

available at www.sciencedirect.comwww.elsevier.com/locate/ecocon

ANALYSIS

Participation of indigenous groups in sustainable development monitoring: Rationale and examples from New Zealand

Nigel Jollands^{a,b}, Garth Harmsworth^{b,*}

^aNew Zealand Centre for Ecological Economics, Massey University, New Zealand

^bManaaki Whenua-Landcare Research Ltd., Private Bag 11-052, New Zealand

ARTICLE INFO

Article history:

Received 30 January 2006

Received in revised form

12 September 2006

Accepted 13 September 2006

Available online 30 October 2006

ABSTRACT

Over the past decade, many government policies have been aimed at the elusive concept of 'sustainable development'. Over the same period there has been a growing awareness of the need to evaluate the progress of these policies as well as the need to encourage broad community participation in that monitoring. Unfortunately, it appears the participation of one important group, indigenous communities, in many sustainability programmes (including the selection and use of indicators in their monitoring and evaluation) is limited.

This paper seeks to understand the role of sustainability monitoring and indigenous community participation in that monitoring within ecological economics and transdisciplinary research. We find that there is a strong need for sustainability indicators and a compelling rationale for indigenous community participation, both from ecological economic theory and from international and national policies. We also find that the present level of engagement of indigenous groups and communities in New Zealand in sustainability monitoring remains low, under-resourced, and uncoordinated. To improve the worldwide quality of sustainability indicators there is an urgent need to address this poor participation.

© 2006 Elsevier B.V. All rights reserved.

1. Introduction

Over the past decade, many government policies have been aimed at the elusive concept of 'sustainable development' (for example, New Zealand's "Sustainable Development Programme of Action" (Department of Prime Minister and Cabinet, 2003)). Over the same period there has been a growing awareness of the need to evaluate the progress of these policies. One tool increasingly being used for this purpose is the sustainable development indicator. Indeed, such indicators are a pervasive feature of both practical application and research literature (Jollands, 2006).

Interest in monitoring the progress of sustainable development initiatives is not the sole preserve of governments.

Community groups are increasingly interested in becoming involved in the development and implementation of monitoring programmes. This is because awareness is growing that those involved in defining the indicators control what is measured and reported.

Indigenous groups and communities are an important sector of society that have a strong mandate to be involved in sustainable development programmes, monitoring and evaluation. For example, in New Zealand Māori have a strong interest in monitoring a wide range of sustainable development policies and outcomes that impact on their communities. Further, groups such as iwi and hapū (Māori tribes and sub-tribes) are significant owners of natural resources (e.g., through settlement of Treaty claims—see below) and articulate a unique

* Corresponding author.

E-mail address: HarmsworthG@LandcareResearch.co.nz (G. Harmsworth).

URL: http://www.landcareresearch.co.nz/research/social/indigenous_index.asp.

cultural–historical connection with the natural environment. Unfortunately, like indigenous groups elsewhere, the participation of Māori in many sustainability programmes is limited.

This paper seeks to understand the importance of sustainability reporting within ecological economics research. We begin first by briefly exploring the theory behind sustainability indicators and the important role they play in ecological economics. We then explore the rationale for indigenous community participation in sustainable development monitoring before describing New Zealand's experience in this area. We use specific case studies to illustrate the lessons we have learnt from the cross-cultural tensions involved in indigenous community participation in sustainable development indicators and monitoring projects.

2. Sustainable development indicators in ecological economics

Sustainable development indicators have an increasingly important place in ecological economics. Indeed, from a theoretical perspective, the rationale for such indicators derives from three dominant themes within ecological economics — the need for policy relevance, the need for accurate and valid information on sustainability for decision-makers, and the need to link the environment and the economy.

A common theme to emerge from the literature is that ecological economics aims to be policy relevant. For example, Costanza (1991, p. 7) states that ecological economic “research should not be divorced from the policy... process, but rather integrated with it.” In other words, ecological economics is focused on the integration of economic and ecological theory specifically to aid decision-making (Proops, 1989; Edwards-Jones et al., 2000; Ruben and van Ruijen, 2001).

Ecological economics' aim to be policy relevant is achieved, in part, by providing information that can assist the policy decision-making and evaluation process. Increasingly, for policy-makers this information comes in the form of indicators. Such indicators can assist decision-makers by highlighting patterns in underlying data (Cleveland et al., 2000, p. 302). It is no surprise, then, to find a significant amount of interest in sustainable development indices in ecological economics literature.

In ecological economics, indicators are seen as one approach to put into effect the concept of sustainability and to introduce it to the policy-monitoring/evaluation arena (Callens and Tyteca, 1999; Kammerbauer et al., 2001; Button, 2002). As the United Nations Conference on Environment and Development (1992, chapter 40.4) states, “indicators of sustainable development need to be developed to provide a solid basis for decision-making at all levels and to contribute to the self-regulating sustainability of integrated environment and development systems”. Furthermore, according to Gustavson et al. (1999, p. 118), “using sustainable development as a planning goal or tool necessitates the identification of indicators that will assist policy-makers in identifying appropriate policies and in monitoring the effectiveness of policy interventions.”

Indicators are mentioned extensively throughout the ecological economic literature and are applied to a wide range of issues. For example, many recent articles in the journal *Ecological Economics* apply indicators to a range of issues, including

resource depletion (Béné et al., 2001; Herendeen and Wildermuth, 2002), tropical mountain development (Kammerbauer et al., 2001), agriculture (Pannell and Glenn, 2000), eco-efficiency (Jollands et al., 2004), sustainable economic welfare (Cobb and Cobb, 1994; Daly and Cobb, 1994; Max-Neef, 1995; Ackerman, 1997), and sustainable development (Gustavson et al., 1999).

Ecological economic theory is also clear about the criteria used to select indicators (Gallopín, 1997; Jollands, 2006). Paramount among these criteria is the need for indicators to be “formulated in terms of broad philosophical or ethical frameworks” (Jollands, 2006, p. 21). Given this criterion, it would seem ecological economic theory also suggests it is important for participation in indicator development to be as broad as possible. The next section explores this issue of participation with respect to one group of communities in particular — the indigenous communities of the world.

3. Sustainable development monitoring and indicators — participation and indigenous groups

A common theme that emerges in the literature is the need for participation by all sectors of society in indicator development and implementation (Gallopín, 1997). Such participation is important for several reasons (as outlined by Elster (1999), Fearon (1999), and Gambetta (1999)), but three relevant to this discussion are that participation:

- a) lessens or overcomes the impact of bounded rationality. That is, according to Fearon (1999, p. 49), faced with a complex problem, individuals or groups might “wish to pool their limited capabilities through discussion and so increase the odds of making a good choice” (of indicators)
- b) legitimises the ultimate choice
- c) makes for better decisions in terms of distributive justice (Gambetta, 1999). That is, participation can improve the allocation of unevenly distributed information leading to better decisions.

In the context of indicators, then, participation can potentially deliver better, more legitimate indicator sets.

