

Models of the Information Flows and Decision Making Process

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ABSTRACT

During pilot surveys at local level individual stakeholders and officials in local government were asked to list the main environmental issues for which they needed to make decisions, and then to select sources of information they used in each case. Overall, habitats were in the most important information topic for decisions, followed by socio-economics, species and hazards. However, models of information flows showed great variation in the priorities and the main sources across the stakeholder categories and tiers of local government.

INTRODUCTION

The ultimate objective of TESS is to design a transactional environmental decision support system, linking central policy planning to local livelihoods. The project aims to assist policy makers to integrate knowledge from the EU, national, regional and local level into the decision making process. There are several aspects of decision making that need to be considered in the design of a support system: information needs and flow; the processes that are to be influenced by the decision and the decision making process itself (Wierzbicki et al. 2000).

A survey of local governments and other stakeholders across the partner countries characterised the use of information on biodiversity and ecosystem services in the environmental decision making process in Chapters 2 and 3. A variety of information flows, analysis approaches and decision processes used for environmental assessment and sustainability assessment for biodiversity were identified by discussions with government departments (Chapter 2) and local case-study sites (Chapter 3) across a limited range of countries, in which partners were based and in which governance approaches were likely to differ. Combining their results revealed complex interactions and patterns of information flows between local, regional and national decision makers.

Conceptual models serve as a key planning and evaluation tools in conservation projects and are useful tools for expressing interactions in complex systems (Margoluis et al. 2009). They are used in information systems development to represent static or dynamic phenomena and to articulate user requirements (Wand & Weber 2002). In this case, conceptual models are used to illustrate the flow of information between local and central governments and local stakeholders. The conceptual modelling format is then used with information from survey across all European states (Chapter 6) to illustrate these flows clearly in Chapter 7.

Information use at local level

During the survey at local level, individual stakeholders and officials at the two tiers of local government were asked where they routinely sourced species information and other environmental data. It was not surprising to find that the largest proportion of respondents used the Internet. All stakeholder categories, except the lowest level of government (Tier 1), kept their own records of

species and other environmental data, ranging from 10% of respondents in the “farming and rural business” category to 100% in the “hunting and recreational animals” category (Figure 1).

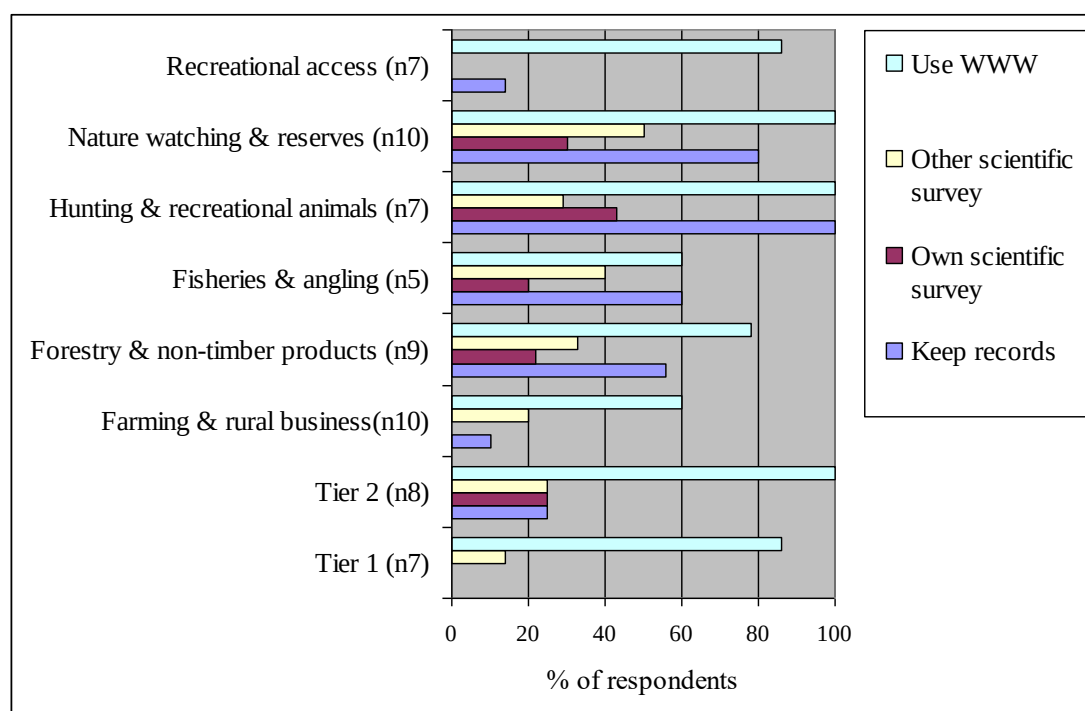


Figure 1. The proportion of interviewees in government and stakeholder categories using species data or other environmental data and the source of those data.

