

# Earth Observation Potential to Support Africa's Strategic Water Resources Management Needs



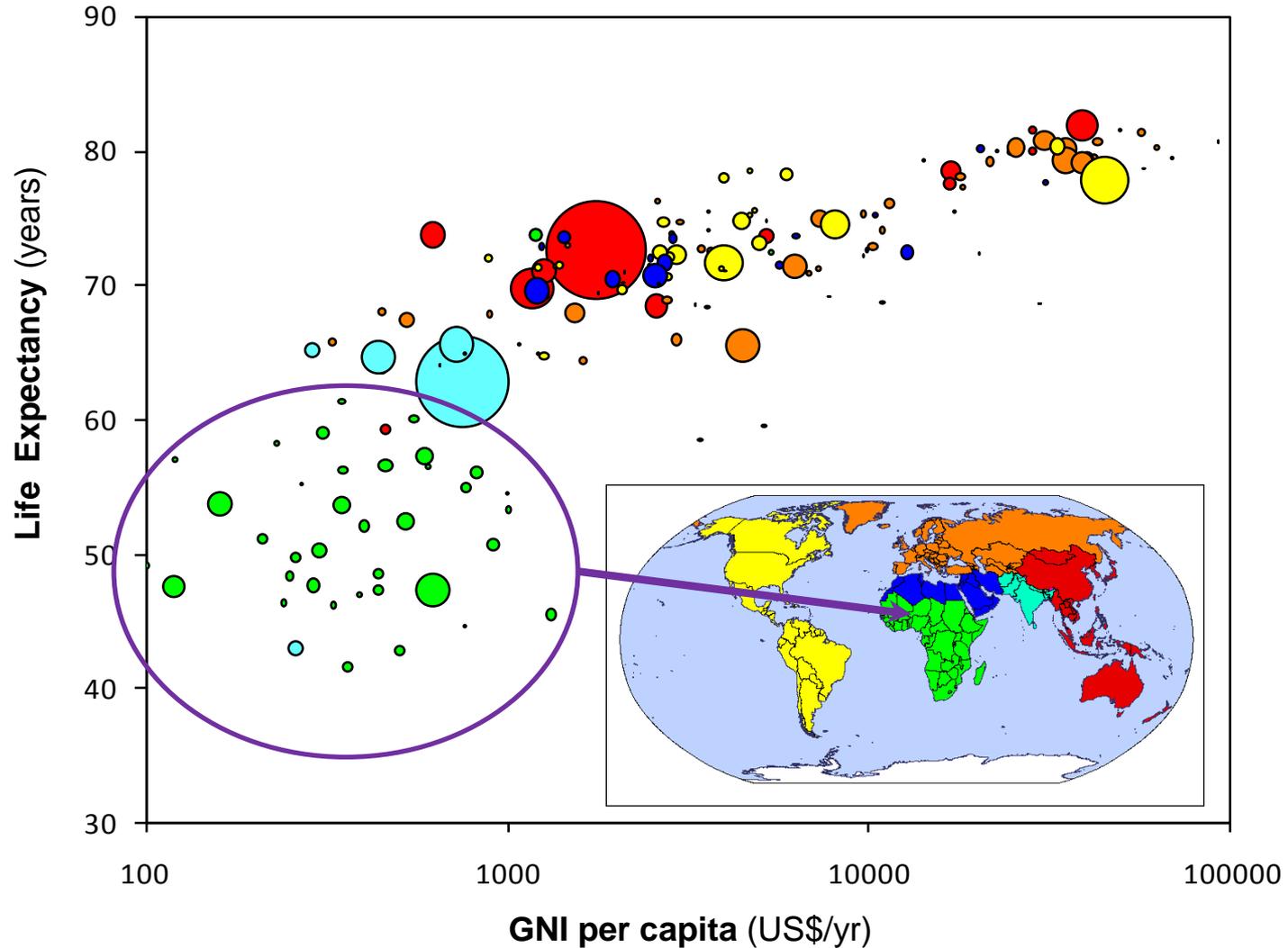
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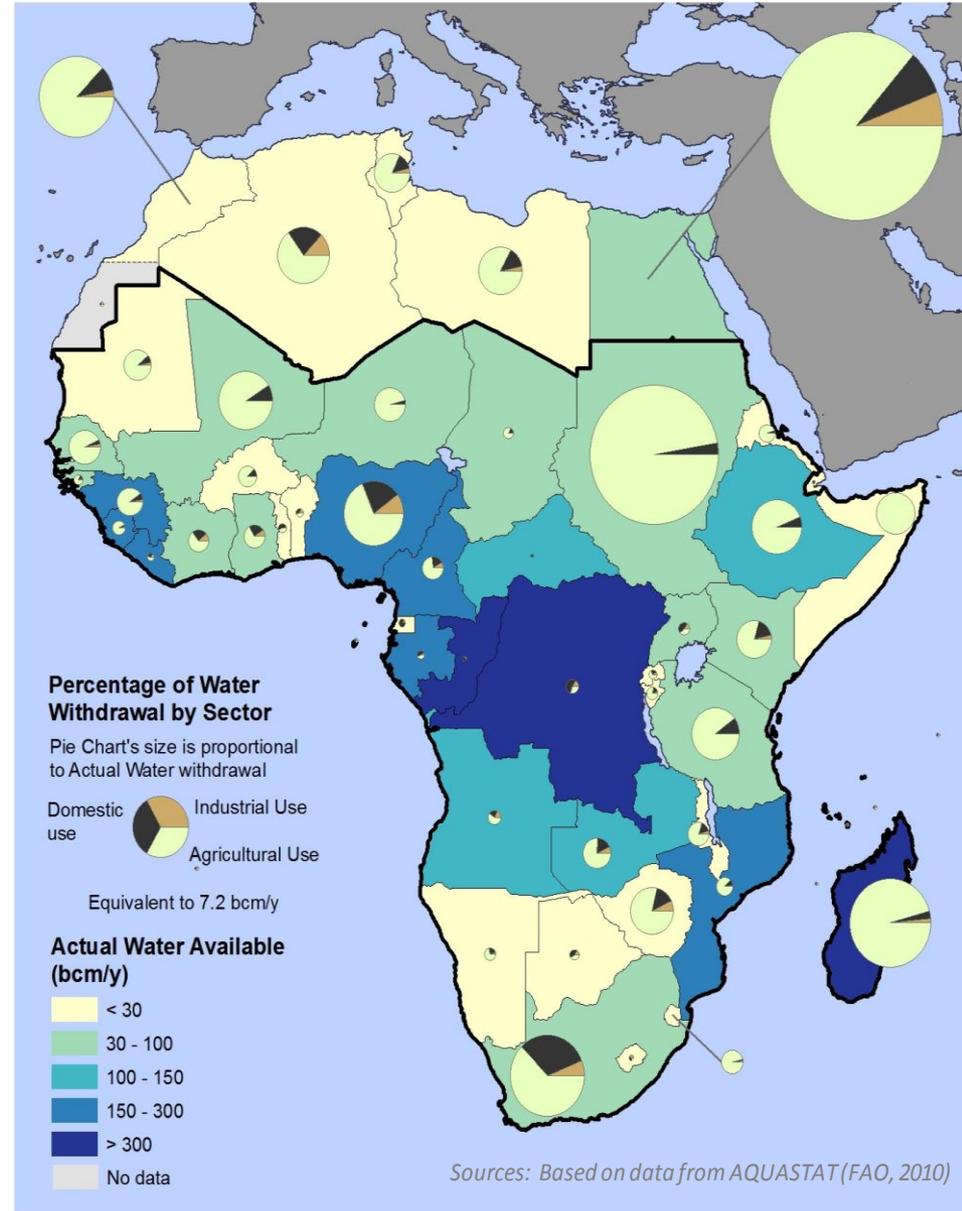
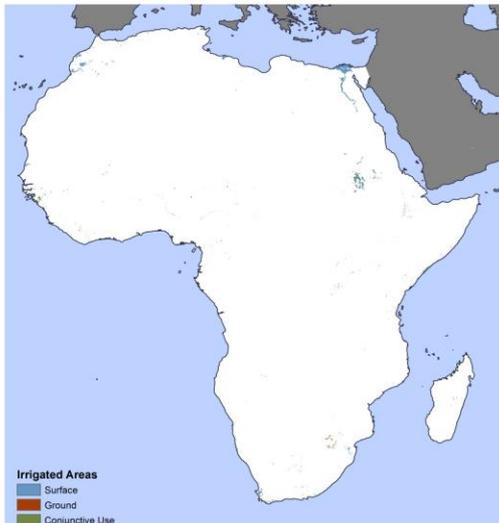
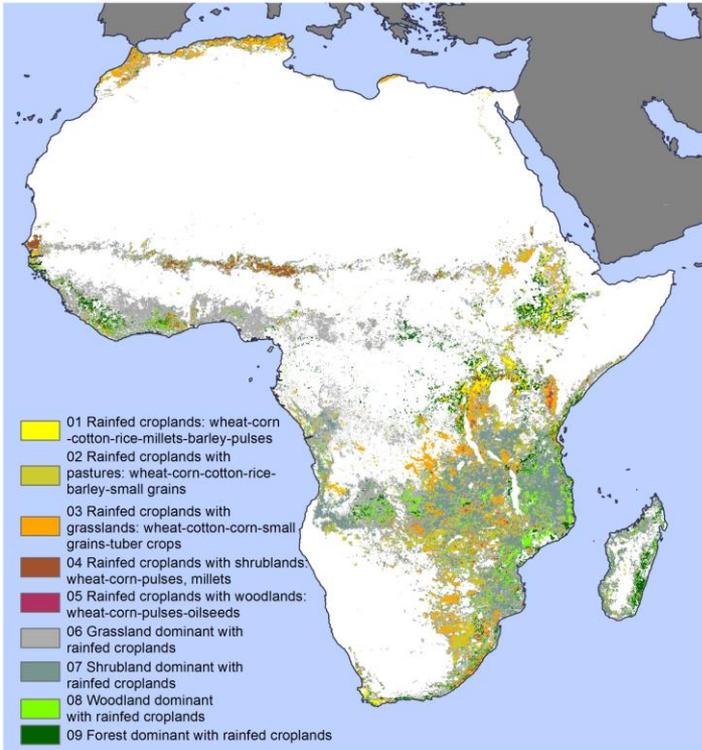
**Presentation at SDN Training Days  
US Govt. – WB MOU: Remote Sensing Aspects  
February 29, 2012**

