Peer review history for:

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Local and national stakeholders collaborate to take on *Prosopis* invasions with biological control and biomass use in South Africa [peer review history]. S Afr J Sci. 2024;120(9/10), Art. #17928. https://doi.org/10.17159/sajs.2024/17928/peerreview

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Reviewer C: Round 1
Date completed: 28 March 2024
Recommendation: Accept / **Revisions required** / Resubmit for review / Decline
Conflicts of interest: None

Does the manuscript fall within the scope of SAJS?
Yes/No
Is the manuscript written in a style suitable for a non-specialist and is it of wider interest than to specialists alone?
Yes/No
Does the manuscript contain sufficient novel and significant information to justify publication?
Yes/No
Do the Title and Abstract clearly and accurately reflect the content of the manuscript?
Yes/No
Is the research problem significant and concisely stated?
Yes/No
Are the methods described comprehensively?
Yes/No
Is the statistical treatment appropriate?
Yes/No/**Not applicable**/Not qualified to judge
Are the interpretations and conclusions justified by the research results?
Yes/Partly/No
Please rate the manuscript on overall contribution to the field
Excellent/Good/Average/Below average/Poor
Please rate the manuscript on language, grammar and tone
Excellent/Good/Average/Below average/Poor
Is the manuscript succinct and free of repetition and redundancies?
Yes/No
Are the results and discussion confined to relevance to the objective(s)?
Yes/No
The number of tables in the manuscript is
Too few/**Adequate**/Too many/Not applicable
The number of figures in the manuscript is
Too few/**Adequate**/Too many/Not applicable
Is the supplementary material relevant and separated appropriately from the main document?
Yes/No/**Not applicable**

Please rate the manuscript on overall quality

Excellent/**Good**/Average/Below average/Poor

Is appropriate and adequate reference made to other work in the field?

Yes/No

Is it stated that ethical approval was granted by an institutional ethics committee for studies involving human subjects and non-human vertebrates?

Yes/No/**Not applicable**

If accepted, would you recommend that the article receives priority publication?

Yes/No

Are you willing to review a revision of this manuscript?

Yes/No

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Yes/No

Comments to the Author:

General comments:

I have completed the review of the manuscript titled "Stakeholders Collaborate to Beat *Prosopis* Invasions with Biological Control and Biomass Use". I commend the authors for addressing the critical global issue of "*Prosopis* invasion management" aimed at sustaining healthy biodiversity and limiting the spread of alien invasive plants in pristine, isolated, arid regions of South Africa. The study is well-written, articulated, and informative, providing a valuable long-term assessment that is of significant interest to various stakeholders, including environmental practitioners, policy developers, academics, farmers, and the general public, who are the primary beneficiaries and end-users of the *Prosopis*-invaded ecosystems.

The study covers practical and replicable Community of Practice (CoP) engagements, biocontrol efforts, and eradication programs that can be easily applied nationally and internationally by other municipalities and provinces to reduce infestations of this species. However, there are a few edits that could enhance the manuscript before publication. I have provided detailed comments and suggestions for these edits in the attached PDF files using track changes. Therefore, I kindly request the authors to address these comments before the manuscript can be considered for acceptance.

[See Appendix 1 for Reviewer C's comments made directly on the manuscript]

Author response to Reviewer C: Round 1

I have completed the review of the manuscript titled "Stakeholders Collaborate to Beat *Prosopis* Invasions with Biological Control and Biomass Use". I commend the authors for addressing the critical global issue of "*Prosopis* invasion management" aimed at sustaining healthy biodiversity and limiting the spread of alien invasive plants in pristine, isolated, arid regions of South Africa. The study is well-written, articulated, and informative, providing a valuable long-term assessment that is of significant interest to various stakeholders, including environmental practitioners, policy developers, academics, farmers, and the general public, who are the primary beneficiaries and end-users of the *Prosopis*-invaded ecosystems.

AUTHOR: Thank you for the positive feedback

The study covers practical and replicable Community of Practice (CoP) engagements, biocontrol efforts, and eradication programs that can be easily applied nationally and internationally by other municipalities and provinces to reduce infestations of this species. However, there are a few edits that could enhance the manuscript before publication. I have provided detailed comments and suggestions for these edits in the attached PDF files using track changes. Therefore, I kindly request the authors to address these comments before the manuscript can be considered for acceptance.

AUTHOR: Comments from reviewer in PDF document addressed in revision. Thank you.

Reviewer D: Round 1
Date completed: 26 March 2024
Recommendation: Accept / **Revisions required** / Resubmit for review / Decline
Conflicts of interest: None

Does the manuscript fall within the scope of SAJS?
Yes/No
Is the manuscript written in a style suitable for a non-specialist and is it of wider interest than to specialists alone?
Yes/No
Does the manuscript contain sufficient novel and significant information to justify publication?
Yes/**No**
Do the Title and Abstract clearly and accurately reflect the content of the manuscript?
Yes/**No**
Is the research problem significant and concisely stated?
Yes/**No**
Are the methods described comprehensively?
Yes/**No**
Is the statistical treatment appropriate?
Yes/No/**Not applicable**/Not qualified to judge
Are the interpretations and conclusions justified by the research results?
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Excellent/**Good**/Average/Below average/Poor
Please rate the manuscript on language, grammar and tone
Excellent/Good/Average/**Below average**/Poor
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Yes/**No**
Are the results and discussion confined to relevance to the objective(s)?
Yes/No
The number of tables in the manuscript is
Too few/Adequate/Too many/**Not applicable**
The number of figures in the manuscript is
Too few/**Adequate**/Too many/Not applicable
Is the supplementary material relevant and separated appropriately from the main document?
Yes/No/**Not applicable**
Please rate the manuscript on overall quality
Excellent/Good/**Average**/Below average/Poor
Is appropriate and adequate reference made to other work in the field?
Yes/No
Is it stated that ethical approval was granted by an institutional ethics committee for studies involving human subjects and non-human vertebrates?
Yes/**No**/Not applicable
If accepted, would you recommend that the article receives priority publication?
Yes/**No**
Are you willing to review a revision of this manuscript?
Yes/**No**
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Yes/No

Comments to the Author:

Title

Since the current was limited to South Africa by design, I suggest the title to be amended as follows "Stakeholders collaborate to beat *Prosopis* invasions with biological control and biomass-use in South Africa" or "Stakeholders collaborate to beat *Prosopis* invasions with biological control and biomass-use: a case of the Northern Cape, South Africa"

Abstract

In lines 2-3 *"When addressing complex environmental challenges in the field of sustainability science, transformative research and collaboration are essential"*… I am suggesting that this sentence can be constructed as the following "Transformative research and collaboration are essential when addressing complex environmental challenges in the field of sustainability science".

In lines 4-5 *"This paper considers the collaborative efforts over the last half-decade to manage Prosopis invasions in the Northern Cape, South Africa"*… one would expect to see the methodological approach used in this study in the main which will show the detailed inclusion and exclusion criteria.

Introduction

The introduction is lacking. The authors should start by telling us about addressing the sustainability issues and in my opinion, I think it should briefly start with the description of the research problem (e.g. *Prosopis* species invasion), the impact of the problem (is it economic, ecological, social or legislative), the causes of the problem, what others have done to address the problem, what has not been done and what the current study is going to do.

The sentence in lines 49 – 53 is too long, rephrase or divide into two sentences *"This disconnect between research and stakeholders and research and implementation is well illustrated by the biocontrol communities response to the Harding[9] study, even though the majority of landowners favoured removal and more effective management of Prosopis, researchers chose not to consider natural enemies that damage the plant"*.

Even the sentence in lines 53 – 57 is too long.

The sentence in lines 58 – 59 does not read well, please rephrase.

In lines 80 – 82, *"This paper explores our efforts over the last half-decade to establish a community of practice that engages different stakeholders in partnerships to achieve the goal of effective management of Prosopis invasions in the Northern Cape, South Africa."* I would expect to see a methodology on how this study was carried out. Without clear methodology, it will be difficult for other researchers to replicate/validate the current study.

Prosopis invasions: history and management

Line 88 "…the 87 benefits of *Prosopis* as a source of fodder, shade and firewood…" this is repetitive to what has already been mentioned in line 85.

Lines 133 – 135: it is important to briefly explain what was the reasons or challenges that hindered the achievement of the vision of managing *Prosopis* in that proposed 20 years.

Establishing a collaborative *Prosopis* management initiative

From lines 137 – 147 as well as 149 – 157: the facts raised here are important, however, they lack citations.
Lines 148 – 149: *"In 2021 and 2022, we investigated the benefit of a local "champion" to promote collaboration and learning[20]."* What was the outcomes/main findings of this investigation?

Farm-scale plans for *Prosopis* management

This section lacks the interpretation of the reported results. For example, the author/s listed the proposed

targets for farm-scale plans by working group, however, the authors' voice is not heard, what is the message that reader should take home from this. I suggest that authors' improve this section.