However, this assessment only indicated that a source of environmental data was available, and not which of many possible internet source types were being accessed e.g. government, NGO consultant), or whether access to each type was daily or once a year. In order to get a more representative picture of the relative importance of each data source, individual stakeholders and government officials were also asked in an open question to list the key environmental issues on which they most often made decisions, and then to indicate, from a list, which sources of information they used to make decisions (Table 1).

Table 1: Information source categories and codes for addressing local issues

Information Source Code	Information Source Category
a	Local knowledge
b	Scientific studies / research
c	Internet search
d	Private consultants / external advisors
e	NGOs
f	Government agencies
g	Local government / data provision
h	National or regional government / legislation
i	Internal management plans/ own records

Stakeholders and representatives of local government reported using a wide variety of information sources to inform environmental issues (Figure 2). Government agencies were the most frequently consulted information source, especially for “Farming and rural business” and “Fisheries and angling” stakeholders. Those managing “Forestry & non-timber products”, together with “Nature watching and reserves”, relied more than others upon their own records, with relatively little use of external local knowledge. NGOs were used very little as an information source in forestry, but this may be

explained by the fact that the large majority of forestry stakeholders were public companies owned and managed by government. For example, only one company in the forestry category was listed as an NGO (Hungary).

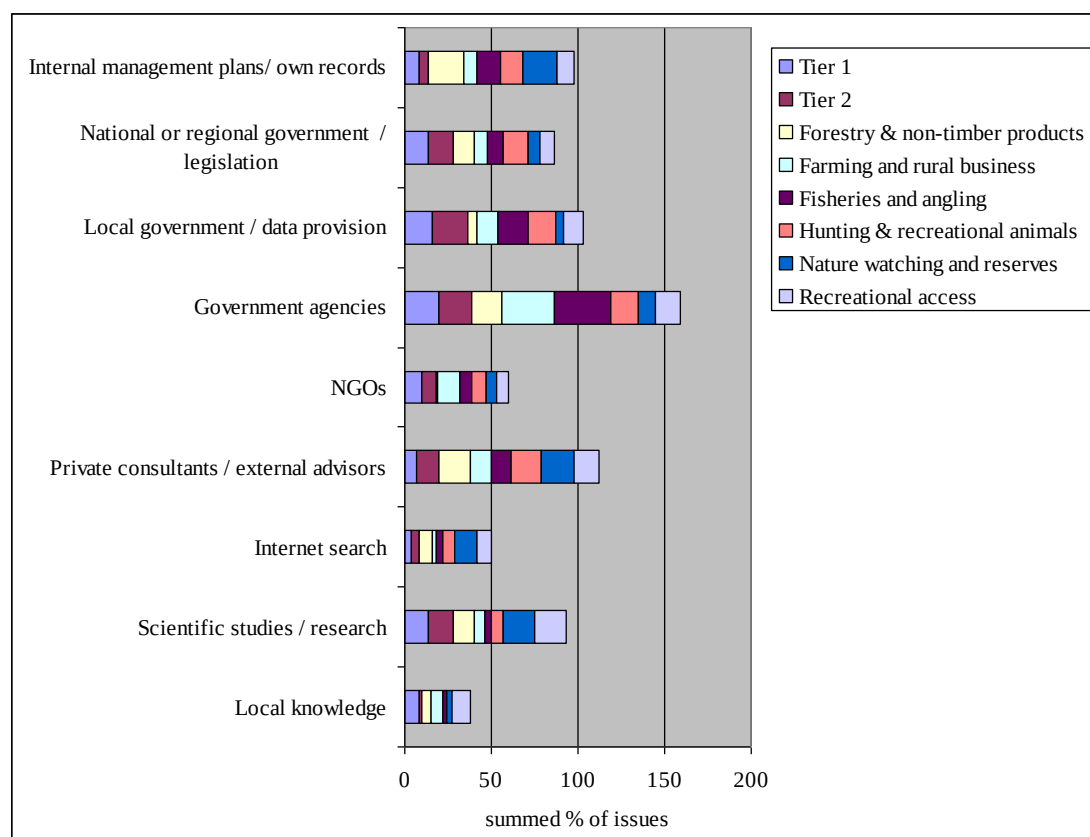


Figure 3. Relative frequency of use of information sources in environmental decision-making by local government Tier 1 (LAU2) and Tier 2 (LAU1) and stakeholders.

