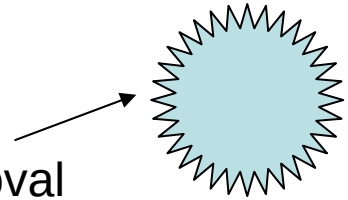
Instead of a title …

Recommended pro-forma business card for members of this group

Freshwater Seal of Approval



Name ⟶ .....

Freshwater Activist

a.k.a. Eco-warrior <Aqua> Grade I

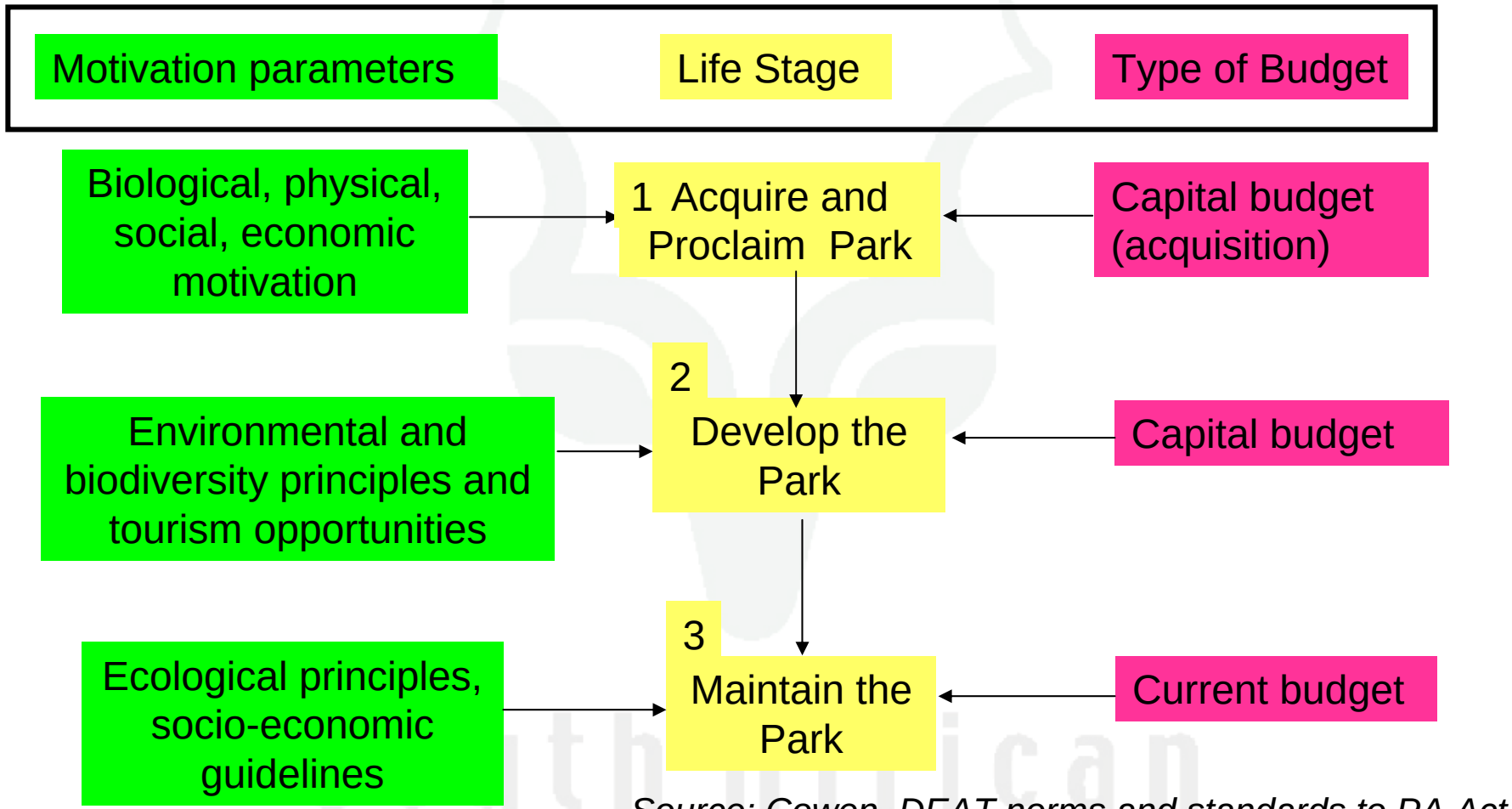
Categories of problems dealt with	* nearly impossible * extremely tough * odds heavily loaded against

Motto: "It's never too late[#]. Start now with something practical!"

[#] licenced to neglect terminally ill ecosystems according to triage guidelines

Some of us tend to belong more strongly to one or the other part of …

Protected Area Life Cycle



Source: Cowen, DEAT norms and standards to PA Act

In practice these are usually not treated as a continuum with functional feedbacks. Stephen Holness and have submitted a candidate symposium at SCB2007 "Partnerships and processes needed to adaptively link conservation assessment, implementation and ongoing management of conservation initiatives"

We try not to

measure/assess/monitor/reflect etc in a vacuum

Hence the emphasis on context – only half this talk is about thresholds*, the rest is the why they exist, how they fit in, and how the feedbacks work which ensure that the whole is meaningful

***Bear with our ACRONYM TPC = threshold of potential concern. Similar, but also very different in philosophical usage from LAC = limit of acceptable change**

TPC not designed for 'trade-offs' but rather for

shared future-building

An article of faith is the “desired state”*

set by the

vision-objectives-thresholds

almost literally ‘steeped’ in

Our little acronym : V-STEEP (VALUES, technological, economic, environmental, political)

…/ next 2 pages – SANParks conservation values

* Unfortunate choice of words which has now stuck

• **Respect the complexity, as well as the richness and diversity of the socio-ecological system making up each national park and the wider landscape and context around it. Respect the interdependency of the formative elements, the associated biotic and landscape diversity, and the aesthetic, cultural and spiritual attributes. Leverage all these for creative and useful learning**

• **Strive to maintain natural processes in ecosystems, and the uniqueness, authenticity and worth of cultural heritage, so that these systems and their elements can be resilient and hence persist.**

• **Manage with humility the systems under our custodianship, and influence, and be influenced by, the wider socio-ecological systems in which we are embedded.**

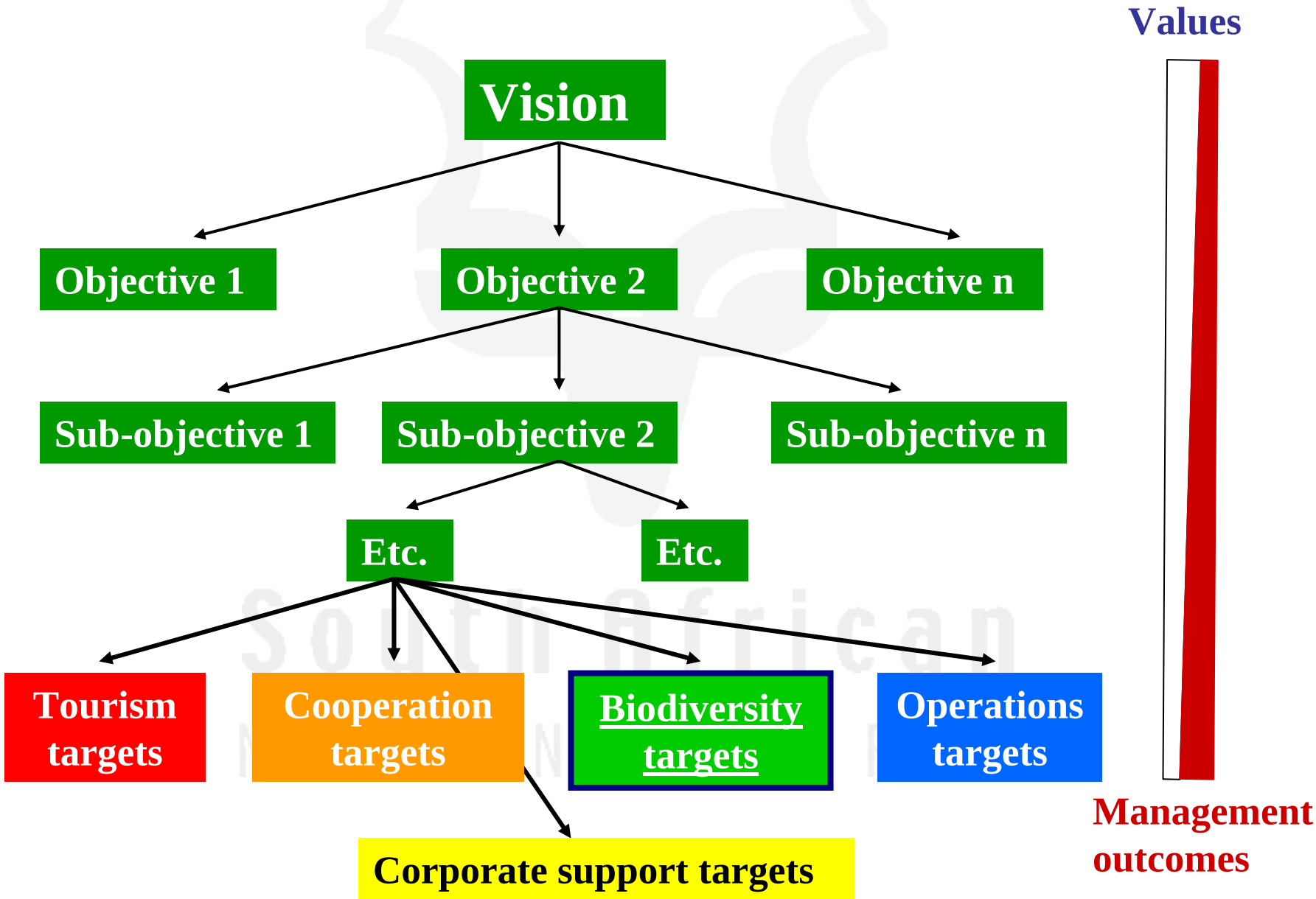
• **Strive to maintain a healthy flow of both ecosystem and cultural goods and services, and to preserve cultural artifacts, promoting from these enjoyment, appreciation and other benefits for people, also via access to nat. parks.**

