



*Outcome of two workshops to develop a research  
framework for the <sup>1</sup>Subtropical (Albany) Thicket  
Biome*

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## Executive summary

A group of about 70 thicket experts were invited to contribute to a workshop to develop a research framework for thicket, its restoration and related praxis in October 2018. The workshop was attended by 65 participants representing a wide range of interests such as academics, conservation managers, consultants and remote sensing experts. The first workshop developed the goals with detailed research objectives in six working groups. The follow-up second workshop with a smaller group of 27 selected thicket experts met in Addo Elephant National Park in June 2019 to evaluate and prioritise these objectives and to develop a way forward. The outcome was that Praxis (the continuous, constructive interflow between research and practice /management) was identified as a clear and urgent priority. This document discusses the importance of appointing a praxis coordinator as well as the tasks of such a coordinator and her/his advisors. Research objectives were also seen as important; however, given the understudied nature of the thicket biome, no clear priorities could be established. Nonetheless, a unanimous agreement was that a group should be selected to co-ordinate and champion research and its implementation in the Subtropical Thicket Biome. A research framework was proposed and is presented in this document with links to the updated Research Objectives. The importance of a synthesis of current thicket knowledge was emphasized, and the advantages of having an international congress to discuss thicket were highlighted.



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## INTRODUCTION

The Subtropical Thicket (previously termed “<sup>1</sup>Albany Thicket”) Biome covers approximately 2.2% of South Africa. It is considered unique in terms of its origin, with the vast majority of vegetation characteristic of thicket probably emerging during the Eocene age (56-33 MYA).

It is characterized by the absence of a continuous grasscover (and is evolutionarily older than grasslands) with succulents forming an important part of the biodiversity. Except for the desert biome, the Subtropical Thicket forms a convergence zone of all biomes in South Africa. The complexity of the geographical area and associated plant species has some of the highest landscape-level heterogeneity in the world and supports a high diversity and density of species. These factors make the thicket a natural biogeographical laboratory. It also provides a wide range of ecosystem services (CEN, 2019).

With funding from the Department of Environmental <sup>2</sup>Affairs, Forestry and Fisheries, Chief Directorate Natural Resource Management (DEAFF:NRM), the Rhodes Restoration Research Group

<sup>1</sup>Subtropical thicket is the updated name for the Albany Thicket according to the National Vegetation map of South Africa 2018 (SANBI).

(RRRG) of the Department of Environmental Science (Rhodes University) arranged two facilitated workshops to develop a research framework that could guide future research and praxis towards sustainable use and restoration of the thicket. The first workshop was held from 23<sup>rd</sup>-24<sup>th</sup> of October 2018 in Grahamstown (Grant-Biggs *et al.*, 2019) and was attended by 65 participants (of the 70 invitations that were sent out). The second workshop from 10<sup>th</sup>-11<sup>th</sup> of June in Addo National Park was attended by 27 selected thicket specialists.

During the first workshop (Grant-Biggs *et al.*, 2019) the stakeholders for which the research and praxis framework was developed were defined as:

1. The Conservation sectors
2. Private landowners
3. Communal rangeland residents

It was agreed that the subtropical thicket biome addressed in this framework should be broadly defined and should have similar characteristics to this distinct forest type internationally (i.e. subtropical thicket).

Six axes were recognised that could guide thicket research:

1. Locational
  - a. Evolutionary history
  - b. Long exposure to megaherbivores
  - c. Lack of exposure to fire
2. Climate interface between summer and winter rainfall along an aridity gradient.
3. Influence of geology and geomorphology.
4. Vegetation associations at different temporal and spatial scales.
5. Cultural axis – oldest evidence of modern humans, with a colonial history of contestation and commonality.
6. Dynamic axis. Acknowledges the change taking place in the system and the system adaptation.

The first workshop led to the formation of two main goals: an ultimate goal and an immediate goal:

Ultimate goal

Recognising the dynamic nature of social-ecological systems (SES), to restore, slow down and (where possible) avoid undesirable transformation, change or degradation in thicket, and yet concurrently improve associated human and social capital.

Immediate goal

To formulate a research and praxis program in support of the ultimate goal.

It was agreed that the subtropical thicket had several vital attributes as referred to in Workshop 1 report (Grant-Biggs *et al.* 2019) that can be summarised as follows:

Vital attributes (summarised)

- Broad academic interest in the thicket with supporting knowledge and information on the function.
  - Social ecological awareness of the importance of thicket to the community both in terms of economy and culture.
  - Awareness of the threats both in terms of legislation and land use.

## Developing Objectives

The first workshop used a goal-setting approach as described for the adaptive planning phase of strategic adaptive management, to develop the main objectives to be addressed in order to achieve the agreed on-goals. Working groups developed research and praxis objectives. Six high level objectives were identified that were required to achieve the ultimate goal: (short titles used during the workshop are given in blue, which is also the link to the detailed objectives ([Appendix 3](#)))

1. Develop a thorough understanding of the Subtropical Thicket ([Understanding](#)).
2. Strengthen ability to function as an “open laboratory” and support appropriate attitudes to achieve immediate and ultimate goals ([Attitudes](#) and [Open laboratory](#)).
3. Investigate scientific (e.g. classification systems, imposed boundaries) and legal constructs (e.g. CARA and NEMBA) and their contradictions, and to what extent these promote or act as barriers to immediate and ultimate goal ([Legal](#) constructs).
4. Develop an overall integrated strategy for praxis and restoration in thicket, including prioritization and pragmatic approaches ([Praxis](#)). Praxis is the continuous, constructive interflow between research and management. Praxis has been explicitly included for the first time in our goals and an ongoing eye needs to be kept on whether the praxis components are happening.
5. Applied research – alien invader plant management approaches such as triage control, or how to plant spekboom, remote sensing, indigenous knowledge, etc. ([Applied](#) research).

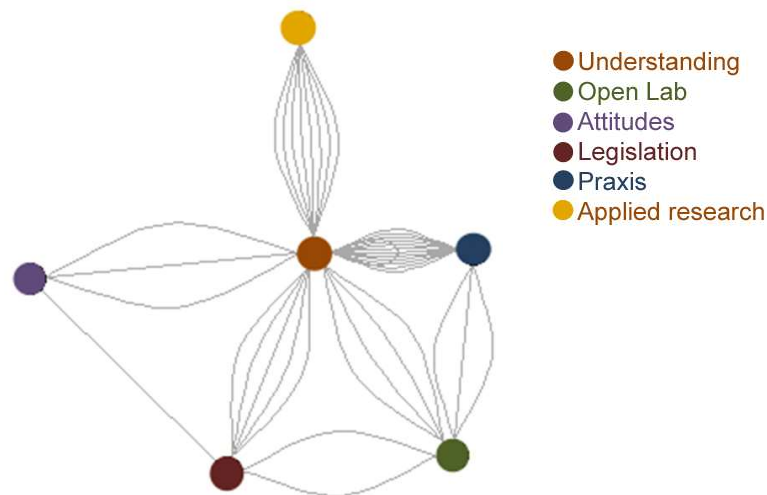


Figure 1: Network diagram of the current links (grey lines) between the high-level objectives (overlapping interests)(Grant-Biggs *et al.*, 2019).

The second workshop attempted to prioritise the research objectives by using a risk assessment approach. The actual method is described in [Appendix 2](#).

Workshop members were divided into six previously determined groups to address each of the six high-level objectives.

Each group worked through an allocated objective and presented, in plenary, why addressing the particular objective is important and what would happen if not attended to.

The audience then evaluated how realistic the presentation was and scored:

<sup>2</sup> Previously called DEA (Department of Environmental Affairs)

- the risk of not reaching the defined goals if particular objective cannot be addressed, based on the presentation
- then scored the likelihood of not addressing the objective and the impact that this would have.
- The product of these two scores was given a “raw score”.
- The next questions that were addressed were:
  - how good is the current mitigation for this risk?
  - what is the estimate of the broad total cost (money, time, energy)of the current mitigation?
  - how effective could mitigation be in the next ten years?
  - What would be the cost of future mitigation?

## The outcome of the risk assessment

Because most objectives were similarly scored (except for praxis discussed last) the presentation deals with each individually. The same overall table (all objectives) presented each time but with the one under discussion **in red font**. The detailed table of the risk assessment is available in [Appendix 4](#).

Summary and outcome of discussion on the importance of achieving each objective.

Investigate scientific (e.g. classification systems, imposed boundaries) and legal constructs (e.g. CARA and NEMBA) and their contradictions, and to what extent these promote or act as barriers to immediate and ultimate goal([Legal](#) constructs).

The conflicting legislation is a huge problem with agricultural laws (CARA) contradicting conservation laws (NEMBA), as well as the inconsistent use of different laws (even within departments). The group felt that it would be very serious, with the risk of losing all thicket not in protected areas, if this objective is not addressed. If not addressed, complete transformation can also be a risk as there is increasing pressure on landowners to make farms more productive to avoid re-allocation with land reform. The likely increase in the number of people dependent on the land will also increase pressure substantially.

