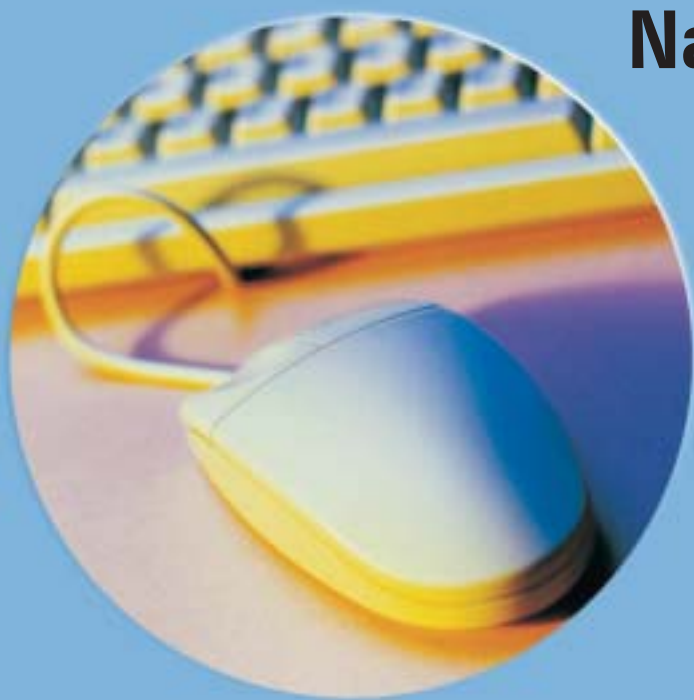




**Cooperative Research Centre for Coastal Zone, Estuary & Waterway Management**

Technical Report 29



# **Natural resource decision-making and the world wide web**

**Jan Tilden  
Kerry Rosenthal  
Donna Barchiesi**

**May 2005**





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## Introduction

The Cooperative Research Centre (CRC) model was developed, in part, to facilitate collaborative research focused around issues relevant to the community, government and industry and to put in place mechanisms whereby such research can be integrated and used rather than gathering dust in reports on library shelves (DEST, 2002). For the Coastal CRC, success with our mission of bridging gaps between science and the community means presenting the results of our research into all aspects of the coastal environment, and its management, in a way that makes it accessible to potential users. Our research is a valuable resource for evidence-based, natural resource management (NRM) decision-making in the coastal zone. One medium for disseminating this research to a wide audience of coastal stakeholders is the World Wide Web.

The survey research reported here is a component of the Software for Knowledge Integration and Exchange (SKIE) project. The aim of this project is “to help us make online data, information and knowledge about the coastal zone more accessible to NRM decision makers and others interested in coastal NRM”. Linked with this survey is a review of the relationships among science, knowledge and decision making (Barchiesi, unpublished CRC report) which examines the cultures of both science and decision making and the factors that influence how decision-makers access and use knowledge. One section of the review examined the characteristics of knowledge-seeking behaviour in decision makers on two dimensions – how decision makers were influenced by time-management considerations and how their behaviour reflected the need for confidence in information sources. Table 1 summarises some common behaviours of knowledge-seeking decision makers.

The aim of the current survey is to build on the findings of the review, especially to examine the impact of wide-spread access to the internet on decision-makers’ knowledge seeking behaviour, as well as to get a clearer idea of the knowledge-seeking characteristics of our particular audience – those charged with making scientifically informed decisions about natural resource management in the Australian context.

How do Australian coastal natural resource managers access the science they need to make NRM decisions? Do they use the world wide web - a resource that puts a great deal of relevant information and knowledge close at hand on their desktops? If not, what stops them from accessing information on the web and what would make a web-based information source more attractive to its potential users? If such an attractive source existed, how would its potential users find it?

With a view to developing a website which makes the outcomes of research widely accessible to coastal NRM decision makers, we conducted the survey whose findings are reported here.

<b>Table 1 Common characteristics of and motivations for knowledge seeking behaviour in decision makers</b>
<b>Decision confidence or social behaviours</b>
<ul style="list-style-type: none"> <li>• They prefer to solicit information from someone they trust rather than a recognised authority in the field</li> <li>• The more experienced, educated and knowledgeable the Decision Maker the wider the range of information sources and networks both inside and outside their organisation they are likely to utilise.</li> <li>• They are likely to accept an idea if the sources are consistent – regardless of the authority of the source.</li> <li>• They are unlikely to search for new information about a topic upon which they feel knowledgeable.</li> </ul>
<b>Time management behaviours</b>
<ul style="list-style-type: none"> <li>• They seek up-to-date, concise overviews of current understandings in a particular area. They do not see the individual research project as the appropriate unit of knowledge transfer.</li> <li>• They avoid time consuming active information ‘search’ behaviours (e.g. libraries, searching for expert opinion) over more passive knowledge transfer behaviours (e.g. call a professional colleague).</li> <li>• They seek until they find the first acceptable answer</li> <li>• They seek information that does not require significant analysis.</li> <li>• They give up searching for knowledge relatively quickly and rarely keep searching for the ‘best’ answer- They tend to go back to past sources of information rather than seek out new ones, even if the information they get is not as useful as other information sources could provide to this particular problem.</li> <li>• They tend to seek knowledge from someone who is easily accessible and will accept inferior information as an acceptable outcome of this behaviour.</li> <li>• They follow habitual patterns in their information seeking. They fall into a pattern of information seeking on particular topics, especially with other people .</li> </ul>

[Barchiesi 2003, from Pollitt 2001; Alcock, 2002; Cullen 2001; Hansen, 2002; Sudiono, 2002]

## Methods

### The survey

Survey questions were based on the findings of the literature review of how decision-makers access relevant scientific research. The focus of the investigation was how decision makers currently use the web as an information source but we also wanted to know what other sources they were using and how far afield they searched for information before making decisions. Finally, because the ultimate purpose of this research is to design a better website, we were interested in decision-makers’ opinions of what the web currently offers and how we could offer something more attractive.

With this view in mind, the survey presented a mix of open ended, tick-box and likert scale items.

Participants were asked to recall a recent situation in which they had to make a natural resource management decision, under time pressure, requiring scientific information outside their field of expertise. The survey instructions emphasised the importance of basing responses on an actual decision, rather than imagining how one might go about making a decision. Based on feedback from a pilot of the survey we stopped short of requiring participants to write a summary of their particular decision-making situation on the front of the survey form. This was to minimise the time needed to fill out the survey and also for confidentiality reasons. It was felt that survey respondents' anonymity might be compromised by revealing an actual situation and that this could influence both their willingness to fill out the survey and any answers they gave.

As well as questions about how and where respondents got the information they needed to make decisions, the extent to which they relied on the web for this and what they liked and didn't like about the web in general, and websites in particular, we also asked for a minimal set of demographic details. These were the gender and age of respondents, where they worked and in what capacity and how long they had been employed at their current level of responsibility. Finally, we asked them to choose, from an extensive list of disciplines and specialties, those in which they had been formally trained or had gained expertise through experience. (Separate tick boxes were presented for each of these alternatives.)

The survey was trialled in-house by 12 members of the SKIE project team including a number of "stakeholder buddies" – people whose role is to provide regular stakeholder input on both the methods and aims of the overall (SKIE) research project. The final version had 14 questions and took about 10 minutes to complete. This was further trialled, along with a covering letter explaining the purpose of the research, by four of the intended sample of respondents. All filled in the questionnaire according to the instructions and returned it without any further suggestions for improvement.

