and site photographs as well as quantitative data from stream monitoring and assessment of bank vegetation.
- Methods and parameters used to collect quantitative data clearly explained and appear to be geared for community use. For example, categories of bank cover are broad and practical – native trees, wetland vegetation, exotic trees, pasture, bare ground, etc.
- Designed to allow interpretation of assessments that links back to land-use and farm management.
- Many useful practical aspects relevant to development of a community-based coastal dune monitoring system, including the manual, data sheets, illustrations, extra information and equipment supplied with the kit.

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3. WETLANDS MONITORING AND ASSESSMENT KIT (WETMAK)

Title: **Wetlands monitoring and assessment kit**
Authors: New Zealand Landcare Trust
Date: 2012
Source: http://www.landcare.org.nz/wetmak

Purpose

WETMAK is an online resource aimed at community groups working on wetland restoration projects in New Zealand. WETMAK provides advice on useful monitoring techniques and methods of assessing the impact of your restoration work. The kit is available in different formats and can be downloaded as an entire resource or alternatively as specific modules. The NZ Landcare Trust also runs WETMAK Training Days to provide a practical introduction to the kit.

Modules

WETMAK is made up 6 independent modules. This allows the choice of a module or modules to suit the site or restoration programme, skills and budget.

1. ***Creating a management map***
    - To indicate where features of interest are, e.g., monitoring plots, hazards
    - Degree of difficulty – Basic
    - Timing – Once, update as needed

2. ***Photopoints***
    - Visual record of change in your site, great way to show how much has or has not been achieved
    - Degree of difficulty – Basic
    - Timing – Yearly, at the same time each year
3. ***Wetland 'WOF' check***
    - General 'health' check based on a range of information and range of factors, to highlight areas of potential concern. Walk around the wetland edge to look for threats, e.g., stock access, weed incursion, dieback
    - Degree of difficulty – Intermediate to Advanced
    - Timing – Every 5 years, or as need arises (e.g., after a major flood or similar event).
4. ***Mapping Wetland Vegetation***
    - Big-picture birds-eye view of your site, allows you to see incremental change in vegetation cover
    - Degree of difficulty – Intermediate
    - Timing – Every 10 years or so (as often as new aerial photos are available)
5. ***Weed survey***
    - To detect weeds before they take hold, to measure success of weed control activities
    - Degree of difficulty – Intermediate
    - Timing – Yearly, in summer, indefinitely
6. ***Vegetation plots***
    - Detailed study of the plant cover , height and species diversity and mix of natives and exotic plants
    - Degree of difficulty – Advanced
    - Timing – Every 5 years

The current version of WETMAK (July 2012) does not include techniques for monitoring fish, pest animals, birds, invertebrates, soil, hydrology or water quality. These may be added as further modules in the future.

Comments

- An easily accessible, step-by-step practical guide for monitoring of wetlands geared for community groups working at range of levels of interest and commitment and adaptable for different sites.
- The 6 independent modules gives users clear indication on what is involved with each module, objectives, the degree of difficulty in their use, time commitment and resources required.
- Modules progress from descriptive and subjective assessments (e.g., photopoints, WOF check) to increasingly more quantitative data collection (e.g., establishment of vegetation plots).
- Scope for using a similar module design for a community-based coastal dune monitoring system ranging from basic to more advanced options.

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4. DUNE VEGETATION MAPPING AND CONDITION ASSESSMENT, TAURANGA ECOLOGICAL DISTRICT

Title: Sand dune vegetation mapping and condition assessment methods for Tauranga Ecological District
Authors: Wildland Consultants
Date: 2008

Source:
http://monitoring.boprc.govt.nz/Reports/Wildlands-090803-SandDunemappingTga.pdf

Scope and objectives
Environment Bay of Plenty required the mapping of the extent of coastal dunes and indigenous vegetation cover, and to capture information on selected 'condition factors' for dunes within the Bay of Plenty coastline. The data collected will be used for long-term monitoring of change in vegetation cover and condition. Wildland Consultants was commissioned to develop methods for dune mapping and condition assessment.

Methods
It was determined that three data sets need to be created:

1. Extent of dunes both developed and undeveloped;
2. Vegetation map of wild undeveloped areas; and
3. Condition assessments undertaken along a stratified series of randomly placed belt transects.

Establishment of transects

- Belt transects were located at 1 kilometre intervals along the Bay of Plenty coastline. A walk-through survey of all dune vegetation within each site was completed. This aimed to sight and identify all vegetation types discernible on 1:1000 aerial photographs.
- A vegetation classification system for the dune vegetation observed by this survey was developed. Vegetation unit condition sheets were completed for each vegetation unit identifiable in transects with aerial photographs used to assist in identification of vegetation units using the method of Atkinson (1985).
- It is intended that the same methods and transect will be used in re-measurements to determine change in vegetation extent or cover composition.

Comments

- Not suited for community groups, although members of Coast Care groups could provide field assistance to professionals undertaking this type and level of monitoring.

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5. MANGROVE MONITORING KIT

Title: Estuary monitoring by communities. Mangrove habitats: a case study
Authors: Anne-Maree Schwarz (NIWA), Sharon Parker, Michael Grose (Waikaraka Estuary Managers)
Date: 2008
Source:
http://www.niwa.co.nz/sites/default/files/import/attachments/monitoring_mangrove.pdf

Purpose
Developed for community groups to monitor mangrove habitats but the principles can be applied to a number of aspects of estuarine ecology in general. They are designed to "provide guidance in planning a simple monitoring programme enabling community groups to increase understanding of mangrove habitat in their local estuary".

Monitoring methods
Several methods specific to monitoring mangroves in estuaries are given in a colourful easy-to-read well-illustrated guide.

1. ***Establish permanent transects –*** to establish permanent sites where measurements can be made to understand how the distribution and character of mangroves and adjacent habitats change over time.
2. ***Record mangrove boundary characteristics –*** to measure changes in the distribution and character of a mangrove forest boundary and adjacent habitats over time.
3. ***Count epifauna (animals living on the sediment surface)*** – to characterise the animals that use different habitats within and adjacent to a mangrove stand.
4. ***Take photographs –*** to maintain a photographic record of each transect.
5. ***Install sediment height monitoring pegs –*** to measure rates of sediment accumulation or loss.
6. ***Make penetrometer measurements –*** to measure the degree of sediment compaction at sites where sediment height monitoring rods are installed.
7. ***Measure water clarity –*** to compare tributaries and how water clarity changes as a result of sediment remobilisation at different places within the estuary.