Finally, the key environmental issues on which stakeholders and tiers of local government made decisions were assigned to four major categories of environmental management, which aligned with the main categories also used in Chapter 3. These were management for: habitat, species, socio-economic issues (effectively for productive and cultural ecosystem services) and hazard control, which was primarily about regulating services (Table 2).

Table 2. Decision variable code for stakeholder categories to aid in the categorisation of survey responses for the development of a conceptual model of information flows.

Decision Code	Decision variable	Examples of environmental issues identified
1	Habitat management	Measuring habitat quality, habitat restoration, soil qualities, public access
2	Species management	Wildlife regulations, game, fish, pest and alien species management
3	Socio-economic issues	Subsidy opportunities and constraints, diversification income, tourism and recreation, incomes and jobs in general
4	Hazard management	Flood prediction, waste management, noise pollution, weather damage, wildfire

There was considerable variability in the categories of decisions made across the different stakeholder groups and tiers of local government (Figure 3). This variability can partly be explained by the nature of activities each stakeholder group was involved in. For example, the “hunting and recreational

animals” category identified the majority of issues related to species management, whereas the recreational access category identified the majority of issues related to socio-economic decisions. Overall, there was most interest in habitat management.

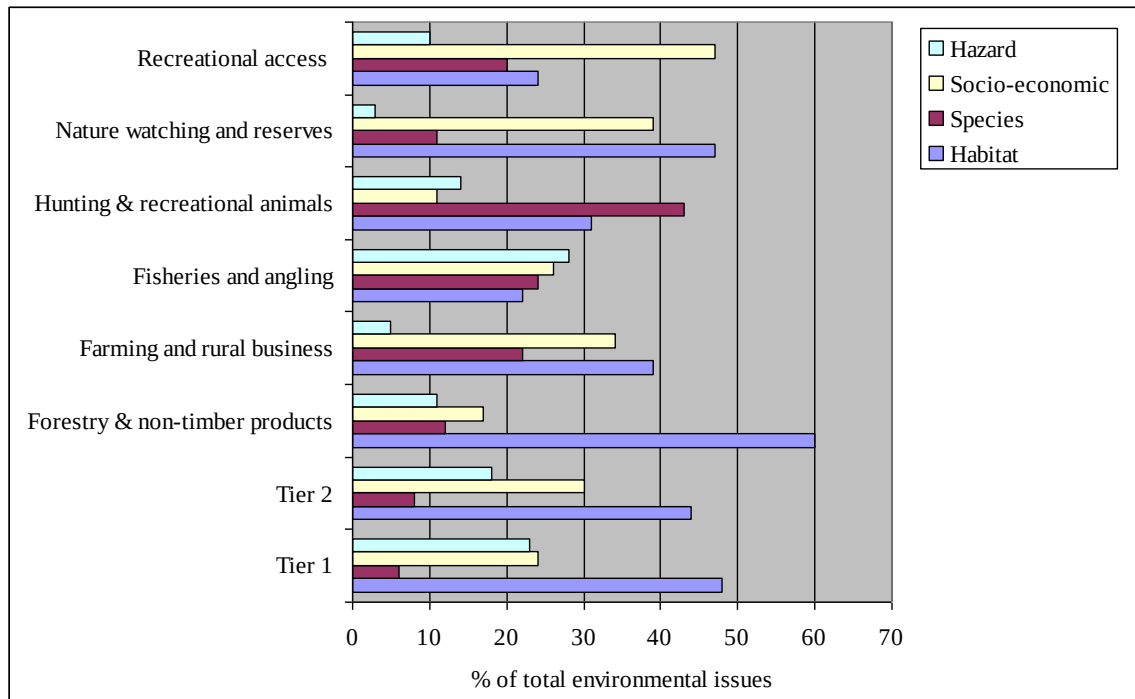


Figure 3. The relative proportion of issues identified in environmental decision making in each stakeholder category and tier of local government

The environmental issues listed by interviewees in the WP3 survey were identified as important issues in decision making. However, no attempt was made to quantify the number or complexities of decisions made per issue identified. The information flow models (figures 4-11) reflect the relative reporting of issues within different categories with a caveat regarding the limit of interpretation.

