Local-scale early warnings for drought can they increase community resilience?

Drought Early Warning Detection (DEWD)
Sida sponsored project

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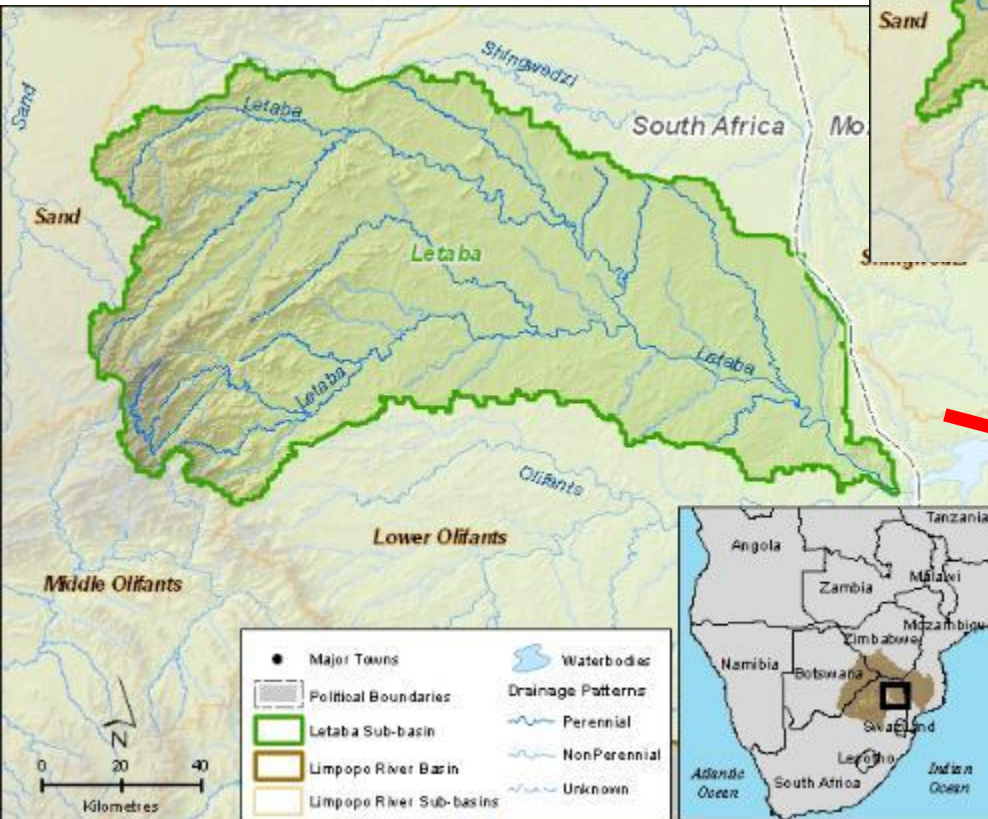DEPARTMENT OF AGRICULTURE