However, the entire thicket area is not threatened, as the areas with red soils are more fertile, while shallow soils can only be used for livestock and conservation usages. Even in shallow soil areas there may be massive transformation, due to injudicious management of large stock numbers. At this stage the Department of Agriculture is reluctant to enforce CARA to limit overgrazing by livestock.

It is difficult to predict what may happen in future and several scenarios may play out. Land may be converted to wildlife uses due to small stock theft; however, game farming may become less attractive as it is seen as unproductive, so people are encouraged to change into higher production such as citrus. Protected areas may also be under more pressure to be productive and visitors are attracted to wildlife which are seen on the open plains, not thicket in its pristine state. An increase in the price of mohair will incentivise mohair production with an amplified threat to the thicket. Acknowledgement of ecosystem services provided by the thicket may play a role in its legal protection.

Table 1. Outcome of the scoring legal objectives

Score sheet of risk assessment							
Likelihood in the next 10 years 1= negligible / <5%, 2= low / 20%, 3=medium / 50%, 4=high /80%, 5= pervasive 90-100%. Impact if the risk realises 1=trivial, 2 =minor (relative quick and easy recovery), 3=moderate (recovery with significant cost and effort) 4=serious (recovery cost in millions and over decades or centuries), 5 = catastrophic/disastrous. Effectiveness: Good, Moderate, Weak. Overall cost: High (dominant budget item), Fair (significant budget), Low =(small budget).							
Objective which if it fails produces risks	Likelihood of risk/s realising	Impact	Raw score	How good is currentmitigation	Overall costs of currentmitigation	How good could mitigation be? How can we improve it?	At what overall cost?
Praxis	4-5	4.5 -5	18-22	W	L	G	F
Understanding	3.5	4	14	M	M	G	H
Open laboratory	5	3	15	W	F	M	F
Attitudes	4	4	16	W	L	M	F
<b>Legal constructs</b>	<b>3.5</b>	<b>4</b>	<b>14</b>	<b>W</b>	<b>L</b>	<b>M</b>	<b>F-H</b>
Applied research	4	3.5	14	M	H	H	H

Addressing the legal constructs and their contradictions is contributing weakly towards mitigating our goals at low cost. The mitigation has at most a medium chance of being improved at a fair cost except for addressing legal constraints which may need high financial inputs to achieve the objectives.

## The ability to function as an Open laboratory and to Change Attitudes

The objectives covering [Attitudes](#) and [Open lab](#) were seen as being closely linked and are therefore combined in this document.

Overall, attitudes and mediation were seen to be very slightly more important than legal issues and it was advised that we should invest in changing attitudes as a priority, or else nothing will change. The working group felt that this could be the lowest hanging fruit and could have a large impact. Efforts should be invested towards building extension services and making people aware of the value of the thicket. It will be essential to hold workshops with a wide range of stakeholders to share values. This should include creating a regional perspective with groups of farmers, communal rangeland residents and conservation managers mapping essential regions for thicket conservation. Case-by-case evaluation (without considering regional impacts) was predicted to often lead to further degradation.

In plenary, the deep divisions and differences in attitudes towards the thicket by different parties (e.g. agriculture versus conservation) were pointed out, and the importance and challenge of these being addressed. Sacred values of thicket must to be acknowledged and included for instance in protected areas management. It was suggested that faster progress could be made by identifying people or groups that can act as leaders to carry positive attitudes towards thicket.

Communication was highlighted as a very important aspect. Without a concerted effort to build relationships and communication between institutions, as well as between stakeholders, no progress can be made. Communication should include information on the thicket being made more palatable and accessible to all. This implies that communication efforts should include different levels of governance as well as farmers.

The research network in the thicket should be expanded to avoid group thinking, and to discourage working in silos. An integrative approach to research and praxis is essential to move forward and

research outcomes should be translated into language for use by farmers to encourage sustainable utilisation of the thicket.

The group felt that if this objective is not achieved, all the other objectives will be at risk and if not achieved we will have the same meeting again in ten years' time. However, with working on attitudes a lot of difference can be made in even five years.

Table 2. Outcome of scoring objectives to change attitudes and strengthen the ability to function as an open laboratory.

Score sheet of risk assessment							
Likelihood in the next 10 years 1 = negligible / <5%, 2 = low / 20%, 3 = medium / 50%, 4 = high / 80%, 5 = pervasive 90-100%. Impact if the risk realises 1 = trivial, 2 = minor (relative quick and easy recovery), 3 = moderate (recovery with significant cost and effort) 4 = serious (recovery cost in millions and over decades or centuries), 5 = catastrophic/disastrous. Effectiveness: Good, Moderate, Weak. Overall cost: High (dominant budget item), Fair (significant budget), Low = (small budget).							
Objective which if it fails produces risks	Likelihood of risk/s realising	Impact	Raw score	How good is current mitigation	Overall costs of current mitigation	How good could mitigation be? How can we improve it?	At what overall cost?
Praxis	4-5	4.5 -5	18-22	W	L	G	F
Understanding	3.5	4	14	M	M	G	H
Open laboratory	5	3	15	W	F	M	F
Attitudes	4	4	16	W	L	M	F
Legal constructs	3.5	4	14	W	L	M	F-H
Applied research	4	3.5	14	M	H	H	H

Developing our objectives towards an open laboratory and improving attitudes is presently contributing weakly towards mitigating our goals at fair to low cost. The mitigation has a chance of being improved to medium even at a fair cost.

Develop a thorough [Understanding](#) of the Subtropical thicket

This working group felt there was a poor understanding of how to balance the economics of retaining functional thicket versus economics of losing thicket to particular production systems. They presented a central [framework](#) for research. The group believed that the framework unifies and integrates social and economic factors at different scales. To be able to balance the economical and conservation needs we need to understand the point where the human and social benefits are high while the thicket is still intact and functional.

Water is going to be one of the biggest issues in the next ten years, with inter-basin transfers possibly becoming more limited. It will be very important to understand the balance between the outcome of management practices of up-stream landowners and how this influences water provision to down-stream land owners and communities in the same catchment. We need to understand regional delivery of such ecosystem services, and what thicket types and patches deliver what services to ensure that these are maintained. In understanding the thicket, an economic argument for the economic resilience of the system has to be developed and has to be effectively worked out also at the small scale and farm level.

Table 3. Outcome of scoring the importance of developing a thorough Understanding of the Subtropical thicket

Score sheet of risk assessment							
Likelihood in the next 10 years 1 = negligible / <5%, 2 = low / 20%, 3 = medium / 50%, 4 = high /80%, 5 = pervasive 90-100%. Impact if the risk realises 1 = trivial, 2 = minor (relative quick and easy recovery), 3 = moderate (recovery with significant cost and effort) 4 = serious (recovery cost in millions and over decades or centuries), 5 = catastrophic/disastrous.							
Effectiveness: Good, Moderate, Weak. Overall cost: High (dominant budget item), Fair (significant budget), Low = (small budget).							
Objective which if it fails produces risks	Likeli-hood of risk/s realising	Impact	Raw score	How good is currentmitigation	Overall costs of currentmitigation	How good could mitigation be? How can we improve it?	At what overall cost?
Praxis	4-5	4.5 -5	18-22	W	L	G	F
<b>Understanding</b>	<b>3.5</b>	<b>4</b>	<b>14</b>	<b>M</b>	<b>M</b>	<b>G</b>	<b>H</b>
Open laboratory	5	3	15	W	F	M	F
Attitudes	4	4	16	W	L	M	F
Legal constructs	3.5	4	14	W	L	M	F-H
Applied research	4	3.5	14	M	H	H	H

Addressing the understanding research objectives is currently addressed with medium impact at medium cost and improving our understanding will have a good chance of improving our mitigation efforts, but this will be at high cost.

#### [Applied research](#)

For areas to be conserved in practice the type of area and the size needed to preserve specific thicket types must be mapped to enable suitable protection of these areas. Potential losses should be defined in terms of biodiversity and ecosystem services with the loss of thicket at different spatial scales.

Restoration is very costly, needing expertise and also an understanding of which areas may not be worth fixing. Large costs have been incurred without the desired outcomes, because this understanding was lacking. To be cost-efficient, approaches should be flexible and practical and not limited to cost per hectare. Fixed timelines in terms of involvement should be defined, and restoration efforts should evolve as knowledge is gained. Future restoration techniques should further include new technology such as remote sensing to trigger early responses when expanding degradation is detected.

There is a scope for further investment of resources to control aliens, but it is important to evaluate the outcome of such potential activities. Management of aliens should include responding to new invasions as soon as possible and rehabilitation should be linked to land use. To make sure investments are adequate and that they are achieving goals, we need to understand what happens to investment in clearing as well as what happens post- investment.

Soil conservation is of critical importance and has been well researched, but at this stage this information is not used effectively. To ensure that old, and new, critically important information is being used, minimum requirements for consultants should be set to make sure that rehabilitation and restoration funds are well spent.

Table 4. Outcome of scoring Applied research objectives.

