The Tsitsa Project

(previously NLEIP*)

Research Investment Strategy (vol 2)

expanding into praxis: a resource library

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This document is a follow-up of the "Ntabelanga and Laleni Ecological Infrastructure Project Research Investment Strategy" ('*NLEIP RIS vol 1')

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Department of Environmental Affairs, Forestry and Fisheries | Natural Resource Management Programme

TSITSA PROJECT (PREVIOUSLY NLEIP)

RESEARCH INVESTMENT STRATEGY (VOL 2)

expanding into praxis: a resource library

AWAITING FINAL FOREWORD

The fruitful use of this document before its publication

The systemic and reflexive way that Tsitsa Project aspires to work is articulated throughout this document. In this worldview, processes begin to assume more importance than particular material products such as reports, which can indeed act as milestones, and are seen as such by funders. We are thus particularly happy if reports generate healthy process activity through their preparation or during their refinement, editing and review. This was very much the case during the long birth process of this report, of almost a year. It drew together and helped consolidate a revised set of coherent objectives, including now praxis-related ones. In particular it stimulated trans-disciplinary stitching together of unifying activity between the Tsitsa Project's original three (and growing number of) originally more "internal" subgroups (called communities of practice), whose co-ordinators were key authors of parts of the report. It strongly influenced some key planning and relationship-building activities. Notably too, it acted as a central pivot for the second meeting of the Project's Strategic Advisory Committee (or "Wisdom Trust") and as an influential starting point of the Project's Strategic Oversight Committee (or "A-team") shortly before publication. Each of these points of influence above in turn fed back into the publication itself. We trust that after publication it will remain as a "living document" whose informally patched-on amendments and arrangements help us through in similar vein, till its successor Volume 3, begins taking shape.

Acronyms

AIP	Alien invader plants
APP	Adaptive planning process
ARC	Agricultural Research Council
AWARD	Association for Water Rural Development
CC	Climate change
CCA	Climate change adaption
CE	Community engagement
CLO	Community liaison officer
CMA	Catchment Management Agency
CMS	Catchment Management Strategy
CMF	Catchment Management Forum
COGTA	Cooperative Governance & Traditional Affairs
CoP	Community of practice
CRG	Catchment Research Group
CSES	Complex Social-Ecological system
DAFF	Department of Agriculture, Forestry and Fisheries
DALRRD	Department of Agriculture, Land Reform and Rural Development
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry & Fisheries
DfID	Department for International Development (UK)
DHWS	Department of Human Settlements, Water and Sanitation
DM	District Municipality
DRR	Disaster risk reduction
DSI	Department of Science and Innovation
DST	Department of Science and Technology
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
ELRC	Environmental and Learning Research Centre
EMs	Environmental Monitors
EPWP	Expanded Public Works Programme
ERS	Environmental and Rural Solutions
G&FM CoP	Grazing and Fire Management Community of Practice
GIS	Geographic Information System
Gov CoP	Governance Community of Practice
GVP	Green Village Project
IAPs	Interested and Affected Parties
IPBES	Intergovernmental Programme on Biodiversity and Ecosystem Services
ICM	Integrated Catchment Management
KM CoP	Knowledge Management Community of Practice
IMS	Information Knowledge System (NLEIP)
KMS	Knowledge Management System (Tsitsa Project)
INR	Institute of Natural Resources
INRM	Integrated Natural Resource Management
IRSLMP	Integrated Restoration and Sustainable Land Management Plan
IUCN	International Union for the Conservation of Nature
IWR	Institute for Water Research
IWRM	Integrated Water Resource Management
L&ES CoP	Livelihoods and Ecosystem Services Community of Practice
L&WF	Land and Water Forum

LDN	Land Degradation Neutrality
LEK	Local Ecological Knowledge
LM	Local Municipality
M&E	Monitoring and Evaluation
MTCMA	The Mzimvubu to Tsitsikamma proto-Catchment Management Agency
NGO	Non-governmental Organisation
NLEIP	Ntabelanga Lalini Ecological Infrastructure Project
nrm	Natural resource management (the activity)
NRM	Natural Resource Management (the national department)
OSF	Operating Support Framework
NWA	National Water Act
PMERL	Participatory Monitoring, Evaluation, Reflection and Learning
PG&CE CoP	Participatory Governance & Community Voice Community of Practice
RIS	Research Investment Strategy
RIS Vol 1	Research Investment Strategy Volume 1 (NLEIP)
RIS Vol 2	Research Investment Strategy Volume 2
RU	Rhodes University
RRRG	Rhodes Restoration Research Group
S&R CoP	Sediment and Rehabilitation Community of Practice
SAM	Strategic Adaptive Management
SANBI	South African National Biodiversity Institute
SciMan	Science-management (Forum)
SDG	Sustainable Development Goal
SDM	Systems Dynamic Modelling
SES	Social ecological system
SFT	Sediment Field Technician
SIP	Strategic Infrastructure Project
SLT	Sediment Laboratory Technician
SLM	Sustainable Land Management
SPLUMA	Spatial Planning & Land Use Management Act (Green Paper Eastern Cape)
SOC	Strategic Oversight Committee
ST CoP	Systems Thinking Community of Practice
TA	Traditional Authority
TCC	Tsitsa Catchment Coordinator
TP	The Tsitsa Project (formerly known as NLEIP)
TPS	Tsitsa Project Strategy
UCPP	uMzimvubu Catchment Protection Partnership
UFH	University of the Free State
UFS	University of Fort Hare
UN	United Nations
UWP	uMzimvubu Water Project
WRC	Water Research Commission

Glossary

Term	Definition and sources
A-team	A colloquial name given to the high-level support and advocacy panel officially called the "High-Level Cooperative Governance Team" (Botha et al., 2017).
action research	An attitude to knowledge creation that arises in a context of practice and requires researchers and practitioners to work collaboratively; a transformative attitude to creating knowledge that requires researchers to seek knowledge beyond the gate-keeping of professional knowledge-makers (Bradbury-Huang, 2010, pg. 93).
agency	The capability or power to be the originator of acts. "[Agency] does not exist in a vacuum, but is exercised in a social world in which structure shapes the opportunities and resources available to individuals; in which appropriate ways of being and behaving are not simply a matter of individual choice" (Cleaver 2007:226).
B-team	A colloquial name given to the governance unit in the Tsitsa Project officially called the "Praxis Evaluation Panel" (Botha et al., 2017).
biodiversity stewardship	"An approach to securing land in biodiversity priority areas through entering into agreements with private or communal landowners, led by conservation authorities. Different types of biodiversity stewardship agreement confer different benefits on landowners, and require different levels of restriction on land use. The landowner retains title to the land, and the primary responsibility for management remains with the landowner, with technical advice and assistance provided by the conservation authority." (SANBI, 2016: 11). To be differentiated in this document from the broader "stewardship", see below.
citizen science	Public participation in scientific research, originally a method for gathering large amounts of data across time and space (Phillips et al., 2018, pg. 1).
citizen technician	A term adopted to distinguish between the Tsitsa Project's approach to employing local residents to undertake technical work to achieve a scientific goal, and that of collaborative citizen scientist projects which aim to build the capacity of communities themselves to manage problems sustainably through community learning (Bannatyne et al., 2017).
collaboration	"The pooling of appreciations and/or tangible resources, e.g., information, money, labour, etc., by two or more stakeholders, to solve a set of problems which neither can solve individually." (Gray, 1985: 912).
community of practice CoP	A group of people who share an interest or a passion for something that they practice, and who learn how to do it better through regular interaction (Wenger 1998).
critical complexity	A perspective on research in complex SES which foregrounds the normative or value-based nature of framing practices (Audouin et al., 2013).
ecosystem services	"The capacity of natural processes and components to provide goods and services that satisfy human needs, directly or indirectly" (de Groot et al., 2002: 394).
equity	Fairness and social justice; greater access to a better quality of life, that is, working to ensure distributive justice (Klugman, 2011).
environmental monitor	People employed to assist with monitoring and collecting data for environmental management. Other activities include conducting wildlife security patrols in protected

	areas, running environmental education initiatives, working with local ecological knowledge (Swemmer, 2015).
epistemology	Epistemology is concerned with the nature of knowledge and how it can be acquired (Snape & Spencer, 2013).
epistemic injustice	Occurs when "someone is wronged, specifically in their capacity as a knower, and wronged, therefore, in a capacity essential to human well-being." (Fricker 2007).
environmental justice	"Equity in the distribution of environmental risk, recognition of the diversity of the participants and experiences in affected communities, and participation in the political processes which create and manage environmental policy …" (Schlosberg, 2004). Environmental justice is also about "the material relationships between human disadvantage and vulnerability, and the condition of the environment and natural world in which that experience is immersed." (Schlosberg, 2013)
framing	The different ways of understanding or representing a social, technological or natural system and its relevant environment. Among other aspects, this includes the ways system elements are bounded, characterised and prioritised, and meanings and normative values attached to each (Leach et al., 2010: xiii).
governance	Political and institutional relationships including those of power and knowledge (Leach et al., 2010: xiii).
high-level cooperative governance team	Colloquially known as the A-Team (Botha et al 2017).
interdisciplinarity	Research that cuts across disciplines, beyond the addition of results from different disciplines (multi-disciplinary research), but does not extend beyond the practices of academic researchers (Castán Broto et al., 2009).
intergenerational equity	Focuses on the value of the rights of future generations, where future generations have the right to equitable access to the use and benefits of resources, implicit in which is ecological sustainability (Summers and Smith, 2014).
landscape	Landscapes are place-based, social-ecological systems that emerge from the interactions between people, through their values and institutions, with land-based ecosystems and the natural resources they produce (Minang et al., 2014; Robinson et al., 2017).
landscape approach	"A conceptual framework whereby stakeholders in a landscape aim to reconcile competing social, economic and environmental objectives. It seeks to move away from the often unsustainable sectoral approach to land management. A landscape approach aims to ensure the realisation of local level needs and action (i.e. the interests of different stakeholders within the landscape), while also considering goals and outcomes important to stakeholders outside the landscape, such as national governments or the international community." (Denier et al., 2015: 10).
level	The units of analysis that are located at the same position on a scale. Many conceptual scales (such as temporal, institutional) contain levels (for temporal, such as annual, seasonal, daily; and for institutional, such as constitutions, laws and regulations, operating rules) that are ordered hierarchically, but not all levels are linked to one another in a hierarchical system (Gibson et al., 2000: 218; Cash et al. 2006).
local ecological knowledge (LEK)	"Local ecological knowledge is knowledge held by a specific group of people about their local ecosystems … it concerns the interplay among organisms and between organisms

	and their environment … it may be a mix of scientific and practical knowledge; it is site-specific and often involves a belief component." (Olsson & Folke, 2001).
multi-disciplinary	Combining or involving several academic disciplines or professional specializations in an approach to a topic or problem (Oxford dictionary, 2018).
multi-functional landscape	"Sustainable multi-functional landscapes are landscapes created and managed to integrate human production and landscape use into the ecological fabric of a landscape maintaining critical ecosystem function, service flows and biodiversity retention." (O'Farrell & Anderson, 2010: 59).
natural resource management	A collective process of sustainable use, conservation, and protection of renewable natural resources (including for example, forests, grazing land, wildlife, fisheries, river catchments, irrigation systems, etc.) by diverse actors (including governments, farmers, business, communities, and NGOs) so that improvements in the condition of natural resources can be achieved (Kumar, 2005; Lockwood et al., 2010).
political ecology	The study of the relationships between political, economic and social factors with environmental issues and changes. Political ecology differs from apolitical ecological studies by politicising environmental issues and phenomena (Bebbington, undated).
polycentric governance	"Polycentric systems are the organisation of small-, medium-, and large-scale democratic units that each may exercise considerable independence to make and enforce rules within a circumscribed scope of authority for a specified geographical area." (Ostrom, 2001).
practice-based knowledge	"Multiple forms of knowledge and learning emanating from on-the-ground action and problem solving." (Weber et al., 2014: 1075).
praxis	The process by which a theory, lesson, or skill is enacted, embodied, or realised. "Praxis" may also refer to the act of engaging, applying, exercising, realising, or practising ideas. https://en.wikipedia.org/wiki/Praxis_(process) Accessed 23 July 2018. In the sense we use it in the Tsitsa Project, it implies systemic application, that is, with an understanding of the context and interrelationships, and hence involving ongoing feedback between practice and theory. (Ison, 2017).
praxis evaluation panel	The formal name for the Tsitsa Project governance team that is colloquially known as the B-Team (Botha et al., 2017).
realist approach or philosophy	This approach draws on the philosophy of critical realism (Gorski, 2013; Bhaskar, 2016) founded on an understanding of the world (or reality) as multi-layered; events and empirically observed events in the world emerge from deeper layers of reality which may not be observable, but from which mechanisms operate to generate observable phenomena. There is a world that exists independently of our knowledge; our knowledge of the world is necessarily incomplete (Sayer, 2000).
reflexivity	"A collaborative process of acknowledgement, critical deliberation and mutual learning on values, assumptions and understandings that enables the generation of 'new meanings, new heuristics, and new stakeholder identities' (Lenoble & Maesschalck, 2010: 199) … the role of such reflexive processes is to encourage processes of critical assessment and social learning on the background values and assumptions guiding research, and on the socio-institutional structures supporting particular norms and practices." (Popa et al., 2015: 47).

resilience	The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedback (Walker et al. 2004).
scale	"The spatial, temporal, quantitative, or analytical dimensions used to measure and study any phenomenon." (Gibson et al., 2000: 218; Cash et al. 2006).
social-ecological systems (complex) (SES)	An integrated perspective of humans-in-nature (Berkes & Folke, 1998) which posits that human systems are embedded in, and entirely dependent, on the biosphere (Folke et al., 2016). SES are complex adaptive systems, and are characterised by non-linear feedback, dynamic interactions, individual and spatial heterogeneity, and operate over varying time scales (Levin et al., 2012).
social equity	The concept of social equity in conservation refers to the need for fair distribution of the benefits and costs of conservation among different social groups and individuals. It recognises that social groups and individuals have differential needs, interests, rights to and responsibilities over resources, and that they experience different impacts of conservation and development interventions (IUCN, 2000).
social justice	Social justice is both a process and a goal (Bell, 2016) and it is achieved when people have equal access to goods, opportunities, and institutions needed to develop their capabilities for human functioning and when people have both the power and the resources necessary to decide how they will use their capabilities (Donaldson & Daughtery, 2011).
social learning	"A change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks." (Keen et al., 2005: 4).
steward, competent steward	Anyone who uses, manages, or owns natural resources, recognising that not everyone who uses, manages, or owns natural resources is necessarily a competent steward. The goal of stewardship initiatives is to facilitate stewardship practice by enabling stewards to become competent (Welchman 2012: 299). To be differentiated in this document from the "biodiversity stewardship", see above.
stewardship (environmental)	"The responsible management of human activity affecting the natural environment to ensure the conservation and preservation of natural resources and values for the sake of future generations of human and other life on the planet, together with the acceptance of significant answerability for one's conduct to society." (Welchman, 2012: 303).
strategic adaptive management (SAM)	Strategic Adaptive Management is a stakeholder-centred approach that facilitates the iterative development of shared rationalities and future-focused objectives as the basis for adaptive cycles of consensual decision-making (Rogers & Luton, 2011).
sustainability	"A normatively explicit form of the general term, referring to the capability of maintaining over indefinite periods of time specified qualities of human well-being, social equity and environmental integrity." (Leach et al., 2010: xiii).
sustainability science	Science that seeks to understand the fundamental character of interactions between nature and society. Such an understanding must encompass the interaction of global processes with the ecological and social characteristics of particular places and sectors, as well as society's capacity to guide those interactions along more sustainable trajectories (Kates et al., 2001).

transdisciplinary research	"A reflexive research approach that addresses societal problems by means of interdisciplinary collaboration as well as the collaboration between researchers and extra-scientific actors; its aim is to enable mutual learning processes between science and society; integration is the main cognitive challenge of the research process." (Jahn et al., 2012: 4).
triple-loop learning	A concept which denotes a third order of organizational learning, often presumed to lead to transformative change in organisations or systems (Tosey et al., 2012).
values	Trans-situational goals and principles that guide human behaviour. Values serve as standards for evaluating whether actions, events, and people are desirable or undesirable (Manfredo et al., 2017).
wicked problems	May be defined as having multiple interdependencies (Roux et al., 2010); they cannot be easily defined and are socially and intellectually complex (Rittel & Webber, 1973; Brown et al., 2010; Clifford-Holmes et al., 2016).

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TABLE OF FIGURES

Preface

This preface provides the background to this document (RIS Vol 2), and includes an executive summary and serves as a road map to its layout.

Purpose

This document presents the guiding principles for the period 2018–2020 for the Tsitsa Project, formerly known as the Ntabelanga and Lalini Ecological Infrastructure Project[a] (NLEIP). This novel and important project is moving into its implementation phase, but we hope it will never lose its dynamic between theory and practice.

The project team realised that it would be appropriate to review and update the RIS at reasonable intervals; this first update is "RIS Vol 2". Although the first document should have been called "RIS Vol 1", it was not given such a label then, but we call it RIS Vol 1 here. We thus anticipate a series of volumes.

The DEFF: NRM started the NLEIP in 2014 with the expressed intention of reducing the volume of sediment from the Tsitsa River catchment likely to enter the proposed Ntabelanga and Lalini dams, components of the planned multi-purpose uMzimvubu Water Project (UWP). The DEFF: NRM approach is to embrace landscape restoration and avoid landscape degradation while promoting all the facets of Sustainable Land Management (SLM) necessary to achieve this. The intention regarding the landscape component is not to impose decisions about land use practice, but to work in a new way, co-developing solutions with local communities and other involved stakeholders that meaningfully uplift local livelihoods.

The original "Research Investment Strategy" (RIS) developed for the NLEIP by late 2015 received its formal approved Ministerial foreword in late 2016 and was distributed for use in 2017. By that time, the adaptive and reflexive way of working had already significantly enhanced and altered the initial approach of the project, and we predict that the Tsitsa Project will continue to evolve along this trajectory.

We believe that a reflexive approach will lead to ongoing pragmatic evolution. An important characteristic of this approach is the phased and a nested approach demanded by the sheer size and complexity of the catchment: for example, activities relating to the catchment area of the proposed Ntabelanga Dam (planned to be constructed first) must be underway ahead of those of the proposed Lalini Dam (planned to be constructed subsequently). Another important characteristic is an agreed widening from the so-called "science-management interaction domain" that dominated RIS Vol 1, to an emergent "Science-Management-Society interaction domain". This led us to incorporate further aspects into the Research and Praxis Investment Strategy, where the addition of such concepts as "praxis" and "societal co-construction" complement the idea of "research".

The name "NLEIP", although well understood in government and funding circles, is not understood by the local communities with whom we engage. The project has therefore been re-named the "Tsitsa Project" and will be effectively branded and reflected in the title of this and subsequent volumes of this document series.

This updated RIS Vol 2 is a largely standalone document that can be used in the short term to guide the programme in the broadest sense. It is not a comprehensive report, nor does it parade all the

[a] The project was launched as the Ntabelanga and *Laleni* Ecological Project but later changed to the correct spelling of Lalini.

Tsitsa Project's achievements, but takes stock of those completed components of RIS RIS Vol 1 that are vital to prioritising the allocation of funds as we move forward.

A stakeholder analysis has been completed for the catchment area of each dam, and plans for a Participative Monitoring Evaluation, Reflection and Learning System (PMERL) have been refined and are ready to be launched. Like these two products, a continuing stream of evolving products will come into action over the next two years as this document's plans unfold – see Appendix 8 for current thinking. A major source of ongoing development in the several years behind us was the very active (as it was originally known) "sediment group" which typified a community of practice and evolved in exemplary ways (Appendix 8). In the last 20 months it has acted as a hub for trans-disciplinarity, and has produced an integrated Restoration and Sustainable Land Management Plan (van der Waal et al. 2017), a keystone document in our range. Without realising this advance, a crucial part of the story told in this document would be missing.

Readership

This document not only serves as a review and strengthening exercise for the "internal" or core Tsitsa Project group, but it also complements our newly produced introductory glossy brochure (see Appendix 10) and serves as a source of particular detail for the following:

- our funders (including any possible new funders, for whom we have prepared a range of particular "Opportunities for Investment" fliers);
- our institutional partners (and potentially new ones) including government departments and the agro-forestry and eco-rehabilitation industries at various levels – including their advisors;
- for fellow managers, scientists, and rural development colleagues with an interest in our current philosophy and planning.

An important aspect of the Tsitsa Project is growing and building the capacity of staff, and attracting new participants, including interns and students. We expect them, and some citizen monitors, to make at least partial use of this information in a way that shapes their own further experience. As the Tsitsa Project widens its reach to society at large, more technically minded members of traditional leadership, commercial farming communities, and other civil society groups may also want to access this document for information. For all these people, we recommended that they read this document in combination with our introductory glossy brochure and any other products in our document range (see Appendix 9) immediately appropriate to their needs. This volume and RIS Vol 1 contain the evolving design philosophy.

Executive Summary

Two key extracts from RIS Vol 1 (The Ministerial Foreword and the Executive Summary; see Appendices 1 and 2) provide a link between this and the previous volume and give the reader an adequate overview. We suggest that new readers to this series take the time to go through these two appendices. Another key development was the progression towards the Integrated Restoration and Sustainable Land Management Plan (IRSLMP), which executive summary is in Appendix 4. These three provide the main threads of the ongoing progress of the Tsitsa (then NLEIP) Project.

The rest of this section provides the equivalent of an executive summary of RIS Vol 2, written in the form of a "road map" to the core document:

The Objectives Tree (Figure 1) is a construct developed from Strategic Adaptive Management (SAM), and designed to supersede the "theme lists" presented in RIS Vol 1 (the theme list of which appears as Appendix 5 to this document), and to illustrate the widening scope of the Tsitsa Project beyond the previous research-limited focus. The reader may wish to look only at the Objectives Tree summary (page 6), and skim through the rest, or to zoom in on objectives of particular interest. At present, not all practical, on-the-ground actions are included in the Objectives Tree, and in future versions we may decide to cover only research and praxis (the two-way linkage between research and practice) rather than the final details of what we understand as "management on the ground".

The remainder of the summary covers:

- Governance in all its facets, including the introduction of "community voice" as part of the overall, co-constructed strategy. The Tsitsa Project continually and effectively balances the dynamic mix of knowledges: scientific, bureaucratic, experiential, indigenous. The governance/community voice section describes both the early ideas that have already been generated, and the intended way forward for coherent and effective engagement with the many stakeholders. The governance section covers engagements such as those dealing with government departmental co-operation and the Tsitsa Project or "internal" governance (including our "communities of practice"), several of which are hybridised with existing structures.
- The fledgling PMERL initiative (our Monitoring & Evaluation), which aims to establish and support our enthusiastic and embedded culture of adaptive practice and reflexivity across all levels, to produce meaningful feedback. A key feature for us is that "the tail should not wag the dog": PMERL is most likely to be feasible when it is easily included and automatically part of all that we do.
- The explicit introduction of Climate Change (CC) and Disaster Risk Reduction (DRR). Although the adaptive co-learning approach automatically reveals and deals with these aspects, we felt it necessary to specifically name, describe and embed them. This section lays the foundation for this, but this will be a work in progress over the next months. We have included a dedicated section on climate change, while raising key issues in other relevant sections.
- Some of the critical learnings from our Science-Management Meetings and elsewhere over the last two years which are recorded here. These learnings shaped and strengthened the principles we describe in this section. While we remain mindful of the central frameworks we have adopted, the Tsitsa Project has reached a stage where we needed to reduce the emphasis on abstract concepts (note: not *ignore*, but rather grow and alter, without letting them overwhelm our agenda) and to build more "internal" Communities of Practice (CoPs) and others linked into them:

    - Have more platforms on which to merge for particular activities, so enhancing trans-disciplinary practice. This is already evident in more integrated planning, much of it taking place in an emergent way, rather than learning only from received wisdom. Examples of such planning are mentioned in this volume.
    - Can jointly set up feasible on-the-ground projects specifically supporting "practising together". This has happened in some areas (for example, the completed "Green Village" Project), and this document will reflect more such aspirations.
    - Can "morph" according to demand: for instance, a potential "grassland and fire in support of SES" or a Grazing and Fire Management CoP (G&FM CoP) appears to be forming under the joint auspices of the Tsitsa Project and its counterparts, the uMzimvubu Catchment Partnership Program (UCPP).
- Knowledge Management, which includes data, information, knowledge and decision support, and which will build on information support through the current pathways: Operational Support Framework and the Project Google Drive. The Tsitsa Project will develop and customise these pathways for particular end-user groupings, including research disciplines, praxis platforms for the interface between managers and researchers, and public understanding and participation. A diagram (see Appendix 9) of the Tsitsa Project Family of Documents guides and supports the Tsitsa Project. The first draft of the Tsitsa Project Knowledge Management Strategy, KMS (Sep 2018) is available from Kyra Lunderstedt (kyra.lunderstedt@gmail.com).
- Several emergent subgroups are in the process of forming or are likely to form in the next year:
    - A Grazing and Fire Management CoP: This proto-group has already run events, and will develop grassland and fire management in the context of the Tsitsa Project.
    - Development of a common systemic way of thinking. The Tsitsa Project implements a systems thinking approach, which includes systems dynamic modelling, to facilitate our understanding of the key "wicked problems" so typical of natural resource management.
    - Advocacy and communications. The latter is partly contained in knowledge flow and partly overlaps with the engagement initiatives. Advocacy and communications also operate at societal scales that include national and international funding.

The main document includes a useful case study in the text box on page 47, which features reflection from the related Green Village Project which took place at one locality in our catchment during an earlier phase. It provides useful lessons for the Tsitsa Project overall.

The main text of the document provides a conclusion and an expected way forward. Finally, there are several useful appendices, and a wider-ranging document (not necessarily mailed with or included in hardcopies) of more elective appendices.

Because the project continues to evolve rapidly and reporting must accommodate different sources and narrative styles, this report is presented as a "resource library" rather than a single coherent report. In its modified style, the document provides an autonomous update to the RIS Vol 1 and, with subsequent similar documents every few years, should be considered part of the same series. Some critical appendices to this document (Appendices 1, 2 and 3) were extracted directly from RIS Vol 1, and describe the originating basis of our current activities. With this historical background, RIS Vol 2 can be easily contextualised within the broader RIS Vol 1 framework. With RIS Vol 2, we aim to provide a current, useful planning basis and a set of initial broad guidelines for the next few years.

Section A: Project Vision and Objectives

An objectives tree is a construct representing the hierarchy of broad project aspirations, starting with a vision (the "root") as the single foundation from which all the "branches" grow. The conceptually "highest level" (root and thickest branches) are generic, and the branches coming from each of them become slightly more specific (meso or intermediate level of detail). Finer branches from these represent even finer detail, down to whatever level of detail is required in any particular context. In practice, these trees need not necessarily be populated down to the same level for everything in a project. Apart from the introductory main schema (root and thickest branches) of the Tsitsa Tree shown sideways in Figure 1 below, it was decided to show the rest of the tree as tables in this document.

Each section or "thick branch" to the right of the vision (1, 2, 3 etc.) is called a headline objective (e.g. 1. Founding Principles; 2. Ecological Infrastructure). Each headline objective is elaborated in a table (See A2–A7) that spells out the details of the objectives. These objectives can be further unpacked any number of times as needed, even into single activities, for example. Communities of Practice (CoPs) in the Tsitsa Project are mainly responsible for particular headlines, though there is a commitment to growing collective responsibility for Headline 5 regarding agency and collective action.

The sub-objectives and especially sub-sub-objectives are sometimes only stubs (that is, short notes about what still needs to happen at that level, or "to be unpacked further"), or even skeleton twigs to simply show that an unspecified heading will be required at that level at least. Under certain headlines (especially those with existing Communities of Practice or CoPs in Tsitsa Project) sub-objectives are expanded in some detail. Stubs can lead to later narrative descriptions and further detail[b] at levels constructed below those shown.

The objectives tree is used in the context of the adaptive planning process (Roux & Foxcroft 2011) and is the product of a central collaboratively derived vision that captures our highest-level intentions and approaches. The current Tsitsa Project vision is often called the "proto-vision" because wide community visioning has not yet taken place, but was determined collaboratively by scientific and managerial components of the project. However, a robust, wider visioning process was first conducted at an early CMF meeting in Maclear, the closest we have to a full visioning exercise with a mixed group of resident stakeholders. Though this visioning went beyond the Tsitsa Project mandate, large parts are relevant, and it produced a vision remarkably similar to our "proto-vision".

[b] Although finer detail has been developed in parts of the tree by certain of our workgroups (called Communities of Practice (CoPs)) this is often still messy and not shown here but can be shared if available. Over time, and as needed and helpful, CoP co-ordinators will develop finer branches of parts of the formal tree.

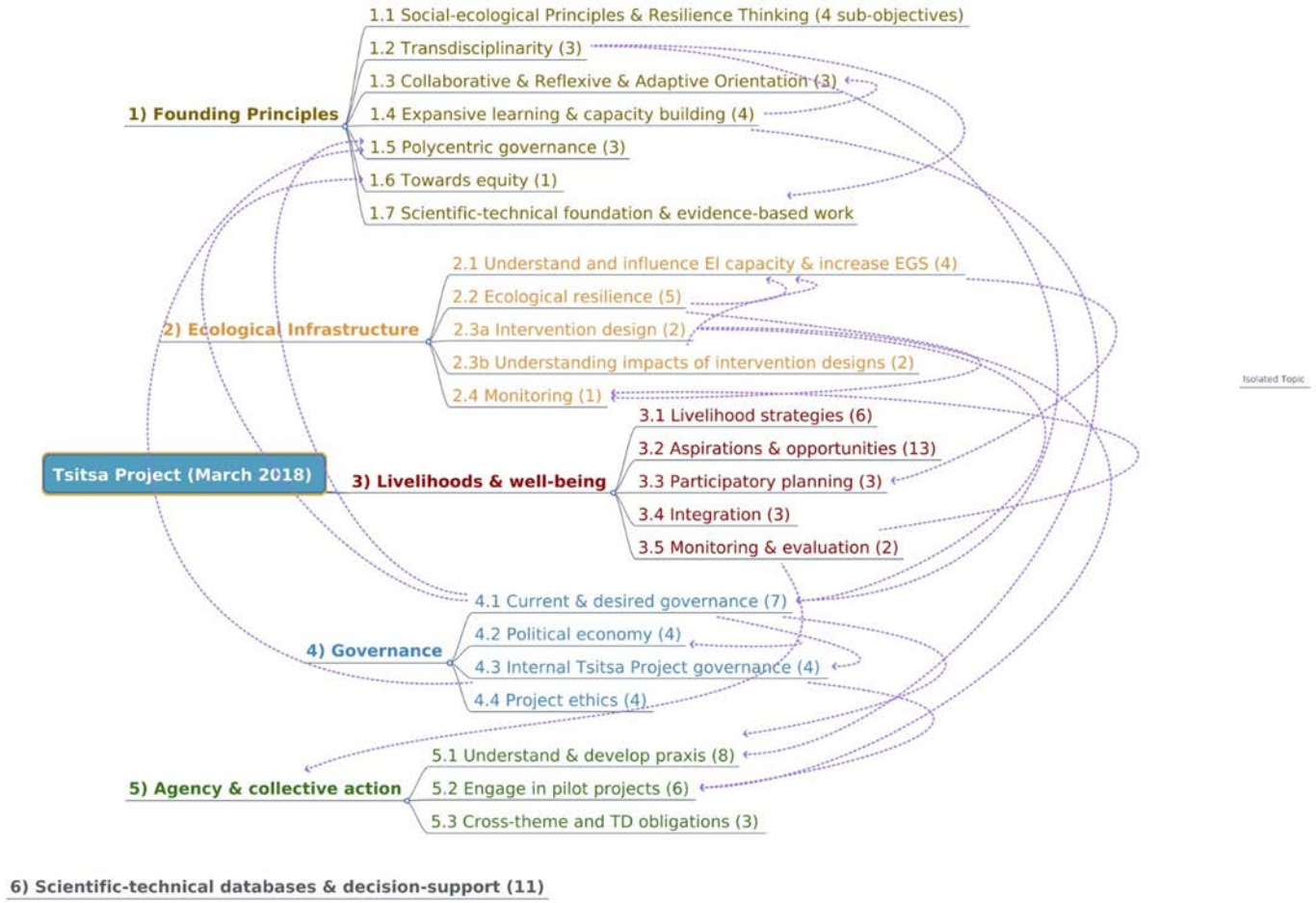

Figure 1: Tsitsa Project Objectives Tree (March 2018)

Represented to the first sub-objective level, but showing the interlinkages. The numbers on the left represent the main stems and the numbers in brackets denote the current number of sub-objectives (collapsed in this graphic).

If the objectives tree is developed to a fine level of subdivision (as "owners" of specific parts of the tree may do), it eventually depicts operationalised, practical, "nitty-gritty" issues. A key attribute of an objectives tree is that whilst it is value-heavy (Keeney, 1992) at the "root", it becomes increasingly technical towards the "branches", showing the explicit pathway via intermediary objectives. These pathways create a better understanding between people working at different scales and levels, while the horizontal links help break down "siloes". Key horizontal (or almost horizontal) crosslinks help indicate the most important possibilities for partnering in a multi-themed or trans-disciplinary sense. However, although too many crosslinks clutter and detract from the visual explanatory power of the diagram. The final graphic after all the tables show a synoptic diagrammatic overview of crosslinks between elements of the tables in this tree.

As is the case in any adaptive environment, this objectives tree is a work in progress. In the spirit of our stated principles, it will require regular collaborative reflection and revision throughout the project. This version is the central articulation of our goals for 2018 and for a few years hence, but if circumstances change rapidly, it may need to be revised even sooner.

The earlier "themes and projects" tables in RIS Vol 1 were the best surrogate we had to date in the Tsitsa Project for an objectives tree, although the tables were intentionally very research-based. This new tree still reflects partial adherence to components of the RIS Vol 1 theme and project listings. Now, however, there are far more praxis-based objectives and some outright managerial ones. In our context, "praxis" refers to the ongoing interaction between theory/research and practice. There is even an objective managing the scope of expansion and involvement of the potential reach of Tsitsa project per se. The "expansion diagrams" (Figure 5) in the internal governance section reflect this process of iterative bounding with occasional links into pure management.

Readers will form their own views of the aims and orientation of the project by examining the tree but should note our insistence on using the seven principles concurrently (a feature particularly associated with the Tsitsa Project). An important study based on internal reflection in the Tsitsa Project and dealing with the perceived meaning of the principles in practice has of been written up (see Cockburn et al. 2018a). We also refer the reader to a detailed internal report (Cockburn et al. 2018b) preceding the publication. Placing Agency and Collective Action as a major headline objective was a conscious decision: the CoP co-ordinators saw it as a central new thrust uniting the other headline activities, though each remains important in its own right.

This objectives tree is foregrounded in this volume to underline our belief that a central, visually explicit articulation of our most important goals will help to "keep everyone on a similar page" (or illustrate why they are perhaps not). It provides a central stem that others can use to understand the Tsitsa Project and to collaborate better with us, for example, by locating their research interests within our context. The objectives tree has been compiled from a variety of sources including:

- CoP contributions
- The Green Village Project
- The CMF meeting in Maclear
- Participatory mapping sessions held with communities from several of the catchments of the proposed Ntabelanga Dam
- Two stakeholder assessments
- Attendance of traditional authority meetings to publicise our cause
- The UCPP "equivalent" from a meeting in Matatiele in the partner catchment of the uMzimvubu.

The outcomes from this process were supplemented by cross-connecting and integrating information from a meeting on 30 November 2017 that had elements of a trans-disciplinary exercise in which CoP co-ordinators began to combine the various objectives from different sources, and blending their experience and opinions. Three individuals consolidated the resulting structure for re-presentation to the CoP co-ordinators on 2 February 2018, coming closer to the objectives tree presented here. Ideally, it would have been better to have engaged directly with a wider group, especially our managers on our B-team, and ultimately, several public fora not only the Maclear CMF statement. However, but this product is seen as a pragmatic start.

