UP Gro Unlocking the Potential of Groundwater for the Poor

BRAVE

Building Understanding of Climate Variability into the Planning of Groundwater Supplies from Low Storage Aquifers

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Co-PI: David Macdonald, BGS

AfClix Africa Climate Exchange | University of Reading | BGS 1835 | christian aid | care | CSIR Council for Scientific and Industrial Research Ghana | Ghana Meteorological Agency | météo Burkina | Populi Sapientia Populo

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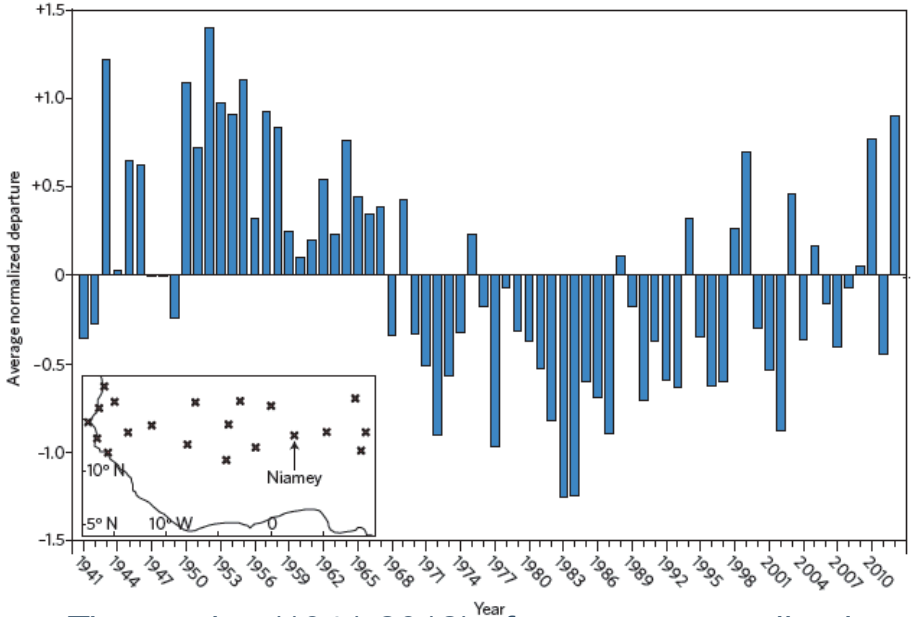
BRAVE2 Priorities

Issues

- Increasing population and water demand in Africa
- GW plays a major role in meeting demand
- Long term recharge >> than current abstraction
- Combined **climatic and hydrogeological factors may result in inadequate supply**:
  - extended periods low recharge
  - low storage/yield aquifers
- Trends? climate, land use, demand

BRAVE1 linked models to explore recharge variability, adequacy in process simulation and sensitivity to inputs and to the conceptual model. Also prioritized needs

Recurring crisis in the Sahel



Time series (1941-2012) of average normalized April-October rainfall departure for 20 stations in the West African Soudano-Sahelian zone (11-18N) west of 10E

Boyd, Cornforth, Lamb, Tarhule, Lele and Brouder. Nature Climate Change (2013)

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BRAVE Project Ojectives

1. Gather information about the VRB to **map the vulnerability** of local communities to CV and EC and establish baseline metrics for monitoring, evaluation and learning purposes **(T1; WP1);**
2. **Develop a model system** that links high resolution global climate model output with the land surface model JULES and the ZOOM groundwater model suite, to quantify current CV and EC impacts on groundwater supplies **(T1, T3; WP3);**
3. **Test the appropriateness** of the model system in relatively data-poor environment; **(T1, T3; WP3);**
4. Use the model as a means to **examine the sensitivity of groundwater recharge** to key climate and land use controls and hence improve understanding of the interaction between the water balance, climate variability and land-use changes **(T1, T3; WP3);**
5. Apply the linked model system to case studies within the **River Volta Basin** to assess the impact of climate variability on water supplies in areas of low groundwater storage;
6. Develop **stakeholder networks** and springboard off **existing platforms** to engage and understand planning needs and how insights from model output might be used in future to **support decisions** made on groundwater development (embedding existing socio-economic information and projected changes) and predicted available groundwater resources; **(T2; WP2);**
7. Combine this information via **meaningful Performance Indices** designed in partnership with smallholder communities in 2 provinces in Burkina Faso and 2 districts in Ghana **and evaluate new tools** and integrated governance mechanisms to support the development of local-level adaptation strategies for supplying groundwater for domestic and productive uses **(T2, T3; WP4 & WP5)**;
8. Deliver a **comprehensive dissemination and knowledge-sharing campaign** to share evidence and tools for water governance with local decision-takers through to national and regional policy-makers **(T2; WP5)**.