Comments

- Similar to WETMAK in providing several options for communities to monitor changes in an ecosystem.
- Succinct brochure-like guide is colourful, well-illusrated and easy to use by community groups with clear objectives and methods for each aspect.
- Includes both subjective assessment of habitat condition and quantitative data collection.
- Scope to use as model for developing factsheets on monitoring of coastal dunes by community Coast Care groups.

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6. MEASURING SUCCESS OF SAND DUNE REVEGETATION

Title: Measuring success. Guidelines for the management of sand dune revegetation programmes.
Authors: Elizabeth Miller and Thomas Paul
Date: 2007
Source: Miller and Paul (2007)

Purpose

This bulletin offers guidelines for procedures that will contribute to successful revegetation projects. It explains the need for monitoring and shows how it can be used to indicate cause and effect in vegetation management.

Monitoring methods

Sections cover the following areas relating to monitoring of sand dunes with a focus on restoration using native plants. These are:

- Importance of developing a management plan;
- Importance of monitoring;
- Importance of site information;
- Assessing factors that influence plant growth;
- Assessing the influence of plants on the environment;
- Assessment of plant cover; and
- Management of data.

Field sheet templates are appended for general site description, monitoring plant cover and plant measurements.

Comments

- A well-illustrated guide produced for community Coast Care groups interested in monitoring restoration projects with practical methods for assessing vegetation cover and plant performance.
- Provides a rationale for assessing the status of sand dune vegetation and the factors that influence it.
- Stresses the importance of using consistent objective methods for obtaining quantitative observations or data on plant growth and factors influencing plant growth.
- Presents a logical order of methods required to undertake monitoring including developing a plan, measuring site factors, assessing plants and managing data.
- The bulletin will be useful in the development of fact sheets on community-based monitoring of restoration projects on coastal dunes using native plants.
- Appended field sheet templates provide useful layouts for recording observations and measurements, although some aspects are likely to be too detailed for some community groups.

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7. GUIDELINES TO MONITORING RESTORATION PROGRAMMES

Title: Guidelines to the development and monitoring of ecological restoration programmes
Authors: I.A.E. Atkinson, Ecological Research Associates
Date: 1994
Source: Atkinson (1994)

Purpose

- This report provides some guidelines for maximising the biological effectiveness, and therefore the cost effectiveness, of terrestrial restoration programmes undertaken by the Department of Conservation.
- An assessment of the Department of Conservation's current restoration programmes considers their extent, goals and objectives, methods, monitoring, problems, and successes.
- Success of a programme often cannot be judged until the final phase of the programme, but progress and success can be measured by the achieving of some specific objectives that can be quantified.
- Systematic monitoring is necessary, but the process should be kept simple so monitoring is not disrupted by changes in staff.

Systematic monitoring

- An effective procedure for evaluating progress and success of a restoration programme will not be possible without systematic monitoring.
- Unless appropriate objectives are quantified , there is no reliable baseline against which to measure progress. The baseline for monitoring must be derived from objectives such as major component and other target species to be established, alien species to be controlled or eradicated, and physical/chemical conditions to be modified or replaced.
- A baseline can be derived from studying the conditions in the surrounding undisturbed ecosystems.
- A simple robust procedure will require estimates (and sometimes mapping) of the numbers of adult plants or animals in a population, together with sampling of the

age class distribution as an indication of the extent of recruitment to the adult population.
- Counts of adults may be the only practical way of judging whether the species is maintaining itself from year to year.
- Important as monitoring is, if the procedure becomes too complex and, therefore, too demanding of time, it will not be done.
- Photopoints should be established at vantage points, both outside and inside the restoration site.
- The qualitative information gained is limited mainly to changes in plant cover, but it can prove an invaluable back-up for other monitoring and a powerful educational and public relations tool.
- Monitoring control and eradication, changes in physical/chemical conditions, non-target effects, as well as educational, scientific, and recreational use, are as important as monitoring populations of native species.
- No programme should be judged by one or two parameters alone.
- Systematic and comprehensive monitoring will give a more accurate picture of the extent to which objectives, and ultimately goals, are being met.
- It is necessary to standardise and properly record the monitoring procedure used in any particular programme. This allows different staff over a period of time to continue the monitoring in a repeatable manner.
- Written instructions for monitoring should be prepared for each restoration programme so that monitoring is not disrupted by changes of staff.

Comments

- While this report is aimed at staff of the Department of Conservation, it is a very useful review of the principles of monitoring of restoration projects by Ian Atkinson who has had a well-regarded career in ecological restoration.
- He clearly indicates the need for systematic monitoring to effectively monitor the progress and evaluate the success of restoration programmes. For example, counts of individual plants may be the only practical way of judging whether a species is maintaining itself over time.
- He also indicates a role for qualitative information to monitor changes in plant cover such as use of photopoints.
- However, he also stresses the importance of keeping procedures simple otherwise it will not be done.
- Need for monitoring programmes to be flexible so that they can be adapted to the range of different sites.
- A range of key principles and practical ideas that is relevant to the development of a monitoring system for coastal dunes and adaptable for local community use.

OTHER MONITORING GUIDES, TOOLKITS AND PUBLICATIONS

There are numerous websites, scientific papers and reports related to monitoring or assessing vegetation with potential relevance to coastal dune vegetation. These use various methods for quantifying vegetation cover and composition, some of which may be useful in developing community-based monitoring guidelines for coastal dunes. References or sources are provided for detail on methods used.

A sample of these information sources is provided.

STEP-POINT METHOD (Atkinson 1985)

- Method developed by Ian Atkinson for surveying the vegetation of Tongariro National Park that includes open vegetation communities on dunes.

Sampling method

- Vegetation types were distinguished on aerial photos, e.g., forest, tussock-shrubland, open communities.
- The sample lines or traverses were positioned to ensure an adequate sampling of each appearance type; some traverses crossed boundaries between them.
- Distances between grid lines were about 3 km; where the vegetation was more variable, distances between traverses were reduced to less than 1 km and increased by up 4 km where vegetation more homogeneous
- Both starting points and bearings of traverses were predetermined from the aerial photos before going into the field.
- To minimise personal bias, samples were spaced regularly by pacing (200, 300, or 400 paces) between samples along the line of the traverse, usually 10 samples per traverse.
- All effort was made to maintain inter-sample distances as nearly alike as possible for each traverse

Parameters measured

- A variety of physical and biological parameters were recorded at each sampling site so that vegetation composition and the presence of vertebrate animals could be related to site factors where appropriate.
- In non-forest vegetation, point intercepts were used to estimate the percentage crown cover of each species in the canopy layers. In tussock-land, shrubland, and open communities, these were obtained using a step-point method in which the uppermost plant crown at the centre-point of the toe of the boot was recorded at every pace along two parallel lines each 25 paces long and spaced 10 paces apart.
- In dense scrub, the uppermost plant crown above a short pointed stick, held at arm's length and at right angles to the direction of travel, was recorded at every pace along a single 25-pace line.

