Water Harvesting Systems in Sudan

Rich Diversity & History,

Significant contribution to water & food security

Part 1

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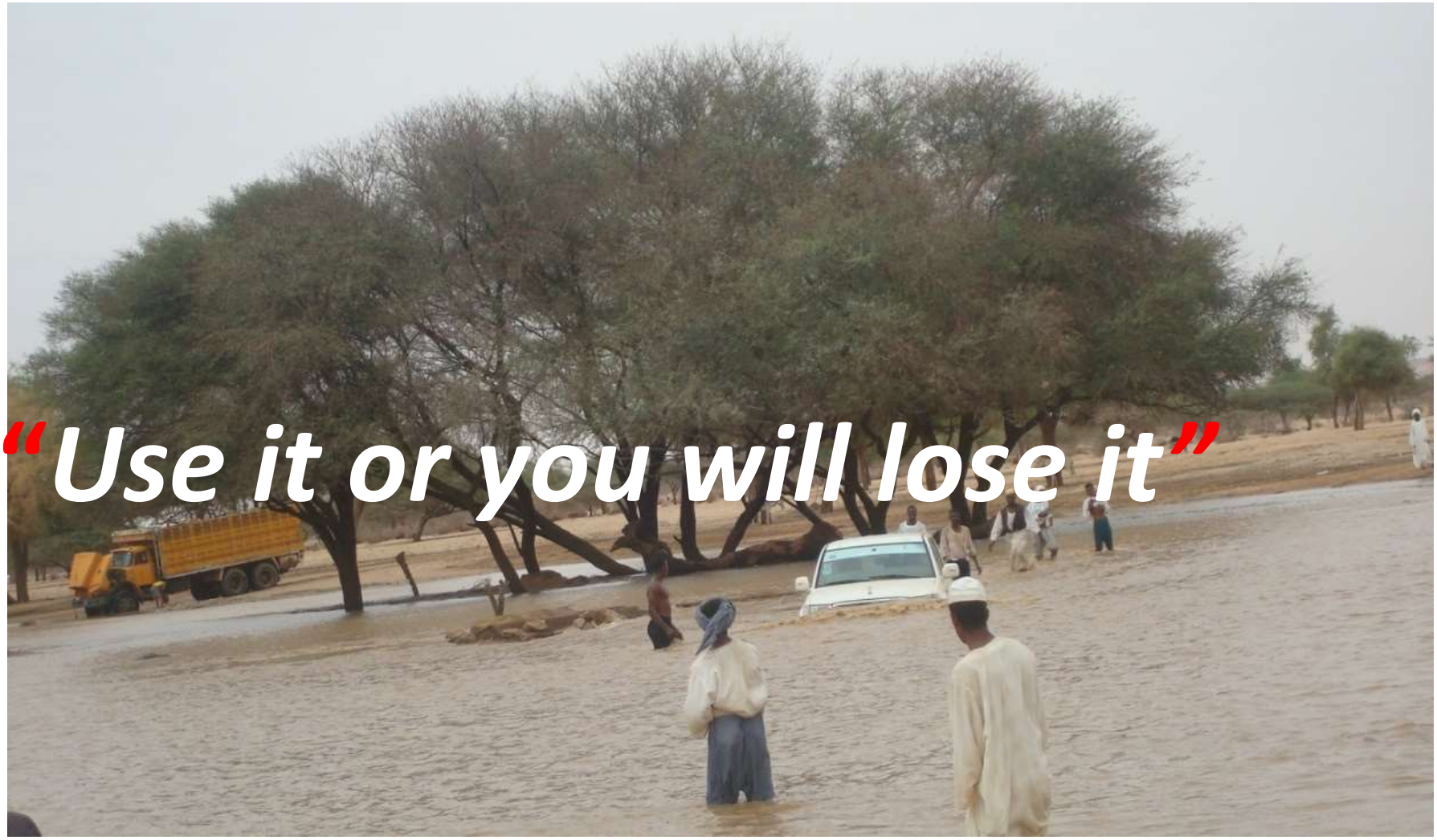
Contents:

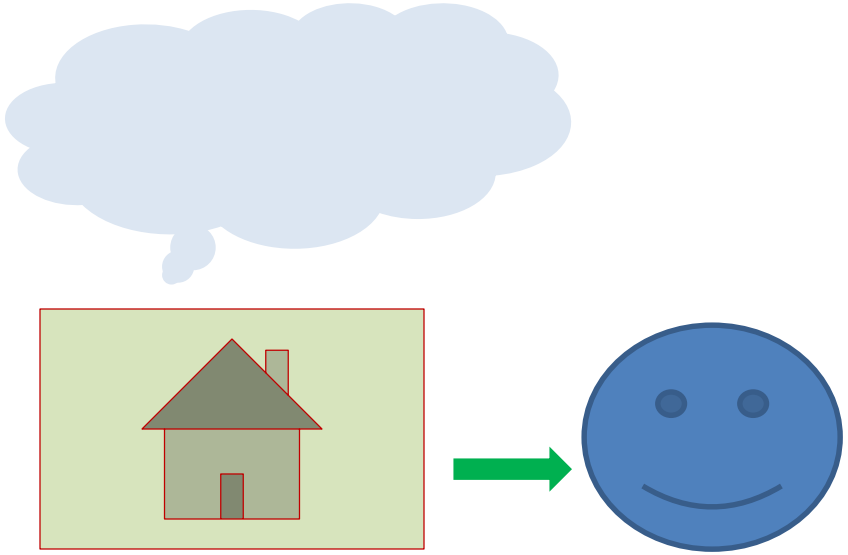

“Use it or you will lose it”

Definition:

"Collection of Runoff for Its productive Use"

Types of WH Systems:

1. **Catchment System**
   - building roofs;
   - ground catchment; and
   - rock catchment.
2. **Conveyance System**
   - gutters;
   - channels; and
   - streams.
3. **Storage system**
   - reservoirs;
   - small dams
   - bonds.



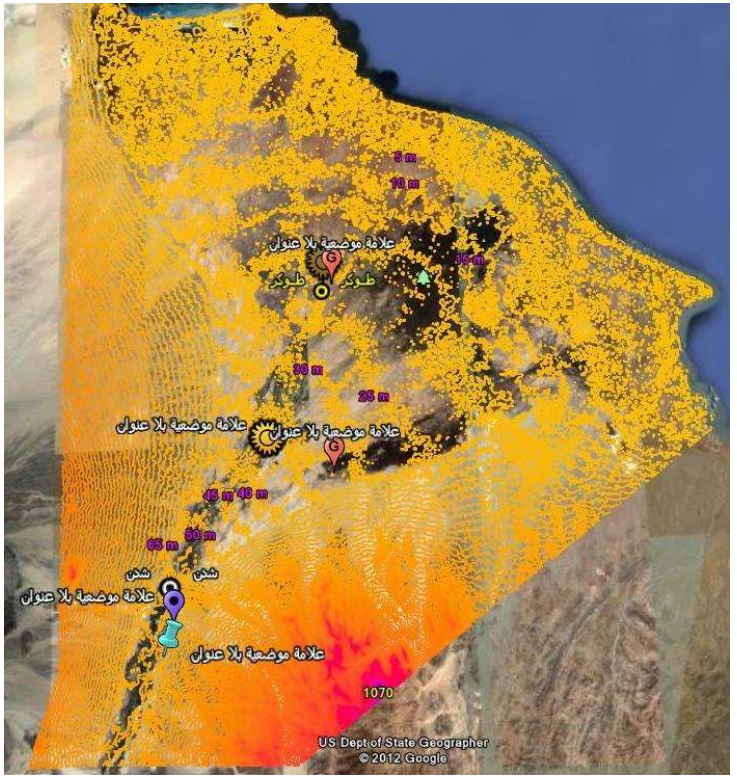
Classification

RAINWATER HARVESTING

water harvesting techniques which harvest runoff from roofs or ground surfaces; and

FLOODWATER HARVESTING

all systems which collect Discharges from watercourses.



2. WHSs in Sudan:

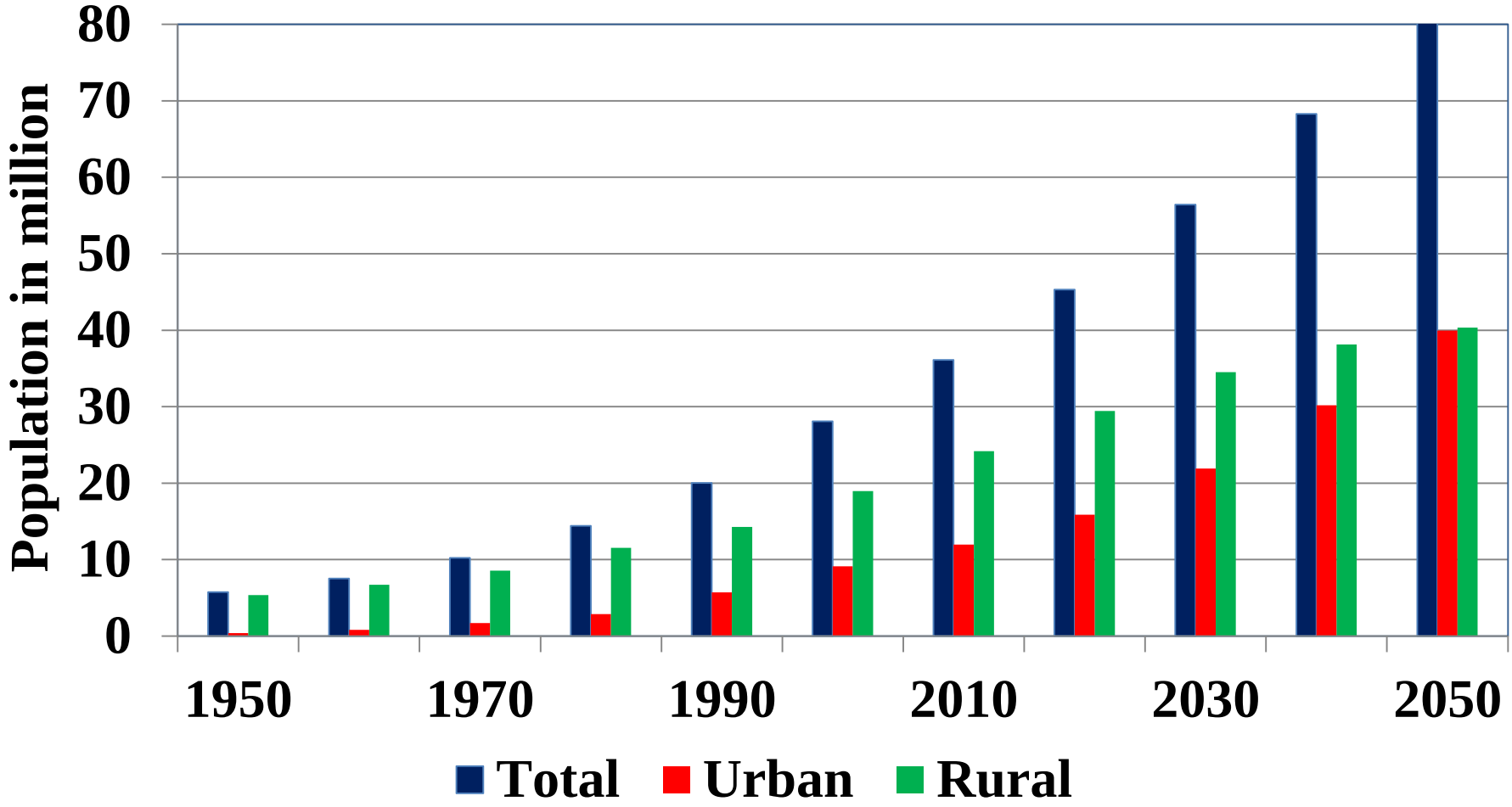
Country Profile: Sudan

- Total population : 43.2 M
- Agricultural population: 22 M
- Land area: 238 M ha
- Arable land: 0.6 ha/capita
- Permanent crops: 208 000 ha
- Pastures: 117 M ha
- Forest area:70 M ha
- Irrigated land : 1.8 M ha