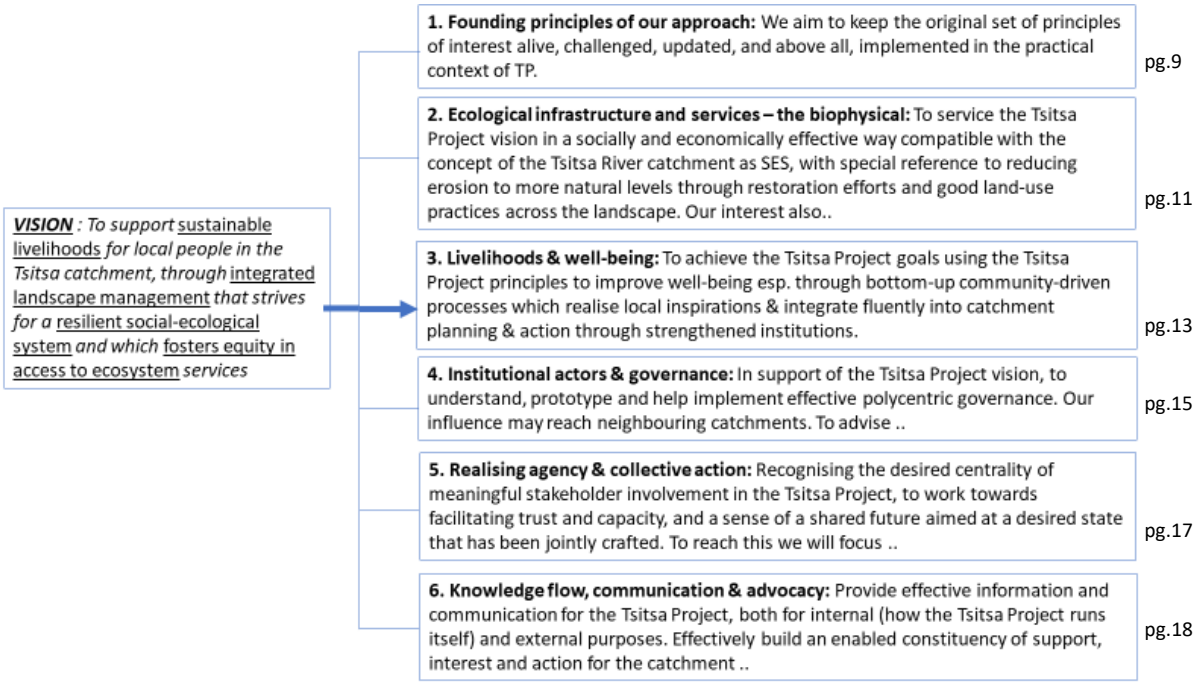

Figure 2: The main schema or root and first branches of the Tsitsa Project objectives tree.

The root consists of the vision; the first branches are the main objectives of the founding principles plus the six headline objectives, some slightly paraphrased to fit this graphic. SES = social-ecological system. TP = Tsitsa Project. Page references for the tables detailing each main component and its respective sub-objectives are given on the right[c].

[c] Recent high-level advice has been to consider reducing the number of primary objectives to one, through which the others could be funnelled. Since most participants intuitively feel that improving livelihoods and well-being of residents is the ultimate main objective, this figure now carries a thicker line and arrowhead to this objective. However, the case can be argued that because our main instrument is repair and protection of ecosystem services, we should mainstream that as opposed to well-being, which requires other inputs beyond what is provided by healthy ecosystems. Sediment reduction was the original "core rationale" for TP, and prevention and reduction of erosion will still be a major desired outcome, even if the dams do not go ahead. Other arguments are that appropriate polycentric governance facilitation is our main novel value-add; or it is the fact that we concurrently practice actions towards all these objectives that characterises TP. Over time TP will further discuss and consider the most appropriate presentation.

Headline Objective 1: Founding Principles

We aim to keep the original set of principles of interest[d] alive, challenged, updated, and above all, implemented in the practical context of the Tsitsa Project. Sufficient consideration needs to be given to the concomitant use of synergies, interlinkages and balance between the seven elements below. Please note that the sub-objectives of this table are less developed than subsequent ones, in line with the call to move on from an emphasis on the abstract. Participants feel comfortable that keeping the objectives in mind is often sufficient. NB – red text denotes cross-linkages to other objectives and sub-objectives and although incomplete at this stage may help the reader, researchers seeking transdisciplinary projects, as well as the authors for revised volumes of this document.

Title of objective	**Statement of objective**	**Sub-objectives**	**Sub-sub-objectives**
1.1 Social-ecological principles and resilience thinking.	1.1 Uphold the centrality of the social-ecological systems view in an appropriate, practical way in all our work. Understand and, where practical, use key concepts in resilience thinking[e] to strengthen our work and to relate it to vulnerability and risk. Further research and reflect on key topics in practical usage of these.	1.1.1 Promoting systems thinking in practice across the Tsitsa Project participation profile.	
		1.1.2 Scenario-ing skills.	
1.2 Transdisciplinarity.	1.2 Recognise and uphold the importance of bridging the science-action gap by integrating diverse knowledges, disciplines, and approaches wherever required in the Tsitsa Project. Support selected high-potential studies in transdisciplinary processes, focusing on practical usage. xlink to 1.7 Technicist Practical key xlinks 2.5, 3.5, 4.5	To be developed if and as necessary. Practical key xlinks 2.5, 3.5, 4.5	
1.3 A collaborative, reflexive, and adaptive orientation.	1.3 Embed a culture of ongoing reflexivity and learning, based on adaptive feedbacks as illustrated in strategic adaptive management, and through participatory monitoring and evaluation which employs realist principles[f]. Ensure timeous, effective inter-flow between science and action ("praxis"). Use the PMERL[g] system as a central mechanism to embed and promote this culture, and adapt it as required to promote feasibility, motivation and willingness to participate. xlink MW 5 PMERL xlink MP 3 M&E	Note: PMERL objectives are spelt out in a full report (Botha et al., 2017).	

[d] These are the key and relatively novel six principles described in Volume 1, the joint practice of which characterises the Tsitsa Project's intended modus operandi. Certain other important principles which are obvious from the mission/vision were not given this emphasis because they were already safely embedded e.g. project ethics, good administration. However, Principle 7 has been added because of the reallocation of most elements of the original Volume 1's theme 5 (see Appendix 3), and its underlying intention at the start of the project.

[e] Apart from socio-ecological systems and systems thinking, this also touches on Resilience / The constructive role of overlap and redundancy / Transformation and transformability trajectories / The generalised adaptive cycle / Panarchy /Scale-dependence, mismatches & cross-scale connections / Alternative stable states / Thresholds / Complexity (generalised complexity as enunciated in the SA context (especially by the work of Paul Cilliers) / Preparedness and scenario-ing.

[f] Sensu Sayer, (2000) "realism simultaneously challenges common conceptions of both natural and social science, particularly as regards causation; critical realism proposes a way of combining a modified naturalism with a recognition of the necessity of interpretive understanding of meaning in social life."

[g] Participatory monitoring, evaluation, reflection and learning (See NLEIP booklet).

1.4 Expansive learning and capacity development.	1.4 Building on our collaborative reflexive mode of operation, embed, support and promote adaptive learning and expansive learning processes[h] as a central capacity-building mechanism in and beyond the Tsitsa Project, emphasising co-operation through iterative co-construction[i]. xlink LC 7	To be developed if and as necessary.	
1.5 Polycentric governance. xlink MW6 definition of polycentric governance	1.5 Building on understanding multi-level effects at different scales, and their interconnection and relationship to the relevant actors, construct a dynamic practical understanding of how the governance network with its formal and informal components might best serve the goals co-constructed between the participants, and support and promote this in practice.	To be developed if and as necessary.	
1.6 Towards equitable participation.	1.6 Against a backdrop of low inter-group[j] interaction and widespread power asymmetries, strive to bring relevant groups together to create a partnership in which partners are closer to becoming equal. The Tsitsa Project will pursue this goal realistically, not to realise benefit sharing in a naïve sense, but to create conditions which are likely to lead to a more favourable situation where power and benefits reflect what is agreed upon by parties as appropriate, in a spirit of co-construction and fairness.	1.6.1 Emphasis will be given to obstacle and trade-offs to realising this, especially so-called elite capture[k]. xlink Political Economy	
1.7 Scientific-technical foundation and evidence base.	1.7 Invariably required to complement all the other major principles to produce robust social-ecological outcomes. While Principles 1.1 to 1.6 are the keystones of the Tsitsa Project, we need to recognise a seventh implicit principle: that the project is strongly influenced by a science and evidence basis. This does not mean that the project should be techno-centric, but it does recognise the reality of the technical backdrop continually being called upon and integrated into the other approaches and knowledges. It would be unrealistic not to admit this facet as a keystone, given our history and values, and the level of funding and energy placed into this as the de facto way of working, bearing in mind that it represents only one aspect of the trans-disciplinary approach. xlink MW5	To be developed if and as necessary.	

[h] Sensu Engeström & Sannino (2010) expansive learning is that in which "the learners are involved in constructing and implementing a radically new, wider and more complex object and concept … the theory of expansive learning puts the primacy on communities as learners, on transformation and creation of culture, on horizontal movement and hybridization, and on the formation of theoretical concepts."

[i] Collaborative learning which results in a process of shared knowledge planning and action. (Pahl-Wostl et al., 2007; Ison et al., 2011)

[j] "Groups" meaning groups at many levels and across many dimensions i.e. not only across the racial spectrum but also gender, age, commercial/communal, urban/rural, and across key scale divides e.g. national, district, local, village and household. The opening statement about low interaction and widespread power asymmetries reflects our opinion. Emphasis will be given to obstacle and trade-offs to realising this, including understanding the political ecology/economy which may yield key clues on which to leverage progress.

[k] Because of the typical way in which such projects as ours are built and funded, certain critics of our slow start in engaging communities have suggested that we are running the project without full participation, or taking so long that we might ourselves be guilty of "elite capture".

Headline Objective 2. Ecological Infrastructure and Services - the biophysical

We have used the vision statement of the Sediment and Restoration Community of Practice (CoP):

To service the Tsitsa Project vision in a socially and economically effective way compatible with the concept of the Tsitsa River catchment as a social-ecological system, with special reference to reducing erosion to more natural levels through restoration efforts and good land-use practices across the landscape. Our interest also includes, wherever possible, ensuring ecosystem services move within the management mandate of other agencies such as Department of Human Settlements, Water and Sanitation (DHWS) and Department of Agriculture, Land Reform and Rural Development (DALRRD), Non-Governmental Organisations (NGOs) and communities.

Title of objective	**Statement of objective**	**Sub-objective**	**Sub-sub-objective**
2.1 Functional ability of landscape.	2.1 Understand and enhance capacity of ecological infrastructure to retain water, sediment and nutrients that support healthy streams/bundles of desirable ecosystem services. xlink 2.2, 2.4 for ecological baselines xlink BW4	2.1.1 Promote soil maintenance, formation and improvement.	
		2.1.2 Water flow regime and routing (reducing surface runoff and increasing groundwater recharge, springs, base flow).	
		2.1.3 Workshop, share knowledge and plan with land users to reduce climate and disaster risk (fire, floods, and drought).	
2.2 Resilience. xlink MW climate change	2.2 Understand and influence the system's ability to remain in (or to recover to, if transformed) a productive state, even after shocks and surprises.	2.2.1 Avoid degradation of currently functioning EI. See point 2.3a for more information.	
		2.2.2 Maintain built infrastructure, such as storm water drains, including discharge areas and wetland rehabilitation structures.	
2.3a Prioritisation and design of practices. xlink BW2 xlink LC4	2.3a. Integrate biophysical and social knowledge to identify priority areas for specific (e.g. replanting bare-soil areas) and more general (grazing management) interventions.	2.3a.1 Identify key areas/EI that are functional, but vulnerable to degradation. This will be done from a technocentric (e.g. GIS, remote sensing, modelling, etc.) and local knowledge (workshops, stakeholder mapping, interviews, etc.) perspective.	
		2.3a.2 Workshop with land users those key areas/EI that are functional, but vulnerable to degradation (e.g. wetlands that form crucial grazing in winter). Integrate wishes and local knowledge of functioning of the identified/ prioritised areas with techno-centric data.	
		2.3a.3 Workshop drivers of degradation and possible/preferred solutions. Identify key	

		interventions and how/where/who the solutions will be implemented and maintained.	
2.3b Impact of practices.	2.3b. Understand and influence different land and water use management practices that impact the resilience of ecological infrastructure. xlink with incentive and motivations, and beliefs, perceptions 3.2.2.2 3.2.5.1 3.2.2.1	2.3b.1 Understand/research current rangeland and fire management. Engage land users where these practices are drivers of the present-day degradation. Examples of present-day practices could be frequent burning around plantations and continuous grazing.	
		2.3b.2 Engage with planning documents, such as the Local Municipality's Spatial Development Framework, new and existing forestry areas, new and existing agriculture parks, etc. to influence project locality, storm water management, landscape buffers, etc.	
2.4 Monitoring. xlink LC5 xlink BW3	2.4 Biophysical monitoring relevant to this theme will be undertaken at multiple appropriate scales with considerable emphasis on local-scale participative monitoring. Results of all monitoring will be reflected upon in an adaptive PMERL driven framework.	2.4.1 Establish biophysical baselines, such as hydrology, sediment yield, vegetation cover, status of alien vegetation, local soil erosion, river fauna, vegetation diversity, etc.	
		2.4.2 Track changes in biophysical indicators at appropriate timescales, e.g. event, season, year.	

Headline Objective 3. Livelihoods and well-being

Revised Livelihoods and Ecosystem Services CoP vision: To achieve the Tsitsa Project goals using the Tsitsa Project principles to improve well-being, especially through bottom-up, community-driven processes which realise local aspirations and integrate fluently into catchment level planning and action through strengthened institutional structures.

Title of objective	Statement of objective	Sub-objectives	Sub-sub-objectives
3.1 Livelihood strategies.	3.1 Understand the impact of macro and micro systems on livelihood strategies and well-being, including risks and vulnerability in time and space (for men, women and youth).	3.1.1 Historicity (changes in ecosystem services (ES), well-being and ways of living over time).	
		3.1.2 Current livelihoods, strategies of local households and links to ecological systems.	
		3.1.3 Resource base or sustainable livelihood assets/capital: human, physical, social, financial and natural.	
		3.1.4 Impact of institutional arrangements and processes on local well-being and livelihoods strategies: political and economic (e.g. local/national/global policies, strategies, plans, etc.); informal rules (e.g. cultural norms, traditions, customary laws, etc.); and impacts of non-resident land users and migrants. xlink LC6	
		3.1.5 Processes, drivers, risk and vulnerability drivers: macro and micro level (e.g. household).	
		3.1.6 Impact of climate change and natural disasters on livelihoods, well-being and ES. xlink MW climate change	
3.2 Aspirations and opportunities.	3.2 Understand the collective/individual aspirations, pathways and opportunities for a green economy, including entrepreneurship options, as well as constraints and enablers (for men, women and youth).	3.2.1 Past and current livelihoods/ES interventions impact on ecosystems and human well-being.	
		3.2.2 Aspirations, attitudes and practices towards land, livelihoods and farming.	3.2.2.1 Stakeholder beliefs about and perceptions of land degradation using chosen frameworks e.g. DPSIR[I].
			3.2.2.2 Incentives and motivators that would inspire actors to adjust their land and management practices.
		3.2.3 Resource opportunities for green economy and entrepreneurship expansion and innovation.	3.2.3.1 Positive and negative impact of NRM interventions, trade-offs and sustainability.
			3.2.3.2 Direct and indirect impact of dam on livelihoods and ES.
			3.2.3.3 Value-added and marketing strategies.
			3.2.3.4 Innovative green economy and entrepreneurship opportunities, and feasibility at local context.

[I] Drivers Pressures States, Impacts, Responses

		3.2.4 Map out pathways for sustainable livelihoods and green economic trajectories.	
		3.2.5 Instrumental and intrinsic value of eco-system services.	3.2.5.1 Quantify the value of ecosystem services (including tourism and cultural); with and without ecosystem restoration interventions - 'the cost of doing nothing'. xlink to avoided degradation
			3.2.5.2 Qualitative intrinsic value of ES by local residents of the catchment.

3.3 Participatory planning.	3.3 Develop participatory micro-level catchment plans and strengthen institutional and governance structures to drive livelihoods and green economy benefits (for men, women and youth) linking to higher-level objectives. xlink LC1 xlink BW4 xlink MW3	3.3.1 Explore appropriate participatory, and thus learning approaches, to the development of micro-catchment level plans. xlink LC7	
		3.3.2 Benefits from investing in ecological infrastructure to support local livelihoods, local economy and well-being.	
		3.3.3 Influence of micro-level plans on higher level strategies and plans and vice versa.	
3.4 Integration.	3.4 Identify appropriate integrated/holistic land use methods, practices, (learning) approaches and knowledge resources to support livelihoods/green economy expansion and strengthen ecosystem-services (for men, women and youth).	3.4.1 Develop most appropriate and cost-effective intervention in different contexts that would foster local sustainable livelihoods and green economic activity. xlink LC4	
		3.4.2 Identify, adapt and develop appropriate learning knowledge and resources relevant to and aimed at different catchment stakeholders and beneficiaries.	
3.5 Monitoring and Evaluation (of well-being and capability).	3.5 Monitor and evaluate livelihoods, green economy and well-being capability expansion including agency and outcomes. xlink LC2 Agency xlink LC5		

Headline Objective 4. Institutional actors and governance

The vision of the Governance CoP: In support of the Tsitsa Project vision, to understand, prototype and help implement effective polycentric governance; to advise on internal governance appropriate to achieving the Tsitsa Project goals overall. Our influence may reach neighbouring catchments.

Title of objective	Statement of objective	Sub-objectives	Sub-sub-objectives
4.1 Current and desired governance arrangements. xlink MW CLIMATE CHANGE xlink BW2	4.1 Map out, understand and influence governance processes, interventions, rules and codes that exist (or should exist) at local, provincial, national and international levels, including informal norms and arrangements. xlink MW1 xlink MW3 xlink LC6 xlink MW6	4.1.1 Map out and understand legal and regulatory environment and act as deemed necessary, e.g. Spatial Planning and Land Use Management Act (Act No. 16 of 2013) (SPLUMA).	
		4.1.2 Identify key gaps and contradictions and work towards pragmatic solutions (also using Institutional Analysis and Design (Ostrom, 2011). xlink 4.2 Political economy	
		4.1.3 Meaningfully influence and contribute to developing appropriate overall governance strategy, including the important facet of overlap between water governance and land governance at different scales. xlink 4.3	4.1.3.1 Communication via policy briefs, "how to" brochures, etc.
		4.1.4 Map out players and roles and non-participators who could be likely players xlink 4.2 Political economy	
4.2 Political ecology/economy. xlink 4.1.2 xlink 4.1.4 xlink MW2 xlink MW3	4.2 Understand the historical and contextual development of the "realpolitik" we observe in the catchment at different levels, as well as the informal and shadow networks and de facto power influences, as this influences and is influenced by natural resources and their management.		
4.3 Internal governance and management of overall expanding scope of the Tsitsa Project. xlink MW6	4.3 Understand, support and, where necessary, improve current internal governance arrangements in the Tsitsa Project such that, overall, the Tsitsa Project goals are more likely to be met. Currently, a particularly important aspect is managing the concentrically expanding scope in multiple dimensions of the Tsitsa Project's reach – this needs to be sensibly constrained. xlink 4.1.3	4.3.1 Improve or create a mature praxis culture in the scientific and management components focusing on core B team. xlink MW4	
		4.3.2 Partnering strategy including our own partnering profile e.g. potentially with uMzimvubu Catchment Partnership Programme (UCPP), various universities, etc.	
		4.3.3 Develop a philosophy and criteria for managing this reach and scope appropriately.	
4.4 Project-related ethics.	4.4 The Governance CoP will act as a central referral point for ethics issues in the Tsitsa Project. These include academic issues such as intellectual property; community engagement issues; ethics codes for research and engagement;		

	broader philosophical issues, such as evolving values, as these influence the ethical views of various stakeholder groupings (including ourselves).		

Headline Objective 5. Realising agency and collective action xlink BW2

Recognising the centrality of meaningful stakeholder involvement in the Tsitsa Project, to work towards facilitating trust and capacity, and a sense of a shared future aimed at a desired state[m] that has been jointly crafted. To reach this we focus on facilitating motivation (including a sense of fun) and ability which helps provide agency at the individual and collective levels, and ultimately, strong and sensible interacting contributions from government, traditional, and civil societyn. Xlink MW1

Title of objective	Statement of objective	Sub-objectives	Sub-sub-objectives
5.1 Principles.	5.1 It may be necessary to understand and develop praxis for the following key attributes of this approach in our context/s	5.1.1 Role of champions.	
		5.1.2 Capacity development. xlinkLC7	
		5.1.3 Motivation for this: how to deepen interest.	
		5.1.4 What is agency?	5.1.4.1 Agency assessment evaluation. xlinkLC2 M&E Define collective and individual agency/action.
		5.1.5 What is collective action?	
		5.1.6 How would we best select entry points and best use of our time and energy e.g. select such projects.	
		5.1.7 Equity warning light.	
5.2 Prototype (pilot) projects that exemplify this goal. xlink LC 1	5.2 To engage in a selected set of projects[o] which involve societal elements (with at least some important/novel linkage and near-equal participation from two or more CoPs) as well as at least some significant transdisciplinary dimensions.	5.2.1 Green-preneurs producing vetiver slips, grass plugs tree seedlings for rehabilitation work. These can be done at the household level in the vicinity of rehabilitation areas and be sold to the implementers.	
		5.2.2 Household and village-scale planning and implementation of rainwater and storm water harvesting and conservation farming (across communal and commercial farming).	
		5.2.3 Expansive systematic learning across multi-level government actors especially DHWS, DEFF, DRDAR, ECSECC. xlink MW4	
		5.2.4 Project awareness and advocacy. xlink5.2.3 xlink MP2	

[m] This desired state requires joint updating as contexts shift and learning occurs; an adaptive principle.
[n] Not all those involved will be part in the long run (like us) so the wording supports this.
[o] These projects should be challenging and novel but feasible (i.e. neither trivial nor overwhelming, nor too many of them overall for our capacity)

		5.2.5 Catchment-wide awareness: Radio, brochures, school competitions. xlink to 6, xlink MP2, xlink LC 3 Com strat	
		5.2.6 CLO capacity development and tools, including monitoring. xlink MP3	

Headline Objective 6. Knowledge flow, communication and advocacy

Provide effective information and communication for the Tsitsa Project, both for internal (how the Tsitsa Project runs itself) and external purposes. Build an enabled constituency of support, interest and action for the catchment and even more widely for the Tsitsa Project principles in multiple areas (scientific, technical, funding, political, and administrative, across various sectors and broadly across resident and other stakeholder communities). Lobby when necessary with appropriate "marketing" or advocacy initiatives.

Title of objective	**Statement of objective**	**Sub-objectives**	**Sub-sub-objectives**
6.1 Scientific-technical databases, libraries and decision support systems.	6.1 Make information and data within the Tsitsa Project accessible, available, understandable, transparent and usable to all stakeholders at different governance levels to best aid further research, management and implementation.	6.1.1 Archive and display scientific-technical datasets in a user-friendly IMS. These can include theses, papers, GIS layers, reports, policy briefs, etc. Include metadata on methodology, tools used, data sources, etc.	
		6.1.2 Archive and display community and stakeholder related datasets in a user-friendly IMS. These can include theses, workshop notes, community maps, GIS layers, reports, etc. Include metadata on methodology, tools used, data sources, etc.	
		6.1.3 Allow interactive spatial data display on an online GIS platform that will support decision making by stakeholders.	
6.2 Community strategies. xlink MP1	6.2 What are the goals of this strategy? What do we want to achieve? xlink LC3 Project	6.2.1 Formulation: internal/external, so called target audience.	
		6.2.2 What do we expect if this works?	6.2.2.1 Especially outside the catchment, e.g. internationally (is this advocacy done by DEFF/DSI etc.? How do we then support them? What limits them? To what extent can Tsitsa staff be expected to expand their scope, and what are the dangers of exaggerating advocacy?

		6.2.3 How do we measure awareness in the catchment?	
6.3 Lobbying/Advocacy. xlink to MW2 xlink to MP2		6.3.1 principles	

Before you read Section B below:

The first working group of the Tsitsa Project was the Sediment and Restoration group which has been very active in the phase till now. It is currently involved with most other working groups responsible for the sections below. The sediment and restoration group produced a major work still in progress: **"Integrated Restoration and Sustainable Land Management Plan"**. The current executive summary is contained in Appendix 4: The Tsitsa Project – Restoration and sustainable land management Plan (ver1) – Executive Summary. With the help of other working groups that have emerged (see Figure 6) this plan and its implementational consequences have drawn together different disciplines, and the research and practical workstreams, into more trans-disciplinary initiatives than Tsitsa Project had just three years ago. Its main documented product, the integrated plan (summary in Appendix 6), could be considered part of this RIS Vol 2 document. That full plan is available from the Tsista Project Knowledge Management CoP (KMCoP) coordinator (Kyra Lunderstedt kyra.lunderstedt@gmail.com).

Section B: Governance

A thriving, sustainable, people-driven landscape with meaningful community voice and agency

This work recognises the importance of both top-down and bottom-up approaches and their continued and increasing interaction. Bottom-up approaches have been lacking in developmental work in restoration contexts, and the Tsitsa Project has had catching up to do, but we can now report an improved emphasis on this approach. The work recognises the nesting of structures, plans and processes at different scales or levels and the ways in which these should overlap meaningfully. All sub-catchment-scale planning is included in this approach as it interacts with an overall catchment plan.

B1 Introduction

The Tsitsa River catchment has not been exposed to large numbers of aid or extension workers in the last two decades. This was recognised in the early days of the Tsitsa Project, and reinforced by two thorough stakeholder assessments (Sisitka et al. 2016, Rivers et al. 2018). Unlike the uMzimvubu Catchment Partnership Project (UCPP), the Tsitsa Project did not have many ready-formed pathways, though there are many existing structures that we are testing and now using partly as vehicles for engagement. We realised that new relationships of trust would have to be built, along with all the pathways required to establish a functional network of collaboration.

Although the word "community" is often used in South Africa to refer to rural black communities, the need to build trusting, collaborative relationships is equally applicable to white, to urban, and to commercial farming communities, all of which tend to be relatively small groups in the Tsitsa River catchment. In addition, there are influential non-residents (such as absentee cattle-owners) who have a significant stake in its governance. The Tsitsa Project, (as was made clear in "RIS Vol 1"), did not start out with any immediately fruitful community collaboration, caused not only by delays in the detailed announcement of the effects of the two proposed dams, but also because DEFF: NRM had not previously used such a community-intensive approach. The Tsitsa Project, therefore, first needed to work out how to facilitate and develop such a culture and practice. In addition, assessments carried out in the catchment area of the proposed Lalini Dam showed differences in various attributes from the catchment area of the proposed Ntabelanga Dam.

The way we reach and connect these different groups to ourselves and each other (and, indeed, connect between ourselves as the Tsitsa Project) and create a sensible but not over-burdening network that makes appropriate natural resource management decisions at various nodes, constitutes polycentric governance (principle 1.5). Connecting to the residents was seen as key.

The planned phased development of the uMzimvubu Water Project prompted us to work first in the area upstream of the proposed Ntabelanga Dam, which is scheduled to be built first. The early engagements mentioned in this Section resulted in a measure of recognition of community voices. Communities were heard and listened to as far as possible in contributing to real consequences – certainly the communities involved appreciated the genuineness of our efforts, but we need to remember now that they do have expectations. While these are early impressions, the Tsitsa Project now has the confidence to continue building this relationship in ways that best serve joint needs. The point has been made repeatedly at science-management meetings that we need to also engage more in commercial white farming and corporate (forestry) areas.

These various initiatives, plus others dealing directly with inter-governmental issues, plus our Tsitsa Project or "internal" governance, are all covered below. However, in order to provide a foundation to carry this, an understanding of complexity and TD is required.

B2 Complexity and transdisciplinary approaches: handling wicked problems

There is a growing trend to view people living in catchments (urban or rural) within the framing of Complex Social-Ecological Systems (CSES) (Pollard et al., 2014). The term 'social-ecological system' emerged from writing by Berkes and Folke in 1998 in which they recognised that the division between social and ecological systems was artificial and that humans are an integral part of the natural system (Berkes & Folke, 1998).

Complexity thinking is being increasingly embraced by a wide range of scholars and practitioners as an imperative for dealing with today's pressing social-ecological challenges (Rogers et al., 2013) because it allows researchers and educators to consider the systems' functionality at the interface of the catchment and the people.

Complexity thinking is a useful approach to untangling issues in social-ecological systems (Audouin et al., 2013; Cilliers, 2000) because it requires a shift in thinking from a reductionist view (which assumes direct lines in relating interactions between independent entities) to a complexity frame of reference in which variability, interacting components and uncertainty are given (Rogers et al., 2013; Swilling & Annecke, 2012). Researchers working within the complex social-ecological system conceptual tradition argue that it is necessary to "live" complexity thinking in order to truly take part in action research and reflexive learning (Rogers et al., 2013; Swilling & Annecke, 2012). Participatory action research involves sequences of planning, acting, and reflecting and, through a participatory orientation, seeks to facilitate personal and institutional change by participants, and may catalyse the emergence of trust among participants (Reason & Bradbury, 2006).

To build collaborative relationships, trust in government needs to be restored and trust built between participants (Goldin, 2010; Sershen et al., 2016). Turner et al. (2016) point out that trust in different sources of information may influence stakeholders' decision-making processes (Gilmour et al., 2015). In complex social-ecological systems, and with marginalised communities, there is a continuous need for commitment and interaction to build relationships (Angelstam et al., 2017; Armitage et al., 2008).

System complexity is related to "wicked problems" (Copteros, 2016; Lach et al., 2005) which may be defined as having multiple interdependencies (Roux et al., 2010); they cannot be easily defined and are socially and intellectually complex (Brown et al., 2010; Clifford-Holmes et al., 2016; Rittel & Webber, 1973). Wicked problems therefore require different approaches toward solutions; these approaches require people across disciplines and ways of knowing to work together, to reflect, integrate knowledge, and bridge the knowledge divides (Angelstam et al., 2017).

Following Cilliers (2000), the key characteristics of complex systems are summarised as:

- comprising many interacting components
- with non-linear processes
- with memory distributed throughout the system (there is a history which is fundamental to the behaviour of the system)
- with feedbacks between components and processes
- which are influenced by scale (temporal and spatial), and
- where small changes can lead to large effects (and vice versa) (Cilliers, 2000).

Cilliers' characteristics enable a different approach to ways of thinking and analysing social-ecological systems, for a sustainable future, one that requires adaptive rather than linear styles of management (Palmer & Munnik, 2018).

A methodology which is increasingly being used to untangle 'wicked problems' is that of transdisciplinarity (Lang et al., 2012; Max-Neef, 2005), a methodology the Tsitsa Project is adapting. In his hierarchical framework of transdisciplinarity, Max-Neef (2005) uses four levels (empirical to level) to frame the research process (Figure 3).

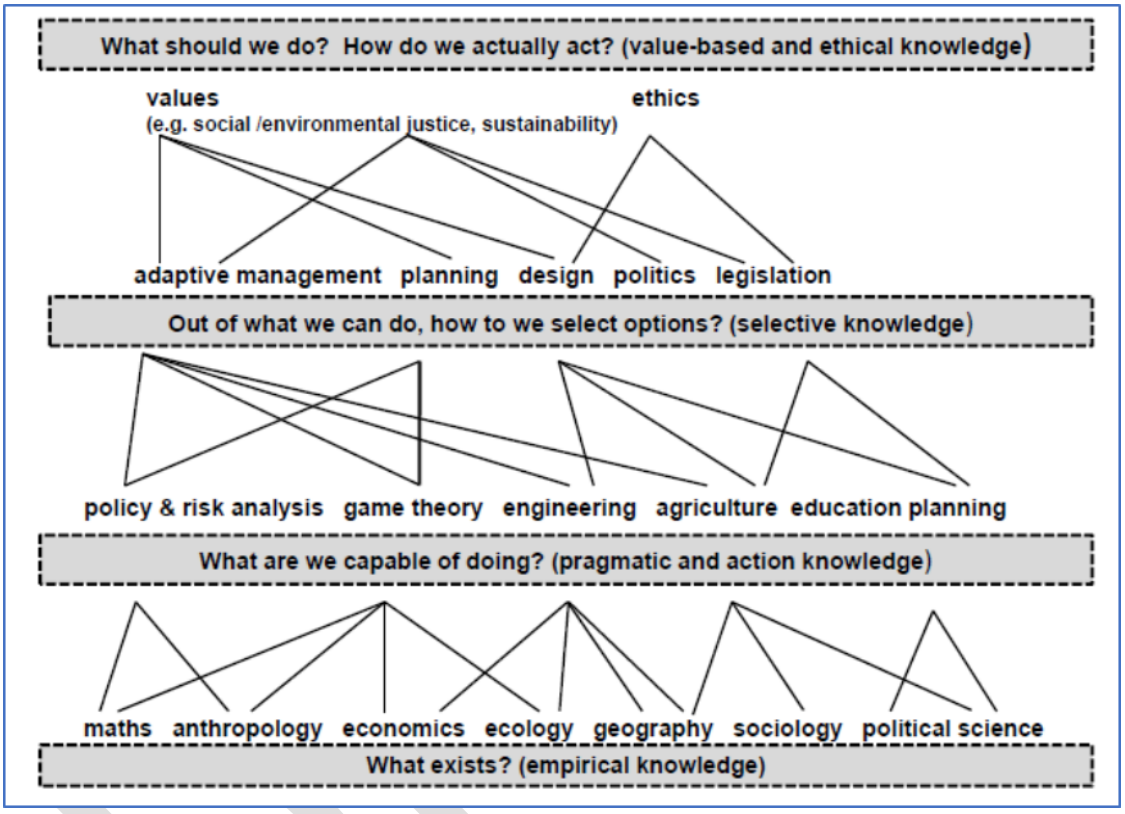

Figure 3: Max-Neef's hierarchy of transdisciplinarity (adapted by Palmer & Munnik 2018)

Max-Neef (2005) suggests that when there is a multiple engagement with stakeholders and participants across all four levels, strong transdisciplinary action occurs (Clifford-Holmes, 2015; Copteros, 2016; Max-Neef, 2005). Max-Neef (2005) also proposes that transdisciplinary research is conducted by progressively building on each layer (Clifford-Holmes, 2015; Max-Neef, 2005). All people gather data through a range of disciplines (or ways of knowing) which reveal what exists (empirical knowledge). Using this empirical knowledge, people think about what they are capable of doing (pragmatic and action knowledge). From of this step – what people are capable of doing – comes the selection of 'how to do what needs to be done' (selective knowledge). What people should do and the ways that they actually act is value-based and ethically driven. The layered approach to thinking, researching and discovering various ways of knowing offered by Max-Neef allows the researchers to consider more than one set of data or behaviour or understanding.

Transdisciplinarity offers the opportunity to untangle 'wicked problems' because according to Clifford-Holmes (2015), Pohl and Hirsch Hadorn (2007), Roux et al. (2010), Wickson et al. (2006), transdisciplinarity works towards several objectives, including:

- active engagement in the problem spaces in which the research is located;
- an explicit focus on learning, both within the research team and among the practitioners and stakeholders, as well as between researchers and practitioners;
- an explicit goal of encouraging a different relationship between science and society that includes uncertainty, complexity, and the contributions of different ways of knowing and experiencing; and
- an active contribution to a social process of resolving issues through social learning and participation.

Palmer et al. (2015) suggest a set of transdisciplinary action research principles:

- Tolerate and even welcome discomfort and unresolved tensions; they are often gateways to knowledge, trust and learning.
- Be sensitive to 'aha!' moments or insights, and note that irritation and conflict often signal moments of insight and a learning opportunity.
- Engage with balanced generosity, listen and share.
- Practice tolerance, build integrity and mutual trust.
- Be sensitive to "arrivals" of both people and ideas.
- Create and use reflective opportunities.
- Be conscious that everyone involved in the process is a whole, multi-dimensional person, with the potential to engage with his or her whole self and capable of many ways of knowing.

Palmer et al. (2015) suggest that a set of principles for engagement in transdisciplinary research prove more adaptive and flexible than a set of rules.

B3 Appropriate praxis: shifting from discipline-based to transdisciplinary innovations

Over the past year the Tsitsa Project team, the various Tsitsa Project components especially (these are explained below, and include Communities of Practice and the B-team), and some of their allied participants (such as research partners) have embarked on a suitable trajectory towards systemic collaboration and transdisciplinary approaches. Although progress in this regard is noticeable, much work is still to be done in order to shift from discipline-based initiatives to transdisciplinary innovations. The Tsitsa Project will continue to enable this shift in multiple ways.

