



Illuminated or blinded by science?

A discussion paper on the role of science in
environmental policy and
decision-making

Summary of submissions

Office of the
PARLIAMENTARY COMMISSIONER FOR THE ENVIRONMENT
Te Kaitiaki Taiao a Te Whare Pāremata
PO Box 10-241, Wellington

December 2003

This report provides a summary of submissions made to the Parliamentary Commissioner for the Environment in response to the discussion paper *Illuminated or blinded by science? A discussion paper on the role of science in environmental policy and decision-making* (PCE, 2003).

Both reports are available on the PCE's website: <http://www.pce.govt.nz>

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ISBN 1-877274-13-5

(Discussion paper ISBN 1-877274-09-7)

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1 Introduction

In July 2003, the Parliamentary Commissioner for the Environment (PCE) released a discussion paper entitled *Illuminated or Blinded by Science? A discussion paper on the role of science in environmental policy and decision-making*. The purpose of this discussion paper was twofold:

- to examine the value and limitations of science in environmental policy and decision-making; and
- to explore barriers and opportunities to improving the quality and effectiveness of environmental policies, decisions, and outcomes.

Illuminated or blinded by Science? highlighted a number of challenges faced by environmental policy and decision makers as they deal with issues that frequently have both scientific and non-scientific components that need to be taken into account. Scientific information may consist of, for example, observations, evidence, expert opinion based on established theories, or predictions based on accepted modelling techniques. In addition, decision makers may be faced with views, preferences and arguments that are not science-based, but nonetheless need to be considered. Giving due consideration to both facts and values is the easy part of environmental policy and decision-making process. The difficult part is giving effect to both the evidence and the various views, and arriving at a decision that is scientifically sound, economically, socially and culturally acceptable, and environmentally sustainable.

Decisions have to be made even though knowledge of environmental consequences may be incomplete or uncertain. Sometimes these decisions must be made within time constraints that are incompatible with time scales required to undertake appropriate scientific research. On other occasions the process may be prolonged and decisions delayed because of disputes over the scientific evidence or a clash of interests among the various parties. Additionally, policy and decision makers must deal with numerous demands, including legislative requirements and assertions of interested parties. Further issues highlighted in the discussion document include:

- effective arrangements for the integration of scientific advice into policy and decision-making;
- the correct framing of questions for science to attempt to answer;
- environmental policy and decision makers' need for and access to independent scientific advice;
- issues around research funding and science purchaser-provider relationships;
- transparency of, and accountability for, decisions that require not only scientific evidence, but also evidence that other viewpoints have been considered;
- communication between scientists, policy advisers, policy and decision makers, and members of the public; and
- relevant approaches for dealing with uncertainties and knowledge gaps in environmental policy and decision-making.

The discussion paper intended to stimulate debate and sought feedback on how science contributes to environmental policy and decision-making and environmental outcomes; how the contribution that science makes can be maintained or improved where necessary; and additional issues regarded as barriers or opportunities to

improving the quality of policies and decisions. Fourteen questions were raised throughout the report to help provide a focus for submissions. Responses to the questions were not intended to be, nor were, restricted to the specific issues raised in the questions.

This report is a summary and analysis of the submissions received. Submissions were compared and contrasted in an attempt to identify themes (where possible), while representing the range of opinions that were expressed. The report contains two major sections. Section 2 is framed in terms of the fourteen questions asked throughout the discussion paper. Additional comments made, that were applicable to the questions, were included in the analysis of each. Section 3 contains a summary of comments received that were inappropriate to incorporate into the discussion contained in Section 2.

1.1 Submissions and generic comments

A total of forty two submissions were received on the discussion paper, *Illuminated or Blinded by Science?* The quality of submissions received was generally high, with a considerable amount of time and thought apparently given to responses. The submissions were grouped into eight categories:

- four submissions were received from central government agencies;
- seven from local government agencies (one district, three city, and three regional councils);
- three from international submitters;
- one from Maori;
- one from a non-government organisation (NGO);
- five were received from individual (non-science) submitters;
- six from non-science organisations; in addition to
- fifteen submissions received from the science community, including both individuals and scientific organisations.

There was considerable support for the arguments made within the discussion paper evident within submissions, with many commending the Commissioner for addressing the issue of the role of science in environmental policy and decision-making. One submitter described the discussion paper as:

“... a fascinating, comprehensive and highly valuable document that demonstrates a truly refreshing view of the role of science in environmental policy and decision-making. It is highly welcome not least for the fact that it is genuinely open, honest, humble and self-reflective in the way that it tackles the nature of science and the inherent uncertainties in the context of wider issues and other forms of knowledge.” (3 OV)

One submitter however, was not in favour of the contents of the discussion paper, commenting:

“Your paper amounts to a demand by environmental policymakers that scientists should not provide a balanced and rationally argued

point of view based on facts and currently accepted scientific principles. Instead they should provide arguments in support of environmental policies and decisions, or risk losing their jobs and careers. You are breeding a generation of scientific yes-men.” (9 I)

It was felt that the discussion paper provided “a good overview of some of the issues facing New Zealand environmental science and policy” (12 S). Strengths of the discussion paper, acknowledged within submissions, included:

- the coverage of the reality of uncertainty in policy-making (19 OV);
- the use of real examples that “offer concrete grounds to support the arguments” (19 OV);
- acknowledgement of the “tension between the need to secure funding for research in a competitive environment and the desirability of a free and open exchange of views for the good of science and the wider public” although it was felt that this deserved a higher profile (2 S);
- acknowledgement of “traditional-knowledge and its equal relevance to policy and decision-making” (19 OV); and
- a highlight of the report was the reminder of the “unique status of DOC as being the only ‘environmental agency’ to have retained the concept of an in-house science capacity” (7 C).

Comments were also made regarding the scope and perceived gaps of the discussion paper. Two submitters commented upon the scope of the discussion paper. A central government agency commented that:

“The report opens up a broad range of issues, notes many situations and stakeholder types, and asks some huge questions, but because of this breadth, the report has not tackled an analysis against ... some or all of these issues. We anticipated the report would go further than it has.” (16 C)

Conversely, another submitter felt that:

“... the paper is [too] wide in scope to focus attention on the role of science in “environmental policy and decision-making” and hence many of the questions seemed somewhat irrelevant to what this author believes should be the focus of the discussion.” (18 I)

Various issues were commented upon by submitters as deserving of more detailed consideration. One submitter wanted to see:

“more discussion and explanation of the context within which scientific research is undertaken, and advice given. This would include more on:
Institutional influences, including democratic processes and governance ... ;
Economic influences, including global market pressures... ;
This means a discussion about the link between social and ecological systems, or political ecology ... The value of such discussion lies in

clarifying how scientific information forms one type of data, and how sophisticated some of these decision-making processes can be.” (15 S)

It was also felt that:

- the distinction between quantitative and qualitative assessments needs to be made more strongly in order to distinguish between science (research, assessment, analysis, hypothesis) and the application of science through technology (15 S);
- it was expected that the discussion paper would identify what and how scientific information and data are needed to support policy and decision-making (31 S);
- the discussion paper over-emphasised regulatory decision-making, largely ignoring management of resources; it also failed to sufficiently cover the competitive nature of science, and the impact of this competition on the ability to get good scientific input (7 C); and
- the discussion paper appears to “use science to define community issues, values and wants, and appears to ignore the role of science to define input of community defined issues, values and wants” (20 L).

2 Analysis of questions

Section 2 consists of the analysis of all submissions that responded to the fourteen questions asked throughout the discussion paper. Relevant comments identified in any additional submissions were also included within the analysis of each question.

2.1 Question 1

What important attributes and skills are needed for effective policy-making and decision-making? Are the right processes in place to maximise the use and effectiveness of such attributes and skills? How can these be encouraged among public authorities with environmental management responsibilities?

Overview

Fourteen submissions were received that directly broached question 1. These submissions were categorised as coming from:

- one central government agency;
- three local government agencies;
- one NGO;
- three non-science organisations; in addition to
- six submissions received from the science sector (both from organisations and individual scientists).

A further five submissions contained comments that were applicable to question 1:

- two of these were received from local government agencies;
- two non-science submitters; and

- another was received from an overseas submitter.

Question 1 consisted of three separate questions. Sixteen submissions dealt with question 1(a), while four and six of the submissions received considered question 1(b) and question 1(c), respectively. Numerous skills and attributes were suggested, in addition to those provided in Section 2.3 of the discussion paper, as being essential to effective policy and decision-making. A need to enhance desirable attributes and skills within public authorities was recognised.

Analysis

One third of all submissions received (33.3%) dealt with this question specifically. A further five submissions contained comments that were applicable to question 1; these responses have been incorporated into the analysis of question 1; and these responses have been incorporated into the analysis. The analysis of submissions has been undertaken separately for each component question.

Question 1(a): What important attributes and skills are needed for effective policy-making and decision-making?

Over one third of submissions received (38.1%) were appropriate to question 1(a). Within these sixteen submissions, general support for the lists of attributes and skills identified in Section 2.3 of the discussion paper was apparent. The lists were described as “extensive and well-considered” (41 S). It was noted by two submitters that the listed skills and attributes required prioritisation (22 L), which would depend upon the situation (15 S). Submissions recognised a wide range of skills and attributes important for effective policy and decision-making. Four attributes were raised in at least three submissions as being important to policy and decision makers. These were to:

- have a grasp of technical knowledge;
- keep an open mind;
- have an ability to handle uncertainty; and
- communicate effectively.

Numerous additional attributes and skills were also suggested; these are recognised at the end of this section.

The importance of sound technical knowledge was commented upon in a number of submissions (7 C; 11 S; 23 N; 34 O). The Department of Conservation (DoC) suggested that education to (at least) upper secondary school level would provide a suitable grounding (7 C). Technical knowledge that would “allow assessment of scientific information and understanding of the place of uncertainty” was highlighted within a submission by the National Council of Women of New Zealand. Such knowledge would preferably be coupled with the ability to assimilate information from a wide range of sources, with the resultant understanding used to “form an opinion based on the balance of probability” (34 O).

Technical skills were recognised as aiding effective communication between scientists and policy makers by providing common ground (22 L). A scientific background was suggested by a NGO as an important attribute in order to aid environmental policy and decision makers to “understand and comprehend complex environmental systems

and their linkages to social, cultural and environmental values” (23 N). An understanding of the scientific method was highlighted as important within another submission (7 C).

Various submissions focused on the importance of policy and decision makers retaining an open mind. For example, the DoC submission described a need to “demonstrate a willingness to embrace new knowledge/procedures” (7 C). Such a standpoint was echoed by the New Zealand Democratic Party, even when new ideas are regarded as “radical” (17 O). Inherent within such openness is a call to “lack a commitment to a predetermined position” (17 O). An ability to see the “big picture” and “treat the environment holistically” was noted by a regional council (4 L) as an important attribute for effective policy and decision makers to possess.

The ability to handle uncertainty was recognised as an important skill in three submissions. Examples included the ability to:

- recognise uncertainty in scientific assessments and the theory underpinning such assessments (30 S);
- handle uncertainty, while retaining freedom from ‘political’ pressure (11 S); and
- appreciate information limitations, from both a ‘gap’ and an uncertainty point of view (4 L).

Three submissions highlighted an ability to effectively communicate as a necessary skill for policy and decision makers to possess (22 L; 41 S).

