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Executive Summary

Integrated **p**lace-based **m**anagement (IPM) has emerged as a promising approach to systematically and practically assisting in managing trade-offs and identifying win-win policies and management options over time, space and across jurisdictions (Waldick, 2010). In the context of environmental issues, many proponents argue that landscape[1] and watershed-level approaches[2] are the most effective ways to sustainably reduce threats and conserve species, communities and habitats. To better understand the effectiveness of landscape and watershed-level IPM initiatives in improving environmental quality, the Policy Research Initiative contracted the International Institute for Sustainable Development to research the following questions:

1. How were the goals and targets defined in the IPM initiatives?
2. What are the major evaluation approaches and frameworks applied in the IPM projects that aim to measure the impacts, success and benefits of the projects, in particular long-term impacts of IPM projects going beyond the time frame of the projects?
3. What were the major commonalities and differences in applying evaluation frameworks and approaches across a number of Canadian and international IPM studies, and what recommendations could be made about the feasibility of applying these approaches in larger numbers?

A set of Canadian and international IPM initiatives were studied to help address these questions. These initiatives were triggered because of growing concerns about the sustainable use of local and regional resources and conservation issues that are threatened due to the cumulative impacts of development on water, soil, land, forests, biodiversity and habitat, and also further anticipation of the negative impacts of climate change and future development choices on regional and local resources. Specifically, the main goals and targets in the IPM initiatives revealed that they were typically intended for the following:

- To better understand the relationships between the human and natural systems in the particular area;
- To investigate consequences of potential changes in human and natural systems in achieving long-term sustainability in the particular area;
- To simulate different policy choices and scenarios and their impacts on people and environment both at the local and regional scale; and

[1] Landscape refers to our perceivable environment and is considered a common cultural commodity. The term "landscape" refers to concepts such as scenery, system and structure and to particular locations (Antrop, 2000).
[2] Watershed-level applications are referred to as Integrated Water Resources Management (IWRM), which is one of the earliest applications of Integrated Place-based Management (Mizanur, Varis & Kajander, 2004)

- To formulate institutional, policy and management recommendations.

In IPM initiatives, the role of monitoring is to collect and demonstrate information about the consequences of the applied actions and about the processes that were utilized in governing resource management. The monitoring combines both outcome-oriented indicators monitoring environmental status such as water quality, flood frequency in vulnerable areas and pest occurrence, and process-based indicators looking at the applied governing process, planning, stakeholders' participation, and data dissemination and sharing. However, there is relatively limited information about the long-term impacts of IPM initiatives on environmental quality, because of long-term monitoring cycles, challenges in attributing changes in practices of IPM to changes in specific environmental indicators, and sometimes because of limited availability of data due to a low number of monitoring stations.

In the paper, we also provide examples of IPM initiatives focused on water (Integrated Water Resource Management) in Lake Champlain Basin (U.S. and Canada); Rhine River Basin (Europe); and South Tobacco Creek (Canada) that all led to the creation of strategic management plans and documented improvements in environmental conditions in water quality, including reduction in phosphorous concentration, levels of chemicals and coliform contamination.

Based on the reviewed IPM initiatives, we identified trends around: 1) goal and targets for the initiatives, 2) monitoring approaches and indicators; and 3) main commonalities and differences in applying evaluation frameworks in IPM. The main identified trends from this study include:

- Planning processes and governance issues are an integral part of IPM and include institutional reviews and changes, strategic planning to help set goals reflecting human/nature relationships, and include both local and national governments in important roles in IPM.
- Monitoring and evaluation of IPM is important to reinforce its role as an appropriate framework for realizing environmental outcomes and governance efficiency and needs to include both outcome-based and process-based indicators. The design of the monitoring system must include an adaptive process to reflect changing planning priorities and stakeholder concerns, and indicators must be used as learning tools for stakeholders.
- Using monitoring schemes and indicators as learning tools in developing strategic plans and policies by multiple stakeholders, and by providing access to the collected information, developing understandable indicators for non-experts, helping with interpreting the information and using the indicators in strategic planning processes (Gyawalli, et al., 2006; Giordano, Urricchio & Vurro, 2009).

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1.0 Introduction

Spatially-based management has proven to be critical to meeting conflicting management goals and objectives (Field, et al., 2006). When investigating complex human and natural interactions in different places, **i**ntegrated place-based **m**anagement (IPM) has emerged as a promising approach to systematically and practically assisting in managing trade-offs and identifying win-win policies and management options over time, space and across jurisdictions (Waldick, 2010). It follows in a tradition of approaches such as integrated assessment, integrated resource management, integrated watershed management, comprehensive regional land-use planning and ecosystem-based management, among others. Currently, an increasing number of studies and initiatives applying integrated approaches to address environmental challenges in the particular region are available in Canada, including case studies on forest management in Alberta, water management in the Okanagan (B.C.) and coastal management in Nova Scotia. Internationally, similar initiatives include: Evolving Landscapes in Oregon (U.S.), Advanced Terrestrial Ecosystem Analysis and Modeling (Europe), Upper Yellowstone River Catchment Study (U.S.), Integrated Approach to Natural Hazard Risk Management (Australia).

Despite this increasing interest and ongoing initiatives, reporting of the IPM initiatives and studies tends to focus on short-term results. Most of the available reports, research papers and other publications published on these initiatives focus strongly on presenting the consequences of current and past trends on environment and policy recommendations. Thus, they are less focused on describing the processes, including interactions with policy-makers, sustained institutional changes, actually implemented policies, and longer-term impacts of new policies and management options on environment (Gyawali, Allan, et al., 2006; Medema & Jeffrey, 2005; Bizikova, 2009). Compared to the increasing number of IPM initiatives, this leads to limited information and evidence of potential benefits of applying IPM approaches to a large number of areas, as well as limited ability to identify what are the issues, challenges and goals that IPM studies would be best positioned to address. In this paper, we will focus on this gap in the evaluation of impacts of the IPM initiatives, especially those centred on the environment, and try to identify approaches used in evaluating the impacts of IPM studies and to present developed monitoring schemes that are used and/or could be used to document changes in the state of environmental conditions, policies and governing process focused on environmental issues.

Key questions explored in this paper are:

1. How were the goals and targets defined in the IPM initiatives?
2. What are the major evaluation approaches and frameworks applied in the IPM projects that aim to measure the impacts, success and benefits of the projects, in particular, long-term impacts of IPM projects going beyond the time frame of the projects?
3. What were the major commonalities and differences in applying evaluation frameworks and approaches across a number of Canadian and international IPM studies, and what recommendations could be made about the feasibility of applying these approaches in larger numbers?

