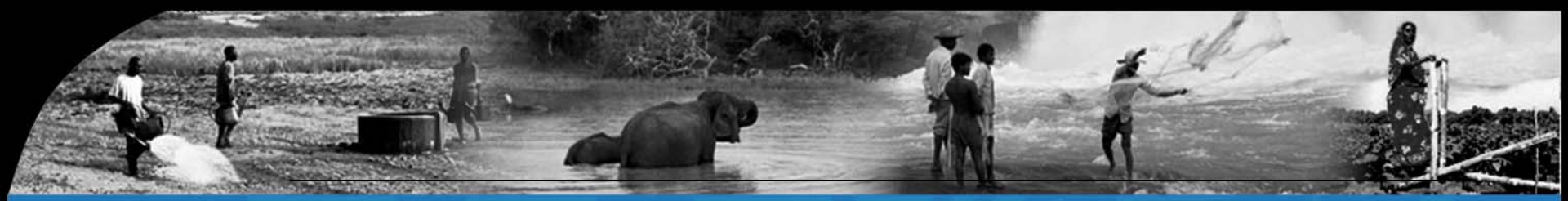


Water accounting in the Nile Basin

Nile Basin Focal Project

February 2009

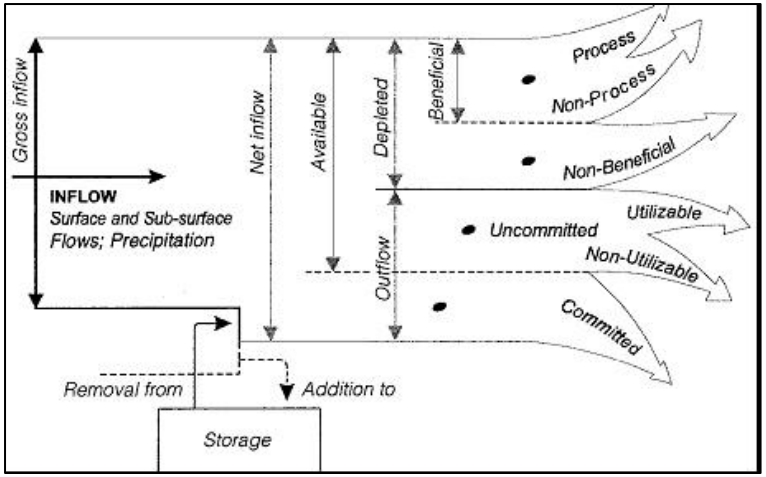
Y. Mohamed; D. Molden; W. Bastiaanssen

Nile water accounting: Objectives

- Assess water resources, uses, and productivity
  - Quantify simple indicators: water balance, water use, and water productivity.
  - Use RS data as key inputs: P, ET, Biomass
  - Assess potentials and limitations of the methodology
- Nile water management: opportunities and constraints

Nile water accounting: Methodology

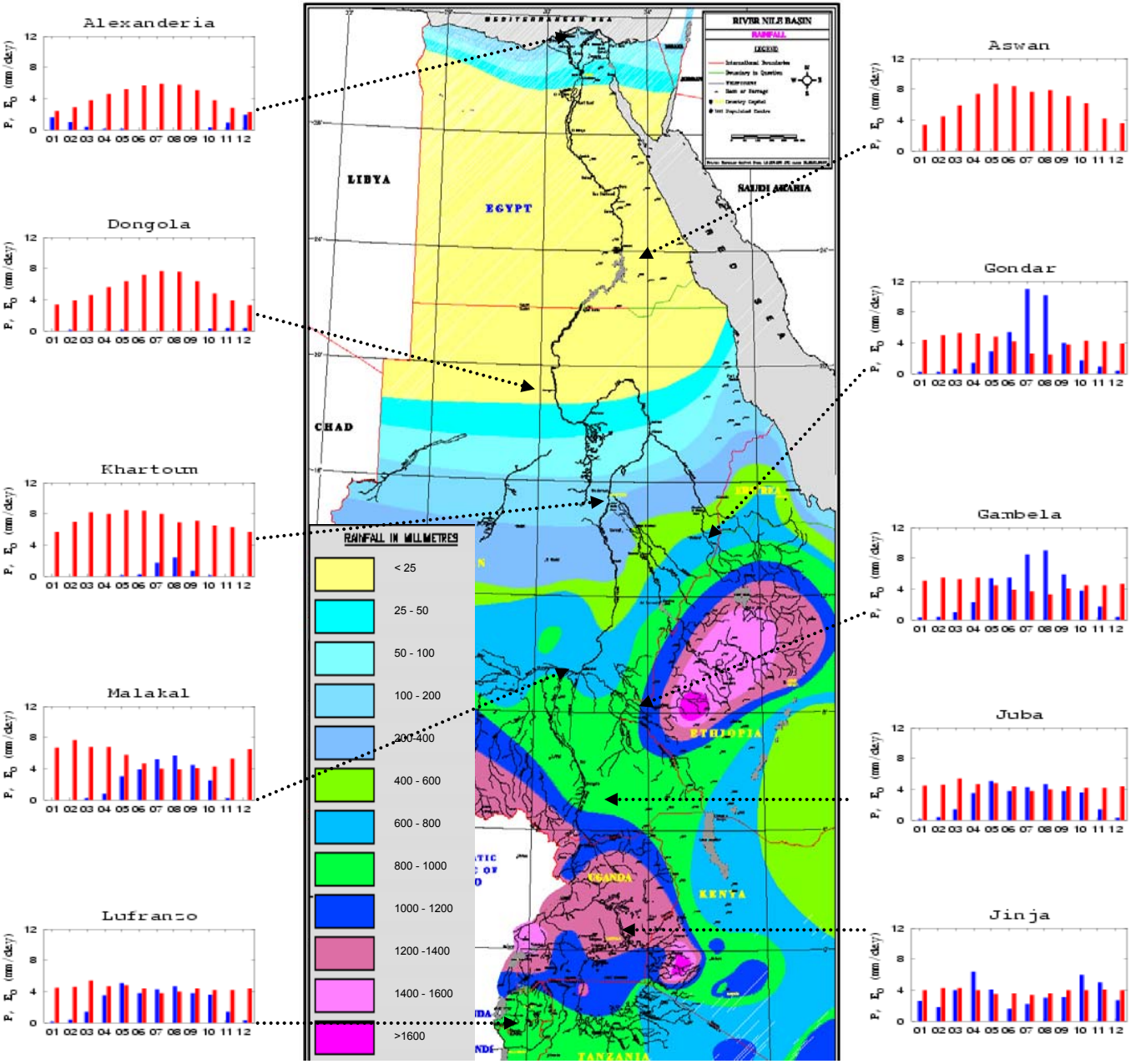
- Based on water balance principle
- Define indictors: supply, consumption, beneficial, non-beneficial
- Boundary conditions (Inputs):
  - Water Supply: Rain, River, Groundwater
  - Water use: Consumptive (ET), non-consumptive, beneficial (T), non-beneficial (E), committed (treaties), etc.
- Scales:
  - Spatial: catchment, production system, sub-basin, basin, country
  - Temporal: month, season, annual, long term mean
- Output
  - Water accounting → water productivity