General indicators of change in such a shift

- Participants and prospective participants start requesting or demanding a wider range of representation in the teams, partnerships or initiatives in which they work. This has already started, for instance between Communities of Practice, and at the last A-team (Strategic Oversight Committee meeting in November 2017. Missing departments and agencies were identified for inclusion.
- People start feeling less threatened and often no longer insist on having their own sub-group meeting before going into a more mixed group. Whilst here is always a need for splitting and joining, there is now enough trust and confidence to operate more often in open or mixed mode. Again, witness the CoPs at recent SciMan meetings.
- There is a greater spirit of sharing and modularity (recognition of potential flexible complementarity ("this and that must fit effectively together, and we can do that if you can't") rather than a model of very strict roles and responsibilities each answering to that discipline's or that group's "best practice". Put another way, there are fewer self-serving silos, instead,

there is a sense of a shared overall goal, which tends to take precedence over individual group interests, though recognition that "selfish interests" also needs to be served. Linked to this, approval or censure from the wider group becomes more effective.

- There is visible tolerance (or at least condonation) of other perspectives or other groups' points of view, and people are able to articulate those other points of view more openly, even if just to minimise misunderstanding.
- People hear and listen better, often delay making their point until they have first heard more from others.
- Power dynamics start flattening slightly: participants feel more respected and freer to express their point of view without it being dismissed or ridiculed.
- Outputs (products or ideas from one discipline and/or group) start to act as inputs to another and vice versa. If these are meaningful and adaptive, this may also lead to sustainability as the overall system evolves. This is a key development to forming a systems point of view.
- An extension of the example of the previous point is that common resources (expensive equipment, rare skills, etc.) start to be identified and shared.
- There is pressure to set up joint initiatives to share experiences and often advocacy. Cross-visits (disciplinary or group wise) start happening more frequently and are valued.

Indications that transdisciplinarity is developing

- Meetings or initiatives are delayed until all the key relevant players are present.
- Fewer/Less frequent claims of specific group or discipline legitimacy are made.
- There is a move from uni-disciplinarity (or tight group ethic) to multi- and inter- and eventually transdisciplinarity (the same applies to group heterogeneity and ethic). There is a balance here though, as group identity often needs to be reassured by the wider group.
- Participants experience increasing spatial and scale awareness; for example, they become aware of the catchment as a whole and the linkages in it and realise incrementally that multi-scale interventions are essential if their part of the story is to work.
- Self-organisation becomes more commonplace. The original (sometimes top-down) structural control may give way to organic more bottom-up organisation of initiatives, forming a loose network or web with others, even at multiple scales.

B4 Review of the Tsitsa Project governance and related research 2014–2017

Each of the Tsitsa Project CoPs has been involved in Community Engagement (CE) efforts, using various workshop methods at different locations within the Tsitsa River catchment. The Tsitsa River catchment comprises 13 quaternary catchments (T35 A-M), with the proposed Ntabelanga dam planned at the downstream point of T35E. The T35 Tsitsa River catchment boundary overlaps with the boundaries of local government (local and district municipalities) and traditional authorities. As described in Lunderstedt et al. (2017), the community engagement processes of the three original CoPs have provided three approaches to learning:

1. Participatory narratives at the village scale;
2. Participatory mapping at the local government/traditional authority scale;
3. The Adaptive Planning Process (APP) that is part of Strategic Adaptive Management (SAM) (Roger & Luton 2011, Palmer et al. in press).

The APP was conducted at multiple scales: village, traditional authority/local government, and whole-catchment scales, and has created a basis from which to maintain communication networks.

A key recommendation from the stakeholder analysis, which emphasised effective communication, was to invest significant time and resources in deeper engagement (Sisitka et al., 2016). Delays in a detailed announcement of the two planned dams, and the time needed to initiate the new CSES approach embraced by the DEFF: NRM complicated the early stages of the community approach motivated in RIS Vol 1. However, the three learning approaches described above have enabled the Tsitsa Project to hear and listen to the voices of the community, and to facilitate their influence on the mental models and cultures of practice of the researchers, implementers and other catchment stakeholders. A brief background, key outcomes and findings are presented from each CoP to provide the context of community voice in the Tsitsa Project as elicited to date. Details can be accessed through each of the projects' associated reports.

Village scale: "The Green Village"

The Green Village Project (GVP) was a WRC-funded project which took place from 2014–2017, and was embedded within the Tsitsa Project programme. It aimed to create agency for rehabilitation within the community, which could be upscaled to the catchment and nationwide (Rowntree, 2018). The project focused on two villages in the Elangeni Traditional Area / Elundini Local Municipality and promoted "green living" to improve the landscape and livelihoods. The approach was participatory and involved co-constructing a timeline of events to identify changes related to natural resource problems, community transect walks to embed story telling on the ground, and a discussion of future prospects.

In co-constructing a timeline, it became clear that changes that took place in certain socio-political contexts had negatively impacted on previous governance structures, inter-person relations and relationships with the landscape. For example, after 1994, salaries for rangers who were mandated to manage grazing camps, fences and livestock, fell away. Also, women, who were previously unable (for whatever reason, but largely apartheid restrictions and disincentives) to visit their husbands in the city, were now able to do so. Changes in school attendance also took children off the land. These changes meant that much of the community no longer engaged with the land, and as a result, knowledgeable maintenance of land declined substantially.

The importance of land management, which was identified by the community as a major problem, was revisited and emphasised. To illustrate community approaches to land management in a similar setting, a village learning exchange was facilitated between a community of women practising water harvesting techniques, and the UCPP in Matatiele. There they met with Economic Research Service, and Meat Naturally (Pty) Ltd. The value of an approach that included rotational grazing, rangers, and healthy livestock was fully apparent to the visitors, especially in terms of the potential monetary gain that can be accrued through looking after the land.

The GVP had a practical focus and enabled the village communities to learn and practice resource rehabilitation and management options that could contribute to sustaining their livelihoods: water-harvesting techniques, exercising land management in relation to livestock and good grazing management, and the development of vetiver grass micro-nurseries. Vetiver is an alien non-invasive grass useful for stabilising soil, protecting against erosion, and feeding animals. Oil extracted from the roots can be used for cosmetics, aromatherapy, herbal skincare and Ayurveda soap. Because of its fibrous properties, the plant can also be used for making handicrafts and ropes. The project chose not to focus on poor grazing management of livestock as a cause of erosion, because of challenges related to possible stock reduction when considering the high value people place on livestock.

Traditional authority/local government scale: Participatory mapping workshops

Six traditional authorities within the area of the Tsitsa River catchment are affected by the proposed Ntabelanga dam (T35A-E). During workshops within each traditional authority area, the Tsitsa Project team sought to understand the locally specific natural resource issues by providing participants with an open space for dialogue. After the key issues were identified, their willingness to engage and the feasibility of land restoration and management options were discussed. Working in groups, the top three issues in each traditional area were prioritised, and their locations were marked on a map. Land use areas including agro-pastoral use, graveyards, residential developments, and various projects were mapped using Google Earth.

The participatory mapping of intervention priorities gave the Tsitsa Project an initial understanding of the issues that people living on the land recognise as most problematic. The priorities and preferences for intervention varied between traditional areas. Applying such diverse restoration and implementation plans in response to community voice is likely to be vitally important to sustainable livelihoods. Table 1 summarises the top three priorities in each of the traditional areas.

Table 1: Summary of land use problem priorities in the traditional areas within the catchment area of the proposed Ntabelanga dam

Traditional Area	Priority 1	Priority 2	Priority 3
Batlokoa	Dongas	AIPs	Fires and spring degradation
Elangeni	Dongas	Fire	Overgrazing and hillslope erosion
Basuto	Dongas	Hillslope erosion	AIPs and fires
Northern Mpondomise	Dongas	IAPs	Overgrazing
Lower & Upper Tsitsana	Dongas	IAPs	Overgrazing and hillslope erosion

Dongas were prioritised as the most important natural resource problems in all traditional areas, with alien invader plants (AIPs) indicated as priority two, except in the Elangeni and Basuto areas. Fires, spring degradation, overgrazing and hillslope erosion were variously a third priority.

Catchment scale: Participatory governance development

The National Water Act (No. 36 of 1998) (NWA) is clear about the importance of public participation:

"Part 3 deals with the functions and operation of catchment management agencies. Initial functions ... the development of a catchment management strategy and the promotion of community participation in water resource management ..."

Section 80: "Subject to Chapter 2 and section 79, upon the establishment of a catchment management agency, the initial functions of a catchment management agency are ... (e) to promote community participation in the protection, use, development, conservation, management and control of the water resources in its water management area."

Section 90: "…. the Minister may make regulations ... (b) requiring the establishment of consultative forums and determining their composition functions..."

The NWA regards a water resource as including the whole hydrological cycle in the context of the landscape. This includes land and water, and their interactions. The natural boundary of a water resource is a catchment, i.e. the landscape unit drained by a particular water resource. In the case of The Tsitsa Project, the catchment is that of the Tsitsa River, which includes quaternary catchments T35A-E. The Tsitsa River is a tributary of the Mzimvubu River, in the East of the DHWS Water Management Area 7. The Mzimvubu to Tsitsikamma proto-Catchment Management Agency (MTCMA) is the key regional water resource governing institution of the DHWS. The Catchment Management

Forum (CMF) is the non-statutory mechanism described in the National Water Act (NWA) for participatory governance in catchments – land and water landscapes.

The Governance CoP researchers engaged with the MTCMA, and together, they ran five preparatory CMF formation workshops across Water Management Area 7 (the Eastern Cape). One of these was held in Mthatha, and was attended by representatives from the Tsitsa River catchment in association with the Tsitsa Project. The CMF formation process elicited local knowledge and shared information about the Tsitsa River catchment context as a social-ecological system (SES). The most important catchment challenges emerged during the workshop, together with possible actions to address them.

The Tsitsa Project team used the DHWS CMF formation workshops, and a Tsitsa River CMF formation workshop as the first steps in developing participatory governance. An Adaptive Planning Process (APP) (part of Strategic Adaptive Management (Palmer et al., 2018; Rogers and Luton, 2011) was used to alert stakeholders to the opportunity for participatory governance. The APP also co-developed a draft Tsitsa River Catchment Management Strategy (CMS) to go to the MTCMA for inclusion in the Water Management Area CMS. Participatory activities included:

- *Engaging with Chief Mabandla and the Green Village residents*: The traditional leader in Quaternary catchment T35E (the site of the proposed Ntabelanga Dam) is Chief Mabandla. T35E is also the focus of early DEFF: NRM landscape restoration in the Elundini local municipality which is the site of the Green Village. The Green Village was a WRC project, aligned with the Tsitsa Project, and engaged extensively on sustainability and livelihood practice. The first governance meeting aimed to gain permission, and to meet with traditional authority to elicit support and understanding. Research funded by IWR examined hill-slope seeps as key ecological features that support livestock.
- *Engaging with a broader range of Tsitsa River catchment stakeholders, including traditional authorities and local government*: The catchment management development protocols referred to above were followed with stakeholders including residents from villages and from Maclear, traditional leaders, implementers of the DEFF: NRM restoration, and officials from local municipalities. A Tsitsa Project researcher translated into isiXhosa, and accessible language was used throughout. The engagement exposed stakeholders to the idea of a catchment (there is no word for catchment in isiXhosa), and a catchment as a complex SES. Participants experienced the workshop with various community values in action, as local knowledge was elicited with respect and inclusion, and provided equal opportunities for participation.
- *Engaging with stakeholders from across the whole Tsitsa River catchment with representatives from the formal land and water governance framework*. The culmination of the participatory governance experience was a two-day workshop where twenty-six stakeholders gathered, and, using IWR-facilitated Adaptive Planning Process (Palmer et al., 2018), co-developed a Draft Catchment (Land and Water) Management Strategy. This draft has been submitted to DEF and DHWS to shape public policy, practice, and development of development institutional arrangements.

The governance framework comprised:

- Traditional leadership
- Local government
    - Joe Gqabi, Alfred Nzo and OR Tambo district municipalities
    - Elundini and Mhlontlo local municipalities
- National government

    - DHWS through the (MTCMA)
    - DEFF: NRM Extended Public Works Programmes (EPWP)
- Stakeholders
    - commercial enterprises and urban citizens (forestry and farming);
    - rural residents

Epistemic Justice

Epistemic justice is an innovation in research into participatory processes (Fricker 2007), and focuses on fairness to participants. It asks two key questions:

1) Do participants feel respected and listened to; do they experience that their knowledge is respected, and feel that each participant has a fair and equal opportunity to contribute?

2) Do participants understand the purpose of the engagement well enough to contribute?

Part of the APP workshop was a detailed investigation and analysis of epistemic justice. Concepts related to catchment access were presented, fully translated, and explored by participants, so providing an opportunity to build capacity for integrated water resources management (IWRM) institutions and for social learning processes. The findings of the epistemic justice analysis were that participants did experience respect, listening and equal participation. Their understanding of concepts came across as weaker, but the method used to assess understanding was flawed as it relied on written responses. The research team learned that evaluating understanding means allocating time for oral feedback.

Serious barriers to participatory governance are the dispersed location of stakeholders, and the lack of funding for transport, food and accommodation. In the case of the APP workshop, these costs were covered by the research budget and in the next stage of research, the employment of a resident **T**sitsa **C**atchment **C**oordinator (**TCC**) and **C**ommunity **L**iaison **O**fficers (**CLO**s) will be used to alleviate the problem. At the moment, interaction among stakeholders from different areas is limited to the few members of the emergent Land and Water Forum. Without funding for that institution, it will be unable to develop fully. **It is vital that the national government departments, DEFF and DHWS, remove this barrier if participatory governance is to become a reality**.

B5 Converging strands: a "Participatory Governance and Community Voice" CoP

The first three years of the Tsitsa Project laid foundation for the participatory mapping and APP approaches to converge, and for a single Community of Practice (CoP) to emerge: the "Participatory Governance & Community Voice" (PG&CV CoP). This CoP will develop and deliver the three strands of learning at different scales and using different approaches, but guided by an explicitly engaged, transdisciplinary, action research approach. The CoP will take account of the uncertainty surrounding DHWS CMFs, but will remain connected with the proto-CMA. Participatory governance development will shift move towards the development of a more generalised "Land and Water Forum", with participants able to interact with any of the formal, statutory institutions that have governance responsibilities for land and water. For the Tsitsa Project, the DEFF: NRM will remain the primary connection, but links to DHWS (as well as to provincial and local government institutions) will, and must, be maintained.

Participatory Governance: Community Voice Research April 2018–March 2021

The vision of the PG&CV CoP is to train the Tsitsa Catchment Coordinator (TCC) and the Community Liaison Officers (CLOs) so that community engagement across the Tsitsa River catchment continues. The aim is that:

- one in five people know and understand what the Tsitsa Project is about;
- the natural leaders in the community feel empowered to participate actively in a "Land and Water Forum" (L&WF).
- the DEFF: NRM annual planning cycle is aligned with participatory governance, and villages have an impact on the location and manner of EPWP activities.

The main process to achieve this will be:

2018/19:

- Share knowledge with the Catchment Coordinator of the conceptual approach of the Tsitsa Project and the realities and possibilities of the way it operates.
- Connect the Catchment Coordinator with the six traditional authorities and both local municipalities to spread the understanding of the Tsitsa Project's approach and practice.
- Involve the Catchment Coordinator in communication with the MTCMA about ongoing developments of a local CMS.
- Select one or two traditional authority areas for focussed engagement, and initiate CLO training.
- Decide on the suite of methods and processes to use.

2019/20:

- In one or two traditional authority areas, the Catchment Coordinator and CLOs will engage with residents at the village scale, and implement the learning programme agreed on.
- There will be regular contact between the Catchment Coordinator, CLOs and the PG&CV CoP.
- Land and Water Forum meetings will be initiated where village representatives will meet with other catchment stakeholders and start working towards collectively agreed forum goals.
- The L&WF will specifically engage with the provincial DEFF: NRM leadership and team in connection with planning and implementing EPWP activities.

2020/21:

- Reflexive feedback: engage with TCC and CLOs to relate the on-the-ground situation to the learning and practice goals, and to adapt the programme as required.
- Work to maintain and grow resident input in the "Land and Water Forum" in the one or two selected areas.
- Track Forum – DEFF: NRM interactions towards co-ordinated EPWP activities that meet the Tsitsa Project outcomes, through collaboration between residents and DEFF: NRM.
- Maintain connection with the MTCMA, tracking the inclusion of the Tsitsa River catchment residents' local catchment strategy, into a provincial-scale catchment management strategy.

B6 Linking the internal Tsitsa Project governance to the Tsitsa River catchment governance

The Tsitsa Project governance is both complex and complicated; but the issue of project governance is the critical point of all restoration and sustainable land management projects – it is essential to sustainability. A deep understanding of the power dynamics across all tiers and scales was and is a key component in drafting the Tsitsa Project Governance Plan (in preparation). The core areas where the Tsitsa Project governance seeks to make an impact are linked to the five major 'change domains' in the catchment CSES (Botha et al. 2017). These change domains are:

- improved agency
- equitable access (primarily to resources)
- integrated land-use management
- participatory governance, and
- sustainable livelihoods.

The full Theory of Change is illustrated in Figure 4.

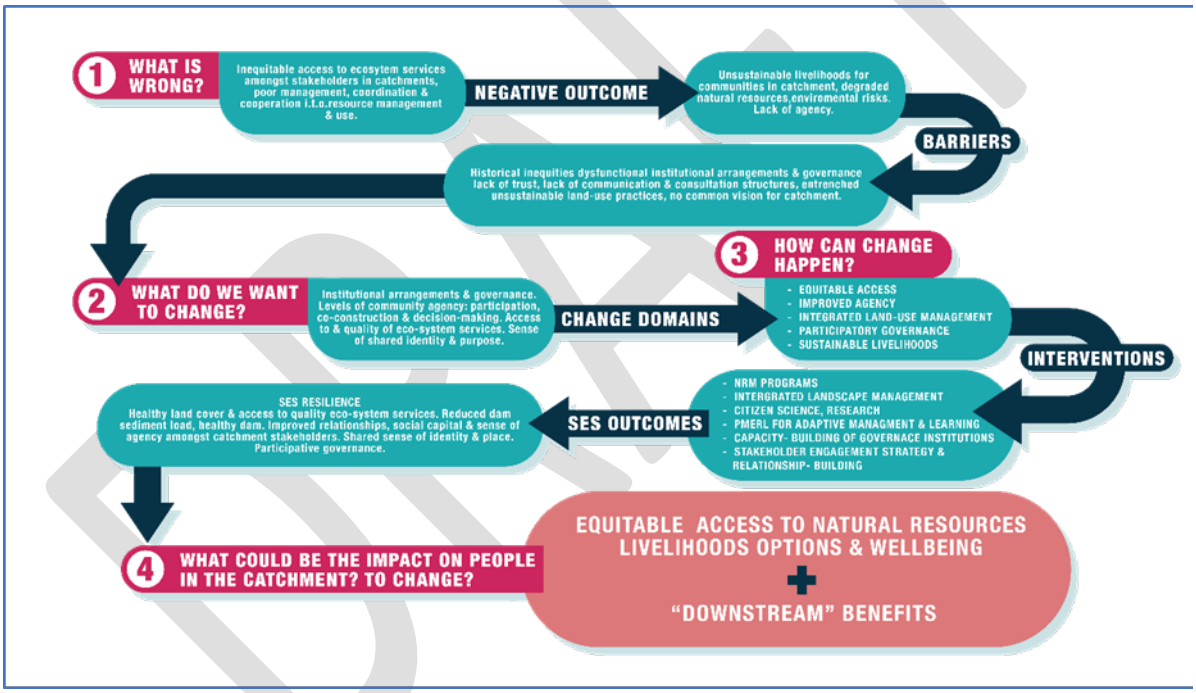

Figure 4: The preliminary Tsitsa Project Theory of Change (Botha et al. 2017).

Expanding reach of the Tsitsa Project

As the science-management relationship developed positively, the members of the Tsitsa Project realised the project could now expand into implementing agencies controlled by the managers and even further, into implementing agents and then into farmers, carrying out sustainable land use practices in the catchment. Soon these players in other catchments showed an interest in interacting with the Tsitsa Project as did National Departments in Government and national and international funders. Members of the Tsitsa Project realised they were not able to meet the expectations of all

these players and that boundaries would have to be established to guide the extent to which the Project engaged with the levels in Figure 5.

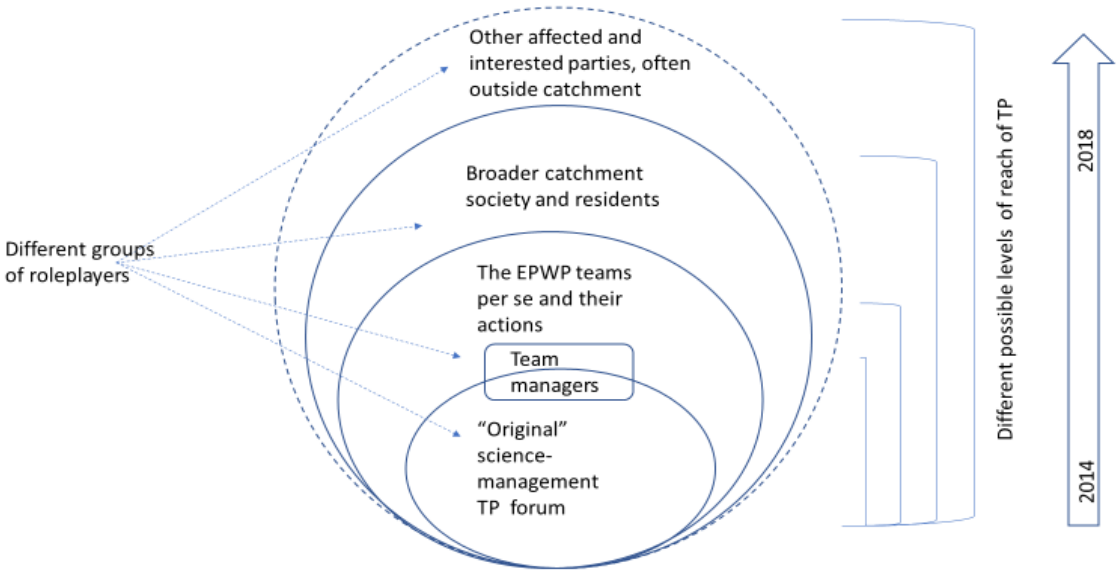

Figure 5: Expanding reach of Tsitsa Project.

External Tsitsa Project governance scales

The first stakeholder analysis recommended engaging with the existing governance structures at three levels (Sisitka et al. 2016): the village level (micro), the traditional authority/district-local municipal level (meso), and the national government level (meta). However, this structure does not consider provincial-scale institutions such as the CMA or Provincial Departments. The revised stakeholder and community engagement strategy will engage on all four levels. A new and different introduction across the scales will be the L&WF where representatives from various levels mentioned, and all stakeholder groups meet to share knowledge, insights and needs, and where the community voice can be heard and find a response.

The Tsitsa Project Governance Plan seeks to find the appropriate mix of spatial scales to deepen democracy, but also to find the right balance between supporting traditional governance structures (headman, traditional leaders etc.) and democratic structures (e.g. municipal managers and councillors). The voice and influence of the traditional leaders in the 'former homelands' needs to be taken seriously (Ainslie & Kepe 2016). A further complication is that the degree and strength of traditional leadership is unequal across the Tsitsa Project area of interest, with differences apparent in the Inxu River catchment which drains into the proposed Lalini dam (Rivers et al. 2018), which suggested a dynamic and nuanced participatory governance development strategy is required.

Internal Tsitsa Project governance scales and bodies

The internal governance 'engineering' over the past three years is represented graphically in Figure 6.

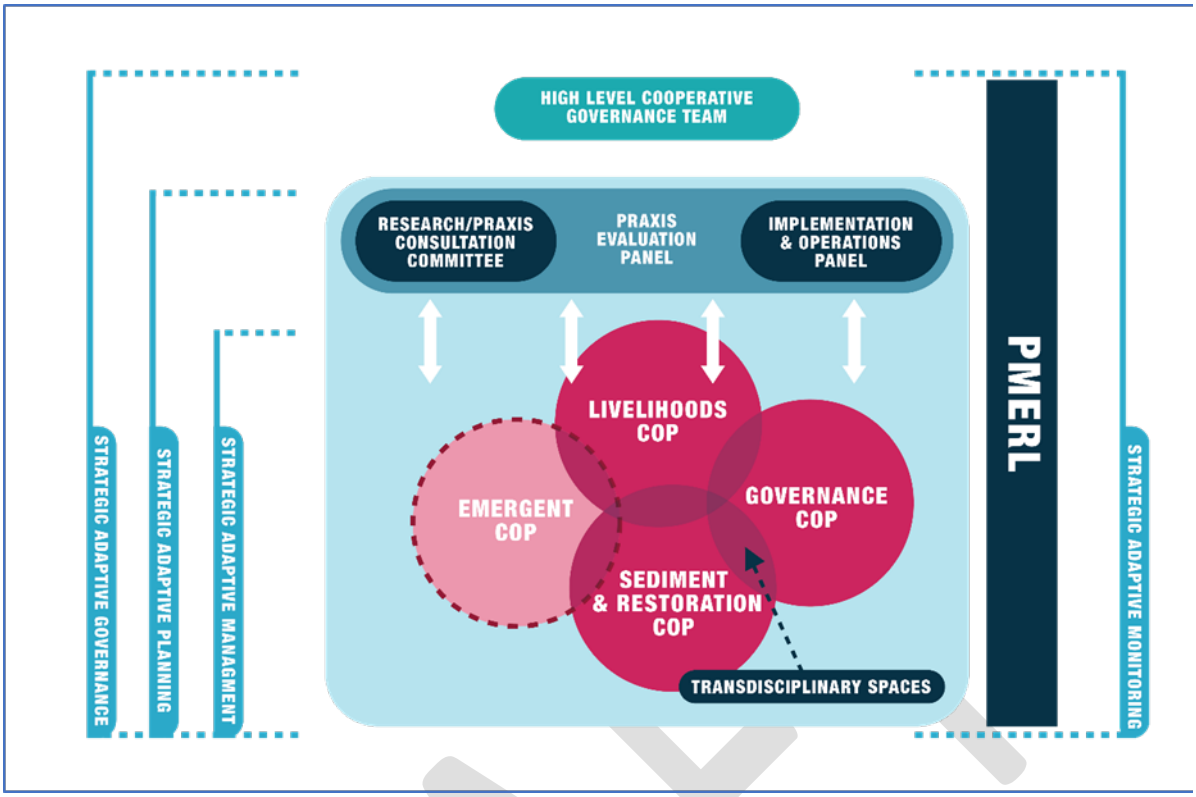

Figure 6: The internal Tsitsa Project governance structures as at February 2017 (Botha et al. 2017).

In the initial stages of the project, a strong focus was on a two-way transfer of knowledge (between practice and theory) and building trust between managers/practitioners and scientist/students. This led to the science-management Forum, which hosted science-management Meetings. These meetings provided safe spaces in which to establish and operate the CoPs. The Tsitsa Project quickly developed three communities of practice or CoPs, starting with the Sediment and Restoration or S&R CoP. These teams were initially called working groups and were composed of voluntary groups of enthusiasts who met and increasingly cross-linked with the other groups. In 2017 there were two further CoPs: Governance (Gov CoP), and Livelihoods and Ecosystem Services (L&ES CoP). From 2018 the Governance CoP will be called the Participatory Governance and Community Voice CoP (PG&CV CoP) and will be responsible for linking internal and external governance processes. The 'emergent' space (Figure 3) has recently been filled with a Grazing and Fire Management CoP (G&FM CoP), which is still finding its feet. In line with the main core themes from the Fabricius et al. (2016) report, a Knowledge Management CoP (KM CoP) is gaining momentum and has had the benefit of CoP coordinator in place from April 2018. In the Fabricius report the "work package" was called Data Support (see appendix 5).

Slightly more formally, there is the 'B-team' (or the Praxis Evaluation and Recommendation Panel) of mid-level managers and researchers who develop and keep the science-management links meaningful. A subset within the B-team (the Core B-team) is specifically charged with ensuring that the recommendations are put into practice, and also plays in important role in refining research projects. The inaugural meeting has taken place of a formal high-level 'A-team' (or High-Level Cooperative Governance Team) which will represent the Tsitsa Project interests at the most senior level and provide the highest level of support. A final component of the Tsitsa Project Governance is provided by the Praxis Consultation Committee (previously, the Tsitsa Project Wisdom Trust). All this is necessary to enable the Tsitsa Project to achieve what it plans to do.

Section C: Participatory Monitoring, Evaluation, Reflection and Learning.

Learning while checking the heartbeat of our adaptive approach.

Participants do not usually regard monitoring and evaluation projects with enthusiasm, nor does the content of the evaluations necessarily reveal the real learning of creative tasks in the unpredictable circumstances of natural resource management projects. This initiative strives for a better fit.

C1 Introduction

Government-funded components of the Tsitsa Project are naturally monitored and evaluated in line with procedures decided by DEFF: NRM, but the Tsitsa Project has also been given the freedom to experiment with extensions to this which more closely match a collaborative and participatory programme focused on learning in unequal, heterogeneous, changeable and challenging developmental situations. If these monitoring and evaluation "experiments" show promise and become more commonplace in future, there may well be very useful outcomes: meta-learnings, that is, designing and implementing a group learning, monitoring and adjusting programme. However, without such an experiment, the broader the Tsitsa Project would fail.

From an adaptive management point of view, thoughtful reflection and action must be based on sensible and appropriate monitoring. Feedback of different types and levels is extensive in functioning adaptive management, and takes place formally and informally as often as needed. This should happen in conventional M&E, but often does not. Successful feedback depends on inculcating willingness by people in one component of the system to want to influence, and be influenced by people working in other components. Some definitions of sustainability, in systems terms, depend exactly on this mutual influence. Maintaining this feedback is difficult but interesting, particularly when heterogeneous partnerships involve different groups, as will increasingly be the case in the Tsitsa Project. Willingness, and a feeling of being part of a bigger, worthwhile system in which one both benefits and gives benefit to the whole is essential. Overall system functionality depends on this, and the PMERL system being proposed in this document is indeed the watchdog of the Tsitsa Project system's heartbeat, and the central regulator of this feedback.

A further requirement for willingness is that PMERL should be feasible and should not be too onerous; perhaps is could even be turned into fun. The success of PMERL is increased if the actions described in this section become part of other regular tasks, for instance, as part of another task such as compiling the monthly report. Skilful organisation by individuals of their obligations, for instance, overlapping key tasks, helps individuals schedule PMERL tasks effectively.

C2 Problem statement

Programme evaluation is essential in order to be accountable to stakeholders (those who invest money, time and expectations). However, we also need evaluation to learn from implementation. We need to ask questions such as "What is working in this project, and why?" and as importantly, "What is not working, and why?" The answers will allow implementers to improve practice and to change course when necessary (i.e., adaptive management). PMERL may thus allow programme designers and government to design innovative programmes and take successful initiatives to scale, based on a deeper understanding of programme theories and mechanisms – why they work and in what contexts. This 'triple-loop' learning (Pahl-Wostl, 2009) is needed to better understand what radical socio-ecological development might look like.

However, across the country and in many different fields, evaluation processes often fail to achieve these intended roles. We are often disappointed with how little we learn from M&E, even though managers are inundated with data and spend much time reading and writing reports, and consultants are paid substantially for producing external ones. Based on research and observations in national NRM and capacity development programmes, the problems include:

- Focussing only on easily measured indicators and targets, which are not "the full story" and can, in fact, distort both findings and programme activities.
- Collecting a lot of data "just in case it's needed" without considering the programme's theory and intended change domains.
- Reducing complex multi-pathway programme theories into linear log-frames.
- Evaluating unsystematically, both at national and at project/programme scale, with little opportunity to put together the small lessons learnt and come to big conclusions: paradoxically, suffering from both too much and too little data.
- Failing to reflect on what went wrong and how to improve on it, focusing exclusively on "getting it right" for the sake of compliance, and little "third loop" learning to interrogate our starting assumptions and targets.
- Excluding stakeholders from M&E processes.

C3 Approach to PMERL in the Tsitsa River catchment

In this project, we want to right all the above wrongs. We plan to draw on experience in other programmes and catchments (e.g. the pioneering work of **A**ssociation for **W**ater and **R**ural **D**evelopment, **AWARD** in the RESILIM-O Project, in the Olifants River, Limpopo Basin) and introduce a comprehensive PMERL system for the Tsitsa Project which will:

- unpack the programme theory, and study community values in order to identify a suitable range of both social and biophysical monitoring indicators. The vision for the Tsitsa Project (which should itself be periodically reviewed, based on PMERL) is key.
- From this vision, protocols need to be developed to establish baselines against which to monitor these indicators. These indicators of positive trajectories could include:
  - reduced sediment load in the rivers and tributaries
  - increased land cover and biodiversity
  - improved cattle management practices
  - reduced number of destructive fires
  - increased household well-being (as defined by residents)
  - higher agency levels (linked to Sen's capability theory)
  - more livelihood options open to residents (linked to ecosystem services access), and
  - increased number of functioning (polycentric) governance mechanisms.
- Extend participatory monitoring to collect data against these indicators. Involving citizens as monitors is a potential livelihood expansion / job creation opportunity that has already started on a small scale in the Tsitsa Project, and research is being undertaken on how to increase the value that can be achieved through citizen monitors. Other monitors will be technical project staff.
- Use the programme theory / theory of change (see Figure 4) to identify key evaluation questions and undertake real case studies to answer them. This could include questions like: What processes increase community agency, for whom, and how? What governance mechanisms are most effective, in which contexts, and why? Ideally, these questions should

be decided on a national basis and eventually, case studies undertaken across a variety of NRM programme contexts, as this is the best way to inform "third loop" or systemic learning and to build programme theory.

- Put in place a PMERL coordinator who will have a synthesising and meta-evaluation function as follows:
  - Compile monitoring data and case study insights on a regular basis, and "package" the findings for different groups.
  - Share these findings with community groups and programme managers at all levels and facilitate reflection sessions leading to "lessons learnt" and adaptive management decisions.
  - Compile outcomes of these reflections for academic scrutiny and wider dissemination; carefully document the PMERL process and review its effectiveness and feasibility, adapting it as necessary.

C4 Proposed outcomes

The first achievement will be to make adaptive management clearly possible (Figure 7). The Tsitsa Project requires feedback, i.e. data and reflection on data. Following SAM best practice, PMERL is built into the design of the Tsitsa Project, as shown in Figure 8.

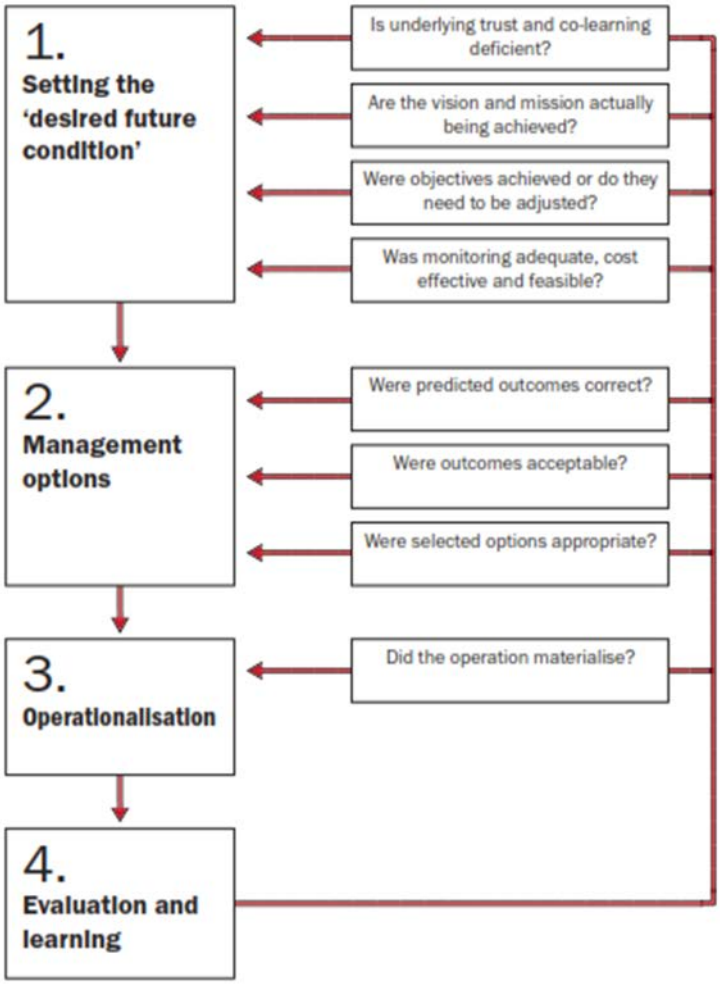

Figure 7: A schematic of the Strategic Adaptive Management feedback mechanisms in the Tsitsa Project (after Pollard et al. 2011).

