

Research

Unpacking "Participation" in the Adaptive Management of Social-ecological Systems: a Critical Review

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ABSTRACT. Adaptive management has the potential to make environmental management more democratic through the involvement of different stakeholders. In this article, we examine three case studies at different scales that followed adaptive management processes, critically reflecting upon the role of stakeholder participation in each case. Specifically, we examine at which stages different types of stakeholders can play key roles and the ways that each might be involved. We show that a range of participatory mechanisms can be employed at different stages of the adaptive cycle, and can work together to create conditions for social learning and favorable outcomes for diverse stakeholders. This analysis highlights the need for greater reflection on case study research in order to further refine participatory processes within adaptive management. This should not only address the shortcomings and successes of adaptive management as a form of democratic environmental governance, but should also unpack the links between science, institutions, knowledge, and power.

Key Words: *adaptive management; democratic governance; participation; stakeholder involvement*

INTRODUCTION

The adaptive management paradigm treats knowledge about ecosystems as both uncertain and pluralistic. It recognizes that, to create more sustainable management strategies, stakeholders must forge new relationships to enhance multi-directional information flows, learn from each other, and together develop flexible ways of managing their environments (Carpenter and Gunderson 2001). Although there is general agreement on the importance of citizen involvement within the adaptive process, it is unclear how best this should happen, and what form it should take (Abelson et al. 2003, Rowe and Frewer 2000). What constitutes "appropriate" involvement varies within and between stakeholder groups. As such, adaptive management strategies commonly involve several mechanisms to encourage groups to learn from each other—"social learning"—and help policy reflect a range of different values and viewpoints. Participation can, therefore, take place in the exploration of a management problem but also in goal setting, planning, and monitoring (McLain and Lee 1996, Johannes 1998, Ludwig et al. 2001, Folke

2003). The development and community resource management literature boasts several reflexive critiques of these different types of participation (see Cooke and Kothari (2001), Hickey and Mohan (2004), Mosse (1994), Agarwal (2001), and Eversole (2003), among others), but understanding what "participation" means specifically within the adaptive management cycle has been largely neglected. Therefore, the purpose of this paper is to "unpack" participation in three case studies and explore how different styles of stakeholder engagement may contribute to adaptive management.

LITERATURE REVIEW

Adaptive management is a methodological approach that views policies as if they were experiments to be studied, such that the results from one generation of study inform subsequent decisions (Holling 1978, Walters 1986). To accomplish this, the adaptive management literature advocates a cyclical approach so policies can be adapted as circumstances change and people learn. Consequently, adaptive management processes

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start with the identification of both problems and desired goal(s), and require the development of appropriate policy. Next come the implementation of policy and monitoring of results, after which the problem and goals are re-visited, and the cycle starts again. The process is iterative, with each stage offering potential to involve different groups and the opportunity for them to learn from each other (Walters 1986). Consequently, this approach borrows much from Bandura's seminal work on social learning (Bandura 1963).

Several overlapping ideas emerge from the literature as to how participatory processes can help the adaptive management of social-ecological systems. The first is that multi-stakeholder participation results in better management plans, and suggests that participatory methods are an effective way of capturing the information and perspectives necessary to manage social-environmental systems (Colfer 2005, see Table 1). Another reason is normative, and draws on the deliberative democracy literature, suggesting people have a right to participate in management processes (Elster 1998) (Table 1). Within the adaptive management paradigm, participation usually takes place for pragmatic reasons, despite agreement among many commentators on the need for more democratic involvement.

As indicated in Table 1, social learning has gained increasing attention as a participatory approach to managing environmental problems within a larger social context (Chambers et al. 1989, Cole and Engstrom 1993, Pea 1993, Maarleveld and Dangbegnon 2002). This view of learning emphasizes social interactions among stakeholders, individual and group reflection on what is being learned, as well as iterative attempts to apply what is being learned to the issues under discussion (Pahl-Wostl and Hare 2004, Leeuwis et al. 2002). It can also lead to the transformation of relationships within that social context: developing new relationships, building upon existing collaborations, and transforming adversarial relationships (Schusler and Decker 2003). These changes occur as individuals within a group learn about the character and trustworthiness of other group members through their interactions, and learn to appreciate the legitimacy of each other's views (Forester 1999). Social learning does not necessarily lead to changes in attitudes or behavior, but is likely to lead to an understanding and appreciation of opposing views (Mathews 1994). This can have significant

implications for group dynamics, enabling diverse groups of potentially conflicting stakeholders to see new ways of working together. It does not preclude conflict, but when conflict is appropriately bounded (e.g., agreeing to rules of engagement and building bridges across socially constructed boundaries between interest groups) it can stimulate learning (Keen and Mahanty 2006). By incorporating social learning as part of its intended goals, adaptive management thus emphasizes the importance of seeing environmental problem solving as a cyclical process, as well as stressing the inclusion and involvement of stakeholders (Colfer 2005). This highlights the need for careful consideration of participatory approaches.

Despite the theoretical promise of participatory approaches, it is not clear when and how participation should take place within adaptive cycles, or who should be involved for social learning to be most effective. Some adaptive management cycles include only scientists and managers (e.g., Walters et al. 2000) or interdisciplinary scientific expert groups (e.g., McGinley and Finnegan 2003). Other processes include, for example, community leaders, government agencies, or NGOs (e.g., Arheimer et al. 2004, Redpath et al. 2004, Gray 2000, Daniels and Walker 1996). Although participatory processes may appear to promote social learning and deliberative democracy in social-ecological management, power sharing can remain elusive, with management largely autocratic. For example, Fraser et al. (2006) describe how—inspired by the promise of adaptive management—the development of sustainability indicators in Guernsey was proposed as a way of involving community members in an open, transparent process to steer environmental management. However, a lack of public enthusiasm in the early stages of the cycle caused the government to invite experts to generate a preliminary indicator list. This demonstrates that to reach the hoped-for benefits of adaptive management, the opportunity for participation must not only be offered by project conveners, but also taken up by potential participants.

It is also important to recognize whose management system is being participated in by whom, and to appreciate the extent to which different perspectives are valued within the adaptive process (Briggs and Sharp 2004). For example, Colfer and Wadley's (1996) research on forest management in Indonesia assumed that "local people would somehow be