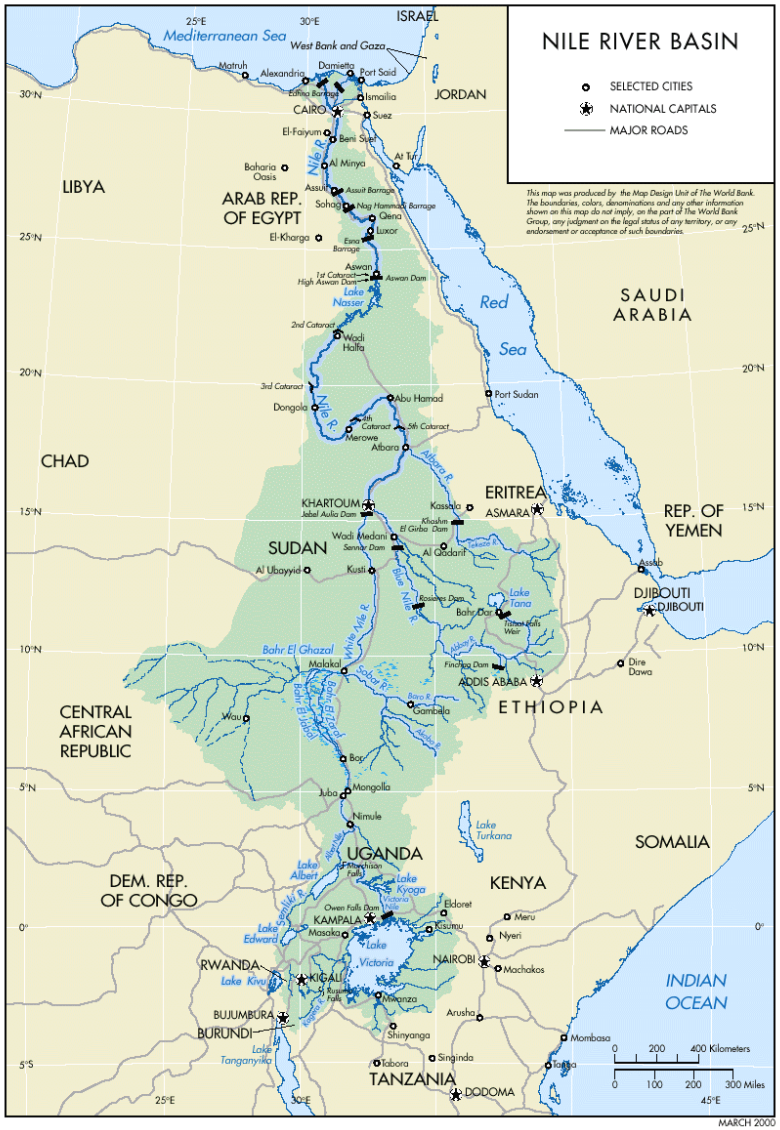
Source: Molden, 1997

Nile Hydrology:

Mean P
Mean ET_0

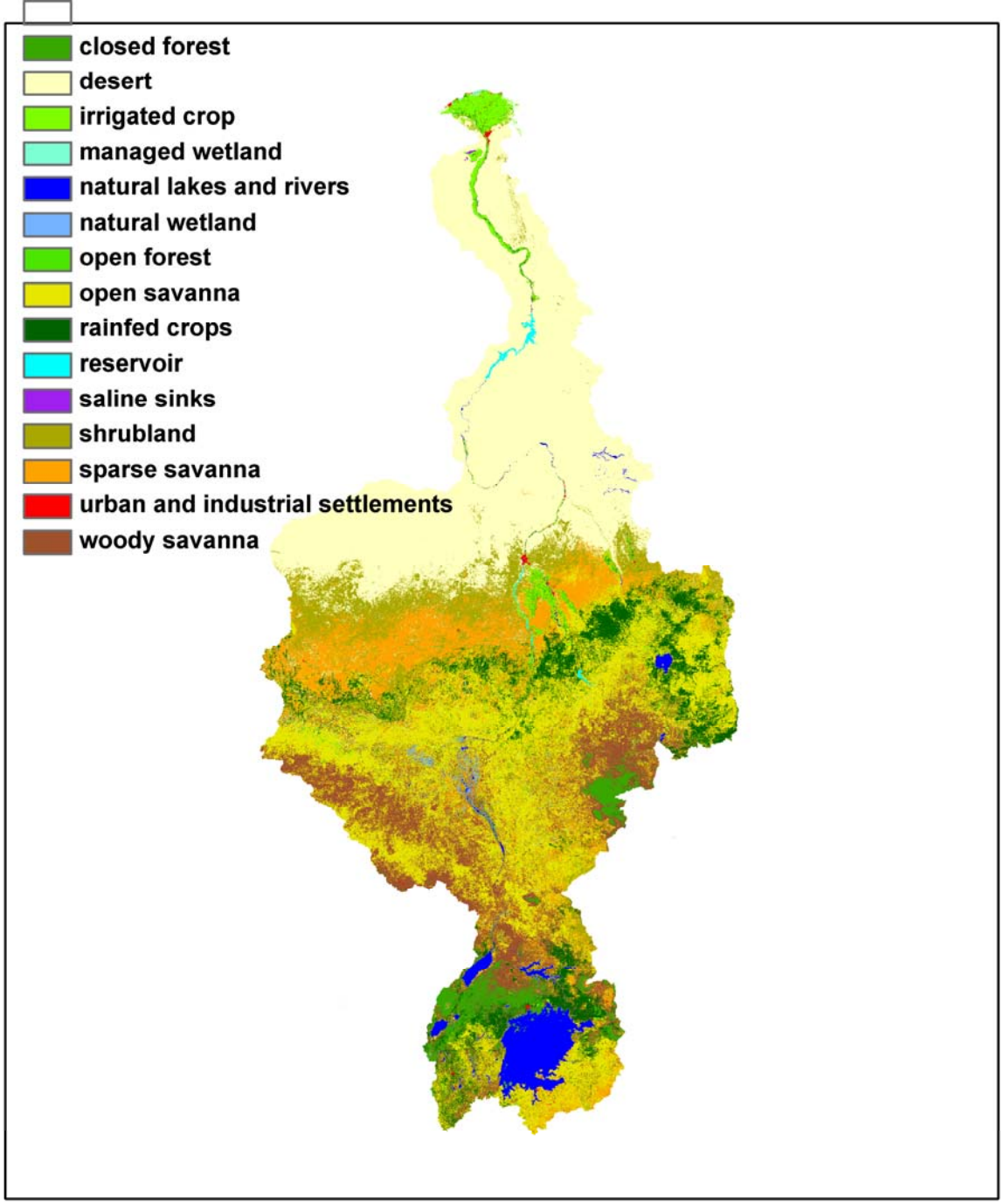


Nile Water use

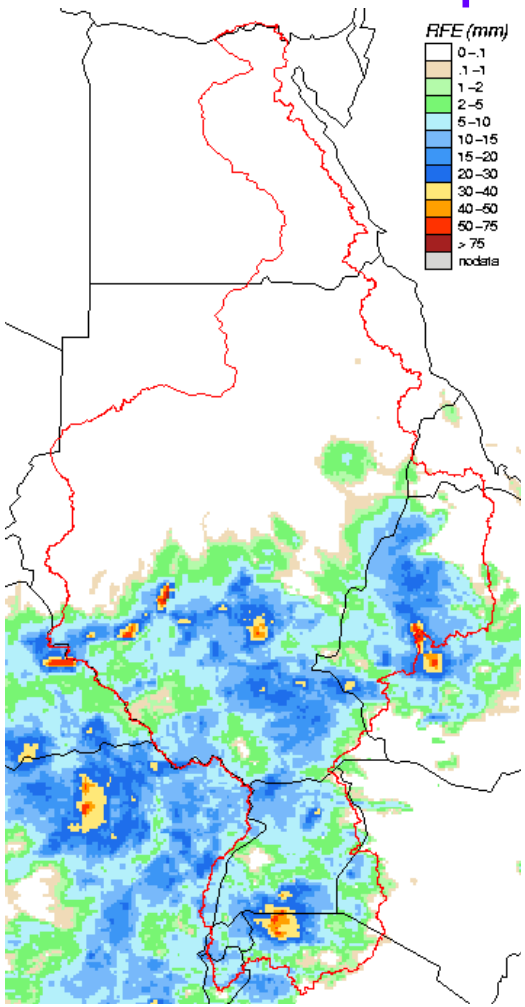


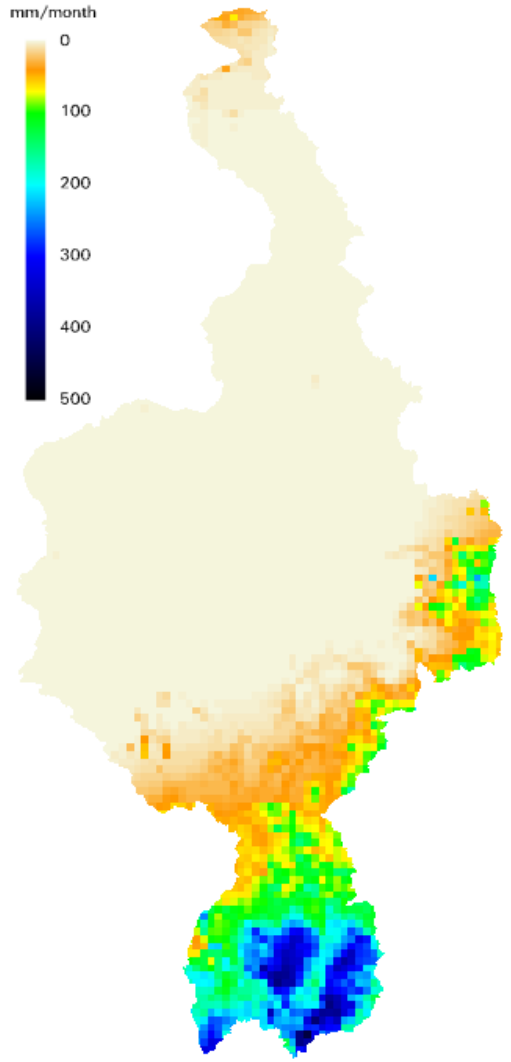
Input: Land and water use classes

No.	Land use	class
1	closed forest	NL
2	open forest	NL
3	shrub land	NL
4	woody savanna	NL
5	open savanna	NL
6	sparse savanna	NL
7	natural wetland	NL
8	rainfed crops	ML
9	Urban + industustry	MW
10	desert	NL
11	irrigated crop	MW
12	reservoir	MW
13	natural lakes and rivers	NL
14	managed wetland	MW
15	saline sinks	MW



