

3. APPROACHES TO ECOSYSTEM MANAGEMENT

This chapter serves to introduce and outline the major theoretical concepts underpinning SANParks approach to Protected Area management and the design of a management planning framework.

The management and decision-making process is required to be:

- **Strategic and value based:**
 - Purposeful and goal-directed, with the first step in planning and management being the description of a desired future state of the protected area based on scientific and societal needs and values.
- **Adaptive:**
 - In the face of uncertainty management actions are treated as an opportunity to learn by doing. Management is planned as a learning experience and improves through frequent review of policy and action.
- **Participatory**
 - Meaningfully involving all stakeholders to serve their needs, access their inputs and secure their cooperation.
 - Governing cooperatively with other agencies to coordinate and integrate goals and actions.

These principles draw on current theory and research on appropriate ecosystem and natural resource management approaches, in particular Adaptive Resource Management and its local derivative Strategic Adaptive Management (SAM) (Biggs and Rogers, 2003). These approaches are outlined briefly, followed by guidelines on facilitating participatory decision-making within SAM.

3.1 Strategic and value-based approaches to ecosystem management

The Protected Areas and Biodiversity Acts have introduced the requirement for conservation management in South Africa to be more goal-directed than has previously been achieved. Strategic management is not merely strategic planning (planning one's future actions) – it is “*acting with a purpose*”. This acknowledges that “the better you know where you are going the more likely you are to get there”. The ‘purpose’ of management needs to be made explicit and operational. The ultimate purpose of Protected Area management is informed by science, societal values and the mandate afforded to SANParks through democratic governance.

Articulating a vision for the desired future state of a protected area is the first step in management planning. It limits and directs all future management actions. This desired future condition is defined by the qualities of an ecosystem, or its components, which an organisation seeks to develop through its decisions and actions.

Prioritising a vision for a desired future state ensures that management employs what Keeney (1992) describes as “value-based decision-making”, which is oriented toward long-term goals serving ultimate values. Without explicit consideration of the values a decision must serve, the process defaults to alternatives-based thinking which is limited to selecting between only the most readily available current strategy options, which are then usually evaluated relative to short-term priorities and goals. A vision encourages strategic thinking with longer term purpose in mind.

BOX 1: The universal characteristics of strategic management (from Meffe *et al.*, 2002)

Strategic management is explicit. Strategic approaches define what an organisation, group or individual intends to do, how and why those actions were selected and whether or not they are accomplished. Being explicit means everyone knows what the group is doing, it *exposes hidden agendas* (because if some does or proposes something else it is easily evident) and makes everyone *accountable*.

Strategic management sets direction but allows flexibility. It focuses people on the agreed intentions of the group. When focussed on the longer-term outcomes people are free to use the best means to advance their common goals.

Strategic management promotes action. When the purpose is explicit and agreed on, people are *empowered* to act.

Strategic management starts at the top. That is it starts with a high level purpose that guides decisions that must fit within its context. Effective management is about choices and a strategic approach helps make good choices to ensure individuals or groups are doing what they should be doing, rather than using resources on actions not directly related to their goals.

Strategic management involves all stakeholders. The purpose must be set and accepted by the full group of people who have an interest in the decisions.

Strategic management requires good communication. Actions will be occurring in many different places implemented by many different individuals or groups. Good communication is needed to sustain energy and commitment and to ensure actions stay aligned with the purpose.

Strategic management seeks improvement not perfection. A supposedly perfect plan will take so long to develop that it will be obsolete before it is finished. Ecosystem management requires major changes in resource allocation which can seldom be achieved in one go. It must be tackled in an *evolutionary* manner.

3.2 Adaptive management

Effective ecosystem management is challenged by complexity and uncertainty. Levin (1999 p. 231) defines complexity as “an interconnected network of components that cannot be described by a few rules; generally manifest in structure, order and functioning emerging from the interactions among diverse parts”.

There are four sources of uncertainty and complexity in ecosystems that profoundly affect management decisions and a manager’s ability to achieve a set of desired conditions (from Meffe *et al.*, 2002):

- Environmental uncertainty (variable weather, natural catastrophes).
- Biological uncertainty (variable weather, natural catastrophes).
- Non-independence of events and interactions (indirect/cascading effects, synergistic/contingency effects and cumulative effects).

