Chapter 3
Building Adaptive Capacity in Systems Beyond the Threshold: The Story of Macubeni, South Africa

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3.1 Introduction

Adaptive co-management theory is based predominantly on case study examples from developed countries where resources are abundant and communities and other stakeholders are, in comparison with their developing country counterparts, well organised and highly educated. Resource-poor developing areas present different challenges to communities, facilitators and other professionals. Because infrastructure is weakly developed, literacy levels are low, and people are reliant on their own knowledge and local resources (CEPSA Consortium for Ecosystems and Poverty in sub-Saharan Africa 2008), developing rural areas are notoriously neglected and have received scant attention from officials and facilitators. People are typically uninformed about their rights and opportunities, and are politically marginalised with decisions taken on their behalf in capitals and head offices. However, two-thirds of sub-Saharan Africa's 770 million people live in rural areas (Anderson et al. 2004), where common property regimes abound and efforts at community-based interventions have largely failed (Campbell et al. 2001; Blaikie 2006). Adaptive co-management is an attractive metaphor for common property management in such areas. The 'collaborative' part of adaptive co-management might overcome some of the capacity challenges by supplementing the pool of available expertise, linking local people to higher level institutions and bringing in financial and human capital. The 'adaptive' part is ubiquitous in rural areas and requires little intervention. Rural people are of necessity adaptive and opportunistic to secure their livelihoods under challenging conditions (Berkes et al. 2000; Ellis 2000; Gadgil et al. 2003).

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South Africa's former separate development 'homelands' are examples of rural areas with weak infrastructure and low capacity, with very low endowments of human, physical and financial capital (sensu Carney 1998). During an exploratory field trip in August 2001 (Fabricius et al. 2002), local community members, government officials and political representatives asked academics at a regional university to initiate a project aimed at enhancing rural livelihoods, repairing ecosystem services and strengthening local capacity to manage natural resources and generate income at Macubeni in South Africa's former Transkei 'homeland'. This area presented a particular challenge to the proponents of adaptive co-management because of heavy levels of resource degradation, very weak human capacity, extreme poverty and poor infrastructure. The community relies heavily on natural resources, remittances and social capital (reciprocity and kinship networks) to make a living (Fabricius and Collins 2007). A window of opportunity (sensu Olsson et al. 2006) opened when a potential funder, the German Agency for Technical Cooperation (GTZ) provided funding, the national government wanted to test its community-based natural resource management or CBNRM guidelines and policies, and the national Department of Environmental Affairs and Tourism (DEAT) launched a number of social responsibility projects with a CBNRM emphasis. There also appeared to be champions for the project, both at local level in the form of an elected municipal Councillor for the Macubeni Ward, and a Local Economic Development official in the Emalahleni Municipality. At Provincial levels, the Department of Economic Affairs Environment & Tourism as well as the Department of Agriculture indicated their support for an intervention that would restore social and natural capital.

At about the same time, we became exposed to resilience and adaptive co-management theory through our links with the Resilience Alliance (www.resalliance.org) and our participation in the Millennium Ecosystem Assessment. This provided a solid theoretical foundation, a scholarship and funding base via the Millennium Ecosystem Assessment and GTZ, legitimacy in the eyes of government and local communities, and a reasonable time horizon of 5 years. Our goals were to (a) increase the available natural, human and financial capital in Macubeni; (b) repair the adaptive capacity of the social–ecological system, to enable it to cope with change; (c) develop the governance capacity for communal property management.

3.2 Study Area

Macubeni is regarded as one of the most degraded areas in South Africa, with extensive sheet and gully erosion on both the hill slopes and valley bottoms (ATS/iKhwezi 2004; Shackleton and Gambiza 2008). The locality 'Macubeni' refers to a cluster of 14 villages that collectively consider themselves part of one community and form part of a single electoral Ward. The population of roughly 7,344 people resides on 16,150 ha of land, held primarily under communal tenure (Fig. 3.1).

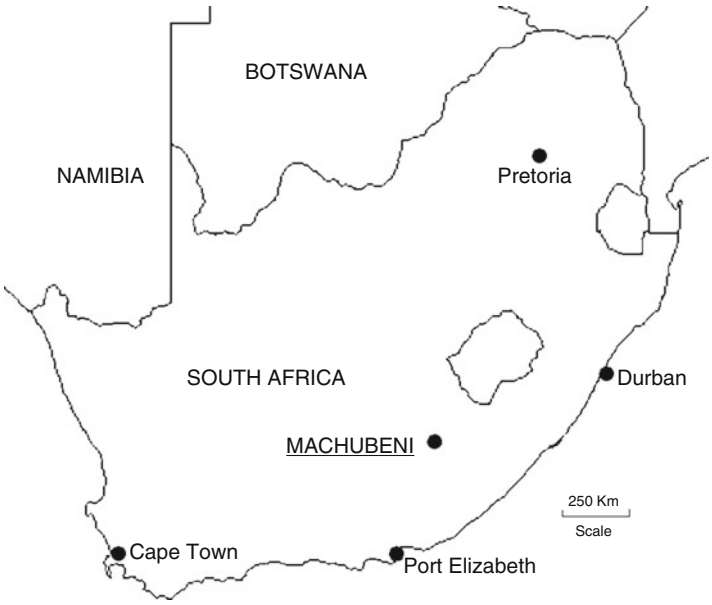

Fig. 3.1 Macubeni

The key issues affecting social–ecological resilience at Macubeni are: (a) historical and contemporary erosion of ecosystem services through land degradation, inappropriate cultivation practices, inappropriate fire management and biodiversity loss; (b) loss of ecosystem productivity through invasion of unpalatable plants; (c) loss of governance capacity through past political oppression and contemporary emigration of resourceful individuals; (d) lack of access to markets for agricultural products and livestock; (e) lack of finances to invest in agriculture, infrastructure and education; and (f) poor infrastructure, particularly related to piped water.

