CbCCA in central Drakensberg improves resilience of smallholder farmers

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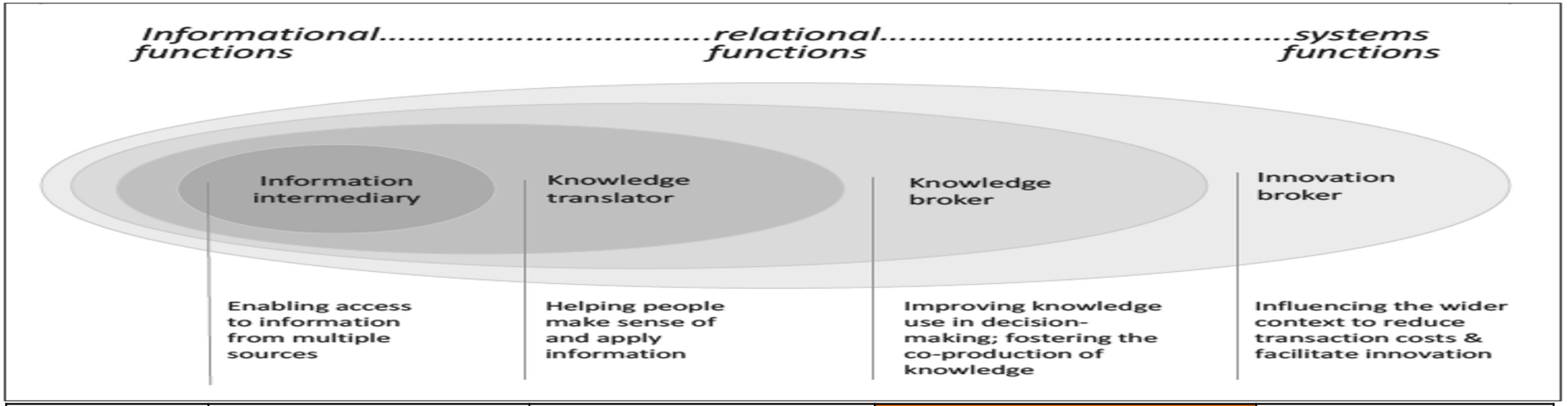
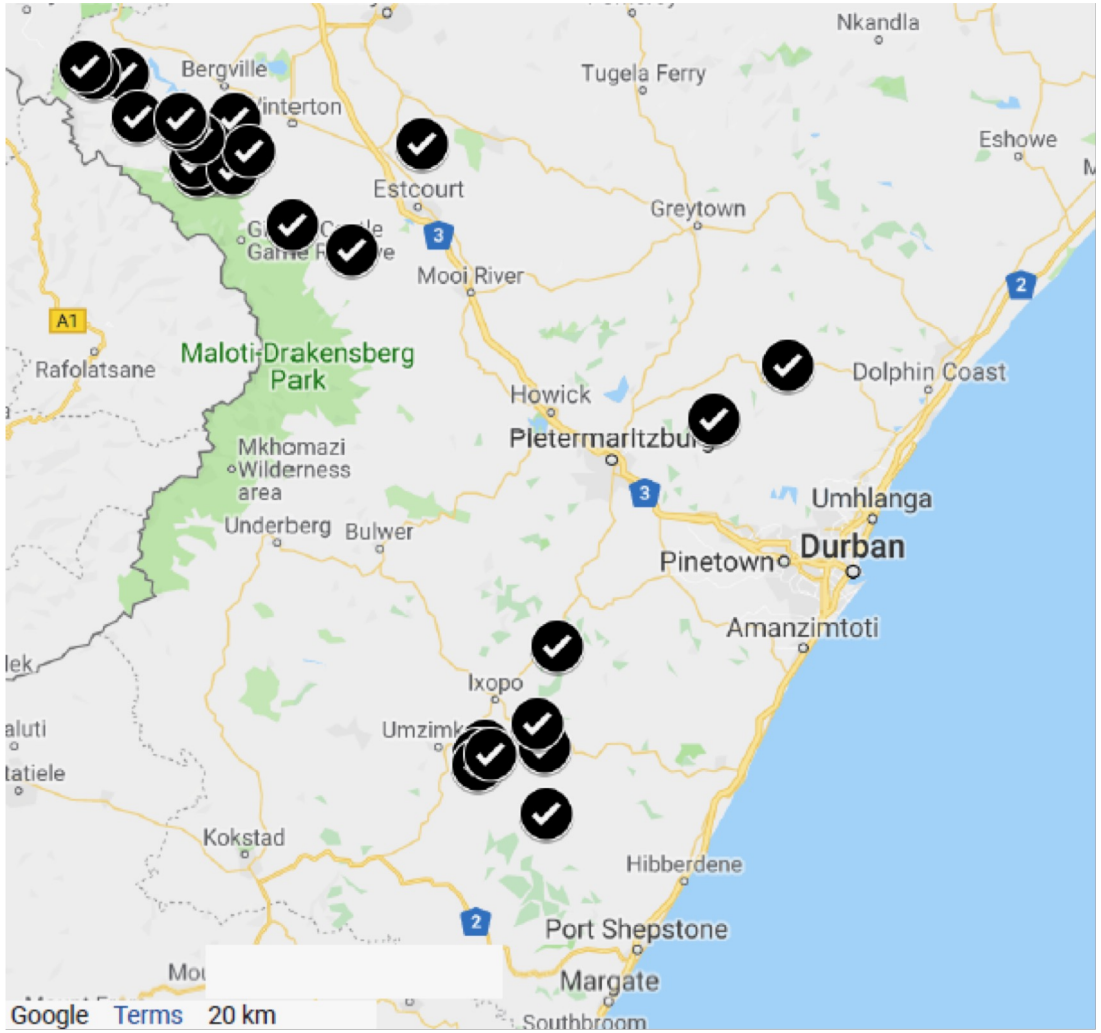
Smallholder CCA decision support system: individual and facilitated