Comments

- This method for assessing vegetation cover includes dunes of wind-blown volcanic sand with vegetation stature and geomorphology similar to those of coastal sand dunes.
- Includes both a descriptive and quantitative assessment of vegetation cover and physical parameters.
- Scope to develop a similar rapid step-point method along transects for as part of a coastal sand dune monitoring system suitable for community use.
- Practical methods described will be useful in developing a guide for monitoring the status of coastal sand dunes.

VEGETATION DESCRIPTION USING TRANSECTS (Brown 1978)

- Within a 3.5k m stretch four transects were laid across Farewell Spit.
- A general description of the vegetation patterns was given and the potential for the development of coastal scrub was discussed.

Sampling method

- A series of four transects was made across the spit from south to north; transects were up to 500 m long.
- Each transect was started at the southern edge of the spit (immediately above the driftline) and was continued northwards until unvegetated shifting sand was reached; bearings were taken by compass.
- A two-metre wide strip of vegetation was studied on each transect.

Parameters measured

- Species frequencies were estimated on the basis of percentage cover:
    - dominant >40%
    - abundant 30-40%
    - common 15-30%
    - occasional 5-15%
    - rare <5%
- A stylised profile for each transect was drawn
- A description of the vegetation cover along each transect was tabulated at variable distances along the transect governed by change in dominant species cover and species frequency.

Comments

- An example of many descriptive studies of ecosystems using transects and cover estimates.
- Transects not permanently marked as there are no plans for many of these types of descriptive studies to re-assess vegetation cover at the same location to monitor change over time.
- Broad categories used for estimating percentage cover of vegetation are subject to observer bias.

SAND DUNE INVENTORY OF NEW ZEALAND (Partridge 1992; Johnson 1992)

- A one-off inventory of sand dunes and beaches in New Zealand carried out during the late 1980s and early 1990s by Trevor Partridge (North Island) and Peter Johnson (South Island).
- Aim was to determine priorities for conservation and highlight degraded and less modified beach and dune systems nationwide.

Sampling method

- At each site, structural and vegetation features were recorded using a standardisd format.
- Each site was rated on a number of criteria – diversity, natives, modification, weeds – the total giving an indication of those areas with greatest botanical value for conservation.

Rating system

- A subjective rating system was used at each site across a number of criteria – diversity, natives, modification, weeds – the total giving an indication of those areas with greatest botanical value for conservation.
- Beach sites were ranked according to the following values: 0 for low value to 5 for high value. Scores were totalled to give an overall score out of a maximum of 20.
- The criteria evaluated at each site were:
    - ***Diversity*** – Included communities and landforms. Systems that have extensive vegetation sequences and/or diversity of dune land forms score highly.

- ***Natives*** – Number or proportion of native sand species, or good representation of characteristic or rare dune species.
- ***Modification*** – Degree of human or animal interference in the system. Unmodified dunes score highly.
- ***Weeds*** – Degree of invasion by weed species. Those without weeds score highly.

Comments

- A rapid, mostly descriptive method for assessing dune health, although scoring system is simple and easy to use.
- Likely to be considerable variation in quality of data (as noted by authors) due to observer bias in subjective assessments of criteria and fragmentary nature of site inspections.

BIODIVERSITY ON-LINE

This site provides information about Aotearoa New Zealand's native biodiversity, what is being done to help conserve and manage it, and who is involved. Ecological management guides listed include:

- Protection and restoration guides (including regional)
- Managing weed and animal pests
- Indicators and monitoring
- Care codes

Source: http://www.biodiversity.govt.nz/resources/guides/ecological.html#indicators

Comment

- One part of this website provides a useful checklist of what is available in New Zealand on monitoring guides across a range of ecosystems.

Relevance to coastal site monitoring

The monitoring toolkits, handbooks and guidelines reviewed can for the most part be placed into one of two categories. These are:

1. Monitoring systems with a high degree of detailed methodology and complexity of data collection required for assessing complex interactions and changes that require for the most part skilled operators; and
2. Community-focussed monitoring systems with practical methods for collection of data and interpretation at a broader level that is relevant to rapid assessment of habitat condition and restoration initiatives undertaken.

A major difference between the two approaches was the focus on quantitative data collection on ecosystem characteristics and condition for agency and professional monitoring systems in contrast to more subjective descriptive data collection methods for community-based monitoring guides aimed at collecting selected data relevant to community groups.

An evaluation of monitoring methods

While the review covered monitoring guides and toolkits for use in a range of ecosystems – wetlands, riparian areas, estuaries, coastal dunes – most included similar elements essential for effective collection of monitoring data that can be used in the development of a community-based monitoring system for coastal sand dunes in Northland and elsewhere in the country.

For assessing the current dune health or condition, essential components of a monitoring system relevant to coastal dunes with a focus on the coastal vegetation cover and dune form which could be used in a community-based dune monitoring system include:

- The use of aerial photographs to map vegetation cover and to determine changes in vegetation type and characteristics;
- Use of a history or a site sheet for each site and restoration project to record site characteristics, and relevant historical information and previous work undertaken;
- Establishment of photopoints to monitor change over time using methods to allow accurate comparison of 'before and after' images of representative sites or highlight particular features;
- Basic quantitative methods for recording any invasive weed and pest animal presence;
- Basic quantitative methods for estimating vegetation cover by species and density across the coastal gradient from foredunes to backdunes;
- Field sheets for recording field data;
- Methods for data entry and storage, analysis and interpretation with options for community input and collaboration with council staff in provision of useful results.

Essential components relevant to developing a monitoring system for restoration activities such as planting and weed and pest animal control include:

- A restoration plan that will allow monitoring of work undertaken, such as using a planting pattern enabling planted native seedlings to be traced for determining performance by species and site;
- Use of a history sheet for recording site information and restoration activities including site identification, Coast Care group, site preparation, planting date, species planted, planting pattern, plant identification system, weed and pest animal control undertaken, etc.
- Providing measurement guidelines for assessing performance of planted natives including survival, plant height, canopy spread, stem diameters and plant vigour or health.
- Set up of photopoints to monitor performance of restoration initiatives over time such as establishment of planted natives using 'before and after' images at key sites;
- Providing fieldsheets for recording field measurements;
- Methods for data entry and storage, analysis and interpretation with options for community input, and collaboration with council staff in provision of useful results.