# Africa faces many development challenges...

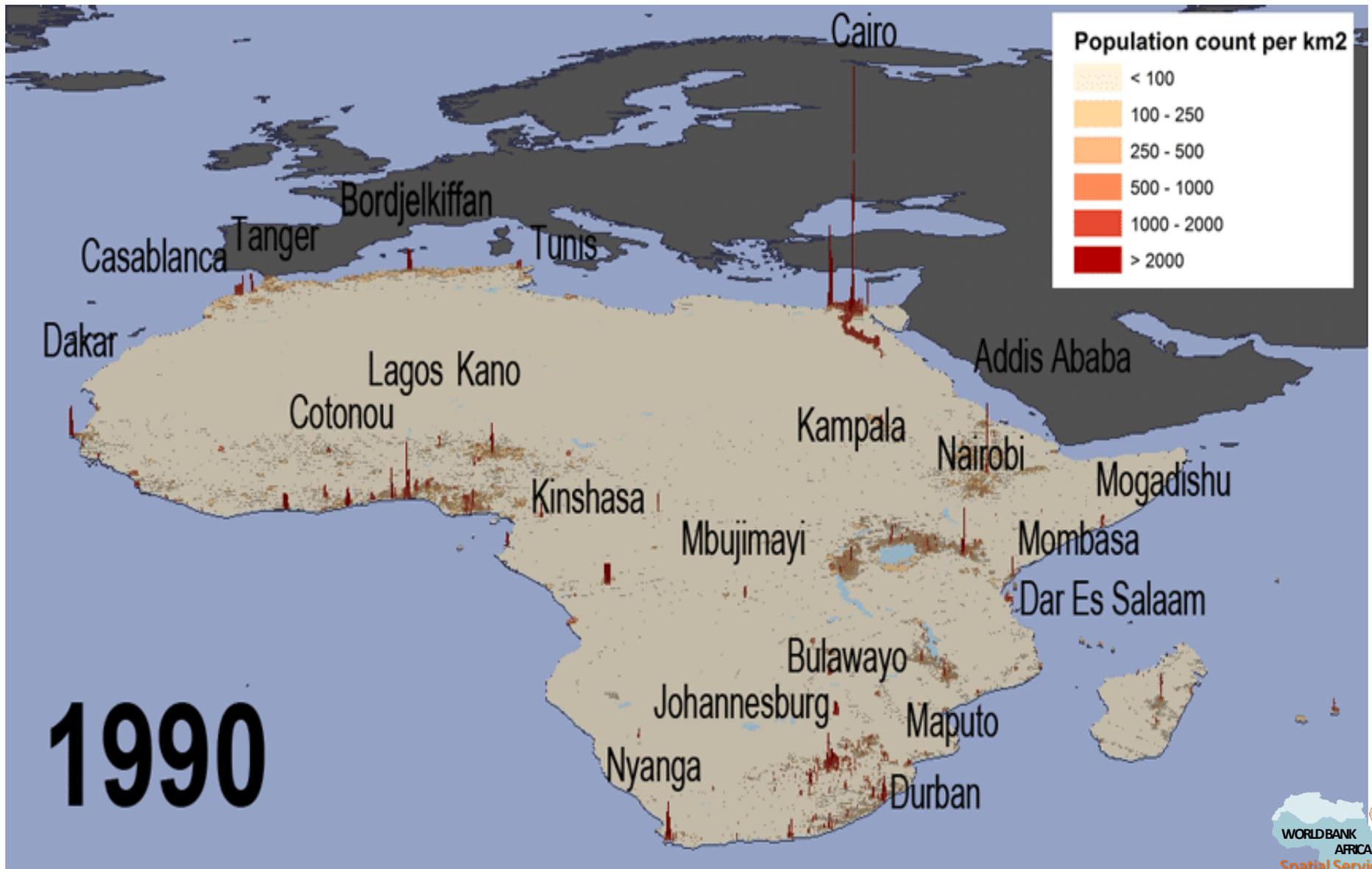


# Africa faces many development challenges...

## Agriculture

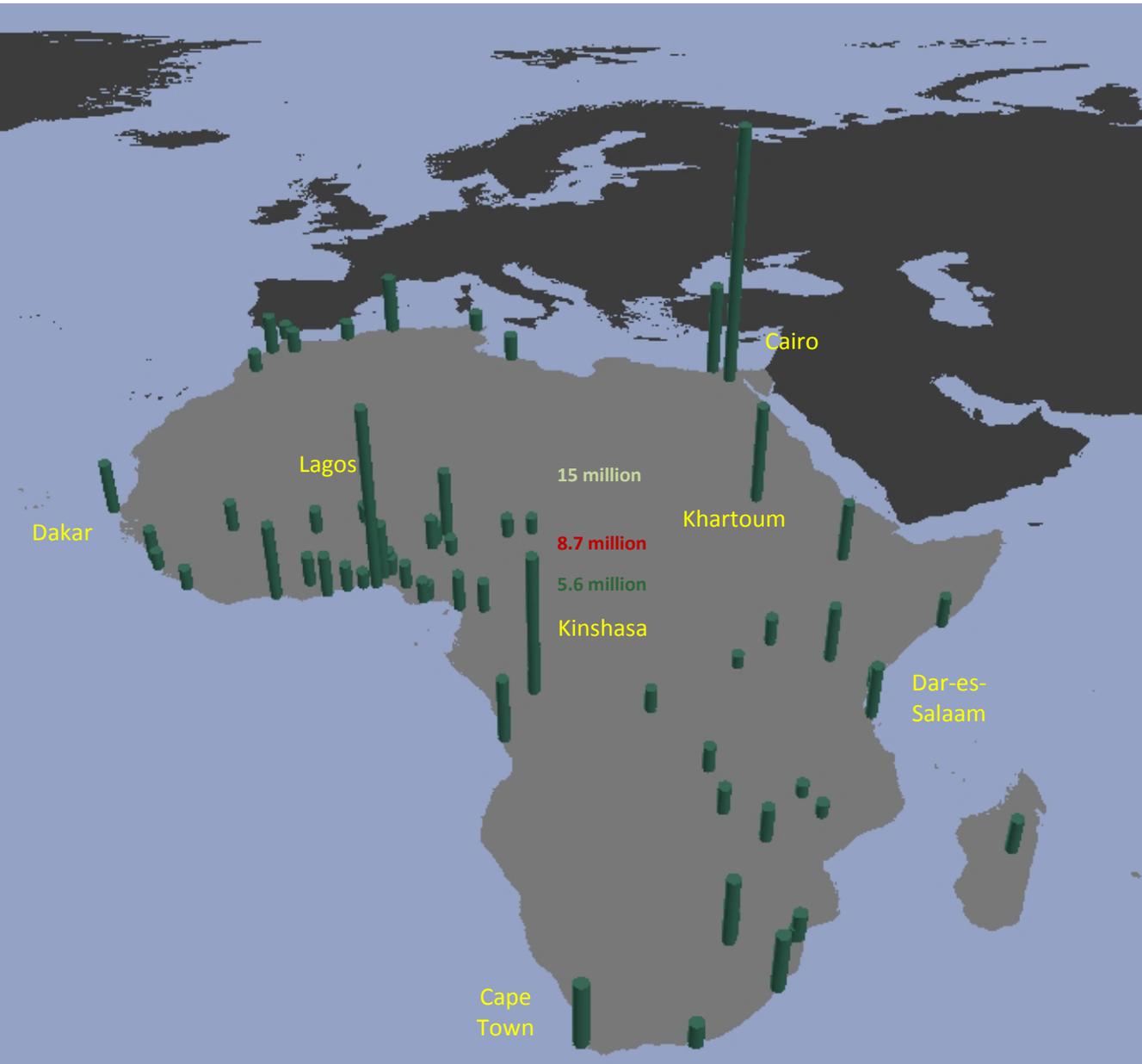


# Population pressures are growing...



Data Sources: GPWv3 (CIESIN and CIAT, 2005)