Activities and processes	Local good practice	Climate Change dialogues	Farmer level experimentation to test practices	CoPs and innovation platforms
	Best practise options	Impacts of CC	Introduction of new practices and ideas to try	Benchmarking for visual indicators
	Stakeholder engagements	Adaptive strategies	Learning and mentoring	**CRA learning groups**
	Materials and information	Prioritized practices	Assessment of outcomes and impacts	
	Internet based platform	CRA best practice	Cyclical, iterative learning and implementation	
Facilitator-Farmer Decision Support System				

Climate Resilient Agriculture learning groups

Research areas and process



- *Bergville: 5 villages. 120 farmers*
- *Midlands: 7 villages. 76 farmers*
- *SKZN: 3 villages. 94 farmers*

PROCESS:

- ➢Village level CRA learning groups
- ➢Implement a range of prioritized CRA activities/practices
- ➢And undertake farmer led experimentation for measurement of results and impact
- ➢ groups do cyclical planning and reviews and engage in further actions and multistakeholder processes

Climate Change Impacts in Bergville area

Climate change impacts on livelihoods and farming (KZN)	
Water	Less water in the landscape; streams and springs drying up, boreholes running dry, soils dry out quickly after rain
	Dams dry up
	Municipal water supply becoming more unreliable
Soil	More erosion
	Soils becoming more compacted and infertile
Cropping	Timing for planting has changed- later
	Heat damage to crops
	Reduced germination and growth
	Seeding of legumes becoming unreliable
	Lower yields (~40% yield reduction for 2018-2019 cropping season)
	More pests and diseases
	Loss of indigenous seed stocks
Livestock	Less grazing; not enough to see cattle through winter
	More disease in cattle and heat stress symptoms
	Fewer calves
	More deaths
Natural resources	Fewer trees; too much cutting for firewood
	Decrease in wild animals and indigenous plants
	Increased crop damage from wild animals such as birds and monkeys
	Availability of indigenous vegetables has decreased
Social	More diseases
	Increased poverty and hunger
	Increased crime and reduced job opportunities

Above Left: Phumelele Hlongwane's (Ezibomvini) crop growth in mid January 2017 compared to Right ; growth in mid January 2019. The extreme heat and drought at the beginning of the season reduced her crop growth considerably, even in her Conservation Agriculture plots.

The smallholder farming system

350 participants across 18 villages

OM and soil fertility

Dryland cropping of staples on small patches of available land (0,1-1ha)

Cover crops, non staples

Feed biomass mulch

Fodder manure stover

Smallholder farming system

Intensive homestead food production; vegetables, fruit, small livestock

Extensive grazing of livestock on stover and veld

Manure mulch

Little to no soil cover

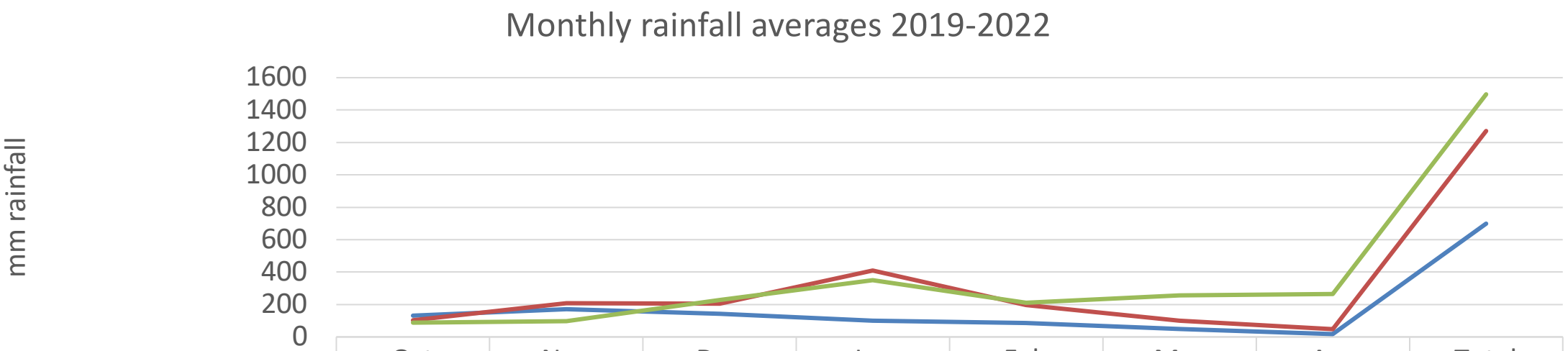
CRA activities

- **Conservation Agriculture:** Quantitative research support to the Smallholder Farmer Innovation Programme: *Intercropping, crop rotation, cover crops, fodder production*
- **Livestock integration:** *Winter fodder supplementation, hay baling, conservation agreements, local livestock auctions*
- **Intensive homestead food production:** Agroecology: *Micro-tunnels, trench beds, mixed cropping, mulching, greywater management, fruit production, crop diversification*
- **Community owned local water access:** Water committees: *Spring protection, boreholes, water reticulation, pipes and tanks at homestead level*
- **Village savings and loan associations:** *Village based savings groups for savings and small loans for productive activities*
- **Local marketing and food systems:** *Monthly produce market stalls, organised per village, exploration of further marketing options, small mills for maize*
- **Soil and water conservation:** *village-based learning groups in Climate change adaptation undertake resource conservation activities*