BRAVE2 Project Team and Community of Partners

Academic Institutes – UK, Africa & US

UK: University of Reading	Emily Black	Meteorologist
	Ros Cornforth (PI)	Meteorologist/KE
	Henny Osbahr	Agric./Social scientist
	Anne Verhoef	Land surface
	Lucy Wallace	Communications Manager
UK: British Geological Survey	Chris Jackson	GW Modeller
	Dan Lapworth	GW Hydrochemist
	David Macdonald	Hydrogeologist
	Jon Mackay	GW Modeller
	James Sorensen	Hydrogeologist
GH: WRI	William Agyekum	Hydrogeologist
GH: Institute for Environment and Sanitation Studies	Shani Haruna	Geographer
	Chris Gordon	Social Scientist
BF: IAVS/Wascal	Narcisse Gahi	Social Scientist
BF: University of Ouagadougou	Jean Pierre Sandwidi	Hydrogeologist
US: Oklahoma University	Aondover Tarhule	Geographer
	Issa Lele	Meteorologist

National Met Services - Africa

GH: Ghana Met Agency	Charles Yorke	Meteorologist
	Kofi Asare	Geographer
BF: Burkina Meteo	Ernest Ouedraogo	Climatologist

NGOs & Specialist KE Intermediaries

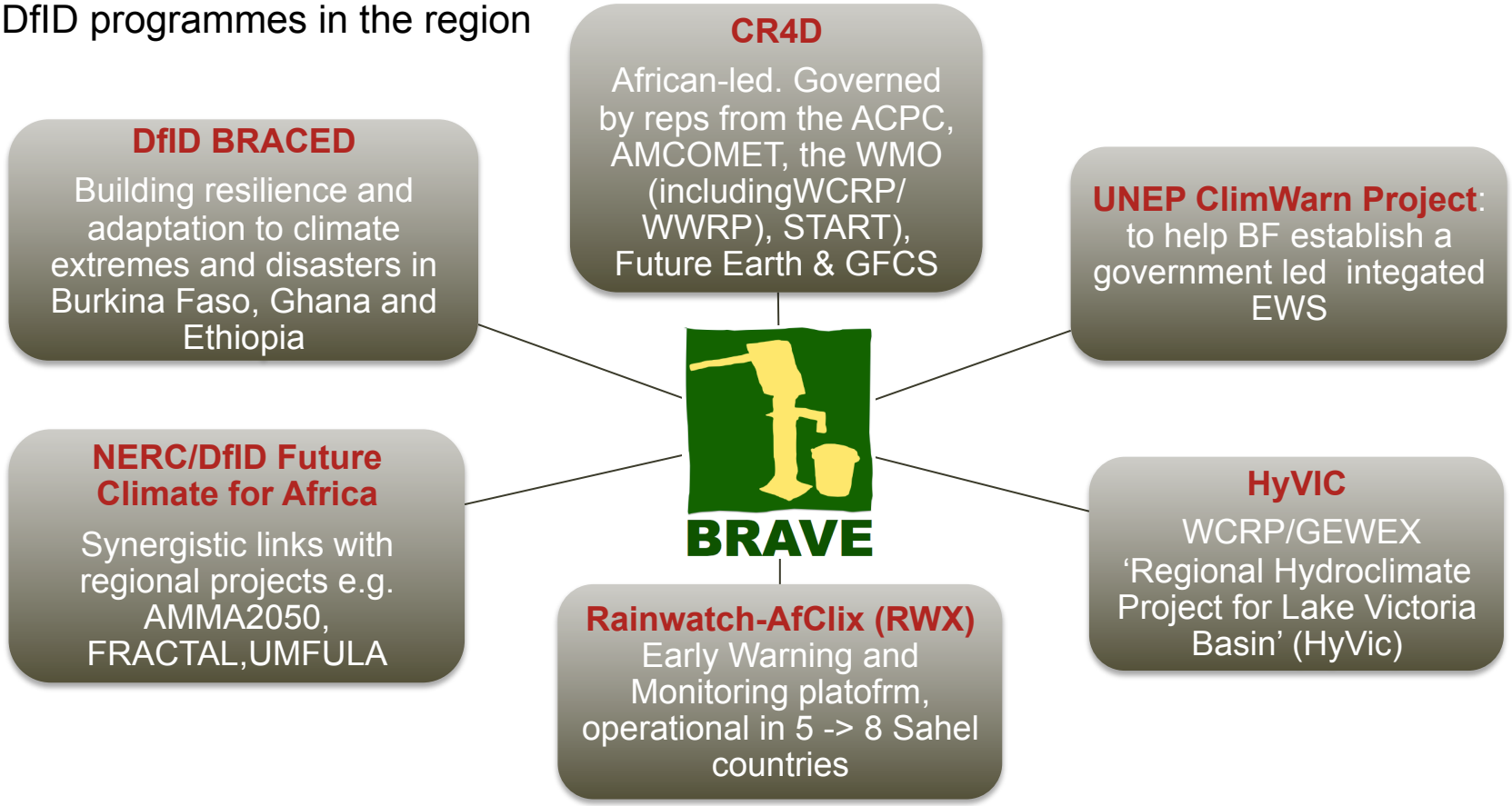
Lorna Young Foundation	Cristina Talens/ Farmers'Voice	Geographer Meteorologist
Practical Action WA	Mary Allen	West Africa Coordinator
GH: CARE Ghana	Romanus Gyang	NGO Practitioner
BF: Christian Aid Sahel	Marc Kabore	NGO Practitioner
	Romain Cardon	NGO Practitioner
Water Aid	Lucien Damiba	Regional Learning Centre Coordinator
AfClix	Ros Cornforth	Senior KE Fellow
GH: Global Water Partnership - Ghana	Maxwell Boateng-Gyimah	Country Director, GH
GH: IRC Ghana	Vida Duti	Country Director, GH
BF: IRC Burkina	Juste Nansi	Country Director, BF

