Scenarios for irrigated agriculture: case study Letaba sub-basin (SA)

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Commissioned by: Eau4Food (EU), Kennisbasis (EZ), PPP Inno-Gyiani (RVO),Openess (EU)

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Objective & approach

- 'TouchScene': Test pilot to evaluate the opportunities & constraints of combining deterministic impact models (Eau4Food) with participatory scenario building to explore possibilities for sustainable expansion of food production with irrigated (smallholder) farming;
- The approach is underpinned with the results of a nested case study in South Africa (Limpopo, Letaba, Giyani);

Contextual conditions

- Limited access to geographical information (economics, environment)
- Food production in a water scarce environment with high climate variability
- Rural development and poverty alleviation

Nested Casestudy

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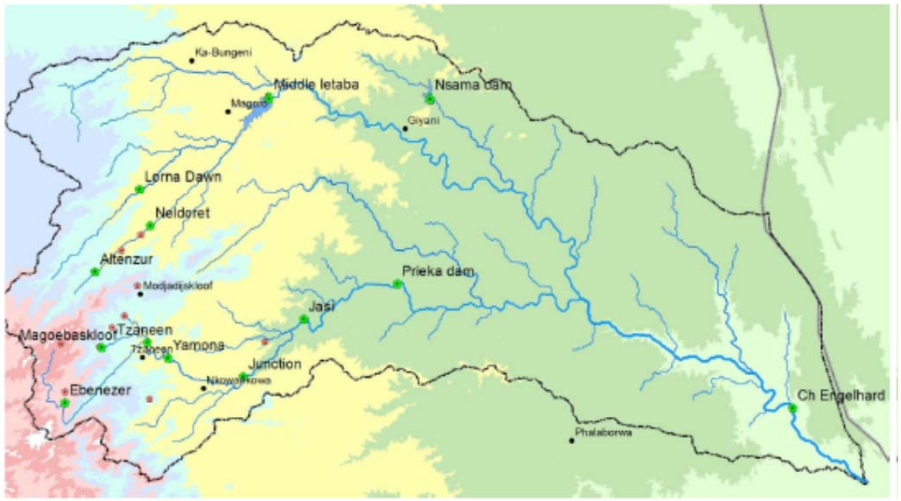
Map of the Letaba basin and the major dams