The research questions were explored by reviewing the published literature and project documents, as published on websites, in reports and in briefings. To complement this information, we contacted eight project representatives, including policy-makers and researchers, to gather information on their experiences with applying evaluation frameworks and approaches.

The paper first summarizes key definitions of the integrated place-based approaches applied in Canada and internationally, followed by an overview of key goals and targets of completed IPM initiatives in order to better understand what constitutes success. We follow this section with an overview of currently applied monitoring approaches and indicators in the context of IPM initiatives. Finally, we conclude the paper with suggestions for the potential future applications of monitoring frameworks and approaches, especially with regard to their ability to assist in the quality of the environment and to their ability measure long-term impacts of IPM projects.

2.0 Key Definitions and Types of Applications

There is a pressing need to move from a reactive approach in resource management, toward a more holistic view of human and natural systems represented by a more integrated and adaptive approach that could better reflect the complex challenges that communities are facing. Reactive and retrospective action, applied piecemeal as a form of "plaster" after damage has occurred, appears wholly inadequate to control the growing pressures of development that places increasing demands on environmental resources (Medema & Jeffrey, 2005). Moving toward such holistic view also requires modifying our institutions and policies to recognize the structure and dynamics of natural ecosystems over spatial and temporal scales covering several orders of magnitude, if we are aiming to move toward truly sustainable human endeavours (Fischhendler & Heikkila, 2010).

The emerging integrated management paradigm recognizes the interdependencies of natural systems, political systems and social systems in addressing "wicked" problems that are an inherent characteristic of natural resource use (Holling & Meffee, 1996; Bellamy & Johnson, 2000). The integrated paradigm has a number of fundamental properties (Bellamy & Johnson, 2000; Holling & Meffee, 1996), including:

1. An integrated systems approach that encompasses the recognition of nonlinear processes and connectivity between problems, the concept of "the whole being more than the sum of the parts," and the recognition of complexity and uncertainty in human and natural system interactions
2. A long-term perspective (i.e., many years, generations) and spatial scale focus (i.e., landscape, region or catchment)
3. Recognition of the relevance of the human and cultural context and the diversity in values relating to natural resources (i.e., people as an integral part of the problem; the need for coordination of decision-making among stakeholders in government, industry and the community; and the need for active involvement of the whole community to encourage community ownership of the problem and its solution)
4. Strategies for resolving conflict through negotiation and mediation among stakeholders

In order to develop policies and implement management options that account for such fundamental principles, narrowly focused policies, assessments and actions fail to provide guidance on "best" options for future action if there is no process of deliberation and discussion amongst a wide range of stakeholders and without taking an interdisciplinary approach (Rijsberman & van de Ven, 2000). To fit the pieces of the puzzle together to indicate priorities for policy (Rotmans & van Asselt, 1996) and frame management choices, a family of integrated approaches has been developed, which

includes integrated assessment (IA), integrated environmental assessment (IEA), integrated natural resource management (INRM), integrated water resource management (IWRM), integrated landscape management (ILM), integrated watershed management and comprehensive regional land-use planning, among others (an overview of key definitions is presented in Box 1). When applied to a particular area, these approaches can be considered place-based approaches to planning, policy design or program delivery, as they provide a collaborative means to address complex socioeconomic issues through interventions defined at a specific geographical scale. Such place-based approaches range from the management of large ocean areas, to watersheds and other ecosystems (Cantin, 2010). In the context of environmental issues, many proponents argue that a landscape[3] and watershed-level approach[4] are the most effective ways to sustainably reduce threats and conserve species, communities and habitats. These approaches are purported to create connectivity and lateral flows between landscape units and water basins, support key ecosystem processes, reduce the fragmentation of areas, and maintain the long-term survival of known and unknown species and communities (Ashley, Russell & Swallow, 2006).

[3] Landscape refers to our perceivable environment and is considered a common cultural commodity. The term "landscape" refers to concepts such as scenery, system and structure and to particular locations (Antrop, 2000).
[4] Watershed-level applications are referred to as IWRM, which is one of the earliest applications of IPM (Mizanur, Varis & Kajander, 2004)

Box 1. Examples of definitions of the key approaches within the integrated assessment as they are applied in Canada

Integrated watershed management (IWM) is the process of managing human activities and natural resources on a watershed basis. This approach allows us to protect important water resources, while at the same time addressing multiple critical issues, such as the current and future impacts of rapid growth and climate change (Integrated Watershed Management: Navigating Ontario's Future, 2009).

Integrated resource management (IRM) is a planning and decision-making process that coordinates resource use so that the long-term sustainable benefits are optimized and conflicts among users are minimized. IRM brings together all resource groups rather than each working in isolation to balance the economic, environmental and social requirements of society. IRM includes planning for minerals, forests, recreation, energy, wildlife and parks (Department of Natural Resources, Nova Scotia: http://www.gov.ns.ca/natr/irm/introduction.html).

Ecosystem-based management (EBM) is an innovative management approach to address these challenges. It considers the whole ecosystem, including humans and the environment, rather than managing one issue or resource in isolation. It integrates ecological, social and economic goals, and recognizes humans as key components of the ecosystem. Specifically, it considers ecological—not just political—boundaries, addresses the complexity of natural processes and social systems and uses an adaptive management approach in the face of resulting uncertainties. It engages multiple stakeholders in a collaborative process to define problems and find solutions. Finally, it incorporates an understanding of ecosystem processes and how ecosystems respond to environmental perturbations (Ecosystem-based tools management network: http://www.ebmtools.org/).

Integrated landscape management (ILM) aims to create or reconstruct a policy domain to produce coherent policy goals and a consistent set of policy instruments that support each other in the achievement of large-scale, land-use and land-management goals, such as eco-system sustainability, in the face of conflicting resource use demands (Rayner & Howlett, 2009).

Source: Bizikova and Waldick (in press)

Operationalizing the concept of IPM involves a series of steps, starting with bringing together key stakeholders' groups and institutions. It moves from identifying key issues and challenges in the particular area to gathering needed information to enable stakeholders to address these challenges in the context of current and potential future pathways. It engages in the development and implementation of a strategic plan (for an overview of key steps, see Figure 1).