Score sheet of risk assessment							
Likelihood in the next 10 years 1 = negligible / <5%, 2 = low / 20%, 3 = medium / 50%, 4 = high /80%, 5 = pervasive 90-100%. Impact if the risk realises 1 = trivial, 2 = minor (relative quick and easy recovery), 3 = moderate (recovery with significant cost and effort) 4 = serious (recovery cost in millions and over decades or centuries), 5 = catastrophic/disastrous.							
Effectiveness: Good, Moderate, Weak. Overall cost: High (dominant budget item), Fair (significant budget), Low = (small budget).							
Objective which it fails produces risks	Likelihood of risk/s realising	Impact	Raw score	How good is current mitigation	Overall costs of current mitigation	How good could mitigation be? How can we improve it?	At what overall cost?
Praxis	4-5	4.5 -5	18-22	W	L	G	F
Understanding	3.5	4	14	M	M	G	H
Open laboratory	5	3	15	W	F	M	F
Attitudes	4	4	16	W	L	M	F
Legal constructs	3.5	4	14	W	L	M	F-H
<b>Applied research</b>	<b>4</b>	<b>3.5</b>	<b>14</b>	<b>M</b>	<b>H</b>	<b>H</b>	<b>H</b>

Addressing the applied research objectives is currently addressed with medium impact at high cost and improving our understanding will have a good chance of improving our mitigation efforts, but this will be at high cost.

Develop an overall integrated strategy for [Praxis](#) and restoration in thicket, including prioritisation and pragmatic approaches.

This working group proposed that there is a sense of urgency to develop an integrated strategy to bring the other objectives into a focus and to ensure progress. Such a strategy must identify actual challenges and set up guiding principles to direct actions. The strategy should include an adaptive management plan to evaluate and build a way forward. An appropriate senior person should be appointed to take the lead. The person should be advised by an inter and trans-disciplinary group of willing and available, capable individuals. This group must be able to tap into research information from different departments and agencies but should not be aligned only to one specific entity to give the initiative sufficient freedom. Such a group should be able to grow organically to make the needed progress.

It is essential to communicate the thicket strategy to government, and alternatives should be presented to the politicians to secure their involvement.

Stewardship in thicket is declining due to a shortage of targets and these targets need to be defined as a priority to encourage stewardship. Such systems should be up-scalable and enabling. Consideration should be given to identifying pilot projects to build trust. Furthermore, the development of a biosphere reserve for thicket, as likely best vehicle, should be investigated.

The working group felt that it is essential to have a system in place with a guiding strategy to direct funding coming towards restoration in future and to avoid further thicket areas being lost. Business as usual will likely lead to the unproductive spending of available funds, and to unsuccessful projects resulting in a continued loss of thicket. In ten years' time we would probably be worse off if we do nothing.

Table 5. Outcome of scoring the praxis objectives

Score sheet of risk assessment							
Likelihood in the next 10 years 1 = negligible / <5%, 2 = low / 20%, 3 = medium / 50%, 4 = high /80%, 5 = pervasive 90-100%. Impact if the risk realises 1 = trivial, 2 = minor (relative quick and easy recovery), 3 = moderate (recovery with significant cost and effort) 4 = serious (recovery cost in millions and over decades or centuries), 5 = catastrophic/disastrous.							
Effectiveness: Good, Moderate, Weak. Overall cost: High (dominant budget item), Fair (significant budget), Low = (small budget).							
Objective which if it fails produces risks	Likelihood of risk/s realising	Impact	Raw score	How good is current mitigation	Overall costs of current mitigation	How good could mitigation be? How can we improve it?	At what overall cost?
Praxis	4-5	4.5 -5	18-22	W	L	G	F
Understanding	3.5	4	14	M	M	G	H
Open laboratory	5	3	15	W	F	M	F
Attitudes	4	4	16	W	L	M	F
Legal constructs	3.5	4	14	W	L	M	F-H
Applied research	4	3.5	14	M	H	H	H

The implementation of the praxis objectives is currently weak at low cost but has a good chance that the mitigation will achieve the defined goals at a medium cost.

#### Summary of plenary discussions and scoring

- Conducting research alone will not achieve the goal of improving human and social capital, therefore the objectives listed under [Praxis](#) came out to be the highest priority to achieve the ultimate goal.
- The objectives listed under [Understanding](#), [Legal](#), [Attitudes](#), [Communication](#) and [Applied Research](#) need to also be addressed urgently and these are of broadly similar high importance.
- Water is the most important system driver and promotion of water conservation is also a strong driver of funding.
- There is an expectation of good funding for restoration, and a strategy should be in place to direct the funding to address the thicket goals to achieve our ultimate defined goal.
- Land reform is a challenge inasmuch as it seems to be in practice incentivising some “existing” owners into short term exploitation of land and associated degradation.

#### The way forward

The outcome of the two workshops (aimed at developing a research framework for the subtropical thicket) highlighted the importance of establishing a unit to implement the praxis objectives urgently. This involves:

1. Appoint a coordinator (or team) to implement the praxis objectives with a selected supporting group.

2. Allocatesufficient time and funds to the praxis group and their staff to achieve the defined goals.
3. Establish a body that will be responsible to evaluate the activities of this praxis groupregularly to ensure that they are keeping to the defined guidelines, without unnecessarily limiting their initiatives.
4. Appoint a body that will be responsible to take the research objectives forward in a broader context not only associated with a single institution.

#### Duties and characteristics of the praxis group (coordinator and committee):

- a) Advocate thicket concerns to the level of the most senior bureaucrats to get national and provincial politicalsupport for sustainable utilization of the thicket without further losses.
- b) Develop an adaptive strategy for praxis and implementation that is regularly reflected on and sensibly adjusted.
- c) Develop a strategy to communicate the importance of thicket and to retard, and avoid, further transformation of thicket.
- d) Develop a theory of change with researchers, managers and stakeholders.
- e) Develop a strategy to co-change attitudes with help from all relevant stakeholders, (including researchers and consultants in this field).
- f) Develop a strategy for support mechanisms for management of existing thicket areas.
- g) Work towards proclaiming all or part of the subtropical thicket as a Biosphere reserve/s.
- h) Link closely with the research groups to incorporate new knowledge and to ensure that information is distributed to interested parties.
- i) Work with communication groups to develop information brochuresand other forms of communication to make new knowledge available.
- j) Develop a strategy for capacity development for persons and institutions that carry this work out.
- k) Ensure that appropriate, reflexive monitoring approaches are developed as well as a comprehensive and systematic M&E system to evaluate the success of the praxis, management, policy and research.

#### Duties of the research group

- a) Organise local thicket forum events to allow for parties from all spheres to share knowledge, problems and solutions.
- b) Organise an international thicket workshop with follow up proceedings to stimulate a synthesis of current thicket knowledge and data sharing and set up an international impression around the importance of thicket.
- c) Develop the proposed research framework further as necessary
- d) Guide future thicket research towards the developed research framework.
- e) Develop working groups as needed to fine-tune and deepen the resolution of the objectives tree.

Prioritising the research objectives developed to address the immediate and ultimate goal.

(Read with the attached objectives document to which it is linked)

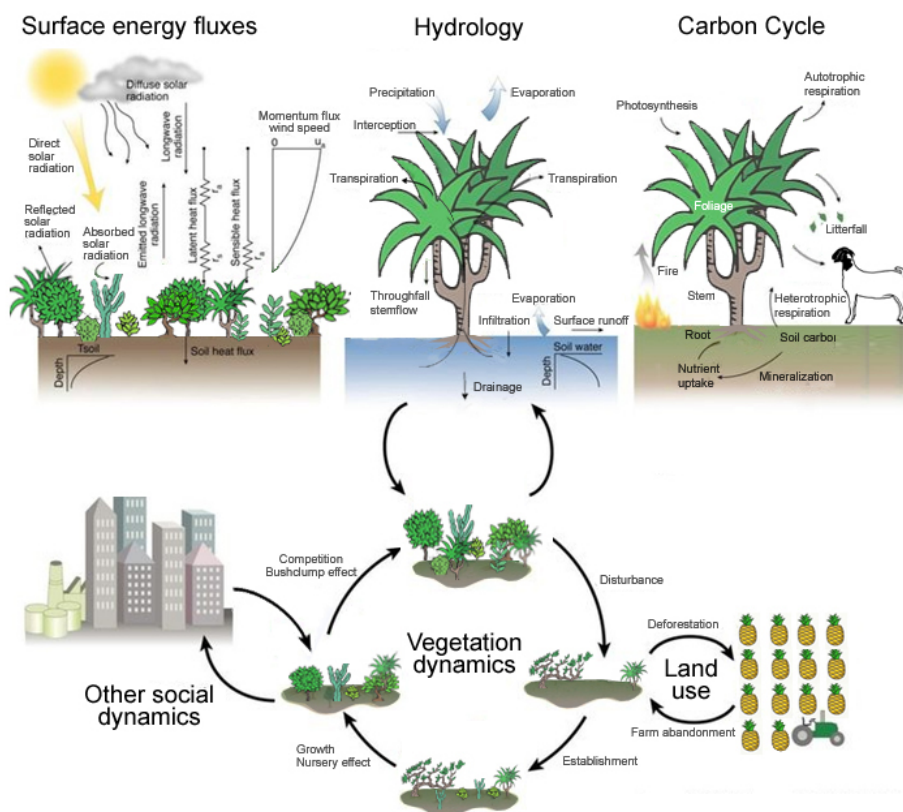


Figure 2: Overview of dynamics of healthy thicket (modified from Bonan 2008).

