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Bottom up and top down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management

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Abstract

The modern environmental management literature stresses the need for community involvement to identify indicators to monitor progress towards sustainable development and environmental management goals. The purpose of this paper is to assess the impact of participatory processes on sustainability indicator identification and environmental management in three disparate case studies. The first is a process of developing partnerships between First Nations communities, environmental groups, and forestry companies to resolve conflicts over forest management in Western Canada. The second describes a situation in Botswana where local pastoral communities worked with development researchers to reduce desertification. The third case study details an on-going government led process of developing sustainability indicators in Guernsey, UK, that was designed to monitor the environmental, social, and economic impacts of changes in the economy. The comparative assessment between case studies allows us to draw three primary conclusions. (1) The identification and collection of sustainability indicators not only provide valuable databases for making management decisions, but the process of engaging people to select indicators also provides an opportunity for community empowerment that conventional development approaches have failed to provide. (2) Multi-stakeholder processes must formally feed into decision-making forums or they risk being viewed as irrelevant by policy-makers and stakeholders. (3) Since ecological boundaries rarely meet up with political jurisdictions, it is necessary to be flexible when choosing the scale at which monitoring and decision-making occurs. This requires an awareness of major environmental pathways that run through landscapes to understand how seemingly remote areas may be connected in ways that are not immediately apparent.

Keywords: Sustainability indicators; Participatory processes; Case study methodology; British Columbia, Canada; Botswana; Guernsey, United Kingdom

1. Introduction

Methods for choosing 'sustainability indicators' to measure progress towards (or away from) social and environmental goals abound in both the academic and practitioner literature (See: Bell and Morse, 1999, 2003). These range from situations where development experts and environmental managers simply choose what they see as the most relevant indicators, to participatory processes to help communities identify their own indicators. The formalisation of 'bottom-up' community involvement in environmental management projects has been driven by past failings of 'top-down' approaches. This shift in emphasis still requires careful analysis of diverse case studies where there has been a move to involve communities in proposing and measuring sustainability indicators to analyse the extra benefits that the integration of top-down and bottom-up approaches achieve. This paper analyses the findings from three, purposefully different, case study settings where there has been a move from top-down initiatives towards greater

Abbreviations: CIDA, Canadian International Development Agency; CIT, Coast Information Team; DFID, Department for International Development; EM, Ecosystem Management; IVP, Indigenous Vegetation Project; SLA, Sustainable Livelihoods Assessment; UNDP, United Nations Development Project; UNEP, United Nations Environment Project; WA, Wellbeing Assessment.

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community involvement as the basis for improving environmental monitoring and management.

The rationale for this is simple: despite the push for community participation in sustainable development initiatives, development research and projects remain constrained by the need for quantifiable and 'objectively verifiable indicators' that allow regions to be compared (Bell and Morse, 2003). These indicators form a key element of Logical Framework Analyses that are now required by all the major national and international funding agencies (e.g. CIDA, DFID, World Bank and UNEP). However, if development experts choose indicators simply to comply with the requirements of funding agencies, then this top-down process may alienate local community members and fail to capture locally important factors. Although this sort of 'results-based management' reduces the chance for corruption, projects designed using this model do not necessarily engage community members or ensure that indicators are relevant at the local level. Alternatively, individuals from the community may be engaged to select relevant indicators, thus ensuring that locally important factors are assessed (See: Chambers, 1994a,b). Such a bottom-up approach matches the wider recognition of the need for active community participation in development projects capable of sustainable environmental management (Chambers, 1997; Pound et al., 2003). However, these processes run the risk of being time and resource intensive and may create non-standardized data that prevents regions from being compared. To explore this tension, and assess the impact that community participation is having on environmental management projects, this paper critically examines three situations where external agencies brought stakeholders together to select and choose sustainability indicators. Although the socio-economic and environmental settings of the three case studies differ greatly, each demonstrates a shift towards integrating participatory 'bottom-up' approaches with conventional 'top-down' systems that had failed to realise sustainable environmental management in the past.

2. Background

The literature proposes a bewildering array of tools and processes to help measure progress towards sustainability. These range from highly aggregated top down indices such as the Environmental Sustainability Index, designed to facilitate cross country comparisons of environmental performance (Global Leaders of Tomorrow Environment Task Force, 2002), to smaller scale efforts such as the ecological footprint designed to help individuals understand their impact on the biosphere (Redefining Progress, 2004). Increasingly, the highly aggregated indexes, which are the most common, have come under attack for failing to engage local communities and in so doing, reinforcing the biases of donor and development agencies (Morse, 2004; The Ecologist, 2001).

Using community participation as a way of selecting relevant indicators is proposed to provide a number of key benefits (Bell and Morse, 1999; Pretty, 1995). The first benefit is pragmatic: since it is impossible to ensure that indicators chosen by 'development experts' will be relevant to local situations, local input is necessary to make sure indicators accurately measure what is locally important. Regular community input should also ensure indicators evolve over time as circumstances change (Carruthers and Tinning, 2003) and help allow projects to continue after funding stops (Freebairn and King, 2003). The second reason is that preliminary research shows local engagement may help build community capacity to address future problems, and that this may be more significant than the results of the actual development projects. For example, in community-based environmental management work in Bangkok, the act of inventorying land and identifying problems played a key educational role in the community (Fraser, 2002). This goes beyond simply identifying community relevant indicators; the methods used to collect, interpret and display data must be easily and effectively used by local communities so all stakeholders can participate in the process.

To assess the impact of participatory processes on environmental management projects, this paper critically examines three case studies where community input has been used to identify sustainability indicators. The recent move to community participation was common in all three case studies and offers interesting comparability despite each coming from radically different social, economic and environmental contexts. The first, based on forest management in Coastal British Columbia, Canada, involves a process of engaging stakeholders to identify sustainability indicators after an extended period of conflict over perceived mismanagement of local resources. The process of selecting indicators was designed to create a baseline of information so that the impact of new and improved forest management practices could be monitored. The second case study is in Botswana where the United Nations Environment Programme and Western-trained academics worked with Kalahari pastoralist communities to better understand desertification by identifying key indicators of sustainable rangeland management. In this case, there was little tension between stakeholders (compared with the Canadian situation); however, poverty and environmental degradation were more acute. The final case study comes from the States of Guernsey, in the United Kingdom's Channel Islands, where the government decided to establish key indicators to monitor the overall effect of economic transition and globalisation in a small and relatively homogenous community.