The quality of figures 1 – 3 need to be improved.

The quality of English need to be improved before the paper can be accepted.

Discussion and way forward

I suggest that the authors should add the conclusion which will give the main points of the study and their implication.

Author response to Reviewer D: Round 1

Since the current was limited to South Africa by design, I suggest the title to be amended as follows "Stakeholders collaborate to beat *Prosopis* invasions with biological control and biomass-use in South Africa" or "Stakeholders collaborate to beat *Prosopis* invasions with biological control and biomass-use: a case of the Northern Cape, South Africa"

AUTHOR: Changed title to the following: "Local and national stakeholders collaborate to take on *Prosopis* invasions with biological control and biomass-use in South Africa"

In lines 2-3 *"When addressing complex environmental challenges in the field of sustainability science, transformative research and collaboration are essential"*… I am suggesting that this sentence can be constructed as the following "Transformative research and collaboration are essential when addressing complex environmental challenges in the field of sustainability science".

AUTHOR: Accept suggestion of reviewer and changed text to the following:

"Research that changes the way stakeholders act and how they collaborate are essential when addressing complex environmental challenges in the field of sustainability science."

In lines 4-5 *"This paper considers the collaborative efforts over the last half-decade to manage Prosopis invasions in the Northern Cape, South Africa"*… one would expect to see the methodological approach used in this study in the main which will show the detailed inclusion and exclusion criteria.

AUTHOR: The paper reflects on previous attempts to better manage *Prosopis* invasions and to an extent excludes past approaches, but does not overtly follow a methodological approach. We have changed the text to the following:

"The collaborative efforts of stakeholders and researchers over the last half-decade to manage *Prosopis* invasions in the Northern Cape, South Africa, highlights the importance of stakeholder engagement and social learning in sustainable invasive species management."

The introduction is lacking. The authors should start by telling us about addressing the sustainability issues and in my opinion, I think it should briefly start with the description of the research problem (e.g. *Prosopis* species invasion), the impact of the problem (is it economic, ecological, social or legislative), the causes of the problem, what others have done to address the problem, what has not been done and what the current study is going to do.

AUTHOR: We slightly disagree with this comment. The impact of *Prosopis* is not the research problem. The research problem is how to better engage stakeholders in the management of *Prosopis*. There is also some contextualization of the impacts in the text under the "history section"

The sentence in lines 49 – 53 is too long, rephrase or divide into two sentences *"This disconnect between research and stakeholders and research and implementation is well illustrated by the biocontrol communities response to the Harding[9] study, even though the majority of landowners favoured removal and more effective management of Prosopis, researchers chose not to consider natural enemies that damage the plant"*.

AUTHOR: We agree thank you. We have split sentence accordingly:

This disconnect between research and stakeholders and research and implementation11 is well illustrated by the biocontrol community's response to the Harding9 study. The majority of landowners favoured

removal of *Prosopis* and more effective management thereof9 but researchers chose not to consider natural enemies that damage the plant and instead focussed efforts on seed eating weevils.

Even the sentence in lines 53 – 57 is too long.

AUTHOR: Agree, have split sentence accordingly:

Likewise, Shackleton et al.12 published co-created guidelines for *Prosopis* management in the peer-reviewed literature (a process driven by scientists), which have not been implemented. A reason for lack of implementation being that there were, and still are, no processes put in place to ensure that government officials and other relevant stakeholders consider or implement the findings of the research (in many cases such work is even sponsored by government departments but never adequately considered or acted upon).

The sentence in lines 58 – 59 does not read well, please rephrase.

AUTHOR: Agree, amended accordingly:

When encouraging invasive species management through collaborative working, it is essential to recognize complexities (like different needs and conflicts) and the legal frameworks in South Africa[8].

In lines 80 – 82, *"This paper explores our efforts over the last half-decade to establish a community of practice that engages different stakeholders in partnerships to achieve the goal of effective management of Prosopis invasions in the Northern Cape, South Africa."* I would expect to see a methodology on how this study was carried out. Without clear methodology, it will be difficult for other researchers to replicate/validate the current study.

AUTHOR: This is not a traditional hypothesis-driven research article and more of a reflection of the development of a collaborative management initiative and what was learned and achieved. Formal scientific methodologies were not followed and it was an adaptive learning process we specifically reflect on – to help others learn from our experiences.

Line 88 "…the 87 benefits of *Prosopis* as a source of fodder, shade and firewood…" this is repetitive to what has already been mentioned in line 85.

AUTHOR: Agree, amended accordingly:

Like many useful invasive species, during the early stages post-introduction, the benefits of *Prosopis* were positive, and increased initially.[7, 22]

From lines 137 – 147 as well as 149 – 157: the facts raised here are important, however, they lack citations.

AUTHOR: To our knowledge this is the first time that these "facts" are being recorded in scientific literature. the information came out of meetings and are baseline qualitative evidence. We have addressed this in the revision.

Farm-scale plans for *Prosopis* management

This section lacks the interpretation of the reported results. For example, the author/s listed the proposed targets for farm-scale plans by working group, however, the authors' voice is not heard, what is the message that reader should take home from this. I suggest that authors' improve this section.

AUTHOR: Thank you for the comment, we agree. It was more of a list and we have made this section more discursive

The quality of figures 1 – 3 need to be improved.

AUTHOR: The reviewer needs to indicate how these figures should be improved. The authors consider these figures give adequate and useful insight into the work.

The quality of English need to be improved before the paper can be accepted.

AUTHOR: We have made the suggested improvements to the English as recommended by this reviewer.

I suggest that the authors should add the conclusion, which will give the main points of the study and their implication.

AUTHOR: We have revised the conclusion section. Thank you.

Appendix 1: Reviewer C comments on manuscript

Stakeholders collaborate to beat Prosopis invasions with biological control and biomass-use

Abstract

When addressing complex environmental challenges in the field of sustainability science, transformative research and collaboration are essential. This paper considers the collaborative efforts over the last half-decade to manage *Prosopis* invasions in the Northern Cape, South Africa, highlighting the importance of stakeholder engagement and social learning in sustainable invasive species management. Through a community of practice approach, stakeholders worked together in an attempt to develop a National Strategy for *Prosopis* management. This strategy aimed to emphasize the need for integration of biomass use (aimed at offsetting the costs of mechanical clearing and necessary herbicide use) but also underscores the significance of biocontrol alongside other management approaches. Adequate farm-scale planning is necessary to provide a sense of purpose and assist in monitoring of progress. We worked alongside land managers to develop such plans. Furthermore, an exploration of the history of biological control of Prosopis sheds light on the challenges faced and decisions made by researchers. The engagement of a local "champion" played a crucial role in facilitating collaboration and learning among stakeholders, emphasizing the significance of inclusive approaches in addressing complex sustainability challenges. Additionally, we get a better understanding of the Community of Practice that has evolved, assessing its progress in ensuring funding and implementation ~~of~~ plans for *Prosopis* management. This study~~'s findings~~ underscore the necessity of meaningful stakeholder engagement and collaboration in effective invasive species management. By promoting understanding and involvement of diverse stakeholders, initiatives can be more sustainable and have a greater impact in addressing broader sustainability issues.

please add Keywords here after abstract, thanks

Significant Findings

The study highlights the fundamental role of stakeholder collaboration in addressing environmental challenges, promoting sustainability, and fostering social learning. Collaboration facilitates exchange of knowledge and allows stakeholders to make informed decisions when addressing sustainability issues. This study emphasizes the importance of a collaborative approach and it demonstrates the potential effectiveness of a community of practice in managing *Prosopis* invasions. A local "champion" played a pivotal role in facilitating collaboration, bridging communication gaps, and promoting inclusive approaches. Sustained stakeholder engagement, transdisciplinary collaborations, effective biological control and market development for biomass products will improve sustained management of *Prosopis*.

Introduction

To effectively address sustainability issues and unlock the full potential of sustainability science, Brandt et al.[1] stress the importance of transformative research and collaboration. This includes promoting stakeholder engagement in co-design and co-management of action-orientated research as well as social learning[2-4]. Collaboration is needed in all domains of environmental management and conservation, including in the forestry and agroforestry areas, but many challenges remain in integrating collaborations and sustainable practices[5].

Collaborative research and action is, however, ~~very hard to do effectively~~ and there is a risk ~~of~~ stakeholders ~~being or feeling~~ like subjects rather than collaborators. This is common in invasion science[6] and in particular, the challenge remains with respect to the management of invasive plants arising from forestry and agroforestry practices such as *Prosopis* species in South Africa[7-8]. For example, Harding[9] and Shackleton et al.[10] surveyed landowners' opinions to *Prosopis* management but lacked consideration of other stakeholders and did not offer avenues of more collaborative

processes moving forward. They merely consulted local actors through one-way dialogues which had limited effects on social learning and the initiation of actions to sustainably control *Prosopis*. As such, poor collaboration meant that invasions continue to spread and impacts from the species continue to rise, and steps need to be taken to correct this. This disconnect between research and stakeholders ~~and research and~~ implementation[11] is well illustrated by the biocontrol communities response to the Harding[9] study, even though the majority of landowners favoured removal and more effective management of *Prosopis*, researchers chose not to consider natural enemies that damage the plant. Likewise, Shackleton et al.[12] published co-created guidelines for *Prosopis* management in the peer-reviewed literature (a process driven by scientists), but there were, and still are, no processes put in place to ensure that government officials and other relevant stakeholders consider or implement the findings of the research (in many cases such work is even sponsored by government departments but never adequately considered or acted upon).