Input: Rainfall in 2007

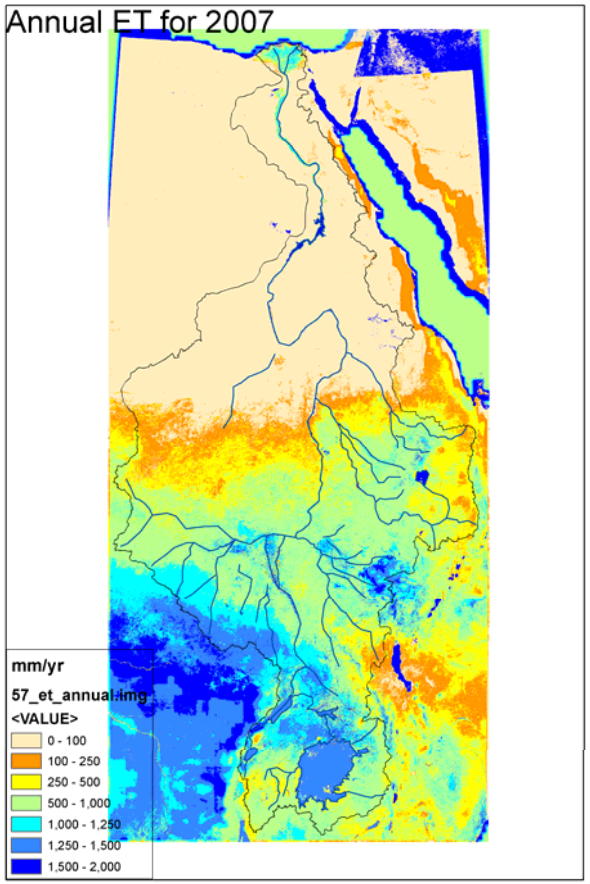


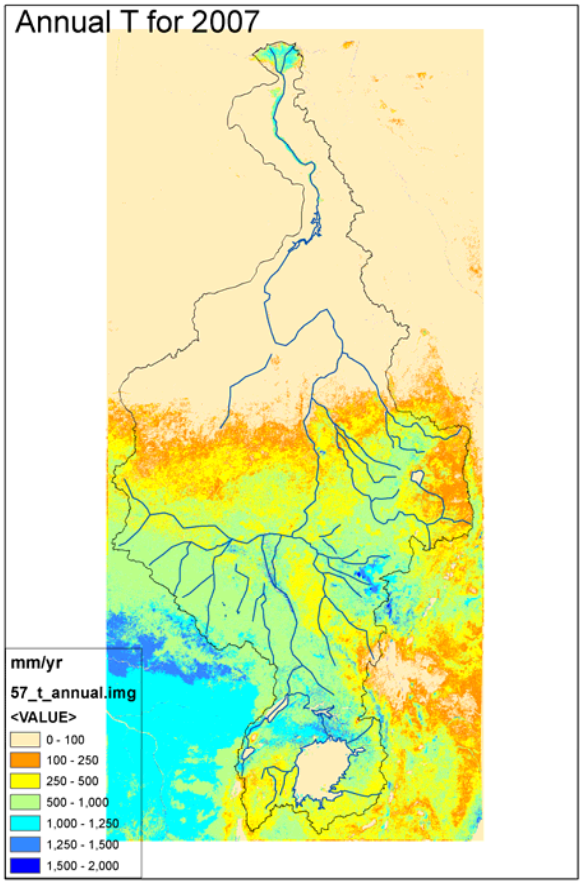


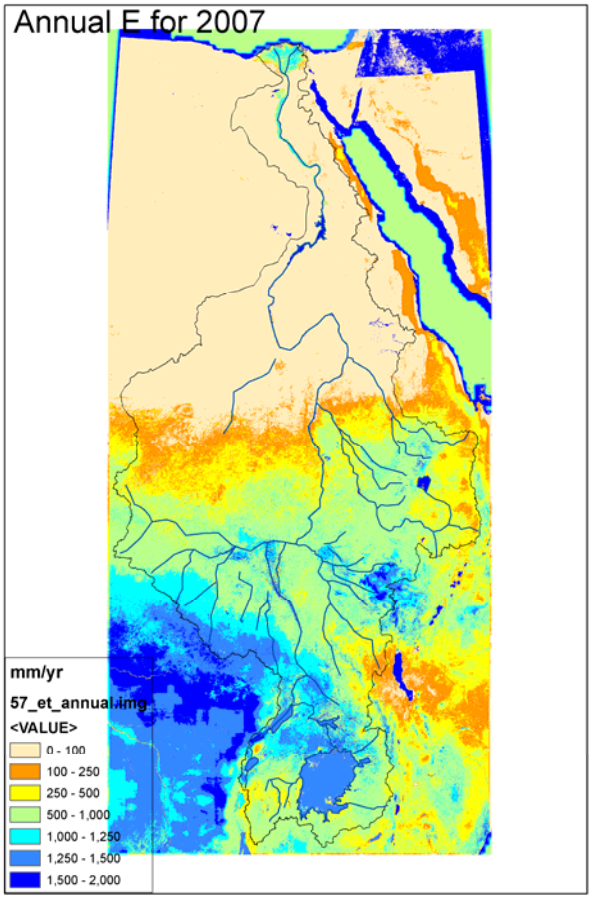
FEWS

TRMM

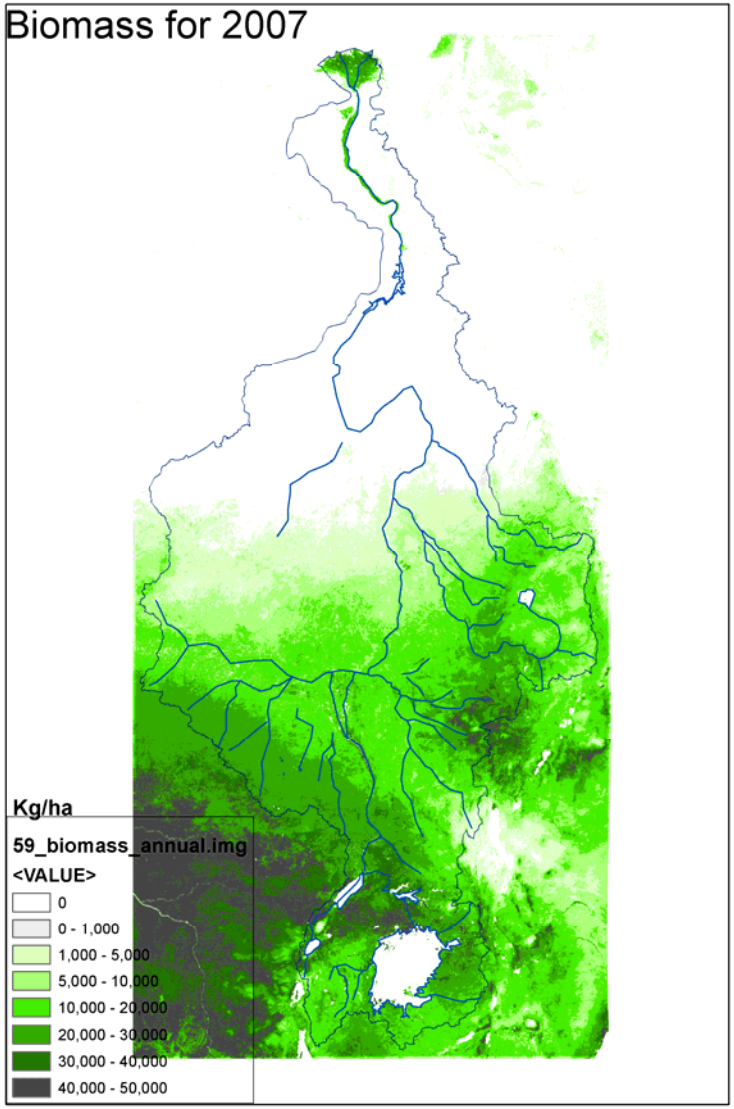