SAM is a highly valued concept for managing CSES contexts, but it is seldom fully implemented. It requires all key role players to subscribe to the plan and participate in regular, institutionalised reflecting, learning, adapting and changing practice/ implementation. This needs to be manifested in four key areas:

- Strategic Adaptive Planning,
- Strategic Adaptive Governance,
- Strategic Adaptive Management/ Implementation and
- Strategic Adaptive Monitoring.

Figure 8 illustrates these key areas.

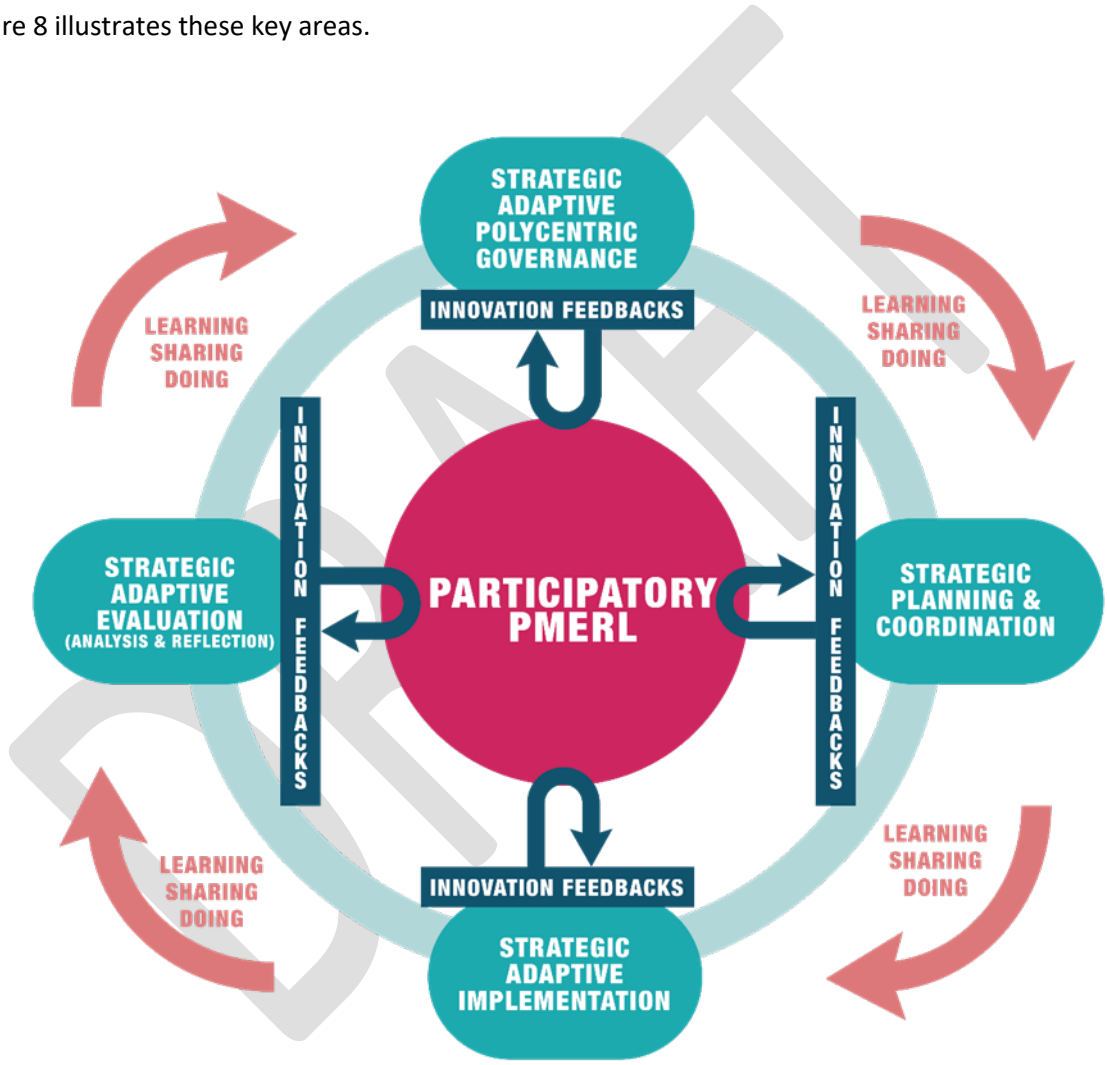

Figure 8: The purpose of PMERL in Strategic Adaptive Programmes (Botha et al., 2017).

The Tsitsa Project aims to combine action research and implementation. This is illustrated in Figure 9, which shows that much thought has gone into the way in which learning from implementation will be used to improve the programme as it rolls out.

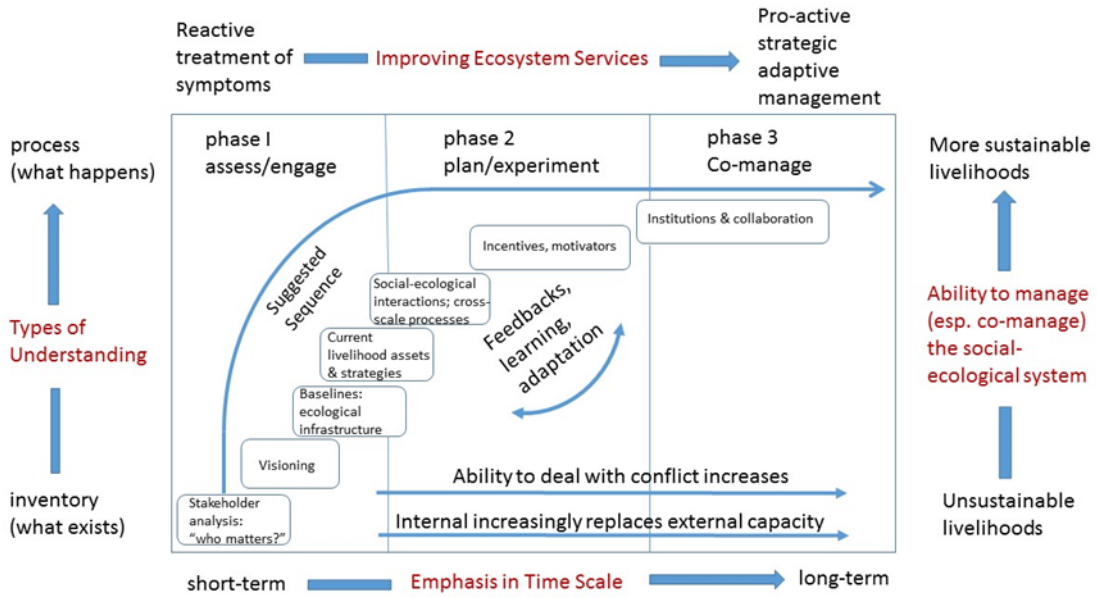

Figure 9: The Tsitsa Project Implementation Framework (Fabricius et al., 2016)

This PMERL pilot also has value beyond the Tsitsa Project. Department of Environment, Forestry Fisheries: Natural Resource Management regard the Tsitsa Project as a flagship in which to innovate, to learn high-level lessons about effective social-ecological development, and to inform the design of other programmes. To this end, investing in an adequately resourced PMERL system has several benefits, including:

- encouraging shared learning;
- ensuring that learning is adequately captured;
- ensuring that learning is adequately communicated;
- piloting the PMERL system itself.

If the proposed PMERL system is feasible and effective, it becomes an innovation to apply elsewhere. To this end, it is worth summarising what is innovative about the proposed PMERL system. PMERL:

- connects in-field, community level monitoring with central evaluation expertise;
- combines broad survey/monitoring data with in-depth case study insights;
- strengthens indicator-based monitoring with reference to the programme theory / theory of change, and with in-depth case study insights;
- improves programme theory / theory of change with in-depth case study evaluation and meta-evaluation / synthesis across various levels of findings;
- ensures built-in, regular opportunities for shared reflection and learning on all levels of programme implementation, from citizen monitors to national leadership;
- has a sound theoretical and applied basis in realist programme evaluation theory (Pawson and Tilley, 1997) and critical realism as social research methodology (Sayer, 2000).

PMERL thus gives us the potential to learn from the field via academia, and to inform South Africa's understanding of radical socio-ecological development to the potential benefit of many communities and landscapes that are at risk.

Section D: Introducing Climate Change and Disaster Risk Reduction explicitly into the Tsitsa Project

The topics dealt with in this section were not explicitly included in v1, though it is true that almost all the actions in Tsitsa Project form part of so-called "no-regrets" measures required under climate change adaptation, even mitigation. Sharing responsibility more explicitly across Tsitsa Programme's component units should thus not be difficult, nor should we as a programme feel that doing so (or that obtaining additional climate change funding) is in any way contrived. The basic rationale in our context and under our mantra, is to produce co-benefits for local communities – two of the most important of which are effective climate change adaptation and disaster risk reduction.

D1 Introduction

This section examines ways of accommodating climate change and disaster risk reduction within the Tsitsa Project, rather than presenting a concrete plan for doing so. Although climate change and disaster risk reduction were not explicitly emphasised in RIS Vol 1 (the Research Investment Strategy – RIS), they were nevertheless addressed to some extent by studies and actions described there. Over the first few years of the Tsitsa Project, both concepts started to feature more often in the general Tsitsa Project discourse, not least because of a clear focus on climate change in a WRC-funded GVP near the proposed Ntabelanga Dam. At the inception meeting of the Strategic Oversight Committee ("A-team", see Internal Governance Section) in November 2017, climate change was raised directly and a recommendation made that it be incorporated more explicitly into the Tsitsa Project. Interestingly, there was also discussion raised by an A-team member under the same point, about why multiple small dams might not be preferable to two large ones in an era of climate change.

D2 Background considerations

The Sinxaku Green Village Project had examined past trends and currently available future predictions or speculations, and had also made recommendations regarding "lessons learnt" from their project for the wider the Tsitsa Project. These are summarised in a report attached as Appendix 5. Key points from Appendix 5 are, however, included here, mainly based on assertions, information and data from the main references used in that report (Kusangaya et al., 2014, Schulze et al 2011, Graham et al, 2011).

Appendix 5 provides insight as to why climate change may not have been foregrounded when the RIS was compiled: there is reasonable evidence to suggest that the Tsitsa Catchment is not among the areas in South Africa that will be most affected by climate change. However, this does not mean it will be unaffected. It is generally accepted that in most locations in southern Africa temperature increases are taking place, and that there is a likelihood of increasingly variable rainfall, and a greater incidence of extreme events. Even if total average annual rainfall were to remain the same in a particular area, stream flows may be reduced due to increased evaporation, and springs may dry up more often, even though mean annual runoff is likely to increase. Soil erosion is therefore likely to increase, but with higher variability of sediment yield. Severity of storm intensity and its relationship with erosion are key issues.

Given that the communal lands in the Tsitsa River catchment are among the poorest and most vulnerable in the country, and are already challenged by land degradation, any additional climatic variability in the already variable area raises concern and calls for action. The effect of climate change on commercial farming and forestry in the catchment may be equally significant, and also deserves investigation. Actions that would help alleviate or improve the situation in the context of the Tsitsa

River catchment include, constructing more small dams (mainly off-channel) and reservoirs, further developing of groundwater resources, adopting soil and water conservation measures, using drought-resistant plant varieties and crops, and providing effective access to multiple early warning systems.

The Sinxaku report emphasises, but does not elaborate on, the realisation that these challenges are unlikely to yield sustainably to piece-meal mechanistic responses (such as the local-scale actions mentioned above) on their own. The overall issue must necessarily be considered holistically, with physical considerations integrated into societal, institutional and power considerations, and must emphasise the complementarity between resilience and vulnerability (Miller et al., 2010).

The Sinxaku report ends with a series of useful direct recommendations, including various (especially landscape-based) water and moisture retention measures, and the important role of rehabilitation in achieving this; the maintenance of tap and reticulation functionality, and livestock management mechanisms, such as cattle auctions to reduce livestock pressure on grazing in pre-drought periods. The report cites Rodina et al. (2017), in suggesting that building resilience in water-stressed areas with social inequities requires, inter alia, broadening the social dimensions of resilience, and engaging critically with decision-making processes. Another of our advisors said, "We, as the Tsitsa Project (and indeed generally) continuously fall short of including the political economy and developmental context, and are then surprised at our poor understanding and performance".

D3 Strategic, social, and social-ecological elements of the climate change challenge

We received further advice on how we might think about embedding climate change into the Tsitsa Project: we would need to develop an approach in which key dimensions (or balance of emphases) was considered. For example, approaches that could be considered in order to embed climate change within the Tsitsa Project praxis include:

- Is predicted future one in which we will emphasise key disruptive events (such as droughts) or one in which we search for and possibly emphasise slow variables (such as loss of capacity to manage water, perhaps coupled to others such as de-agrarianisation) which over time, will reach a tipping point, or possibly already have?
- Are we interested in or describing mere "coping" of residents, or actual adaptive responses?
- Are we interested in mitigation or adaptation?
- Are we uncovering enough multi-driver information to start sensing whether the overall effect of well-intended small-scale actions might be overwhelmed by large governance systems for instance, possibly blocking transformation?
- Will our approach be able to see the series of related events and compounding of risk drivers, and detect how they will accumulate?
- Are we being naïve by targeting the "system's ability to recover to a productive state" (RIS Vol 1 p 22) when we should also be considering the common reality that the system is "limping along" and degrading over time, with some recovery at times, but often set back by severe compounding stresses?
- Are we spanning urban, peri-urban and rural settings? If not, should we be?

Suggested projects and specific approaches recommended were:

- Differentiating vulnerability, especially (but not only) at the poorest and the most vulnerable ends of the spectrum. Who is most vulnerable? Different types of households; different primary livelihoods strategies.

- Food security needs more specific attention, at times also in relation to the water-energy-food nexus at multiple scales (comment also made that community-owned wind farms might be great, but are not allowed by current legislation)
- Seeing climate change as an opportunity is sometimes seen as contentious. However, viewing climate change as an opportunity would open the window, for example, emphasising climate-smart methods in the planned irrigation scheme.
- Looking backwards generally, but especially at specific critical points in the past (in the same way we were recommended to do to better understand the breakdown of fences and land-use control in the late 1980s) might deliver helpful clues or even revelations. For instance: is there any evidence of periods in the past when one might conclude that the social-ecological system was recovering, or "building back", or falling apart? Why? How? What key associated levers can we identify? This may help us to understand system fragility to "creeping" change (as in the Western Cape water crisis).
- When looking at belief systems, try to understand whether, for instance, responsible officials saw a particular crisis as a "hazard" or "an Act of God". Or did they, and to what extent, see it as a development that revealed the vulnerability of society and its management?
- Tracking and understanding the extent to which, for example, officials from key departments or agricultural and extension staff work together or are stuck in siloes, around the dam, its construction and its associated environmental management. Are they jointly promoting an enabling environment? The Tsitsa Project has started working on this point.
- Tracking the green and the hard infrastructure in the area, and especially the perceptions of those responsible as to their roles, and the overlap and synergy between these. This would give key clues as to the possibilities of social learning, joint visioning and the like.

D4 The way forward

It appears that the Tsitsa Project is an appropriate programme in which to explicitly embed climate change and disaster risk reduction activities, because of the strong correspondence between the Tsitsa Project principles (see Objective Tree, principles) and the possibilities described above. We believe this combination could promote the chance of climate change activities becoming viable, particularly because the Tsitsa Project exercises these holistically. One could argue that the Tsitsa Catchment is less affected by climate change and its potential risks and disasters than many other sites in South Africa. However, even the historic and present changes in climate changes pose massive risks for highly vulnerable communities. The type of environmental management required to deal with uncertainty and risk is similar, and the "no regrets" type measures are worthwhile and, if they are thoughtfully applied, should benefit livelihoods, a primary goal of the Tsitsa Project.

Seeking funding marked for climate change activities is completely consistent with what we are carrying out. There is close association between funding for current environmental studies and the activities that most environmental programmes (such as, rehabilitation and water and land use management) have in common with the ones addressing climate change.

It is strongly recommended that the Tsitsa Project, further develop ways of appropriately embedding climate change into its investment strategy. There is little or no risk that this will undermine any of its declared major focus areas, and it should be relatively straightforward and very productive in multiple ways.

Section E: Emergent Transdisciplinary Projects: Innovation hubs and networks in transformative spatial scales

Much of what was learnt and acted upon in the Tsitsa Project came through the Communities of Practice (CoPs) interacting with each other and discussing feasible mini-projects that would assist further progress towards the goals of the project. This section describes the emergence of potential joint projects that can act as prototypes. The section relies on much of what was stated under "Section B: Governance", and clearly recognises the relationship between scales, top-down and bottom-up processes, and the relationships between the two, as well as the fact that sub-catchment plans always nest under an overall catchment plan. The leading indicators of emerging transdisciplinarity under that Section are equally relevant here.

E1 Integration and Scaling to enable Transdisciplinarity:

Integrated Water Resource Management (IWRM) principles and catchment planning scales in formulating transdisciplinary projects in Tsitsa Project

The Tsitsa Project's vision and its associated principles promote an integrated, transdisciplinary approach to managing catchments as planning units for improving social-ecological resilience and social justice. In general terms, Integrated Water Resource (IWRM) and associated catchment management approaches constitute a specific process to sustainably manage the natural resources, people's actions, and their livelihoods in a catchment. IWRM and thus **I**ntegrated **C**atchment **M**anagement (**ICM**) link the management of land, water and related natural resources with the aim of achieving a balanced use of natural resources for present and future needs. The resources in our catchment are linked by the way that they are used, and thus all environmental, economic, and social problems must be managed together in a catchment area (MOAIWD, 2015).

Since the 1980s, catchment approaches and technical interventions have been implemented in order to improve natural resource management and prevent catchment degradation impacting on downstream users through, for example, increased sedimentation and flooding. More recently, the focus was broadened to include using strategies for decentralised governance to sustainably improve the incomes of the rural poor, and for participatory development of the communities' asset base, especially its natural assets. These would create a more inclusive economic growth model and sustainable livelihoods. Catchment development programmes provide a useful planning tool for achieving both rural development and water resources conservation and management goals. In South Africa, catchment planning and management guidelines are being developed and adapted to suit the Tsitsa Project context. The guidelines will be available from the WRC document database (Braid et al. in prep).

The most relevant levels of catchment planning at which the Tsitsa Project should work range from micro-catchment (including village level plans) to sub-catchment and catchment level (Figure 10). The extent of the lower spatial catchment levels may not necessarily follow strict hydrological boundaries but will consider the geographical factors and density of settlements within the catchment, as well as other factors such as political and/or tribal boundaries.

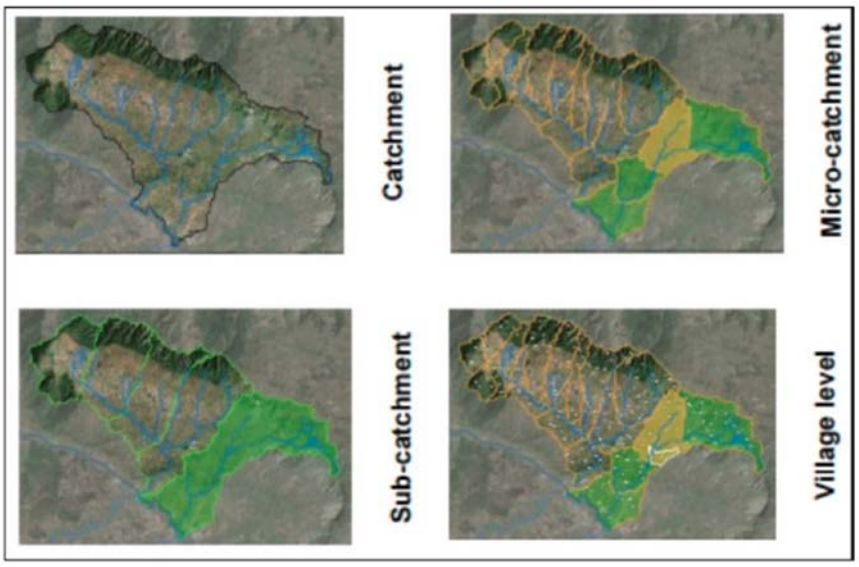

Figure 10: Catchment Scales and Management Plans. (Source: Ministry of Agriculture, Irrigation and Water Development. 2012. Shire River Basin Management Project. Project Implementation Plan. Version 3. Government of Malawi).

As mentioned, catchment management planning can be carried out at various scales from a catchment level strategy to village level planning.

- A Catchment Plan includes a set of actions to manage the natural resources, as well as people's actions and livelihoods in the catchment. The plan aims to find a balance between how resources are used in a catchment for today's needs (like harvesting wood, planting crops, herding livestock and building houses) and protecting those resources for tomorrow's needs. (MOAIWD, 2015). A catchment plan is strategically oriented and identifies catchment level priorities, challenges and opportunities. It also considers information and outcomes derived from sub-catchment or quaternary catchment level planning processes and the local knowledge and needs of stakeholders.
- Sub-catchment Plans are developed interactively with the micro-catchment plans that are developed at group village level. They are most likely to be at Traditional Administrative area level, would include several (5-30) micro or village level plans and broader sub-catchment level land tenure agreements (e.g. fire and grazing and the larger regional and catchment level plans) as well as possible hydrological possibilities. This level may act at the interface between micro-catchment and catchment level plans where stakeholders from different levels of leadership, mandates and responsibility interact. For example, local resource users and associated sub-headmen, headmen, chiefs, municipal officials and provincial government officials may come together in a sub-catchment planning process.
- Micro-catchment Plans are more practically oriented and are directly linked to the opportunities in the local context. These plans should identify mini-projects at the village level and could include, for example, soil and water interventions such as erosion protection work, plants nurseries, and rainwater harvesting, among others.

As an example, the Sinxaku Village, inside the Green Village Project, has worked with a "mini-demonstration catchment" linked to a government-driven food garden initiative that can be regarded as being situated in the micro-catchment scale. Livestock management initiatives promoted by the

Green Village Project were planned at the sub-catchment scale, the scale of the communal grazing lands.

For the next three years, the Tsitsa Project will, through its transdisciplinary "working groups" or CoPs, focus on developing ICM plans at the micro-catchment level which will incorporate projects and initiatives to address land-water-livelihoods-justice problem nexus (see potential projects below). For best results, key stakeholders will participate in planning the use of local resources with input from scientists, managers and other stakeholders. Plans will aim to ensure that local strategies are aligned to higher-level strategic catchment management plans and social development priorities.

If any of these plans are carried out in isolation within a larger catchment system, there is no certainty of meeting the goals at the required scale (e.g. Tsitsa River catchment); that is, the goals of protecting and conserving natural resources and ecosystem and hydrologic services, and/or managing negative downstream and groundwater impacts. At the same time, local priority areas (e.g. agricultural productivity aspirations, and improvement of livestock) will be communicated through the institutional channels, such as a L&WF, and networked to other levels of governance such as municipal structures and mini-catchment Management Committees. In this way, through its governance structures, the catchment plans should be relevant to the ecological improvement needs of the area as well as valuable to the catchment's residents.

When linking project level to catchment level, the following levels of planning scales could be considered:

- Take account of catchment management strategies and plans from the relevant CMA in order to link to high-level priorities and long-term national and provincial agendas by promoting inclusiveness (and a higher degree of representation of both the political and traditional authorities to gain support. These processes may require raising the awareness of stakeholders and sensitizing them to catchment management at the meso level.
- At the quaternary or sub-catchment catchment level, "innovation hubs" of biophysical, social and political priorities can be identified as primary nodes to work in, and mini-projects identified based on the most do-able projects, the resources available, and other factors. Local priorities and aspirations can be introduced here to drive or yield benefits. This level of planning may act as the intermediary between the higher and the micro spaces. For example, investment in ecological infrastructure projects at nodal level would provide an opportunity to be embedded within the macro-nodes of the DEFF: NRM 'Working for …' interventions and funding streams.
- At a micro-level or 'intervention' phase, project level plans may be networked to other village-based activities within the micro-catchment scale. Small groups of enterprises can be formed and expanded in a modular approach.

These considerations are illustrated in Figure 11. Of particular interest in this diagram are the four quadrants at the "micro" level where often-concurrent attention is given to each.

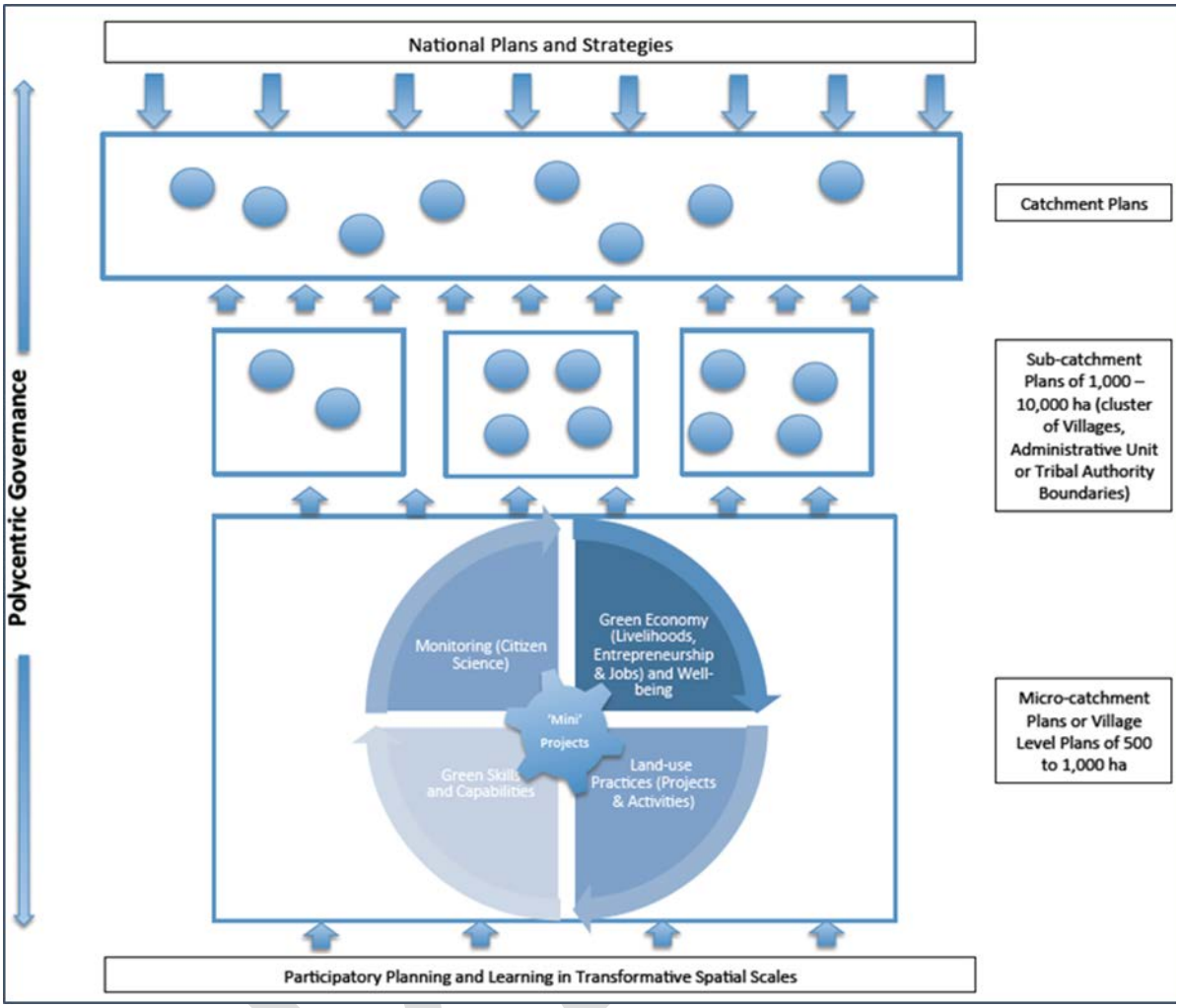

Figure 11: Mini-projects within the catchment management and planning framework in the Tsitsa Project.

Mini-projects could have the potential to become local niches for development if they are supported with meaningful community engagement processes (e.g. social and expansive learning). Their networked engagement with local activities and catchment institutions could drive the ICM agenda as a modular and "organically" expansive approach. This is in contrast to the desire to find a working "blueprint" and somehow "roll it out" mechanistically across the catchment, as though one size, with minor variations, more or less fits all.

E2 Features of "mini-projects" at the micro-catchment and village level

Several aspects need to be considered in identifying and designing suitable projects at local level. Overall, the Tsitsa Project will drive projects that incorporate at least some, if not all, of the following features:

- Integrated practices supported by ICM principles, i.e. considering the management of land, water and related natural resources, including the way in which they are linked to environmental, economic and social problems (e.g. the green economy agenda).
- Informed by national priorities in order to contribute to the achievement of job creation targets, land/water security, poverty and equity, climate change benefits and the United Nations (UN) Sustainable Development Goals (SDGs) at large.

- Developed in consultation with project beneficiaries (see community engagement section) by working from local aspirations in order to support individual and collective agency capabilities through participatory and learning engagements.
- Enable the expansion of new green skills and capabilities of national/provincial/local institutions, including local actors or communities.
- Built on current activities (most do-able) but bringing innovation to sustain catchment management outcomes through linking natural resource management to livelihoods.
- Incorporate an element of citizen science/environmental monitoring as an activity which, in turn, adds to the local livelihood opportunities through upskilling, empowerment and building capacity.
- Promote social transformation and justice (equity aspect).
- Leverage finance in order to "upscale" as funds become available through various streams (e.g. government, private sectors, etc.).
- Enable de-centralised institutional arrangements at the local level (micro-catchment) to drive a "deep democracy" agenda.

E3 Potential mini-projects for 2018-2020 and possibly beyond

At the 5th Tsitsa Project SciMan Forum, the Livelihoods/Ecosystem Services and Restoration CoPs breakaway session was an opportunity to consolidate ideas for projects. The Livelihoods and Ecosystem Services (L&ES) and Sediment and Restoration (S&R) CoPs jointly considered various livelihood options to support restoration work. Informed by the various community engagements and other engagements at village, tribal authority and catchment level (refer to Community Voice section) the following projects have also emerged, and will be considered for implementation during the coming phase:

- Hillslope run-off water harvesting and cultivation at household level;
- Incorporating small-scale rainwater harvesting practices into permaculture gardens for both consumption and fresh produce market sales; micro-poultry enterprises;
- Employment of "eco-rangers" to manage livestock and veld fires;
- Plant nurseries (e.g. vetiver and indigenous trees);
- The "plug and tree-preneur" model to supply government-funded (or private investors) restoration activities, whereby people are able to generate income from the sale of plants grown in their own property;
- Rehabilitation of priority wetlands and hillslope seeps; implications for livestock;
- Approaches to IAPs clearance and improvement of grazing lands;
- Re-forestation of indigenous forests through local employment and management of woodlots;
- Rehabilitation of old grazing and cultivation lands; and
- Compost and wood chip production from suitable cleared IAP such as wattle.

Some of these initiatives have already been implemented in South Africa and other parts of the world, and models have already been developed. However, further work on the restoration of old lands and a move away from complete removal of AIPs (particularly black wattle) towards thinning are being explored. The feasibility of the above will require input from the local communities.

Education and learning as well as wide community awareness regarding the benefits of the rehabilitation work to local livelihoods is a key component and would need to be embedded in all the proposed projects and activities outlined above.

Lessons for the Tsitsa Project from the Green Village Project

There are many themes around which to synthesise "lessons learnt" and the Tsitsa Project is in the fortunate position that it has a ready-made exemplar of one of these: the Green Village Project in the Sinxaku area of the catchment. This WRC project became partly embedded in the Tsitsa Project because of its geographical and institutional circumstances. We sheared certain advising participants, students and resident beneficiaries from the area. In some respects, this has been a microcosm and partial testing area for the Tsitsa Project. The following reflections are carefully considered findings and opinions of the GVP principals viewed through their particular lens.

Community benefits of rehabilitation

The central aim of the GVP was to investigate livelihood benefits from landscape greening, i.e. rehabilitation activities promoted by the DEFF: NRM through the Tsitsa Project.

Ways in which community members can benefit from rehabilitation include the following:

- A general improvement of natural resources; increased areas of productive land; improved water retention and springs. The community sees dongas as a hazard to children and livestock. Therefore, any measures to control the advance of dongas or to fill them in is seen as beneficial.
- Water availability is a major constraint, so modifying erosion control structures to double as watering points would be appreciated by the community.
- Erosion control planning should be carried out at the village level. Erosion control installations can be designed to assist household water harvesting to improve water security in household gardens. Braid et al. (in prep) have developed Catchment Management guidelines that can be used at the scale of the micro-catchment.
- Controlled grazing management is strongly recommended to protect/restore grassland in the whole catchment area. Seed funding is needed to pay rangers. The Tsitsa Project could help here. Environmental Rural Solutions (ERS) has expressed willingness to help establish an improved grazing system and organise auctions for livestock sales in Sinxaku. These auctions would raise money to assist long-term sustainability of the grazing.

Income-generating activities include:

- Direct employment – this is short term and unpredictable. Frustration arises because of the on-off nature of employment. Longer-term job security is needed.
- Potential employment of rangers. This needs a long-term commitment from both sides; training can be provided by ERS who advocates that rangers can also act as monitors. The first step would be to employ rangers to protect ongoing rehabilitation sites until the vegetation has recovered sufficiently to be grazed. Sinxaku livestock owners would welcome this initiative. In the long term, rangers can look after herds in a controlled grazing system.
- Employment of monitors to record effectiveness of erosion control structures, etc. These could be rangers or a different group of people. ERS training would include monitoring.
- Establish vetiver gardens; sale of vetiver to the project is an income earning opportunity.

Reflections on the research process (Green Village Project)

- People recognise erosion as a problem and want to be proactive in solving the problem, but need guidance and resources.
- The original GVP committee (elected group of 16 members) could have acted as an effective planning group if there had been better coordination with the DEFF: NRM rehabilitation activities. Delay in these and a lack of a clear communication channels frustrated the process.

- Communities are not cohesive groups; there are many divisions and possible resentments. The strength of leadership at different levels and within different areas of the villages varies. It is difficult to get the agreement needed for action in communal areas, and there is considerable resistance to change.
- Many young people have left the area, leaving schoolchildren and elderly people, so there is less energy for manual labour and less incentive for change. Providing paid employment is one way to keep younger people in the area.
- The school project engendered interest in the environment and better ways to manage the land. The project needs to be sustainable and extended to other schools.
- GVP worked with the combined Upper and Lower Sinxaku villages because they shared a topographically defined basin with common erosion problems. One major donga formed the boundary between the two villages. Problems arose because of the long distances to be covered to attend meetings; divisions within communities made it difficult to get consent. Working in smaller planning units linked to micro-catchments under one or two sub-headmen is recommended.
- GVP was a two and a half-year project with meetings every three to four months. It took time to get group dynamics working but if working in a smaller area more consistently one could probably achieve effective results in a shorter time. Prepared handbooks can be used to help raise awareness of issues.
-

Resources available from the GVP

- Business plans for vetiver gardens and improved grazing management (English).
- Handbooks for explaining rehabilitation practices and rainwater harvesting (isiXhosa and English).

Section F: Knowledge Management and Integration

To achieve the vision articulated by the Tsitsa Project, a well-coordinated set of role players are required, all of whom need to be committed to the same vision. This can only truly take place when the role players are making timely and informed decisions (INR 2015). This crucial aspect in the larger Tsitsa Project machinery requires the collecting, assimilating, reflecting, learning, disseminating and integrating the correct information at the correct spatio-temporal scales, where the potential success of the DEFF: NRM investment relies heavily on how well the Tsitsa Project's efforts integrate effectively with the existing governance structures (INR 2015).

F1 History of data management in the Tsitsa Project

The **I**nstitute for Natural Resources (INR) completed and populated a web-based GIS platform for the current Information Management System (IMS), known as the Operational Support Framework (OSF). Initially, a strong reason for the IMS was to have the data to assist in NRM planning, decision making and governance. Data storage and sharing has also occurred through a Google Drive managed by Rhodes University (RU), which has connections to the OSF.

At the time of designing and creating the IMS, the Tsitsa Project team had not yet completed the framework and design of the PMERL (Botha et al. 2017). Collecting, processing, cataloguing and archiving all the biophysical, social and institutional data will, clearly not provide the solutions needed on its own. A systematic process of gleaning and analysing data for the purposes of reflection and learning is required. The PMERL seeks to demonstrate the return on this investment, and the revised IMS will be designed to cater for these needs.

A more thorough assessment process was needed to qualify who are the intended users of data and information that will be collected, housed and distributed through an IMS. This was a top priority for the first year (2018) in the Tsitsa Project plans. The process was carefully thought through, as described below, and the IMS has been modified to a Knowledge Management System (KMS).