“Communication skills are vital, and these include the willingness to listen to alternative points of view and respect difference[s], the ability to use language that is clear to all listeners, and questioning skills that elucidate discussion.” (34 O)

Additional desirable skills suggested for policy and decision makers to develop and retain included:

- the ability to assess scientific information outside their area of expertise and apply it to their situation (21 L);
- critical analysis skills, i.e. being able to “think through issues, asking the right questions” (34 O);
- avoid being unduly influenced by the prestige of an information source (17 O);
- be unaffected by the popularity of a view, whether it is held by the ‘lay’ public or academia (17 O); and
- maintain trust and demonstrate good judgement (28 S). It was pointed out in another submission that whether someone demonstrates good judgement requires a subjective measure of performance (15 S).

Two attributes raised within the discussion paper itself: (1) an ability to substantiate and communicate the rationale for decisions, and (2) the ability to critically assess the quality and reliability of information provided for decision makers, were reiterated by the Auckland City Council as vital attributes for council officers dealing with politicians and members of the public to possess (36 L).

A submission provided by the New Zealand Business Roundtable commented on the failure to recognise skills necessary to incorporate sound economic, legal and constitutional analysis into environmental policy and decision-making, in the list attributes and skills provided in Section 2.3 of the discussion paper (42 S). However, the scope of the discussion paper (Section 1.4), clearly stated that it was limited to the role that science plays in environmental policy and decision-making, but acknowledged the importance of the role that economic analysis plays in policy and decision-making (see page 9 of discussion paper).

Additional sought-after attributes and skills identified within submissions were an ability to:

- be aware of and value spiritual and cultural values (7 S);
- define community values and expectations and integrate such information with scientific information (20 L);
- work to change entrenched bureaucracy where necessary (17 O);
- consult to an appropriate level for a given issue (4 L);
- understand the political process (34 O);
- consider the social implications in addition to the environmental implications of introducing a new technology (30 S);
- seek redress through the regulatory or judicial system (3 OV); and
- an ability to fund and access peer reviews of scientific studies (21 L).

It was recognised that many necessary skills and attributes develop with experience and training (28 S; 34 O). However, “emerging disciplines like ‘systems thinking’... can help considerably with the acquisition of these high-level skills and attributes” (28 S).

Question 1(b): Are the right processes in place to maximise the use and effectiveness of such attributes and skills?

Only four submissions discussed whether the right processes were in place in order to maximise the use and effectiveness of attributes and skills identified in Section 2.3 and their response to question 1(a). Two submitters clearly felt that the right processes are not currently in place, while the other two submissions focused on suitable processes, rather than whether or not these are extant.

One submitter noted that:

“The right processes are not in place as technical experts are subject to direct and indirect pressure from ‘employers’ due to funding mechanisms. Overcoming these difficulties will require structural changes in the way scientists are funded so they are independent of those requiring advice.” (11 S)

Question 1(c): How can these be encouraged among public authorities with environmental management responsibilities?

Six of the forty two submissions received attempted to answer question 1(c). Within these, various approaches were suggested to encourage important skills and attributes

among public authorities with environmental management responsibilities. These included:

- utilising the experience already present within public authorities through best practice guidelines and workshops (4 L);
- enhancing the quality of relationships between environmental policy and decision makers at a national and regional level with science providers (29 S);
- on-going training in desired skills and attributes (34 O); and
- raising awareness of the need for people with a scientific background in managerial roles (23 N).

2.2 Question 2

What aspects of the role of scientific advice in proceedings of the Environment Court could usefully be applied to environmental policy and decision-making? How appropriate would it be to apply the principles behind the 'rules of evidence' in the context of environmental policy development?

Overview

Fifteen submissions were received that considered question 2 directly. These submissions were categorised as coming from:

- one central government agency;
- three local government agencies;
- one NGO;
- one individual (non-science) submitter;
- three (non-science) organisations; in addition to
- six submissions from the science sector (organisations and individuals).

Five additional submissions contained views pertinent to question 2. These submissions were received from:

- one central government agency;
- two local government agencies;
- one overseas submitter; and
- one science organisation.

Question 2 comprised two separate questions. Eleven submissions addressed question 2(a), while twelve submissions considered question 2(b). Eleven of the twenty relevant submissions felt that the role that scientific advice played in the Environment Court could usefully be applied to environmental policy development and decision-making, although three of these felt this applicability was limited. Two submissions did not regard either the role of scientific advice within the Environment Court or the 'rules of evidence' as applicable to environmental policy and decision-making. Interestingly, these two submissions were received from the science sector.

Analysis

Nearly half of all submissions received (47.6%) contained a response applicable to question 2. The analysis of submissions has been undertaken separately for the two component questions.

Question 2(a): What aspects of the role of scientific advice in proceedings of the Environment Court could usefully be applied to environmental policy and decision-making?

The discussion in Section 2.5.1 of the discussion paper (The role of the expert witness, and rules of evidence) was said to “read well, and suggests that the Environment Court provides a model for other decision bodies” (18 I). The influencing factors identified within this section (see page 22 of the discussion paper) were regarded as relevant and applicable to the analysis of what is an ‘expert witness’ (28 S). Scientific advice was acknowledged to lend rigour to Environment Court proceedings (41 S). It was felt that:

“Those who formulate policy and make decisions clearly need to seek expert knowledge on important issues and the same rigour should be required for those who give advice as those who give evidence.”
(41 S)

The approach used to include scientific advice in Environment Court proceedings was deemed to provide a “useful model” for policy and decision makers (15 S). If such a model were to be implemented, two points were highlighted for consideration within this submission:

- within such a model there is a “comparative lack of ‘independent’ scientific advice to weigh up against advice provided by researchers working for, or being paid by, advocates of a certain position”; in addition
- there is a need for “recognition [that] the politics involved in the evolution of what amounts to acceptable scientific viewpoints may be insufficient to compensate for the sometimes biased nature of these views” (15 S).

A submission received from an overseas organisation noted that the four factors commonly used to assess the admissibility of scientific evidence “tend to reinforce the extant paradigm and squeeze out new thinking and policy surprises, [which] are often valuable in policy and decision-making” (3 OV).

Another submitter felt the role that scientific advice plays in Environment Court proceedings to be applicable in theory to policy and decision-making (18 I). However, the submitter expressed concern that such evidential tests do not always occur in practice (within the Environment Court):

“... my experience is that the Environment Court is running two different “evidence based systems” – one which is applied with some rigour to scientists presenting evidence in well established fields based on well established theory, and another which allows almost anything to be read into the evidence provided the witnesses declare themselves to be expert and label themselves as “planners”.
I submit that the one system should be. Equally, other decision making bodies should be wary of experts whose only claim to expertise is their frequent employment in the Environment Courts by local authorities anxious to support their own plans.” (18 I)

The Waikato District Council, expressed the opinion that application of the role of scientific advice in Environment Court proceedings assumes that:

“...science is playing a role only in policy outcome and not process. If there was robust science behind the process of developing environmental policy and decision-making, then whatever the outcome would be accepted. That is because any policy frame that was developed would recognise knowledge deficiencies, accommodate new information and reflect the current state of knowledge of the environment.” (20 L)

Two submissions portrayed the view that the role that scientific advice plays within Environment Court proceedings was not applicable to environmental policy and decision-making. Numerous reasons were provided for this perceived lack of applicability, including:

- the Environment Court system “promotes and maintains binary and hierarchical values of different forms of knowledge”, which may lead to “the privileging of one form of knowledge over another” (28 S), thereby marginalising alternative views (30 S);
- the choice of expert witness is likely to be influenced by the ability to pay for their advice and the desired outcome (28 S);
- the adversarial nature of the Environment Court (28 S);
- a potential conflict of interest exists for institutions where experts are witnesses for different sides (28 S);
- expert witnesses may “over-emphasise the amount and quality of evidence that supports their point of view in order to advance a personal agenda” (30 S); and
- policy makers may become too reliant upon expert witnesses, lacking the ability to assess whether advice given has been accurately represented (30 S).

The standard of proof relied upon in Environment Court proceedings (balance of probabilities) was highlighted as an aspect that could usefully be applied to environmental policy and decision-making in a number of submissions (3 OV; 14 C; 21 L). The North Shore City Council professed that the ‘balance of probabilities’ approach is generally followed at local government level, as “there is often insufficient time to establish a scientific level of standard of proof beyond reasonable doubt” (21 L).

Additional aspects of the role of scientific advice in the Environment Court recognised as applicable to environmental policy and decision-making included the quality and testing of the process and peer review (22 L).

Question 2(b): How appropriate would it be to apply the principles behind the ‘rules of evidence’ in the context of environmental policy development?

A general degree of support for the principles in Section 2.5.1 of the discussion paper was apparent. The application of these principles was seen to “further enhance the likelihood of decision-making using the best information available” (5 O). An individual science respondent felt applying the ‘rules of evidence’ used in the Environment Court to be “highly relevant in the context of environmental policy

development” (11 S). A NGO also regarded the ‘rules of evidence’ applicable in the context of environmental policy development, provided:

“...they did not jeopardise community consultation in any way, and provided the expert scientific advice was totally reputable and of a high, unbiased standard. This is particularly important because policy making does not have the same avenue for cross examination that the Environment Court has, where dishonest expert advice is often revealed under cross examination and ruled inadmissible.” (23 N)

North Shore City Council (21 L) further endorsed the applicability of the ‘rules of evidence’:

“The principles behind the ‘rules of evidence’ are generally followed when assessing scientific issues at a local council level. The problem comes in when trying to match this evidence with other forms of evidence such as local knowledge, beliefs and community interests.” (21 L)

Two additional principles for determining the admissibility of scientific evidence for policy development were suggested by The Treasury. These were:

- the length of time and cost involved in gathering scientific evidence in relation to the time frame in which policy decisions are required; and
- the likely value / contribution of additional scientific evidence to the quality of the policy decision and whether there is a systematic way of obtaining ongoing information (32 C).

Four submissions regarded the principles behind the ‘rules of evidence’ as having limited applicability within the context of environmental policy development. The Auckland Regional Council suggested the principles could provide some guidance “particularly with respect to ways to test the credibility of science input & the ‘expert witness’ status” (4 L).

The Department of Conservation described the role that scientific advice has in Environment Court proceedings and the ‘rules of evidence’ as being more applicable to knowledge than environmental decision-making *per se*:

“They are probably fine for removing some risk of unsound advice. They will also probably remove innovation which is desirable for court proceedings but not for policy.” (7 C)

The National Council of Women of New Zealand did not consider the adversarial nature of Environment Court proceedings to provide the most appropriate model for obtaining scientific advice. However, the principles behind the ‘rules of evidence’ were regarded as appropriate in the context of policy development (34 O).

It was felt by one science submitter that the ‘expert’ is often “the one who pronounces most strongly on a topic and [gets] the best soundbite, rather than the person necessarily most knowledgeable” (37 S). Two submissions from the science sector

highlighted potential difficulties resulting from the application of the principles behind the ‘rules of evidence’, which include:

- emphasis being placed on the credibility (or lack of credibility) of an expert witness rather than on the issue at hand, or the quality of advice they offer (28 S; 30 S); and
- opinions being taken too narrowly, without recognising or acknowledging important background information (30 S).

2.3 Question 3

Questions and answers developed for a science framework may not necessarily be useful for environmental policy and decision-making purposes. How should this be addressed to ensure that, where appropriate, science and research is relevant to the policies and decisions that have to be made?

Overview

Fourteen submissions directly considered question 3. These were categorised as coming from:

- one central government agency;
- three local government agencies;
- one NGO;
- three (non-science) organisations; in addition to
- six submissions received from the science sector (organisations and individuals).