SOME CHARACTERISTICS OF SUDAN

- **cereals in 2014:**
  - **total cultivated area 11.8 million ha**
  - **total cereal production 8.06 million ton**
  - **200 kg/person**
- **cereal dependency ratio 25%**
- **expansion of arable land is possible**
- **while most production under rainfed conditions, low yields and large fluctuations**
- **potential of expansion of irrigated agriculture**

Main Challenge - Sudan



WHSs in Sudan: Background

- main source of water in rural areas.
- estimated as 400 bcm/annum.
  - wet season: July – November.
  - dry season: December - June
- History:
  - 1947 El Seimah scheme (Khor Abu Habil – North Kordofan).
  - 1949 Golo dam (North Darfur).
  - Rural Water Corporation.
  - Thirty fighting project.
  - Drought Alleviation project
  - Local & foreign organizations effort (Sugya , UNICEF,
- Involved Institutions: MWRIE, UNESCO CHAIR WR, RCCRWH,

Objectives

Strategic:

- Securing drinking water (human & animal).
- Support national security through developing boarder areas & alleviating disputes.
- Secure utilization of our shared resources.
- Contribute to food security through self-sufficient.
- Contribute to rangelands and forest development.
- Support water security.
- Encourage donor to fund Sudan development programs.
- Achieve socio-economic rural development.
- Contribute to soil protection and ground water recharge.

Environmental:

- flood and drought protection.
- reduce diseases and improve health situation.

RWH Development:

Types:

- Haffirs (bonds) + Dinder National Park;
- Natural bonds - Turda (Rahad, Abu Zabad);
- Small earth dam (a lot);
- shallow wells (WN State);
- Family reservior … (tabaldi trees).

Shallow wells

roofs harvesting

Trees harvesting

Family Reservoir as an Input To Integrated Development in Rural Area – North Kordofan, Sudan -

Terraces

To improve rangelands

Simple technology – Khartoum state

contour barriers (Karari)

Key issues:

- relatively small capacities;
- evaporation & seepage;
- sedimentation & weeds;
- pollution;
- vandalism;
- development priority;
- absence of periodic maintenance.;
- tenure disputes … etc.


sedimentation

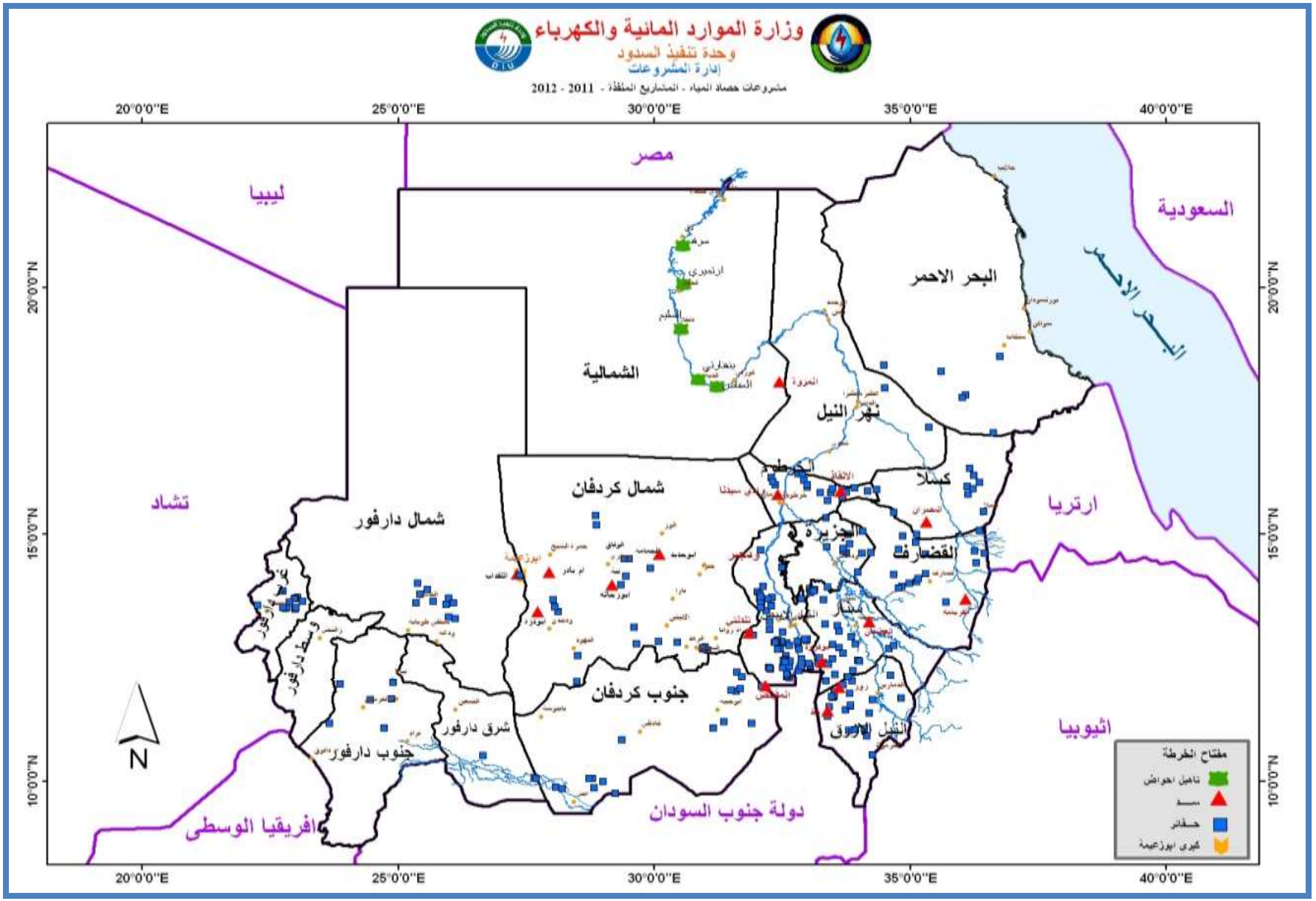

Pollution


damage


damage


Abu Gebayha Haffir – South Kordofan
Weeds

Recent Achievements (2010 -2013)



Including:

- mapping & database for 119 small earth dams;
- 65 automatic hydrometric stations;
- 15 automatic climatic stations;
- 20 automatic rain gauges;
- 45 automatic water level gauges;
- 241 haffirs;
- 17 small earth dams;
- rehabilitation of 5 projects (Tulus, Shakhara …).

Wadis Mapping

وادي ابـوحـبـــل

3674.69 Km2
Branch 3
Length 91.87 Km

15401.79 Km2
Branch 4
Length 279.950 Km

8985.01 Km2
Branch 2
Length 152.707 Km

8748.26 Km2
Branch 1
Length 148.943 Km

GOZASHGAR
EL-OBEID TOWN
EL OBEID
TENDELTI
ERRAHAD
ABU HABL
ABU-ZABAD
EL DILLING
ABBASIYA
UMM ABDOLLA
ABU GUBEIHA
HIDEIBAH
KOSTI
KERKERA