Table 1. Participation within adaptive management: why it is important

Why is participation important?	Examples
<p>(1) By using perspectives from a range of sources, a more complete overview is obtained, creating a more robust factual base and reducing uncertainty (Olsson et al. 2004, Berkes 1999, Woodhill and Roling 1998). As a result, local inputs are often considered central to adaptive management processes, ultimately leading to better results and sustainability (cf. Arheimer et al. 2004). However, some commentators warn that participation may not necessarily enhance the quality of outcomes because of the interaction of competing interests (e.g., Brody 2003, Connelly et al. 2006).</p>	<p>(1) Daniels and Walker's (1996) work on the Oregon Dunes National Recreation Area illustrates how different users of environmental systems have different needs. Incorporating the perspectives of all user groups minimized conflict, allowing creation of a common knowledge base about dune issues, which fed into the production of a new management plan. Walters et al. (2000) used participatory modeling with researchers and stakeholders in an iterative process to identify alternative management strategies for the Glen Canyon Dam on the Colorado River. The process showed how changes in management led to the transfer of benefits from one stakeholder group to another, necessitating the development of a shared vision with input from all stakeholders. Numerous other adaptive management projects have cited a range of substantive reasons for ensuring active participation from stakeholders (e.g., Wollenberg et al. 2000, Peterson et al. 2003, Redpath et al. 2004, Colfer 2005).</p>
<p>(2) The participation of "non-scientific experts" provides insight into social, ethical, and political values that cannot be gained through scientific approaches (Middendorf and Busch 1997). These ideas are not uncontested, however, and some commentators question the role of local "lay" knowledge in today's dynamic and globalized world (e.g., Krupnik and Jolly 2002, Doolittle 2003, Briggs and Sharp 2004).</p>	<p>(2) Kelsey (2003) used participatory techniques to combine local and scientific knowledge to develop biodiversity conservation initiatives that took local values into consideration. Robertson and McGee (2003) used oral histories to identify local values concerning wetland rehabilitation in Australia.</p>
<p>(3) Top-down approaches violate democratic ideals, so a critical function of participation is for local people to be allowed to control the speed and direction of changes in their social-ecological systems (Colfer et al. 1995, Colfer 2005). "Lay" participation is, therefore, said to afford legitimacy to the adaptive process.</p>	<p>(3) There are numerous examples of government-sponsored initiatives with varying degrees of participation in response to normative arguments coming out of international and national policy debates, e.g., LA21 (e.g., Fraser et al. 2006)</p>
<p>(4) Political concerns may be used to justify participation, such as the wish to empower previously marginalized groups. Whether the opportunity for empowerment and democracy is taken, however, varies between cases. Participation is also particularly pertinent when consensually agreed targets need to be reached (e.g., Arheimer et al. 2004) or when "the governing" need access to relevant information, networks, or target groups (Geurts and Mayer 1996), which, in some cases, could not occur without the participation of "the governed."</p>	<p>(4) Connelly et al. (2006) argue that normative political demands for enhanced public participation have driven the development of a "new governance" of partnerships between government agencies and NGOs to manage socio-ecological systems in the UK. They analyze three deliberative arenas for environmental management in the UK's Peak District National Park and conclude that the effects of participatory partnership working on the sustainability of decision making are by no means clear cut.</p>
<p>(5) By encouraging diverse stakeholders to work together in the framework of adaptive management, participation can foster social learning. This can transform relationships, changing people's perceptions of each other's views, and enabling them to identify new ways of working together.</p>	<p>(5) The HarmoniCOP project stimulated social learning to develop new urban water management strategies with Swiss stakeholders in an adaptive management framework (Pahl-Wostl and Hare 2004). There are numerous other examples of the stimulation of social learning for the adaptive management of socioecological systems in the literature (e.g., Daniels and Walker 1996, Leeuwis and Pyburn 2002, Keen and Mahanty 2006), and Social Network Analysis and Stakeholder Analysis can be used to select representative, yet sufficiently small, groups to engage in learning activities.</p>

brought into the management system of the government or the timber concessionaire.” However, after examining the roles of all the stakeholders, they found that despite top-down legislation and the assumed dominance of the government, the traditional local management system was actually the only fully operational management system. Therefore, it became necessary to bring the government and timber concessionaire into local management strategies rather than vice versa.

In addressing when participation should occur, the literature again displays a wide-ranging spectrum, with participation taking place at various stages of different projects, inevitably with different levels of success. Dougill et al. (2006), in their work in the UK’s Peak District National Park, identified all the stakeholders to be involved at the outset of their study, and used a variety of participatory processes flexibly to encourage their involvement throughout. In the Guernsey example cited earlier, the initial apathy of participants gradually faded throughout the iterative process. Following the production of a preliminary indicator list by government experts, the list evolved incrementally as an increasing number of stakeholders engaged in the process. This eventually led to broader participation and creation of a platform through which stakeholders could be actively engaged (Fraser et al. 2006). In another example, Walters et al. (2000) followed an adaptive process to assist Grand Canyon scientists and managers in developing conceptual and simulation models for the Colorado ecosystem affected by Glen Canyon Dam. In this case, different groups participated in the development of different aspects of the model, resulting in various levels of participation by each stakeholder throughout.

Monitoring activities represent one stage of the adaptive cycle where the literature shows that successful participation can take place (e.g., Fraser et al. 2006, Guijt and Proost 2002, Olsson et al. 2004). Moller et al. (2004) use case studies from New Zealand and Canada to show how the combination of scientific and traditional monitoring methods can be used to enhance participation, build partnership and community consensus, and facilitate learning. A further positive outcome of this work was that participation in monitoring allowed indigenous wildlife users to evaluate scientific predictions critically according to their own values, perceptions, and assumptions, and test sustainability using their own forms of adaptive management.

Together, these examples demonstrate that participation takes many forms and can occur at different stages of the adaptive process. However, more meaningful participatory processes involve social learning and an exchange of information between stakeholders that is linked to management decisions. Successful mechanisms in this respect include the use of interactive techniques, such as workshops (e.g., Walters et al. 2000), focus groups and group model building, and scenario development (Peterson et al. 2003, Pahl-Wostl 2002, van den Belt 2004). In each of these mechanisms, social learning is facilitated, and information flows between different stakeholders are multi-directional.

There are several typologies that distil participation based on their objectives, structure, or function (e.g., Pimbert and Pretty 1994, Arnstein 1969) or on the direction through which information travels among participants (Rowe and Frewer 2005) (see Table 2). However, the examples provided in many of these remain extremely broad and capture so many elements that each category in each framework still varies across a number of different dimensions. This limits their usefulness somewhat within the adaptive management context, because they fail to illustrate how different parts of the cycle might benefit from different types of participation.

Therefore, the remainder of this paper views participation a flexible concept. We explore how the issues and potentials that emerged in our literature review played out in our case studies: namely, whether power sharing was achieved, whose system was being participated in by whom, how participation was adapted throughout the adaptive cycle, and how conditions for learning and information flow were created.

ANALYSIS

This section introduces our case studies. The first case describes the role of local participation in plans for the improved provision of urban green space in Bangkok, Thailand. It was a community-level initiative operating on small, unused plots of land in poor areas of the city. The second case draws on work with pastoralists in the Kalahari rangelands of Botswana, and involved collaboration between farmers and district-level authorities. The third case study describes the establishment of a trans-boundary National Park in Austria and Hungary, and involved a wide range of stakeholders. These

Table 2. Different forms of participatory involvement in environmental management projects (developed from Rowe and Frewer (2005))

Differentiation	Nature of information flow
Public communication	Information flows from the initiative's sponsor to the public in a one-way, linear process. Public feedback is neither sought nor required. Fiorino's (1990) arguments demand a greater role for the public than is made possible in this type of activity.
Public consultation	Information is collected by the sponsor from the public, following a process initiated by the sponsor. The process is one-way and linear. It is this and the next degree of participation that are most prevalent within the adaptive management literature.
Public participation	Information is exchanged between the sponsor and the public through the establishment of dialog. The process is two-way and often cyclical or iterative.

cases were selected because each attempted to use elements of participatory adaptive management as a basic rationale, each operates at a different scale, and each experienced both successes and challenges. Together, they present a range of social and environmental contexts, operating at different spatial and institutional scales.

