Deliverable

8

Water Research Commission

Project Number: **C2022/2023-00746**

Project Title: **Dissemination and scaling of a decision support framework for CCA for smallholder farmers in South Africa**

Deliverable No.8: Refined CbCCA decision support framework with updated databases and CRA practices
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Submitted to:
Executive Manager: Water Utilisation in Agriculture
Water Research Commission
Pretoria

Project team:
Mahlathini Development Foundaction (MDF)
Erna Kruger
Temakholo Mathebula
Betty Maimela
Nqe Dlamini
Institute of Natural Resources (INR)
Brigid Letty
Environmental and Rural Solutions (ERS)
Nickie McCleod, Sissie Mathela
Association for Water and Rural Development (AWARD)
Derick du Toit

Table of Contents

1. INTRODUCTION

This section provides a brief summary of the project vision, outcomes and operational details.

AIMS	
No	**Aim**
1.	Create and strengthen integrated institutional frameworks and mechanisms for scaling up proven multi-benefit approaches that promote collective action and coherent policies.
2.	Scaling up integrated approaches and practices in CbCCA.
3.	Monitoring and assessment of environmental benefits and agro-ecosystem resilience.
4.	Improvement of water resource management and governance, including community ownership and bottom-up approaches.

OUTCOME

Vertical and horizontal integration of this community- based climate change adaptation (CbCCA) model and process leads to improved water and environmental resources management, improved rural livelihoods and improved climate resilience for smallholder farmers in communal tenure areas of South Africa.

EXPECTED IMPACTS

1. Scaling out and scaling up of the CRA frameworks and implementation strategies lead to greater resilience and food security for smallholder farmers in their locality.
2. Incorporation of the smallholder decision support framework and CRA implementation into a range of programmatic and institutional processes
3. Improved awareness and implementation of appropriate agricultural and water management practices and CbCCA in a range of bioclimatic and institutional settings
4. Contribution of a robust CC resilience impact measurement tool for local, regional and national monitoring processes.
5. Concrete examples and models for ownership and management of local group-based water access and infrastructure.

5. Chronology of activities

1. Desktop review of CbCCA policy and implementation presently undertaken in South Africa
2. Set up CoPs:
    a. Village based learning groups: A minimum of 1-3 LGs per province will be brought on board.
    b. Innovation platforms: 3 LG clusters, one for each province consisting of a minimum of 9- 36 LGs will be identified to engage coherently in this research and dissemination process.
    c. Multistakeholder platforms: Engage existing multistakeholder platforms such as the uMzimvubu catchment partnership, SANBI- Living Catchments Programme, the Adaptation Network, etc.

3. Develop roles and implementation parameters for each CoP

    a. Village based learning groups: CCA learning and review cycles, farmer level experimentation, CRA practices refinement, local food systems development, water and resource conservation access and management and participation and sharing in and across villages.

    b. Innovation Platforms (IP): Clusters of LGs learn and share together with local and regional stakeholders for knowledge mediation and co-creation and engagement of Government Departments and officials (1-2 sessions annually for each IP)

    c. Multistakeholder platforms: Development of CbCCA frameworks, implementation processes (including for example linkages to IDPS and disaster risk reduction planning and implementation at DM and LM level), reporting frameworks for the NDC to the CCA strategy, consideration of models for measurement of resilience and impact (1- 2 sessions annually for each multi stakeholder platform)

4. Cyclical implementation for all three CoP levels (information provision and sharing, analysis, action, and review) within the following thematic focus areas: Climate resilient agriculture practices, smallholder microfinance options, local food systems and marketing and community owned water and resources access and conservation management plans and processes. Each of these thematic areas is to be led by one of the senior researchers and a small sub-team.

5. Monitoring and evaluation: Consisting of the following broad actions:

    a. Focus on 3-4 main quantitative indicators e.g. water productivity, production yields, soil organic carbon and soil health.

    b. Indicator development for resilience and impact and

    c. Exploration of further useful models to develop an overarching framework.

6. Production of synthesis reports, handbooks and process manuals emanating from steps 1-4 with the primary aim of dissemination of information.

7. And refinement of the CbCCA decision support platform, incorporating updated data sets and further information form this research and dissemination process.

DELIVERABLES				
No.	**Deliverable Title**	**Description**	**Target Date**	**Amount**
1	Desk top review for CbCCA in South Africa	Desk top review of South African policy, implementation frameworks and stakeholder platforms for CCA.	01/Aug/2022	R100 000,00
2	Report: Monitoring framework, ratified by multiple stakeholders	Exploration of appropriate monitoring tools to suite the contextual needs for evidence-based planning and implementation.	02/Dec/2022	R100 000,00
3	Handbook on scenarios and options for successful smallholder financial services within the South Africa	Summarize VSLA interventions in SA, Govt and Non-Govt and design best bet implementation process for smallholder microfinance options.	28/Feb/2022	R100 000,00

4	Development of CoPs and multi stakeholder platforms	Design development parameters, roles and implementation frameworks for CoPs at all levels, CRA learning groups, Innovation and multi stakeholder platforms; within the CbCCA framework.	04/Aug/2023	R133 000,00
5	Report: Local food systems and marketing strategies contextualized - Guidelines for implementation	Guidelines and case studies for building resilience in local food systems and local marketing strategies towards sustainable local food systems (local value chain)	08/Dec/2023	R133 000,00
6	Case studies: encouraging community ownership of water and natural resources access and management	Case studies (x3) towards providing an evidence base for encouraging community ownership of natural resource management through bottom-up approaches and institutional recognition of these processes.	28/Feb/2024	R134 000,00
7	Case studies: CbCCA implementation case studies in 3 different agroecological zones in SA	CbCCA implementation case studies in 3 different agroecological zones within South Africa	12/Aug/2024	R133 000,00
8	Refined CbCCA decision support framework with updated databases and CRA practices	Refined CbCCA DSS database and methodology with inclusion of further viable and appropriate CRA practices	13/Dec/2024	R133 000,00
9	Manual for implementation of successful multistakeholder platforms in CbCCA	Methodology and process manual for successful multi stakeholder platform development in CbCCA	28/Feb/2025	R134 000,00
10	Final Report	Final report: Summary of all findings, guidelines and case studies, learning and recommendations	18/Aug/2025 (Feb 2026)	R400 000,00

Deliverable 8 focusses on reviewing and updating the decision support framework designed between 2017-2021. The framework and methodology have been expanded to include community-based water and resources management into the overall design alongside the climate resilient agriculture activities to provide for a more coherent landscape/catchment approach and a broader range of activities and synergies for implementation of community-based climate change adaptation (CbCCA).

The process still relies on a two-pronged decision support process; one facilitated at community and village level and one as an online, individual app-based process. For both, a range of new practices have been included and are described in this report.

2. PROCESS PLANNING AND PROGRESS TO DATE

The intention is threefold, as describe below and shown in the diagram:

- Expand introduction and implementation of the CbCCA DSS framework within the areas of operation of MDF with a number of different communities. Work with existing communities as the basis of the case studies in specific thematic areas. (*Note: This aspect of implementation will be finalized by December 2024)*

- Introduce and implement the CbCCA DSS framework with a range of other role-players expanding into new areas, including different agroecological zones (*Note: This aspect of implementation will be finalized by December 2024)* and
- Work at multistakeholder level to introduce the methodology as an option for adaptation planning and action, both within civil society and also including Government stakeholders. This is the first step towards institutionalization of the process and will involve mainly working within existing multistakeholder platforms and networks as the starting point.
- Further exploration of the categories of stakeholders and the roles and relationships between stakeholders is important for the present research brief.

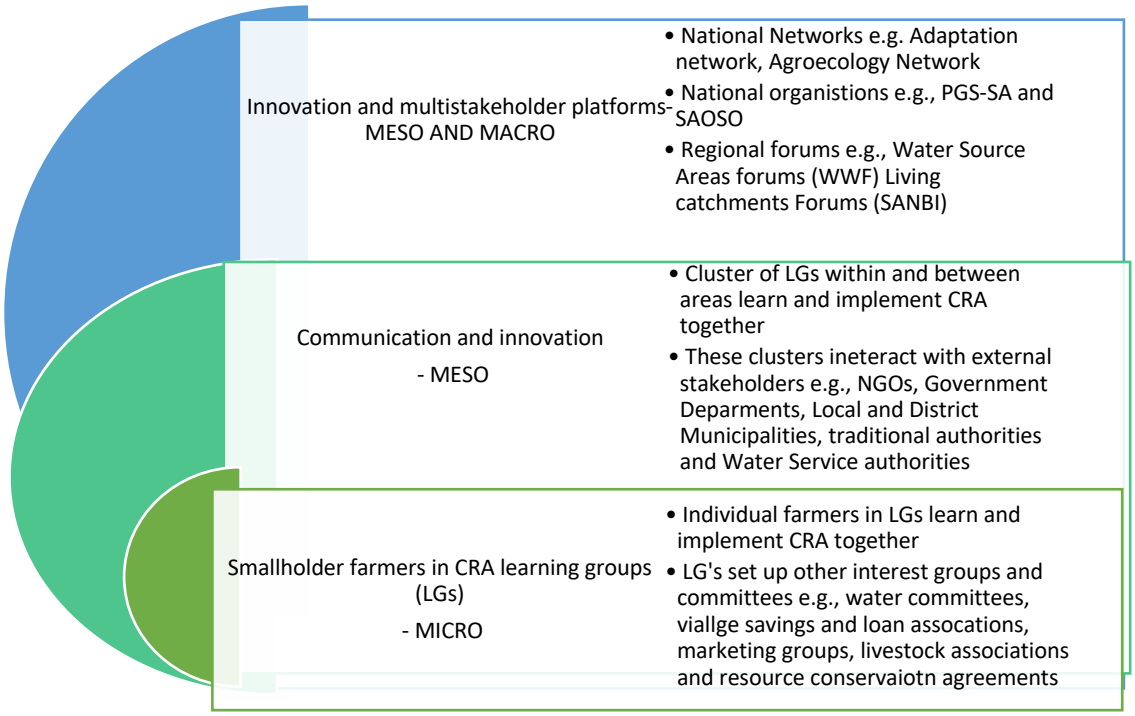


Figure 1: Conceptualization of stakeholder platforms at multiple levels to support CbCCA

Smallholder farmers in climate resilient agriculture learning groups

This process has been initiated by continuing and strengthening specific CRA learning groups, which have been supported by MDF in the past and who have done well in implementation and building of social agency. These groups will provide the focus for further exploration of food systems, water stewardship and governance and engagement with local and district municipalities.

CRA learning group summary:

Province	Area	Villages	No of participants
KZN	Bergville	Ezibomvini, Stulwane, Vimbukahlo, Eqeleni, Emadakaneni	130
	Midlands	Ozwathini, Gobizembe, Mayizekanye, Ndlaveleni	110
	SKZN	Mahhehle,Mariathal, Centocow, , Ngongonini	90
Limpopo	Sekororo-Letsitele	Sedawa, Turkey,Willows, Santeng, Worcester, Madeira, Sofaya	130
EC	Matatiele	Ned, Nchodu, Nkau, Rashule,	75
	5	24	535

Table 1: Micro-level CoP engagement: February 2023 to December 2024

Note: Collaborative strategies in bold undertaken during this reporting period

Description	Date	Activity
Establishing learning groups at village level	2022/11/25, 12/09 2022/11/15, 11/29, 2023/02/07 2023/02/09 2023/01/18 2023/03/27 2023/06/15, 07/07	Limpopo: Sophaya SKZN: Mahhehle -CCA workshop x 2 days, Bergville: Eqeleni EC: Ned, Nkau Limpopo: Madeira KZN Midlands: Ndlaveleni, Montobello, Noodsberg, Inkuleleko primary school
Training and mentoring for climate resilient agriculture	2022/12/02 2022/10/26 2022/10/08-14 2022/11/23,24,29 2022/02/10 2022/02/27, 03/28 2022/03/08, 03/17, 03/28 2022/03/15 2023/03/07,08 2023/03/29,30 2023/03/24,27,30 2023/04/, 2023/05, 2023/06 2023/04/21,25, 05/26, 06/08 2023/04/19,20 2023/06/22 2023/08/07,08,10 2023/09/19 2023/10/16-19 2023/11/13-17 2023/12/04 2023/12/14 2024/02/23 2024/03/22 2024/05/28 **04/07/2024** **05/07/2024** **08/07/2024** **10/07/2024** **16/08/2024** **11/09/2024** **25/09/2024**	Midlands: Ozwathini contouring workshop SKZN: Mahhehle – tower gardens EC-Matatiele: Drip irrigation workshops in 5 villages SKZN: CA demonstration workshops in 3 villages SKZN: Plainhill Drip irrigation training Limpopo: Sofaya trench beds SKZN: Mahhehle tower gardens, poultry production, trench beds SKZN: Mariathal gardens and experimentation Bgvl: Madakaneni, Mahlathini – gardening training EC: Ned, Nchodu poultry production EC: Nec, Nchodu, Mzongwana- Pest and disease control Limpopo and KZN: trench bed training with assembling of tunnels for 45 households across 8 villages, including distribution of seedlings, mixed cropping and mulching learning inputs and drip irrigation Limpopo: Willows, Sedawa, Mametja Sophaya. Bergville-Matwetha, Emadakaneni – Natural Pest and Disease control Bergville, SKZN: Poultry production: eMadakaeneni, Mjwetha, Mariathal, Mahhehle, Centocow EC: Ned, Nkau, Rashule, Nchodu- Soil and water conservation Matatiele: Multipurpose chicken production and cage construction (Ned(13), Rashule(22), Nchodu(23) Matatiele: Nchodu -Value Adding training (32) Limpopo: Boschvelder feeding and management training x 5 villages (50 participants) Limpopo (30): CA demonstrations and farmer level experimentation: intercropping cover crops -Midlands: Gobizembe Youth group- seedling production training -Limpopo: Sofaya(10) , Madeira and Willows (16) CA training and demos -Limpopo: advanced nutrition workshop x 5 villages -SKZN: gardening refresher workshops (Centocow, Mahhehle, Mariathal, Ngongonini) -Matatiele (EC) nutrition workshops x 4 villages **Poultry training-Ndlaveleni** **VSLA meeting+ delivery of boschvelders-Ozwathini** **Calf rearing meeting (farmer centre finalization)-Ozwathini** **Progress meeting-Gobizembe** **Seedling production Youth group, Gobizembe** **Pest and disease training Mayizekanye** **Seedling production training Ozwathini**
Cyclical implementation through mentoring for capacity development for LG at local level	 2022/08/16,17,18,19,30 2022/10/16 2022/11/21-24 2023/01/24-30 **ONGOING** 2023/10/03-06 2023/11/05-12/15	CCA review and planning workshops -Bergville: CA review and planning (5) -Midlands: CA review and planning (3) -Limpopo: CCA review and planning (4) **CCA prioritization of practices** -Matatiele: 5 villages (Ned, Nchodu, Rahsule, Nkau, Mzongwana -**All areas: garden monitoring, poultry support, tunnel and drip kit installations, VSLAs monthly meetings, CA production and monitoring** KZN-Bergville Boschvelder chicken delivery and maintenance mentoring for 45 participants

	2023/11/30-2024/02/28 2024/ 03/ 30 2024/07/08 **11/07/2024** **16/07/2024** **17/07/2024** **31/07/2024** **23/08/2024** **26/08/2024** **14/10/2024**	KZN: Bergville_CA farmer experimentation planting for 124 participants, incl cover crops awa collaboration with Forge Agri to Fodder Beet trials and Zylem SA for new Maize variety trials Midlands: Seedling nursery project initiation for youth group in Gobizembe (11 members) -KZN,EC and Limpopo – 2nd round micro tunnel introduction and deliveries (x30 tunnels) -KZN ,EC and Limpopo- 2nd round of multipurpose chicken delivery, training and mentoring, including introduction of incubators for local breeding **-VSLA meeting- Ozwathini** **PIA meeting-Ozwathini** **Purchasing and decanting of farmer centre stock-Ozwathini** **Monitoring of tower gardens and chickens in Ndlaveleni** **Nursery monitoring-Gobizembe** **Purchasing and decanting of farmer centre stock** **Purchasing of farmer centre stock and decanting**
	Ongoing - Monthly Jan-December 2023 July-Sept 2023 **Ongoing- Monthly** April-June 2024 May-July 2024	***Market days: monthly farmers markets*** -**Midlands: Bamshela (Ozwathini**) -SKZN: Creighton (Centocow) -Ubuhlebezwe LED Ixopo flea market - Bergville: Bergville town ***Market exploration workshops*** -Midlands: Mayizekanye, Gobizembe -EC_Ned-Nchodu market day in Matatiele -SKZN: Mariathal PGS follow-up w/s Limpopo SKZN: Mahhehle **VSLA meetings and share outs** -Bergville (18) -SKZN: Ngongonini (2), Centocow (4) -Midlands: Ozwathini (6) Limpopo: (7) -Youth Dialogues – Limpopo (Sedawa, Turkey, Willows, Madeira) -Income diversification individual interviews - all areas (x12)
Income diversification and economic empowerment of local farmers (LG at local level)	**Ongoing - Monthly** July-October 2024 02/08/2024 03/09/2024 **Ongoing- Monthly** **July-Oct 2024** **12/08/2024 and 07/10/2024**	***Market days: monthly farmers markets*** -**Midlands: Bamshela (Ozwathini**) **-**Ozwathini Market Day -Ozwathini Matket day **VSLA meetings and share outs** -Savings meetings Ozwathini (7) -Share out meetings Ozwathini (1) F**armer centre meetings – Ozwathini Midlands**
Implementation and capacity development for innovation (3) and multi-stakeholder platforms (3)	2022/11/18 2022/11/10 2022/12/01 2023/02/23 2023/02/28 2023/03/08,09 2023/03/89,29, May-July 2023 2023/03/30, 06/02 2023/04/26 2023/05/09 2023/07/10-15 2023/08/18	-SKZN: Centocow P&D control cross visit and learning workshop -uThukela water source forum: Visioning and action planning – Bergville -Adaptation Network AGM -Regenerative Agric farmers' day in Bergville incl Asset research, uThukela Water Source Forum, uThukela Development Agency -Adaptation Network: CCA financing dialogue -SANBI_gender mainstreaming dialogue -WRC-ESS: Bglv Ezibomvini, Stulwane – resource management mapping and planning Bergillve:Stulwnae weekly community resource management workdays -Okahlamba LED forum -Farmers X visit between Bulwer (supported by the INR0 and Bergville around CRA, fodder and restoration -PGS-SA: market training input: Online training Session 5 -Giyani Local Scale Climate resilience Project: Introduction of CCA model and local water governance options. -World Vision: CCA workshops for women cooperatives and LED project (60 participants)

	2023/08/29 2023/08/30 2023/09/04 2023/09/08 2023/09/13 2023/09/22-24 2023/08/23, and 09/27 2023/07-12 2024/03/12,20 **2024/07/08-12** **2024/08/07, 11/07** **2024/08/08** **2024/10/20-23** **2024/10/29-11/04**	-Giyani Climate resilience project: Input into WRC reference group meeting -KZN DARD_ Okahlamba Agricultural Show: display and talk ACDI: Dialogue on community adaptation and resilience (Stellenbosch) Food systems article for newsletter WWF-Business Network meeting (SAPPI Durban)- presentation Joint Bergville learning group local marketing review session Gcumisa_multistakeholder innovation meeting – with the INR, ~60 participants (value adding, stokvels and local marketing Food systems dialogue: online event Uthukela water source forum: Core team meeting and Multistakeholder field visit around community resource conservation in Stulwane (Bgvl) -LIMA -Social Employment Fund: Training for work teams and employed youth in nutrition, value adding, climate change adaptation and agroecological gardening practices including soil and water conservation in 7 areas: Zululand, SKZN, Lichtenburg, Sekororo, Musina and Blouberg (140 participants trained). Northern Drakensberg collaborative (NDC) multistakeholder meeting in Bergville (55 participants) **Adaptation network (AN) – colloquium CT- vulnerability assessments and MERL for CCA** **AN_SANBI EbA farm – Global Climate Fund proposal discussion (24 participants)** **NDC -Farmers x visit from Hlatikhulu to Bergville-Endangered wildlife Trust, WWF, SEAON, INR (45 participants)** **Mopani District water dialogue- Tzaneen. In association with AWARD, Panel member and participant.** **SABNI_Catchment Indaba-KleinMond – Western Cape**
Indicator development for evidence-based indicators, M&E and handbook development	2023/01/30- 02/03 2023/02/02 2023/01/18 2023/01/18 2023/02/20 March-May 2023 June 2023 2023/10/16-20, 11/13-16 2024/02/26 May-July 2024 31/05/2024, 07, 12, 18 /07/2024 **31/07/2024** **20/10/2024** **2024/11/15**	Limpopo: Focus Group discussions for VSLA and microfinance for the rural poor x 3 (Turkey, Worcester, Santeng) Garden monitoring: -SKZN: Plainhill -EC: 5 villages CA monitoring -EC:5 villages -KZN: Bergville -30, Midlands 15, SKZN 15 -All areas: Poultry production list -All areas: Livelihoods survey for farmgate sales and asset accumulation -M&E resilience indicator development team meeting and process with Karen Kotschy -Design of framework -Development of individual interviews and Participatory impact assessment outlines for testing. Interviewing of 120 participants across KZN,EC and Limpopo and running of 10 PIA workshops - Initiate development of analysis platform and dashboards for Climate resilience impact assessments - **Garden Monitoring Ndlaveleni** **-Resilience snapshot assessments with new indicator sets across three provinces (240 interviews)** -**Finalize climate resilience dashboard development**
Implementation of sustainable water management	2023/01/03-02/03 2023/03/07 2023/03/25, 06/15 2023/04/25, 06/01,02, 06/14. 2023/07/26-28, 09/14,10/09-14, 11/06-10, 12/05-15, 2024/01/21-02/02 **Ongoing** **2024/11/30**	KZN: Bergville: Stulwane – Conflict man and upgrading spring protection. EC: Nkau: Water walk and meetings for spring protection and reticulation. KZN: Bgvl Stulwane_ Engineer visits (Alain Marechal) for scenario development and follow up planning meetings with community. Set up committee, work parties and start on quotes and budget outline KZN: Bgvl Vimbukhalo: Governance of communal borehole water supply KZN: Bgvl Stulwane_ Engineer visits (Alain Marechal) for scenario development and follow up planning meetings with community. Set up committee, work parties and start on quotes and budget outline. Work on scheme initiated. Final implementation of scheme. Gobizembe water access discussions **-NED-Matatiele water access scenario development with Alain Marechal and the community**
Organisational & capacity development	2022/11/17 2022/12/05 2023/02/13	-MDF AGM and organisational capacity development workshop -Mentoring and planning with new finance officer to implement SODI financial reporting system - Internal short learning event for rainfall and runoff results, as well as soil fertility and Organic carbon

	2023/02/09, 02/16	- Mentoring in CCA workshop implementation. Temakholo from Midlands assisted Bergville team
	2023/03/06	-Team session on gender mainstreaming
	2023/03/13	- UKZN- Ecological mapping and use of resource planning – Bgvl team -VSLAs review and discussion re group based rules, BLF updates
	2023/04/17	- Nutrient analysis for livestock fodder options: facilitated by Brigid Letty from the INR
	2023/05/26	
	2023/06/12	-Small business development support planning and Livelihoods survey
	2023/07/04	-MDF AGM and organisational capacity development workshop
	2023/10/09	Conservation agriculture participatory research outcomes and presentation for CA forum with interns and staff
	2023/10/16	- Training plan development with interns
	2023/10/17	- M&E frameworks discussion with Karen Kotschy and team members
	2024/02/26 – ONGOING	**-Financial team: Introduction to online Sage platform**
	2024/10/24	**- First Aid training for 6 staff members**

Communication and innovation

This aspect relates to platforms for sharing and learning with clusters of learning groups (LGs). During the period between August and December 2024, two such platform events were undertaken

Mycotoxin and bio-stimulants workshop – Bergville

A workshop bringing participants from 5 village-based learning groups in the Bergville (KZN) region, was held on the 17th October 2024. 53 participants (Ezibomvini, Eqeleni, Stulwane, Vimbukhalo and eMadakaneni) came together for a learning session on the presence and impact of mycotoxins in their maize harvests. Research undertaken in collaboration with the ARC-VOPI was used as a basis for the presentation and discussion. In addition, input was provided on what biio0stimulants are in the context of field cropping and an experimentation protocol for inclusion of the Zylem Regen-Z products was outline. MDF is collaborating with this private agricultural service provider to introduce these products into the CA system in Bergville and start to move the production system to more organic options.

