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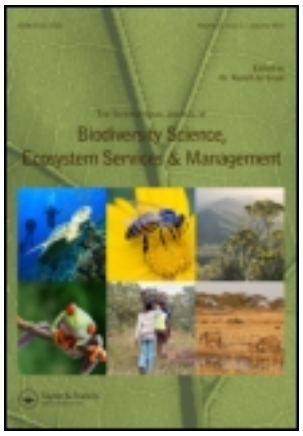

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An adaptive participatory approach for developing an ecosystem services framework for South East Queensland, Australia

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This article describes the adaptive participatory approach that was adopted to develop an ecosystem services framework for planning and natural resource management in South East Queensland (SEQ) Australia. SEQ is one of the fastest growing regions in Australia, placing strong development pressures on ecosystems and the environment. The SEQ Ecosystem Services Project addresses the need to protect and enhance ecosystems in the region, contributing to the general well-being of the population. The key aim of the Project has been to develop an ecosystem services framework (the SEQ Ecosystem Services Framework or simply the Framework) and incorporate it in policy and planning relevant to the SEQ region. The Framework developed is now officially recognized by the Queensland and local governments in policy and planning documents and in State of the Region reporting. The Framework is based on the Millennium Ecosystem Assessment (MA), with modifications that make it more suitable for application at the regional scale and for the particular conditions of SEQ. The Project has been coordinated by a non-government organization in collaboration with government, universities, other non-government organizations, business and industry. This article describes the important features of the approach, such as the direct participation of experts and/or stakeholders (more than 160 in all); the use of relatively simple systems models based on subjective expert judgements about causal connections among key variables; transparency of results; maps to support spatial planning; and the ability to revise the baseline information as the outcomes of management and planning decisions take place.

Keywords: ecosystem services; regional planning; participatory approach; expert judgement; decision support systems

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Introduction

This article describes the adaptive participatory approach adopted in the South East Queensland (SEQ) Ecosystem Services Project (the Project) to develop an ecosystem services framework (the Framework) for the SEQ region of Australia. The aim of the Project has been to develop an agreed Framework across stakeholders and incorporate the Framework in planning, policy and natural resource management (NRM) for the region. Success of the Project has been evidenced by its incorporation in statutory regional planning documents, NRM plans and other supporting local government documents and plans for SEQ. This article identifies key features of the Project and lessons learnt: in particular, direct participation of experts and stakeholders; the use of relatively simple systems models; subjective judgements regarding causal connections of key variables; transparency of results; maps to support spatial planning; and the ability to revise baseline information following the outcomes of management decisions.

Adaptive management of the environment and natural resources has a long history (Holling 1978; Walters 1986; Sabine et al. 2004). The Framework lends itself to an adaptive management approach, capable of being modified on an ongoing basis, providing valuable relevant information for policy and planning decisions. It constitutes a comprehensive representation of ecosystems, ecosystem functions and ecosystem services in SEQ, including their interconnections, spatial distribution and implications for community well-being. Intended applications of the Framework include assessing the effects on ecosystem services of changes in exogenous factors such as climate change, population growth and economic development as well as policy interventions and management actions.

This article highlights similarities in the approach adopted for the Project with other examples of participatory approaches to planning and management, such as collaborative planning (Healey 2003, 2005), Bayesian networks (Neapolitan 1988; Pearl 2009), participatory systems analysis (Smith et al. 2007), artificial intelligence (Callan 2003) and decision support systems (Janssen 1994). A common characteristic is 'learning by doing' which creates empowerment and encourages a sense of ownership for stakeholders in developing and applying the information system. The Project draws heavily on this management principle. Sabine et al. (2004) and Cowling et al. (2008) demonstrate that learning by doing is attractive to both natural and social scientists who attempt to interpret and incorporate their work in terms of policy, planning and management, as well as decision-makers and technical practitioners who attempt to understand how the concept of ecosystem services may relate to their everyday activities and responsibilities.