3.2.1 Ecosystem Services

Macubeni is characterised by hilly and mountainous terrain. The soils are generally shallow and stony, except in the valley bottoms. The area falls within the Grassland Biome, and is characterised by both Tsomo Grassland and Tarkastad Montane Shrubland (Mucina and Rutherford 2006). The average annual rainfall is 590 mm, 80% of which falls in the summer months, between October and March. This rainfall is erratic however, and dominated by convective storms (iKhwezi and Setplan 2004). Although temperatures can exceed 40°C, average day time summer temperatures are 20°C, and 12°C in winter. Temperatures of below zero do occur and winter snowfalls are not uncommon.

Ecosystem productivity is severely undermined by extensive and increasing gully and sheet erosion (iKhwezi et al. 2004). Sheet erosion is found close to roads and on the open veld, caused by trampling and over grazing. Gully erosion occurs along the water courses and in the relatively deeper soils of the valley bottoms. Because of the deeper soils and flatness of the land, these areas have historically been cultivated, and the villages are generally located in these areas too. The majority of the erosion occurs in these flatter areas due in large to inappropriate ploughing practices.

Although crop production and arable lands are highly valued in Macubeni, crop yields are extremely low (iKhwezi et al. 2004). Nevertheless, fruit trees tend to be grown within garden plots, while maize, sorghum, wheat, barley, pumpkins and a range of legumes are grown in fields. Crops are rain fed, and hand held tools are the dominant mode of cultivation. The main restraining factors for cultivation are the lack of water, infrastructure and resources such as equipment and capital.

The main water source is the eCacadu River, which flows through Macubeni and into the Macubeni Dam. This river only flows after rains and during the wet season. There are also numerous natural springs, which are utilised for domestic and stock water.

Livestock ownership is widespread within the community, with an estimated 37% of households owning stock, and average ownership across Macubeni being ten large stock units (LSU) per stock owner. There is no fencing between villages or to divide grazing camps. There is no rotational grazing system or collective system of grazing management. Macubeni's long term ecological 'carrying capacity' is 1,129 LSU, with a maximum potential of 2,691 LSU if erosion was prevented and the veld restored to its optimum. A survey conducted in 2003 suggested that there were 7,670 LSU in Macubeni, while a Department of Agriculture estimate placed the number in excess of 11,000 LSU (iKhwezi et al. 2004). Macubeni is therefore severely overstocked and the productivity of the land is constantly being reduced.

There are three planted woodlots, and also three brick making plants within the area. Grasses are harvested for roofing and for sale, as are medicinal plants. The invasive *Euryops,* a plant species that has flourished in the degraded soil, is used by the majority of households for fuel, and for kraal (enclosures for livestock) building (Shackleton and Gambiza 2008).

3.2.2 History of Land Management and Institutional Capacity

Land allocation and management has until recently taken place largely through traditional structures, with a sub-headman responsible for each of the 14 villages that make up Macubeni, and a headman to whom these sub-headmen report. The creation and enforcement of rules governing access to resources similarly took place through these structures. However, the last six decades have witnessed growing incursions into land management by the state, and the concomitant weakening of local institutional structures for resource management.

During the 1960s and 1970s, the government's 'Betterment Planning' model was implemented in Macubeni and entailed moving scattered homesteads into consolidated villages. Those living on the mountain sides were the most severely affected as they were forced to relocate with very little consultation. As in other areas, it is likely that the traditional leaders in Macubeni co-operated in the process. Two decades later, between 1986 and 1987, the Macubeni Dam was constructed to supply water to the Lady Frere district and surrounding areas. Once again, there was no consultation or negotiation with the community. Some compensation was paid to households; however, resentment still lingers over the lack of consultation over the construction of the dam and the subsequent relocations.

The 1990s witnessed a period of institutional inertia and confusion over land use and management. During this period, traditional leaders in many cases lost their ability to control land use, largely because of being associated with the state's Bantu Authorities system, whereby traditional leaders were paid by the state, and because of their apparent collusion with the state during the forced removals in the 1960s and 1980s. The result was that many people felt that leaders were accountable to the state rather than to the people. Traditional leadership in Xhosa culture has always relied on the support of the people (Pieres 1981), and therefore the lack of faith in traditional leadership severely reduced their power base. During this period, democratic processes began to gain momentum, and local democratic structures attempted to assert their authority (Manona 1995). However, there was no clear national policy or locally accepted norms that gave these democratic structures the power to manage and allocate land use rights. Thus, land use and management all but disappeared in the leadership vacuum that resulted. One symptom of this collapse was the fact that fences that formerly separated grazing areas and fields were stolen in the 1990s to fence off homesteads, with no repercussions for the perpetrators (iKhwezi et al. 2004).

The former Transkei homeland, in which Macubeni was situated, was reincorporated into South Africa in 1994. Since 1994, land allocation and management have formally fallen into the hands of local government structures, particularly the Ward Committee and an elected Councillor, although traditional leadership still has a strong position and is consulted of necessity. Indeed, an application for land by an individual would seldom reach the elected Councillor without first having gone through the hands of the sub-headmen and the headman, and rule enforcement is not considered possible by community members unless the traditional leaders are involved, as indicated by the following quote

> The major challenge [with rule enforcement] is the support from the traditional leaders, if they won't support the rules then we can't enforce them (MPASC member, March 2007).

3.2.3 Social Vulnerability

Social vulnerability has increased progressively at Macubeni through the combination of multiple forced relocations, the resultant weakening of local institutional

capacity for land management, and the progressive erosion of the land as a result of this. These factors represent successive and synergistic stresses on the social–ecological system. Social vulnerability is equally influenced by the socio-economic conditions that characterise the area.

The Eastern Cape has the highest proportion of people living in poverty in South Africa, with 71.9% of the population living on less than US$87 per month, and 12.3% of the population surviving on less than US$1 a day (Kane-Berman et al. 2007). Macubeni is remote, with little infrastructure or formal employment opportunities, and therefore households are reliant on family members sending remittances from urban centres, arable production, livestock and ecosystem goods and services as described earlier (Shackleton and Gambiza 2008). Fifty seven percent of households are female headed, and 41% of households are headed by people aged above 60. Well over 50% of the population is under 20 years of age, indicating that the permanent population is made up largely of children and the elderly. Population figures from the 1995 to 2001 census suggest that the population declined by 13%, a rate of 2.6% per annum. Population growth in the area is affected by both out migration and a high death rate rather than a declining birth rate.