Figure 2: Smallholder farmer participants in the local innovation platform workshop in Bergville, KZN. October 2024

Livestock management and conservation agreements: Sekororo, Limpopo

On the 18th September 2024, 24 livestock owners from 3 neighbouring villages in Sekoror0 (Willows, Mulalani and Turkey) came together to start the discussion around developing a conservation agreement for the shared communal grazing area. Such agreements would serve to improve the grazing management and also provide further incentive for this work through provision of local

livestock auctions. This activity is being undertaken in collaboration with Conservation South Africa and Meat Naturally. These farmers are also working together across their villages to buy in fodder for their livestock, which were under severe drought and heat pressure.

This work is an example of clusters of village-based learning groups and committees working together on catchment level actions

Figure 3: The Willows-Mulalani-Turkey livestock farmers' meeting to discuss conservation agreements, Sekororo September 2024.

Multistakeholder platforms

To date the research team has participated in a range multistakeholder platforms, networks and communities of practices (CoPs) towards developing a framework for awareness raising, dissemination and incorporation of the CbCCA-DSS methodology into local and regional planning processes and developing methodological coherence for a number of the themes to be explored in this brief.

The table below outlines actions and meetings to date.

Table 2: Planning and multi stakeholder interactions for the CCA-DSSII research process: December 2024

Organisation	Activity - Description	Dates
Asset Research-Maize Trust, SODI	Regenerative Agriculture farmers' open day in Bergville Annual Maize Trust CA forum workshop, Bethlehem – MDF presentation 9th World Conference in Conservation Agriculture (Cape Town). Presentation of 3 papers (E Kruger, T Mathebula and N Mbokazi and Smallholder farmers panel member.	23rd Feb 2023 10th October 2023 23rd-26th July 2024
Zylem and Regen-Z (sustainable agriculture company-KZN)	Collaboration in farmer level experimentation with application of liquid supplements for soil health and testing of 10 varieties of climate adapted maize with 10 farmers in Bergville, KZN. **Planning for 2nd round of experimentation and distribution of input packs to smallholder farmers -20 participants**	December 2023-May 2024 9th July 2024 **October-end November 2024**
ESS research - WRC	UKZN research in ecosystem services mapping supported by MDF: water walks, focus group discussions, planning, eco-champs, spring protection work in Stulwane, thematic and mapping workshops in Ezibomvini and Stulwane, local level planning and implementation. Cross visit Ezibomvini to Stulwane to see resource management work Finalisation and handover of maps, updated community resource management plans for Ezibomvini and Stulwane Final report preparation and ref group meeting Farmer level cross-visit between Hlatikhulu and Bergville communities involved in Community level resource management and EbA activities (Endangered Wildlife trust and MDF	23rd September 2022 14th October 2022 13,29,30 March 2023 1-30th May 2023 29th September 2023 18th October 2023 22nd November 2023 9th, 18th July 2024

WWF Water source forum (Northern Drakensberg Collaborative)	uThukela catchment partnership: Stakeholder meetings, online and in person at OLM board room Bergville (new name: Northern Drakensberg Collaborative). Development of vision, membership profile, constitution and core team and full collaborative meetings Core team meeting for visioning and constitution development Multistakeholder field day for community level resource conservation in Stulwane, Bergville. **Core team meetings and planning of stakeholder event for August 2024. 9EWT farmers' ross visit** **NDC stakeholder meeting - Bergville** **Development of catchment partnership proposal with Lewis Foundation**	29th September 2022 10th November 2022 11th April 2023 23rd May 2023 23rd August 2023 28th September 2023 **3rd March, 31st May, 7th July, 8th Aug, 12 Sept 2024.** **13th Nov 2024** **24th-26th March, 8th and 18th July, 14th Aug , 3rd Nov, 2nd Dec 2024**
SANBI- Living Catchment Programme	Social facilitation capacity building workshop – Western Cape; M Malinga Olifants' water indaba: M Malinga, N Mbokazi, H Hlongwane, B Maimela and E Kruger Video on local initiatives in catchment management **SANBI Catchment Indaba-Kleinmond Western Cape**	3rd-5th October 2022 30th Oct-2nd Nov 2022 24th March 2023 **29th Oct-4 November 2024**
SANBI	Climate change adaptation and gender mainstreaming dialogue – presentation and participation SANBI newsletter- runoff impacts of restoration and CA **CCA and gender dialogue task team for planning 2024 event**	8th-9th March 2023 4th June 2023 **6th June, 27th July 2024**
Adaptation Network	Policy input and AGM Ongoing input and involvement in the Capacity development working group: to implement the new Civil Society Organisation Skills Enhancement and Excellence Development (CSO SEED) project, funded by the Flanders government. Some of these activities include youth-led participatory videos on adaptation initiatives and some thematic field visits and exchanges between AN CSO member projects. Meetings with AN to discuss capacity building and outline CCA training for Socio technical Interface NGO in Hammanskraal AN newsletter: Food systems article by Tema Mathebula AN-AGM **AN-Colloquium (Cape Town) Dialogue and presentation on CC vulnerability assessments and MERL frameworks (Betty Maimela).** **'EbA farm' – Adaptation fund planning with SANBI**	13th October 2022 1st December 2022 7th , 8th Feb 2023 15th March 2023 **13th June 2024** 11th May 2023 15th June 2023 20th September 2023 16th November 2023 **14th-17th July 2024** **3rd May, 27th June 2024, 7th August,7th November**
PGS-SA	Quarterly meeting: Discuss mapping of PGS organisations, finalisation of certificate and use of seals and logos. Finalisation of smallholder farm assessment form PGS-Certification working group Online market development training: Input into session 5	17th Nov 2022 13th Feb 2023 9th May 2023
Okhahlamba LM	Agriculture and Land summit: MDF presentation and marketing stall: All Bergville staff, farmers representatives and eco champs Okahlamba LED forum meetings OLM – support with transport for farmers' markets and tractors for field preparation Okhahlamba Agricultural show	30th November 2022 30th March 2023,7th June 2023 Ongoing 29th August 2023
Afromontane research Centre	Maloti-Drakensberg Climate Change Workshop Wageningen/UFS: Land futures course - Bgvl	12-14 December 2022 7-10th March 2023
Water Research Commission/ AWARD	Giyani Local Scale Climate Resilience Project: Support for CCA and VSLAs	8-10th May 2023 10th-14th July 2023 30th-31st October 2023

	Water governance and infrastructure management community dialogue in Mayephu, Giyani – for development of guidelines and proof of concept WRC- ref grp meetings for: Enterprise development and innovation for rural water schemes- GLSCRP	3rd and 29th November 2023**, 24th June, 3rd July 2024**
Umzimvubu Catchment Partnership and ERS– *Nicky McCleod, Sissie Mathela*	Webinar to review CRA and spring protection implementation and plan for future projects Planning for combined spring protection in Nkau and next deliverable Multi stakeholder governance inputs	8th Nov 2022 15th June 2023 2nd August 2023
AWARD – Derick du Toit	Meeting in Hoedspruit to discuss AWARD's contribution Youth induction programme– Tala Table network Planning for CRA learning group expansion, Mametja-Sekororo PGS continuation. Group marketing review and farm level assessments **Youth dialogues in 5 villages. Outline for proposal to DKA** **Mopani District water dialogue linked to GLSCRP**	2nd November 2022 30th January 2023 22nd March 2023 8th May 2023, 29th September 2023 **April-July 2024** **October 2024**
Karen Kotshcy	Learning in M&E interest group meeting. Discussions re methodology for UCP and Tsitsa project multi stakeholder engagement evaluation Discussions and MoU development for M&E framework and indicator development and submission of report for WRC deliverable 4. **Development of Climate resilient indicators for CbCCA** **Climate resilience dashboard Development**	11th November 2022 15th May 2023 24th May 2023 **16-20th October, 13th-16th November 2023** **8th and 19th February 2024, 27th June, 8th and 12th July 2024** **July-November 2024**

3. ADDITION OF FURTHER PRIORITIZED PRACTICES

1 INTRODUCTION

For the initial research brief (2017-2021), we were considering climate change adaptation from an agricultural lens moving from a household level out into the landscape. We also expanded the concept of climate smart agriculture (CSA) to climate resilient agriculture (CRA).

In this round, conceptualisation has now included the broader landscape moving to the concept of Community based Climate Change Adaptation (CbCCA) which includes community level water and resources management and livestock integration. This includes both a change in the participatory methodology for intervening with the CRA village-level learning groups as well as the inclusion of a range of new CRA practices. It needs to be noted that the practices presented here are by no means exhaustive, but are the ones tried and tested with the village-level learning groups supported by MDF.

Practices under each are summarized in the table below. Those marked in green are further described in the narratives following.

Livestock integration	**Water access and management**	**Natural resource management**	**Field cropping**
social-ecological mapping and adaptive planning			
multipurpose breeds – poultry	Self-supply options (springs, streams, boreholes)	Erosion control: Stone lines, brush packs, check dams, re-seeding,	Plant bio stimulants: to reduce external inputs and improve crop

			growth and resistance to abiotic stress.
Fodder production	Governance	Alien clearing	
Nutrients from fodder	Low-tech spring protection options	Wetland rehabilitation and restoration: Building concrete, earthen or gabion structures to arrest erosion, trap sediment and re-wet drained wetland areas. Plugging artificial drainage channels. Addressing other causes of degradation, such as poor agricultural practices and invasive alien plants. Providing convenient livestock watering points	
protein block making	access road and low-level bridge maintenance	grazing management – maintenance of fences and cattle paths	

2 SOCIAL-ECOLOGICAL MAPPING AND ADAPTIVE PLANNING

This aspect has been explored through a separate WRC brief (WRC 20192020-00150) entitled: *"Building social agency and local capacity for sustainable and equitable community resource management: A framework for co-learning, adaptive planning, and participatory mapping of land uses and ecosystem services",* with Dr Rebecka Henriksson from CWRR-UKZN as the lead researcher and EFTEON and MDF as research partners.

Mahlathini Development Foundation has been active in the Northern Drakensberg communities supporting smallholder farmers with implementation of conservation agriculture (CA) as well as climate resilient agriculture practices, through a number of project initiatives. The importance of also including broader natural resource and water management concerns into these processes has already been noted and initial steps have been taken with the learning groups involved to focus on these issues, primarily fodder flow and grazing management for livestock and access to and management of water resources for micro-scale irrigation. These processes have provided a strong entry point into these communities for the exploration and adaptive planning related to integrated water resource management (IWRM) and ecosystem services that this project undertakes.

A transdisciplinary mixed-method approach was employed. The integrative science-action approach involved methods such as historical and current monitoring of climatic and hydrological observations, hydrological modelling, landscape mapping, veld assessment, citizen science water quality tests, participatory mapping workshops, village walks, co-learning workshops, focus group discussions, in-depth interviews, participant observations and facilitated management plan development (adaptive planning). These methods were occurring in parallel with various community-led activities for spring protection, water reticulation, grazing management, erosion regulation and restoration, river clean-up, alien clearing and climate resilient agriculture. All

processes were focused through the village level learning groups in two villages in the Emmaus region of the Northen Drakensberg (Ezibomvini and Costone).

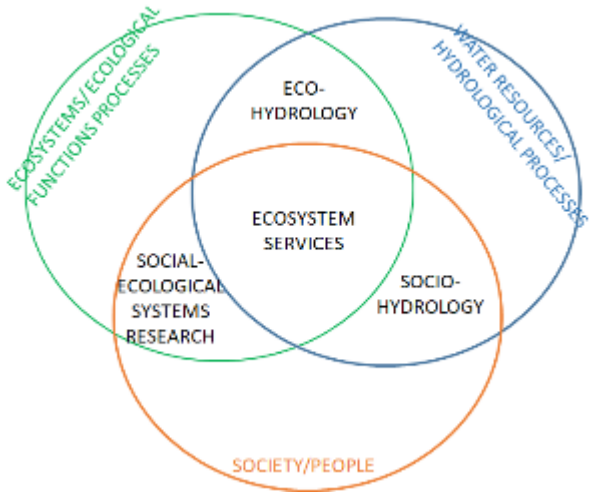


Figure 4: Methodological framework for integration of ecosystems, water resources and people in the social-ecological mapping and planning processes.

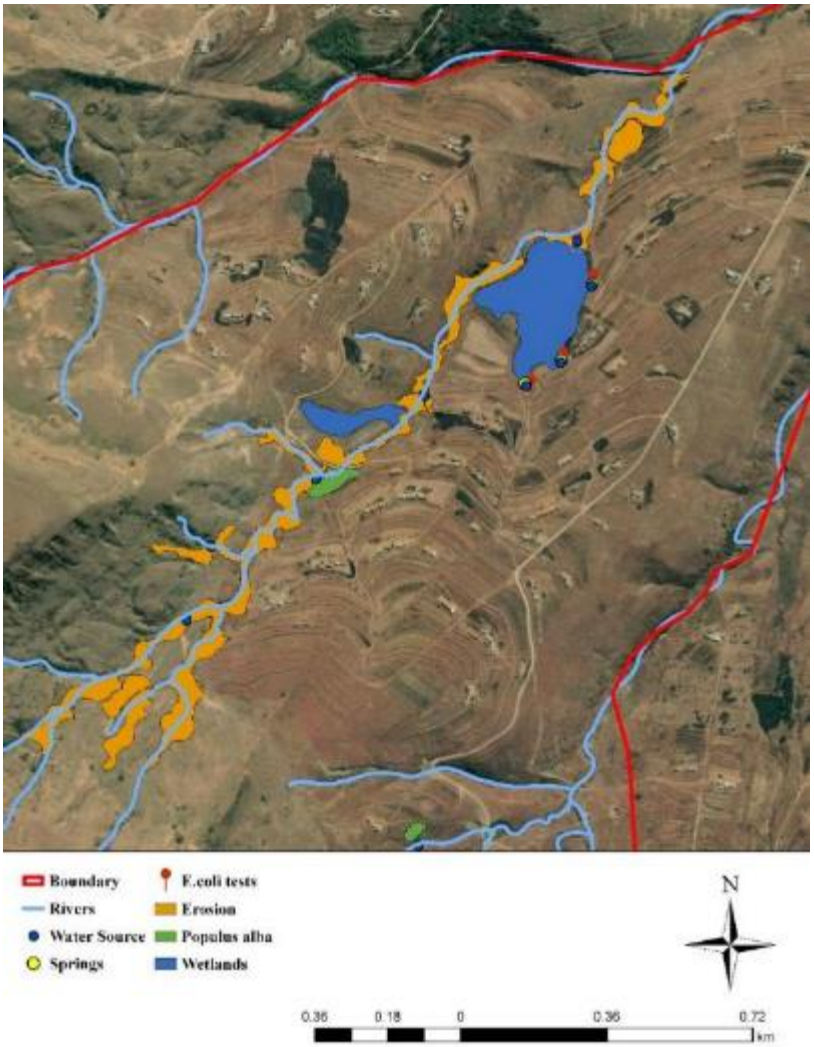
The research conducted in this project includes assessment of all the components: water resources and hydrological processes, ecosystem functions and ecological processes, and people's and societies' resource use, management and dependence, as well as cross-domain dynamics. Activities in this process included:

- Complication of historical and present weather patterns and data and interactive, participatory workshops at community level to jointly analyse this data, discuss climate change impacts and suggest adaptive strategies for action at village and catchment level
- Biodiversity and land use assessments, including a veld assessment for each of the villages, linked to
- Village walks with local key informants to discuss key features and issue in the landscape.
- Community level workshops (women, men, youth and governance structures) to discuss landscape and land-use activities, using both the community level and scientific information related to biodiversity, veld condition, erosion, alien vegetation and water sources and inclusive of considerations of access and governance.

From these processes, a transdisciplinary social-ecological GIS support tool was developed for decision making and management of water and natural resources, and locally defined land uses were linked with ecosystem services and livelihoods. The communities have a rich and detailed understanding of their landscape and describe a diverse utilization of, and appreciation for, the various land uses and their benefits. A wide variety of ecosystem services are associated with specific land uses and places in the landscape, although many of the ecosystem services were perceived as having declined by the participants.

A series of map layers were produced for each of the communities, with spatial information about the community landscapes, co-generated between the project team and the communities.

Figure 5: An example of the mapping tool indicating a number of layers including the boundary, water sources, rivers and springs, wetlands, erosion and alien vegetation



The map reading literacy and ability to interpret spatial information was significantly improved during the course of the project, which enables the communities to use the printed maps for continued decisions around community resources and management strategies.

A framework for supporting innovation and decision making for sustainable resource use management and improved livelihood opportunities has been designed and tested. Co-learning between the project team and community participants about the climate, the environment, and the communities' needs, priorities and decision-making structures enabled the development of participatory community resources management plans that are community-led and expert guided. The social learning approach provided for more informed decision-making about appropriate adaptive measures to ameliorate negative impacts and synergise for positive re-enforcements in the social-ecological system. The process particularly empowered the community to plan, innovate and take action towards management of their resources and to build social agency.

a. Building the picture into one whole: the CbCCA framework

Within the context of governance, decision-making, power and access, one of the developmental goals is to provide for a process of building social agency in the villages. This was facilitated by initially setting up voluntary learning groups in Climate Resilient Agriculture (CRA). The learnings groups were set up to facilitate exploration of adaptive strategies and improved agricultural practices, as this was a priority for community members.

Over time, these CRA learning groups, being inclusive, open, participatory and developmental, have become the hubs from which further community organisation and relationships with external stakeholders have developed. They have provided community members with a process for engagement, for developing systems of representation and building motivation for involvement in the larger water and resource management issues, which have been mired in intractable conflict in the past.

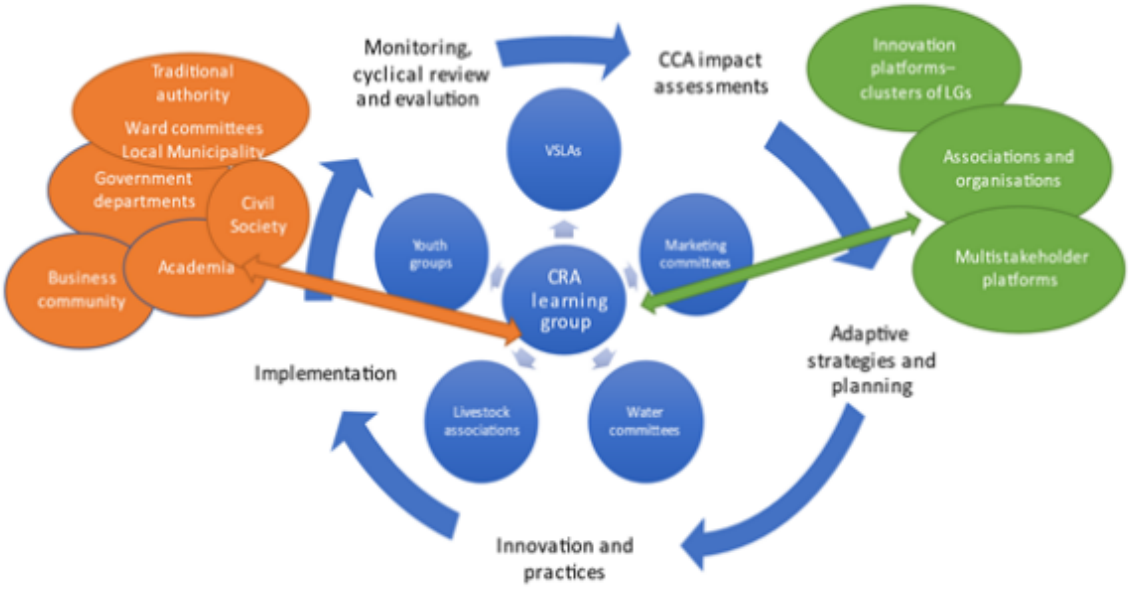


Figure 6: The village-level learning groups and relationship-building with local and external stakeholders.