A copy of the final survey is appended to this report.

### **The sample**

The findings presented are based on a purposive, non-probabilistic sample of NRM decision makers primarily drawn from the three sectors we considered to be the most likely users of the proposed website – state and local government NRM decision-makers and decision-makers in regional NRM groups set up under the National Heritage Trust (2) and National Action Plan for Salinity and Water Quality. The sample was drawn from all over Australia and included people who were not well-known to the Coastal CRC as well as some who were.

Initially, the on-line survey was emailed to 110 individuals we thought typical of likely users of the proposed website. Because it was important that those surveyed were responsible both for gathering information *and* making NRM decisions, those initially targeted were asked to pass the survey on to a more suitable person in their organisation if their role did not involve both functions. We also asked them, for follow-up purposes (and to keep track of the characteristics of our sample) to let us know to whom they had forwarded the survey.

After the initial email, a follow-up email was sent three weeks later. We chose the email route because it was considered relevant to the study to get an idea how effective email was for this purpose. A final reminder was sent by mail, enclosing a survey form and a return envelope, a month after the first (email) reminder. In all, 17 people responded by email and an equal number by mail. This represented between a quarter and a third of those who had received the survey (assuming everyone was conscientious about telling us who they had forwarded the form to if they were not filling it out themselves). Initial analysis of results showed that most respondents were from state and local governments with very few from NRM groups. Among several possible reasons for the lack of response from NRM groups, we chose to eliminate the possibility that we had simply sent the survey to the wrong people by sending out a further set of email surveys to a group of 47 people associated with NRM groups. In turn, the members of this extra (NRM group) sample were very conscientious about not sending the survey to others fitting our sample criteria. We chose to enlarge the sample in this way because we considered it important to get a substantial response from this sector if possible.

We received a further 23 responses to the initial email survey alone, as a result of this action. However, the majority of this new group of respondents indicated that they were from state or local government agencies, not from NRM groups. Time did not permit sending out email or mail reminder notices in this second round.

The final sample consisted of 57 respondents (estimated to be just over a quarter of all people who received the survey). Of these, 24 were from the state government sector, 16 from local government and 11 from NRM groups. The remaining 6 gave their affiliation as "other" and included people who identified themselves as working for the federal government, for industry or, in one case, as "independent". Because of the non-probabilistic nature of this sample and the way in which it was gathered, we cannot generalise these results to all coastal NRM managers and their information gathering habits. We do make some generalisations based on the fact that survey results accord with the findings of the literature review with regard to how decision-makers get their information and what sources they trust.

## Analysis

Summary statistics (percentages, medians etc) were calculated from the returned data. Chi-square tests were performed to see whether there were any significant differences in the responses of members of the three sectors – state government, local government and NRM group – to questions about how they gathered scientific information to make decisions and about internet use. We also tested for differences between women and men and to see whether there were any differences between the group who answered the on-line survey and those who mailed in their responses (after a second reminder).

## Results

### Demographic information

41 men (71.9%) and 14 women (24.6%) returned the survey. Two respondents declined to identify themselves with either category. Assuming compliance with the requirement to supply details of on-posting, the percentages of males to females among those who received the survey was 73% and 27% respectively.

A histogram of the age distribution of the sample is given in figure 1. The median age of the sample was 41.9 years and there were no significant differences in age by sector with median ages of 36 for the NRM group subsample, 38.5 for local government respondents and 43.4 for those in state government positions (chi square = 10.87, df = 8). There was also no significant age difference between women and men in the sample (chi-square = 6.01, df = 4).

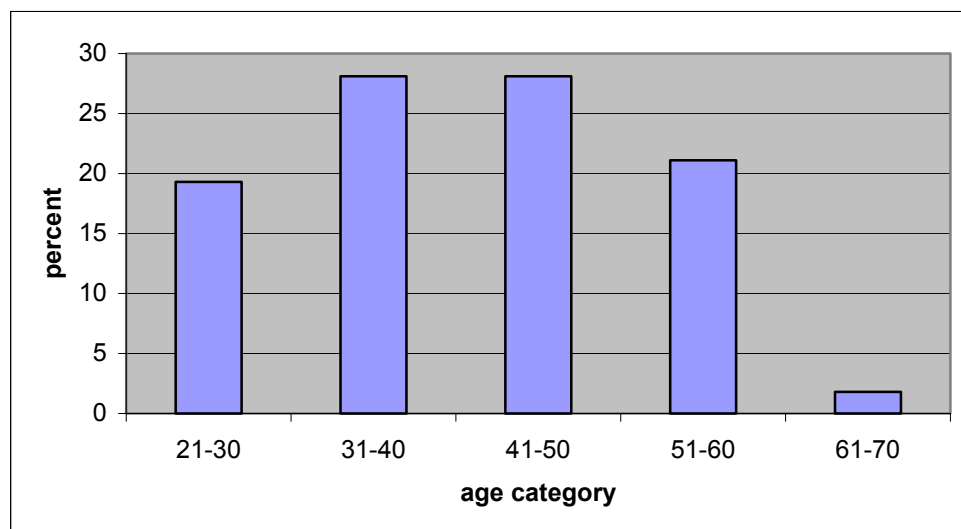


Figure 1: Age distribution of the survey sample

Length of experience at current level of responsibility produced a range of 0.5 years to 30 years with the distribution heavily skewed towards the lower end of the scale as reflected in a mean of 6.09, a median of 5 and a mode of just 2 years experience (see figure 2).



Figure 2: Distribution of experience at current level of responsibility

Tests for relationships between sector and experience and also between gender and experience did not show any significant relationship (respectively, chi-square = 13.87, df = 8; chi-square = 7.69, df = 4). There was also no significant relationship between gender and sector (chi-square = 1.99, df = 2).

### Formal training and experience of sample

The set of disciplines and specialties was ranked according to the number of people claiming to have done formal study in that area and again according to the number who said they had gained experience in that particular specialty or discipline in the course of their work. The highest rank for formal study was achieved by environmental science with 71.9% of the sample saying they had studied it formally. This was followed by ecology (64.9%), biology (50.9%), statistics (47.4%) and then the physical sciences – geology/geomorphology (45.6%), chemistry (38.6%) and physics (28.1%). Law achieved the highest score of all the non-science specialties, also being formally studied by 28.1% of respondents (significantly more women than men – chi-square = 11.28, df = 1, p = .001). Altogether, this seems an unsurprising set of disciplines to have been studied by a group of people who are making natural resource management decisions. When it comes to areas of experience, an entirely different pattern emerges, with government ranked highest at 82.5%, followed by planning and policy (66.6%) and communication (57.9%). Environmental science was ranked equal third at 57.9%, followed by human resources at 56.1%.

We took this pattern of responses as confirmation that we had tapped the desired population with our sample, that is, we were dealing with a group of people working in the area of natural resources and that we had captured those making deci-

sions rather than those who were actually engaged in scientific research. In passing, however, it is interesting to note how few of the natural resource decision makers in our sample had received any formal training in government (21.1%), policy and planning (26.3%) and communication (24.6%) compared with the number who had been scientifically trained.