One additional submission, received from an overseas submitter, included comments that were applicable to question 3; these have been included in the analysis of question 3.

Three principal means of ensuring that, where appropriate, science and research is relevant to policies and decisions that have to be made, were apparent within these sixteen submissions. These were early interaction between scientists and policy and decision makers, effective communication between the two parties, and a suggestion that policy and decision makers commission research themselves.

Analysis

As stated above, sixteen submissions, or 38.1% of submissions received, contained comments relevant to question 3. Three concepts were discussed by more than one respondent. These were:

- the necessity of early interaction between scientists and environmental policy and decision makers (21 L; 29 S; 34 O);
- the importance of effective communication between scientists and policy and decision makers (4 L; 3 OV; 23 N; 30 S); and
- a need for policy and decision makers to instigate (and fund) research themselves to ensure research questions are applicable to their needs (7 C; 30 S; 34 O).

The early engagement of scientists in the policy and decision-making process received support within three submissions. The value of such early involvement was regarded as enabling researchers to “see what is needed” (34 O). It was noted by a city council that:

“Having [policy and decision makers] involved in setting the brief for a research project can help in targeting it at environmental problems. This slows down the scientific process but helps both scientists and [policy and decision makers] to understand the limitations or assumptions in the information each can contribute to a problem.” (21 L)

Effective communication between policy and decision makers and scientists was regarded as vital to ensure that scientific research is useful for policies and decisions. A NGO (23 N) described the necessary communication as twofold: ‘bottom-up’ and ‘top-down’.

“From the bottom up: there need to be opportunities for scientists to consult with regional council managers as to exactly what scientific questions need to be answered ... There are frequently ... communication difficulties. Sometimes further research is needed to provide useable outcomes.
From the top down: government funding agencies need to be more aware of the scientific needs required by decision makers so that research applications are more targeted to the requirements.” (23 N).

As recognised in a submission from the Auckland Regional Council: “Managers and scientists can easily talk past one another when discussing needs” (4 L). This may be a result of the fact that “often a single management question may break down into a number of research questions” (4 L). Auckland Regional Council found the most effective solution to be:

“...giving the staff the skills to phrase clearly what the management issue is, employing suitably qualified technical staff to act as the interface with scientists & the development of a rapport with individual scientists who are then used to dealing with ‘lay’ [practitioners].” (4 L)

The “numerous ‘degrees of separation’ between policymakers and scientists” was noted by a submitter as inhibiting effective communication (30 S). It was felt by this submitter that direct communication between scientists and policy makers should be encouraged. Such communication difficulties were seen as again raising “the question of the need for ‘translators’, or other forms of intermediaries between science and policy” (3 OV).

The third suggestion was evident in a number of submissions. Three submitters suggested that in order to ensure science and research are relevant to policies and decisions that have to be made, it may be necessary for the policy and decision makers to commission research themselves (7 C; 30 S; 34 O).

One submission thought question 3 raised two related issues: (1) the relevance of the science conducted, and (2) the uptake of this science into policy and decision making (41 S). It was felt that:

“Ensuring the relevance of research conducted requires some forethought on the part of decision makers as to the kind of research that could be needed in the future, with enough lead time to develop a research programme. Alternatively, tapping effectively into existing research programmes is possible, providing that the answers to a given question are already being researched. Of course, there is no guarantee of this. Some central coordination of research thrusts would go some way to addressing this.

Both science providers and decision/policy makers have a vested interest in making sure that uptake of scientific information is effective. Researchers are often able to communicate their key issues effectively, and often serve on expert panels. However, where this is not possible, or where additional synthesis or interpretation is required, it would be useful to have in place a pool of science translators/interpreters, who could either be housed with the science providers or the policy/decision makers, but would have strong links with both, potentially linking in with existing programmes (e.g. DOC Science Transfer Programme).” (41 S)

Additional comments contained within submissions highlighted the following:

- the need to generate policies may exceed the ability of science to provide answers (11 S);
- science is only one of many factors that should be informing policy and decision-making; consideration needs to be given to “economic, social and cultural impacts as well as those on the environment. The resulting policies should be appropriate for and support New Zealand society and serve New Zealand’s interests both short and long term.” (34 O);
- scientists should “participate in environmental management as key stakeholders, like policy people, politicians, and the general public” (29 S); and that
- science is unlikely to be of use to decision makers where it has not yet developed sufficient understanding to offer even tentative support for a position (17 O).

2.4 Question 4

How adequate is the current environmental science and research system, and its level of funding, for meeting the information needs of environmental policy and decision makers? What real difference has investment in science made to the quality and success of environmental policy and decision-making processes and outcomes?

Overview

Fourteen submissions considered question 4. These submissions were grouped into five categories:

- one submission was received from a central government agency;
- three from local government agencies;
- one from a NGO;
- three from various non-science organisations; in addition to
- six submissions received from the science sector (individuals and organisations).

An additional four submissions contained comments applicable to the discussion on the adequacy of the current environmental science and research system. These submissions were received from:

- one regional council; along with
- three submissions from the science sector.

These comments have been included in the analysis of question 4.

The current level of science funding was regarded as inadequate by five of the eighteen respondents. An alternative view expressed, was that the adequacy of the research system lay not so much in the level of funding, but how effectively completed research is utilised.

Analysis

Eighteen submissions, or 42.9% of the total number of submissions received addressed question 4. As pointed out by one submitter (41 S), question 4 facilitates two major discussions: one on the adequacy of the current research system, and its level of funding, for meeting information needs, and secondly, how effectively the information produced is incorporated into policy and decision-making processes and outcomes. The discussion of these two issues has been undertaken separately, under each of the two component questions.

Question 4(a): How adequate is the current environmental science and research system, and its current level of funding, for meeting the information needs for environmental policy and decision makers?

The adequacy of the current environmental research system, particularly the current level of funding, was an issue that prompted strongly phrased responses. Five respondents felt the level of funding was inadequate. (Only one of these responses was received from the science sector.) One submitter expressed the opinion that:

“The funding of science research in New Zealand has been allowed to fall well below the requirements for informed debate ... Much of the needed research will not now proceed, and scientific knowledge and skills will be lost as researchers either leave New Zealand to find work in their fields of expertise overseas or are diverted into other research fields. Few young New Zealanders are coming into research with such an uncertain future and the lack of career pathways within CRIs.”
(34 O)

One submitter commented that:

“Direct funding of research by interested parties puts pressure on scientists to come up with the ‘right’ result ... Many scientists are funded from a mixture of public and private sources and with funding which is insecure so pressures on scientists to ‘conform’ and to refrain from publishing can be high ... Unfortunately, current ‘science structures’ have been determined on the basis of economic dogma without evaluation of the merits of the *science outcomes* of alternative ways of structuring scientific research.” (11 S)

Additional opinions regarding the adequacy of New Zealand’s system of science funding included views that:

- there is a fundamental problem getting innovative research funded, which is compromising the degree to which science can potentially contribute to policy and decision-making (4 L). It was recognised that not everything can be funded, “but some very credible, valuable research is not being funded” (4 L);
- there are difficulties in aligning science research and policy when “long-term to the policy people is three years ... while long-term scientifically can – sometimes should – be decades. How do you get good research and policy when science can be funded on an annual basis, and you don’t know if your program will be supportable three years from now?” (37 S)
- the current science system is directed more towards economic than environmental outcomes (11 S);
- there is a bias towards funding national and international issues, rather than research on regional and local environmental issues (29 S); and
- scientific research undertaken for the ‘national good’ should be government funded (33 L).

Another submission highlighted numerous changes perceived as necessary in order to facilitate an adequate funding system. A number of these suggestions have been included below:

- *CRI competition*. “It is currently unclear whether CRIs are operating in a purely competitive funding environment or whether there is an unacknowledged base of funding that is non-competitive. If CRIs have a certain baseline of funding that can always be relied upon, this should be explicitly acknowledged so that this funding can be used with confidence to maintain unprofitable but essential services (for example, seed banks of New Zealand native plants) ... Currently, the system is encouraging wastage of funds as money is needed for attracting and/or maintaining money.” (30 S)
- *Understandable funding*. “... When CRIs submit funding proposals that do not fit in with FRST’s strategic plan, it should be made very clear what the problem is without the need for second guessing.” (30 S)
- *Intellectual property*. “If taxpayer funds are used, then the IP [intellectual property] rightly belongs to NZ. There should be a requirement for IP to be placed in the public domain ... IP development is not the domain of state owned institutions. Aside from the risk associated with development, the use of taxpayer money often means elements of due diligence or market research are ignored or not addressed.” (30 S)

- *Self-interest*. “Under the current model science providers must make business-like decisions which may not be in the best interests or intentions of the public or agencies acting on their behalf ... Unbiased advice becomes difficult to obtain from the scientists who know the most about the area.” (30 S)

One submitter discussed the system of science administration and funding in relation to a reduction in shared information:

“Unfortunately, the current culture of science administration and funding does not encourage the free sharing of scientific information or the involvement by individual scientists in environmental (including conservation) policy development, so such scientific advisory groups are uncommon – even among conservation boards. As a result, the interested public often does not have easy access to information which would be helpful in connection with discussions on significant local and national environmental issues. For example, the former DSIR had a very useful role in commenting on district schemes and other local authority plans (i.e. feeding scientific data in at the “grass roots” of management), but the CRI system has removed this input. The board advocates changes in science management which would allow more participation by scientists in these issues.” (39 S)

An organisation capable of taking a lead, dealing with national issues, ensuring there is adequate uptake of science, in addition to acting as an advocate for future opportunities for environmental science in the long-term, was believed to be missing:

“What we have instead are: a politicians who seem to be driven by “buzz words” that do not necessarily result in sensible decision-making, government departments with patchy science management capabilities and that are funded in a way that their operational science agendas are fragmented, sharply decreasing real PGS&T science funding, a FRST that is fragmenting the research agenda, and FRST reference panels that appear to have short-term views and that have an unpredictable influence on research priorities. This state of affairs ensures that scientists are now feeling completely disempowered” (6 S)

Two submissions presented alternative perspectives on the funding system. As put by one Crown Research Institute:

“Problems with the current system are not so much to do with the level of funding (there is never enough funding), but more to do with the ability of scientists and science organisations to evolve with the changing needs of environmental policy and decision-making, and society in general. It is possible for scientists and science organisations to evolve with the support of organisational managers, and the policy agencies they work with in partnership paradigm ... This requires new management approaches based on an understanding of professional intellect and “making the most from the best” and the use of systems methods to

facilitate reframing and changing boundary decisions. E.g. being prepared to work with new disciplines like social science and systems thinking to complement biophysical science.” (28 S)

Another scientist highlighted the need for effective uptake of existing research:

“I would argue the primary problem is the poor use of existing research ... the priority is to take existing knowledge and concepts and shape them in ways that fit into management and decision-making systems; this is as [opposed] to boosting research funding.” (15 S)

Question 4(b): What real difference has investment in science made to the quality and success of environmental policy and decision-making processes and outcomes?