Although there are many differences between the case studies, comparison and analysis of such different regions is appropriate because local issues such as poverty (are people too poor to engage in long-term management?), biophysical

issues (what are the major environmental issues in a region?) and the structure of the society (do some groups depend on the environment for different resources?) will affect the manner in which local residents engage in the integration of past top-down and participatory approaches. As a result, the three case studies represent a wide range of experiences in how participatory processes structured around identifying and monitoring sustainability indicators may affect environmental management.

3. Case studies

3.1. Case study one: Coastal British Columbia, Canada

The Coast Temperate Rain Forest, which extends throughout the Pacific coastal region of British Columbia, Canada, is rich in biodiversity, cultural and natural resources. Trees grow well in this mild wet region, helped by a lack of major natural disturbances such as insect outbreaks and wildfires. The size and quality of the trees in coastal rain forests supported the development of a thriving forest industry, which has played an important role in the economic development of the region for the past century. Ongoing harvesting activities, planned in a top-down manner by forestry companies and involving extensive clearcutting, were observed over time to be associated with environmental problems. For example, it has been shown that the frequency of landslides is nine times greater on harvested sites than in undisturbed forest areas in the region (Jacob, 2000). The failure of the top-down approach to prevent significant erosion on clearcut areas spurred experimentation with alternative planning approaches that involved greater community participation. These failures also attracted the attention of eco-tourists and environmental groups, who have fought to protect the remaining old-growth forests from continued logging. The coastal rain forests of BC are also the traditional territory of a number of aboriginal bands or First Nations, who have historic, spiritual, and cultural ties to the land. These three stakeholder groups presented all necessary elements for the serious conflict that erupted over the use of forest resources in the early 1990s. Known as 'the War in the Woods', the conflict began when environmental groups and First Nations communities blocked logging roads to prevent clearcutting in the old-growth rainforests of Clayoquot Sound, on the west coast of Vancouver Island. Years of acrimony led the provincial government to negotiate a process explicitly recognizing that community input and scientific expertise needed to come together to develop long-range management plans that would meet both economic and environmental goals. To do this, a new group called the Clayoquot Sound Scientific Panel was established to make land use recommendations.

To develop a new strategy for land and resource management in Clayoquot Sound (and ultimately for the rest of British Columbia), the Scientific Panel worked closely with various stakeholder groups including local populations (both First Nations and non-aboriginal), industry, and government, as well as international environmental groups such as Greenpeace. To a large extent, these stakeholders were self-identified through their participation in the conflict. To bring stakeholders together, the Scientific Panel decided to utilize 'Ecosystem Management' (EM) as a common basis for resource planning exercises (for a brief introduction to the concept of EM see: Christensen et al., 1996). Ecosystem management has been described by Grumbine (1994) as a concept that balances ecosystem functions and human requirements in the stewardship and utilization of natural resources (Yibarbuk et al., 2001). EM, therefore, represents a shift from a single-species management, which focuses primarily on economic demand for specific resources such as timber, towards a more holistic approach that recognizes the intrinsic values and interconnected nature of ecosystem function and human needs (Blockstein, 1999).

To apply EM, stakeholders needed access to large amounts of information to make locally-relevant, science-based decisions, thereby preventing further conflict. To do this, the Coast Information Team (CIT) was established as an independent, peer-reviewed scientific body that would collect, collate and analyse data in conjunction with local stakeholders. Among the tools that the CIT employed was the 'Wellbeing Assessment' methodology, pioneered by Prescott-Allen (2001). This combines ten categories of social and environmental indicators (five of each) into a single matrix to provide a rating of community, regional or national wellbeing (a graphical representation of the process used to conduct the wellbeing assessment is provided in Fig. 1). This tool balances and contrasts social and ecological factors by informing resource planners about the environmental implications of human needs and the impact of land-use decisions on human populations. The wellbeing assessment is designed to actively work within the principles of EM by determining the goals for resource management, and to provide the necessary mechanism for local-level involvement.

To conduct this wellbeing assessment, the CIT establisheda process that brought together scientific experts and community members to agree on what data to collect and how data should be interpreted. This consultative process was designed to allow stakeholders the opportunity to comment on and shape each phase of the assessment, including indicator selection and analysis. The first step was for members of the CIT to meet formally with 'technical committees' that were drawn from the resource planning bodies (such as government departments) and made up of representatives from First Nations, other local communities, government, and forestry companies. The purpose of these initial meetings was to decide on relevant variables that would be inputted into the various categories that make up human and environmental wellbeing. From the end of 2002

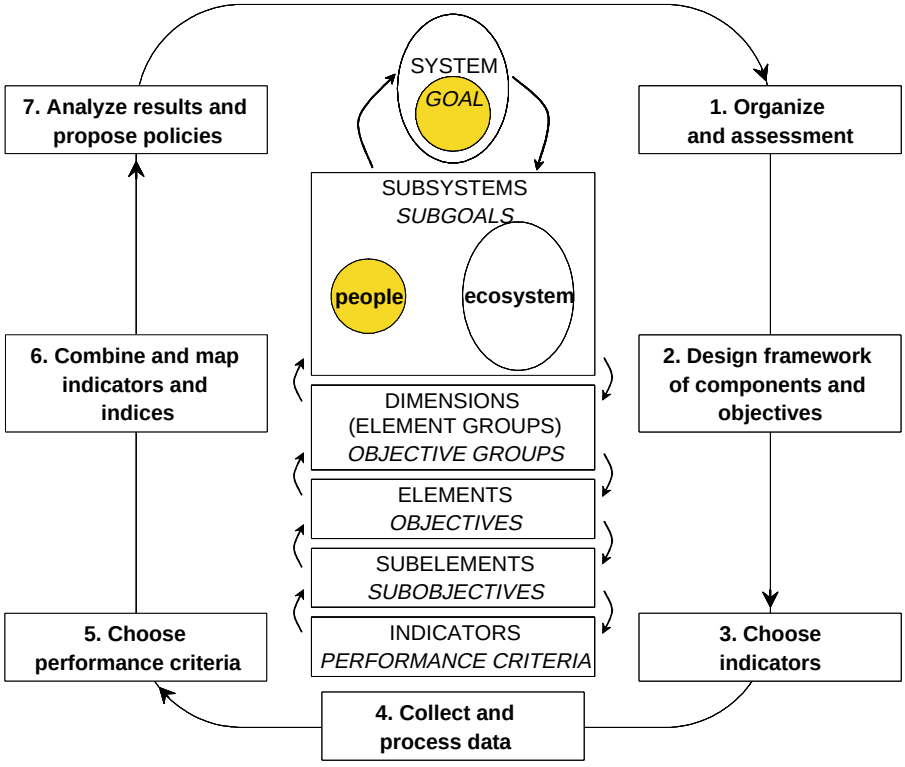

Fig. 1. Outline of the 'Wellbeing Assessment' used to engage communities in forestry planning in Western Canada. Steps 1-7 (listed on the outside of the figure) identify the steps in the community consultation process. The figure inside the diagram outlines how indicators are aggregated into a final overall assessment. Adapted from (Prescott-Allen, 2001).