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SMHI

Pilot study in the Limpopo region

Aim: Identify and analyse possibilities and constraints and provide recommendations for development of local drought monitoring and forecast systems
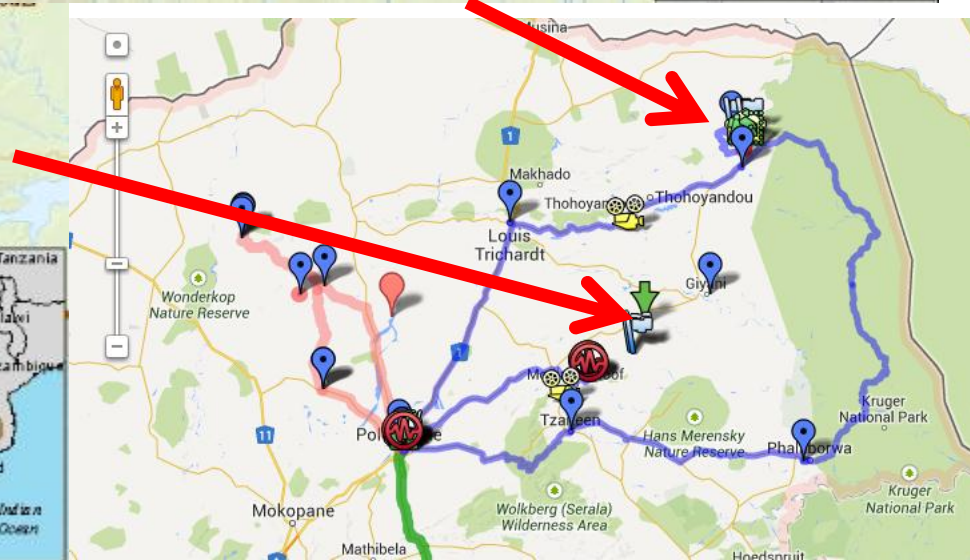
Method: Based on input from workshops build and test (in two villages) how an early warning