Assess impact with measurement of quantitative and qualitative indicators

Measurements

Rainfall - SAEON

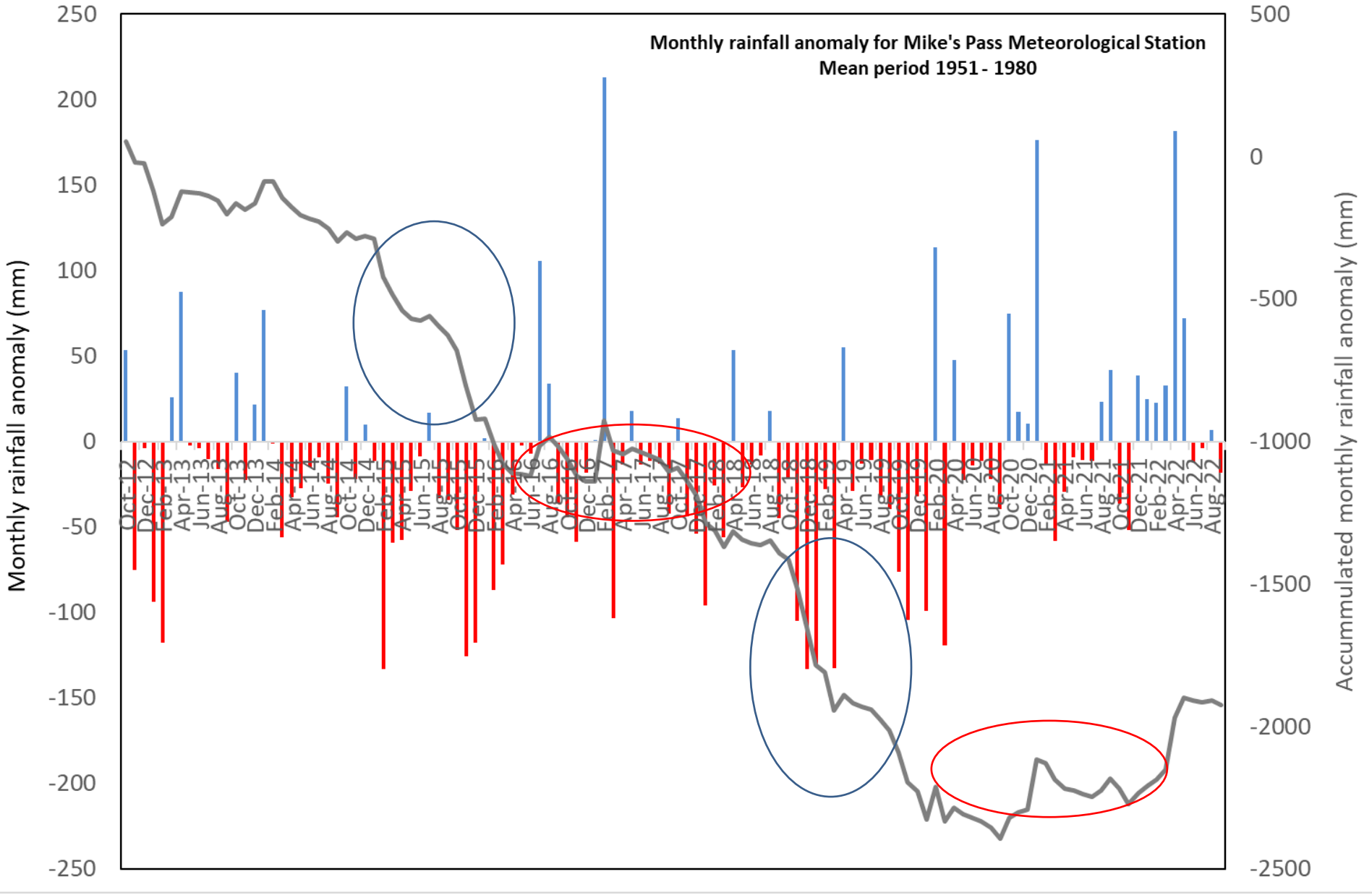


	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
Rainfall 2019/20 (mm)	131	172,6	143,5	99,1	86,1	49,2	17,7	699,2
Rainfall 2020/21(mm)	103,4	207	204,7	409,2	197,1	101,6	48	1271
Rainfall 2021/22 (mm)	88,1	96,2	229,4	349,9	211,3	256,4	266,1	1497,4

- Overall rainfall for 2020/21 almost double that of 2019/20
- Rainfall this season (1497,4mm) was even higher than in 2020/21 (1271mm)
- Periodicity is different: For 2020/21 and 2021/22 much more rainfall later in the season
- For 2021/22 rainfall early in the season even lower than the previous 2 years.
- Late season rainfall (March-April) affected bean yields and caused increased fungal load in maize grain