until the spring of 2003, the Coast Information Team held a series of 25 meetings with different stakeholder groups across the coastal region of British Columbia. Based on this input, the CIT then hired students and researchers to collect data on the indicators chosen. After data had been collected and inputted into a database, the CIT returned to the technical committees, who reviewed the information to determine what specific indicators they felt represented environmental and human wellbeing in their regions. By comparing each of these indicators against the provincial, national, and international averages, the technical committees were able to assign scores for each indicator, categorizing each from excellent (given a score of 100%) to poor (0%). These scores were then averaged across the five human wellbeing categories (health and population, wealth, knowledge and culture, community, and equity) and five ecosystem wellbeing categories (land, water, air, species and genes, and resource use) to make up the final wellbeing assessment.

In many cases, the technical committees initially selected indicators that could not be measured (due to issues like restricted data availability). Instead of ignoring these indicators, the CIT decided to maintain them within the Wellbeing Assessment as a way of highlighting key knowledge gaps. For example, out of 141 social indicators that the technical committee selected, 15 could not be quantified. Thus, over ten percent of the indicators that key stakeholders deemed important were unavailable to policy makers. Table 1 shows the distribution of these data gaps. This illustrates that health, wealth, and education had the best data to support them. On the other hand, within 'culture,' almost half of the desired indicators could not be assessed. These gaps seem to have had a mixed impact on the outcome of the wellbeing assessment. Although they reduce the overall quality of the final assessment, this provide a clear signal to policy makers that valuable data is missing and needs to be collected.

Overall, the role of public participation in this exercise was a mixed success. Ostensibly, the wellbeing assessment was intended to provide a realistic measure of the wellbeing of communities and ecosystems on the coast of BC that would provide concrete guidance to policy makers. Given the significant data gaps, it is not clear how useful the final output actually is. In addition, the involved process of community consultation proved extremely time-consuming and expensive. The Wellbeing Assessment took significantly longer than originally expected, with the final report being submitted almost one year late. The missed deadlines led to cost overruns; this, combined with unwieldy data tables and skewed results meant that by the time work on the assessment was complete, the utility of this tool was diminished. Towards the end of the process, there was also a significant shift in political power with the left-leaning New Democratic Party decimated in a provincial election in

Table 1
Breakdown of categories that make up the 'Human Wellbeing' of Prescott-Allen's Wellbeing assessment, showing the number of indicators community members chose for each category, the number of indicators for which data could not be collected, and a sample of selected indicators provides for illustrative purposes

Category/Dimension	# of indicators	Gaps (% total ind.)	Selected examples
Health and Population	35	0 (0%)	Life expectancy at birth, mortality by cardiovascular disease, population fluctuations (migration)
Wealth	53	1 (2%)	# businesses with employees, aggregate total income, *access to economic opportunity*[a]
Knowledge and Culture	32	5 (16%)	% attending school full-time, % employed in arts and culture, *# of cultural spaces at risk*[a]
Community	21	9 (43%)	% of volunteers, # of homicides/attempted murders, total women in government, *corruption of local officials*[a]
Equity[b]	63	1 (<1%)	Aboriginal life expectancy at birth, female aggregate total income, % of non-aboriginal population attending school full-time, total women in government

[a] Indicates a data gap.
[b] As the data was collected, it became evident that some data measured health and population, but could also be broken down by gender and/or aboriginal status. Thus, some indicators were used twice: once in the context of the entire population, and once for an examination of equity issues. The total number of indicators therefore reflects a summation of the first four categories, while the equity category reflects a selection of indicators from these categories rather than new indicators.

the spring of 2002, being replaced by a fiscally conservative right wing government. In all likelihood (though this is difficult to prove at the present), this change also undermined the influence that the wellbeing assessment might have had.

Despite these problems, the CIT's efforts on the coast of British Columbia cannot be considered a failure. The process of engaging local residents on the technical committee alongside experts in the fields of social science and ecology resulted in a two-way learning experience that was highly beneficial to both parties. The technical committees served as a neutral forum, in which normally disparate groups, such as the forest and the tourist industry, might come together and discuss issues. This allowed ecosystem management goals to be determined in full light of the local human requirements. The wide variety of interests that were present on these committees also served to broaden the perspective of individual participants. Thus, the process that was undertaken leading up to the wellbeing assessment itself was a highly valuable contribution to the planning process. The mechanism of independent, peer-reviewed data collection combined with multi-stakeholder dialogue proved fruitful, and provided community members a level of confidence they did not have before the process began. In addition, it provided a forum to allow traditionally disenfranchised residents (specifically some of the First Nations communities) a direct forum through which to engage policy makers. Therefore, the process that involved selecting and analysing indicators was an effective method of introducing the informal desires of local stakeholders into the formalized planning process.

3.2. Case study two: Kalahari Rangelands, Botswana

Since independence in 1966, the Government of Botswana has privatised large areas of communal grazing land in the Kalahari by fencing off land for use by commercial cattle producers. Many environmental assessments show that this top-down policy, partly designed to reduce degradation concerns associated with overgrazing of communal rangelands (Tsimako, 1991), has actually increased degradation problems on both commercial ranches (e.g. Dougill et al., 1999; Perkins and Thomas, 1993) and in the remaining communal lands (See: Cooke, 1985; Thomas et al., 2000; White, 1993). Problems have emerged as wealthy private landowners increase cattle stocking densities by drilling more deep boreholes to tap groundwater reserves giving cattle greater access to drinking water. This land-use intensification has increased 'bush encroached ecosystems' found close to waterpoints, where thorny shrubs such as *Acacia mellifera* out-compete grass species through a combination of intense grazing, drought and a reduction in the frequency and intensity of fires that traditionally maintain grass dominance (Dougill et al., 1999). Since these bush encroached ecosystems have low biodiversity and provide little in the way of fodder for cattle, this presents a disturbing trend. There is a real concern that a positive feedback cycle exists whereby privatisation leads to more boreholes, which leads to bush encroachment, leading to a loss of productive rangeland for cattle, leading landowners to drill additional boreholes in remaining grass dominant areas that then rapidly become bush encroached. This is especially troubling since the ecological literature suggests that a dryland's ability to support livestock depends on maintaining a diverse and heterogeneous landscape in terms of fodder resources (Scoones, 1995) and that bush encroachment can only be checked by fire events (Scholes and Walker, 1993).