# Africa is getting quickly urbanized with large cities growing rapidly...

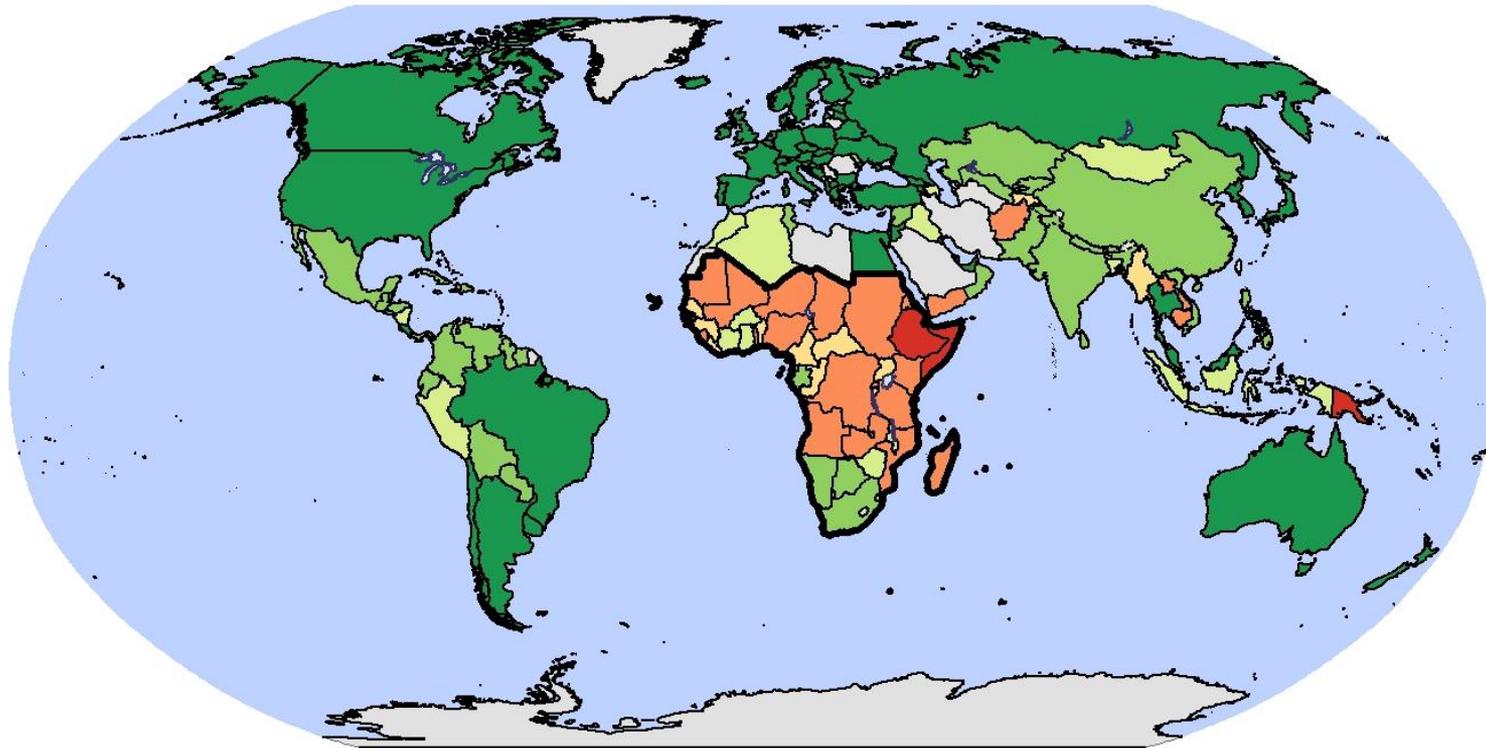


- Addnl. population in 2025
- Addnl. population in 2010
- Population in 2000

Data Source: UN Agglomerations Population Data

# Africa faces many development challenges...

Need to improve access to water supply...



Access to an improved water source in % of total population (in 2005-2009)

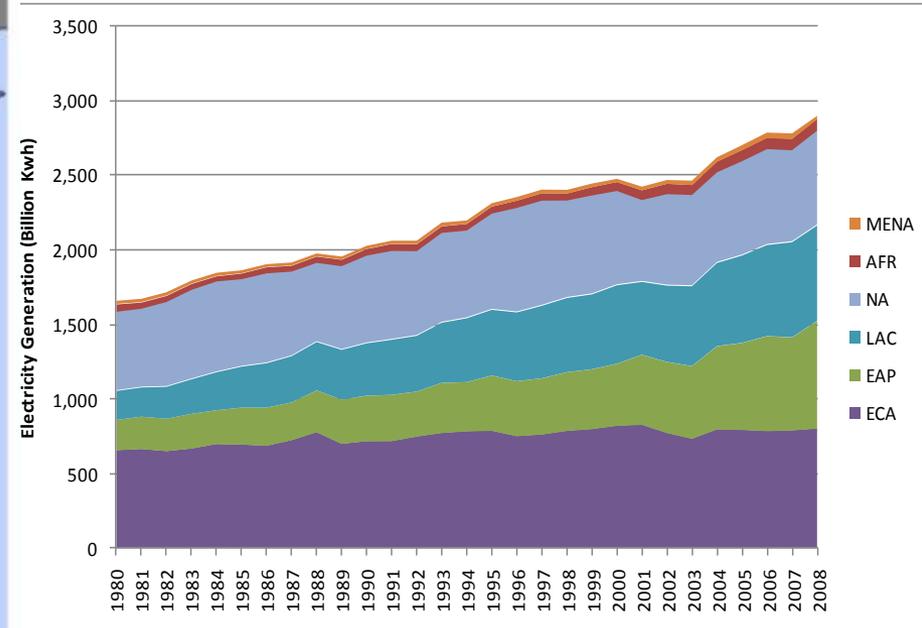
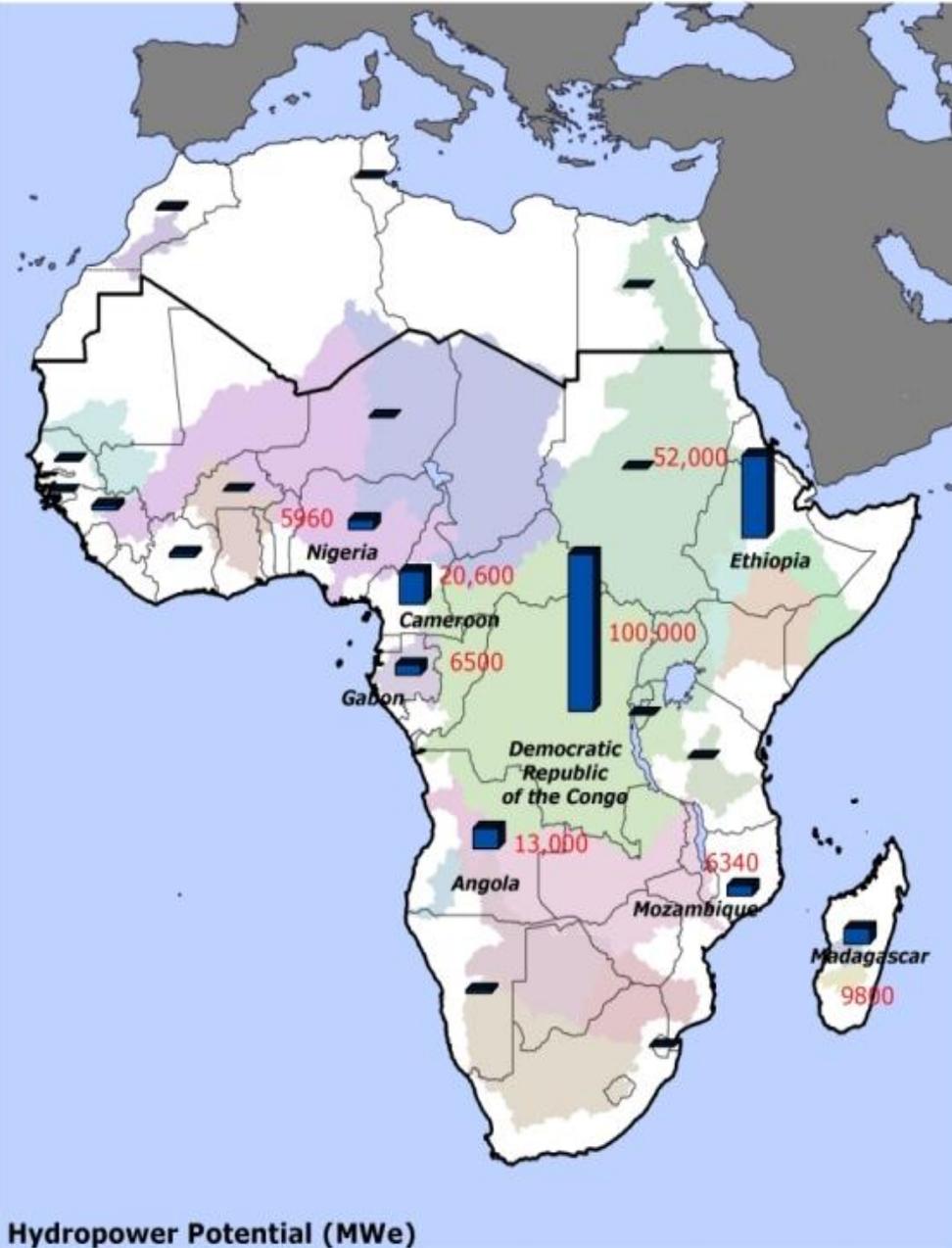


**Below world average (85.8%)**

Data Source: Improved water source (WHO and UN Children's Fund, JMP, 2009), from the World Development Indicators, World Bank database.