Conceptual models of information flows

For each type of stakeholder and tier of local government, information flow models could be used to show the relative importance of information from each source (in Figure 2) for each category of decision making (Figure 3). Such models enable a detailed visualisation of data exchange between local, regional and central information sources. Boxes represent the sources of information, and the thickness of arrows reflect the number of times each source was listed for management decisions involving species, habitats, hazards and socio-economic issues.

A first example of the information flow model (Figure 5) is for based on data from 7 managers of recreational access in the countryside (see Figure 1 for sample sizes). As for the other individual stakeholders and government officials, decision making generally required access to information held at all levels (local, regional and central) and a number of different information sources were used for each (coloured) decision category.

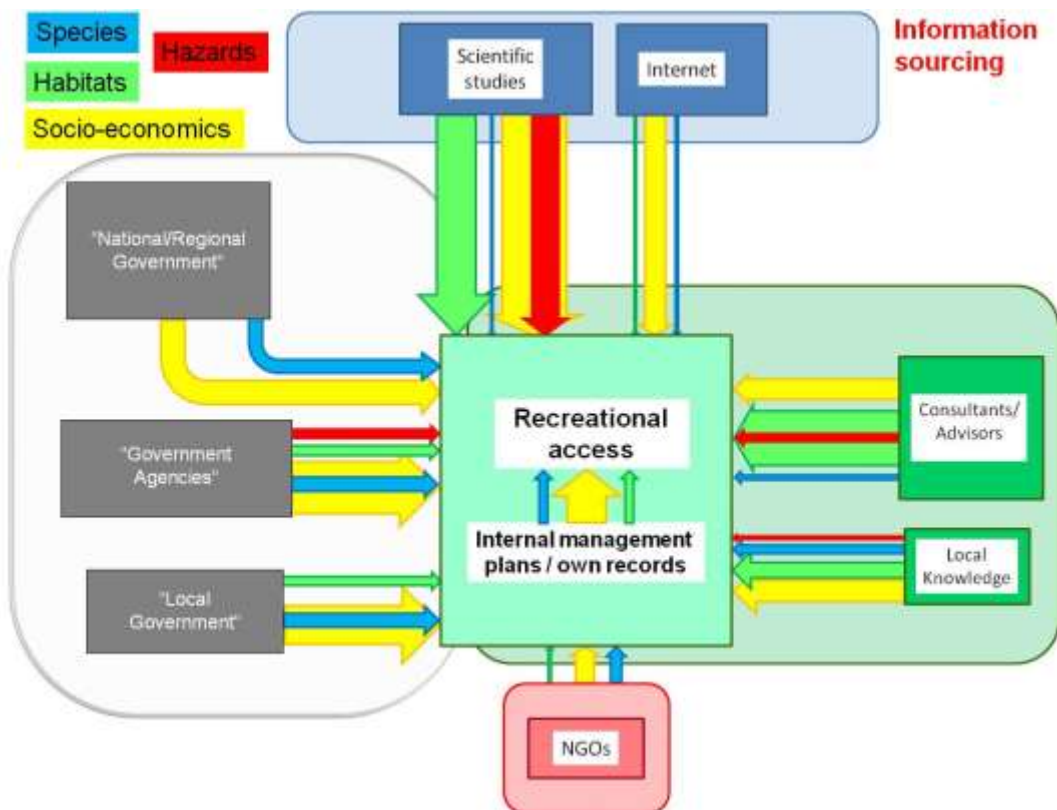


Figure 5. Information sources used by 7 “Recreational access” stakeholders for environmental decision making.

Socio-economic considerations (46% of 61 issues listed) were the most prevalent decision type for these stakeholders, with information coming from all source categories but with the highest proportion from scientific studies (16%), followed by government agencies (14%). Information for habitat decisions was sourced from consultants/advisors (27%), as well as from scientific studies (23%), while all information sources provided some data on decisions to do with species, and information on hazards was sourced chiefly from scientific studies (44%) but also from government agencies and consultants/advisors (22% each).