Although the second workshop did not address all the sub-objectives listed in the first Workshop Proceedings Report (Grant-Biggs *et al.*, 2019) in detail, the discussions highlighted the need for a systemic approach to prioritising and integrating the listed objectives. As the objectives developed in the first workshop cannot be complete it must be assumed that these objectives can still be expanded with new knowledge and participants.

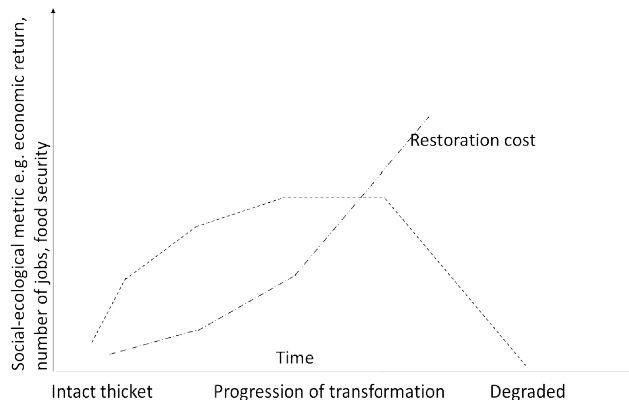
At this stage, degradation and transformation are considered to be the main threats to the thicket and a priority would be to look into approaches to limit further degradation of the thicket as far as possible. However, this has to be done whilst taking the social and economic needs of the stakeholders into account to concurrently improve the associated human and social capital as stated in the ultimate goal. Understanding the links between social and economical benefits and ecosystem services from the thicket with increasing levels of thicket degradation is important to be able to understand the resilience of the system.

Degradation needs to be meaningfully defined to understand approaches to rehabilitation. Understanding the human and social capital gains from degradation and from possible approaches to successful rehabilitation is essential to achieve the ultimate goal.

The intention is that by addressing the Praxis objectives, research, policy and management will be linked and knowledge would be implemented to achieve the ultimate goal of avoiding further degradation and transformation while improving human and social capital.

A framework was proposed to examine the social and economic benefits along a gradient of change of thicket vegetation from intact to severe degradation. It is acknowledged that thresholdscan change with year and area and that the principle of SES is multi-scale and multi-context.

Figure 3. Proposed framework for research, to be adapted at various multiple interconnected communicating temporal and spatial scales taking the full social-ecological impacts into account.



Focus points for research as captured by the framework:

1. Understand the point where the human and social benefits are high while the thicket is still intact and functional. For example, a well-managed private nature reserve or a tourism facility will not have to follow the trajectory of degradation (except in a highly localised way) to obtain high dividends and still remain sustainable. We need to understand how this ideal can be achieved.
2. In the light of above we need to understand the changes in the transformation slope from intact and functional thicket with increasing social benefits to one of degraded thicket and small social benefits.
3. Understand when social benefits are becoming limited with thicket degradation, while there is still some advantage in rehabilitation.
4. Understand where restoration becomes worthless both in terms of social benefits as well as thicket restoration.
5. This conceptual model could hopefully be improved by including “reclamation”, “revegetation” and “rehabilitation” on the degradation gradient.

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## Appendix 1. Table 6. Prioritisation of actions.

Actions to be taken	Budget salary	Running expenses	Timeline
Decide on an institution that would house the praxis and research coordinators			December 2019
Select a small advisory and supporting committee to advise and support the praxis team			by March 2020
This committee should develop a framework for actions of the praxis group			by March 2020
Appoint a praxis coordinator with a supporting team representing research, policy and praxis and advocacy and communication.			by March 2020
*Select a group of scientists to help coordinate and direct thicket research			Before the end of 2019
**Develop a short term high priority list for critically important research gaps.			
Provide office space and infrastructure			July 2020 or sooner
Appoint administrative staff			September 2020
Praxis group to develop a draft strategy for management and conservation of the thicket			October 2020
Organise workshops with farmers and managers to inform the strategy			November 2020
***Organise a workshop with conservation managers to inform the strategy			November 2020
Do a deep synthesis of the wisdom and local ecological knowledge of thicket management possibly a Post Doc			
Finalise the first version of the strategy with inputs from the supporting committee			December 2020
Organise a workshop with selected managers, commercial farmers communal rangeland farmers and residents and conservationists to examine different scenarios of the possible outcome of different approaches to thicket management			March 2021
Re-evaluate the strategy			Ongoing
Develop the necessary theories of change for the thicket in a culture of systemic thinking, acknowledging the complexity of the challenge.			Ongoing
Appoint a scientist/s to synthesize current thicket knowledge			To be presented at the international congress
Organise the International Thicket Forum/Congress in Addo			July 2021
Develop MOAs with SANParks, Rhodes University, East Cape Parks & Tourism Agency and the other Universities etc.			December 2020

\*It is a high priority for a suite of external specialists able to start a parallel process of: 1) detailed stakeholder analyses across the biome across sectors 2) Social assessments (needs, aspirations, values, visions etc) 3) Institutional governance (political ecology).

Although these are going to take a few years they can be done broadly at first and then becoming more nuanced and drilling deeper and becoming more spatially explicit....Eventually the DEAFF\_NRM agency will have a practical working domain such as the Kowie River Valley. This Praxis team will need to know the nitty gritty of political the geopolitics and resource economics. The broad level assessments are going to be needed to develop the first round of praxis plans.

\*\*This needs to be compiled in the next 6 months to have available for funding opportunities. If we wait until the full product is available, it will be 18 months and some opportunities will have been missed.

\*\*\* Proper Trans-disciplinary principles should be adhered to. Develop the grass roots visioning from the start and make sure that visions include the societal needs. This may take longer and be more expensive but will ensure that we can have confidence to proceed with a mandate.

\*\*\*\*We also need to very carefully define stakeholder/s. Landownership is flawed as the only proxy for being a stakeholder. Intergenerational equity is a key concept as well as the right for non-property owners to have a say in the degradation of natural capital. If we include these two in a visioning exercise, we are more likely to find equity in the long term.

## Appendix 2. Comparative Risk Assessment as an effective nuanced means of prioritisation of objectives

[lifted from Box 1 (written by Cillie Malan and Harry Biggs) in the article Gaylard, A. & Ferreira, S., 2011.

Advances and challenges in the implementation of strategic adaptive management beyond the Kruger National Park – Making linkages between science and biodiversity management', *Koedoe* 53(2), Art. #1005, 8 pages. [doi:10.4102/koedoe.v53i2.1005](https://doi.org/10.4102/koedoe.v53i2.1005), and the editorial of the special edition, mentioned below, is Roux, D.J. & Foxcroft, L.C., 2011, 'The development and application of strategic adaptive management within South African National Parks', *Koedoe* 53(2), Art. #1049, 5 pages. [doi:10.4102/koedoe.v53i2.1049](https://doi.org/10.4102/koedoe.v53i2.1049)

Risk assessment is part of the process of enterprise-wide risk management, which has become a key aspect in the focus on corporate governance over the last number of years. The comparative risk assessment (CRA) process is a technique used by risk assessors to compare different often very disparate risks. By making certain modifications to its application, SANParks is currently experimenting with CRA as a way of prioritising park objectives in a nuanced way that effectively supports decision-making. This modified CRA is applied towards the end of the adaptive planning process (see editorial) once the park objectives have been decided upon. None of these objectives are challenged (i.e. it is accepted that they are all valid and require attention and implementation) but the modified CRA process helps decide whether new additional effort or funds should be given to particular objectives, and actions regarding other objectives simply maintained or sometimes downscaled with acceptable attendant risk. Without such a process, park managers have a list of (say) eight major objectives, with champions for each of these often feeling that that the objectives for which they are responsible deserve at least equal urgency and at least an eighth of the resourcing. This technique allows group participation in a transparent process which tends to build a shared rationale around prioritisation.

The key modification is a particular emphasis, if each objective fails, on what impact that will have on the park vision and mission. It requires that "failure" of each objective is re-articulated as a risk, and a narrative generated as to what the situation might look like then. This is usually done on (say) a 15 year time horizon, and we began with a "business-as-usual" scenario (in other words, conditions continue roughly as they are now). We soon realised that at least another scenario is useful, namely a "worst scenario", and possibly further scenarios.

The table below lays out the basic process

Risk associated with failure of ...	Chance that risk realises in next 15 years (rated 0-4)	Impact on park vision and mission if it does (rated 0-4)	"raw score" is product of chance X impact (0-16)	How effective are current actions in controlling this risk and what resources are used to do so?	Is this level of risk control deemed acceptable i.e. "within park risk appetite" (yes or no)	How effective could risk abatement be if improved? What would this take in resourcing?
Objective 1						
Objective 2						

Objective 3						
etc ...						