### **What information sources do people use?**

Ranking the information sources according to the number of people who gave each a score of 4 or 5 on the scale (with 1 representing no use of the source and 5 major use), the most used information source for this group was their own experience, followed by the web, with internal papers, email to external sources and person to person contacts with people outside the organisation being equal third in rank. This indicates a strong acceptance of the web as a source of scientific information, at least among our survey sample. On the other hand, over a quarter of respondents said they used the web very little or not at all (scores of 2 and 1). This is reflected in the bimodal distribution of the web use scores (see figure 3).

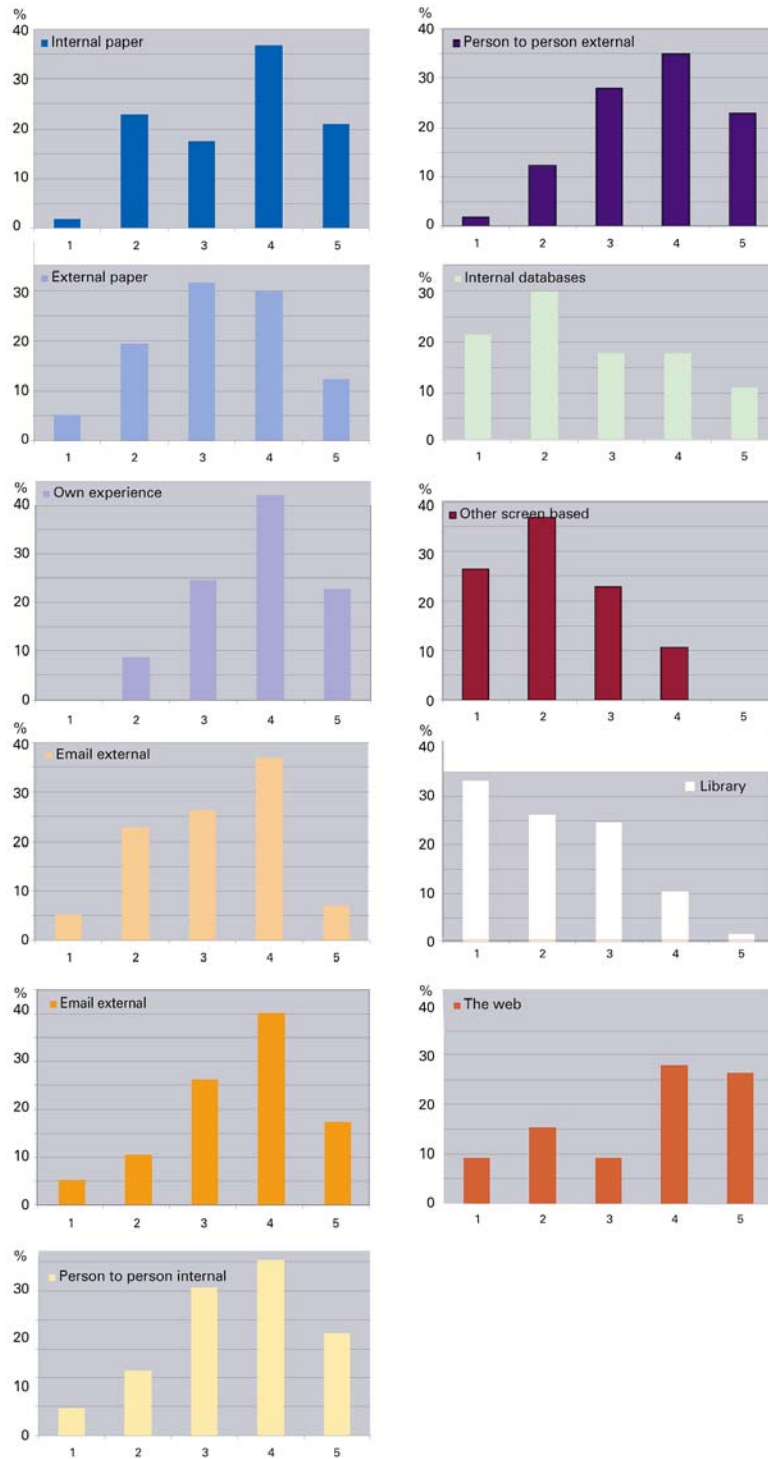


Figure 3: Sources used by NRM decision makers for science-based decision making. Bar graphs show distribution of responses on a scale of 1 (did not seek) to 5 (major source) for each of 11 sources listed in the survey. Note the bimodal distribution of the web as an information source and see figure 4 for an explanation.

Breaking web use down by sector reveals that while local government and NRM group members of our sample relied on the web as an important source of information to make their NRM decisions, state government respondents tended to use the web much less (chi-square = 18.8 df = 8, p = .025) (see figure 4). State

government decision makers tended to rely on internal information sources, with "own experience" ranked highest followed by internal papers, internal person to person communication and internal email. The web was ranked third lowest in importance as a source by respondents from this sector. This is possibly a reflection of the capacity of government departments to conduct research in their own right compared with local government and NRM groups, an hypothesis backed up by the fact that "internal paper" as a source of information also shows a bimodal distribution (the only other source to do so in addition to the web) and this is accounted for by the low number of NRM group respondents relying on internal papers as an important source (not surprisingly).

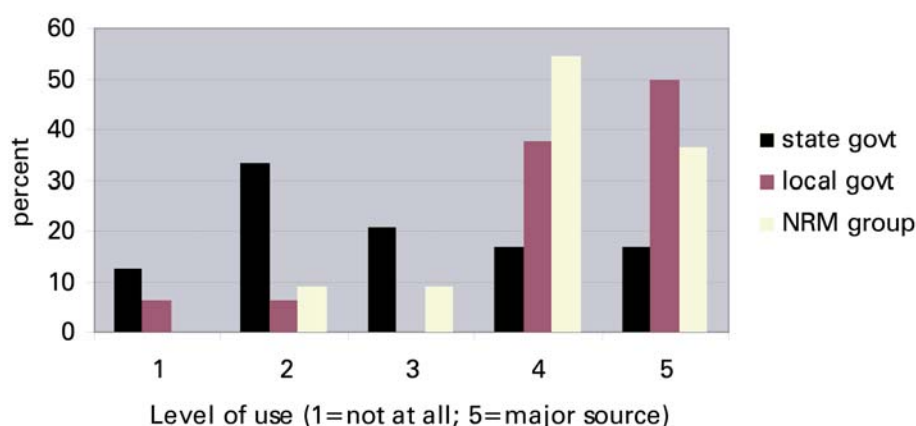


Figure 4: Use of the World Wide Web as an information source broken down by sector.

Considering only those who gave a score of 1 or 2 to the web as a source of information for their case-study NRM decision, what was their reason for not using the web? In 50% of cases the web was not consulted because the information required was too local or specialised to be found on-line. The next most common reason for not consulting the web to any great extent was the amount of time it takes to do so.

Returning to the question of people's preferred sources of information for NRM decision-making, there was a difference between women and men with regard to "emails to contacts outside your organization". The men in our sample were significantly more likely to use this source (chi-square = 10.14, df = 4, p = .05). The data suggest that women may be more likely to phone or speak personally to outside sources instead of emailing but the difference between men and women on this variable ("phone or face to face communication with people outside your organization") did not reach significance.

### **How do people seek web-based information to help them with NRM decision making?**

For most people, the first step to finding web-based information is to use a global search engine such as Google or Yahoo. Nearly 60% gave this as their response. A further 17.5 % searched their internal website first. A further 10.5% began their web-search by using a site recommended in a paper-based source.