Case Study 1 Urban Greening in Thailand: Participatory Methods in Micro-level Environmental Management

In the late 1990s, a Thai non-governmental organization (NGO), the Thailand Environment Institute (TEI) approached a Canadian NGO, the International Centre for Sustainable Cities (ICSC) to collaborate on an urban greening project. One of the co-authors on this paper was the project manager for the ICSC, and was responsible for all project documentation (for a full description see Fraser (2002)). The rationale for the project was simple: Bangkok, home to approximately 12 million people, desperately needed urban green space that could provide a range of social, economic, and environmental benefits. The TEI was responding to high-level policy signals from the Bangkok Metropolitan Administration (BMA), which had sought to increase green space from 1 m² per capita to approximately 10 m² (W. Apichat, personal communication). This is not as unrealistic as it might seem. Despite its huge population and densely developed urban core, the greater Bangkok region

is 39% vacant or undeveloped, being mostly abandoned agricultural land with little environmental or amenity value (Pornchokchai 1992).

Funded by the Canadian International Development Agency (CIDA), this project began with a series of high-level meetings in Bangkok in 1999 and 2000, at which the Thai and Canadian NGOs, together with members of the BMA, discussed how best to improve Bangkok's green space. During these meetings, project planners realized that, because community members would maintain the green spaces into the future, they needed to ensure that at least some members of each community felt ownership of the project. Furthermore, project planners were aware of Jacobs' (1961) critique that, although urban parks offer the promise of a better environment and recreational space, unless planned in conjunction with communities, parks can attract anti-social behavior. Consequently, an adaptive management framework was decided upon, which began by identifying goals, developing implementation strategies monitoring progress, and then feeding these results back into further goal setting and project implementation. Multi-stakeholder participatory processes were used as the primary mechanism through which management goals and strategies would both be set and revised. It also enabled social learning, so lessons learned at the community level could be incorporated into future rounds of policy development at the BMA. At this stage, TEI and ICSC staff also chose criteria to monitor the overall effect of the project (Table 3).

In actually developing urban green spaces, activities were both top down and participatory. First, TEI organized an education day, where members of two pilot communities listened to a series of presentations on the benefits of urban green space. These were attended by approximately 50 people from each community; afterwards, community working groups were established within each neighborhood. A series of planning days were then held in each community, at which TEI and ICSC staff and landscape architects were on hand to help the working groups map their neighborhoods, identify unused areas, and set goals for local green space. These activities allowed community members to take ownership of the process and work iteratively with urban greening experts, including landscape architects and academics from local agricultural colleges.

At this point, even community members who had been skeptical of the motivations of TEI and ICSC began to participate more actively. Communication flows between stakeholders changed at this point, and moved from a situation where most information flowed one way from “experts” to “communities” to much more of a two-way interaction between individuals, regardless of their stakeholder group. Concurrently, TEI and ICSC staff visited local municipal authorities known as “kehts” (Bangkok is divided into kehts that are responsible for day-to-day municipal services and are somewhat independent from the BMA). These visits ensured the urban greening plans had the active support of on-the-ground urban planners. This step proved both challenging and vital, and clearly highlights the diverse and important role the “external expert” can play. Taken alone, it is unlikely that local planners would take small-scale community initiatives seriously. However, as keht officials were approached by “international development experts” working under the auspices of the BMA’s urban greening strategy, it was possible to secure the support the communities needed. Ultimately, keht officials in both pilot projects provided considerable resources (Table 3). However, planning, preparing, and maintaining the community green space was the fundamental responsibility of the community. To ensure this happened, TEI and ICSC worked closely with the working groups to establish a regular work schedule.

Throughout this process, results were monitored and project staff ensured that there was regular feedback and social learning among the different

groups involved. The iterative steps are summarized in Fig. 1. Indicators chosen to assess the impact of the project also proved invaluable. For example, one goal of the project was to empower women. To monitor progress toward this, staff collected data on the gender of participants at all events. In one community, it was clear that women were not participating, so TEI staff adapted their approach to meet this goal. After a number of ineffective attempts, such as specifically inviting women to attend—this failed because the women who did attend did not participate in any discussions—project staff instigated a separate “women’s” forum to ensure women’s perspectives were not marginalized.

The final phase was to expand activities beyond the pilot communities. In the second year of the initiative, the process was replicated in three additional communities. At this point, the BMA adopted the adaptive process that had been developed and offered small amounts of funding to any community wanting to develop their own urban greening plan. This resulted in approximately 50 projects. Given this growth, it proved impossible for TEI and ICSC to closely monitor all the initiatives. Nevertheless, subsequent anecdotal reports suggest that some projects were extremely successful, whereas others were less so.

This project, based around a highly participatory ethic, illustrates some of the challenges faced when using participatory management in adaptive management projects. During the early stages, TEI and ICSC staff worked with high-level officials to obtain funding and set basic goals and indicators. When it came to actually devising and implementing urban green plans, TEI and ICSC staff became facilitators, ensuring that communities, local landscape experts, and government officials worked and learned together and overcame conflicts. At the end of the first year, TEI and ICSC staff also acted to ensure lessons learned at the community level were translated into subsequent urban green space policy.

Case Study 2 Participatory Rangeland Monitoring and Management in the Kalahari, Botswana

Botswana has been described as “one of the most desertified countries in sub-Saharan Africa” (Barrow 1991:191), and there is evidence that the

Table 3. Goals, indicators, and results from Bangkok urban greening project (adapted from Fraser (2002))

Goal	Indicator	Highlights from year 1
Establish urban green plans	Area planted/improved	55 x 55 m area planted with shade trees; 5 x 300 m area of gardens
Empower communities	Number of people active in community working group	Approximately 20 people in each community in working group, 100 person days of labor volunteered to project
Reduce poverty	Income generated by gardens	Ten gardens, each of which provided 10% of household food requirements
Empower women	Equal gender representation at all events	Initial lack of any female participation in working group in one community
Forge links between communities and government	Resources provided by government to communities	60 person days of labor paid for by government

privatization of communal rangeland is further worsening land degradation and deepening stark social and economic inequalities (Thomas et al. 2000). To address these concerns, the Indigenous Vegetation Project, a Global Environment Facility-funded project involving UNEP, UNDP, and the Government of Botswana, is being piloted to empower pastoral communities to monitor and manage their rangeland more sustainably. Researchers worked with these communities to develop a learning process for environmental sustainability assessment that integrates local and scientific knowledge bases. This was applied and refined at a district scale in three land degradation hotspots in the Kalahari, Botswana. Hotspots were identified through a national degradation assessment based on scientific expert opinion, integrated with evidence from remote sensing, and ecological and economic studies (Reed 2005).