F2 Understanding data and information needs - a pre-survey

To have a clearer understanding of who the intended users of the data are, and how and what information needs to be made available in a the KMS, a survey was sent out to the Tsitsa Project stakeholders. Although only 21 people responded, the survey was met by a multitude of stakeholders such as researchers, government officials and implementers. Over 80% of the respondents were interested in non-student research reports and data, as well as publications and literature related to the project (Figure 1). Fewer (less than 50%) wanted more complex information, such as GIS data layers and other spatial data. Most disappointing was the large lack of awareness of the data sharing platforms, with those (21%) who have used the OSF or Google Drive complaining of their complexity.

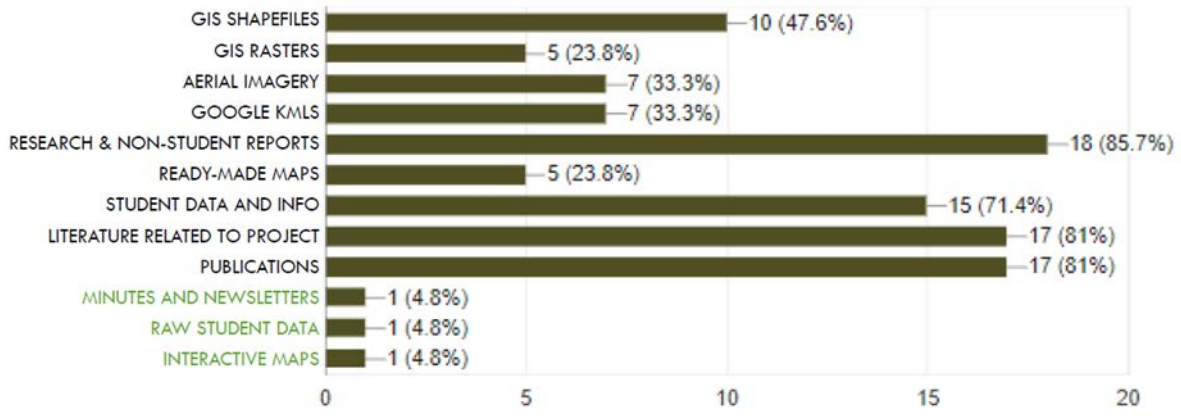

Figure 12: Number and percent of respondents who wished to access the above categories of data and information.

The open-ended questions of how the platforms should operate and for whom have helped guide the thinking for the KMS in the next project phase, with requests for "simplicity" and "aiding in report writing" and "decision support" being the norm. However, the integration at the community-level was only stressed by a single respondent, and the importance of this integration will need to be stressed more in the future.

F3 The future of knowledge management in the Tsitsa Project- what does it wish to achieve?

A proto-vision for the Knowledge Management Community of Practice (KM CoP) was developed by the co-ordinators:

"To make information, data and knowledge within the Tsitsa Project and T35 catchment accessible, available, understandable, transparent and usable to all stakeholders at different governance levels to best aid further research, management and implementation and enable interaction with similar projects."

As part of the KM CoP Strategy Report, four strategies were developed. These were: 1) maintaining current web-based platforms; 2) identifying knowledge, data and information for the Tsitsa Project, 3) putting the Tsitsa Project "on the map" in terms of website development, project branding and supplying resources, and 4) establishing the role of the KMC in providing supporting documentation. The difficulties of achieving these strategies means that the responsibilities of addressing and maintaining knowledge management cannot rest only with the CoP that manages the KMS, but with the groups of stakeholders it wishes to support by providing information.

These groups, shown in Figure 13, exist at varying spatial, governance and operational scales. On one hand, there are the stakeholders who are internal to the project area, such as the local governments and communities; on the other hand, there are those which are external to the project area, yet have their own influence on the working of the Tsitsa Project, such as students, researchers and national government.

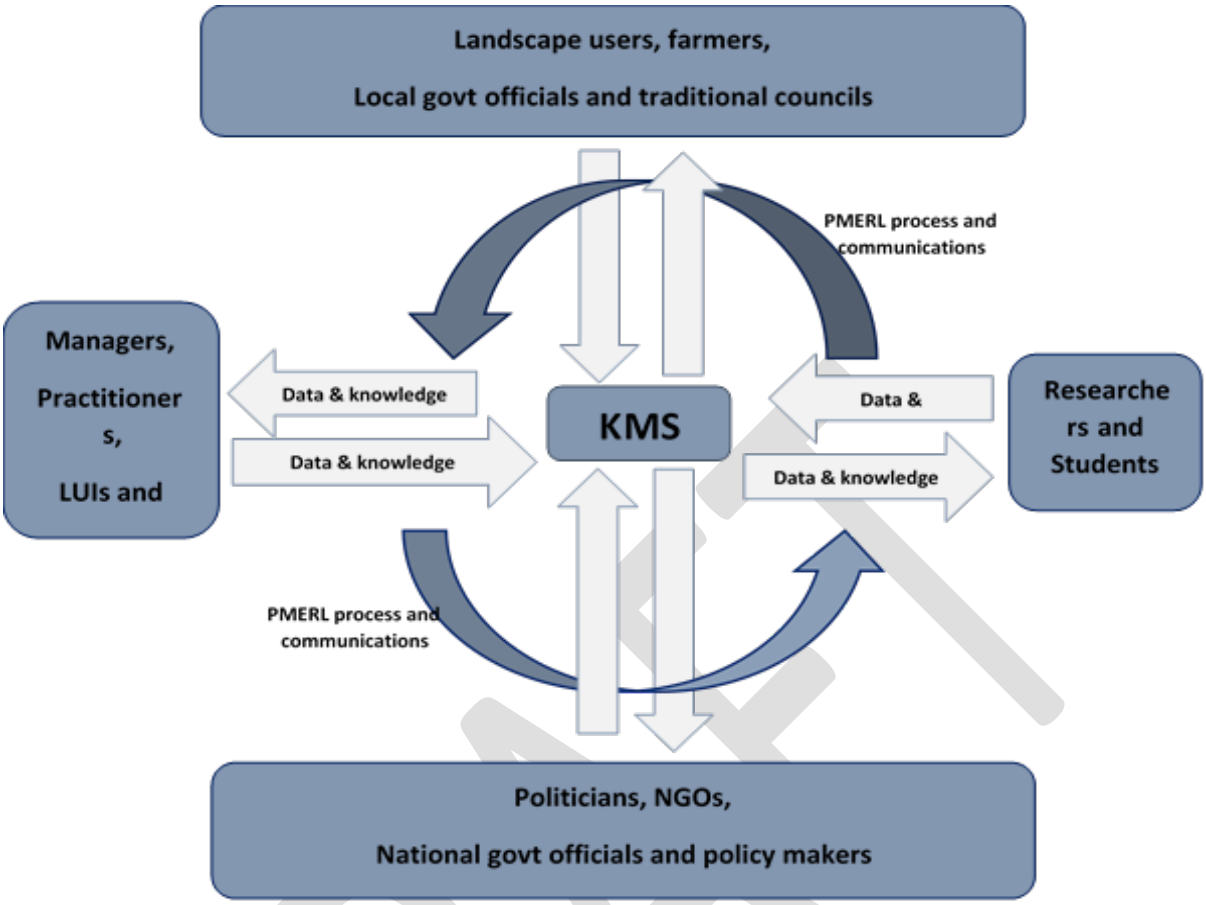

Figure 13: Schematic diagram of the four pillars or stakeholders supported by the Knowledge Management System (KMS).

The multi-directional flow of data and knowledge between all stakeholders to and from the KMS will naturally differ, depending on the stakeholder. However, it is likely that the information from the IMS to the politicians would need to be succinct and tailored (e.g. policy briefs and summary reports), while the information from communal land-users to the KMS may be in the form of oral histories and spiritual in nature. In addition, the rate of data flow will vary, depending on the end-user. Students and some practitioners may be GIS literate and download vast amounts of geospatial data for analysis, while government officials may require the data when it comes to decision-making when the information becomes available. These types of data flows and sharing of knowledge should encompass the cornerstones of the Tsitsa Project approach (Figure 14) to address each of the stakeholders in a manner which is understandable and transparent.

Figure 14: The cornerstones of the Tsitsa Project approach.

To achieve the integration of these cornerstones into the KMS, we anticipate that information will need to be carefully assimilated and perhaps even translated and streamlined to reach the stakeholders at all scales and follow a transdisciplinary approach: a step which will inevitably be met with challenges that will require much thinking, as identified by Lang et al. (2012). In this regard, the CLOs, Citizen Technicians (CT) and Environmental Monitors (EMs) will be vital two-way conduits of information at the grass-roots level. We therefore acknowledge that Local Ecological Knowledge (LEK) is of equal importance to the western scientific literature and hence to Tsitsa Project as a whole. The combined process (and culture) of SAM and the PMERL will bring challenges to the processing and analysing of rich qualitative data through the development of the IMS, but the CoP seeks to address these challenges.

F4 Considerations and obligations

The KM CoP is ethically obliged to be considerate and protective of an individual's or group's intellectual property rights. It is our aim to be constantly cognisant of this and to develop a set of "terms and conditions" and protocols in 2018 that will ensure ethical and rightful sharing of information that acknowledges the source.

Section G: New Subgroups under development in the Tsitsa Project

The dynamic, evolving nature of our project has necessarily led to the formation of new activities and collaborations by groups of individuals which get together to initiate these activities. Whether these turn out to be Communities of Practice (CoPs) – as has happened in the case of the three initial subgroups – or whether they are more like working groups with bureaucratic tasks, service delivery or capacity development, or perhaps even short-term task forces, remains to be worked out in practice as they hopefully become specifically funded in a dedicated way.

G1 Grazing and Fire Management in service of the Tsitsa / Mzimvubu SES

This seemingly inevitable need has already grown considerably, and even without specific organisation, is being partly met (see box following E3) – but not adequately for the perceived demand. Discussion at the 4th Science-Management meeting led to a request that this theme area be strengthened. As a consequence, at the 5th meeting, there was a special session bridging much of the previous contention (see Appendix 6 for a concise, thorough summary of the session presentations, a unified summary of the discussion, and the compiler's view of how we might move forward).

This led to much enthusiasm and to a delegation of Tsitsa Project folk attending a knowledge exchange meeting at Matatiele early in 2018 organised by UCPP and partners. Here some of the issues were illustrated in practice: mass mustering for vaccination, rehabilitation acting in concert with high density grazing plans, associated innovative marketing of livestock off communal lands. This visit was very fruitful and underlined the idea that such a group as the envisioned grassland and fire one could be a joint focus of UCPP and the Tsitsa Project – in other words, would involve the bigger Mzimvubu catchment of which Tsitsa is an important tributary. In fact, the need is more widely felt in South Africa as a whole, so we will need to keep our context in mind if the group expands very widely, as seems possible.

At this stage, the Tsitsa Project is still seeking an appropriate individual prepared to put the effort into developing the specific aims for this group and running it. We may even have to decide to use a graduate student for the interim. It will be a stimulating but daunting task, with an interest base of over fifty persons (and the potential to grow), and important broader societal issues to consider, such as grass-fed versus feedlot interests, abattoir politics, veterinary certification, and public perception issues such as perceived cruelty to livestock. Apart from keeping grassland and fire researchers and experts engaged in that disciplinary space, the co-ordinator will need have to spend considerable time with all the Tsitsa CoP co-ordinators to ensure transdisciplinary viability in our project's context. However, it certainly seems all this will have to happen, and should do so soon if we are not to leave an important gap.

G2 Systems Thinking

Systems thinking is already partly established in the core team, but the Tsitsa Project seeks to spread systems thinking in practice more widely at various appropriate levels throughout the project and many of its stakeholders. The drive behind this quest is to establish a broader collective grasp and common understanding of the key "wicked problems" central to the Tsitsa Project. This drive is likely to start off with a Systems Analysis to contextualise the situation and set a starting pitch, after which wide training and practice will spread the skills more generally at various levels amongst participants. The overall initiative will be led by a small group of dedicated practitioners who may form their own appropriate subgroup or CoP.

This approach is being followed to help achieve the ambitious vision and objectives that are outlined in this document, particularly in the light of recognising that we have a heterogeneous set of drivers with multiple inter-connections and complex dynamics. Hence, we seek to develop a collaborative and systemic understanding of all the various and dynamic interactions that relate to integrated natural resource management – and at an appropriate set of scales. At various forums, it has become evident that a wide array of mental models exists for some of the larger components of the Tsitsa SES system(s), and that we need to try to bring particular systems into widely acceptable joint framings. Although it takes time, we believe that investing in resources to enhance systems thinking will pay dividends in the future, when we can work with more overlapping understanding than now, as is consistent with the complex systems imperative in SES.

The next three years should see the active establishment, development and integrated growth of Systems Thinking, including the use of Systems Dynamic Modelling (SDM) for particular settings. The work will be guided by professionals, one of whom will help coordinate. A combination of interns and a Master's student will provide the human resources on the ground. An annual short course on systems thinking may be run to provide some insight and understanding for managers, scientists, students and others into systems thinking. This course seeks to take key individuals at various levels in various settings and expose them appropriately to systems thinking and, where relevant and feasible, to the use of SDM. The training will provide the participants with experience in describing, modelling and analysing the complex SES environment. An important benefit will be to ascertain the possible outcomes and scenarios from multiple inventions (such as, Working-for-Water or WfW, Working-for-Wetlands or WfWetlands, Working-on-Fire or WoF, and Working-for-Forests or WfForest, etc.) through the use of causal-loop diagrams, for instance. With time, the systems thinking culture should become embedded in the Tsitsa Project modus operandi, including where necessary, the use of computer modelling to understand and predict the possible outcomes of various strategic management interventions, taking into account the complex feedbacks.

The grazing-fire-restoration nexus is a central wicked problem that NLIEP seeks to address. In the context of landscape degradation, highly dispersive soils and excessive sediment transport in the catchment, it would seem logical that the first SDM model and central problem could tackle this central issue. Through a consultative process the SDM study will seek to get stakeholders to visualise (and possibly quantify) key inter-relationships, and so develop sufficient consensus as to the best approaches for DEFF: NRM in terms of livestock and fire management.

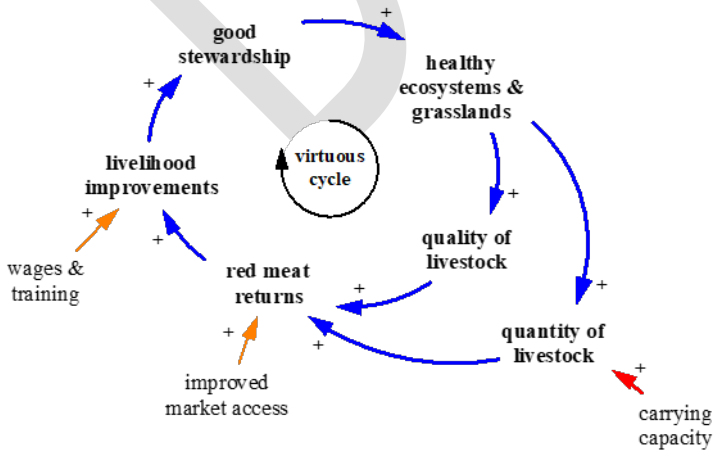

Figure 15: A basic generic example of a causal-loop diagram (courtesy of Jai Clifford-Holmes).

The primary outcomes from this research and the short courses will build a better understanding in the team of each other's perspectives and how the biophysical and social and governance feedback affects the system. The investment in these resources will build capacity and also raise awareness and improve the effectiveness of communication in the Tsitsa team and beneficiaries.

G3 Advocacy and Communications

This has been a largely neglected area in the Tsitsa Project so far, so it may be appropriate to examine the articulation of our intent. The wording of Headline Objective (A6) is:

- Provide effective information and communication for the Tsitsa Project, both for internal (how the Tsitsa Project runs itself) and external purposes.
- Effectively build an enabled constituency of support, interest and action for the catchment and even more widely, for the Tsitsa Project principles in multiple areas (scientific, technical, funding, political, administrative, across various sectors and broadly across resident and other stakeholder communities).
- Specifically lobby, when necessary, with appropriate "marketing" or advocacy initiatives.

Although admittedly wider in scope than the "advocacy and communications" heading above, the wording of A6 provides enough texture to deal with the question that has been widely discussed in the Tsitsa project: "Are engagement and communications not such closely-related functions that the same group should run them?"

Protagonists who believe the functions are integrally related worry that a separate communications function is more like an advertising house, and will lose contact with the all-important local communities whose trust we need. Those who differ feel that functions, such as overseas funding advocacy, are unlikely to be able to be carried out effectively by a person or group concentrating on rapport with local communities. We are underway with local community engagement, and that engagement certainly requires the broad communications support (for those communities) such as brochures, radio broadcasts, and likely WhatsApp groups and Twitter feeds. The content of these needs to be very much in line with what the Tsitsa Project persons engaged in the activities want and do, and not, broadsided by disconnected advertising from propaganda experts. Any website we create (and we probably must) will probably need to serve both communities and (for example) overseas researchers looking for opportunities here and wanting to write collaborative grants. This gives some idea of the balance we must strike in configuring these functions; again, they interface with the data management and sharing functions described in Section F. And, again, this all is urgent.

Conclusion and way forward

This volume represents an attempt at re-guiding ourselves (akin to checking our compasses and jointly drawing up the navigation plan) for the next two years. These plans will have considered the learnings of the past two years, our experience, achievements, mistakes, welcome outside guidance, and regular joint reflection.

Although this volume is more like a resource library than a fluent overall decision support tool, it covers the main bases or refers to other available ones. It is still partly based on the original founding Research Investment Strategy (now called "version 1"), and only partly covers what we will find we actually need. However, our hope is that it contains several important pillars to use and build on soundly and progressively, until the next checkpoint, when we produce RIS ver 3.

As is natural in any complex initiative such as this, progress is uneven. After a long lag period, we have eventually started the engagement processes on what we hope is a sound footing, requiring ongoing feedback to and interaction with communities. It has a long way to go, with some ambitious planning concerning "external" governance, expanding the domain of influence, but requiring careful management so as not to get us swamped. Praxis (the interaction between theory and practice) has improved on multiple levels, and must continue to do so. The PMERL plan is thoroughly thought through (though we are sure it, too, will change) with its implementation yet to begin. We have begun thinking about how the explicit climate change embedment might take place – and have many good constituent ideas to draw on. "Internal" governance has become one of our strong points according to our external advisers: a backbone we ought to be able to build on. This perhaps requires maintenance and adaptation only, rather than any further immediate expansion. A common "systems thinking" underbelly is planned for the entire the Tsitsa Project.

As all these collaborative, polycentric and adaptive approaches become increasingly internalised and set (Cockburn et al., 2018a), there an encouraging, growing sense of a functional team in which participants enjoy working. They are held together by the idea of working together towards ecosystem stewardship and repair for better livelihoods. Hopefully, we can also show early advances towards improved and more equal participation and access in the governance and use of these.

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Appendix 1: Ministerial Foreword from the NLEIP Research Investment Strategy (RIS Volume 1 2016)

The uMzimvubu catchment in the Eastern Cape is currently undergoing a series of developments. The proposed Ntabelanga and Lalini Dams are both part of the ongoing uMzimvubu Water Project (UWP) led by the Department of Water and Sanitation (DWS), and on completion, are intended to supply potable water to 730 000 people by 2050 and irrigate about 2 900 ha of land. There is also a small hydropower plant planned at the Lalini Dam site. For these dams to be filled with good quality water and to reduce sedimentation and other problems that dramatically reduce the lifespan of dams, it is essential to have healthy upstream ecological infrastructure (EI).

Occasionally opportunities come together to create an exciting "flagship project". The Department of Environmental Affairs (DEA) Natural Resource Management (NRM) Programmes will invest in the catchments around the proposed Ntabelanga and Lalini Dams for at least the next eight years – in a range of natural resource management and restoration projects, and through investment in a research programme that will address the understanding of the management and restoration, and importantly, the social context of such work.

How did this come about? The catchment is an area of known rural poverty and land degradation; one where local people could build a more sustainable future, based on improving natural resources (ecological infrastructure). This makes particular sense given that Ntabelanga and Lalini Dams will silt up prematurely if land degradation in the catchments around them continues.

The vision for the ambitious rehabilitation component, led by DEA, is "to support sustainable livelihoods for local people through integrated landscape management that strives for resilient social-ecological systems and which fosters equity in access to ecosystem services." The Natural Resource Management teams, with support from the Expanded Public Work Programme (EPWP), spearhead environmental improvement in various ways and create additional work opportunities (e.g. invasive alien plant clearing; land and wetland rehabilitation; appropriate fire management through the Working for Ecosystems, Working for Water, and Working on Fire programmes), and at the same time reduce sediment load going into these planned dams. Collectively, these DEA: NRM teams will create a possible 558 real jobs in the green economy per year (48 in Working for Forests, 120 in Working for Ecosystems, 15 in Working on Fire and 375 in Working for Water). Over the life-span of the current project this could equate to roughly 714 000-person days, and a major injection into the local economies of the catchments.

The restoration work, in conjunction with the sustainable land use management implicit in the Ntabelanga Lalini Ecological Infrastructure Project (NLEIP) goals, can be seen as an "insurance policy" for all the DWS investments (and other developments). The investments in restoring and maintaining ecological infrastructure in an optimal condition will sustain benefits that will accrue from the water infrastructure investments (crops and pastures from the irrigation, power supply from the hydro-electric plant and, most importantly, potable water for more previously disadvantaged communities).

This work will be linked to the activities of the imminent Catchment Management Forums (CMFs) in the area. It is intended that all these joint actions and events will be carried out in a manner that engages and involves local communities, sensitively and with a view to their own benefits.

Another critical success factor is the applied research involvement, supported by many universities, especially those in the Eastern Cape. The way in which this research has to be carried out is guided by the approach in this document and will test the "comfort zones" of many researchers, but will

concurrently promote links between science, management and society. The key partners supporting the restoration of the ecological infrastructure in the catchment are the Department of Environmental Affairs (DEA), the Department of Water and Sanitation (DWS), the Department of Science and Technology (DST) and the Water Research Commission (WRC), as well as the Proto-CMA, Rhodes University, the University of Fort Hare, University of the Free State, and the Agricultural Research Council (ARC). The intention is to also enlist the help of Walter Sisulu University in the near future.

The frameworks in this report describe sensible and tested ways of carrying out interventions in a complex and changing world. This and the provisional set of research programmes and interacting management actions are designed to build more resilient societies – ones which can adapt and flourish in a changing future.

Independent sediment yield calculations for the Ntabelanga Dam predict that it can silt up in between 34–49 years if no sediment management is applied (Le Roux et al. 2015). Restoration efforts in the Tsitsa River catchment will extend the lifespan of the proposed dams. The exact improved life expectancy of the dams due to restoration efforts are unknown, but can be as high as 30%, and depends on the restoration effort invested and co-operation of the land users and stakeholders in the catchment. What is certain is that restoration efforts will reduce the loss of valuable soil, improve water quality, reduce water treatment costs, prolong and ensure the livelihoods of upstream and downstream land and water users. The NLEIP will also make a solid contribution towards the intergenerational equity for the future local residents, who for the first time, may inherit a landscape in better condition than their forebears did.

I wish the participants in this important programme, and especially the communities from the region, all the best, as they go into this important phase of this project and from there into the longer-term future.

MRS B E E MOLEWA, MP

MINISTER OF ENVIRONMENTAL AFFAIRS

DATE: 2016/10/06

Appendix 2: Executive summary from the NLEIP Research Investment Strategy (RIS Volume 1 2016)

The purpose of this document is to develop an initial research investment strategy for the Tsitsa sub-catchment of the Mzimvubu catchment in the Maclear area of the Eastern Cape. The impetus was provided by plans to construct the tenth largest dam in South Africa, Ntabelanga Dam in the ~20 000 km^2 catchment, situated in a high relief landscape with erodible soils and a history of land degradation and lost productive capacity. A subsequent dam, the Lalini Dam, will be constructed slightly lower down in the Tsitsa system. The project has been estimated to cost between R12.5 and R20 billion. Although this report deals with the Ntabelanga Dam research opportunity, the same principles (with further learnings) are foundational for the entire project. The macro-context for the project is provided by government's Strategic Infrastructure Investment Projects (SIPs) and a range of national, provincial and local strategies, plus, importantly, several of the UN's Sustainable Development Goals.

DEA: NRM, while not a primary research funding organization, is interested in supporting research that provides the necessary information, methods and toolkits to inform and enhance evidence-based decision-making, and to support more effective ecosystem management interventions.

The construction of the Ntabelanga and Lalini dams and the associated NRM interventions present a window of opportunity which could fundamentally change the direction of development in this area. It could signal a departure from negative social-ecological linkages such as low institutional capacity, loss of ecological infrastructure, low agricultural productivity, dependence on social grants and low adaptive capacity, towards a new future characterised by:

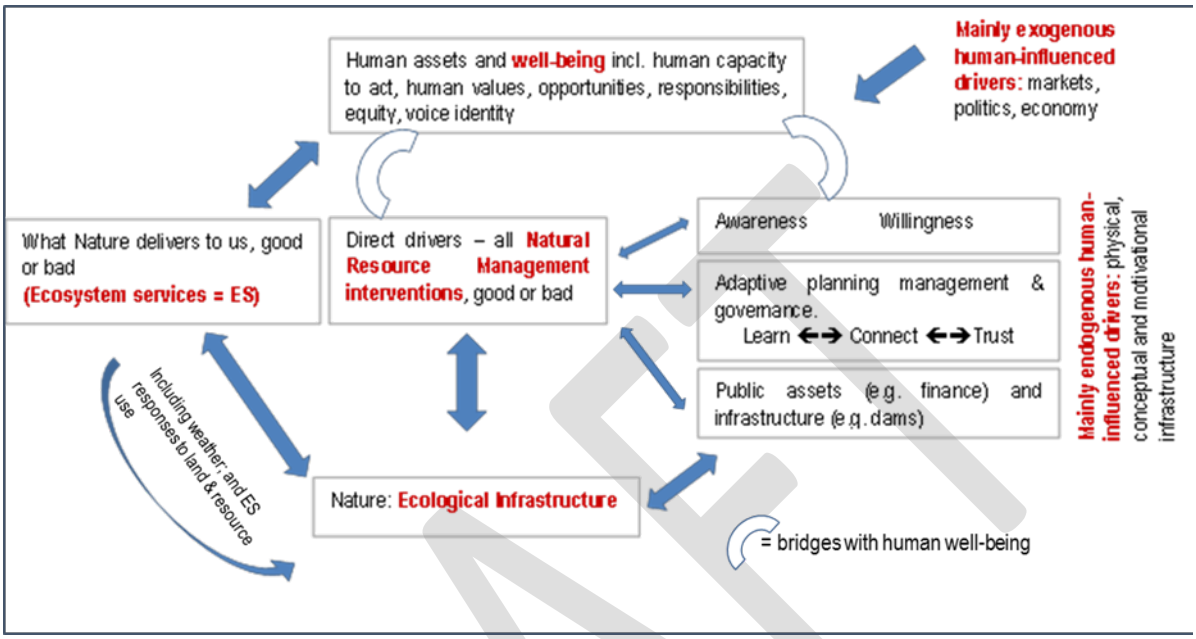
- stronger institutional capacity
- leadership
- strategic restoration of ecological infrastructure
- more productive agriculture
- greater independence, and ultimately,
- increased adaptive capacity and resilience at multiple scales.

This could be achieved through quality research, high-level commitment, collaboration, good communication and leadership.

The project, when viewed through a social-ecological systems framework, consists of resources, resource users, public infrastructure providers and public infrastructure. The crucial links to strengthen are those between the resource users and the resource; and between public infrastructure providers and resource users. This is described in more detail in Figure 1, page 4 of the full RIS Vol 1.

An adaptive and reflexive process was followed in arriving at a suite of themes and topics which are worth considering for funding. After an initial workshop in August 2014, two additional expert workshops were held in March and July 2015. At the first workshop (2015), a range of conceptual frameworks were presented and evaluated. A provisional conceptual framework, based on the Intergovernmental Programme on Biodiversity and Ecosystem Services (IPBES) of Díaz et al. (2015) and incorporating the Sustainable Livelihoods framework of DfID (DfID 2000), and Social-Ecological Robustness framework of Anderies et al. (2004) was adopted. Four broad research themes were identified: system dynamics; land degradation; livelihoods; institutions, actors and governance. A fifth theme, decision support, was later added. A subsequent meeting, with a particular emphasis on the science-management relationship in this Project, was held in November 2015, and presented an

important opportunity to critique the two central frameworks once more (both reproduced below) at a thorough level, as well as other key components of this document – the suggested changes have been incorporated in this report. These two frameworks have been copied as such (with captions, but without figure numbering) into this executive summary, as has a summary table of the research themes and their main components. The conceptual framework to promote integrated social-ecological understanding, appears first, immediately below.



Integrated Social-Ecological Framework – compact technical version

PLUS two key overarching issues to remember throughout:

1. Always think of this playing out at multiple interconnected scales (local …. regional …. global) and across multiple corresponding levels of governance.
2. Assume a constantly changing and bumpy milieu, with thresholds and tipping points, involving history, power changes, baselines, trends and scenarios.

A social-ecological systems framework for integrated natural resource management, understanding and action in the Tsitsa River catchment*. At the centre of the hub in our framing are natural resource management interventions which impact on ecological infrastructure (bottom block), in turn influencing ecosystem services (left block; the reason for the curved return arrow is to remind us that sometimes certain exogenous natural happenings like floods or droughts can impact ecological infrastructure without necessarily any human involvement). The ecosystem services in the left block go on to interact with human assets and well-being in the top block. The three closely positioned blocks on the right refer to endogenous "human infrastructures/capitals" which play a key role in influencing NRM, whilst the strong arrow coming from the top right-hand corner depicts exogenous human drivers usually out of our control as local residents or actors. The bridges (open curves) designate overlaps where it may be difficult to place an attribute in one or the other block category, or the two blocks and their links may need more unpacking than shown here, in order to be clear. Two overall messages (1 and 2 at bottom) apply throughout.*

The vision adopted at the March 2015 workshop after several rounds of refinement is: *Through applied research, to support integrated landscape management that improves the sustainability of*

local people's livelihoods, fosters equity in access to ecosystem services and strives for more resilient social-ecological systems.

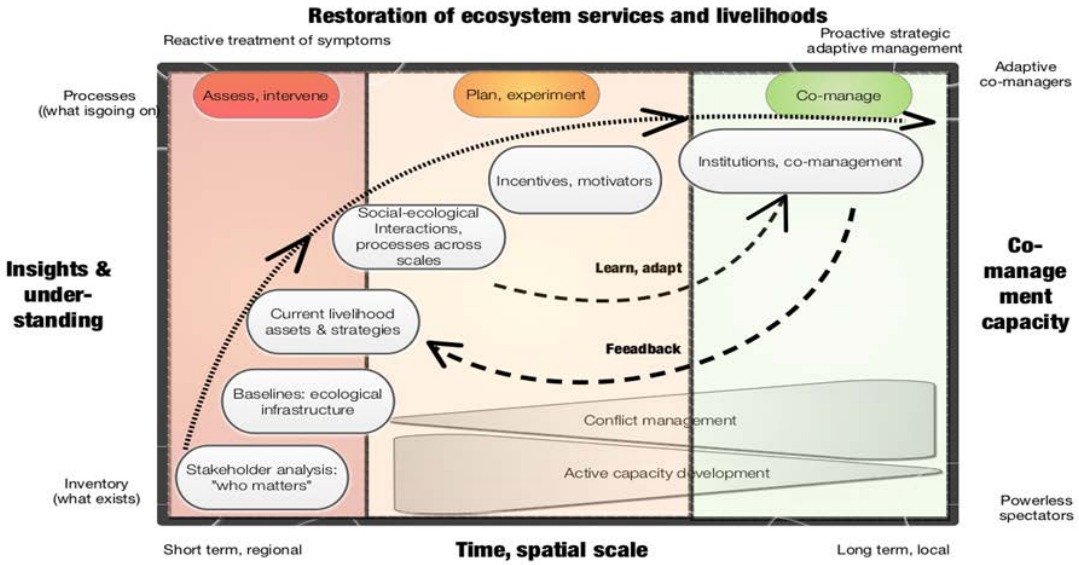
The five research themes were further discussed in an expert workshop in July 2015, followed by consultations with DEA: NRM, WRC and DST, to produce a list of topics that fit within the conceptual framework. These were aired again at a Science-Management meeting in November 2015, where very few further changes were suggested. Additional information and provisional costs are provided in spreadsheet format later in the document. Topics in **bold** are immediate priorities that are both urgent and important. The summary is presented below.

Research themes and topics. Suggested priority topics for immediate funding are in bold.

Theme	Research topic
1. Social-ecological system dynamics	**1.1. Driving factors and processes at different scales**. 1.2 Understanding and predicting the capacity to self-organise and recover from shocks; capacity to learn, adapt and transform. 1.3 Past and future trajectories under different scenarios. **1.4 Developing and testing theories of change, incorporating stakeholder goals, drivers and trajectories of change under different scenarios.**
2. Land degradation	**2.1 Capacity of ecological infrastructure to retain sediments, water and nutrients.** **2.2 System's ability to recover to a productive state after shocks and surprises.** **2.3 Stakeholder beliefs and perceptions of land degradation.** 2.4 Incentives and motivators that would inspire actors to adjust their land management practices. **2.5 Impacts of different land use and land management practices (e.g. fire; grazing; cultivation and farming practices, plantation forestry) on ecological infrastructure and sedimentation.** 2.6 Quantification of the value of ecosystem services (including tourism), with and without ecosystem restoration interventions - 'the cost of doing nothing'.
3. Livelihoods	**3.1 Available livelihood assets.** **3.2 Current livelihood strategies and their changes over time.** 3.3 Local well-being influenced by economic and political processes at local, national and global levels (including the impacts of non-resident land users and migrants). 3.4 Pathways into and out of sustainable livelihoods and livelihood strategies. 3.5 Livelihood strategies and assets and their trade-offs with ecological infrastructure management.
4. Institutions, actors and governance	**4.1 Governance processes, interventions, rules and codes of conduct that exist at local, provincial and national levels.** **4.2 Formal and informal power relations between different institutional actors and its implications for governance.** 4.3 Institutional links and disconnects between decision makers ('public infrastructure providers') and resource users, and their implications for ecological infrastructure and livelihoods. 4.4 Stakeholder perceptions and beliefs about drivers, pressures, state, ecosystem services and responses [see 2.3].
	5.1 Prioritization of landscapes for ecosystem repair / restoration, priority areas for investment.

Theme	Research topic
5. Decision support	5.2 Assessment of the effects of previous and current interventions for ecosystems and human well-being, and development of the most appropriate and cost- effective interventions in different contexts. **5.3 A monitoring system to implement adaptive management.** **5.4 A learning and decision-making system to implement adaptive management** **5.5 Stakeholder analysis and social-ecological inventory.** **5.6 Time-line and seasonal and events calendar.** **5.7 Ecological baselines for critical ecological infrastructure.** **5.8 Liaison and facilitation of collective action between researchers, resource users, implementers and decision makers – building on the primary engagement in 4.5 and using the principles generated by that process.**

The framework to guide the implementation process is copied below. It is loosely based on the operational frameworks proposed by Cowling et al. (2008) and Stringer et al. (2006), tailored to the Ntabelanga-Lalini SES.



Conceptual framework for implementation phases. *This operational framework depicts three phases: assessment and engagement; planning and experimentation; co-management. The process starts with a coarse-scale stakeholder analysis, visioning, baselines of ecological infrastructure, and descriptive analysis of current livelihood strategies and assets. It then proceeds to understanding the interactions and feedback between elements of the SES, followed by action research on adaptive co-management which includes institutional analysis and active collaboration. Facilitation is essential, with an initial bias towards externally-driven capacity development, shifting towards more internally-driven capacitation and to an increased ability to handle conflict management. Over time, research insights evolve from understanding what exists, to understanding 'what is going on'. Thinking changes from shorter to longer term, the management of agreed-on ecosystem services becomes more pro-active and, through encouraging the use of feedback for learning, more adaptive in a*

structured and strategic way. Unsustainable livelihoods hopefully evolve through management (including at least some forms of co-management) to become more sustainable, in a way that allows a greater sense of genuine agency.