Community workshops

The three field-based workshops held with representatives of local Coast Care groups were:

1. 18th March and 13th May 2013 at Ruakaka, south of Whangarei, east coast Northland, with the Bream Bay Coastal Care Trust.
2. 20th March and 15th May 2013 at Ahipara, 90 Mile Beach, Far North, west coast Northland with the Ahipara Community Coast Care Group.
3. 21st – 22nd March and 14th May 2013 at Rarawa Beach, north of Houhora, Far North, east coast Northland with Friends of Rarawa (FOR).

Each site was visited twice with the discussions focussing on collating their ideas on the development of a community-based monitoring programme and where practical testing the practicality of selected methods that could be implemented by Coast Care groups in collaboration with managing agencies such as NRC.

Current monitoring by coastal communities

Existing monitoring carried out by community based Coast Care groups in Northland was wide ranging and included:

- Taking of photographs of restoration activities and outcomes; generally informal with no fixed points and no regular programme of monitoring vegetation changes over time; early photographs (e.g., those displayed in local Surf Club buildings) sometimes used to indicate historical status of beaches and dunes including vegetation cover.
- Monitoring of predator tracking and trapping lines on some coastal sites where focus is on protection of dotterel and other native wildlife; includes well established record systems and compilation of data (e.g., predator trapping at Rarawa Beach).
- Observation undertaken on an irregular basis by some groups of weed invasion only of high-profile exotic plants such as wattle, pampas and gorse; no formal recording or quantitative assessment of weed invasion; some exotic species such as South African iceplant at some sites (not all) are not considered a priority for removal from foredunes and are therefore of little interest for monitoring.
- Annual observations of damage from pedestrian beach users particularly in high-use areas with most concern resulting from sand movement due to wind resulting from loss of vegetation cover; no formal community-based monitoring of beach use and consequences for dune form and function other than input into programmes run by NRC, DOC or other agencies.
- Observations and collaboration with NRC and other agencies such as safety issues with the police in the use of vehicles on beaches; no formal monitoring of damage caused by vehicles on beaches including indiscriminate use of motorcycles on backdunes.
- Observational information on erosion of foredunes by storms and associated damage by human use, sand movement over carparks and around other infrastructure such as Surf Club buildings; no formal recording or monitoring undertaken by communities;
- Observations of vegetation cover and condition of habitat for key native bird species such as dotterels and oyster catchers, e.g., Friends of Rarawa Beach;
- Feedback to agencies (NRC and DOC) based on observations by community coastal groups at loss or dieback of key/high profile native species such as pingao;
- Largely informal observational methods of monitoring of survival of planting programmes; there was no formal recording of planting and success, use of plots, measurement of plants, etc and therefore no followup to changing future restoration initiatives other than that undertaken by the Coast Care coordinator/NRC staff.

Community monitoring requirements

As a result of these field inspections and discussions with community representatives at each site, the following ideas and community requirements for monitoring on coastal sand dunes are presented at a broad level. These ideas were also supported by wider consultation with staff of NRC, DOC, and community and agency representatives in other regions, and with discussions held with trustees and members of the Dune Restoration Trust of New Zealand.

- ***Basic methods***
    - Overwhelming support for ensuring that any monitoring systems developed for community participants is kept basic and easy-to-use;
    - A range of monitoring options from basic to advanced could be provided for Coast Care groups to uptake at a level that suits their competencies and resources;

    - Any monitoring has to be meaningful in terms of providing data of direct use and relevance to Coast Care groups involved in dune restoration programmes and assessing dune form and function.
- **Quantitative methods**
    - Less support for intensive monitoring options such as quantitative techniques used in a range of ecosystems, e.g., monitoring change over time using plots and transects;
    - Most participants indicated that most groups would not have the time for or commitment to a detailed monitoring programme such as using standardised methods for collection of quantitative data;
    - Coast Care members would be happy to assist council or other agency staff in monitoring programmes on dunes that involved detailed monitoring techniques (not a community-based monitoring system).
- ***Responsibilities for monitoring***
    - There was uncertainty as to whether monitoring should be undertaken or coordinated by Coast Care groups or by managing agencies such as the regional council, or both.
- ***Participation of youth***
    - Substantial interest by community members in supporting involvement of schools and tertiary institutes (e.g., NorthTec) in monitoring of dunes and in particular planting programmes;
    - Some Coast Care groups are already involved in supporting schools in dune planting projects, but none are involved in monitoring;
    - Realisation by community members that school involvement is largely reliant on enthusiasm, time and resources of participating schools.
- ***Support from councils***
    - Many workshop participants expressed interest in the continuing input and support from the Coast Care Coordinator or staff of managing agencies in implementing and managing a community-based monitoring system;
    - Support for proposed factsheets to be produced by NRC, as hard copy and online via the NRC website, on methods and options for community groups to implement and undertake monitoring programmes.
- **Providing information and resources**
    - Community groups would require techniques to set up basic monitoring methods, e.g., how to set up permanent photopoints, undertake survival counts by species and site type, carryout plant measurement methods (height, canopy spread, stem diameter, plant vigour).
    - Equipment required – tapes, species ID charts, fieldsheets.
- **Data processing and feedback**
    - Workshop participants were concerned at what to do with the data collected during monitoring;
    - They indicated the need for a data processing system and community roles and options for data entry, analysis and interpretation;
    - Call for user-friendly systems for direct feedback of results from community monitoring programmes back to Coast Care groups to allow improvements in future restoration initiatives and improved understanding of dune form and function.

Monitoring options

Development of detailed methods for community-based monitoring of coastal dunes is beyond the scope of this report.

Two areas of coastal dune monitoring of interest and relevance to Coast Care community groups are:

1. monitoring dune condition/health, and
2. monitoring restoration programmes.

Monitoring dune condition and health

A community-based method is required for determining current dune condition or health of coastal dune systems. This entails:

- Allowing community groups to assess and determine a range of factors such as the degree of natural character of their beach and dune systems including status of indigenous biodiversity, the influence of human disturbance from beach users on their dunes including impact of access, the impact of browsing by rabbits, and the invasion by weeds;
- Providing communities with an understanding of natural dune form and function and in particular, the gradient in environmental change from seaward margins of their dunes to landward and the importance of coastal zonation in dune form and function and vegetation cover including species composition and abundance.
- Providing community groups with data that has been systematically gathered to determine the current status and health of their dune systems and the potential to recognise key areas of degradation and threats and allow them to determine and prioritise restoration options.