Government Advisors - Africa

GH: Savannah Accelerated (SADA) Development Authority	Emmanuel Inge	Director
GH: Water Resources Commission	Ben Ampomah	Director
BF: Ministry of Water, Hydraulic Installations and Sanitation (DGRE)	Jean Mathieu Mme Zougrana	Director

International Context

- Linked into the Africa Climate Research for Development (CR4D) Platform and key DfID programmes in the region



- CR4D and linked DfID programmes & KM (e.g. SKAT, CCKE) will provide a path for upscaling lessons learnt (Observations", "Capacity Development", "Main-streaming Climate Sciences & Integrated Research", "Co-designed Multi-disciplinary Research)

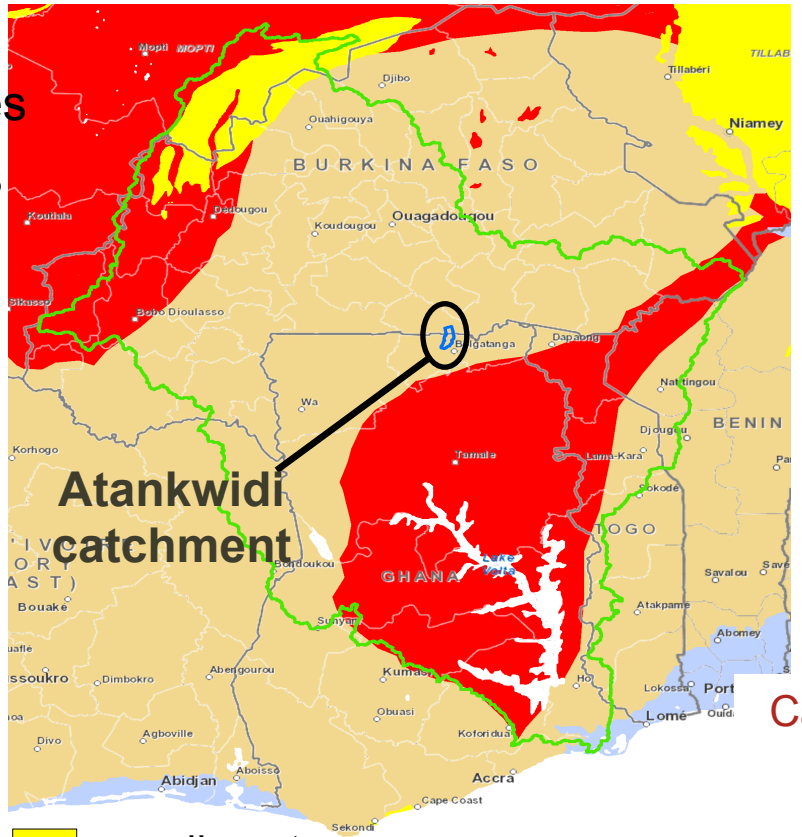
National & Local Context

Case study areas:

8 focus communities

2 study catchments

4 sites linked to Rainwatch

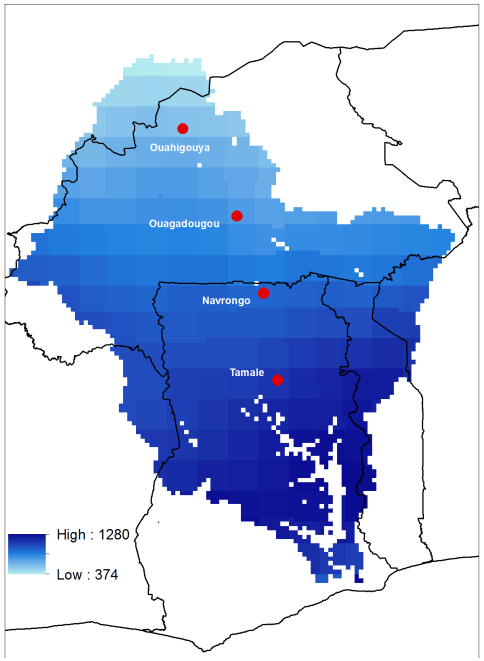


sedimentary

weathered & fractured

fractured

Average annual rainfall



Case study area links include:

- BRACED
- GroFutures?
- AMMA-2050 (FCFA)
- WASCAL?

WP1: Understanding Vulnerability - Past, Current and Future

WP2: Understanding Policy Context and Changing Socio-Ecological Environment

WP3: Improving Understanding of the Hydroclimate

WP4: Improved strategic planning & adaptive capacity

WP5: Delivering evidence & Demonstrating Resilience

WP1: Understanding Vulnerability - Past, Current and Future

- **WP1.1** Large-scale mapping of GW supply vulnerability to climate variability
- **WP1.2** Baseline assessment of susceptible communities
  - Coping capacities to the impacts of climate variability
  - Local level engagement
  - 8 baseline communities – stratified selection
- **WP1.3** Generation of vulnerability indices and livelihood impact metrics to track changes to livelihoods and food security
  - indices

WP2: Understanding Policy Context and Changing Socio-Ecological Environment

- **WP2.1** Understanding political economy and governance structures
  - Identifying decision-making pathways & institutional structures
  - Assessing how power flows through the culture, politics, and society
  - Examining how perceptions & decisions around environmental challenges are made for water sector
- **WP2.2** Enabling stakeholders by bringing together policy processes and community-based knowledge using:
  - Learning alliance platform
  - Innovative dialogue approaches e.g. games