In light of these trends, and the limited impact that ecological research has had at the community and policy level, both ecological and social development researchers in the region have started using community participation to

help analyse these issues and to suggest land use policy advice (e.g. Chanda et al., 2003; Phuthego and Chanda, 2004; Reed and Dougill, 2002; Sporton and Thomas, 2002; Thomas et al., 2000; Twyman, 2000). Increased levels of community participation in environmental monitoring is also supported by the Government of Botswana since this is a requirement of both the UN Convention to Combat Desertification and the UN Convention on Biological Diversity, which Botswana ratified in 1996 and 1995 respectively. This support for bottom-up participatory initiatives is also prevalent throughout the Ministry of Agriculture where seminars have openly discussed the past failings of top-down, rangeland fencing and commercialisation focused policies. To support community participation, the Botswana Ministry of Agriculture is now home to the UNEP-funded Indigenous Vegetation Project (IVP) that aims to develop models for the conservation of biodiversity and rehabilitation of degraded rangelands, and to develop sustainable management systems using indigenous knowledge. To accomplish this goal, researchers have worked with local community members to develop sustainability indicators in three sub-Districts identified as severely degraded.

The process used to harness community participation is summarized in Fig. 2 and uses community volunteers to develop a series of indicators that identify environmental degradation so that communities can then monitor environmental change. Initially, this model was developed in study sites in the southern Kgalagadi District where scholars used community participation to study the process of bush encroachment with communities along a 100 km transect between Tshabong and Bray (Reed and Dougill, 2002). More recently, this approach has been applied to the Indigenous Vegetation Project study sites in the Bokspits region of South West Kgalagadi District and the mid-Boteti region of Central District.

The methodological approach starts with household-scale livelihood analyses in which livelihood constraints and opportunities are identified and discussed. Changes in natural capital (or environmental resources) form a key part of such discussions and respondents in all areas identified threats caused by both long-term rangeland ecological change and from recent drought events. The approach was based on a 'sustainable livelihoods analysis' (SLA) that involved semi-structured interviews to examine social, financial, physical, human and natural capital assets used by households to ensure livelihood security (Scoones, 1998). SLA analyses have been used widely throughout Southern Africa to examine the links between land use decisions and ecological changes (see Scoones and Wolmer (2003) for a recent review). The SLA approach provides a mechanism to facilitate an extended discussion between experts and community members of rangeland degradation indicators and how these indicators have changed through time, specifically in association to rainfall variations, policy changes and market shocks. These iterative discussions between the researcher (who has both ecological and social science training) and local residents provide a range of sustainability indicators and management strategies that are then discussed further in community focus groups and with agricultural extension workers from across a district. It is the iterative nature of the community-science dialogue that is central to establishing a more diversified understanding that combines scientific and local knowledge. The framework

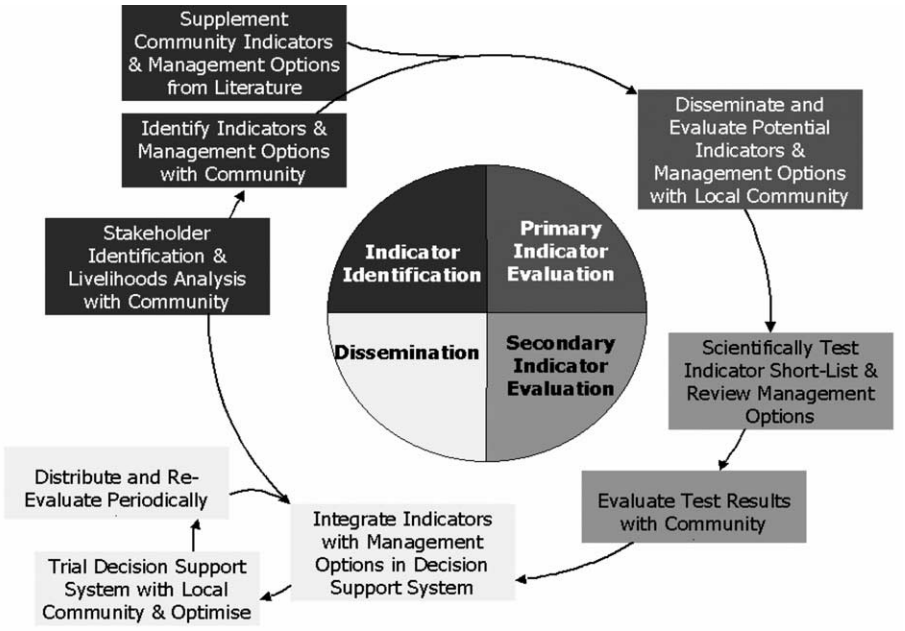

Fig. 2. Outline of the steps to engage community members in developing indicators of rangeland degradation in the Kalahari region of Botswana. The circle in the centre identifies key stages in the process, while the major steps in the process are identified in the outside circle.

outlined in Fig. 2 builds on the view that community empowerment can be enabled by using local knowledge as the starting point in research and then using western scientific tools as a means of extending the local findings to wider areas for environmental management (Forsyth, 1996; Nygren, 1999). The process was developed over an 18 month timeframe initially in South Kgalagadi sites. The Framework shown in Fig. 2 was then applied in a two week timeframe at the other study sites with the use of the lead researcher as well as the Government extension service staff who conducted interviews after an initial training session. This ensures widespread community participation (over 50 interviews in each region) in a relatively short timeframe.

The initial semi-structured interview stage of the research produced long lists of indicators based on local knowledge in each of the three study sites (83 indicators provided in South Kgalagadi; 57 in South West Kgalagadi; and 75 in mid-Boteti). This displays the wealth of information available in pastoral communities and also the breadth of this information with indicators covering vegetation changes, soil attributes, livestock condition, wild animal and insect communities and socio-economic conditions (Table 2). Evaluations of the utility of each of the different indicators was then conducted in two stages (right hand side of Fig. 2): (1) with communities in focus group meetings; and (2) in scientifically led appraisals based on field monitoring at sites of different degradation status and in discussion between ecological researchers and agricultural trained extension workers. This two-stage process was designed to examine the 'accuracy' and 'ease of use' of each of the indicators proposed before testing them empirically. Focus group meetings were held in three communities within each site and ranked indicators on matrixes to assess each indicator in terms of its perceived accuracy and ease of use. Group discussions were also initiated in these meetings on what communities perceived as 'early warning indicators' that were defined as 'the first signs that land is going to lose its productive potential due to human use.' Discussion on these early warning indicators proved valuable in linking environmental monitoring to the management decision-making process. This process produced significantly shorter lists of agreed early warning indicators at each site (9 indicators agreed as useful by at least 2 focus group meetings in South Kgalagadi; 12 in South West Kgalagadi and 14 in mid-Boteti).