Ninety five percent of the local population is unemployed with only 14.8% actively looking for work (Statistics South Africa 2001). However, between 35 and 40% of households have access to some form of wage income during the year by part time, seasonal and self employment (iKhwezi et al. 2004). In terms of household income, between 1995 and 2001, the number of households declaring a nil income doubled, indicating growing poverty in the area. Forty nine percent of households receive a government welfare grant (iKhwezi et al. 2004). Two of the 14 villages have community taps for household water, and none of the households have taps inside the home.

3.3 Methods

We took a complex adaptive systems approach (Holling 2001), and conceptualised Macubeni as a linked social–ecological system (Berkes and Folke 1998). The social system consisted of the culture and traditions of the amaXhosa, their livelihood strategies, decision making structures and processes, as well as their belief systems and world views. The ecological system consisted of the soils, rangelands, livestock and landscape level processes within the Macubeni watershed (Fabricius and McGarry 2004). Knowledge, institutions and management practices formed the ‘bridge’ between the social and ecological systems (Berkes et al. 2003) (Fig. 3.2). We relied on Sustainable Livelihoods theory (Ashley and Carney 1999) to assess the available social, human and natural capital in the system and, ultimately, to attempt to enhance financial capital by stimulating the establishment of small enterprises. We aimed to stimulate adaptive co-management by strengthening the adaptive capacity of institutions and their ability to respond to social–ecological feedback (Berkes and Folke 1998; Olsson et al. 2004a) in an attempt to transform

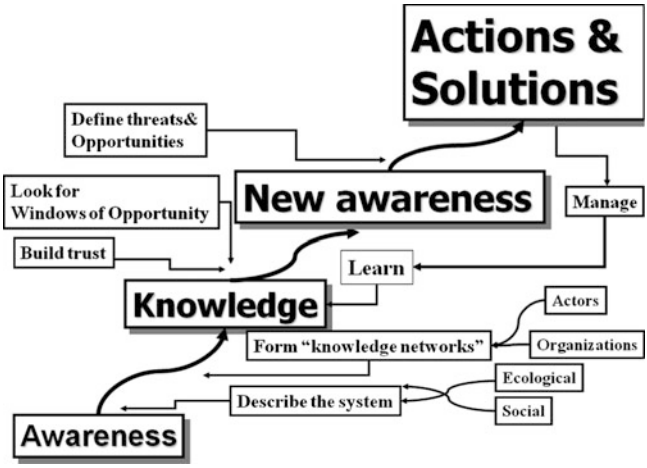

Fig. 3.2 Human capital (knowledge, governance capacity, management systems and institutions) at local, national and sub-national levels acts as the link between social and ecological systems

the community from a 'powerless spectator' state to an 'adaptive co-manager' state (Fabricius et al. 2007). Through ecological restoration, we also aimed to strengthen the ecosystem's capacity to respond to shocks and surprise (Walters and Holling 1990) in particular floods and droughts, which were a major threat at Macubeni and threatened the integrity of soils and rangelands (iKhwezi et al. 2004). A multi-disciplinary team of plant ecologists, rangeland scientists, development economists, social scientists and modellers was involved and expert facilitators formed part of the core team. The capacity of community members to take control of resource management and decision making was developed by assigning specific roles and responsibilities to individuals through a process of discussion and consensus building between the different role players. However, because of the administrative requirements of the funding agencies, there were significant limitations to implementing a comprehensive community-based approach (Mitchell et al. 2007).

Our intervention focused on the trajectory: awareness → knowledge → new awareness → motivation → action with a feedback loop called 'learning' from 'action' to 'knowledge' (Fig. 3.3) (Fabricius et al. 2007). Trust building, institutional development and strengthening of governance systems were key elements of this process (Table 3.1), and every step of the process was strongly linked to cultural practises (Xu et al. 2005; Folke et al. 2005b). This will be discussed in subsequent sections, but included, for example, the integration and traditional decision making processes and authorities within the governance structures that were developed during the initiative, and the inclusion of local knowledge about indicators of ecosystem change within community-based monitoring and management plans.

We attempted to stimulate the awareness of stakeholders by first gathering background information about the social–ecological system and about people's

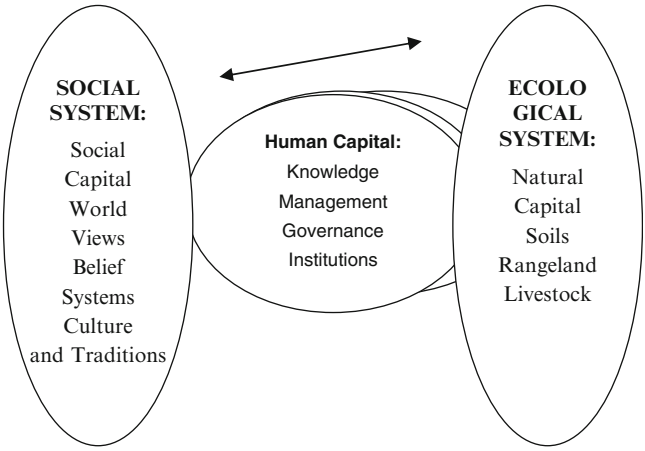

Fig. 3.3 A conceptual framework for strengthening social–ecological systems through adaptive co-management

Table 3.1 Key interventions aimed at building adaptive capacity and social–ecological resilience