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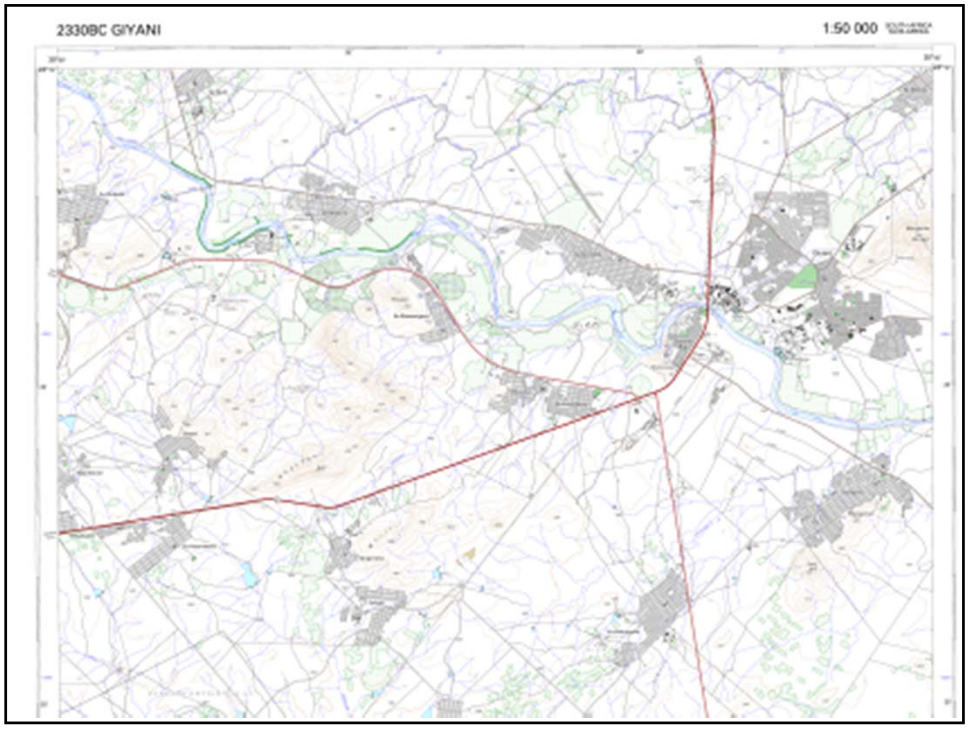
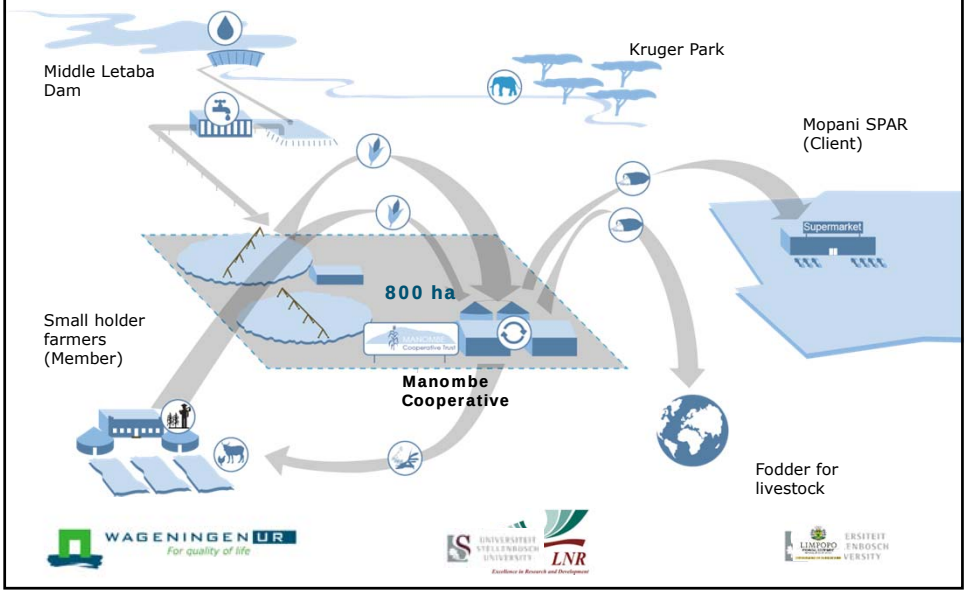


PPP – INNO Giyani: Water supply and link to market



Regional challenges in case study

- Local economic development (rural development plan)
  - Increase production (GDP)
  - Increase income (smallholders)
  - Create market access for smallholders
- Food security and a better quality of life (small holders)
- Increase resilience to increasing weather extremes (climate change).

PS: food production exert also pressure on water resources with consequences for humanity (drinking water, sanitation) and biodiversity (Kruger Park).

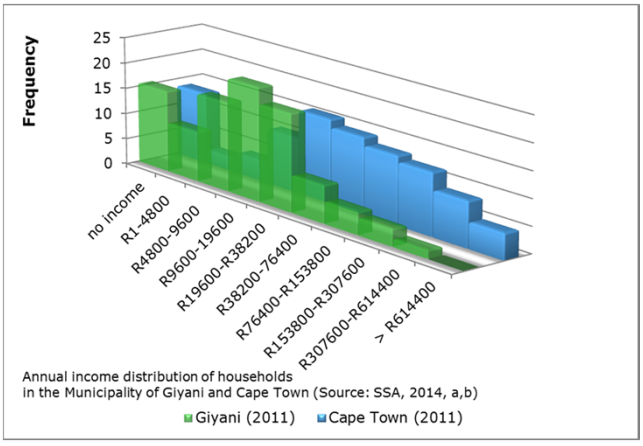
Interventions under consideration

- Groot Letaba River Water Development Project (GLeWaP):
  - increase storage capacity Tzaneen dam (from 157,5 to 203 Mm3)
  - New storage dam (144 Mm3) (Killick 2010).
  - The management rules of the Tzaneen dam will be optimized to minimize restrictions on water allocations for the irrigation of permanent fruit orchards (Killick 2010).
- ***Revitalisation of irrigation schemes***
- Water allocation rights