When applying place-based approaches, the focus should not only be on current and future environmental status or predictive model development; "softer" parts of a system in the particular place, such as governance, institutions, politics, relationships and trust among the relevant stakeholders, are crucial to using the identified policies, management plans and implement actions. By explicitly focusing on governance issues in the context of IPM, we are highlighting the processes involved in decision-making that take place through institutions (including mechanisms, systems and traditions) involving multiple actors (Goodrich, et al., 2005; Rauschmayer, Paavola & Wittmer,

2009). From the monitoring perspective, which is the last step in the iterative process of the IPM, this implies that attention should be focused on two issues:

1) Governance, related processes and institutions involved in decision-making, such as transparency, participation, competence and capacities of managing institutions
2) The impacts of the outcomes of that decision-making on the status of the environment, such as changes in water and habitat quality, biodiversity and species at risks.

3.0 A Closer Look at IPM Initiatives

3.1 Definitions of Goals and Targets in the IPM Initiatives

In practice, the IPM studies and initiatives reviewed aim overwhelmingly at addressing growing concerns about the sustainable use of local and regional resources and conservation issues that are threatened due to the cumulative impacts of development on water, soil, land, forests, biodiversity and habitat. For example, one IPM initiative aimed to identify planning and management tools to address current water challenges in the Okanagan that could be further compromised because of climate change and socioeconomic changes (including increasing population, urban development and agricultural changes) (Cohen & Neale, 2006). Furthermore, the IPM initiatives focus on the functioning and dynamics of local and regional ecosystems in relation to human activity to provide scientific information that can be used to promote better awareness of potential environmental change impacts and local development decisions. In the case of the Upper Yellowstone River Catchment Study, this meant looking at the consequences of increased development—roads, buildings, and other surfaces associated with urban land cover replacing vegetated and natural areas in the watershed—and impacts on stormwater infiltration and storm water runoff to streams causing an increase in the frequency and severity of floods, and accelerating channel erosion (Booth & Jackson 1997; Aspinall & Pearson, 2000).

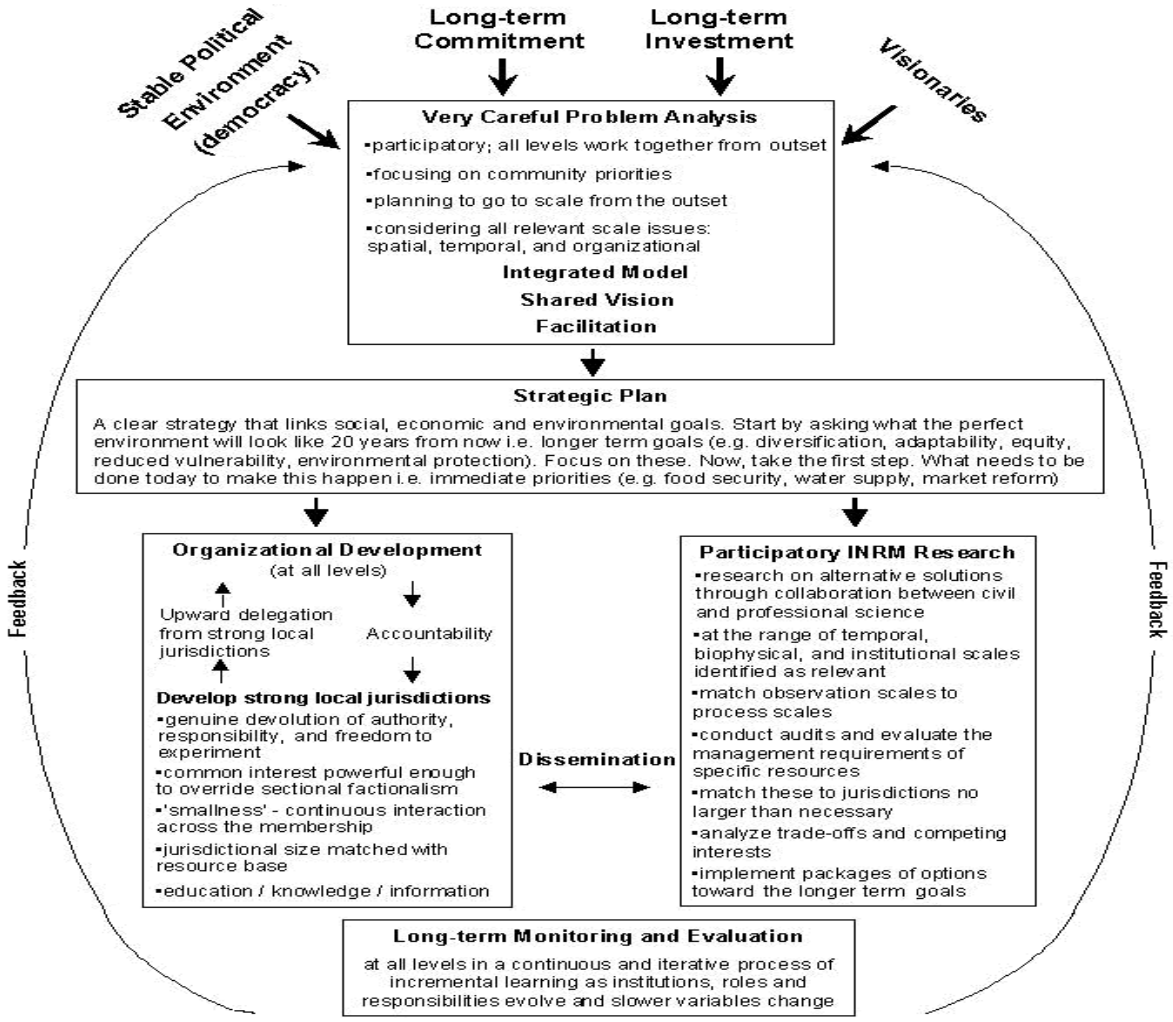

Figure 1. Overview of the key elements of an INRM plan that combines interdisciplinary approaches, participation, strategic plan development and monitoring and evaluation approaches (Source: Lovell, Mondando & Moriarty, 2002)

The actual triggers for the initiatives, however, were the negative impacts of human development on the environment that were already being experienced, including water shortages; increasing demands on scarce resources; the impacts of environmental quality on the local economy, health and well-being; and a further anticipation of the negative impacts of climate change and future development choices on regional and local resources. For example, the main instigator of the Mississippi River Basin IPM initiative was the nitrate load, mostly from agricultural nonpoint sources,[5] which has

[5] Nitrate inputs up to 90 per cent were coming from nonpoint agricultural sources (Nassauer, et al., 2007).

doubled since 1993 and has created large, hypoxic areas in the river basin (Nassauer, Santelman & Scavia, 2007).