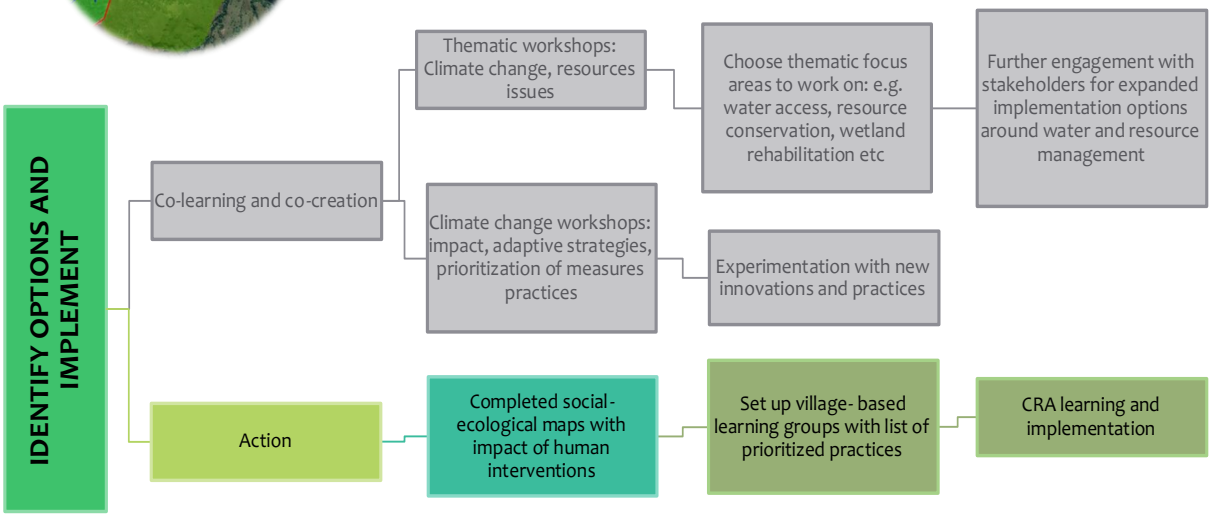
From this a framework innovation and decisions for sustainable resource use management and improved livelihood opportunities was developed. The methodological process of ensuring knowledge co-creation and innovation development in and beyond these CRA learning groups entails three broad facilitated interventions: A***nalysing the present situation, identifying intervention options and processes and implementing these and building improved systems and social agency.*** This is also a cyclical process where learning and implementation can be strengthened and deepened over time.

Below are diagrams outlining the activities in each of these steps:

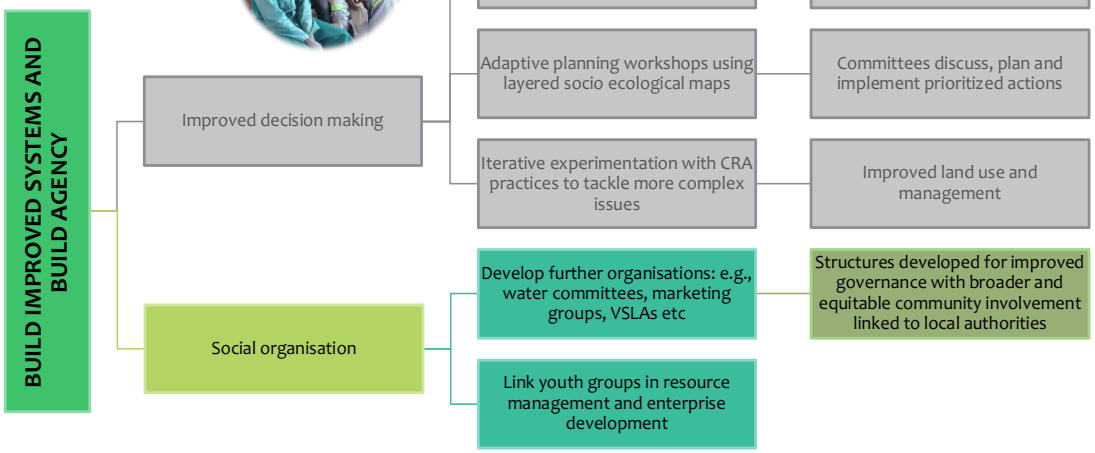
> ***Analysing the present situation***: Collect and analyse information and then allow for joint analysis and co-learning that highlights the issues and needs of different community members.
>
> The flow-diagram below outlines the steps in this process through focus group discussions, individual interviews, mapping and village walks.

Identifying intervention options and processes: Co-learning and co-creation for action. The flow diagram below outlines the steps in this part of the process, which include thematic workshops, climate change impact and adaptive strategies workshops, prioritization of a suite of climate resilient practices for implementation and adaptive resource management planning workshops.

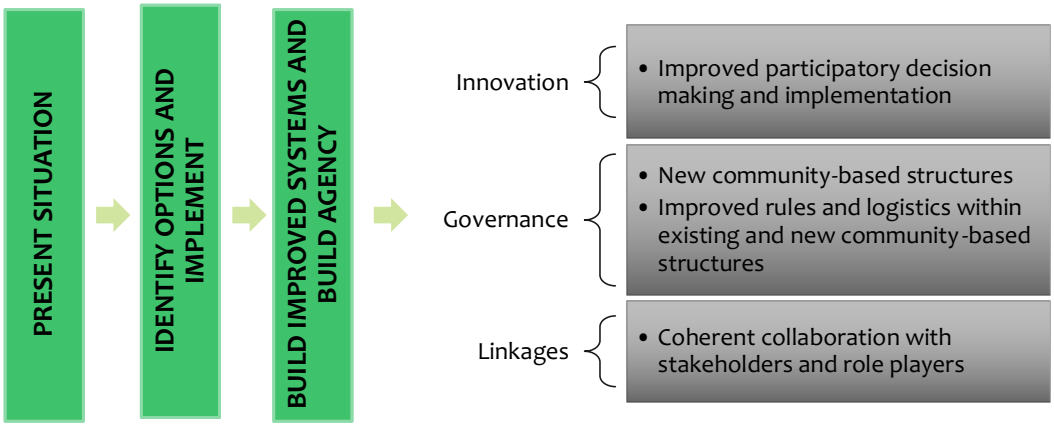
This aspect includes the individual farmer and learning group implementation of a suite of CRA practices as well as farmer level experimentation.



Building improved systems and social agency: focusing on improved decision making and social organisation. As shown in the flow diagram below, this aspect includes the adaptive planning workshop and community level implementation for resource management activities. It also includes stakeholder engagement as well as social organisation as well as inclusion of youth. The review and replanning sessions for the CRA implementation also fall under this aspect given that the deepening and expansion of the CRA activities relies heavily on increased social agency, such as the increased ability to work cooperatively, share information and learning and make joint decisions.



Putting this all together into one picture, then provides for the overall improvement in social agency and local organisational development as an emergent property of the process as shown in the diagram below, with improved decision making, improved local organisational management and improved collaboration with stakeholders being the three main outcomes.



It is important to note that this gradual development of capacity and trust forms the backbone of greatly improved collaborative efforts in the community - between community members and also with local authority representatives, enabling them to develop systems and rules for water and resource management at community level, to which the Traditional Authorities have been party to.

The existing CRA learning groups also enable a valuable entry point for further ideas and projects into the community. The ongoing activities in the communities are efficaciously and positively expanded or built on.

In the Bergville area with the two villages (Ezibomvini and Costone) where this methodology was developed the process has enabled community members to engage in a number of different activities that have brought both social and environmental improvement in their communities.

Members have engaged in:

- ***Joint farming activities:*** providing land preparation and planting support to each other, engaging in bulk buying of inputs together, learning and implementation for a range of CRA practices and integration of livestock through production of fodder and winter supplementation. Rules around livestock movement and management have been an emergent characteristic of this, as has increased involvement in farming by community members as well as intensification of agricultural activities for greater productivity. Other outcomes have been much reduced runoff and erosion in and around fields.
- ***Joint water access activities:*** Community members have formed localised water structures and have provided labour and financial support towards provision of small multipurpose use water schemes from protected springs and boreholes reticulated to either communal standpipes or household connections. Emergent characteristics of this participatory process of water access design have been increased awareness of water resources, how they are used and water quality issues. Community members have undertaken operational and maintenance control of their small schemes and have developed rules for daily management. They have become more aware of the importance of both wetlands and groundwater in their systems and the basic requirements for protection of these water sources.

- ***Joint economic activities:*** These have included village levels savings and loan associations, providing for better financial management and cash flows of individual members, increased access to village based and local markets in their marketing groups, increased ability to manage group funds for mutual benefit and increased ability to engage in productive activities rather than only consumptive ones.

- ***Joint social activities:*** Through the learning groups community members have become more aware of and willing to assist vulnerable individuals and groupings in their villages, including for example young single mothers and ailing pensioners. Emergent characteristics here have been the improved status of both women and youth in these villages and has seen women both young and more mature take on prominent leadership positions in their community structures. And

- ***Joint resource conservation activities***: This is a more recent development, as a result of the intensive participatory mapping and planning processes undertaken in this project, linked to information provision regarding the state of their communal resource, such as veld assessments, climate information, and resource assessments. Now, community members, through the CRA learning groups and Dip tank committees have been engaged in regular environmental workdays, undertaking erosion control measures, grazing management, river clean ups, alien clearing and road maintenance.

The table below summarises this planning for Stulwane and Ezibomvini.

Table 3: Local resource management plans for village based CRA platforms: March 2023

Local resource management areas for improved eco system services- Community defined		
Key Area	**Management required**	**Notes**
Grazing areas (Amadlelo) -Livestock feed and water, firewood, medicinal plants,	**Restoration and management**. -Clear Lantana and use poison after cutting to stop regrowth -Rotational grazing -Control wildfires and make firebreaks. Storage drums for emergencies with fire one can use -Explore financial benefit – grant/incentive mechanisms -Monitor and manage nutrition of veld (erosion control, overgrazing control, removal of poisonous weeds, re-seed of palatable species) -Awareness raising in the community and for livestock owners.	-Eco-champs to do clearing -Dip tank committees and livestock associations -Better community collaboration with dip tank committee as well as TA and councillors -Community workdays
Wetlands (Amacaphuza), -Reeds (incema) -Food and water for cattle, also in winter -Medicinal plants -Fire retardant -Runoff and flood water management -Improved water quality	**Small management changes to manage condition of wetlands.** -Fencing to ensure good condition and make drinking troughs for livestock -Awareness raising on wetlands functions and services -Replanting important species into wetlands; then someone needs to police this and ensure people don't just harvest everything -Protection and restoration of important medicinal species for sale: Stop people with big bags who come in and take for selling -Avoid pigs coming in as they mess things up -Avoid fires and burning -Livestock inclusion managed e.g. –allow them in at certain times only. Or maybe make camps	-TA involvement and 'landowners' in wetland areas to outline rules and responsibilities -Community as a whole to follow these -Local water and land use committees to undertake specific actions related to water access and management -Issues around rights around use of water and important medicinal plants need further interventions -Suggestion: talk to livestock association then bring their comments and suggestions to the water committee to continue the conversation and include all

-Fertile soils with earthworms	and move them. Or allow them to graze on the edges. Or cut and carry feed.	
Erosion control -To ensure availability and quality of water and soil resources	**Restoration** -Awareness raising and outline of responsible actions to enforce -Avoid expanding of minor erosion into dongas. -Prevent siltation and pollution. -Allow re-vegetation, naturally or through re-seeding -Prevent run-off -Check dams, brush packs, stone packs, -Prevent livestock from causing further damage -Control wildfire- make fire breaks Storage drums for emergencies with fire one can use	-TA and livestock committees to undertake some actions -Eco champs to assists -Some actions and contributions from community as a whole (e.g. loan of tractors, small financial contributions -External support -Continued support from UKZN and MDF in mapping, planning, proposal development, community structures and management
Alien trees -Eucalyptus, poplar, and wattle plantations, and patches	Small changes -Promote better management by 'owners' -Cut down and poison lantana and encroaching poplars -Ensure management of wattle patches -Remove trees from water sources and streams in all cases	-TA, Nkosi and 'owners" encouraged to undertake management activities as trees are useful in the community and cannot just be cleared.
Springs and streams -Water provision for drinking, laundry, irrigation, construction and livestock -Water quality and quantity - Issues are floods, livestock trampling, children use as toilet, litter	Protection, restoration, and management – must protect the water sources to ensure supply. - Should protect water so that livestock don't disturb the sources -Protect the springs; with fencing and the ditches above to avoid water from flowing in overland and contaminating these springs. -Check water quality. -Remove eutrophication. -Check springs regularly. -Drinking spots for livestock -Community awareness and education – and for children -Maintain the water infrastructure that is there. -Avoid doing laundry in the water sources and keeping them clean, no pampers, no urination, no use as toilet, no dumping of dead animals. -Protect springs with pipes to be able to irrigate the gardens (reticulation to taps) -Also use grey water for irrigation. - water harvesting and use. -Make sure children don't play around the water sources… or pollute them -WATER ACCESS:-Big issue	-TA, local municipality, water committees and localised groups of people using specific water sources to work together on access and management plans and implementation -Community must come together and make rules and regulations re hygiene and water -Those that are involved should talk to others and ensure they also learn - involve the TA councillors and Nkosi…. -Asking Mahlathini to help with fencing and funding for water access -Day to day activities of cleaning springs, digging furrows to reduce contamination to be done by locals -Dig refuse pits for disposal of waste – in each locality -Awareness raising and communications -Involve schools -Eco champs to assist with spring protection and management and schools' interventions

Figure 7: The Adaptative planning session undertaken in Stulwane, 29th March 2023

3 LIVESTOCK INTEGRATION

b. Multipurpose poultry breeds

One aspect of climate change adaptation and more climate resilient agriculture is the introduction of breed of livestock more suited to the changing conditions. In South Africa, for poultry this means working with poultry breed that are heat tolerant, generally tough in the face of different stresses and multipurpose. This means a breed that is good both for laying and for meat. This is also necessary given the pressure on the poultry industry, post COVID-19, which has meant sharp increases in commercial feed as well as difficulties and delays in supply of day- old chicks (broilers) and point-of-lay hens (layers), reducing the profitability of keeping poultry by smallholder farmers significantly.

The Boschveld chicken (www.boschvled.co.za) is a multipurpose breed originating from Limpopo and is a cross between the Venda, Ovambo and Matabele chickens. The main aim of breeding was to produce a hardy, no-fuss chicken, which is provides both meat and eggs. They can continue laying eggs for at least two and a half years with in-bred disease resistance and hardiness. The roosters are ready for slaughter at 12 weeks with hens ready to lay eggs at 18 weeks.

Boschveld chickens are good for free-range situations and can adapt to a range of management systems. They do perform better when provided proper housing, feeding and vaccination. For maximum performance and laying, Boschvelders are managed in the same way as layers and are provided with pullet starter and grower mash/pellets and later layer mash/pellets. They need to be provided with nesting boxes to lay well. Otherwise they tend to hide their eggs in different places. They are also easy to breed at home, either through separating broody hens and providing them with clutches of eggs or using small incubators.

With Boschveld chickens eating and selling both eggs and meat a smallholder can average a profit of around R580/ month from 10 chickens something that is not possible with the same number of either broilers or layers (Information was obtained from a survey undertaken with 120 CRA learning group participants engaged in poultry production).

Figure 8: Above left: Boschveld pullets (around 8weeks old) and Above right: 12-18 week old Boschveld hens and roosters.

Figure 9: Above left: An example of a nesting box provided by a smallholder in Limpopo and Above right: Boschvelder eggs prepared and ready for sale

Case study for introduction of Boschveld chickens to smallholder farmers in MDF supported CRA learning groups across Limpopo, KZN and EC (March 2024)

In addition to supporting existing participants with their broiler and layer production, MDF introduced a focus on multipurpose chickens in 2023.

Specifically for layer production, supply of point of lay hens has been very sporadic in 2022-2023. In addtion, feed and transport prices have escalated dramatically. This has meant a substinatial reduction in participants keeping layers. In Limpopo specifically, the rolling heatwaves has increased the mortality of layers substantially. In addtion, there has been a number of large scale outbreaks of avian influenza/bird flue across South Africa, which has negatively affected the industry. The trend for broilers has been similar, but not quite as severe.

A decision was thus taken to experiment with multipurose chickens as well as local production of feed rations and cultation of crops for feeding poutlry. The intention is to assist farmers to also breed their own flocks.

The Boschveld chickens were bred in Limpopo in the late 1990s' from a combination of three indigenous Aafrican breeds (Venda, Ovambo and Matebele). They are suitable for both meat and egg production and can withstand extreme temperatures. The breed has inbred diseases resistance and is alert and active. It is best suited to fee-range conditions and doesn't do well in close confinement.

In terms of egg production they compare well with layer breeds and their production potential is on average around 70% of that of layers. They start laying at around 18weeks of age (4eggs/hen/week) and continue to lay for on average 2,5years. Laying declines in winter and declines sharply during molting. Hens go broody and make excellent mothers.Roosters mature at around 12 weeks.

Boschveld Chickens in Bela-Bela, supplies Boschvelderes at various ages. Givne thier longer maturing times, MDF has been procuring 4 week old chicks for the farmers. However they aren't sexed yet at that age, meaning a batch can contain many roosters. POL hens are also sold.

The small table below outlines the number of farmers who started with Boschvelders. Initially they were provided with 10x4wk old chicks, one bag of 10kg pullet grower and 10 kg of layers mash. From there any further orders of chickens and feed are to be managed by the farmers themselves. This is in keeping with the strategy of supporting farmers to try out new things, to reduce the opportunity risk for them, but not to create dependency in the longer term.

Area	**No of villages**	**No of participants**	**No of 4wk old chickens (Oct 2023)**
Bergville	5	39	390
Southern KZN	1	15	150
Midlands	2	30	300
Matatiele	5	40	400
Sekororo	5	50	500
	18	174	**1740**



Figure 10: Above left: Boschvelder 4-week-old pullet delivery to a village in Bergville, KZN. Above centre: Betty works with Mr Malatji in devliering pulltets for turkey viallge in Limpopo. Above right: Pullets and feed enroute to Matatiele.

Small learning and mentoring sessions were undertaken around Boschvlered management in each village, primairly to ensure good hygiene, proper feeding and appropriate housing for these chickens. They are good at scavenging and can get a proportion of their nutrients in that way, but diets need to be supplemented with commercial feed. Quantities to be fed at specific times of day were covered, to avoid over or under-feeding.

A poultry monitoring process was undertaken for all areas between February and March 2024. Learning group participants were selected: those who had ordered more rounds of broiler chicks and layer hens (although this number has been very small due to unavailability of commercial POL hens) and Boschvelder chickens.

Table 4: Poultry monitoring Feb- March 2024: Participant numbers and poultry types.

Area	Village	No of farmers	Gender (% female)	broilers	Layers	Boschvelders	Traditional chickens
October 2023-March 2024							
EC, Matatiele	Nchodu	3	73%	1		3	2
	Ned	7		1		7	4
	Rashule	5		2	1	4	4
Limpopo, Sekororo	Turkey	12	64%		1	12	7
	Willows	10		3	1	10	4
	Sedawa	10			1	10	7
	Worcester	3				3	
Southern KZN	Ngongonini	6	74%	1	1	5	5
	Mariathal	4			1	4	2
	Mahhehle	11		1	11		4
	Centocow	3			1	3	2
	Spring Valley	6		1	1	6	4
	Nkoneni	5			1	5	3
Midlands, KZN	Gobizembe	9	85%	5	1	9	2
	Ozwathini	14		2	3	12	9
	Noodsburg	5		4		4	3
	Ndlaveleni	6				6	4
Bergville ,KZN	Eizbomvini	5	79%	5	3	5	ND
	Eqeleni	8		1	3	8	
	Emajwetha	5		20		5	
	Emadakaneni	6		5		6	
	Ezinyunyane	3				3	
	Stulwane	6		6	4	5	
	Vimbukhalo	5				5	
Totals		**157**	**75%**	**58**	**34**	**140**	**66**

Note: All participants were supplied with 10 Boschveld chickens to start their exeprimentation with this breed. For most participants htis number has reduced significantly as hosueholders opted to slaughter ‚extra' roosters. At 4-weeks, upon delivery, chicks were not sexed and some partcipants recieved more roosters than others.

Overall, the number of participants still invovled in layer production has dwindled from 70 participants in 2022-2023, to 34 participants in early 2024. The number of participants involved in broiler production has also decreased substantially from 249 participants in 2022-2023 to 92 participants in early 2024. These trends are a combination of reduced availability of chickens commercially, drastically increased prices of feed and fuel and less expendable cash at household level. This was compounded by MDF's decision to only supply bulk orders where farmers have come together to collect their monies and ordered 1 large consignment, rather than assisting a few individauls at a time, as was done before. The latter was a conscious decision as it became clear that most participants were working with numbers of broilers and layers which are too small to be profitable (<50 broilers per round and fewer than 10 layers) and that for these farmers this production was only possible through the' subsidisation' by MDF (ordering, transport and delviery). The plan is to move as much as possible to multipurpose chickens, production of fodder and feed rations and home breeding to develop a local value chain for poultry production which is more independent of commercial fluctuations and more sustainable.