The evaluation can be done on a quick “round table first estimate” basis by a variety of park personnel or even a wider stakeholder group. In our experience it is remarkable how similar such subjective scores (in the chance and impact columns) turn out to be from persons with different viewpoints or tasks in the organisation. So far we have decided not to “numericise” the answers to the questions in the two “how effective” and “at what cost” columns, but essentially these tend to be answered as “very high”, “high”, “medium”, “low”, or “not/none”. If detailed data are available on some themes, perhaps from business analyses or monitoring results, these can be presented as an improvement on intuitive evaluations. Over time it is good to strive towards this better evidence base, with the proviso that narrow data should not be allowed to cloud good wider judgement. Although the “raw scores” (product of chance of occurrence X impact if the risk materialises) are very instructive, the objectives associated with the highest “raw score” are sometimes not ones into which the most effort is directed. This is because of clear insight offered by the right hand columns – for instance an objective-risk with a high “raw score” may already be being well contained with medium cost, whereas it may be clear to all that the only way to raise the effectiveness to excellent might be at great cost. The group may then realise in a consensual way that far greater “bang for buck” can be obtained by using any additional resources elsewhere in the objective profile. The decision on where exactly they might be most profitably be used is also assisted by this assessment.

There are several fine-tuning issues we have encountered in the early use of this technique (for instance, the level at which objectives need to be split or bundled to be meaningfully assessed; and whether or not vision/mission elements need to be dissociated or viewed together when the impact on them is considered) but our experience is generally positive and we are hopeful that the technique gives us added value in a sorely needed dimension. It is almost as though risk is a common currency which can help decide on allocation of resources between say refurbishment of tourist infrastructure, upgrades of IT equipment, a new research project, and enhancement of security to protect endangered biota.

## Appendix 3 Updated objectives table

(from the first version coming out of the first workshop Grant-Biggs et. 2019)

This table was updated in response to requests from the second workshop of the Research Framework for the Subtropical Thicket 9-10 June in Addo National Park.

Priorities are based on the group discussions as well as inputs from the preliminary research committee (Mike Powell, Kathleen Smart, Alistair Potts, Susi Vetter and Rina Grant-Biggs).

This update consists of the following:

Changes or additions and consolidation brought about as result of contributions immediately before, during and after the second workshop.

Changes in format requested by the second workshop, to a more regular rectangular outline of lists.

A partial response to the request that some obvious individual objectives (or smaller subgroups of objectives) be highlighted as ones considered by the organising committee, in the light of discussions at the meeting, as being priorities). This lower-level prioritisation is indicated in **red font**.

This objectives hierarchy is linked to the outcome report for the meeting which gives an indication plus considerable discussion, on the relative acceptance of the (now five) headline objectives, on which clusters the meeting focussed.)

New contributions to the objectives are welcome.

List of updated research objectives

Red font indicate priority projects

The outline of the boxes immediately below, and at the top of each new section, corresponds to the original colour of the high level objectives in the workshop proceedings of the first workshop (Grant-Biggs et al 2019.)

High level priorities

<p><b>1. Develop a thorough understanding of the Albany Thicket especially as a social-ecological system.</b></p>	<p><b>2. Strengthen the ability to function as an “open laboratory” and to support appropriate attitudes to achieve immediate and ultimate goals.</b></p>	<p><b>3. Investigate scientific and legal constructs, especially their current contradictions, promoting actions to achieve the immediate and ultimate goals</b></p>	<p><b>4. Enable an overall integrated strategy for praxis and restoration in thicket.</b></p>	<p><b>5. Applied research in support of goals.</b></p>
<p>Understand the ultimate *system of interest through understanding the sometimes paradoxical state of degradation in the region. Understand the major drivers of the system thoroughly including human livelihood needs and cultural attitudes to land management. Prioritise and collect missing basic information such as the influence of climate change and how to embed responses widely in a research programme and resultant praxis.</p>	<p>This should be done in a way that involves funders, policy bureaucrats, implementing officials, NGO’s residents and scientists. Internal and external communication should include advocacy and promote stewardship. Desirable attitudes include systems thinking, and sensitivity to different value systems, taking the current political context into account. Multi scale approaches are needed in multi-use landscapes as in an understanding of novel ecosystems. Pragmatic tradeoffs and realistic goals should be set to achieve overall SES goals.</p>	<p>Investigate how scientific classification systems with their imposed boundaries, and legal constructs (such as CARA and NEMBA) and their contradictions affect thicket management and conservation. Understand to what extent these promote or act as barriers to achieve the immediate and ultimate goal.</p>	<p>These objectives should include ongoing nuanced prioritization of objectives and use of pragmatic approaches.</p>	<p>Understanding what cannot be feasibly rehabilitated, what is worth rehabilitating and what is so little affected and threatened that it can be a last priority. Topics such as methods of clearing alien vegetation, thicket planting strategies, remote sensing and use of indigenous knowledge should be considered as important potential areas of work.</p>
<p>*This word ultimate is used in the sense used in “ultimate goal” and the “immediate goal” see p 2 of the Report.</p>				

# 1. Develop a thorough understanding of the Subtropical Thicket *especially as a social-ecological system*

## 1.1 System definition

### 1.1.1 Classification

- 1 Understand thicket – describe the different thicket types and agree on them
- 2 Understand how dynamic and persistent each thicket type is as different stable states and the causes of state change, what maintains these states and how does succession take place e.g. what is the role of *V.karoo* and grass succession
- 3 How is thicket establishment affected by the starting point.
- 4 Determine whether this is a critically endangered biome
- 5 Determine the minimal conservation size for a thicket patch
- 6 Determine the recovery dynamics of thicket once disturbed
- 7 Determine whether this is a critically endangered biome
- 8 **Determine the minimal conservation size for a thicket patch**
- 9 Determine the recovery dynamics of thicket once disturbed.

### 1.1.2 Understand the ecophysiology of the thicket

1. Understand the difference between obligate and facultative CAM species
2. Understand the shade tolerance of different thicket species
3. Determine how unique this thicket is as a vegetation type
4. Understand the ecology of thicket pioneers – what allows them to invade and transform grasslands
5. We need a better understanding of the biology of keystone plant species, including spekboom (*Portulacariaafra*), wild plum (*Pappeacapensis*), boerboon (*Schotiaafra*), and aloes.

### 1.1.3 Understanding the paleo history and evolution

1. Use paleo studies to determine the extent of the thicket and what the original patches were like
2. Understand the evolutionary history of the thicket and its role in endemism
3. Understand the extent of the thicket taking the role of fire and herbivores into account
4. Understand the change in thicket over a timeline looking backwards and forwards
5. Investigate the use of paleo ecology to look at long term regime shifts

### 1.1.4 Effect of climate change

1. Understand how the thicket will respond to climate change.
2. Understand how will different CAM species respond to climate change?
3. Understand the role of protected areas in adaptation to climate change.
4. Understand how the thicket responds to increased CO<sub>2</sub>.
5. Develop scenarios to cope with future climate change.

## 1. Develop a thorough understanding of the Albany Thicket *especially as a social-ecological system*

### 1.2 Social-ecological systems, land use and resilience

1.2.1 Define social-ecological system of the subtropical thicket.

1. Understand the land users and land use systems in the thicket
2. Understand the links between land tenure and land use: communal vs traditional farming areas
3. Understand the overarching SES interested in degradation and the prevention thereof

1.2.2 Identify factors needed to improve the resilience of the system

1. Do a gap analysis to clarify priority research and actions to indicate what key information is lacking

1

## 1. Develop a thorough understanding of the Albany Thicket *especially as a social-ecological system*

### 1.3 Drivers

#### 1.3.1 Ecological

1. Understand the key drivers and their feedbacks at different scales e.g. fire and herbivory
2. Understand the impact of herbivores i.e. grazers and browsers, at different spatial and temporal scales and on different vegetation types
3. Understand the historic role of these species in the system and how the system changed since mega-herbivores were exterminated at the turn of the century
4. Understand large herbivore dynamics in thicket-grassland-Karoo matrixes
5. Understand the role of large carnivores in changing/maintaining systems. Potential trophic cascades?
6. Understand the effect of domestic stock on thicket ecosystem function.
7. Understand the effect of water provision in the thicket biome e.g. waterholes for wildlife and water availability of agriculture.
8. Understand how the socially unstable Anthropocene will influence the ecological systems and vice versa.

#### 1.3.2 Social and economic drivers

1. Determine the possible impact of global change drivers on thicket (and other areas of concern) and associated mitigation and adaptive strategies.
2. Learn from international institutions how to deal with socio-legal issues of changing ecological boundaries to address social needs.
3. Understand the economic drivers of land-use in thicket; what is the economic advantages of different types of land uses and their combinations?
4. Understand the state of knowledge of different land uses and their economic value.
5. Understand the economics of existence and related decision-making.
6. Understand the balance between mining and sustaining resources in the thicket.
7. Understand the resource economics of the thicket.
8. Investigate the green/wildlife economical opportunities that thicket can contribute towards and how to grow that.