Emphasizing collaboration for invasive species management, it is essential to recognize complexities (like different needs and conflicts) and legal frameworks in South Africa[8]. For example, legislatively the onus of invasive species management, including *Prosopis*, is on private landowners[13] but the government is responsible for public areas and communal lands. Despite government efforts, such as the Working for Water programme (WFW), allocating substantial funds to manage invasive species on public and private lands, the effectiveness of management remains limited, with WfW targeting only 4% of the area invaded by *Prosopis*.[14] Scientists attribute this failure to various factors, including a lack of prioritization, misguided success metrics, and insufficient funding. Overall, one option to encourage the sustainable management of *Prosopis* and other plant invasions in the country is to promote collaboration and introduce integrated management, including the introduction of biological control agents[15-16]. However, this has at times been controversial, suffers from funding issues and requires coordination amongst stakeholders.[17-18]

Management of invasions and progress of biological control to manage invasive alien plants might be slow and occasionally the chosen natural enemy is not effective, therefore the biocontrol community has legitimate concerns about managing expectations of stakeholders. These concerns should not prevent a mutually beneficial relationship between land managers, responsible for control of *Prosopis,* biological controllers and other relevant stakeholders. Ultimately, it is necessary to develop a partnership, which will ensure a virtuous cycle of information sharing between farmers, researchers and managers. An effective way of supporting such collaborations and expansive learning between relevant stakeholders is through an insider interventionist researcher who links communities to information[19], this person can also act as a champion in the space for collective learning[20]. However, this is not always easy to do.

This paper explores our efforts over the last half-decade to establish a community of practice that engages different stakeholders in partnerships to achieve the goal of effective management of *Prosopis* invasions in the Northern Cape, South Africa.

Prosopis invasions: history and management

Numerous species from the genus *Prosopis* were introduced from the Americas into arid regions of South Africa in the late 1800s to act as fodder, shade and fuelwood trees. These *Prosopis* species, and hybrids thereof[21], are now invasive in arid areas of the country, with several negative social-ecological impacts. Like many useful invasive species, during the early stages post-introduction, the benefits of *Prosopis* as a source of fodder, shade and firewood were positive, and increased initially.[7, 22] However, once *Prosopis* populations got too dense the supply of benefits dwindled and negative impacts arose. Ecological impacts of *Prosopis* invasions include reductions in insect, bird

and plant diversity[23-25] and increased mortality of native tree species[26], loss of scarce groundwater resources and grazing potential[27-28]. Social impacts include negative effects on local economics[22] and people's livelihoods[25, 29]. With time, the net value of the *Prosopis* trees in South Africa becomes negative as the cost of managing the invasion and its negative impacts far outweigh any positive values. With the fall of benefits and rise in costs most landowners in the Northern Cape now perceive the cost of *Prosopis* invasions outstrips the benefits of the plant.[10] Due to increased impacts and loss of benefits, many countries globally, including South Africa are regulating and managing *Prosopis* invasions using various methods.[30-32]

Prosopis management in South Africa has initiated interactions between government officials, forestry and agricultural researchers, and landowners from the time of the first introduction of the species to the present. Between 1880 and 1960, the community was focused on establishing *Prosopis* populations (Figure 1a) as forestry officials facilitated the planting of *Prosopis* on private and public land. Essentially there was a "community of practice" that worked together to promote *Prosopis* in arid areas. Van den Berg et al.[33] estimated that by 1974, *Prosopis* infested up to 127 thousand hectares in the Northern Cape (Figure 1a).

Between 1960 and 1987, a new ~~"community of practice"~~ was taking shape to understand the extent of unwanted *Prosopis* invasions and on how best to manage the growing problem (Figure 1a), of which biological control was considered the most sustainable solution. Biological control researchers~~,~~ in South Africa, discussed the status of *Prosopis* at their annual research meetings and agreed that a researcher visit the Northern Cape to "*gauge the pest status of the species*".[34] In order to understand the issue better, Harding[9] surveyed 175 landowners on *Prosopis* control. There was strong response in favour of control of *Prosopis* with 51% calling for eradication and 24% suggesting a level of management to prevent further impact.[9, 21] Even with this show of support for eradication, the research community "erred on the side of caution" and chose to focus on biological control agents that damaged dry seeds in an attempt to reduce germination, and did not consider natural enemies that might damage vegetative parts of the plants and kill either seedlings or adults. We might considered this a "failure" of the ~~community of practice~~ at the time as researchers "chose" to act contrary to the expressed view of the landowners (the most important and legitimate stakeholders). In all likelihood the approach adopted by biological control researchers was motivated by the paper, "Tactics for Evading Conflicts in the Biological Control of South African Weeds"[34]. This motivates for selection of a biological control agent that could reduce the spread of the plant but protect the pods used as animal fodder.[21, 35] In 1987, after thorough research to confirm that three species of weevils ate only seeds of *Prosopis*, managers released these weevils in large numbers across the Northern Cape. It was found that weevils could destroy up to 92% of seeds in ideal environmental conditions but the 8% of seed remaining in the environment continued the spread of *Prosopis*.

From 1988 to 2002, the community gained insights into the impact of biological control and considered other approaches for management of *Prosopis* (Figure 1a). Even though the seed feeding biological control agents appeared to be failing to halt the spread of *Prosopis* there was an optimistic outlook for its management, a 2001 workshop proposed, that: "*in 20 years from now, invasive Prosopis in Southern Africa will be under control and confined to areas where it can be managed to deliver sustainable benefits.*"[36] Unfortunately, 23 years on, the optimism of this workshop has not delivered this vision, in spite of much further work South Africa is not close to reaching the goal of having *Prosopis* under control and currently, invasions are estimated to be over 6 million hectares.

Establishing a collaborative *Prosopis* management initiative

In July 2018, researchers from the Agricultural Research Council – Plant Health and Protection and the Centre for Biological Control (CBC) met with the Natural Resources Management Committee of Agri Noord Kaap. At this meeting, the biological controllers presented information on the management of both *Prosopis* and cacti. After this initial meeting, Agri Noord Kaap in partnership with the CBC co-ordinated and facilitated a workshop to discuss *Prosopis* management in February 2019. At this meeting, stakeholders from multiple backgrounds and institutions formed a working group to develop "A National Strategy for Management of *Prosopis*". This had the ultimate goal of promoting sustainable management of invasive *Prosopis* to protect lives, livelihoods and biodiversity. The partnership developed several drafts of this National Strategy, but there were numerous reasons why it went no further: COVID, drought, fire, locusts, and the threat of land expropriation without compensation preoccupied stakeholders' minds more than the need to manage *Prosopis*. In 2021 and 2022, we investigated the benefit of a local "champion" to promote collaboration and learning[20]. A researcher from the Northern Cape farming community co-ordinated ~~awareness raising of~~ stakeholders and interaction between stakeholders and researchers. At a workshop in June 2022, farmers raised concern that the focus of management was too biased towards biological control, "Ons het vergaderings, en jy bring net goggas en nog goggas" (We have meetings and you just bring bugs and more bugs). In response to this, a roadshow was arranged (October-November 2022) where experts presented on invasive plant management, biomass use and use of *Prosopis* pods. The content from these roadshows was well received and slowly cooperation improved. The local "champion" has now moved on but the networks and relationships established continue.

Promoting sustainable *Prosopis* management

In collaboration, we explored what behaviour change and actions are required to achieve the final goal of "Sustainable management of invasive *Prosopis* to protect lives, livelihoods and biodiversity". This process identified intermediate outcomes to achieve to get from the current situation (2020) to the final goal (Figure 2). We explore these intermediate outcomes in the following sections.