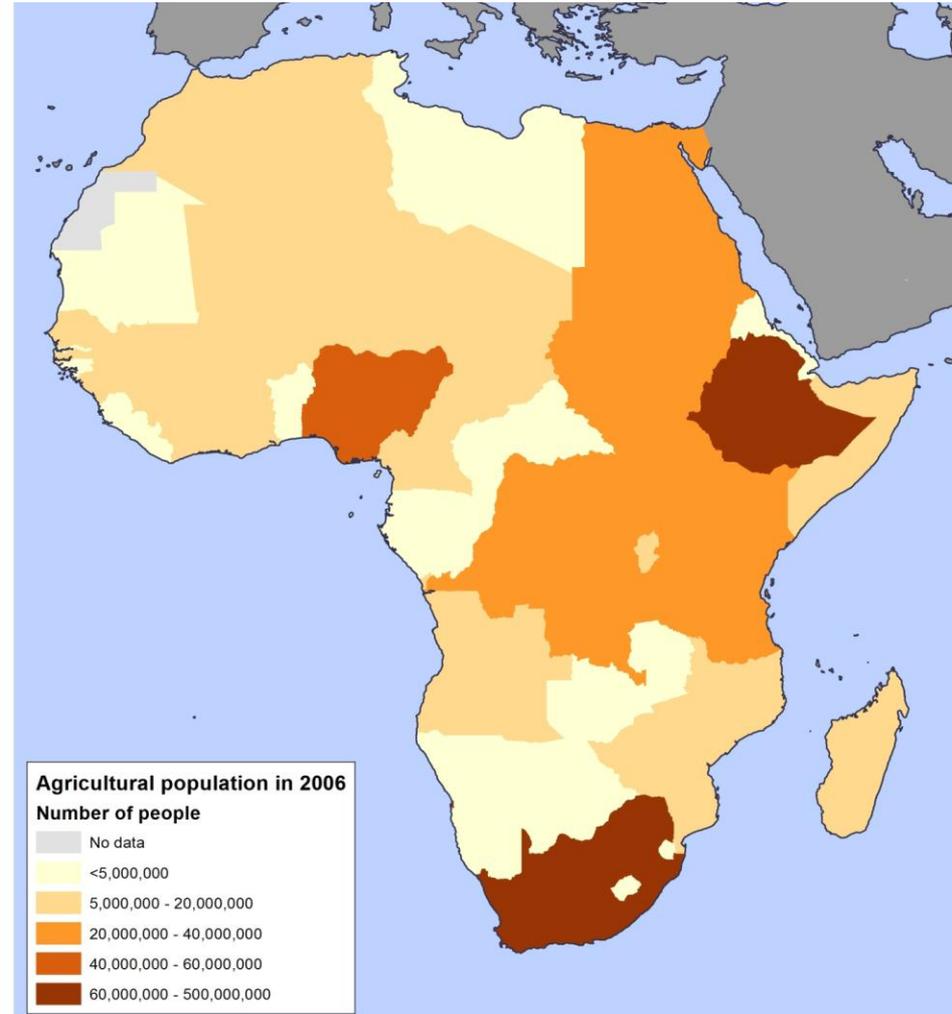
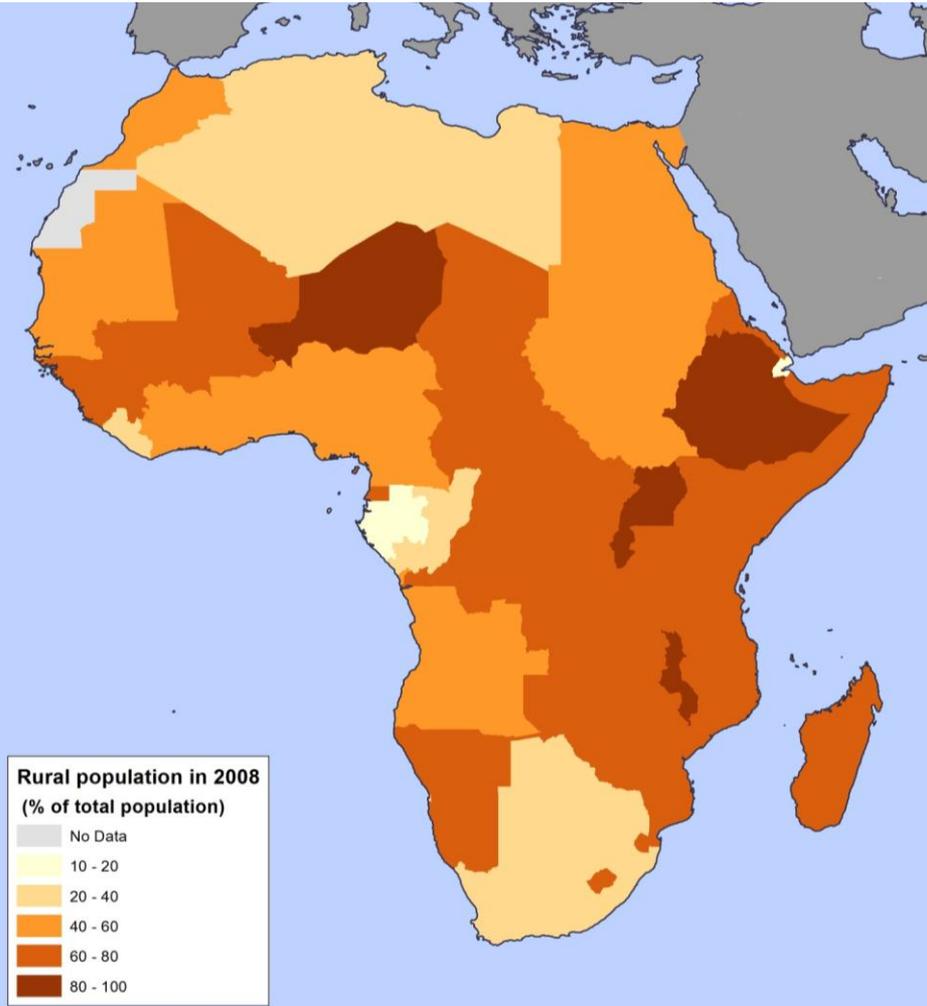
# Africa faces many development challenges...

## Hydropower



# Africa faces many development challenges...

Africans livelihoods are still largely agricultural...



# World Bank Water-Related Support for Africa

## Information:

- Knowledge Base
- Monitoring Systems

## Institutions

- Capacity-building (at sectoral/multi-sectoral; regional/national/local levels)