Measurements

Rainfall – Long term averages



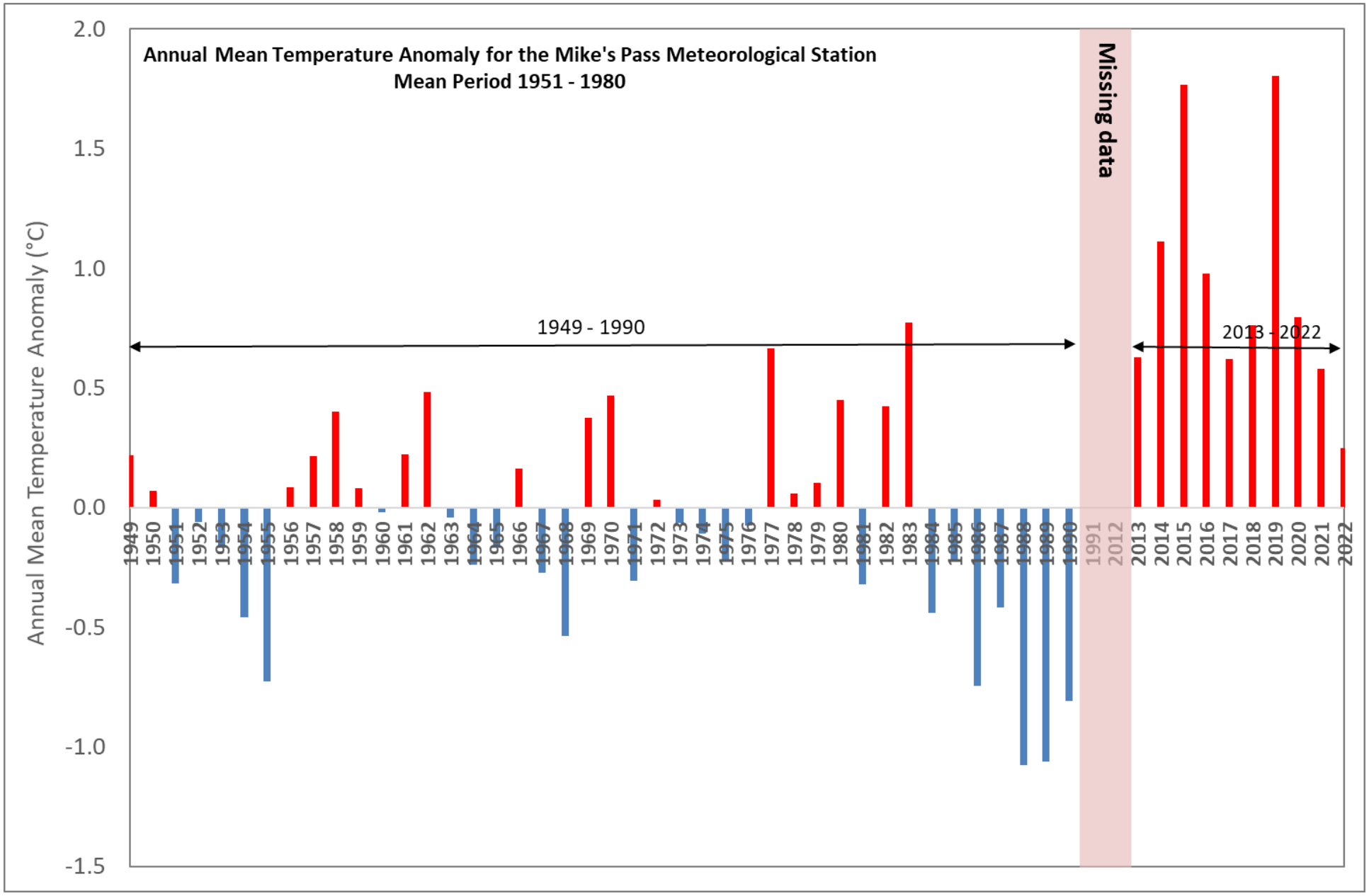
- *Rainfall in the last 8 to 9 years has been lower than the long- term average more often than higher.*

(The grey line is the sum of deviations over time)

- *The trend in the line is mostly downwards indicating drier than average conditions for a sustained period of time.*
- *There are two relatively stable periods for the line where conditions indicate rainfall similar to the historical average.*

Measurements

Temperature – Long term averages



- *Average annual temperature in the last 10 years has been consistently higher than the long-term average*
- *And for 6 of those years the average is higher than any temperatures coming before.*
- *An average temperature change of >1,5°C has been measured*

Measurements

Runoff – Pans in CA experimental and control plots in cropping fields

% Rainfall conversion to runoff (6 participants across 4 villages)	Runoff CA trial plot (L)	Runoff CA control plot (L)
2019/2020	4%	7%
2020/2021	6%	11%
2021/2022	5%	7%
Average	**5%**	**8%**

Right and far right: *Installation of run-off pans in control and CA trial plots, respectively.*

- Run-off averages across all CA trial plots almost 30-50% lower than runoff in the control plots (CA control maize- mono cropped)
- Between 2%-5% of total rainfall is saved through reduced runoff in the CA trial plots