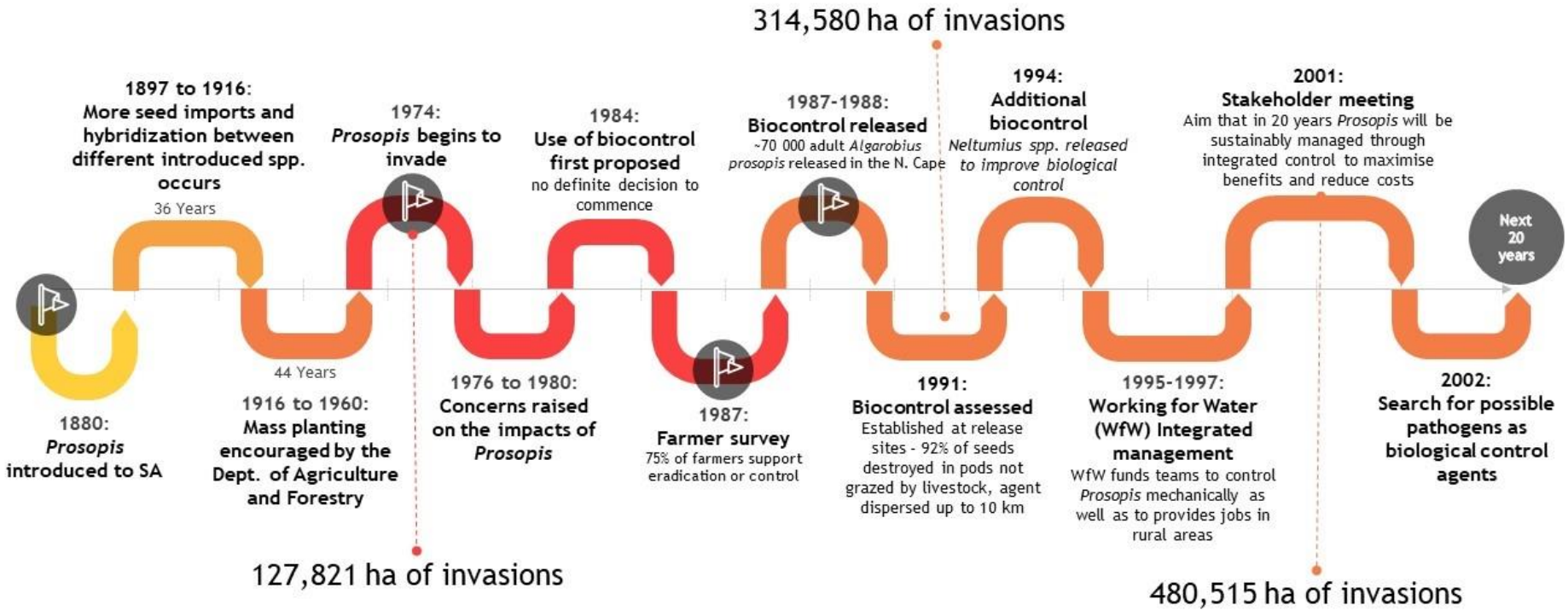

Figure 1a. A visual description of the history of *Prosopis* in South Africa (1880 to 2002). Data drawn from different sources referenced in the text and from notes of biological control meetings held during the period 1976 to 2002. The extent of *Prosopis* invasion as estimated by van den Bergh (2013) appears in "ha of invasion".

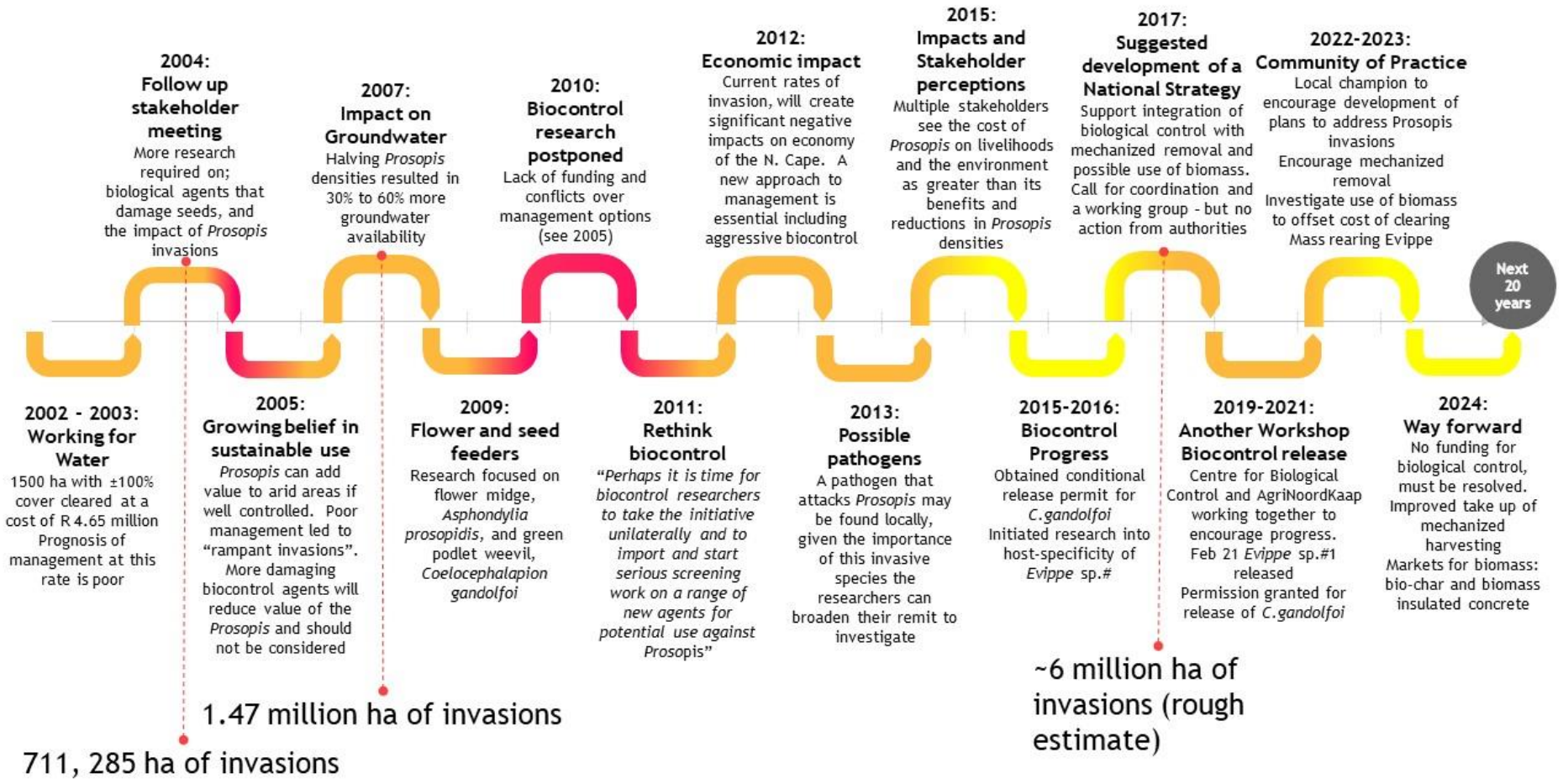

Figure 1b. A visual description of the history of *Prosopis* in South Africa (2002 to 2024).

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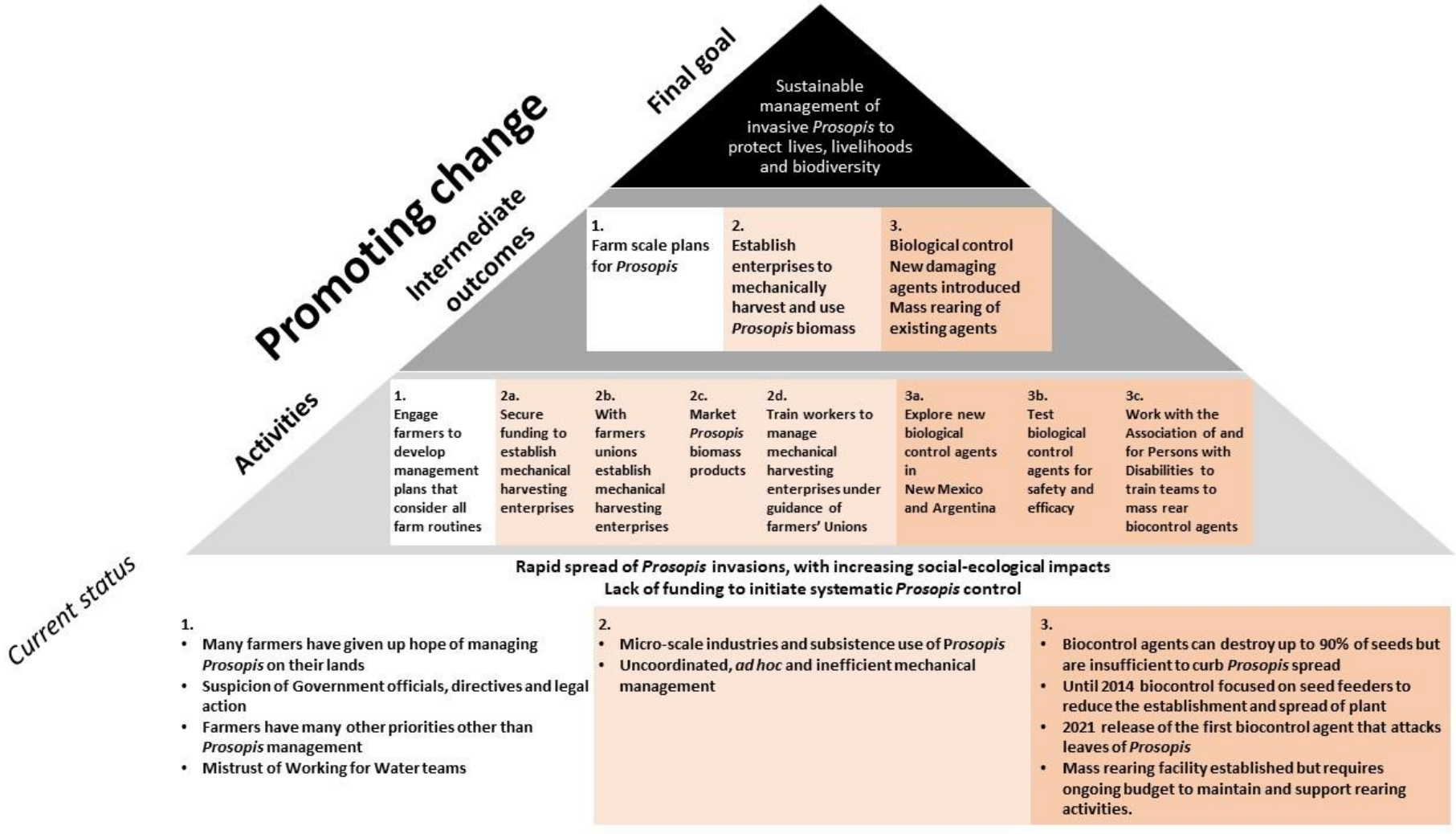