Monitoring of the current status of dune condition in effect provides a baseline to determining changes over time including the effect of any restoration programmes that may be undertaken such as controlling weeds and pest animals or restoring the vegetation cover by planting native seedlings.

Monitoring restoration initiatives

Community Coast Care groups in collaboration with the NRC and other agencies are involved in numerous aspects of restoring degraded dunes most often focussing on controlling invasive weeds, managing access and facilities at high-use beaches, and planting native seedlings. Methods for monitoring such restoration initiatives by community groups are required to:

- Determine maintenance requirements such as timely weed control for planted natives.
- Provide a systematic method for recording the success or otherwise of restoration projects to determine whether restoration goals are being met.
- Based on monitoring data, providing Coast Care groups and NRC with opportunities to change approaches for future restoration activities and improve outcomes.

Most interest from community feedback in the workshops was for methods to assess the effectiveness of restoration works with an emphasis for rapid user-friendly assessment methods.

Conclusions

Most monitoring of dune condition and vegetation cover undertaken by community Coast Care groups is based on non-quantitive observations by members. This often anecdotal information is sometimes collected over long timeframes and over substantial areas of dunes and beaches, but seldom formally recorded other than, for example, comparing earlier photographs with current states of the dunes. Little quantitative data is collected on a formal or regular basis, especially on vegetation cover on coastal dunes or on monitoring the performance of restoration programmes.

Feedback from community members during the workshops clearly indicate that many involved in Coast Care groups are already very busy with restoration activities such as planting and weed control progammes. These restoration programmes are well established on many beaches in Northland where Coast Care groups are operating in collaboration with NRC and on some sites with input from DOC and district councils. Most Coast Care representatives indicate that there are too few group members participating regularly enough to provide substantial and sustained input into a major programme of monitoring on their coastal dunes.

There is overwhelming support for some monitoring of coastal dune condition and restoration activities. There is also support for community involvement in monitoring with most keen to be involved in implementing and contributing to a basic rapid monitoring systems that can be operated and used by community groups. The resounding message from community representatives already involved in coast care is that a monitoring system has to be practical and rapid. As stated by Atkinson (1994):

> ***Important as monitoring is, if the procedure becomes too complex and, therefore, too demanding of time, it will not be done.***

Of interest to communities are basic methods for determing the status of their dune systems, whether restoration activities are achieving their restoration goals, and key threats that may be looming, such as invading weeds or consequences of increased human use. Communities require direct feedback on their monitoring efforts, so the challenge will be to develop methods to process community-gathered data and provide relevant and meaningful results to assist in planning their future restoration activities.

For community participation in quantitative data gathering, it may be best to develop a range of options from basic to more advanced methods of monitoring similar to that provided for wetlands using WETMAC (Landcare Trust 2012). Providing short colourful and well-illustrated factsheets with a range of monitoring options such as that developed for estuaries by NIWA is a likely practical option for monitoring of coastal dunes by Coast Care groups.

Developing a community-based monitoring system for coastal dunes will also provide the opportunity for participating groups to learn of the environmental gradients and differences in vegetation pattern and sequences, and the characteristic zonation of coastal dunes. As supported by Coast Care groups, embracing the younger generations in coastal dune monitoring programmes through the involvement of local schools, Te Wānanga o Aotearoa and other tertiary institutes provide another exciting opportunity.

A further challenge is the development and promotion of community-based monitoring of coastal dunes at national level to allow comparisons between sites and sharing of information on monitoring methods and success of restoration and management programmes. This is an initiative that the Dune Restoration Trust of New Zealand is currently exploring in collaboration with regional councils and Coast Care groups nationwide.

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Appendix – Edited selected extracts from monitoring guides

1. WETLAND MONITORING HANDBOOK

Title: **Handbook for monitoring wetland condition. Coordinated Monitoring of New Zealand Wetlands**
Authors: Beverley R. Clarkson, Brian K. Sorrell, Paula N. Reeves, Paul D. Champion, Trevor R.Partridge, Bruce D. Clarkson
Date: June 2003, revised October 2004
Source:
http://www.landcareresearch.co.nz/publications/researchpubs/handbook_wetland_condition.pdf

Scope and objectives:
This handbook describes a set of science-based indicators that have been developed to monitor the condition of New Zealand estuarine and palustrine wetlands. It has been designed for managers, landowners, community groups and anyone else with a need to monitor the condition of wetlands.

The handbook specifically covers:

- The approach and process involved in developing the indicators
- A detailed description of each indicator and how to assign a value and tally
- scores to analyse the results
- How the indicators can be used to answer a range of monitoring questions
- How the science-based indicators relate to the other objectives and products of the Co-ordinated Monitoring of New Zealand Wetlands Project

Development of indicators
The development of wetland condition indicators is part of a wider project to develop tools for consistent monitoring of New Zealand wetlands. The project is linked to the Environmental Performance Indicator Programme being run by the Ministry for the Environment.

The indicators that have been developed follow the international trend of using soil and vegetation characteristics as the most important indicators of wetland condition. Five semi-independent indicators of current state (condition) have evolved during trials in different wetland types throughout New Zealand. They are based on major threats and stress factors known to damage wetlands.

The wetland condition indicators are:

- Change in hydrological integrity.
- Change in physicochemical parameters.
- Change in ecosystem intactness.
- Change in browsing, predation and harvesting regimes.
- Change in dominance of native plants.

Hydrology is probably the single most important determinant of the establishment and maintenance of specific types of wetlands and wetland processes.

Scoring of indicators at wetland and plot scales
Each indicator comprises a number of components, scored using a semi-quantitative technique that enables assessment of the degree of modification that has occurred. The numerical scoring system is used to score indicators at both a broad wetland-wide scale and a more detailed plot scale to cater for differences in scale and monitoring requirements, and to underpin scores with quantitative scientific data. The plot-based

approach involves detailed field reconnaissance (recce), ground-truthing, selection of representative plots and collection of data to allow assessment and scoring of indicators.