system for drought could be created in order to initiate early actions on the local and central levels

- Hydro-climatological simulation (P.Graham, SMHI)

- Sensor networks (J. Wikner, Electrical Engineerig, LiU)

- Local knowledge, interviews, dialogues/workshops (J. Wilk, CSPR, LiU)
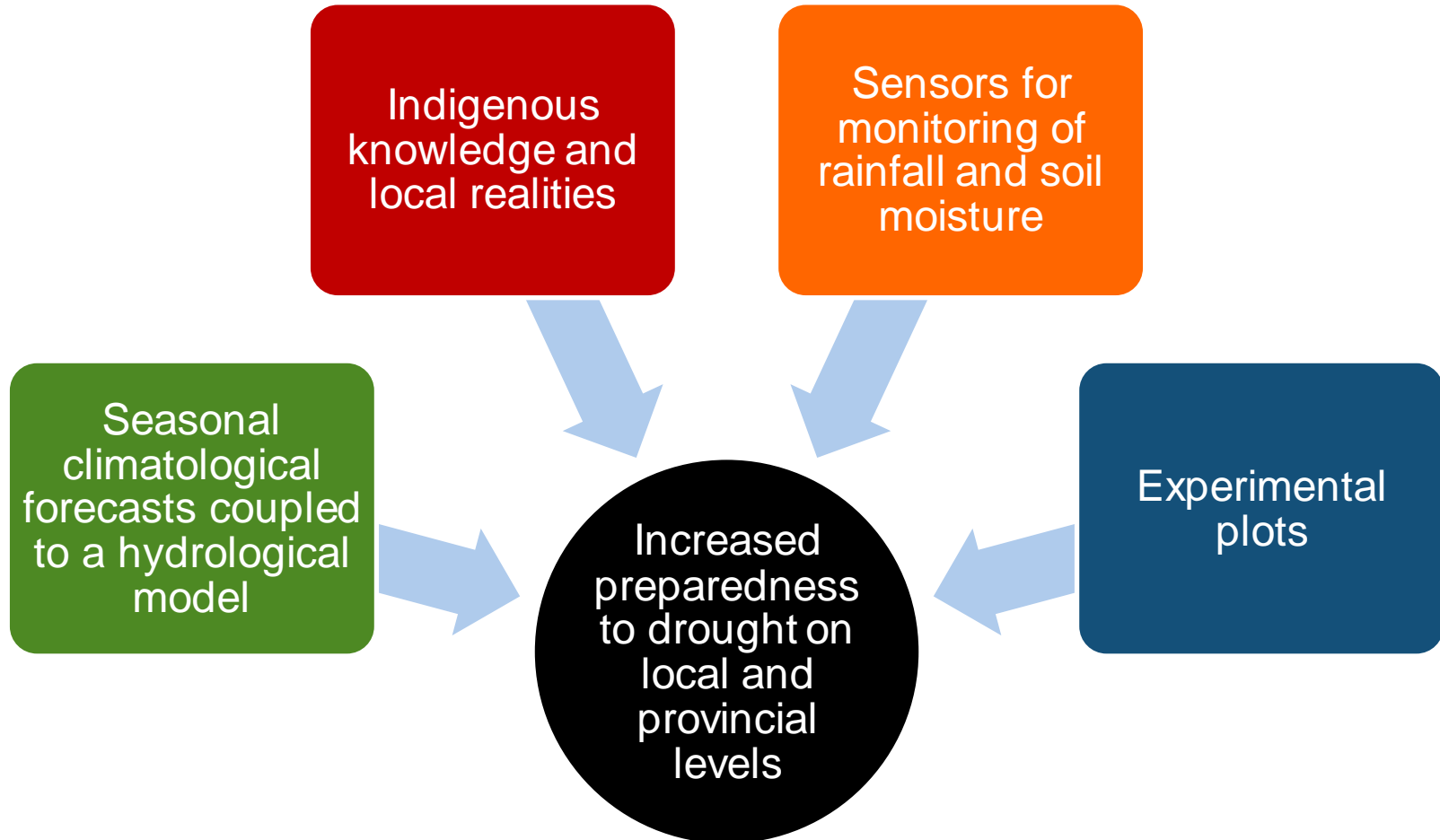
- Project coordination (L. Andersson, LiU & SMHI)