Comments applicable to question 4(b) tended to portray the view that there is “room for improvement” in investment in science, and the resultant contribution that science makes to the quality and success of environmental policy and decision-making processes and outcomes (41 S). It was, however, pointed out by one submitter that:

“Science has made a demonstrable difference in environmental policy and decision making. The placement of marine reserves, control of possums and other introduced pests, knowledge of biosecurity threats, and the potential impacts of bio- and nuclear technology are just a few of the most important examples.” (41 S)

Additional examples of the areas in which science contributes to environmental policy and decision-making processes and outcomes were provided by the Auckland Regional Council:

“Sciences major input to environmental policy & decision making occurs at a much more mundane level. Examples are; the justifications for riparian management, stock exclusion from waterways, management of ephemeral water bodies, restrictions on land development, vehicle emission controls, the setting of environmental standards, etc.” (4 L)

The effects of investing in science on the quality and success of environmental policy and decision-making processes and outcomes, noted in submissions included:

- definition of magnitudes, e.g. population sizes, amount of exploitative take, size of area to be protected (7 C); and
- an increased investment in “band wagon partnerships” (23 N); being too focused on commercial outcomes (5 O).

It was noted that there is an opportunity for improvement “with regard to the flow of information from the research providers to the decision/policy makers” (41 S). Also noted, was a need to “... redirect the current funding from outcome focused research to process related research, as much of the current knowledge is not used due to the

nature of the political process of policy making and community lack of knowledge or understanding” (20 L).

2.5 Question 5

What should be the role of science in environmental policy and decision-making? What criteria should govern such a role?

Overview

Question 5 was broached directly in twelve submissions, which were categorised as coming from:

- one central government agency;
- three local government agencies;
- one NGO;
- three non-science organisations; as well as
- four submissions received from the science sector (organisations and individuals).

In addition to these twelve submissions, a further eight submissions contained comments pertinent to the discussion on the role of science in environmental policy and decision-making. These eight submissions were provided by:

- two central government agencies;
- three local government agencies;
- one overseas submitter;
- one individual (non-science) respondent; and
- one submission from the science sector.

The two major roles of science in environmental policy and decision making recognised by submitters were: (1) as an information provider, and (2) to be responsive, even proactive, anticipating the needs of policy and decision makers.

Analysis

Twenty submissions – 47.6% of the total number of submissions received – discussed the role of science in environmental policy and decision-making. The analysis of these has been dealt with separately for the two questions that comprise question 5. While all twenty submissions broached part (a) of question 5, only one submission provided a response to the second component question.

Question 5(a): What should be the role of science in environmental policy and decision-making?

The role that science can play in environmental policy and decision-making was described by a regional council as “poorly recognised & definitely under utilised” (4 L). The role that science should play in environmental policy and decision-making included a view that it should have a strong role (23 N), perhaps being a partner in decision-making (11 S). It was also recognised however, that science is an aid for policy and decision-making, not an answer in itself (36 L).

Two principal roles for science in environmental policy and decision-making emerged from the submissions that dealt with question 5(a). The first role highlighted was as an information provider. Science was seen by a central government agency as informing and delineating “boundaries of applicability” (7 C). While another submission stated that the role of science is to:

“provide unbiased technical information and offer rational alternatives to aid decision-makers who do not have science backgrounds [and] inform the public – at present the media are poor at passing on information except adversarially” (34 O).

This sentiment was echoed in another submission:

“... science should be thought of as a general source of expertise and knowledge about broad areas likely to be of use to policymakers. Additionally, science can be used to answer specific questions that come from various sources both before, during and after policy implementation. Science is thus an information provider to:

- Policymakers, for specific questions before a policy is formulated
- The public, for questions about a policy after its formulation but before its implementation
- Both the public and policymakers, to monitor the effectiveness of a policy after it has been implemented.” (30 S)

Waikato District Council described science as having a necessary role in “transferring knowledge to the community to assist its decision-makers, and to increase community awareness and accountability for outcomes as a result of community behaviours” (20 L).

The second theme evident within the eighteen relevant submissions related to a desire for science to be both responsive, and go further, anticipating the needs of environmental policy and decision makers, and communities. This theme was evident within three of the eighteen applicable submissions (5 O; 17 O; 28 S). Couched within this desire for proactive science was the need for a close relationship, between scientists and policy and decision makers. This was evident within one submission, which stated that:

“Science should be closely tied into policy goal achievement. At the moment it is asked for if a need arises, but it should be able to anticipate policy needs – through an iterative process involving policy developers – the politicians, and scientists experienced in developing research programmes, which would address policy development needs. A balanced system would be required so that one “side” did not dominate the other. Feedback through a public process would be needed, possible through the local authority annual plan process – although the science would need to be coordinated nationally.” (5 O)

One submitter felt that in order to develop “rational and objectifiable environmental policy that has power and effectiveness, scientists must be consulted” (10 S). While, yet another expounded:

“Scientists should not be merely 'on tap'. They should feel free to draw attention of decision makers to issues they have become aware of as a result of their research or awareness of others' research. They should feel free to break away from normal protocols if they feel insufficient attention is being given to serious concerns.” (17 O)

Another submitter commented that the role of science is not to necessarily drive policy and regulatory decisions, but rather:

“along with other relevant factors, inform and support those decisions ... Science can, however, play a role in ensuring that decisions are made with clear understanding of the problem and its possible consequences and likely solutions” (22 L).

Alternative roles of science in environmental policy and decision-making suggested within submissions, included:

- monitoring impacts, change, and warn of future effects; and explain phenomena, providing critical analysis and evaluation (34 O);
- aid definition of research questions to ensure the feasibility of providing a “useful answer” (3 OV; 21 L);
- defining and describing outcomes (playing both a process and an outcome related role) (20 L);
- provide ‘on tap’ skills at the science-policy interface during international treaty formation and implementation (32 C); and
- scientific information based on the best information available at the time serves to provide “councils with the confidence that to the information can be defended by experts in the Environment Court if required” (40 L).

A submitter commented that

“It is not helpful to discuss the role of science in environmental policy and decision making without recognising the wide scope of views about science. It will certainly not be helpful to develop criteria for the assessment and inclusion of science into environmental policy and decision making without ensuring that the language is the same or similar for all those speaking and listening.” (25 I)

Question 5(b): What criteria should govern such a role?

Only one submission dealt with the latter part of question 5. It was felt by this respondent that suitable criteria to govern the “strong role” that science should play in environmental policy and decision-making could include:

“... funding science that is policy relevant and whose outcomes are easily understood by policy and decision makers, based on the science provider’s track record perhaps.” (23 N)

2.6 Question 6

Where science is needed for policy and decision-making, how should the interface be managed to ensure that scientific advice is accurately interpreted for, and understood by, policy and decision makers? What role should science play in the post-decision phase?

Overview

Thirteen submissions addressed question 6 directly. These thirteen submissions were categorised as coming from:

- one central government agency;
- two local government agencies;
- one NGO;
- three non-science organisations; in addition to
- six submissions received from the science sector (individuals and organisations).

Five additional submissions contained comments pertinent to question 6. These submissions were received from:

- one central government agency;
- one individual (non-science) respondent; and
- three scientists.

A desire for scientifically aware policy and decision makers was apparent within three of the eighteen submissions; conversely, a need for ‘translators’ to aid communication between scientists and policy and decision makers was also suggested. Science was seen as having a role in the post-decision phase through monitoring and evaluation.

Analysis

Almost one half of all submissions (42.9%) contained comments relevant to question 6. Question 6 comprised two separate questions. Sixteen submissions addressed part (a) of question 6; nine submissions contained an applicable response to the question 6(b).

Question 6(a): Where science is needed for policy and decision-making, how should the interface be managed to ensure that scientific advice is accurately interpreted for, and understood by, policy and decision makers?

Suggestions as to how the interface between scientists and policy and decision makers should be managed to ensure that scientific advice is accurately interpreted and understood by the latter group were varied, however all related to some degree to facilitating better communication between the two parties. One submitter commented that:

“... legal decision makers seem to talk past each other when they talk about science. They use the same language but can be talking about very different concepts. Science has a very different scope for different

people, and that difference includes the content, methods, fields of endeavour, qualifications and many more criteria... Even when decision makers do discuss the role of science and scientific concepts between themselves, there is no guarantee that misunderstandings will not occur.” (25 I)

Four submitters portrayed a desire to have “scientifically aware” policy and decision makers (7 C; 11 S; 15 S; 37 S). One submitter stated that:

“The objective is to sensitise decision-makers to the broad areas of concern, and the general flavour of scientific knowledge or understanding within each of these areas.” (15 S)

It was acknowledged within another submission that:

“Sometimes superb scientists are poor communicators. It may sometimes be useful to employ a scientifically literate person who is a good communicator to act as a bridge or translator between specialist and decision makers.” (17 O)

In order to ensure the accurate interpretation and understanding of science advice, it was felt by one submitter, that both scientists and policy and decision makers need to be aware of the limitations of each:

“The interaction envisioned ... would ensure that policy makers were aware of the limitations, and the ability of, science providers to answer questions about the implementation of environmental policies. Scientific providers would also be more aware of the needs of policy makers, both in terms of the science programmes required and the way the information could be provided to the policy makers so they could understand it and implement it.” (5 O)

A number of submitters discussed the need for closer, more enduring relationships between scientists and policy and decision makers. A NGO described this as follows:

“The scientists and policy makers need to be better welded than they currently are, both in the pre-decision and post-decision phase, in fact at all stages of decision making where their information is needed – the scientists also need to be included in the policy making in interpretive roles. They (scientists and policy makers) need to be accountable for all their information, and they need to be given realistic (for them) timeframes, not expected to work under continual pressure to “get a quick fix answer” for politicians or the wealth class.” (23 N)

Partnerships based on trust were regarded by one submitter as being more enduring and effective than those based on written contracts. An example given of such a relationship was that which exists between ESR and the Ministry of Health:

“ESR’s relationship requires that both organisations are jointly responsible for being forward-looking, environmental scanning, and contributing to outcomes; and the science that is undertaken is just as much initiated by ESR as it is by the Ministry ... The responsibility for interpretation and understanding scientific research has not traditionally been the domain of scientists on the basis that their expertise is in developing the knowledge, not its implementation, and scientists may, in fact, want to distance themselves from implementation of their work depending on how the science is used! Dialogue between policy makers/decision-makers and scientists, then, needs to be more open and iterative during research programmes, and FRST are, to some extent, seeing that this happens in the funding criteria. This funding regime – which also promotes the development of knowledge to support a ‘knowledge economy’ - opportunities for economic gain (competitive capitalism) – does not acknowledge the tensions between sharing knowledge/research findings and a competitive environment in terms of knowledge generation (intellectual property).” (28 S)

Other suggested means of ensuring scientific advice is accurately interpreted and understood by policy and decision makers included:

- open acknowledgement and discussion of the tension between sharing knowledge / research findings and the competitive environment in terms of intellectual property (28 S);
- open and iterative mechanisms for monitoring and evaluation, with an additional bonus of identifying gaps (28 S);
- good scientific support that is free from political or financial pressure, that may affect the quality of advice (11 S);
- constant interaction between science providers and policy makers so that all parties “speak the same language” (34 O);
- communication between scientists and advisors need to be initiated from an early stage and maintained throughout all stages of the ‘policy cycle’ (29 S; 30 S); and
- independent review of policy decisions to ensure decisions are aligned with sound science (7 C; 30 S).

A scientist questioned who is responsible for ensuring the accurate uptake of science:

“A dominant objective of FRST is now the uptake of the research. That is, scientists appear to have **all** the responsibility for ensuring uptake of their work. No one else appears to be held accountable, among several government departments that we assume are making evidenced-based decisions on environmental management.” (6 S)

Question 6(b): What role should science play in the post-decision phase?

Eight of the nine submissions pertinent to question 6(b) expressed the view that the role of science in the post-decision phase is that of monitoring / evaluation. The exception to this described the role of science in the post-decision phase as being to:

“explain to the public their speciality as it relates to the issue. They should apprise decision makers of new information which supports the existing decision or modification of it” (17 O).