Key focus within the social–ecological system	Intervention
Ecosystem services	Ecological restoration of wetlands, rangelands, natural springs and cultivated land
Governance and institutions	Development of mini-management plans for key resource areas in each village
	Formation of village land committees to implement and enforce mini-management plans
	Formation of the MPASC, the smaller technical sub-committee of the MPASC, and eventually the Section 21 Company
System dynamics – adaptive management	Community based monitoring and evaluation of both social and ecological components of the system
Financial capital	Temporary employment through government social responsibility funds
Human capital	Skills development – fencing, erosion control, natural spring development and alien plant removal, formal training in CBNRM and ecological and social monitoring, the formation of 'not for profit' organisations for land management and business and accredited training in small and medium enterprise development

understanding and perceptions of the reasons behind land degradation. In this we relied heavily on local and traditional knowledge and made extensive use of participatory methods (Chambers 1994). Initiating collaborative monitoring was a core component of efforts to raise awareness and build knowledge in an on-going way during the initiative. Through this approach, new knowledge was developed and shared among stakeholders, and solutions were sought to identified challenges and trends. Knowledge was shared and awareness further raised when community

members who participated in information gathering regularly reported to villagers at general meetings. These report-backs became increasingly more sophisticated when certain members were assisted in developing computer-aided presentations.

3.3.1 Scale

We adopted a spatially and temporally multi-scale approach (Capistrano et al. 2005) by, from a temporal perspective, assessing landscape change over time and political change since 1930, and, from a spatial perspective, assessing the key institutions, and landscapes and land elements, at multiple spatial scales from the local to District level (Adger et al. 2005; Hein et al. 2006). At the local level, we matched the scale of governance and institutions to the scale of ecosystems being managed (Murphree 1993; Murphree 2000; Bohensky and Lynam 2005) by focusing on fine-grained key resources such as springs, prime grazing patches and cultivated lands on deep and nutrient-rich alluvial soils in the landscape. Together with village level leaders and community members, we developed mini management plans, to be governed at the village level and this is discussed further in the sections that follow.

3.3.2 Drivers

Through the multi-scale approach, we focused on and aimed to understand the key, or driving, social and ecological processes operating at local, sub-national and national scales that influence current social–ecological trends (MA 2005) at Macubeni. These key drivers were political, economic and biophysical. In conjunction with this analysis, we combined an assessment of the roles of critical social actors, such as leadership figures and visionaries and their ability to steer the system toward a different trajectory (Schultz et al. 2007) with an analysis of the key ecological elements that maintained the integrity of the social–ecological system (Machado 2004).

3.3.3 Governance and Co-Management

We viewed knowledge, institutions and management practices as the ‘bridges’ between the social and ecological components of the system (Berkes et al. 2003) and aimed to strengthen them by augmenting the ‘soft’ and flexible traditional institutions (Becker and Ghimire 2003) with ‘harder’ and more formal institutions that would be compatible with formal government policies and local governmental processes. We drew substantially on common property theory (Ostrom et al. 1999;

Dietz et al. 2003) by putting much effort into strengthening the institutions that govern human behaviour.

We aimed to strengthen local governance systems and institutions and worked closely with a new structure, the Macubeni Project Advisory and Steering Committee (MPASC), an offshoot of an existing organisation, the Macubeni Ward Committee. The MPASC was established by the local municipality and national government as a link between the community and local political representatives in the implementation of the project. The MPASC formed the primary stimulus for co-management. The MPASC was established as a multi-stakeholder steering body aimed at improving communication between role players operating at different spatial scales (Table 3.2). Two elected representatives from each of the 14 villages in Macubeni sat on the MPASC, along with representatives from community institutions, government departments and implementing agents.

The MPASC met monthly and was intended to support the project management team in various ways. First, the MPASC played a guiding, advisory and sometimes decision making role. Second, the MPASC aimed at improving relationships between the various project partners by creating a forum for conflict management and discussion. Third, the MPASC played a critical communication role between all partners, but especially between the steering committee and the larger community. Community representatives on the MPASC were expected to regularly inform their constituencies about the progress of the initiatives. A community working group, the Macubeni Technical Committee was also established, consisting of eight members elected on the basis of their exceptional local knowledge and dedication (Chalmers and Fabricius 2007), and closely involved the traditional leadership structures at Macubeni.

Noticing an institutional vacuum, we set out to establish management plans as institutions for natural resource management. Conscious of the need to create congruence between institutional and ecological scales (Carpenter et al. 2001; Bohensky et al. 2004), we focused on fine-grained 'key resource areas', which were identified by local villagers and assisted the community in creating mini management plans for each key resource area. Each of the 14 villages identified three key resource areas: a grazing area, a spring and a cultivation area.

Table 3.2 Role players in the Macubeni MPASC

Community institutions	Ward committee, headmen, sub-headmen, youth forum, farmers association
Local and district government departments	Emalahleni local municipality, Chris Hani District Municipality, Department of Agriculture, Department of Water Affairs and Forestry
Implementing agents and supporting organisations	GTZ transform, Ruliv (Eastern Cape Rural Livelihoods Support programme), iKhwezi (consultancy sub-contracted for project implementation)
Provincial and national government departments	Department of Agriculture, Department of Environmental Affairs and Tourism

Seven steps were followed in the construction of these plans, which consisted of the following seven sections:

1. Where is it? This section contains a general description of the key resource area, its locality and importance for the village including a locality map.
2. What does it produce? The goods and services it produces for the community, including tangible and intangible services.
3. Who has access to the key resource area?
4. Who is responsible for its management?
5. What are the rules and regulations, with sub-sections containing general and specific rules, and sanctions?
6. Management recommendations.
7. Revision intervals.

The document used by the village was in isiXhosa, with a translation into English for the purposes of reporting to donors. Each village received a file containing its management plans, monitoring data sheets and maps.

Towards the end of the project, Village Land Committees were established, tasked with implementing these fine-scale management plans for key resource areas. The traditional leaders (sub-headmen) operating at village level headed these committees.