Branch No	Length Km	Catchment Area Km2	Z_h	Z
Total		36809.75		

Legend: State, Nile, Road, Catchment, SubCatchment, Abu Habel, Metstations

0 5 10 20 30 40 Kilometers

N

1:520,000

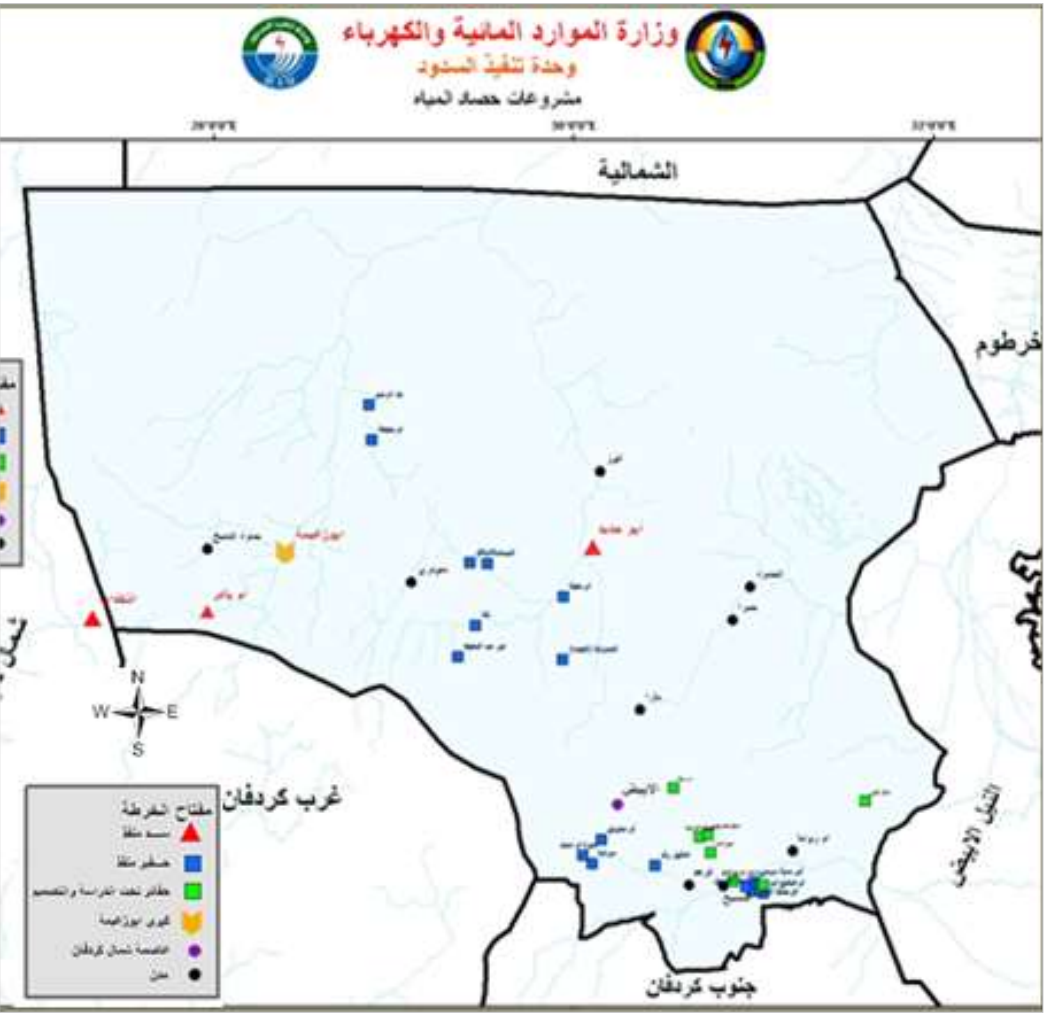
Hydrometric station – Red Sea

automatic cliamatic station – Damzin, BNS

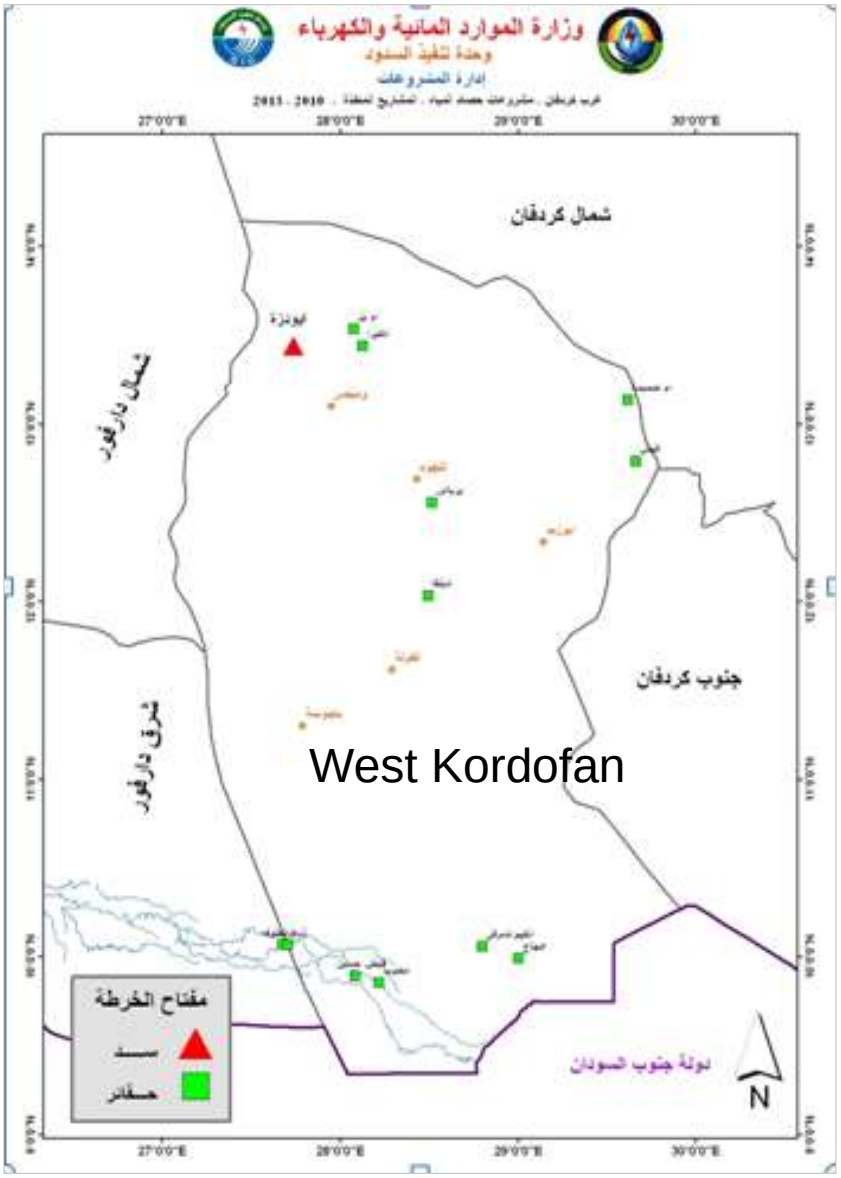
Examples:

shallow wells (41) West Bara – North Kordofan.

Haffirs & small earth dams - North Kordofan

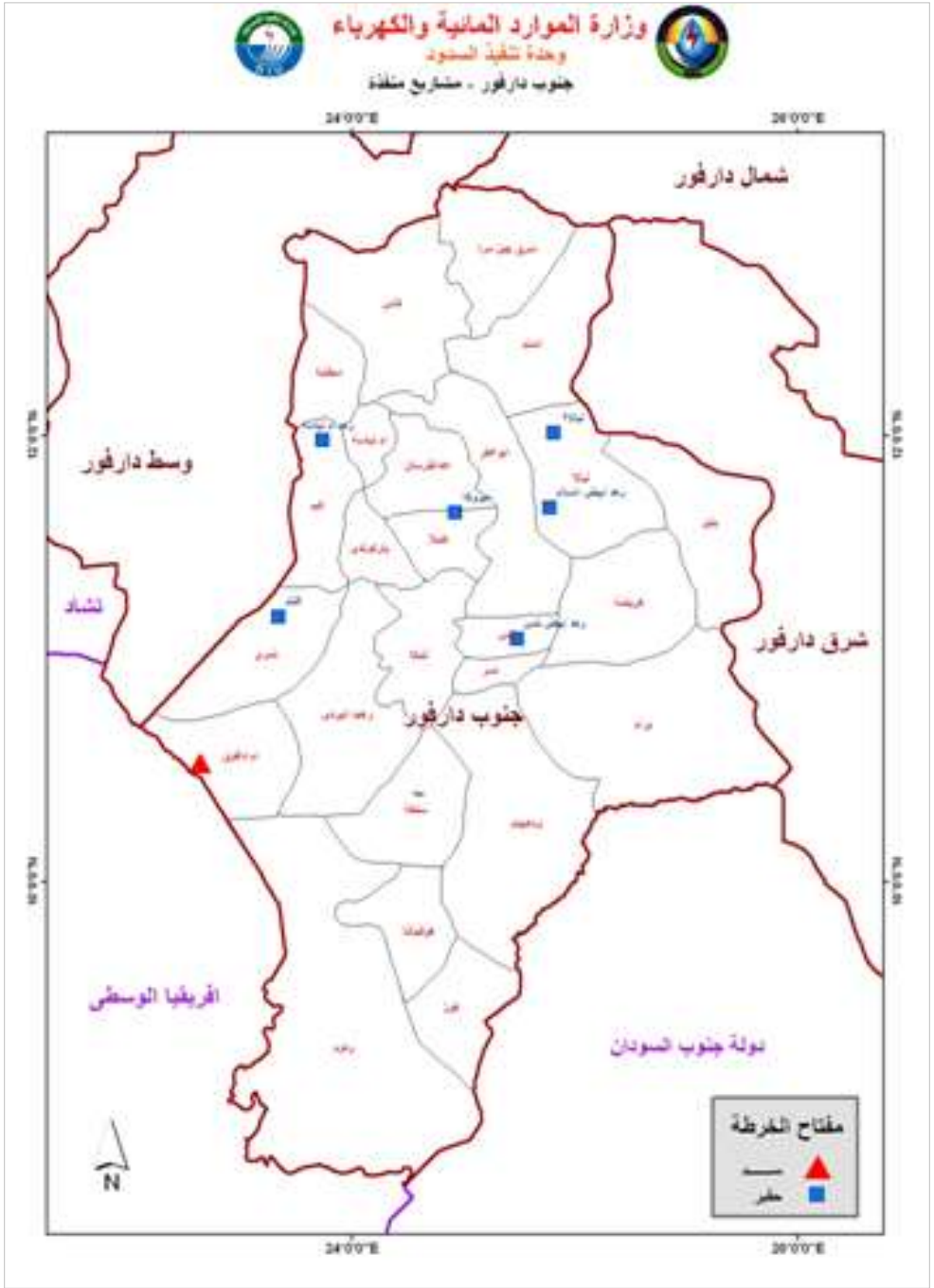


Haffirs & small earth dams - West Kordofan



Haffirs & small earth dams - South Kordofan

Haffirs & small earth dams – South Darfur



Shakhara Haffir – Sheariya Locality

Wad Bulbul - Tulus (5,000 fd) - 1

Wad Bulbul - Tulus (5,000 fd) - 2

Wad Bulbul - Tulus (5,000 fd) - 3

Examples of Success Haffirs:

1. Dar El Salaam Village – Gezira State:

Committee formed for the management of the Haffir.

Achievements:

- Operator & keeper appointed;
- 1 SDG/ barrel of water as fee agreed upon and approved;
- O&M costs (including salaries) to be paid from collected fees;
- Excess fees support education & health services at village.

2. Seeli Village – North Darfur:

Committee formed for the management of the Haffir.

Achievements:

- Resettlement (education at home);
- Improved health & heigne among pupils;
- work opportunities (agriculture & bricks making);
- support education & health services at village.
- Vegetables at home;
- Improved animal breeding … etc.

Examples of Success Shallow well:

West Darfur State:

1. Committee to be formed for the management of the well - Doonkey (10 males + 3 females).
2. 30% of the collected fees to be paid to the state water corporation against heavy maintenance;.
3. the remaining 70 % of fees to meet the operation and periodic maintenance costs and incentives of the committee members.

To Improve the Situation (study carried-out):

- *Assessment of the WH system (capacity, protection, purification, excess flow … etc.);*
- *Assess management system - texperience of the states;*
- *Water fees and collection tool;*

- Khartoum;
- Gedarif;
- West Darfour;
- North Kordofan;
- Blue Nile; and
- White Nile.