• **When necessary, intervene in a responsible and sustainable manner, complementing natural processes as far as possible, using only the level of interference* needed to achieve our mandate. (*in fine print "sometimes severe")**

• **Do all the above in such a way as to preserve all options for future generations, while also recognizing that systems change over time.**

•**Finally, acknowledge that conversion of some natural and cultural capital has to take place for the purpose of sustaining our mandate, but that this should never erode the core values above.**

A Hierarchy of Objectives



KNP Mission

In keeping with the SANParks mission, to maintain biodiversity in all its natural[1] facets and fluxes, to provide human benefits and build a strong constituency and to preserve as far as possible[2] the wilderness qualities and cultural resources associated with the Park

Biodiversity Objectives

To maintain biodiversity in all its natural facets and fluxes.

Integrating Objectives

To develop a thorough understanding of the integrated socio-ecological system (SES), especially in the regional context, for maintenance of a resilient SES and to balance human activities and development inside and around the KNP with the need to conserve ecosystem integrity and wilderness qualities by agreeing on a desired[1] set of future conditions, and by developing an adequate suite of principles and tools.

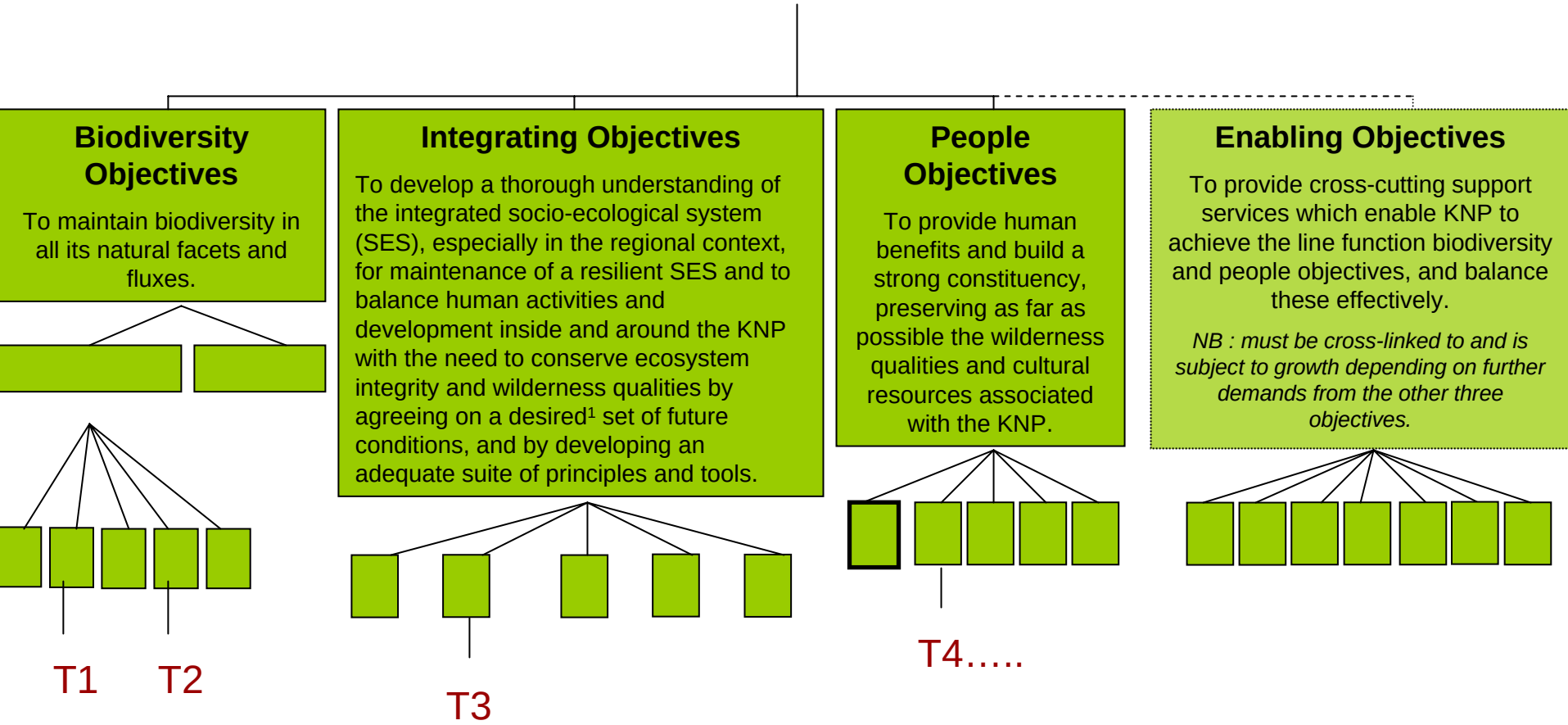
People Objectives

To provide human benefits and build a strong constituency, preserving as far as possible the wilderness qualities and cultural resources associated with the KNP.

Enabling Objectives

To provide cross-cutting support services which enable KNP to achieve the line function biodiversity and people objectives, and balance these effectively.

NB : must be cross-linked to and is subject to growth depending on further demands from the other three objectives.



T1,2,3,4 etc = various thresholds

Ecosystem Objective

To understand and manage the KNP as part of the lowveld savanna and its river catchment areas in such a manner as to conserve and restore its varied natural structure, function and composition over time and space, and its wilderness qualities, through an approach integrating the different scales and types of objectives in the objectives tree.

Atmospheric Effects

To understand the major effects of climate (esp. rainfall) in influencing biodiversity, and therefore if, when and how to take management decisions (including the no-action decision) with this clearer context.

Water in the Landscape

To develop an integrated understanding of non-terrestrial ecosystem diversity and dynamics (including sub-surface water) and it's links with terrestrial systems, and to maintain the intrinsic biodiversity as an integral component of the landscape and maintain or where necessary restore or simulate natural structure, function, composition and processes

Terrestrial Ecosystem

To develop an integrated understanding of ecosystem diversity and dynamics, and where necessary intervene with appropriate strategies, in order to conserve and restore terrestrial biodiversity and natural processes

Alien Impact

To anticipate, prevent entry and where possible control invasive alien species, in an effort to minimise the impact on, and maintain the integrity of indigenous biodiversity

Rare Biota

To prevent extinction within the Kruger Park of any species on the IUCN's global critically endangered or endangered lists[1], and to work with other conservation initiatives to secure and strengthen the future of such species over their historic distribution ranges. To put in place appropriate conservation efforts of other threatened[2] species or lower taxonomic division, including considering recommendations of experts of invertebrate taxa for which no formal redlisting has been done, according to a realistic framework. Except in crucial instances for the survival of globally critically endangered species management for system integrity and biodiversity must take precedence over species management.

River Health Objective

To ensure implementation of the ecological reserve in all KNP river systems and where this is not meeting biodiversity or ecosystem health goals, to ensure refinement or revision of the reserve. Through promoting integrated catchment management, to ensure the the role of rivers in landscape biodiversity is realised, allowing for fluctuations in time and space.