Despite the advantages of participation, the involvement of some groups in sustainable development indicator work has been limited. In particular, involvement by indigenous communities in indicators has been extremely poor (Ehrlich et al., 1996; Jollands, 1998).

UNESCO defines indigenous communities as

peoples and nations are those which, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing in those territories or parts of them (United Nations Working Group on Indigenous Populations, 2004).

Such communities form “non-dominant sectors of society and are determined to preserve, develop, and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions and

legal systems” (United Nations Working Group on Indigenous Populations, 2004).

The lack of participation by indigenous communities in many areas of society has been acknowledged by the United Nations. In April 2000, in recognition of the importance of indigenous communities, the Commission on Human Rights adopted a resolution to establish a permanent forum on indigenous issues. The permanent forum was established because the United Nations felt that the participation of indigenous peoples in the United Nations was limited. The “vital role of Indigenous Peoples in sustainable development” was reaffirmed by the political declaration of the World Summit on Sustainable Development, Johannesburg 2002 (para. 25) (United Nations, 2002b). One of the areas where such participation is necessary is the use of indicators for evaluating sustainable development.

There are several compelling reasons why indigenous communities should participate in developing indicators for monitoring the sustainability of development. These reasons can be categorised below into three groups: theoretical requirements; international obligations; and country-specific reasons.

3.1. Theoretical requirements

Ecological economic theory provides a strong justification for the participation of indigenous communities in sustainability monitoring. Specifically, the ‘plea for pluralism’ (Norgaard, 1985, 1989; Soderbaum, 1990; Faber and Proops, 1994; Vedeld, 1994) adds weight to calls for more participation from a range of communities in sustainability monitoring. In contrast to universalism, pluralism requires an acknowledgement that there are multiple perspectives of reality. In the context of this paper, pluralism provides the imperative for recognising that there are many valid perspectives of whether development is sustainable or not and on how to measure sustainable development.

The motivation for pursuing pluralism is often based on the need to avoid potential knowledge cul-de-sacs. Multiple models, the maintenance of methodological diversity, and methodological flexibility are used to hedge our bets in a world of uncertainty (Norgaard, 1985, p. 389; 1989, p. 37). While this rationale is important, the reason for the pursuit of pluralism in ecological economics can be regarded as being more than simply risk management. It is about open mindedness (Soderbaum, 1990) and acknowledgement of the interrelationship and complementarity of the different multiple perspectives — for example, acknowledging that different perspectives of sustainability are at once many and single, separate and interconnected.

At a general level, clearly no single model has yet been developed that provides a means for understanding how economic, social, cultural and ecological sustainability might be achieved (Norgaard, 1985, p. 388; Munda, 1996). Because of the complexity of problems faced when dealing with ecological-economic interactions “there is no one mutually agreed upon ‘right’ approach, model, or paradigm” (Costanza and King, 1999, p. 2). For this reason the richness of perspectives that indigenous communities can offer is essential.

A good example of how indigenous communities can add to the richness of perspectives of sustainable development is given by the contribution of Māori to New Zealand's environ-

mental management. For local government, understanding values, issues, cultural perspectives, and Māori aspirations has been an essential first step to building relationships with iwi and hapū (Harmsworth, 2001, 2005).

3.2. International obligations

Sustainable development and its monitoring needs to reflect a raft of international legislation, conventions and strategies — and many of these strategies mention the important place for indigenous people. For example, those international obligations affecting indigenous peoples include the Draft Declaration of the Rights of Indigenous Peoples, and the Declaration on the Health and Survival of Indigenous Peoples (United Nations, 1993, 2002a).

The United Nations, mainly through UNESCO and its culture programmes, is very active in trying to encourage the inclusion of cultural perspectives in policy agendas and strengthening links between cultural and development policies. For example, the United Nations Draft Declaration on the Rights of Indigenous Peoples (United Nations, 1993, Center for World Indigenous Studies, 2006) is being considered by a working group of the Geneva-based UN Commissioner for Human Rights. Article 4 of this declaration states

“Indigenous peoples have the right to maintain and strengthen their distinct political, economic, social and cultural characteristics, as well as their legal systems, while retaining their rights to participate fully, if they so choose, in the political, economic, social and cultural life of the State.” (United Nations, 1993).

Furthermore, Article 19 of the draft Declaration states:

Indigenous peoples have the right to participate fully, if they so choose, at all levels of decision-making in matters which may affect their rights, lives and destinies through representatives chosen by themselves in accordance with their own procedures, as well as to maintain and develop their own indigenous decision-making institutions. (United Nations, 1993)

Given that sustainability monitoring is one way indigenous communities can participate in the governance of their resources on which they depend, it would seem this draft Declaration provides an important mandate for indigenous people with respect to their involvement in the monitoring process.

Another relevant international convention is the Convention on Biological Diversity, Article 8(j) of which requires the government to:

respect, preserve and maintain knowledge, innovations and practices of indigenous communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the innovations and practices and encourage the equitable sharing of benefits arising from the utilisation of such knowledge, innovations and practices.

Posey and Dutfield (1996) suggest that implementation of Article 8(j) requires a number of actions including support for

indigenous-based and designed conservation and sustainable development monitoring efforts.

3.3. New Zealand-specific rationale

There are two broad reasons why Māori organisations in New Zealand may wish to monitor their own development:

- Internal drivers
- Exogenous drivers.

3.3.1. Internal drivers

By internal drivers we mean motivation deriving from Māori groups' perceived cultural responsibility towards the environment based on knowledge and values. Māori have been observing and interacting with their environment for centuries and have developed a strong sustainability ethic and philosophy through that time. Māori cosmology acknowledges a natural order to the universe. The central belief is that all parts of the environment were interrelated or interdependent through the domains of primordial parents (papatuanuku the earth mother — earth, land and biosphere, and Ranginui the sky father — air and space) and Atua or gods (e.g., Tane Mahuta, god of forests and living things etc.).

Māori also have a strong ethic about the need to safeguard and manage natural resources for future generations. This derives from strong imperatives such as whakapapa, kaitiakitanga, tikanga and from tribal expectations. These internal drivers lead Māori to pursue monitoring that measures progress towards desired cultural goals such as enhancement of cultural resources and cultural well-being.

From the perspective of pluralism, a rationale for encouraging Māori to express their cultural needs for sustainability monitoring is that traditional Māori knowledge provides an insight into sustainability that Western science does not, and perhaps cannot, provide.

A second internal driver is the fact that Māori are significant resource owners in the New Zealand economy (*Business and Economic Research Ltd., and Federation of Māori Authorities, 1997*). As resource owners, Māori groups such as iwi and hapū have been intimately involved in ensuring the sustainable development of their resources over hundreds of years (for example, *Ngai Tahu Development, 2005*). Māori continue to see the need for involvement in all aspects of the development process, including evaluating its success (*Winiata, 1988; Durie et al., 2002; Harmsworth et al., 2002*).

Finally, Māori have also highlighted a need to engage in the monitoring of specific development and environmental issues such as sewage disposal/outfall, pollution, contamination, toxic waste, water quality and dwindling fish stocks.