## 1. Develop a thorough understanding of the Albany Thicket *especially as a social-ecological system*

### 1.4 System function and ecosystem services

1.4.1 Determine criteria to maintain a functional thicket biome realistically.

1. Develop criteria to decide what has to be saved and what can be sacrificed
2. Determine which patches are exceptionally biodiverse and need specific protection
3. Determine which criteria should be used to prioritise thicket areas for protection

1.4.2 Understand the ecosystem services rendered by thicket

1. Understand the patch size required to deliver ecosystem services
2. Assess the importance of different thicket types for the water provision of the catchment
3. Understand the ecological infrastructure and ecosystem services of the thicket biome and the related limitations to human well-being.g water supply
4. Determine what are the water resources and how can they be made sustainable
5. Understand how soil in degraded areas have changed and how to recover soil processes
6. Understand ecosystem services provided by large herbivores in thicket systems. Who are the seed dispersers, ecosystem engineers etc. Which species maintains thicket and which ones changes it into a different state and under what conditions.

1.4.3 Understand the requirements of the thicket system.

1. Understand the connectivity , corridor width and patch size between thicket patches needed to preserve the thicket
2. Understand the difference in function in areas with intact thicket and encroached areas.
3. Understand the balance of thicket to cleared patches needed to maintain thicket function.
4. Identify the leverage points where you influence the system

## 1. Develop a thorough understanding of the Albany Thicket *especially as a social-ecological system*

### 1.5 Degradation and restoration

*1.5.1 Understand degradation its causes and extent and how can it be avoided*

1. Understand the status and rate of degradation and transformation.
2. How can degradation of the thicket be avoided without compromising economics?
3. Understand how degradation is perceived with special emphasis on the occurrence of *V karroo*.
4. Understand what the role of herbivores and fire is in degrading thicket.
5. Develop a framework and key strategies to avoid degradation in the future.
6. Understand the relationship between degradation and pollinators.

*1.5.2 Understand Rehabilitation and restoration of the thicket*

1. Develop a way forward with restoration taking the role of conservation and stewardship areas into account
2. Understand the mechanisms and outcomes of restoration vs rehabilitation.
3. Establish the criteria to determine whether areas are rehabilitating towards forest.
4. Determine the characteristics of naturalising forest.

## 1. Develop a thorough understanding of the Albany Thicket *especially as a social-ecological system*

### 1.6 Understanding biodiversity related to the thicket

#### 1.6.1 Improve our knowledge of species distribution patterns in the different thicket types

1. Understand the distribution and occurrence of succulents in the thicket
2. Determine what the effects of declining forest and thicket on functional diversity are and at what densities do losses occur?
3. Determine which factors underlie the species composition pattern and how they respond to disturbance.
4. Identify thicket pioneers that can move into grasslands

#### 1.6.2 Document biodiversity at a landscape scale to guide agricultural development

1. Understand biodiversity to support spatial planning by municipalities and provincial institutions
2. Understand the biodiversity benefits of re-establishing thicket
3. Document vegetation and associated biota to inform future conservation requirements.

## 2. Strengthen ability to function as an “open laboratory” and to support appropriate attitudes to achieve immediate and ultimate goals

2.1 Promoting an understanding of perceived problems in establishing good relationships and their solutions

2.1.1 Develop a system of diagnosing and defining problems

1. Understand the balance of biodiversity, agricultural and social needs in the various landscapes
2. Understand the links between restoring thicket and restoring human and social capital
3. Understand how to maintain environmental and social sustainability

2.1.2 Understanding stakeholders with economic aims

1. Understand the utilitarian, cultural and social values associate with species and thicket
2. Determine how economic outcomes and thicket functionality can be optimised.
3. Determine how to we shift values, rules and knowledge within the current types of land use
4. Investigate how to respond realistically and practically to improve poor relationships
5. Understand the major drivers across different temporal and spatial scales in terms of economic and other challenges
6. Determine how communities can be supported to develop economically and what background information is needed to support this e.g. livestock numbers, sales, etc.
7. Initiate case studies e.g. compare management of landowners who go bankrupt or struggle to those that make a success in the thicket.

2.1.3 Improve relationships between researchers and institutions

1. Promote participation in research from the four academic institutions in the thicket.
2. **Identify silos and actions needed to move away from isolation.**
3. Identify and develop links between institutions and communities of practice for research and implementation.
4. Identify and engage all parties that need to be consulted regarding land use options and restrictions.

2.1.4 Improving relationships

1. Work towards a community that relates to each other.
2. Develop forums for open discussions.
3. Understand and foster cooperation, especially with the agricultural sector.
4. Identify important relationships that need to be developed.
5. Understand the issues around the conservation vs land use debate and how best to address them.

2. Strengthen ability to function as an “open laboratory” and to support appropriate attitudes to achieve immediate and ultimate goals

2.2 Communication and co-changing

2.2.1 Develop a strategy to change attitudes

1. Understand what mechanisms and institutions can be used to make stakeholders more aware of the value of natural resources, specifically the thicket
2. Develop tools, models and mechanisms to effect change in attitude
3. Develop an awareness campaign of the value of the thicket both in the cultural and biodiversity domains
4. Understand how behaviour and values shift and develop such knowledge – use pathways to illustrate impact of different decisions

2.2.2 Develop a communication system to inform stakeholders of new research, understanding and improved knowledge.

1. Develop a central database for data storage that will be readily accessible to all stakeholders.
2. Develop systems to support stakeholders in understanding differences between encroachment and intact thicket.
3. Understand how reporting can be made more accessible to other stakeholders.
4. Investigate how people can be aided in making decisions in spite of uncertainties.
5. Investigate the use of social media as a communication system.
6. Investigate how communication can be improved to increase awareness of the importance of protecting thicket.
7. Investigate how extension services could facilitate communication and participation.

2. Strengthen ability to function as an “open laboratory” and to support appropriate attitudes to achieve immediate and ultimate goals

2.3 Develop support mechanisms for existing thicket areas

2.3.1 Supporting institutions and initiatives

1. Develop stewardship models as applied to the thicket context.
2. Determine how to bring restored areas into stewardship and examine the possibility of certification that would make intact land more valuable.
3. Develop conservation stewardship initiatives as a conservation tool on private land within the thicket biome.
4. Develop mechanisms to support institutions such as ECPTA and SANParks.
5. Determine how we can get evidence-based data on efficient offsets.
6. Understand how to package and market thicket needs to be directed at selected funders.
7. Understand what the thicket has that can be marketed to possible funders.

2.3.2 Supporting tourism

1. Understand how best the rich history of a hundred years of conflict and warfare can be used to promote cultural tourism.
2. Understand the economic and social needs of tourists and tourism providers in the thicket.

2. Strengthen ability to function as an “open laboratory” and to support appropriate attitudes to achieve immediate and ultimate goals

2.4 Building capacity

2.4.1 Develop an overall support for capacity development

1. Elevate the importance for thicket research and capacity development in the thicket.
2. Understand what and where the research capacity is, in the various universities, state institutions etc.
3. Understand the research capacity that is needed, and sources of funding student training develop principles of prioritisation i.e., triage.
4. Develop capacity in remote sensing.
5. Develop appropriate training to enable extension services.

2.5 Economics and sustainability

*2.5.1 Understand how to maintain environmental and social sustainability*

1. Compare commercial, traditional and conservation areas in terms of sustainable utilization.

*2.5.2 Understand how communities can be supported to develop economically.*

1. Determine what background information is needed to support communities e.g., livestock numbers and sales, livelihood expectations etc.
2. Understand how to develop work opportunities in the thicket.
3. Understand employment issues.

*2.5.3 Understand money flows*

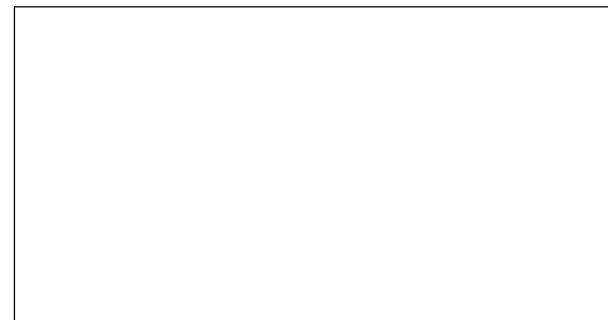
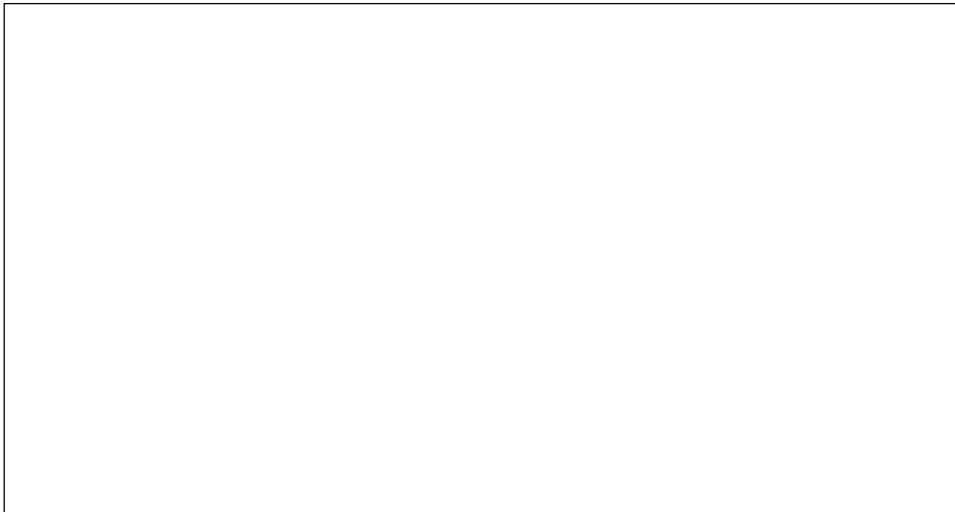
1. Understand money flows during ownership changes in the thicket especially related to transformation
2. Understand markets of agricultural produce related to global health requirements