Figure 2. Changes in behaviour and actions required to reach the final goal of "Sustainable management of *Prosopis* to protect lives, livelihoods and biodiversity".

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Farm-scale plans for *Prosopis* management

The proposed National Strategy for Prosopis management[12] recommends the development of a manual for private landowners outlining best practice for farm-scale management of *Prosopis*. Subsequent to the 2019 stakeholder meeting, the working group considered this and proposed targets for farm-scale plans:

- Engage experts to develop a template for *Prosopis* management plans.
- Encourage each landowner to produce a management plan.
- Aim for 300 plans by December 2025.
- Encourage 300 plans annually thereafter.
- Encourage landowners from adjacent farms to work concurrently to enable expert to visit groups of farmers at one time.
- All 3600 Agri Noord Kaap registered farmers to have plans in 12 years.

To promote effective *Prosopis* management, the CBC engaged a private company to develop a template and work with 30 farmers, to prepare plans that included an emphasis on biological control. Plans also had to include guidance on herbicide use and post-clearing follow-up (company's expert knowledge).

A proposed goal is to get 300 farmers to develop plans by 2025. Despite roadshows in October and November 2022, attracting over 150 stakeholders, farmer response to date has been weak. In February 2023, the company reported that they, were "battling to get farmers to come forward and join for management plans to be drawn up for their property". They ~~suggested that~~ two factors ~~for this~~:

- Farmers fear that a management plan of this nature would lead to the Department of Forestry, Fisheries and the Environment (DFFE) issuing "directives" that force them to clear their land or face legal proceedings.
- Some farmers have a lack of knowledge of, and fear of technology, which hampers their use of tools such as Google Earth to map the populations of invasive alien plants on their properties.

The company identified thirteen farms for the development or review of invasive species management plans: three in the Groblershoop area (owned by a single family), two in the Carnarvon area, and eight possible farms in the Brandvlei area. In order to encourage more farmers to make use of the offer of assistance to develop and review plans we circulated messages on WhatsApp groups. A further nine farmers from various parts of the Northern Cape indicated an interest in development of plans. Of these nine, only four were able host a visit from the private company during April 2023. Thus far, the company has gathered the following insights from farmers about the status of *Prosopis* invasions on their farms and their attempts to control the spread and impact of the plant:

- Farmers focus on dense stands of *Prosopis*, feeling helpless.
- There are negative perceptions of ~~Working for Water~~'s effectiveness (poor work ethic, long travelling times limits number of hours at work and at the hottest part of the day).
- Choice of what herbicide to use is sometimes poor and based on what is available not what is effective.
- The available labour force on farms is greatly reduced and limits the ability for physical control.
- A 9-year drought has had major impact on grazing and farmers' finances to fund control initiatives.

- The value of land (R300-R1000/ha) is lower than the mean costs of *Prosopis* management (≥ R6000/ha). As a result farmers are not inclined to invest in clearing *Prosopis* and will rent land for grazing rather than address the invasion.

Options for management

Effective management strategies are crucial to reduce the impacts of *Prosopis* invasions, and integrated approaches likely to achieve the best results. Based on the opinions of stakeholders at a facilitated workshop, consider four different scenarios[12] (Figure 3):

- Current Approach: Maintaining the status quo (uncoordinated manual clearing) would lead to increased invasion extent and management costs.
- Increased Mechanization: Enhancing mechanical control and use of biomass to produce higher value material for "sale" to offset costs.
- Biological Control: Investigating and introducing biological control agents that damage plants and not only seeds.
- An Integrated Approach: Integrating increased mechanization, use of *Prosopis* biomass, and employing more damaging biological control agents together.

While efforts in Kenya to limit *Prosopis* spread through utilization have not been effective[37], South Africa's unique context, including landownership and an existing biological control program, suggests that the fourth scenario, with careful planning and effective biological control, could potentially curb *Prosopis* spread.

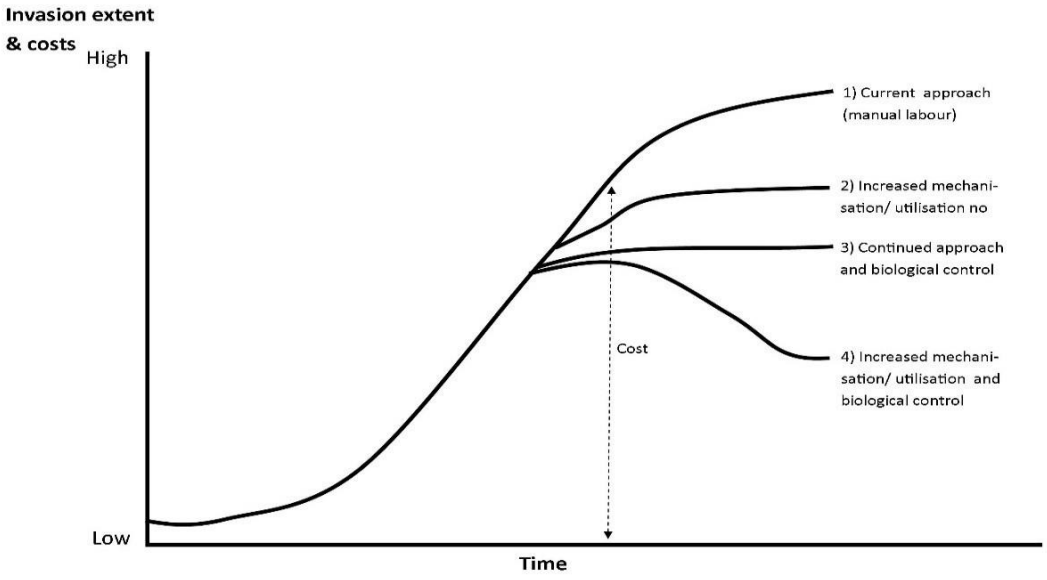

Figure 3. Scenarios of the potential extent of *Prosopis* invasion and associated costs over time based on different control options, combinations of options, and their potential effects on invasion extent.[12]

Mechanical harvesting and utilization of biomass

The cost of clearing *Prosopis* trees is high so the working group investigated options to utilise biomass to cover the costs of control. Marais et al.[38] estimated that the initial clearing of *Prosopis* cost on average R1730/ha. Almost two decades later, Shackleton et al.[12] estimated the costs of labour-intensive clearing with chain saws and brush cutters to be ~R9000/ha and the costs of mechanised clearing to be ~R10000/ha. A way of "subsidising" these costs through potentially using biomass are needed. There might be competing interests between those who have developed income-generating industries around the exploitation of a resource[39], such as *Prosopis*, which land managers want to remove from the landscape. The greatest benefit of *Prosopis* management is the restoration of access to groundwater and grazing and not any income generated from use of the biomass. Restoration of ecological infrastructure is the ultimate aim of *Prosopis* management. Furthermore, encroaching indigenous tree species (swarthaak, *Senegalia mellifera* (M. Vahl) Seigler & Ebinger) have an impact on quality of grazing and can potentially provide biomass to ensure sustainability of biomass businesses. The working group identified several possible uses of *Prosopis* biomass, including: firewood, charcoal/briquettes, biogas and biomass insulated concrete materials.

Firewood: Farm managers believe the market for firewood from *Prosopis* to be saturated and that many users prefer to use wood from indigenous trees[29]. The costs of both production (controlling *Prosopis* and preparing firewood) and transporting firewood to market makes this use of biomass in this way uneconomical.