Improving the management of WH Projects

Republic of Sudan

Ministry of Water Resources and Electricity
Dams Implementation Unit

ABU HABIL INTEGRATED WATER RESOURCES MANAGEMENT (IWRM) PLANNING PROJECT

DEVELOPMENT SCENARIO REPORT

Prepared by

SHOURACONSULT Co. LTD

SWECO

Republic of Sudan

Ministry of Water Resources and Electricity
Dams Implementation Unit

ABU HABIL INTEGRATED WATER RESOURCES MANAGEMENT (IWRM) PLANNING PROJECT

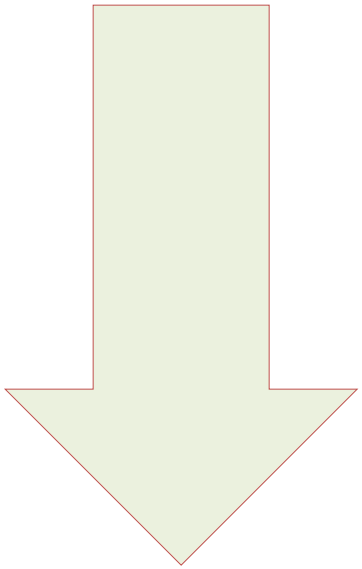
ABU HABIL IWRM PLAN

Prepared by

SHOURACONSULT Co. LTD

SWECO

FLOODWATER HARVESTING



Next

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Rich Diversity & History,

Significant contribution to water & food security

Part 2

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Objectives

1. To Shed light on some issues regarding Floodwater Harvesting (FWH) in Sudan.
2. Knowledge sharing.

SPATE = FLOOD

Destructive

Threatening Life

Gash 2007

Abu Habil 2007

Country Profile

- Total population : 43.2 M
- Agricultural pop. : 22 M
- Land area: 238 M ha
- Arable land: 0.6 ha/c.
- Permanent crops: 208 000 ha
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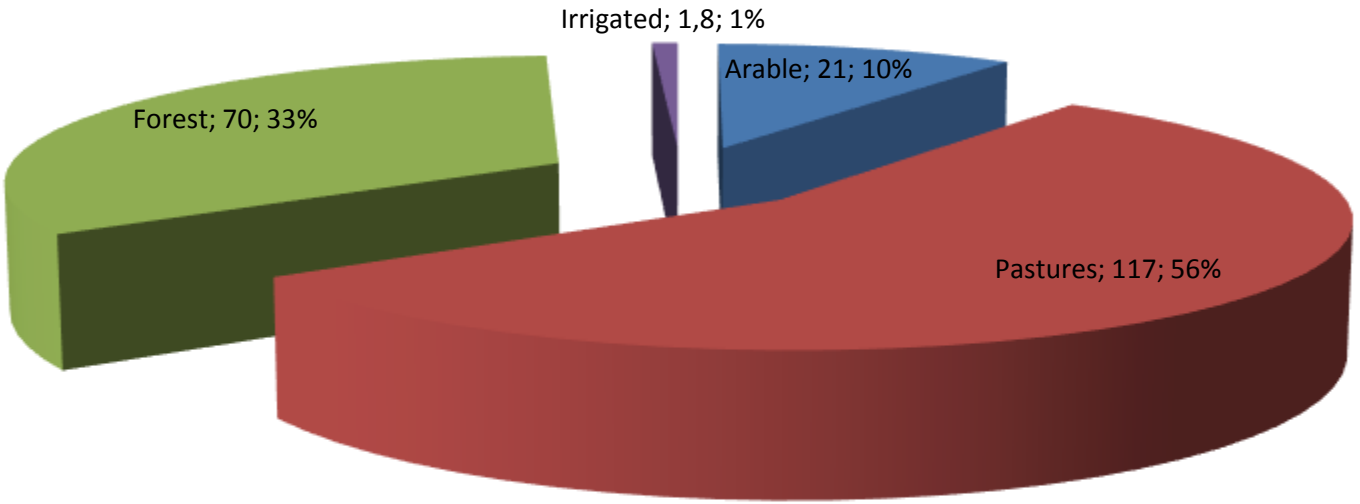
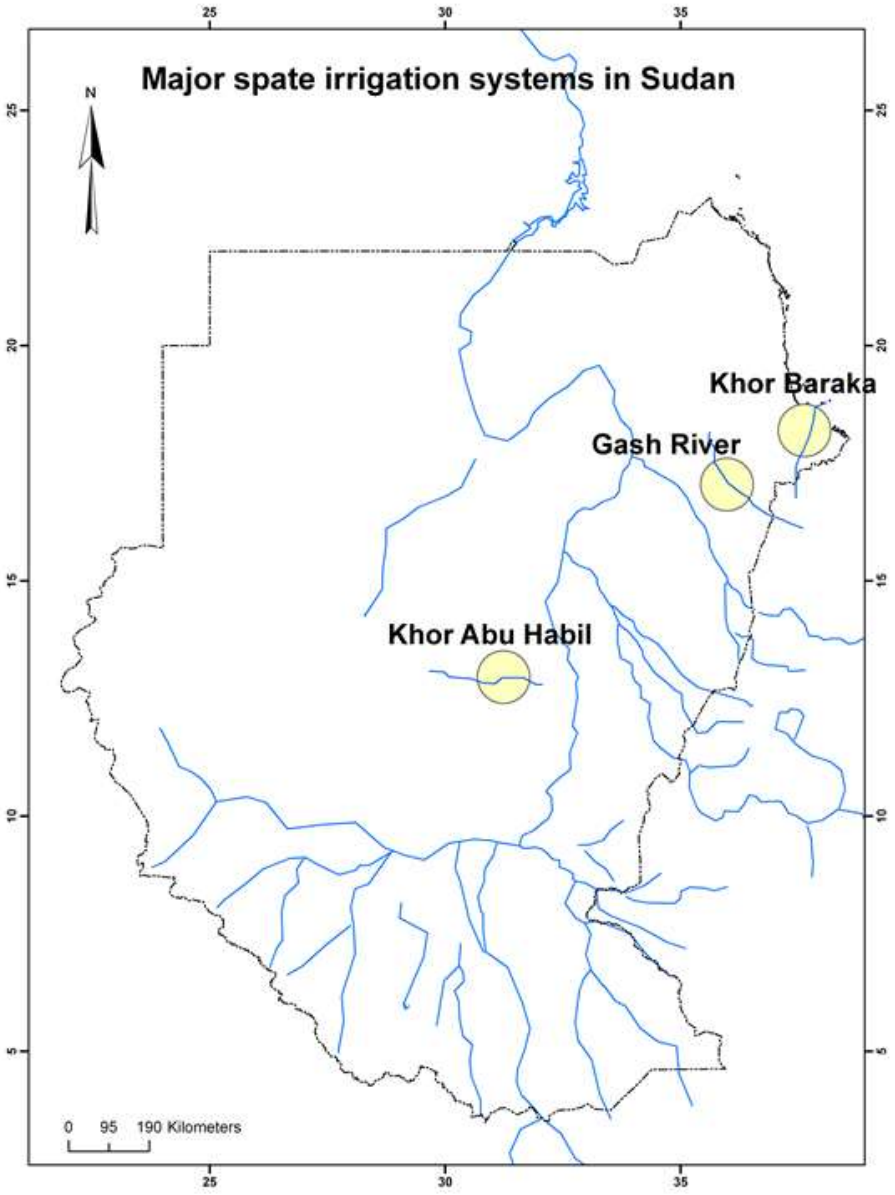
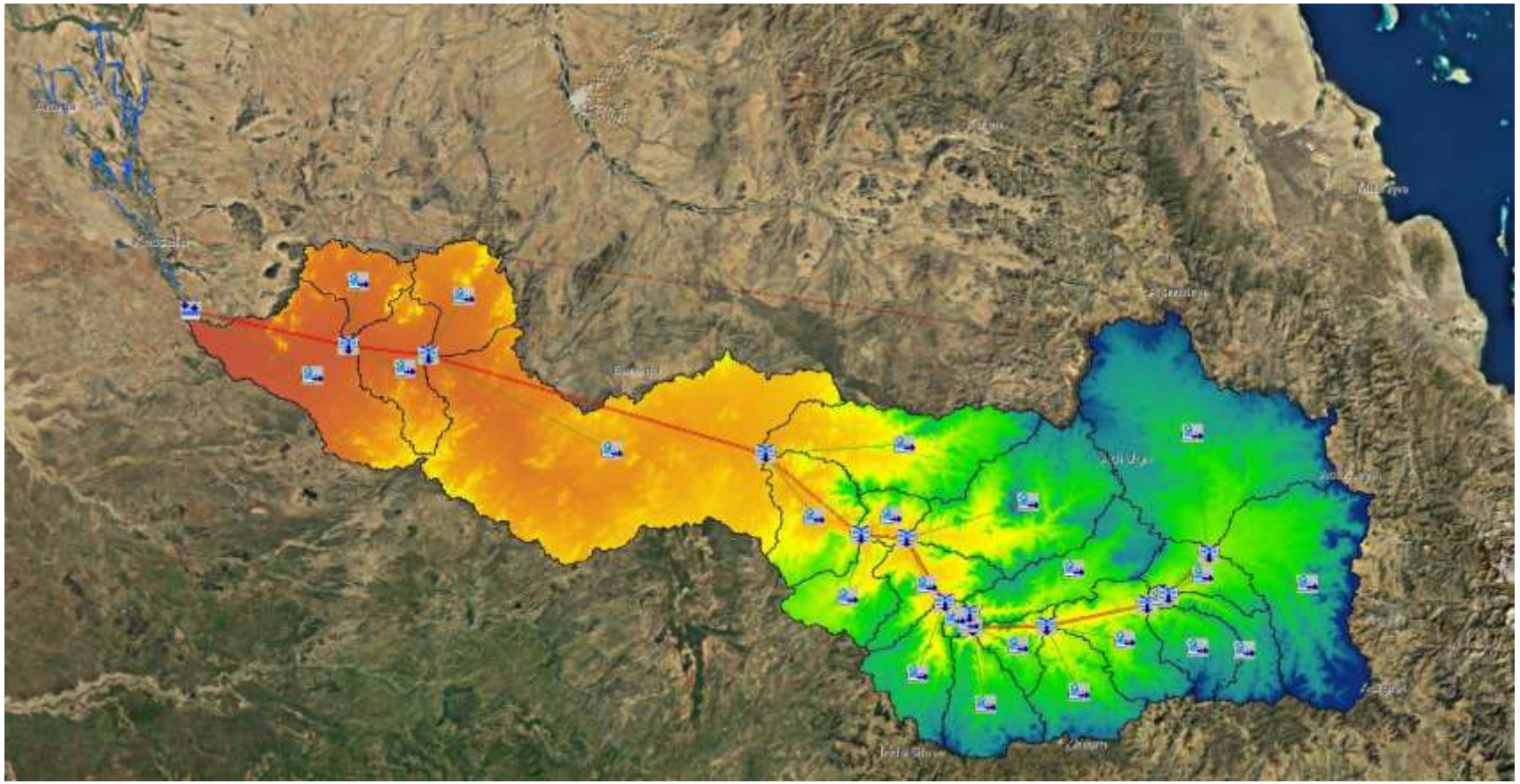