3. Investigate scientific and legal constructs and their contradictions, and to what extent these promote or act as barriers to immediate and ultimate goal

3.1 Understand the role and implications of legal boundaries set by land or vegetation classification.

3.1.1 Understand the stakeholder perception around protected thicket.

3.1.2 Develop techniques for fine scale mapping of threatened areas



3. Investigate scientific and legal constructs and their contradictions, and to what extent these promote or act as barriers to immediate and ultimate goal

3.2 Understand and address the contradictions in especially agricultural and conservation laws and how they can be overcome

*3.2.1 Understand the aims of the different legal systems governing land use in the thicket: CARA, NEMBA, NEMA and protected species*

1. Develop mechanisms to support regulators as well as agriculturalists
2. Understand how agricultural and conservation laws and land issues overlap and contradict each other
3. Understand approaches to engage with the legal system to address concern around thicket conservation and land use
4. Understand the tension between conservation regulators and agricultural producers
5. Determine how commercial or unsustainable harvesting of forest and thicket can be controlled legally

*3.2.2 Understand the restrictions on land use in natural and changed systems in the thicket according to the different laws*

1. Understand the legal restrictions on consumptive use in the thicket
2. Determine how existing regulations affect tourism potential
3. Understand the restrictions on extralimital species and its consequences
4. Understand the restrictions on firebreaks
5. Understand the restrictions on clearing areas with bush encroachment
6. Understand the restrictions on clearing of the original thicket

*3.2.3 Understand how the contradictions in the laws can be overcome*

1. Investigate the contradictions between CARA, NEMBA, NEMA and protected species and how these influence thicket protection.

3. Investigate scientific (eg classification systems, imposed boundaries) and legal constructs (eg CARA and NEMBA) and their contradictions, and to what extent these promote or act as barriers to immediate and ultimate goal

3.3 Develop legal incentives for land owners to conserve thicket

3.3.1 Understand which funding opportunities can be developed or exist.

3.3.2 Develop evidence-based data on efficient offsets

3.3.3 Develop a mechanism to allow effective peer review of developing legislation

3.4 Understand the international agreed on treaties for rehabilitation.

3.4.1 What are the implications of international treaties on thicket conservation and land use

3.4.1 Understand how the thicket strategy is embedded in the national strategy

3.5 Develop monitoring techniques to detect transformation in the thicket

3.5.1 Develop assessment protocols where farmers and communities can co-create legislation

3.5.2 Understand the rates of habitat change by examining change regularly

3.5.3 Develop a peer review system to help identify unacceptable, gradual changes in the thicket

4. Co-develop an overall integrated strategy for praxis and restoration in thicket, including prioritization and pragmatic approaches

4.1 Co-develop the strategy for thicket protection and resource use

4.1.1 Co-develop a strategy to identify challenges and maintain

1. Identify important areas for protection using criteria developed.
2. Identify areas to be utilized for livestock farming.
3. Develop a landscape plan to identify areas acceptable for citrus/dairy/chicory/pineapple farming.
4. Develop a strategy for compatible farming with rehabilitation such as planting spekboom

4.1.2 Co-develop a strategic framework to guide current thicket

1. Compare economically productive veld to spekboom thicket.
2. Determine how land can be restored to be productive and support the people on the land
3. Understand who buys the products produced in the thicket biome – can they play a role in protecting the thicket?
4. Investigate alternative economic approaches and outcomes
5. Develop a sustainable grazing/browsing regime for thicket
6. Understand how tourist's animal viewing needs can be balanced with sustainable management.
7. Determine how large wildlife areas in thicket should be managed to be sustainable.

#### 4. Co-develop an overall integrated strategy for praxis and restoration in thicket, including prioritization and pragmatic approaches

##### 4.2 Consult and cooperate with key role players including stock farmers

4.2.1 Co-develop a strategy for resource use.

1. Determine how wild harvested plants can be supplemented satisfactorily with cultivation.
2. Understand how valued plants can be harvested sustainably

4.2.2 Understand approaches towards declaring the subtropical thicket as a biosphere reserve.

1. Use other biospheres as an example such as the Gouritz Biosphere Reserve.
2. Work towards biodiversity certification and stewardship.

4.2.3 Understand tools to support thicket conservation such as stewardship initiatives

1. Develop conservation stewardship initiatives as a conservation tool on private land within the thicket biome
2. Determine the possibility of dropping fences to create larger more open systems covering private land and conservation areas.
3. Determine how to bring restored areas into stewardship and examine the possibility of certification that would make intact land more valuable

##### 4.3 Develop a monitoring protocol

1. Examine the use of earth observation techniques to monitor ecosystem function.
2. Review available earth observation and airborne data suitable for monitoring vegetation transformation.
3. Investigate approaches to establish patch size in transformed thicket.
4. Develop practical techniques to evaluate landscape health.
5. Develop techniques to evaluate the outcome of different management and restoration approaches.

## 5. Applied research

### 5.1 Investigate different approaches to rehabilitation

*5.1.1 Determine how areas that are degraded due to previous land uses e.g. chicory farming can be rehabilitated to correct for the resultant acidification and nutrients depletion of soils.*

1. Synthesize the current understanding of restoration recipes for degraded areas.
2. Determine how succulents removed from cleared areas should be re-established.
3. Establish whether spekboom is indeed the ideal plant for Carbon capture as claimed.

### 5.2 Determining extent of alien invasions and approaches to their control

#### 5.3.1 Understand the distribution and impacts of alien species

1. Understand the extent and impact of alien species like prickly pear as well as alien and extra limital mammals
2. Understand the distribution of cacti spp and their links to soil erosion
3. Understand the susceptibility of the thicket to succulent invaders
4. Understand the impacts of alien biota on biodiversity
5. Understand the relationship between degradation and alien invaders

#### 5.3.2 Understand the impact of alien management and restoration

1. Investigate alternatives for controlling alien invasions effectively
2. Understand how well biocontrol works in areas does that is too thick to reach
3. Understand the links between restored areas and different management practises and subsequent invasion by alien plants

## Appendix 4 Detailed notes on risk assessment discussion.

Objective	Likelihood 1-5	Impact 1-5	Raw score	How good is current mitigation, G/M/W	Overall costs of current mitigation, H/F/L	How good could mitigation be? How can we improve it? G/M/W	At what overall cost? H/F/L
1. Understanding	Economic returns v. % transformation - peak returns are followed by steep crash. Y-axis to be dual or joint social-ecological - for more granularity. Risk uninformed policy that pushes us towards the right.	Maximised (NOT OPTIMIZED) ecosystem service flows are often not in intact thicket. Perverse outcomes.					
	3.5	3-4.5	fail				
2. Open lab	Key bridging objective, can undermine all other endeavours. Silos remain. High conflict with disbenefits. NO 'praxis what you preach'. No evolution in interested/engaged parties, non-inclusive. More polarised thinking.					Attend other meetings - embeddedness in different fora. Applied research WITH stakeholders, w farmers, different unis etc. Reframing and re-packing thicket. Careful wording. Knowledge not bodies needed. Autonomy needed, possibly extensive services. We can develop the curriculum to inform these individuals - where is the education pipeline? Recast as a global change grand challenge and invite international collab.	
	5	3	15	W	L	M	F
3. Attitudes	Silos remain, trench warfare, death by a thousand cuts, case-by-case reactive decision making, high levels of frustration across all stakeholders. Unable to take advantages of co-beneficial opportunities.	breakdown/recovery of goodwill		not connecting the dots between stakeholders		Low hanging fruit is getting a meeting of minds. Mediated consensus. Mapping of individual land parcels.	needs to be researched (psychologists etc), extension offers
	4	4	16	W	L	M	F