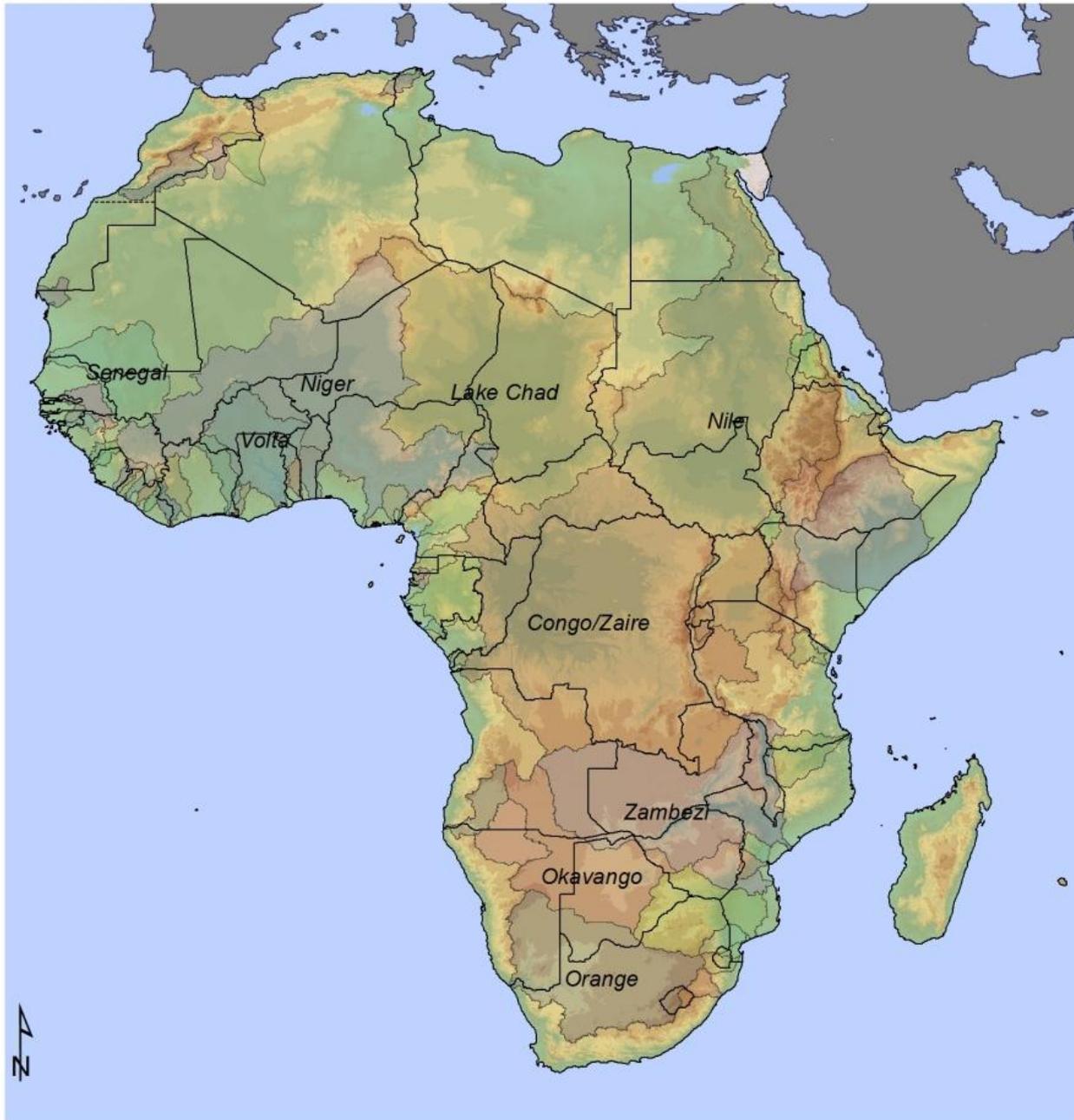
## Infrastructure

- **Water Supply and Sanitation** (Rural, Small towns, Large Urban)
- **Agriculture** (Rainfed, Irrigation)
- **Storage and Hydropower Development** (Rehabilitation, New)
- **Environment and Natural Resources Management** (Watershed Management, Water Quality, Wetlands)
- **Information Infrastructure** (Hydromet Systems, Planning and Real-time DSS)

# Water Resources Management

- Basin Planning – Knowledge Base, Analysis, DSSs
- Water Investment Assessments and Design
- Water Resources Systems operation
- Sediment/Water Quality Assessments
- Wetland dynamics
- ...

# Africa's Water Resources are primarily in International River Basins...



Mangochi

# Targeting Watershed Management Investments (e.g. Malawi Shire Basin)

**Ncheau**

**Neno**

**Zomba**

**Blantyre**

Balaka

Machinga

Nkula

Chiradzulu

Mulanje

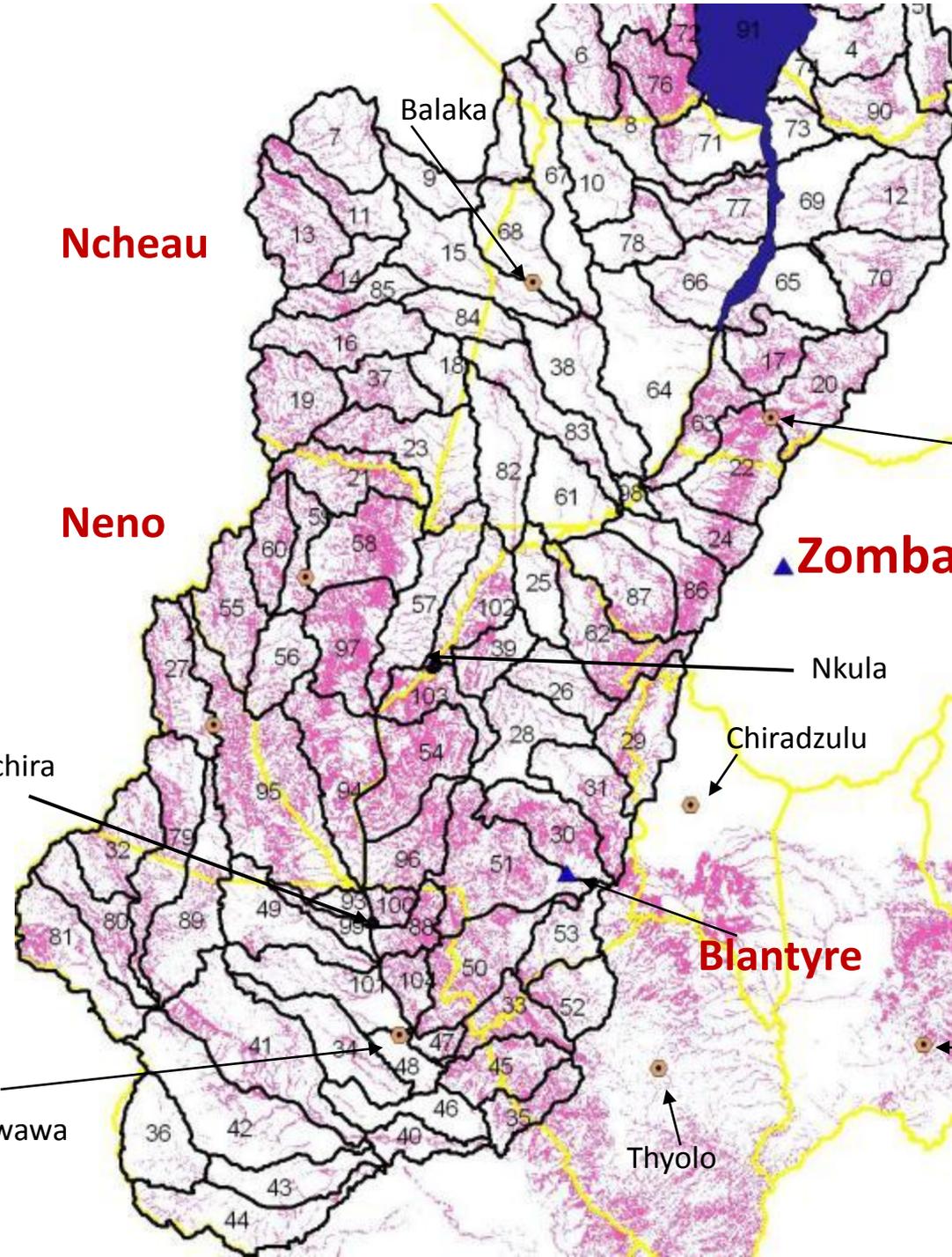
Thyolo

Kapichira

Chikwawa



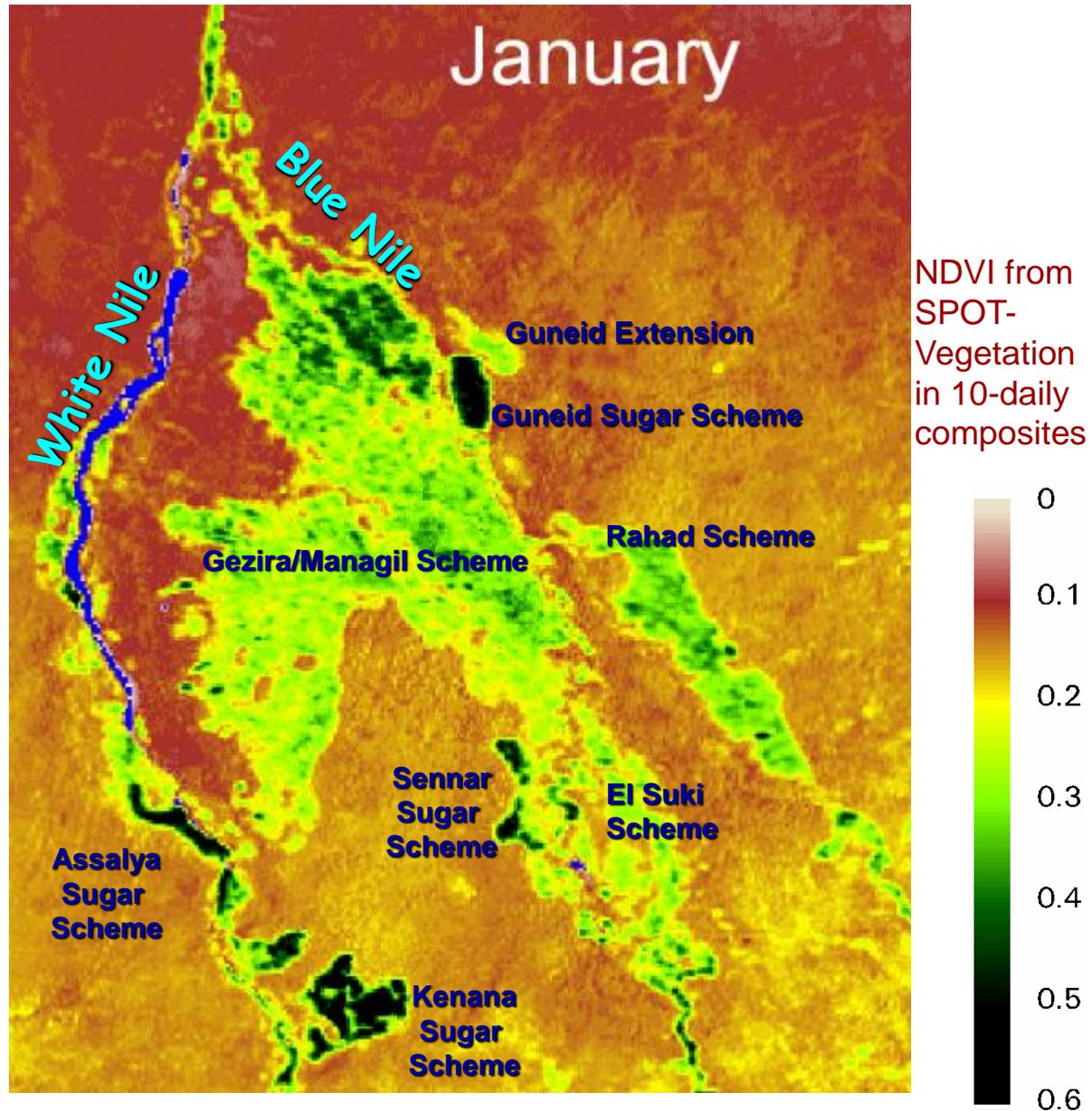
**Hotspots with soil loss > 25 t/ ha/ y**