3.3.4 Capacity Development

Because of the acute multi-dimensional poverty at Macubeni, and the shortages of financial, human, natural and physical capital, we aimed to strengthen the quantities of these four capitals (Fabricius and Collins 2007). To some extent, the physical capital was strengthened by the introduction of critical infrastructure such as water storage tanks, nurseries and fences to regulate livestock and fence off key resource areas. Material incentives were improvements in people's livelihoods through restoring the ecosystem's capacity to produce goods and services; training to improve people's management and technical skills; and financial incentives in the form of short term income from government's social responsibility funds, as well as longer term income from the establishment of small and medium enterprises (Mitchell et al. 2007) by individuals and consortiums. Natural capital restoration included the repair of ecosystem services through erosion control works, the removal of alien species, re-vegetation and management of key resource areas, establishment of nurseries and restoration of some of the key natural springs.

Participants received training in a wide variety of areas. At a basic level, those employed in the work teams aimed at building physical infrastructure as part of the Social Responsibility programme received training in fencing, erosion control, natural spring development and alien plant removal. Within the MPASC, participants received formal training in CBNRM, ecological and social monitoring, giving presentations, and the formation of organisations for land management and

Table 3.3 Types of formal training received and percents o respondents who received training ($n = 110$)

Formal training received	Percentage of respondents
Land Management	49
Technical (Basic, e.g. fencing, hole digging)	43
Construction	15
Leadership	13
Health and Safety	12
First Aid	4
Financial Management	3
Tourism	0.5

business. Accredited training in small and medium enterprise development was offered to a core group of individuals following an application and selection process. This training included aspects of financial management and leadership. Table 3.3 summarises the types of training provided and the percentage or respondents who benefited.

3.3.5 Motivation

Awareness raising does not automatically lead to action and adaptation. People need to be motivated to transform their social–ecological system. Motivation consists of two components: vision and leadership; and incentives for transformation (Lambin 2005). Leadership existed in the form of the locally elected Ward Councillor, the traditional leaders (Headman and sub-Headmen), and elected members of the Macubeni Technical Committee. The Macubeni vision was established very early on and reiterated at every important community meeting.

3.3.6 Adaptive Management and Monitoring

Adaptive management implies an ability to learn from mistakes (Colding et al. 2003) and to respond to feedbacks and innovation (Armitage 2005). This requires the establishment of participatory community-based monitoring systems (Fleming and Henkel 2001). Although acknowledging that communities have their own informal monitoring systems, and regularly track changes in ecosystem services (Moller et al. 2004), community-based monitoring is however less prevalent in tracking change in the social domain of social–ecological systems. Therefore, we initiated a community-based monitoring system to track change in both the social and the ecological domains of the system by focussing simultaneously on the process of implementation, governance, livelihoods and ecosystem services. The monitoring indicators were selected collaboratively with community representatives and contained

as many as possible traditional indicators already in use or widely recognised within the community (Berkes and Jolly 2001).

The frequency of monitoring was matched to the rate of change of different aspects of the social–ecological system. Because MPASC meetings took place monthly, governance and process monitoring took place on a three monthly basis as a means of capturing change and allowing space for adaptive decision making whilst not overloading the already busy MPASC members. Livelihood monitoring took place during and after the employment phase of the Social Responsibility initiative, and included 'hindsight' questions about activities prior to the initiative. These 'hindsight' questions provided the baseline from which changes could be measured. Natural resource monitoring took place primarily as training exercises aimed at developing tools that each Village Land Committee could use to adaptively manage key resource areas using the mini management plans, and was intended to be conducted seasonally. A monitoring toolkit was developed, containing descriptions of monitoring methods and data sheets. Each village was provided with a file containing the toolkit, monitoring data sheets and its management plan. The toolkit can be accessed at (http://oldwww2.ru.ac.za/academic/departments/environsci/CBNRM/index.html). Results and insights from this ongoing collaborative monitoring toolkit are presented throughout the following section.

3.4 Outcomes

3.4.1 Identifying Drivers

Our initial assessment indicated that the ultimate drivers of the system were as follows: (a) emigration of human capital, mainly as migrant workers, thereby depleting the capacity for governance; (b) weakly developed infrastructure such as road networks, piped water and electricity supply; (c) human population density that was too high for the capacity of the resource base to provide goods and services; and (d) the historical impact of separate development policies which affected traditional institutions, infrastructure, human population density and local and municipal governance systems.

Proximate drivers were the following: (a) depletion of ecosystem services, mainly through overgrazing and inappropriate cultivation, which increased soil erosion and decreased soil fertility; (b) the collapse of local institutions, leaving an institutional vacuum and leading to open access resource management; (c) extreme poverty, which resulted in short term planning and 'struggle and survive' attitudes due to perceptions of an uncertain future; and (d) weak capacity of municipal, national and provincial government structures to promote rural development.

3.4.2 Strengthening of Governance

Governance gradually improved between 2001 and 2007 when the intervention ended. The Village Land Committees became key organisational structures, with their activities centering on monitoring, and the development and implementation of mini management plans.

Mini management plans were developed for 13 of the 14 villages in the Macubeni Ward, and people were trained in natural resource management, monitoring and rangeland management. Village Land Committees were formed, and they took responsibility for implementation of the mini management plans. To begin with, these Village Land Committees worked through the MPASC and were specifically supported by the Technical Committee. During the course of the project, people were introduced to different types of legal entities for contractual and business purposes. In 2007, a legal entity in the form of a Section 21 company was formed with representatives of national, provincial and local government and with two representatives from each of the 14 Macubeni villages. People also received training in entrepreneurship and small enterprise development, and small enterprises were established for meat production, to run nurseries and to produce and sell firewood from local woodlots.

However, a number of governance surprises were experienced. At the beginning of the initiative, the locally elected Ward Councillor played a critical role in garnering community and local government support for the initiative. As a result, the members of the MPASC, although elected by each village, were drawn largely from this individual's political party. However, in early 2007, this councillor's term came to an end, and the democratic elections were won by a political rival from a different party. This candidate won the support of the traditional leadership. Many community members were suspicious about the benefits that the MPASC members had accrued over the years, for example through training and access to information about employment possibilities. As a result, when the Section 21 Company was finally formed later in 2007, the elections for village representatives resulted in all but one of the original members being replaced. None of these new members had received land management or leadership training over the course of the initiative. The build up of human and social capital envisioned at the outset of the initiative, and pursued over the course of a number of years, was effectively lost in just a few days, although it could be argued that the skills remained within the community.