In this context, the goals and targets of the IPM initiatives focused on trying to better understand the causes and long-term consequences of human activities on the environment and to identify policy and management actions that could limit the negative impacts and help the area to move towards more a sustainable pathway. Specifically, the goals and the aims of the IPM initiatives that would frame their success could be summarized as follows:

- **To better understand the relationships between the human and natural systems in the particular area,** for example, by incorporating both anthropogenic and natural processes affecting landscape change and by choosing benchmarks by which to measure and compare sets of scenarios and assessing these benchmarks in scientifically defensible ways (Bolte, et al, 2006)
- **To investigate consequences of potential changes in human and natural systems in achieving long-term sustainability at the particular area** by building on experiences with adaptation to water shortages and assessing effectiveness and costs of potential future adaptation options (Cohen & Neale, 2008), and by investigating institutional constraints and opportunities that could hinder the progress of implementing sustainability action plans and prioritized policy instruments and management options (CIT, 2005)
- **To simulate different policy choices and scenarios and their impacts on people and environment both at the local and regional scale**, for example, by modelling implications of different water allocation schemes to sectors (Cohen & Neale, 2006) and different management policies and their consequences on important landscape attributes relevant to representing landscape change (Bolte, et al., 2006)
- **To formulate institutional, policy and management recommendations** by putting forward those policies and management options that lead to desired landscape, watershed and ecosystems conditions over selected time, by identifying spatially explicit allocations of actions done in the particular area of focus and by assessing the implementation potential of these recommendations at larger scales to increase effectiveness of these actions (Nassauer, et al., 2007; Pintér, Bizikova, Kutics & Vári, 2008)

Specific measurable targets and thresholds to quantify the success of the IPM were seldom listed in the initiatives, but, for example, the initiative focused on the Mississippi River Basin directly specified that their interest was to see if it were possible to reduce loads by 40 per cent and also investigate economic and spatial choices to give flexibility for policy involving key local institutions (Nassauer, et al., 2007). When reviewing the goals, most of the studies paid less attention to goals focused on governance, institutional change and participation. However, to achieve changes in the

environment, IPM would have implications for governance structures and processes, ways of collaboration and policy implementation. But these issues were seen as a "means to an end" that would be necessary to implement identified policies and actions. How well the IPM initiatives achieve their goals and how they monitored the progress towards them will be addressed in the next section.

3.2 Monitoring Approaches and Indicators as Part of the IPM

Although the concept of IPM seems very sensible and attractive and is increasingly accepted as the appropriate framework to deal with complex resource management issues, there are significant challenges in implementation (Medema & Jeffrey, 2005) and in gathering evidence of the impacts in the area. Many of the current IPM initiatives are project-based and supported from diverse funding sources; thus, the reporting on IPM initiatives and studies tends to focus on short-term results often covering immediate outcomes required by the agencies providing the funding. Many of the available documents were produced immediately following the completion of the IPM initiatives, so the authors had very limited access and evidence of potentially adopted policies, measurements and improvements in environmental quality that require longer time horizons.

When focusing on the impacts of the IPM initiatives on the environment, we especially need to account for many uncertainties when trying to attribute actions related to IPM to improvements in the environment. For example, there are considerable medium- and long-time lags because measurable impacts in environmental indicators could occur many years after the implementation of the initiatives. Furthermore, in the context of many issues happening in the places, it could be hard to attribute the changes in environmental quality to the specific initiatives without further assessments. For instance, participation and transparency can be reflected in decision-making by the level of stakeholder inclusion and the degree of open disclosure of information and decision-making criteria, respectively. By contrast, improvements in water quality may result from an improved water governance process, but many other processes at different scales could contribute to these changes, including lowered economic activities, population changes and better enforcement of quality standards in upstream areas (for details, see Figure 2).

Despite all these uncertainties, outcome-oriented monitoring that provides on-the-ground evidence of the consequences, policies and actions—in this case, on the environmental status—is widely accepted as an approximation for assessing environmental policies and governance processes. Key challenges in addressing uncertainty in causal linkages between IPM and actual changes in environmental quality have various facets and could be presented as follows (Rauschmayer, et al., 2009):

1. Most issue domains have a multi-scale nature of biogeophysical and human systems, with the interactions between them across scales. However, evaluating outcomes on different spatial scales is a costly and time-consuming undertaking, and the results may be too diverse for an overall conclusion.
2. In order to attribute changes in the system to specific policies and management options, we have to assess their influence over time, but long-term effects can be seen only after several years, provided that other variables remain somewhat stable. This requires an approach that could isolate diverse influences, including those related to policy. Systemic approaches would suggest that adaptive, iterative evaluation of the monitored indicators in the context of an understanding of the processes and influences in the area is useful as an ongoing learning exercise.
3. The outcome of a governance process is hard to isolate; likewise, any one governance process may cause side-effects in other settings and policy arenas. An outcome-oriented evaluation network will ideally have to consider diverse causal linkages with a broad range of sub-systems, from tourism to the paper industry. We are unable fully to capture these linkages due to ignorance and practical constraints.

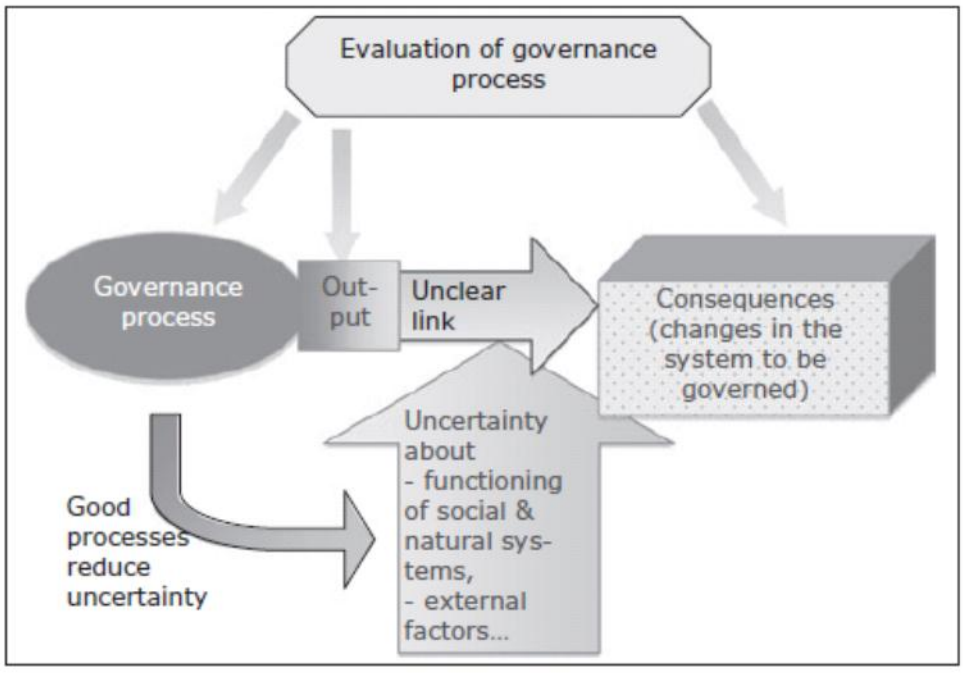

Figure 2. Evaluating governance processes. (1) Evaluation of governance processes needs to refer to three elements: the process itself, output and consequences. (2) Good processes reduce some uncertainties and thereby improve the reliability of outcome-oriented evaluation (Source: Rauschmeyer, et al., 2009).