NRM decision-makers found a very broad range of websites helpful for gathering information upon which to base decisions, in fact there was very little overlap among respondents' favourite sites except that 11(19.3%) said they favoured government NRM sites generally. The most popular individual site was the Commonwealth Department of Environment and Heritage (8.8%) (a complete list is given in appendix 2 along with other summarised data).

People found their favourite sites for the first time via a variety of sources, the most popular being word of mouth and links or references from other sites (36.8% each). Search engines were the source of favourite sites for 33.3% and printed publicity material for 31.6% (multiple responses were allowed on this item).

We also asked people what sort of information they got from these websites. The most popular response was "publications as downloadable or printable files" (59.6%) followed by summaries (54.4%), map-based information/GIS (45.6%) and interpreted data generally (42.1%) (again, multiple responses were allowed). However, the number of people saying they would like these things from websites is greater than the number who claim to get them. This is the case for each item among the options listed except "other information needed to make the decision" (which perhaps just indicates a lack of imagination as to what that "other information" might be, if not one of the alternatives offered). The biggest discrepancy was for "interpreted data", wanted by 71.9% of respondents and got by only 42.1%. This is in line with the findings of Barchiesi (in an unpublished CRC report) that decision makers under tight time constraints want information that does not require significant analysis (see table1).

### **What do people like in websites and what don't they like?**

Respondents were asked open-ended questions about what helped them feel confident about the information found on websites and what interfered with their confidence. In addition, they were asked to indicate features of websites they found helpful and those they found annoying. Confidence was most strongly engendered by the reputation of the site owner and contributing authors. About a quarter of all respondents listed this as a factor that helped them feel confident. A similar number of people specifically mentioned government or university

sources as confidence-inspiring. Other important issues (in rank order) were referencing, how regularly the site was updated, whether it referred to scientific research, whether the respondent knew the source and had previous experience with it, whether there was evidence of peer-review and the availability of good metadata. People's confidence was diminished by lack of references (unsubstantiated claims), sites sponsored by commercial or political, advertising and sales pitches, lack of regular updating, lack of organisational credibility and poor site design.

On the subject of what is helpful in a website, clear logical navigation is the most highly regarded feature, followed by good clear links to other relevant information, a good internal search feature and a site map or list of contents. On the other hand, respondents found unclear navigation and lack of logical flow, bad internal search features, moving flashy things, pop-ups and slow download times most annoying.

These results were mirrored in a question which asked respondents to rate the helpfulness of some specific features. Downloadable files/PDFs, good search features and clickable links to related sites were all considered to be most helpful, with interactive maps and illustrations (such as conceptual models) moderately helpful. Only moving graphics to draw attention were considered to be unhelpful by the majority of respondents. There were no differences by gender or sector on these variables.

### **How could people be encouraged to find a website and how will they find it?**

Data were reported earlier about how people usually find their favourite websites: word of mouth is the most powerful stimulant, followed by links from other sites, global search engines, printed publicity material and references in journal articles.

We also asked people to rate how enticing they would find certain forms of publicity. Having the website in question adopted as the "industry standard" was the most enticing, followed closely by "recommendation by others". Also high was reading an article in a respected magazine that billed the website as "state of the art". Surprisingly, the least enticing option was the offer of free training in how to use the site. Both this, and having a role in the development of the site, were considered even less enticing by respondents than the humble and often over-used publicity brochure. This is perhaps a reflection of the time-commitment required by training or having a role in site development. Quite reasonably, busy decision makers may expect websites to be self-evident in what they have to offer the user. Again, there were no significant gender or sector differences in what people thought would entice them to try a new website.

### **What sort of paper-based sources do people use?**

Finally, we asked people to rate the usefulness of various paper-based sources when it came to making their NRM decisions. Executive summaries of external reports were rated as most useful followed by executive summaries of internal reports. Full external reports and peer-reviewed journal articles were also popular. Least popular was text downloaded and printed from web-pages (as opposed to downloaded PDFs of reports which are the most popular aspect of websites according to our survey). There were no gender or sector differences in respondents use of paper-based sources of information.

There were no significant differences on any of the variables tested between the group who answered by the on-line survey and those who answered by mail. (Only the respondents to the first survey round were tested because of the possibility of confounding variables.)

## **Discussion**

Barchiesi's literature review gave leads to effective web design for sites that would appeal to busy NRM decision makers. Many of these insights are backed up by the survey findings. To some extent, there is a trade-off between decision makers' confidence in material available to them and the time it takes to access that material. The literature review suggests decision makers will rely on their own expertise if they can and this is backed up by the finding that "own prior experience" was the most popular source of information for those surveyed (see figure 2). The web was the second most popular source overall, perhaps reflecting the fact that it is so accessible to most NRM decision makers. However, the web is *not* so popular with State government employees, who have access to high-level internal expertise and research. State government workers gave high scores to internal papers, internal person to person communication and internal email as information sources, reflecting a finding of the literature review that decision-makers "tend to seek knowledge from someone who is easily accessible" (see table 1). In contrast to the other sectors surveyed, they gave a low score to the web as in information source. It may be significant that all survey respondents who did not use the web because it took too much time to find what they wanted were from the State government sector (although this cannot be tested statistically, due to low numbers).

Other relevant findings of the review were that, for time management reasons, decision makers only sought information until they had found the first acceptable answer, that they gave up searching relatively quickly and did not look for the "best" answer and that they followed habitual patterns in their information seeking (see table 1).

Considering all these findings together, it seems reasonable to suggest that, because State government NRM decision-makers have speedy access to trusted sources without going beyond the bounds of their departments, they are less likely to look for things on the web and furthermore, this is not because of lack of accessibility but either because they regard their internal sources as more trustworthy or because they have a habit of going to internal sources. On the other hand, for those who don't have access to so many internal experts to inform their decisions (i.e. local government decision makers and those in NRM groups), the web is the most accessible source of trustworthy information. For these sectors, the critical factor in deciding whether or not to use a particular website will be how much *confidence* they have on the information presented, since they already tend to go to the web for their information. On the other hand, State government decision makers will tend not to use the web until convinced they will be able to get good information *faster* from that source than from their internal sources.

This suggests that marketing for a knowledge-based website should focus on those features which engender trust when appealing to local government and NRM group decision makers, while focusing on the speed and convenience to attract those from the State sector.

#### **How do people find a new site?**

When the sampled decision-makers are looking for web-based material, 71% begin with a key word search through Google or another global search-engine so it will be important to ensure that the site is easy to find by that method.

The survey also offers clues about how to pre-empt the need for searching, by promoting the website through other media. A third of the people surveyed had found one or more of their favourite websites in printed publicity material. Nevertheless brochures were not generally rated very highly as enticements to draw new "customers" to sites. A better strategy would be to publish an article in a high-profile, relevant, industry magazine promoting the site as the "state of the art" in websites facilitating evidence-based decision making. 31% of respondents rated such an article at 4 or 5 on a five point scale of effectiveness as an enticement to use a website – twice as many as those who gave a 4 or 5 rating to a "brochure or booklet describing the site and what it offers". Also highly rated (29% at 4 or 5) was "an e-newsletter that gives a regular update of improvements to the site with a link encouraging you to open the site and have a look". Since this is one promotional tool that is directly within the control of those wishing to market a website (unlike "adoption of the website as the industry standard by your organization" – which achieved the highest score as an enticement) any campaign to market a new website could benefit from such a newsletter.