Each indicator component is scored on a scale from 0 to 5, with 5 representing the unmodified or best condition and 0 representing the most degraded condition. A 'Specify and Comment' column provides information on the reason a particular score has been given so it can be recalled at a later date. This is essential if the scoring system is to be used to monitor change in condition over time, which is its main function. The scores are based on observations made and data collected during site visits and from knowledge/data about the site already available.

Wetland Plot Sheet

The Wetland Plot Sheet (Table 3) has three main components:

- The first section is for recording plant species presence, abundance (cover), and height within the various vegetation layers
- The second section is for determining indicator scores
- The third section is for recording physical and chemical parameters measured either in the field or from laboratory analysis of substrate and foliage samples

The plot sheet also has fields for recording location details, the field team leader, vegetation structure and composition, additional species in the vicinity growing in the same vegetation type, and other comments about the site.

Permanent plots are used, as they detect changes in condition at specific locations and yield quantitative data on biotic, physical, and chemical parameters. The plots are established in each of the main vegetation types within a wetland so that species/ environmental relationships can be characterised.

Vegetation types are determined at an appropriate scale during an initial mapping phase. In practice this may involve a simple pre-assessment of the number and extent of the main vegetation types using aerial photographs, high vantage points, and prior knowledge. Large wetland complexes may be pre-classified into separate wetland classes.

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Plot locations are selected on the basis that they are a representative sample of the typical plant community within the vegetation type, e.g., characteristic species composition, uniform habitat, and plant cover as homogeneous as possible with no obvious community boundaries. A minimum of one plot per major vegetation type is suggested, although replicate sampling is preferable, particularly in the early stages of the survey when expertise is still developing. In addition, if the ecological pattern is heterogeneous, or a mosaic of vegetation types, an attempt should be made to sample the variation, by establishing several permanent plots.

The plot sheet can also be used as a basis for more intensive monitoring, with other components added as required, e.g., 5-minute bird counts, invertebrate sampling, photo-monitoring points.

A plot size of 2m x 2m (4m2) is suggested as this satisfies minimal sample area requirements for relatively short (<2m) and/or homogeneous wetland vegetation. During the field trials, this plot size proved to be relatively quick to sample, with minimal trampling or other damage because virtually all parts could be accessed from outside plot boundaries. However, in taller and more diverse vegetation, an area of 4m2 may not adequately represent the community species composition, and minimal area and/or running mean methods may need to be implemented to determine a more appropriate sample size. The sample size will not affect comparisons between plots because vegetation indicators are based on relative measures such as % cover.

Methods

Pre-sampling

- The first step is to determine the different vegetation zones or types present in the wetland appropriate to desired scale – using aerial photos, high vantage points and field reconnaissance

Plot establishment

- Within each vegetation zone, select an area typical of the zone and then randomly choose the starting point of a permanent plot (e.g., using random number tables).
- Mark out the 2m x 2m plot (or a pre-determined larger area) using a tape measure. Permanently mark the four corners, e.g., with fibreglass (stock poles), wooden or plastic poles.
- Fill in GPS coordinates and altitude.
- Fill in III Structural class and IV Composition according to wetland classification

Vegetation sampling

- Decide on the number of vegetation layers (1, 2 or 3) represented in the plot. In all vegetation stands there will be at least one layer: canopy. If there are two layers, these will be canopy and groundcover.
- Estimate % cover for each of the canopy species (in top layer, i.e., bird's eye or aerial photo view) within the plot, regardless of whether rooted in the plot or not. If there is a canopy break, bare ground and litter are included (and recorded) in the canopy layer, not the groundcover layer. The total canopy cover (vegetation and substrate) should be 100%.
- Measure height of tallest individual of each species based on foliage, not seed or flower heads.
- Estimate % cover of each species in the remaining vegetation layer(s) as described above. The total % cover for each of the understorey layers will virtually always be less than 100%.
- Indicate all introduced species by using an asterisk (*).
- List any species in the vicinity that are growing in the same vegetation type (or zone) and were not encountered within the plot. Any notable species, e.g., threatened species, encountered on the way to the plot can be included in the Comments section.

Other sampling

Guidelines are provided for collecting substrate cores for bulk density and nutrient analysis, foliage samples for analysis of N, P and K, and measuring the height of the water table.

Calculating data

Methods for calculating vegetation-based plot indicator scores and condition index is provided in the Handbook.

Analysing change

Suggestions are provided for analysing change in condition over time at different scales and within different layers of the classification system (as in Phase 1). The monitoring framework used may be representing change in condition over time using bar graphs or radar charts. Such analyses can be used to determine priorities for wetland management.

2. STREAM HEALTH MONITORING AND ASSESSMENT KIT (SHMAK)

Title: **Stream health monitoring and assessment kit**
Authors: Developed by the National Institute of Water and Atmospheric Research (NIWA) in partnership with Federated Farmers of New Zealand.
Date: June 2003, revised October 2004
Source: http://www.niwa.co.nz/our-science/freshwater/tools/shmak

Purpose
The New Zealand Stream Health Monitoring and Assessment Kit (SHMAK) has been designed for use by farm families and others in New Zealand to monitor the "health" of the streams that flow across their land. It allows farmers to keep a record of long-term trends (i.e., whether streams are improving, degrading or staying the same) and also of short-term impacts. It provides a way to help farmers to assess whether their land use practices are affecting waterways. The methodology is also appropriate for community groups, Fish and Game officers, regional council field officers, or anyone wishing to obtain a general indication of the ecological health of rural streams.

The function of SHMAK is not to replace more formal methods of stream health monitoring. It is an additional tool to allow greater community participation in the process."Stream health" refers to the condition of the whole waterway. Monitoring stream health involves looking at not only water quality but also the physical features of the stream and the plants and animals living there."Monitoring" means making a standard set of measurements and observations at regular intervals (for example, every month) and keeping records of the results so that they can be compared over time.

The "Assessment" part of the kit involves assigning scores to each monitoring result and then using the scores to determine the condition of a stream. These scores are compared over time to see whether stream health is changing. This provides an opportunity to make management changes if necessary and then to see how effective such changes are in improving the stream.

Types of data
The data collected using this kit fall into three categories:

- Biological data – based on common and easily recognised "indicator organisms" which are known to be characteristic of certain stream health conditions;
- Data about the stream habitat – measurements and observations of conditions at a monitoring site;
- Land-use and farm management data which are required for interpretation of the stream assessment result, and cover both the area immediately upstream of the site and the whole stream catchment.