Overall, when applying place-based approaches on focused human activities and ecosystems, water and land management, we need to recognize that these are highly complex activities, requiring new monitoring arrangements, new forms of assessment and multiple criteria by which to determine the quality of waters, forest and soil (Hendry, 2008). Such assessments and criteria are far removed from the application of a simple chemical quality and quantity standard as often applied in environmental monitoring (Lautze, de Silva, Giordano & Sanford, 2011).

Despite the high uncertainties, attributions addressing human/nature relationships by new governing approaches and promoting more integrated approaches are at the centre of the current approaches to managing environment, including IPM. For this reason, place-based approaches do not merely bring together information on environmental trends and status, but connect the various parties together to discuss this information in the context of needs, priorities, best practices, past knowledge and experiences. IPM provides a process for stakeholders and their organizations to come to a shared understanding of the possible effects of current and future choices on environment, and to help determine what this knowledge should mean for the planning, policy design or project at hand (Michaels, 1999). This implies that we need to pay equal attention to evaluating governance processes and outcomes. When combining these two approaches in evaluation, we can identify a series of key criteria moving from process-based evaluations, such as knowledge management, social dynamics, legitimacy and effectiveness, towards outcome-oriented evaluations represented by criteria focused on effectiveness (Wittmer, Rauschmayer & Klauer, 2006; details are presented in Table 1).

Table 1. Overview of the proposed representative elements of frameworks comprising process and outcome-oriented evaluation approaches (Source: Rauschmayer, et al., 2009; Witter, et al., 2006)

Criteria	Description	Sub-criteria	Focus
Knowledge management	This refers to the various and distinct ways in which the various knowledge is elucidated and integrated, and how the governance process addresses issues of uncertainty and ignorance.	• Integration of different types of information • Dealing with complexity • Dealing with uncertainty	Mainly process oriented
Social dynamics	This highlights the significance of participatory processes involving individuals in the area, and focuses on evaluating the types of involvement.	Changing behaviour, changing perspectives/learning • Agency/empowerment • Respect/relationship • Facilitating convergence or illustrating diversity	Mainly process oriented
Legitimacy	This combines process- and output-oriented indicators and deals with accountability, representation issues, rule of law and transparency.	• Legal compatibility and integrating procedural knowledge • Inclusion/representation • Transparency of rules and assumptions for insiders and outsiders • Accountability	Process and output oriented
Effectiveness	This is centred on outcomes and emphasis is placed on the state of the system to be governed.	• Ecological state • Cost-effectiveness (including cost of the process)	Output oriented

Recently, the European Commission conducted a review of international research projects related to IWRM[6] to assess what has been learned over the last decade and how useful and effective the research has been in informing societal and technological innovation in the context of the macro-goals of sustainable development and the Millennium Development Goals (MDGs). They concluded that the short time frame of approximately three years since the projects' completion provided only opportunities to look at key criteria, including: knowledge management for capacity to integrate information (including scientific and traditional knowledge) and approaches dealing with legitimacy, especially in relation to inclusion and representation (Gyawalli, et al., 2006). This assessment did not specifically investigate the links to changes in water quality, mostly because of the short implementation phase of the evaluated projects and the uncertainties in attribution (Gyawalli, et al., 2006). One further conclusion emphasizes the importance of using monitoring schemes and indicators as learning tools in developing strategic plans and policies by multiple stakeholders, by:

[6] At the EU, a lot of attention has been devoted to the Water Framework Directive (WFD) for the last 15 years. The EU WFD provides an appropriate institutional role by anchoring coordination at the highest level and creating coordinating bodies at the river-basin level, but it is weak in the allocation of responsibilities for water services to the lowest appropriate level (Mizanur, et al., 2004)

providing access to the collected information, developing understandable indicators for non-experts, helping with interpreting the information and using the indicators in strategic planning processes (Gyawalli, et al., 2006; Giordano, Urricchio & Vurro, 2009). Seeing the importance of monitoring in learning represents a departure from the top-down model of monitoring targeted at experts to more participatory and bottom-up processes that produce indicators understandable by the public that focus on communication and the accessibility of the collected data.

4.0 Case Study Examples on Monitoring Indicators and Impacts of IPM

When considering the contribution of IPM to practices, one must recognize that the concept itself is often initiated as a research project, emerging from a series of studies investigating different changes in the environment in the area. However, currently IPM is increasingly seen as a model for a universally applicable means of safeguarding the natural resource base and improving well-being in the areas. An important task for IPM, therefore, is to test and subsequently transform the hypothesis into proven principles that can, with confidence, be applied in practice (Medema & Jeffrey, 2005). In this chapter, we will outline few examples of developed monitoring frameworks and gathered data showing the relevance of IPM for policy-making and management in the particular area.

4.1 Monitoring the Impacts of IPM

Tables 2 and 3 provide a set of key indicators to be used to monitor the outcomes and process of two IPM projects focused on water and land-use management. In the case of the water management case study (Table 2), the predominant focus was to design a set of monitoring indicators that is able to reflect on a new and more collaborative water governance process and to reduce the amount of monitored environmental indicators to those that reflect the priority management areas and concerns such as flood protection and tourism development, presented in a way that is usable by diverse groups of stakeholders (Saiki, 2009; Slootweg, n.d.). The second case study (Table 3) focused on monitoring the capacity to implement the long-term plan, covering both economic and environmental goals and monitoring the effectiveness of these actions in improving environmental quality and meeting community priorities in the Waikato region of New Zealand (Huser, 2011).