Post decision evaluation was seen as a desirable means of determining whether a decision is achieving the intended outcome by one submitter (7 C). Another submitter (30 S) recommends this be done by independent persons to avoid accusations of bias:

“Review is a process requiring outside contributions as a counter to accusations of bias. A statement of the expected policy results should be included in the final policy and would give future reviews a point of reference upon which to focus.” (30 S)

Such independence of reviewers was not regarded as essential by another submitter:

“Science providers would be involved in the evaluation of the policies to adjust their own programmes so that the information they provided was relevant and practical.” (5 O)

Two submitters regarded monitoring and evaluation of policy decisions as necessary to establish flexibility and an ability to adapt policies. Such monitoring was seen as a “joint responsibility, based again on openness and iteration” (28 S). It was noted that:

“With the rate of development in some areas of science new policy should not be seen as permanent. Policy makers and government should be prepared to change on the basis of new knowledge and the results of public discussion.” (34 O)

Stated elsewhere in their submission, the National Council of Women of New Zealand recognised that:

“Every environmental policy should have clear objectives and targets; science provides the means of measuring achievement against these.” (34 O)

2.7 Question 7

Given the importance of gaining public confidence in integrity of scientific advice and its role in decision-making, how can the public’s trust in the system be effectively achieved and maintained?

Overview

Thirteen submissions addressed question 7 directly. These submissions were categorised as coming from:

- one central government agency;
- three local government agencies;

- one NGO;
- three non-science organisations; along with
- five submissions received from the science sector (organisations and individuals).

In addition to these thirteen submissions, one further submission, received from a city council, broached the issue of gaining public confidence. This submission was included in the analysis of question 7.

The greatest number of submitters felt that public confidence in the decision-making system could be achieved and maintained through the understanding and involvement of the public in the decision-making process. Inclusion of scientists in the presentation of information to the public was also deemed to be important within a number of submissions.

Analysis

One third of all submissions (33.3%) were applicable to question 7. Throughout these submissions a discernible sentiment was that by involving the public in the decision-making process, trust in the system could be achieved and maintained. Trust was seen as arising from understanding of and involvement in the decision making process, from problem specification through to resolution (4 L; 28 S; 34 O; 41 S). It was noted that how the public is involved would vary with the issue (28 S). One submitter suggested that:

“... feedback through the annual planning process, and reporting in local authorities annual reports would provide opportunities for the public to be involved.” (5 O)

Another submission highlighted the use of a partnership approach between key stakeholders at all stages as a means of developing and maintaining public trust (28 S).

Honesty was specified within two submissions as a means of gaining public confidence in the integrity of scientific advice and trust within the system (23 N; 28 S). A submission received from scientists portrayed the view that gaining public trust would always be an issue in New Zealand:

“We believe that this issue will always be problematic in New Zealand because of our small science population. It may [be] inevitable that scientists will have conflicts of interest and links with corporate interests that are incompatible with providing unbiased public advice. In this case, clear declarations of interest may help maintain trust.” (30 S)

Several submitters commented on the importance of including scientists in the presentation of information to the public. It was felt that:

- Greater confidence and understanding of the information is achieved as a result of the community being able to directly question scientists (21 L).
- Scientists need to demonstrate their impartiality and be dispassionate in their statements (4 L; 17 O).

- Scientists should suspend judgement in public (17 O).

Additional means suggested within submissions of gaining the public's confidence in the integrity of scientific advice, its role in the decision-making process, and trust in the system, included:

- transparency of the process (34 O; 41 S);
- admitting uncertainty (28 S);
- recognition and application of the precautionary approach (34 O);
- policies developed need to take public opinion into account and “not get too far ahead of it” (34 O);
- through understanding of scientists and scientific methods, “currently there is a mistrust born out of ignorance and misinformation ... More scientifically trained journalists would help this” (34 O);
- a need for scientists to be more effective in communicating what they are doing and why (34 O);
- more professionalism is required by the government in dealing with the science behind environmental issues (34 O);
- science addressing the needs of the community rather than defining those needs (20 L); and
- genuine consultation, as opposed to “just going through the motions” to avoid public distrust of both the policy and decision-making process and the results (34 O).

It was pointed out by a central government agency that there is no guaranteed way in which public confidence can be maintained:

“Good process and transparency are helpful insurance, but do not guarantee immunity from externally-driven public opinion.” (7 C)

2.8 Question 8

Given the current emphasis by central government on 'whole-of-government' policy formulation, does New Zealand have the right mix of models for providing the appropriate scientific advice for policy and decision-making? If not, what changes are needed?

Overview

Twelve of the forty two submissions received directly addressed question 8. These submissions were categorised as coming from:

- one central government agency;
- two local government agencies;
- one NGO;
- three non-science organisations; in addition to
- five submissions received from the science sector (individuals and organisations).

Four additional submissions contained comments relevant to question 8. These were received from:

- two central government agencies;
- one city council; and
- one from the science sector.

Many submissions did not agree that New Zealand currently has the right mix of models for providing the appropriate scientific advice for policy and decision-making. However, comments were also focused around the necessity of achieving better uptake of research already undertaken.

Analysis

Only two submissions (or 4.8% of the total number of submissions received) felt that New Zealand currently has the right mix of models for providing appropriate scientific advice for policy and decision-making. It was noted by one that:

“The current model for providing scientific policy advice is probably adequate for providing advice on existing technologies. Because most existing technologies are likely to be mature and non-controversial, scientific advice on these technologies will probably be easily obtained, will not require much public input, and will be able to provide useful predictions on which to base policy.” (30 S)

These submitters felt, however, that when scientific advice was required to provide policy advice on emerging technologies the current mix of models is insufficient.

The ‘whole-of-government’ approach was discussed within three submissions. Such an approach to policy formulation was regarded as sounding “better in principle than in practice” by the Department of Conservation (7 C):

“Cross-departmental cooperation in, for example Biosecurity, has been a resounding failure, both at the science and at the policy ends.” (7 C)

A CRI commented that:

“There appears to be genuine efforts for an improved ‘whole-of-government’ approach to policy formulation, but at the same time there are still rigid divisions between environmental, and social and cultural foci, and how different government departments/agencies define their jurisdictional boundaries and responsibilities which are likely to be determined – to a large extent – by budgets. These persistent divisions are reflected in research funding structures and processes, as well as persistent adherence to a hierarchical valuing of certain kinds of knowledge generation and research methods and methodologies. The role of end-user engagement in research proposals, research and dissemination of findings requires evaluating in light of what is hoped to be achieved in terms of the goal of better integration between research institutions, and regional and national policy/decision-makers. Accountability goes both ways.” (28 S)

The Crown Research Institutes model was regarded by several submissions as being “seriously flawed” (34 O). Comments included a view that expertise is frequently captured by one sector group; “generally the group with the deepest pockets” (7 C). The business model of CRIs was regarded by two submitters as causing serious difficulties to the provision of the best scientific information to be provided to the policy process. CRIs were seen by an NGO as having, on occasion, become severely compromised, limiting evidence that may jeopardise their client’s case or application (23 N):

“It is purely ideological to assume that a dual role such as the one held by CRIs will produced balanced and reliable scientific policy advice for the benefit of NZ ... the research provider has a clearly accountable role to provide ethical, unbiased results, not a dual role as in the current situation. Science cannot be run as a business successfully.” (23 N)

The funding regime for CRIs was also seen as a difficulty of the CRI model allowing the provision of the best scientific information:

“... The current funding regime requires researchers to submit proposals every 3 to 5 years – this is too short for research into long-term problems. The long time frames in which environmental problems develop require a similarly long time to develop effective solutions.” (34 O)

It was also said that:

“The mix of commercial and state funding with individuals receiving support from both sources can compromise outcomes.” (11 S)

One submitter commented that:

“There may be conflicts between publicly funded research and private clients required to keep the organisations funded and associated intellectual property rights. This may lead to scientists being denied the opportunity to comment publicly on important contemporary issues, because of the possibility of alienating potential clients.” (8 S)

Independence of scientific advice was desired by a number of submitters. One submitter felt that independent scientific advice was becoming more difficult to obtain (11 S). However, a central government agency regarded CRIs as having the capability to act as independent research providers (16 C).

Comments within two submissions were related to the efficacy of decision-making authorities to harness research that has, or is currently been undertaken. As stated by one submitter:

“This would not require any major re-jigging of existing institutions, but would require a major rethink on the process of distributing

scientific information. That is, the problem lies with regulatory authorities and private sector up-take.” (15 S)

In order to achieve this, it was recommended that there be “... far better use of existing institutions and organisations to improve the flow of information, rather than putting in place new institutional frameworks. This would include providing information directly to community groups, including iwi or hapu.” (15 S)

2.9 Question 9

How can the quality of both scientific and policy advice be assured?

Overview

Eleven of the forty two submissions received directly addressed question 9. These submissions were categorised as coming from:

- one central government agency;
- two local government agencies;
- one NGO;
- three non-science organisations; in addition to
- four submissions received from the science sector (individuals and organisations).

Four further submissions contained comments relevant to question 9; these submissions were received from:

- one city council;
- one individual (non-science) submitter; along with
- two submissions from the science sector.

Means of ensuring the quality of scientific and policy advice suggested included transparency of process, peer review (for both science and policy), monitoring and evaluation of decisions.

Analysis

Approximately one third of submissions (35.7%) contained responses that were applicable to question 9. Three submitters discussed the importance of transparency of process in order to ensure the quality of scientific and policy advice provided. It was said within one submission that:

“An open and transparent decision-making process involving canvassing a range of points of view will raise the quality of advice. The lack of absolutes can make it difficult to be assured that the advice is the best in the long-term.” (34 O)

A process of rigorous monitoring and evaluation of scientific and policy advice was seen as a means of providing quality assurance by four submitters. A regional council felt that the Environment / High Court review process was the appropriate medium for such review (4 L). Another submitter stated that:

“Reviews of science-based policy should cover both the policy’s success or failure, and new scientific information that may suggest ways to improve the policy’s success. Alternatively, we suggest that it would be beneficial to have a review of a particular policy be conducted by someone who is familiar with the field but not active scientifically, so they have no (or minimal) preconceptions and biases.” (30 S)

More than half of the pertinent submissions suggested that peer review, used for quality assurance in science, could be extended for use in the policy arena. It was said that:

“The quality of scientific advice can be assured by a rigorous process of peer review and publication of work in an ongoing way. If this is the foundation of policy advice it too will be of the required standard.” (5 O)

Another submitter stated:

“... One way to increase the robustness of science in policy is to ensure that sources have been properly critiqued. Having said that, the peer-review process is not infallible, and users should be prepared to submit their sources to comprehensive scrutiny.” (41 S)

One submitter however, did not perceive the peer review system to act as quality assurance for science and policy advice:

“... the peer review system actually begins to do the very thing it sets out to prevent, that is:
“... adding to the stock of scientific knowledge and misleading future research.” [Page 15 of the discussion paper]
... The peer review process is failing. It is becoming less reliable. In fact it is reinforcing false paradigms more than true paradigms... The peer review process often fails to expose failings in the method of inquiry.” (26 I)

Alternative means of ensuring the quality of science and policy advice suggested within submissions included:

- attracting and using high quality staff (7 C; 34 O);
- use of best practice guidelines (4 L);
- interaction of parties to build trust and understanding (4 L);
- convincing the public that advice is good and appropriate (5 O);
- assurance that scientists and other policy advisors are free from pressure to “take a particular line” (17 O);
- investing in research (34 O);
- encouraging information sharing (34 O);
- using senior scientists to mentor and develop the skills of emerging researchers (34 O);

- funding security for scientists in order to produce unbiased, quality scientific advice (11 S); and
- compliance by scientists to the “Royal Society of New Zealand Code of Professional Standards and Ethics” (8 S; 39 S).