A promotional tool that failed to excite much interest was a free training workshop in how to get the most from the site. Furthermore (and perhaps surprisingly) this lack of enthusiasm for training was across all sectors surveyed. This may be due to the fact that people (reasonably) expect websites to be self-evident or because our respondents are generally too busy to find training attractive or perhaps a combination of both.

Another popular way for people to find sites is through word of mouth (WOM). 36.8% of people found their favourite sites this way and a similar percentage (37%) rated "others in [their] work environment" using and recommending the site as a strong enticement. Of course good WOM will depend on having a good website – the parameters of which will be covered in a following section. However, it should also be possible to generate WOM by talking about a site and encouraging others to do so.

The other way people often found their favourite sites was through clickable links or references on other websites. These can be organized by asking those administering related sites to host links to a new website.

**Once people know about the website and have made the critical mouse-click that gets them there, what will they want to find?**

They won't want anything that moves, flashes, makes a sound or pops up without them asking for it – these were all rated as annoying ... but not as annoying as unclear navigation or lack of logical flow which was the single most irritating feature, followed by bad search features that don't deliver. Features considered helpful include clear navigation, good clear links that work without fail and a good search feature. A contents list or site-map was also rated highly, presumably because this gives browsers extra clues about where to look for things if the conceptual framework of the web-designer is not transparent to them.

While the emphasis is clearly on content, there are certain design features that send unprofessional signals – bad layout, too much text, too many colours, bad background colours and seriffed fonts (e.g. times roman) were all mentioned.

There is some overlap between what helps people to feel comfortable while using a website and what encourages them trust the website but respondents tended to distinguish between the two, with design features being more related to user comfort and content to user confidence.

The people in our sample would feel confident in a website which clearly signalled its association with recognizable and reputable authors, sources and networks, especially by referencing all material well. Overwhelmingly, "reputable" sources are government and university sources. If people are to trust scientific information available from websites it must be peer-reviewed (or linked to well-

referenced peer-reviewed sources), well-written, have good meta-data and be well-summarised, but with access to the original data. It is also important to provide evidence that information is regularly updated.

On the other side, people will be less confident in information on a website if there is any hint of commercial or political interests, advertising or sales pitches or unsubstantiated claims.

As for how people want their information delivered, publications in the form of downloadable and printable files, summaries, including executive summaries of reports and map-based or GIS information are the most popular formats. Respondents wanted more interpreted data from their favourite websites but over a third also wanted to be able to access the original data. Even if they never did so, the fact that they could gave them more faith in the interpreted and summarized data that was presented.

Finally, while most of the sample gave the web a score of at least three (on a five point scale) as a source of information to help them make their particular NRM decision, those who gave a lower score pointed to lack of specificity and lack of speed as things that put them off making more use of this resource. To the extent that websites can be designed to be speedy and specific to the needs of NRM decision-makers, as well as fulfilling the recommendations below, new users may be enticed to take advantage of the benefits of the world wide web as a source of science knowledge.

## Recommendations

### Design of websites

- downloadable pdfs, summaries and map-based/GIS data are all popular and should be prominently featured
- as far as possible information should be referenced to peer-reviewed, recognized research sources
- there should be prominent information to indicate how recently the site or important elements of it were updated
- where possible, original data and metadata should be available and its existence clearly signalled
- as far as possible, if not absolutely, avoid advertising or any hint of commercial interests
- in general, avoid moving flashy things

- the most important design element is the navigation and menu structure. People want clarity, repetition and continuity of structure.
- consider, in addition, including a site-map
- a good search feature is an essential element (and a bad one will be very poorly received).
- non-functional links and slow downloads will also be very poorly received
- things to avoid in the design include coloured backgrounds, too much text, seriffed fonts and too many colours.

### **Marketing and promotion of new websites – media**

- make sure the website is as prominent as possible in Google searches
- investigate suitable publications (such as industry magazines) where the site can be promoted as a state-of-the-art website to assist evidence-based decision-making. Write and submit appropriate articles
- consider sending an e-newsletter about the proposed news site and its progress to those who may be its users. Include the option to unsubscribe to avoid antagonising potential users
- generate word of mouth about the forthcoming resource at every possible opportunity
- ask administrators of appropriate sites (fitting all the criteria for good sites given by our respondents) to host links to the site
- use networks in potential user groups to promote the website, by word of mouth and other means. For example, encourage communication officers to put articles in internal newsletters. Extra effort is needed to encourage State government users and internal WOM rated highly as a source of information in this sector.

### **Marketing and promotion new websites – messages**

- marketing generally should emphasise the availability of things people want (such as summaries and downloadable PDFs) on the site as well as design and content features that make the site a quickly accessible source of trustworthy information
- in marketing to the State government sector, speed of access may be the critical factor to emphasize. As well, it might be worth pointing out that more up-to-date information could be available on the site than from internal sources

- in marketing to other sectors where the web is already very popular as a source, the critical factor will be the trustworthiness of the information presented

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## Appendix 1 Survey form

# Natural Resource Managers Survey

Software for Knowledge Integration and Exchange Project

CRC for Coastal Zone  
Estuary & Waterway Management



This survey is part of the Software for Knowledge Integration and Exchange (SKIE) project being conducted by the Coastal CRC. Your participation is important because the findings will help us make online data, information and knowledge about the coastal zone more accessible to decision-makers and to others interested in coastal Natural Resource Management.

The time needed to complete the survey is approximately 10 minutes. Information will be used for research purposes only and will not be reported in any way that identifies individuals.

The basic information sought is –

***How do you, as a natural resource decision maker, find online data, information or knowledge you need to make decisions quickly?***

Before answering the questions, please take a moment to think of a natural resource management decision in which you recently participated. Choose a decision that required you to gather information under tight time constraints and outside your own experience or field of expertise.

The questions on the following pages relate to how you sought information before making the decision.

Before answering them, please give a brief outline of the decision you were involved in making. Use the space below.

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Please return the completed survey in the attached envelope or send to:

Dr Jan Tilden,  
Coastal CRC,  
80 Meiers Road  
Indooroopilly, Queensland 4068  
Ph: 3896 9205 email: [jan.tilden@nrm.qld.gov.au](mailto:jan.tilden@nrm.qld.gov.au)

**1. Below is a list of information sources you may have used (or employed others to use) to help with your decision-making.**

Please rate them on a scale of 1 to 5 according to the *extent* to which you sought information from each of these sources (1 = did not seek information from this source; 5 = put a lot of effort into getting information from this source; please circle a number on each scale)

**(a) Internal (own organisation) paper-based media such as technical reports or files**

1 (did not seek)	2	3	4	(major source) 5
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**(b) Technical reports, journals or other external (other organisation) paper-based media**

1 (did not seek)	2	3	4	(major source) 5
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**(c) Your own prior experience**

1 (did not seek)	2	3	4	(major source) 5
------------------	---	---	---	------------------

**(d) Email to contacts within your organisation**

1 (did not seek)	2	3	4	(major source) 5
------------------	---	---	---	------------------

**(e) Email to contacts outside your organisation**

1 (did not seek)	2	3	4	(major source) 5
------------------	---	---	---	------------------

**(f) Phone or face-to-face communication with others in your organisation**

1 (did not seek)	2	3	4	(major source) 5
------------------	---	---	---	------------------

**(g) Phone or face-to-face communication with people outside your organisation**

1 (did not seek)	2	3	4	(major source) 5
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**(h) Internal databases**

1 (did not seek)	2	3	4	(major source) 5
------------------	---	---	---	------------------

**(i) The Web**

1 (did not seek)	2	3	4	(major source) 5
------------------	---	---	---	------------------

**(j) Other screen-based media such as CD ROM**

1 (did not seek)	2	3	4	(major source) 5
------------------	---	---	---	------------------

**(k) Citation abstracts, libraries or library services**

1 (did not seek)	2	3	4	(major source) 5
------------------	---	---	---	------------------

2. The World Wide Web gives you access to enormous amounts of information across many disciplines and sources. This information can be accessed from your desktop. If you gave the Web a score of less than 3 in the previous question, what stopped you from using the Web in preference to other information sources?