4. Legal	Sticking to their guns - some tempering, but essentially the same. Adding the threat to protected areas.	Granularity issues. Loss is premanent.		Things are being done - new veg classification - to improve the status quo. Land reform completely changes incentives, and weakens efforts. Very vulnerable to incentives.	Not vulnerable to manpower/capacity CARA . Provision to change title deeds hampers potential conservation. SIGNIFICANT man power issue NEMBA. Vegetation identification compounds legal contradictions and undermines legislative power. Weak and poor value for money.	We can map it (with consensus maybe??) gives legitimacy. STFs and IDPs mainstreamed. Unknown impact of carbon economy. Certification and big stick approaches possible. Good governance and legislative fixes ultimately necessary, dialogue between conservation and agriculture (bridge gap) necessary. If not, everything undermined. Poverty alleviation and jobs are possible ways to turn things around IF the higher ups talk. Unless you call 'crisis' people don't come together - do people perceive thicket clearing as a crisis?? Could they ever? Will the conflict in legislation accelerate the perception of crisis. How many people actually understand what CARA / says - deep reading suggests there is no conflict in legislation - how do we address this difference in interpretation? What power do national ministers have? If ministers change or remain the same - what are the impacts on mitigation effort. Need to get the private sector involved instead.	less budget and more work as ten years pass. budget too small
	3.5	4	14	W	L	M	H
5. Praxis	BAU expansion of reserves with post-priori reasoning. On going, high cost, isolated restoration. BAU * 10 = money in flux - will be blow it or invest it wisely? Ah doc, high conflict, little collaboration. Disparate, bumbling along, high goodwill but... Even without the BAU*10, there is still a lot of money in the system and it will be squandered.	Could be 5/5 - linked to political undermining.					Most of the budget would be spent on salaries to attract the right level of candidates. What economic lens are we using - compared to what, at what scale?
	4	4.5	18	W	L	G	M
6. Applied research	improvements in key areas regarding: flexibility, success and revisiting, techniques. HOWEVER BAU	Wasting a window to save things, wasting money - at smaller scale. If scale is larger then the impact is higher.				RS techniques. Biocontrol. Cacti invasion, and new species. Better a priori decision making for investment in rehabilitation regarding prior land use.	
	4	3.5	14	M	H	H	H

Objective	Comments
1. Understa	Need to tease out regional delivery of ecosystem services, and what thicket types and patches delivery what services. Scenario depends on where water comes from i.e. Patensie v Sundays catchment. The water issue is a national crisis. Reliance on intercatchment transfer should decrease ?? How to we make a regional plan that is not too local/a multi-scale plan for multiple contexts. Needs to be relevant down to farm scale. Economic argument for the (economic) resilience of the system.
	portfolio of stressors, mixed model for any area. We assume a top down limit of water. Is this likely?
2. Open lab	Need to invite other researchers, to avoid group thinking. links w attitudes and praxis. Possibly combine this objective w objective 3. Clarify obj 3. Divergences w obj 2: scientific leadership, setting scientific agenda, setting mental capacity. 'Internal vs external' communication: are we too insular and cut-off because of our uniqueness. Create global importance - generate critical mass. Afrotheria - the heart of Africa, heart of the preservation. Rewilding will come here - do we know what megaherbivores do here. Cannot risk top - down.
	Reinterpret all the work done to date, more palatable, easier to access. Need champions. Platforms? Need an access point
3. Attitude	Quite a range of landowner types - who, where, what for, on what time horizon? Do you want to prioritize (budget limit), who?? Target leader farmers? How do people develop an appreciation, affinity or sense of sacredness for thicket? Is it a low hanging fruit - the level of division between stakeholder is deep and historical. Not a priority - difficult to sell thicket is something people need 'it's not water' - what are the benefits to the different landowners? Do we know, can we communicate it? Reference to Fynbos perception - how did this happen, by whom? What is thicket, do we know - can the people in this room describe it - can we propagate that education? People know spekboom... strelitzia, plumbago etc. what other sp can we sell? We are at a remove, and enjoy the ability to partition what we want to enjoy, and what we need to make a living. 'Viable thicket' - different to different groups - can we define them? WHERE IS THE BUDGET to pay for people to go see other people? Hashtags FTW, social media, education videos on a modest budget. Challenging the Fynbos win - just too remote?. It depends how you sell it - will a conservation angle ever work? Sell utility value. Where are the social scientists and farmers in the meeting? Future farmers might hold totally different attitudes and values - could go either way pro or con. Chicken and egg - attitude or legislation - which needs to change first/have the biggest impact?
	Can we generate metrics on how to sell the benefits of thicket? Quantify them. We say yes. Ecosystem services, security - food, MEAT, more? Benefits per ha preserved thicket. What are we selling, how can we link it to jobs? How to make thicket iconic? Game farming industry. Jobs, heritage, culture. Aloe, rhino expansion projects. promote emerging farmers in the thicket. Improve human capital, esp. advocacy. Caution don't replace goats with impala. Play up megaherbivores i.e., rhino breeding hotspot.

4. Legal	<p>Not all thicket is the same. How can it all be degraded outside the protected areas? More extreme economic scenarios: If the mohair booms? carbon economy? Comments on the budget: to achieve the legislative ideal, we need 6 fold more of value (not percent). Patches that are transformed are completely gone. Do we understand the granularity of the potential change?</p>
	<p>Dicotamy in scenario: No thicket (complete loss/complete transformation) outside conserved areas is not feasible? Where is the desirable soil? Is there evidence of ongoing decline that will be qualitatively different in the next ten years? Better soils in conservation areas... perhaps conserved thicket will be on steep slopes and the protected areas will be deproclaimed? The vision of CARA - will it be achieved?? If the contradictions remain, all the downstream efforts are undermined - makes the risks higher for everything failing - (more later). NDP not addressed, but supports narrative for widespread transformation but suggests reserves would be at risk. Game farming is viewed as 'unproductive' - the need to appear productive might promote thicket removal. Will there be a move away from game farming because of this pressure? People come here to watch the animals in the thicket - not the vegetation - and there is a preference for the open undesirable states. Pressure on protected areas to bend to this desire, and undermine conservation? CARRYING CAPACITY IN THICKET...creates more troubles.</p>
5. Praxis	<p>Not ad hoc. Mandated and dedicated group of people. Diagnose challenges and have an formulated approach. Free moving, quick action. Agile. 5 people. 5 principle of Acts of War. Emerging fruits not low hanging fruits (beware). But is this a career path, is it alluring for high level leaders (not positions for young and emerging scientists)? Some oversight would still be needed, who are the right people for this, and how to avoid re-creating the beauracy. Is there any model we can learn from? Start up model, google, walmart? Need to look outside the ecological discipline. Biosphere reserve model with a team of champions. What is the growth pathway? Start with a smaller group with a strong vision. Funding possibilities? AFR100 should not be invested in negative emissions approaches (vegetation planting - area required is vast and contribution is negligible), and rather focus on energy interventions - tackle coal. AVOIDED DEGRADATION How to communicate the message without being branded a naysayer/ignored? Rivers project tells us Independence is key. The SA economy needs/wants investment - so the money will be sought/wlecomed - so we need to put other options on the table. It will be life changing for many people in South Africa - and how to we deny that? IPBES speaks to this - there is a high level push back emerging. Umgeni Ecological Infrastructure project - highlights that we need the right peoplr who have the right tough. Camdeboo - good intial pathway development was successful, driven by the fear of fraking, good example of a focus group in later years. What the forces that would push back? Government? The entire endeavour could be undermined by a single political decision - ?</p>
	<p>Cape Nature reference: many successes but failure with alien invasives - loss of trained labour teams. Loss of commitment, loss of responibility, with contractor teams. There is huge potential to stream line the incoming investment - guidelines must be in place. Biome projects of the past - good example - reflection: it was a less competative model, more communication and report back based, Brian Huntley and a few making funding decision. We need a Fred Kruger. Major sources of continued funding were obtained to support the growth - i.e. WfW. What issues with in EC functioning does this highlight? Most conservation is now pushed by partnerships. How can this be taken forward for an alternative offering to investors? Who is the appropriate funder NRF v international investor - how do we best avoid all the strings. There is a lot of power, and a lot of ways this could go wrong... This needs to be hammered out. Need a more inclusive group, more representative, better or differently skilled? However, this group can start the parameterizing - we have the context and enthusiasim.</p>
6. Applied	<p>Decade of restoration in Africa means there will be cheap person days. This is dangerous. Potentially misplaced efforts. Potential AFR: manage FOR bush encroachment, slash and burn thicket; what is we are not clear about what we want to do in this group, if we do not parameterise the process, things could do badly wrong. What is the definition of bush encroachment?? LEGISLATION needs to be realigned.</p>
	<p>Mapping, minimum areas for particular thicket types, sp. response to different structures/patch arrangement. Triage - at what point do you walk away? Is there an AIP game changer? jointed cactus, vines. Changing animal movement - yes - but is that undesirable? What is the scale, what is the objective, what is the view of our starting point - should we consider alternative land uses? Can you make something else worthwhile or novel? Site scale restoration - current - is not viable in the long term. We have experts that are retiring - we need to tap into that. We do not need to reinvent the wheel - methodolgies of the past are not being . We are allowing people to make the decisions on land rehabilitation that should not. Need to be implemented like an engineering works. KNOWLEDGE TRANSFER is key. To what extent are carbon credits funding restoration - this market is likely to evaporate.</p>