Early warning indicators were evaluated using appropriate scientific sampling at sites of different degradation status assigned by using a grazing gradient sampling approach with degraded sites sampled close to boreholes and with degradation viewed as declining exponentially with distance from borehole (Perkins and Thomas, 1993). The involvement of key informants from communities and extension workers in the ecological sampling process enabled a greater depth of management information to be obtained from land users in terms of their use of different ecological habitats at different times of a year, and between years. This research, in a similar vein to previous studies elsewhere in the Kalahari (Thomas and Twyman, 2004; Twyman et al., 2002), highlights that communities have spatial and temporal awareness of the environmental variability that typifies dryland environments. It also supports the conclusion that conventional expert-led indicators of degradation (e.g. % cover of palatable perennial grasses) over-simplify degradation assessment by leading to polarised views of either 'good or bad' rangeland (Thomas and Twyman, 2004), rather than focusing on the management adaptations to ecological changes that retain overall pastoral system productivity. Our research highlights the need for the process of integration of local knowledge, scientific research and policy support to be initiated from the bottom-up (i.e. putting the pastoralist first). This is particularly true as regional scientific views of grass fodder nutritional value (e.g. van Oudtshoorn, 1999) provide only a single value for any single grass species, compared to the more detailed views of pastoralists on the need to retain a suite of grasses in rangelands that can provide benefits at different times in local management decision-making. Our findings also display that setting a project goal of an agreed list of scientifically applicable and policy relevant indicators offers a mechanism to involve researchers and policy-makers in indicator evaluation and thus to achieve the hybrid knowledge conceptualised in academic debates (e.g. Thomas and Twyman, 2004). The scientific evaluation stage successfully tied each of

Table 2
Breakdown of types of indicators identified by communities in initial semi-structured interviews in three Botswana study sites (full findings reported in Reed and Dougill; 2002 and Reed, 2004)

Category/Dimension	% of indicators in South Kgalagadi	% of indicators in South West Kgalagadi	% of indicators in mid-Boteti	Selected Examples
Vegetation	54	58	39	Decreased grass cover; Increased *Acacia mellifera* cover; Increased weed/creeper cover
Soil	16	9	19	Soil becomes 'softer'; increased incidence of dust storms
Livestock	21	11	19	Declining livestock weight; increased rates of botulism
Wild animal and insects	5	14	17	Decreased abundance of small antelope species; decreased abundance of harvester termites
Socio-economic	4	9	7	Increased household expenditure on food; increased out-migration

the agreed early warning indicators to management suggestions for the specific region and guided the production of rangeland assessment guides that will facilitate community monitoring of rangeland condition. The rangeland assessment guides produced in the selected communities in each region will be distributed more widely by the Ministry of Agriculture to attempt District-scale adoption of participatory rangeland monitoring and management.

The participatory methodological framework developed in this case study (Fig. 2) has successfully engaged a wide range of stakeholders (communal and commercial pastoralists, rich and poor, extension workers, researchers and policy-makers) in the identification and evaluation of degradation indicators, resulting in the production of three sub-District level rangeland assessment guides. The differences in the lists of key 'early warning degradation indicators' between the three sub-District regions (Table 3), and between conventional scientific indicators (Field, 1978; van Oudtshoorn, 1999), displays that the bottom up indicator development process can be usefully integrated with participatory, expert and scientific evaluation to provide shorter, sub-District specific lists of indicators that can then guide wider community-based rangeland monitoring and management. The impact of assessment guides on longer-term livelihood and environmental sustainability remains to be seen. However, preliminary indications suggest that the process has aided community empowerment and provided a formal framework that the Ministry of Agriculture could use to move to the participatory methods of environmental monitoring and management advice recommended by international environmental conventions.

3.3. Case study three: The states of Guernsey

The Island of Guernsey is a British Crown Dependency, located 30 miles north west of France in the Bay of St. Malo. It has a land surface area of 63 km^2 and a population of approximately 60,000. In the last fifty years, Guernsey has undergone a series of socio-economic transitions beginning after the Second World War when the traditional fishing industry began declining and the Island established a successful horticulture and floriculture industry. These industries lost their competitive advantage after the UK joined the European Union in 1972 when cheap imports from countries such as the Netherlands first entered the UK market on a large scale. More recently, Guernsey has emerged as an international finance centre and, in a matter of years, its financial services have superseded traditional industries with off shore insurance and banking now accounting for 45% of the Island's total annual income (World History, 2004).

In 2001, the Island Government (The States of Guernsey) decided to establish a variety of sustainability indicators to track quality of life, and to form part of a monitoring and evaluation cycle, using the indicators to help guide the 'Policy and Resource Plan' that sets out the Islands annual strategic planning policies. Developing the indicators began in 2002 when representatives of the States of Guernsey spent a year engaged in public and private consultation both

Table 3
Early warning degradation indicators agreed by community focus groups in Botswana study sites

South Kgalagadi	South West Kgalagadi	Mid-Boteti
Vegetation indicators		
Decreased grass cover	Decreased grass cover	Decreased grass cover
Increased proportion of trees dropping leaves	Trees and bushes stunted	Trees and bushes stunted
Decreased abundance of trees	Decreased abundance of trees	Decreased abundance of trees
Increased abundance of unpalatable grasses	Decreased abundance of palatable creepers	Increased quantity of dead trees
Decreased abundance of palatable grasses	Decreased abundance of veld fruits	Decreased rain use efficiency of vegetation
Increased abundance of unpalatable forbs	Increased abundance of *Rhigozum trichotomum* bush species cover	Increased ability to see through vegetation stands
		Decreased availability of thatching grass
		Decreased grass height
Soil Indicators		
Increased soil looseness	Active unvegetated dunes	Softer, more powdery, appearance
	Increased soil looseness	Increased incidence of dust storms
	Reduced soil moisture retention (soil dries out faster)	Reduced soil moisture retention (soil dries out faster)
		Increased water infiltration rate
Livestock indicators		
Reduced livestock weight	Livestock walk further from water	
Increased incidence of botulism		
Wild Animal and Insect Indicators		
	Decreased abundance of game and predators	Decreased abundance of game and predators
	Decreased abundance of grasshoppers	
	Increased abundance of harvester termites	
	Increased abundance of 'malelekatou' ants	

on and off the Island to establish 'headline' indicators that were to reflect quality of life across social, economic and environmental dimensions. The process of engaging public participation was based on Local Agenda 21's call for widely based consultations with community stakeholders. However, public interest and commitment to the sustainability indicators proved difficult to maintain, reflecting the traditional scepticism of many small communities to policy based issues that are seen to originate from outside their own locality (McAlpine and Birnie, 2003). The reluctance of the local community and business to fully engage in the development of the sustainability indicators meant that most of the initial work was driven by the States of Guernsey's Policy and Research Unit, who eventually managed to reduce the 112 proposed headline indicators down to 17 that were themselves broken into a total of 51 sub-categories or 'strategic indicators' (see Table 4). Data was then collected for these strategic indicators, and reported in an annual publication titled 'Sustainable Guernsey' and made available at http://www.gov.gg/esu/.