Operational guidelines for the project include:

1. Research is user-inspired, and feeds as directly as possible into addressing management problems with maximum information flow between users, managers, and researchers.
2. Researchers abide by a mutually agreed code of ethics.
3. All projects are contextualized within the social-ecological systems approach and the adopted conceptual framework.
4. The research group is committed to transdisciplinary learning and reflection and to incorporating a diversity of world views and disciplines.
5. There is appropriate and requisite inclusivity in access to research funding, opportunities for learning and knowledge sharing.
6. All participants are committed to building relationships and trust, and promoting synergies.
7. Stakeholder engagement commences early and happens throughout the process; all project participants engage with stakeholders and each other.
8. Capacity building of early career researchers and students, especially those from historically disadvantaged backgrounds, is paramount.

A code of ethics needs to be developed, which must include prior and informed consent, regular communication in the local language, respect, acknowledging people's rights to land and resources, and giving preferential employment and capacity development to local communities. The code of ethics also includes communication with fellow researchers, respect for their knowledge systems and methods, and striving towards maximum synergies with them. A proposed code of ethics is provided on page 31, RIS Vol 1.

This report is a first step towards defining research priorities for the Ntabelanga and Lalini Ecological Infrastructure Project. It has been made available to a wide range of users and researchers for open discussion, as well as subsequent comment and input, and amended accordingly. There is therefore reasonable-to-good agreement by technical stakeholders on the adoption of the conceptual and operational frameworks presented in this document. A more ideal (and longer, more complicated and more expensive) situation to be strived for in future such initiatives is the derivation of the key elements above, *collaboratively with resource-use communities* on the ground in the catchment – something that is widely espoused yet hardly ever achieved. This project has made an early yet promising start to a stakeholder engagement process. It is now possible to check acceptability of what has been derived above to local communities living and using resources, and to assist them to garner alternatives. The principles and frameworks provide a basis for approaching forthcoming components of this project in a systemic way that is broadly stakeholder-influenced, and not only the result of the decisions of technical stakeholders.

We were fortunate in receiving the NLEIP Stakeholder Analysis (Part 1) just before the release of this report. We have strengthened certain points under the Research Themes because of these recommendations, and will more fully align the first full revision of this RIS – scheduled for the second half of 2017 [Editorial note from 2018: this foreshadows what turned out to be this very 2018 document in which this 2016 executive summary is included] – with the wider consequences of the learning from the ongoing stakeholder analysis.

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PREVIOUS OBJECTIVES TREE

Appendix 3: The NLEIP RIS Volume 1 core themes and work packages.

Theme 1. Social-ecological system dynamics		
Theme Objective: Understanding and depicting the general resilience and transformability of the social-ecological system		
Research topic	**Rationale**	**Approach and methods**
1.1 Driving factors and processes at different scales.	Understand influences from and feedback to processes and dynamics at local, provincial, national and global scale – Panarchy.	Annotate and populate Ntabelanga conceptual framework with reliable information and data, incorporating the Panarchy model (Gunderson & Holling). Specialist workshop, 15–20 systems researchers and managers. Refine and popularize conceptual framework.
1.2 Understanding and predicting the capacity to self-organize and recover from shocks; capacity to learn, adapt and transform.	Social-ecological resilience and adaptive capacity are key goals in restoring the social-ecological system. Learning is pivotal. This needs to be tracked over time.	Develop resilience and adaptation assessment system, implement and test. Include community workshops, questionnaire surveys, participatory assessment. Encourage innovative ground-breaking research, using the resilience workbooks published by the Resilience Alliance as departure points. Link with and learn from other resilience assessment programmes globally.
1.3 Past and future trajectories under different scenarios.	Important for stakeholders to realize there are multiple pathways and to make choices about the trajectories they want to navigate towards.	Participatory scenario development with 'Future Search' approaches incorporating dynamic systems models, available biophysical data and projections, narratives and historical analysis. May include forum theatre and other innovations.
1.4 Developing and testing theories of change, incorporating stakeholder goals, drivers and trajectories of change under different scenarios.	The purpose of social-ecological restoration is to influence the trajectory of the social-ecological system towards more positive connections and greater adaptive capacity. This involves a number of intermediate processes, elucidated by change theory.	Develop theoretical frameworks and models to predict the influencing factors. Workshop with participants to get their responses. Test the model under different scenarios, and ground truth over the course of the project, using real data.

PREVIOUS OBJECTIVES TREE

Theme 2. Land degradation		
Theme Objective: Understand the drivers, pressures, state, ecosystem services, and responses underpinning land degradation, within the Ntablelanga SES interventions framework		
Research topic	**Rationale**	**Approach and methods**
2.1 Capacity of ecological infrastructure to retain sediments, water and nutrients.	Capacity to retain nutrients, water and sediments is crucial for local livelihoods and life-span of the proposed dam.	Field studies and models to refine the work of Roux et al. () and le Roux (2018) at a finer resolution. Spatial delineation of critical ecological infrastructure using remote sensing and **G**eographic **I**nformation **S**ystems (**GIS**).
2.2 System's ability to recover to a productive state after shocks and surprises.	Climatic, economic and political shocks and surprises are common; current capacity to transform to a productive state and build resilience in the new direction is low and needs to be strengthened.	Use a resilience lens, adopting the principles outlined by Biggs et al. (2012 and 2014) focusing on connectivity and diversity as proxies for resilience. Analyse historical aerial and satellite images to assess recovery time after disturbance. Identify bench-mark sites.
2.3 Stakeholder beliefs and perceptions of land degradation.	Decision makers need to understand reigning beliefs and perceptions in order to design effective interventions that increase awareness and motivate local actors (see 4.4.).	Analyse mental models, perceptions and dominant paradigms of different stakeholder groups, using social science instruments developed for that purpose, supplemented by semi-structured interviews and participatory learning and action methods.
2.4 Incentives and motivators that would inspire actors to adjust their land management practices.	After transformation, the system needs to build resilience in a new direction. This will require lasting benefits that motivate people to implement land-use practices that maintain functioning ecological infrastructure.	Participatory methods e.g. participatory mapping, with cost-benefit analysis and motivational theory.
2.5 Impacts on different land use and land management practices (e.g. fire; grazing; cultivation and farming practices, plantation forestry) on ecological infrastructure and sedimentation.	Current and novel land use practice has positive and negative impacts on ecological infrastructure and livelihoods. These trade-offs and feedbacks need to be assessed at a fine scale, modelled and tested over larger areas.	Assessments of ecological impacts on biodiversity, bundles of ecosystem services, ecological infrastructure across gradients of land use types and biophysical conditions.
2.6 Quantification of the value of ecosystem services (including tourism), with and without ecosystem restoration interventions – 'the cost of doing nothing'.	The costs of ecosystem restoration need to be compared to the gains in ecosystem services, and their direct and indirect values to different user groups at different scales.	Resource economics methods coupled with participatory workshops.

PREVIOUS OBJECTIVES TREE

Theme 3. Livelihoods		
Theme Objective: Understand the drivers, pressures, state, ecosystem services, and responses underpinning the sustainability of livelihoods and livelihood strategies within the Ntablelanga SES interventions framework		
Research topic	**Rationale**	**Approach and methods**
3.1 Available livelihood assets.	Interventions must use existing assets, including knowledge, as their departure points and aim to strengthen those, before introducing new practices, assets and technologies. However, the proposed dam will bring a range of new assets into the area which need to be incorporated into the local asset base.	Detailed livelihood assets analysis, adopting a multi-scale approach and assessing historical and contemporary livelihood assets and strategies. GIS for spatial delineation of distribution of livelihood assets. Use SRL frameworks developed by DfID (2000) and ESPA Fisher et al. (2015), with a strong focus on risk and vulnerability linked to assets.
3.2 Current livelihood strategies and their changes over time.	Effective interventions take current livelihood strategies into account and work towards strengthening their financial and ecological sustainability, while improving local people's capacity to exploit new opportunities. Capacity to self-organize and adapt is an integral part of sustainable livelihoods.	Detailed livelihoods strategy analysis, adopting a multi-scale approach and assessing historical and contemporary livelihood strategies. Use SRL frameworks developed by DfID (2000) and ESPA Fisher et al. (2015), with a strong focus on risk and vulnerability reduction and adaptation as outcomes. Interviews, questionnaire surveys.
3.3 Local well-being influenced by economic and political processes at local, national and global levels (including the impacts of non-resident land users and migrants).	Global processes are changing faster than ever and can have a major impact on local dynamics. Local actors are often unaware of these. Processes at provincial and national levels, for example the uMzimvubu Water Project, bring new challenges and opportunities; actors from outside the area, such as migrant workers and absentee resource users, may influence ecological infrastructure and livelihood strategies in subtle ways.	Desk-top study of policies, strategies and interventions affecting the study area, supplemented by participatory workshops and key informant interviews, especially with older residents, to develop time-lines.
3.4 Pathways into and out of sustainable livelihoods and livelihood strategies.	Sustainable livelihoods can follow multiple trajectories, depending on the way drivers are managed or serendipitously emerge. All actors need to understand the implications of their actions for trajectories towards or away from resilient or vulnerable futures.	Historical analysis of human well-being and livelihood indicators; time-lines linked to system drivers represented in the Ntabelanga SES framework. Participatory scenario development (see 1.4).
3.5 Livelihood strategies and assets and their trade-offs with ecological infrastructure management.	Interventions aimed at repairing ecological infrastructure may have positive and negative impacts on local resource users. Some of the negative impacts may exceed the benefits, whether real or perceived, with important implications for the sustainability and acceptability of interventions.	Gradient analysis of different land use strategies and associated ecological infrastructure, focusing on comparison of soil fertility, erosion, connectivity and diversity. Use participatory mapping, GIS and participatory workshops.

PREVIOUS OBJECTIVES TREE

Theme 4. Institutions, actors and governance		
Theme Objective: Understand the drivers, pressures, state, ecosystem services, and responses underpinning the links between different institutional actors, their governance systems and codes of conduct within the Ntablelanga SES interventions framework		
Research topic	**Rationale**	**Approach and methods**
4.1 Governance processes, interventions, rules and codes of conduct that exist at local, provincial and national levels.	Important to understand existing institutions and governance systems, their associated uncertainties, strengths, positive and negative impacts on the system's adaptive capacity and trajectory, before introducing institutional and governance innovations.	Overlap with 3.5
4.2 Formal and informal power relations between different institutional actors and their implications for governance.	Historical and contemporary power relations influence beliefs and perceptions and may either empower or disempower actors to pursue their objectives. Experience has shown that power dynamics have an important influence on the ability and/or willingness of actors to make choices about land use, governance and codes of conduct.	In-depth interviews for critical discourse analysis, social network analysis and 'who counts' matrices. Link this to a social-ecological inventory and analysis of system drivers (see 1.1).
4.3 Institutional links and disconnects between decision makers ('public infrastructure providers') and resource users, and their implications for ecological infrastructure and livelihoods.	The functionality of interactions between decision makers and resource users may influence the robustness of institutions, could have important impacts on governance and, ultimately, on ecological infrastructure. This is the central tenet of cooperative governance and adaptive co-management.	Use Institutional Analysis and Development (IAD) framework of Oström (2005) and robustness-vulnerability framework of Anderies et al. (2004) to assess strengths and weaknesses of institutional connections and how these have changed over time. Desk-top studies, supplemented by participatory workshops and in-depth interviews with key actors.
4.4 Stakeholder perceptions and beliefs about drivers, pressures, state, ecosystem services and responses	Decision makers need to understand reigning beliefs and perceptions in order to design effective interventions that increase awareness and motivate local actors (see 2.3).	Instruments such as Dominant Social Paradigm and New Environmental Paradigm tools, elicitation of mental models, using methods such as participatory learning and action, photo-voices, narratives, discourse analysis and in-depth interviews.

PREVIOUS OBJECTIVES TREE

Theme 5. Decision support		
Theme Objective: Provide tools to improve the effectiveness and efficiency of decision making		
Research topic	**Rationale**	**Approach and methods**
5.1 Prioritisation of landscapes for ecosystem repair / restoration, priority areas for investment.	Essential to focus first on areas which are either a) critical to ecological infrastructure; b) can demonstrate short-term advantages; c) a large impact can be demonstrated at low cost.	Rule-based models linked to GIS, to proactively identify urgent and important areas for ecosystem restoration.
5.2 Assessment of the effects of previous and current interventions for ecosystems and human well-being, and development of the most appropriate and cost-effective interventions in different contexts.	An understanding of present and past impacts is an important departure point for learning about appropriate interventions, and designing innovations.	
5.3 & 5.4. A monitoring, learning and decision-making system to implement adaptive management.	Management wishes to follow the principles of adaptive co-management. This requires frequent monitoring and reflection, with robust monitoring systems and logical decision flows.	Set goals, identify indicators, collect monitoring data, set decision rules and identify methods for reflection, learning and adaptation. Workshop to deliberate and refine.
5.5 Stakeholder analysis and social-ecological inventory.	Project participants need to understand 'who does what, where' as a departure point for future work.	Snowball sampling, linked to social network, database and GIS indicating functionality of links, management activities, responsibilities, activities, and organizational characteristics linked to legitimacy, and compatible or conflicting goals.
5.6 Time-line and seasonal and events calendar.	The project needs an historical baseline as well as a community calendar of events and activities to be able to plan its activities.	Desk-top analysis, time-lines and participatory community annual, seasonal and weekly calendar.
5.7 Ecological baselines for critical ecological infrastructure.	Baselines for critical ecological infrastructure are essential to be able to evaluate progress with ecosystem repair.	In addition to sediment yield study: remotely sensed NDVI indices at 30x30 m resolution; water run-off; sediment yields in individual streams; landscape connectivity indices using remote sensing and ground truthing; agricultural yields for randomly sampled fields, and for the study area as a whole; inventory of landscapes actively being managed to improve provisioning; cultural; regulating and supporting ecosystem services; hectares of land in different degradation/ productivity categories. Fixed point photographs (geo-referenced). Data should be incorporated in GIS.
5.8 Liaison and facilitation of collective action between researchers, resource users, implementers and decision makers.	Maintain and communicate up-to-date information about role players, and promote synergy, cooperation and trust between role players mentioned above through regular communication, dialogue, information-sharing and social learning. This should lay the foundation for adaptive co-management of ecological infrastructure, and the formation of an appropriate and legitimate local governance structure. [The development of such governance structure does not form part of this assignment]. Communication, networking, learning and information-sharing crucial for adaptive co-management and requires skilled facilitation.	The consultant(s) will: familiarize themselves with the study area through an extensive literature review and interviews; maintain an up-to-date database of role players, their issues and interactions; maintain regular (bi-monthly) personal contact with all key role players through monthly site visits ; proactively identify areas of potential synergy and conflict, and use appropriate methods to promote positive interaction towards adaptive co-management; provide leadership, mentoring and capacity development to local community facilitators; develop codes of conduct for all researchers working in the study area; develop relevant researchers' capacity to enact the code of conduct through ethical research in a rural community setting; keep all role players informed of developments through information materials, written and verbal communication, the media, facilitated dialogues and six-monthly information sharing workshops ; make a special effort to communicate with illiterate and marginalized role players.

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Appendix 4: The Tsitsa Project – Restoration and sustainable land management Plan (ver1) – Executive Summary

Dec 2018

The Tsitsa Project (TP) aims at carrying out erosion prevention, avoided habitat degradation and general rehabilitation efforts in the Tsitsa catchment (T35), particularly those reducing sediment delivery into proposed dams and associated infrastructure of the Mzimvubu Water Project (MWP). In the long-term TP will strive towards ***avoiding land degradation*** and ***sustainable land management*** across the catchments. TP is a collaborative venture into polycentric governance with the main proponents and sponsors being the Department of Environmental Affairs, Forestry & Fisheries (DEFF), The Department of Science and Technology (DST), the Water Research Commission (WRC) and the Department of Water and Sanitation (DWS).

The project framing is social-biophysical (or social-ecological as it was termed in the formative initiatives) and systemic (holistic) in nature, and centres around local livelihoods especially in the ex-homeland areas of the catchment. Although the MWP and TP began in a top-down manner, efforts are now being made to secure a meaningful, even where possible central, participatory position for local resource users. This report is (at this stage) the first draft, reflecting a process which began as a more biophysically-centred sedimentation and rehabilitation plan but which evolved quickly as the commitment of the team to social-biophysical linkages deepened. In addition, commitment to pragmatic interfacing with the many realities on the ground, such as local power structures and governmental schedules, has in part given the report a nitty-gritty touch. These various evolving emphases will be apparent to the reader, and will grow further in future drafts as TP, hopefully successfully, gains the wider collaborative and trans-disciplinary reach to which it aspires. A central conceptual framework in the founding "Research Investment Strategy" (Fabricius *et al.* 2016) document reminds participants of the social-biophysical and systemic obligations in TP's approach (see diagram in Appendix 1). The reader will thus appreciate that the TP's view is that, without these social and other contextual considerations properly incorporated, any biophysical design or "fix" is very likely to be unsustainable. Another way to put this is to say that we recognise that biophysical, institutional and social considerations have their own "minimum requirements" – below which sustainability will not be possible – and that it is in the particular way the social and the biophysical are related, or can be brought to be so, that often offers the most promise.

Effective stakeholder assessment and engagement was spoken about from the outset of TP, but in reality took over a year to move anywhere beyond some research contact. There have, however, been some routine prescribed interventions such as the EIA for the MWP project and such as the committees formed by DEA-NRM (Project Steering Committees) when their teams operate in an area; and notably, there has been more intensive engagement at one pre-existing local site in the catchment (the Green Village Project or GVP). Engagement is now increasingly being placed more centrally, and this report reflects many of the principles and plans in this regard. A thorough stakeholder assessment of the sub-catchments related to the proposed Ntabelanga Dam (the first proposed dam of the two) was conducted in 2016 (Sisitka *et al.* 2016) and its recommendations form, along with the outcomes of much discussion since, the basis of the stakeholder section in this document.

TP is also evolving in an era when developmental evaluation is starting to be seen alongside conventional M&E efforts. The TP effort does not discount classic M&E, but has an initiative focussing on (initially internal) learning as a consequence of a developmental (adaptive, emergent) reflection,

partly through narrative. In line with current trends there is also an evolving theory of change which draws on the underlying systemic understanding of inter-relationships, particularly the process links between biophysical, institutional and social elements.

The commitment to adaptive and reflexive ways of thinking throughout all TP activities, is encouraged by various Strategic Adaptive Management (SAM) guidelines including the adaptive planning process. The elements of this whole report, for instance, are cross-mapped onto the adaptive planning process which rests primarily on agreed-on values or deeply held beliefs (ideally derived by joint visioning) and whose implementation themes are usually represented by a tree of objectives. Constructive feedbacks between processes are seen as crucial to sustainability, and these are sought and explicated throughout. Representations of this type of thinking are used in this report, but probably need expansion (as seen by a demand for a fuller objectives tree in mid-2017). These collaborative adaptive approaches help realise the elements of the other (called the "implementation framework") in the founder Research Investment Strategy (Fabricius *et al.* 2016) (see figure in Appendix 2).

The governance structures of a programme such as TP need to themselves have the requisite variety to represent the heterogeneity and complexity of the larger task at hand. To this end TP evolved three communities of practice or COPs (initially called working groups) that span to a reasonable extent the breadth of what is taking place (Figure A). These three essentially voluntary groups of enthusiasts meet amongst themselves and increasingly cross-link with the other groups, helping form a more coherent blend. Currently the three COPs are: Governance, Sediment & Restoration, and Livelihoods and Ecosystem Services. There are bi- or tri-annual Science-Management meetings at a broader plenary level. Slightly more formally, there is an evolving "B-team" (or the Praxis Evaluation and Recommendation Panel) of mid-level managers and researchers who grow and keep the science-management links meaningful, a subset of this group specifically charged with ensuring that the recommendations are operationalised in both directions. There are concrete plans for a formal high-level "A-team" (or High Level Promotion of Cooperative Governance Committee) which will represent TP interests' at the most senior level and provide the highest level of buy-in in a vertical governance sense. A final component of the TP Governance is provided by the Praxis Consultation Committee (previously thought of as a potential TP Wisdom Trust). All this is necessary to enable TP to achieve what it is setting out to do.

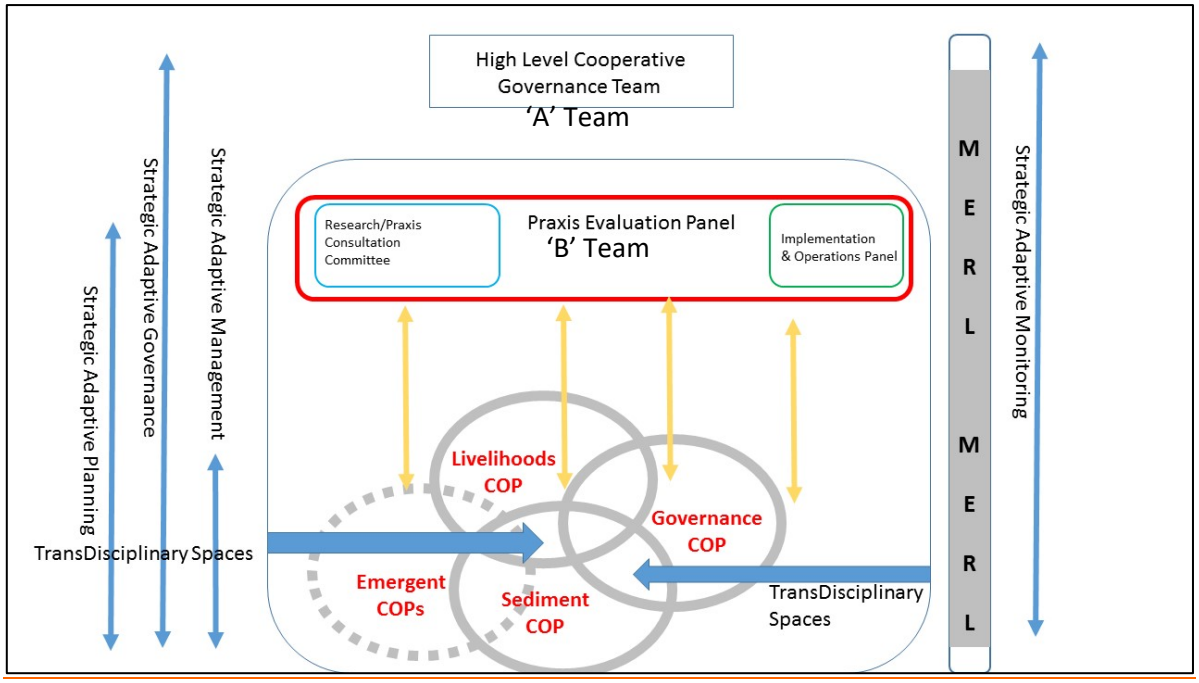

Figure A: Governance arrangements within TP

This report describes in some detail what the catchments look like and how they function, both biophysically and socially, and then (true to the social-biophysical calling) how the key linkages across these domains work. The implementation of TP has required a phased approach, purely due to the size of the catchment and the complexity of the total system. As with the stakeholder analysis (Sisitka *et al.* 2016), this plan focusses purely on the ***five quaternary catchments (T35A-E)*** that impact directly on the proposed Ntabelanga Dam (Figure B). The second stakeholder analysis and the second TP Integrated Adaptive Management and Restoration Plan will focus on the balance of the quaternary catchments in T35 (T35F-M) which materially impact the proposed Lalini Dam and associated infrastructure (see Figure A).

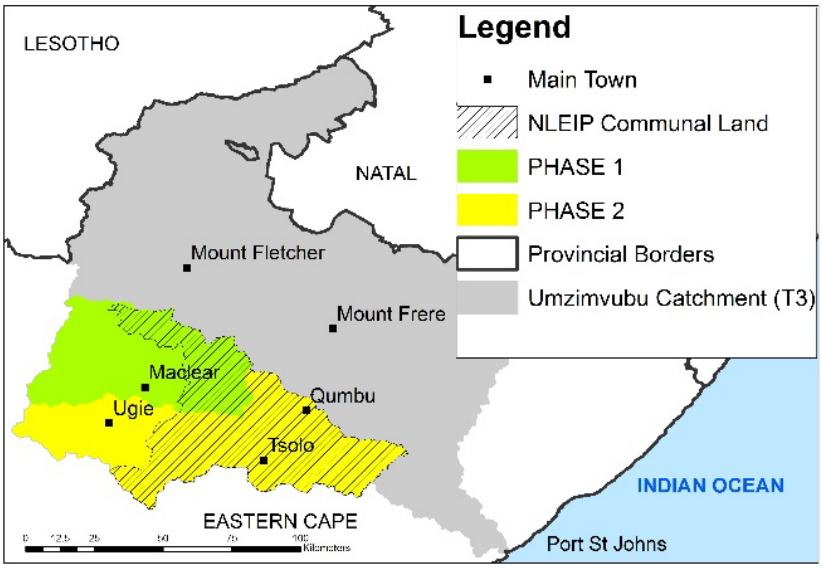

Figure B: Locality map for the TP depicting the two phases (Ntabelanga – Phase 1 and Lalini Phase 2).

The Ntabelanga catchment receives summer rainfall (~600-1 000 mm pa) and is marked by steep topography, with the pronounced Drakensberg Escarpment forming the headwaters of the catchment, followed by a second smaller escarpment in the lower catchment. Soils become more erodible towards the lower parts of the catchment, as is demonstrated by the extensive gully features in the lower catchment. Grassland is dominant throughout with primary grasslands in the upper catchment and degraded secondary grassland in the lower catchment. The upper catchment is wetter and has more crop production. The south-western upper catchment is privately owned with commercial livestock, crop production and forestry, whereas the north-eastern part of the upper catchment and entire lower catchment is communally owned with subsistence livestock and crop production.

Various socio-economic factors contribute to land degradation. Key elements that impacted on the Tsitsa were: the political and administrative separation of the former Transkei homeland from Republic of South Africa (RSA); laws that restricted black ownership of land; the loss of able bodied men who were enrolled to work in the mines, reducing available labour in the rural areas; pass controls which prevented women from living in urban areas with their husbands; limited investment in education, especially at school level. Forced removals from the RSA from 1960s onwards contributed to rapid population growth. Betterment planning, introduced from the 1930s, led to resentment and political resistance. Social grants in the form of pensions also affected people's reliance on the land, often abandoning agricultural land and practices. Since 1994 the focus of direct government support has shifted from white commercial farmers to black farmers, with an emphasis on 'emerging' black commercial farmers. The effectiveness of this support can, however be questioned as new farmers need a huge investment in material and social capital (e.g. business and agricultural skills). The level of support through extension services in communal areas is variable. Poverty remains a reality within the communal area.

Three stakeholder groupings were identified in the catchment: a **high level** that includes district and local municipalities (possibly elements of national and provincial government departments), ward councillors, traditional authorities, chiefs, AmaMpondomise Royal Council, Maclear Fire Protection Association, Maclear Farmers Association, JGDMASAFA, ORTDMAFASA TP and partner reps; an **intermediate level** that includes MFPA or subcommittee, Tribal Councils/Royal Council (or sub-committees) + Ward councillor, agricultural extension officer, TP and partner reps, others; a **local level** that includes farms, village areas, farmers or sub-headmen, resource users/managers, TP and partner reps, community facilitators. Despite the presence of various government departments in the catchment, natural resource related decision making is mainly controlled by individual farmers (with advice and support from their agricultural suppliers) and traditional authorities (chiefs, headmen and sub-headmen). TP will need to engage stakeholders at all these levels in order to effectively influence natural resource management (NRM).

Various social ecological links can be identified that impact on natural resource management in the Tsitsa River catchment. The climate, soil stability and terrain steepness make agricultural activities less successful and reliable. Without technology to overcome these challenges, agriculture is not a reliable source of income. Break-down of local governance systems leads to lack of control over resource use. Land management is often reactive and fuels further degradation. Migrant labour, increased school attendance and new generation less interested in hard physical labour reduces interest in land and NRM. Government grants support families, but much time is still spent on collecting water and fuel

wood instead of engaging with economic activities. Poverty is common and reduces health, education opportunities and resilience to environmental challenges, leaving residents vulnerable. Landownership is communal, thus a disincentive to invest in common-pool natural resources. Livestock are culturally very important, with less focus on productivity. Large numbers on small areas result in under nourished, often old animals that are not worth much on commercial markets. Reliable markets are far away and expensive to get to, thus excludes active farmers from turning livestock into cash. Current levels of degradation make any new agricultural activity unlikely to remain successful without continued support and investment.

Our social-biophysical approach helps understand the environmental, social, economic and governance factors (and importantly the particular linkages between them) which drive the system of interest to the residents and stakeholders. We do not underestimate the severity of challenges facing the region, but increasingly recognise that we can act jointly on the opportunities and hopefully work coherently towards agreed-on goals for a better future. The essence of a strategic adaptive management approach means that we have to have the determination to act firmly in the ways we have jointly decided, learn from the results, and hence also adapt accordingly. This implies that we will navigate our progress altogether, and that we expect at least some setbacks and adjustments. Engendering this culture will be an important contributor to an ultimately better future. We do not promise quick fixes, rather a drive towards a sustained systemic effort which is co-constructed and builds trust based as far as feasible on shared values. In this way ecological goods and services will be improved and support the success of alternative livelihoods and the wellbeing of land users.

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Appendix 5: Climate change lessons from the Green Village Project.

Observed and projected climate change

Climate change research can be described under two headings – evidence of current change and predictions of future change. The former depends on the availability of climate data retrieved either from ground stations or, more recently, from satellite data. The latter depends on the development and application of climate change models, whose predictions are uncertain. Applying these predictions to an assessment of future water resources adds another layer of uncertainty linked to hydrological models (Kusangaya et al. 2014). What is presented below is therefore our 'best guess' at the future.

Temperature and rainfall are the two most relevant climatic variables that affect hydrological processes, soil erosion, and water resources. Research on the impact of climate change on water resources of southern Africa is reviewed by Kusangaya et al. (2014). Their review provides the basis of the present overview.

Temperature

An analysis of available data from southern Africa shows a general warming over the last half century. Data presented by Kusangaya et al. (2014) confirm this trend. They provide evidence that temperatures have been increasing since the middle of the twentieth century, with minimum temperatures rising faster than maximums. They review recent studies that show increases of between 0.12^{o}C to 0.31^{o}C per decade for mean annual temperature. Current temperatures (1990s) are generally 0.2 to 0.3^{o}C warmer than the 1961–90 average.

New et al. (2006) analysed data for the southern African region for the period 1961–2000. Over this period, they found that the number of extreme cold days had decreased, but both the number of extreme hot days and nights and the duration of warm periods had increased.

Climate change models indicate a projected increase in temperature of around 3ºC over southern and South Africa by the middle of this century. The highest increases are in the drier north-west of the area so may be less in the Tsitsa. Studies include the Thukela catchment (Graham et al. 2011), which has a similar geography to the Tsitsa Catchment. Kusangaya et al. (2014) note that the results are highly dependent on the climate change model applied.

Rainfall

Global warming is predicted to impact on rainfall patterns due to increased evaporation over the land and an increase in the frequency and intensity of tropical storms over the Indian Ocean. Evidence for ongoing changes to rainfall patterns, however, is less conclusive than that for temperature due to the high spatial and temporal variability of the region's rainfall which exerts a strong cyclicity. New et al. (2006) found that a decrease in regionally averaged precipitation was accompanied by an increase in the duration of dry spells, rainfall intensity and the annual maximum one-day rainfall. Kusangaya et al. (2014) note significant regional and temporal differences.

There is much uncertainty around projected changes to rainfall over the next half century. Most models indicate a general reduction in rainfall over southern Africa, though some predict an increased rainfall in the north-eastern region. The general consensus is that there will be decreased rainfall over the growing season, increased variability, more extreme events, and longer dry spells (Kusangaya et al., 2014).

Analyses of annual rainfall and storm intensity in the area in and near the Tsitsa Catchment have been presented by Drewett (2015) and Moore (2016). Moore was not able to identify a trend in annual rainfall for Maclear, nor did Drewett find a trend for Mtata annual rainfall over the period 1955–2014. New et al. (2006) point to the lack of trends shown by individual stations. Drewett did, however, indicate a possible increase in rainfall intensity at Mtata. Her analysis of drought identified a number of severe drought seasons in the early part of the record, but since the mid- 1990s, the climate has been wetter, with especially heavy rain in 2000. Drewettt's analysis did not include the dry years of 2016-2017.

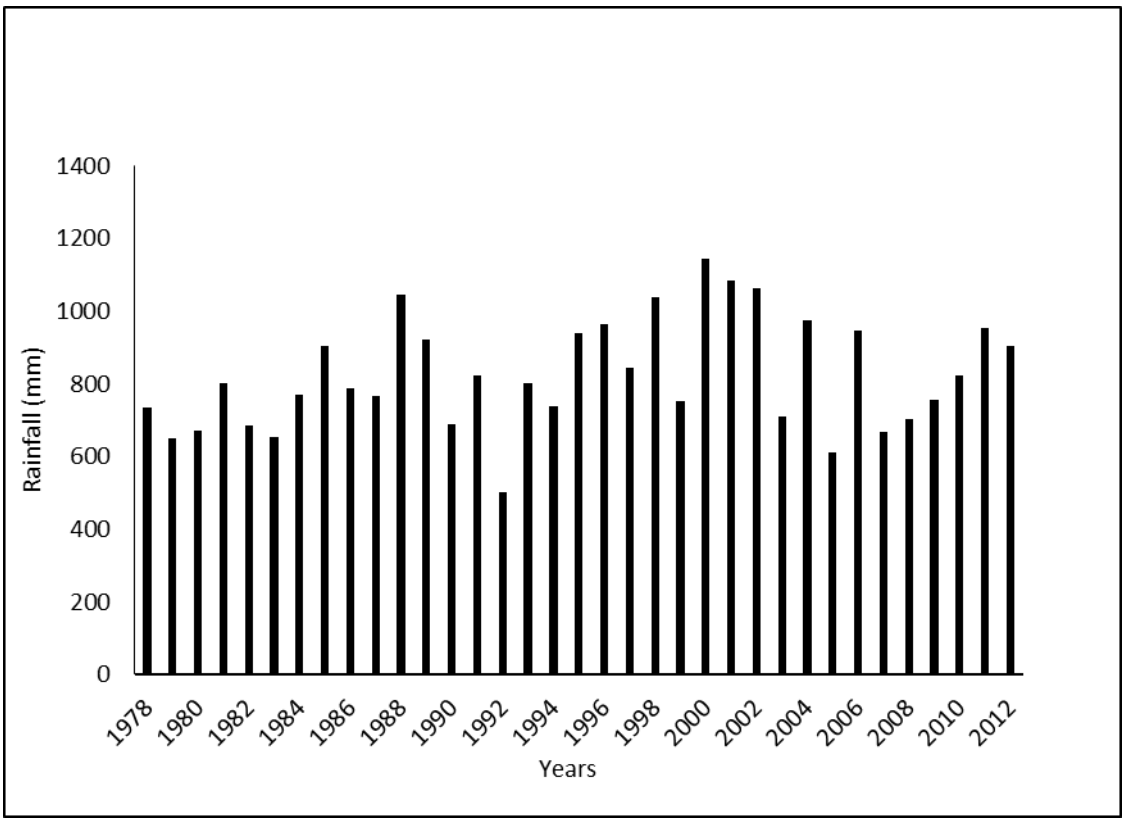

Figure 1. Annual rainfall for Maclear, 1978–2012 (Moore, 2016)

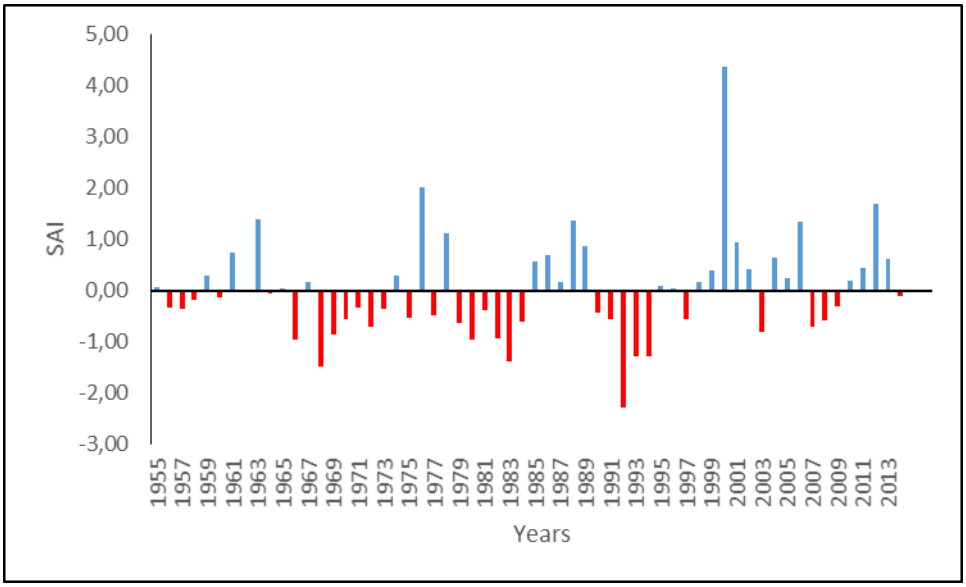

Figure 2. Rainfall variability at Mtata Dam, 1955–2015. SAI is the Standard Anomaly Index derived as the difference between the annual total and the long-term mean (Drewett, 2015).