Letaba

Luvuvhu

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Integrating various sources of information to increase preparedness for drought on the local (and provisional) level

Indigenous knowledge and local realities

Sensors for monitoring of rainfall and soil moisture

Seasonal climatological forecasts coupled to a hydrological model

Increased preparedness to drought on local and provincial levels

Experimental plots

2013/2014 and 2014/2015 seasons:
Sensors, modelling, community, extension service, provincial meetings, interviews.

2015/2016 Lessons learned and ways forward?

Communicated by participants in villages during community meetings provided on blog

Readings by extension service mailed to us - provided at the blog. Discussed at community meetings

Results communicated to extension/communites and available at the blog

Local signs of drought

Sensors for monitoring of rainfall and soil moisture

Seasonal climatological forecasts coupled to a hydrological model

Increased preparedness to drought on local and central levels

Experimental plots

Monthly updates provided on blog and at community meetings

Monthly integrated reports provided at the blog – aim: in addition to community meeting - feedbacks from the villages communicated back to the central level

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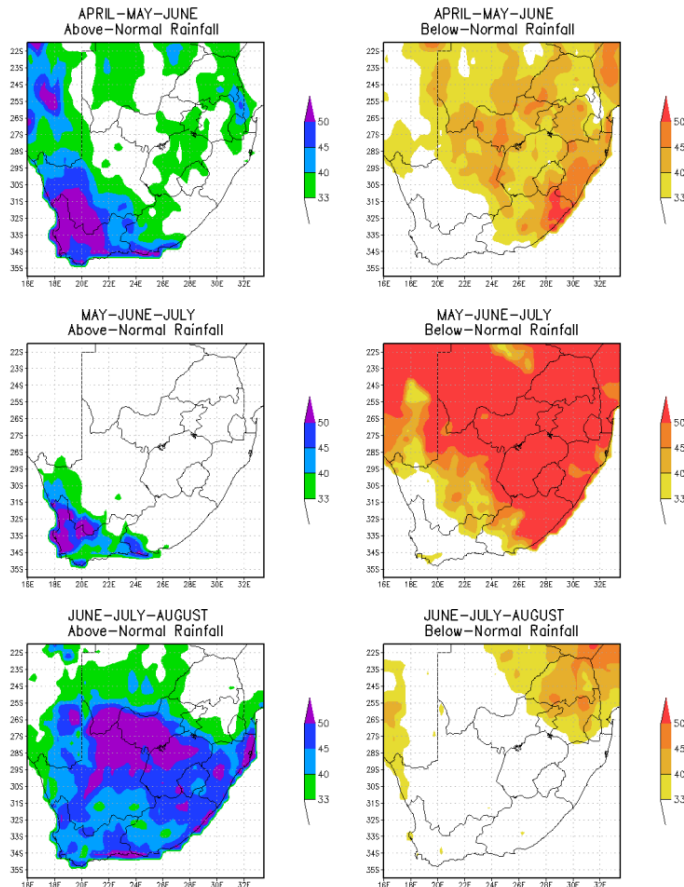meeting - feedbacks from the villages
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meeting - feedbacks from the villages communicated back to the central level
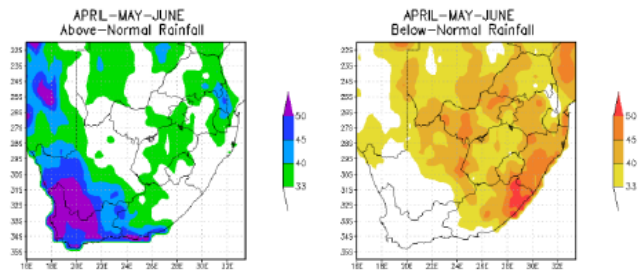
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The forecasting system indicates the likelihood of below normal rainfall for season in April 2015 to June 2015. Furthermore, a higher probability of below normal rainfall is expected to continue for season May 2015 to July 2015. In actual facts, dry conditions are expected during April to July 2015.