Right: *Signs of run-off in a CA control M plot in Bergville*

69 Liter /m^2 now in the soil. That is 694 000 L/ha per year, more water in the soil and available to crops

Measurements and results

Water productivity field cropping

- Water productivity for CA maize grown as an intercrop with beans or cowpeas is higher than single cropped CA maize and
- Water productivity for CA plots is significantly higher than conventionally tilled plots.
- Despite annual differences in water productivity, these trends remained the same across three seasons for all three areas within KZN.
- The close spacing used in the CA trial plots provides extra WP benefits when compared to the 'normal' spacing used in these villages

Cropping options	WP (kg/ m^3)	WP (kg/ m^3)	WP (kg/m^3)	Ave WP (3 yrs)
	2021/22 (n=7)	2020/21 (n=11)	2019/20 (n=9)	
CA – Maize (M)	2,64	2,28	1,11	**2,0**
CA- Maize, bean intercrop (M+B)	3,07	2,50	1,21	**2,3**
CA- Maize cowpea intercrop (M+CP)		2,84	1,43	**2,1**
CA- Maize control (M-CA control)	1,42	1,1	0,8	**1 ,1**
Conventionally tilled maize (M-Conv Control)		0,75	0,36	**0,6**

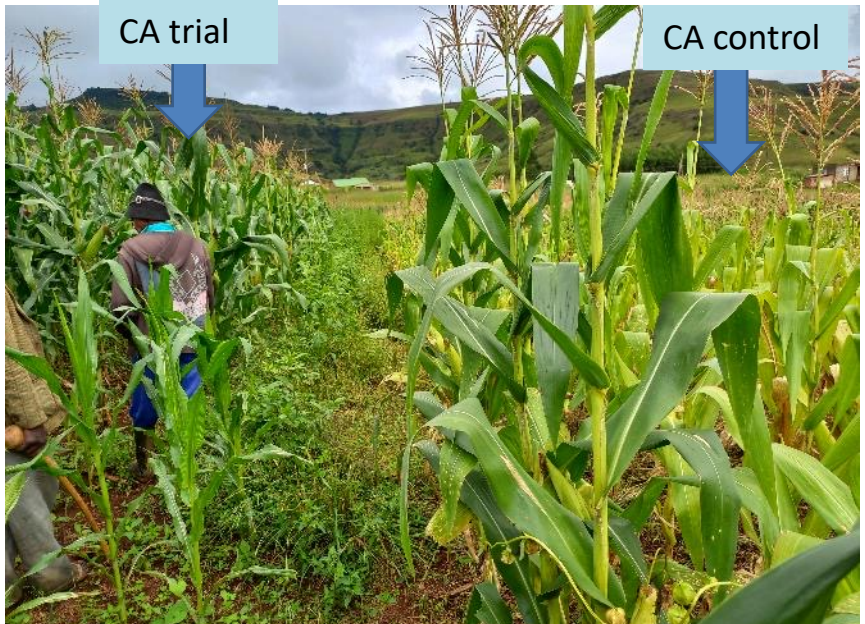
WP for maize grown in a multi-cropping rotation CA system is much higher (x2) than CA mono-cropped maize or conventionally tilled maize (x3)

Measurements and results

Volumetric water benefit field cropping

	CA trial (inter cropping and crop rotation)	CA control (mono cropped M)	Conv control (mono cropped M)
kg/m3 (WP)	2,3	1,1	0,6
Difference (CA trial- CA control- Conv control)	1,2	0,5	
Volumetric water difference (l/kg)	1 200	500	
Yield (t/ha)	5,11	2,87	
VWB (l/ha)	**6 132 000**	**1 435 000**	

Volumetric water benefit for intercropped and rotated CA plots is ~6 million litres/ha more than conventional tillage and for mono-cropped CA plots is ~1million litres/ha more.