WP3: Improving Understanding of the Hydroclimate

- **WP3.1** Data collection
  - Comprehensive instrumentation of two study catchments
  - Improving conceptual understanding of physical system
- **WP3.2** Enhancement of the model system
  - Incorporating additional processes currently poorly simulated e.g. transpiration by deep-rooted plants and soil bypass flow
- **WP3.3** Sensitivity Analysis/Trends & Co-development of scenarios (→ WP4)
  - Based on new FCFA high resolution climate model simulations
  - Investigating the resilience of well yields in the context of environmental and societal change

WP4: Improved strategic planning & adaptive capacity

- **WP4.1** Produce innovative regional maps for planners of GW supply reliability & potential (from WP1/WP3)
  - Supporting strategic national-scale planning
  - Through knowledge exchange and scenario planning workshops
- **WP4.2** Developing integrated seasonal planning tools at a local scale
  - Linked to “real-time” groundwater conditions to assess developing drought
  - Accessible products for communities and stakeholders use
  - Awareness of sustainable adaptation pathways
- **WP4.3** Stakeholder Information on Current Groundwater Resource Status

Burkina Faso, Jan2014

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RWX: end Nov 2014

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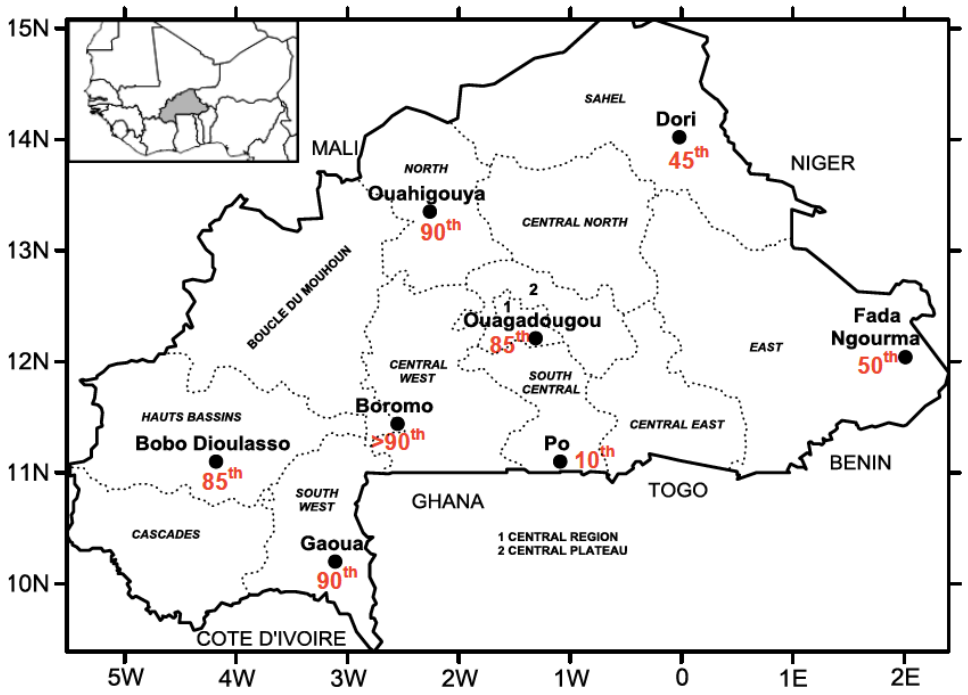
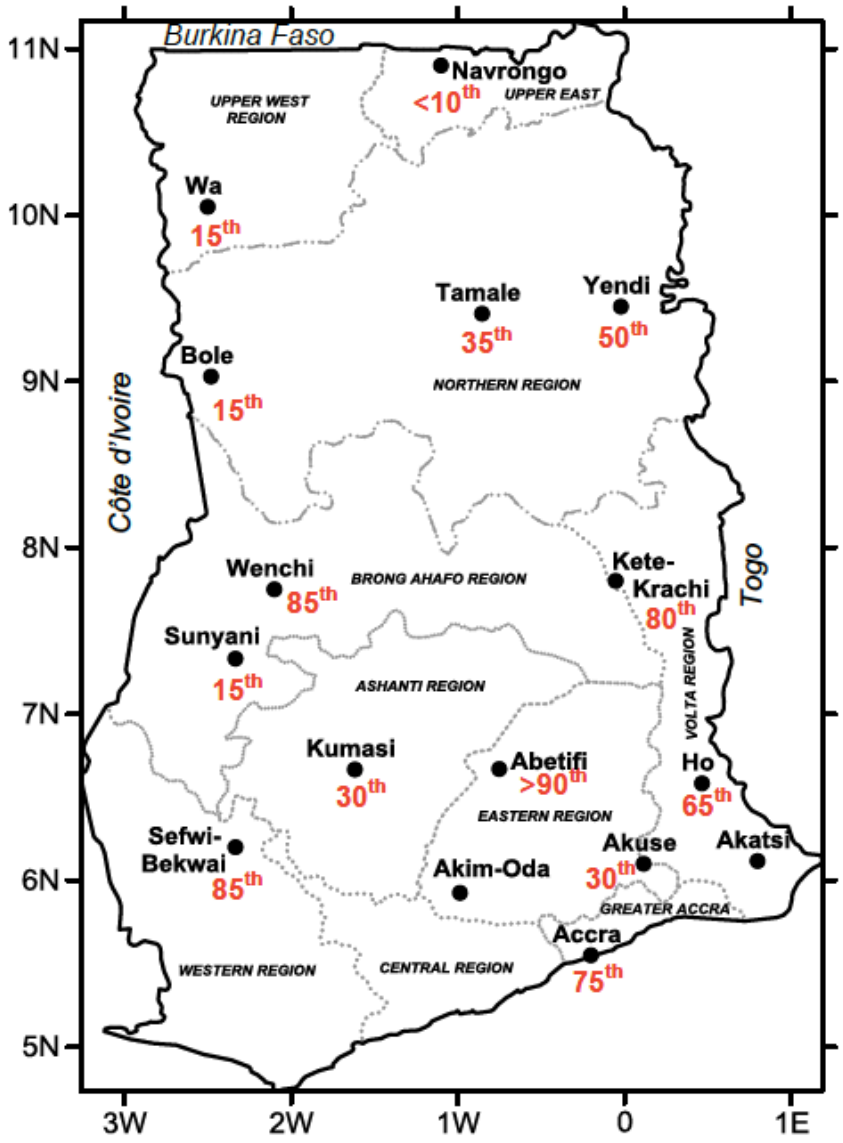
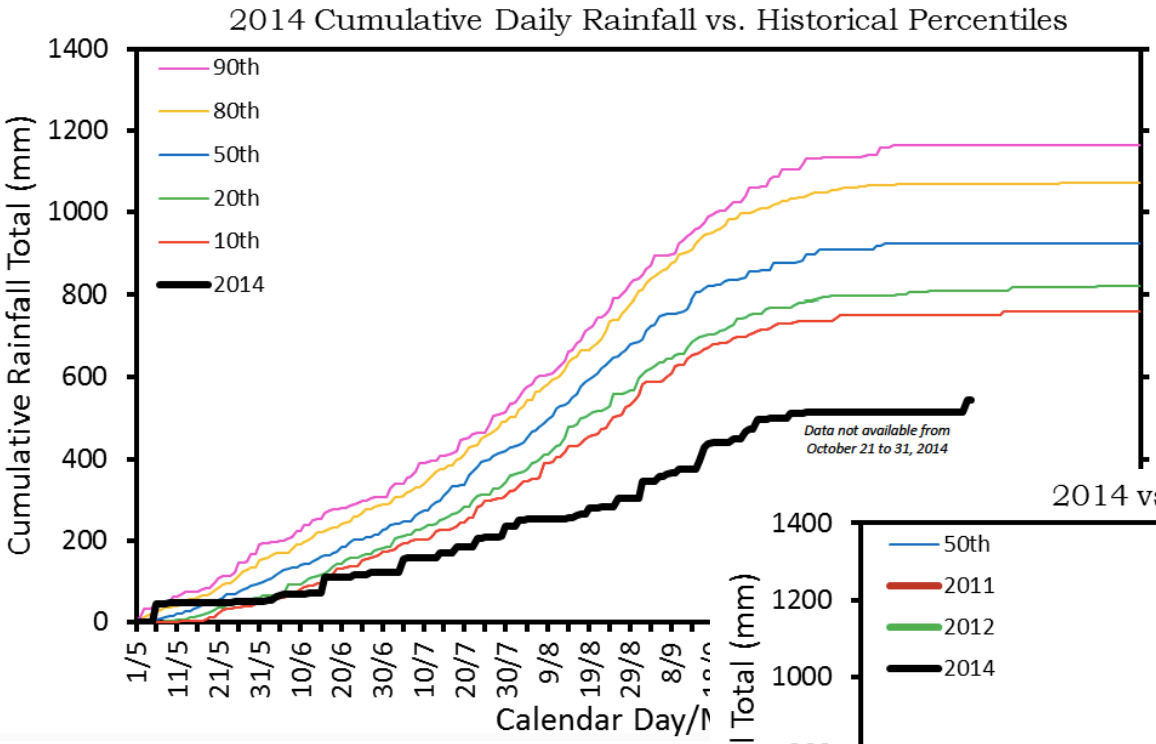