3.3.2. Exogenous drivers

There are also three exogenous drivers that provide a strong mandate for Māori engagement in sustainability monitoring. These derive principally from the Treaty of Waitangi.

3.3.2.1. The Treaty of Waitangi. Much of the recognition of indigenous rights in New Zealand is based on, and can be attributed to the signing of the Treaty of Waitangi in 1840 (*Orange, 1990; Burton and Cocklin, 1996; Durie, 1998*). This document

provides a basis for indigenous rights, bicultural development, and partnership in New Zealand.

The principles of the Treaty (see below) are enshrined in most New Zealand environmental and local government legislation, and the Resource Management Act (RMA) of 1991 is the dominant and most important piece of environmental legislation (*Ministry for the Environment, 1992*). The purpose of the Act is “to promote the sustainable management of natural and physical resources” (Section 5), and it provides a comprehensive framework to achieve that principle.

The Treaty is, therefore, central to the work of both government and Māori agencies and provides a framework for Māori to participate in formal monitoring programmes.

3.3.2.2. Principles of the Treaty of Waitangi. The key principles of the Treaty¹ that are considered relevant to Māori participation in sustainable development monitoring are partnership, active protection, and consultation, as outlined below:

- Partnership

The Treaty principle of partnership incorporates notions of cooperation, reciprocity and opportunities for power sharing through the transfer of certain functions. The Treaty requires parties to act reasonably and in good faith and the responsibilities of the parties are analogous to fiduciary duties (Court of Appeal, 1987, *Māori Council v. Att. General 1 NZLR 641*).

- Active protection

The principle extends to the active protection of Māori people in the use of their resources and other guaranteed taonga to the fullest extent practicable as well as active protection of the environment itself. This principle obligates the Crown actively to protect Māori tino rangatiratanga (sovereignty) and kaitiakitanga (guardianship) over their resources (Court of Appeal, 1987, *Māori Council v. Att. General 1 NZLR 641*).

- Consultation

Another key Treaty principle relevant to this discussion is the requirement to consult Māori on key issues. This principle is made clear in several provisions of the RM Act and some key court cases (*Burton and Cocklin, 1996*).

3.3.2.3. The Waitangi Tribunal and the Ngai Tahu grievance settlement. The Waitangi Tribunal was formed to hear petitions from Māori people affected by government policies that were inconsistent with the Treaty. One of the claims that has been settled is that of the Ngai Tahu tribe of the South Island. The Ngai Tahu Settlement is significant because it deals specifically with an aspect of the issue of sustainability monitoring. That is, the settlement seeks a guarantee that the Ministry for the Environment, in consultation with Ngai Tahu, will work towards developing a set of Māori environmental

¹ The principles of the Treaty emerged as a result of Government steps to address breaches in the Treaty. There are different options as to what the actual principles are. There are also those who disparage the notion of the Treaty principle. For example, *Kelsey (1989)* states that “the... principles therefore reiterated and entrenched existing Pakeha political, cultural and economic supremacy”. Nevertheless, given that the principles are enshrined in legislation, they provide a strong mandate for Māori participation in all government processes.

indicators as part of the Government's environmental monitoring programme.

The Ngai Tahu Settlement has also set a precedent for other claims to address resource management matters, including the Motunui–Waitara, Kaituna, Manukau, and Mangonui claims.

Clearly there is a compelling case for the participation of indigenous communities in sustainable development indicators. And, given the extent of the rationale outlined above, it would seem appropriate for that participation to be substantial, and focused on the entire process from indicator development to implementation.

The next section investigates how extensively this rationale has been implemented in New Zealand.

4. Sustainable development indicators — indigenous community participation in New Zealand

In this section we describe some of the challenges faced in the context of one indigenous culture's participation in sustainable development monitoring; that is, Māori (indigenous New Zealanders). We begin by briefly describing Māori in New Zealand, and then presenting a series of case studies outlining recent experience of Māori participation in sustainable development monitoring.

4.1. Māori indigenous people of New Zealand

People from northern Polynesia migrated to Aotearoa–New Zealand well over 1000 years ago. It was in this new country that Māori culture developed and flourished, drawing on the early Polynesian cultural beliefs, customs, language, and philosophies. At present, Māori make up around 15% of the total New Zealand population of 4 million. About 80% of all Māori now live in urban areas. This society is very different from when Europeans (*Pakeha*) first colonised New Zealand in the early 19th century, when there were two distinct and separate cultures – one Māori, one English – and Māori lived across the country in a large number of geographically located tribes (*iwi*). Contemporary Māori represent themselves as having values, status, and responsibility acquired through their links to their ancestors.

Māori reserve a special position in New Zealand as the indigenous people of the land, their role as signatories of the Treaty of Waitangi, and the fact that spoken and written Māori is recognised as an official language of New Zealand. For these reasons, Māori can not be treated as “just another cultural group”.

While Māori are generally actively engaged in wider New Zealand society, they also like to express themselves as having a different set of views and perspectives. These perspectives come from their distinct indigenous culture, where beliefs, knowledge, values, and aspirations may digress from those of the mainstream population. Ancestral lineage (*whakapapa*) provides an origin and a common bond for all Māori, linking them to each other and to the environment. It is this genealogical web that provides the basis for a point of difference to other New Zealand communities and Māori societal structure.

The basic tenets of traditional Māori society remain strong alongside more contemporary groupings, beliefs and values. Contemporary and traditional values influence the way Māori

conduct themselves, have tribal status and authority, relate to each other, manage, organise and address issues, and collaborate with other individuals and agencies. This is often reflected in custom and protocols, strategic planning approaches, behaviour, ethics, social and environmental responsibility, and environmental standards. The challenge for Māori is how to balance aspirations for cultural enrichment, retaining strong elements of traditional culture such as values, language and knowledge, with those more modern elements of advancement, growth, commerce, and economic development (Durie, 1998, 2000). These challenges are being met in many areas by a large number of Māori groups and organisations, where capacity building, planning, and leadership are essential ingredients.

4.2. Māori values and knowledge

Indigenous Māori values in environmental management are a mix of the traditional and the modern. For Māori, values and cultural perspectives help develop standard forms of interpretation that provide the framework for much of their resource management work. These frameworks have helped Māori articulate the way they interpret their present environment (both natural and human-modified ecosystems), the issues they contend with, how they assess effects, how they measure change, and how they process information and arrive at decisions. Examples include: characterising resources and ecosystems; prioritising issues; cultural understanding of adverse effects; assessing cultural impact; planning to protect and manage culturally significant areas; and planning ecosystem restoration and enhancement projects.