Irrigated; 1,8; 1%
Arable; 21; 10%
Forest; 70; 33%
Pastures; 117; 56%

Three Distinguished Area

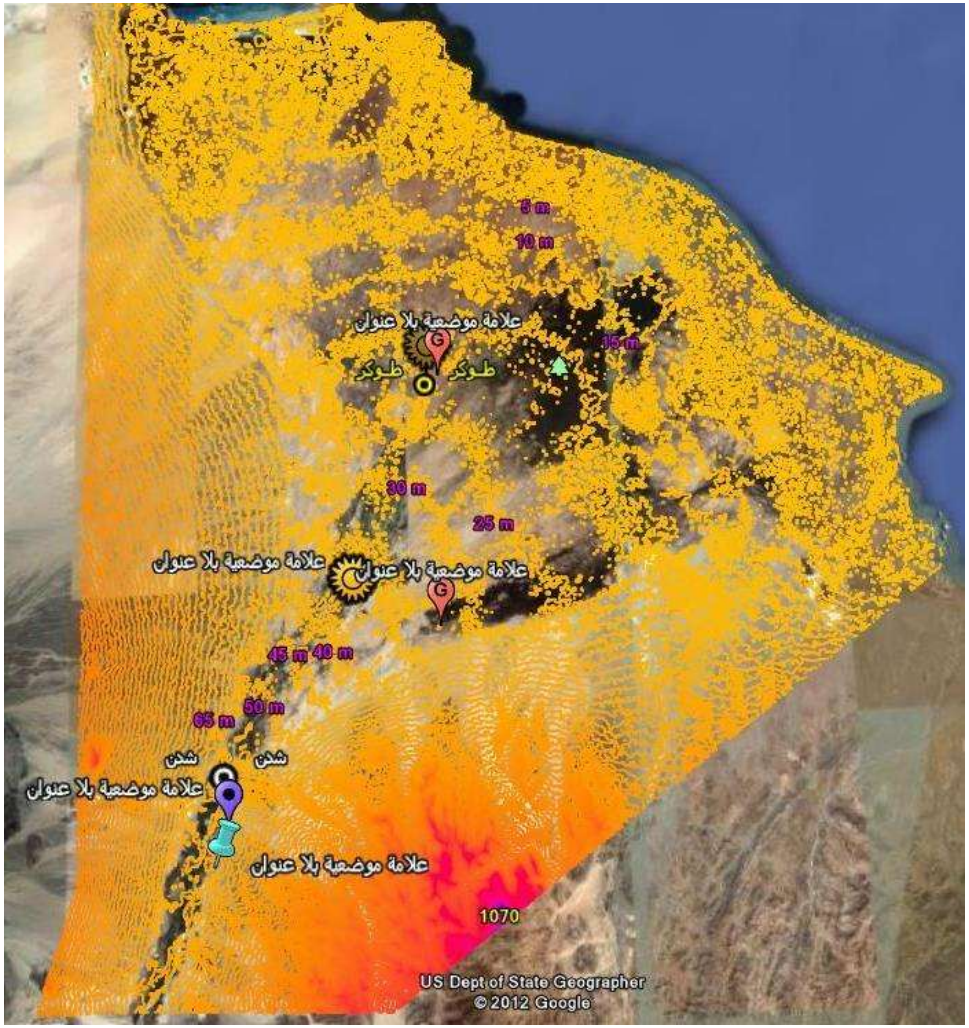


GASH

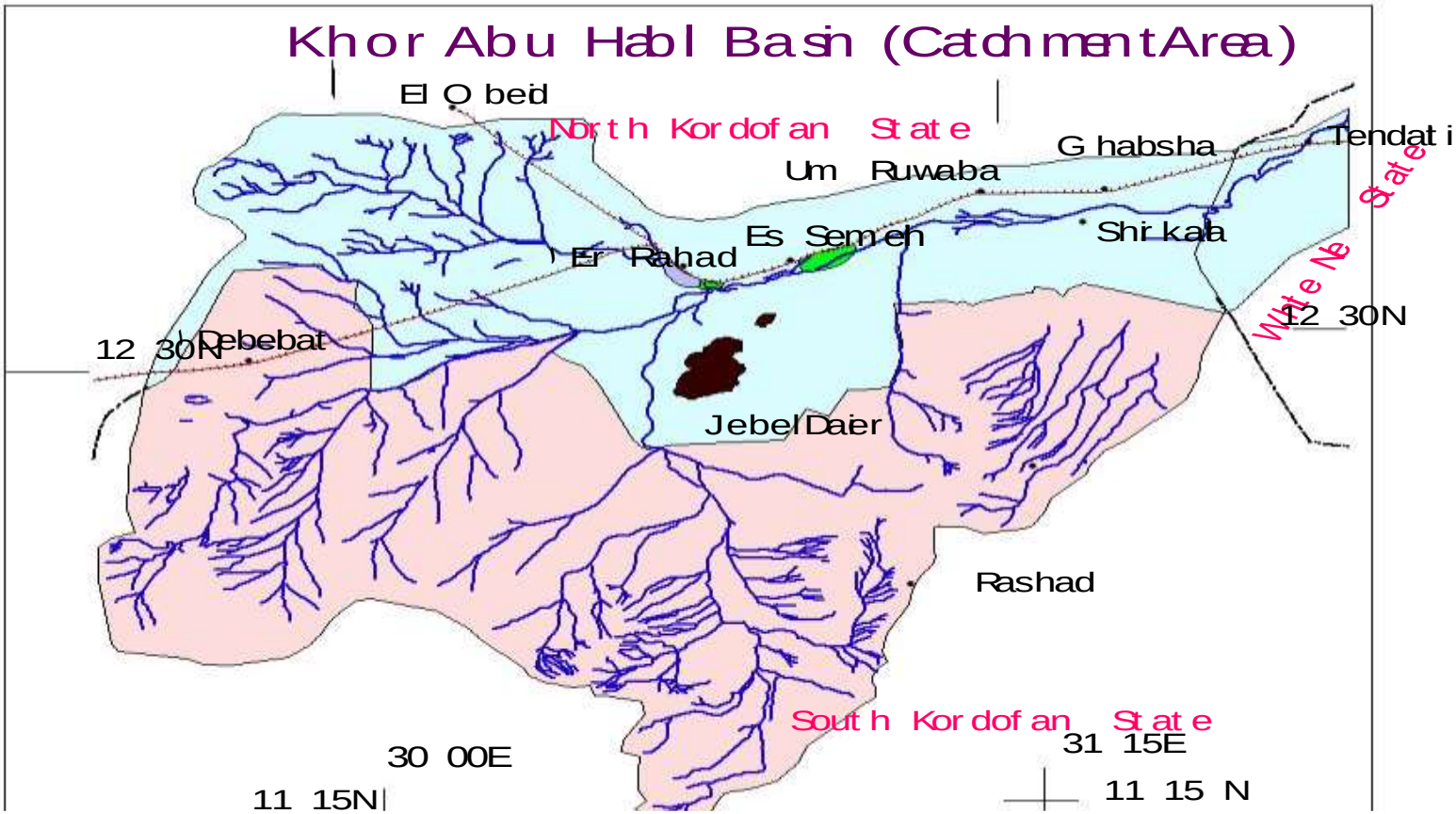


Trans-boundary – Regional

Toker

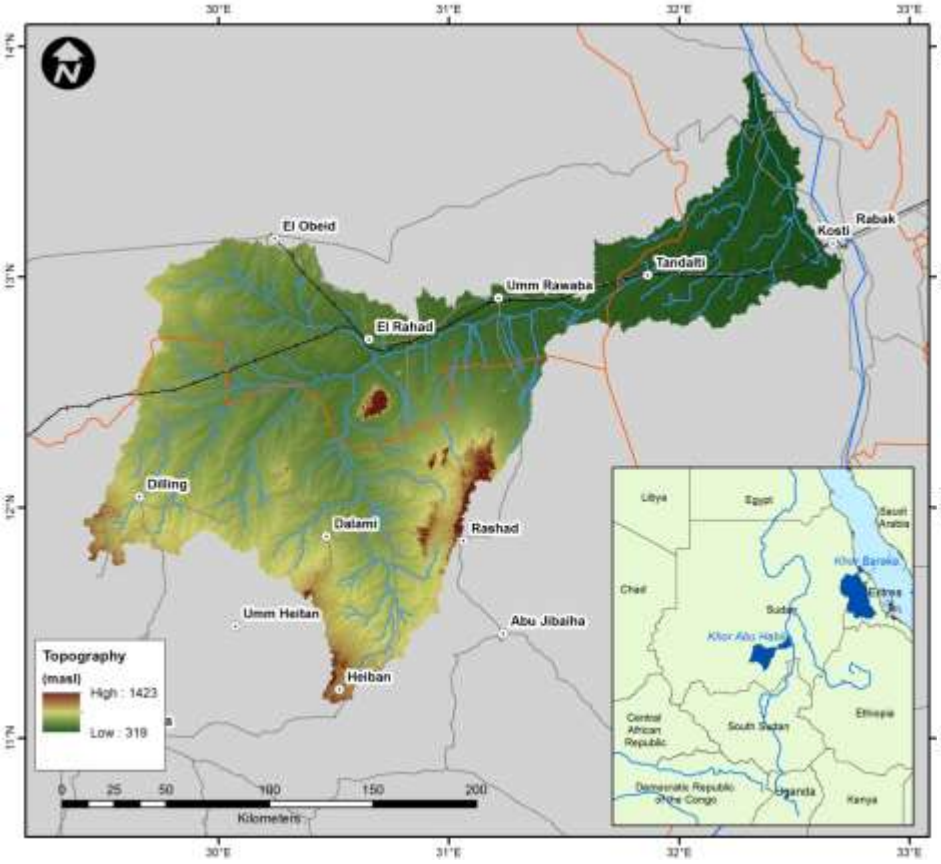

5 m
10 m
علامة موضعية بلا عنوان
طـوكر
طـوكر
15 m
30 m
25 m
علامة موضعية بلا عنوان
علامة موضعية بلا عنوان
45 m 40 m
50 m
55 m
شدن
شدن
علامة موضعية بلا عنوان
علامة موضعية بلا عنوان
1070
US Dept of State Geographer
© 2012 Google

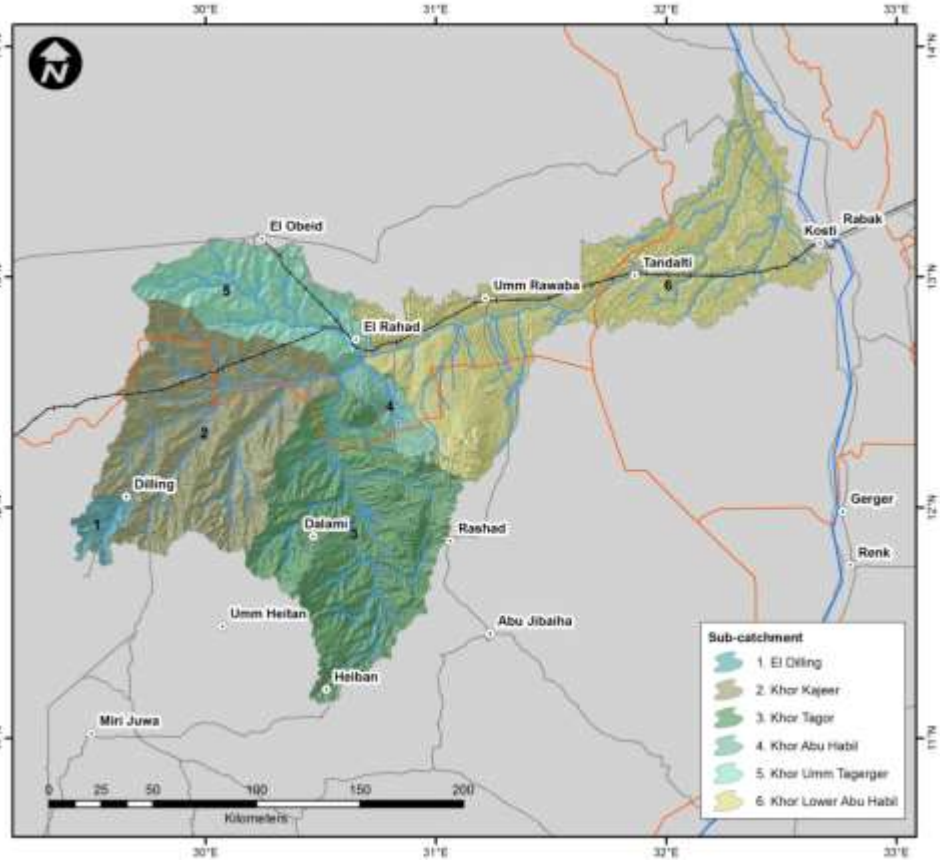
Abu Habil



Source: YAM (2004), IFAD.