Charcoal and briquettes: Low input technology (200 litre iron drums) can produce charcoal from *Prosopis* that is suitable for restaurant's barbeque fires and pizza ovens. If there is a local market and transport costs are borne by other activities, then production of charcoal may defray some of the expense of *Prosopis* control. For example, over four months the cost of managing *Prosopis* and producing the charcoal was R120000 and the income was R60000 for 7200kg, half of the production costs. Charcoal production results in smaller pieces that the farmer cannot sell. One option is to manufacture briquettes from these pieces but this requires special machinery.

BosKos fodder: To manufacture a cost-effective and abundant fodder, some farmers, mill *Prosopis* leaves and branches to which they add sources of protein and energy as necessary. This allows farmers to address specific nutritional needs of their livestock. This fodder source is both economical and readily accessible, and offers a solution for emergencies such as droughts or providing sustenance to animals after wildfires, when natural grazing is scarce. Fodder "recipes" must comply with current legislation and be registered accordingly. Further research is required to determine the feed composition for different seasons to ensure consistent nutritional values.

Biogas: Engineers have investigated the production of biogas from *Prosopis*. While the technology is currently unproven, it has the potential to supply both heat and electricity for agro-industrial processes (possibly even for export to Europe). This form of electricity generation is appealing given the uncertainty of electricity supply from the national grid.

Biomass insulated concrete construction: This approach aims to improve the thermal and noise insulation qualities of buildings, replace sand and stone aggregate with biomass (possibly invasive alien plants), and reduce greenhouse gas emissions from the combustion of biomass by fixing carbon in building structures.[40] Researchers combined fine biomass chips with fly ash, cement and chemical binders to prepare a sample, which proved that *Prosopis* is acceptable for biomass insulated concrete construction. The CBC and the Association of and for Persons with Disabilities (APD) required an office and a store at the biological control mass-rearing facility in Upington, which were built using *Prosopis* biomass insulated concrete techniques (Figure 4). Relevant stakeholders can see

this construction technique by visiting these two units. By creating a market for this construction method, farmers will be able "sell" *Prosopis* biomass to construction companies enabling them to get some reimbursement for the control costs.

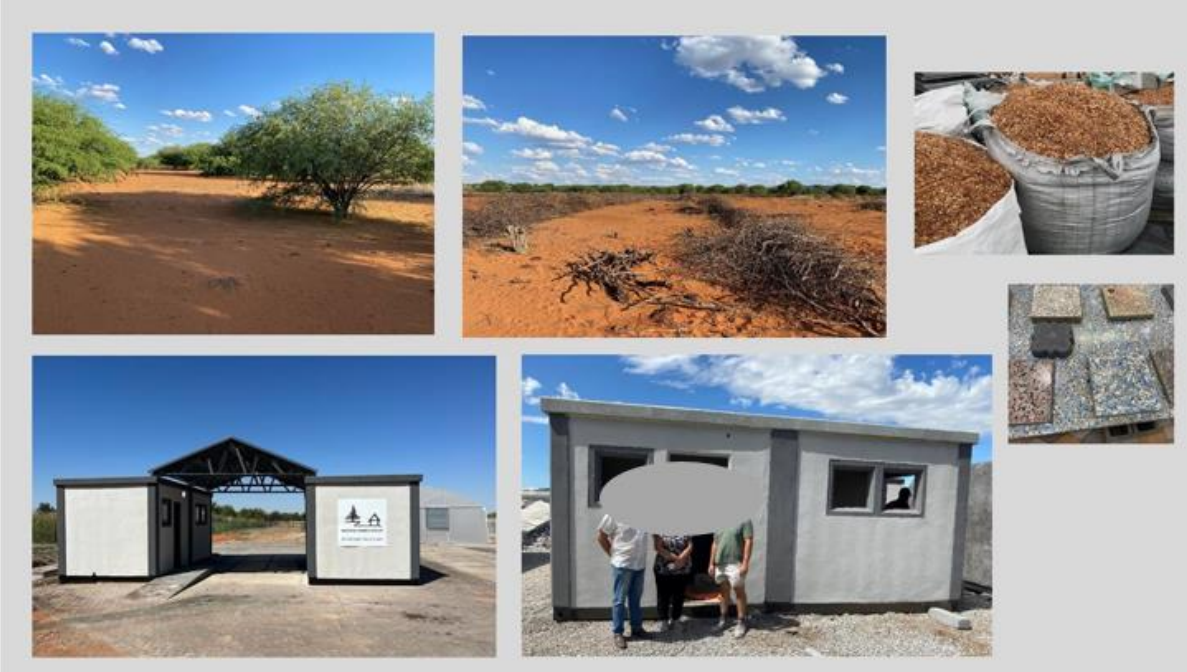

Figure 4. Clockwise from top left. *Prosopis* invasion in Groblershoop area illustrating absence of grass and shrubs for grazing, felled biomass, biomass chips for biomass insulated concrete construction, different aggregates in "concrete", *Prosopis* biomass building in Cape Town, completed buildings made from *Prosopis* biomass insulated concrete at APD Upington. [Faces anonymised by journal administrator for peer review]

Biological control research and implementation

A core avenue for management identified in the collaborative workshops was the use of biological control[12] This approach has caused controversy which has limited its use, as *Prosopis* was seen as beneficial by some landowners in the 1980s.[9, 41] As such only agents which ensured the continued supply of *Prosopis* benefits (fuel/fodder) were considered. In 1984, the Plant Protection Research Institute initiated research to introduce seed feeding insects specific to *Prosopis*. After extensive testing of the host-specificity of *Algarobius prosopis* (60 different species of legumes were tested), the government authorities deemed this species safe for release in South Africa.[21] Even though this seed feeding agent can destroy up to 92% of seeds under optimal conditions, and is able to spread rapidly[21], it is estimated that the size of the *Prosopis* invasion continued to grow from 127000ha in 1974 to over 314000ha in 1990[33] (Figure 1a).

Between 1999 and 2011, the biocontrol community restricted research to two species of natural enemies one that damaged flower buds (*Asphondylia prosopidis*) and the other that targeted seeds in the green pods (*Coelocephalapion gandolfoi*) (Figure 1b).[42] From 2014, biocontrol research began on natural enemies that damaged the whole plant with research into the suitability of *Evippe* sp. #1 for South African release.[43] The aim of biological control of *Prosopis* is not to eradicate but to reduce the density, spread and impact over time, to a level at which the plants do not have a significant negative impact on the environment (Figure 5). In September 2020, the Department of Agriculture (DOA) granted permission for the release of *Evippe* sp. #1 and first releases were made in February 2021. Likewise, in 2019, researchers completed the final testing required for the release of

C. gandolfoi. Finally in November 2021, with help of farmers who found sites with *Prosopis* that had suitable green pods, *C. gandolfoi* was released.