Input: SEBAL ET, T, E



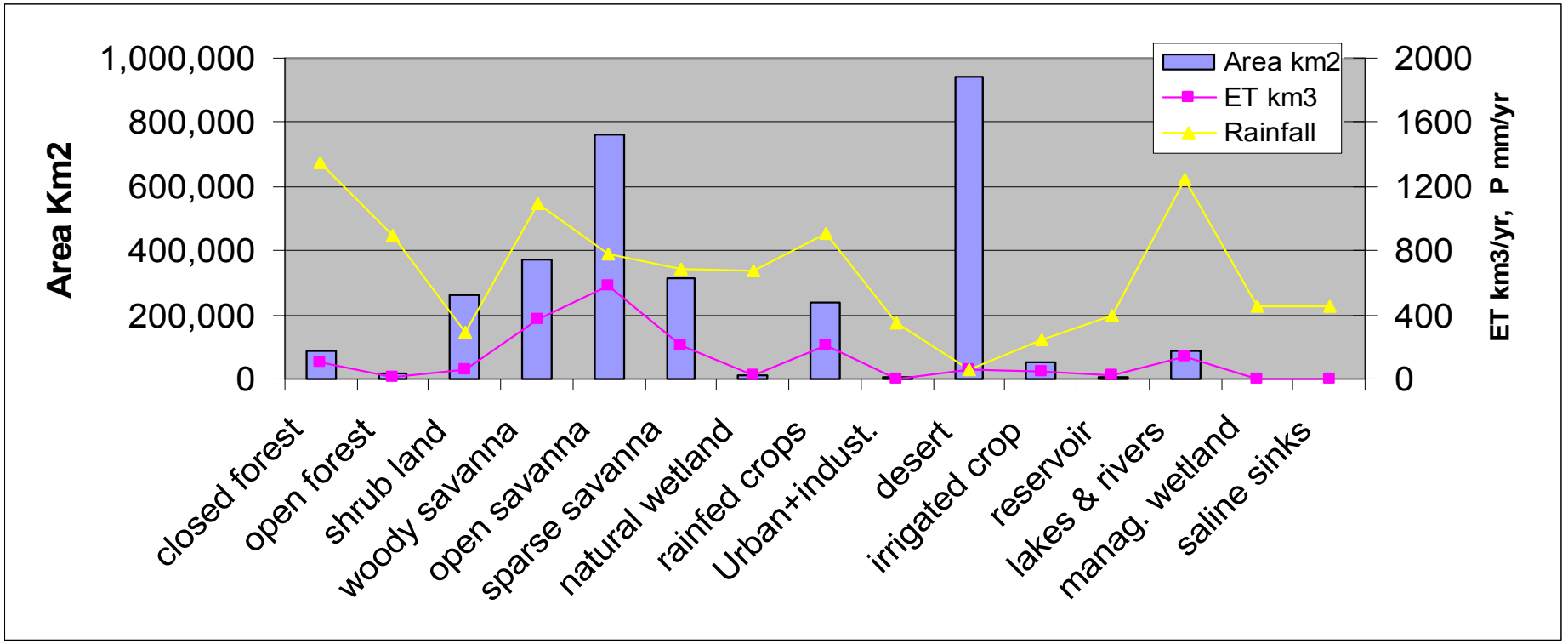




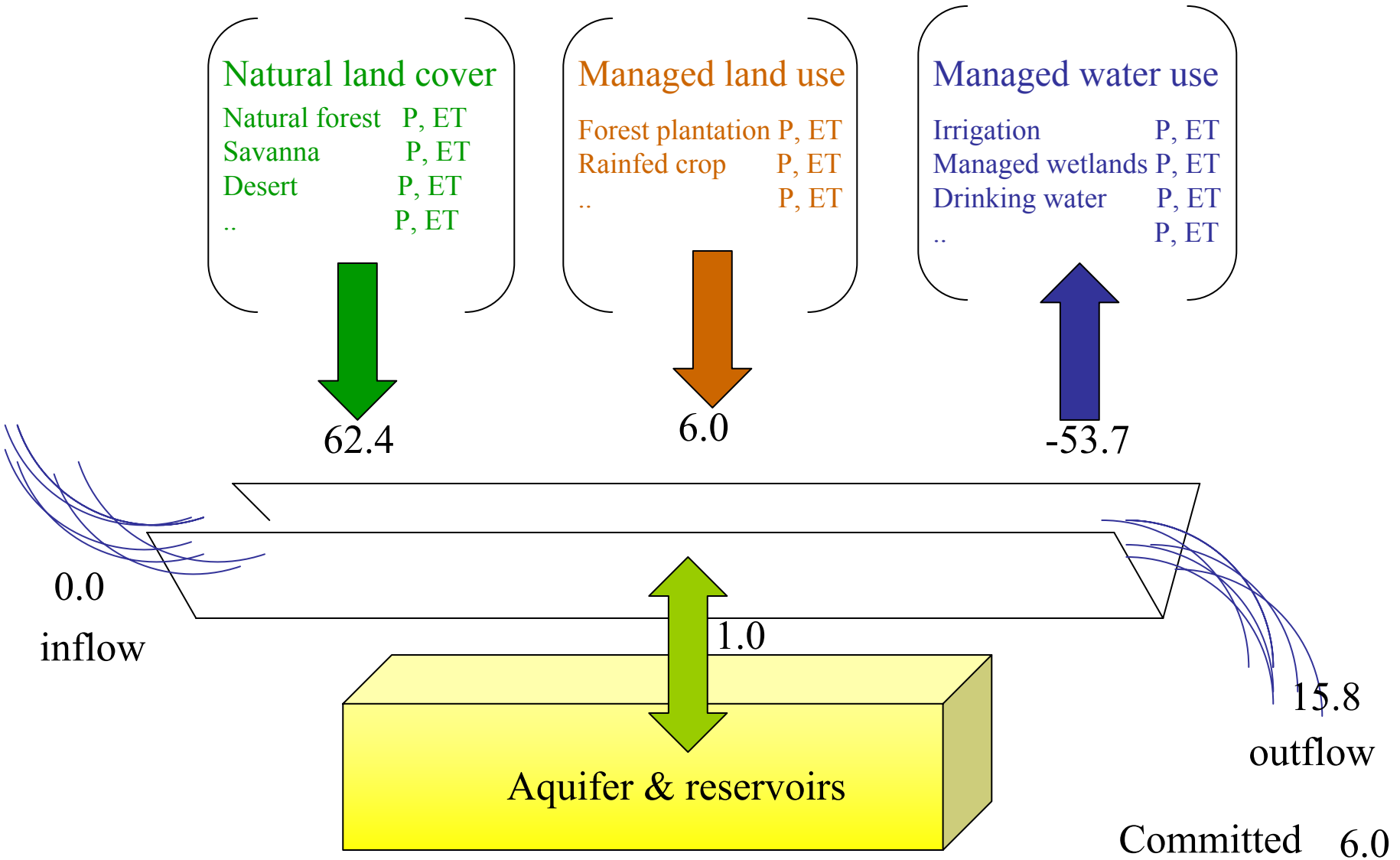
Input: SEBAL Biomass



Land use and water use (=consumption)