Abu Habil





Trans-boundary – Statal

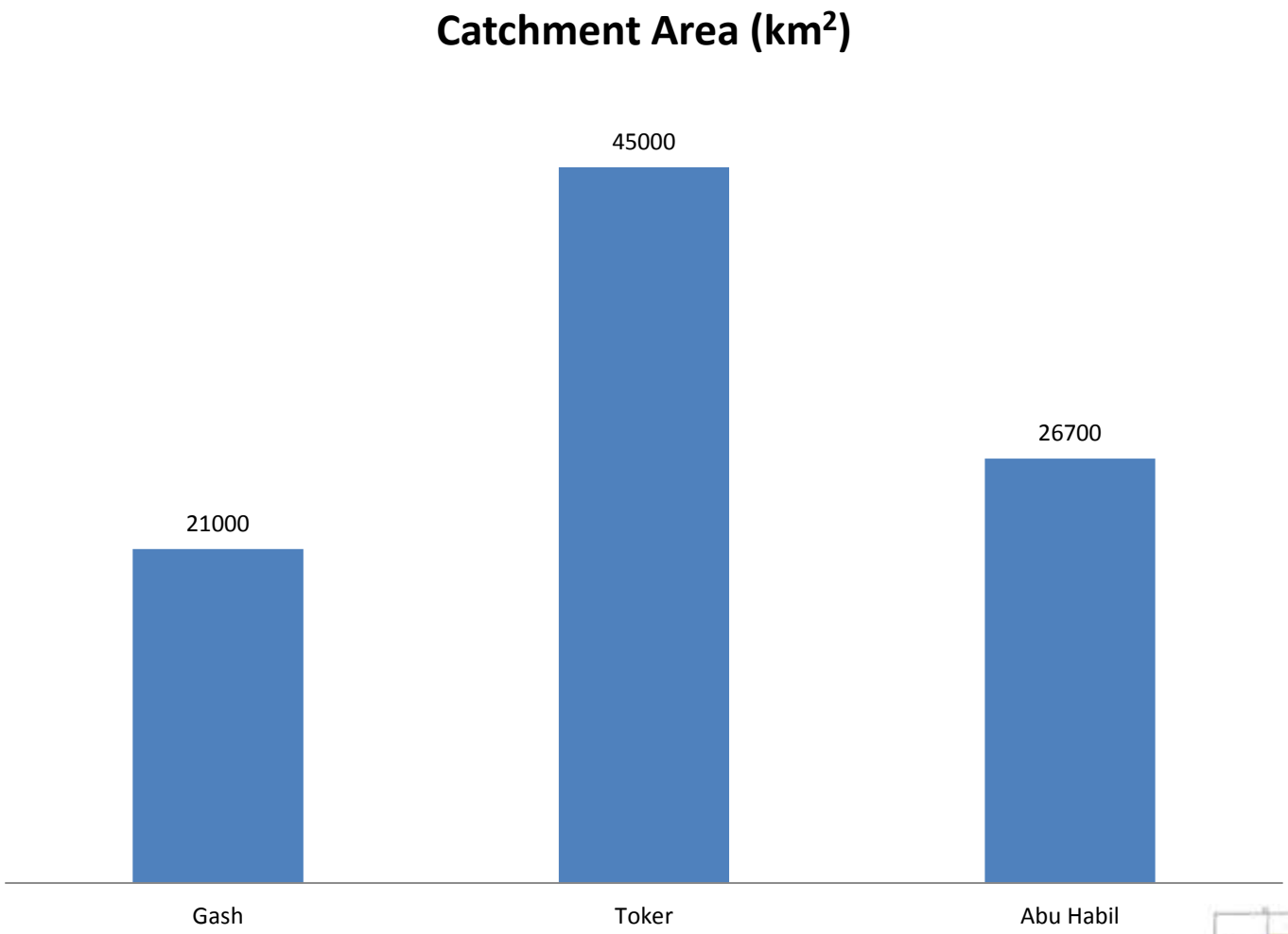
Main Common Features

- Flushy (high flow variability)
- Seasonal
- Steep slope
- Sedimentation (high rate)
- Weeds … etc
-

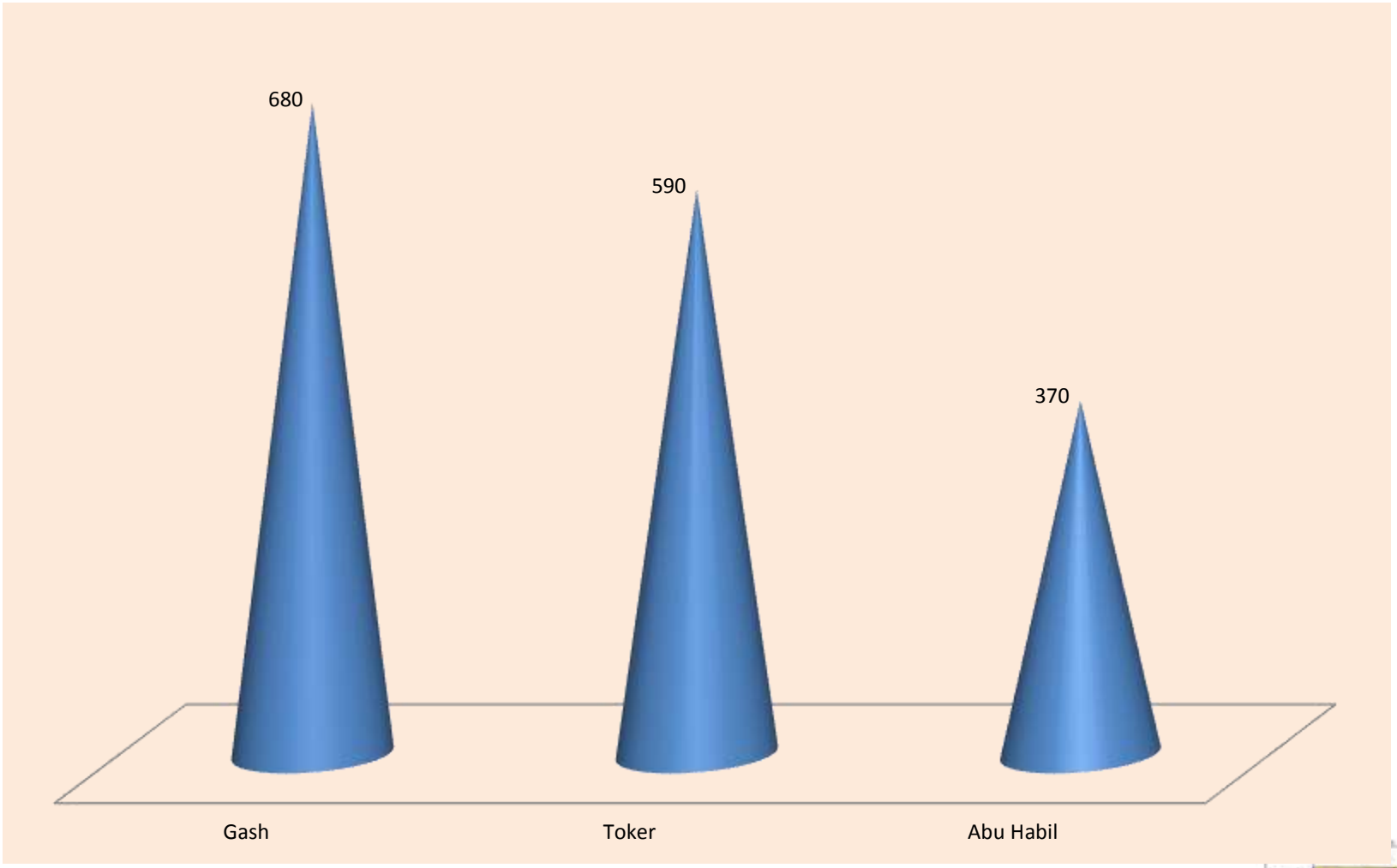
Economic Activities

- Agriculture
- Livestock
- Charcoal
- Bricks
- … etc

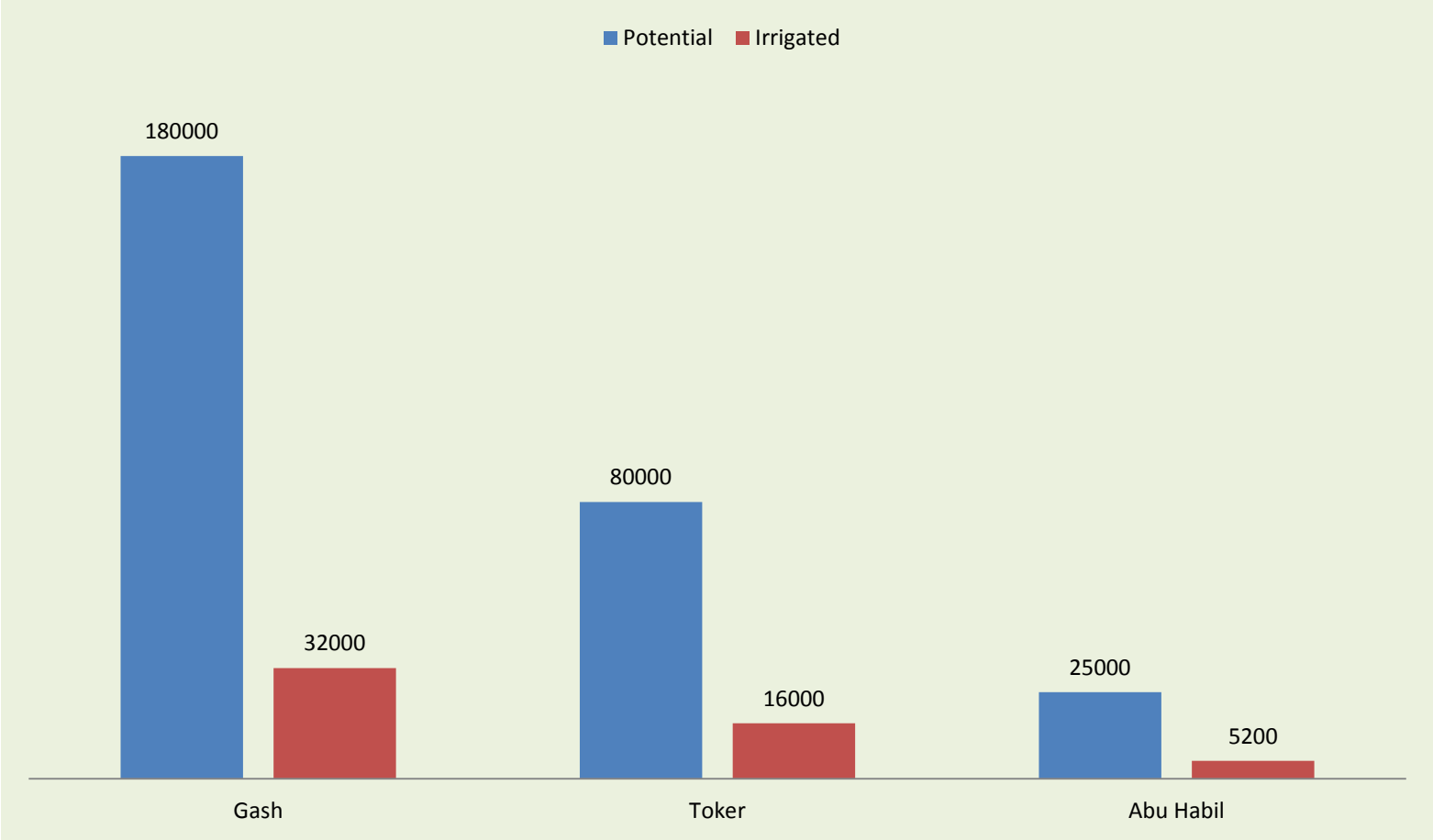
Catchment Area (km^2)