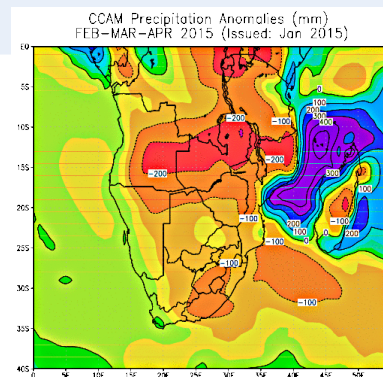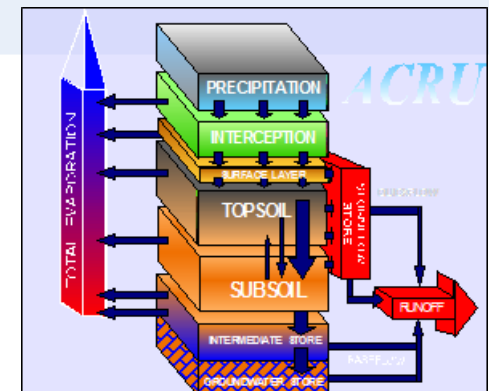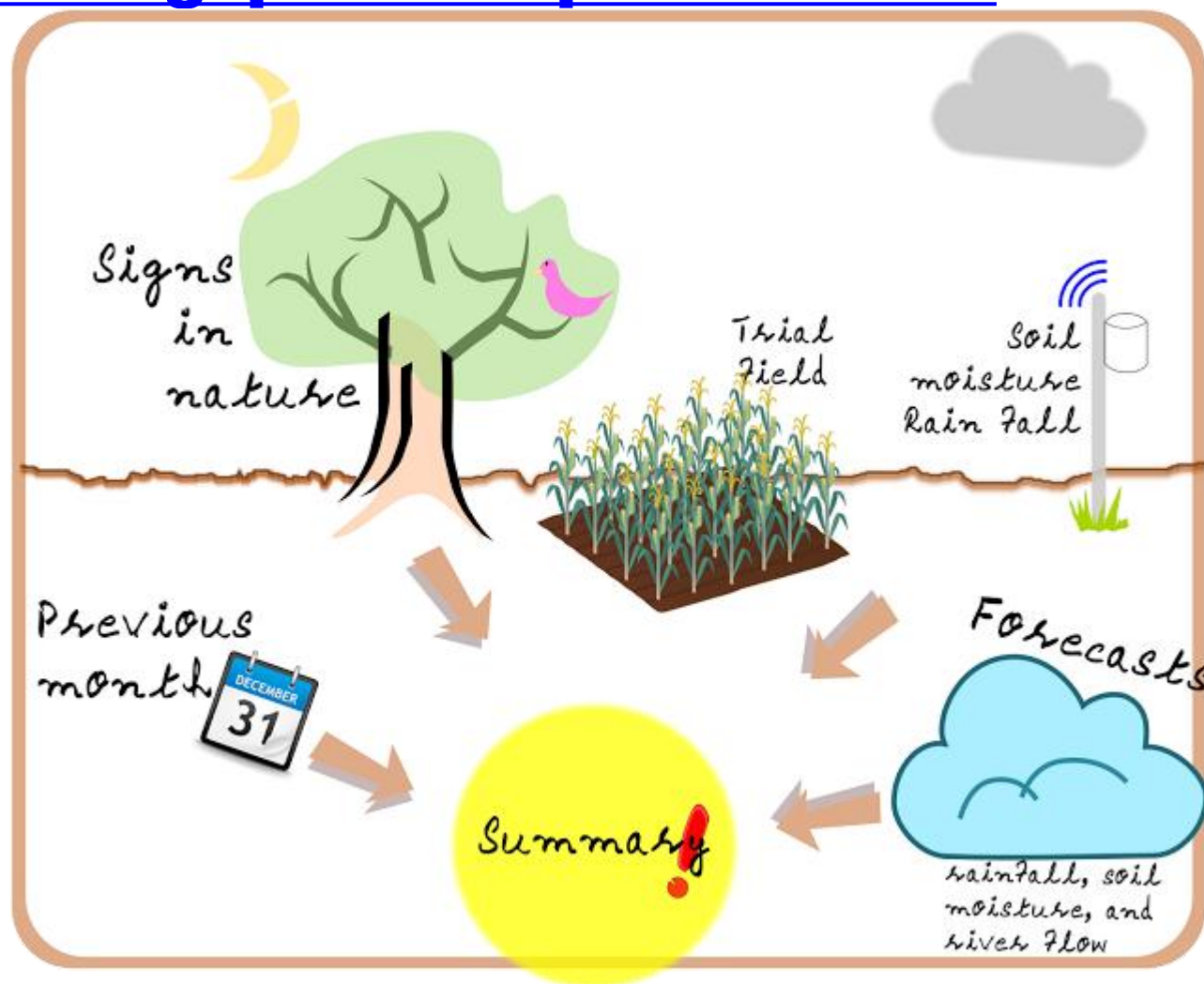| LDA information	DEWD
Based on probability to be below/above normal precipitation (**probabilistic**)	Based on deviations (mm) from normal (precipitation anomalies) (**deterministic**)
	Use a hydrological model to forecast (for a sub-catchment – in our case Letaba and Luhvuvu): Rainfall (mm) the following five months Soil moisture the following five months River runoff (mm) for the following five months Problem: Based on a historical time series – limited access to more recent/real-time data