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Background

The SEQ region

The SEQ region (22,890 km^2) stretches from the Queensland–New South Wales border, north to the Southern Cooloola Coast and west to the Great Dividing Range (DERM 2009; Australian Government 2010) (Figure 1). The region supports a large diversity of ecosystems, including rangelands, bushland, beaches, rainforests, rivers, islands and various kinds of urban ecosystems (e.g. cities and peri-urban areas). The region is recognized by the Australian government as a 'biodiversity hotspot' and includes Ramsar-listed wetlands, a Gondwana Rainforests of Australia World Heritage Area and a UNESCO 'Man in the Biosphere' reserve.

The SEQ region is one of the fastest growing regions in Australia, in large part a consequence of the ecosystem services that support the health, security, lifestyle and economy of the region. The population of SEQ is projected to grow from approximately 2.8 million in 2006 to 4.4 million in 2031 (DIP 2009). By then, SEQ will contain over 70% of the total projected population of the State of Queensland and will require an additional 754,000 dwellings, as well as supporting infrastructure and services (DIP 2009). A fundamental challenge for planners and policymakers is how to accommodate the increasing population without degrading the capacity of the region to provide ecosystem services (DERM 2009).

Planning functions for SEQ are a major responsibility of the State Government, in particular the Department of Local Government and Planning. SEQ Catchments (SEQC) plays an active role in the planning process and management of natural resources within the region. SEQC is a community-based not-for profit business overseen by a board that consists of representatives from industry, government, community, research and education (South East Queensland Catchments 2008). SEQC is one of 56 regional bodies in Australia established by the Federal Government (15 for the State of Queensland) to facilitate NRM serving landholders, the community, business, government and industry through a single, recognized organization. Guided by national objectives and regional targets, SEQC acts as an interface between the government and the community and relies strongly on stakeholder participation to formulate and implement effective NRM strategies.

Planning in the State of Queensland is guided by statutory regional plans. In SEQ the SEQ Regional Plan 2009–2031 is the key planning document. A review of the regional plans occurs every 5 years. As the Project began in 2005, deadlines for the development of an ecosystem services framework and its potential incorporation into the statutory planning process were tight. Missing an opportunity to develop and incorporate the Framework in the SEQ Regional Plan would have meant waiting for the next policy cycle. Following the development of the Framework, the statutory planning requirements for SEQ relating to ecosystem services have been strengthened and now include clear reference to ecosystem services (DIP 2009). The two relevant principles are

- Principle 3.1 – Regional Landscape Values:
  States the need to '[p]rotect, manage and enhance the multiple values of the regional landscape and optimize the contribution these values make to the region's liveability, health, lifestyle and economy'. Policy 3.1.1 supporting this Principle is to '[p]lan, design and manage development, infrastructure and activities to protect, manage and enhance regional landscape values'. Program 3.1.2 recognizes the use of the SEQ Ecosystem Services Framework to '. . . identify and evaluate the multiple benefits