A city council (36 L) commented that quality assurance of scientific advice would always be an issue in New Zealand due to the limited scale of the scientific community in the country.

2.10 Question 10

How can environmental policy and decision makers most effectively and usefully engage with the diverse range of other information, values, worldviews and ethics alongside science?

Overview

Fifteen of the forty two submissions received dealt specifically with question 10. These submissions were categorised as coming from:

- one central government agency;
- three local government agencies;
- one Maori Trust Board;
- one NGO;
- three non-science organisations; in addition to
- six submissions received from the science sector (individuals and organisations).

Seven additional submissions commented upon the issues contained within Chapter 4 of the discussion paper, which dealt with the interface between non-scientific information and environmental policy and decision-making. These submissions were received from:

- two local government agencies;
- one overseas submitter;
- two non-science organisations; along with
- two submissions from the science sector (one individual and one science organisation).

These seven submissions have been included in the analysis of question 10.

Many means were suggested to allow environmental policy and decision makers to effectively and usefully engage with other information, values, worldviews and ethics alongside science. Consultation was recognised by a number of submitters as a valuable way of including the above into policy and decision-making. Recognition of the value of including a range of information, values, worldviews and ethics alongside science was regarded as an important starting point by two submitters.

Analysis

A total of twenty two submissions tackled issues related to question 10. These submissions comprised 52.4% of the total number of submissions received. Resolving the question as to how environmental policy and decision makers can most effectively

and usefully engage with the diverse range of other information values, worldviews and ethics alongside science, was acknowledged to be “a complex and difficult process” (36 L). One submitter regarded the process as going “a long way towards overcoming the problems of distrust, dispute and poor communication. It will also help improve the understanding of the inherent uncertainty that exists in environmental decision-making, if not actually resolving that uncertainty” (27 O).

A submission from a Maori Trust Board requested the focus of environmental policy and decision-making be returned to a focus on the environment:

“Successful environmental policy should determine the needs of the environment as opposed to the people who live on it, within it or off it. If people make the environment the priority in time it will care for the people.

Similarly with [environmental] decision makers, if the decisions are first made around the wellbeing of the environment then the benefits will return to the people as opposed to seeing how you can get the maximum use out of the environment for the benefit of the people first.” (13 M)

A call for a more relaxed approach to consultation was apparent within two submissions. One submitter considered that:

“Consultation [and] the seeking of other input tends to be done with unrealistic timeframes involved. This is particularly so for [statutory] processes – it gets tacked on [and] late. We need to be able to discuss important local [and] national issues in a more relaxed, facilitating environment. This requires forward vision so that time can be made. The forums need to be flexible so that participants feel comfortable. The use of hui is an example of good intentions in that it goes some way to satisfying Maori culture but can be very uncomfortable to non-Maori. We need a flexible approach, not dogma or [a] rule driven one.” (4 L)

Continued long-term interaction between the parties was seen as enhancing “understanding by giving time for engagement with other perspectives and ways of thinking” (34 O). Such long-term interaction was perceived to be:

“... a two-way process with participants willing to adapt, modify and look for common ground in perception.” (34 O)

Another submitter commented that the effective and useful engagement of a diverse range of information, values, worldviews and ethics required:

- early identification of stakeholders;
- early and frequent consultation;
- taking account of concerns and recommendations; and
- providing feedback mechanisms to ensure that the results are commensurate with the initial goals (41 S).

A similar approach was suggested by Auckland City Council. They suggested that improved communication channels between scientists, policy and decision makers and the public as an important aspect of effective and useful engagement with the diverse range of other information values, worldviews and ethics alongside science:

“It is imperative to clarify all stakeholders objectives and standpoints as early in the process as possible as this will clearly identify problem areas and the potential different interpretations people may have of the same issue. This process would help to develop a common basis and potentially a common set of objectives from which to proceed with the particular issue.” (36 L)

Desirable characteristics of staff were included within discussion of question 10 in two submissions. It was felt that by

- recruiting policy and decision making staff with knowledge of cultural or value systems, other than the most persuasive (34 O), in addition to
- staff that are “well grounded and experienced in the reality of the New Zealand culture and community and [that are] aware and tolerant of a broad range of indigenous and spiritual values” (7 C)

the effective and useful engagement of other information, values, worldviews and ethics alongside science, would be assisted. The North Shore City Council felt that it was useful for scientists involved in an environmental issue to “recognise the value of tangata whenua and community knowledge” (21 L).

Additional means of facilitating effective and useful engagement of policy and decision makers with other information, values, worldviews and ethics alongside science included:

- preparation of discussion papers directed to specific groups using advice gained from the communities involved (34 O);
- hui and other meeting type approaches may be appropriate for some groups (34 O);
- transparency in decision-making, including specifying reasons for decisions, will assist the process (7 C);
- use of a Soft Systems Methodology; an approach that can take into account multiple functions and worldviews (29 S);
- develop process related science to enable “decision-makers to ‘trade off’ differences between views coming from particular communities” (20 L);
- admit, when necessary, that wrong decisions were made (17 O); and
- use of impact assessment (IA); the principles of which “emphasise the need for IA to be, among other things, integrated, participative, interdisciplinary and transparent” (27 O).

The provision of scientific information directly to the community was suggested as a means of facilitating better engagement of other values and worldviews:

“This would get away from the idea of experts coming in and providing their opinions on local conditions. This can alienate communities. Instead, experts act in an advisory capacity alongside community groups, who own the information about their region or

district. This may not change the process in effect, but will give local people more credibility and involvement in the process.” (15 S)

The value of incorporating alternative information, values, worldviews and ethics alongside science into all environmental policy and decision-making was questioned within one submission. It was noted that:

“There is a growing demand for the acceptance of views which are not “scientific”. It is becoming more accepted that these views should be incorporated into environmental policies. These views arise because of a suspicion of science that it does not accommodate ethics and alternative ways of looking at the world. However science simply attempts to discover the truth about a particular issue. The use of subjective based worldviews will ultimately lead to unsustainable communities ... Communities will have to accommodate these views as legitimate ones but at the same time examine them as rigorously as the scientific views are examined (if that is possible) to work towards a better understanding of science. They may need to be put on different levels since it is not possible to compare them side by side. Alternative worldviews may be relevant for some types of policies but for those that demand a science-based answer they are not.” (5 O)

The use of the term ‘science’ throughout the discussion paper was commented on by a scientist:

“There appears to be confusion between the scientific method as a technique for establishing knowledge and the knowledge itself often called ‘science’. Knowledge is made up of a number of hypotheses which are accepted. Whether these hypotheses have been accepted on the basis of tests using the scientific method or accepted on some other basis is immaterial. In all cases an hypothesis is an approximation of the ‘truth’ not necessarily ‘the truth’. I believe (may be incorrectly) that the document is about science – the body of knowledge – and not the scientific method. Consequently I had difficulty with chapter 4 ... The important question in this chapter is the interaction of knowledge and ethics but that is not a question which science can answer.” (11 S)

Another submitter questioned the separation of ‘science’ from other forms of knowledge, worldviews and values. Such demarcation was regarded as counter-productive, “especially in light of ongoing challenges to science as value-free, objective etc” (28 S). It was pointed out that:

“Social and systems science disciplines also engage in systematic processes for generating questions, analysis and application of findings. Social sciences also tend to be reflexive about the ways in which research is carried out and implemented which promotes a dynamism well suited to an increasingly complex world.” (28 S)

One submission included comments that information gathered from a single source, whether from a single scientific expert, or matauranga Maori should be corroborated:

“The problem may lie in the fact that there exists a culture in science of expecting independent verification of information, but insisting on independent verification of traditional knowledge may be viewed as offensive as it implies a lack of trust. However, it should also be noted that science is not immune to inappropriate over-emphasis on information from a single uncorroborated source. Science may be more objective than other forms of knowledge due to internal processes that emphasise objectivity, but these processes will never deliver perfect objectivity because science is also a social process, with embedded social values.” (30 S)

2.11 Question 11

What gaps and weaknesses exist in the environmental management capacities of central and local government? How should the effectiveness of their environmental management be monitored and assessed?

Overview

Eleven of the forty two submissions received dealt specifically with question 11. These submissions were categorised as coming from:

- one central government agency;
- three local government agencies;
- one NGO;
- two non-science organisations; in addition to
- four submissions received from the science sector (individuals and organisations).

A submission received from a city council also contained comments relevant to the analysis of question 11; these comments have been incorporated into the analysis of this question.

Question 11 consisted of two separate questions. The analysis of each component question has been undertaken separately. Gaps and weaknesses identified by the twelve submitters varied so that no themes could be identified. Similarly, there was wide variation in responses to the question of how the effectiveness of environmental management by central and local government agencies should be assessed.

Analysis

The analysis of question 11 has been undertaken separately for each of the two sub-questions. No major themes were identified from the twelve applicable submissions. Praise was given for Section 5.1 of the discussion paper, described as an “excellent summary” (7 C).

Question 11(a): What gaps and weaknesses exist in the environmental management capacities of central and local government?

It was felt that the principal gap in environmental management had been identified in Section 5.1 of the discussion paper – the lack of forward-looking, environmental scanning research (11 S; 34 O).

Other gaps and weaknesses were identified within the following areas:

- biophysical monitoring, reporting, assessment, analysis and application to policy formulation (15 S);
- difficulty in comprehension of science within decision-making authorities in addition to a lack of surety as to how to access and utilise scientific information (30 S; 34 O);
- a lack of connection between research providers (e.g. CRIs and tertiary institutions), purchasers of research (e.g. FRST) and the end users (e.g. local authorities);
- a lack of appropriate skills in local authorities (4 L);
- the complexity or lack of guidance on best practice (4 L; 34 O);
- limited time frames and a high demand for short-term outputs in local government (4 L; 36 L); as well as
- the attraction and retention of scientists to environmental management authorities (4 L; 30 S).

“At the local level this has most to do with cost. Being reliant upon the rateable capacity of the authority area, compliance with regulatory requirements is a case of ‘how much can we afford’. At the central government level it appears to have more to do with political will.” (30 S)

Question 11(b): How should the effectiveness of their environmental management be monitored and assessed?

Monitoring and assessment of the effectiveness of the environmental management capacities of central and local government was thought to be best achieved by:

- investigating outcomes of environmental monitoring, e.g. through the Environmental Performance Indicators programme, with the results reported regularly to the public (34 O); and
- monitoring by communities, “Increased community awareness and understanding of [the] consequences of action would better monitor plan effectiveness” (20 L).

It was felt by scientists that long-term assessment of the effectiveness of environmental management by central and local authorities should be performed by an independent body; the role of ministries should be limited to policy development and short-term assessment of policy effectiveness (30 S).

Tools for monitoring the effectiveness of environmental management by local authorities, and possibly central government, were regarded by a regional council as

being already in place, but under-utilised – “it’s like many well intentioned areas simply not done or done poorly” (4 L). Difficulties associated with monitoring the effectiveness of environmental policies such as district plans were highlighted by the North Shore City Council (21 L). Difficulties identified included:

- results of environmental policies will not be evident for several years or even decades;
- factors that can be measured (e.g. water and air quality) are dependent upon numerous factors in addition to the regional or district plans; and
- the interdependence of local and regional councils for environmental monitoring, which requires consistency of monitoring methods (21 L).