Seasonal climatological forecasts coupled to a hydrological model

http://limpopo-dewd.blogspot.com/p/home.html

Seasonal climatological forecasts coupled to a hydrological model

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http://limpopo-dewa.blogspot.com/p/summary.html

September 2015

In summary – the forecast indicates dry conditions but not as much as was forecasted in the previous year.

Low rainfall
The rainy summer season in Letaba and Luvuvhu usually provides an increasing amount of rainfall, with a peak around January-February.

For Luvhuvhu and Letaba, seasonal forecasts indicate higher rainfall than what normally occurs for the period September 2015 to February 2016. Even the forecast which provides the lowest rainfall amounts indicates normal rainfall except for the month of January. For both areas, the rainfall peaks in December.

High soil moisture deficit
For Letaba and Luvuvhu, the soil moisture deficit usually decreases as the rainy season progresses as the water reserves in the soil fill. Then the soil moisture content starts to decrease again around March.

Both for Letaba and Luvuvhu, the estimated soil moisture availability is forecasted to be lower than normal for the period to February 2016. The forecast with the lowest deficits shows normal soil moisture conditions except for the months of January and February, and especially so for January where forecasts predict rainfall much lower than normal. The median and the higher moisture deficits show much drier soils throughout the period.

Low river runoff
For both Letaba and Luvhuvhu the river runoff shows normal amounts in the highest forecasts until December after which it drops quite drastically in January and February. In the middle and lowest forecasts it is lower than normal for the whole period, September to February again with a drastic drop in January.

Most recent forecasts

Runoff: Letaba 2015-2016

Purple = Max
Turquoise = Median
Orange = Min

Columns = Runoff-mean
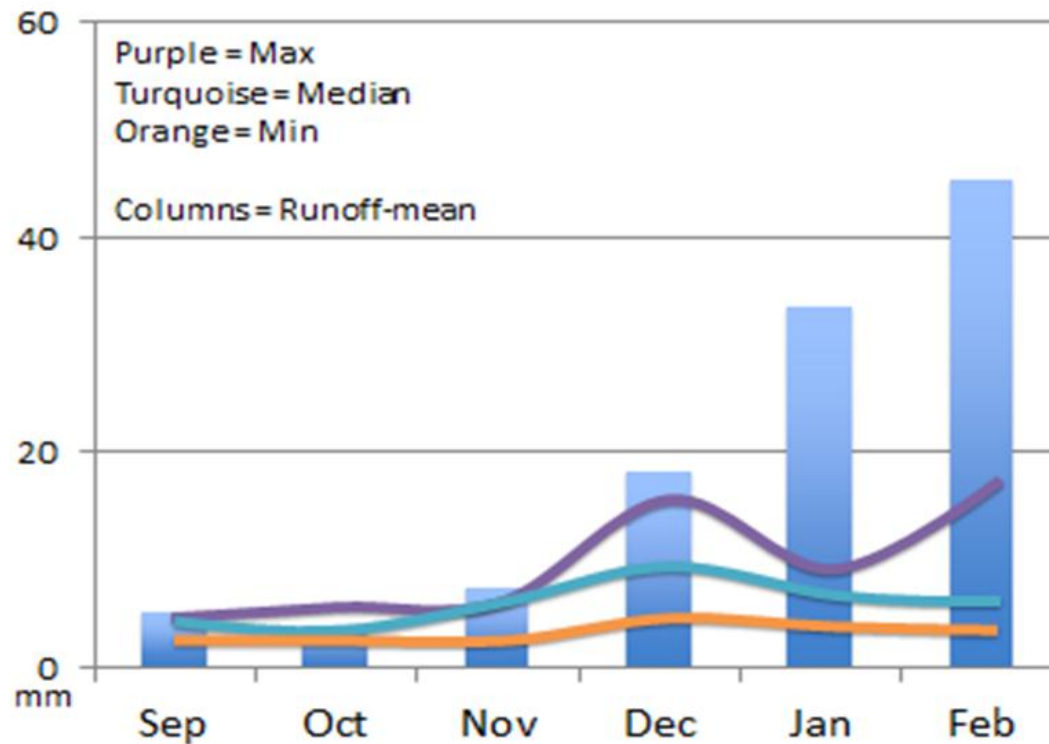
Sensor stations

- Soil moisture sensors

- Soil temperature (and flow)

- Rain gauges (precipitation)

- Three depths, 15 - 60 cm

Back to the basics, the scope of the sensors

- Bring a feeling of responsibility
  - My sensor, my field, I can see that data and weather align

- Distribute many sensors
  - Make them small
  - Make them cheap

Sensors for monitoring of rainfall and soil moisture

9/24/2015, 15.()

Back to the basics, the scope of the sensors

Sensors for monitoring of rainfall and soil moisture

Sensors

- Sensor data:

- To locally follow what is happening - obtain information about, e.g. soil moisture, rainfall.