For Māori, therefore, indigenous values (Barlow, 1991) are the underlying cornerstone for all sustainable resource management, decision-making, and the development of monitoring tools (Harmsworth and Tipa, 2005). Some of the key concepts include:

- Whakapapa (ancestral lineage)
- Mana whenua (status, authority, prestige over a defined area)
- Kaitiakitanga (guardianship)
- Maintenance of the mauri (life force) in all component parts of the system and striving for balance
- Understanding that all parts of the environment are interrelated and using a whole system approach; understanding cause and effect, cumulative effects
- Tau utuutu, the principle of reciprocity, giving back what you take
- Recognition and use of mātauranga Māori (Māori knowledge)
- Action and association (active guardianship of resources and ecosystems through relationship and practice)

4.3. The Environmental Performance Indicators (EPI) programme — a case study

One example of where a government policy evaluation programme has attempted to accommodate indigenous community participation was the New Zealand Ministry for the Environment's (MfE) EPI programme (1997–2001). While this

programme focused only on the environmental dimension of sustainable development, it did provide an insight into the issues encountered in such cross-cultural enterprises.

In 1997 the MfE established the EPI programme to coordinate the development of New Zealand's official national environmental performance indicators (EPIs). The main purpose of the EPI programme was “to develop and use indicators to measure and report how well we are looking after our environment” (Ministry for the Environment, 1998a). The government's objectives for the EPI programme were to:

- measure systematically the performance of its environmental policies and legislation
- better prioritise policy and improve decision-making
- report systematically on the state of New Zealand's environmental assets.

Programme documentation suggested implementation required a cooperative effort by a range of stakeholders — including central and local government, science providers, iwi, and communities. The annual budget for the programme was in the order of NZD 1.2 million pa (approx USD 600,000). This funded about 5 staff and a range of consultants.

About a year into the programme, a problem emerged. Despite the best intentions, it became apparent that the level of Māori involvement in the EPI programme was inadequate. This was highlighted by Parliamentary Questions to the Minister for the Environment from an Opposition Member of Parliament in October 1997.² The questions essentially asked what effort had been devoted to including Māori in the EPI programme, to which the honest response was, “very little”.

The lack of the involvement of indigenous peoples in government environmental programmes is not unique in Oceania. For example, the Australian Environmental Protection Agency notes that indigenous perspectives have frequently been neglected (Ehrlich et al., 1996).

Unfortunately, it is not surprising that Māori feel marginalised from government environmental programmes. Quite apart from the willingness (or lack thereof) of government agencies to involve Māori, Māori themselves are often not in a position to engage those agencies. Māori tend to lack resources, and their attention is often directed towards more immediate needs (such as employment, education and health) (Hutchings and Tipene, 1998).

In response to political pressure to increase Māori participation, in late 1997 the EPI Programme adopted what it referred to as a “comprehensive three-pronged” approach (as shown in Fig. 1) to involving Māori in the development of a core set of environmental indicators. This approach mirrored the input of mainstream advice from the general public into the programme. It was essentially a risk-management approach. That is, the EPI programme engaged in testing three avenues of Māori participation because of uncertainty over what the most appropriate format for Māori input would be.

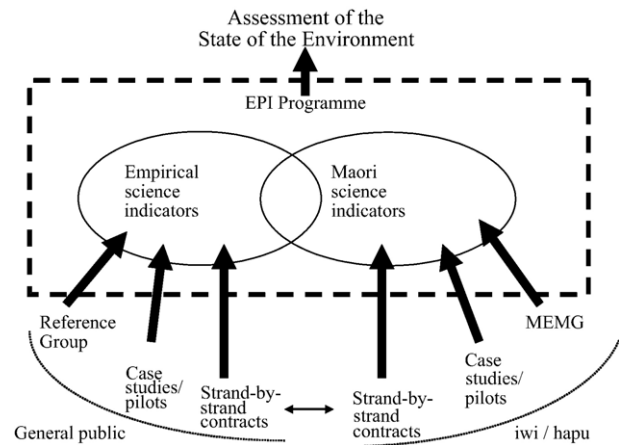


Fig. 1 – The comprehensive approach to Māori involvement in the EPI programme.

The so-called ‘comprehensive three-pronged’ approach involved: the Māori Environmental Monitoring Group (MEMG); strand-by-strand contracts; and ecosystem-cultural case studies. The approach was an attempt to provide for Māori involvement in all aspects of the EPI programme. Each of these components is discussed below.

4.3.1. *The Māori Environmental Monitoring Group (MEMG)*
 The MEMG was an independent group of individual Māori with expertise in the area of environmental monitoring, which provided input to the EPI programme at a higher conceptual level. Their report (Māori Environmental Monitoring Group, 1998) covered questions such as:

- What is an environmental indicator from a Māori perspective?
- What issues must be considered for Māori environmental monitoring?
- What generic, nationwide environmental indicators can be identified that are relevant to Māori?
- How can these indicators be implemented in the future?

What the EPI programme expected from the MEMG and what was received were very different — most likely as a result of a conceptual tension between the EPI programme and a Māori worldview. That is, the EPI programme wanted the MEMG to focus only on environmental monitoring. However, the MEMG necessarily found it difficult to separate monitoring issues from wider environmental concerns or socio-economic and political issues. Therefore, the MEMG developed a broad framework through which the rest of the Māori input could be developed. This invariably led the MEMG to highlight the shortcomings of the then current approach in involving Māori in the programme. The main messages from the MEMG report included a series of concerns and challenges relating to:

1. *Process.* The MEMG expressed concern that the EPI programme did not design a Treaty-consistent process for Māori involvement from the beginning of the programme. The MEMG proposed a Partnership Two Cultures Development model (Winiata, 1997). To all intents and purposes, this implies the need for a separate Māori EPI programme. The

² Question from Nanaia Mahuta (Member of Parliament, Labour Party) for written answer from the Minister of the Environment: #14578, 14579, 14580 (pers. com. Clerk of the House of New Zealand Parliament).

challenge was to bring the programme more into line with Treaty obligations.

2. *Timing.* The MEMG quite rightly stated that their work should have been done before engaging Māori consultants to work on selecting Māori indicators (see Section 4.3.2). This led to a situation where the consultants were operating in a potential conceptual vacuum.
3. *Partnership.* The MEMG maintained that the EPI programme was not willing to relinquish control of the programme's resources. Therefore, they argued, the programme was not consistent with the partnership provisions of the Treaty.
4. *Resourcing.* Māori communities often do not have the resources (financial, time, technical expertise) to engage in activities such as the EPI programme at the level required. The challenge for the EPI programme was to ensure Māori were resourced adequately to participate in the programme. In the 1998 financial year the programme allocated NZD 85,000 to Māori input (roughly 7.1% of the total programme budget).
5. *Conceptual differences.* The MEMG noted that the EPI approach, which divided the environment into several parts, was not consistent with a Māori worldview. Furthermore, the programme focused on the biophysical aspects of the environment, and did not always explicitly acknowledge the place of people in the environment. The pursuit of these conceptual approaches therefore alienated Māori from the programme. This was supported by the observations of Gardiner and Parata (1998, p. 3): "Participants were reluctant to agree to a categorising of information into convenient boxes for the purposes of 'meeting western science logic'".
6. *Consultation approach.* The MEMG noted the EPI programme's attempts to consult with Māori. However, they commented that this consultation needed to be carried out at hāpu (sub-tribal and family unit) level. This would have had significant cost implications for the EPI programme. There was also mention of the need to consult with a mandated group of Māori.