Given the top-down way that the initial indicators were chosen, the Policy and Research Unit decided not to set the strategic indicators 'in stone', but rather to allow degrees of modification as feedback was provided by Island politicians, policy users and relevant stakeholders. For example, over the past year, the strategic indicator 'changes in percentage of charitable donations,' which was initially part of the headline indicator 'Social Participation,' has been dropped. In its place, the numbers of people voting in local elections and the percentage of residents who are involved in local voluntary groups have been chosen as strategic indicators that better capture social participation. In allowing this flexibility, the Policy and Research Unit hopes that the monitoring process will gain acceptance amongst a wide variety of stakeholder, translating into public support for the process that will ultimately become a platform through which interested stakeholders will be able to contest data and contribute to refinements of the policy planning process.

Although this process is still unfolding, preliminary evidence suggests this approach is working and that a wider group of stakeholders is now more engaged than at the beginning of the process. For example, in 2002, the Research and Policy Unit was only able to collect 34 (66%) out of the total 51 proposed strategic indicators due to a lack of available data. In 2003, they established 47 (86%) of the proposed indicators thanks to extra data provided by a wider group of stakeholders who had become engaged over the previous year. By 2004, the third 'Sustainable Guernsey' report introduced 4 new strategic indicators and contained data supporting all of the 55 indicators, in other words 100% of the data required to monitor the Islands sustainability had been actively collected.

The evolution of the 'land use' indicator (Headline Indicator (HI) 15 in Table 4) illustrates this incremental data collection process. Initially, the 'land use' indicator was broken into two separate 'strategic indicators.' The first was 'building on previously developed land' and it was anticipated that this strategic indicator would measure the percentage of building completions on previously developed sites. However, data to accurately measure this was not available, and so wider consultation led to 'Digimap Ltd', a GIS based mapping company on the Island to annually measure the land area used by the built environment. The second strategic 'land use' indicator was 'land used for public amenity'. This strategic indicator was designed to measure the amount of land devoted to parks, recreation and other public amenity uses. This indicator has remained true to its original concept, but has been augmented by a number of key groups who, through the provision of extra data, dramatically increased its value to the monitoring process. These new data providers included groups such as; La Société Guernesiaise (a non governmental natural history and conservation society), Guernsey National Trust, Guernsey Water Board and the Vale Commons Parish Council. Finally, over the past two years, a new strategic indicator has been added to the 'land use' indicator that is designed to measure the quality of the land on the Island. This strategic indicator maps nitrate quantities using stream catchment data provided by the Guernsey Water Board.

Overall, the process of developing Guernsey's Sustainability Indicators was envisaged to involve local community members, in an open and transparent process designed to monitor and help steer the Islands policy planning process. Initially, a lack of enthusiasm frustrated this process and the government decided to move ahead by tasking experts, including members of its own civil service, to generate the preliminary sustainability indicators. From this preliminary iteration, this list has evolved incrementally, slowly involving an increasing number of stakeholders. In this way, although the process was instigated in a top-down fashion, developing and collecting these indicators has created a platform through which a wide range of people can express their concerns. This continuous re-development of sustainability indicators ensures that the indicators remain relevant to the dynamic needs of a diverse range of stakeholders, helping to realise Local Agenda 21's call for greater grassroots participation through 'bridging data gaps' and 'improving the availability of information'.

Developing the role of Guernsey's sustainability indicators so that they meaningfully evaluate and inform policy is a future challenge for the Island's government. The potential for this role is promising, as support within the Island's civil service and amongst its politicians is gathering strong momentum. The difficulty however is finding ways to actively engage policy formation around the sustainability indicators. This challenge requires meaningful links to be forged between the 'Sustainable Guernsey' report and the Island's 'Policy and Resource Plan' that do not instigate a reactionary policy making process, but help nurture

Table 4
Indicators chosen by States of Guernsey to monitor the Island's sustainable development

Headline Indicators	Strategic Indicators							
	SI 1	SI 2	SI 3	SI 4	SI 5	No. of SIs with data gaps		
						2002	2003	2004
H1 Population	Population trends	Immigration and emigration				0	0	0
H2 Health	Life expectancy	Cost of health care	Death rate by cause	Self Perceived Health status and well-being		0	0	0
H3 Education	Education literacy and numeracy	Education of young people	School leavers with no qualifications	Post-16 participation rates	Adult education (19yrs+)	1	0	0
H4 Social Participation	No. of people voting in local elections	Community involvement in voluntary groups				2	0	0
H5 Housing	Quality of housing	Use of previously developed land	Subsidised housing	Affordability of housing		1	1	0
H6 Crime	Recorded crime levels	Public fear of crime				0	0	0
H7 Economic Performance	National income	Island Inflation	Economic activity	Average earnings		1	0	0
H8 Energy Consumption	Amount of energy consumed	Per capita electricity consumption	Energy from renewable sources			2	2	0
H9 International Transport	Air transport	Sea transport				0	0	0
H10 Workforce Development	Workforce skills	Organisation commitment				1	0	0
H11 Biodiversity	Natural habitats and key species	Island garden birds				2	2	0
H12 Air Quality	Emissions of Greenhouse gases	Sea level rise	General air quality and roadside air quality	Noise pollution		2	2	0
H13 Water Quality	Water pollution incidents	Raw water storage analysis	Water treatment works compliance	Service Reservoir Water Quality	Bathing Water Quality	0	0	0
H14 Water Resources	Raw water storage	Properties connected to the Island's water supply	Potable water supplied	Annual water consumption	Water distribution losses	3	0	0
H15 Land Use	Land use using GIS mapping techniques	Land used for public amenity	Land quality using nitrate mapping			2	1	0
H16 Household and Commercial Waste	Household waste	Commercial waste	Materials recycled			0	0	0
H17 Local Transport	Traffic volumes	Access to public transport	Mode of travel			0	0	0

a corporate 'sustainability' framework, fed both from the 'bottom-up' and the 'top-down'.