- Uncertainties about or caused by human behaviour (human-induced catastrophes, insufficient knowledge, effects of random variation or noise, unpredictable social, institutional, and economic changes).

There are four potential methods of dealing with uncertainty and complexity (Meffe *et al.*, 2002):

- Get as many people as possible thinking holistically about the system (biophysical, socioeconomic and institutional) and events likely to occur there.
- Use mathematical and computer modelling and statistical analyses that account for random events.
- Make decisions with buffers to absorb surprises.
- Employ adaptive management which seeks changes in direction as new information becomes available.

Adaptive Management (Holling, 1978, Walters, 1986, Walters and Holling, 1990) is an approach to natural resource and ecosystem management that acknowledges the uncertainty and complexity inherent in natural systems and which limits our knowledge and understanding of ecosystem functioning. Adaptive management offers a means of dealing with this uncertainty by incorporating research into conservation action. Specifically, it is the integration of design, management, and monitoring to *systematically test assumptions in order to adapt and learn*.

Within an adaptive approach management policies are treated as experiments – the practicality of trial and error learning is combined with the rigour and explicitness of the scientific method, to produce learning that is both relevant and valid. Learning together in this way is the basis of a partnership between scientists and managers. Three different categories of adaptive management have been recognised:

Active adaptive management:

This follows the classic Holling and Walters method which is a series of steps that resemble the scientific method but are applied in large scale management settings. It has been attempted in full only a few times and has been successfully implemented even less. The basic steps of active adaptive management are as follows:

- List imaginative policy options.
- Undertake explicit modelling of how the system functions and how it might respond to the new policy.
- During the modelling exercise identify gaps in knowledge that prevent the new approach from being implemented.
- Design management actions to gather information about the gaps. The management experiment would reference sites for making comparisons.
- As management proceeds collect data to measure performance.
- Modify the model on the basis of experimental outcome to help decide on best policy.

Passive adaptive management:

The most common adaptive approach is less experimentally demanding and means a few aspects of an experiment are missing although learning remains the major objective. The most common differences are that there is no construction of elaborate models, and sites are chosen non-randomly on more immediate, pragmatic needs. Reference sites may be used for comparison with the managed sites but often this is not possible. For example, in adaptive management of a river there can be no replicates or reference sites because there is only one river and it changes down its course.

Documented trial and error adaptive management:

Trial and error learning can also resemble adaptive management as long as the implementers collect data, analyse them objectively and share their learning with others. Almost any task

can be turned into a learning opportunity by asking a few questions, while ensuring one is rigorous and explicit.

BOX 2: Principles for the Practice of Adaptive Management (from Salafsky, Margoluis & Redford, 2001)

- Principle 1: Do Adaptive Management Yourself
- Principle 2: Promote Institutional Curiosity and Innovation
- Principle 3: Value Failures
- Principle 4: Expect Surprise and Capitalize on Crisis
- Principle 5: Encourage Personal Growth
- Principle 6: Create Learning Organizations and Partnerships
- Principle 7: Contribute to Global Learning
- Principle 8: Practice the Art of Adaptive Management

3.3 Adaptive Management in South Africa: Strategic Adaptive Management

The term “adaptive management” is used quite often in South Africa but such management seldom systematically tests assumptions. It is generally “trial and error management” and is not really adaptive at all. Occasionally there is documentation but it is usually after the fact, and is not explicitly built into a clearly defined learning process. It would therefore be inappropriate to call it “Documented Trial and Error Adaptive Management”.

In 1996 a group of conservation and river scientists and managers developed a formal process termed “Strategic Adaptive Management” (SAM) (Rogers and Bestbier, 1997) which aimed to move environmental management away from reactive, conflict-driven management of human impacts, to consensus-driven, learning-oriented management for explicitly stated ecosystem goals.

The SAM approach is similar to what Meffe *et al.* (2002) describe as Ecosystem Management: “an approach to maintaining or restoring the composition, structure and function of natural and modified ecosystems for the goal of long term sustainability” and which is “based on a collectively developed vision of desired future conditions that integrates ecological, socioeconomic and institutional perspectives applied within a geographic framework defined primarily by natural ecological boundaries.”

