



Water Accounting +: A tool for Water Scarcity Management

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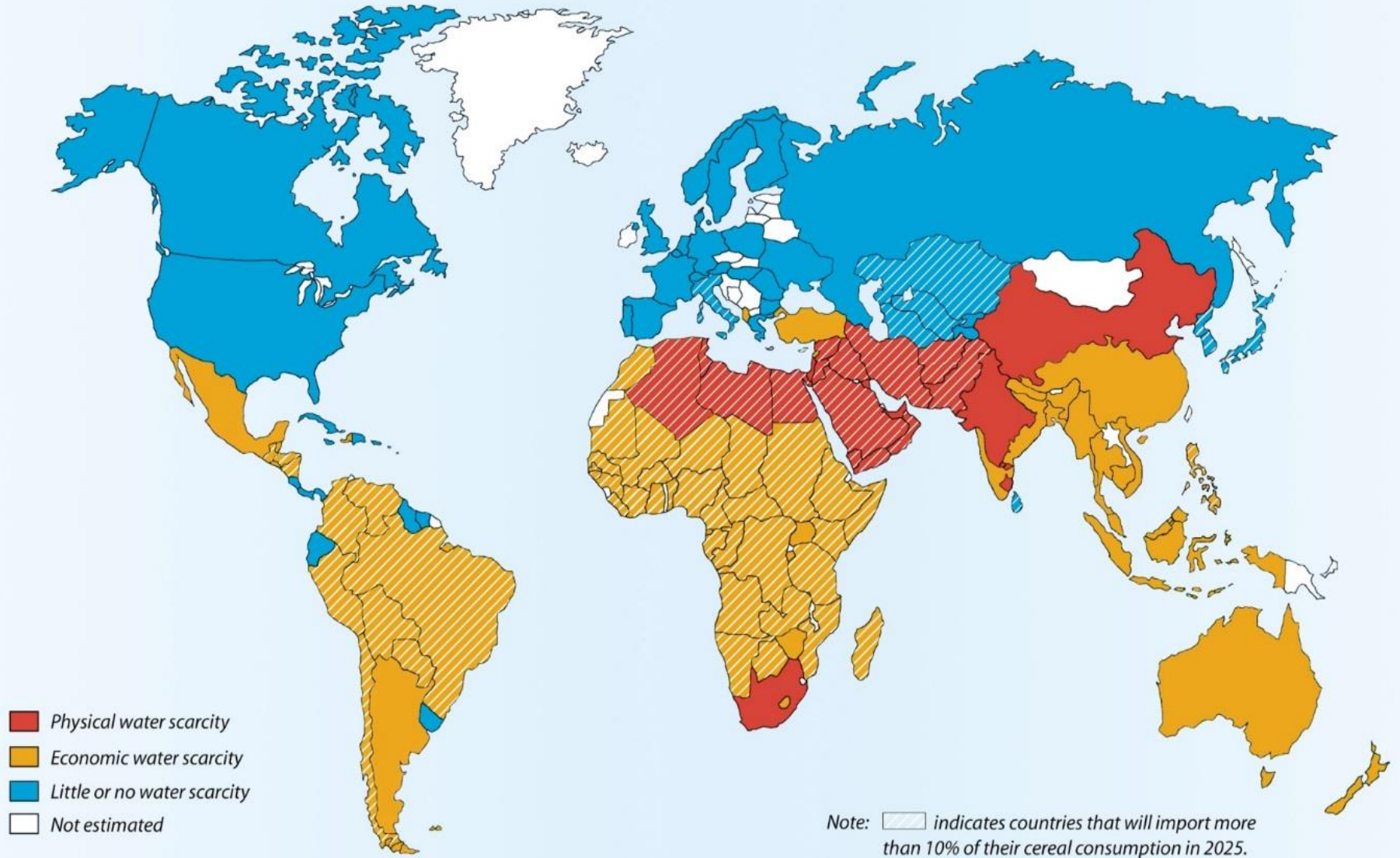
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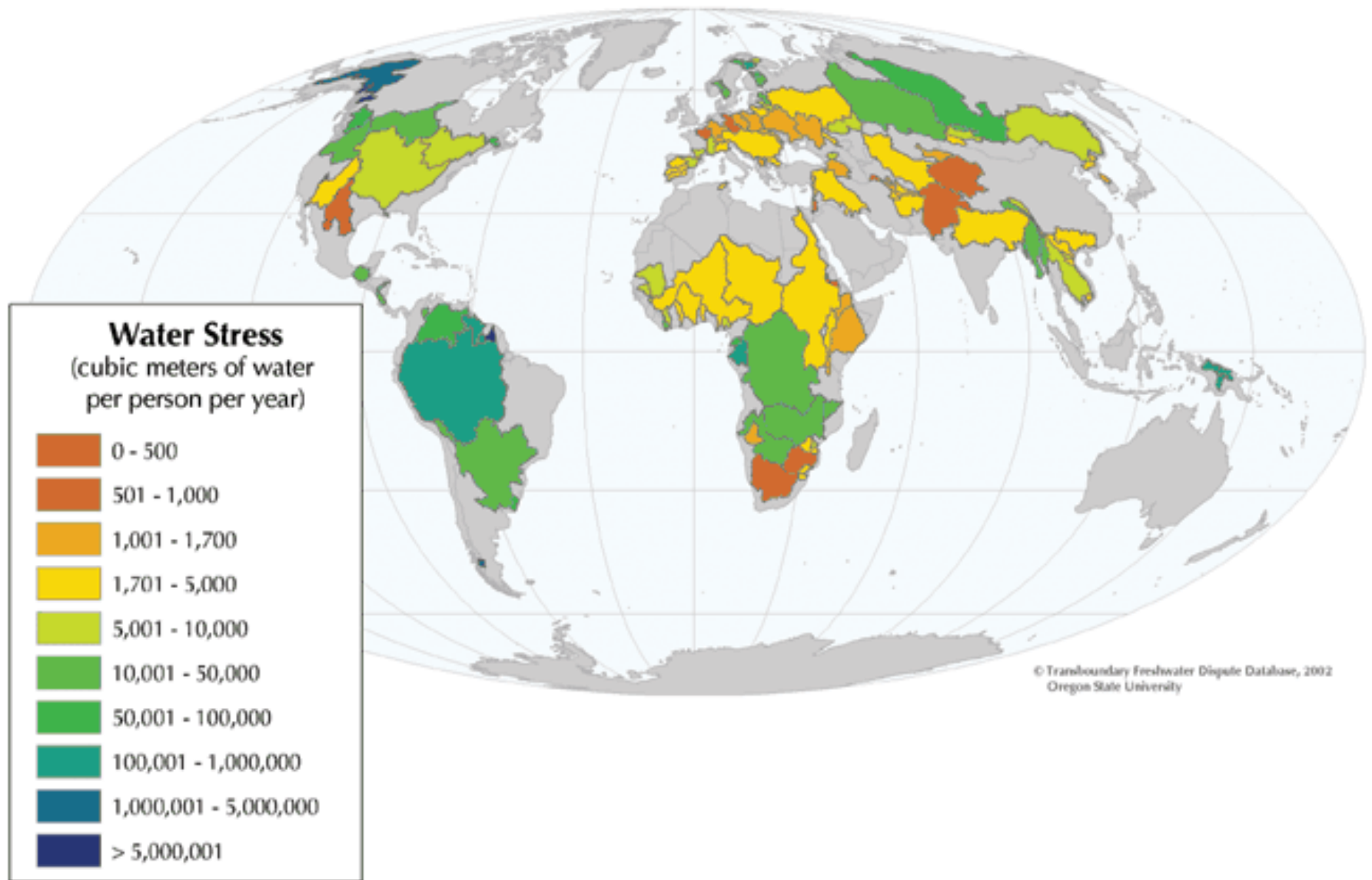
UNESCO-IHE
Institute for Water Education