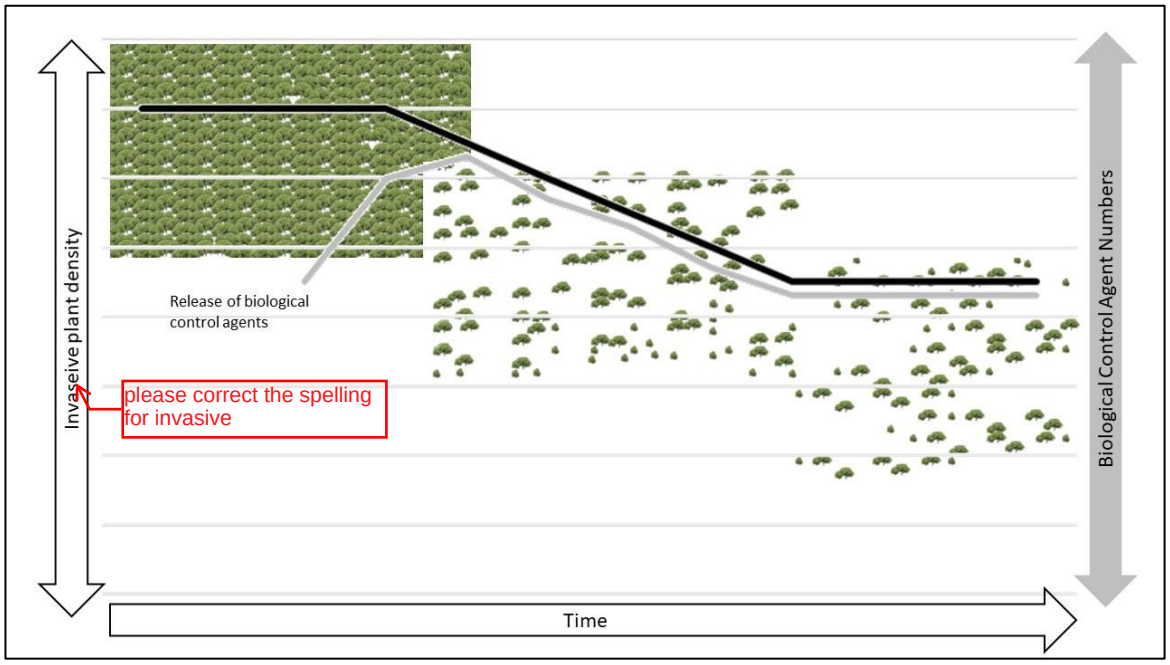

Figure 5. The desired outcome of biological control of *Prosopis* over time

After the DOA granted permission to release additional biocontrol agents, mechanisms to promote equity inclusion and social justice in the programme were also considered. There are extremely few work opportunities for the approximately 45 000 persons with disabilities in the Northern Cape[44]. Much of the population of this region is rural and this can further entrench persons with disabilities in poverty, as transport distances and costs restrict access to work opportunities and health care.[45] To this end, the CBC engaged organizations (particularly the ADP) that support persons with disabilities and those living in poverty to see if the rearing of biological control agents could be an avenue to create meaningful work for them[46, 47] and work toward the focus of APD, which is to empower, uplift and assist the disabled person in such a manner that they will be able to function independently and earn their own income or at least have funds supplementary to their social grant. Without sponsorship it would be impossible for APD to provide services and help or assistance to the members of the workshop. The CBC further has collaborated with biokineticists to develop suitable work environment for persons with disabilities in biological control mass-rearing facilities.[48]

With co-funding from the DFFE and private entities, the CBC and APD erected a mass-rearing nursery tunnel, offices, storeroom and ablution facilities (all with wheel chair access) at the APD premises in Upington and a team including persons with disabilities has been created (Figure 6). Long-term funding remains essential for this project to succeed, and funding from different sources is vital, as central government funds appear unreliable.

Figure 6. Training day. Faces and names anonymised by journal administrator for peer review.

Discussion and way forward

It remains essential to establish meaningful engagement, co-management and learning, and reduce research-implementation gaps to ensure the successful management of biological invasions.[8, 11, 49] With regards to the management of *Prosopis* in South Africa there has been some engagement[12], but the community has been lacking and most research to date has rather treated people as subjects of research[10] which has limitations. Realising these limitations, the CBC has aimed to promote collaborative research and management for *Prosopis.* Since 2019, the collaboration amongst stakeholders for the management of *Prosopis* has made good progress. On reflection, the following lessons have been learnt through the process:

- Finding a champion to act as an insider researcher and lead collective learning in the Northern Cape community, which has a small number of people spread over a large area, was ~~tough~~, but it helped us progress. Forming this ~~community of practice~~, through the identified champion, better enabled stakeholders (including farmers and researchers) to communicate with one another and share challenges has been extremely beneficial.
- Stakeholders are keen to better manage *Prosopis* on their properties, but are overwhelmed by the problem and often have more important farming issues to address, even though *Prosopis* invasion can destroy livelihoods if not addressed. Finding methods to manage multiple stressors simultaneously was identified by stakeholders as a key entry point to promote management.
- Management plans are generally accepted as a plan to clear the infestation. The planning approach ~~taken~~ aims to make the farm more manageable by focusing operations to open roads, water points and fences, and then to target areas where success can be achieved.
- Through engagement and social learning processes, biocontrol is now better understood and accepted by the stakeholders. This is best illustrated by the assistance received in identifying sites for the release of *C. gandolfoi*. More work is required to raise understanding of stakeholders of concepts such as host-specificity and establishment of founder populations, but the foundations are established for this collaborative learning.
- Mass rearing of biological control agents to target *Prosopis* can provide meaningful work for people living with disabilities. Through, transdisciplinary collaborations ways of making this a reality were achieved[48], and teams of disabled persons have not been found and trained. Sustained funding is required to support this initiative, which remains a challenge but through co-financing could be achieved.
- There are several ways in which *Prosopis* biomass can be processed into products including bio-char and biomass insulated concrete construction. This would benefit many stakeholders though

covering control costs, establishing new industries and promoting job creation. Together stakeholders need to build the market for these products.

Overall, we suggest that moving forward research on controlling plants like *Prosopis* should be less about "studying what the farmer and other stakeholders want", but about how the "researcher becomes more part of the farmer's/stakeholders' reality" and developing a sustainable partnership between all the stakeholders with a joint mission. We illustrate in this study that this is possible and believe this should ~~be come of~~ a common practice to reduce research implementation gaps into the future.

References

1. Brandt P, Ernst A, Gralla F, Luederitz C, Lang DJ, Newig J, Reinert F, Abson DJ, Von Wehrden H. A review of transdisciplinary research in sustainability science. Ecological Economics. 2013;92:1-15. http://dx.doi.org/10.1016/j.ecolecon.2013.04.008
2. Reed MS. Stakeholder participation for environmental management: a literature review. Biological conservation. 2008;141(10):2417-2431. http://dx.doi.org/10.1016/j.biocon.2008.07.014
3. Armitage DR, Plummer R, Berkes F, Arthur RI, Charles AT, Davidson-Hunt IJ, Wollenberg EK. Adaptive co-management for social–ecological complexity. Frontiers in Ecology and the Environment. 2009;7(2):95-102. http://dx.doi.org/10.1890/070089
4. Reed MS, Evely AC, Cundill G, Fazey I, Glass J, Laing A, Stringer LC. What is social learning?. Ecology and society. 2010;15(4). http://dx.doi.org/10.5751/es-03564-1504r01
5. Lindley D, Lotz-Sisitka H. Expansive social learning, morphogenesis and reflexive action in an organization responding to wetland degradation. Sustainability. 2019;11(15):4230. http://dx.doi.org/10.3390/su11154230
6. Shackleton RT, Adriaens T, Brundu G, Dehnen-Schmutz K, Estévez RA, Fried J, Larson BM, Liu S, Marchante E, Marchante H, Moshobane MC. Stakeholder engagement in the study and management of invasive alien species. Journal of environmental management. 2019;229:88-101. http://dx.doi.org/10.1016/j.jenvman.2018.04.044
7. van Wilgen BW, Richardson DM. Challenges and trade-offs in the management of invasive alien trees. Biological Invasions. 2014;16:721-734. http://dx.doi.org/10.1007/s10530-013-0615-8
8. Novoa A, Shackleton R, Canavan S, Cybele C, Davies SJ, Dehnen-Schmutz K, Fried J, Gaertner M, Geerts S, Griffiths CL, Kaplan H. A framework for engaging stakeholders on the management of alien species. Journal of environmental management. 2018 Jan 1;205:286-97. http://dx.doi.org/10.1016/j.jenvman.2017.09.059
9. Harding GB. The genus Prosopis spp. as an invasive alien in South Africa [Doctoral dissertation]. University of Port Elizabeth; 1988.
10. Shackleton RT, Le Maitre DC, Richardson DM. Stakeholder perceptions and practices regarding Prosopis (mesquite) invasions and management in South Africa. Ambio. 2015;44(6):569-581. http://dx.doi.org/10.1007/s13280-014-0597-5
11. Esler KJ, Prozesky H, Sharma GP, McGeoch M. How wide is the "knowing-doing" gap in invasion biology?. Biological Invasions. 2010 Dec;12:4065-75. http://dx.doi.org/10.1007/s10530-010-9812-x
12. Shackleton RT, Le Maitre DC, van Wilgen BW, Richardson DM. Towards a national strategy to optimise the management of a widespread invasive tree (Prosopis species; mesquite) in South Africa. Ecosystem Services. 2017;27:242-252. http://dx.doi.org/10.1016/j.ecoser.2016.11.022
13. Lukey P, Hall J. Biological invasion policy and legislation development and implementation in South Africa. Biological Invasions in South Africa. 2020;p. 515-552. http://dx.doi.org/10.1007/978-3-030-32394-3_18
14. van Wilgen BW, Forsyth GG, Le Maitre DC, Wannenburgh A, Kotzé JD, van den Berg E, Henderson L. An assessment of the effectiveness of a large, national-scale invasive alien plant control strategy in South Africa. Biological Conservation. 2012;148(1):28-38. http://dx.doi.org/10.1016/j.biocon.2011.12.035
15. Van Wilgen BW, De Wit MP, Anderson HJ, Le Maitre DC, Kotze IM, Ndala S, Brown B, Rapholo MB. Costs and benefits of biological control of invasive alien plants: case studies from South Africa: working for water. South African Journal of Science. 2004;100(1):113-22. http://dx.doi.org/10.4314/wsa.v38i2.19