4.3.2. Māori input into the EPI programme strands

While the MEMG took a green-fields approach to Māori and EPIs, the second component involved Māori input directly into the existing EPI programme. That is, input into aspects of the environment such as biodiversity, waste, the marine environment and climate change.

The process for Māori input at this level took the form of a series of hui (meetings) on marae (meeting houses). These hui were arranged by Māori consultants.

In hindsight this was the least successful of the EPI programme work with Māori, in part due to the issues outlined by the MEMG. The Māori consultants (Gardiner and Parata, 1998) also highlighted two other concerns:

1. *lack of framework* — this relates to the MEMG's timing concerns: a framework was not developed "until well after the ground process [sic] of information collection for the various strands was underway"
2. *lack of clarity* — Gardiner commented that the EPI programme had not adequately prepared Māori for the consultation. The lack of prepared material to focus attention at hui meant that it was (not surprisingly) "noticeably

difficult to try and focus the minds of participants on defining national indicators...".

4.3.3. Māori environmental monitoring case studies

The final component of the EPI programme's approach involved Māori environmental monitoring case studies. This was an acknowledgement that the Māori worldview may not sit well with an approach that breaks the environment into chunks (the strand-by-strand approach followed by the Ministry). The case studies were an attempt to provide for the holistic worldview outlined by the MEMG.

Case studies were initially conducted with three iwi (tribes): Ngai Tahu, Hauraki, and Ngāti Porou. While the aims of these case studies differed slightly, they all focused on three core aspects:

- documenting historical Māori environmental monitoring practices
- testing new Māori-relevant environmental monitoring practices
- investigating the potential interface between Māori environmental monitoring and "official" environmental monitoring regimes.

Through the case studies, the EPI programme built stronger relationships with iwi and developed a much broader network. In a few cases it also showed that, contrary to popular belief, several iwi organisations were well equipped to engage in monitoring the state of their environment. It appears these case studies were also useful for the iwi involved. The case studies provided financial resources that created an opportunity for upskilling iwi personnel in environmental monitoring.

4.3.4. Lessons and current status of Māori participation in Ministry for the Environment indicator development

The lessons learned from the EPI programme's attempts to increase Māori participation were well articulated by the MEMG (above). Most important, the process was criticised as being too late, inadequately resourced and superficial (given that the MfE was not willing to share control of the programme resources). Perhaps because of these criticisms, the Ministry appeared to reduce its focus on Māori participation. Thus, despite the initial flurry of Ministry activity over Māori participation in indicator development, much of the effort dissipated. Interest on the part of officials and politicians waned, and attention diverted to other priority areas.

However, one advantage of the initial work in the late 1990s was that it stimulated increased awareness and interest by Māori themselves in the contribution they could make to sustainability monitoring. Therefore, for further examples of Māori participation in sustainable development monitoring in New Zealand, we need to look to Māori-initiated processes.

4.4. Māori-initiated sustainability monitoring

Many recent Māori projects have made a significant contribution to the development of tools and approaches for Māori sustainability monitoring. In the environmental-cultural area, examples include Harmsworth (2002), Hauraki Māori Trust Board (1999), Kowhai Consulting Ltd. (2002), Mattingley and Pauling

(2005), and Tipa (1999). These examples often coincide with a range of Māori-led environmental projects, such as restoration, riparian plantings, coastal enhancement, and environmental health assessment, where iwi- and hapū-based monitoring methods, standards and frameworks are being tested and evaluated. Further, a large number of iwi and hapū groups have developed cultural impact assessments, and several models exist (Te Rūnanga o Ngai Tahu, 2005). In the Māori health and social area, outcomes and indicators have been developed for measurement of goals and targets in national strategy frameworks and for local application, for a key example see Durie et al. (2002).

The following section highlights three high-profile examples of these Māori-led initiatives.

4.4.1. Case study 1: the cultural stream health index

The Cultural Health Index (CHI) (Ministry for the Environment, 2006; Tipa and Teirney, 2002, 2003) for streams and waterways was originally developed as one of the EPI case studies (see Section 4.3). It was initially developed, tested and evaluated in the Taieri and Kakanui catchments, Otago, by Ngai Tahu researchers and locals between 1997 and 2003 (Tipa, 1999), and more recently evaluated for its applicability to other river types by Ngāti Kahungunu researchers and locals in the Tukituki river, Hawke's Bay (2004–2005). The CHI was developed to give iwi/hapū a tool to express their cultural values of stream health and mahinga kai in a way that could be incorporated into catchment management decisions. The index comprises a score (e.g., A-1/2.9/4.1) for recognising and expressing Māori values, and for environmental assessment. It can be used for entire river and stream catchments rather than solely for small sections or sites along a river/stream. Three components make up the numeric index at any given river or stream site:

- establishing the relationship or association by tangata whenua, iwi/hapū (site status)
- evaluating mahinga kai values (mahinga kai measure)
- assessing stream health (stream health measure).

The CHI is now being used by a number of iwi and hapū groups, mainly in the South Island and forms the basis for the Ngai Tahu Takiwā state of the environment (SOE) reporting framework and database template (see Section 4.4.3).

4.4.2. Case study 2: the Māori wetland indicators project

The Māori wetland indicators project (Harmsworth, 2002; Harmsworth et al., 2002) was part of a national project, Coordinated Monitoring of New Zealand Wetlands, funded under the MfE sustainable management fund (SMF) (Clarkson et al., 1999; UNEP/GRID, 1999; Downs and Clarkson, 2000; Clarkson and Ward, 2002). The project was designed to develop a national monitoring approach and classification for wetlands (Clarkson et al., 2002), and ran parallel to the MfE environmental performance indicators programme (Ministry for the Environment, 1997). Within this larger wetlands project, the Māori indicators objective developed a Māori approach for assessing wetlands together with a set of indicators, and was carried out using participatory research with a number of iwi and hapū throughout New Zealand. The

P-S-R model (Organisation for Economic Co-operation and Development 1993; Ministry for the Environment, 1998b) was used to develop the main indicator groups and more specific or key indicators in each group. Within a participatory research framework the P-S-R model was explained as:

- what causes the problems?
- taonga and mauri
- trends, getting better or worse? (from a cultural perspective).

A final set of nine key Māori indicators, largely based on mātauranga Māori, included mauri, taonga iconic species, % spatial area change, and perceived problem or exotic species. The indicators were strongly linked to assess progress towards desired cultural and environmental goals for wetland rehabilitation and can be applied to other environments where goals are determined and trends are measured. The indicators can be used from site to catchment scale. Methods can be used both to complement other Māori and scientific approaches and to support cultural impact assessments and long-term monitoring programmes.

The Māori wetland indicator monitoring methods have been incorporated into a number of iwi and hapū monitoring plans (e.g., Kaikoura, Ngāti Kuri resource management plan, and Ngai Tahu Takiwā SOE reporting framework and database template (see Section 4.4.3). They are also recognised by the national wetlands monitoring handbook as a complementary cultural method to science methods.