Nonetheless, analysis of the outcomes from on-going collaborative monitoring, based on self-administered rating systems, suggested that governance trends were positive with a 50% improvement in social capital (with indicators such as trust building, common rules and norms and incentives for collective action c.f. Pretty 2003) and a 100% improvement was reported for adaptive governance (with indicators such as access to information, conflict resolution mechanisms, compliance with rules and being prepared for change c.f. Dietz et al. 2003). No change was identified in the capacity for self-organisation (with indicators such as enabling legislation, access to long term funding, effective leadership and social networks

c.f. Olsson et al. 2004a) or adaptive capacity (with indicators such as maintaining options and the willingness to learn from mistakes and to engage in collaborative decision making c.f. Armitage 2005).

3.4.3 Capacity Development

Although many people received formal training, most of the training was in land management (49%), and in technical skills such as fencing and erosion control (43%). Seventeen percent received training in leadership, and health and safety. Very few individuals were trained in financial management and leadership (16%). As part of collaborative monitoring activities, random surveys of those involved in the training activities suggested that although the majority of participants (64%) were happy with the training they received, and 60% believed that the training will improve their livelihoods, only 4% had used the training to find employment.

The capacity of the Macubeni Technical Committee was however strongly developed through their on-going involvement in management planning, monitoring and reporting back to the community. Most of them became involved in small enterprises, although this also contributed to their institutional downfall when it came to election of the Section 21 Company, as described previously.

3.4.4 Motivation

Local actors were highly motivated to develop their capacity and improve the ecosystem's capacity to deliver goods and services. They developed a strong vision, expressed as 'our dream is to have the maximum benefit for the Macubeni community from our natural resources, and to secure its sustainability by forming partnerships with all relevant structures and create a production market from these resources and encourage youth to participate and to motivate the home coming of those who had left to study'. This vision was confirmed at every stakeholder meeting and placed on a flip-chart in a prominent place.

Material incentives in the form of employment in the social responsibility project played an important role in motivating people, but only temporarily. Although people were aware that these stipends would be terminated within 24 months, they continued to hope that the SRP would be renewed. A number of them hoped to find permanent jobs, while a small minority, who were already entrepreneurs, used opportunities to establish small enterprises.

One of the main motivating forces was ecosystem repair and restoration of ecosystem services, particularly soil and rangeland conservation measures, and measures to protect springs for water security. There was visible evidence of improvements in rangelands, erosion and water provision, but this was limited to

small areas with the largest part of the catchment still remaining in a degraded state. This was because of financial and time constraints.

3.4.5 Adaptive Management and Monitoring

Between mid 2006 and the end of 2007, members of the MPASC and the Technical Committee regularly monitored the process of implementation, governance, livelihoods and (to a lesser extent) the natural resource base and kept records of trends. This process enabled community members to hold implementing agents responsible for their actions, and lead to the active questioning of the status quo.

Active adaptive management took place during monitoring workshops, where participants identified 'actions' that should be taken to rectify problems and challenges identified. These actions became 'the way forward' at the end of the workshops, and individuals were assigned by their fellow community members to follow up and report back. At the beginning of the following workshop, the way forward was returned to and the successes or failures in solving the problems were reflected upon. Generally, the recommendations that emanated from monitoring were presented and discussed at the monthly MPASC meetings with all stakeholders. Process monitoring revealed clear of evidence of learning having taken place, and of active questioning of the values that underpinned existing institutions. This was revealed particularly through the creation of the Section 21 Company, which was based equally on traditional norms of governance, as evidenced by the inclusion of traditional leaders at all levels of the organisation, and more conventional norms in keeping with legal requirements. Community-based monitoring was therefore critical in raising awareness of changes that were taking place, generating new knowledge and understanding, and leading to appropriate action (Fig. 3.3), as the following quote from community members attests:

> Before we started monitoring, things just happened here, now we are able to plan. Monitoring opens our eyes to see forthcoming crises, so that when those crises arrive we are not surprised (MPASC member, September 2007)

3.4.6 Co-Management

As a forum for conflict resolution and information sharing, the MPASC model was very effective. For example, it soon became apparent that the roles of the various government departments overlapped considerably, which caused confusion and highlighted the importance of the MPASC. While irrigation water was provided by the Department of Water Affairs and Forestry, once the water reached the fence of a farmer responsibility for irrigation infrastructure fell to the Department of Agriculture. In Macubeni, it was therefore critical that these two departments be

engaged concurrently in long term land use planning. However, critical shortages in staff, capacity and resources, such as a vehicle to reach Macubeni, meant that all relevant departments were not able attend every meeting. Indeed, the local agricultural extension officer soon proved to be a vital link between the community and other government departments.

Some of the challenges with co-management, which we observed, were the dominance of government and municipal officials' views (when they were present), and the frequent absences of officials from meetings due to their limited budgets and staff shortages, but also because they seemed to be very involved in internal meetings and processes, the importance of which seemed to override community development considerations.

3.5 Discussion

3.5.1 Linking Resilience and Adaptive Co-Management Theory to Practise

The approach described in Fig. 3.3 is a useful structure for the facilitation of adaptive co-management initiatives. It provides a logical, sequential approach to focus the attention of facilitators and communities. The initial knowledge generation step was essential, as it exposed the key drivers of the system, and provided a focus and catalyst for the formation of knowledge networks, through for example the formation of the MPASC, which became one of the mainstays of the project. The challenge in this phase was to balance the powers between informal local knowledge and formal scientific knowledge (Healy 2003; Libel et al. 2006). Our regular local workshops, where information was consistently shared and all stakeholders were given the opportunity to present their views, guarded against imbalances. We also made specific efforts to strengthen the confidence of local people in their own knowledge by assisting them with developing their own presentations, and providing numerous opportunities for community members to present their own ideas and solutions in community and broader public forums. Community knowledge about the local uses and distribution of natural resources was readily accepted, but local knowledge about management, and processes, was less readily trusted by outsiders.