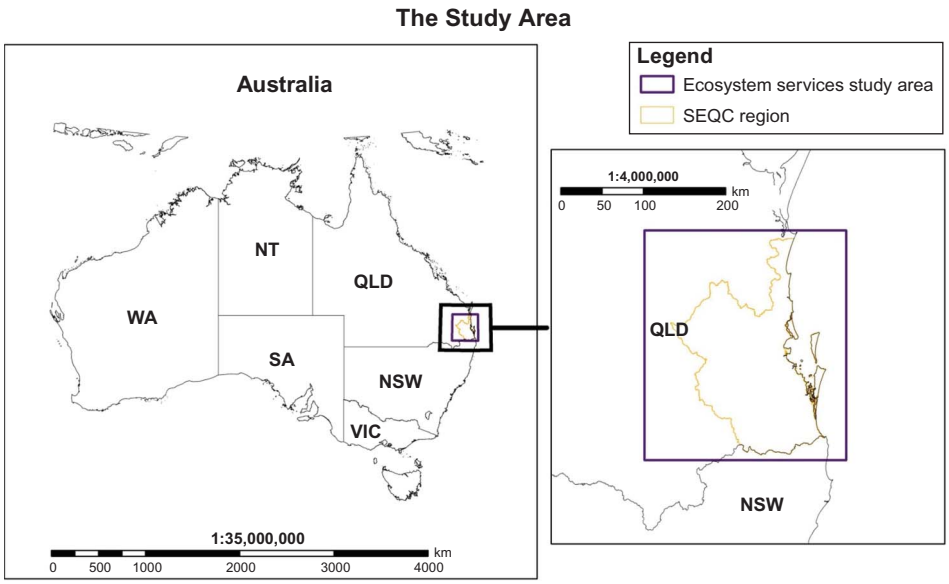

Figure 1. The South East Queensland (SEQ) region, Australia.

provided to communities by regional landscapes and ecosystems' (DIP 2009, p. 56).

- Principle 4.3 – Ecosystem Services:
  States the need to '[p]rotect, maintain and enhance the capacity of the region's ecosystems to supply ecosystem services'. Policy 4.3.1 supporting this Principle is to '[p[rotect areas supplying high levels of ecosystem services from development impacts'. Program 4.3.2 states the SEQ Ecosystem Services Framework should be used to '. . . identify and measure ecosystem services'. Further, the notes state that '[c]oordination of actions to maintain SEQ's ecosystem services should be aligned with the SEQ Ecosystem Services Framework' (DIP 2009, p. 71).

With greater general recognition of the importance of ecosystem services in SEQ and stakeholder support for the Framework, amendments made under the SEQ Regional Plan are being extended to other policy and planning functions of local and state governments. They include Local Government Planning Schemes and Community Plans, and Water Resource and Nature Conservation Strategies. Ecosystem services are mentioned in State Planning Policy and have also featured in the State of Region report for 2008 (Queensland Government 2008) and the State of Environment Report for the state of Queensland (unpublished). The SEQ NRM Plan 2009–2031 (DERM 2009) has adopted ecosystem services as one of two guiding principles underpinning the plan.

Recognition of the Project by professional associations in Australia has greatly enhanced acceptance of the Project. In 2009 the Project received a Planning Institute of Australia (Queensland Division) Award for Excellence in Environmental and Rural Planning. The Planning Institute of Australia is an influential body offering guidelines and technical advice to the planning profession in Australia.

Origins of SEQ Ecosystem Services Project

SEQC initially developed an interest in the concept of ecosystem services to see how it might assist in meeting its general objectives and responsibilities. Concurrently, the Regional Landscape and Open Space Advisory Committee, a forum for key stakeholders to discuss policy development and implementation of the SEQ Regional Plan as it impacts on the regional landscape and rural production areas of SEQ, developed an interest in ecosystem services for planning purposes. The need to apply the concept of ecosystem services in planning and natural resource decision-making has been advocated for some time (Costanza et al. 1997; de Groot et al. 2002; MA 2005). Stakeholders from the SEQ region recognized the need for only a single assessment methodology. It was agreed that SEQC should coordinate the Project and introduce procedures and management arrangements that would achieve its general aims.

The Project began with a comprehensive review of relevant literature and a scoping workshop attended by invited participants from government agencies, research institutions and community groups (Graymore 2005). The main aims of the workshop were to devise a strategy to investigate the potential for applying the concept of ecosystem services in SEQ, seek agreement on common definitions and features of an ecosystem services framework and establish appropriate project management and working arrangements. Progressing from general concepts of ecosystem services and their benefits to workable management tools, especially those that would be accepted and applied by a wide range of government agencies and other stakeholders, highlighted the need for a carefully planned and managed process that encourages a large number of relevant people to be involved.