Below is a summarized anlaysis for the in-depth moniotring of the management of hte boschvlder chickens for 119 participants across Limpopo, KZN and EC.

Table 5: In-depth monitoring for Boschvelder chicken management across 4 sites.

Record keeping for Boschvelders.	**Matatiele**	**Limpopo**	**SKZN**	**Midlands**
No of farmers	14	35	23	31
Number of birds in flock	99	350	124	225
New chicks born			62	4
Mortality	7	16	80	
Number of hens/rooster (Ratio)	0,9	2	1,5	0,3
No of participants selling birds	2	9	4	7
Price per bird?	R110,00	R120,00	R150,00	R130,00
No of birds sold	4	57	24	30
No slaughtered for home consumption	29	59	28	51
No of hens laying eggs	28	109	64	36
No of farmers selling eggs	2	8	8	5
Ave eggs sold/week/farmer	30	65	31,5	38
Price /egg	R3	R2	R2	R2
Ave eggs consumed/week/farmer	6	27	36	12
Ave monthly income/farmer	R580,00	R715,00	R402,00	R354,00
Ave monthly cost of consumption	R128,00	R326,00	R235,00	R226,00
Ave total income (incl consumption)	R708,00	R1 041,00	R637,00	R580,00
Ave monthly costs	R642	R456,00	R649,00	R649,00
Ave monthly'profit'	**R56,00**	**R585,00**	**-R12,00**	**-R69,00**
Feed bought no of farmers:				
Maize crush only	7	1	14	10
Mix of maize crush +layers mash	5	3	1	8
Layers mash only	2	22	5	15
None		7	3	

From the analysis, the farmers in Limpopo have grapsed the concept of working with their multipurpose chickens better than the other areas, already realizing that they are a good alternative to layers and feeding them layers mash to promote egg production for sale. They have also comparatively consumed fewer of the birds provided and focused more on breeding with these chickens. They have focsed more on providing good housing and laying arrangements for thier birds than the other sites.

Figure 11: Two examples of housing arrangements for the Boschvelders in Limpopo

The Midlands-KZN learning group bore the brunt of the distribution between hens and roosters- as 4 week old birds are not yet sexed and it only becomes apparent a bit later on. For this group most farmers had many more roosters than hens, and thus also the trend of more consumption as roosters have been eaten at home. They are not that easy to sell as their meat is tougher than the more well-known broilers.

It is clear from the table above that those farmers who have not fed their Boschvelders, and treated them like „normal“ traditional chickens have not reaped the potential benefits of this breed. In addtion those who have fed their Boschvelders layers mash or a mixture of layers mash and maize crush have seen the best results.

The belief in the villages that maize crush is cheaper than layers mash has not been shown to be correct. Generally when farmers buy maize crush they buy in small quantities (5 or10kg bags) which are in fact proportionally much more expensive. The feed costs in Limpopo were quite a bit lower than KZN and EC, partly because farmers worked together to buy larger quantities in bulk and then shared the feed between them.

Figure 12: Examples of Boschvelder housing, a hen with chicks and an egg laying box for the Bergville villages.

c. Fodder production

An element of sustainable livestock production is the production of livestock fodder for feed supplementation for livestock (cattle and goats) grazing on low quality natural veld. Sourveld in higher altitude and rainfall areas is of low quality in winter months and in all smallholder farming regions due to sustained over-grazing.

In smallholder farming systems, fodder species need to be incorporated in a way that is appropriate to the needs and requirements of the farmers. To date, the best option tried out with farmers is the incorporation of fodder species into the multi-cropping Conservation Agriculture dryland field cropping process to allow for soil and environmental benefits in the system, while also producing food and cash crops. Within this, two different options are available: annual and perennial fodder crops.

Annual fodder production

This category consists of a mixture of cover crops, either planted in separate blocks or inter-cropped with the food crops (maize, beans and pumpkins) in the CA system.

There are summer and winter cover crop mixes that are suitable for the temperate dryland climatic conditions in KZN, EC, Free State and Mpumalanga. These cover crops are chosen for their fodder value both green and as hay as well as for production of seeds/grain. The small table below provides examples of cover crop mix species that have performed well under smallholder conditions.

Summer cover crops		**Winter cover crops**	
Sunflower	seed and dry biomass	Black/Saia oats	green biomass
Sun Hemp	seed and dry biomass	Fodder rye	green biomass
Fodder sorghum	seed and dry biomass	Fodder radish	green biomass
Bird resistant sorghum	seed		
Turnips	green biomass		
Dolichos beans	dry biomass		
Sugar beans and cowpeas	dry biomass		

A few crops tried out that were not hardy enough for the context (including dry, harsh winters), or was heavily predated by birds include millet, vetch, fodder peas, lucerne and sugar beets. Grass species such as teff and Mooi river mix (Smutsfinger, Rhodes and buffalo grass) grew well, but provided small quantities of dry biomass.

Figure 13: Above Left: An example of turnips planted as fodder and intercropped with summer cover crops. Middle:: Fodder radish produces big tubers which are eaten by livestock. Right: Mooiriver mix grass

Figure 14: Above Left: Intercropping of a summer cover crop mix (sunflower, Sun hemp and fodder sorghum) with maize. Middle: Winter cover crops (Saia oats, fodder rye and fodder radish) planted in a block and Right: Including of earth bunds in a field of summer cover crops for erosion control and in field water flow management.

These crops can be cut and cried as green feed for livestock, grazed in situ (mostly for winter cover crops) or allowed to grow to maturity and then harvested for seed and dry biomass which can be either left in the fields for grazing or baled for late winter fodder supplementation.

Perennial fodder crops

These species are permanent in that they continue to grow for a number of seasons throughout the year. Generally, these have been planted in contour strips in between maize and other cash crops. This has provided an added advantage of soil erosion and runoff control. The two most hardy species tried out, that could withstand both the harsh winters and livestock grazing pressure are Lespedeza (bush clover) and Tall Fescue grass. Of the grasses, Tall Fescue has outperformed other species given its ability to withstand drought as well as water logging.

Figure 15: Above Left: Strips of Lespedeza growing in a CA field. Right: Tall Fescue grass. Note the line where the green starts, indicating the growth of tall fescue in autumn going into winter while other grass species die back,

Nutrients from different fodder options

The idea of producing fodder in a smallholder situation is to augment the nutrition of livestock which are grazing in the veld. Important nutritional aspects to consider include the amount of fibre and protein the fodder can add to their diet.

Fibre is usually calculated through two processes, one that quantifies the cellulose and lignin in a feed (ADF) and one that gives an indication of all fibre (NDF). If crude protein is also provided as a percentage, then the small table alongside can be used to get an idea of the quality of the feed being analysed.

Uses	NDF %	ADF %	protein
Prime dairy (Very good)	<40	<30	>11
Good dairy (Good)	40-44	31-35	>8<10
Good beef (Moderate)	47-53	36-40	>7-8
Maintenance	54-60	41-42	<7
Poor quality	61-65	43-45	<7
Very bad	>65	>45	

It is possible for a feed source to be either a good source of fibre or a good source of protein or both. This depends also on the stage of growth at which the fodder was cut and dried.

As an example, the table below summarizes the nutrient analysis undertaken in March and June 2023, for fodder species grown in the Bergville KZN region and indicates fibre and protein content as the two main ingredients.

Table 6: Fodder nutrient analysis for a range of fodder production options in the Bergville villages (July 2023).

Species	NDF %	ADF %	Quality	Protein %	Quality
Lespedeza (Cut Feb)	67,13	54,59	Very bad	10,31	Good
Lespedeza (June regrowth)	40,42	32,77	Good	4,84	Poor
SCC (Mature, still green)	59,09	36,56	Moderate	10,49	Good
SCC (dry, seeded)	38,65	27,79	Very good	4,73	Poor
Beans (full plants with seed)	46,40	36,49	Moderate	16,73	Very good
Beans (dry stover, without seed)	34,17	26,02	Very good	8,94	Good
Maize (dry stover)	39,07	20,92	Very good	5,90	Maintenance
Veld (Cut Feb- green)	78,76	45,50	Very bad	5,08	Maintenance
Veld (Cut May- June- dry)	40,36	23,06	Good	7,12	Moderate

The values in the table above indicate that the best fodder options from those tested are mature green summer cover crops, bean stover with seed, maize stover and veld grass cut in May-June.

Recommendations developed with the farmers are:

- Maize stover and veld grass would benefit from supplementation with a source of non-protein nitrogen such as urea/SP33 or premix54, which would allow the rumen microbes to digest it, and then to serve as a protein source.
- The fibre content of the Lespedeza could be improved by harvesting it before it is mature to reduce the stem: leaf ratio (December-January). Lespedeza needs to be harvested and dried carefully to reduce the loss of leaf materials.
- The dry bean residue can be fed ‘as is’ but would benefit from retaining some of the bean seed, though this is perhaps a loss in terms of household income or nutrition. In this regard, planting of cowpeas to use full plants (leaf, stem and seed) as feed has been suggested.
- Summer cover crops that are cut while still growing (December to January) are a good source of nutrition.

- Mature veld grass cut green in March had poor digestibility and low protein content. Veld cut dry for baling in May-June showed much improved digestibility and a higher protein content, similar to the maize and cover crop stover.

Baling and supplementation

In addition to growing some fodder, non-protein nitrogen and mineral supplementation added to the roughage or hay is required to improve livestock nutrition.

Below is a suggested list of supplements that are easy to add to bales and reasonably priced:

- VOERMOL LS 33 is a molasses-based protein, vitamin, mineral supplement in liquid form (added at 100ml/kg of roughage)
- VOERMOL PREMIX 450 is a cost effective, ready-mixed maintenance lick for cattle on dry veld. It can either be fed on its own or mixed with roughage/hay (at ~450g/animal/day)

Veld grass is cut at the end of the summer season (May-June), and baled for storage, so that it can be used in the fodder supplementation process towards the end of winter (August-September) when a lack of feed is common for livestock. It is possible to use locally made hand balers for this purpose.

Figure 16: To Left: Cattle feeding on bales mixed with supplements. To right: Veld hay bales stored during winter and Bottom: the locally made hand baler used to bale cut veld grass.

Production of feed for poultry

Although it can be quite tricky to produce and mill full feed rations for poultry of various types and ages it is worthwhile to supplement commercial feed with grit, grains, grubs and greens produced locally. Chicks and pullets can be fed on demand and fully grown chickens need around 1/4cup of dry feed per day for hens and 1/3 cup for roosters.

Never feed your poultry the following:

- Their own eggs
- Rotten or mouldy food
- Fatty or spicy cooked food.

The four G's should all be provided for a balanced diet:

Grain:

This is seed like: sorghum, millet, oats, maize, or sunflower seeds. It should also include seeds with high levels of protein such as soya, Sun hemp, cowpeas, mung beans or sugar beans. Yellow maize is probably the best and cheapest grain to feed your chickens.

If the seeds are large, then provide cracked grains. It is always a good idea to provide a mixture and range of grains, rather than just one type to provide more of a balance.



Greens:

Greens keep chickens healthy. They will get greens themselves if you let them scavenge during the day, or you can feed them cabbage, comfrey, herbs and most kinds of fruit. They also like eating vegetable scraps. A good idea is to feed the chickens weeds from your vegetable garden.

Further examples of greens include cabbage leaves, mustard spinach, Chinese cabbage, lettuce, carrot tops, etc – basically any kind of leaves humans can also eat – but not leaves from tomatoes, or peppers for example. Pumpkin leaves and squash are also a good source of Vitamin A.

Good sources of vitamin A and protein are clover, stinging nettle and lucerne.



Herbs can also be included and have additional health benefits for poultry include a wide range such as parsley, comfrey, coriander, sage, oregano, rosemary, lemon balm and mint. Small amounts of finely chopped onion and garlic are known to control internal parasites. Aloe gel included in the water assists in reduction and treatment of bacterial infections (10ml/l of water). Turmeric and cinnamon powder (roughly 1g/kg of feed) included in feed have anti-microbial and anti-inflammatory effects.



Grit:

These are small stones that chickens need to help them digest their food. Good sources of grit are coarse sand and small pebbles as well as clean gravel. Chickens can collect their own grit if they have somewhere to scratch around. Sometimes using used eggshells that have been baked and ground are recommended. This however increases the danger of your chickens starting to eat their own eggs and should rather be avoided.

Grubs:

Bugs and insects provide the chickens with most of the protein that they need so that they can grow. They need protein to make muscles in their bodies and to make eggs. Growing soya beans and feeding this to the chickens is another way to give them protein. If they are kept in a 'chicken tractor', they can help you clear a new planting bed of bugs, prior to planting. It is also an idea to collect insects and worms in your garden and feed these to your chickens. They will eat snails, worms, and grasshoppers as well as aphids, moths flies and termites.

In winter you should feed your chickens commercial feed or mash (bought food), because there are fewer insects and less grass/greens for them to eat outside.

d. Protein blocks

These can be provided as licks to cattle during winter and can either be pre-bought or made locally. Moulds for making of cement or earth bricks, which are commonly used work well for making these blocks.

The ingredients and proportions to mix are as follows:

Product	Description	Amount
Voermol Procon 33 	This is a urea free high protein concentrate for home mixing of high-quality animal feeds.	32 kg
Coarse salt	Needs to be feed grade -can be bought from supermarkets. Important mineral in livestock feed.	4kg
Maize meal 	Bought from supermarkets. Helps to maintain weight and lactation for cattle	14kg
Whitewash 	Hydrated lime – bought from building supply stores. In the protein block it assists in making the protein more palatable. It supplies calcium and acts as a hardener for the block	8kg
Molasses 	Molasses improves appetite and digestion and provides energy for the cattle	16L

Protein lick blocks are placed in kraals or areas where livestock can easy daily access. They provide supplemental protein at levels that improve forage digestion and increase forage intake, for low quality fodder.

4 NATURAL RESOURCE MANAGEMENT

e. Erosion control measures

Brush-packing

Brush packing involves using woody material in eroded areas and small gulleys to restore the area, provide for slower water-flow, some sedimentation and re-grassing of the area, either naturally or through planting seed.

A variation on this practise which involves stacking the woody material on contour between a set of pegs/stakes was tried out in the Stulwane village in Bergville as a joint activity between Mahlathini Development Foundation, the Institute of Natural Resources and the Stulwane community. The site was also used to gather runoff and sedimentation data and to experiment with planting of grasses to speed up the rehabilitation effort.

The area was selected to build on previous exposure of the Eco champ team at Stulwane to work being done by INR in the uMkhomazi Catchment with funding from Umgeni Water. A group of the Eco champs appointed by Mahlathini through the Amanzi Ethu Nobuntu (AEN) Programme, spent a few days in the field with the INR work teams learning about clearing alien invasive plants and building brush packs from the wattle biomass harvested during clearing.

The site in Stulwane was chosen jointly between the three groups; a gulley formed on the edge of a wattle thicket that has worsened substantially over a short period of time. The first activity was to smooth the edges of the steep sided gulley, to allow for rehabilitation (measurement of contours using self-constructed A-frames and construction of brush packs).

Edges needed to be smoothed and levelled and some trees and small saplings of wattle in the gulley itself needed to be removed before measuring the contours.

Figure 17: Above left to right: Gulley identification for rehabilitation jointly by community and support organisations, starting the rehabilitation effort by smoothing out the steep sides of the gulley and constructing A-frames to measure the contour lines.

Brush from cleared wattle close by was used. Two lines of pegs around 30cm apart were knocked into place along the contours measured and the brush was packed in between these lines and held in place by the pegs. The contours themselves were placed at a distance that provided for a 1metre height difference between the contours, roughly 4-5 metres apart.


Figure 18: Above Left and Right: Constructing a brush pack and a view of one full brash pack constructed across the gulley. Note that the line for the brush pack is roughly a half-moon shape along the contour.

Over time the brush in these packs disintegrate and become composted. Sediment is deposited behind the packs and seed can be planted in these areas


Figure 19: Above Left and Right: Pictures showing the slow composting of the brush packs with sedimentation accumulation and planting in of grass seeds into this sediment.

As sediment builds up, it then becomes possible to include further brush packs to allow for the overall filling in of the gulley over time. A second set of brush packs were constructed roughly one year after the first round.

Figure 20: Right; A view of the new brush packs that were built, both over the 1st set which had been covered by sediment and in-between the initial brush packs to allow for further sedimentation and re-seeding of grass. In the foreground is one of the run-off pans that were placed throughout the site to measure run-off.

Measurement of sedimentation was done in terms of both the depth of the sediment above and below each brush pack as well as the length of the sedimentation behind the brush packs.

Figure 21: Right and Far-right: Showing how the measurements of sedimentation were done.

The small table below provides a summary of the sedimentation data collected by the Eco champs.

Table 7: Average sedimentation measurements for the brush packs in the rehabilitation site in Stulwane, Dec2023.

Brush pack no from top of slope	Depth of sedimentation (above-below) in cm	Length of sedimentation plume in cm
B1	17,5	27,3
B2	14,4	44,8
B3	20,3	93,4
B4	14,5	133,8
B5	8,7	67,5
Average	**15,8**	**73,4**

This data indicates significant sedimentation with an averaged depth of 15,8cm, with a length of sedimentation of on average 73,4cm behind each brush pack.

Eight run-off plots were installed within the restoration site. The run-off plots were fitted with buckets that collected run-off and the amount of water accumulating in the buckets was measured after any rainfall event. This took place over the period from December 2022 to May 2023. Measurements of rainfall received as well as run-off measured were maintained by the local Eco-champs. Each of the buckets was buried downstream of its run-off plots to facilitate ease of flow. The nature of the site is that it is a conduit for run-off from an adjacent road and despite all efforts, heavy rainfall events dislodged a number of buckets during severe rainfall events. The readings from these run-off plots are captured as 'false' below.

The replenishment figures are based on the reduction that is achieved through restoration efforts, which both flatten (terrace) and revegetate the degraded area, transforming it from a steep sided gulley with compacted, hard surface.

Figure 22: graphs outlining total runoff in litres from each of the 8 run-off plots installed in the rehabilitation site.

Two scenarios are provided below. The first compares a flat, well vegetated plot adjacent to the original gulley (Plot 7) with run-off generated by a plot placed on the hard, compact, bare side the gulley (Plot 8). This demonstrates the potential impact that restoration measures can have in the long-term.

The second scenario demonstrates the current effect of the restoration measures (given that the revegetation process is still underway but the area has been flattened through the accumulation of sediment behind the brush pack where the run-off plot has been installed. Thus, we compare the run-off measured for Plot 5 with that measured for Plot 8.

Based on these two scenarios, restoration can lead to *potential retention* of 0.945 ML per hectare, while *current levels of restoration* can retain 0.441 ML that would otherwise have been lost as run-off, as shown in the diagram alongside. Information was provided by Dr B Letty from the INR.

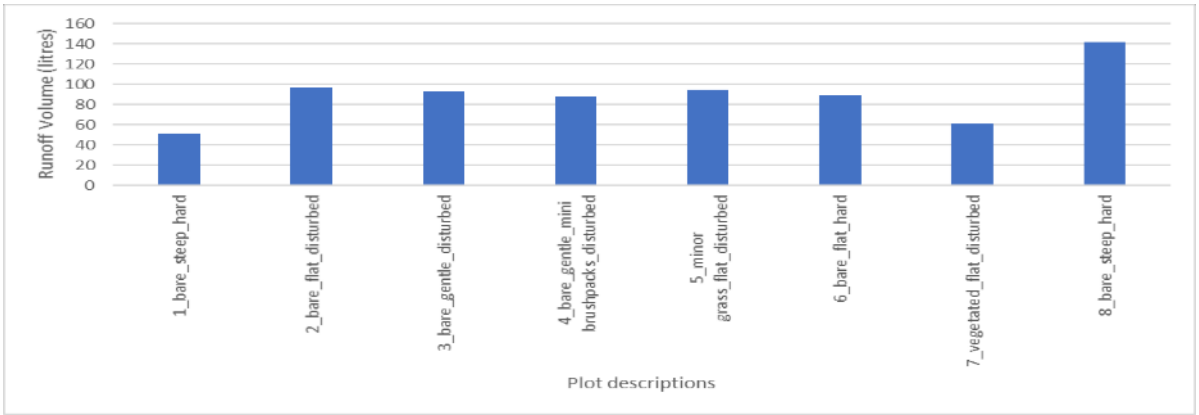
Plot	Runoff volume (litres)
1_FALSE_bare_steep_hard	87.59
2_sparse grass_flat_disturbed	121.3
3_FALSE_bare_gentle_disturbed	125.81
4_FALSE_bare_gentle_mini brushpacks_disturbed	149.71
5_minor grass_flat_disturbed	138.35
6_bare_flat_hard	137.01
7_vegetated_flat_disturbed	87.75
8_bare_steep_hard	182.4

Replenishishment calculation		
Compare plots 7 (vegetated and flat pre-restoration) and 8 (steep, bare & hard):		
Amount of water retained in plot 7 is difference	94.65	litres
So on 1 m2 we hold	94.65	litres
Thus on 1 ha (10000 m2)	946500	litres
There are 1,000,000 litres in a megalitre		
Thus, per hectare restored this holds	0.9465	ML
Thus, on 3 hectares, this holds	2.8395	ML
THIS DEMONSTRATES POTENTIAL		

Replenishishment calculation		
Compare plots 5 (partial restoration) and 8 (steep, bare & hard):		
Amount of water retained in plot 7 is difference	44.05	litres
So on 1 m2 we hold	44.05	litres
Thus on 1 ha (10000 m2)	440500	litres
There are 1,000,000 litres in a megalitre		
Thus, per hectare restored this holds	0.4405	ML
Thus, on 3 hectares, this holds	1.3215	ML
THIS SHOWS CURRENT SITUATION		

This is a significant amount of water that can now be held in the landscape due to the restoration efforts.