2.12 Question 12

What are effective arrangements for integrating scientific advice into policy and decision-making, and how should the interface between science, policy and decision-making be structured to provide that integration?

Overview

Ten responses were received that addressed question 12. These submissions were categorised as coming from:

- one central government agency;
- three local government agencies;
- one NGO;
- two non-science organisations; in addition to
- three submissions received from the science sector (individuals and organisations).

An additional three submissions were received from:

- one city council; and
- two submitters from the science sector

contained comments applicable to question 12. These comments have subsequently been included in the analysis.

A call for independent scientific expertise was made by one submitter. However, in-house scientific advice was advocated by three respondents. In order to effectively integrate scientific advice into policy and decision-making, a large degree of interaction between all relevant parties was commented on within four submissions.

Analysis

Almost one third (31.0%) of the total number of submissions received responded to question 12. A desire for both in-house and independent scientific expertise was evident within a few of the thirteen submissions, as was a request for participation and interaction of all relevant parties.

A large degree of interaction between scientific advisors and policy and decision makers was regarded as essential by four submitters to in order to facilitate the

effective integration of scientific advice into policy and decision-making. Comments included a desire for:

- science to develop better means of “integrating colloquial and science based information together so that the debate can take place between the two in a rational manner” (20 L);
- a strong involvement of policy advisors in establishing scientific research, including an iterative process of refining the science to answer the relevant questions. Such involvement depends upon a large commitment of time and funding by both parties (scientists and policy advisors) (21 L);
- greater participation and interaction amongst all parties through all stages of the policy process (5 O); and
- development of specialist groups comprising scientists and policy makers to concentrate on developing policy in a particular environmental area, e.g. climate change (34 O).

One scientist commented that:

“It would be nice to see more science-trained people in the policy arena and political arena – maybe that will happen as science jobs dry up!” (37 S)

Three submissions highlighted in-house scientific expertise as a means of creating and maintaining an interface in order to provide for the effective integration of scientific advice into policy and decision-making. In-house advice was regarded as beneficial for many reasons:

- it allows for the development of an institutional memory (30 S);
- enables assessment of the quality of external scientific advice received (7 C); and
- facilitates the establishment of links with scientists, allowing better formulation and direction of contracted work (30 S).

“Thus policy and decision processes have a simple route to access scientific advice and interpretation both formally and informally.” (30 S)

Conversely, a need for independent scientific advice was also highlighted (30 S).

The effective integration of scientific advice into policy and decision-making was also seen to require:

- the provision of an over-arching system of government funded scientific monitoring programmes of all science features developed in New Zealand (23 N); and
- sharing of scientific information with decision-making bodies (34 O).

It was noted by one submitter that:

“The significant effect of the Government’s restructuring in the 1980’s and 90’s, whereby many departments lost their science capacity are now forced to obtain it by contract to research-providing CRI’s or private consultants, inevitably means the science reports usually

remain confidential to the client and thus not available to the wider community (see S 5.2 p.52). Moreover, Government scientists are usually formally constrained in what they can say publicly, ‘particularly in fields of their own expertise’ in order not to upset possible clients.” (8 S)

2.13 Question 13

How can communication be improved between scientists, policy advisers, policy and decision makers, and members of the public?

Overview

Ten submissions received addressed question 13 directly. Of these,

- one was received from a central government agency;
- three from local government agencies;
- one from a NGO;
- two from non-science organisations; and
- three submissions were received from the science sector (individuals and organisations).

A regional council and one overseas submitter also made comments that were pertinent to question 13. Comments within these two submissions have consequently been included in the analysis of this question. The primary means of improving communication between scientists, policy advisers, policy and decision makers, and members of the public commented upon in the submissions was to engage in direct communication with communities to educate and involve them in public discussions.

Analysis

28.6% of submissions provided suggestions as to how communication could be improved between scientists, policy advisers, policy and decision makers, and members of the public. Communicating directly with the public was an idea that was put forward in four submissions (11 S; 20 L; 29 S; 34 O). One submission put it that:

“Where scientists, policy advisers and decision-makers are working with communities solving community problems, communication is no problem. Where scientists, policy advisers or decision-makers get ahead of the community’s knowledge, then problems with plan administration are manifested. Science needs to develop in relation to processes of wider community information sharing so that better definition of issues is developed before solutions are presented. Situations where communities are involved in issue definition and solution development readily achieve full community support and are implemented to an end. In contrast other projects often founder for lack of community support.” (20 L)

The National Council of Women of New Zealand commented that “Policy agencies need to improve their ability to engage in public discussions on environmental issues” (34 O). This could be done through:

- the use of clear, simple language;

- information meetings held at no cost to the public;
- having qualified staff available to answer questions in a way that encourages the public to ask questions without feeling intimidated;
- improving the quality of public broadcasting and print journalism standards; and by
- making environmental science a core part of the school curriculum (34 O).

A regional council submitted that good communication requires “science to be relevant and to be interpreted and communicated in media/politically relevant ways” (22 L).

Environmental education was regarded as a means of improving communication between the many relevant parties by two submitters. Scientists felt that by ensuring that everyone receives “at least a basic grounding in science helps communication and understanding for everyone” (29 S). It was also felt that:

“Although a curriculum document exists for environmental education and there is increased funding for advisors in the subject, there is at present little buy-in by schools especially at secondary level. Because it is crosscurricular it is seen as hard to staff and hard to timetable. Those schools, such as Christchurch Girls High School and Marlborough Boys College, which have initiated courses, are to be commended. They will give pupils a solid grounding in issues likely to affect their futures.” (34 O)

Another scientist commented that:

“Policy and decision making needs to include an educational element so the information used in the process becomes widely disseminated.” (11 S)

Developing ongoing relationships between scientists and policy advisors so that an understanding of the issues faced by each can be created and enhanced was regarded by the North Shore City Council as an important contributing factor to improved communication between parties (21 L):

“This requires commitment from individuals to keep informed of what is happening in science or policy. It can be assisted by councils or government departments funding access to publications, conferences and workshop that might normally be thought of as outside a scientist or policy advisor’s area of expertise” (21 L).

Additional means of improving communication between scientists, policy advisers, policy and decision makers, and members of the public suggested within submissions included:

- according greater value to communication skills and practices, including time for communication as part of valued work, so that this becomes a core part of what biophysical scientists do (28 S);
- both scientists and policy and decision makers making an effort to clearly communicate their work (29 S);

- transparency of process – how scientists and politicians use information needs to be understood by all parties (7 C; 22 L); and
- publication of research (7 C).

One submission highlighted risks of over communicating:

“For example, having unreasonably high expectations of attendance or written feedback from poorly resourced 'stakeholders' - the consultation overload syndrome. Proceeding down this track in order to get more science into policy could send negative messages about science and what it stands for to people already likely to be the most sceptical.

The idea that science and scientific information is important in developing public policy needs to be 'sold' to the public. More information does not equal more trust! A successful 'campaign' needs to be measured in terms of changed attitudes.” (7 C)

2.14 Question 14

What are the most relevant approaches for dealing with uncertainties and knowledge gaps in environmental policy and decision-making, and are they being applied most effectively and usefully?

Overview

Eleven submissions were received that dealt with question 14 directly. These submissions were categorised as coming from:

- one central government agency;
- three local government agencies;
- one NGO;
- two non-science organisations; as well as
- four submissions received from the science sector (individuals and organisations).

Eleven additional submissions contained comments relevant to question 14. These submissions were received from:

- one central government agency;
- four local government agencies;
- two overseas submitters;
- two individual (non-science) submitters; and
- two science organisations.

Approaches endorsed for dealing with uncertainties and knowledge gaps in environmental policy and decision-making included those identified within Section 5.1 of the discussion paper.

Analysis

Over one half of respondents (52.4%) addressed the question of the most relevant approaches for dealing with uncertainties and knowledge gaps in environmental policy and decision-making and whether they are being applied effectively and usefully. Uncertainties and knowledge gaps were acknowledged as an ever-present issue for policy and decision makers:

“Scientific information always includes some degree of uncertainty and is subject to varying interpretations.” (22 L)

“Uncertainty is inherent in all sorts of decisions and there are a variety of tools to deal with it such as risk management and prioritisation. Ultimately a process that expressly deals with uncertainty will be in a better position to defend itself than one that doesn’t.” (22 L)

An overseas submitter described uncertainty as “a reality of today’s decision-making, that require adequate, and perhaps new tools to deal with it” (19 OV). Auckland Regional Council raised the importance of uncertainty being acknowledged and dealt with upfront, “science shouldn’t be defensive about what it doesn’t know... We can’t hope to know everything perfectly [and] in most cases it’s not required for policy [and] decision making” (4 L). Recognition and understanding were deemed necessary initial steps to handling uncertainty by two further submitters (11 S; 30 S).

Difficulties in translating scientific uncertainties into a specific change in land use planning were highlighted by a city council (21 L). A level of frustration for both scientists and decision makers was highlighted:

“It should also be noted that this problem can be compounded by trying to fit scientific modelling that predicts future environmental change to a scenario that involves future land use change and population change. Scientists require a high level of detail and certainty regarding where people will live and what type of developments they will build when such matters depend on many factors such as political decisions, migration, and employment trends. Planners and policy makers can be as frustrating for scientists as scientists can be for policy makers.

Science also often comes out with an answer that is a very precise number and even if degrees of error or uncertainties are quoted with the answer, decision makers often focus on the single key answer rather than considering the assumptions that went into a model. Sometimes the initial conditions assumed can make the conclusion very vague and then decision makers must make a precise decision about where exactly to rezone or impose environmental controls.” (21 L)

No single approach was deemed suitable to effectively handle uncertainties and knowledge gaps in environmental policy and decision making; rather a range of approaches, including those listed in Section 5.1 of the discussion paper were deemed necessary (28 S).

“The approaches listed to help deal with uncertainties and knowledge gaps are, of course, not mutually exclusive, but each includes (and indeed requires) elements of the others to various degrees.” (3 OV)

The importance of monitoring and feedback as effective means for handling uncertainty were commented on in a number of submissions. A submitter regarded iterative review and evaluation as the surest tool for handling uncertainty (7 C). “An iterative feedback process complementary to strategic research” was deemed necessary by another submitter (5 O). A scientist commented however, that monitoring the effects of environmental decisions often fails to occur (11 S); or is often “poorly done” (15 S).

A ‘systems’ approach was regarded by a CRI as a potential way forward. It was noted in this submission that:

“Systems thinking or methodology assumes that effective action in terms of the system as a whole can only result from the careful study of the complete system, rather than individual parts or aspects. It is suggested that most research to date has been focused on single issues, rather than in an integrated or systemic way except for a few notable examples.

Systems methodology varies from the traditional scientific model of reductionism, and cause and effect. What both reductionist and cause-and-effect approaches fail to adequately deal with is the relationship and properties between the parts of the system (emergent properties).