Global Partnership
for Water and
Development

Water scarcity



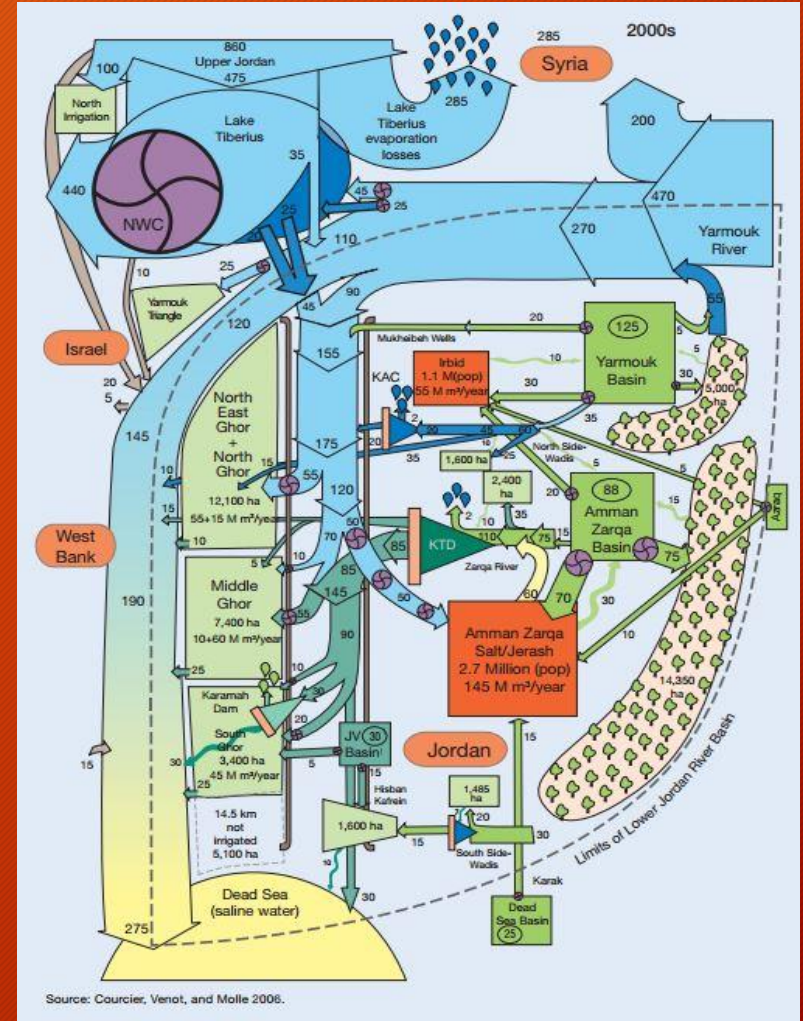
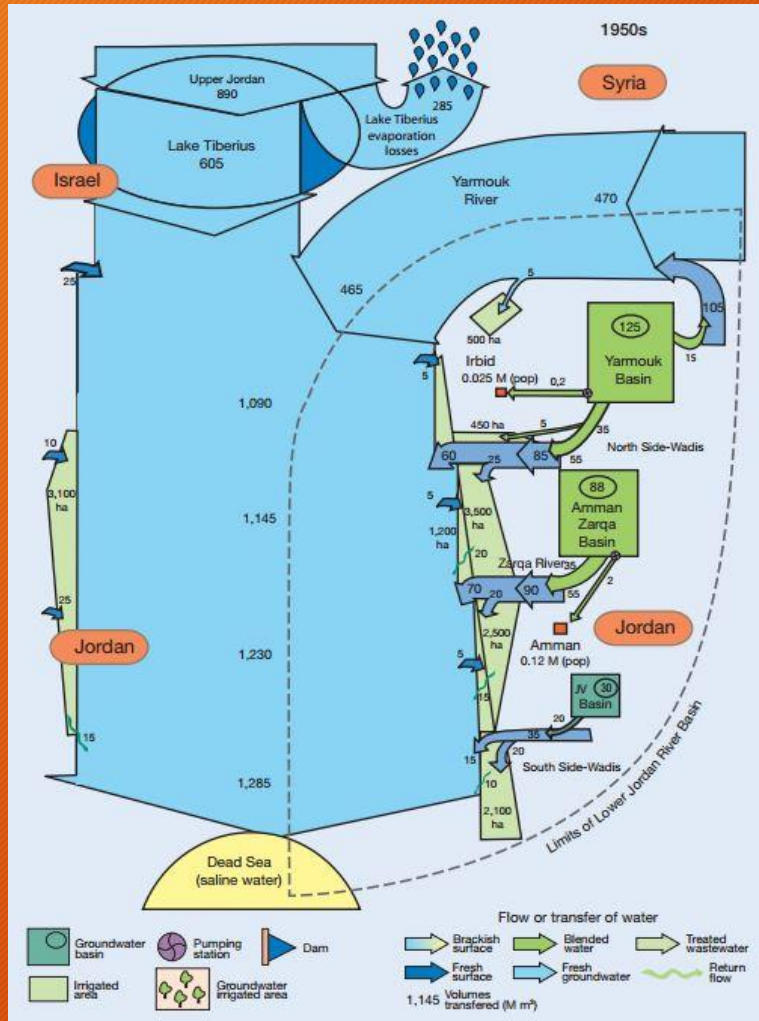
Water Stress by International River Basin