Water Availability



Potential Versus Irrigated Area (ha)



Main crops

- Cotton;
- Sorghum
- Millet
- Vegetables
- Fruits
- Sun flour
- Forest …

Main Crops

Associate Problems

- Upstream intervention:

(e.g construction of 6 earth-dams u/s khor Abu Habil)

- Rapid change in topography:

(high sediment concentration?, weeds)

- Lack of holistic thinking

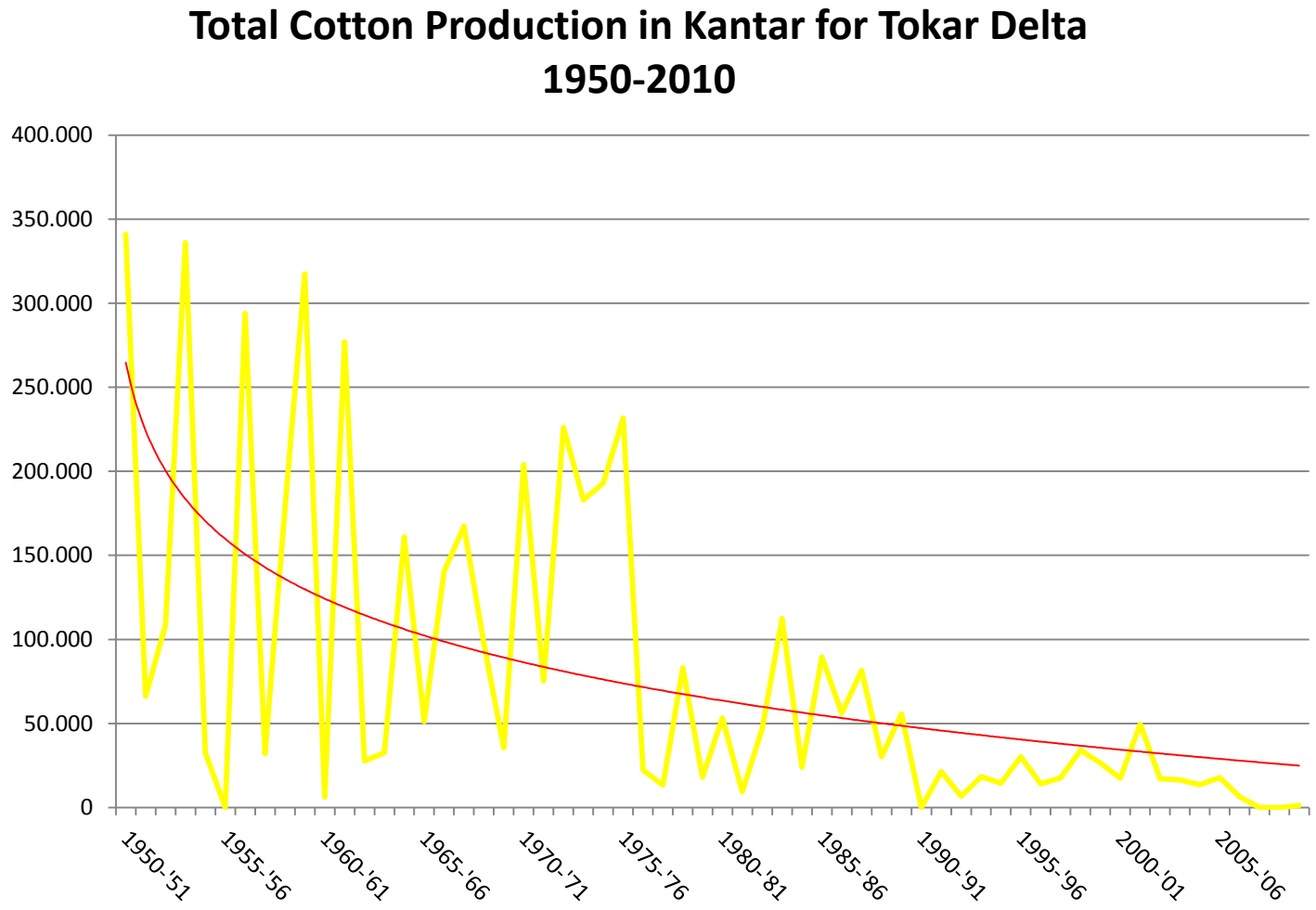
(water diverging, increase of retention time in u/s side)

➢ Irrigation methods and practices ?

Site	Yield (ton/ha)	Water (mm)	Productivity (kg/mm)
Upstream	1.34	663.60	2.02
Middle	1.90	542.01	3.51
Downstream	2.79	412.80	6.76

- The water lost was:
  - ✓ 50% at head
  - ✓ 22% at middle section.

(Source: Adeep, IGAD Water Dialogue Forum, 2015)

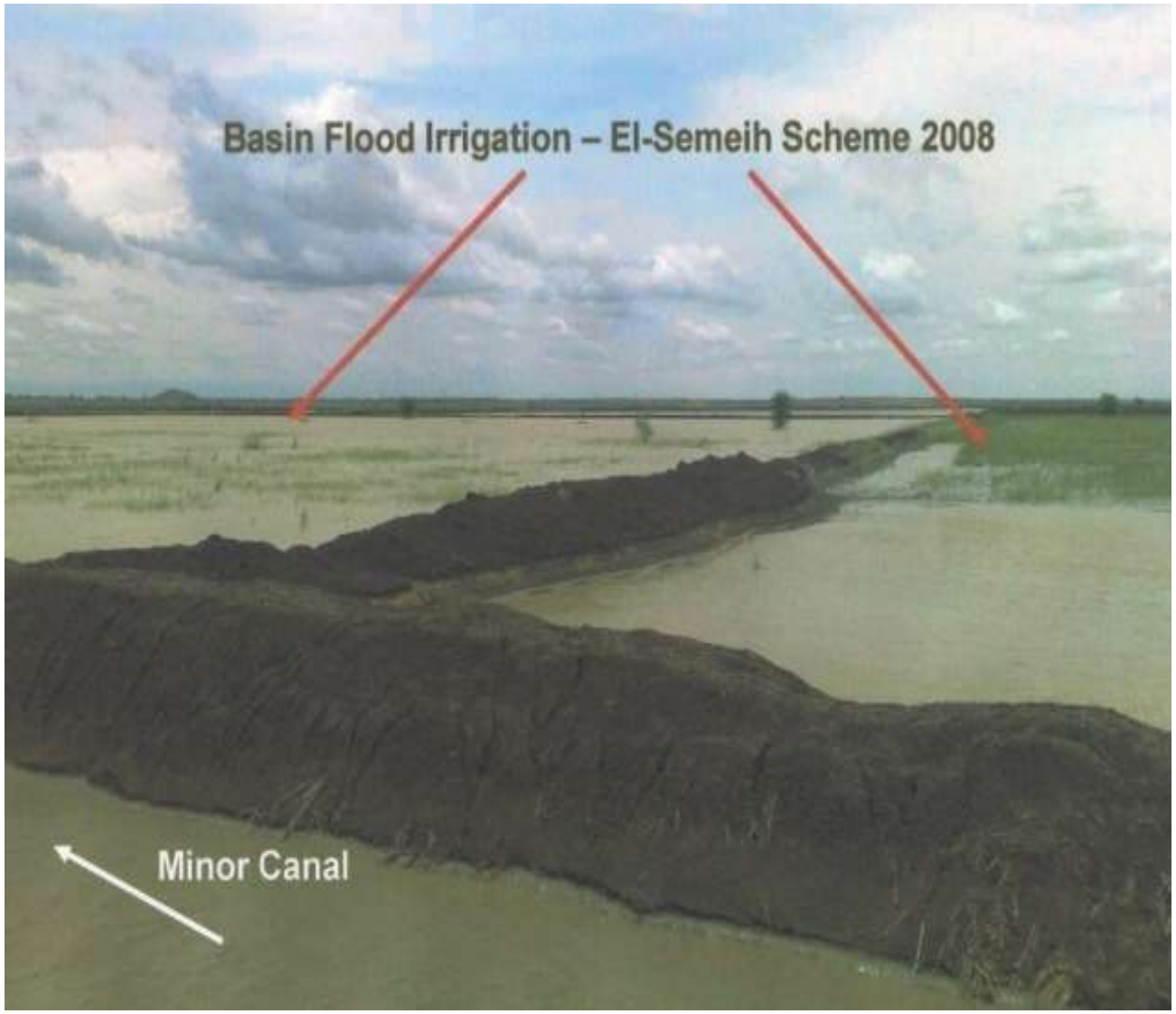

Total Cotton Production in Kantar for Tokar Delta
1950-2010
400.000
350.000
300.000
250.000
200.000
150.000
100.000
50.000
0
1950-'51
1955-'56
1960-'61
1965-'66
1970-'71
1975-'76
1980-'81
1985-'86
1990-'91
1995-'96
2000-'01
2005-'06

Is it a problem of Productivity or Production?