However SAM differs from Meffe *et al.*'s Ecosystem Management in five important respects:

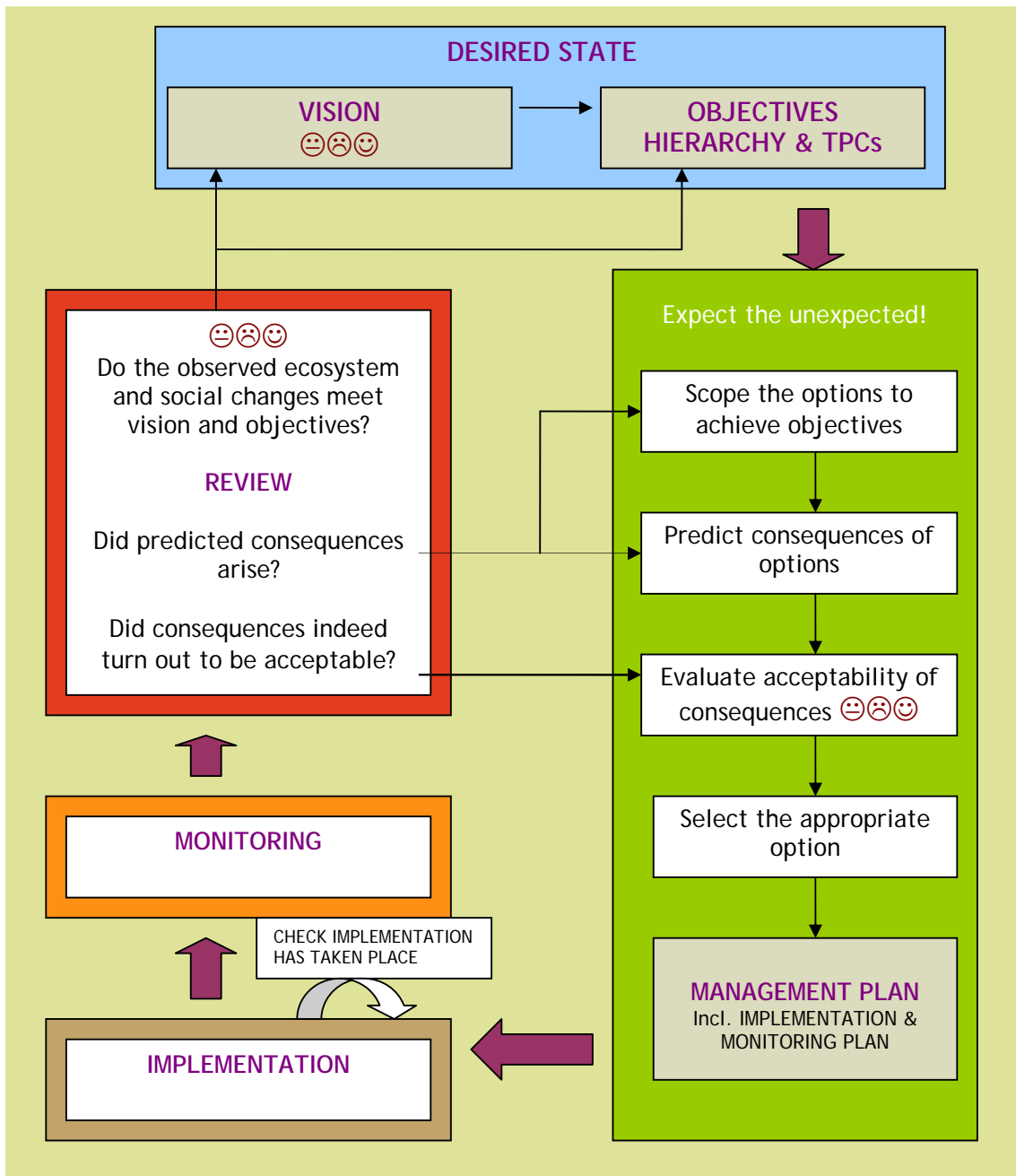
- The formal recognition of the role played by values in decision making. Consensus seeking methods are used to align stakeholder values in the definition of desired future conditions.
- A process for developing an ‘objectives hierarchy’ to translate a broad values-based vision into achievable science-based ecosystem outcomes.
- A process for defining spatially and temporally explicit ecosystem/biodiversity outcomes expressed as hypotheses of ecosystem response to natural flux and management actions. Thresholds of Potential Concern (TPCs) are the upper and lower levels along a continuum of change in selected indicators, and are hypotheses of acceptable change in ecosystem structure, function and composition.
- The use of multiple modes and paths of scientific enquiry to improve understanding. Thus it can better deal with ecosystem level “noise”, synergistic, cumulative and indirect effects, than can experimental approaches. Experimentation, in a scientific