Contents of the kit
The kit consists of:

- Stream Monitoring Manual, which includes:
- Guidelines on how to plan and set up a stream monitoring programme;
- Data sheets for recording monitoring results;
- Instructions on monitoring procedures;
- Illustrations to help you recognise different stream plants and animals;
- Guidelines on how to use monitoring information to assess the health of your stream;

- Extra information about the monitoring process, including the scoring system, and some suggestions on how to improve streams that are not healthy;
- A directory of useful contacts and further reading;
- A set of equipment for setting up sites and collecting data.

It is being promoted for use in rural communities by the NZ Landcare Trust. The projects have been partly funded by the Ministry for the Environment's Sustainable Management Fund.

Monitoring forms

Sample monitoring forms are provided including:

- Site register - a record of all the sites on your property
- Site photographs - a record of all photographs taken at monitoring sites
- Stream monitoring forms for recent flow conditions, recent farm conditions and activities, and habitat quality
- Stream-bed life
- Monitoring record
- Stream assessment worksheet

Assessment of bank vegetation

- The kit provides method for describing stream bank vegetation along each bank up to 5 metres wide and parallel to the water's edge.
- Percentage cover is estimated by vegetation category on each bank to the nearest 5%.
- Categories of vegetation are broad and are based on their primary stream functions are as follows:
    - Native trees.
    - Wetland vegetation.
    - Long tussock grassland, not improved.
    - Exotic hardwood trees.
    - Other exotic trees (conifers).
    - Scrub.
    - Short tussock grassland, improved.
    - Rock, gravels.
    - Pasture grasses and weeds
    - Bare ground (soils, clays)
    - Buildings, yards, roads.

3. WETLANDS MONITORING AND ASSESSMENT KIT (WETMAK)

Title: **Wetlands monitoring and assessment kit**
Authors: New Zealand Landcare Trust
Date: 2012
Source: http://www.landcare.org.nz/wetmak

Purpose
WETMAK is an online resource aimed at community groups working on wetland restoration projects in New Zealand. WETMAK provides advice on useful monitoring techniques and methods of assessing the impact of your restoration work. The kit is available in different formats and can be download as entire resource or alternatively as specific modules. The NZ Landcare Trust also runs WETMAK Training Days to provide a practical introduction to the kit.

Modules
WETMAK is made up 6 independent modules. This allows the choice of a module or modules to suit the site or restoration programme, skills and budget.

1. ***Creating a management map***
   - To show volunteers/staff where features of interest are, e.g. monitoring plots, hazards
   - Basic Once, update as needed
2. ***Photopoints***
   - Visual record of change in your site, great way to show how much you have achieved
   - Basic Yearly, at the same time each year
3. ***Wetland 'WOF' check***
   - General 'health' check based on a range of information and range of factors, to highlight areas of potential concern. Walk around the wetland edge to look for threats, e.g. stock access, weed incursion, dieback
   - Intermediate to AdvancedEvery 5 years, or as need arise (e.g. after a major flood or similar event).
4. ***Mapping Wetland Vegetation***
   - Big-picture birds-eye view of your site, allows you to see incremental change in vegetation cover
   - Intermediate Every 10 years or so (as often as new aerial photos are available)
5. ***Weed survey***
   - To detect weeds before they take hold, to measure success of weed control works
   - Intermediate Yearly, in summer, indefinitely
6. ***Vegetation plots***
   - Detailed study of the plant cover , height and species diversity and mix of natives and exotic plants
   - Advanced Every 5 years

- The current version of WETMAK (July 2012) does not include techniques for monitoring fish, pest animals, birds, invertebrates, soil, hydrology or water quality. These may be added as further modules in the future.

- As you become comfortable with each technique you can start combining them. For instance, while you are doing your perimeter walk you can also do a weed

survey at the edge, set up edge photopoints, and maybe even have your field buddy collect wax tags or tracking tunnels previously laid out to detect pests.

Reviewing available data

- Start your monitoring before you lift a spade. This gives you 'baseline' or 'before' data against which to track the results of your work. Gather as much data on the current state as you can:
    - Lists of native plant, fish, bird, insects and other species
    - Lists of non-native species
    - A map of each type of habitat: open water, each vegetation type (e.g. raupo reedland, kahikatea forest) – if none exists, use the WETMAK Mapping Vegetation module to create one
    - Information on the water source, type and levels
    - Extent of the wetland subject to e.g., stock damage, fire damage, vegetation clearance
    - Photographs of a range of vegetation types from fixed photopoints
- If you have already started on your restoration project find out if anyone, e.g. the landowner, local council, or DOC office, has any 'before' or early 'during' photos or data, see if you can follow their methods.
- Alternately, you can compare the part you are restoring with a similar area that you haven't yet started (remembering to set up monitoring there before you start!), or with areas you aren't able to restore (e.g. because it is on another property within the same wetland).

Preparing a monitoring plan

- Wetland restoration work should be guided by a management or project plan that outlines your agreed vision and objectives for the site.
- A simple monitoring plan should be included as part of your project plan. It will allow you to measure progress against each objective.
- List the objectives in your wetland management/project plan, and then what, how, when, and how often you will monitor.

Deciding what to monitor

- Your wetland plan will clarify which modules are relevant to your restoration objectives. The modules will guide you in what indicators to monitor, but you may wish to extend this to include Māori indicators and general record keeping.

WETMAK datasheets

- Any form of monitoring requires collecting (and usually writing down) information (data). Using a standard form (also called datasheets, field cards, or field sheets) will ensure you collect all the information you need, every time.
- Blank datasheets for all of the monitoring methods are available as part of this kit. Completed (mock) examples are presented with each method.

Storing the data

- Ensure that the information collected is safely stored where others in the group can find it – ideally in several formats and locations so you have backups.
- Link the data to a map showing the location of plots/ photo points etc.

Analysing the data

- Collecting the data is just the beginning. You need to make sense of it and turn it into useable information that can tell you how your restoration project is going. Each module will have tips on how to analyse the data. For the first report you will have no trend or previous monitoring data to compare so your report will focus on the current state of the wetland.

Preparing reports

- At regular intervals, depending on how often you collect data, all the monitoring information should be compiled into one report.

Re-measuring the data

- Monitoring is a regular exercise to compare change over time. Repeat data will be required to undertake some of the analysing and reporting listed above.
- Each module has a recommended re-survey period, e.g. annual, 5-yearly, 10-yearly.