The situation was fairly similar for 10 surveyed managers of areas reserved for nature watching, with socio-economics accounting for 40% of 93 issues, but habitats (45%) were slightly more important. All information sources contributed information to these decisions but internal management plans/own records, consultants/advisors and scientific studies were referred to most often (20, 19 and 18% of the time respectively), with consultants/advisors slightly more important than scientific studies in the case of socio-economics (24% vs. 19%) but internal management plans/own records more important (28%) in the case of decision making for habitat management. Recreational access stakeholders was the group that used the internet the most in decision making, with 13% of information sourced this way overall. Information for decision making on issues to do with species come from a variety of sources, with information on hazards provided either by the internet (60%) or government sources (40%).

The 7 surveyed hunters reported proportionally the most environmental decision making of any of the stakeholders (or in fact local government) involving species (22 of 64 or 34%), with a similar percentage of habitat related decisions (Figure 6). Although all information sources provided some information on most of the types of decision making, the information source providing the highest proportion of data for species decision making was government agencies (19%), followed by consultants/advisors (17%). Consultants/advisors provided the most information to hunters for habitat related decision making (23%) and it was remarkable that only 19% of decisions overall by hunters involved socio-economics, with information provided by a variety of sources. In the case of hunters, the “local knowledge” information source was not used, subsumed by hunter’s internal management

plans and own records, in which species data accounted for 5% of the total data provision, compared to 3% for foresters and 1-2% for other stakeholders.

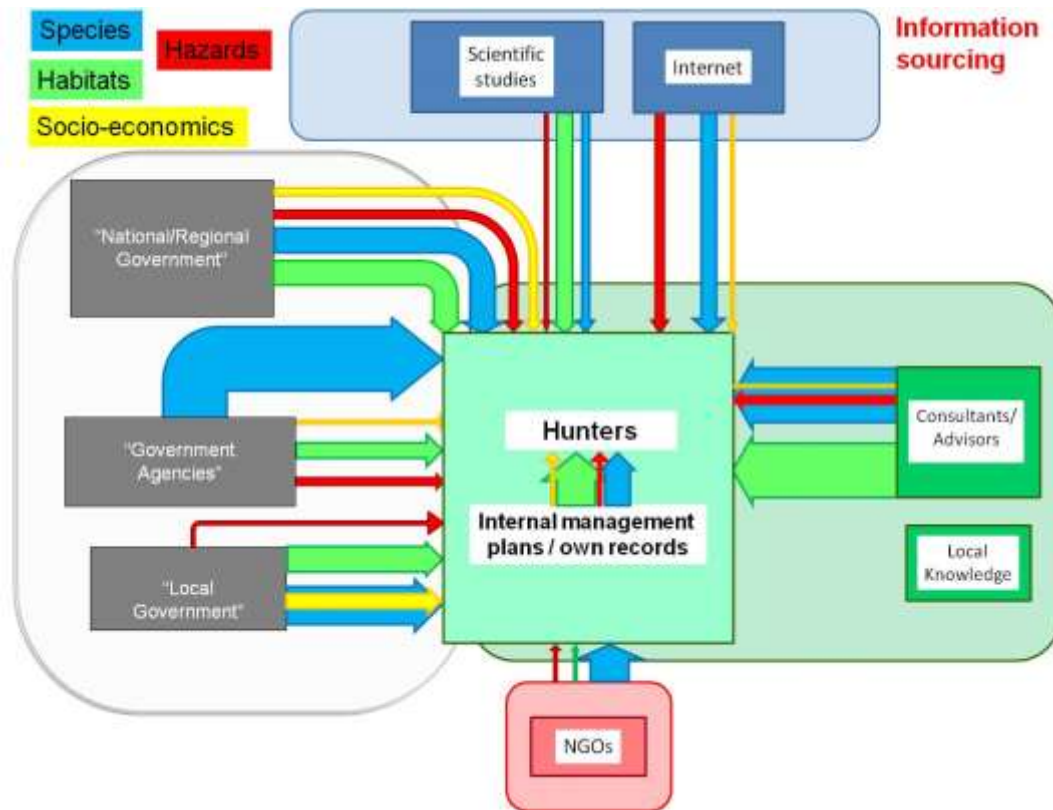


Figure 6. Information sources used by 7 "Hunting and recreational animals" stakeholders for environmental decision making.