Symptoms of the Water Crisis

- Polluted waters, damaged ecosystems, loss of biodiversity
- Drying Up - Yellow River, Syr Darya, Colorado River, the Nile, Tana River, Urmia Lake, The dead sea
- Malnourishment - lack of access to water for drinking and agriculture

Drivers: Growing demand and competition for water, Economic growth, Climate change



1950's



2000's

Jordan River Basin's Evolution

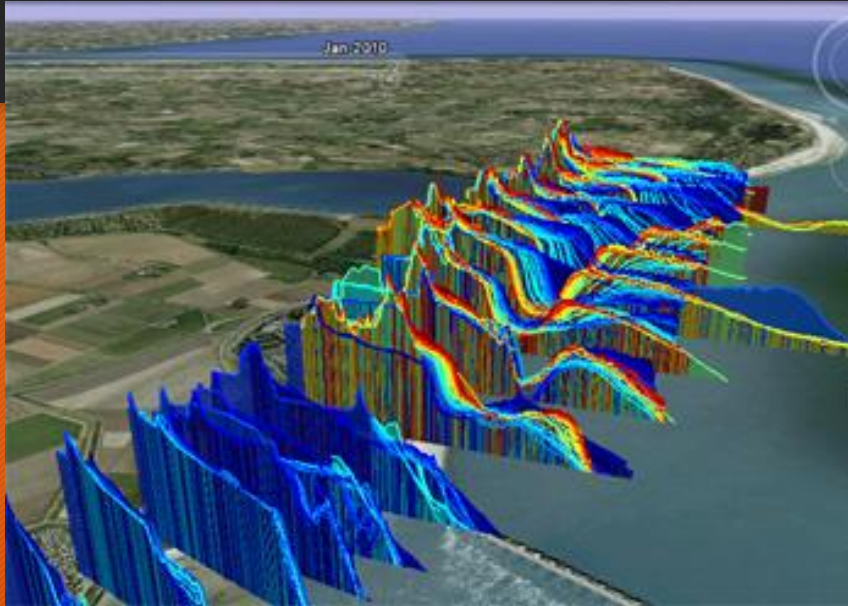
Source: Courcier et al. (2005)

Water Scarcity Management: Need for DATA & Information

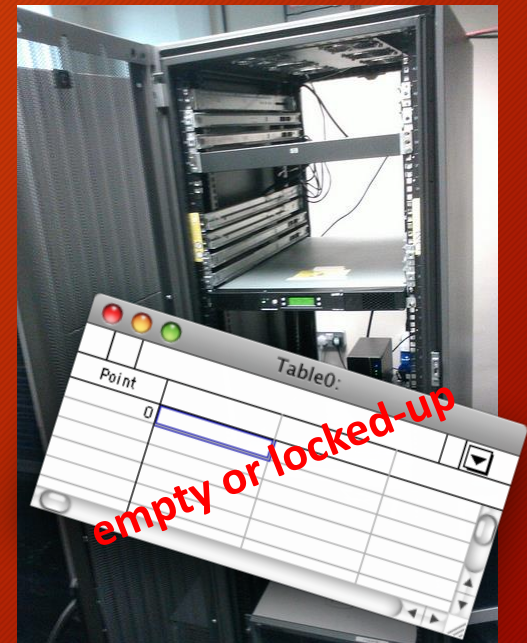
- Data availability
- Data Reliability
- Data Accessibility

What about data?