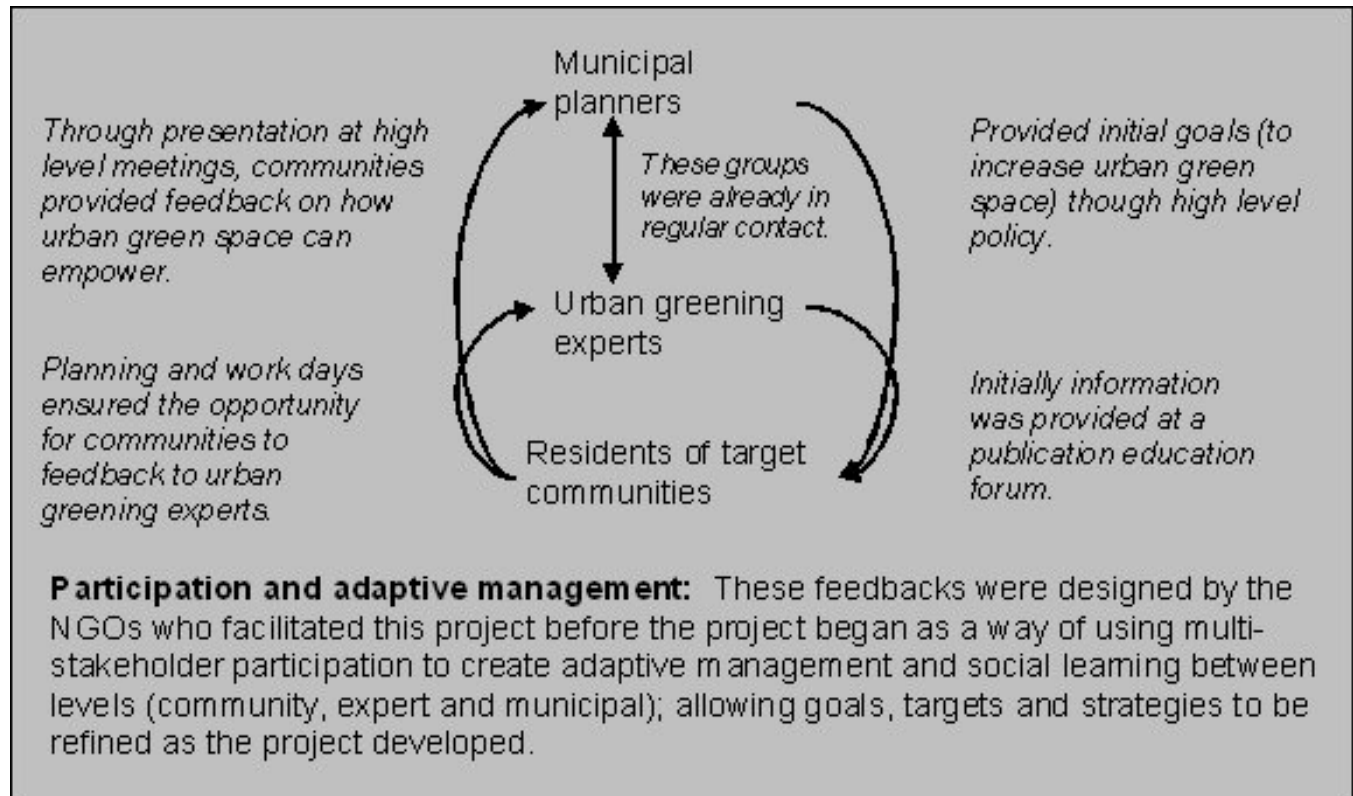
The learning process combined public communication, consultation, and participation to create conditions for social learning among local communities, researchers, and policy makers (Tables 2 and 4). A four-stage process was followed to enable two-way information flows between and within stakeholder groups (Fig. 2), including the return flow of information from empirical research back to communities. Replication of the learning process in three study areas allowed the participatory methods

to be refined, enabling more active and time-efficient input from representative stakeholders. In each community, the process was coordinated by a lead researcher, who was responsible for bringing together the different stakeholder groups and facilitating the learning process. This involved engaging in the process as a co-learner and setting the conditions for learning to take place (see Buck et al. 2001). Specific facilitation tasks involved guiding discussions, exploring participants' needs and expectations, and summarizing the session outputs to allow reflection on the elements that had been discussed. In the first study area, facilitation took place in collaboration with district-level staff from the Ministry of Agriculture. In the other two communities, the lead researcher was assisted by national-level Ministry of Agriculture staff, and researchers from an international project also played a key role.

Figure 2 shows how the four-step research process was applied through 12 tasks over a 2-year period. The four steps aimed to:

1. establish the social and environmental context in which the sustainability assessment was being conducted (consultation);
2. establish the sustainability goals that the

Fig. 1. Iterative steps and feedback used to apply adaptive management and community participation to green-space planning in Bangkok.



project or community was working toward, and identify strategies to reach those goals (participation);

3. identify, evaluate, and select sustainability indicators that could be used to monitor progress toward the goals (participation); and
4. collect and analyze empirical data (participation) and disseminate the findings (communication).

Following the learning process in Fig. 2, system boundaries were identified through consultation with stakeholders at local and national levels (task 1). Relevant stakeholders were identified through focus group consultations with local communities. During these consultations, a conceptual model of the system was developed and expanded to describe its wider context—historically and in relation to

other linked systems (task 2). This proved important as it helped the researchers understand the processes, functions, constraints, and opportunities within the rangeland system. It also allowed them to identify the causes of existing system problems, realize the likelihood of future shocks, and thus predict the constraints and effects of proposed revisions to rangeland management strategies. Throughout these tasks, information flowed predominantly from stakeholders to researchers. However, only after all relevant stakeholders had been identified and their power relations assessed could two-way information flows commence effectively between the stakeholder groups. This reflects a growing awareness that participatory processes take place in specific social–ecological and institutional contexts and that power relations set limits and social conditions on people’s participation in research, decision making, and action.

Table 4. Communication and information flow in the Botswana research process (based on Rowe and Frewer's (2005) classification)