method sense, is of very limited value in a complex, dynamic social-ecological system.

- Explicit theory and guidelines for institutional change needed to align previously bureaucratic organisations with the imperatives of becoming an adaptive or learning institution.

The basic steps in SAM are (Figure 3.1):

- **DESCRIBE THE DESIRED STATE:**
 - **Visioning:** Understand, with stakeholders, the social, economic and ecological context of the system to be managed, and the principles/values that guide management. Develop a broadly acceptable vision of the future.
 - **Translate vision into ecosystem objectives/outcomes:** Develop an ‘objectives hierarchy’ that documents the sequential reasoning used in translating a broad societal values-based vision into science-based ecosystem outcomes.
 - **Generate a set of TPCs to define the acceptable levels of change in ecosystem/biodiversity composition, structure and function.**
- **DEVELOP A PLAN TO ACHIEVE OR MAINTAIN THE DESIRED STATE:**
 - **Expect the unexpected:** Use a variety of tools (scenario planning, systems thinking, models, historical records, etc.) to scope the range, and likely spatiotemporal limits, of unusual events and their implications for management towards the desired future conditions.
 - **Scope the range of management options** to achieve the desired future conditions and predict (formally or informally) their likely outcomes under different scenarios.
 - **Select the best options:** In co-operation with stakeholders decide which management options provide the best potential learning opportunities, and social-ecological system outcomes.
- **IMPLEMENT:**
 - **Implement the planned management interventions.**
- **MONITOR:**
 - **Monitor and audit achievements:** Use a range of research projects, traditional monitoring, modeling and surveys to understand system response to natural flux and management intervention. Weigh this against the desired outcomes.
- **REVIEW:**
 - **Reflect at each step:** Is thinking and action congruent with principles, values and vision? What does knowledge gained tell us about (1) our understanding of the ecosystem, (2) its responses, (3) how realistic are the desired outcomes and (4) how useful are the processes used to achieve them?



☺☺☺ Stakeholder involvement crucial

Figure 3.1: Strategic adaptive management (SAM) process

Bounding and defending the Desired State: setting Thresholds of Potential Concern (TPCs)

The desired state is based on a vision for a set of desired future ecosystem conditions. It is important to note that this refers to a 'desired set of varying conditions' rather than a static state. Ecosystem conditions are not fixed but inherently dynamic. We cannot aim to achieve specific and unchanging ecosystem conditions, but only to maintain natural variation and processes as the basis for ecosystem resilience – resilient ecosystems are able to absorb environmental stressors without undergoing an irreversible change in their state.

But some changes may be undesirable as they form part of a long-term trend moving the ecosystem away from the desired state. Over time this trend may become irreversible. The desired outcomes of management are therefore expressed as limits of acceptable change – termed Thresholds of Potential Concern (TPCs). TPCs are upper and lower levels of change in selected indicators. If TPCs are reached it is very likely that the desired state will not be achieved or will not be able to be achieved into the future.

In parks that are within the desired state, TPCs are red flags to managers warning that management intervention could be necessary to defend the desired state. Modelling is also used to predict the results of future monitoring and thus give early warning that a TPC is likely to be breached. For parks that are in the process of rehabilitation toward a desired state, TPCs represent achievable goals for management to work toward.