Ideal
data



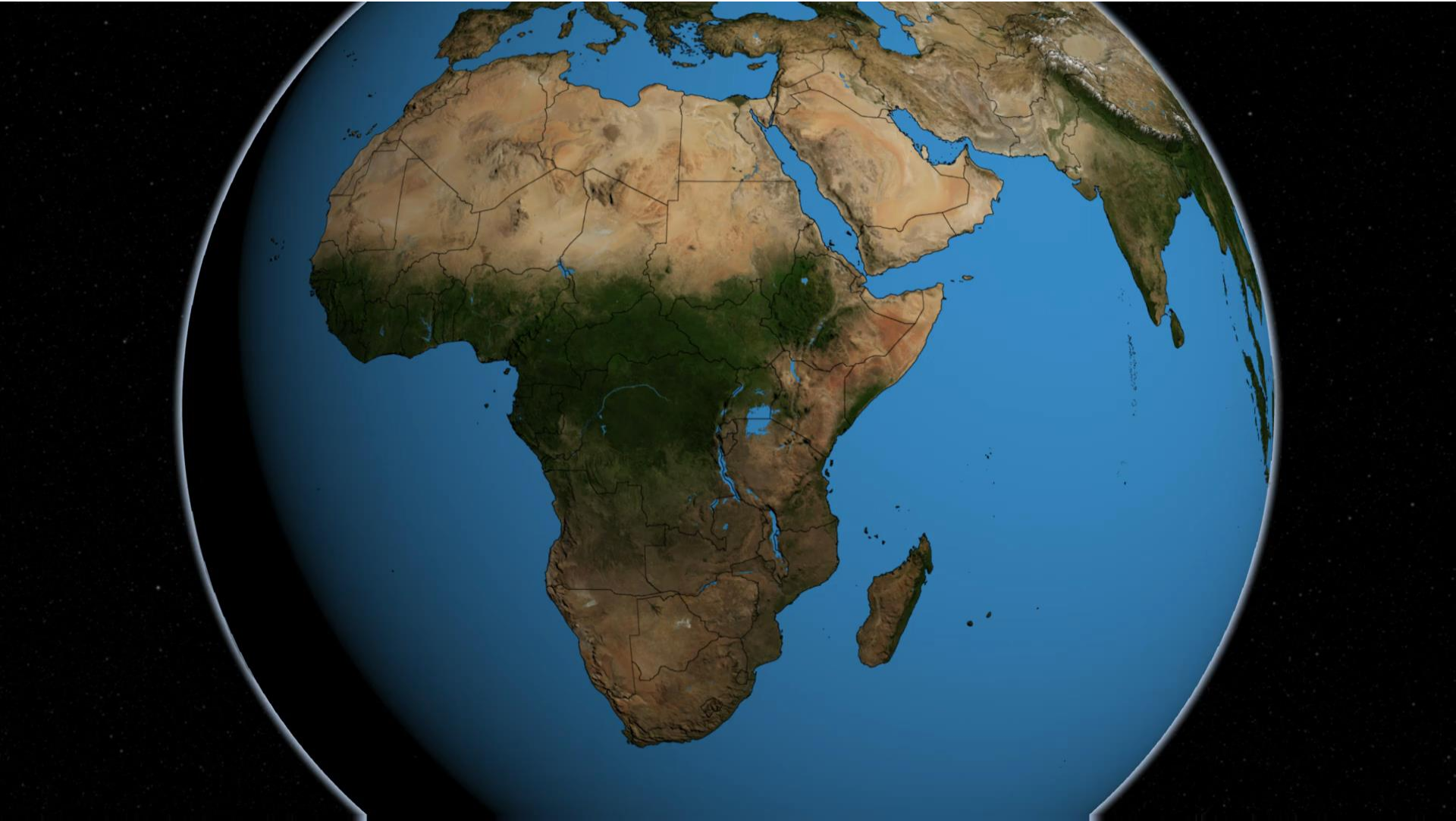
Real
data



Satellite data: a New opportunity



Examples of the public domian satellite data



Source: NASA

Water accounting:

Process of communicating water related information about a geographical domain, such as a river basin or a country, to users such as policy makers, water authorities, managers, etc.

Assets

Liabilities

Uses/depletion

Benefits and
services

Interventions



Water Accounting!

Who is going to use it?

- **Policy makers:**
 - Accountability of water managers
- **Water managers:**
 - Quick overview of current status of all water issues
- **Water planners:**
 - Impact of changes (climate, land cover)
 - Effectiveness of adaptation
- **Donors**
 - Impact assessment
- **Water users:**
 - Overall picture