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3. If you looked for information on **the Web**, what was your first step? (Please tick one)

- (a) Search internal website
- (b) Use a global search engine (such as Google or Yahoo) and key words
- (c) Go directly to a website suggested in some paper-based source
- (d) Ask someone for advice about websites to visit
- (e) Browse by following links
- (f) Had someone compile information for you from the Web
- (h) Other please list -----

4. Are there websites that you regularly find useful for helping you make natural resource management decisions? If so please list them in the space below (by name, URL not necessary)

-----  
-----  
-----

5. How did you find these sites the first time? (please tick)

- Word of mouth
- Printed publicity material (e.g. brochures, postcards, bookmarks)
- Printed reference in a paper or journal
- Link or reference from another website
- Email recommendation from a known source
- Email magazine or newsletter (subscribed)
- Unsubscribed or unsolicited email
- Search engine
- Other (specify) -----
- Not sure

6. What sort of information do you get from these sites? (Please tick one or more)

- Raw data
- Pictorial representations of data analysis (e.g. graphs, figures)
- Map-based representations (e.g. GIS)
- Summaries
- Interpreted data
- Other information needed to make the decision
- Tools to help you find information you need
- Tools to help make the decision
- Other useful tools (specify) \_\_\_\_\_
- Lists of publications or other material to search for information
- Publications as downloadable or printable files (e.g. PDFs)
- Details of useful contacts
- Other (please specify) \_\_\_\_\_

7. What sort of information would you like to get from a good website? (Please tick one or more)

- Raw data
- Pictorial representations of data analysis (e.g. graphs, figures)
- Map-based representations (e.g. GIS)
- Summaries
- Interpreted data
- Other information needed to make the decision
- Tools to help you find information you need
- Tools to help make the decision
- Other useful tools (specify) \_\_\_\_\_
- Lists of publications or other material to search for information
- Publications as downloadable or printable files (e.g. PDFs)
- Details of useful contacts
- Other (please specify) \_\_\_\_\_

8. Thinking about websites whose content you trust and those you *don't* trust, please list in each box the features which affect your confidence in the information provided:

Features which help you feel confident about the information	Features which interfere with your confidence in the information

9. Please rate the following website features on a scale of 1 to 5 according to how helpful you find them. (1 = feature can be more annoying than helpful; 3 = feature is neither helpful nor annoying; 5= feature can be very helpful. Circle one number on each scale.)

(a) Downloadable files and other text suitable for printing (e.g. PDF files)

1 (annoying)	2	3 (neutral)	4	(very helpful) 5
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(b) A "search" function (for searching within the website)

1 (annoying)	2	3 (neutral)	4	(very helpful) 5
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(c) Moving graphics to draw your attention to particular features

1 (annoying)	2	3 (neutral)	4	(very helpful) 5
--------------	---	-------------	---	------------------

(d) Clickable links to related websites

1 (annoying)	2	3 (neutral)	4	(very helpful) 5
--------------	---	-------------	---	------------------

(e) Interactive pictorial representations of concepts (e.g. interactive conceptual models)

1 (annoying)	2	3 (neutral)	4	(very helpful) 5
--------------	---	-------------	---	------------------

10. Please describe any other features you find either helpful or annoying on websites.

Helpful features	Annoying features

11. When you need information, which disciplines can you draw upon from your own **formal studies or past experience**? (Please tick one or more)

	formal studies	past experience		formal studies	past experience
Ecology	<input type="checkbox"/>	<input type="checkbox"/>	Human relations management	<input type="checkbox"/>	<input type="checkbox"/>
Planning and policy	<input type="checkbox"/>	<input type="checkbox"/>	Communication	<input type="checkbox"/>	<input type="checkbox"/>
Remote sensing/GIS	<input type="checkbox"/>	<input type="checkbox"/>	Psychology	<input type="checkbox"/>	<input type="checkbox"/>
Geology/Geomorphology	<input type="checkbox"/>	<input type="checkbox"/>	Environmental science	<input type="checkbox"/>	<input type="checkbox"/>
Modelling	<input type="checkbox"/>	<input type="checkbox"/>	Government	<input type="checkbox"/>	<input type="checkbox"/>
Sociology	<input type="checkbox"/>	<input type="checkbox"/>	Statistics	<input type="checkbox"/>	<input type="checkbox"/>
Biology	<input type="checkbox"/>	<input type="checkbox"/>	Economics	<input type="checkbox"/>	<input type="checkbox"/>
Physics	<input type="checkbox"/>	<input type="checkbox"/>	Law	<input type="checkbox"/>	<input type="checkbox"/>
Chemistry	<input type="checkbox"/>	<input type="checkbox"/>	Other -----	<input type="checkbox"/>	<input type="checkbox"/>

12. Assuming you sought some **paper-based information** (including files printed from the Web) to help make the NRM decision outlined on the first page, indicate how useful each of the following was to you (circle a number on each scale)

(a) Executive summaries of internal reports

1 (not at all useful)    2    3    4    (very useful) 5

(b) Internal reports generally

1 (not at all useful)    2    3    4    (very useful) 5

(c) Executive summaries of external reports

1 (not at all useful)    2    3    4    (very useful) 5

(d) External reports generally

1 (not at all useful)    2    3    4    (very useful) 5

(e) Peer-reviewed journals

1 (not at all useful)    2    3    4    (very useful) 5

(f) Summary brochures

1 (not at all useful)    2    3    4    (very useful) 5

(g) Books

1 (not at all useful)    2    3    4    (very useful) 5

(h) Text (other than reports and journal articles) downloaded and printed from websites

1 (not at all useful)    2    3    4    (very useful) 5

**15. Demographic questions**

(a) Gender    M     F

(c) Number of years of experience at current level of responsibility

-----

(b) Age group (please tick)

Under 20      
 20 – 30      
 31 – 40      
 41 – 50      
 51 – 60      
 61 – 70      
 Over 71   

(d) Current position

-----

(e) Type of organisation (please tick)

State government      
 Local government      
 regional NRM group (NAP, NHT2)      
 Other (specify) -----

*Thank you for your assistance with this survey. If you would like a copy of the results or more detailed information about the survey, please email separately to [jan.tilden@nrm.qld.gov.au](mailto:jan.tilden@nrm.qld.gov.au)*

## Appendix 2 Summary statistics

## Demographic characteristics

### Question 14a

Male	41	71.9%	(original sample 73%)
Female	14	24.6%	(original sample 27%)
DK	2	3.5%	