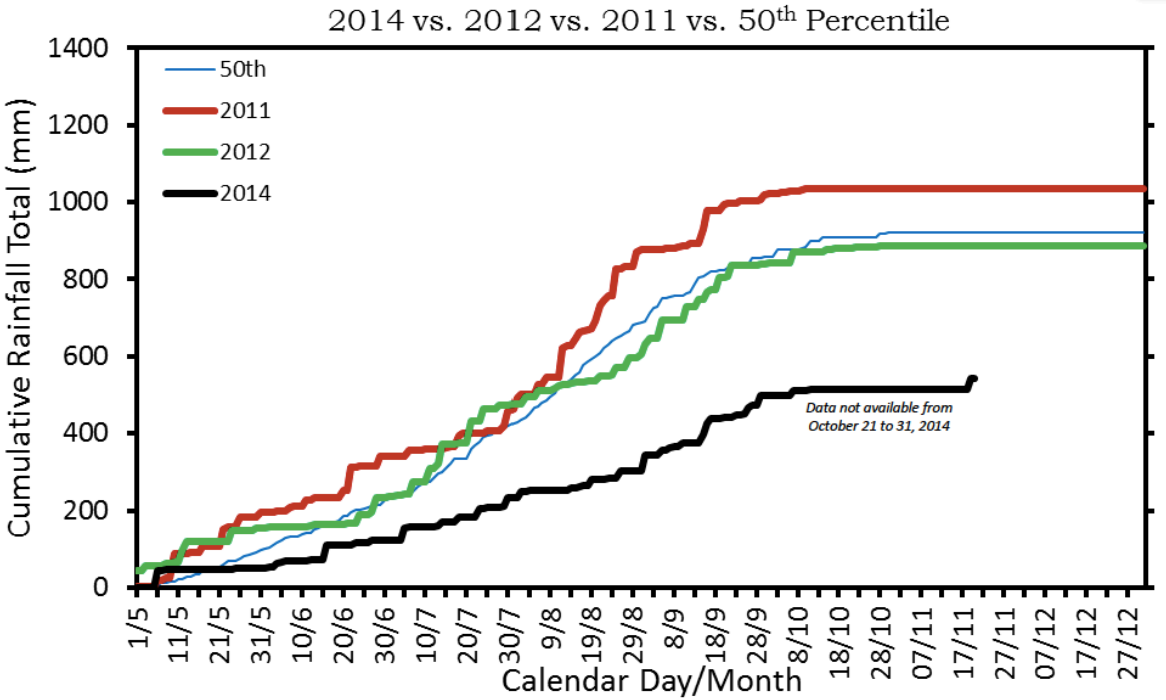


Example plots from Rainwatch-AfClix

RWX: end Nov 2014



Navrongo, Ghana



Example plots from Rainwatch-AfClix

WP5: Delivering evidence & Demonstrating Resilience

- Pilot groundwater planning tools including:
  - Community capacity building through citizen science network & implementing partner NGOs
  - Integrating BRAVE2 products on operational Rainwatch-AfClix system
  - Radio campaign & training
  - Partnership building with range of stakeholders – ownership of tools
- Monitor livelihood outcomes for 2016/17 seasons (WP1)

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LORNA YOUNG FOUNDATION
LOUDER THAN WORDS

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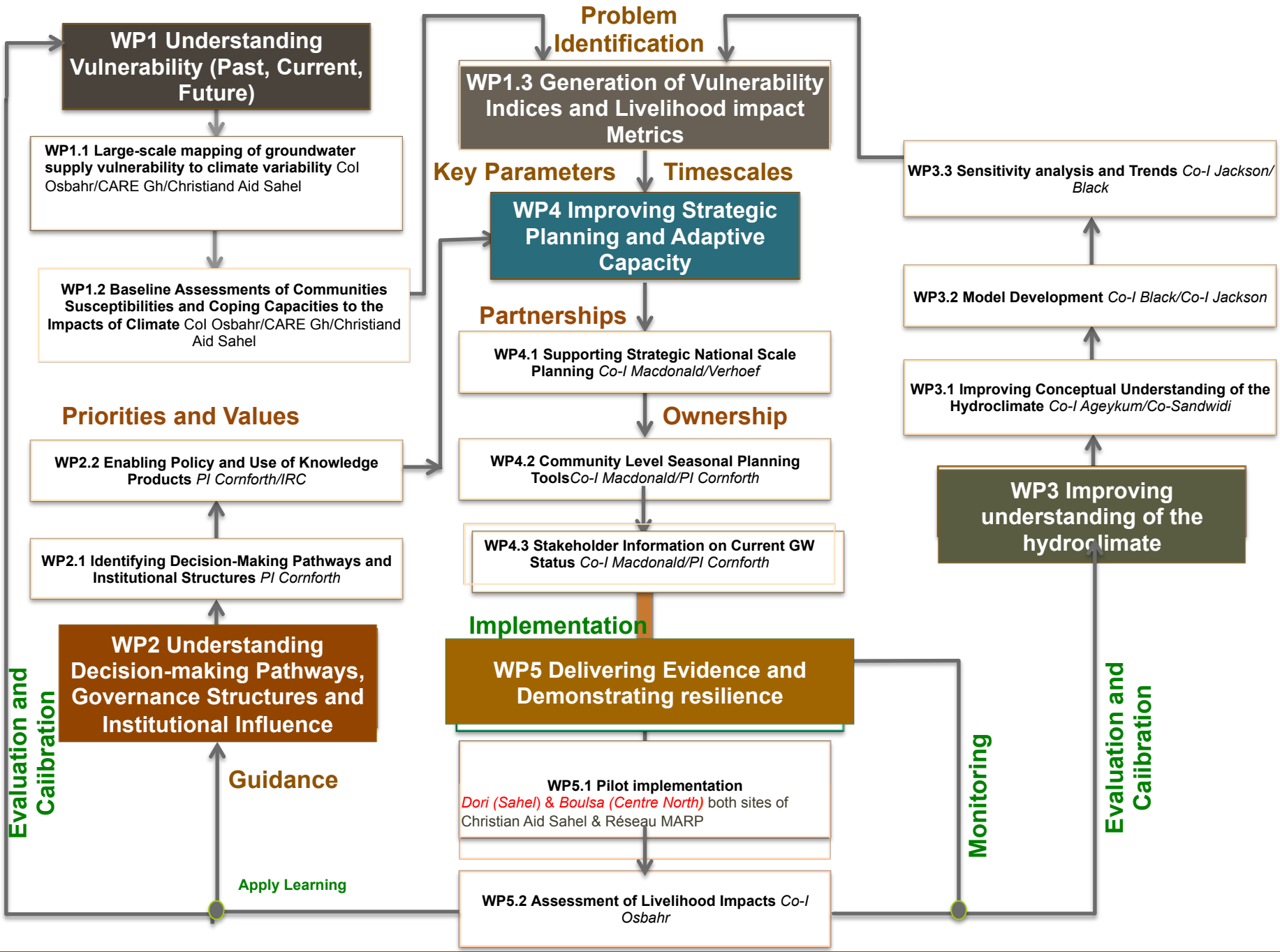
Lorna Young Foundation - BRAVE2 Partners

- Aims to alleviate poverty of smallholder farmers through improved yields, quality and trading partnerships.
- Provide training through radio, SMS, farmer field listening groups and Multi-stakeholder platforms.
- Focusing on climate change, food security, markets, agricultural calendar, weather & sustainable land management.