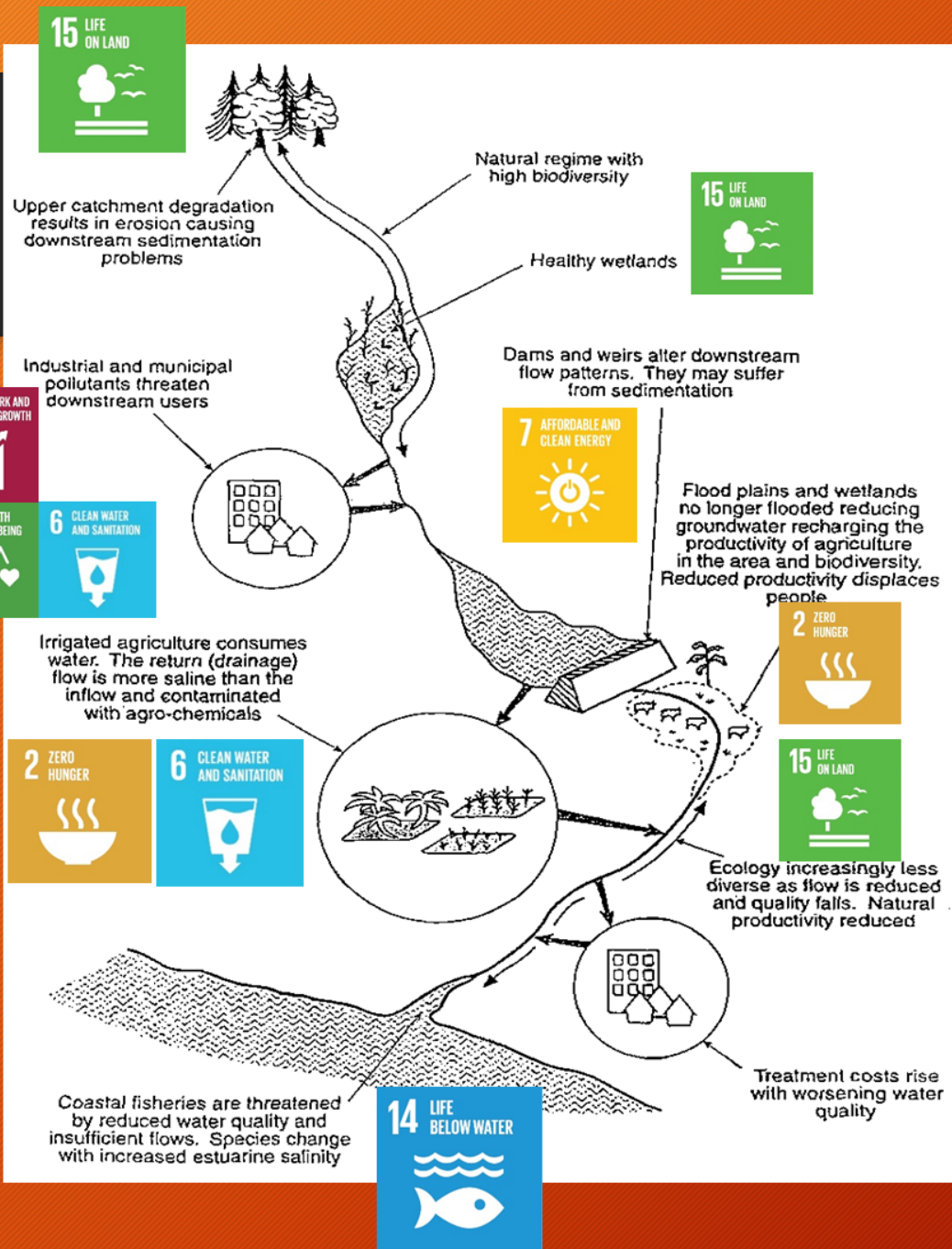


INFORMED DECISIONS

Water Accounting Plus:

A standard reporting system on water resources conditions in river basins, including hydrology, water management, land use and the services from consumptive use with a standard terminology

- Tracks water net consumption rather than withdrawals
- Amenable to remote sensing analysis
- Applicable to ungauged and poorly gauged basins

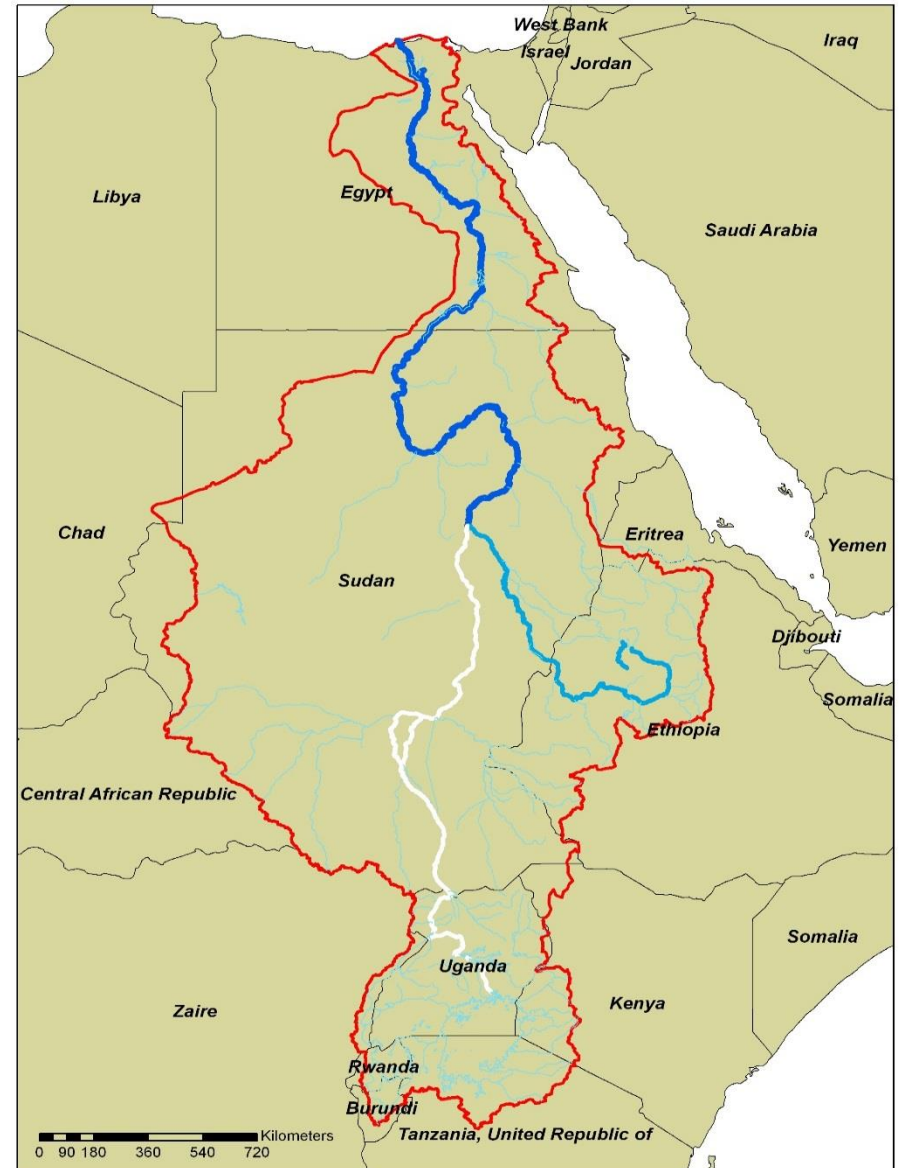


River Basin

Think about water in a basin context: various water users

Example: The Nile Basin

- Rapid population growth, Water scarcity, Closed basin, Poverty
- Competition for water among riparian countries.
- Need to increase food production despite limited water available



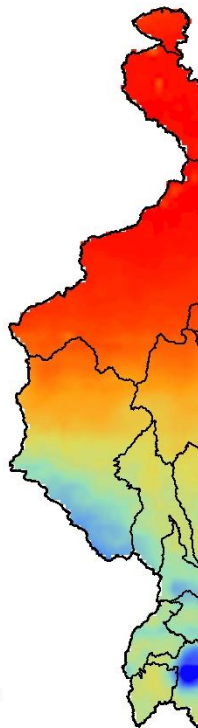
Water Accounting and water productivity assessment: Input RS data

Water

Precipitation 2005-2010

Precipitation (mm/yr)