Scale interactions

- Giyani (local level), 800 ha revitalized irrigation, current water supply offer little other opportunities for revitalisation of additional irrigation schemes
- However, the foreseen future (2030) additional freshwater supply (51 Mm3 yr-1) creates opportunities at sub-basin level.
- If half of this additional water supply is allocated to irrigation schemes with smallholders like in Homu and Hllaneki it is possible to revitalize 3000 – 6000 ha
- To achieve this, the current distribution of water between commercial companies and small holders must be reassessed.

Socio-economics Giyani



The objective of NDP is to reduce the number of households with a minimum month income of R418

(≈ annual income of R6900 in 2015 (corrected for inflation rate)

Water demand irrigated agriculture Letaba sub basin

Letaba

Giyani region (Klein Letaba)

Farmer

Agr. Water demand:
160 - 220 Mio m^{-3} yr^{-1}
(DWAF, 2012 ; klick, 2010)

Water supply:
Surface : 195 Mio m^{-3} yr^{-1}
Groundw. : 32

Agr. Water demand:
25 Mio m^{-3} yr^{-1} (DWAF, 2012)

Water supply:
Surface : 24 Mio m^{-3} yr^{-1}
Groundw. : 8

An (informed) guess:
5000 m^{-3} ha^{-1} (500 mm)
(Wichern, 2013)

Uncertainties:
depends on crop choice, farm type, etc.

Deterministic scenarios (SIMGRO)

Scenarios - irrigation water use

Small-holder farms - 7500 ha:

		all farms	
Present situation	450 mm/a*	33 mln m^3	
1. Max. water crop yield	550 mm/a	41	More water applied
2. Environmental crop yield	600 mm/a	45	Optimal nutrient appl.
3. Maximum crop yield	700 mm/a	53	Opt. Water & nutrient appl.

* precipitation = 400 mm; irrigation from groundwater and surface water

Querner, 2014
Eau4Food

Conclusions applied deterministic scenarios

- Water resources in the Letaba basin are limited
- Increase production small holders has little effect on water resources while Climate change (2050) has a big impact on available water resources
- You need deterministic scenarios to assess such impacts!

Constraints approach:

- high inter-annual climate variability (precipitiation, evaporation);
- Restricted data availability (crop choice, land use, etc)
- Is groundwater or surface water used for irrigation? (data availability)
- Water demand nature (Kruger Park)

Expansion of irrigation by smallholders at river basin scale depend for a large part on local entrepreneurial initiatives, which are difficult to include in quantitative deterministic models.

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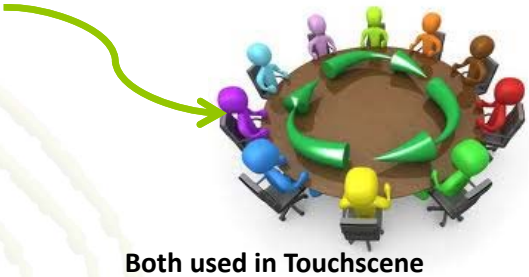
QUICKScan & Touchscene

QUICKscan: Software tool

Spatial (and spatio-statistical) analysis tool
to link available data to knowledge rules