For example, KNP uses about ten major TPC groupings. Jointly, these represent a multidimensional envelope in which park management and stakeholders wish the system to remain, “bouncing around” as much as possible, without going to the undesirable zone.

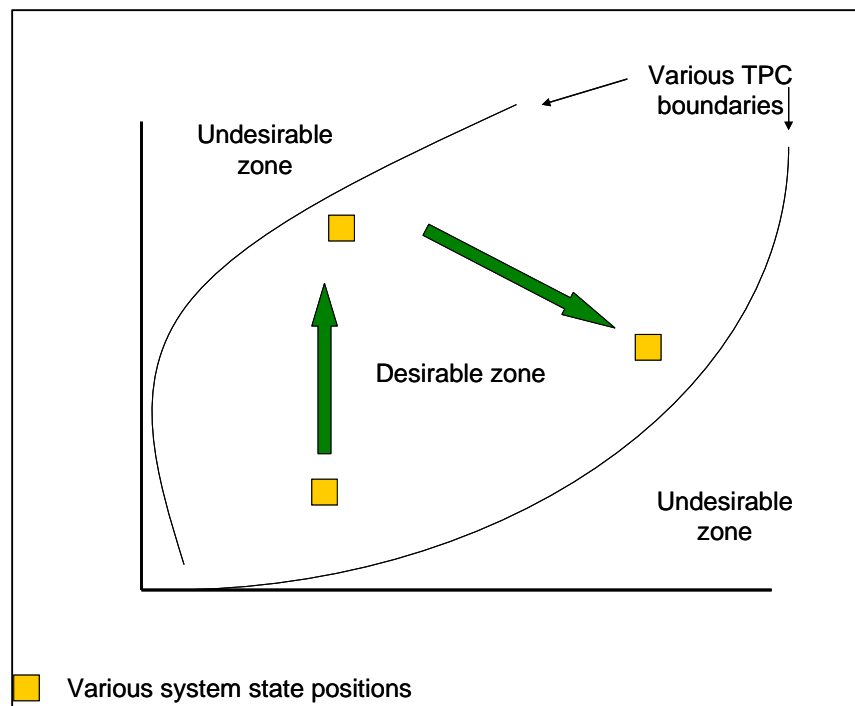


Figure 3.2: TPCs as boundaries of the desired state

3.4 Systematic Conservation Planning

Systematic conservation planning (Margules and Pressey, 2000) is a structured and systematic approach to locating and designing protected areas so that they achieve representativeness (represent the full variety of biodiversity ideally at all levels of organisation) and persistence (promote the long-term survival of the biodiversity they contain). Because conservation planning has generally not been systematic in the past, existing systems of protected areas worldwide contain a biased sample of biodiversity, generally being that of areas that are very remote or have little value for commercial use.

SANParks uses SCP to address specific issues of protected area management planning within the broader context of the SAM process. SCP helps to quantify some of the spatial biodiversity and landscape objectives that are identified in the adaptive management process. SCP provides a spatial framework with which to quantitatively monitor and evaluate the attainment of these spatial biodiversity objectives within a park. Additionally, the process/tool is useful in prioritizing management actions and activities in attaining the desired state/objectives.

Systematic planning goes through a number of steps, which can be mapped onto the various phases of the Strategic Adaptive Management cycle.

- Measure and map biodiversity in as systematic and uniform a way as possible. (This contributes to an assessment of context and current state as part of a desired state process.)
- Set quantified targets for the biodiversity features and processes that have been identified. (This provides spatially explicit quantified objectives as part of a spatial desired state.)
- Evaluate the current state against these objectives. (Comparison of the current and desired state identifies the need for management intervention.)
- Identify and prioritise actions which are required to move from the current state to the desired state, which typically takes the form of identifying areas that require some sort of conservation action. (This forms part of the process of considering and selecting management actions.)
- Implement the actions to achieve the desired state.
- Monitor and evaluate the attainment of the objectives against the quantitative targets.

SCP is used within 4 key areas of SANParks management planning:

- To better understand the context for decision making in SAM.
- Park expansion planning.
- Internal land use planning to produce a Conservation Development Framework (CDF).
- External land use planning to analyse spatial aspects of threats (in the 'park interface zone') to biodiversity in a park.