### Question 14b Age

21-30	11	19.3%
31-40	16	28.1%
41-50	16	28.1%
51-60	12	21.1%
61-70	1	1.8%

median = 41.9

(I'll summarise with a graph)

### Question 14c Years of experience

Range .5-30 years      Mean 6.09      Median 5 years Mode 2 years

### Question 14d

#### Question 14e

State Govt	24	42.1%
Local Govt	16	28.1%
NRM Group	11	19.2%
Other (inc dk)	6	10.5%

### Question 13

(a) Areas of formal study (ranked by number)

Environmental science	41	71.9%
Ecology	37	64.9%
Biology	29	50.9%
Statistics	27	47.4%
Geology	26	45.6%
Chemistry	22	38.6%
Physics	16	28.1%
Law	16	28.1%
Planning and policy	15	26.3%
Human resources	15	26.3%
Remote sensing	15	26.3%
Economics	15	26.3%
Communication	14	24.6%
Government	12	21.1%
Modelling	10	17.5%
Sociology	10	17.5%
Psychology	7	12.3%

(b) Areas of experience (ranked by number)

Government	47	82.5%
Planning & policy	38	66.6%
Communication	33	57.9%
Environmental science	33	57.9%

Human resources	32	56.1
Ecology	24	42.1
Remote sensing	22	38.6
Physics	19	33.3
Geology	15	26.3
Biology	15	26.3
Modelling	14	24.6
Sociology	13	22.8
Statistics	13	22.8
Economics	13	22.8
Psychology	11	19.3
Chemistry	7	12.3
Law	5	8.8

n.b. Do differences between these two – what people are formally trained in and what they are experienced in suggest we have targeted the right group (i.e. NRM decision makers as opposed to scientists)?

## Dependent variables

### Question 1: What information sources do people use:

	1(%)	2	3	4	5
Internal paper	1( 1.8)	13(22.8)	10(17.5)	<b>21(36.8)</b>	12(21.1)
External paper	3( 5.2)	11(19.3)	<b>18(31.6)</b>	17(29.8)	7(12.3)
Own experience	0( 0%)	5( 8.8)	14(24.6)	<b>24(42.1)</b>	13(22.8)
Email internal	3( 5.2)	13(22.8)	15(26.3)	<b>21(36.8)</b>	4( 7.0)
Email external	3( 5.2)	6(10.5)	15(26.3)	<b>23(40.3)</b>	10(17.5)
Phone or face to face internal	3( 5.2)	7(12.3)	16(28.1)	<b>19(33.3)</b>	11(19.3)
Phone or face to face external	1( 1.8)	7(12.3)	16(28.1)	<b>20(35.1)</b>	13(22.8)
Internal databases	12(21.1)	<b>17(29.8)</b>	10(17.5)	10(17.5)	6(10.5)
The web	6(10.5)	10(17.5)	6(10.5)	<b>18(31.6)</b>	17(29.8)*
Other screen-based (CD)	15(26.3)	<b>21(36.8)</b>	13(22.8)	6(10.5)	0(0%)
Libraries or lib. Services	<b>19(33.3)</b>	15(26.3)	14(24.6)	6(10.5)	1( 1.8)

\* The bimodal effect for “web” as a source of info. has all but disappeared now that we have this new sample. It might have reflected a difference between the mail-in group and the email group. I’ll check for this.

### Question 2: Web...if not, why not?

Specialised or local knowledge that is not on the web	8
Time...takes a long time to find what’s needed	3
Sufficient info available from other sources	2
Local knowledge is more reliable	1
Too much information	1
Don’t know how to use	1
Don’t know relevant addresses	1

**Question 3: If you looked for information on the web what was your first step?**

Global search engine	34 (59.6%)
Search internal website	10 (17.5%)
Go directly from a paper-based source	6 (10.5%)
Browse by following links	4 ( 7.8%)
Ask someone for advice	1 ( 1.8%)
Have someone else compile info	1 ( 1.8%)

**Question 4: Are there websites you regularly find useful?**

Government NRM sites generally	11
DEH	5
QEPA	5
QNR&M	3
QDPI&F	3
Coastal CRC	3
Own agency website	2
Australian natural resource atlas	2
DIPNR	2
Land and water australia	2
Audit atlas	2
Dept. of Environ. & Conservation	2
Govnet	2
Legislation websites	2
Education institutions/universities	2
NHT	2
Regional NRM websites	2
AFFA	2
CSIRO	2
CANRI	2
Auslig	2
Landuse planning websites/planning schemes	2
Geolink	1
urbanwater.info	1
wsud.org	1
Local council websites generally	1
Australian Spatial Data Directory/Australian Spatial Data Infrastructure	1
CRC reef	1
OzEstuaries	1
AIMS	1
Qld parliamentary council	1
Regional bodies	1
Environmental consultant sites	1
Enviroinfo	1
Coastal maps atlas of SA	1
WA dept of agriculture	1
Productivity commission	1
US EPA	1
OECD	1
?EPA	1
ABARE	1
BRS	1
CRCs generally	1
Department of Local Govt and Planning (Q)	1
WA govt portal	1
WA govt websites	1
DAFF	1
QLD and NT coastal and marine networks	1

SA govt websites 1  
 Victorian DSE 1  
 Manly hydraulics laboratory 1  
 University of Delaware 1  
 University of Oregon 1  
 National Committee on Coastal and Ocean Engineering EI Aust 1  
 Danish Hydraulics Institute 1  
 GBRMPA 1  
 NPWS 1  
 RBG 1  
 NRM options 1  
 Department of Commerce 1  
 OneCoast National Fisheries ESD Website 1  
 WAFIC 1  
 Recfishwest 1  
 Conservation Council of WA 1  
 MCCN 1  
 AMSA 1  
 SeaNet 1  
 Surfrider 1  
 CRC for sustainable tourism 1  
 Integration and Application Network 1  
 Environs (local govt website) 1  
 MHL water level data 1

**Question 5: How did you find these sites the first time? (ranked)**

Word of mouth	21 (36.8%)
Link or reference from another site	21 (36.8%)
Search engine	19 (33.3%)
Printed publicity material	18 (31.6%)
Printed ref. in paper or journal	13 (22.8%)
Email recommendation from known source	12 (21.1%)
Email magazine or newsletter (subscribed)	9 (15.8%)
Unsubscribed or unsolicited email	9 (15.1%)
Personal knowledge/helped design	3 ( 5.2%)

**Question 6,7: What sort of information do you get from these sites? Like to get? diff**

Publications as downloadable or printable files	34 (59.6%)	36 (63.2%)	+ 2
Summaries	31 (54.4%)	43 (75.4%)	+12
Map-based info/GIS	26 (45.6%)	36 (63.2%)	+10
Interpreted data	24 (42.1%)	41 (71.9%)	+17*
Graphs figures etc	22 (38.6%)	37 (64.9%)	+15
Other information needed to make the decision	21 (36.8%)	21 (36.4%)	0
List of publications etc to search for information	19 (33.3%)	26 (45.6%)	+ 7
Tools to help find information needed	16 (28.1%)	30 (52.6%)	+14
Details of useful contacts	14 (24.6%)	27 (47.5%)	+13
Tools to help make the decision	13 (22.8%)	25 (43.9%)	+12
Raw data	10 (17.5%)	22 (38.6%)	+11

\* Biggest discrepancy between what people want and what they get is in "interpreted data" and "graphs, figures etc" which is really the same thing.