There were only 5 managers of fisheries interviewed and they listed only 38 issues, half that of the 61 from those interested in recreational access, which listed the second lowest number of decisions. The greatest proportion of decisions for fisheries involved hazards (29%). This group sourced the majority of their information for all decisions on government sources, particularly government agencies (33% of the overall information sourcing, 38% of those involving hazards). Fisheries also reported the lowest proportional use of consultants/advisors of all the stakeholder groups, only using them for 11% of information sourcing overall.

Most of the environmental issues identified by 9 foresters involved habitats, 41 of 71 issues or 58% (Figure 7, left). For these they used their own internal management plans and records as an information source in just over a quarter of cases (26%). They sought advice from either consultants/advisors or a government agency each in 16% of cases, followed by national /regional government or scientific studies with 12% of cases each. The majority of information for decisions by forestry stakeholders involving hazards was sourced from the internet (44%) or scientific studies (33%).

The largest category of environmental issues identified by farmers (Figure 7, right) was in the socio-economic category (31 of 79 listed – 39%). This was followed closely by issues involving habitats (29 or 37%). The largest single source of information was government agencies (29 of 97 decision/source combinations or 30% of these information sourcing episodes), with NGOs, consultants/advisors and local government all relatively equal in their information provision (13, 12 and 12%, respectively). Government agencies tended to provide information on habitats (26% on these decisions) and socio-economic issues (27% of them) – though they were the only reported source of information on decision making involving hazards. Consultants/advisors were used primarily for socio-economic data (27% of this information sourcing), local government more for habitat information (16%), with NGOs used for habitat (16%) and species decisions (24%).

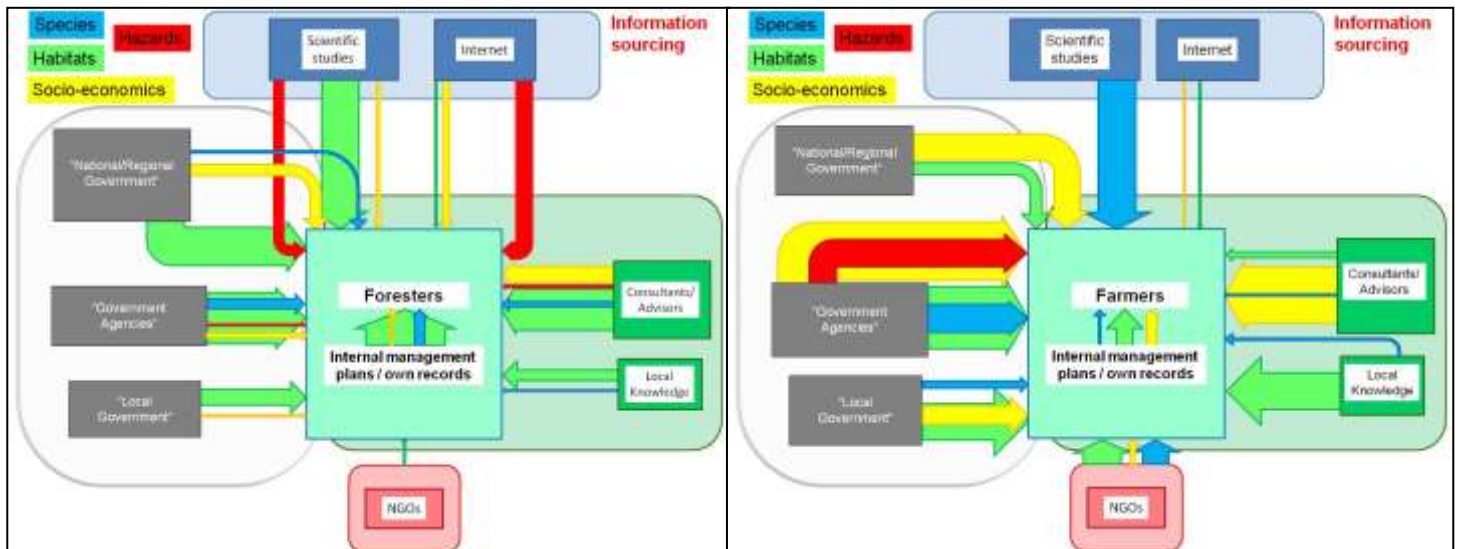


Figure 7. Information sources used for environmental decision making by 9 “Forestry and non-timber products” stakeholders (left) and 10 “Farming and rural business” stakeholders (right).