The community's awareness about their responsibility for ecosystem management increased dramatically between 2006 and 2007, with the percentage of people believing it was the community's responsibility, in collaboration with government, almost doubling from the 2006 to the 2007 survey. The motivation of participants was stimulated through the training they received, personal recognition received from the community and the prospects of improvements in ecosystem services, improved fecundity and condition of livestock, and, most importantly, greater water security because of the repair of deteriorating springs.

As an attempt to match the scale of institutions and decision making to the ecosystems being managed (Bohensky and Lynam 2005), the development of fine-grained or mini management plans at the village level for key resources was effective. The seven elements made them easy to conceptualise and implement: a typical mini management plan took one working day for preparation and training, and one day to complete. These management plans focused people's attention on land elements that were directly relevant to their respective villages, and were small enough to make people feel capable of managing them. Most of the key resource areas were within visible distance of the villages, and were therefore constantly in people's minds. The involvement of sub-headmen and direct users of ecosystem services proved to be extremely effective: people were motivated, and felt they had the ability, to manage their own resources. The facilitators assisted by documenting the management plans and providing the necessary stationary and equipment such as files, data sheets, and, most importantly, training. These training sessions were attended by a diversity of village members such as the youth and people of different ages, and many more people than those who served on the Village Land Committees attended the training sessions, which greatly benefited broad-based awareness raising.

Power-knowledge dynamics are an inherent feature of adaptive co-management in resource poor communities. This dynamism was evidenced several times during the project. For example, the power dynamics that eventually resulted in the 'overthrow' of the MPASC, during the critical change-over phase of becoming a Section 21 Company, were centered largely around access to information. MPASC members were accused of holding on to knowledge for personal gain. This conflict over access to information was overlaid by political power struggles, which, together, produced a wholly unexpected outcome in the election of the members of the Section 21 Company. Another example was the fact that the Technical Committee formed out of the MPASC to receive intensive training in monitoring and management became increasingly alienated by other MPASC members, who felt that they were receiving undue attention from facilitators. Since these technical committee members were originally voted for by the MPASC because they were regarded locally as experts in several fields, their loss during the elections for the Section 21 Company represented the loss of a substantial amount of skills and knowledge from the system. The interaction between power and knowledge is one of the sources of novelty and surprise in complex systems, and this is explored further in the section that follows.

3.5.2 The Impact of Surprise in Systems Beyond the Threshold: Politics, Conflict, Government Decisions

Despite the existence of a window of opportunity, and the benefits of adaptive co-management coupled with several decades' experience working in rural African

communities in community-based natural resource management settings, things still went wrong. It seems that, in the early stages of capacity development when capacity is low, social–ecological systems are extremely vulnerable to surprise. A relatively 'normal' occurrence of local political change, when the local councillor and champion of the project was ousted, catalysed an entire cascade of events culminating in the rejection of almost every individual trained during the project when the time arrived to re-elect community members. However, this turn of events was paralleled by political change at national level, with the split within the ruling party and the development of two political 'camps' at national, provincial and, ultimately, local level (Majova 2007). The consequence of these events was that the higher level co-management institution faltered due largely to a lack of understanding of the long term vision and intended role of the institution by its new members, and a complete lack of training. Since there was no structure to report to, the Village Land Committees, while continuing to exist, have not progressed further than developing the mini management plans, with negative implications for monitoring, institutions and, ultimately, ecosystem resilience. These political upheavals were beyond the control of anyone inside the project but, we contend, would have been overcome had the capacity to cope with change been more fully developed. On the positive side, no major or life-threatening conflicts occurred during this period and the events demonstrated two key elements of a community's capacity for governance: democracy and decisiveness.

3.5.3 Implications for Adaptive Co-Management Theory

Conceptualising Macubeni as complex, adaptive social–ecological system enabled the team to, from the outset, interrogate the interactions between the different components of the system, their change over time and the complex drivers of change. This informed the nature of interventions proposed to government and international development agencies, and also guided awareness raising and training programmes. Using resilience as a lens enabled us to focus on repairing the adaptive capacity of the social–ecological system, rather than merely adding or restoring capital as advocated by many development practitioners. The adaptive co-management approach meant that 'learning by doing' and constant reflection was deliberate. This was communicated up-front to project funders to obtain their buy-in into a less rigid but more informative approach to development. The local stakeholders readily and intuitively accepted this approach, as this reflected their traditional and contemporary livelihood strategies and natural resource management and governance systems. The learning and reflecting aspects increased awareness amongst local people and government officers of flaws in their current resource management practises, and the reasons for degradation. This catalysed innovation and adaptive governance.

Adaptive co-management under resource-poor conditions has six challenges: (1) Maintaining key individuals and balancing power relations; (2) Motivating all

actors to collaborate; (3) Making the most of available capacity and resources; (4) Overcoming and coping with disturbances during the early stages of capacity development; (5) Focusing on the finest resolution that time and budget allows; (6) Persisting long enough to facilitate long-term change.

3.5.3.1 Maintaining Key Individuals and Balancing Power Relations

A key challenge in initiating adaptive co-management under resource poor conditions is finding a balance between nurturing key individuals and managing the power dynamics that emerge from this process. Jealousies flared at all levels in Macubeni when certain individuals took the lead in the initiative: for example, the MPASC felt that the Technical Committee was not sharing information and was receiving undue attention and possibly benefits, whilst the broader community felt that the MPASC was not sharing information effectively and was holding on to information about employment possibilities. Political leaders capitalised on this distrust and ushered in an entirely new set of committee members from their own political party.

Attempts to manage these power relationships should not however undermine community self-determination. It would have been tempting, for example, to insist that at least some of the members of the MPASC should sit on the Section 21 Company. It is even more tempting to state that the initiative has failed. However, it is in the reorganisation phase of the adaptive cycle, immediately following collapse, that learning and novelty are thought to emerge (Folke et al. 2003). Indeed, community members are already suggesting that in the future only 50% of the committee can be rotated during any one election cycle. Balancing power relations relies on patience, and an understanding that initiatives will experience periods of rapid development and periods of comparatively little change.