# Agricultural Water Management

- Monitoring: Evapotranspiration (ET) monitoring, Cropping systems
- Irrigation management support
- Rainfed agriculture
- ...

# Irrigation Systems

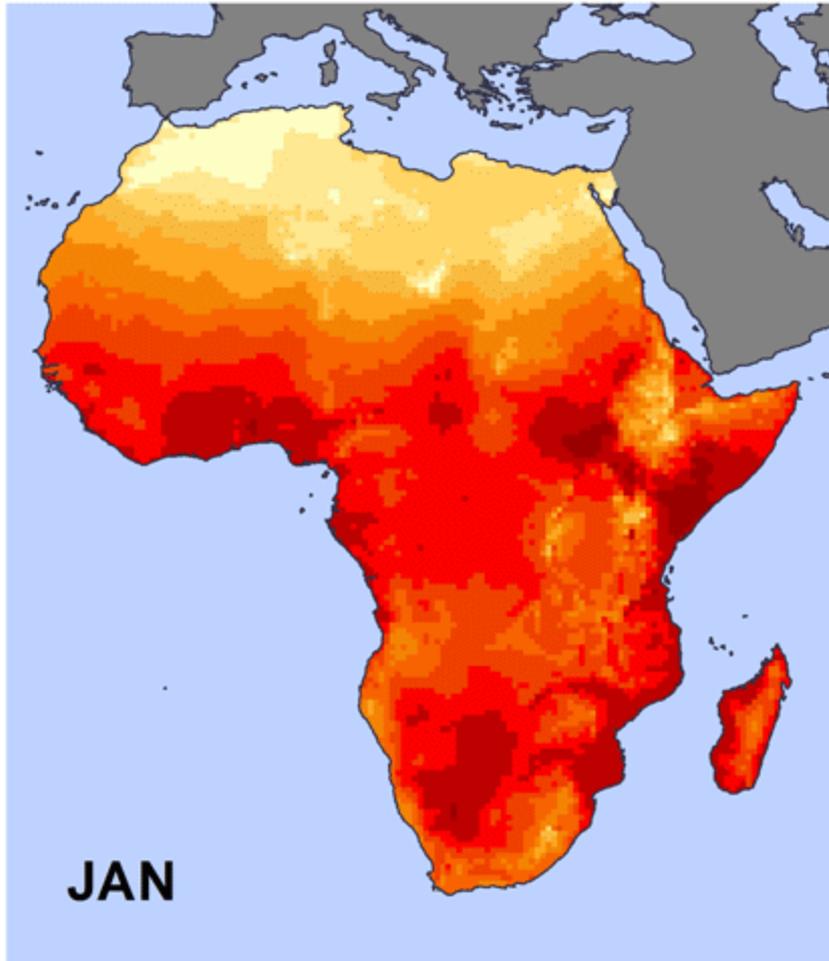


*Sudan: By WaterWatch, NL for the World Bank*

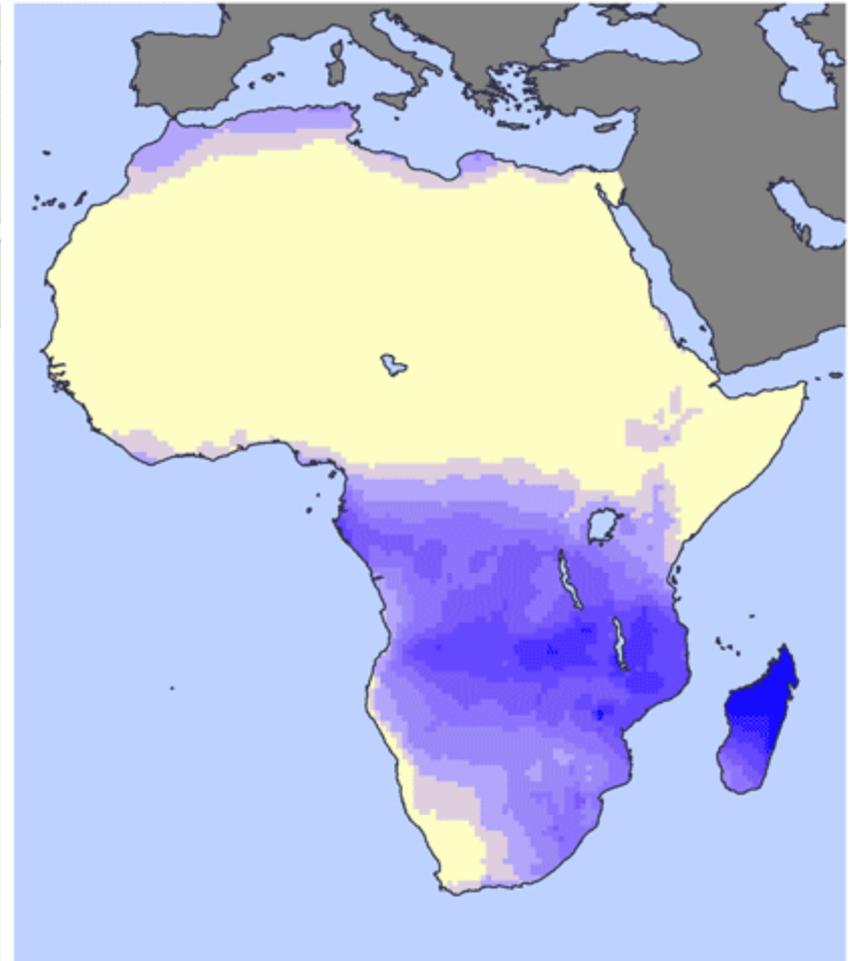
# Climate Resilience

- Real-time Monitoring & Visualization Systems
- Climate Knowledge Portals
- Disaster management (floods, droughts, storms) and early warning systems
- Climate variability and climate change mainstreaming into water resources development and management
- ...

# Africa's climate shows significant spatial and seasonal variation...



Average temperature (°C)

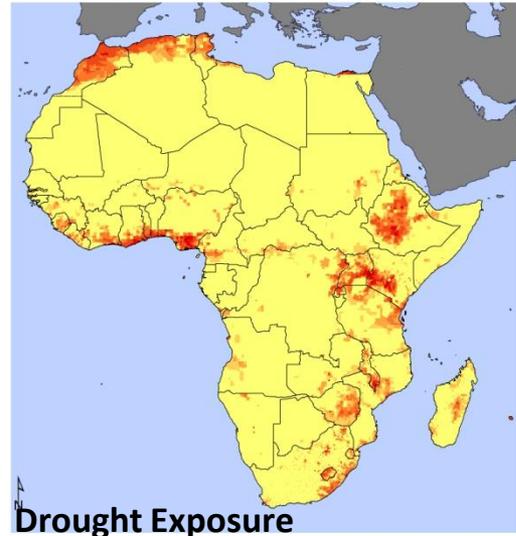


Average precipitation (mm/month)



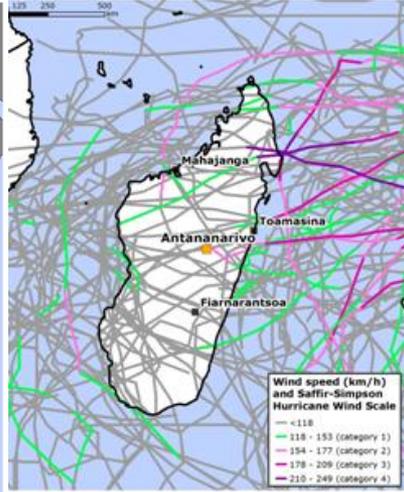
# Africa currently faces many climate risks...