The 7 administrations at lowest level of local government reported 71 environmental issues, of which 52% (37) involved habitats, with a quarter of the information from government agencies; local government and national/regional government provided 15% each and 10% came from scientific studies (Figure 8, left). Decisions involving hazards were the next most common for this level of government (24%). Just over a fifth of the information sourcing for these came from scientific studies, but in total 54% of information for decisions relating to hazards came from a government level or agency. Just over a fifth of decisions involved socio-economics, with the information for these sourced from either scientific studies (19%) local government (16%) or government agencies and NGOs (12%) each. Species were the least frequent component of decisions made at this level of government.

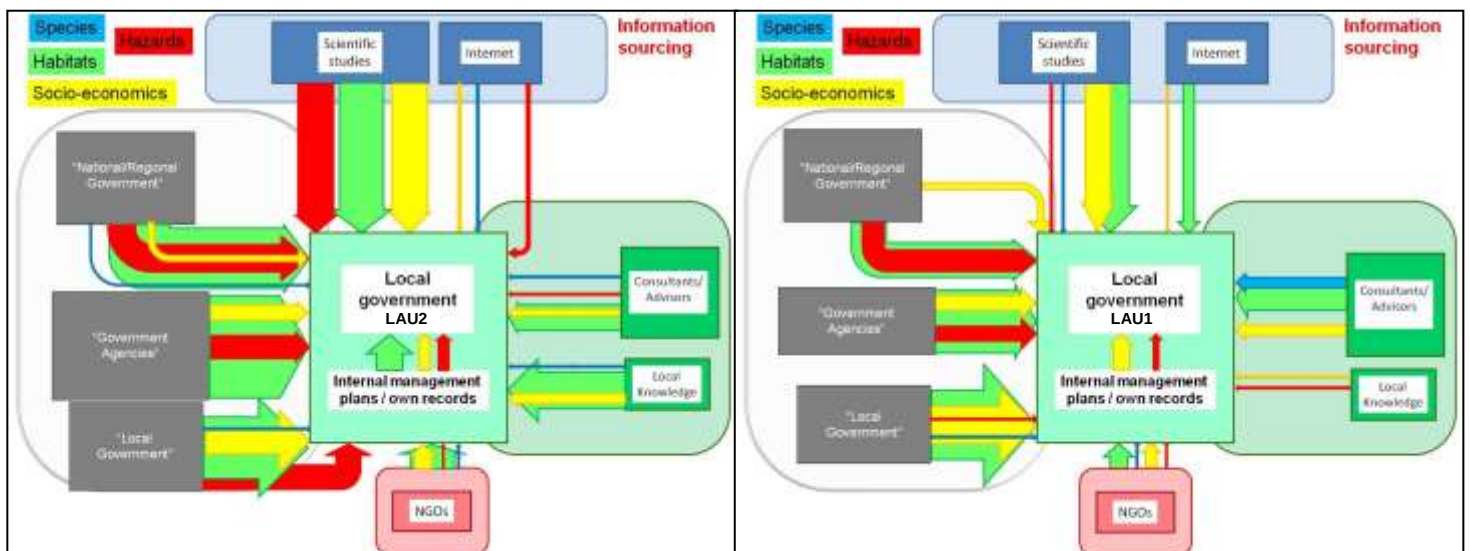


Figure 10. Information sources used by local government for environmental decision making, at the lowest level (LAU2, left) or one level above (LAU1, right).

The majority of the environmental issues identified at LAU1 again involved habitats (26 of 56, or 46%), with a quarter related to socio-economic issues and nearly a fifth involving hazards (Figure 8, right). Information for decisions on habitats was sourced chiefly from either local government (24%) or government agencies (22%), although most other sources provided some information for these decisions. Local government provided 21% of the information for making decisions on socio-economic issues, followed by scientific studies (17%), while information for hazard related decisions was dominated by government sources, mostly national/regional government and government agencies. This level of government used local knowledge for only 2% of decisions, compared with 8% for decisions made by the lowest level. Few issues it identified were considered to involve species, with most of the information for these decisions coming from consultants/advisors (50%).