Participants in the early stages of the Project recognized that an assessment of the full range of benefits derived from ecosystems could assist decision-makers to manage ecosystems more effectively in SEQ. Better management would entail maintaining, enhancing or protecting ecosystem services in the region and, where relevant, calculating losses in services resulting from development activities and ameliorating such losses (Maynard et al. 2010).

Development of the Framework

Approaches to constructing the Framework

There are two approaches to preparing databases and assessment tools for natural resource and environmental management. The first is for a team of experts to conduct the process independently, consulting with potential users to identify their needs and supply a final product they consider would be useful. It can be difficult under this approach to convince users that an appropriate model or tool has been developed and provide tuition in how it is constructed, how it functions and how to apply it (Cowling et al. 2008).

The second approach is more participatory. It involves engaging potential users actively in the process of developing the tools, creating opportunities for open discussion and group interaction and maintaining transparency of activities, results and outputs. Data collection and interpretation is iterative. A flexible approach is required to develop products with practical value, especially where multiple stakeholders are involved.

The participatory approach in relation to ecosystem services has been advocated by the MA (2005), van den Hove (2000) and Cowling et al. (2008) on the presumption that those who are most likely to apply frameworks or assessment tools should carry the responsibility for their development, adoption and implementation. As noted by Cowling et al. (2008), the information system should be 'user friendly, user inspired and user useful'. For the Project a decision was made to adopt a participatory approach to development of the Framework.

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Steps in establishing the Framework

The broad features of the Framework were established through a series of specially convened workshops attended by a wide range of stakeholders and technical experts from different disciplines. The structure of the Framework follows closely the MA (2005). The MA endorses the use of conceptual frameworks for creating the language and a common understanding of the relationships between ecosystems and human well-being, presenting a preferred approach to ecosystem service assessment, assembling knowledge and communicating issues across different disciplines. For the Framework, certain modifications of the MA were introduced: in particular, the ecosystem functions analysis developed by de Groot et al. (2002).

Description of the Framework

The Framework at the time of writing (December 2011) comprises

(1) classification and descriptions of four major interconnected components: (32) Ecosystem Reporting Categories, (19) Ecosystem Functions, (28) Ecosystem Services and (15) Constituents of Well-being;
(2) descriptions of the relationships between these four components in the form of matrices with simple scores; and
(3) maps of Ecosystem Reporting Categories and Ecosystem Functions that identify where ecosystem services are derived from in SEQ.

A critical consideration in spatial planning for the region is identification of the areas that contain the most highly valued ecosystem services so they can be protected from the pressures of development. Other policy initiatives, such as environmental offsets and enhancement programmes, similarly require information relating to the spatial distribution of ecosystems and the services they provide. A more detailed description of the components of the Framework and their interconnections, including examples of the key matrices and maps, appears in Maynard et al. (2010).

Valuation of ecosystem services

Allowing stakeholders to agree on an appropriate method for assessing and/or ranking the relative importance of ecosystem services in SEQ was a critical aspect of the Project. Only 3 of the 160 participants involved in developing the Framework suggested that the relative importance of ecosystem services represented in the Framework should be assessed in monetary terms. Participants sought a more general concept of 'human well-being', consistent with the approach taken in the MA. Participants from the physical and biological sciences were more at ease and strongly supported rating and scoring systems rather than monetary valuation methods.

While it was acknowledged that monetary valuation would be useful in certain decision-making contexts, given the particular circumstances within which the Project was conducted, it was considered beyond the means and scope of the SEQ Project to conduct a full economic assessment of the values of all ecosystem services and ecosystem categories for the whole of SEQ. Economists participating in the process agreed that with limited time, budget and other resources, and with such a large range of ecosystem services to be valued, simpler methods would be required to establish the relative values of the ecosystem services and the ecosystems themselves. Broad-brush assessment methods, such as scoring and rating, were the only feasible means of deriving a ranking of ecosystem services and/or ecosystems for SEQ, based on their relative contributions to community well-being. The controversial issue of explicit monetary valuation versus relative value weighting in environmental and NRM entails a major debate in its own right, well beyond the scope of this article.