**Question 8:**

**(a) Features that help people feel confident (46 people provided comment)**

Recognised/Reputable networks/authors/sources 14  
Government/university sources 14  
Referencing of/Information about sources 11  
Recently/regularly updated (with evidence of this i.e.date) 9  
References to scientific research 9  
Known sources/ previous experience with source 7  
Peer-reviewed 6  
Good metadata 6  
Well written/clear format 3  
Access to summaries and interpretation but also data and full paper 3  
Background information on why the project developed, its aims, audience etc 3  
Follow-up contacts available 3  
Publication dates 2  
Links to similarly cited sites 2  
Local relevance 2  
Party political/vested interest independence 2  
Free and easily accessible information 1  
Seeing the same info in more than one reliable place 1  
Knowing the joint partners on the project 1  
Limitation of information is acknowledged 1  
Client focussed information 1  
Govt audit 1  
Balance in editorial content 1  
Maps at a sufficient level of detail 1  
Ability to view contents from other users 1  
Recommendations from other users 1  
Ethical position of website sponsor 1  
Industry standard 1  
Visual trends 1

**(b) Features that interfere with confidence (N=42)**

Lack of references/unsubstantiated claims 14  
Sites sponsored by commercial/political interests 9  
Advertising and sales pitches 9  
Not updated for some time/regularly 7  
Organisations without credibility 6  
Poor site design/ presentation 5  
Pop-ups 2  
Overseas material with source unknown 2  
No peer reviewed material 2  
Hyperlinks that don't work 2  
Pictorial representations and summaries but no access to original data 2  
Overly flashy graphics 2  
Maps/information not detailed enough or at the wrong scale to be useful 2  
Hard to navigate 1  
Too many pages/too much information 1  
Pages that make you pay for info/articles 1  
Too much X referencing to sort how who's who and what's what 1  
Links to commercial groups  
Contacts or links to other components of site or similar external site (?)  
All fluff and no content 1  
No access to metadata 1  
No apparent quality control 1

Sites about issues that are highly critical but offer no constructive suggestions 1  
 Not academic/opinions 1  
 Inconsistent material 1  
 Unsolicited requests 1  
 Non-visual trends 1  
 Lack of case-studies 1

Question 9: How effective would each of the following be in encouraging you to try a website?

	1(%)	2	3	4	5
Training	2(3.6%)	<b>26(46.4)</b>	12(21.4)	12(21.4)	4( 7.1)
Recommended by others	0(0%)	1( 1.8)	16(28.6)	<b>22(39.3)</b>	15(26.8)
Brochure	3(5.4)	18(32.1)	<b>20(35.7)</b>	14(25.0)	1( 1.8)
Magazine article "state of the art"	1(1.8)	7(12.5)	17(30.3)	<b>22(39.3)</b>	9(16.1)
Adopted as "industry standard"	0(0%)	4( 7.1)	13(23.2)	<b>20(35.7)</b>	19(33.9)
Regular e-newsletter update	4(7.1)	13(23.2)	10(17.9)	<b>25(44.6)</b>	4( 7.1)
Role in site development	4(7.1)	<b>18(32.1)</b>	<b>18(32.1)</b>	11(19.6)	5( 8.9)

Question 10: Please rate the following website features for helpfulness

	1(%)	2	3	4	5
Downloadable files/PDFs	0( 0%)	2( 3.6)	7(12.0)	15(26.8)	<b>32(57.1)</b>
A search function	1( 1.8)	3( 5.4)	7(12.0)	19(33.9)	<b>26(46.4)</b>
Moving graphics to grab attention	12(21.4)	<b>19(33.9)</b>	11(19.6)	9(16.1)	5( 8.9)
Clickable links to related sites	0( 0%)	4( 7.1)	13(23.3)	17(30.3)	<b>21(37.5)</b>
Interactive illustrations	2( 3.6)	11(19.6)	13(23.3)	<b>16(28.6)</b>	13(23.3)
Interactive maps	0( 0%)	6(10.7)	8(14.3)	<b>25(44.6)</b>	17(30.3)

Pity "interactive conceptual models" don't come up stronger. I guess people have never been exposed to good ones. Still it does much better than moving graphics which are clearly the pits!

Question 11:

(a) Helpful features

Limited drilling to find info/ Logical entrance hierarchy/ Clear navigation 12  
 Good clear links/Links to relevant alternative sites 6  
 Good search feature 5  
 Extensive webpage contents list/site map 5  
 Repeated navigation panes/ continuity of structure 3  
 Downloadable files 3  
 Contacts (email and phone) 2  
 Regular update on what's new and available 2  
 Good diagrams/maps 2  
 Contact details for further info 2  
 Able to download info in a separate window 2  
 Access to basic GIS info 1  
 Accessible print and fonts 1  
 Compact 1  
 Pages load quickly 1  
 Date of last update 1

Regular update 1  
 Reports available in multiple formats 1  
 Linkages to show context of material 1  
 Information 1  
 Proper referencing 1  
 Contact details at the bottom of sections 1  
 Statement of purpose of site 1  
 Easy to find site with search engines 1  
 Opportunities to feed back about out of date things or better links 1

(b) Annoying features  
 Unclear navigation/lack of logical flow 6  
 Bad search feature 5  
 Moving/flashy things 5  
 Pop-ups 4  
 Slow to load/Large files 4  
 Bad layout 3  
 Lots of text 2  
 Focus on design rather than useful content 2  
 Circular links 2  
 Dead links 2  
 Downloads not linked 2  
 Advertising/sales pitches 2  
 Use of video etc which is mandatory to go through 1  
 Too many colours 1  
 Bad background colours 1  
 Times Roman font 1  
 Links within links within links 1  
 Blinking banners 1  
 Redirection 1  
 Cookies that do more than register you 1  
 Passwords 1  
 No create dates 1  
 Pages not linked 1  
 Unable to back arrow 1  
 Out of date info 1  
 Map searches that are too slow with too many layers you don't want to see 1  
 Maps that don't have info at a useful scale 1  
 Info without background material 1  
 Biassed assessments 1  
 Music 1  
 Not having main menu accessible at all times (even when scrolled to bottom of information) 1

**Question 12: Usefulness of various paper-based media (N=55)**

	1(%)	2	3	4	5
Exec. sum. internal	1(1.8%)	9(16.4)	10(18.2)	13(23.6)	<b>22(40.0)</b>
Internal report	1(1.8%)	7(12.7)	<b>21(38.2)</b>	17(30.9)	9(16.4)
Exec. Sum. external	1(1.8%)	5( 9.1)	8(14.5)	14(25.4)	<b>27(49.1)</b>
External report	1(1.8)	1( 1.8)	18(32.7)	<b>29(52.7)</b>	6(10.9)
Peer-reviewed journal	1(0%)	6(10.9)	17(30.9)	<b>23(41.8)</b>	7(12.7)
Summary brochure	3(5.5)	12(21.8)	<b>18(32.7)</b>	15(27.3)	7(12.7)
Books	5(9.1)	12(21.8)	<b>18(32.7)</b>	14(25.4)	6(10.9)
Text from websites (not as above)	4(7.3)	10(18.2)	<b>20(36.4)</b>	13(23.6)	6(10.9)