DRC – North Kivu
Mali Shambani

- Audience 1 million on Radio Graben
- Target 10,000 women cocoa farmers
- Original Beans, Organisation Nationale du Café/ Cacao, Agronomists - Catholic University in Beni.

www.afclix.org/Brave



BRAVE2 Project Structure and Information Flow

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	BRAVE2 ACTIVITY	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1	2018 Q2	2018 Q3	2018 Q4
WP1	*Understanding Past, Current and Future Vulnerability*																
	WP1.1 Large-scale mapping of GW supply vulnerability to climate variability																
	WP1.2 Baseline assessments of community susceptibility and coping capacity to the impacts of CV																
	WP1.3 Generation of vulnerability indicies and livelihood metrics																
WP2	*Understanding Decision-making Pathways, Governance Structures and Institutional Influence*																
	WP2.1 Identifying decision-making pathways and institutional structures																
	WP2.2 Enabling policy and use of knowledge products																
WP3	*Improving Understanding of the Hydroclimate*																
	WP3.1 Improved conceptual understanding																
	WP3.2 Model development																
	WP3.3 Sensitivity analysis and trends																
WP4	*Promoting Adaptive Capacity*																
	WP4.1 Supporting strategic national-scale planning																
	WP4.2 Community-level seasonal planning tools																
	WP4.3 Stakeholder information on current groundwater resource status																
WP5	*Delivering Evidence and Demonstrating Resilience*																
	WP5.1 Pilot implementation																
	WP5.2 Assessment of livelihood impacts																

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Investing in People

- New African-Northern research **partnerships** working at the forefront of research on climate, water resources and rural livelihoods with **secondments**
- Incorporates key users within Burkina Faso, Ghana and the Volta River Basin, tapping into established **networks and knowledge platforms**, facilitating capacity building **workshops**
- Obtaining required observations builds **trained observing capacity** to sustain this
- Implements a **comprehensive monitoring, evaluations & learning** programme to increase the visibility of the benefits of investments in large-scale complex interdisciplinary research

AfClix Africa Climate Exchange · University of Reading · BGS 1835 · christian aid · care · Council for Scientific and Industrial Research Ghana · Ghana Meteorological Agency · Météo Burkina · Populi Sapientia Populo

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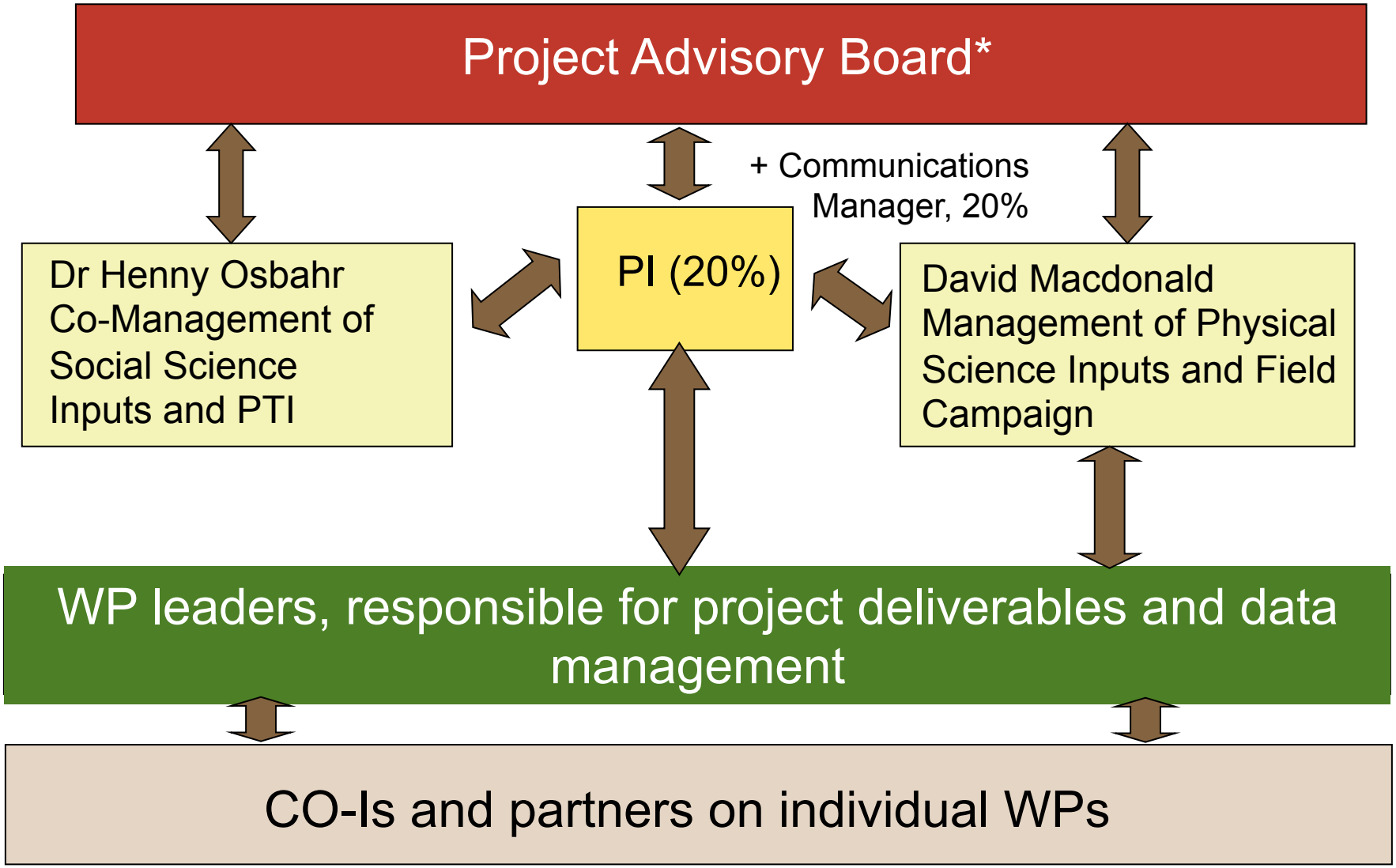
Spare Slides Follow