16. Zachariades C, Paterson ID, Strathie LW, Van Wilgen BW, Hill MP. Assessing the status of biological control as a management tool for suppression of invasive alien plants in South Africa. Bothalia-African Biodiversity & Conservation. 2017;47(2):1-19. http://dx.doi.org/10.4102/abc.v47i2.2142
17. Barratt BIP, Moran VC, Bigler F, Van Lenteren JC. The status of biological control and recommendations for improving uptake for the future. BioControl. 2018;63:155-167. http://dx.doi.org/10.1007/s10526-017-9831-y
18. Bean D, Dudley T. A synoptic review of Tamarix biocontrol in North America: tracking success in the midst of controversy. BioControl. 2018;63(3):361-376. http://dx.doi.org/10.1007/s10526-018-9880-x
19. Mukwambo R, Lotz-Sisitka H, Mukute M, Kachilonda D, Jalasi E, Lindley D, Conde-Aller L, Thifulufhelwi R, Mponwana M, Kuse M. Insider formative interventionist researchers' experiences of co-generating reparative futures. Futura. 2022;(3):26–36.
20. Lotz-Sisitka H. Think piece: Pioneers as relational subjects? Probing relationality as phenomenon shaping collective learning and change agency formation. Southern African Journal of Environmental Education. 2018;34.
21. Zimmermann HG. Biological control of mesquite, Prosopis spp.(Fabaceae), in South Africa. Agriculture, ecosystems & environment. 1991 Oct 1;37(1-3):175-86. http://dx.doi.org/10.1016/0167-8809(91)90145-n
22. Wise RM, Van Wilgen BW, Le Maitre DC. Costs, benefits and management options for an invasive alien tree species: The case of mesquite in the Northern Cape, South Africa. Journal of Arid Environments. 2012;84:80-90. http://dx.doi.org/10.1016/j.jaridenv.2012.03.001
23. Steenkamp HE, Chown SL. Influence of dense stands of an exotic tree, Prosopis glandulosa Benson, on a savanna dung beetle (Coleoptera: Scarabaeinae) assemblage in southern Africa. Biological Conservation. 1996;78(3):305-311. http://dx.doi.org/10.1016/s0006-3207(96)00047-x
24. Dean WRJ, Anderson MD, Milton SJ, Anderson TA. Avian assemblages in native Acacia and alien Prosopis drainage line woodland in the Kalahari, South Africa. Journal of Arid Environments. 2002;51:1-19. http://dx.doi.org/10.1006/jare.2001.0910
25. Shackleton RT, Le Maitre DC, Richardson DM. Prosopis invasions in South Africa: Population structures and impacts on native tree population stability. Journal of Arid Environments. 2015;114:70-78. http://dx.doi.org/10.1016/j.jaridenv.2014.11.006
26. Schachtschneider K, February EC. Impact of Prosopis invasion on a keystone tree species in the Kalahari Desert. Plant Ecology. 2013;214:597-605. http://dx.doi.org/10.1007/s11258-013-0192-z
27. Ndhlovu T, Milton-Dean SJ, Esler KJ. Impact of Prosopis (mesquite) invasion and clearing on the grazing capacity of semiarid Nama Karoo rangeland, South Africa. African Journal of Range & Forage Science. 2011;28(3):129-137. http://dx.doi.org/10.2989/10220119.2011.642095
28. Dzikiti S, Ntshidi Z, Le Maitre DC, Bugan RD, Mazvimavi D, Schachtschneider K, Jovanovic NZ, Pienaar HH. Assessing water use by Prosopis invasions and Vachellia karroo trees: Implications for groundwater recovery following alien plant removal in an arid catchment in South Africa. Forest ecology and management. 2017;398:153-163. http://dx.doi.org/10.1016/j.foreco.2017.05.009
29. Shackleton RT, Le Maitre DC, van Wilgen BW, Richardson DM. Use of non-timber forest products from invasive alien Prosopis species (mesquite) and native trees in South Africa: implications for management. Forest Ecosystems. 2015;2:1-11. http://dx.doi.org/10.1186/s40663-015-0040-9
30. van Klinken RD, Fichera G, Cordo H. Targeting biological control across diverse landscapes: the release, establishment, and early success of two insects on mesquite (Prosopis spp.) insects in Australian rangelands. Biological Control. 2003 Jan 1;26(1):8-20. http://dx.doi.org/10.1016/s1049-9644(02)00107-x

31. Shackleton RT, Le Maitre DC, Pasiecznik NM, Richardson DM. Prosopis: a global assessment of the biogeography, benefits, impacts and management of one of the world's worst woody invasive plant taxa. AoB plants. 2014;6:plu027. http://dx.doi.org/10.1093/aobpla/plu027
32. Wakie TT, Hoag D, Evangelista PH, Luizza M, Laituri M. Is control through utilization a cost effective Prosopis juliflora management strategy?. Journal of Environmental Management. 2016 ~~Mar 1~~;168:74-86. http://dx.doi.org/10.1016/j.jenvman.2015.11.054
33. Van den Berg EC, Kotze I, Beukes H. Detection, quantification and monitoring of Prosopis in the Northern Cape Province of South Africa using remote sensing and GIS. South African Journal of Geomatics. 2013;2(2):68-81.
34. PPRI. Minutes of the seventh informal meeting to discuss biological control, 12 August 1978, Pretoria [unpublished]. Plant Protection Research Institute.
35. Neser S, Moran VC. Tactics for Evading Conflicts in the Biological. In: Proc. VI Int. Symp. Biol. Contr. Weeds. 1984. p. 25.
36. PPRI. Workshop Proceedings: Workshop on the status and long-term management of Prosopis. 21-22 November 2001, Kimberley [unpublished]. Plant Protection Research Institute.
37. Mbaabu PR, Ng WT, Schaffner U, Gichaba M, Olago D, Choge S, Oriaso S, Eckert S. Spatial evolution of Prosopis invasion and its effects on LULC and livelihoods in Baringo, Kenya. Remote Sensing. 2019;11(10):1217. http://dx.doi.org/10.3390/rs11101217
38. Marais C, Van Wilgen BW, Stevens D. The clearing of invasive alien plants in South Africa: a preliminary assessment of costs and progress: working for water. South African Journal of Science. 2004 Jan 1;100(1):97-103. http://dx.doi.org/10.1016/j.sajb.2008.01.175
39. Pirard R. Rethinking the role of value-added industries for invasive trees in South Africa. International Forestry Review. 2023;25(2):223-243. http://dx.doi.org/10.1505/146554823837244428
40. Göswein V, Silvestre JD, Lamb S, Gonçalves AB, Pittau F, Freire F, Oosthuizen D, Lord A, Habert G. Invasive alien plants as an alternative resource for concrete production–multi-scale optimization including carbon compensation, cleared land and saved water runoff in South Africa. Resources, Conservation and Recycling. 2021;167:105361. http://dx.doi.org/10.1016/j.resconrec.2020.105361
41. Impson FAC, Moran VC, Hoffmann JH. A review of the effectiveness of seed-feeding bruchid beetles in the biological control of mesquite, Prosopis species (Fabaceae), in South Africa. Biological Control of weeds in South Africa (1990-1998). http://dx.doi.org/10.1006/bcon.1993.1003
42. Zachariades C, Hoffmann JH, Roberts AP. Biological control of mesquite (Prosopis species) (Fabaceae) in South Africa. African Entomology. 2011;19(1):402-415. http://dx.doi.org/10.4001/003.019.0230
43. Kleinjan CA, Hoffmann JH, Heystek F, Ivey P, Kistensamy Y. Developments and prospects for biological control of Prosopis (Leguminosae) in South Africa. African Entomology. 2021;29(3):859-874. http://dx.doi.org/10.4001/003.029.0859
44. Statistics South Africa. Census 2011: Profile of Persons with Disabilities in South Africa. Report No. 03-01-59. Pretoria: Statistics South Africa. 2014. Available from: http://www.statssa.gov.za/publications/Report-03-01-59/Report-03-01-592011.pdf http://dx.doi.org/10.1163/2213-2996_flg_com_322456
45. Bock SL. A case study on the experiences of persons with disabilities of the disability grant processes occurring at SASSA Springbok in the Northern Cape [Master's thesis]. Faculty of Health Sciences. 2021.
46. Weaver KN, Hill JM, Martin GD, Paterson ID, Coetzee JA, Hill MP. Community entomology: insects, science and society. Journal for New Generation Sciences. 2017;15(1):176-186.

47. Weaver KN, Hill MP, Byrne MJ, Ivey P. Efforts towards engaging communities to promote the benefits of biological control research and implementation in South Africa. African Entomology. 2021;29(3):1045-1059. http://dx.doi.org/10.4001/003.029.1045
48. Davy J, Weaver K, Todd A, Paphitis S. "Ergonomics on the Ground": A Case Study of Service Learning in Ergonomics Education. In: Proceedings of the 20th Congress of the International Ergonomics Association (IEA 2018) Volume IX: Aging, Gender and Work, Anthropometry, Ergonomics for Children and Educational Environments 20. Springer International Publishing; 2019. p. 693-702. http://dx.doi.org/10.1007/978-3-319-96065-4_73
49. Shackleton RT, Shackleton CM, Kull CA. The role of invasive alien species in shaping local livelihoods and human well-being: A review. Journal of environmental management. 2019;229:145-157. http://dx.doi.org/10.1016/j.jenvman.2018.05.007