4.4.3. Case study 3: state of the environment reporting by iwi groups

A small number of Māori organisations are also developing frameworks and tools to report on the SOE in specific areas (e.g., tribal areas — rohe) and to monitor and report on environmental and cultural change from a cultural perspective. One of the first Māori examples was the SOE report, Te Purongo Maniapoto (Kowhai Consulting Ltd., 2002), and more recently the State of the Takiwā project developed by Te Rūnanga o Ngai Tahu (Matingley and Pauling, 2005). Since 2002, a number of groups are designing monitoring approaches to contribute to SOE reporting, complementary to that of local and central government. SOE reports for iwi and hapū rely on collating their own knowledge and accessing quality scientific and technical information about the environment from a number of sources.

Reports such as Te Purongo Maniapoto and Takiwā articulate indigenous Māori values, provide natural resource and cultural inventories, assess and provide a snapshot of environmental and cultural health, highlight issues, and state necessary actions from recommendations. One of the areas most often highlighted in these reports is that participation and building effective relationships with local and central government is seen as a key to improvement of the natural and cultural environment.

Te Purongo Maniapoto provides a snapshot of Ngāti Maniapoto values and natural resource and cultural inventories for its rohe, highlights issues, and provides actions and recommendations. The report states that Māori participation is the key for improvements to the natural and cultural environment, and provides baseline information for

environmental monitoring; however, no formal systematic monitoring programme for iwi or hapū was developed.

The State of the Takiwā Report (Mattingley and Pauling, 2005) describes a culturally based environmental monitoring and reporting system developed by TRONT (Te Rūnanga o Ngai Tahu) as part the overall Ki Uta Ki Tai — Mountains to the Sea Natural Resource Management framework, outlined in the tribal vision, Ngai Tahu 2025 (Ngai Tahu Development, 2005). The main goal is for Ngai Tahu Whānui to record, assess and report on the cultural health of the natural resources and environment in the Ngai Tahu Takiwā. The approach takes into account Ngai Tahu cultural values, such as mauri and mahinga kai, and integrates mātauranga Māori and western science. Major outcomes of the project to date include a sophisticated but easy-to-use database for recording, storage, and analysis of mātauranga and science information, a statistical function, and a reporting system for environmental and cultural monitoring. Takiwā uses a bi-lingual interface, and site evaluation forms will be used to record and enter data into the database. The project is currently being piloted, and when expanded will establish a baseline of the natural environment over the whole Ngai Tahu Takiwā to monitor change, develop policy, and set goals to improve environmental health.

5. Conclusions and lessons from New Zealand

There is a strong case for sustainable development indicators derived from ecological economic theory and the need to monitor and evaluate policy. There are also several compelling reasons for indigenous community participation in sustainability indicator development and implementation. Given this context, it is concerning to find that the level of engagement of indigenous communities in sustainability monitoring is generally limited.

This indigenous level of engagement in sustainability monitoring in New Zealand remains low, under-resourced and uncoordinated. Many New Zealand agencies have tried to remedy this situation. For example, when in the late 1990s the lack of Māori participation in the environmental reporting area became a political issue, the New Zealand's Ministry for the Environment attempted to improve the situation through a number of targeted strategies and actions intended to make the environmental performance indicator programme (EPI) more inclusive. Many problems were encountered, and the solutions that were set in place were essentially too late to change the overall direction of the national EPI programme and therefore gain full Māori support through the MEMG.

However, there are signs of hope that participation by Māori in sustainability monitoring is increasing. Examples in this paper show that indigenous groups in New Zealand are active locally in setting sustainability goals, particularly in environmental guardianship (e.g., through assessment, monitoring and activity) and also in the Māori health delivery and outcome area. These indigenous groups tend to define sustainability through a holistic worldview that is outside purely 'economic' views of development. This worldview, with its inclusive management concepts and practice, sits comfortably with innovative transdisciplinary approaches advocated through ecological economics.

From the case studies in this paper we have highlighted a number of critical success factors for increasing indigenous community participation in government-led sustainability programmes:

- *Process is very important.* As with any community, indigenous communities need to be engaged at the beginning of the process. It is also important that the process is appropriate for the community involved.
- *Resourcing is essential.* Indigenous communities often do not have the resources necessary to participate in official, and often drawn out, processes. If the communities are to be involved, adequate resources need to be allocated at the outset.
- *Openness to different perspectives is essential.* Cross-cultural interaction will often lead to tensions as different world views collide. It is only a genuine openness to learning from each other that can take advantage of the lessons from the diversity of opinions for sustainable development.

We also find that the most enduring participation of Māori in indicator development is in those activities initiated by the indigenous groups themselves. However, these initiatives pose several challenges:

- They are often inadequately resourced
- Groups often lack the capacity to engage in broader sustainability programmes
- They often lack coordination and an effective means of disseminating the approaches and lessons to other communities and groups.

All monitoring of sustainable development goals, such as the use of indicators, provides a useful means for measuring the progress towards desired social, cultural economic, and environmental goals and outcomes. It is important that communities are included in this goal setting and that within this framework the aspirations of indigenous groups are taken into account, clearly articulated and understood.

In conclusion, it is important to understand that different communities will define sustainable development goals differently. It is important to embrace these different value systems and worldviews as a way of enhancing our overall understanding of sustainability and to build a more inclusive and equitable society.

REFERENCES

- Ackerman, F., 1997. Human Well-being and Economic Goals. Island Press, New York.
- Barlow, C., 1991. Tikanga Whakaaro: Key Concepts in Māori Culture. Oxford University Press, Auckland.
- Béné, C., Doyen, L., Gabay, D., 2001. A viability analysis for a bio-economic model. *Ecological Economics* 36, 385–396.
- Burton, L., Cocklin, C., 1996. Water resource management and environmental policy reform in New Zealand: regionalism, allocations and indigenous relations. *Colorado journal of international Environmental Law and Policy* 7.
- Business and Economic Research Ltd., and Federation of Māori Authorities, 1997. The nature and extent of the Māori economic base. Unpublished report, Te Puni Kōkiri, Wellington.