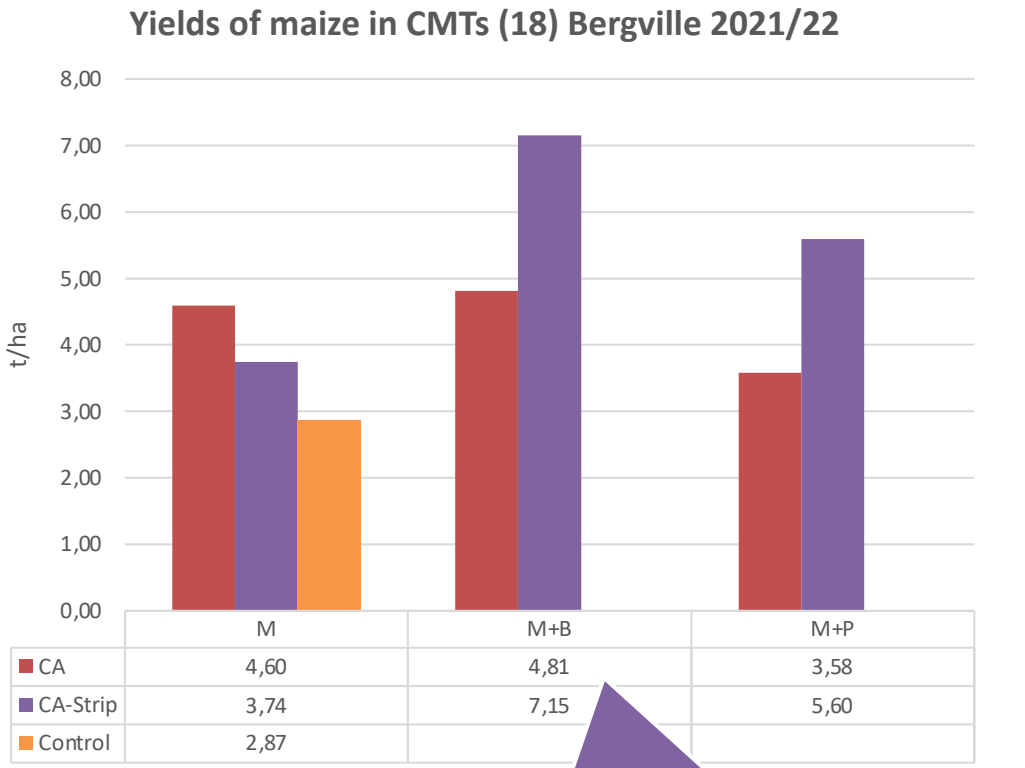


Measurements and results

Yields of maize in CA trials - Bergville

Weighing of maize yields per plot in CA trials

- Average yields for maize planted in intercropped plots (M+B , M+Pumpkin) are much higher than the yields in maize only plots
- Average yields for the CA trial plots (intercropped and maize only averaged) are much higher than maize yields in the CA control plots (planted to maize only in consecutive years)
- For 2021/22 yields were on average 1-2 t/ha lower than the previous season.



	M	M+B	M+P
CA	4,60	4,81	3,58
CA-Strip	3,74	7,15	5,60
Control	2,87		

Yield advantages for maize through intercropping and crop rotation are evident after a continuous CA implementation cycle of 4 or more years

Ave yield M- intercrop: 5,22t/ha,
Ave yield M- monocrop: 4,18 t/ha
Ave yield M- control: 2,87t/ha

Maximum yields have increased from 6,7 t/ha to 13,6 t/ha between 2014 and 2021, for high performing smallholder farmers. **A yield gain of ~1 t/ha per annum is possible under CA cropping systems despite difficult climatic conditions**

Measurements

Water productivity vegetable production

- Water productivity for vegetables grown inside the tunnels is between 140%-250% more than outside the tunnels

Water productivity calculated for a range of vegetable crops for Phumelele Hlongwane (Ezibomvini), Feb 2019-March 2020

Plot	Crop	Simple scientific method (ETc)		
		Yield per plot (5x1m) (kg)	Water use (m3)	WP (kg/m3)
Trench bed inside tunnel	Chinese cabbage	60,5	0,5	**122**
Trench bed outside tunnel	Chinese cabbage	34,7	0,5	72,1
Trench bed inside tunnel	Green pepper	30,1	0,7	**46,5**
Trench bed outside tunnel	Green pepper	24,6	0,7	34,5
Trench bed inside tunnel	Spinach	49	0,7	**73,7**
Trench bed outside tunnel	Spinach	19,6	0,7	29,1

This means that on average you will save 500-1 250 liters of water for every kg of vegetables produced.

This equates 36 000-92 000l /tunnel/ annum of water saved

Measurements

Bergville market stall

Bamshela market stall

Collapse of market stalls after social unrest. Seasonality of vegetable production

~R382 / farmer/ market

Marketing –summary of sales on market days

Summary of market incomes for Market stalls: April 2021-August 2022					
Date	**No farmers**	**Villages**	**Amount**	**Market**	**Produce**
2021/04/10	11	2	R2 419,00	Emmaus	
2021/05/09	16	3	R1 580,00	Emmaus	
2021/06/09	18	4	R5 072,00	Emmaus, Stulwane	
2021/07/10	16	4	R3 415,00	Emmaus, Stulwane	
2021/08/07	9	3	R2 379,00	Emmaus	
2021/09/09	18	4	R3 745,00	Emmaus	VEGETABLES: Broccoli, cauliflower, cabbage, kale, chinese cabbage, mustard spinach, leeks, onions, lettuce, carrots, beetroot, green peppers, chilies, brinjals, green maize, green beans, tomatoes,
2021/10/08	8	4	R845,00	Bergville market	
2021/06/04	16	4	R11 527,50	Bamshela - Ozwathini	
2021/08/04	8	4	R3 866,00	Bamshela - Ozwathini	
2021/09/03,06,07	12	5	R5 448,00	Bamshela - Ozwathini	HERBS: coriander, parsley, fennel,
2021/10/05,06	12	5	R3 354,00	Bamshela - Ozwathini	
2021/11/03,04	9	4	R2 964,00	Bamshela - Ozwathini	FIELD CROPS: Maize, dry beans, sweet potatoes, amadumbe, pumpkins, butternut
2021/10/11	3	2	R19 800,00	Sale to shops in Bergville: Boxer and Saverite	
2022/03/02	19	4	R1 310,00	UEDA – Emmaus Hall	FRUIT: Bananas, avocadoes, naartjies, lemons
2021/12/02,03	10	4	R2 964,00	Bamshela - Ozwathini	
2021/12/03	10	4	R1 400,00	Ozwathini- social media	MEAT: Pork, broilers, chicken pieces, eggs
2022/01/05,06	6	3	R2 610,00	Bamshela - Ozwathini	PROCESSED FOOD: Bottled chilies, mealie bread vetkooek
2022/02/05,12,19	8	4	R3 010,00	Bamshela - Ozwathini	
2022/03/11	6	4	R1 216,00	Bamshela - Ozwathini	OTHER: incema, seed potatoes, pinafores, grass brooms , mats, beads, art work
2022/05/03,04	7	3	R2 565,00	Bamshela - Ozwathini	
2022/06/02,03,04	7	4	R4 782,00	Bamshela - Ozwathini	Combo packs - via social media in Pietermaritbrug: Potatoes, carrots, eggs, chillies, onions, cabbage (half and chopped), green beans, beetroot, avocado, brinjals, green peppers, chopped mixed veg.
2022/07/05	11	3	R2 500,00	Bergville town market stall	
2022/08/03	17	6	R4823,00	Bergville town market stall with FSG farmers	
2022/08/04,05,06	7	3	R4248,00	Bamshela-Ozwathini	
	11	**4**	**R96 626,50**	**INCOME: ~ R6 901 800/month**	Ave income per participant: R382 per market day (R100-R1,600)