Currently, values and priorities associated with ecosystem services and constituents of well-being are being assessed in specially convened community workshops attended by representatives of local government areas within the region. The workshops are being conducted with guidance from a professional facilitator in accordance with a predetermined plan shaped by experts involved in constructing the Framework. Workshop participants are asked to complete carefully crafted questionnaires, using scores to indicate relative values for ecosystem services and constituents of well-being.

The adaptive process

Project management

SEQC's position as a non-government body, operating at the interface between government, business and community allowed for a bottom-up participatory process enabling stakeholders to learn about ecosystem services and the potential for applying the Framework in their own organizations. Overall guidance and management of the Project has been provided by an Ecosystem Services Steering Group comprising representatives of key organizations and technical advisers from various disciplines (e.g. planning, natural and social sciences, economics, Geographic Information Systems (GIS)). Engaging professionals from within agencies and organizations wanting to use the Framework has helped to align the main features of the Framework with key planning and management objectives and practices in the region. The rapid turnaround of Steering Group responses in the course of developing the Framework has permitted quick decision-making and flexibility of approach, creating the scope to manage the Project adaptively.

Expert Working Groups were established, comprising professionals from relevant disciplines who helped to plan professional workshops, oversee the Project results and ensure that the technical elements of the Framework effectively supported the requirements of potential users.

Separate Expert Working Groups were convened for the biophysical and socio-economic aspects of the Framework. Within the workshops, Expert Panels were formed comprising peer-referred technical and scientific experts with specialized local knowledge of ecosystems, their functions, services and different elements of community well-being in SEQ. The panels were delineated according to the kinds of expertise that were required to evaluate them, often involving transdisciplinary workshops.

Each stage in the development of the Framework has been peer reviewed in an open forum of SEQ stakeholders who were encouraged to provide feedback and suggest amendments to any information and tools developed. Full consideration was given to views expressed by participants in meetings and workshops and information was amended accordingly. The assemblages of people and major activities undertaken to construct the Framework are further described in Maynard et al. (2010).

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Participants in the process

Based on the recommendations of various researchers (MA 2005; Barbier 2007; Boyd 2007; Cowling et al. 2008; Fisher et al. 2008) experts and stakeholders were engaged to develop their own tools for planning and management. Their inputs have been provided via the Steering Group, Expert Panel and Working Groups and the open forum of SEQ stakeholders.

The natural, urban and cultivated ecosystems in the region support a high quality and diversity of lifestyles (DERM 2009). As both SEQC and the Regional Landscape and Open Space Advisory Committee are governed by SEQ stakeholders, it is evident the impetus to develop an ecosystem services framework for SEQ can in part be attributed to the importance the community and stakeholders attach to the environment of SEQ. Participants involved in the development of the Framework mostly live in SEQ and have extensive knowledge and experience of the region. With the threat of a rapidly growing population, and increasing public awareness of the importance of ecosystem services, participants in the process were strongly motivated to contribute to the Project. Local expert information and support for the Framework helped to fill gaps in information, provide credibility of results and garner public and professional support for the inclusion of ecosystem services in statutory regional planning documents for SEQ.

Matching skills with tasks

Expert knowledge is recognized as essential to address areas of limited data availability, provide detailed local knowledge and ensure maximum acceptance of the final products (MA 2005). Cowling et al. (2008, p. 9485) have recommended that, where circumstances permit, subjective values should be used to 'enable social influence and consensus to define knowledge about ecosystem services'. Achieving agreement on a set of definitions, the classification of elements and the general structure of the Framework has been an essential part of the process.