If these results are compared with increased infiltration (through reduction of runoff) in the Conservation Agriculture experimentation on around 20ha in the same area which averages around 0,223ML/ha, it is interesting to note that this type of rehabilitation effort can keep 2 to 5 times the amount of water in the landscape than the CA principles of minimum tillage, soil cover and crop diversity. It also shows the importance of tackling water conservation and management in the landscape from multiple angles to create and overall improvement.



Check dams

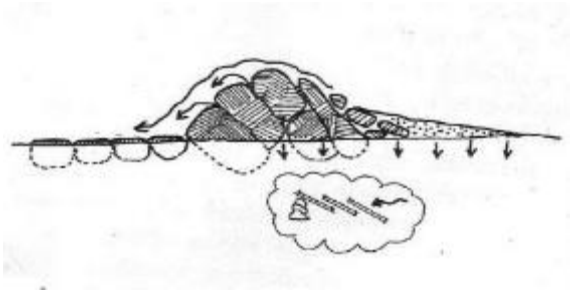
A water harvesting check dam is a low barrier that is permeable (let's some water through) and is placed perpendicular to the flow of water within a drainage line. They are an improvement in the design of 'rocks in dongas' or stone packs, which is a temptation for most people who first try to undertake rehabilitation work. The two pictures below are examples of this. Despite the fact these stone packs have had a positive effect in terms of slowing down water and catching sediment, the danger of these rocks being washed further down the gulley or the water flowing underneath or

around these structures, causing further damage, is high. In addition it also shows the temptation to undertake one large structure further down the slope, rather than doing a series of smaller structures, starting at the top of the gulley and moving all the way down its length.

Figure 23: Right and far Right: Community level efforts in a village in the Northern Drakensberg to do gulley restoration. This structure was quite stable due to it's size and also the size of the rocks used, but was not well constructed and not keyed into the banks – making it vulnerable to further erosion.

By slowing down and spreading the flow of water the check dams help moisture infiltrate into the soil, reduce downstream flooding and erosion, retain soil and organic matter on the upslope side of the check dam and stabilise the landscape.

Figure 24: A line drawing of a check dam viewed from the side, showing the larger rocks placed downstream, the angles of the upstream and downstream slopes and the apron downstream to protect the gulley floor from further erosion.



Gabions are check dams in which the rocks are encased in a wrapping of wire fencing or a wire basket that holds everything together. It is also possible to use netting, brush and straw bales for check dams if rocks are hard to find.

Where are check dams used?

Check dams are mostly placed across drainage lines and where water flows after rainfall- but does not flow permanently. They are also placed across eroding gullies. They work well to stabilise roads or paths that cross drainage lines

Figure 25: Right: An example of a check dam constructed in a homestead field in turkey, Limpopo, clearly showing the rocks keyed into the bank of the small gulley and the downstream apron of this structure.

Materials

ROCK: Use angular rocks or stones rather than round ones. They should be about 30-60cm in diameter and weigh around 9kg to have enough anchoring weight. The smaller stones or rocks should be 15-22cm in diameter.

How to build a check dam

Siting

- The check dam needs to be in a straight section of the drainage line.
- Place the check dams in gradually sloping sections of the drainage line.

- Do not place check dams in the narrowest point or just downstream of a narrow point, because it will be subjected to increased speed and force of water.
- Build the check dam perpendicular to the channel you are placing it in.

Spacing

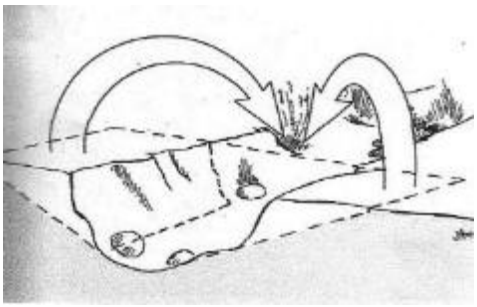
- Typically you start at the top of the drainage line and work your way down.
- Ideally a series of check dams should be placed heel-to toe, where the level terrace of accumulated sediment and soil behind each check dam extends to the downstream end of the check dam higher up.

Size

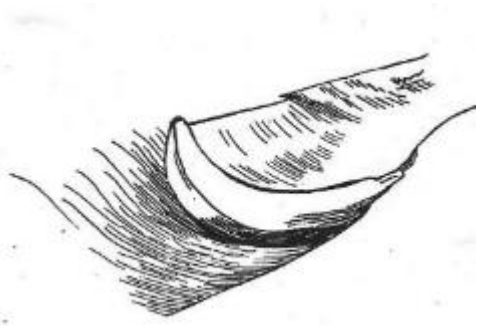
- They should be no taller than 1/3 to ½ of the channel; generally, 0.6-0.9m high.
- This height restriction ensures that the check dams are stable.

Construction

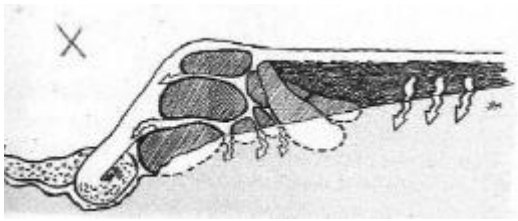
- Dig down into the bed and banks of your drainage line to create an anchoring trench. The trench should be deeper depending on the stability of the soil and size of the water flow.
- Unstabilised banks (abrupt edges) should be cut back to a 1:1 slope. Then dig your trench into the more gradual slope. Place the soil from the trench into the channel upslope of the check dam to help initiate the silting in of the dam, as shown in the small line drawing alongside.

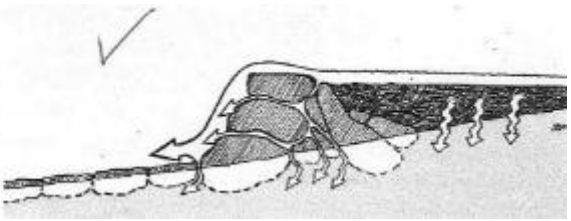


- Carefully lay the larger, heavier rocks on the downstream side of the check dam's trench. It is important that they are keyed into the bottom and sides of the trench and are firmly in position. They should not move when you push against them.
- Place smaller stones in the spaces between the larger rocks.
- The face of rock on the downstream side can be at an angle of 1:1. The upstream face should be more gradual at 1.5-2:1. This diverts a portion of the water over the check dam rather than absorbing the full force of flowing water.
- Build the top of the check dam in the shape of a banana; with the lowest point in the centre. The centre should be much lower than the ends which should extend upwards to the top of each bank. Preventing water from cutting around the ends of the dam. This shape directs overflow water down the centre of the drainage line, away from the sides where it could cause more erosion.



- It is a good idea to place and apron of smaller even stones, almost like paving, below the downstream face of the check dam. This will reduce the eroding effect of the overflow water.





- If it is built correctly, you should be able to walk across your check dam wall without the rocks moving or slipping.

Stone lines

Stone lines are a variation on the concept of stone packs, and are smaller structures built on contour across a slope. The same concept of keying in the stones into the slope needs to be employed. This means digging a shallow ditch for the bottom layer of larger stones to fit into, to avoid the rocks rolling down the slope. Again, the larger rocks are places downslope and are filled in with smaller rocks upslope at a less steep angle.

Stone lines are most effective where sheet erosion is occurring due to the effect of waterflow and wind on denuded landscapes and where small gulleys are in the process of being formed.

Figure 26: Above Left and Right: Examples of stone lines constructed in the grazing lands of a Northen Drakensberg village.

f. Alien clearing

Generally processes for alien clearing are well documented through the many stewardship processes undertaken in South Africa during the last few decades. As it involves mostly training of participants in clearing techniques and judicious use of the correct herbicides, these will not be re-explained here. The following points serve to emphasise best management options in alien clearing activities.

- The clearing programme and type of herbicide to us is specific for each type of alien and needs to be given strict attention. These are different for different agroecological zones.
- As aliens take hold in soils or areas that have been disturbed, cleared or mismanaged- a big component of a systemic approach would be management of areas post-clearing – something that can be tricky to manage as these are generally large areas. Post-clearing management includes: replanting, re-clearing, fencing or other actions to reduce grazing pressure, and other grazing management processes.
- Productive use of cleared biomass is also considered good practice – e.g. use for erosion control, firewood, fencing, and biochar production.

g. Wetland rehabilitation

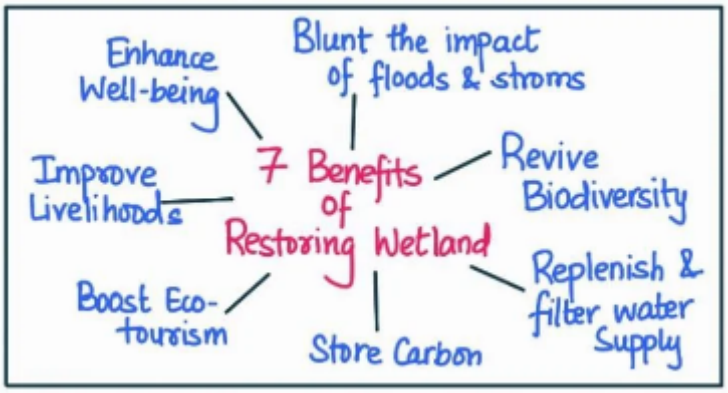
A wetland is land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils.

Riverine and palustrine wetland complexes occur in mountainous area. Palustrine wetlands are marshy areas without open water, such as swamps, marshes, and wet meadows. They are characterized by the presence of trees, shrubs, and emergent vegetation, which is vegetation that grows above the surface but is rooted below water.

Wetlands are important because they:

- Clean water,
- Provide hydrological buffering: Flood and drought management in systems,
- Provide for natural vegetation and wildlife corridors,
- Provide resources for local livelihoods and
- Have spiritual and cultural value

The 'wise use' principle acknowledges that wetlands can provide numerous benefits to human communities while ensuring their long-term ecological sustainability. It involves promoting actions that maintain the ecological character of wetlands, while also addressing the needs of local communities, promoting sustainable livelihoods, and considering cultural values.



In rural communities, wetlands often are quite badly degraded because they are channelled to reduce the water-logged areas, and also heavily utilised for resources such as reeds, sand, silt, clay and water and are often severely overgrazed, providing much needed grazing in winter, when other grazing is limited. Their critical value in terms of water management and eco system services are often not well recognised by communities.

In order to be cost effective, wetland rehabilitation should be integrated with wetland conservation within a broad-scale, holistic wetland management programme that is, in turn, nested within a catchment management programme.

The most typical rehabilitation interventions designed to assist in the recovery of degraded wetland ecosystems are 'plugs' constructed within artificial drainage channels. The 'plugs' are placed with the intention of re-instating a more natural hydrology. Typical interventions for maintaining the health of wetland ecosystems that are in the process of degrading are the placement of erosion control structures which assist in halting the advance through a wetland of an erosion head cut. Rehabilitation may also include interventions such as reducing livestock grazing-pressure or reducing the frequency of burning (Russel, 2009).

It is also important to restore the areas around the riverine and palustrine systems in mountainous areas, to improve the waterflow in the system and reduce erosive pressure on the wetlands. Thus starting upstream of the wetland patches is a good idea.

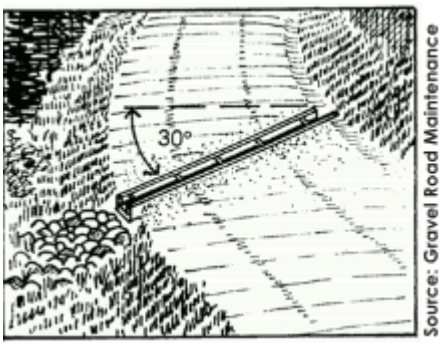
1. Some ideas to fix paths and side walls of dongas that threaten wetland patches

Stone pitching: the path is changed into steps by digging in stones into the path surface, flat side up (above). It may need a bit of sculpting of the soil and banks around the paths to create on flattish reasonably sloped area where the path should be and removing the smaller side paths formed by heavy traffic (below)

The stone paths are constructed into the small gulley that is forming, rather than the'newer' path alongside.

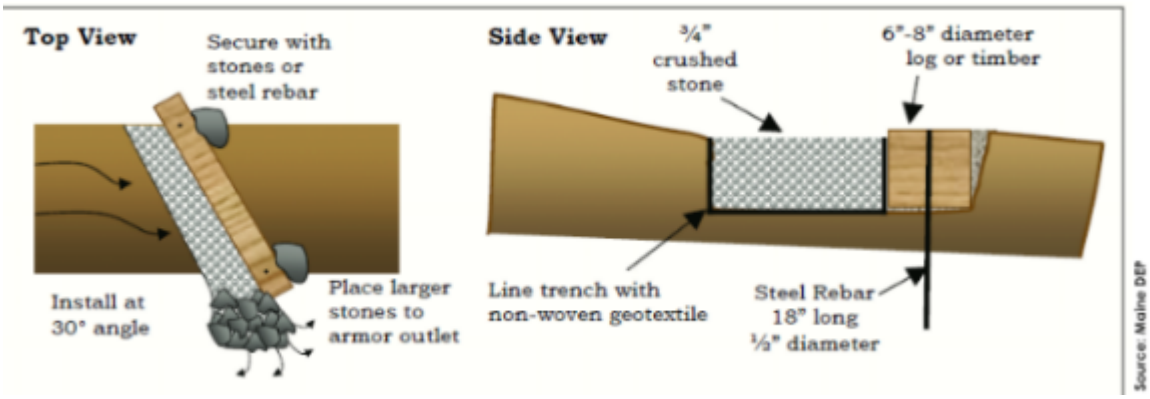
Soil inversion paths: Here in a 'bad land' patch where multiple small paths and gulleys are forming, the soil is dug out and placed sub-soil up, to create a raised path with drainage ditches on the side (Above). It also works well in patches that become bogs or wetlands in the rainy season (below)

Water bars: Install water bar "speed bumps" to break up the slope and keep water from concentrating on a pathway.



1. Dig the trench – Dig a trench for the wood that is a 30° angle across the path. Be sure the trench and the water bar extend off both sides of the path. The trench should be deep enough that the top of the log will be almost flush with the trail on its downhill side once in place. Soil and rock excavated from the trench should be heaped on the trail below the water bar to be used later as backfill.
2. Install the log or timber – Place the log or timber in the trench. The log should fit snugly in the trench with no high point or voids under the log. Secure the water-bar with large stones, rebar pins or wooden stakes. If using stones, partially bury on downhill side. If using rebar, make sure that the rebar is flush or slightly recessed with the top of the log.

3. Backfill around the water bar – Dig a 30cm wide and 15cm deep trench along the up-hill side of the bar. Fill the trench with crushed stone, leaving a few inches of the timber exposed. Place a flared apron of stones to armour the water-bar outlet. Pack soil and gravel up against the downhill side of the water bar so that the top of it is flush with the trail. Cover all disturbed soil with seed and mulch or leaf litter.



Steep slopes

Here one can use vegetation or fibre rolls placed in small ditches on the slope and pegged in with erosion mats or blankets in-between. Or silt fences can also work, but not on very steep or unstable slope.

Erosion control blankets: Used to prevent surface erosion and enhance vegetation establishment. Soil is loosened and seeded beneath the blanket, so that vegetation can grow through - Appropriate for disturbed soil on steep slopes, as a flexible liner for drainage ways, stream banks, swales, basins and behind rock slope protection - protection for stream banks, outfalls and spillways.

Here shade cloth was pegged into an embankment using strong 30cm long pegs to clad the slope. In the far right ditches were dub into the slope as well and planted to vegetation in between the clad embankment areas. Above the embankment a drainage/diversion ditch leads water away from edge,

reeds/vetiver, deep rooting grasses are planted.

5 WATER ACCESS AND MANAGEMENT

h. Self-supply options (springs, streams, boreholes)

The policy framework for water service provision in South Africa consists broadly of the Water Services Act 108 of 1997 (WSA), the National Water Act 36 of 1998 (NWA) and the National Environmental Management Act 107 of 1998 (NEMA) which make provision for the regulation and provision of water services by different state institutions in South Africa. The revised and updated Water Act (2023) allows for various levels of self-supply options in collaboration with water service authorities as options for local level water supply.

The first important concept in self-supply and collaboratively managed systems is that of multipurpose use of water. Households in rural communities need more than the 25l per person per day of drinking water, which is the present allocation being used by Water Service Authorities. Water for health and hygiene and productive purposes is also required. For these systems point of use purification is recommended thus at household level.

These self-supply options can take a number of forms:

- **Self-supply** is 100% user-funded, governed and operated. A community-based and informal organisation is usually established to deal with governance and operational matters. Water infrastructure is provided on incremental basis. Users decide on the most appropriate technology, financing arrangements, cost-recovery strategy and type of services they want. Spring water protection and small piped water schemes that use gravity to feed small reservoirs are preferred options...
- **Blended self-supply** provides for an arrangement where communities are supported by organisations (mostly NGOs) and funders in their local water supply schemes. This allows for a more formal initiation of community-based institutions, a coherent process for full community participation and capacity development in taking some project management

roles as well as operations and maintenance roles post project completion. This approach is more appropriate for small, reasonably isolated rural communities.

- **Collaborative/co-managed water management** between communities and mandated Government stakeholders is presently considered a good option. IN this approach communities and the Water Service Authority (WSA) and water service providers (WSP) jointly negotiate and outline each party's role in the water provision and management process. Generally, the community will undertake day-to day management, upkeep and maintenance of a water supply scheme installed by the WSP after full negotiation with the community about the particulars of the scheme. The WSA holds the responsibility for major repairs and refurbishment of the system.

Important principles that should be considered and implemented if communities are to play a role in their own water management are:

- Communities should be given a voice in making decisions regarding their own water.
- Mobilisation of communities should happen from the very start of the endeavour and not only in the use phase.
- Recognising (on both community- and authority side) that communities have co- or complete ownership of scheme and the responsibility that goes along with it.
- Co- or complete ownership requires commitment on the community's side to take up their portion of responsibility in terms of operations and management of the scheme and its infrastructure.
- Different stakeholder input and support is required through the different phases of the intervention and through its life cycle.

An initial assessment or hydro census is required to identify sources of water in the community, to understand how this water is presently being used and by whom, and to identify existing challenges and start to think into possible solutions. The prioritization of water sources (springs, small streams and or boreholes) depends on the strength of the source, the location, whether appropriate protection and use options can be implemented for this source, how it can be reticulated and who can have access. In reality, these local sources are generally limited in terms of the number of households that can be supplied. Thus, it is important to look at the whole landscape to design a patchwork of local options that can supply water equitably to the large community, while also protecting the environment and these sources form over-use and contamination.

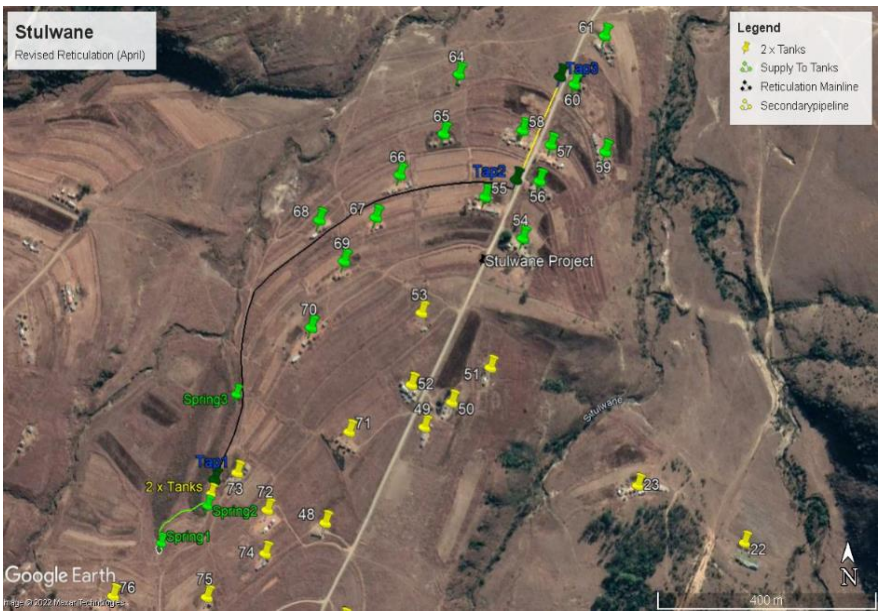


Figure 27: An example of a community meeting, in Stulwane Bergville, to discuss protection of prioritized springs and exploring the maps to outline each household's access. The map and a close up of women discussing where the header tanks and taps for household access should be placed.

i. Low-tech spring protection options

Springs occur in a landscape when underground water is pushed to the surface. This occurs most frequently for gravity springs in and around wetlands and streams and also as seepages along gradients. Springs can be either seasonal or perennial and vary in strength. To protect a spring, its flowrate needs to be no less than 10l/second (Rose, Mojela, Msomi, & Matandela, 2021).

Generally, all protected springs will have the following key elements in their design: the eye, a silt or settling chamber, and a collection or storage chamber with a tap or access point. The actual structures can differ greatly. The pictures below show a community level effort at spring protection.



Figure 28: Left to Right: the 'intake' pond for the spring leading to the siltation chamber which has a slotted pipe buried and covered with gravel and bidim cloth, to lead the water to a storage tank (2500l Jo-Jo tank) lower down the hill.

In this example 9 households were involved and the water was gravity fed to a 2200l Jo-Jo tank and then reticulated to each of the households using 200Ldrums with float valves to manage the daily water allocations for each household

Figure 29: Above Left to right: the 2200L header tank from which water is gravity fed to 9 households. The piping being installed leading to the households. The 200L drum with float valve installed at each household.

The eye is the point where the water emerges from the ground. An **intake chamber** is usually built around this point. The **silt chamber** allows for settling of sediment. An upper outlet draws cleared water out and a lower outlet scours and cleans out sediment from the tank. The **storage chamber** stores the water or directs to larger storage structures. It needs an overflow.

Steps in spring protection:

There are two routes to follow, the more formal structural process of installing a spring box as the intake chamber or a less formal route where the intake is protected with gravels, stones a weir is built the area is fenced.