CONCLUSIONS

The conceptual models of information flow were designed to illustrate the flow of environmental information between local and central governments and local stakeholders in the decision making process. The models show that decision-making within the environmental sector is a highly complex process that relies on highly variable patterns of data exchange between stakeholders and local, regional and central levels of government. Understanding and quantifying these relationships is key to designing an effective decision support system to enable informed decisions.

Information types and their sources

The largest number of environmental issues overall involved habitat issues, on average 36% of issues identified by stakeholder groups and 49% of issues identified by local government. Although information was supplied for these decisions from all sources, for local governments these tended to be skewed towards central sources. Foresters and nature watcher stakeholders both made use of their own internal management plans or records for these decisions (26% and 28%, respectively), but also relied on government agencies, scientific studies and consultants for information for these decisions.

Socio-economic issues were more important for the various stakeholder groups (32% of issues) compared to the local government levels (23%). In particular nature watchers, farmers and recreational access stakeholder groups identified relatively more issues (an average of 42%). They used a variety of information sources for these decisions with particularly consultants (24%), scientific studies (19%) and the internet (14%) important for nature watchers, while farmers relied more on government sources (55% in total) instead of scientific studies and the internet, with consultants still quite important (27%). Recreational access stakeholders used all of the information sources for socio-economic decisions fairly evenly, as did the two levels of government.

Decisions involving species were more important overall for stakeholder groups (average of 19% versus 6% for local government) and figured highly for hunters and fisheries stakeholders (average of 29% of decisions). These two stakeholder groups used a variety of information sources to make their decisions, with consultants (17% for hunters and 18% for fisheries) and government agencies (19% for hunters, fisheries 27%) figuring highly. Interestingly farmers were the group that made the most use of scientific surveys for these types of decisions (29%).

Hazard issues were relatively more important for the local government levels than for the stakeholder groups, with an average of 22% of issues by local government involving hazards, whilst the average was 13% for stakeholders. Fisheries stakeholders were the outlier amongst the stakeholders, with 29% of their issues involving hazards. For local government, fisheries and farmers, the government figured highly as an information source for hazards (average of 71% of information sourcing), particularly government agencies for fisheries and farmers (33% on average).

Comparing sources

Government figured highly as an information source for all decisions, with stakeholders using them for an average of 41% of information sourcing, and local government for an average of 51%. Amongst the three types of government information source, government agencies were the most

consulted, with an average of 20% of information sourcing by stakeholders and 19% by local government. Stakeholders and local government both used scientific studies and the internet for roughly 18% of their information sourcing on average, with stakeholders relying more on internet searches, 7% versus 4% for local government, while local government relied more on scientific surveys, 14% versus 11%. Local knowledge and NGOs did not figure highly as sources of information, with only 5% and 8% of stakeholder and local government information sourcing on average. Consultants/advisors were more important for stakeholder groups, with 15% of information sourcing provided by them versus 10% at the local government level. Nature watchers, hunters and foresters were noticeable in the relatively high use of consultants 19, 18 and 18% of information sourcing respectively. However, some stakeholders relied nearly as much on their own records on average (14%) as they did on consultants; this was true for especially foresters (20%) and nature watchers (20%), as well as hunters (13%) and fisheries (13%) stakeholders.

The most notable effects can be summarised as:

- Habitats were in the most important information topic overall but came second to socio-economics for access managers and to species for hunters.
- Socio-economics had the lowest priority for hunters but was second highest for all other groups.
- Natural hazards generally had the least priority, except for governments and fisheries.
- Farming and fishery interests used government agencies for information relatively more than any other stakeholder category or tier of local government.
- Managers for nature watching and reserves and for forestry relied most upon their own records, which were also important in hunting and fisheries.
- Local knowledge was used relatively little as an information source overall, but most by access interests and the lowest level of local government (but not the level above).

The models illustrate the complexity of information exchange and participation in local decision making. Most decision variables require information held at all levels; local, regional and central and the majority of decisions use a variety of different information sources. The differences between stakeholder categories may reflect the nature of their activities and the complexity and number of decisions taken in these categories. However, the models incorporate data from only eight case study areas. Therefore care should be taken in drawing general conclusions before considering the more representative study in Chapters 6-8.

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KEY TERMS

Keywords

Farming, Fisheries, Forestry, Government Agencies, Habitat Management, Hunting, Information Flows, Local Government, Local Knowledge, Recreational Fisheries