Succession Objective

To use existing knowledge and understanding of vegetation succession on the physical river template to aid our understanding of long-term river system functioning and the delivery of goods and services in a multi-scaled way.

- To determine how altered flow regimes, fire regimes and sediment dynamics (influenced by changing land use and management practices) affect riparian vegetation succession and recovery.
- To evaluate how riparian alien plant infestations change the competitive environment of colonisers and vegetation recovery. xref:alien impact
- To determine the effects of increased animal densities (esp. large herbivores) on succession patterns and outcomes.
- To explore the ecosystem consequences of increased population growth and development.

Migration Objective

To ensure that migration patterns and processes are retained or restored to allow movements between habitats based on connectivity over space and time.

- To restore migration patterns by removing unnecessary dams, debris or by installing functional fishways.

River Rehabilitation Objective

To restore natural river ecosystem health and functioning by rehabilitating or redesigning redundant and other man-made structures.

- To restore natural flows in those systems that have been affected by man-made structures (e.g. Hapi pan system).
- To encourage neighbouring landowners / stakeholders to rehabilitate riparian zones.
- xref: alien impact (free-floating aquatic aliens)

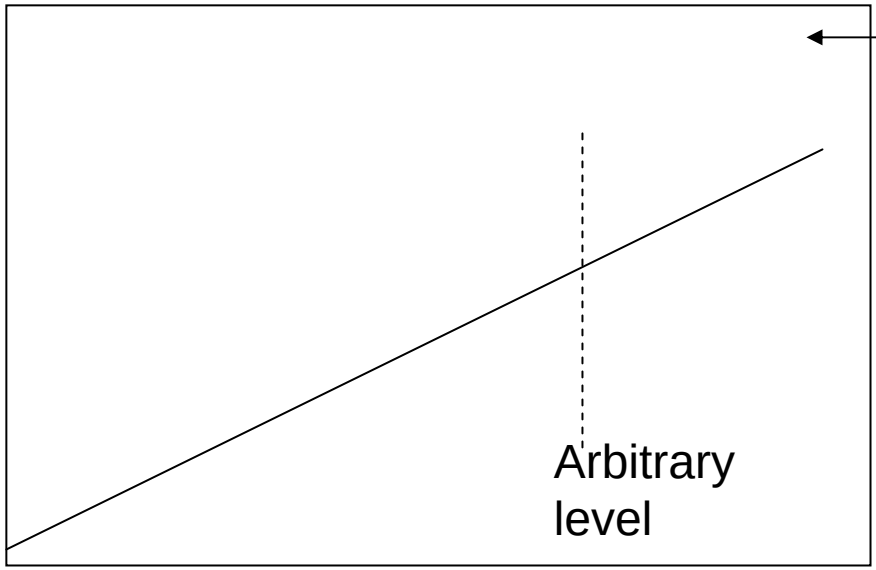
Integrated Catchment Management Objective

To facilitate water resource management in a sustainable manner in the lowveld, to ensure ongoing river ecosystem health.

- To integrate biophysical, social and resource management aspects in the context of long-term variability in all these dimensions.
- To embed social processes in river management.
- To move towards understanding the ways in which river ecosystem structure and function support the delivery of goods and services.
- To promote an understanding of renewable resource exploitation and carry out resource economic evaluations of factors affecting river health and functioning.

This is one of 10 pages of the detail on Water in the Landscape objectives section; followed by a 1 page way forward summary of crucial actions which maximises chance of achievement of most of these

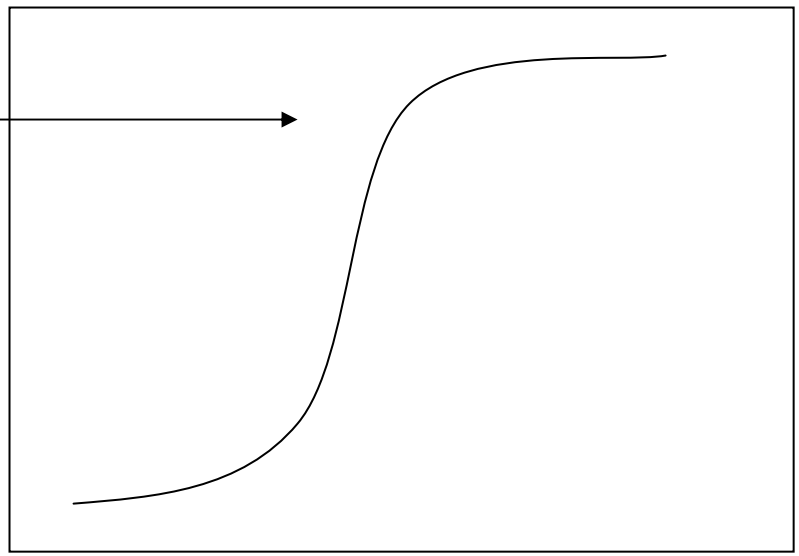
Some theory …



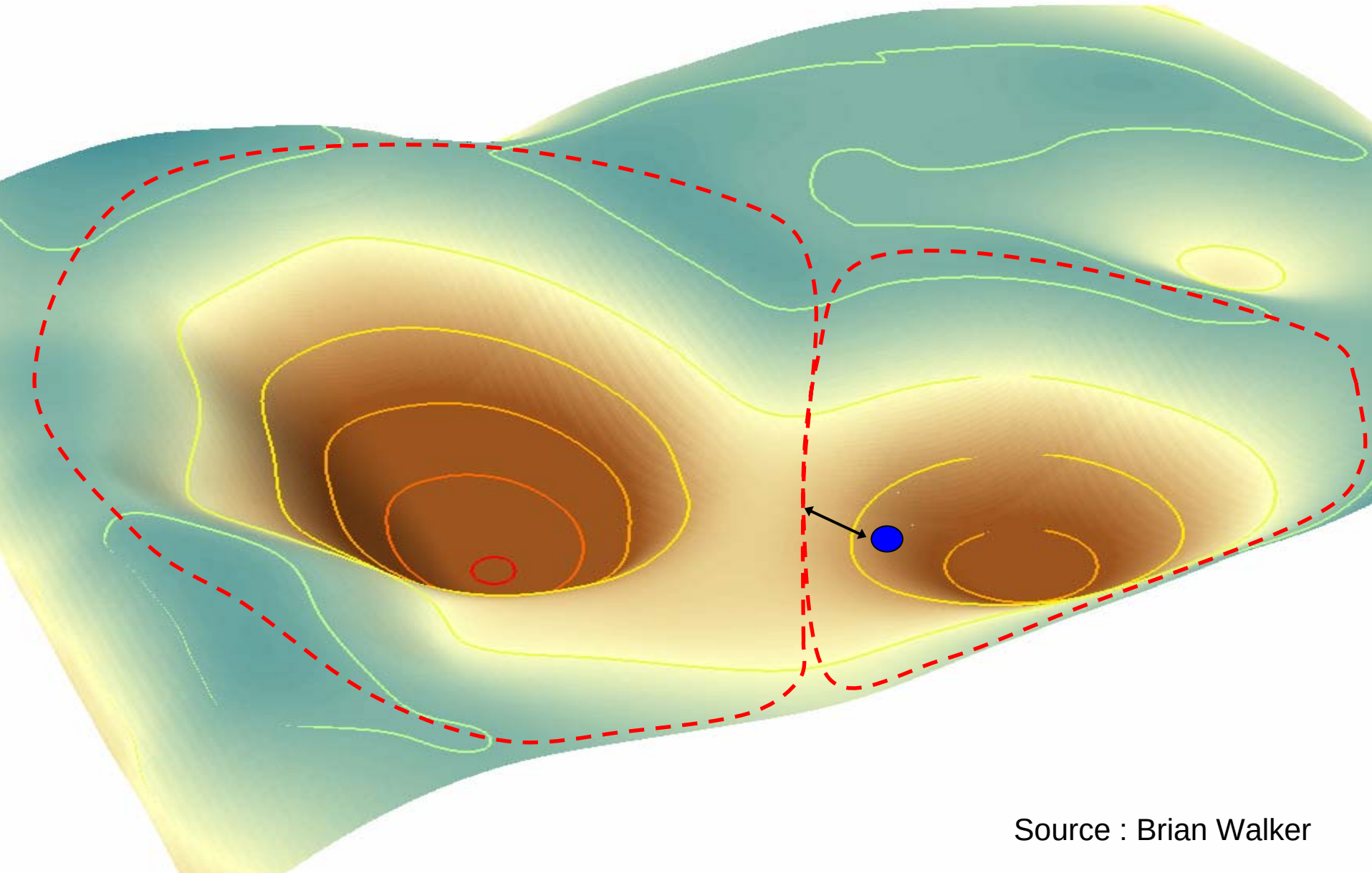
Technically, not an ecological threshold

But we may choose an arbitrary level which we consider unacceptable – so in fact defining a psychological "point of no return" which is thus an aesthetic (or other non-ecological threshold)

THIS is an ecological threshold. Importantly, the "threshold of potential concern" (TPC) now widely used is designed to fall just short of the ecological threshold (more later…)



Alternate states (basins of attraction), thresholds



Source : Brian Walker

Thresholds are…

a compatible and well-articulated set of adaptive management goals and endpoints (usualy upper and lower levels), each of which is:

- a worry level to monitor
- a hypothesis to examine
- a traceback to a particular agent of ecosystem change
- an achievable environmental goal
- one dimension of the composite desired envelope represented by all objectives together.