4. Discussion

A number of key issues emerge directly out of these case studies. First, the participatory methods were good in that they helped generate long and comprehensive lists of indicators. This involved a trade off, and these processes tended to be very complicated and take a long time to complete. A second key lesson is that during the process of selecting indicators, communities became more empowered. This was probably the most significant benefit in each case. Finally, it is not clear from these cases the scale at which this kind of process works best. If this is done at too local a scale (perhaps at the community or household level) then there may be too many site-specific indicators, and it would become impossible to compare regions. It is also unclear on the best way to choose a higher level of aggregation.

4.1. Comprehensiveness versus use-ability

In general, participatory methods resulted in long and complex lists of sustainability indicators that provided a comprehensive assessment of local social, environmental, and economic issues. In many ways, this is a significant benefit. Environmental policy and management is too often driven by simple and incomplete sets of indicators. For example, in Canada, forest practices are traditionally determined by measures such as net annual growth and the price of lumber, with little regard to broader socio-economic and ecological impacts of forest management. The participatory processes described in all three cases provided a more complete list of indicators that could lead to a more accurate assessment. In British Columbia, the list of indicators established by the communities revealed significant data gaps where information deemed important to assess community wellbeing were simply not available; while these gaps were not subsequently filled, their presence alerted planners and increased sensitivity to local issues. In Botswana, the initial long lists of indicators was evaluated to determine which were accurate and easy to use, and then indicators were short-listed to develop an effective list of 'early warning' indicators that community members and experts agreed would alert rangeland managers about pending environmental problems. In Guernsey, the initial lists established by civil servants have been significantly revised in light of local input, and the latest iterations are widely viewed as containing a more accurate list of indicators. There is at least one problem, however. The extra accuracy and detail that participatory processes bring to indicator selection make an apparently simply job (choosing performance indicators) very complex. Therefore, participatory processes may take much longer than anticipated. The British Columbian example highlighted this problem and the process used to harness community input into indicator selection resulted in such a lugubrious list of indicators that it took years to collect and input data. During this time, the value of the activity as a tool to influence policy diminished.

4.2. Community empowerment

Another impact of participatory processes on sustainability indicator selection has been to increase community capacity to manage the environment in all three regions. In British Columbia, there is little doubt that this process has defused many of the tensions that led to previous resource-based conflicts. Disparate stakeholder groups learned to work together, and continue to do so; there are new co-management agreements between First Nations Communities and forestry companies in British Columbia today. In the Guernsey case, the evidence that levels of stakeholder participation have increased in the last year provides some clue that this process has been a success. In Botswana, the actual process of identifying indicators built capacity within communities. Despite the large number of indicators elicited through the research process, most individuals had knowledge of only a few indicators. By sharing and evaluating the community's knowledge in focus groups, and providing feedback from empirical testing of indicators, each individual's knowledge increased. There are at least two notes of caution, however. First, in order for participatory processes to result in real environmental management changes, it is necessary to find win-win solutions within political and economic constraints. If land management decisions are driven by political, social, or economic concerns, then participatory processes aimed at increasing environmental awareness may prove ineffective. This issue has been raised in both British Columbia and Botswana cases. In British Columbia, a Non-Governmental Organization, has argued that significant environmental problems still exist in how coastal forests are managed, and the illusion of local control over the resource merely masks the continued exploitation of a fragile ecosystem (David Suzuki Foundation, 2004). In Botswana, it remains unclear whether the empowerment generated by the process described in this paper will result in better land management.

On the issue of translating participatory indicator selection processes into good policy, it is important to note a significant difference in the British Columbian case. In British Columbia, the Scientific Panel was the body responsible for developing land use plans. They decided that they needed a large database of social, economic and environmental indicators to make plans and hired a consultant to conduct the wellbeing assessment to obtain these indicators. This meant that community participation, which was organized by the consultant were removed from actual land use decision-making that was still under the control of the Scientific Panel. The distance between the communities, who contributed to the wellbeing assessment, and land use decisions makers may have reduced the effectiveness of the participatory process in influencing environmental policy. Therefore, although it was important in all three cases to establish a clear framework to facilitate a multi-stakeholder processes to choose indicators, this in no way guarantees that environmental management will change. The experience in British Columbia suggests that this process must also feed quickly into formal decision-making forums or else risk being viewed as irrelevant by policy makers.

4.3. Scale

The merits of the participatory approaches described here are significant. However, there still remain a number of significant operational issues that need to be tackled before communities begin defining relevant indicators in other regions. One of the most challenging of these is deciding the scale at which management and public participation should take place. For example, there was considerable discussion by stakeholders involved in developing the Wellbeing

Assessment in British Columbia on how to aggregate social data so that policy makers could adopt the best scale for planning. Generally, it was argued that the Province was too large a scale to be meaningful because it disguised inter-regional variation important to developing appropriate land management plans. However, community level data was also inappropriate since many communities face the same problems and a planning approach based exclusively on community level data disguised broader trends and might lead to inefficient duplication of services and a lack of harmonization across the region. Ecosystem data was also difficult to work with since migratory animals, watersheds, and prevailing ocean and atmospheric currents mean that environmental problems can travel independently of political boundaries. Because of these multiple borders, finding an appropriate scale for planning was no easy task, and was only resolved when the Coast Information Team, responsible for collecting and assessing data, made the choice to make all datasets available at the finest possible resolution, and then to provide a transparent framework for aggregation of this data up to the planning levels. Similar issues arose in Botswana, and the process of community involvement highlighted regional variances. For example, significant differences existed between South Kgalagadi and South West Kgalagadi lists of indicators in terms of the invasive species associated with degradation and the perceived nature of soil degradation problems. These differences display the distinctly different environmental conditions in two regions that are only *c.* 120 km apart. Significant differences also existed between different stakeholders within a given region (e.g. commercial v. communal farmers in S. Kgalagadi). This means that policies must be flexible in how they target these communities, and that 'a one size-fits all' approach cannot work.