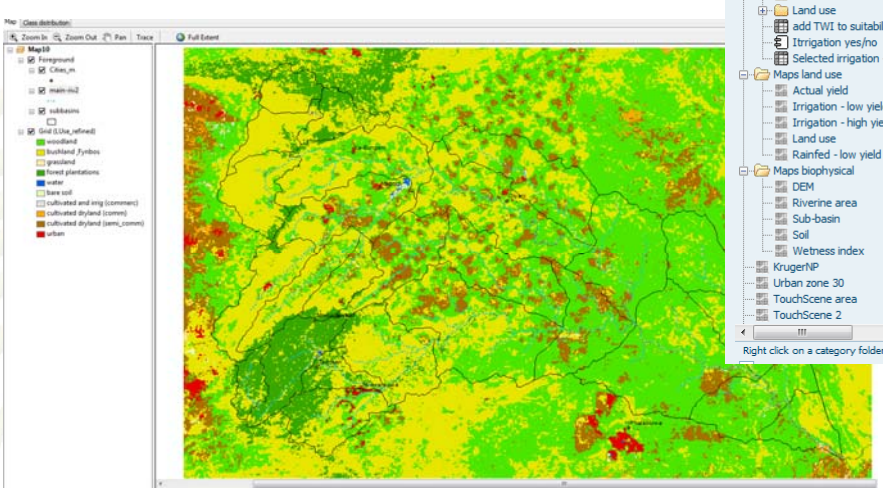
Touch table: ICT Tool

To map knowledge for which no maps exist

Both used in Touchscene
to support exploratory dialogue
in a facilitated workshop

Before the workshop (preparation)

The Land use map forms the basis for most analyses
The project library shows other available maps (tables)

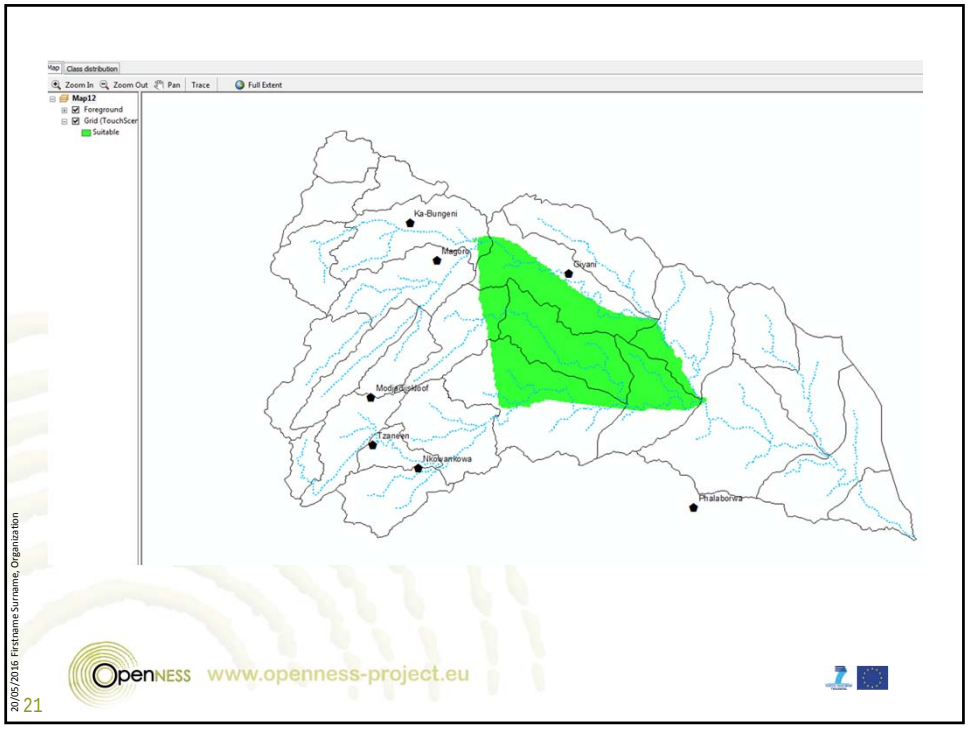


Step 1

Participants identified the green area as most suitable for irrigation:
- combination of expert knowledge & geographical information