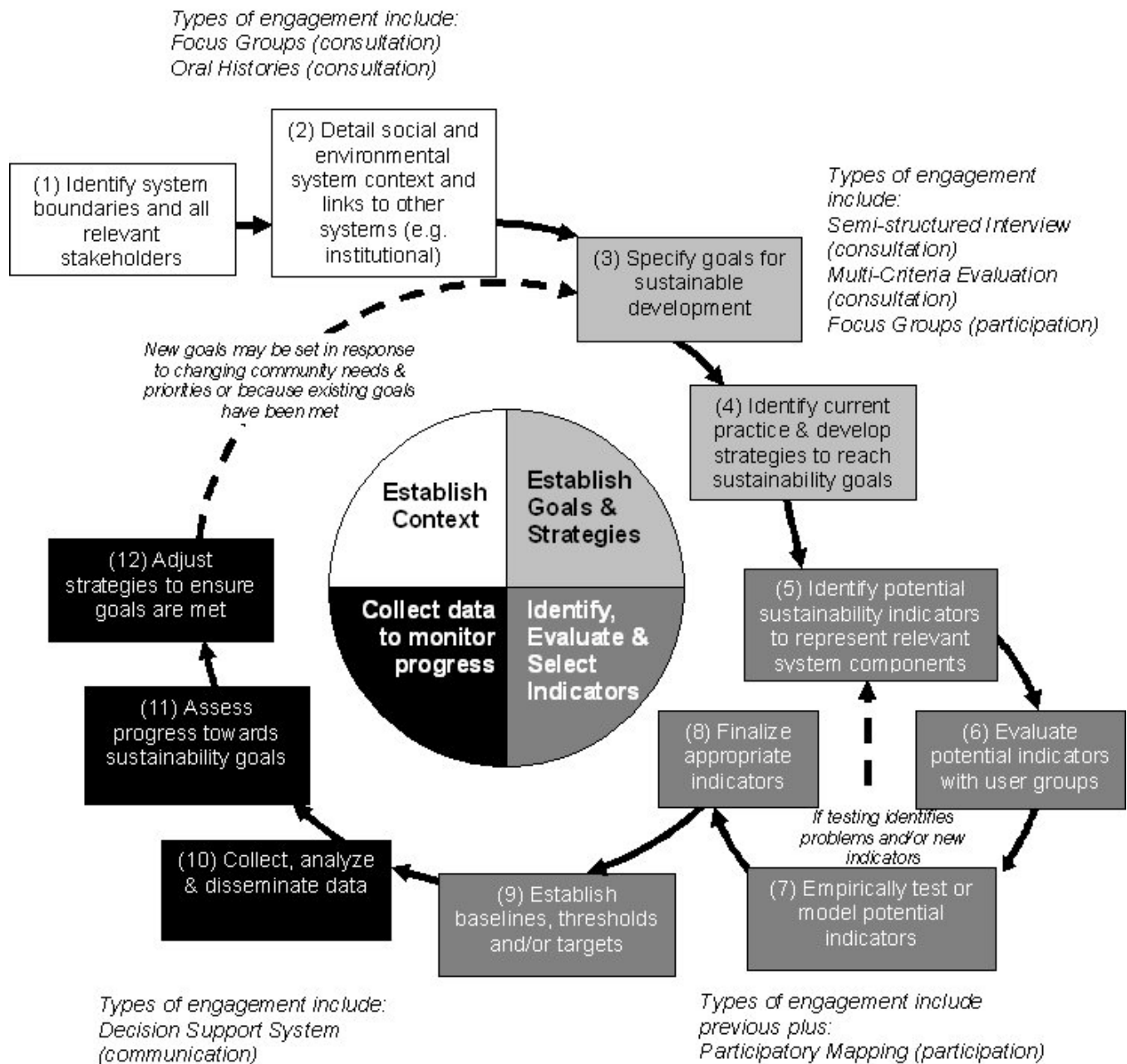
Tasks in Fig. 2	Selection of participants	Elicitation of information from participants	Aggregation of information from participants	Information flow to participants	Rowe and Frewer's (2005) Classification
1–3, 5	Controlled	Face-to-face, facilitated, open response mode	No use of structuring tools	N/A	Consultation type 4 "Focus Groups"
4, 8, 9	Controlled	Face-to-face, facilitated, open response mode	No use of structuring tools	Flexible/ responsive	Participation type 1: consensus conferences or citizen's juries
6	Controlled	Face-to-face, facilitated, open response mode	No use of multi-criteria evaluation to structure aggregation of information	Flexible/ responsive	Participation type 3 "planning cells"
10–12	Not controlled	Not face-to-face, not elicited	N/A	Flexible/ responsive	Communication type 4 "hotlines"

Based on the context described in step 1, goals were then established to help stakeholders identify suitable management strategies that could facilitate a more sustainable future (task 3). This was achieved through consultations with pastoralists using semi-structured interviews. Next, potential strategies to reach sustainability goals were evaluated in community focus groups (task 4). This was also designed to stimulate social learning within community groups. At this point, the process moved into a fully participatory mode with researchers providing a flow of information back to the community (Table 4). This took two forms: the collation and dissemination of the information collected in semi-structured interviews, and the dissemination of findings from the rangeland management literature. During the discussions, focus group participants discarded, accepted, or adapted the proposed strategies, sometimes combining separate elements to develop novel strategies. The research stimulated a social-learning process that combined knowledge from local stakeholders with the scientific knowledge of researchers to provide a range of often innovative management options. By combining participatory research with insights from the scientific literature, more relevant results were provided than either

scientific or local knowledge could have achieved alone. This matches outputs from a range of participatory agricultural development research on African farming systems which highlights the value of farmer knowledge and innovation, ultimately improving agricultural management practices (e.g., Bassett and Crummey 2003, Reij and Waters-Bayer 2001, Scoones 2001, Pound et al. 2003, Mougeot 2005, Conroy 2005).

The participatory process was not without problems: notably, the initial lack of engagement of poorer community members who did not own livestock. Group dynamics in participatory research can discourage minority perspectives from being expressed (Nelson and Wright 1995), whereas external facilitators may inadvertently constrain meaningful dialog and learning (Mohan 2001). Some of the focus groups held during the early stages of the process met some of these challenges. Issues arose from the British white-male positionality of researchers and the use of a translator with connections to the tribal chief. As these problems were identified at an early stage, efforts were then made to use local extension staff to facilitate focus groups and interviews. Key individuals still attempted to dominate group

Fig. 2. Learning process for environmental sustainability assessment using indicators based on local and scientific knowledge. (Adapted from Reed et al. 2006; methods used in this case study are shown in italics around the outside of the figure, showing the type of engagement according to Rowe and Frewer's (2005) typology).



sessions, so careful facilitation involving small groups, especially of poorer people and women, was essential to minimize social exclusion within the participatory research process.

Despite these problems, the outcomes proved suitable enough to move to the second step of the project, where indicators were developed to monitor progress toward sustainability goals. This was achieved through a participatory process based on the facilitation of community-level focus groups, where:

- potential indicators were elicited from stakeholders (task 5);
- these indicators were collated and disseminated in focus groups, where they were evaluated according to their accuracy and ease of use and short-listed using multi-criteria evaluation (task 6);
- short-listed indicators were tested empirically by researchers and key informants using field-based ecological and soil sampling in sites selected during participatory mapping exercises (task 7); and
- results were presented to stakeholders and evaluated in further focus groups, where final discussions and agreement on locally applicable indicators took place (task 8), and baselines, targets, or thresholds (from which progress can be monitored) were established (task 9)

This third stage was the most participatory, as iterative and two-way exchanges of information about indicators and social learning occurred among researchers and stakeholders in the follow-up focus group discussions.

Finally, sustainability indicators were linked to management strategies in locally appropriate manual-style decision-support systems (DSS). These were designed to be easy for land managers to use. Indicators and strategies were communicated to stakeholders in this way to optimize the uptake and utility of the sustainability assessment (Table 4). Stakeholders could then use the DSS to collect and analyze data on indicators (task 10), in order to assess progress toward their sustainability goals

(task 11). Although data analysis is usually the domain of external experts, DSS can facilitate easy and rapid analysis and interpretation by local communities. If necessary, information collected during monitoring can be used to adjust and adapt management strategies, ensuring that decisions are made with sustainability goals in mind (task 12 and feedback to task 3, as shown in Fig. 2).

Work is continuing with the Indigenous Vegetation Project to assess the local impact of this process on pastoralists' decision making. This ongoing research will examine the potential for the DSS developed in each region to be used across a wider area. Such up-scaling of the outputs of the participatory process is essential if the benefits of such work are to be transferred to district and national levels. However, this will require institutional support if agricultural extension services are to move away from top-down dissemination practices and education-driven programs, toward more bottom-up, community-led monitoring and management approaches.

This case study shows that, by combining qualitative insights from stakeholders with more quantitative empirical research, participatory processes can produce more accurate and locally relevant outcomes than either group could have achieved alone. Combining different levels and mechanisms of participation has been shown to enhance the quality of participation and bring benefits for both local communities and researchers. However, communication flows between all the stakeholder groups must be maintained for the process to be successful. Our experiences also show that working with different stakeholder groups is not without its challenges. The context-specific nature of participatory research may compromise transferability of results between district and national scales. Furthermore, the very people who are meant to benefit from participatory research may end up feeling exploited or disempowered (Cooke and Kothari 2001). This became apparent when significant time lapses occurred between focus group meetings; such a problem can only be overcome by passing control of such processes and dissemination to local institutions and empowered community groups.