2000
1600
1200
800
400
0



RESEARCH PROGRAM ON Water, Land and Ecosystems
CGIAR

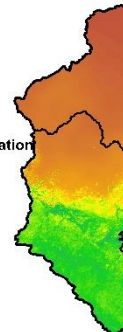
Lead by IWMI
International Water Management Institute

Water

Actual Evapotranspiration (ET)
2005-2010

Actual Evapotranspiration (ET) (mm/yr)

2000
1600
1200
800
400
0



RESEARCH PROGRAM ON Water, Land and Ecosystems
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Water

Land use land cover

Legend



RESEARCH PROGRAM ON Water, Land and Ecosystems
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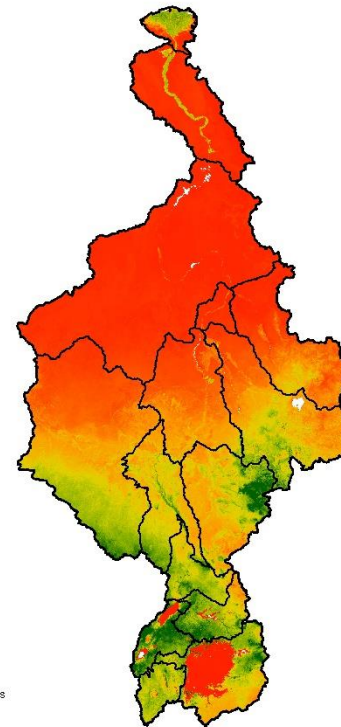
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International Water Management Institute

Water

Biomass production 2005-2010

Biomass production (kg/ha/yr)

40000
30000
20000
10000
0



RESEARCH PROGRAM ON Water, Land and Ecosystems
CGIAR

Lead by IWMI
International Water Management Institute

0 250 500 1,000 Kilometers

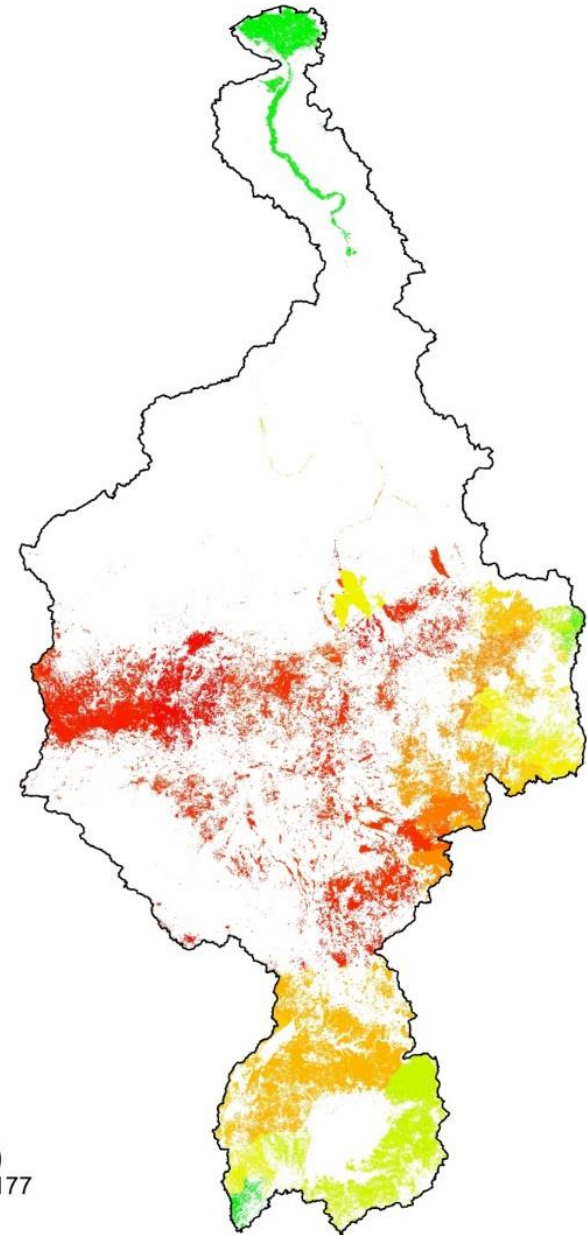


Crop Water Productivity in The Nile

$WP = SGVP / \text{Eta}$

- Average WP in the basin 0.045 \$/m³ and the minimum, maximum WP are respectively 0.01, 0.18 \$/m³