4. DUNE VEGETATION MAPPING AND CONDITION ASSESSMENT, TAURANGA ECOLOGICAL DISTRICT

Title: Sand dune vegetation mapping and condition assessment methods for Tauranga Ecological District
Authors: Wildlands
Date: 2008
Source:
http://monitoring.boprc.govt.nz/Reports/Wildlands-090803-SandDunemappingTga.pdf

Scope and objectives

- Environment Bay of Plenty required the mapping of the extent of coastal dunes and indigenous vegetation cover, and to capture information on selected 'condition factors' for dunes within the Bay of Plenty coastline.
- The data collected will be used for long-term monitoring of change in vegetation cover and condition.
- Wildland Consultants was commissioned to develop methods for dune mapping and condition assessment.

Methods

It was determined that three data sets need to be created:

- Extent of dunes both developed and undeveloped;
- Vegetation map of wild undeveloped areas; and
- Condition assessments undertaken along a stratified series of randomly placed belt transects.

Establishment of transects

- Belt transects were located at 1 kilometre intervals along the Bay of Plenty coastline. A walk through survey of all dune vegetation within each site was completed. This walk through survey aimed to sight and identify all vegetation types discernible on 1:1000 aerial photographs.
- A vegetation classification system for the dune vegetation observed by this survey was developed. Vegetation unit condition sheets were completed for each vegetation unit identifiable in transects with aerial photographs used to assist in identification of vegetation units using the method of Atkinson (1985).
- It is intended that the same methods and transect will be used in remeasurements to determine change in vegetation extent or cover composition.

5. MANGROVE MONITORING KIT

Title: Estuary monitoring by communities. Mangrove habitats: a case study
Authors: Anne-Maree Schwarz NIWASharon Parker, Michael Grose Waikaraka Estuary Managers
Date: 2008
Source:
http://www.niwa.co.nz/sites/default/files/import/attachments/monitoring_mangrove.pdf

Purpose
Developed for community groups to monitor mangrove habitats but the principles can be applied to a number of aspects of estuarine ecology in general. They are designed to: "provide guidance in planning a simple monitoring programme enabling community groups to increase understanding of mangrove habitat in their local estuary".

Monitoring methods
Several methods specific to monitoring mangroves in estuaries are given:

1. ***Establish permanent transects –*** to establish permanent sites where measurements can be made to understand how the distribution and character of mangroves and adjacent habitats change over time.
2. ***Record mangrove boundary characteristics –*** to measure changes in the distribution and character of a mangrove forest boundary and adjacent habitats over time.
3. ***Count epifauna (animals living on the sediment surface)*** – to characterise the animals that use different habitats within and adjacent to a mangrove stand.
4. ***Take photographs –*** to maintain a photographic record of each of the transects.
5. ***Install sediment height monitoring pegs –*** to measure rates of sediment accumulation or loss.
6. ***Make penetrometer measurements –*** to measure the degree of sediment compaction at sites where sediment height monitoring rods are installed.
7. ***Measure water clarity –*** to compare tributaries and how water clarity changes as a result of sediment remobilisation at different places within the estuary.

6. MEASURING SUCCESS OF SAND DUNE RESTORATION PROGRAMMES

Title: Measuring success. Guidelines for the management of sand dune revegetation programmes.
Authors: Elizabeth Miller and Thomas Paul
Date: 2007
Source: Miller and Paul (2007)

Purpose
This bulletin offers guidelines for procedures that will contribute to successful revegetation projects. It explains the need for monitoring and shows how it can be used of indicate cause and effect in vegetation management. The objective is to minimise effort while increasing local understanding of the influences that govern plant development on sand dunes.

Monitoring methods
Sections cover the following areas relating to monitoring of sand dunes with a focus on restoration using native plants. These are:

- ***The importance of developing a detailed management plan***
  - Defining the objectives of the programme;
  - Recognising site issues;
  - Addressing work required;
  - Ensuring resources are available and responsibilities have been assigned;
  - Ensuring appropriate methods are specified;
  - That appropriate monitoring methods and schedules are included.
- ***Importance of monitoring***
  - Defines monitoring as the basic procedure of recording change over time;
  - Measurement should be consistent and relevant to the desired outcomes;
  - Method of monitoring should be chosen to allow simple interpretation of information collected;
  - A procedure for monitoring is outlined.
- ***Importance of site information***
  - Provides the framework for the management plan and a baseline for making comparisons and evaluations in the future.
  - Useful site information includes:
    - Site location;
    - Exposure, geomorphology, site stability;
    - Site history;
    - Wahi tapu;
    - Description of existing vegetation;
    - Presence of browsing animals;
    - Presence of insects;
    - Human activity.
  - Methods for taking ground photographs are provided.
- ***Assessing factors that influence plant growth***
  - Measuring factors that are likely to be influencing plant growth including:
    - Environmental factors – rainfall, exposure/shelter, presence of other plants, dune stability, nutrient deficiency;
    - Human induced factors – browsing by introduced animals, invasion of weeds, pedestrian and vehicle use.
- ***Assessing the influence of plants on the environment***
  - Measuring site conditions before and after restoration programmes;
  - Contribution of plants to the natural character of the dunes

- ***Assessment of plant cover***
    - Methods detailed for sampling and measuring growth and condition of plants on dunes in several steps:
        - Step 1 – define the area relevant to the project objective;
        - Step 2 – define the sampling system to be used;
        - Step 3 – determine the size and shape of the sampling unit (points, plots, or transects);
        - Step 4 – determine the number of sampling units;
        - Step 5 – determine the position of the sampling units within the study site including randomly and systematically distributed sampling units.
    - Options for permanent marking/labelling sample plots and transects;
    - Measurement methods for assessing plant performance including:
        - Number of plants per unit area;
        - Proportions of different plant species;
        - Proportion of ground covered by plants;
        - Plant spread;
        - Plant height;
        - Plant health and vigour;
        - Presence of reproductive structures.
- ***Management of data***
    - recording observations, data storage, data analysis and interpretation, use of the results.

Field sheets

Templates to be used for field data collection are appended:

- ***General site description***
    - Recording information – date of measurements, personell involved;
    - Site information – location, grid references, diagram;
    - Site description – position on dune, type of beach, description of existing vegetation cover;
    - Planting information – dates, density of planting, sampling layout.
- ***Plot/transect description***
    - Recording information – date, site description;
    - Plot/transect information – plot form, plot size, transect length;
    - Photographs – table for recording image number, subject.
- ***Plant measurements***
    - Site and plot information – plot number, date;
    - Fieldsheet grid for recording plants in plots – species, suvival, abundance, plant cover, plant height, plant vigour, comments;
    - Fieldsheet grid for recording individual plants – species, plant number, plant spread, height, comments.