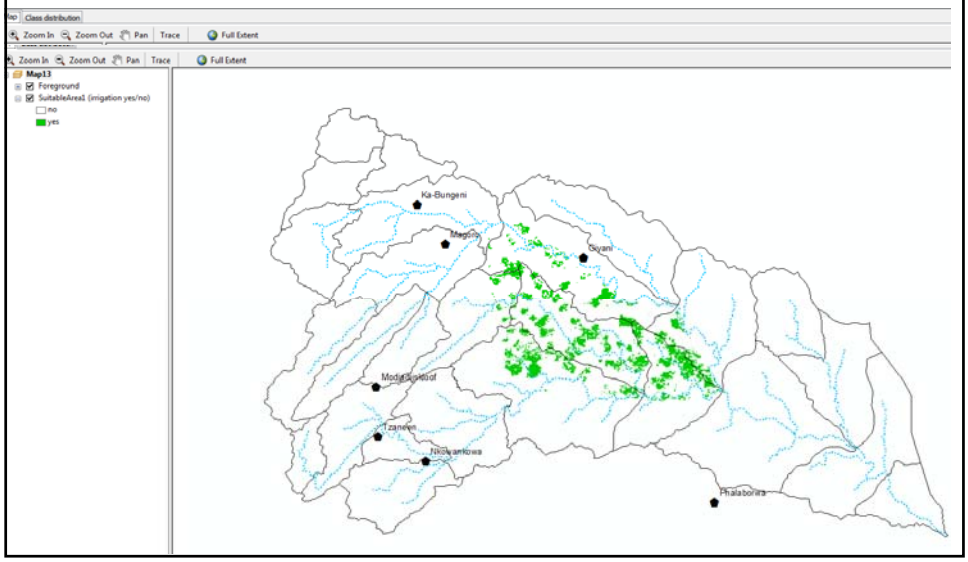
Simple expert rules were demonstrated:

- Market access (e.g. areas within 30 km from a town);
- Access to water resources (e.g. areas within 1 km from the Letaba River);
- Potential Yield estimated based on land use or soil type



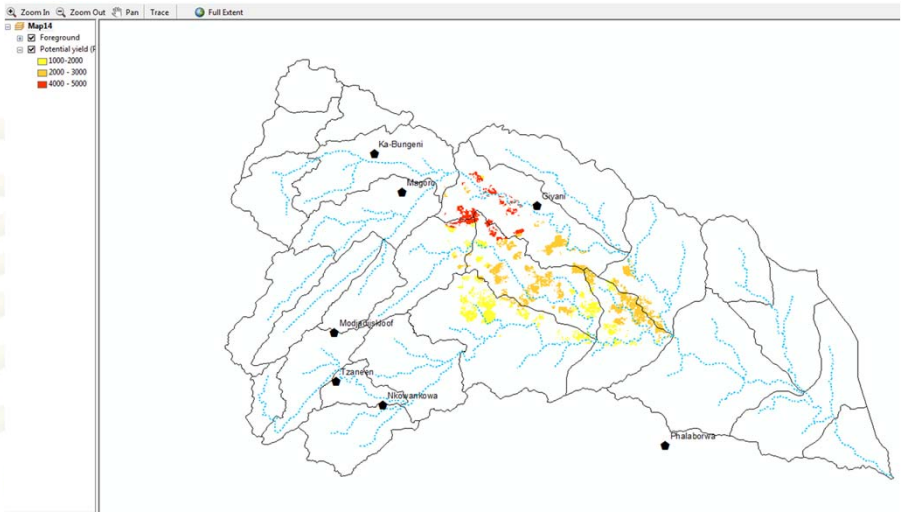
Step 2:

In this case, the 'agricultural areas' (from the land use map) were selected as basis, which results in the following map:



Step 3:

We combine the potential areas with a soil map, and experts can provide their estimate of potential yield (very roughly) for the respective soils.



Conclusions Touchscene Pilot

- When climate change and local socio-economic conditions, such as market access, energy costs and global macro-economic developments are taken into account the area where revitalisation of irrigation schemes is feasible becomes smaller, but probably also more realistic.

Recommendation: Combined use of deterministic & participatory scenarios

- Expert rules at multiple scales about water supply, water requirements and market access are necessary to make the solution space spatially explicit and to be able to anticipate on future water requirements and climate adaptation options.

This is possible with Touchscene

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Thank you for attention