In both case studies, the role of monitoring is to collect and demonstrate information about the consequences of the applied actions and about the processes that were utilized in governing resource management. The indicators combine both outcome-oriented indicators monitoring environmental status such as water quality, flood frequency in vulnerable areas and pest occurrence, and process-based indicators looking at the applied governing process, planning, stakeholders' participation, data dissemination and sharing.

Table 2. Overview of suggested key indicators to evaluate the IPM with a focus on water in Japan (Source: Saiki, 2009; Slootweg, n.d.; selected)

Indicator	Description and details
Qualitative regular monitoring (every 2–5 years)	
I. Stakeholders	
Customer involvement	A measure of the level of customer involvement in the decision-making of the resource management and therefore their acceptance of the organizational goals and operation
Customer feedback	A measure of the level of customer involvement in the decision-making monitored by regular and ad-hoc surveys, accepted producers for providing feedback and how frequently they are used
Environmental audits	A measure of the level of environmental awareness and intention to protect against environmental degradation
Basin livelihoods	A measure of the overall change in livelihoods in the basin
II. Learning and growth	
Human resource development	A measure of the maturity and effectiveness of the human resource development system, reflecting its likely contribution to achievement of integrated planning priorities
Technical development	A measure of the level of commitment to adopting appropriate technology solutions that will aid in the delivery of the mission.
III. Internal management objectives	
Planning maturity	To identify the level of planning operation in the governance system and its likely impact on delivery of mission
Resource allocation	Measures resource allocations in the basin that determine delivery and performance of services
Data sharing	A measure of the commitment to and implementation of effective data management and information dissemination between the involved organization and the public
Quantitative indicators (multiple times per year–yearly)	
IV. Environmental status with focus on water	
Recreational water quality: for example, standards for fecal coliforms	
Raw water supply: for example, as annual supply planned ratio index and minimum supply planned ratio index	
Flood vulnerability: for example, flood frequency in vulnerable areas; low-flying and unprotected areas	
Chemical spills: for example, levels of cadmium and zinc	
Environmental water quality: total phosphorus, NH4-N, dissolved oxygen, eutrophication	
Biodiversity index or indicator species occurrence, including fish species, invertebrates, aquatic plants and migratory birds	

These examples emphasize the integrated nature of the IPM initiatives that are developed around particular environmental resources, but account for the humans and their activities in the region. This is done by focusing intently on the monitoring of the planning practices, including stakeholders' participation and other sectors that are important for community economic activities and well-being. When focusing on planning practices, indicators include:

- Monitoring internal capacities and collaborations among managing authorities to implement IPM
- Monitoring direct and indirect interactions with and among stakeholders' groups that are relevant for the planning processes
- Monitoring communications with stakeholders to adjust monitored and published environmental indicators so they are relevant to the quality of stakeholders' livelihoods in the area. For example, indicators focusing on environmental quality also include those that provide information on recreation, water availability for agriculture and water contamination relevant for aquaculture, as these are the key sectors in the local economy.

Such selection of indicators monitoring planning processes, capacities and environmental status indicates the specific design of the monitoring and indicators that is somewhat uniquely tied to the particular place.

Table 3. Overview of key indicators to evaluate the IPM with a focus on land-use change in Waikato (New Zealand) (Source: Huser, 2011)

Community partnerships	
Regional democracy and direction	Governance support and leadership, planning and reporting, community and economic information and communications
Relationships with other organizations	Engagement and co-management with other organizations
Community actions and initiatives	Coastal community action, enviroschools and significant places
Natural heritage program	Natural heritage program
Environmental management	
Community health	Airshed management, protecting community water resources, pollution response, contaminated land and diffuse contamination and public threat pest management
Resource management	Resource allocation and compliance monitoring, agricultural services
Environmental information	Environmental indicators, monitoring and reporting and environmental initiatives
Ecosystem health	Biodiversity pest management, catchment health pest management, biodiversity programs and production pest management
Regional development	
Integrated management	Growth strategies and local area plans, regional integration, regional planning
Connected communities	Regional land transport policy, operations and programs
Sustainable industries	Agriculture, aquaculture, business sustainability and waste reduction and management
Safe & resilient communities	
Community safety	Emergency management, navigation safety and dam safety
Resilient development	Regional hazards and coastal hazards
Catchment management	Catchment management, land drainage and integrated harbour management

Furthermore, the monitoring is targeted at multiple stakeholders' groups involved in resource management, planning and other relevant areas of community development. Especially for environmental indicators in both examples, the aim was to narrow down a key set of indicators so that they are understandable for experts from different sectors and for the public. Such focus created an opportunity to use the monitoring indicators in different contexts in planning, understanding current trends and as a learning tool for stakeholders' for future planning. For example, the indicators for monitoring IWRM in Japan were chosen from almost 120 indicators focusing on water quality and availability (Saiki, 2009) and validated by different groups of stakeholders to assess their relevance for their planning and decision-making needs.

4.2 Documented Impacts of IPM Studies on Environment

Given the complexity in the IPM initiatives, including the uncertainties in attributing improvements in environmental status to the outcomes of IPM, providing evidence of the effectiveness of an IPM by showing improvements in specific environmental indicators is fairly challenging. Furthermore, IPM initiatives are relatively new approaches; current funding schemes are mostly focused on supporting actual initiatives, not providing support by conducting reviews of impacts for initiatives under implementation after a longer time period (i.e., 10+ years). Even well-reviewed applications,[7] such as Evolving Landscapes, which is applied in a number of regions in the U.S. and elsewhere, have not conducted a review of actual impacts (J. P. Bolte, email communication, Feb 15, 2011).

From the family of the IPM studies, IWRM probably has the longest tradition, spanning over 20 years (Mizanur, et al., 2004). Below, we provide three examples of IWRM case studies that documented improvements in environmental indicators after implementing IWRM in their watersheds in the U.S., Canada and parts of Europe (Boxes 2, 3 and 4). The case studies provide different examples of IPM developed on diverse scales from a local initiative in the South Tobacco Creek project (case study 3; Box 4) to a study covering a number of European countries in the Rhine River basin (case study 2, Box 3).[8]

Similarly to other examples presented in this paper, all the three case studies have been instigated because of the concerns over worsening environmental conditions, especially water resources, impacting biodiversity, health, tourism and other economic activities. In all of the initiatives, a number of local and regional stakeholders and their organizations were involved in initiating the

[7] Evolving Landscapes initiatives have been positively received by planners and practitioners in the U.S. and applied in number of jurisdictions mainly thanks to its ability to link current environmental, economic and social challenges and potential future policies in an integrated, spatially-based framework (Bolte et al., 2004)