Case Study 3 Neusiedler See (Seewinkel) National Park, Austria: Participatory Methods to Resolve Conflicts that Involve National and International Players

The implementation of the Neusiedler See-Seewinkel National Park is an interesting example of the interaction of top-down and bottom-up approaches to adaptive management within the context of large-scale, socioeconomic trends (see Hubacek and Bauer 2000). One of the authors of this paper was contracted by the Austrian Federal Environment Agency and UNESCO to analyze the factors that helped in the establishment of the National Park and to outline the significance of the Biosphere Reserve. This was achieved through semi-structured interviews with key stakeholders and document analysis.

The Neusiedler See-Seewinkel National Park was the first of its kind. It was co-established in 1993 according to the criteria of the International Union for Conservation of Nature and Natural Resources (IUCN) by a Western European country (Austria) and former Eastern European country (Hungary). Some 1500 people were involved in the negotiations to establish the park, each owning land that is now an integral part of the protected area. Moreover, the park is used for multiple, conflicting, social and economic purposes, including agriculture, tourism, hunting, fishing, reed-grass cutting, and settlement. Such diversity of interests makes effective environmental protection highly challenging. These dynamics, and the ways in which the park is managed, make this a useful case study. It highlights the challenges of managing different stakeholders and demonstrates the need for participatory processes to operate at and across a range of scales and institutional boundaries.

As the proposed park transcended a national border, it presented a further challenge for participatory management, because it required the cooperation of two national governments as well as the various conservation NGOs, community groups, and landowners. However, this project has gained strong appeal across so many diverse sectors of society that it is now celebrated as a symbol of how people can overcome political differences to solve common problems. Throughout the negotiation of these ideas, information flowed initially from policy makers (specifically those working for national governments) to other stakeholders. During the mid-stages of the process, however, community

members were able to feed information back to the policy makers. This represents an evolution from Rowe and Frewer's "public communication" (Rowe and Frewer 2000) toward "public consultation," as people gradually became more involved in decision making. However, there is little evidence that stakeholders were ever engaged in social learning in the early stages of the project (from the 1960s to 1980s), such that the way the process began was not particularly adaptive.

This changed, however, as active planning for the park formally moved ahead in the 1990s, with the associated recognition that many diverse interests had to be recognized and satisfied. In the course of the negotiations, various claims for use of the land had to be settled (Table 5). Broader stakeholder participation, particularly on the Austrian side, was becoming increasingly necessary for pragmatic reasons (cf. Fiorino 1990), so the process became more deliberately iterative and adaptive.

Smaller-scale landowners were encouraged to form shared interest associations and choose representatives to participate in the negotiation processes. These associations were based on existing entities to govern common land that were remnant of a legal institution of the Austro-Hungarian monarchy. A negotiating team comprising representatives of provincial authorities, the Austrian Ministry of the Environment, and environmental NGOs completed the necessary informative and persuasive tasks so that the Park could be established. A National Park planning institution acted as an arbiter between the interests of landowners and private businesses, governmental institutions, and environmental NGOs. The government organized regular meetings with the representatives of all relevant interest groups to facilitate learning and reach consensus-based decisions. Despite their top-down initiation, these meetings provided an opportunity for public participation, but also afforded the government a level of public legitimacy. Some groups, such as tourism enterprises and hunters and fishermen, were already organized in legal institutions that effectively acted as political pressure groups, so these provided the government with a legally authorized partner. Representatives were able to come together to discuss immediate problems and possible solutions pertaining to the implementation of the Park. This corresponds with the "problem solving" and "goal setting" stages of the adaptive management cycle, particularly as consensus was reached as a result of this learning opportunity on

Table 5. Modes of involvement and policy tools in the National Park case study (note that individuals would fall into several categories)

Stakeholder group	Policy tools	Participatory mode	
		During establishment of the National Park	After the establishment of the National Park
Land owners	<i>Contractual agreements</i> between landowners and the government, subsidies, and compensation	Discussions in small regional groups; represented in negotiations by elected representatives	Education through environmental programs and agricultural institutions; participation through established institutions
Residents and businesses		Informal discussion platforms were established, on which each region had representatives for individual groups—such as the fisher and hunter association, the Lord Mayors of the individual towns, tourist representatives, and government officials. In addition, general information meetings were held in each of the villages to discuss the next steps in the planning process and to deal with fears and problems that might arise through the implementation of the National Park	Platforms still exist today and meet twice yearly National Park newspaper and other educational material
Fishers and hunters	Landowners, fishers and hunters are compensated for incurred losses through not using “common economic practices”	Hunters and fishers are organized in legal institutions designed as a means of self organization and as political pressure groups. In the negotiations for the National Park, these institutions provided the government with a legally authorized partner	Involvement in discussion platforms
Regional and national bureaucratic institutions		Civil servants from involved departments and representatives from provincial and state governmental institutions	National Park authority serves as a coordinating body
Tourists	Access restriction; guided tours; education	Tourists were targeted through media reports, press events, and various educational activities	National Park information center
The environment	Legal instruments and international treaties protecting biodiversity, and regulating economic and public activities in sensitive areas	Represented by environmental NGOs and governmental nature conservation authorities	National Park authority, biological station responsible for ongoing monitoring and research

issues that had previously caused conflict. At the government level, a similar institutional infrastructure was developed, comprising civil servants from relevant departments and representatives from provincial and state levels. These high-level stakeholders met to coordinate their internal plans toward the National Park, discuss legal affairs and financing, and make decisions about the next steps. These processes illustrate how participation is necessary both within and between different institutional levels in order to achieve broader learning and understanding of different viewpoints.

Today, following the successful establishment of the National Park, reflection on the roles of participation, communication, and information in the adaptive process shows a clear evolution. To keep the local people informed about the Park, every household in the area receives a National Park magazine. This represents an ongoing process of communicating information to the public. Similarly, tourists receive information through processes of information flow, detailing how they should behave in the protected areas. These guidance and area supervision measures allow visitors to experience their environments without endangering sensitive individual habitats. Other tools for communication include a National Park Centre, information centers in each town and village in the area, and a variety of printed documentary materials. Biodiversity issues and conservation were also introduced into the curricula of local schools and other educational institutions at all levels.

The case of this park demonstrates that traditional top-down approaches were, for the most part, ineffective, supporting the need for pragmatic, substantive, and normative participation in social-ecological system management. Only by fostering communication and learning among stakeholder groups, decades after the idea for a National Park was proposed, was consensus reached on the establishment of the park. Top-down and bottom-up processes have worked together to allow the park to reflect local social attitudes and preferences but also to maintain its environmental assets. The top-down meetings and information provision not only sensitized the population to the environmental value of the area but also helped them deal with their fears. This enabled them to view the park as an opportunity rather than a barrier to their livelihoods, and the iterative process that developed helped the stakeholders better articulate their concerns and

needs. Biological resources could not be protected by declaration alone, and even by complementing environmental regulations with economic-incentive measures, conservation was not fully assured until understanding and learning about different viewpoints had been achieved. More meaningful protection emerged through the more active participation of the people living in the area. This took place in the context of broader societal trends, such as an increasing ecological consciousness and the recognition that environmental protection need not always limit livelihood options.