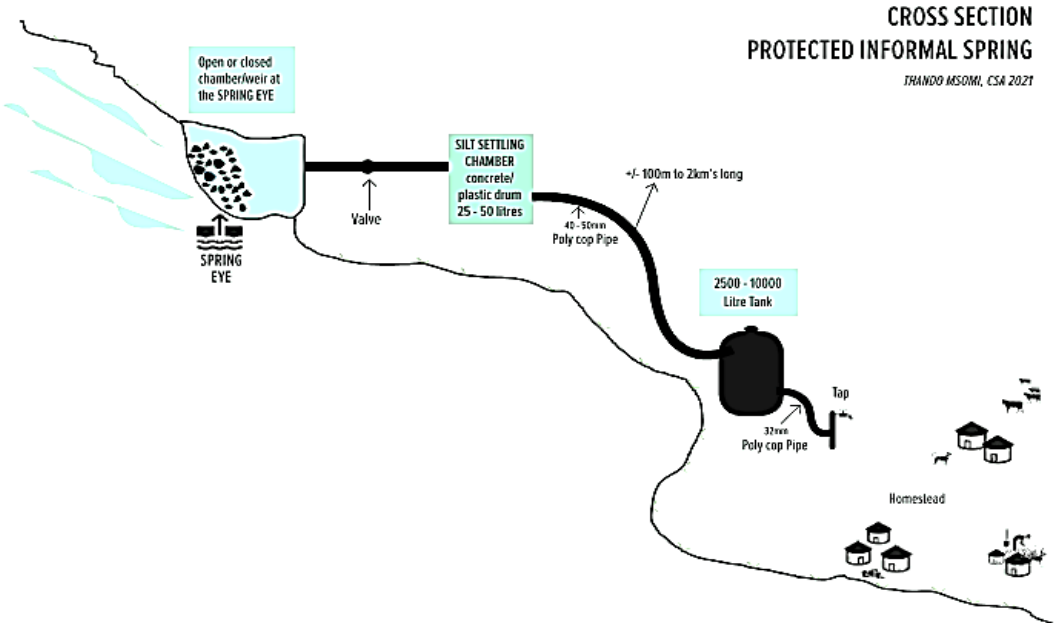


Figure 30: Line drawing of an informally protected spring, showing an open/closed chamber/weir at the spring eye, the silt chamber and the storage tank. (Rose, Mojela, Msomi, & Matandela, 2021)

The steps in constructing such an informal protected spring will be provided in a bit more detail below

Protection of the spring catchment area

A surface water drainage ditch is dug above and around the spring area to divert surface water run-off from polluting the source. This should be dug a minimum of 8m from the source, preferably further away if possible. The area should then be fenced to keep animals and people out of the area. (OXFAM, 2008)

Opening up the eye of the spring

- This must be undertaken with great care as any form of 'back-pressure' on the water could cause it to change its route and the eye of the spring to move. Spring water follows the path of least resistance.
- A temporary drainage channel can then be made to ensure that the water can continue flowing during construction and to prevent puddling.
- The area immediately beneath the point of discharge (eye or seepage area) should be excavated until either the horizontal water layer or firm rock are reached.
- The excavation should proceed into the slope until a height of earth above the discharge point is a minimum of 1m. A spring from a rock face requires minimal excavation, but a spring with widespread seepage may require an excavation of several cubic metres.
- Place loose stones and gravel over the area of the eye of the spring for some initial protection.
- After excavation the spring area should be left for 24-48 hours to enable it to stabilise, before additional construction work.

The structure which is required to catch the water from a spring will depend on several factors. These include the size of the spring and whether the users will come to the spring, or the water will be taken in a pipe to the users.

Construction of retaining wall, catchment dam or cut off wall, spring box and valve chamber

- A dry-stone retaining wall should be built against the excavated slope. This wall is built using cement bricks or similar sized stones and both acts as a retaining wall and allows the water to pass through into the collection areas with minimal sediment.
- A catchment dam or 'cut-off' wall with wing walls, is designed to catch as much water as possible and direct it into the collection chamber (see the diagram below). It should be constructed in an excavated trench of minimum depth 20cm to help ensure that water does not seep under the wall. (Penn State Extension, 2023)

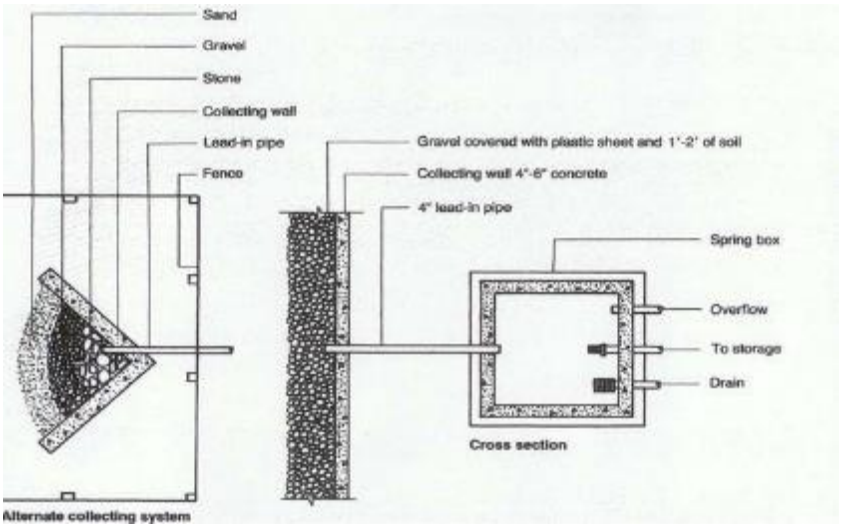


Figure 31: Alternative collecting system and cross-sectional view of concentrated spring. (Adapted from Safeguarding Wells and Springs from Bacterial Contamination, Department of Agricultural and Biological Engineering, The Pennsylvania State University.)

- The collection chamber and valve chamber are then constructed on the downstream side of the catchment wall and the bottom of the collection chamber should be concreted. It is possible also to construct this chamber inside the catchment wall, created at the lowest point of the wall (v-box).
- The overflow pipe from the collection chamber should be lower than the catchment dam wall to prevent back-pressure.
- The area behind the catchment dam is filled with stones and, with smaller stones nearer the eye and larger nearer the wall.
- In most circumstances this catchment box is provided with a cover (first a heavy duty plastic sheet, then the excavated soil and then a layer of topsoil).

Below is a small example of how this construction process was used and adapted for a wetland spring protection and reticulation process for Costone village in Bergville, KwaZulu-Natal. In this case the collection chamber was built into the catchment wall, the area behind the catchment wall/dam was filled with stones and small rocks and the are was fenced off. The pictures below are indicative.

This localised community owned system, was initiated as community level process of allowing the community to frame their request and start the process by setting up a water committee and doing the initial ‘water walks” and surveys. As it is a gravity fed system, ongoing financial contributions are not required. 28 Households have been supported, with an allocation of between 200-380l of water per household per day, from 4 standpipes.

Figure 32:Above Left to Right: The original spring before protection in Stulwane, Bergville. The catchment wall with v-box in the bottom corner and covered with rocks, gravel and sand towards the eye. Building in the overflow pipes. The protected spring with a fence around to protect it and a small catchment area above the spring.

Construction of storage tanks and taps for community access.

A supply pipe from the v-box in the catchment wall gravity feeds water to the storage tanks. Many different options are possible. In our example from Costone in Bergville a cement base was constructed for the two linked 2500l Jo-Jo tanks. From there pipes were laid towards 4 taps, to allow for household level water access not more than 200m away from each homestead supplied by this small scheme. The pictures below are indicative.

Figure 33: Above Left to right: Construction of the cement platform for the tanks. The two joined 2500l JoOJo tanks. Digging ditches and laying pipes for the community taps. An example of a community tap upon completion.

Below is a small example of working with small mountain streams which have perennial springs within their system. For these sources, it is important that the overall stream flow is not impeded, as there are also legal restrictions on top of the environmental and equity concerns. In addition, the amount of water abstracted here should not be in excess of 10-15% of the total volume of streamflow. If this water is used for any commercial concerns or is in excess of the basic human consumption requirement, water use licences will be required. All such abstractions need to be registered with the relevant WSA. Below is a small example of how this was tackled for a mountain stream in Stulwane, Bergville.

Here a small intake and silt chamber is built next to another small chamber which has the pipe taking water to the brake pressure tanks and the main storage tanks.

Figure 34: Above Left to right: the intake and silt chambers built into a small mountain stream in the dry season. A view of these small structures in the rainy season. The cement lid for the 2nd chamber to only allow 'cleaner' water from the initial intake chamber to pass through to the tanks.

Figure 35: Above Left to Right: A brake pressure tank with float valve under construction. One of the header tanks. An example of an air valve for further air and pressure release. A section of carbon-steel piping in a portion where pipes could not be buried.

Strengths of this process

- Community involvement from inception through to completion.
- All households in the scheme (75) have been involved in the meetings.
- Understanding at community level of the intention for multiple sources and multipurpose water provision.
- All households involved provided both labour and financial contributions to the scheme.
- Sub-committees were set up for each section to allow for around 20-30 households working closely together.
- The sub-committees are represented on the village-level water committee.
- Involvement and inclusion of the Traditional Council ward councillor.
- Ongoing facilitation and problem-solving support from the NGO partner in the process
- Linking of water access to broader water resources management issue in the village and catchment.
- Incremental inclusion of neighbouring villages in discussion
- Community level agreements for water access and water use (quantity/day /household) have been agreed to and is policed by the water committees.

Weaknesses

- Despite numerous attempts peripheral involvement only of the municipal councillor and no involvement from the uThukela WSA.
- The implementation of a borehole reticulation system by uThukela WSA in parallel to this community initiative, without clear linkages and or management agreements between the

two has exacerbated the lack of trust between the community and the municipality – strengthening the community belief that the municipal intervention is an election ploy.
- Planning for implementation and water supply as well as handover by the WSA has been unsatisfactory, with an emphasis on quickly supplying something, rather than a considered approach to be able to reliably supply the basic water service requirements.
- Despite recognition of different flow volumes in the streams for summer and winter, planning and implementation by the NGO and the community, was unable to fully take into account the severity of flooding- causing damage to v-boxes and piping.
- Community members themselves work on a mainly verbal basis, meaning that agreements and decisions often morph to what individuals want them to be, rather than what was actually decided. Discipline in holding to group decisions is generally a bit low.
- Community members, despite agreeing to the communal standpipes will be tempted to splice their own household taps into the system. Given that it is a gravity fed, low-pressure system, such actions could leave a number of the existing taps dry.

j. Governance

These localised community managed water schemes (self-supply) are constrained by the topography of the areas, the strength of the source and the distance to households. It is important to ensure that the schemes are designed to provide a reasonable amount of water (100-500l/day) to the participating households and that the whole community understands that the concept is to provide a patchwork of smaller supply schemes to specific households only, in a way that all households are eventually included from different sources. This is a model for managed equitable access, rather than open access. The original protected sources remain open for use by the community at large and this needs to be planned into the design of the system. In addition, planning of livestock watering points is a further important element of these systems.

Two strategies exist for formalising the localised water committees – one of intensive upfront organisational structuring, election of office bearers and development of constitutions and rules. The second is to develop this process over time, based on the experiences and motivation of the group. Mahlathini has opted for the second approach, as this allows the members of the informal groups to slowly formalize their institution as required by circumstance and also provides weight to the decisions made in a participatory way. Governance improves over time. Although this process primarily works through resolution of conflict and instituting rules to avoid specific circumstance from occurring again, it is much more participatory and inclusive than the first strategy and generally leads to a more sustainable outcome. It also allows for an understanding that conflict is inevitable and for 'experimentation' with ways in which to resolve emerging conflicts, rather than providing an initial top-down approach. This process, however, does need to be facilitated over a period of time, as communities need to learn how to agree to and honour negotiated agreements.

Roles of committee members:

- Responsible for any issues arising with the water scheme
- Fix problems with any people not following the rules
- Allocate the use of water and ensure everyone who is eligible gets
- Check regularly that the system is working and used properly
- Open a bank account for the financial contributions and undertake small maintenance activities.
- Call meetings with membership to report on usage, maintenance issues and get permission to use funds for specific activities.

- Communicate with the community level water committee and also the Traditional Authority and councilor.
- Request assistance from community level water committee for issues they cannot solve.

Local water committees

Care needs to be taken to ensure that these committees are well represented and should include representation from:

- The traditional ward councils
- The Local ward councils (Local Municipality)
- Local representatives of the Water Service Authority and providers
- Members form local development structures and interest groups, including for example the livestock association, development committees, farmers associations and groups, cooperatives, churches, schools and creches and
- Local household members; both with access to individual water supply options (like boreholes and springs) and without.

These committees need well developed constitutions with roles and responsibilities outlined therein. These committees also need to have arrangements in place for operations and maintenance of the water service in their village as well as security of infrastructure.

Guidelines for community level engagement

Community members need to be engaged in initial baseline, vulnerability and feasibility assessments for proposed water supply schemes.

Community members need to understand water access options, water sources and availability and water use implications for their village.

Community members need to be provided with information to be able to assess the proposed scenarios for development of water access options.

Community members need to be provided space for learning and analysis of concepts related to water management in their areas, including for example climate change impacts, rainfall and water infiltration, groundwater and groundwater management, water quality for drinking and multipurpose use, technical aspects of proposed systems, solar energy, water purification options, water use and conservation etc., so that they are better able to make informed decisions.

Community members need to develop an understanding of water provision as a service with the potential for different levels and sources of access for different purposes and different levels of access to this service dependant on financial and other contributions.

In complex programmes scenarios are developed. These are refined in the planning and implementation and yet further changes can occur during the contractual and commissioning phases. Expectations are raised in each phase and community members often remember well what was “promised’ at the beginning. This process requires careful explanation on an ongoing basis. NOTE: the tendency is to not provide detail or make specific ‘promises’ to avoid the resultant conflict, but the better practise is to explain the changes and difficulties as the process unfolds, which despite being a lot more intensive has the advantage of also increasing community level understanding of the issues and problems involved and this level of transparency builds trust and rapport between the role players, as well as a level of accountability in expenditure.

Community members need to engage with and negotiate all parameters of the scheme to be able to take responsibility for further operation, management and maintenance.

Community members need to be involved in decision making on a day-to-day level and in selection/election of local water governance structures/committees.

They need to be a part of the process of decision making around beneficiation and equity.

k. Field cropping

Plant bio stimulants

Bio stimulants are substances or microorganisms that, when applied to seeds, plants, or on the rhizosphere, enhances flowering, plant growth, fruit set, crop productivity, and nutrient use efficiency, and are able also to improve the tolerance against a wide range of abiotic stressors, such as heat and drought.

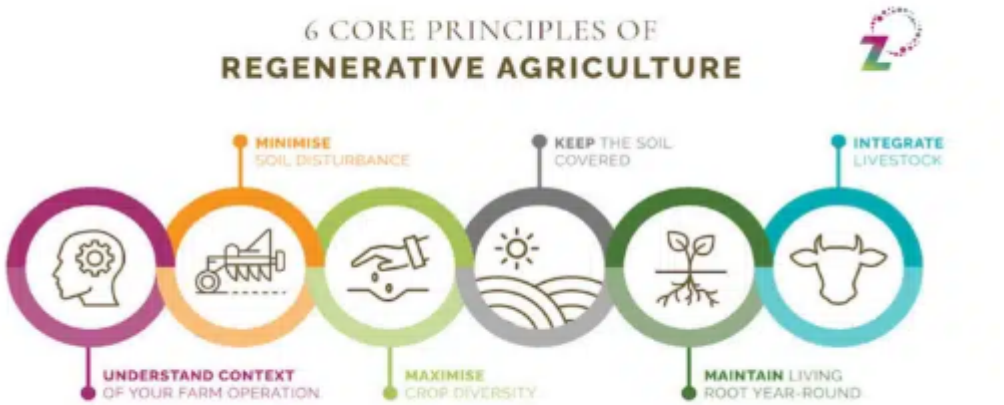
Plant bio stimulants are very heterogeneous materials, and fall roughly into the following functional categories:

- humic and fulvic acids,
- animal and vegetal protein hydrolysates, (peptides and free amino acids which enhance germination and plant growth and soil microbial functioning)
- macroalgae seaweeds extracts, (Contain the amino acids, but also a range of other organic and inorganic elements) and
- silicon, as well as
- beneficial microorganisms: Arbuscular mycorrhizal fungi (AMF) and N-fixing bacteria of strains belonging to the genera Rhizobium, Azotobacter, and Azospirillum (sustainable and efficient tools for providing yield stability under low-input conditions in particular N and P deficiency, and to improve crop tolerance to extreme temperatures, drought and salinity).

The most popular ingredients include humic substances (humic and fulvic acids), seaweed extracts, beneficial bacteria, and beneficial fungi (Rouphael & Colla, 2020).

The Zylem products

Regen-Z (https://regenz.co.za), is an agricultural services business focusing on regenerative agricultural practices and innovative farming solutions and have tailored bio-stimulant products to improve soil health and fertility with the aim to reduce and ultimately replace chemical fertilizer inputs in conservation agriculture farming systems.



The range of bio-stimulants produced by Zylem include the 5 products below

PopUp: Is a combination of AminoK, Seabrix and MicrosZ and contains triacontanol, kelp, fish hydrolysate, fermented molasses, essential trace elements and fulvic acid fractions in optimal ratios for boosting crop growth. It is used as an in-furrow application for all row crops as well as foliar and soil application at regular intervals to enhance plant growth.

Seabrix: Is a formulation of fermented molasses, fish hydrolysates, kelp and triacontanol. It is effective as a foliar and soil application at regular intervals to enhance plant growth an to feed the biology in your soil.

AminoNPK: Is a pH netural , carbon buffered NPK liquid fertilizer, combined with natural enzymes, vitamins, minerals and trace elements. Regular foliar srpaysing of AminoNPK assures maximum yiled and qualtiy and reduces incidence of diseases.

PSSP blend: Is an organic fertilizer product can be added in combination with the liquid bio stimulants to completely replace chemical fertilizers over time. This blend is mixed in a 50:50 ratio with local compost and then added to the furrows before planting, at a rate of 500kg/ha.

Smallholder experimentation

For the standard block and strip trials for smallholder farmer in Bergville the recommended products and quantities are provided in the table below.

	Product	Events	Quantity required (mL)	Bottles(L)
Per single 1000 sqm package/plot				
	PSSP (500kg/ha)	1	50kg	
	Seabrix (0.5%)	5	250	1
	PopUP(0.5%)	4	400	1
	Amino NPK (0.5%)	20	2000	2

These are mixed with water and sprayed on the soil and plants using knapsack sprayers. Generally, the plot is sprayed at weekly intervals. It is also possible to spray every 2nd week by doubling the amount and water or every third week by tripling the amount and water. Spraying weekly is the most effective. The table below shows how they should be diluted.

Area sqm	**1000**			
Application rate	**0,50%**			
Growth Stage	**Required water (L/ha)**	**L/Application (ml of product)**	**Weeks (No of applications)**	**Total L**
Seedling	150	15 (75ml)	3	45
Vegetative growth	250	25 (125ml)	3	75
Tasselling and Silking	350	35 (175ml	3	105
Grain fill and maturation	400	40 (200ml)	5	200
Senescence	250	25 (125ml)	2	50
Total Liters of water				475
Total of Biostimulant				2,375

The diagrams below indicate the use of fertilizer vs PSSP and also the maize varieties that are being trialled in 2024. The green blocks also indicate where the bio stimulants will be used in the strip and fodder trials. These are provided as an example of how the local level experimentation process can be set up with participants on their farms.

BLOCKS (10x10m)

1 M	2 M+B	3 SCC	4 M	5 M+B
10 M+CP/Pk	SCC	8 M+B	7 M	6 SCC

trial 2-3 varieties of maize

Strips

1 M		1 M	
2 M+B		2 M+B	
3 SCC		3 SCC	
4 M		4 M	
5 M+B		5 M+B	
6 SCC		6 SCC	
7 M		7 M	
8 M+B		8 M+B	
9 SCC		9 SCC	

CAP341NG

PAN53 fertilizer (grey)

SPPS (green)

	10 M+CP/Pk		10 M+CP/Pk	

Fodder Strips	M	Zylem Maize CAP9006Q SPPS (green)
	B/WCC relay, fodder Rye or Lab-Lab	
	M	
	Lespedeza	
	M	
	Tall Fescue	
	M	
	B/WCC relay/fodder rye/ lab-lab	

Next steps

The next steps are to finalise the inputs for the new practices, produce the 1page summaries to be used in the DSS and to update the online profile and system

4. DSS REFINEMENT

An aspect of this research brief is the refinement of the online decision support tool that was developed in the 1st round of this research process, and which is presently hosted on the MDF website.

The main points we wanted to consider are the following:

- How best to disseminate this decision support process
- Inclusion of up-to-date climate data into the model to provide for a more nuanced decision support process with respect to climate change.

1. DISSEMINATION OF THE DSS

Use of this platform, as an independent and individual process for making decisions around appropriate climate resilient agriculture practices has been extremely low. The diagram below provides an indication of the traffic on the MDF website for 2024, of which only a proportion (`30%) would be for looking at the DSS page. The report indicates 11 visitors to the site during 2024.