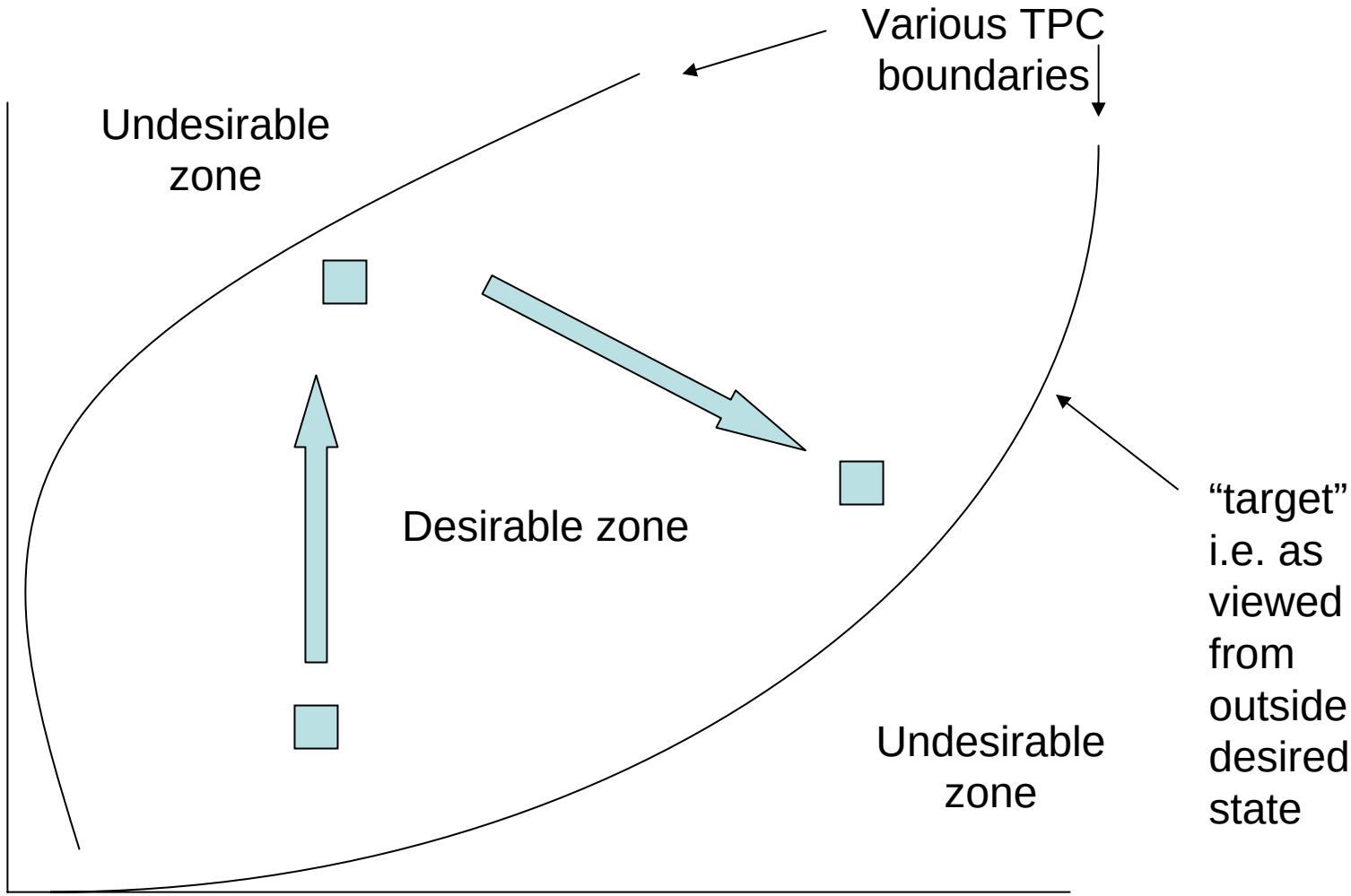
The suite of thresholds and rules around them is designed to ensure that:

- they are NOT overwhelming

- they are NOT too rigid

- they are firm enough to withstand strong personalities, departmental cover-ups etc i.e. to reinforce accountability

Why do we wait so long, till before the "cliff"?
Answer (esp. for biodiversity managers) is resilience



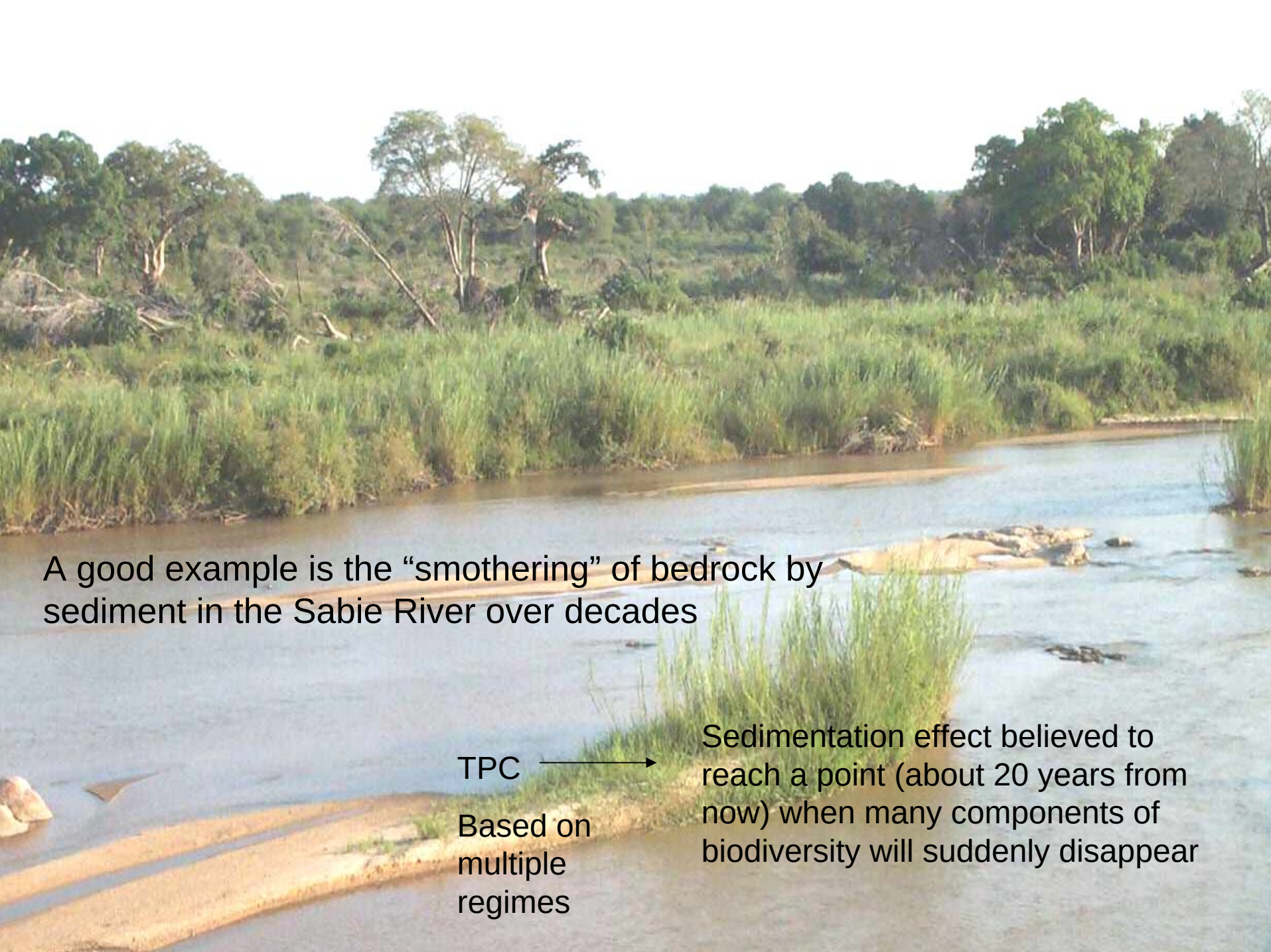
Various system state positions

This is all fine for single effects in clear cases

(in fact you can look at a whole database of ecological thresholds at

http://www.resalliance.org – their “thresholds database”) **. . . . .**

But in our situation in savannas we are usually talking about ***multiple regime shifts*** for which it is instructive to look at similar examples in other ecosystems



A good example is the “smothering” of bedrock by sediment in the Sabie River over decades

TPC →

Based on multiple regimes

Sedimentation effect believed to reach a point (about 20 years from now) when many components of biodiversity will suddenly disappear

Example TPC's from Kruger (very summarised – actual technical wording strenuous)

Fluvial geomorphology and riparian vegetation:

Flow and sediment as agents of change

Rationale: Increased sediment storage causes alluviation, loss of habitat diversity from bedrock influence; reduction in diversity of woody species regeneration niches.