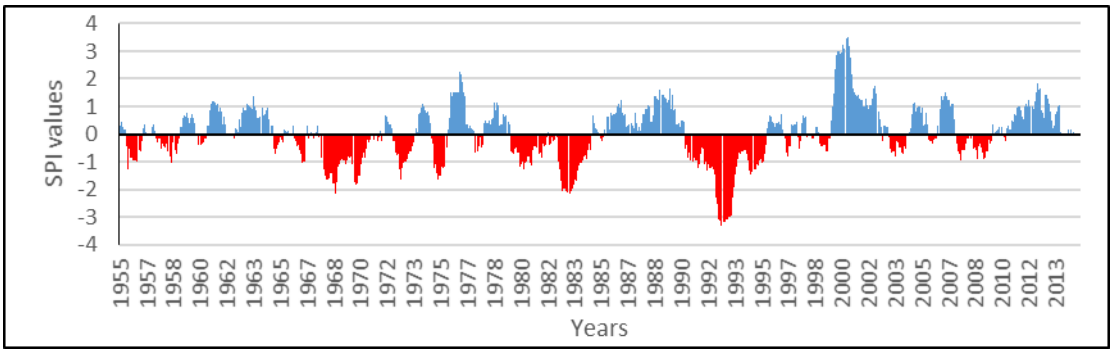

Figure 3. Drought analysis of Mtata Dam rainfall using the Standard Precipitation Index (SPI) for 12-monthly time periods (Drewett, 2015).

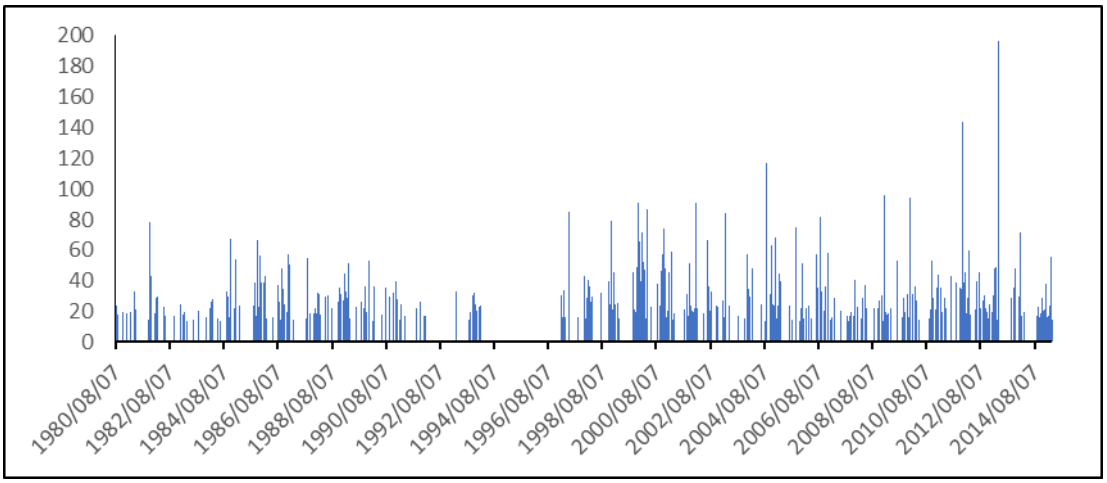

Figure 4. Time series of days with over 14 mm of rainfall per day, 1980–2015 gauged data (Drewett, 2015).

Hydrology and water resources

Catchment hydrology will be affected by changes to both temperature and rainfall. Higher temperatures will lead to higher evaporation loss and reduced water availability, as well as increased periods of heat stress. Even if rainfall were to stay the same, streamflow would become more variable with longer low-flow or no-flow periods. Springs would dry up more often. Any increases in rainfall variability will have an exaggerated effect on hydrological variability, whilst increases in rainfall intensity will exacerbate storm runoff and flooding.

Streamflow responses to climate change are highly variable and, in part, depend on local catchment conditions. According to Kusangaya et al. (2014), modelled projections indicate a general decrease in streamflow. Graham et al. (2011) applied ten regionally downscaled future climate projections to assess the future hydrology of the Thukela River Basin, an area that is geographically similar to the Mzimvubu Basin. Despite a consistent increase in temperature showed by all models, there was less consensus regarding streamflow. The predominant outcome, however, was for increased runoff with intermittent dry periods.

Schulze et al. (2011) showed the Mzimvubu to be outside the hotspots of climatic change-related water stressed areas. These were given as the south-west, the west coast and the extreme north. Increased (and often a high increase) year-to-year variability of the future hydrological response. Variability related to rainfall, stormflows, accumulated streamflows and sediment yields. The most sensitive components to change were baseflows and hydrological droughts. Hydrological droughts are more sensitive to change than meteorological drought.

Soil erosion

Increases in rainfall intensity will lead to increased runoff, reduced water retention, erosion and flooding. Loss of vegetation cover due to desiccation of the landscape will further increase erosion potential. There is therefore a strong likelihood that the potential for erosion will increase in the future in response to climate change. Future scenarios modelled by Schulze et al. (2011) showed projected increases in the annual variability of sediment yield.

Adaptation and mitigation

A number of authors have contended that the impact of climate change will be exacerbated by the low levels of development in southern Africa, levels that increase people's vulnerability and reduce their resilience to coping with change. There is a significant literature on both climate change vulnerability and climate change resilience, but it is beyond the scope of this report to review this here. Miller et al. (2010) examine the convergence or synergy between resilience and vulnerability in the context of socio-ecological change. They argue that resilience research takes a systems approach and looks at how people can adapt to change through learning and transformation. It stresses the ecological-biophysical relationships. Vulnerability research investigates the power dynamics that increase vulnerability to change and stresses the social-political dimensions. It is an actor-orientated approach. Both approaches are relevant to the socio-ecological systems model espoused by NLEIP. Miller et al. (2010) urge that researchers, practitioners and policy makers work together to develop an integrated approach "that address both the socially differentiated nature of responses to social-ecological change, and the environmental implications of investment in different coping and adaptation activities." (Miller et al., 2010 online). NLEIP provides a suitable platform for adopting this recommendation.

Schulze (2011) considers the impact of and adaptation to climate change of rainfed agriculture and livestock activities as are found in the Tsitsa Catchment. He proposes a number of adaptation strategies that include constructing small reservoirs and sand dams, accessing groundwater through boreholes, adoption of soil and water conservation practices, including water harvesting, and changing to drought-resistant crop varieties or changing the type of crop to meet changed climatic conditions. He also advocates the adoption of early warning systems to aid farm planning. He points to the need for advanced information on heatwaves as well as rainfall. More accessible and affordable loan facilities, ranging from commercial banks to micro-lenders, would reduce vulnerability in times of stress and would allow forward planning through investment.

Based on our experience in the Sinxaku Villages, specific actions that address resilience and vulnerability in the Tsitsa Catchment include the following:

- Land degradation is synonymous with desertification; rehabilitation increases water retention and water availability; therefore, rehabilitation is itself a strategy to increase resilience.
- Water harvesting and water retention practices increase garden productivity and provide increased resilience to drought. Roof tanks are a good way to increase household water security. Successful gardens invariably are those with sufficient rain water storage.
- Village taps are linked to groundwater but the pumps seldom work. Municipal workers need to be more effective in providing technical support, but trained local people could manage the pumps themselves. At present someone is employed to report problems but not to fix them.
- In the future the Ntabelanga and Lalini dams should prove a reliable household water supply, but only if connections are maintained.

Improving people's capacity to engage with the national weather forecasting system would increase their resilience as they would be able to plan ahead. Ziervogel et al. (2005) investigated the effectiveness of seasonal climate forecasts as a means to increase the planning capacity of small-scale farmers' in Lesotho. They found that the results varied with the household characteristics; that they had potential to decrease vulnerability to drought, but poor forecasts could be harmful. It is also necessary to adapt the forecasts so that they are suited to users' needs (Ziervogel, 2004). There is clear scope for NLEIP to build on this early research to test and develop the relevance of seasonal forecasts to small-scale farmers living in the Tsitsa Catchment.

Cattle auctions would provide an opportunity to sell off stock before drought conditions set in. This both increases the biophysical resilience through reducing veld degradation and reduces the vulnerability of the livestock owners to the ensuing drought.

Baudoin & Ziervogel (2017) stress the need to strengthen the capacity of local organisations that can support vulnerable communities. NLEIP has within its ambit the intention to strengthen the capacity of local organisations to address climate change impacts. Stronger local governance from the village scale up to the municipality would aid the capacity for proactive decision making.

Rodina et al. (2017) set out the following recommendations for research in order to "pursue more just and resilient water futures in highly unequal and water-stressed regions" (Rodina et al., 2017, p.26). These recommendations could be considered by NLEIP in their future research strategy:

"(1) place greater emphasis on the transformative potential of resilience,
(2) broaden the social dimensions of resilience to account more fully for intangible and other social factors,
(3) engage critically with the decision-making processes and practices of building resilience,

(4) contribute to the development of indicators and guidelines for building just and resilient water futures,
(5) strengthen the role of situated knowledges,
(6) critically engage with scale and boundaries in complex adaptive systems,
(7) strengthen the policy–science–civil society interface." Rodina et al. (2017, p.26).

Conclusion

There is clear evidence from research that global warming has already caused a change in climate, with a warming trend over the second half of the last century being identified. The effect on precipitation and water resources is more uncertain, but there is consensus that rainfall will become more variable and droughts more pervasive. This will have as yet unknown consequences for people living in the Tstisa Catchment. This section has highlighted the changes in temperature and precipitation that have been observed over the southern African region and summarised the outcomes of projected climate changed based on climate change models. Adaptation to and mitigation of climate change is addressed, with recommendations as to how NLEIP can assist in achieving this in the Tsitsa Catchment.

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Appendix 6: The Summary Report from the Special Session on Grazing and Fire (Science-management Meeting no: 5).

NLEIP Science-Management Forum # 5
December 2017, Rhodes University, Grahamstown
Report on special session: towards Fire and Grass management in SES context
6 December 2017
Compiled by Rina Grant

The rationale for this session was given as follows in the introduction (verbatim from .pptx):

Fire and natural grassland management since the advent of ecologically-advised management has an interesting, if controversial, history.

When a (at one time, perhaps still?) controversial approach made a potential appearance in NLEIP, this science-management meeting requested a discussion, suggesting perhaps even the formation of an ongoing group to discuss grassland and fire management.

Grassland and fire management is regarded as a keystone (by some a "make-or-break") issue.

Whatever is decided should obviously conform to the NLEIP vision's pillars (SES etc.).

Many of the members of this group are unaware or only partly aware of the history of these debates and are not up to speed with recent research and attitudes in this regard, and the group has not had a chance to have its own proper discussion in this regard. The extent to which "contested" approaches are actually being used, also needs clarification.

HENCE TODAY – TO HELP PERHAPS ALL "GET ONTO A SIMILAR PAGE"

This constitutes an opportunity to mount a meaningful joint approach in which there seems to be considerable interest.

Please refer to each of attached PDFs of the presentations in this session for more detail on the talks, as you need them.

The presentation programme was as follows:

Part 1:

Rangeland ecology and management. Dogma, paradigm shifts and doing the right thing (Vetter).

Historical fire/herbivory prevalence, resource availability and the Savory approach (Hawkins).

Sustainable veld management for livestock production (Kirkman).

DISCUSSION

Part 2: Useful additional info from other work:

- Optimal rangeland management in the Tsitsa catchment (Clark).
- Acknowledging and utilising the intrinsic diversity of African savannas (Grant).

Part 3: Towards making ecosystems work for a long time: Making the socio-economic explicit (Blignaut).

DISCUSSION, followed by information about a field trip in February, and choice of an interim co-ordinator.

Suzi Vetter introduced this session with an overview of the history and development of the grazing management debate. Insights have generally moved along a cycle of a new idea or insight from research that becomes the new paradigm, until implementers become aware of its limitations, after which the generality of the idea becomes discredited – i.e. no "one size fits all" but most ideas apply in particular contexts but often not in others.

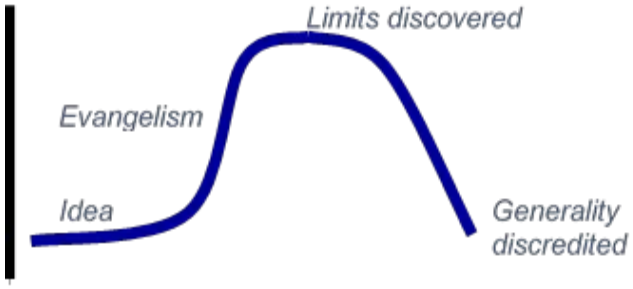

Figure 16: Reflections on IRC (Mark Stafford-Smith, 2003)

Following this cycle, new insights and ideas on management of grasslands started with a steady state model of succession of grass species towards a desired climax state. Over time, this model changed towards an ecosystem approach with the understanding of state and transition models, and the fact that rangelands have multiple uses, many not represented by the climax state. Over time, the ecosystem model was again replaced by the current resilience-based management model. The resilience model acknowledges the existence of novel states as well as the need for ecosystem services and the importance of providing services to human well-being. The debate around equilibrium and disequilibrium was part of this cycle and has received a lot of interest since the seventies. The balance of nature or equilibrium model saw the animals and plants in a balance – with too many animals causing degradation. The disequilibrium model describes the role of climate in controlling animal numbers overriding herbivore effects, with animals dying due to shortage of resources before they could cause degradation.

Approaches to grazing and fire management have varied over this time from very controlled, to more adaptable and "natural" approaches, acknowledging the importance of working with heterogeneity over time and space. The importance of key resources has been highlighted. Key resources are those resources that determine the chance of animals surviving during the dry period when no forage is produced. Although many management options have been explored with success, from high-density fast rotation to large camps with no rotation, it always seems that stocking rates matter and that plants need rest to survive over time. Fire is a natural driver of grasslands and savannas, but must be used purposefully and with care.

Heidi-Jayne Hawkins and co-authors looked at prevalence of fire and herbivory to help us think about appropriate management practices. Fire and herbivory both utilize forage, and high herbivore densities in the longer-term past reduced the incidence of fire. Following such historical trends, changing from fire-dominant to herbivore-dominant regimes is possible but very difficult. The systems have changed over time to adapt to fire as herbivore numbers declined. Woody biomass has also generally increased, and plant species composition has changed towards species that are adapted to

fire, e.g. species with thick bark. To be able to change once more to a more herbivore-dominant system may also be difficult because there is less variation in domestic animals than in wildlife, and an absence of large browsers and non-ruminant mega-herbivores

The presence of high herbivore densities in past millennia elicited the question of the use of high-density grazing systems (such as that of Savory) in our current management. The holistic grazing system was compared in one study to a four-camp system and a season-long grazing system. There were no differences in plant and patch selection of cattle, with the average daily gain slightly higher in summer in the season-long treatment being the only difference detected in production. The difference in cost to establish these different systems was not considered in the reported study, and herbivore densities were conservative in all treatments. The possibility that higher densities can improve production still needs to be examined.

Her closing message was that the use of fire and herbivory should be balanced using rainfall and nutrient status as a guide. Fire can also be used to promote herbivory if used strategically. Currently, Conservation SA are working with communal farmers using planned grazing as a tool in Meat Naturally. They have developed a rangeland restoration toolkit and a decision-making framework.

Kevin Kirkwood presented an alternative approach to rangeland management based on the Serengeti system. In the Serengeti, animals move on an annual basis. They spend the growing season in summer on the short, high-quality, palatable grassland in the south, where they drop their calves over a very short period. In winter, they move to the tall, high-quantity, less palatable grassland in the north, where the tall grasslands form a key resource. The reason for the preference of the short grass plains is that as grass matures, the cell wall content increases and the nitrogen levels decrease, resulting in a decrease in plant quality in taller more mature grass. The animals thus maintain the grassland in a short state by grazing the grass as soon as it is sufficiently high to utilize again. The result is that 85% of the short grass areas are used over the growing period. Hence, fires are small and not frequent.

We should also match seasonal supply and demand with livestock farming. In summer, we should use quality forage and ensure that it effectively overlaps with calving and mating periods. In winter, quantity is important and is provided by the taller, rested veld. We can use this approach for both moister and arid rangelands, using at least a two-camp or three-camp system. In the higher rainfall areas, one camp is rested during the growth season while the other is kept short and of high quality. The following year the rested camp is used for summer grazing and the camp grazed in the previous summer is rested. In the higher rainfall areas, this system will result in a camp resting every second year. In the low rainfall areas, three camps are recommended, with each camp of the three resting two out of three years. Such a system will ensure variability and resilience. Unplanned fire is a risk in the rested veld and should be taken into account. It is also important to keep in mind that in winter, quality declines even more in old lands than the veld in sourveld areas.

Rina Grant explored very similar ideas (and hence this summary description has been placed straight after that of Kevin Kirkman's paper) of quality and quantity, but on a much smaller scale, using the way wildlife utilizes the rangeland in the Kruger National Park as example. Herbivores create patches of short, high-quality grass by concentrating in certain areas – these have been dubbed FUPs or frequently used patches. These may be along footpaths, around waterpoints, sodic patches etc. As in the short grass areas of the Serengeti, animals utilize these patches for as long as there is green grass growth, and move off during the dry season. Many species utilize the patches, even large megaherbivores such as elephant, and browsers such as giraffe.

Even though the animals prefer the high-quality, short-growing grass, these small patches cannot provide sufficient quantity to satisfy the needs of all animals, especially larger animals such as buffalo, and they must meander between high-quality and high-quantity patches to provide their nutritional requirements.

We can use this type of knowledge in different grazing systems. In areas where it is not possible to divide rangeland into camps that can be utilized for a season, large unfenced areas can be used in the same way as herbivores do – they create high-quality spots in suitable areas, and complement these as needed with high-quantity spots. In communal areas where all the grazing is often turned into high-quality short grass areas in summer, other forage is required to allow animals to survive the dry season. Alternatively, animal numbers have to be reduced sufficiently and in time to allow the remaining animals to obtain a sufficient quantity of forage left from summer into winter. In the high-rainfall sourveld areas, fire can be used to create patches of short-growing grass. The extent of these fire patches should be kept to a (small enough) size that the animals can maintain in a short-growing state during the summer months.

Ralph Clark discussed how to move towards ecologically optimal rangeland management in the Tsitsa catchment. This catchment is a strategic water source area, a production landscape and is also rich in biodiversity and endemism. According to SANBI, rangeland management in this context should therefore consider water production, economic sustainability and biodiversity conservation. The Tsitsa catchment consists of two types of grassland: these are high-altitude grassland and sub-escarpment grassland.

It may (should) never be possible to implement a blanket top-down catchment grazing and fire plan. Rangeland research in the catchment should partner with a variety of rangeland managers (communal and commercial) to understand the complexities driving decisions around grazing and fire regimes, and plan adaptive management accordingly and co-operatively. There is a shortage of suitable studies on appropriate rangeland management in higher altitude areas and this needs to be addressed. Even the sub-escarpment is very complex, and one type of management will not fit all situations. The top-down general recommendation of SANBI for management, although intended as broad guideline, cannot be definitive at all scales and localities, as the system is too complex and heterogeneous. Managers must learn on the ground and try to use appropriate practice rather than just broad-scale “best practice”. It is also important to determine what people want in their area in terms of ecosystem services. We need to be modest in what we believe we know, keep learning in this spirit, and should not over-interpret results.

James Blignaut brought new and important insights towards making ecosystems work for in the long term. It is important to realise that the valuation of ecosystem services is not a commodification of nature, but actually a value judgement of human decisions. These important services are being valued in monetary terms as the best tool we have to do that. The provision of grazing is one of the most valued ecosystem services, being almost as important as water.

Rural economic development is an important goal and a huge task. The development of the (small/emerging) farmer is pivotal for development and for the future, but it is challenging. In the current economic climate there are many barriers facing the emerging farmer: biological issues, management issues, economic issues and institutional issues that need to be overcome and addressed. Stock theft has been one of these challenges; people often kraal animals to avoid stock theft, which negatively impacts the surrounding area and decreases forage time for cattle. Presently in communal areas, there are often only a few cattle owners, and most of the larger herds belong to individuals that make a living in the cities. Feedlots have become the preferred way in South Africa to

sell and finish off cattle for beef production. Thus, there has been more growth in beef production than in cattle numbers over the past decade. Most small-scale and communal farmers have difficulty entering this market, and production alternatives should be explored. We need to think about how to unlock the potential of animals in the such rural areas.

To develop rural areas, it is important to remember that people tend to avoid risky investments and so it is necessary to create a safe space to attract money there. Trust in and among the community is also essential to create a suitable environment for this development. To create this type of trust, towns must deliver basic services. Without such services, people will eventually leave, and trust for investment will decline further. The farmer plays a pivotal role in providing stability in these rural areas, and national security increasingly depends on these farmers as resources become threatened. It is therefore essential to keep rural communities functional, which means that these areas have to be sufficiently attractive for the youth to stay and work on the rangeland, or to be attracted back.

The vision of the Ntabelanga-Laleni (Tsitsa) catchment is to significantly improve the livelihoods of the local communities through job creation and improved delivery of ecosystem goods and services, as well as reduce the local residents' vulnerability to threats like climate change. Various models were used in Rozanne Bester's research to examine scenarios of possible change in the welfare of people with regard to various decision-making options, for example regarding various NRM options by DEA and farmers, as well as the effects of various management decisions on the different projected life spans of the dam.

James concluded that:

- Rural development depends on farmers and farming communities functioning well.
- Small beef producers are facing enormous challenges, exacerbated by rapid advances made in the commercial sector.
- The lower the level of development of the farming operation, the higher the environmental cost for farmer and country.
- Managing a system depends on a range of factors; we cannot isolate only one, such as the creation of the market. Just creating a market in isolation may worsen matters.
- Benefit forecasting for the two dams, if anthropogenic and biophysical feedbacks are neglected, will over-estimate the impacts of such benefits.
- Without embracing people in the system and endogenising plausible behavioural changes, mitigation could be wasted.

The General Discussion (after individual talks and in the two longer discussion sessions) can be taken together under headings and summarised as follows:

Institutional needs

We should try to ensure that DWS (and all other key stakeholders) attend these types of workshop, as part of ensuring that we involve all the key players in the in the catchment. There is a significant mismatch between institutions and on-the-ground leadership. We need to understand how to bridge this gap. Institutional failure is a huge problem and has to be reversed to solve the problems in the catchment. We need to understand just how these institutional problems can be overcome.

The South African experience seldom, if at all, included in international textbooks such as the 2017 one edited by Briske (2017), and their use is limited as there are huge differences in our areas. We

need for a homegrown equivalent synthesis that incorporates local ecological knowledge (LRK) or IKS (indigenous knowledge systems) that pertains to cattle and fire management.

Forced pest control measures, such as the control of East Coast Fever, played an important role in some of the erosion problems of the catchment. Animals had to be dipped regularly and were forced to walk up and down mountainous terrain on a weekly basis, causing erosion along their paths, and compromising animal condition. With the possible changes in distribution of disease vectors with climate change, we may well be faced with similar problems, something that should be kept in mind when thinking about alternative management systems, and planning future research.

Community structure

The structure of local communities has changed profoundly (e.g. age distribution) and we have to think new of how to address the consequences. We also need to clearly understand the dynamics between the individual and the collective in terms of behaviour.

The dams and water infrastructure development

The estimated cost of building the dam and the projected benefits are not balanced. The cost of the dam/s will probably not be recovered in the period before it/they are silted up, even if we lengthen this period slightly. We need to link the building of the dam and production around it, with behavioural change, to avoid premature sedimentation.

Cattle management

Marketing

What are the alternatives to the present marketing systems? At this stage, most animals in the mainstream system in South Africa go through the feedlot system or else are marketed as class 3. However, many of the communal animals are marketed locally and do not reach the formal market. In such circumstances, the return on these animals can be 100% of the selling price as there is often no money lost to intermediaries such as agents. Many communal cattle farmers (especially bigger owners) do not depend on selling cattle for an income, although livestock is still seen as a form of wealth. Older people living in the catchment see cattle as a direct medium of exchange, while younger people see cattle as cash. From a production perspective, these animals need to be able to be marketed. Small stock may improve resilience and have other benefits; diversification is good.

Improved grazing management will benefit the owners as buyers are prepared to pay higher prices for animals in good condition. Sales are a small part of the range of purposes cattle serve in communities – they are also kept for ploughing, manure production, status and many other reasons.

Grazing management

Grazing management strategy must fit into the larger system. We have to understand the needs of the larger cattle owners and work with them, as they are key to adjusting cattle management as needed. They are also able to create related jobs.

Animal numbers should be adjusted according to production potential, and it is important to ensure that there is enough forage from production in the summer through until the next summer.

In some highland grass areas such as the Drakensberg, certain patches are clearly heavily grazed throughout the year, and some of these areas indeed handle this high grazing pressure sustainably.

Historically in communal areas, fodder banks were available for winter use, as people moved animals to the mountains in summer and back to the lowlands in winter. This type of system is still used widely in some communal areas. Unfortunately, in others, the animals stay in the high-quality areas in the lowlands during summer, and stay on there in winter because people are disinclined to use the high, cold exposed mountains in winter. They also prefer to graze the old croplands in summer, which are mainly in the low-lying areas, because grazing quality is higher then. This results in few forage resources in the lowlands in winter. Where no upland and lowland areas are available to rotate grazing, temporal variation can be used to create summer and winter forage. In some ways, this is easier with only one type of area that needs to be divided for use in the plan.

Rehabilitation

The rehabilitation of gullies and cleared areas was not touched on in this session as this is often seen as separate from management of livestock. Exposed areas can be re-seeded but this is a lengthy and difficult process. Kraaling of cattle is another option for rehabilitation, as animals fertilize and seed areas where they are kraaled. The most important aim for rehabilitation is to get basal cover back, more so than worrying about particular species establishment.

Areas in very erodible soils should be handled with particular care and it is important to keep the ground cover optimal to avoid high runoff. The models for sedimentation and grazing should be tested in different soils, and particularly in highly erodible soils if there is to be grazing, to avoid further degradation.

Fire

The role of fire should be kept in mind, as it can create quality grazing. If the areas around homesteads are going to be used as winter resource areas, this large biomass around the homesteads will increase the fire risk. We also need to consider how to persuade some farmers not to just burn “haphazardly” as sometimes happens when they want to burn veld simply to destroy ticks, rather than to create better grazing. We therefore need to devise together when is the best time to burn and how to select priority-grazing areas.

Future research needed

Future research may help understand how the quality-quantity approach can be operationalised throughout the catchment, just how feasible doing so might be, and at what focal scales. How would we use rehabilitation to augment production and improve the grazing range? How can such improvement be maintained? Interest must be triggered to develop ideas from this workshop. UCPP are already implementing some of the ideas in a 20 000 ha area. Research also needs to inform the prevention of erosion caused by cattle/livestock paths. At this stage the suggestion is that when animals go into the highlands, they stay there as long as possible to avoid wearing the depth of the animal paths. The effective use of old lands needs particular investigation, as they cover a large area and are generally impoverished.

There were repeated calls to investigate the potential for livelihood diversification strategies to supplement livestock management, especially for the vulnerable households. Connected to this, research is necessary into how to improve the value chain for livestock production (as well as complementary livelihood diversification efforts), with a specific understanding of the SES context. This may become a balancing act between advocacy and certification efforts. The call was for multiple approaches to reverse the migration of youth to the urban centres.

The value of appropriate baselines and a sensible monitoring system was also highlighted.

The way forward

It is important for a group, such as the one envisaged in this session, to work towards improved livelihoods by looking at the rangeland challenges of communal areas, considering all the various factors discussed above. The catchment has a varied rainfall, and this should be taken into account when recommendations are made. The historically, and still mainly, white-owned commercial farming area in the upper catchment should not be ignored, as these farms are mostly in the high-altitude grasslands that are important for biodiversity, and constitute the area producing most of the catchment's water. Plans for land reform in this part need to be carefully factored into the planning.

Suggestions for the way forward based on an interpretation of the most important points for the fire-grazing working group. The following activities would provide the starting point:

- Find out how to also make contact with the large cattle owners, (irrespective of race or sector) and determine their needs and expectations. The purpose of any resultant workshops should be to determine how behaviour around cattle management could be collaboratively changed to address the livelihood challenges, as well as the problems with erosion.
- In the appropriate forums, determine how the various communities use fire and how much they feel they understand about controlling it. This is important in order to be able to collaboratively work out how fire can be used to create high-quality grazing, balanced with and avoiding fire risks.
- To address the issue of grazing management, it is important to determine how feasible it would be to implement a simple rotation system where animals spend the growing season in areas where they can create and maintain short grass in summer, to allow sufficient forage to be saved to maintain animals on lower-quality, high-quantity grazing in winter. It is also important to determine how such a system could be implemented. Would it be possible to implement such a system with herders? How would they be rewarded? Will fences be needed? How can the market be accessed if owners want to sell animals?
- Erosion around footpaths of cattle (and small stock) moving between high and low-lying areas was highlighted as a big concern in the workshop. It is important to determine how this can be addressed and yet serve the needs of the community and their animals.
- In many of the communal areas, degradation is a concern as this leads to soil loss and erosion. It would be very helpful to look at practical and easy ways to determine when pastures are moving towards a state of degradation, and to determine whether the pastures improve after implementing rehabilitation measures. It would be very advantageous if community members could be trained to do the monitoring. The landscape assessment method of Tongway is a possible monitoring system that might be helpful here.

References:

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Appendix 7: Executive Summary: NLEIP Stakeholder Analysis Part 1 (Sisitka et al. 2016).

This stakeholder analysis is premised on the vision for the NLEIP articulated in the document "Collaborative Programme for Improved Management of the Upper Tsitsa Landscape", which seeks to identify in some depth the stakeholders currently active in the Ntabelanga sub-catchment, with a brief survey of those in the Lalini sub-catchment. A recurring theme in the report is the relationship, often contested, between the Department of Environmental Affairs: Natural Resource Management (DEA: NRM) project, the NLEIP, and the Department of Water and Sanitation (DWS) project to construct two dams in the area. There is a strong connection between them, although each project is currently operating relatively independent of each other. The latest information from senior management in the respective departments concerning both projects is that: a) The dams are likely to be constructed, once suitable funding mechanisms have been finalised, and b) that the NLEIP will continue irrespective of the progress with the dams' project.

It is important to note that this report, together with its associated Excel database of key stakeholders and the GIS layers illustrating the geographical locations of most activities and actors, represent only a partial snapshot at this moment in time. As new developments emerge and new stakeholders come into the frame there must be constant updating of this information. There is every chance that some important stakeholders who are currently active may have been omitted (together with their activities), and the authors welcome any input in this regard to complete the picture.

A key component of this analysis has been assessment of the effectiveness of various levels of collaboration between stakeholders, and an identification of where this collaboration appears strongest. The groupings within which ongoing collaboration is most consistent are identified as Networks (those relating to the DEA: NRM NLEIP, and the DWS dams project), and Clusters, which is geographically located collaboration, mainly between the District and Local Municipalities, Traditional Authorities (in the communal areas), private landowners and commercial farmers (in the commercial sector), and provincial and local government departments, with the additional involvement in some cases of national government departments, researchers and consultants. The composition of and relationships within and between these Networks and Clusters are analysed in some detail.

Further explorations include the areas of decision-making: who makes decisions concerning land and natural resource use and management in the different sectors within the study area – and of knowledge and ownership; what kinds of knowledge are involved in such decision-making, who holds this knowledge, and how is it shared? Central to these questions is the issue of communication and how effective this is between the many different stakeholders.

NLEIP Ntabelanga/Lalini Stakeholder Analysis 2

One of the critical findings of the analysis is that, at present, the people living in the area, particularly in the communal sector, remain in considerable ignorance of both major projects, although this does vary according to individuals and to the geographical positioning of different groups. For the NLEIP, the challenge is to bring the local residents and their elected and traditional representatives into a more central position with regard to the decisions being taken about the management of their land.

The broad outcomes of the analysis point to quite a complex picture involving a large number of stakeholders with varying interests in and perspectives on the various activities taking place in the area. This leads to a situation in which, although there is strong collaboration supported by effective communication between certain stakeholders, these often operate in relative isolation from other

stakeholders. While the Networks and Clusters have some overlaps between them, they are not currently functioning in any well-coordinated fashion. The main message from this for the NLEIP is that there needs to be considerable strengthening of relationships and collaboration to achieve the vision of a sustainably managed catchment, and this will require a very clear focus on improving communication. Only such improvement can create more genuinely participatory decision-making, and the knowledge-sharing essential for equable decision-making take place. The recommendations (Section 9), which have come out of this analysis, focus strongly on means to strengthen relationships and collaboration through improved communication and more pro-active involvement of local actors.

Appendix 8: The Tsitsa Project – an Overview (glossy brochure ver1)

AN OVERVIEW OF

THE TSITSA PROJECT

environmental affairs
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University of Fort Hare
Together in Excellence

Restoring land and water in the Tsitsa River Catchment, Eastern Cape, South Africa.

Shifting our approach to use governance principles that include the voices of resident communities.

The Tsitsa Project is a novel approach to restoring and managing land and water sustainably in the Tsitsa River Catchment

The idea for the Tsitsa Project (previously known as NLEIP*) was born when two dams were planned on the Tsitsa River – provisionally called the Ntabelanga and Lalini Dams. These dams are a key part of the Mzimvubu Water Project and intended to supply water to communities as far away as Mthatha and to irrigate an area near Tsolo. However, key parts of the Tsitsa Catchment (~494 000 ha) are degraded, posing the possibility that the dams will fill with sediment and silt within a few decades. The solution? Repair the catchment by restoring the landscape to prevent the silting and, at the same time, improve the livelihoods of the people who live there.

Since its beginning in 2014, the Tsitsa Project has grown considerably and now aims at developing and managing both land and water in a sustainable way. Sustainability involves improving the land, the water, and the lives of the people who live in the catchment. The project approach has been different from most other, similar projects because:

- it deliberately seeks out the community's ideas and participation as a starting point;
- it recognises that physical, biological, human and social factors are inextricably linked together and;
- it recognises the importance of collaboration and knowledge sharing in achieving successful natural resource management and sustainable land management.

Many development facilitators have started from this point and recognise how much background work, how many meetings and how much effort it takes to implement a programme based on these starting points. At the time of writing (late 2018), we feel we have made a good start and are gradually building trust and are optimistic about improved collaboration.

*Ntabelanga and Laleni Ecological Infrastructure Project (NLEIP)

Figure 1. A Participatory Mapping workshop held with the Lower and Upper Tsitsana traditional council, where the participants outlined their land use (left) and prioritised their top natural resource problems for intervention (right). This mostly included alien invasive species, erosion features and overgrazing.

We have held many meetings, especially in the communal part of the upper Tsitsa catchment. The active participation of the residents help to build trust, collaboration and optimism. Without their input, the project would be unsustainable. [1, 2, 3, 4]

Everyone who participates brings specialist knowledge to share with the whole group: NGOs, national, regional and municipal officials, senior traditional leaders, community representatives, scientists, students, commercial and subsistence farmers and businessmen, all of whom have something to contribute to building a comprehensive picture of the catchment, an understanding of the problems, and ideas for solutions. Working together – sometimes with a project liaison or engagement officer to assist with avoiding and clarifying confusion and listening to the wide range of knowledge the participants bring to meetings - builds respect and trust.

The project makes a special effort to skill participants in ways of thinking, planning and acting together. Sustainability depends on the interest and empowerment of local residents, and on the continued presence of the other 'experts' to help us all adapt to a changing world.

Project role-players and expectations

What can catchment residents and participants expect?

The project is soon to appoint a permanent catchment co-ordinator and ten or more local catchment liaison officers to strengthen ongoing community and involvement. Ideally, a catchment co-ordinator could be based in Maclear, a major base for catchment activities, and the catchment liaison officers should be deployed throughout the catchment area. They would act as on-the-ground ambassadors between government and residents.[5,6] Already, one of the tasks carried out by selected local residents is sediment monitoring (Figure 2), a task that could extend to other useful monitoring such as that of water quality and veld condition.[7]

The next important step to sustainability is establishing a **Land and Water Forum** of all role-players, which will seek to produce a **Participatory and Integrated Land Management Strategy** to turn the vision of the project into reality.