Assessing ecosystem services necessarily involves a transdisciplinary and trans-sectoral effort. Construction of the Framework involved a wide range of scientific and technical skills. Each skill group provided information relevant to their own knowledge and expertise. Developing a common language has overcome barriers between and within different disciplines and sectors and empowered stakeholders to communicate the ecosystem services concept within their fields and/or organizations.

Decomposition could be objected to as the main approach to information gathering whereby each group of experts was asked to handle only a subset of information. Ecosystems are often viewed holistically and there is a risk that decomposition might not capture the functioning and characteristics of ecosystems appropriately. However, the process has at least provided general representations of the biophysical elements of the Framework and good progress is being made in the work with community groups regarding the relative importance of different ecosystem services and constituents of well-being. Technical workshops conducted for the Project have been led by facilitators with backgrounds in ecology, planning and environmental economics, while the community workshops were managed by a professional facilitator with skills in community engagement.

Role of Expert Panels

Each scientific Expert Panel was composed of peer-referred professionals with knowledge and expertise relating to particular ecosystems or ecosystem functions, such as hydrology, soil science, botany, climatology and ecology. Typically, four or five experts were appointed to small working groups within the Expert Panels. There is also an Expert Panel on socio-economic aspects, embracing the services and the 'well-being' elements of the Framework. Experts had knowledge and experience in economics, social resilience, human well-being, health and community planning.

The Expert Panels worked together in facilitated groups during the Project workshops. At other times they worked separately, either as groups or individually, revising preliminary data, modifying the expert scores and fine-tuning descriptions of the various categories of ecosystems, functions, services and well-being in the Framework. Development of the Framework necessarily involved an adaptive and iterative process of data collection, analysis and review.

Model structure and supporting data

Data collation

The Framework relies on qualitative data and simple linear representation rather than detailed modelling and analysis. It was recognized that a large amount of information would be required to develop an ecosystem services framework

but there was insufficient time, funding and research capacity to construct complex ecological systems-based models for the whole region. Urgent results were needed to complete the Framework to meet the deadline for incorporating it in the revised SEQ Regional Plan.

Two types of information were used to construct the matrices that interconnect the four main components of the Framework. The first is scientific information. While this information ideally should be derived empirically, it was only possible to obtain subjective judgements from the relevant experts because of the vast amount of information required. Raw data to populate the elements of the Framework were provided by the Expert Panels in the main workshops and then revised by the relevant Working Groups or by professionals in specially convened working sessions.

The second kind of information is the value preferences of community representatives from local government areas within the SEQ region. This information was obtained from facilitated workshops where participants were asked to indicate the relative importance they attach to the different types of ecosystem services and constituents of well-being for their own subregion.

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Model structure

Sabine et al. (2004) argue that simpler models are less vulnerable to misspecification than more complex ones, and they require less data and are quicker to develop. Adopting a simple scoring approach within the Framework made it easy to handle what would otherwise be a complex data set or suite of models. The use of matrices and simple scoring systems provided a means of comprehensively assessing the ecological attributes of the region and their implications for community well-being. Inter-relationships between the components of the Framework are defined in terms of scores on a scale from 0 to 5 based on expert scientific judgement, arranged in matrix form. The community preferences are scored on a scale of 0 to 10. Simplicity of model structure encouraged participants to provide information on preferences and values and to incorporate the Framework in local government planning schemes and programmes.

Presentation and application of results

Transparency of process and results

The MA (2005) endorses the use of conceptual frameworks for (1) creating the language and common understanding of the relationships between ecosystems and human well-being; (2) presenting a preferred approach to ecosystem service assessment; (3) bringing together knowledge; and (4) communicating issues across different disciplines. Transparency in process and results was essential to maintain interest and engagement by participants. One of the advantages for stakeholders is that the underlying matrices, scores and other data comprising the Framework are fully transparent.

A dedicated website is currently being constructed to make all information arising from the Project publicly available. Creating a website and a stream of associated products, with details of available data and examples of practical applications should also assist in promoting awareness of the Project and what it can offer.