Africa Union: Exposure to Droughts



Exposure to droughts  
(Average number of people exposed to droughts per grid cell per year)

0 - 25	50 - 100	250 - 1000	5000 - 150000
25 - 50	100 - 250	1000 - 5000	

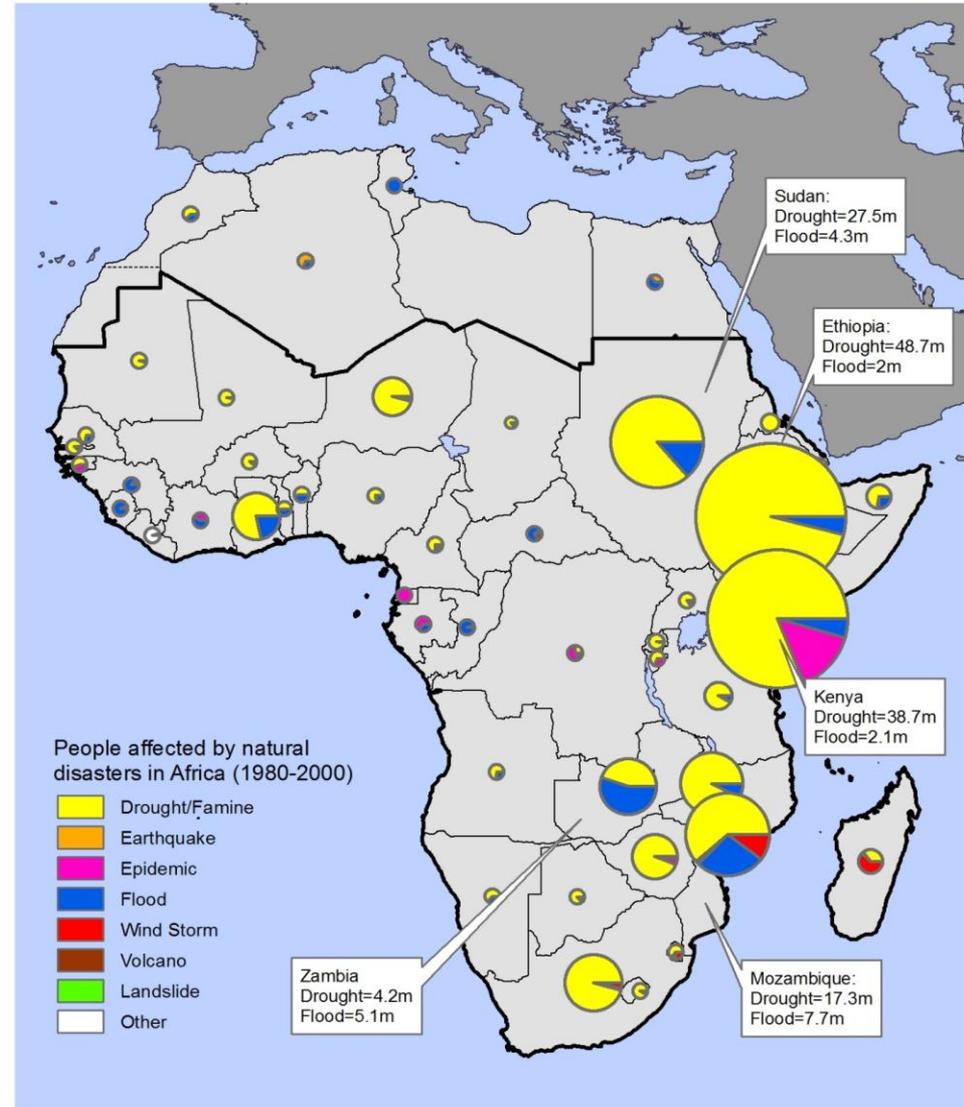


Cyclones tracks: 1980 to 2006



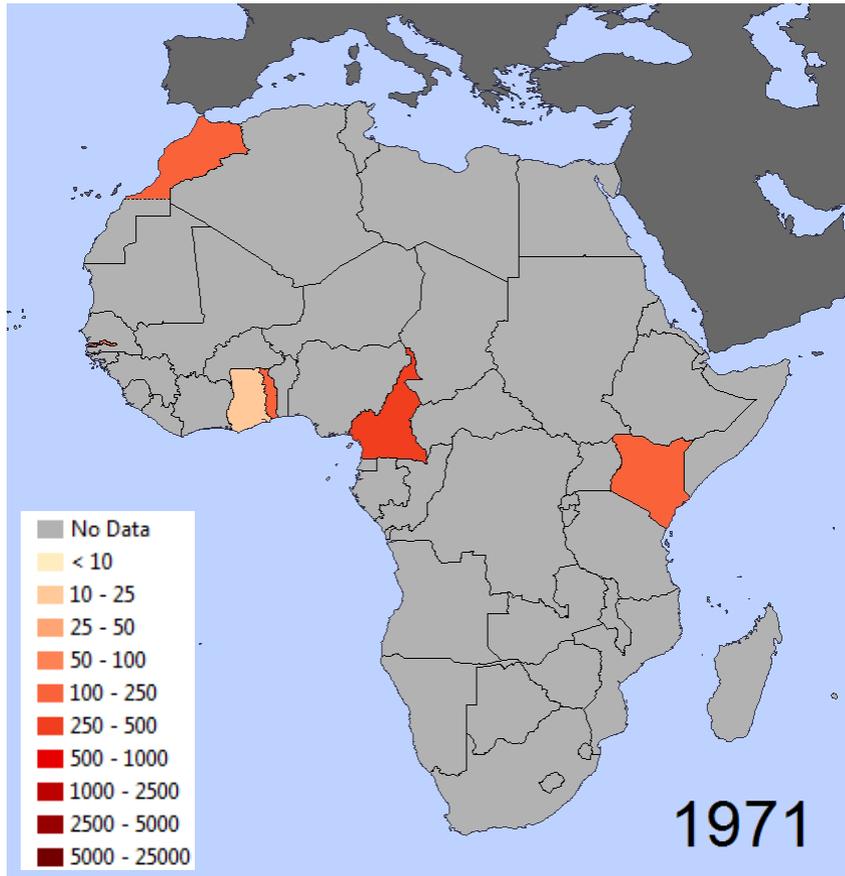
Exposure to floods  
(Average number of people exposed to floods per grid cell per year)