DISCUSSION

Flexible participation is central to adaptive management because it provides a mechanism to facilitate feedback and social learning. In both the Bangkok and Botswana cases, non-adaptive management approaches would simply have planned and implemented strategies, without necessarily consulting local people. In the urban planning context, this is exactly what Jacobs railed against when she described how urban parks can become magnets for social problems (Jacobs 1961). As such, the organizers of the urban greening in Bangkok project created a relatively complex series of multi-stakeholder steps, inspired by adaptive management, which ensured a diverse range of stakeholders regularly interacted to help guide and shape the project. Project staff also worked to address power imbalances between groups in order to increase the chance that different types of people would provide meaningful input and guidance. The success of such initiatives is grounded in the feedback loops based on communication and institutional support structures at each stage in the process. These permit participation to be flexible. In the Bangkok case, the first participatory feedback loop was between urban greening experts, such as landscape architects and academics from local agricultural colleges, and community members. Initially, this was a one-way flow of information from experts to community members at the educational workshop. At subsequent planning events and on work days when community members actually developed new green spaces, however, project staff facilitated two-way discussions between experts and community members. These helped ensure the benefits of the new green space reflected the needs of local residents as well as capturing the less immediate environmental goals of interest to municipal planners. This project also

used participation as a way of ensuring social learning among more senior planners. Although the initial impetus for this project was provided at a high level of municipal planning, the NGOs that ran the project were able to organize a series of meetings between senior planners and community members as the pilot projects unfolded. This meant that communities provided input into subsequent urban greening initiatives and senior planners incorporated public participation as a key component in future years. Therefore, participation was the key mechanism whereby urban management plans were able to adapt to local needs and changing circumstances. Participation was what allowed the project to be adaptive in this case, because it brought different viewpoints, problems, and goals into the arena for discussion. As the opportunity for participation was both offered and taken up, it resulted in more democratic solutions.

Clearly, one key ingredient in the success of this project was the scale at which it operated. The green spaces that communities planned were quite small; the largest area was less than 1500 m². Sites were sufficiently small to allow communities to come to grips with problems, goals, and indicators, and because the land being worked on was marginal, community greening activities did not threaten anyone. As such, the small scale in the Bangkok project helped the adaptive management activities. Also, the TEI was respected by both community members and senior officials alike. This meant that staff members were in the rare position of being able to facilitate dialog and two-way feedback across groups and institutional levels. A similar process evolved with Indigenous Vegetation Project staff in the Botswana case study, although work needs to continue to ensure that community empowerment goals are realized. The situation was different in the Austrian case study, as the perceptions of the various "opponents" were known, but no consensus conducive to environmental protection could be achieved in the early stages of the process. Farmers, particularly, were not prepared to accept any financial losses in exchange for environmental protection. Political institutions reflected the divide in environmental regulation and agricultural policies in different agencies and ministries. Change at the local level required accompanying change within higher institutional levels, as well as across institutional boundaries. Participation could only work effectively in an appropriate institutional framework, with the political will, and wider public values conducive to environmental protection.

These case studies display how the complexity associated with participation is scale dependent, and real challenges exist with the scaling up from successful local-scale studies to projects of wider significance to national policies (cf. Roling and Wagemakers 1998). Effective participation of local stakeholders typically involves a trade-off between the scales at which adaptive management can operate. Involving local stakeholders across wide spatial scales can be prohibitively time consuming and expensive. Transferability and comparability of results between communities and districts may be problematic, particularly if results are context specific. If the adaptive management paradigm is to tackle cross-boundary issues in a way that is sensitive to local needs and values, then these issues must be addressed. By using a combination of methods, the Botswana case study showed how it was possible to identify land degradation hotspots at a national scale using expert opinion maps combined with evidence from remote sensing and ecological and economic studies. Using these methods, degradation assessments at coarse spatial scales can be rapid and cost effective. However, to interpret an assessment in an appropriate environmental and socioeconomic context, it is essential to supplement this information with participatory and ecological data from finer spatial scales. Such participatory ecological work with communities in degradation hotspots was able to provide context-specific evidence for land degradation that took local perspectives into account. Given the multi-dimensional, dynamic nature of land degradation, assessments that do not consider local interpretations often neglect to capture the complexity of the problem or fail to provide results that are meaningful and useful to land managers. The Botswana case suggests that the participation of scientists at a range of scales and the combination of participatory methods with other methods can help to overcome the trade-off between effective participation and crossing scales.

Our case studies also provide evidence that multi-stakeholder participation can play a very important role in shaping on-the-ground projects, but can also feed information back to policy makers so that future policies can be more appropriate. Although the stakeholders in our case studies participated in projects initiating from higher institutional levels, feedback and learning acted as vehicles that shaped both the local system and broader management context. This is because learning was both horizontal (between stakeholder groups) and

vertical (fed back to higher institutional levels) (Olsson et al. 2004), as local perspectives were introduced to higher levels through the iterative processes that took place. Nevertheless, our experiences suggest that achieving such feedback across institutional levels requires an agent or institution acceptable to all groups who can ensure that this sort of dialog does take place. For example, in the Botswana case, this role was assumed by the lead researcher, who facilitated the learning process; in the Thai case, TEI and ICSC staff took on this role. Without these key “mediating” players, it is unlikely that these projects would have had the successes they did. It is here that the “outside” development researcher faces real challenges and must ensure that strong institutional support for the work exists in order to avoid the failings of participation that are increasingly voiced (e.g., Cooke and Kothari 2001).

In considering whether power sharing was achieved, our cases all show that, unless stakeholder identification and selection are explicitly considered at the outset, there is a danger that adaptive management only engages the “usual suspects;” that small but vocal group of stakeholders who are already widely engaged in research and policy debates. This may reinforce the marginalization and exclusion of groups whose voices are rarely heard, thus limiting social learning. This became clear in the Austro-Hungarian case. In the 1960s, when the idea for the park first emerged, people felt that their livelihood options were being threatened and that their views were not heard. Therefore, it marked an important step when authorities began to involve local people, as it devolved a degree of power. Nevertheless, many resource management exercises refer casually to stakeholders as if their existence and identity were self-evident. In practice, stakeholders are both self-identified and construed as such by others. Some are associated with formal organizational roles and interests; others are not. There is a dialectic between problem definition and stakeholder identification. Consequently, there is often some circularity in identifying a (preselected) group of stakeholders for an area and asking them to define its problems. Should the issues identify the stakeholders? If so, how do we know we are focusing on the most relevant issues? Alternatively, should the stakeholders identify the issues? If so, how do we know the right stakeholders are included? Our case studies provide examples of both approaches, each resulting in different challenges and successes.

In each of our case studies, the projects were conceived by a small group with a clear vision for the future. Ultimately, it was the conceptualization of “participation” of these groups that initially played out the start of the adaptive process, as planning is not an objective process and those initiating the projects are not neutral (McLain and Lee 1996). However, once the vision was established (and funding or political support obtained), each case highlights the role for participatory styles of management, broadening ideas about who constitutes a decision maker, and using a variety of techniques to allow different values to be shared and acceptable trade-offs to be reached. It also allowed different groups to insert themselves into the process at different stages, and once part of the process, people could change the ways in which they participated. For example, in the Thai case, once funding had been obtained by a small group of international staff, communities were engaged to begin planning and managing the project. The role of the community evolved from being a “target population” to being “active participants” and “decision makers,” as their goals, priorities, and knowledges shaped the path the project followed.