Opportunities have been created in workshops and group discussions for participants to review progress and recommend changes where appropriate. Draft documents inviting comments and suggestions have been circulated to participants at all stages of the Project. Helping stakeholders to understand that there will never be a perfect data set, and that the data, or even structure, underlying the Framework should be subject to ongoing improvement and modification is essential to maintain transparency and stakeholder commitment.

Visual representations of results

Visual aids were useful to assist participants in the workshops and potential users in understanding what the Framework entails and how it may be applied. The visual aids included diagrams describing the Framework and photographs of different ecosystems and natural environments within the region. A strong vehicle for demonstrating the practical value of the Framework has been the maps that support the Framework, as they enable stakeholders to identify areas that are important for ecosystem service provision and warrant being given special consideration. The ecosystem function maps indicate areas where hotspots of ecosystem functions occur and hence have the greatest potential to provide a high level of ecosystem services. Such areas may be foci for protection. Conversely, areas of low ecological importance could be good candidates for rehabilitation or restoration programmes and to maintain ecosystem service provision across the entire region, as required in the SEQ Regional Plan. Maps of the Ecosystem Reporting Categories and Ecosystem Functions have generated great interest in the Project and have contributed to the willingness of participants to continue with its development and application. Case studies are now needed to demonstrate how the information system can be implemented.

Applications in policy and planning

Experience on the Project has identified that different potential users of the Framework have different needs to meet their operating objectives. It has accordingly been important to design and create a flexible non-prescriptive framework capable of a wide range of applications. Organizations also have different capacities to conduct assessments and incorporate the information into planning. For example, different state agencies carry the responsibility for managing different facets of the environment and natural resource systems. Local governments have different populations, natural environments, planning objectives and available financial resources. Community values may also

differ from one locality to another. Such differences mean that management actions typically must be specially tailored to protect and/or enhance ecosystems in the relevant jurisdictions.

It should also be noted that SEQ stakeholders operate at different geopolitical scales, with some crossing several geopolitical scales. The information requirements vary according to scale. It was important to identify common sets of data and information already applied in current programmes by the majority of stakeholders when conducting assessments in order to integrate the Framework more effectively into current management and planning practices. A key feature of the Framework is that it can be flexibly applied by different stakeholders within their own capacities at the scales most appropriate to their needs.

Conclusions

Success of the Project is evidenced by the incorporation of the Framework in statutory planning policy and documents in SEQ and the interest shown by government agencies and other organizations in applying it in their management and planning activities. This outcome has accordingly met the original overall aim of the Project. Its success can be attributed to several factors.

Engaging a wide range of stakeholders and technical experts from the natural and social sciences in developing the Framework has been essential in encouraging its general acceptance. 'Learning by doing' has been an important element of the adaptive process adopted, vital in assisting stakeholders to understand ecosystem services and the integration and application of the Framework in their management, policy and planning practices. Creating the language and a common understanding of the relationships between ecosystems and human well-being and developing a consistent approach to ecosystem services assessment has enabled experts from a wide range of disciplines to contribute to the Project. Explaining how different participants could contribute to the Project and carefully structuring the ways in which critical information has been sought from technical experts and community representatives have been crucial ingredients for success.

Transparency of the process and results has been supported by the ongoing involvement of participants, the release of interim and final documents and the establishment of a website for the Project. Maps produced have provided a sound basis for spatial planning within the region.

Being realistic about the kind and amount of ecosystem services information that decision-makers can incorporate in their programmes is important in developing tools that are user friendly and user useful. In an ideal world, with dedicated researchers, unlimited research resources, comprehensive data, a full range of ecosystem models and flexible time limits, stronger empirical underpinnings may well have been developed for the Framework. However, this was not feasible in the particular circumstances of the Project. The use of simple scoring systems based on subjective judgements rather than complex modelling has enabled a comprehensive information system to be developed that is flexible in its application and capable of being adapted as new information becomes available.

Acknowledgements

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