WP (US\$/m³)
High : 0.177
Low : 0.007



0 100 200 400 600 800 Kilometers

Source: Karimi et al. 2012

➤ **High productivity zone**

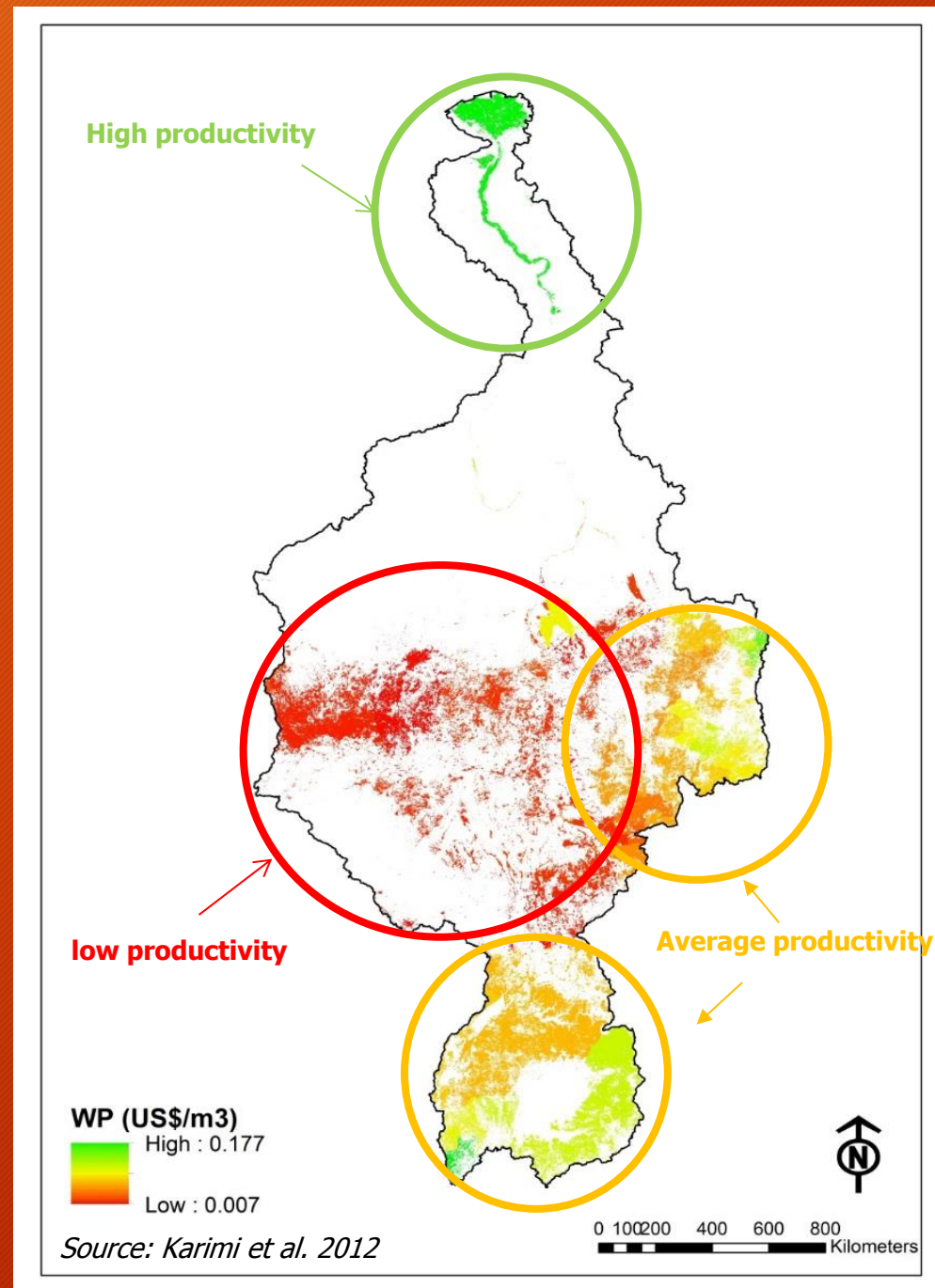
includes the delta and irrigated areas along the Nile River; characterized by intensive irrigation, high yields and high value crops.

➤ **Average productivity zone**

two major areas, one in eastern part (Ethiopia mainly) and the other in southern part. Relatively low yield despite receiving enough rainfall ; **Water control and storage interventions; e.g. Rain water management; Supplemental irrigation**

➤ **Low productivity zone;**

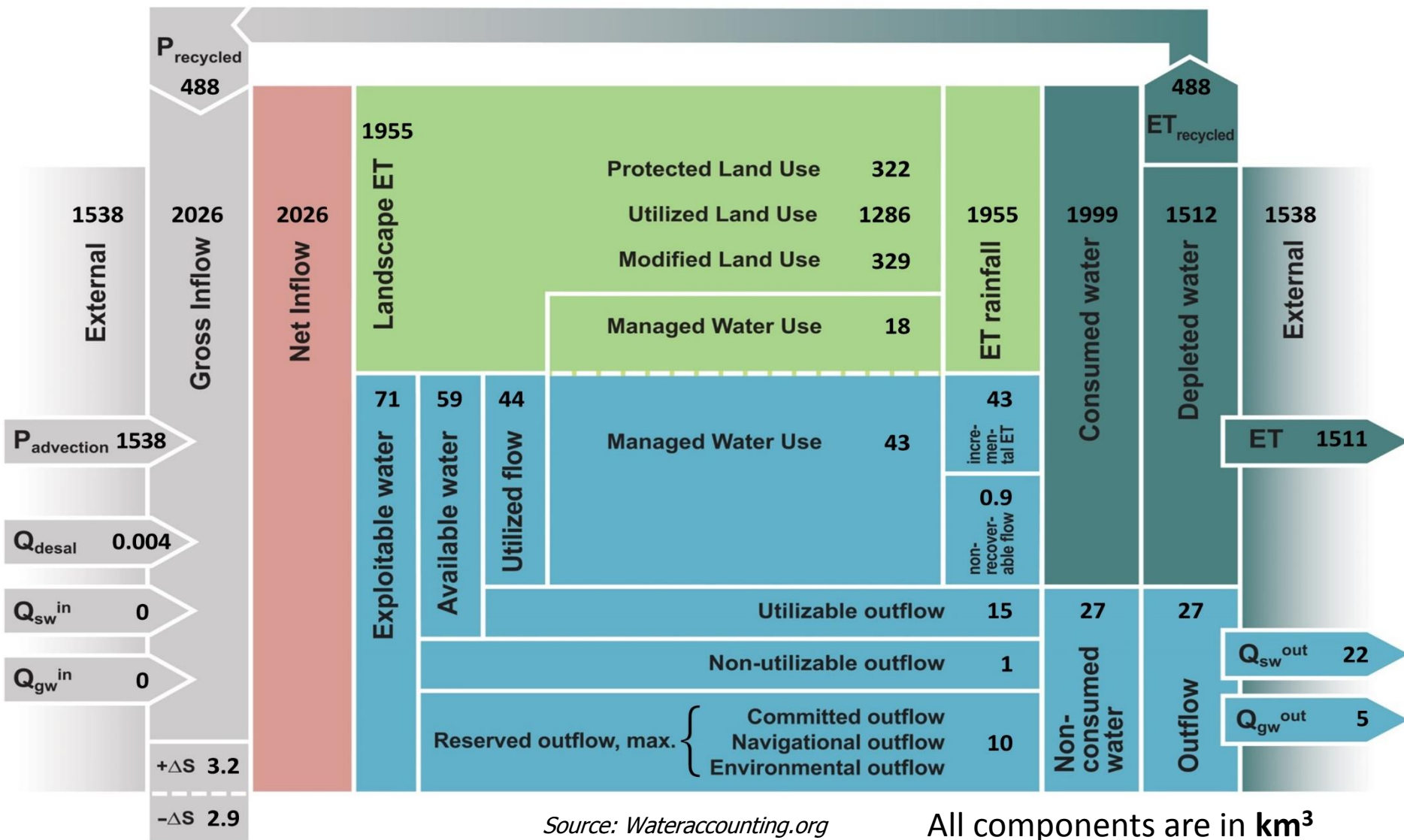
Dry areas of Sudan mainly. Low rainfall, low yields; **Potential for livestock and fisheries (Sudd)**