- Button, K., 2002. City management and urban environmental indicators. *Ecological Economics* 40, 217–233.
- Callens, I., Tyteca, D., 1999. Towards indicators of sustainable development for firms. *Ecological Economics* 28, 41–53.
- Clarkson, B., Ward, J., 2002. Coordinated monitoring of New Zealand wetlands: a ministry for the environment SMF fund project. National Phase 2 workshop, Brentwood Hotel, Kilbirnie, Wellington.
- Clarkson, B., Clarkson, B.R., Denyer, K., Gerbeaux, P., Harmsworth, G., Johnston, P., Partridge, T., Richmond, C., Smith, S., Wilde, R., 1999. Monitoring Changes in Wetland Extent: An Environmental Performance Indicator for Wetlands. Ministry for the Environment, Wellington.
- Clarkson, B.R., Sorrell, B., Reeves, P., Champion, P., Partridge, T., Clarkson, B.D., 2002. Handbook for Monitoring Wetland Condition: Coordinated Monitoring for New Zealand Wetlands. Ministry for the Environment, Wellington.
- Cleveland, C.J., Kaufmann, R.K., Stern, D.I., 2000. Aggregation and the role of energy in the economy. *Ecological Economics* 32, 301–317.
- Cobb, C.W., Cobb, J.B., 1994. *The Green National Product*. University Press of America, Lanham, M.D.
- Costanza, R., 1991. *Ecological Economics: The Science and Management of Sustainability*. Columbia University Press, New York.
- Costanza, R., King, J., 1999. The first decade of Ecological Economics. *Ecological Economics* 28, 1–9.
- Daly, H.E., Cobb, J., 1994. *For the Common Good: Redirecting the Economy Toward Community, the Environment, and a Sustainable Future*. Beacon Press, Boston.
- Department of Prime Minister and Cabinet, 2003. *Sustainable Development for New Zealand — Programme of Action*. Department of Prime Minister and Cabinet, Wellington.
- Downs, T., Clarkson, B.D., 2000. Coordinated monitoring of New Zealand wetlands: a ministry for the environment SMF. National Phase 2 workshop. Ministry for the Environment, Centre for Biodiversity and Ecology Research, University of Waikato, Hamilton.
- Durie, M., 1998. *Mana, Te Kawanatanga: The Politics of Māori Self-determination*. Oxford University Press, Auckland.
- Durie, M., 2000. *Māori Development: Reflections and Strategic Directions*. A paper presented at Toi Te Kupu, Toi Te Mana, Toi Te Whenua Conference on Māori Development in a Global Society held at Putahi-a-Toi, School of Māori Studies, Massey University, Palmerston North 4–6 July 2000. He Pukenga Korero, Vol 5, No. 1. in.
- Durie, M., Fitzgerald, E., Kingi, T.K., McKinley, S., Stevenson, B., 2002. *Māori specific outcomes and indicators: Wellington*. A Report prepared for Te Puni Kokiri (Ministry of Māori Development). Ministry of Māori Development.
- Edwards-Jones, G., Davies, B., Hussain, S., 2000. *Ecological Economics: An Introduction*. Blackwell Science, London.
- Ehrlich, C., Ross, K., Lane, H., Northern Land Council, 1996. *Indigenous participation in Commonwealth environmental impact assessment*. Agency Review of Commonwealth Environmental Impact Assessment report series. Australian Government Publishing Service, Canberra.
- Elster, J., 1999. Introduction. In: Elster, J. (Ed.), *Deliberative Democracy*. Cambridge University Press, Cambridge, pp. 1–18.
- Faber, M., Proops, J., 1994. *Evolution, Time, Production and the Environment*. Springer-Verlag, Berlin.
- Fearon, J., 1999. Deliberation as discussion. In: Elster, J. (Ed.), *Deliberative Democracy*. Cambridge University Press, Cambridge, pp. 44–68.
- Gallop, G.C., 1997. Indicators and their use: information for decision-making. In: Moldan, B., Billharz, S. (Eds.), *Sustainability indicators: report of the project on indicators of sustainable development*. John Wiley, Chichester, pp. 13–27.
- Gambetta, D., 1999. “Claro!”: An essay on discursive machismo. In: Elster, J. (Ed.), *Deliberative Democracy*. Cambridge University Press, Cambridge, pp. 19–43.
- Gardiner, G., Parata, H., 1998. Report to the Ministry for the Environment: Coasts and Estuaries, Biodiversity, Fisheries, Climate Change and Ozone. Gardiner and Parata Ltd., Wellington.
- Gustavson, K., Longeran, S., Ruitenbeek, H.J., 1999. Selection and modelling of sustainable development indicators: a case study of the Fraser River Basin, British Columbia. *Ecological Economics* 28, 117–132.
- Harmsworth, G.R., 2001. A collaborative research model for working with iwi: discussion paper for FRST. Landcare Research Contract Report LC 2001/119 for FRST. 29 pp.
- Harmsworth, G.R., 2002. A collaborative research model for working with iwi: discussion paper for FRST. Landcare Research Contract Report LC 2001/119 for FRST (unpublished).
- Harmsworth, G.R., 2005. Good practice guidelines for working with tangata whenua and Māori organisations: consolidating our learning. Report for Landcare Research ICM web site.
- Harmsworth, G.R., Tipa, G., 2005. Māori environmental monitoring in New Zealand: Progress, concepts, and future direction. Report for Landcare Research ICM website. http://www.landcareresearch.co.nz/research/social/indigenous_index.asp.
- Harmsworth, G.R., Barclay-Kerr, K., Reedy, T., 2002. Māori sustainable development in the 21st Century: The importance of Māori values, strategic planning, and information systems, He Puna Kōrero. *Journal of Māori and Pacific Development* 3, 40–68.
- Hauraki Māori Trust Board, 1999. *Hauraki Customary Indicators Report*. Prepared for the Environmental Performance Indicators Programme of the Ministry for the Environment. Technical Paper No. 57, Māori Indicators Case Study. 117 pp.
- Herendeen, R., Wildermuth, T., 2002. Resource-based sustainability indicators: Chase County, Kansas, as example. *Ecological Economics* 42, 243–257.
- Hutchings, J., Tipene, B., 1998. *Tohu Waotu - Māori Environmental Performance Indicators*. Technical Report, vol. 18. Ministry for the Environment.
- Jollands, N., 1998. Incorporating indigenous values into the environmental performance indicators programme: some lessons on cross-cultural communication. Proceedings of the Biennial International Conference of the International Society of Ecological Economics, Chile.
- Jollands, N., 2006. Getting the most out of eco-efficiency indicators for policy. In: Lawn, P.A. (Ed.), *Sustainable Development Indicators and Public Policy: Assessing the Policy-Guiding Value of Sustainable Development Indicators*. Edward Elgar Publishing, Northampton, pp. 317–343.
- Jollands, N., Lermitt, J., Patterson, M.G., 2004. Aggregate eco-efficiency indices for New Zealand: a principal components analysis. *Journal of Environmental Management* 73, 293–305.
- Kammerbauer, J., Cordoba, B., Escolán, R., Flores, S., Ramirez, J., Zeledón, J., 2001. Identification of development indicators in tropical mountainous regions and some implications for natural resource policy designs: an integrated community case study. *Ecological Economics* 36, 45–60.
- Kelsey, J., 1989. *The principles of the Treaty of Waitangi*. Unpublished report for the Ministry of the Environment. Centre for Resource Management.
- Kowhai Consulting Ltd. 2002. *Te Purongo. Maniapoto State of the Environment Report: A Tribal Perspective*. Kowhai Consulting Ltd. Te Anga Rd. Rd 8, Te Kuiti, Wellington, Ministry for the Environment, 54 pp., Wellington.
- Moāri environmental monitoring group, 1998. *Māori Environmental Monitoring – Prepared for the Ministry for the Environment by a Panel of Independent Māori*. July 1998. Technical Paper, vol. 26. Ministry for the Environment.
- Mattingley, B., Pauling, C., 2005. *State of the Takiwā: Cultural Monitoring and Reporting on the Health of our Environment –*