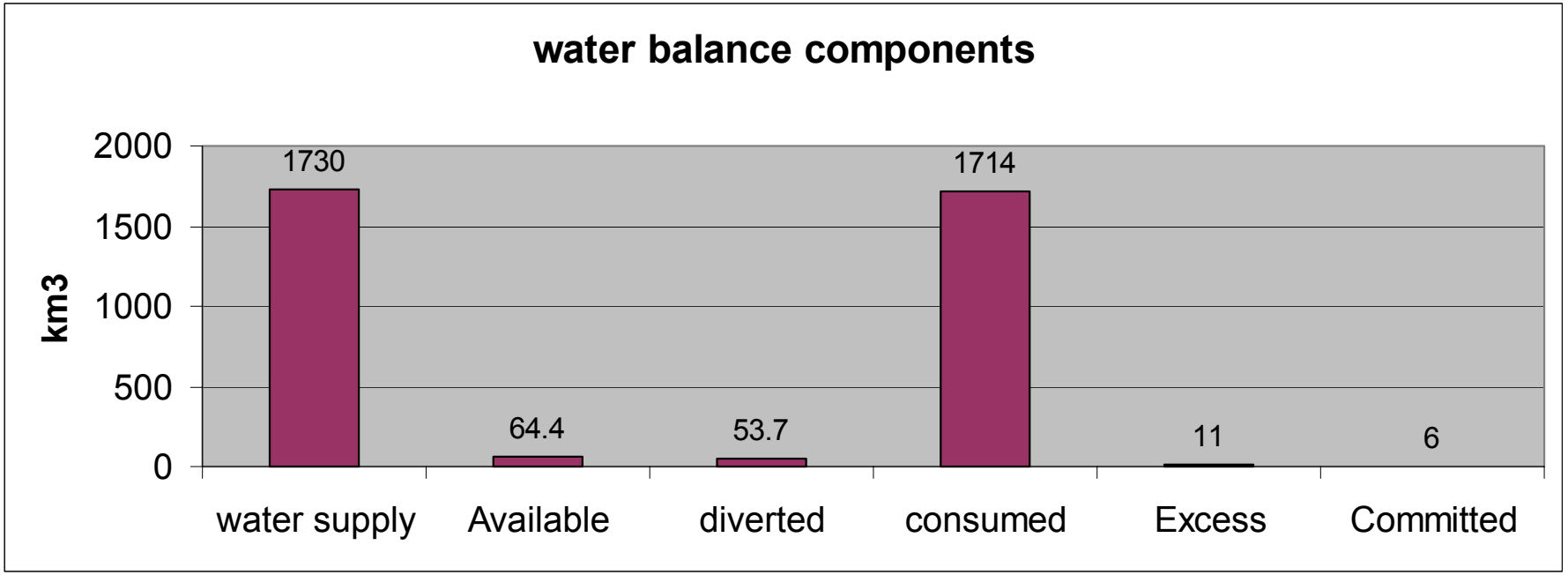
Water balance for 2007 in km^3



Water balance components

- Total water supply = $Inflow + P$
- Available Water = $Inflow + (P - ET)_{NL} + (P - ET)_{ML} - Committed$
- Diverted Water = $(P - ET)_{MW}$
- Consumed water = $\sum ET_{NL,Ml,MW}$
- Outflow water = $Inflow + \sum (P - ET)_{NL,ML} - diverted + \Delta S$
- Excess water = $Outflow - Committed$