Water Accounting: Resource Base Sheet

Sheet 1: Resource Base Sheet

Basin: Nile basin
 Period: 2005-2010 (km³ yr⁻¹)



Source: Wateraccounting.org

All components are in km³

Evapotranspiration Sheet

Sheet 2: Evapotranspiration (km³/yr)

Basin: Nile Basin
Period: 2005-2010

All components are in km³

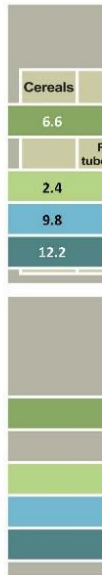


		ET	T			ET	T				
2000	Non-manageable	Protected Land Use	Forests		50	34		939	Interception	Non-Beneficial	587
			Shrubland		189	110					
			Natural grasslands		5	4					
			Natural water bodies		6	1					
			Wetlands		38	20					
			Glaciers		0	0					
			Other		34	21					
	322	322	189								
	Manageable	Utilized Land Use	Forests		259	161		674	Soil	Beneficial	1413
			Shrubland		740	380					
Natural grassland				11	8						
Natural water bodies				126	3						
Wetlands				71	40						
Other				79	29						
1286			1286	621							
Managed	Modified Land Use	Rainfed crops		111	63		131	Water	Agriculture	326	
		Forest plantations		56	38						
		Settlements		1	0.4						
		Other		162	118						
	329	220									
	Managed Water Use	Conventional	Irrigated crops		44	24		1061	Transpiration	Environment	924
			Managed water bodies		8	0.1					
			Industry		1	0.1					
			Aquaculture		0.10	0.03					
			Residential		2	0.4					
Other				8	5						
Managed Water Use	Non-conventional	Indoor domestic		0.45	0		1061	Transpiration	Economy	37	
		Indoor industry		0.32	0						
		Greenhouses		0.12	0.07						
		Livestock & husbandry		0.13	0						
		Power and Energy		0.55	0						
		Other		0.09	0						
63	30										
392											
Total evapotranspiration											

Sheet 3: Agricultural services

Part 1: Agricultural water consumption (km³/yr)

Basin: Nile Basin
Period: 2005-2010



Sheet 3: Agricultural services

Part 2: Land productivity (kg/ha/yr) and water productivity (kg/m³)

Basin: Nile Basin
Period: 2005-2010



Sheet 4: Utilized Flow

Part 1: Manmade (Mm³/yr)

Basin: Nile Basin
Period: 2005-2010

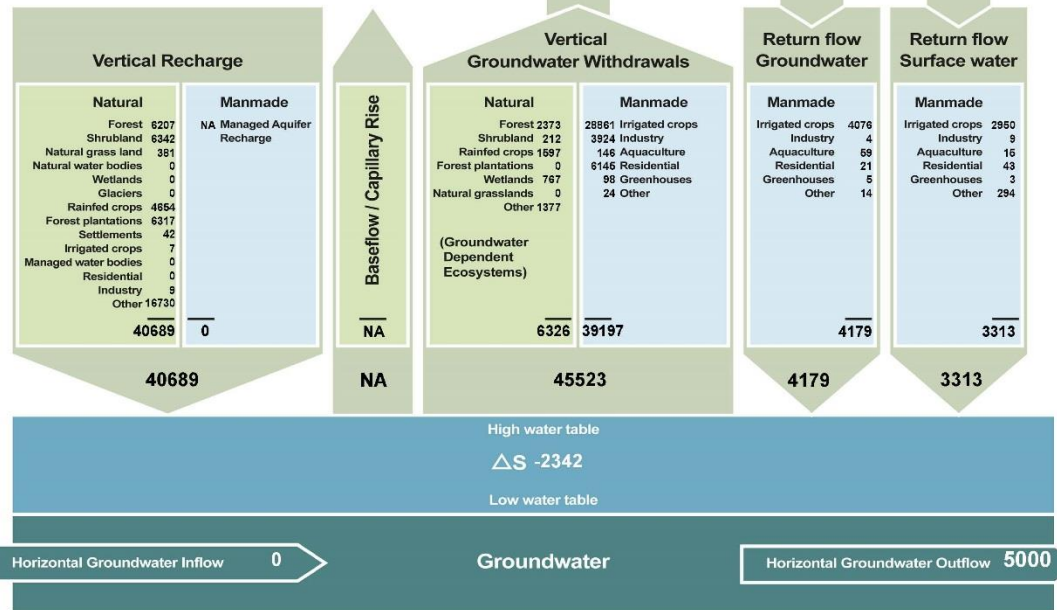
Sheet 4: Utilized Flow

Part 2: Natural (Mm³/yr)

Basin: Nile Basin
Period: 2005-2010

Sheet 6: Groundwater (Mm³/yr)

Basin: Nile Basin
Period: 2005-2010



Summary/discussion points:

- Satellite based data can be used to support planning and dialogue in data scarce regions
- Satellite based data are transparent, verifiable, reproducible and a continuous source of data
- Water accounting plus provide a framework to use the RS data in a standardized way to report on different aspects of water, identify the problems and guide solutions
- Rs based water accounting can be used to identify issues, propose solutions and evaluate impact of intervention in water scarce regions

Follow UNESCO-IHE's work on Water Accounting at:

www.WaterAccounting.org