In none of the cases could everyone be involved at all stages of the process. For example, one of first steps in the Thai study was to appoint community working groups of a manageable size that were responsible for planning, implementing, and monitoring plans. In the National Park case, which operated at multiple scales, stakeholders were encouraged to form groups to represent them at the negotiations that helped to establish the Park. This also happened in Botswana where researchers, assisted by key informants from the local community, used stakeholder analysis and wealth ranking to select a representative sample of stakeholders. Representation is a necessary component of participatory projects, as it is difficult to imagine diverse communities having all the necessary skills, time, and capacity to activate a major environmental management plan. Nevertheless, it requires the stakeholders to take up the opportunity to participate. Whilst questions of representation, democracy, power, and legitimacy will always emerge when one person or group represents other people or groups, the democratic procedures for selecting stakeholders as followed in our case studies deliberately aimed to minimize these issues.

One important lesson from our case studies is that, although participation will generally be deemed necessary for substantive or pragmatic reasons by project initiators at various stages of the process, the reasons for participation will generally be interpreted differently by different participants. This was the case in particular with the trans-boundary National Park study, as the participatory process emerged from decades of environmental activism by NGOs and local residents who had a strong normative justification for why they should be involved.

Monitoring and evaluation are clearly activities where broad-based participation is absolutely necessary, as shown by the Botswana case where the participatory process was developed, applied, and refined so that it could be used in other locations. Two-way communication and information flows were paramount in this process, as it was the people that participated in the research who were also the end users of the resulting tools that were developed. Their participation in monitoring was, therefore, empowering, as well as pragmatic. In the Botswana case study, synergy was also found between the knowledges of communities and “experts,” further supporting participation as a step toward social learning between groups. The approach allowed the boundaries between expert and local knowledges to be questioned and, despite being built on different logics and epistemologies, the identification of common ground enabled knowledge integration. Along with the Austria–Hungary case, the importance of social learning as an outcome of participatory processes is emphasized. New knowledge and collective understanding were generated through the capture of different interests, values, experiences, and beliefs of the participants, ultimately leading to more inclusive and empowering management. The reasons for and means of involvement adapted from stakeholders shaping the park to residents, tourists, and businesses being educated and engaged to co-exist alongside vulnerable ecosystems.

Each case study used a variety of different mechanisms for participation and these adapted in parallel with the projects. Education and planning days in the Thai study saw communication and consultation evolve into more participatory processes. In Botswana’s rangelands, participatory mechanisms included focus groups, semi-structured interviews, and the production of informative documentation developed through participatory

means. Again, this combined consultation, communication, and participation. It was in the establishment of the trans-boundary national park that the broadest range of mechanisms was used. These included: encouraging the formation of shared interest groups and active participation in civil society; consensus panel meetings at both local and government levels; and documentation and information provision through print and other media, including school curricula. Once more, this shows elements of communication, consultation, and participation, culminating in an overall process of social learning.

CONCLUSION

This paper has examined the role of participation in three different adaptive management projects. It has critically reflected upon the ways that stakeholders participated within the adaptive cycle, and has shown that, although adaptive management offers the potential for more democratic management through the involvement of different groups, it can still remain autocratic at some stages of the adaptive cycle. Public participation can take many forms and our case studies illustrate how participatory approaches must be developed according to the management context in which they are to be used. They must also be applied flexibly if they are to meet the goals of adaptive management and democratic decision making. Diverse stakeholders have changing needs and priorities, and different objectives may require different approaches to participation within the same project (see Tables 3–5 and Figs. 1–2). Also, different voices may need to come through at different stages of the adaptive cycle for shared understandings to develop. Maintaining a flexible view of participation is, therefore, paramount in creating the conditions for this to take place. Types of participation in our case studies ranged from consultation (seeking views on predetermined issues), to engagement (entering a mutual dialog where both parties are involved in setting the agenda and the initiator seeks a deeper level of understanding), to devolution (where full decision-making power was transferred to participants). The most democratic forms of participation, however, facilitated social learning and maximized the opportunity for information flows between stakeholders.

One pattern emerging from our paper is that participation needs to be flexible, not only to meet

project phase objectives, but also to allow for context-specific needs. For example, reflection on the learning process in the Thai case resulted in special consideration being given to ensuring that women were not marginalized. This led to the enactment of new participatory mechanisms and the facilitation of new platforms for social learning that had not been envisaged at the start of the project. In this instance, institutional responsiveness was vital in allowing participation to remain flexible and for meeting changing needs. This required information flows and learning to be horizontal (among groups) as well as vertical (among institutional levels) (see Olsson et al. 2004).

The diversity of stakeholders involved inevitably influences the success of a participatory project, as does their representativeness in terms of the issue or system concerned. However, regardless of the power balances between groups, management efforts need to be oriented toward developing joint understandings by finding shared perspectives to help bring different knowledges together. This requires more than simply selecting the technical means by which information can be transferred between stakeholders; it requires a flexible conceptualization of participation. Any form of social learning requires the consideration of epistemological questions about how knowledges are developed, linked, and validated (Berkes 1999, Berkes and Folke 2002), and ways to minimize trade-offs between groups need to be found. So, although it is important that different knowledges, values, and perspectives are considered and combined, consensus plays an important role. It requires the collection, assimilation, and understanding of a variety of information sources, as well as learning and the negotiation of shared meanings by everyone involved. This is another of the key lessons to emerge from the case studies. Time needs to be spent developing shared understandings of the system to be managed. This should involve the groups and individuals who know the system best, who are embedded within it and who hold a stake in what happens to it. With iterative input from stakeholders in this way, we have shown that it is possible to identify and adapt participatory approaches for successful adaptive management.

We have questioned the trade-offs between effective participation from local stakeholders and the scales at which adaptive management can operate. Involving local stakeholders across wide spatial scales can raise issues of transferability,

comparability, time, and expense, making the scaling-up of results from participatory research problematic. However, by facilitating the participation of different groups at a range of scales, using a variety of methods, this trade-off may be minimized.

The problems addressed in this paper are as much scientific, social, and political challenges as they are technical and managerial. However, by thinking about social learning as a framework for knowledge generation and a project goal, participation can be both socially meaningful and environmentally beneficial (Roling and Wagemakers 1998). Indeed, lessons from the case studies show the need to emphasize the learning process for all participants, and also to maintain regular two-way communication between all stakeholders during monitoring and evaluation. We conclude, nevertheless, that such discrete participatory projects only go some way toward reversing the technocratic elements of social-ecological system management, regardless of the scale of the project. Further research is needed to address the shortcomings and successes of processes of more democratic and participatory environmental governance, but also to critically reflect on the links between communities, science, institutions, knowledge, and power. Adaptive management offers one way to potentially make environmental management more democratic. However, to ensure meaningful participation, ways to maximize social learning need attention, in order to engage social actors across levels to address the wide range of different dimensions within social-ecological management.

Responses to this article can be read online at:
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