BRAVE2 Management Responsibilities



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BRAVE2 Priorities

Priority needs:

- Establish groundwater demand for the vulnerable areas in the project area
- Assess the impact of climate variability on the groundwater supplies
- Understand the future trends in rainfall and impact on water supply

Desired outputs:

- Groundwater planning and analysis tools
- Policy recommendations for groundwater management
- Comprehensive range of co-produced communication outp
- Capacity building for relevant stakeholders
- Access to improved climate data
- Renewed interest and responsibility taken for WRM
- Reliable groundwater resource database

"Outreach at the community level is particularly challenging …is there a possibility to exploit radio more?"

Weakest link in groundwater planning: local government-to-NGOs involved with the provision of groundwater in rural areas. District assemblies and regional coordinating councils are key implementing agencies

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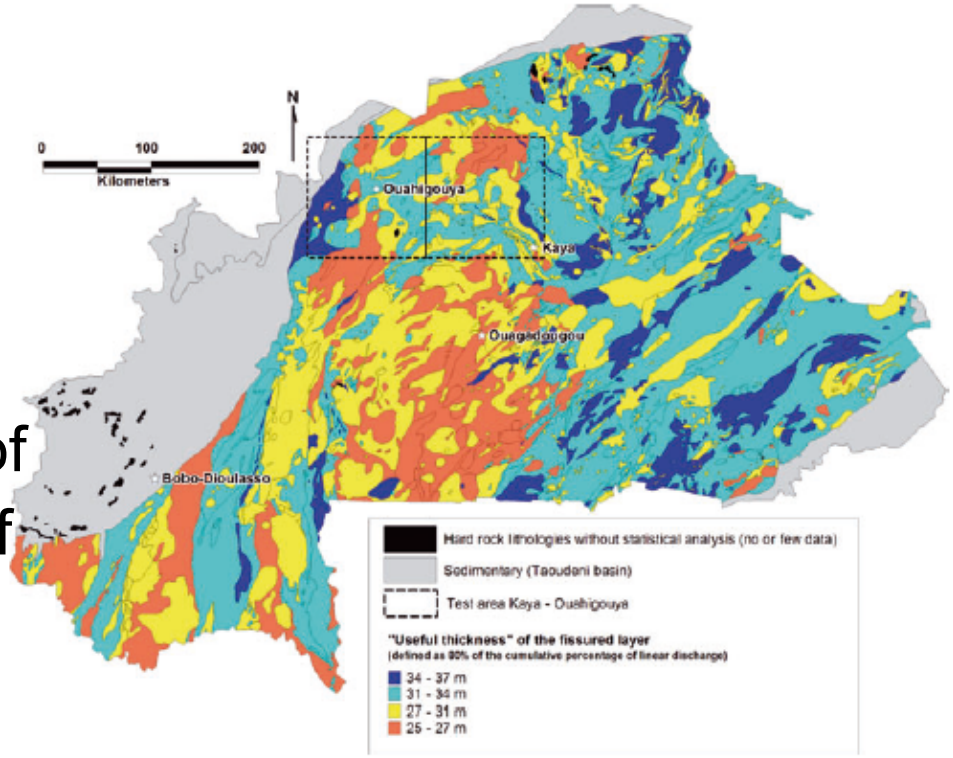
BRAVE2 Planning tools

- Regions where groundwater development needs to incorporate measures to address impacts of extended periods of low recharge
- Combining national mapping of areas at risk with monitoring of current status of resources
- Local-level advice on sustainable groundwater development



Courtois et al 2010, Ground Water

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Our BRAVE2 Partners – Lorna Young Foundation

KENYA
Dhahabu Ya Murimi

- Audience 4.5 million on Coro FM
- Target 500,000 coffee farmers
- Dormans, CMS, Coffee Research Foundation & Central Kenya Coffee Mills.

DRC – North Kivu
Mali Shambani

- Audience 1 million on Radio Graben
- Target 10,000 women cocoa farmers
- Original Beans, Organisation Nationale du Café/ Cacao, Agronomists from the Catholic University in Beni.