Indicators	Measurement	TPC
Bedrock dominated geomorphic units (4 of 14) in representative reaches of bedrock channel types (5 of 9)	**Aerial extent. Every 5 years and after floods/ droughts >1:25 yrs. 20x20m grid square**	**E.G. Pool-rapid reaches; point and lateral bars >20% cover; pools >15%**
Population structure of key woody species in each of 6 vegetation assemblages	**Size class frequency distribution every 3 yrs and events >1:25 yrs in selected representative reaches**	**E.G. *Breonadia salicina:* loss of negative J population structure in pool rapid reaches**

River TPCs as at present

(as per catchments outside park too)

Flow per river, actual environmental flow regimes (“normal & drought”)

Quality, per river but following water qual guidelines (some have 3 month lag)

From Rivers Research Programme, biodiversity and habitat indicators)

Breonadia recruitment

Geomorphology

Terrestrialisation (not impl.)

Problem with these is that Kruger has battled to get them implemented outside Sabie, original river of dvpt.

River Health programme (regional and national)

Inverts SASS (actually a water quality indicator)

Fish community and habitat indices (sensu Kleynhans)

Riparian indices

These are not strictly TPCs but more to assist regional descriptive “state of rivers” reports. Can be adapted.

Threshold system institutionalised as follows

Main management committee (with equal research and ranger/warden /manager representation) have as a central driver a TPC agenda point, with a “running list of unclosed TPCs”). Persistent audit track, only closed when system back in desired state. Credible PREDICTIONS (requiring modelling) far preferred over actual exceedances, becoming commoner i.e. system is increasingly forward-looking. Clear corresponding change over 10 years from reactive to more pro-active.

Clear rules as to TPC generation and challenge/maintenance. May not contest once exceeded and till resolved – action (including option for conscious decision to take no action) mandatory

Research aims to discover new ones or refine existing ones (this is a central driver now); monitoring meant to be guided strictly by these (still some resistance); and management actions determined by responses

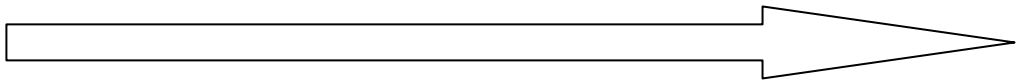
{LIKE AN EVERLASTING RELAY RACE, WITH TPCS AS THE BATON}

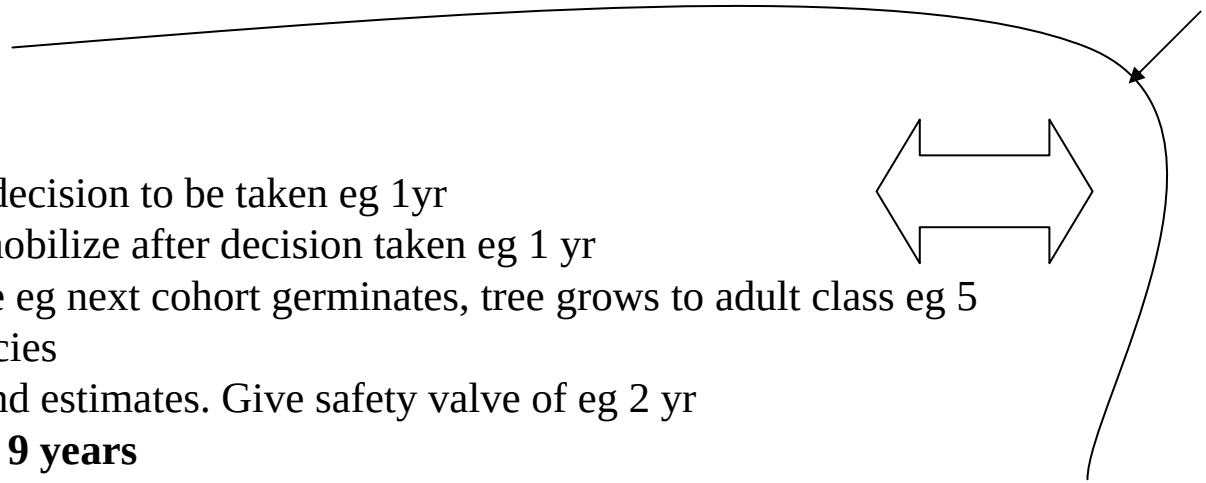
Some practical issues when setting Thresholds of Potential Concern

Net rate of approach
e.g. losing 3 trees/ha/yr and gaining 1 recruit/ha/yr
i.e. net rate of loss of 2/ha/yr

Threshold or "edge of cliff"
Believed to be **4 tree/ha**

Current level of stock
e.g. 36 trees/ha





"Buffer factors":
time needed for decision to be taken eg 1yr
time needed to mobilize after decision taken eg 1 yr
time for response eg next cohort germinates, tree grows to adult class eg 5 yrs for a fast species
uncertainty around estimates. Give safety valve of eg 2 yr
TOTAL buffer = **9 years**

Source: SANParks workshop Nov 05, being improved and to be written up by Bob Scholes and Judith Kruger

TPCs = when should we be worried?

There are only 3 classes:

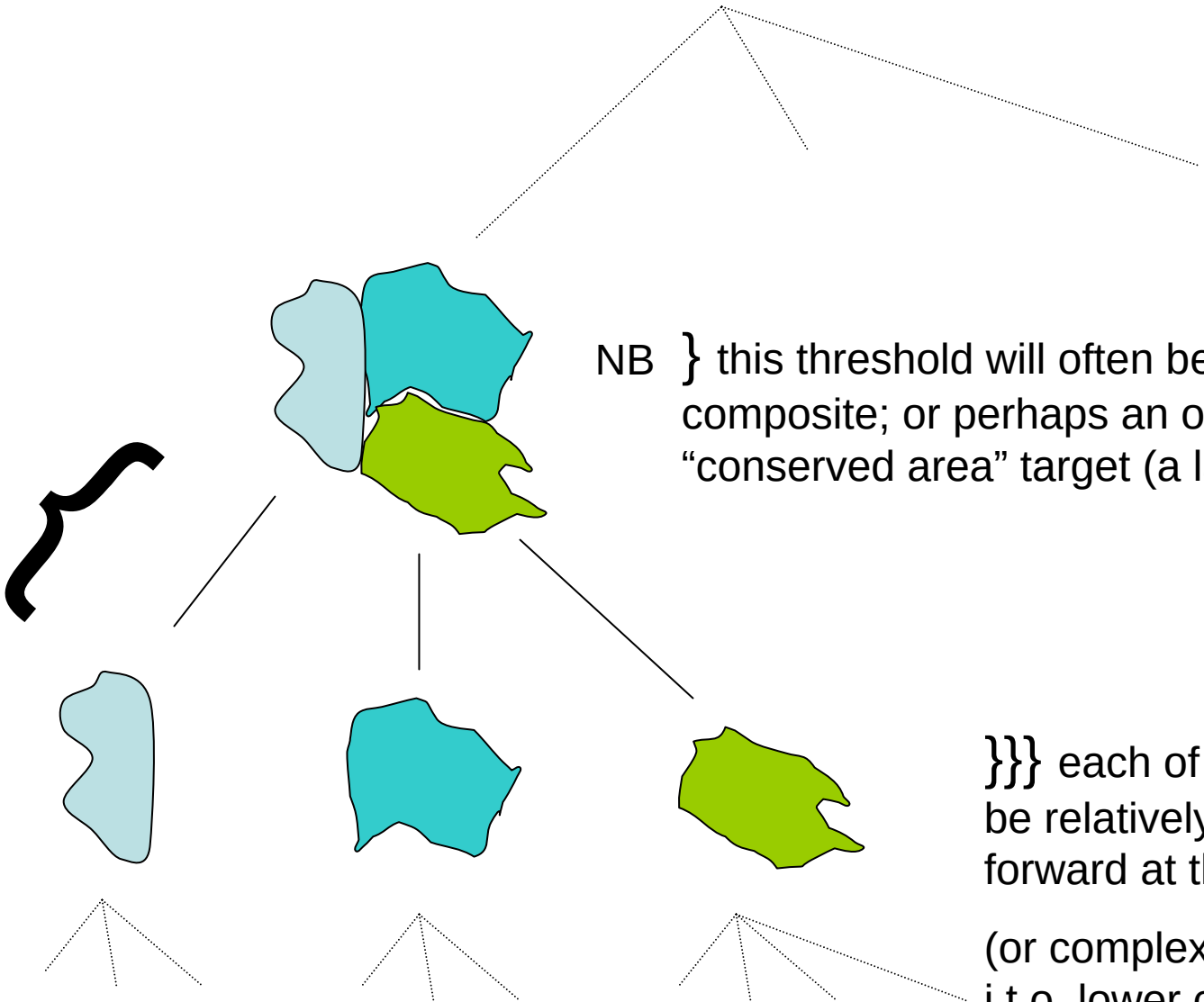
These are the two impending threats of:

- Irrevocable system (regime) change
  - Sometimes well-understood, sometimes speculative; be honest if not ecological, but then probably a psychological or economic threshold
- Global loss of a species (obviously an agency can set a local extinction threshold, but be honest)

And the third one being -

- Zero tolerance of aliens (some feel this should later not be used at all, and should be translated to system state or species loss threats; links with idea of *novel landscapes*)

Meaningful threshold setting (under a heterogeneity framework) ultimately requires a NESTED design:



May even have inter-dependent thresholds spanning both scales

NB } this threshold will often be a composite; or perhaps an overall "conserved area" target (a la SANBI)

}}} each of these might be relatively straight-forward at this scale

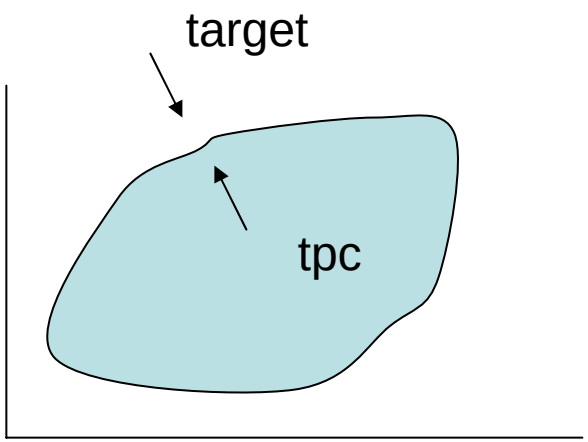
(or complex, if specified i.t.o. lower composites)

We are actively doing this around the elephant debate ….

Zonation SCP guidelines – which at the national levels are simply SANBI “TPCs”*

TPCs (nested)

Practical considerations which (1) may cause some compromises – never great and (2) will guide choices between equally desirable alternatives



Broad lessons learnt

- Looking back, was fairly easy to do, and while it cannot and should not last forever, is looking like a launch-pad for ongoing learning=sustainability. Trickiest part is identification and setting of TPCs, but can (and should) be done as ‘quick-and-dirty’ initially - just to get going, but in an enabling environment which emerges (sensu Ruitenbeek & Cartier “Magic Wand” paper of CIFOR)
- Has transformed way we work, rivers almost starting to “lag behind” many of the other objectives now. Hence Craig McLoughlin initiative.
- Detailed lessons learnt and litany of hitches available

All of this takes place (and has no justification whatsoever without) forward-looking (what we call “strategic”) adaptive management

This is guided by only three generic processes, and we have a fair amount of documentation and evaluations etc, also for the river case

e.g. IUCN EPP review: Part 1 available; part II in prep – we know basic results

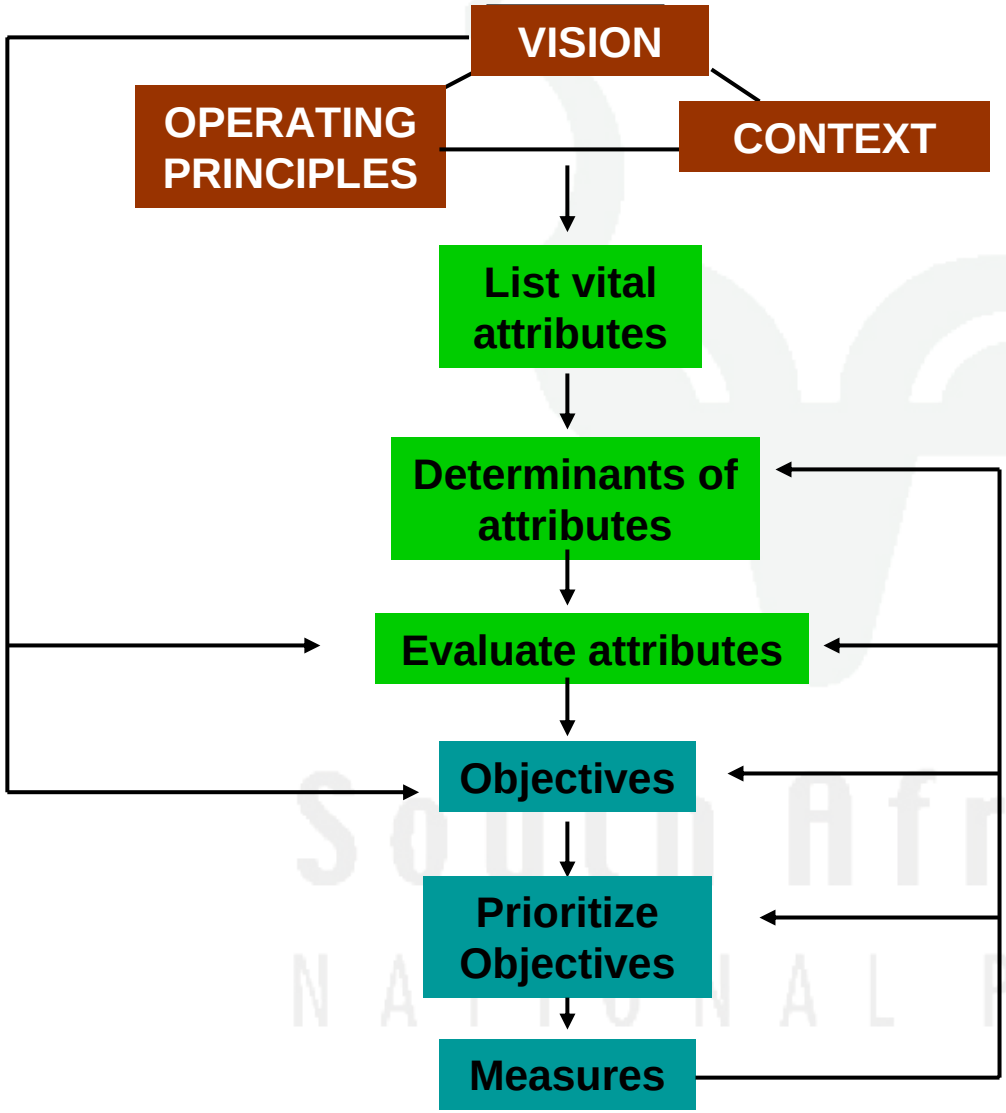
Internal and external audits

Peer-review – policies and large parts of management plan

Continual exposure to esp official visitors and to media ‘pressure’ (eg elephant debate)