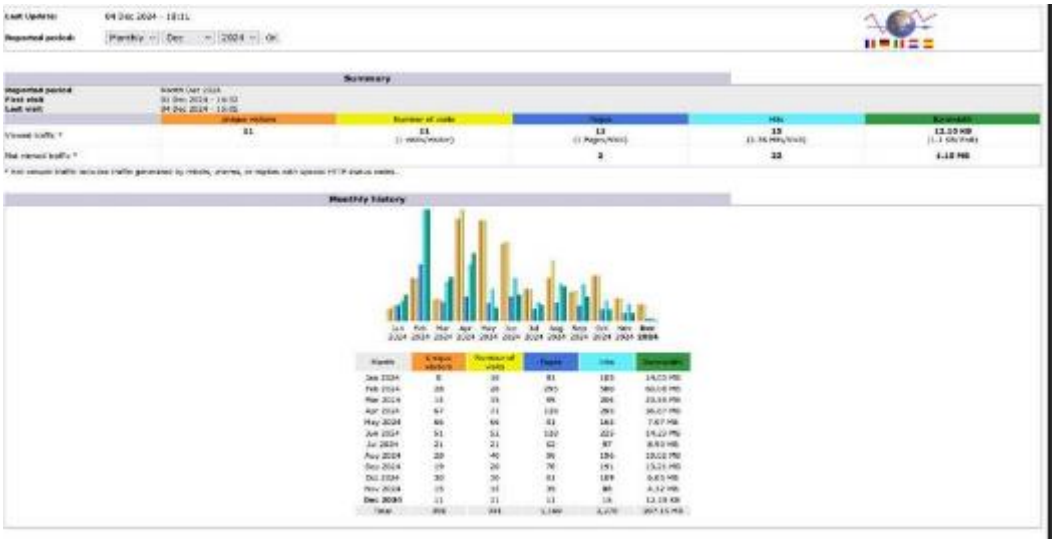


Figure 36: MDF website traffic statistics for 2024.

The largest interest has been from other academics in the climate change policy space and specifically those involved in considering early warning systems. Other service providers in the sector, mainly NGOs have also shown some interest in the use of this tool. Smallholder farmers however have not used the online tool at all, which was not an unexpected outcome and is also the reason why the bulk of this process has focused on facilitated support towards decision making in adaptation. The tool has been very useful to facilitators running workshops and processes with community members and small-scale farmers.

Due to this, it was decided to disseminate the online tool through existing online networks and platforms. For this process we focused on the Adaptation Network and the Amanzi for Food online platform (Rhodes University)

a. Adaptation Network

Through financial support from the Flander government, the Adaptation network has spent 18months on a capacity enhancement programme for the network and members. One aspect of this work has been the development of an online climate Information Tool, which allows exploration of a curated set of open access toolkits designed to support climate change adaptation. These toolkits have been developed by a range of organisations in South Africa and globally and cater to various needs. The weblink is https://adaptationnetwork.org.za/climate-information-tool/

Makhathini's smallholder decision support system is one of five featured tools on this link (of 39 tools in total) and has been given a central place on this website. The network has over 50 organisational members and 100 individual members and is well represented across a diverse range of stakeholders and role players in the sector and is well situated to host the smallholder decision support system

b. Amanzi for food

The Amanzi for Food project, also supported through the WRC and run by the Environmental Learning Research Centre (ELRC) at Rhodes university, provides open and free access to materials and education on different ways of using rainwater for food production. The project makes these materials available in user-friendly formats for use by everyone who is interested in the use of rainwater for growing food, or in teaching others about RWH&C.

Throught discussion with Wilma van Staden and Lawrence Sisitka who are presently developing the materials, running the online courses and developing digital tools, MDF has joined this project as a partner (https://amanziforfood.co.za/partners/).

Mahlathini Development Foundation

Mahlathini, founded in 2003, is an NGO focused on promoting sustainable agricultural practices among smallholder farmers. Led by Ms. Erna Kruger and Mr. Mazwi Dlamini, the organization specializes in supporting smallholder farmers across provinces like the Eastern Cape, KwaZulu-Natal, and Limpopo. Mahlathini implements a holistic approach, encompassing the entire agricultural value chain, microfinance solutions, and sustainable land management practices such as conservation agriculture, organic food production, and rainwater harvesting. Their efforts are underpinned by a commitment to climate change adaptation and resilience, with recent additions to their portfolio including integrated water management and ecosystem-based adaptation strategies.

Through a participatory innovation development learning system, Mahlathini collaborates closely with farmers and facilitators to experiment, learn, and implement best practices within their communities. This action research approach allows for careful assessment and monitoring of practices tailored to local contexts. Furthermore, Mahlathini has played a pivotal role in shaping the Amanzi for Food program, contributing to its development and providing learners with access to its courses. Committed to advancing this collaborative effort, Mahlathini aims to further enrich the program's offerings and materials, fostering sustainable agricultural practices and resilience in farming communities.

development foundation

https://www.mahlathini.org/

The materials developed in the WRC project entitled *Climate change adaptation for smallholder farmer in South Africa,*(WRC K5-2179-4) (Kruger, 2021), have also been included in the social learning section of the website (https://amanziforfood.co.za/sociallearning/). This adds a further valuable dissemination process for the learning materials and the decision support tool developed for smallholder farmers and also serves to enrich the Amanzi for Food repository with information on climate resilient agriculture to augment the rainwater harvesting and conservation focus.

2. INCLUSION OF CLIMATE DATA

When the Dss tool was designed between 2019-2021, the idea was to add a layer of climate data information into the model, which could further 'filter' practices according to various scenarios of climate change and or weather variability.

Discussions were held with SAEON, the SA weather Services and Professor Peter Johnston from Climate Systems Action group (CSAG) at the University of Cape Town.

Prof Johnston presented the ongoing development of a seasonal forecast platform designed to enhance accessibility and comprehension for farmers. This initiative, which has been in progress for three years, involved collaboration with farmers and agricultural students to address the challenges of existing forecasts that were difficult to access and understand. The new platform allows users to select their location and view tailored forecasts, emphasizing the need for a user-friendly interface that can handle robust bandwidth due to its interactive nature. Johnston explained the methodology

behind selecting rainfall thresholds, illustrating how users can utilize historical climatology data to make informed decisions based on average rainfall patterns. The idea is to provide the likelihood (as a percentage) of the scenario being forecasted, to allow for a more informed decision-making process by farmers.

One of the problems with this platform, also an issue with all such platforms that provide real time data, is that the process needs a lot of bandwidth and data computing capacity to be reliable. In some ways this has been the most difficult aspect of the process to manage, and a stable solution has as yet not been found.

Prof Johnston provided an advisory using the platform, to give an example of the kind of information that could be gleaned from this platform, if it were to be linked to the farmer decision support tool.

The advisory which is for the Westen Cape is provided in the Attachments section *"Report on SW Cape winter rainfall season 2024 (April- August): Overberg and Swartland"* to give an idea of the depth of analysis used by the platform to provide a reliable probabilistic forecast. Effectively data from three different modelling platforms were analysed to provide an advisory that stated a 40% chance of below normal rainfall in the region.

This advisory clearly provides and extra level of detail to enhance decision support tools by incorporating climate variability and local weather conditions. It clearly also cannot be incorporated or linked directly to the DSS for smallholder farmers as it stands. There is still a need for farmers to analyse this information alongside their present practices and the suggested climate resilient agriculture practices before they can make informed decisions. As mentioned, this is a process best undertaken in a facilitated environment and in person.

Collaboration between the two processes is to continue to find the best way to link these two aspects. For the moment the DSS process will continue to include such climate advisories into the climate change impact and adaptive strategies workshops at community level.

5. CAPACITY BUILDING

5.1 POSTGRADUATE STUDENTS

Two postgraduate students are a part of this research process.

NQE DLAMINI- PhD: **Learning values through participation in savings groups in Kwazulu-Natal: An Afrocentric case study**. UKZN_Dept of Education (registered in February 2023) and

TEMAKHOLO MATHEBULA –MPhil**: The socio-political dynamics influencing farmer adaptation to climate change in Ozwathini, Kwazulu-Natal.** PLAAS_UWC (registered in February 2024

For Nqe Dlamini the following summary of his thesis applies:

Problem statement: Users of savings groups may not be aware that they learn while they participate in their groups. There is a possibility that users unknowingly resolve the tensions between Eurocentric values and Afrocentric values while they participate in their groups.

Purpose: To explore/understand what values people learn through participation in savings groups and how they learn these, and how people navigate possible tensions between Eurocentric values and Afrocentric values.

Objectives: (1) To explore what values people learn through participating in savings groups; (2) To understand how people learn these values; (3) To understand how people navigate possible tensions between Eurocentric and Afrocentric values

Data collection: Commenced in February 2024.

For Tema Mathebula the following summary of her thesis applies:

Problem statement: In South Africa, the rise in temperatures and instances of extreme weather conditions have had devastating effects on infrastructure, livestock, and crop yields. These critical events have intensified the pressure on smallholder farmers to develop strategies to enhance the resilience of their farming systems. Research and experience have shown that approaches to adaptation and mitigation have been disproportionate and ineffective without an in-depth understanding of the socio-political processes embedded in communities

Purpose: This study aims to provide insight into how unequal distribution of power and political processes undermine the ability of smallholder farmers to cope with climate change. It also seeks to provide a more nuanced understanding of the differentiated impacts of climate change across gender, caste, age, and ethnicity. Lastly, this study aims to investigate the factors which lead to maladaptation of climate change interventions in smallholder farming systems.

Political ecology will be used as a theoretical framework for the study. It is underpinned by two theories, namely, "political economy", which focuses on the dynamics of power distribution and productivity; and "ecological analysis" which focuses on environmental factors.

Research questions: What are the existing socio-political dynamics that influence smallholder farmer adaptation to climate change**?**

Sub Questions

- What do farmers understand about climate change and its influence on their farming activities?
- What are the existing institutional structures for smallholder farmers and how do these influence adaptation to climate change?
- What are the core values, norms and belief systems and how do they shape the allocation and distribution of resources?
- What are the major causes of inequality, power imbalances and social injustice in the agricultural sector and how do these entrench vulnerability?

Data collection: Through semi-structured interviews and focus group discussion. To commence in December 2024.

5.2 COMMUNITY LEVEL AND ORGANISATIONAL TRAINING AND CAPACITY BUILDING

These two aspects have been exhaustive and ongoing and have most recently include First Aid training, Project management, Veld assessment and Poultry production short courses for staff and one day learning events on seed saving, nutrition, management of mycotoxins in field crops and development of conservation agreements at community level.

6. WORK PLAN: JANUARY-FEBRUARY 2025

The following broad activities are to be undertaken during this period:

- Finalization of implementation for the CRA learning groups across three provinces
- Ongoing involvement in CoPs: AN-capacity building and learning, PGS-SA, Northern Drakensberg collaborative
- Update on postgraduate students' progress: Nqe Dlamini (PhD) _UKZN and Temakholo Mathebula (MPhil)_ UWC.
- Finalization of climate resilience monitoring framework and indicator sets, analysis frameworks and dashboards and
- Finalization of the manual for a framework for successful implementation of multi stakeholder platforms

Table 8: Work plan –January-February 2025

Work plan Jan-Feb 2025	Team	Activities	Jan 25	Feb 25	Submission
Manual for implementation of successful multistakeholder platforms in CbCCA	MDF: Erna Kruger,	Write up methodology and process manual for multistakeholder platforms			28 February 2025
	MDF: Erna Kruger INR: Brigid Letty. WWF; Londiwe Dlamini	COPs: Northern Drakensberg Collaborative continuation Proposal development through Lewis Foundation			
	MDF; Erna Kruger and Karen Kotschy	Finalise online Climate resilient MERL tool with dashboards			

7. ATTACHMENT: REPORT ON SW CAPE WINTER RAINFALL SEASON 2024 (APRIL- AUGUST): OVERBERG AND SWARTLAND

Peter Johnston

19 April 2024

CAVEAT:

The author, the producers of the forecasts and their institutions take no responsibility for the accuracy and skill thereof. While great care and effort is taken to produce and interpret forecasts, there is great uncertainty in the modelling process and since forecasts differ, NO indication is given of which should be given more credit or validity.

BACKGROUND:

There are 3 seasonal forecasting products that cover South Africa. Each is produced by a different institution, and they comprise the use of General Circulation Models (also known as Global Climate Models or GCMs). 2 forecast providers employ a multi-model ensemble which averages a set of different models, while one uses a specific model, specifically selected for its skill in this region.

Each institution's forecasts are presented below for 3 3-month periods, each showing the likelihood of specific probabilities. Each has a slightly different nuance to the probabilities, so GREAT CARE should be taken to interpret them.

Where possible skill scores (i.e. verification statistics) are provided. These indicate the historical reliability of these forecasts for specific regions during these seasons.

Most of the forecasts are produced for three categories:

- Above-normal ("wet" – rainfall totals are higher than the 66th percentile of the climatological record)
- Below-normal ("dry" – rainfall totals are lower than the 33rd percentile of the climatological record)
- Normal or Near-normal ("average" rainfall between the 33rd and 66th percentile of the climatological record)

Probabilistic forecasts can help users understand risks and opportunities in order to make more informed decisions.

The seasonal rainfall forecast uses probabilities (% chance) of only the most likely outcome for Below-, Near-, or Above-normal (B, N or A). The probabilities shown are always less than 100% - so there is no absolute certainty that the less favoured outcome will not occur. For example, if the forecast claims a 75% of below-normal rainfall totals for a season, it means that 1 out of 4 times, it will **not** develop into a dry period.

The nature of a probabilistic forecast implies that the less likely outcomes are always possible. In fact, for the probabilistic forecasts to be considered reliable, the less likely outcomes will, and must, occasionally occur.

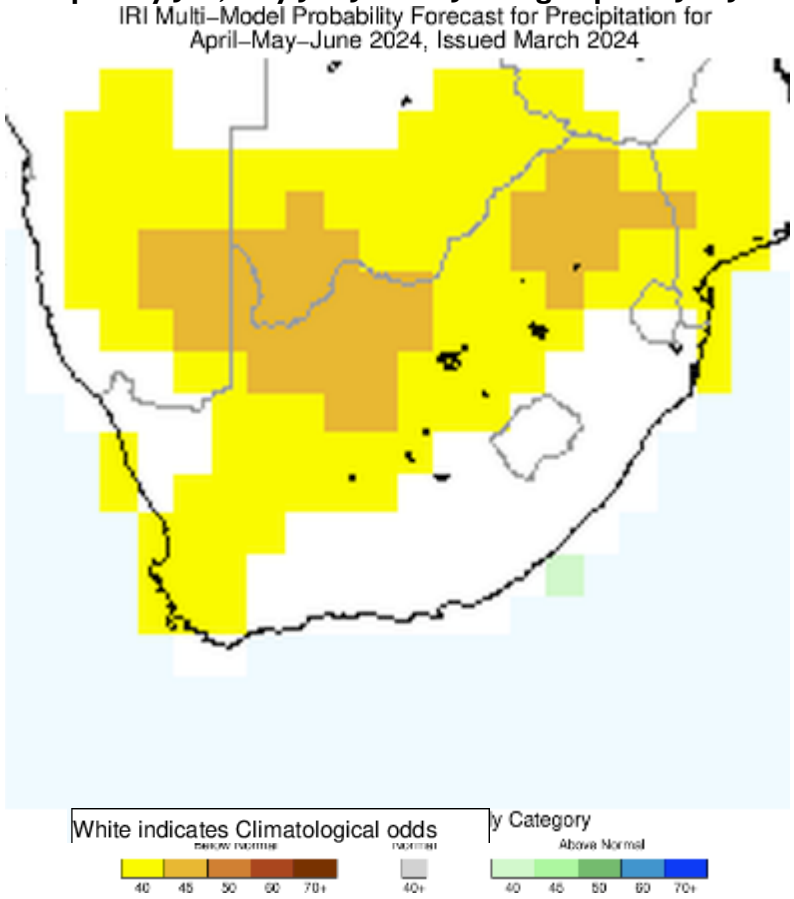
FORECASTS

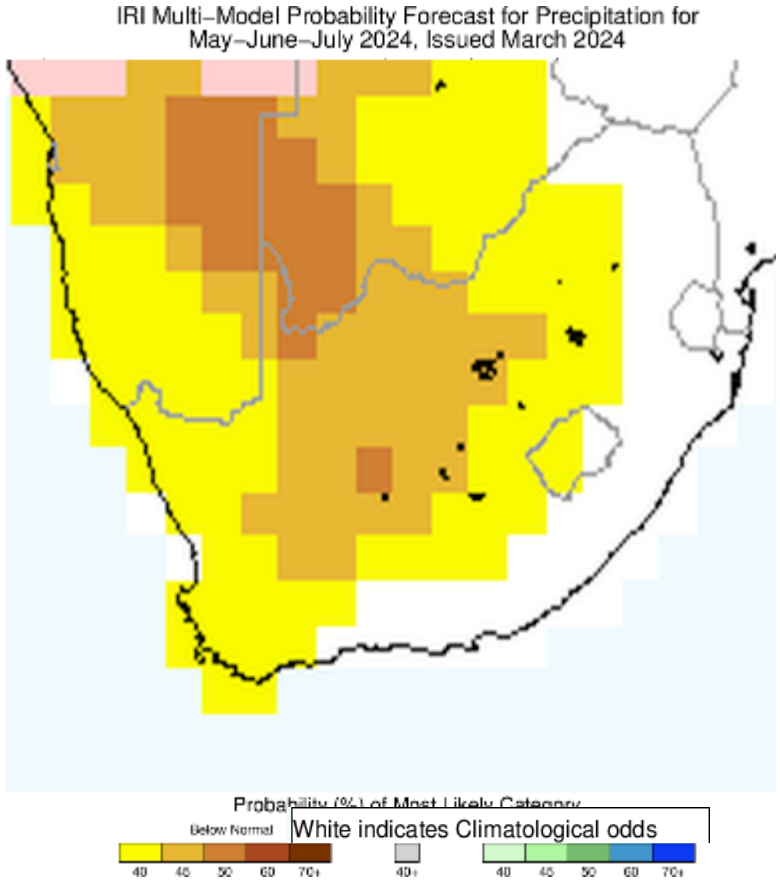
1. International Research institute (IRI)
2. SA Weather Service (SAWS)
3. University of Pretoria (UP)

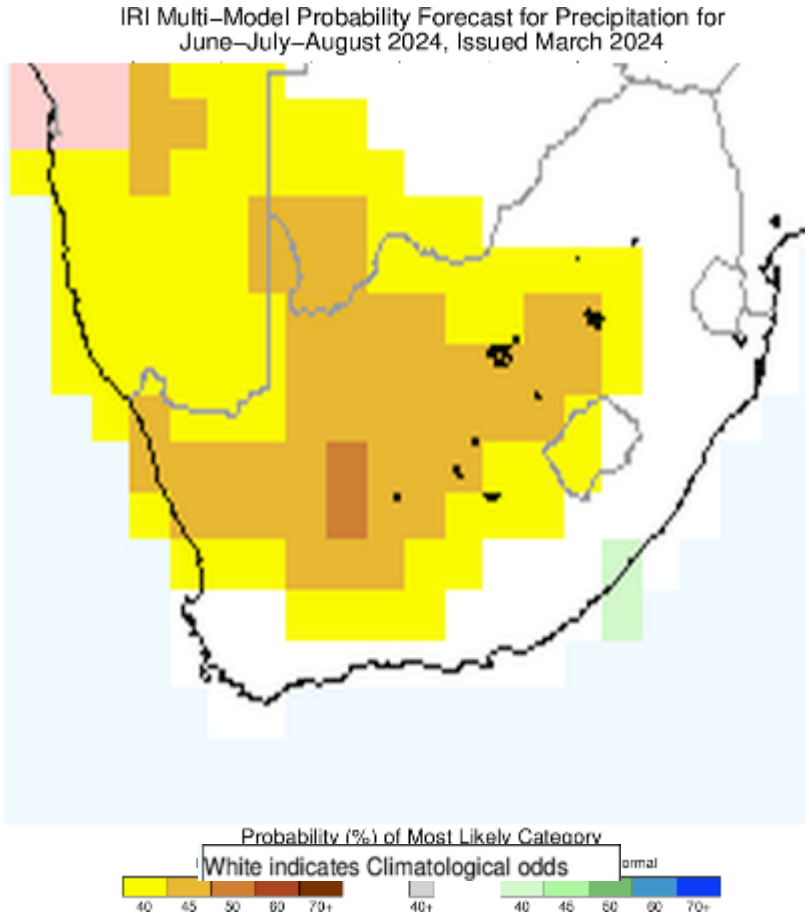
International Research Institute
for Climate and Society
EARTH INSTITUTE | COLUMBIA UNIVERSITY

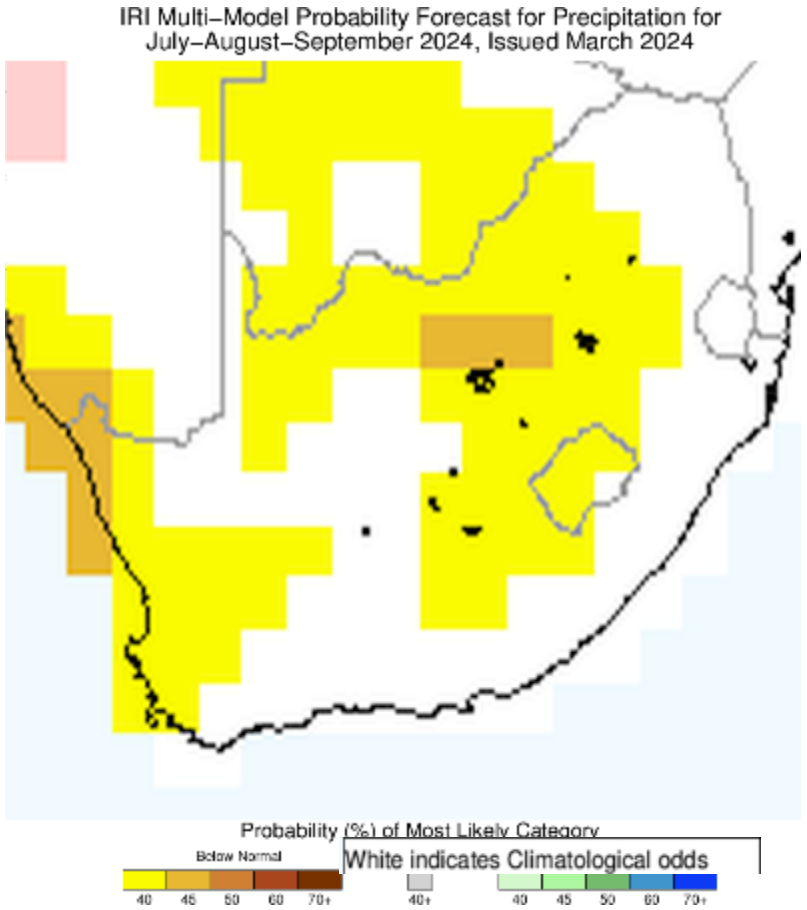
FORECAST 1: IRI

SUMMARY: A **slightly *enhanced probability*** for **Below-Normal precipitation** is forecast for **Overberg** and **Swartland** regions of South Africa for **Apr/May/Jun, May/Jun/Jul and Jul/Aug/Sep.** For **Jun/Jul/Aug** no significant variation from the climatology is forecast.