The Tsitsa Project vision is:

"To support sustainable livelihoods for local people through integrated landscape management that strives for resilient social-ecological systems and which fosters equity in access to ecosystem services."

Local and district municipalities, industry, NGOs and other local role-players will be involved. Although such meetings are focused on the Tsitsa area at present, they will extend to other nearby catchments with similar challenges, and to government, and even to potential international funders. [6]

Figure 2. Demonstration of citizen-science monitoring of sediment during a Wisdom Trust meeting to the catchment.

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Scientists and postgraduate students (mainly from universities in the Eastern Cape: Rhodes, Fort Hare and Walter Sisulu) and others including Free State and Pretoria Universities will continue to be involved. Research has been established as a sub-component of the project for many years, and two Science-Management Forums are held annually. Now the project is broadening out to share knowledge with society at large.[5, 6, 8, 9]

The Department of Environmental Affairs, partnered by the Department of Science and Technology and the Water Research Commission started the Tsitsa Projects. Prior to the projects inception, the Expanded Public Works Programme teams (Working-for-Water, Working-for-Ecosystems, Working-on-Fire, Working-for-Wetlands and Working-for-Forests teams) took a significant early lead in rehabilitating the catchment. Through their implementing agencies, ways will be found to promote the entrepreneurship necessary to sustain the slow, careful work of restoring and protecting the landscape and rivers so that they support better human health and prosperity. [10]

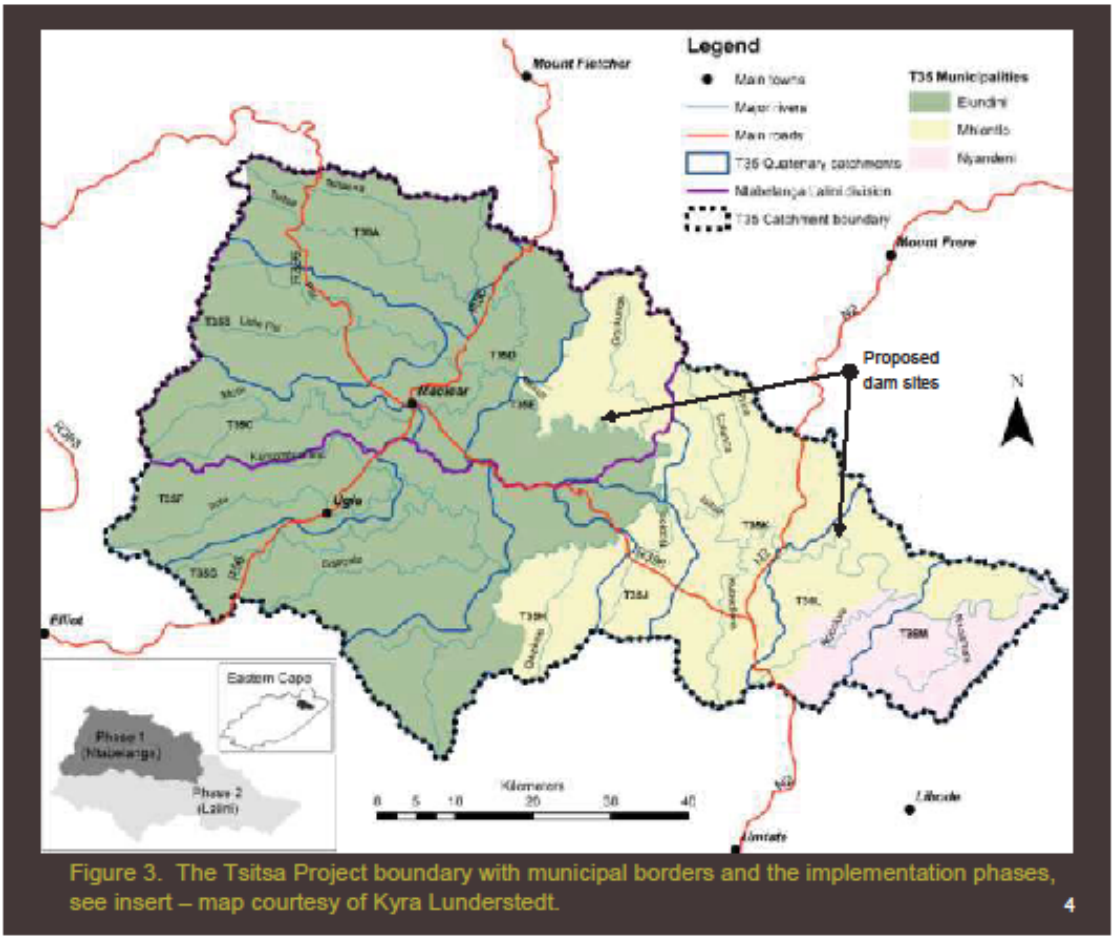

Figure 3. The Tsitsa Project boundary with municipal borders and the implementation phases, see insert – map courtesy of Kyra Lunderstedt.

Collaborating a way forward

Real community engagement deepens democracy and sustains progress. The Tsitsa Project aims to give stakeholders and rural residents the level of representation and skills to manage the natural resources, improve the quality of their lives, and foster a culture of inter-generational equity.

Many parties and funders play an essential role in the ambitious attempt by a large group of people and organisations passionate about proving that collaboration and effective co-operative governance is possible. Working together meaningfully like this takes time; trust is not built overnight, nor are new skills picked up immediately. For this reason, we seek longer-term ways to support and sustain this resilient behaviour.

We hope that the on-going learning built into our approach through knowledge sharing and collaboration will keep us on an adaptive pathway to achieving our aspirations in an ever-changing world.

Photo credits:

Nosi Mtati: front and back cover & house, pg 2 footer, all pg 3 & pg 5 top left, top right & bottom left.

Kyra Lundersiedt: pg1, fig1, Aloe pg 5.

Margaret Wolff: pg5 top centre, middle left & bottom centre.

Sentinel. Pg.5 satellite image.

Mike Powell: pg1 flower & pg6.

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1 Fabricius C, Biggs H & Powell M. (2016). The NLEIP Research Investment Plan.
2 Biggs H (2018). The Tsitsa Project – Research and Praxis Investment Plan (ver2)
3 Wolff M, Palmer CG & Mtati N (2019). The Tsitsa Project – Community Engagement Plan (ver1).
4 Lunderstedt K, Mtati N, Ntshudu M & Powell M (2017). Participatory Mapping reports from Ntabelanga traditional council areas (Series).
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7 Bannatyne LJ, Rowntree KM, van der Waal BW & Nyamela N (2017). Design and implementation of a citizen technician-based suspended sediment monitoring network: Lessons from the Tsitsa River catchment, South Africa. Water SA, 43(3): 365-377.
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9 Botha L (2017). NLEIP PMERL Framework (ver1).
10 Van der Waal (2017). The Tsitsa Project - Restoration Plan (ver1).
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Additional material
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Clifford-Holmes JK & Bester R (2018). The relevance of systems thinking and systems modelling to the Tsitsa Project (ver.1).
Rivers N, Burt J, Ntshudu M, Mtati N & Lunderstedt K. (2018). Lalini Rapid Stakeholder Analysis Report.
Rosenberg E (2018). The Tsitsa Project - Opportunities to Invest in Monitoring and Evaluation or the Participatory, Monitoring, Evaluation, Reflection and Learning (PMERL) Approach (ver1)
Rowntree K (2017). Opportunities for improving livelihoods through landscape greening in the Tsitsa Catchment: Reflections on lessons learnt from Water Research Commissions Green Village Project.
Sisitka L, Ntshudu M, Hamer N & de Vos. (2016). Ntabelanga (Laleni Stakeholder Analysis Report.
The Tsitsa River
For further information and access to project resources, please contact the Knowledge Management coordinator k.lunderstedt@ru.ac.za
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DISCLAIMER

This brochure has been reviewed and approved by the Department of Environmental Affairs: Environmental Programmes – Natural Resource Management Programmes. Directorate – Operational Support and Planning.

Approval does not signify that the contents necessarily reflect the views and the policies of DEA, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

The research has been funded by the Department of Environmental Affairs: Environmental Programmes – Natural Resource Management Programmes. Directorate – Operational Support and Planning

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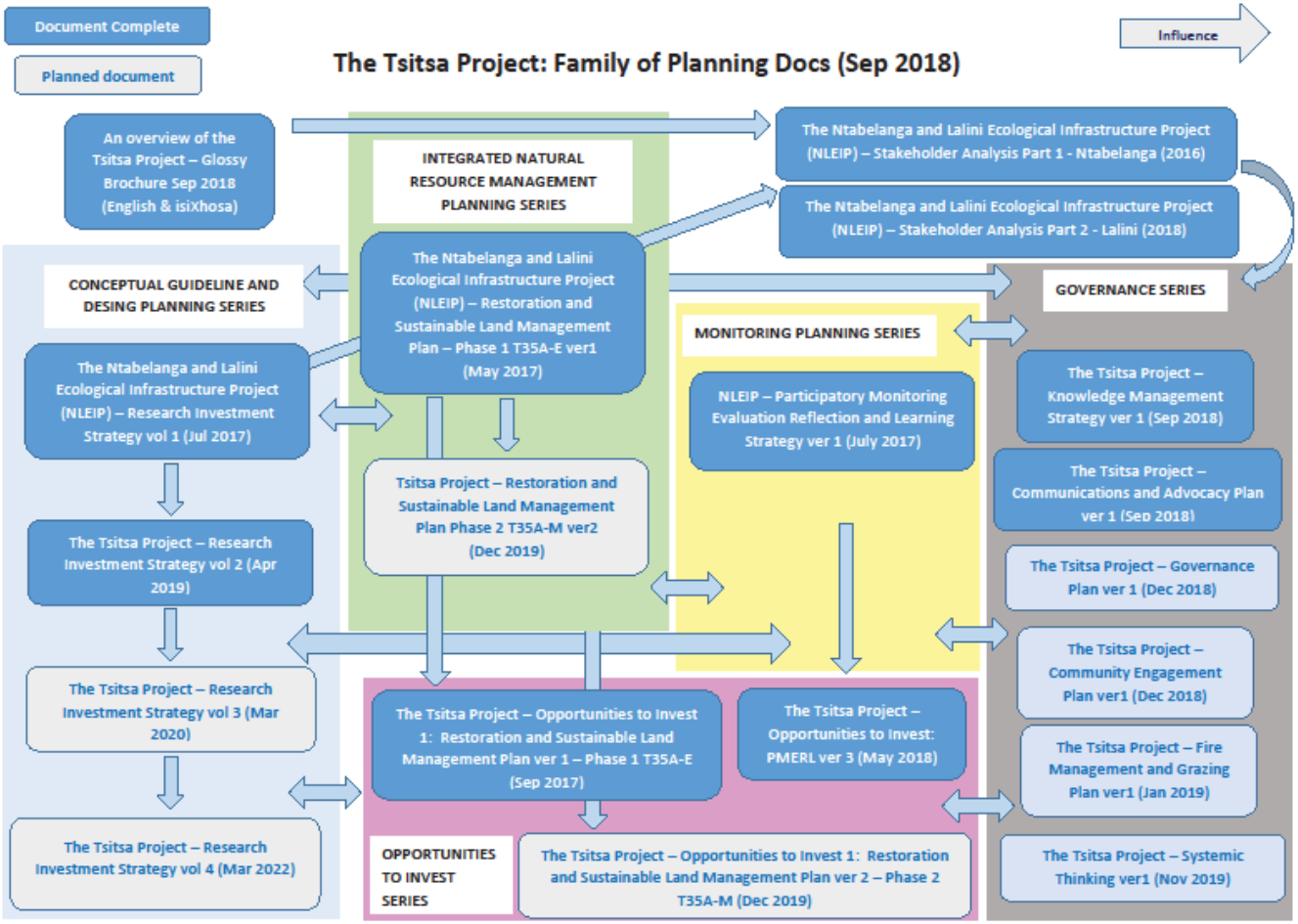
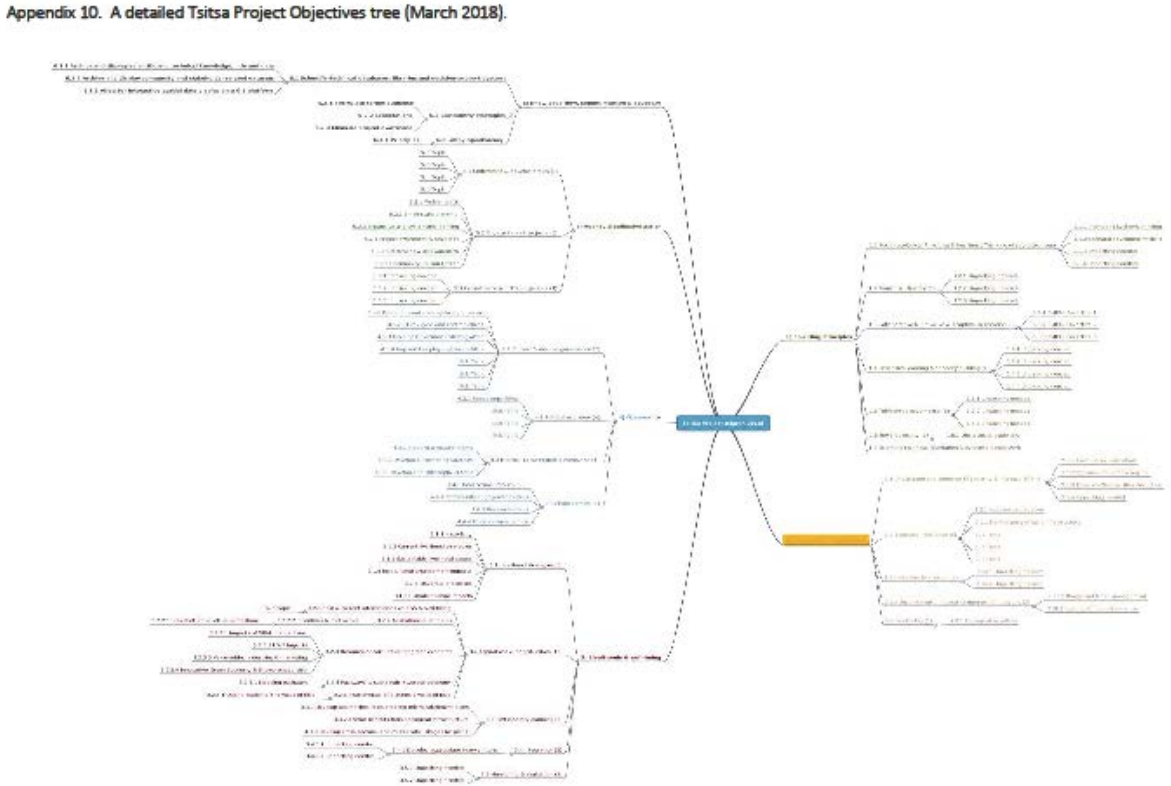
www.tsitsaproject.org (in development)

Appendix 9: The graphic representation of the Tsitsa Project family of documents



Appendix 10: A detailed Tsitsa Project Objectives tree (March 2018)



Appendix 11: Executive Summary: Rapid Stakeholder Analysis – Lalini (April 2019)

Executive Summary: Lalini Rapid Stakeholder Analysis Report

TSITSA PROJECT

Nina Rivers

April 2019

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The research has been funded by the Department of Environmental Affairs: Environmental Programmes – Natural Resource Management Programmes. Directorate – Operational Support and Planning.

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Executive Summary: Lalini Rapid Stakeholder Analysis Report

Nina Rivers

PROJECT SUMMARY

The Lalini Rapid Stakeholder Analysis Report is an analysis of the opportunities and challenges of working with different stakeholder groups in the Lalini sub-catchment of the Tsitsa River catchment. The overall need to identify key stakeholders in Lalini is to ensure their meaningful participation in developing and implementing local-level land use and integrated natural resource management plans in line with the DEA-NRM's Tsitsa Project in the Eastern Cape.

This research has been conducted as a rapid, provisional inventory of relevant stakeholders, their institutions and contemporary power relations and interactions with the natural resource base, at the scale of individual villages in Lalini.

BACKGROUND

The national Department of Environmental Affairs: Natural Resource Management branch (DEA: NRM) launched the Tsitsa Project[1] in 2015. The objective of the Tsitsa Project is two-fold: to rehabilitate areas where necessary and improve the land-use and management practices within the components of the T35 sub-catchment impacting on the proposed building of two dams in the catchment. It is within the Tsitsa Project that a rapid stakeholder analysis of Lalini was commissioned by DEA: NRM.

This study builds on the main findings of the first stakeholder analysis conducted in the Ntabelanga sub-catchment in 2016 by Sisitka et al. (2016). Although Ntabelanga and Lalini are different they are similar in character and many of the findings for Ntabelanga are true for Lalini, with a few exceptions which are elucidated below and in the Lalini report.

RESEARCH APPROACH AND DELIVERABLES

A qualitative research approach was employed in order to collect data. This included document analysis (desktop study), semi-structured interviews and spatial mapping workshops with various stakeholders.

Research activities:

- Initial identification of key stakeholders through Tsitsa Project team.
- A desktop study to identify key institutions, informed by initial interviews with key informants.

[1] In the Lalini stakeholder analysis report, the Tsitsa Project is referred to as the Ntabelanga Lalini Ecological Infrastructure Project (NLEIP), as it was named at the time of reporting.

- Four week-long field visits to the Lalini sub-catchment. Meetings were held with stakeholders on the ground, namely community leaders, chiefs and headmen, ward councilors, local and provincial government officials and research institutes.
- Three, one-day field visits to East London, Bhisho and King Williams Town to meet with provincial government officials.
- Numerous telephonic and Skype discussions with government officials, research institutes, consultants, NGO representatives and others involved in the catchment.
- Four GIS mapping workshops facilitated with four different traditional councils to map respective headmen and sub-headmen boundaries in Lalini.
- Development of a stakeholder database (Appendix 2) translated into GIS format. The database is by no means exhaustive and needs to be updated regularly.
- Attendance at the December 2017 and May 2018 Tsitsa Project Science Management Meetings to present research findings.

Deliverables:

- A desk top study of key institutions and relationships
- Local level governance map of four traditional council areas in Lalini sub-catchment
- An annotated database of institutions, key contact person, contact details and their links to the resource base in a geo-referenced format that can be imported into an ArcView Geographic Information System
- Final rapid stakeholder analysis report, addressing the key research questions and including a social–ecological network analysis and diagram.

LALINI CONTEXT

Lalini falls within the Umzimvubu-Tsitsikamma Water Management Area which is predominantly situated within the Eastern Cape Province, with a small portion in Kwazulu-Natal. Many dispersed homesteads and small villages dot the hillsides and valleys in this sub-catchment. Land tenure in Lalini is much the same as in the Ntabelanga area with land in towns generally characterised by freehold tenure and communal tenure in the rural areas. The local economy is characterised by high levels of unemployment and low levels of skills and household income. Lalini is still strongly dependent on agriculture and livestock farming. Large areas have been developed under cultivation (commercial sector) but in many communal areas, either the terrain, soils or rainfall are not favourable for cultivation. Large-scale commercial forestry operations in Lalini are also an important source of income for individuals. Residents in rural areas also rely on natural resources for various household needs.

From this brief contextual profile, Lalini is similar to Ntabelanga and other parts of the rural Eastern Cape in that it faces many of the same socio-economic challenges such as poor infrastructure and investment, high unemployment and low levels of skills and education. It is therefore important for the Tsitsa Project to keep this in mind when working in this context.

KEY FINDINGS OF STAKEHOLDER GROUPS

The Lalini and Ntabelanga sub-catchments are very similar in character with two primary differences. The first significant difference is that, in line with the Tsitsa Project's phased approach, much more attention has been focused on Ntabelanga in terms of research and implementation than in Lalini. This was evident as very little was initially known about local stakeholders and institutions before the analysis. Depending on resources available to the Tsitsa Project, the project may want to continue focusing on one sub-catchment at a time rather than engaging with a second without adequate

resources. In time however, the Tsitsa Project's focus will have to shift to Lalini in order to truly understand and engage with local actors in this sub-catchment.

Fluid Traditional Authorities (TAs)

The second marked difference between the two sub-catchments is that traditional authorities in Lalini seem more fluid and, at times, fractured than in Ntabelanga, with independent pockets of headmen and chiefs emerging within the boundaries of other TAs. This fluidity presents a challenge to the Tsitsa Project of keeping pace with the positions and roles of key stakeholders. There is also a high level of mistrust by some TAs of outsiders due to unmet expectations and promises in the past. Relations between TAs and local and district municipalities and provincial departments vary, but on the whole both authorities acknowledge they need to work together. TAs are eager and expect to be involved and have a voice in initiatives that will impact their livelihoods. The challenge for the Tsitsa Project will be to find a way of engaging with a representative enough sample of TAs, as there are many (17 in Lalini alone), and maintain strong and continual engagement with these authorities despite the large area.

Local structures

The research team found active community based projects within some of the traditional areas, such as food security and home food gardening initiatives and sewing clubs and women's groups. There are many burial societies in most villages which are stokvels[2] of sorts which enable families, who would usually not have the means, to bury deceased relatives. These societies act as a safety net for community members. As the Tsitsa Project invests more time in Lalini, perhaps more of these local structures will emerge.

Agricultural sector

The agricultural sector, both commercial and emerging, face similar challenges to those in Ntabelanga in terms of poor infrastructure (lack of electricity, service roads, fences etc.) and seeking to obtain additional water licenses from DWS. Relationships proved to be friendly and helpful between the two farmer groups, with strong knowledge sharing networks regarding agricultural practice. Existing networks like farmer associations are potential opportunities for the Tsitsa Project to engage more intensively with this group.

Government departments: local to national

With regards to government departments from the local through to the national, under-capacity, poor horizontal and vertical communication, poor integration between programmes, lack of coordinated legislation and directives, lack of funds and the politicized nature of some municipalities are the primary challenges. In order to work with these challenges, the Tsitsa Project will have to make a conscious effort to engage with as many people as possible, from national government departments to local programme units, in order to encourage collaboration around a shared vision for the Tsitsa catchment.

Private sector

There are several private sector stakeholders operating within Lalini from commercial forestry operators to environmental consultants. In terms of relational tensions, one of the main findings was that some farmers see themselves in competition for water licenses with the commercial forestry sector and some local municipalities see commercial forestry as hindering new market entrants as most raw material is committed to large commercial operators. In terms of building relationships with different stakeholders, Environmental and Rural Solutions (ERS) have been working in the broader area for many years and have a strong working relationship with stakeholders across sectors on the landscape. ERS is also the

[2] Stokvels are informal financial associations where members pool financial resources together in order to save and invest.

secretariat of the Umzimvubu Catchment Partnership Programme (UCPP), a successful and active landscape forum.

Research institutes

The Tsitsa Project has a strong research focus with the intention of developing a coherent research strategy and therefore a coherent implementation strategy and plan. In line with the phased approach of the Project, research institutes have focused most of their attention on the Ntabelanga sub-catchment and in time will need to focus on Lalini. At the time of reporting, the academic institutions involved included Rhodes University, University of Fort Hare, University of the Free State, Walter Sisulu University, University of KwaZulu-Natal and the Council for Scientific and Industrial Research (CSIR). All these are active partners or seek to be more involved in the Tsitsa Project and a strong foundation is being laid for better coordination between the Tsitsa Project, researchers and implementers.

Dearth of non-governmental organization presence (NGOs)

Both stakeholder analyses (Sisitka et al. 2016 and Rivers et al. 2018) identified a lack of NGO presence within both sub-catchments, with most civil society actors operating out of Matatiele (north Eastern Cape). Civil society organisations are important actors in a landscape as they work closely with, and are therefore able to mobilise, a vast spread of stakeholders. To this end the Tsitsa Project has already made inroads into linking into the successful and dynamic Umzimvubu Catchment Partnership Programme (UCPP), which holds a similar landscape vision and goal for the area.

Stakeholder engagement challenges

Truly collaborative stakeholder engagement is never an easy task. A prominent challenge noted by both government and NGOs is not only being able to work with a representative sample of stakeholders but also maintaining the interest and commitment of stakeholders over an extended period of time, especially in the case with restoration programmes that have a long life span. A suite of logistical challenges also make effective stakeholder engagement difficult and include the large spread of people across the catchment, poor infrastructure, lack of civil society organisations, engaging certain interest groups and limited resources to bring people together. The Tsitsa Project will need to keep these challenges in mind when seeking to engage with stakeholders in Lalini.

STAKEHOLDER NETWORK ANALYSIS AND RECOMMENDATIONS

The different stakeholder groups presented above are done so in relatively neat and separate groups whereas in reality it is a lot more complex and can be thought of rather as what Burt and Munnick (pers. comms. 2017) term as a constellation of stakeholders. In this constellation, people are always overlapping in their roles, mandates and the rules that guide them. These groups cannot therefore be understood as static at all, but ever changing.

Figure 1 below illustrates the relationships and power dynamics between stakeholder groups as identified in the Lalini sub-catchment at the time of reporting. The concentric circles are levels of governance: local, district, provincial and national. Some stakeholders may operate across all four levels and some may only operate at one or two levels.

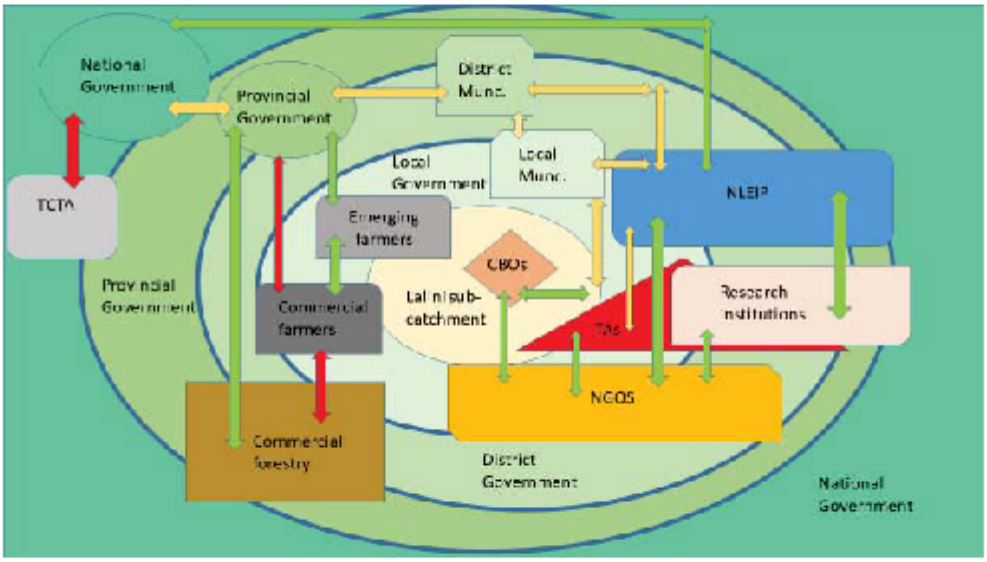

Figure 1: Network diagram of relationships and some of the power dynamics between stakeholder groups in the Lalini sub-catchment.

The arrows between stakeholder groups are indicative, albeit in a rather crude form, of some of the prominent power dynamics between stakeholder groups. Green arrows indicate a relationship that is generally either strong, dynamic or active, with regular communication between the two stakeholder groups. Yellow arrows indicate a more neutral relationship that may be quite weak with little communication between the two groups or may even be slightly strained. Red arrows indicate a relationship where there is either a complete breakdown of communication, mandates are not communicated properly or there is tension between the two groups. The diagram below is of course unable to capture the nuances of each relationship as there are always strengths and weaknesses to any relationship which are detailed in Section 2.2 of the full report.

A second stakeholder diagram (Figure 2) illustrates the current strength of relationships the Tsitsa Project has with the above stakeholder groups and potential opportunities or avenues of engagement for the Project with these stakeholders. National and provincial government departments, NGOs, research institutes and private sector/consultancies are depicted in close proximity to the Tsitsa Project as they are already active in their engagement with the Project. Local actors such as traditional authorities, farmers, local and district municipalities and private sector actors are depicted in the outer circles or a further distance away from the Tsitsa Project hub as these stakeholders still need to be drawn in closer to Project activities.

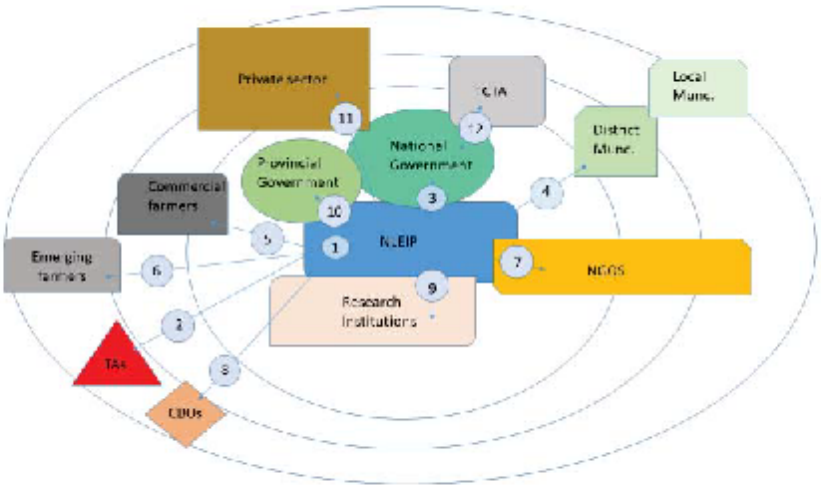

Figure 2: Current strength of relationships the Tsitsa Project has with stakeholder groups and potential opportunities or avenues of engagement for the Tsitsa Project with stakeholder groups.

Sisitka et al. (2016) referred to these 'inner' and 'outer' circles of stakeholder groups as 'networks' in relation to the two national government headed processes, and 'clusters' in relation to the more local, daily interactions of local stakeholder groups. The Lalini research team have found and agree with Sisitka et al. (2016: 59) that these local actors need to be more included in the Tsitsa Project programme as "....these actors not only possess vital forms of knowledge which should make considerable contributions to the work of the Tsitsa Project, they are also involved in the day-to-day decision-making regarding land and natural resource use and management."

To this end, several recommendations or avenues of possible engagement for the Tsitsa Project are provided, indicated in the numbers and arrows radiating out from the Tsitsa Project to each stakeholder group:

1. *Tsitsa Project (NLEIP)*: The Tsitsa Project has harnessed much expertise within the programme already. Increased alignment between the working groups will increase the programme's momentum and synergy.

2. *Traditional authorities (TAs)*: The Tsitsa Project acknowledges that it needs to work in close partnership with TAs and needs to work carefully and consistently in nurturing partnerships in the Lalini area. Although it takes some time to map headmen boundaries, some TAs are very enthusiastic about having their areas mapped. Providing TAs with these maps is a good opportunity for the Tsitsa Project to give real value back to communities for their time and partnership.

3. *National government departments*: The Tsitsa Project is already closely engaged with many national government departments and programmes such as the Working For programmes which offer opportunities for integrating programmes and for the Tsitsa Project to stay closely linked to activities within the catchment. The Tsitsa Project must also be conversant with current mandates and legislation

that may impact on the DEA programme as well as be aware of various projects being implemented in the catchment so as to avoid replicating activities.

4. District and local municipalities: In order to engage with stakeholders at the district and local municipal level, the Tsitsa Project can initially tap into existing district and local municipal participatory structures. This kind of engagement is a good start but there will need to be more of a local government presence in Tsitsa Project -initiated meetings and forums. It will also be helpful for the Tsitsa Project to identify a key contact person within municipalities with which to build a strong working relationship with. Inquiring from other civil society or private sector stakeholders who they work closely with in local and district municipalities is a helpful way to identify these individuals.

5. Commercial farmers: Commercial farmers in the area belong to farmer associations such as the Ugie Commercial Farmers Union which meet regularly. The Tsitsa Project team needs to engage with structures such as these in order to realise programme objectives of rehabilitation and improved land use practices. Sisitka et al. (2016) suggest that farmer's associations or members of these associations can form the nuclei of CMFs in each of the upper catchments.

6. Emerging farmers: *Emerging farmer associations such as the Umnga Flats Farmers Association meet regularly (about once every month) and the Tsitsa Project should engage with these structures. Good working relationships exist between emerging and commercial farmer groups which the Tsitsa Project can also learn from and work with.*

7. NGOs: Although there are no NGOs actively working in the immediate Ntabelanga/Lalini area, the Tsitsa Project has already identified the Umzimvubu Catchment Partnership Programme (UCPP) as an important stakeholder to engage with as much synergy exists between the vision and goals of both.

8. Local structures: Grassroots groups have the responsibility to actively participate in governing their municipalities by informing their municipalities of their developmental needs and challenges. By engaging with these structures, the Tsitsa Project can better understand the priorities and goals of local communities.

9. Research institutions: With its strong research focus, the Tsitsa Project has done well with engaging with research institutions across the country. Some institutions have called for closer engagement and inclusion with universities within the province such as the University of Fort Hare and Nelson Mandela University. The Tsitsa Project should support and encourage these institutions toward engagement.

10. Provincial government departments: The Tsitsa Project currently has good working relationships with a number of provincial government departments but needs to engage departments who are not as active such as EC COGTA, the Eastern Cape Rural Development Agency and Eastern Cape Socio Economic Consultative Council. In terms of lack of communication and coordination between different departments it will also be important to understand a) exactly where the blockages are in communication, and b) what communication strategies already exist (how people prefer to communicate). Extension officers are also key role players in agricultural landscapes, acting as a source of knowledge as well as networkers across the landscape. Supporting extension officers both in terms of knowledge as well as how to engage with social learning in mind can go a long way to developing strong learning networks across the catchment.

11. Private sector: Many private sector partners such as commercial forestry operators and environmental consultants are already engaging with stakeholders across different sectors in the Lalini sub-catchment. Aligning Tsitsa Project efforts with partners such as Environmental Rural Solutions (see Section 2.2.7.2), as the Tsitsa Project has already done, opens up opportunities as they have already brokered many relationships and trust with various stakeholder groups in the surrounding areas.

Commercial forestry company PG Bison is a primary stakeholder in the area and has begun to build partnerships with government programmes. This builds momentum on a landscape for programmes like the Tsitsa Project as people begin to invest and initiate projects themselves.

12. Trans Caledon Tunnel Authority (TCTA): Although the Tsitsa Project is independent from the TCTA, clear communication is required between the two programmes (Umzimvubu Water Project and the Tsitsa Project), especially to avoid conflation between the two programmes should stakeholder engagement commence on the part of the TCTA.

13. Stakeholder engagement: Stakeholder engagement and the management of stakeholder relationships cannot be an add-on, but is deeply integral to achieving positive transformation in a socio-ecological landscape. To this end, the following is recommended:

Building trust, first impressions and long-term presence: Creating trust between and with stakeholders is a primary means to successful implementation of programmes. To this end the Tsitsa Project needs to demonstrate respect and value for stakeholders' time and inputs, especially communities who live and work on the landscape as well as incorporating their suggestions towards true collaboration. The Tsitsa Project will also need to demonstrate that it intends to invest in these sub-catchments for the long-term by developing partnerships with other programmes and projects that could continue or support ongoing work in the area as it is already doing with the UCPP.

Adequate resources: In order to ensure that communities are not peripheral but are made central to the Tsitsa Project, adequate resources and time must be allocated for extended and earnest stakeholder engagement.

Managing stakeholder expectations: When engaging with stakeholders, especially around their needs, interests and vision for the catchment, the Tsitsa Project will need to clearly define expectations in a collaborative manner, that way everyone is able to take ownership of what the plan is (strategy) and how to get there (outcome).

Tangible activities and incentives: A series of core activities that are regular, repetitive and have value to stakeholders is a valuable way of developing relationships. These activities can then also be used for other purposes such as feedback, sharing knowledge, and engagement in other activities. Incentives also help maintain the commitment of stakeholders to programmes, for example, such as economic incentives for livestock farmers to adopt rotational grazing patterns. Through its engagement with partners who are doing similar work in a similar context, these lessons can inform the Tsitsa Project's future strategic design.

Engaging with existing platforms and structures: The Tsitsa Project can interphase with already existing community participation structures within DMs and LMs such as Ward Committee meetings and provincial government programmes like DRDAR's LandCare programme. These platforms however, should be treated as initial entry points for the Tsitsa Project only, as the nature of these structures cannot support or sustain the kind of trust building required for the rigorous type of stakeholder engagement both the Lalini and Ntabelanga teams propose. It is important for the Tsitsa Project to create spaces in which stakeholders with different positions of power, hierarchy, status and views can interact and be heard without feeling threatened or undermined.

By adopting this trust-building approach to stakeholder engagement, the Tsitsa Project will be able to develop a truly shared and collaborative vision for Lalini and Ntabelanga.