Monitoring tools

Calves fed on cover crops, or stall fed in cut and carry system

Micro poultry units of layers and broilers

~Average increased value of livelihood is ~R3000/ month per participant

Income and livelihoods

Commodity (n=100)	Average monthly income per participant	Annual income potential
Broilers	R1 024,50	R12 294,00
Layers (eggs)	R641,00	R7 692,00
Field crops:		
Maize	R209,41	R3 713,00
Beans	R237,50	R2 850,00
Vegetables	R247,00	R2 964,00
	Average monthly value of food per participant	
All commodities: This is an estimate only (further corroborated in resilience snapshots)*	R700,00	R8 400,00
Commodity for a selection of participants only	Average monthly income per participant	Annual income potential
Green Maize	R1 300,00	R15 600,00 (up to R24 000)
Stall fed calves	R750,00	R9 000,00 (up to R50 000)
Total value of production (incl all commodities but excl the selection)	R3 059,41	R36 712,92

Monitoring tools

CA Innovation system monitoring dashboard 2013-2020

Social agency	2013	2020	Value chain	2013	2020	Productivity	2013	2020
No of female farmers	89%	**75%**	Saving for inputs	0%	**28%**	Intercropping – maize and beans	0%	**92%**
No of participants involved	41	**487**	Reduced labour in CA plots	0%	**78%**	Intercropping maize and other legumes	0%	**17%**
Learning groups (No)	4	**31**	Reduced weeding in CA plots	0%	**39%**	Crop rotation	0%	**20%**
Months of food provisioning:			Use of planters:			Cover crops; summer mix – sunflower, millet, Sunhemp, sorghum	0%	**26%**
10-12	-	**15%**	Hand hoes	97%	**26%**			
7-9	-	**38%**	Hand planters		**69%**			
4-6	-	**39%**	Animal drawn planters	3%	**5%**			
1-3	100%	**8%**	Tractor drawn planters		**5%**			
VSLAs (Village Saving and Loan Associations) - % of participants involved	0%	**79%**	Local financing of infrastructure	0		Cover crops; winter mix relay cropping – Saia oats, fodder rye, fodder radish	0%	**31%**
			Threshers		**1**			
			Mills		**1**			
			Spring protection		**2**			
Sale of crops locally (maize, beans, cowpeas, sunflowers)	0%	**15%**	Farmer centres	0	**2**	Fodder: provisioning of livestock through cut and carry	0%	**10%**
Innovation platforms; including external stakeholders	0	**3**	Ave maize yield (t/ha)	3,7	**6,4**	Seed saving	0%	**11%**

Monitoring tools

Resilience snapshots: Individual interviews

Resilience indicators	Increase for Drakensberg	Comment
Increase in size of farming activities	Gardening > 18% Field cropping > 63% Livestock > 31%	Cropping areas measured, no of livestock assessed Dryland cropping has reduced significantly due to drought conditions and infertile soil
Increased no of farming activities	No	All involved in gardening, field cropping and livestock management
Increased season	Yes	For field cropping and gardening- autumn and winter options
Increased crop diversity	Crops: 12 new crops Practices: 8 new practices	Management options include; drip irrigation, tunnels, no-till planters, JoJo tanks, RWH drums,
Increased productivity	Gardening > 72% Field cropping >79% Livestock > 25%	Based on increase in yields (mainly from tunnels and trench beds for gardening CA for field cropping
Increased water use efficiency	25%	Access, RWH, water holding capacity and irrigation efficiency rated
Increased income	23%	Based on average monthly incomes, mostly though marketing of produce locally and through the organic marketing system
Increased household food provisioning	Maize- 20kg/week Vegetables – 7kg/week	Food produced and consumed in the household
Increased savings	R267/month	Average of savings now undertaken
Increased social agency (collaborative actions)	>3	Learning groups, farmer centres, local water committees, marketing groups, livestock associations
Increased informed decision making	> 5	Own experience, local facilitators, other farmers, facilitators, extension officers
Positive mindsets	2 to 3	More to much more positive about the future: Much improved household food security and food availability

Monitoring tools

Participatory Impact assessments

	Soil; health and fertility	Money; income and savings	Productivity; acceptance of practice, saving in farming – equipment, labour	Knowledge; increased knowledge and ability to use	Food; how much produced and how healthy	Water; use and access	Social agency; Support, empowerment	Total
Conservation Agriculture	22	21	26	28	18	23	18	156
Savings	6	15	14	15	12	11	15	88
Livestock	19	11	18	7	5	12	11	83
Gardening	14	15	12	13	15	17	21	107
Crop rotation	16	12	13	12	12	15	10	90
Intercropping	12	13	15	12	11	11	9	83
Small businesses	11	17	15	10	20	11	9	93