DISCUSSION:

The green colour that is displayed over the **Overberg** and **Swartland** for **Apr/May/Jun**, **May/Jun/Jul** and **Jul/Aug/Sep** indicate the **most likely** category of rainfall probability is a 40% chance of **BELOW NORMAL**. This means that of the 3 possible categories (AN/N/BN), the BN category's probability is the highest. It is, of course, important to understand that there are no percentages given for N and AN (theoretically there could be any split

of the remaining 60% in these 2 categories, but the indication is that neither would be over 35%). For **Jun/Jul/Aug** there is no likelihood of any particular category being dominant.

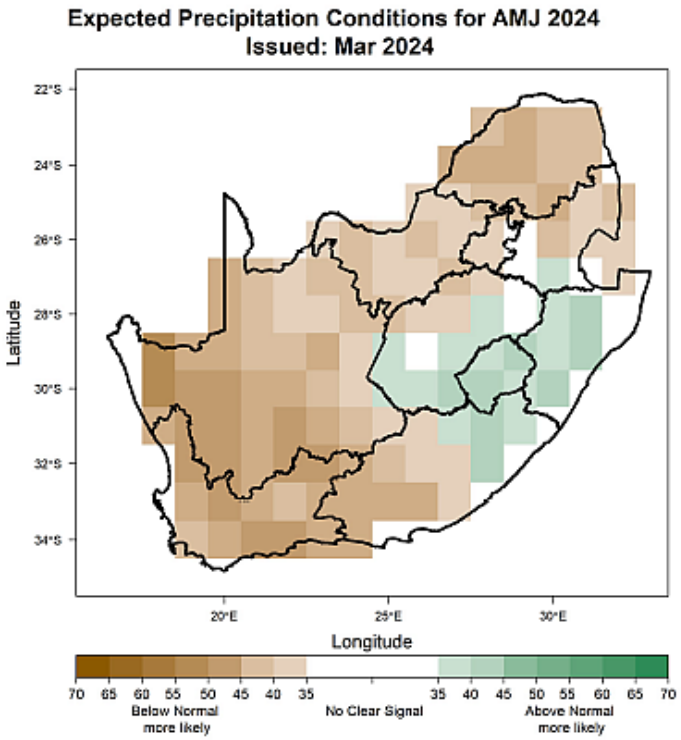
INTERPRETATION

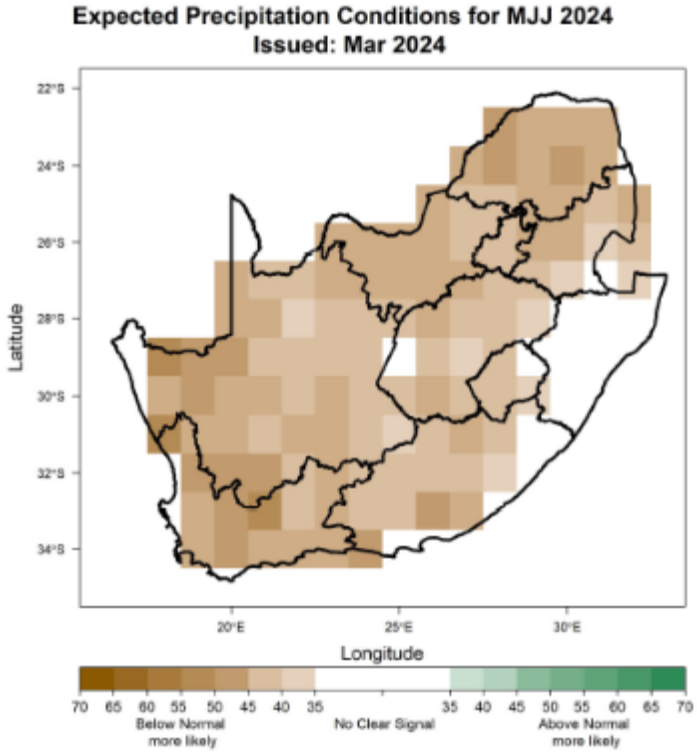
This forecast favours a **drier than normal** season overall, but the likelihood of 40 % probability of drier conditions is not much higher than climatological odds of ($33^{1/3}/33^{1/3}/33^{1/3}$)

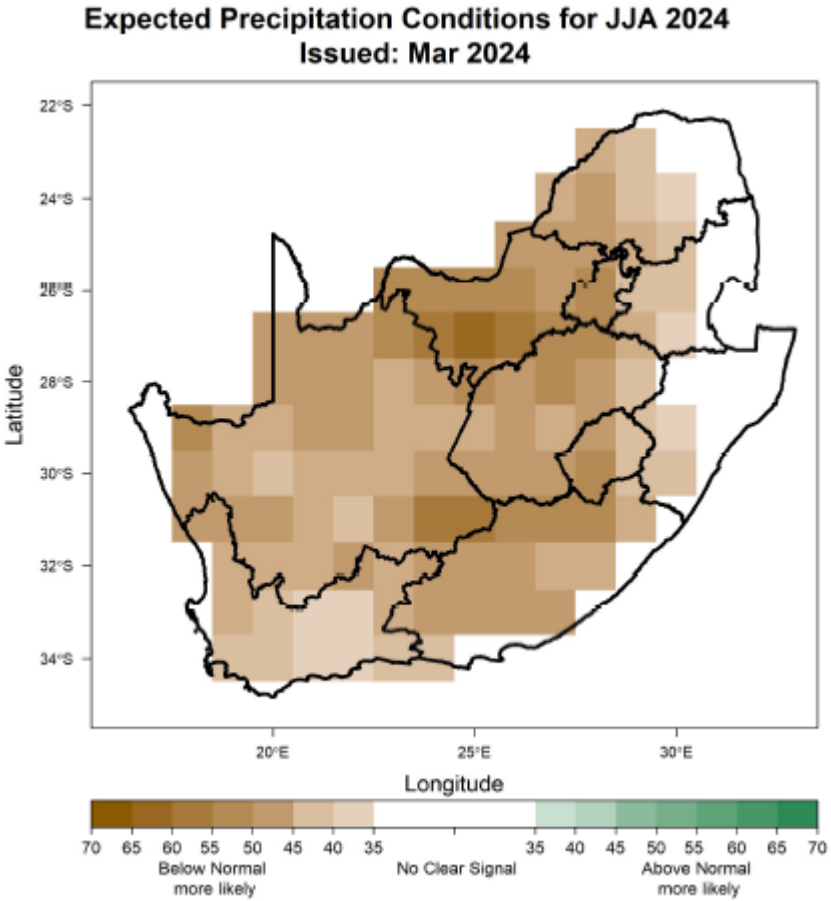
South African Weather Service

FORECAST 2: SAWS

SUMMARY: The **Overberg** and **Swartland** regions of South Africa are expected to experience **Below-Normal** rainfall during the period **Apr/May/Jun, May/Jun/Jul, and Jun/Jul/Aug**







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April-May-June (AMJ; left) May-June-July (MJJ; right) and Jun-July-Aug seasonal precipitation predictions. Maps indicate the highest probability from three probabilistic categories namely Above-Normal, Near-Normal and Below-Normal

DISCUSSION:

The brown squares indicate the "more likely" probability of **Below Normal rainfall** for the **Overberg** and **Swartland** regions for all 3 seasons. This forecast shows the highest probability being for "below normal" conditions. SAWS uses a multi-model ensemble and is careful to note that the El Niño-Southern Oscillation (ENSO) is currently still in an El Niño state and the ENSO forecast indicates that it will most likely ease to neutral conditions during

autumn and winter. Any influence of ENSO during the autumn and winter months on South African rainfall **is relatively unproven** and thus cannot be used as a helpful predictor.

INTERPRETATION

This forecast favours **Below Normal to Normal** rainfall in autumn and winter for the **Overberg** and **Swartland** regions in the April to August period, but the significance of the likelihood of dry conditions is not given quantitatively.

No skill scores of reliability are given.

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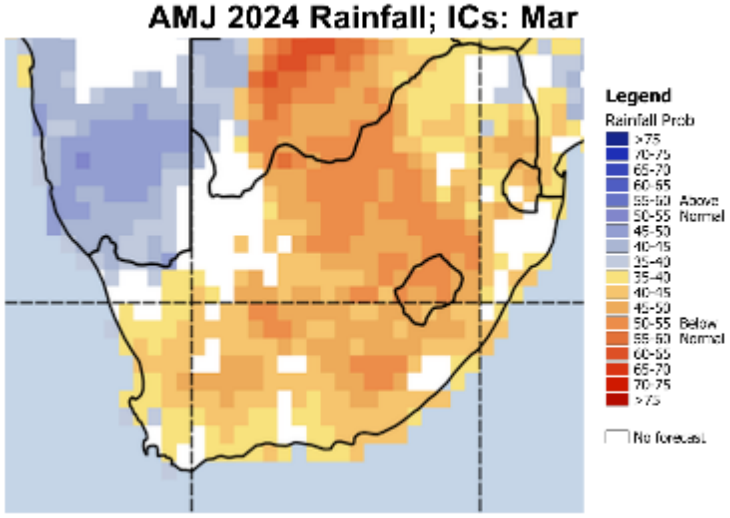
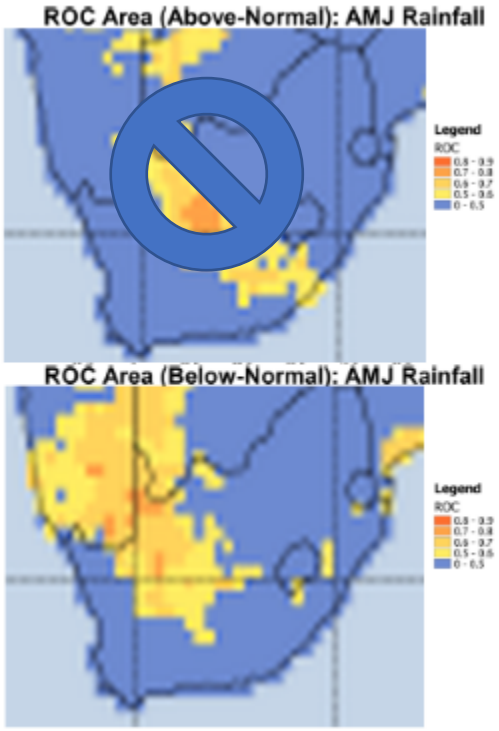
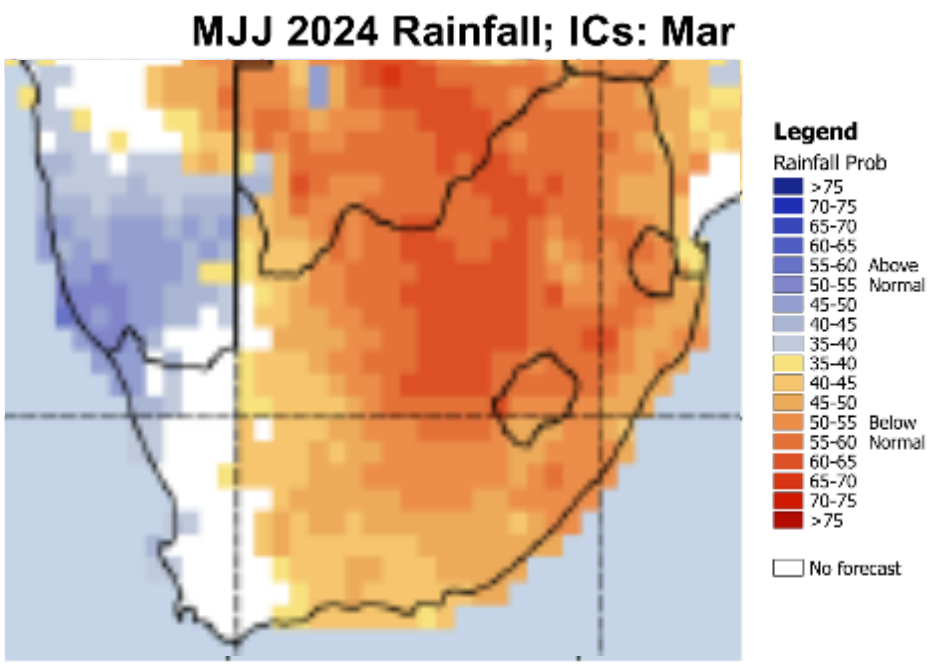
FORECAST 3: UP

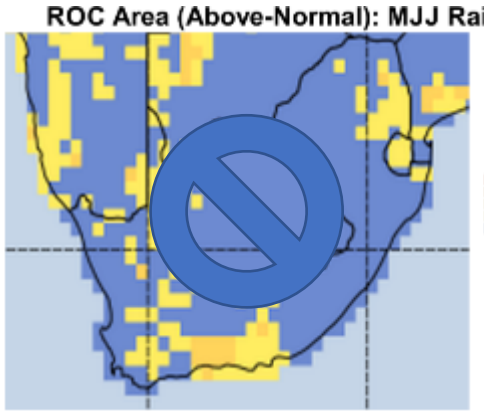
SUMMARY: **Below Normal** rainfall outcomes are suggested for the AMJ, over the **Overberg** and **Swartland** regions during the autumn and winter rainfall season. This forecast uses a single General Circulation model.

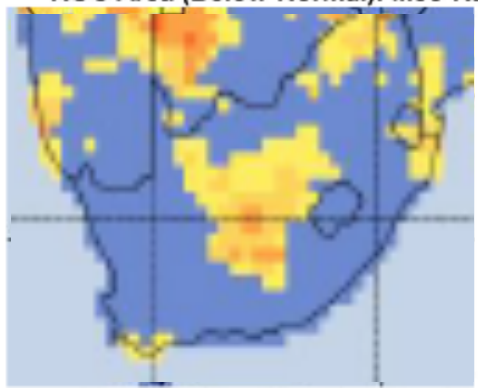


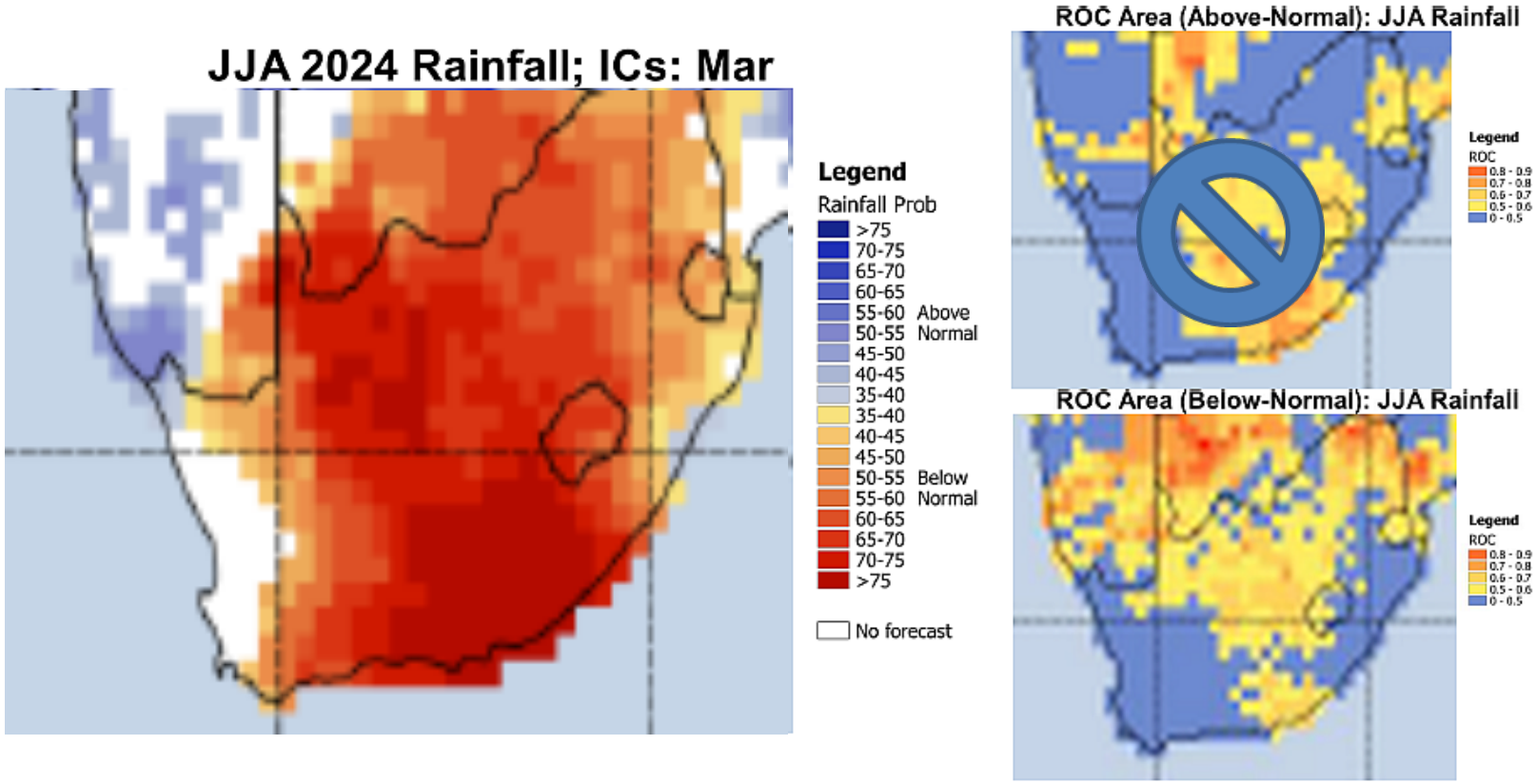


April-May-June 2024 (AMJ; above), May-June-July 2024 (MJJ, below) and June-July-August (JJA, below) seasonal precipitation prediction. Maps indicate the highest probability from probabilistic categories Above-Normal and Below-Normal. Percentages indicate the most likely probability for each grid square. The ROC maps on the right show verification scores for the predictions for each category, above and below. The higher the ROC score for each pixel, the more skilful is the prediction on the main map.









DISCUSSION:

The colours of the squares indicate the "most likely" probability of rainfall for the **Overberg** and **Swartland** regions. This forecast shows of the probability of rainfall for the April-May and June-August seasons (light to dark orange), between 45-55% probability of **Below Normal** rainfall for the

Overberg for the 3-monthly forecast periods. For the **Swartland** the forecast displays a 35-40% probability of **Below Normal** rainfall for April-June but can give no information regarding the other 3 month periods.

The **Verification maps** on the right-hand side display **ROC**[1] scores, an indicator of skill.:

- ROC Area (Below-Normal) – The forecast system's ability to discriminate dry seasons from the rest of the seasons over a 32-year test period. ROC values should be higher than 0.5 for a forecast system to be considered skilful.
- ROC Area (Above-Normal) – The forecast system's ability to discriminate wet seasons from the rest of the seasons over a 32-year test period. ROC values should be higher than 0.5 for a forecast system to be considered skilful.

INTERPRETATION

The **Overberg** and **Swartland** regions region shows AVERAGE to LOW skill for **Below Normal** rainfall for the AMJ, MJJ and JJA 3-month periods.

CONCLUSION:

Since the 3 forecasts are MOSTLY in agreement, it is tempting to predict a **BELOW NORMAL** rainfall outcome in the **Autumn** and **Winter** seasons for the **Overberg (and in Autumn for Swartland) regions.** The IRI and SAWS forecasts rely on multi-models, which, on balance, should thus be more skilful (an average of many forecasts could give a more realistic outcome), but, historically, SAWS forecasts have not shown significant skill for the SW Cape (this was highlighted during the 2015-2018 drought). On the other hand, the UP forecast, while based on only a single model, shows evidence of higher historical skill, which gives it an advantage over the others. The OVERALL conclusion is that **there is a greater possibility of a Below Normal winter rainfall season than there is of receiving Normal or Above Normal rainfall.** This is not a guarantee (the calculated skill of the forecast is not high) and does also not mean that there will not be significant individual rainfall events during the season.

[1] ROC stands for Relative Operating Characteristics and is a skill score measure of hit rate vs false alarm rate

RAINFALL FIGURES: these **long-term average** figures are provided as context for the expected season.

Caledon

Month	Average	
Jan	15	
Feb	21	
Mar	26	
Apr	64	MAM 145mm
May	55	AMJ 186mm
Jun	67	MJJ 186mm
Jul	64	JJA 186mm
Aug	55	JAS 150mm
Sep	31	
Oct	40	
Nov	17	
Dec	26	
Total	481	

Swellendam

Month	Average	
Jan	55	
Feb	62	
Mar	72	
Apr	68	MAM 201mm
May	61	AMJ 178mm
Jun	49	MJJ 161mm
Jul	51	JJA 163mm
Aug	63	JAS 171mm
Sep	57	
Oct	71	
Nov	64	
Dec	53	
Total	726	

Malmesbury

Month	Average	
Jan	9	
Feb	7	
Mar	7	
Apr	27	MAM 80mm
May	46	AMJ 143mm
Jun	70	MJJ 181mm
Jul	65	JJA 193mm
Aug	58	JAS 158mm
Sep	35	
Oct	18	
Nov	12	
Dec	15	
Total	368	