[8] There is also an increasing interest in comparing the costs of IPM approaches to conventional management and monitoring. None of the analyzed case studies compared the cost effectiveness of the applied IPM frameworks to conventional environmental management approaches. They were truly driven by the pressing need to improve worsening environmental conditions, while accounting for other socioeconomic priorities in the area.

studies and in collaboratively developing new policies and management practices covering a number of sectors and jurisdictions. The case studies also provide examples of significant changes in governance and institutional structures such as forming an international council to manage the Rhine River, a cross-provincial/state program of both Canada and the U.S. to manage Lake Champlain and a management associations of farmers to manage Tobacco Creek that successfully enabled these collaborative efforts involving a number of stakeholder organizations. Government offices and their local and regional representations played important roles in coordinating and managing the collaborative processes. These collaborations led to the development of strategic planning documents within the new governance structures that laid down the key priorities and management principles for the places. The creation of such strategic documents such as the *Opportunities for Action Plan in the Champlain Basin* (Goodrich et al., 2005) served as a basis to articulate different concerns of the stakeholders' groups over the environmental quality in the area and outline key synergies and ways forward for "working together" to reconcile the narrowly focused interests of the diverse involved groups.

Box 2 Lake Champlain Basin (U.S. and Canada) Case Study

The Lake Champlain Basin occupies 21,326 square kilometre just south of the St. Lawrence River in the United States and Canada. Approximately 56 per cent of the basin lies in Vermont (U.S.), 37 per cent is in New York (U.S.), and 7 per cent is in Quebec (Canada).

The Lake Champlain Basin Program (LCBP) was established to provide an institutional framework for the implementation of a management plan for Lake Champlain and its watershed. The LCBP is a partnership between the States of New York and Vermont, the Province of Quebec, the United States Environmental Protection Agency (USEPA), other federal and local government agencies, local non-governmental organizations (NGOs) and citizen leaders.

Principal water-management issues, expressed in Opportunities for Action (2003), detail needed actions, timelines, costs, and likely implementation partners. The plan identifies four high priorities that guide remedial, preventive and restorative actions by New York, Vermont, Quebec, and U.S. federal agency partners:

- Phosphorus Reduction: Phosphorus concentrations in shallow and near-shore areas
- Toxic Substance Reduction [polychlorinated biphenyls (PCBs) and mercury (Hg)]
- Non-Native Aquatic Species Management
- Human Health Protection (illness from coliform bacteria contamination)

Innovative integrated water management arising from the efforts of the LCBP is guided by the best available physical and natural science in a consensus-based collaborative approach involving a broad array of stakeholders. The plan encourages partnerships with existing agencies and organizations to implement needed actions rather than unfunded regulatory mandates. Water quality protection is advanced through an ecosystem approach in the context of watershed rather than political boundaries. Pollution prevention is emphasized as a cost-effective means to protect the environment by eliminating pollution before it is generated. Improvements in all key high priorities have been observed since the early 1990s and after the plan implementation.

Source: Goodrich, et al., 2005

Strategic plan development was accompanied by the development of the set of indicators that monitored the changes. Compared to recent IPM initiatives in which indicators included monitoring the changes in governance, these earlier applications only included outcome-oriented monitoring as a set of indicators that reflected only the status of the environment. However, these earlier indicators were designed in such a way that they aim to account for the perspectives that are relevant for the main socioeconomic activities in the watersheds, such as tourism, transportation and agriculture. In the case study of the South Tobacco Creek, further benefits of the IPM study are shown, including savings in infrastructure maintenance, erosion control, reduced flooding and increased farmers' benefits (Box 4). This case study also shows that narrowly-defined monitoring and indicators focused exclusively on environmental quality may overlook other valuable contributions of IPM to the community.

Box 3: Rhine Water Basin (Europe) Case Study

In the 1970s the Rhine River was declared biologically dead and heavy metals were found in high concentrations. Water operators had great trouble finding fresh drinking-water sources. In 1987, the Rhine Action Plan was approved, and, recently, more ambitious aims were assumed through the Rhine 2020 Programme for the Sustainable Development of the Rhine. The plan brought other regional, national and local institutions, including an umbrella organization, the International Commission for the Protection of Rhine, which includes three countries.

In early 2004, when the impacts of the plan were evaluated, the outcomes managed to meet the target level for 37 substances from the 63 target values for water quality; furthermore, 21 substance levels were close to the target and only five were lagging behind the targets. The targets in the 2020 plan include: habitat consistency, flood protection, water quality and ground water protection. Water quality targets include:

- Water quality must be such that the production of drinking water is possible using only simple, near-nature treatment procedures
- The water constituents or their interaction must not have any adverse effect on the biocoenosis of plants, animals or micro-organisms
- Fish, mussels and crayfish caught in the Rhine must be suitable for human consumption. It must be possible to bathe in suitable places along the Rhine.
- It must be ensured that the disposal of dredged material does not have any adverse impact on the environment.

Source: López, Sullivan & Aguido, 2007; Conference of Rhine Ministers, 2001

These initiatives have also shown specific and significant improvements in environmental conditions in the three areas with at least five years of continuous data monitoring. They documented changes in water quality, including reduction in phosphorous concentration, levels of chemicals and coliform contamination. However it is mentioned in the water quality reviews for the Rhine Water Basin that the initiative was not successful in meeting all the reduction targets, for example, the concentration of substances such as polychlorinated biphenyl (PCB), cadmium, zinc, copper, diurone and benzo(a)pyrene were above specified limits (Conference of Rhine Ministers, 2001). The targets for

these substances are part of the new program finalized in 2001 (López et al., 2007). Actual changes in environmental indicators were also demonstrated in the South Tobacco Creek study, which showed peak flow reduction as well in an area that is prone to periodic flooding.

In all three case studies, the status of the environment was regularly reviewed and the strategic planning documents were updated as well. In all cases, this was done in broad institutional and stakeholder' groups collaborations. However, in the Rhine Water Basin and Lake Champlain Basin case studies the stakeholders have developed strong governance systems that then take up the revisions of the strategic planning documents and oversight over the monitoring. On the other hand, the South Tobacco Creek is a fairly unique example of a truly bottom-up approach where farmers themselves initiated a watershed monitoring process and priority indicators have been monitored for over 20 years. This was possible in all the cases because the developed relationships created new ways of collaborative governance and overall orientation of monitoring processes towards the involved stakeholders' groups so that they are understandable and usable by not only experts but other non-professionals.