- To update and verify the forecasts against local data.

- Difficulties in communicating that the sensors not will provide seasonal forecasts

Community meetings

June 2013   **Sept 2013**   **May 2014**

Sept 2014   **Oct 2014**   **June 2015**

If you had had resources…

Mokwakwaila

If you had had resources…

Signs in nature

- For the two years in which the study was held, the signs in nature and the seasonal forecasts pointed in similar directions. Indigenous knowledge is important to include because if you respect the knowledge people have themselves, they might be also being open to new technology and knowledge.
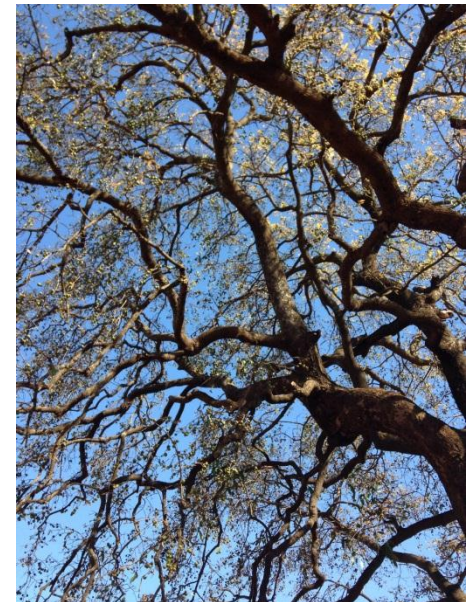
Comments during the final provisional workshop

- Training would be needed in the care and data collection as related to the sensors, hydrological modeling and analysis of seasonal forecasts as well as scale issues.

- Early warning is only one part of the story. There must be willingness and opportunity from farmers to act on the information they receive.

- Uncertainty is not only related to the resolution of rainfall forecasting but also about how soil moisture is different according to soil types, vegetation, etc.

- Steering group estblished…

Comments from final extension service workshops

- Seasonal forecasts do very seldom reach extension service officers

- Short summaries with interpreted information is most useful.

- More workshops on interpretation of data and maps required.

- Good examples from champion farmers with demonstrations and trials needed in order to make farmers take action based on forecasts.

- Although younger take advice quicker and have better literacy level they are difficult to engage and few continue with farming.

- Assistance to farmers is reactive rather than proactive. Creates a dependency syndrome where many wait for the grant instead of doing on their own activities.

- Limited possibilities to communicate and bring information to the district/provincial level (only when demanded from provincial).

Reflections from (final) community meetings

- Useful to get the local early warning forecasts .
- Some planted in rows to save water. Others sold their cattle. Or used information to plan soil preparation and known which types of seeds to use.
- Planted at first rain. Used drought-resistant seeds.
- In spite of forecast, planted on the entire area available to them, They planted maize, groundnuts and vegetables (cowpeas, spinach and tomatoes) to see what plants would make it.
- Others did not take the forecast into account but just ploughed and planted as they always do.
- Some said that also signs in nature had indicated a dry year. The moon was not covered with thin cloud during the night and the clouds during the day were not chased away by wind, both indicating a dry season. Normal amount of fruits, not extra and swallows were flying about but not in large number indicated a normal rainfall year.
- Happy to get the forecast information. Some also said that the signs in nature are not always correct or show conflicting information (as indicated above).

Reflections from (final) community meetings

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- Pl...
- In... m... pl... ed ...hat
- O... s th...
- So... ot co... ot ch... not ex... mal ra...
- H... are n...

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Scientific papers and policy briefs to be written before the project is to be reported to Sida/Swedish Research Council in June 2916

Intensified contacts established between provincial and municipality/local levels

Training to be held in October 2015

Plans for further cooperation linked to operationalization of local systems for provision and use of seasonal forecasts