0 - 50	100 - 250	1000 - 5000	10000 - 70000
50 - 100	250 - 1000	5000 - 10000	

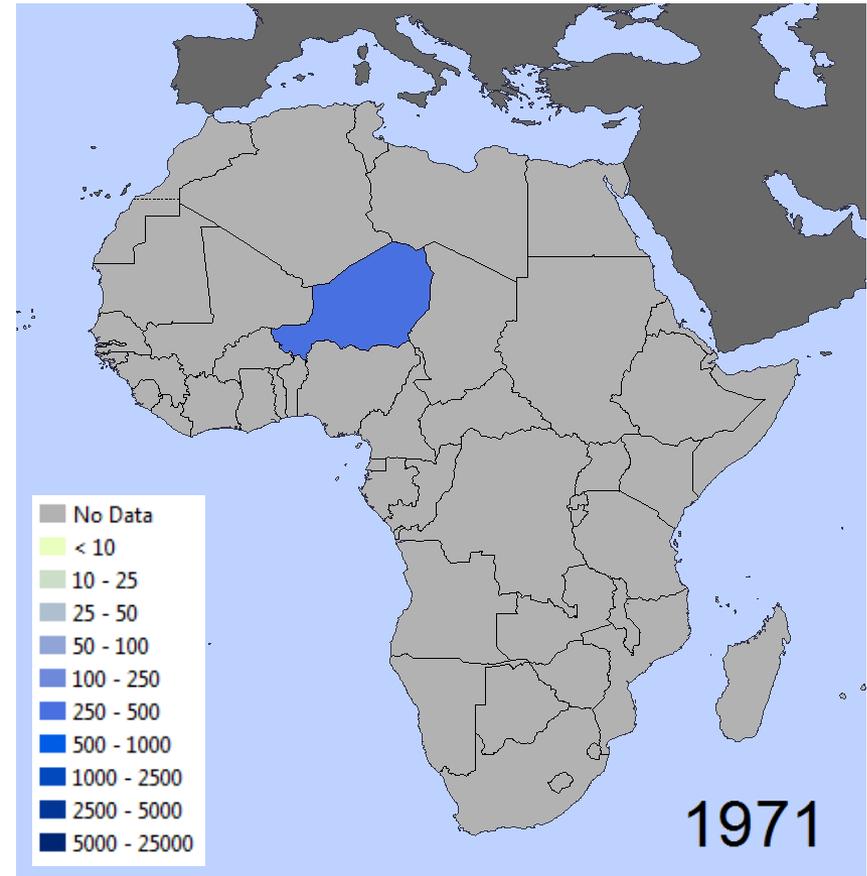


# Not a year passes... ...without some part of Africa being devastated by floods or droughts...

## Droughts



## Floods

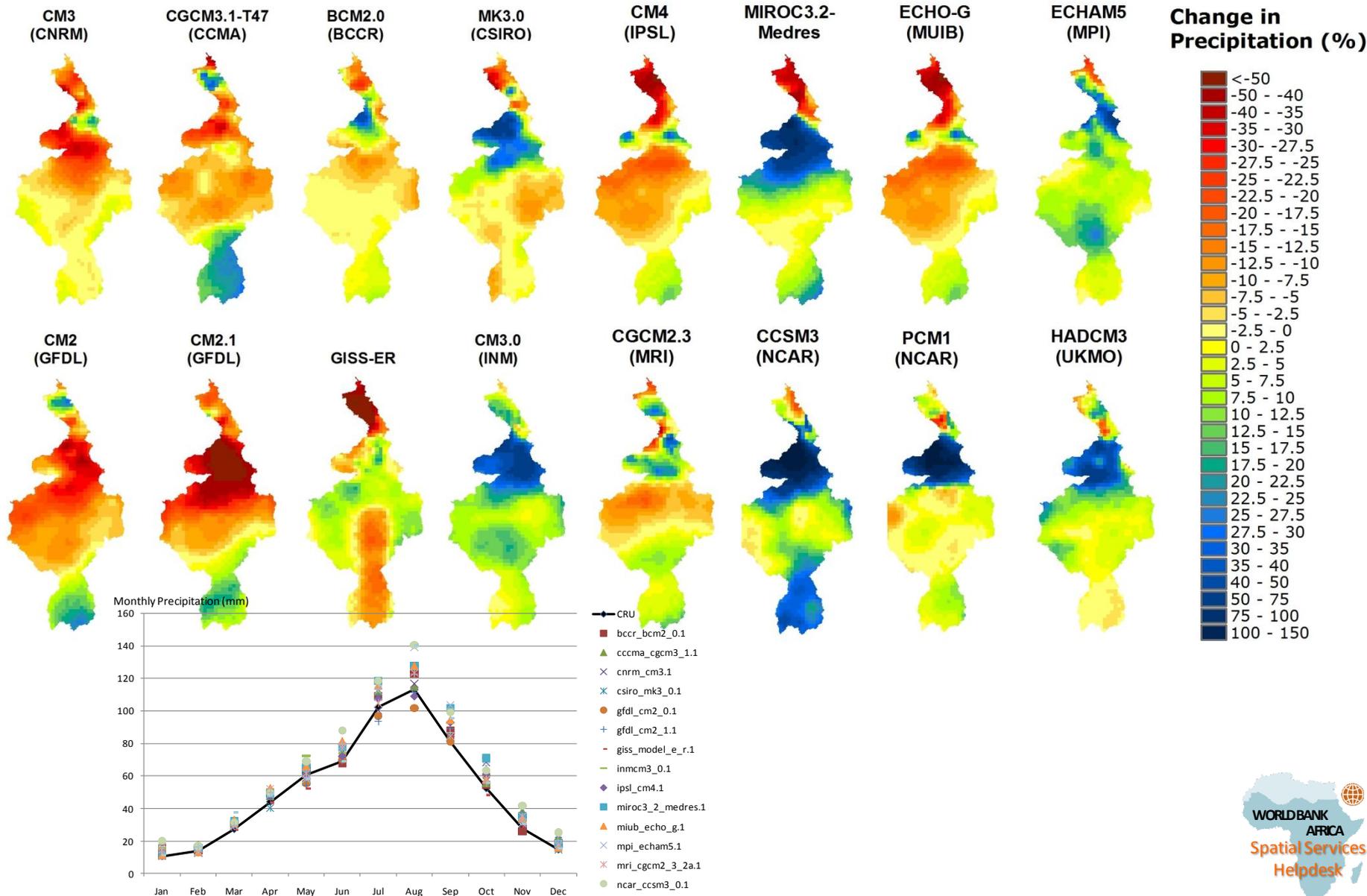


Total number of people affected annually (in thousands)

Source: World Bank AFR Spatial Services Helpdesk

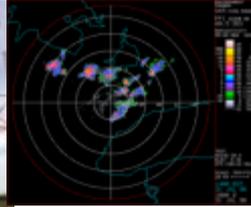
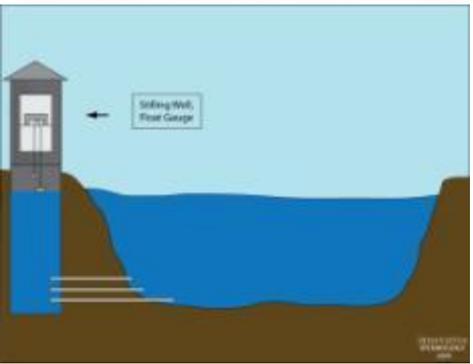
# Picking Climate Futures...P

Nile Basin - Differences between GCMs, in terms of Change in Annual Precipitation by the 2050s



# Real Time Hydromet Measurements

## *“Bottom-up” From the Ground*



Primary Source: Mark Heggli, Innovative Hydrology



# Real Time Hydromet Measurements

## *“Top-down” From Space*

27 Mar 2008 22:17:05 GMT



“Space-based Groundwater monitoring” e.g. GRACE

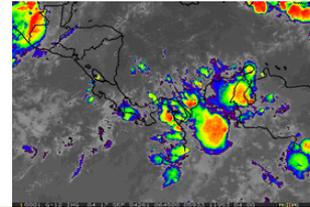
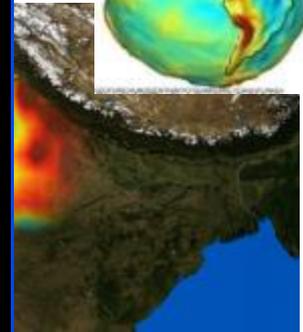
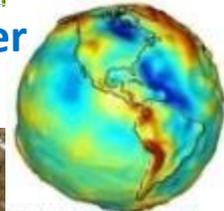
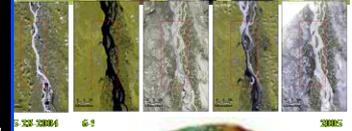
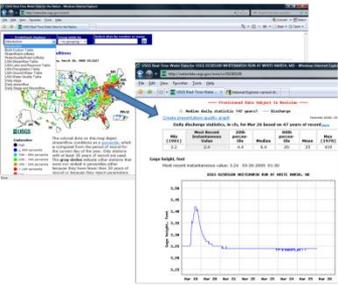


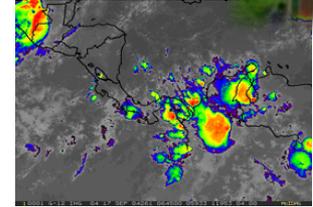
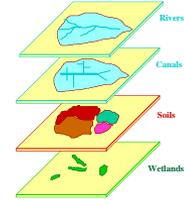
Figure 11 Observed ( $Q_o$ ) and modified ( $Q_m$ ) runoff at Besham Gila, Upper Indus based on remotely sensed (TRMM) snow cover and precipitation data.

Source: Immerzeel et al. (2009)





## Data Acquisition & Knowledge Base



“Last-mile Connectivity”

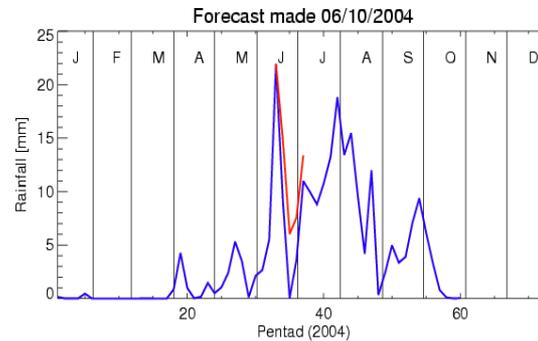
Information Access & Stakeholder Interaction



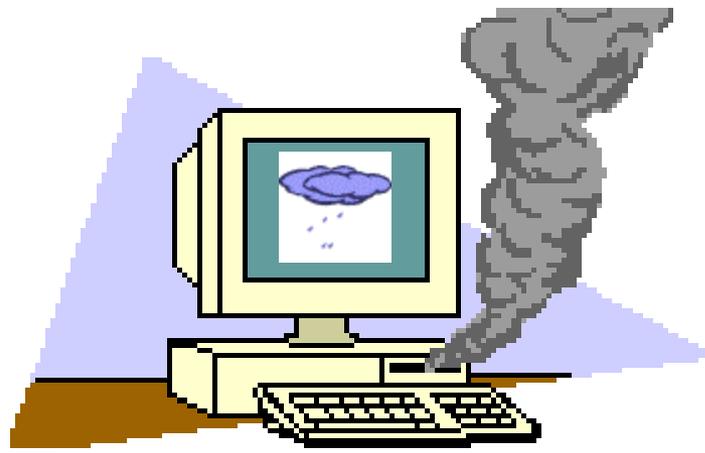
Data Processing



Modeling/DSS



# Thank you!



For more information:

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