In KZN positive impact of CRA and associated practices in order of importance: CA, gardening (tunnels, agroecology) , small businesses (farmer centres, poultry), savings, livestock (integration – fodder, health)

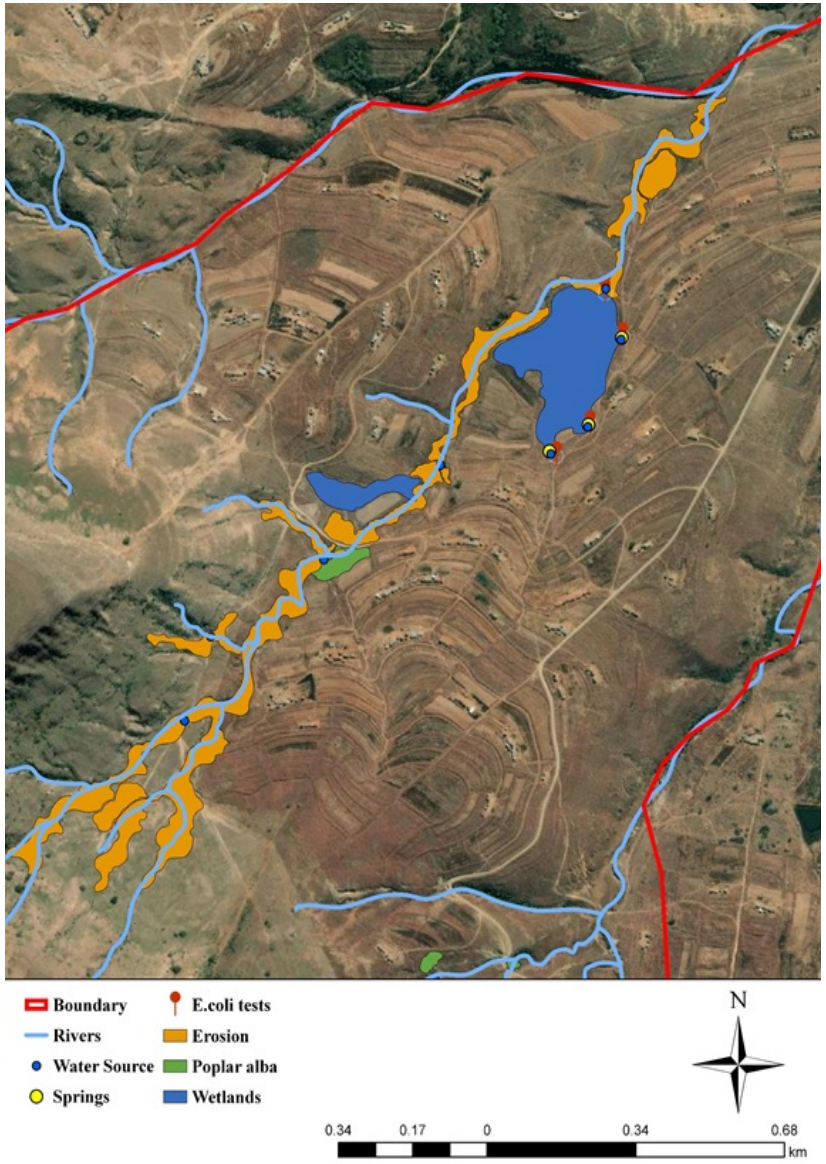
Learning groups

Development of social agency

- Learning groups provide institutional focus
- Exploration of many associated issues
- Link to stakeholders both internal and external
- Platform for change and innovation
- Blended finance options: E.g. job creation, spring protection

With partners: UKZN-CWRR, DUCT-AEN, SANBI-LCP, WWF-WSA

Local governance structures absent or weak Financial support required by communities to tackle the big issues



Conclusion

CRA implementation within a CbCCA approach is providing:

- Water, soil health and fertility and productivity improvements
- Livelihoods and social security improvements
- Social agency improvements and
- Evidence based increased resilience to climate change

Effective model for CbCCA; locally contextualised and owned

Appropriate for partnering in different contexts

Policy implications

- Local water committees who undertake communally managed and owned water access infrastructure management need a legal framework of support and legal recognition through the Water Service Authorities and need to be able to make agreements of mutual support
- The CbCCA framework and linked climate resilient agriculture practices and implementation options can provide a good entry point for both LMs and DM's to engage in a considered, longer term support process for adaptation that is both participatory and sustainable – to move the implementation away from the vote forcing superficial placebo actions presently in place and provide for an integrated development option.
- Enabling processes for market entry and development of local value chains are very long overdue

Policy implications continued

- For CCA strategies are in place, but Government appers to see themselves only as a directive and overseeing institution and expect both funding and implementation to happen from external sources and by other organisations – It has been very slow in the making and thus in practical terms have only got as far as vulnerability assessments in the process
- Our National Adaptation Fund process for involvement has been very convoluted, slow in the making and a bit lacking in building the technical and social expertise required to get new innovations and ideas into the adaptation space. There needs to be more of a recognition that adaptation requires a shift in mindset and paradigm and needs collaboration across sectors.

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Thank You