Productivity = f (Crop, Soil, water, Climate, Practices …)

Production = f (Area) --> Policy, Opportunity, Attitude, Market …)

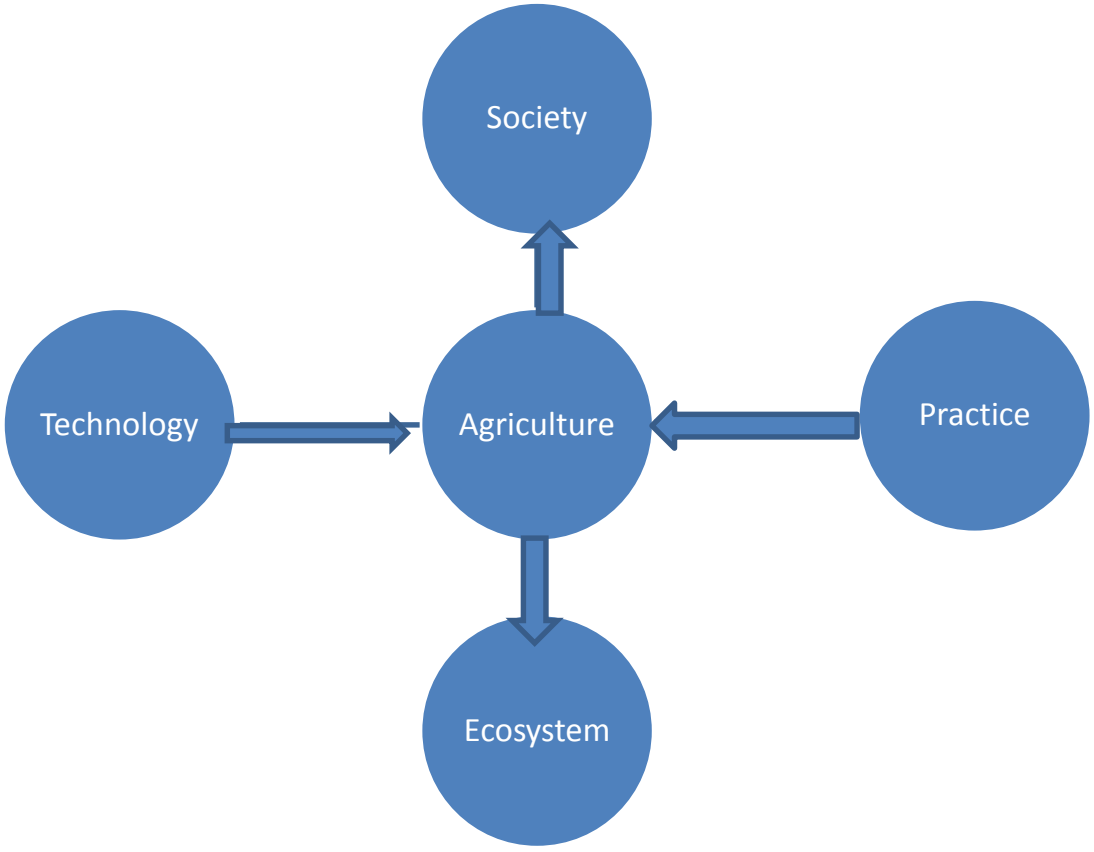
➢ Accessibility



- Over abstracting (Depletion)

Why FBFS? S P A T E

- **S** Society
- **P** Practices
- **A** Agriculture
- **T** Technology
- **E** Ecosystem

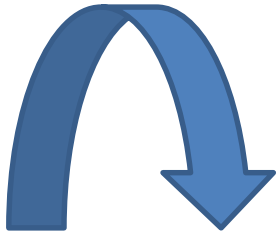


If **S**ociety **P**ractice **A**griculture through appropriate **T**echnology, sustainable **E**nvironment(Ecosystem) become a reality.

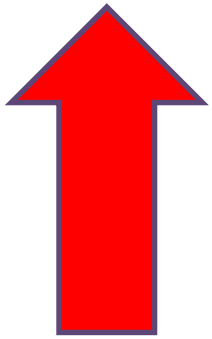
Traditional method of river training.

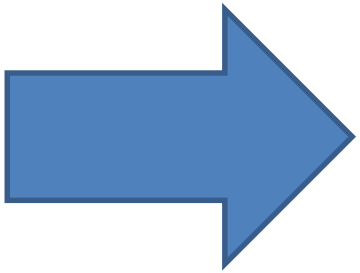
Sometimes machine doesn’t work.

Encourage Innovation



XI + I = X





Looking from different Angles









Accommodate Diversity

Opportunity

- Good soil
- Abundant of water
- Different activities

Resultant

- Achieving food security and Poverty alleviation.
- Better Social services.
- Improving livelihood of households
- Livestock fodder.
- Increasing incomes.
- Employment opportunities for State people
- The low cost of production, decreases cost per unit produced and consequently increases its competitive advantages.
- Devoid of use of chemicals increases its marketing features among competitors.
- Improving the productive capacity of the rural environment.

Watershed Experience in implementation and Management of WH Structures (ENTRO Project)

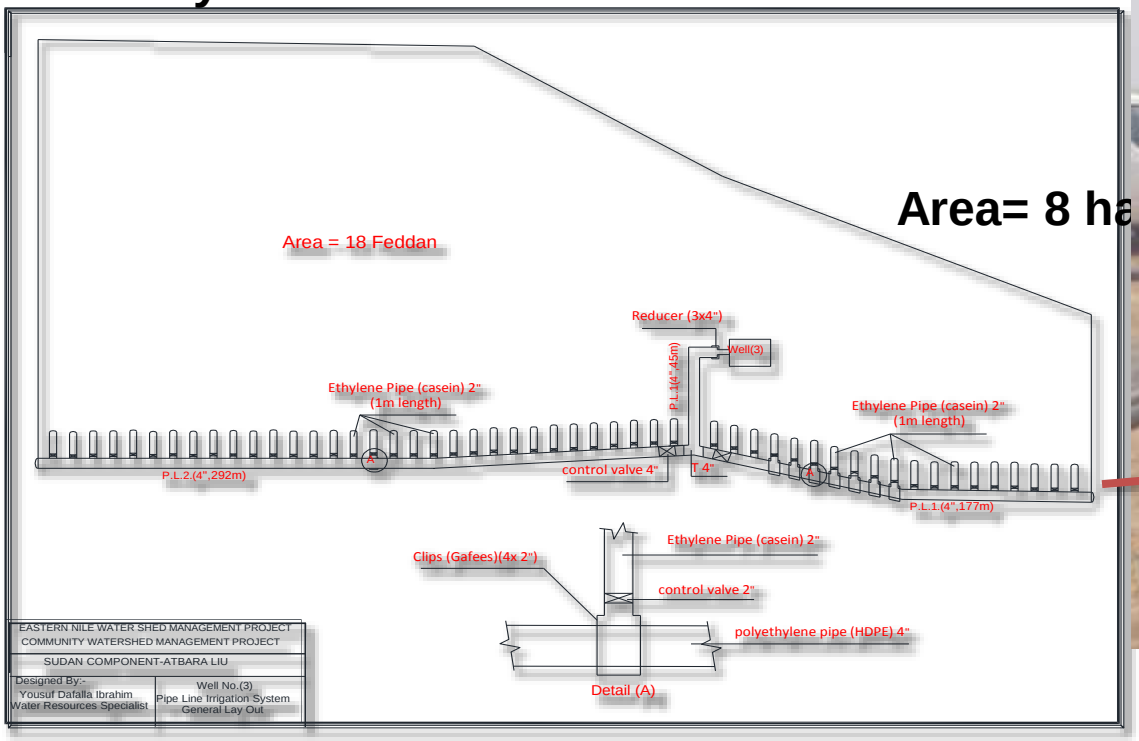
Gully treatment- Jeldok Village

March 2013

July 2013

Gully treatment- Shabana Village

Upgrading of Irrigation System – Atbara LIU



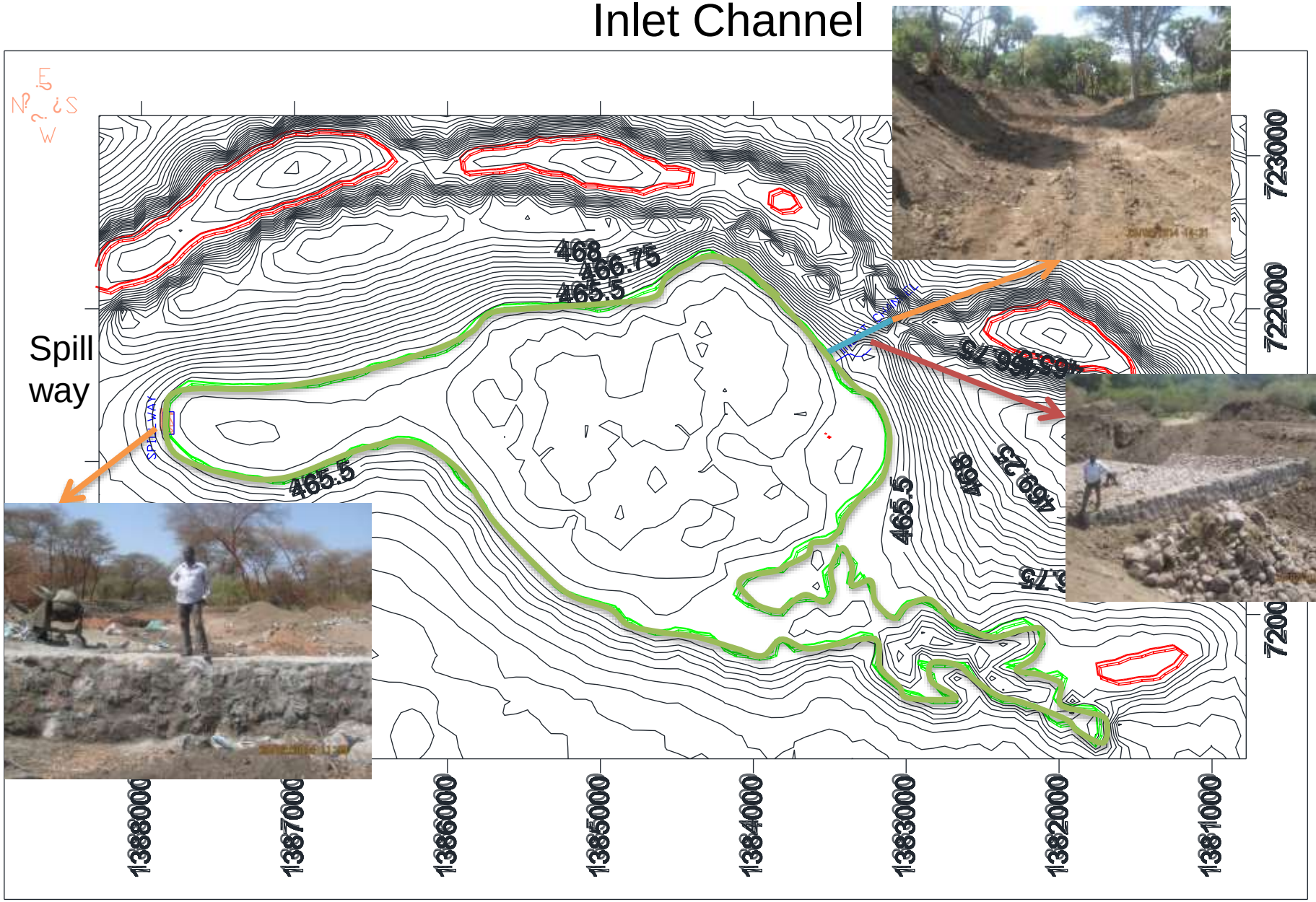
Area= 8 ha

Well No.(3)-General Layout

Pipe Irrigation System

Inlet Channel

Spill way



Bait Alwahash Maya Contour Map

Roof water harvesting-Gali Ras Camp(DNP)

enhanced Haffirs management system









Agroforestry using groundwater

How to manage each WH Structure?

- IWRM approaches tailored to each specific case:
- Private
- Communal
- Institutional
- Public
- Public and communal Partnership

The way out

- To reform legal and institutional frameworks for water resources management and development;

- Adopt IWRM approaches and Principles

- To enhance cooperation and coordination among government sectors responsible for natural resources management through awareness raising and legal reforms

- To strengthen human and institutional capacities in water resources management and the related fields;

- To adopt participatory approaches and involvement of stakeholders at all levels including the private sector, in water resources management;

- To adopt efficient technologies for water uses and management;

- Research and development is to be strengthened in water related fields

Thanks for your Attention