... Systems methodology recognises that it is important that decision making is guided by a systemic and comprehensive methodology because although we are endowed with amazing faculties of reasoning and insight, most of us are unable to cope with more than a very few factors at the same time. Furthermore decision-making does not occur under idealised conditions in a laboratory, so the methodology has to be able to cope with the complexity of the real world...” (28 S)

Effective application of approaches to deal with uncertainties and knowledge gaps in policy development was noted to be dependent upon science being proactive, identifying environmental issues requiring solutions and communicating these issues to agencies (4 L). There was a call for a closer working relationship between scientists and policy agencies:

“Scientists and policy agencies need to work closely together, and the present business model abandoned for environmental research. Environmental research takes a very long time and the business model does not allow for this. For our long-term futures there must be investment in research that is unlikely to produce an immediate commercial return. There needs to be greater understanding of limits of certainty, and acceptance that uncertainty exists in many environmental problems. Investment is needed, even if the risk of not being totally right is high, in problems such as climate change where the associated damage is costly and permanent so that effective risk mitigation strategies can be developed.” (34 O)

Adaptive management was an approach that stimulated debate. The Department of Conservation did not regard adaptive management to be a tool for resolving uncertainties, but was seen to have a role in “ensuring that a managed system is caught before it gets hopelessly out of control” (7 C). Two submitters endorsed the use of adaptive management as a basis of research by the Department of Conservation (8 S; 39 S). Adaptive management requires recognition that some uncertainties and ignorance are inevitable. A city council recognised that decisions sometimes need to be made in spite of inadequate information. It was said that:

“In such situations adaptive management is the best technique provided that monitoring is put in place as part of the decision.” (40 L)

This necessitates flexibility being built into decision-making systems (3 OV). The Northland Regional Council stated that:

“The approach of adaptive management and the continual improvement of management policies should be weighted against the ability of organisations to continually update and improve their environmental policies and management.” (33 L)

Similarly, the precautionary principle inspired responses. The Ministry of Foreign Affairs and Trade preferred the use of the term precautionary approach, rather than the precautionary principle:

“We do not support a precautionary *principle*, because this would imply that precaution has acquired independent status as a principle of general or customary international law. To facilitate further discussion on precaution, we suggest that you use the term “precautionary approach”. (32 C)

Adoption of the precautionary principle was supported within two submissions, however, “especially when the relevant scientific information is limited” (8 S; 39 S). Three submissions debated the relevance of the precautionary principle to environmental policy and decision-making (9 I; 18 I; 37 S). The precautionary principle was described as implying “complete opposition to all new ideas” as “every action, no matter what, has an element of risk” (9 I). Another submitter commented that:

“I’m not confident that the precautionary principle per se is a means of good or appropriate decision-making. All too often we are only capable of imagining the very worst in scenarios – we shouldn’t really be driving around as any speed over 40mph should flatten the human body, and who, before cars were invented, knew the long-term effects... We also run the risk of counter-intuitive results and the sheer uncertainty of the threat drowning out our ability to rationally assess real risk factors. What’s more dangerous for my children – a [cellphone] tower next to their school or all those urban combat vehicles circling madly outside it twice a day?” (37 S)

Two submitters discussed the relevance of risk management to handling uncertainty in environmental policy and decision-making. One submitter described risk management as:

“... the current magic potion but generally it is poorly implemented and understood. The theory of risk management will mature in the next 20 years and then possibly its limitations will be more widely appreciated.” (7 C)

A regional council commented that:

“Policy should always be developed within a fairly rigorous, evidence based framework. Policy needs its own risk criteria so resources can be applied effectively or efficiently and to enable it to be rigorous enough to withstand challenge, and the process is transparent and repeatable. The role of science in that framework is significantly partly due to the western culture belief of science. The challenge for policy makers is to frame the risks and to communicate community perceptions in an unbiased way.” (22 L)

Additional comments included:

- science based policy was regarded by another district council as “creating artificial certainty and exactness, when in reality such is not true” (20 L);
- honesty was identified as essential in order to accommodate uncertainty and knowledge gaps (20 L);
- ignorance is useable if it comes with an honest assessment of the type and nature of uncertainties (3 OV); and that
- being honest and open about uncertainty does not guarantee good decisions will always be made (3 OV).

3 Additional comments

In order to account for the full range of comments received, inclusion of an additional section within this ‘summary of submissions’ was deemed necessary. Section 3 is comprised of two sections that broach (1) various miscellaneous views (i.e. those which were not found to be applicable to any of the fourteen questions posed in the discussion paper) and (2) recommendations posed by submitters on the desired content and structure of the final report (to be completed during the first half of 2004).

3.1 Miscellaneous views

Three submissions commented that issues raised throughout the discussion paper were relevant not only to environmental policy and decision-making, but were topical for discussion by all sectors of government. For example, one submitter stated:

“Again these arguments apply to all government decision making. There is nothing particularly different about environmental decision-making other than to say that if we focus on the biophysical issues of sustainable management rather than the central planning dogma of

sustainable development, it should be easier and more science dominated than most.” (18 I)

It was also acknowledged within various submissions that science plays a contributory role to policy and decision-making, but that this role is framed within a political context:

“... The role of science although important, must be recognised as one of the many components that influence the choices that are made into policy and weighted accordingly. It is important to remain fully aware that environmental policy making must consider a wide range of views and values including technical and non-technical, economic, social, cultural, ethical, local, national and international issues, in addition to the fundamental political process of elected representatives in public authorities.” (22 L)

Another submitter noted that:

“... science can identify issues and areas of knowledge (and non-knowledge), but ultimately we are making political and social decisions. Perhaps we need it to be clearly announced – “yes, this is an irrational decision and we are making it irrationally because we want to, in the face of evidence we have because the loudest voices say we should do it this way”. That at least would be intellectually honest and ethical...” (37 S)

Scepticism was apparent in two submissions regarding the integrity of people using scientific information:

“Government departments tend to bias scientific information to suit their objectives ... Scientific information is often too complex to be properly handled in Government structures and its various substructures are often vested interests which select what they want Ministers and Cabinet to know...” (26 I)

“Science can often be manipulated to portray the end result that the scientist requires. They can look at things from all different perspectives. There is always a better scientist out there somewhere who will work to alter the situation.” (13 M)

An issue that was frequently raised was the need for application of social science within environmental policy and decision-making:

“The report [*Illuminated or blinded by science?*] appears to concentrate on the role of science in the outcome of environmental policy and decision-making by concentrating on description of natural processes and state of real components of the environment ... However, there is an absolute lack of good science in relation to the process of developing environmental policy and decision-making. There is a crying need for increased social science in relation to

consultation processes so that community views and values receive better understanding, prioritising community expressed outcomes, and integrating colloquial information and knowledge with the applied science described environment... This lack of process oriented science is the single biggest hurdle to development of quality environmental policy and decision-making, and is unfortunately almost completely ignored by the science community. There is an apparent focus in the science community in outcome related research.” (20 L)

Two submitters expressed the opinions regarding the importance of allocating funding for research for purely scientific reasons. This issue was seen to lack sufficient emphasis within the discussion paper (23 N; 33 L). The same submitter also commented that the discussion paper “should have included a discussion on the importance of identifying the needs of policy and decision makers.” (33 L)

Two submitters had difficulty with Table 1 (page 54 of the discussion paper). It was described as looking “a little rigged – cultural biases showing all over it...” (37 S). Another submitter commented that this table “in which you compare different systems of knowledge makes it plain that you prefer prejudice, superstition, religious belief, myth and fantasy to investigations into true facts. It is a recipe for disaster.” (9 I)

Other comments included within submissions were:

- That different belief systems will strongly influence (if not dictate) decisions made (31 S);
- There is a tendency for science to only ask questions to which it thinks there is an answer (3 OV);
- The definition of science in the discussion paper (Section 2.4) was seen as “very short and superficial... As the role of science is the main header subject it seems reasonable to expect better coverage. The text devotes <10% of its content to “science” and much of the remainder to explaining how difficult it is to “translate” facts and information into policy and legislation” (31 S)
- “The title of the discussion paper is “Illuminated or blinded by science?”. I would say that it is neither, in any strong sense. There is a degree of illumination, but I feel often it is a case of “Unmoved by science”... I suspect it is often the case at present that scientific advice is ignored because it is not deemed to be definitive enough.” (12 S)

3.2 Recommendations for final document

Multiple submissions contained comments implying areas they deemed important to focus on when undertaking future work investigating the role of science in environmental policy and decision-making. Many of these recommendations are included within this section:

- selected detailed analysis could be the next step, i.e. “select some of the issues at a variety of policy-making levels and ask the question “how well are we doing?”” (16 C) and seek ways to remedy any deficiencies found (7 C);

- one submitter found the recurrent reference to BSE and GM within the discussion paper to be “somewhat misleading & a distraction, in that these are highly emotionally charged & special cases.” (4 L);
- the use of case studies would be useful to explain the differences between inter- and multidisciplinary approaches to research to a general audience (15 S);
- greater recognition should be given to the value of impact assessment to the effective integration of science and environmental policy and decision-making (27 O);
- the discussion on ethics either be expanded or deleted: “It doesn’t add much as is.” (4 L);
- setting out the different types of uncertainty may prove to be useful. These different types “relate to the extent to which there is knowledge about the outcome of an event and its probability.” (3 OV); and that
- the concept of Comparative Risk Assessment (CRA) should be revisited. “The idea is to prioritise the most important environmental issues, and as they are managed, priorities can then shift to other issues. Overall, a better understanding and application of risk management is required throughout New Zealand.” (15 S).

4 Conclusion

Overall, the forty two submissions received portrayed support for the discussion paper *Illuminated or Blinded by Science?* The discussion of the role of science in environmental policy and decision-making was regarded as timely. Science was regarded by numerous submitters to be an aid to decision-making, acting as an independent information provider. A call was also sent out for science to be proactive, identifying issues for policy and decision makers.

A degree of frustration was apparent with the current environmental science and research system, and its level of funding; with the CRI model regarded as flawed. It was suggested that the focus must be on improving the utilisation of science, rather than trying to reinvent the system.

Effective communication between scientists, policy and decision makers, and the public, and gaining and enhancing trust between all parties, were highlighted as important issues for consideration. Science was certainly recognised as having a strong role to play in policy and decision-making by many submitters, with acknowledgement that decisions are made within a political context.

5 Appendix 1: List of submitters

Code	Submitter / Organisation
1 I	Jim Chapple
2 S	Euan Mason
3 OV	Gary Kass
4 L	Auckland Regional Council
5 O	Fish & Game New Zealand
6 S	Janet Grieve
7 C	Department of Conservation
8 S	Alan Mark
9 I	Vincent Gray
10 S	Dennis Gordon
11 S	Herbert Madgwick
12 S	Jim Renwick
13 M	Whanganui River Maori Trust Board
14 C	The Treasury
15 S	Stephen Knight
16 C	Foundation for Research, Science and Technology
17 O	New Zealand Democratic Party
18 I	Owen McShane
19 OV	Maria Partidário
20 L	Waikato District Council
21 L	North Shore City Council
22 L	Environment Bay of Plenty
23 N	East Bay Conservation Society Inc.
24 I	P.J. Fleming
25 I	Joan Forret
26 I	Don Stewart
27 O	New Zealand Association of Impact Assessment (NZAIA)
28 S	ESR
29 S	Terry Kelly, Janet Reid, and Ian Valentine
30 S	Dan Jones and Andrew Bell
31 S	The Royal Society of New Zealand
32 C	Ministry of Foreign Affairs and Trade
33 L	Northland Regional Council
34 O	National Council of Women of New Zealand
35 S	Paul White
36 L	Auckland City Council
37 S	Vicki Hyde
38 OV	Canadian Environmental Assessment Agency
39 S	Otago Conservation Board
40 L	Wellington City Council
41 S	Eric Dorfman
42 O	New Zealand Business Roundtable

C = central government agency, I = individual (non-science), L = local government agency, M = Maori, N = non-government organisation, O = non-science organisation, OV = overseas, S = science (individuals and organisations).