There is still the need in all three case studies to allow planners to observe region-wide change to understand the larger context of policy decisions. Unless a policy maker happens to be working in a region like Guernsey, where bureaucratic and environmental boundaries synch up, choosing any particular scale will be problematic. The case studies offer two valuable lessons that can simplify this task. The first is that data on indicators should be collected at as fine a resolution as possible, and the process of data aggregation should be transparent. This allows maximum flexibility in assessing and interpreting the information that indicators provide, and neatly side-steps the issue of scale during the initial data collection phase. In turn, this can help to speed up the overall process, which makes local participation more relevant to decision-making. The second lesson pertains to the identification of stakeholders for the indicator selection itself. Many populations, some of whom live far beyond the physical boundaries of local communities, can be affected by resource management decisions. To identify these disparate stakeholders at an early stage, the authors propose using a simplified flow diagram that shows major environmental pathways through a landscape, (heuristically presented in Fig. 3). In the British Columbia case study, forest harvesting activities high in the hills surrounding the Sound disrupted terrestrial biomass, and in turn the loss of forest cover led to significant disturbance of the soil systems underlying these sites. These disturbances also impacted the flow of water on watersheds through the site, which disturbed fish populations and led to mutually reinforcing interactions between aquatic and soil systems that destabilized slopes and caused landslides. Harvesting operations, therefore, impacted a larger population than those whose activities took them into the forest; and included people who utilized local streams and rivers, and even who could simply observe the slopes beneath clearcuts felt the impact of industrial activity. These connections spread the disturbance well beyond the bounds of the clearcut itself.

The approach shown in Fig. 3 is based on long-standing assessments that plot the fate of chemicals that have been emitted into the environment. In 1901, G.N. Lewis introduced the concept of fugacity, or the fleetingness of chemicals, as a convenient way to describe the various pathways, or transport media that exist in the environment (Lewis, 1901). By focusing on the pathways outlined in Fig. 3, we can evaluate the best scale for specific problems: airsheds for atmospheric problems, watersheds for flooding and droughts, the connectivity of agricultural land for pest outbreaks, and transportation corridors for the spread of diseases. This makes it possible to identify future vulnerabilities in human systems to remote threats, and

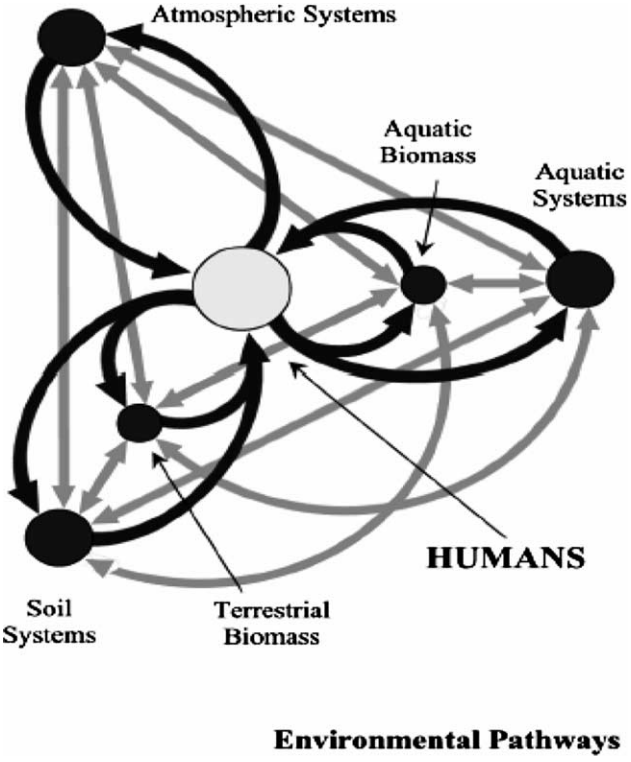

Fig. 3. Schematic representations of environmental pathways for defining understanding and defining environmental factors that affect social or political planning jurisdictions.

ultimately should allow us to prevent problems by changing practices at the source (Fraser et al., 2003, 2005).

5. Conclusions

Traditionally, developing environmental management plans has been the domain of highly trained experts who are hired for the task. It is generally perceived that this approach has led to a number of failures as these managers rarely had the benefit of detailed local knowledge and failed to generate community support for policy changes. As a result, environmental managers and policy-makers need tools to bring together local community input along side expert advice to measure the impact of policies and management plans. By reviewing three disparate case studies where this process has been tried, we can learn a number of lessons.

First, a common theme among the case studies was the need to develop a mechanism that brings together experts and community members to develop indicators that measure progress towards sustainability. This can provide databases that reflect local values, and on which specific management decisions can be made. The process of engaging people to select key indicators provides a valuable opportunity for community empowerment and education. It is not necessary that this process be initiated from the bottom-up, but it is important that local stakeholder input be allowed to drive the process. For instance, in Guernsey, the process was instigated in a top-down fashion, but indicator development and data collection has proceeded in a bottom-up manner. This has created a platform that empowers and educates the local population, and provides a forum through which a wide range of people can express their concerns to the planning process.

A second need was to connect the selection of subnational indicators with the decision-making process, so that policy can be usefully directed. The case studies showed variable success on this front. The framework used in Botswana resulted in a high degree of community engagement, and is likely to result in observable changes to policy because policy-makers and local stakeholders were included in the same process. In British Columbia, the process of indicator selection was confined to the application of a new method (the Wellbeing Assessment), which was designed to inform decision-makers. Unfortunately, the process took too long to be effective for policy makers. The presence of a gap between those involved in indicator selection and decision-making meant that top-down processes were allowed to dominate policy development. Therefore, although the framework used in British Columbia paid dividends in terms of community empowerment and capacity building, it was not altogether successful in one of its primary objectives, which was to provide timely and useful input into long-range land management.

Finally, there is the challenge of choosing the best scale for analysis. Although a huge amount of policy is generated at the national level, it is clear that is not always the best scale for environmental management. By the same token, it is inefficient to base much environmental planning at the community level since this may result in duplication and a lack of harmonization across landscapes. To resolve this we propose two things: first, that data be collected and made available at the finest possible scale, but that it be aggregated into larger planning units using a transparent process. Second, since planning is usually based on political or bureaucratic boundaries, it is necessary to explicitly include environmental concerns that cross human-made borders, for example by basing policy on watershed boundaries or migration corridors. We have identified environmental pathways as one potential way whereby external environmental factors can be accounted for.

In conclusion, the authors believe that we can use community input to select and choose relevant indicators to monitor and guide planning towards sustainable development. However, this must directly and quickly feed back into the formal planning process. Indicators need to be collected at as local a level as possible, and then aggregated using a relatively simply and transparent aggregation process, thereby allowing information to be both summarized quickly for policy makers, and unpacked for more careful monitoring and follow-up. Matching environmental and socio-political boundaries will always prove to be a challenge. However, by recognizing major environmental pathways, it should be possible to capture at least the most significant external environmental factors and include them as part of the environmental planning process.

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