1

Adaptive Planning Process



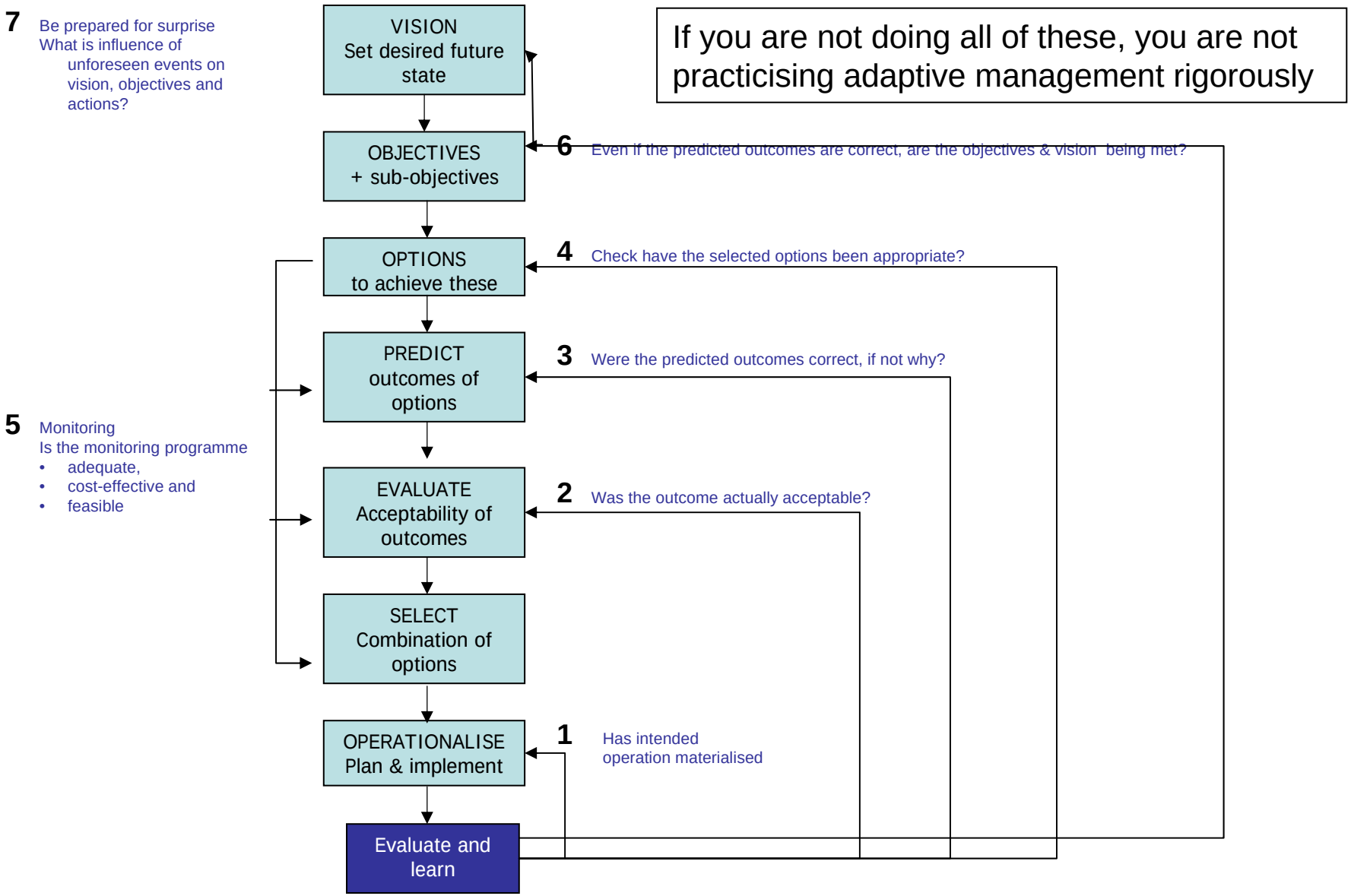
The decision making environment

Understanding the "V - STEEP" system to be managed

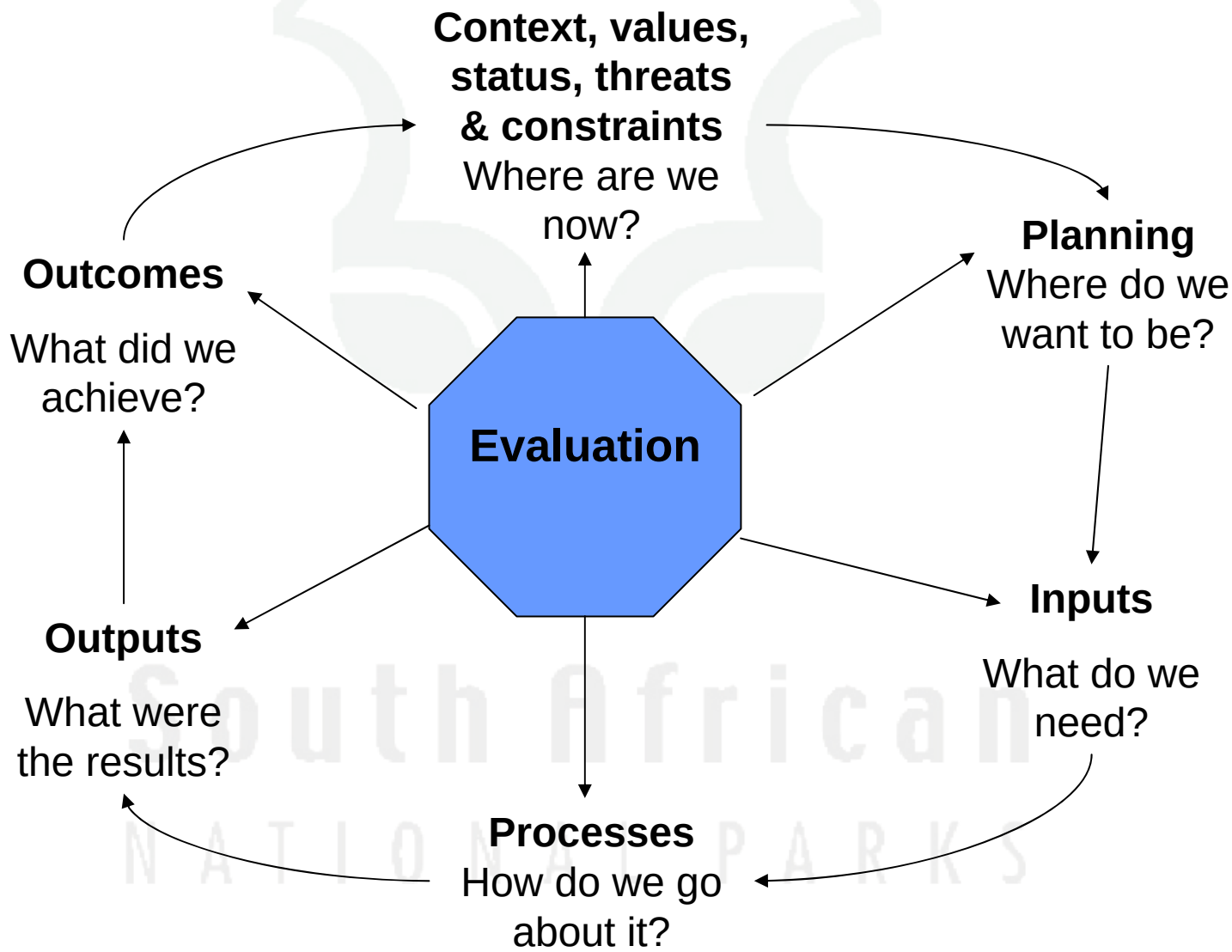
Where we want to go

2 Sharon Pollard's graphic re-work and improvement of a strategic adaptive management process, explicitly emphasising the feedbacks we described.

Some detail eg initial public participation, omitted for clarity



Adaptive Review of Protected Area Management



Source: Mark Hockings

To help remind us all in SANParks, the norms and standards from the PA Act are translated physically into a **"family look"** for each park management plan, with three main sections (extract from Mapungubwe National Park plan)-

1. **BACKGROUND TO AND FORMULATION OF THE PARK DESIRED STATE**

1.1 The fundamental decision-making environment

Mission, Context, Location and boundaries, History, Physical environment and land use, Biological environment, Social, economic and political context, International and national context, Values and operating principles

1.2 **Vital attributes underpinning the value proposition of the Park: determinants and prioritisation**