Our observations that officials' views tended to dominate meetings are not new. This resonates with the critiques of co-management raised by other authors, for example, Nadasdy (2003) and Reid and Turner (2004). Other challenges with co-management are that officials who are crucial to the notion of adaptive co-management take their natural resource management obligations less seriously than communities do, lack of resources for officials to actively participate, and some powerful role players within the community and outside it abusing the co-management process to promote their own materialistic objectives.

3.5.3.2 Motivating all Actors to Collaborate

A key challenge to adaptive co-management is to motivate those collaboration partners who are not directly affected by or benefiting from ecosystem services, to commit themselves to co-management. It is relatively easy to mobilise and motivate local people to restore ecosystem services, but their capacity is seldom adequate to go it alone. Therefore, other partners have to

be motivated to actively participate and contribute. However, the capacity of local municipalities and government officials to perform this function is relatively low. Therefore, academic institutions have crucial roles to play as sources of knowledge and intellectual capital in adaptive co-management. Action research (Blythe et al. 2008) therefore has a crucial function in resource-poor countries, and academic entities should explicitly pursue this in their strategic objectives (Tyler 2006).

3.5.3.3 Making the Most of Available Capacity and Resources

Under resource-poor conditions all forms of capacity matter. This relates to knowledge of both social and ecological processes; infrastructure; finances; and social relationships in particular. These assets are the 'seeds of renewal' and, if nurtured, can grow to increase the resilience of the social–ecological system (Gunderson et al. 1995). We made abundant use of local and traditional knowledge, and made the most of government, development agency and academic funds as well as municipal resources. We collaborated with government agricultural experts, international development advisors, other academics from different disciplines, NGOs and other universities. We used community halls, schools, clinics and people's homes to conduct workshops and meetings, and stayed in with local families during visits to the area. The key resource areas repaired and managed by the community were not extremely rich in biodiversity or nutrients, and were relatively small but important patches of 2–10 ha in size, and the springs did not deliver more than a few hundred litres per hour, but they were critical to the livelihoods of the community. Existing institutions such as the traditional leadership were in disarray and had all but collapsed at the start of the project. They were, however, critical to the establishment of the Village Land Committees committees, and we can assume that the adaptive co-management process strengthened their legitimacy and played a catalytic role in reviving them.

3.5.3.4 Overcoming Disturbances During the Early Stages of the Project

Because of the shortages of capital during the early stages of adaptive co-management, small disturbances can have a large impact on the trajectory of transformation (Folke et al. 2002; Olsson et al. 2004b). Because of the complexity of system interactions and the plurality of actors involved (Fabricius et al. 2007), adaptive co-management is prone to disturbance and surprise throughout. When surprises such as political upheaval, institutional challenges such as transgressions of rules, conflicts, ecological disturbances such as flash floods or fires occur in the early stages of adaptive co-management they can de-rail the system, especially in the absence of facilitators (Jones 1999). In well-resourced systems such as those described by Olsson et al.

(2004a, b), the system has enough 'buffering capacity' (Folke et al. 2005a) to cope with disturbance.

3.5.3.5 Focusing on the Finest Resolution Within Time and Budget Constraints

The fine resolution approach was advocated by Murphree (2000) in his analysis of success factors in Zimbabwe's CAMPFIRE (Communal Areas Management Programme for Indigenous Resources). One of the principles advocated by Murphree is that the unit of management should be at the same level as the unit of resource utilisation (Fabricius 2004). In the case of Macubeni, the shift in focus to fine-grained key resource areas, 'owned' and managed by individual villages, created new impetus and maintained the continued provision of ecosystem services. These resource patches were highly visible, and in daily use by the people directly responsible for their management. Matching the unit of management to the resolution of the ecosystem by facilitating the formation of Village Land Committees, further promoted the functioning of lasting institutions. When political turmoil occurred, these Village Land Committees survived, because of the close relationships between their respective members, their focus on ecosystem services that mattered to the community, and their ability to regularly meet without much cost to their members.

3.5.3.6 Persistence

Our intervention started in mid 2001 and ended in early 2007, when key individuals left, government's social responsibility funding cycle ended, and the international development agency withdrew. We contend that 6 years is not enough to facilitate transformation and the restoration of human, physical, natural and financial capital in systems beyond the threshold. This is because of the hysteresis effect (www.resalliance.org), where the 'memory' of past impacts (Folke et al. 2003) linger on in the system. In the Macubeni case, the impacts of historical social engineering and ecosystem degradation are still highly visible in the form of extreme poverty, low formal qualifications, demographic distortions with weak representation by middle-aged males, and large areas that remain eroded despite the ecosystem restoration efforts. Close to two million US$ were spent over the 6 years (Mitchell et al. 2007), with many organisations contributing to the funding base. We maintain that this represents only a fraction of the investment and effort required to truly transform these resource-poor, degraded systems. This has major implications for rural development in South Africa's former 'homeland' areas, as Macubeni represents just one of the hundreds of Wards in a similar state. The shortage of skilled facilitators, funds and weak project management capacity in South Africa make this a formidable challenge, requiring the formation of a dedicated Ministry for Rural Development with a significant budget.

3.6 Conclusions

Despite the substantial investment of expertise, time and money at Macubeni over a 6 year period, the social–ecological resilience of the system could not be adequately strengthened to survive a relatively small disturbance in the form of orderly political change. We believe, however, that the use of the theoretical principles of adaptive co-management maximised the impact of the intervention, and that the Macubeni community is more knowledgeable, skilled and aware of the challenges facing them, and much more resilient than before. To overcome the legacy of historical policies will, however, require prolonged interventions and investments by local authorities, national and provincial government, academic institutions and international development agencies and the local community, who understands that ecosystem management is primarily their responsibility.

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