- Development of the Takiwā Database. Te Rūnanga O Ngāi Tahu, Christchurch.
- Max-Neef, M., 1995. Economic growth and quality of life. *Ecological Economics* 15, 115–118.
- Ministry for the Environment, 1992. *Kia Matiratira: A Guide for Māori. Information on Provisions of the Resource Management Act that Affect Māori Interests.* Ministry for the Environment, Wellington.
- Ministry for the Environment, 1997. *Environmental Performance Indicators for Land, Air and Water.* Ministry for the Environment, Wellington.
- Ministry for the Environment, 1998a. *Environmental Performance Indicators: Proposals for Terrestrial and Freshwater Biodiversity.* Ministry for the Environment, Wellington.
- Ministry for the Environment, 1998b. *Project Update – The Indicator. Information Brochure on the Environmental Performance Indicators Programme.* Ministry for the Environment, Wellington.
- Ministry for the Environment, 2006. *Using the Cultural Health Index: How to assess the health of streams and waterways. Te Whakamahi i te Kuputouhu Hauora Ahurea: Me pehea te arotake i te hauora o nga pukaki me nga awa wai.* Ministry for the Environment, Wellington, New Zealand (Available at <http://www.mfe.govt.nz/publications/water>).
- Munda, G., 1996. Cost-benefit analysis and integrated environmental assessment: some methodological issues. *Ecological Economics* 19, 157–168.
- Ngāi Tahu Development, 2005. *Kairangahau Kaupapa Taiao and Manaaki Whenua.*
- Norgaard, R., 1985. Environmental Economics: An evolutionary Critique and a Plea for Pluralism. *Journal of Environmental Economics and Management* 12, 382–394.
- Norgaard, R., 1989. The case for methodological pluralism. *Ecological Economics* 1, 37–57.
- Orange, C., 1990. *An Illustrated History of the Treaty of Waitangi.* Allen & Urwin New Zealand Ltd, Wellington.
- Organisation for Economic Co-operation and Development, 1993. *Organisation for Economic Co-operation and Development Core Set of Indicators for Environmental Performance Reviews. A synthesis Report by the Group on the State of the Environment.* Organisation for Economic Co-operation and Development, Paris.
- Pannell, D.J., Glenn, N.A., 2000. A framework for the economic evaluation and selection of sustainability indicators in agriculture. *Ecological Economics* 33, 135–149.
- Posey, D., Dutfield, G., 1996. *Beyond Intellectual Property.* International Development Research Centre, Ottawa.
- Proops, J.R., 1989. Ecological economics: rationale and problem areas. *Ecological Economics* 1, 59–76.
- Ruben, R., van Ruijen, A., 2001. Technical coefficients for bio-economic farm household models: a meta-modelling approach with applications for Southern Mali. *Ecological Economics* 36, 427–441.
- Soderbaum, P., 1990. Neoclassical and institutional approaches to environmental economics. *Journal of Economic Issues* XXIV, 481–492.
- Te Rūnanga o Ngāi Tahu. 2005. *Cultural Impact Assessments CIAs: Resource Consents: Draft Fact Sheet and CIA TOR.* Te Rūnanga o Ngāi Tahu, Christchurch, New Zealand.
- Tipa, G., 1999. *Taieri River Case Study. Technical Paper, vol. 58.* Ministry for the Environment, Wellington.
- Tipa, G., Teirney, L., 2002. *Mauri and Mahinga Kai Indicators Project: Final Report - Developing the Cultural Health Index.* Garth, Dunedin.
- Tipa, G., Teirney, L., 2003. *A Cultural Health Index for Streams and Waterways: Indicators for Recognising and Expressing Māori Values.* Ministry for the Environment, Wellington.
- UNEP/GRID, 1999. *Coordinated monitoring of New Zealand Wetlands, Phase 1: monitoring changes in wetland extent: an environmental performance indicator for Wetlands, final report.* United Nations Environment Programme and Global Resource Information Database, Christchurch.
- United Nations, 1993. *Draft Declaration on the Rights of Indigenous Peoples: Report of the Eleventh Session of the United Nations Working Group on Indigenous Populations.* United Nations, Geneva.
- United Nations, 2002a. *The Geneva declaration on the health of and survival of indigenous peoples.* United Nations Permanent Forum on Indigenous Issues, New York.
- United Nations, 2002b. *Report of the World Summit on Sustainable Development. Johannesburg, South Africa, 26th August – 4th September 2002.* United Nations, New York.
- United Nations Conference on Environment and Development. 1992. *Agenda 21.* United Nations Conference on Environment and Development, New York, N.Y.
- United Nations Working Group on Indigenous Populations. 2004. *Indigenous definition accepted from the study of the Problem of Discrimination Against Indigenous Populations, Martinez Cobo, J., United Nations Special Rapporteur 1987.* in: United Nations Statistics Division.
- Vedeld, P.O., 1994. The environment and interdisciplinarity - ecological and neoclassical economical approaches to the use of natural resources. *Ecological Economics* 10, 1–13.
- Winiata, W., 1988. *Hapū and Iwi Resources and Their Quantification, Volume III, Part two: Future Directions.* Department of Social Welfare, The Royal Commission on Social Policy, Wellington.
- Winiata, W., 1997. *The Treaty of Waitangi: Māori political representation.* Pipitea Marae, Wellington, 1–2 May.

Glossary of terms

- Atua*: God, deity, supernatural being
- Hapū*: sub-tribe, pregnant
- Iwi*: Tribe, bones
- Kaitiaki*: guardians or the agent who practices kaitiakitanga
- Kaitiakitanga*: exercise guardianship or stewardship of the environment and tikanga, through an act beneficial to the resource
- Mahinga kai Māori organisation*: iwi or hapū authority, kaitiaki group, or other organisation e.g., Inc, trust, marae
- Mana, mana whenua*: prestige, control, authority over an area
- Mātauranga Māori*: Māori knowledge
- Mauri*: life force, life principle, internal element, metaphysical component of all things, animate and inanimate
- Noa*: free from tapu, ordinary, unrestricted
- Papatipu rūnanga*: rūnanga based on ancestral links and centred on marae, hapū, districts
- Rahui*: restrictions, regulation, or temporary sanction
- Ritenga*: Rules, regulations
- Rohe*: tribal area, boundary
- Taiapure*: estuarine or coastal fishing areas of special significance to tangata whenua, a customary Māori area management tool
- Takiwā*: area/region/district
- Tangata whenua*: people of the land, having an ancestral link and authority to a given area
- Tapu*: sacred, ritual prohibition, off-limits
- Taonga*: Something treasured, e.g., treasured flora & fauna species; iconic, highly valued, precious
- Tikanga*: customary values and practices
- Wairua*: spiritual dimension, spiritual qualities
- Whānau*: extended family, relationships
- Whakapapa*: ancestral lineage, genealogy
- Whenua*: land, placenta