1.3 Setting the details of the Park desired state

1.3.1 **An objectives hierarchy for Mapungubwe**

1.3.2 **Thresholds of concern** and other exact conservation targets

1.3.3 **Conservation Development Framework**

2. PROGRAMMES TO ACHIEVE THE DESIRED STATE

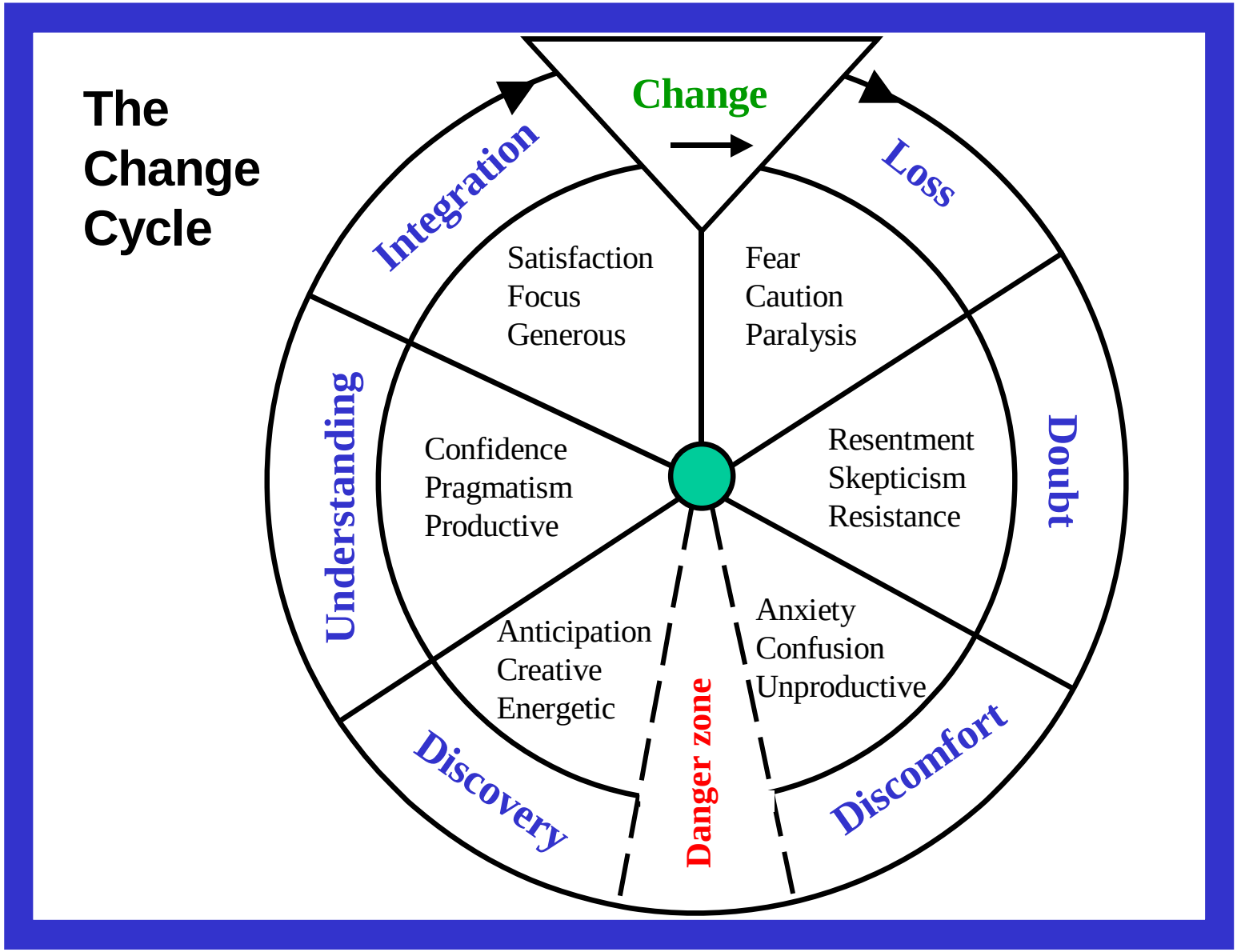
2.1 Heritage and biodiversity conservation: Zonation programme, Park Expansion Programme, Land Restitution Programme, Transfrontier Programme, Cultural Resource Programme … etc 2.2 Sustainable tourism: 2.2.1. Tourism Programme. 2.3 Building cooperation. 2.3.1. Stakeholder relationship Management Programme, 2.3.2 Environmental Education and Interpretation Programme, 2.3.3 Local Socio-economic Development Programme. 2.3.4 Other Programmes (including Constituency Building Programme). 2.4 Effective park management etc…2.5 Corporate support. 2.5.1 Research Support Programme 2.5.2 HIV/AIDS Programme etc

3. ADAPTIVE AND INTEGRATIVE STRATEGIES TO SUSTAIN THE DESIRED STATE INITIATIVE

3.1 Key Prioritisation, Integration and Sequencing Issues 3.2 Steps to Operational-isation 3.3 Key Ongoing Adaptive Management and Evaluation Interventions

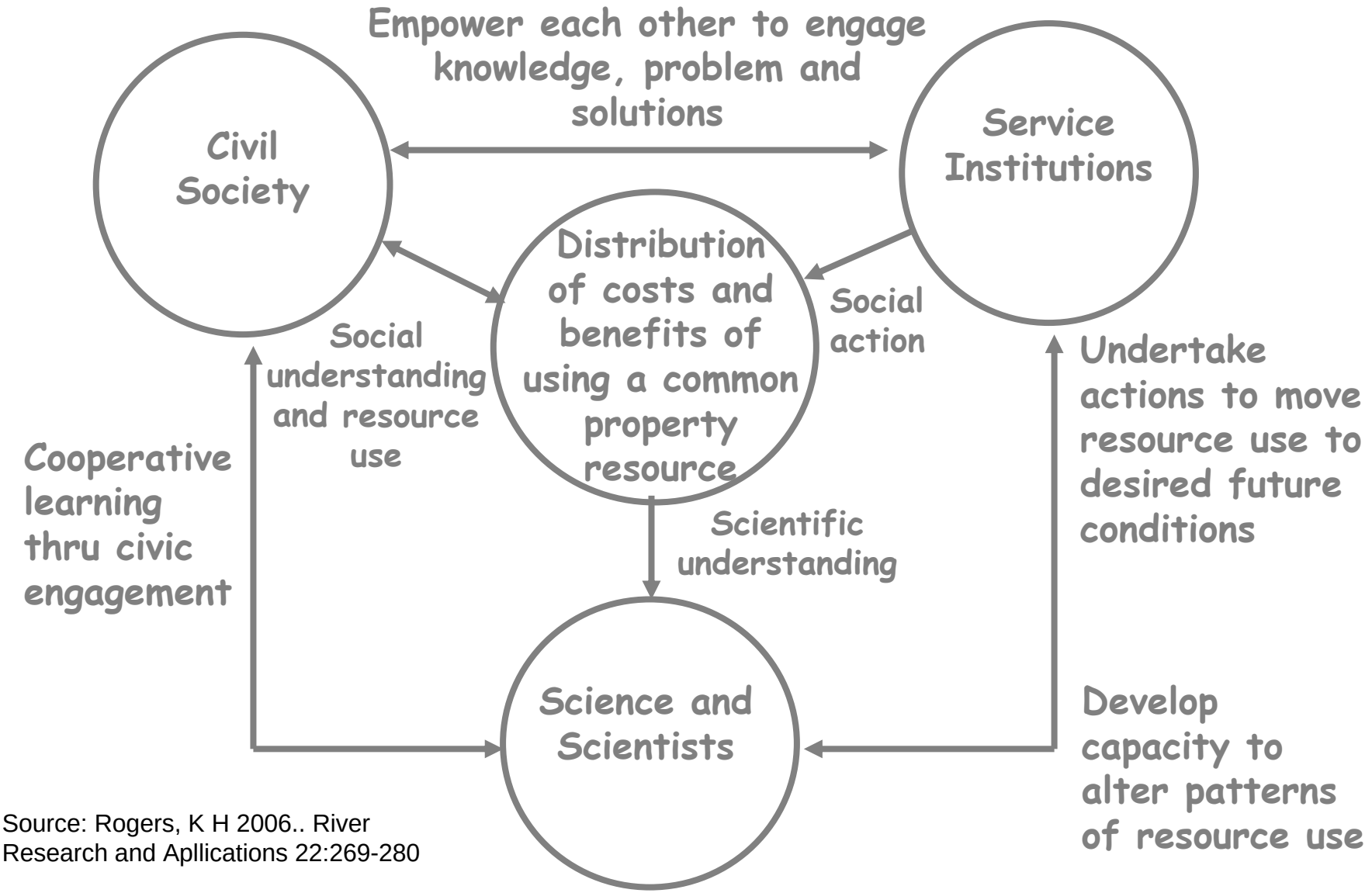
Water allocation is a social process

So we believe personal behaviour and governance are central



Brock L R and Salerno M A (1998) *The secret to getting through life's difficult changes*. Bridge Builder Media, Washington DC/Durban RSA

Learning and Doing for a Shared Rationality



Source: Rogers, K H 2006.. River Research and Apllications 22:269-280

A central sustainability issue in South Africa is whether or not the environmental reserve, so well crafted in legislation, can now be successfully implemented over the next 10 years. It will not be an easy road but there is reason for hope.

Thanks to Kevin Rogers, Dirk Roux, and many others for ideas and crucial contributions over many years