Box 4. South Tobacco Creek Project, (Canada) Case Study

In the early 1990s, motivated by the need to know the environmental impacts of their farming practices in the watershed, a group of farmers joined together to form the Deerwood Soil and Water Management Association. They created the South Tobacco Creek (STC) project in an approximately 75 square kilometre sub-watershed in south-eastern Manitoba in Canada. Today, all 44 agricultural landowners within this 75 square kilometre drainage area are members of the association and voluntarily provide all of their land-use and management data for watershed-based monitoring and reporting. This self-motivated group has since partnered with government, NGOs and academic organizations to be the site for many scientific studies based on the quantity and quality of data availability.

Some of the projects and studies conducted in this watershed by the Deerwood Soil and Water Management Association include:

- Construction of small dams for water storage and the impacts of these on water quality and peak flow reduction;
- Manure, watershed studies
- Water quality impacts of conservation tillage
- Aquatic habitat research on the Manitoba escarpment
- Watershed evaluation of beneficial management practices
- Sediment and nutrient movement

The effectiveness of the small dams in the South Tobacco Creek watershed have been highlighted through studies evaluating their cost-effectiveness and efficiency in addressing serious land and water management concerns such as flooding and erosion. Small dams in the region have reduced damaging peak storm water and spring runoff flows by up to 90 per cent at individual sites. Deerwood's efforts were estimated to be saving two local municipalities in excess of $50,000 per year in reduced costs for the maintenance and repair of roads, bridges and drainage ditches (Oborne, 1995).

Based on the recognition and success of the STC project, the Deerwood group has been working on the development of the Tobacco Creek Model Watershed (TCMW) project that would emphasize the need for research and results-based solutions, highlight the role of the watershed as an appropriate ecosystem framework for real solutions and community development, as well as find ways to harmonize public policy and community priorities. To this end, this project has the following goals:

- Improving net farm income and landscape diversity
- Building producer participation and scientific monitoring
- Planning for drought, storage and water management; protecting water quality and riparian areas
- Addressing drainage and fisheries habitat issues

Source: Deerwood Soil and Water Management Association website (http://www.cici.mb.ca/deerwood/dswma1.html)
TCMW: People, Landscape, Planning, Action. December 2004.

5.0 Conclusions and Recommendations

Concerns about the status of the environment, both for its intrinsic values as well as its ability to contribute to the socioeconomic development of countries, regions and places, draws the attention of decision-makers to IPM. IPM approaches provide a holistic framework that links science across a number of disciplines, integrates diverse stakeholder perspectives and, ultimately, aims for more balanced approaches to resource governance that account for human/nature relationships. These studies provide good examples of:

- Goals and targets for improving societal and natural processes to improve environmental quality in the area
- Examples of major evaluation approaches and frameworks used to monitor and evaluate impacts and consequences of the IPM initiatives
- Major commonalities and differences in applying monitoring and evaluation frameworks across number of IPM studies focused on land and water management

IPM is an iterative process in which monitoring indicators and evaluation of impacts are conducted to inform and help in revising strategic plans and goals. Even though there are increasing numbers of IPM initiatives, perhaps because of the relatively short history of actual applications and the uncertainties in the monitoring process, there is relatively limited information on actual long-term improvements in environmental quality due to IPM initiatives. However, IWRM provides examples of improvements in water quality achieved by new governing schemes, collaborative planning processes, and monitoring and evaluation schemes that reflect the overall community goals. Compared to recent IPM initiatives in which indicators included monitoring the changes in governance, these IWRM initiatives' earlier applications only included outcome-oriented monitoring as a set of indicators that reflected only the status of the environment.

Learning from the listed examples on evaluation and monitoring schemes developed within analyzed IPM—and especially IWRM—and the challenges presented in the literature, we would like to suggest the following key recommendations:

Planning and governance issues as part of IPM studies:

- **Institutional reviews and changes are an integral part of IPM:** In order to address the complexity of the environment and human linkages, the governance systems and created institutions have very important roles in ensuring that allocation of resources across sectors and priorities are brought together in the context of the carrying capacity of the local

systems, and thus provide guidance for resilient policies.

- **Strategic planning helps in setting goals reflecting nature/human relationships:** It is important to move beyond investigating current challenges and priorities in the context of the environment, to creating overarching documents to guide policy development and management.
- **Both local and national governments have important roles in IPMs:** IPMs operate in a system of nested decision-making scales. While there are some decisions that are in the jurisdictional competency of the place, there are others that would need to be harmonized and guided by decisions at higher levels of governance. This would require the local jurisdiction to promote the enforcement of standards, build public participation and develop the skills base. However, setting standards, guiding good practices, and providing higher level data and tools are better suited as priorities for regional and national governments.

Monitoring and evaluating impacts of IPM

- **Key elements of the monitoring:** There is a shift occurring in applied monitoring approaches towards focusing on indicators that monitor governance, collaboration, and stakeholders involved, as well as indicators that monitor actual changes in the environment (process and outcome-oriented monitoring), creating a framework of both process- and outcomes-based indicators.
- **Designing the indicator systems:** Monitoring the indicators needs to be a process that can build on the current indicator systems, but it would need to be revised to address stakeholders' concerns and strategic planning priorities. Choosing an appropriate scale for indicator selection is a key determinant of the success of the monitoring process as well. The chosen indicators would also need to be relevant for different types of socioeconomic activities ongoing in the area. This would perhaps mean devoting more attention to bottom-up indicators systems design that bridges the end-user needs and feasibility of the monitoring systems
- **Using indicators as learning tools:** When designing planning documents, evaluating impacts of decisions and changes in the region through monitoring indicators provides important information for stakeholders to better understand processes in the area. An important driver for stakeholder participation in integrated processes is the knowledge that their actions are resulting in positive impacts on their environment, institutions and economy. Therefore, monitored indicators should be provided to stakeholders and their use should be encouraged.

Research priorities:

- **Lessons learned from IPM:** It is important to gather more information about the impacts of IPM, and thus investigate how successful the monitoring, evaluation and actual outcomes were in projects that are already in place.
- **Examine relationships between indicator system developments and their usability:** Support projects that are helpful in linking the monitored environmental indicators and needs by planners, decision-makers and other stakeholders to define indicators that are usable in sectoral and spatial planning.

Innovative ways of communicating gathered data: Promote initiatives that look at new ways of communicating monitored indicators, especially environmental data, to different groups of stakeholders and for different purposes so the data and information gathered through monitoring could be used in planning and policy development to address diverse socioeconomic challenges instead only using them in environmental planning.

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