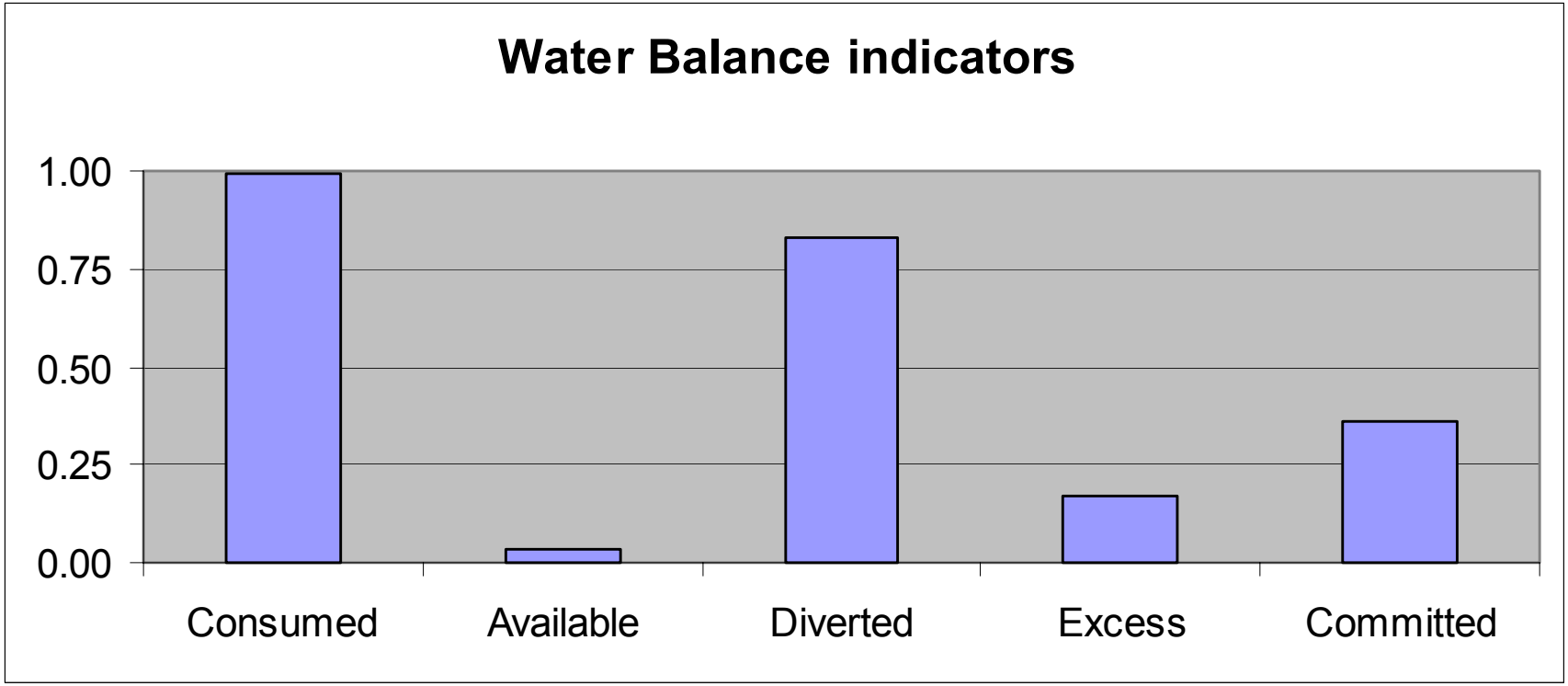
Water balance components



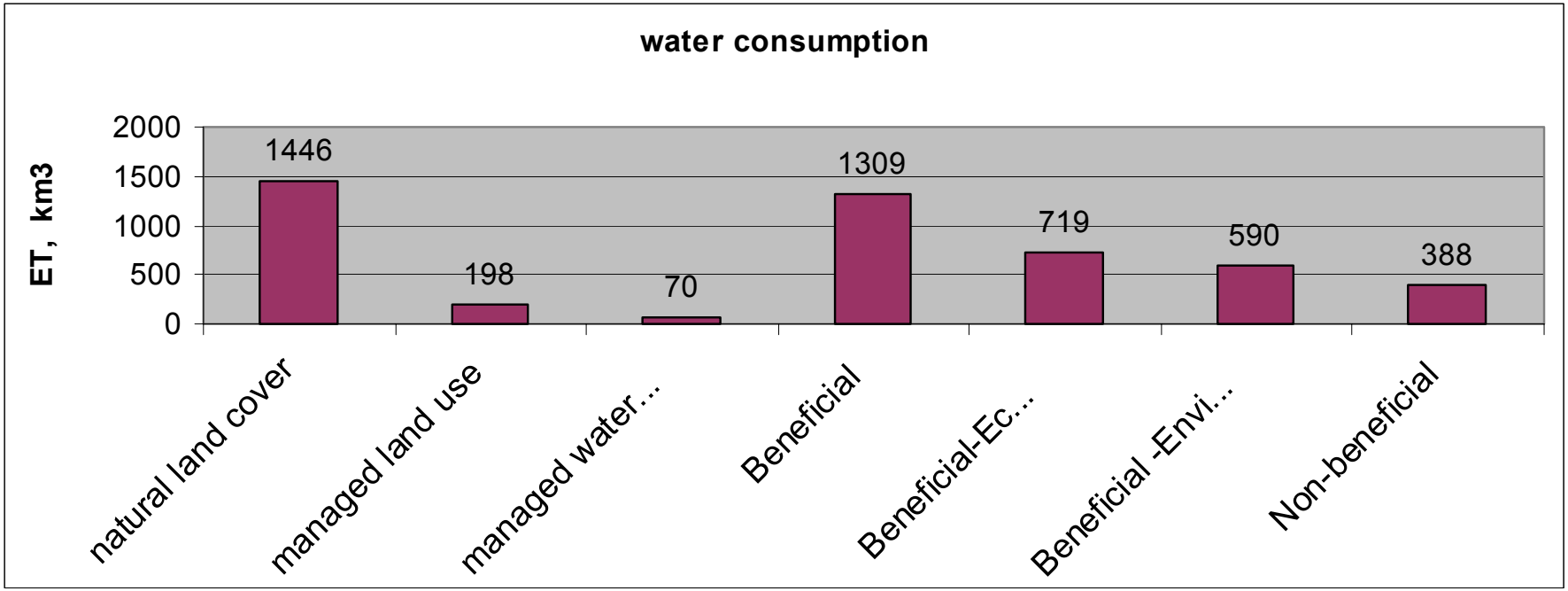
Water balance indicators

- Consumed fraction = $\frac{\sum ET_{NL,ML,MW}}{(Inflow + P)}$
- Available fraction = $\frac{Available}{(Inflow + P)}$
- Diverted fraction = $\frac{Diverted}{Available}$
- Excess fraction = $\frac{Excess}{Available}$
- Committed fraction = $\frac{Committed}{Outflow}$

Water balance indicators



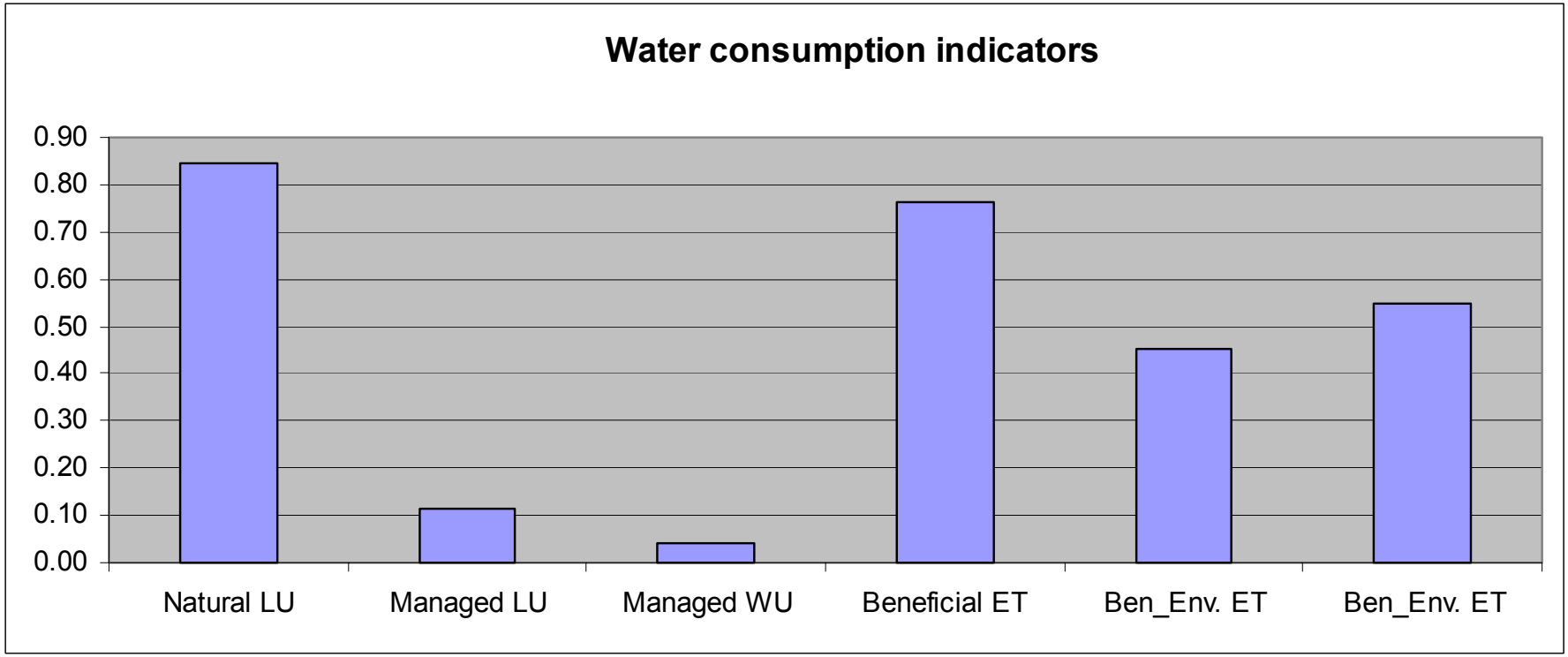
Water consumption



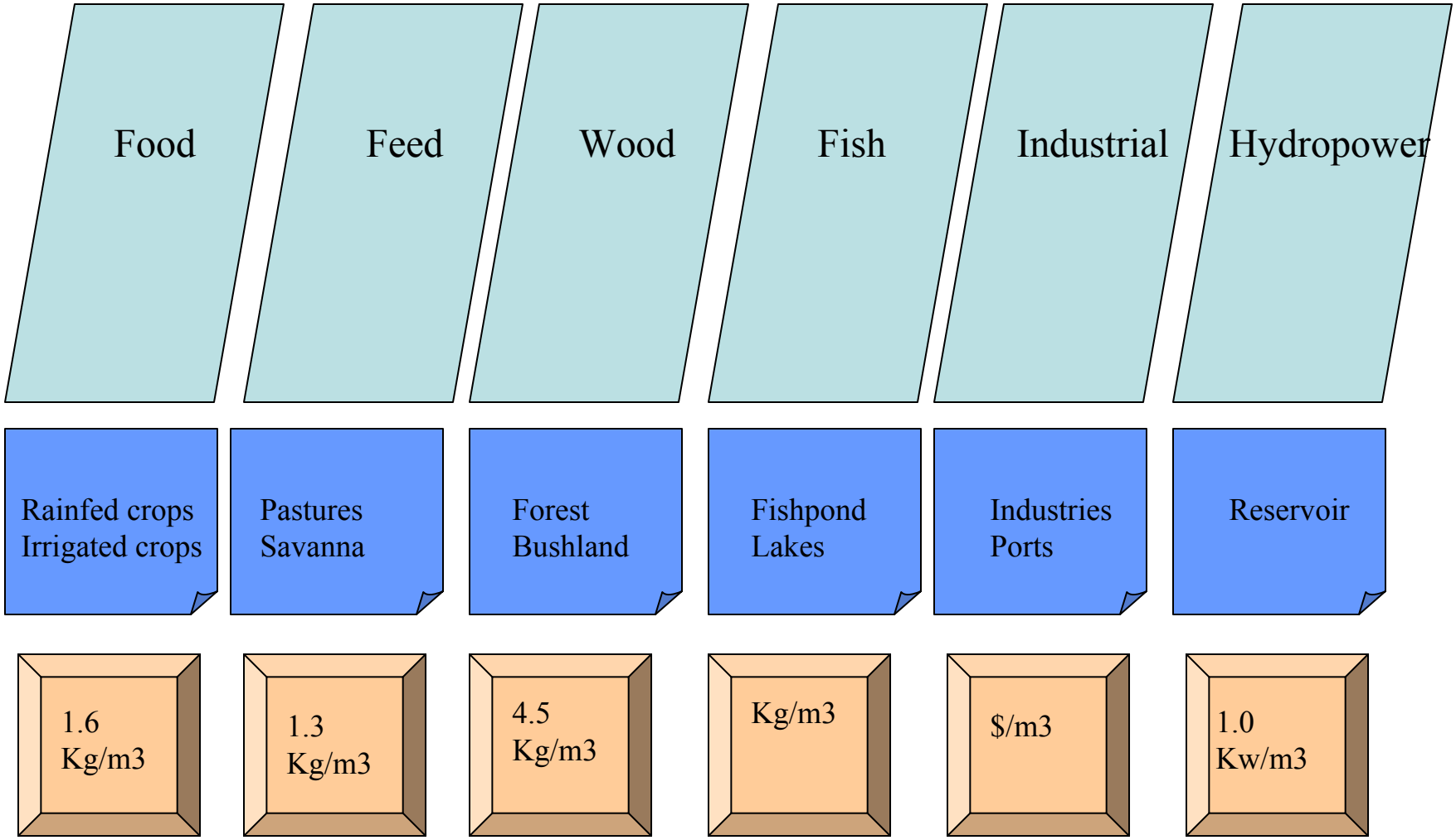
Water consumption indicators

- ET Natural land cover = $\frac{ET_{NL}}{\sum ET_{NL,ML,MW}}$
- ET Managed land use = $\frac{ET_{ML}}{\sum ET_{NL,ML,MW}}$
- ET Managed water use = $\frac{ET_{MW}}{\sum ET_{NL,ML,MW}}$
- ET Beneficial water use = $\frac{ET_{ben}}{\sum ET_{NL,ML,MW}}$
- ET Beneficial – Economics = $\frac{ET_{ben}^{Econ}}{\sum ET_{ben}}$
- ET Beneficial – Environment = $\frac{ET_{ben}^{Env}}{\sum ET_{ben}}$

Water use indicators



Economic productivity sheet



Discussions

- Water accounting at basin scale is effective to understand supplies, uses and production of major systems
- Major part of Nile water is consumed, mainly by natural land cover, and managed land use, not necessarily non-beneficial.
- Still there is excess)not closed)
- Future work:
  - Refine water consumption by different systems (livestock, fisheries, environment, etc.)
  - Refine estimates of productivity (not only biomass)
  - More validation on P, ET, T, E
  - Spatial calculation, sub-basins, countries,
  - Compute accessibility