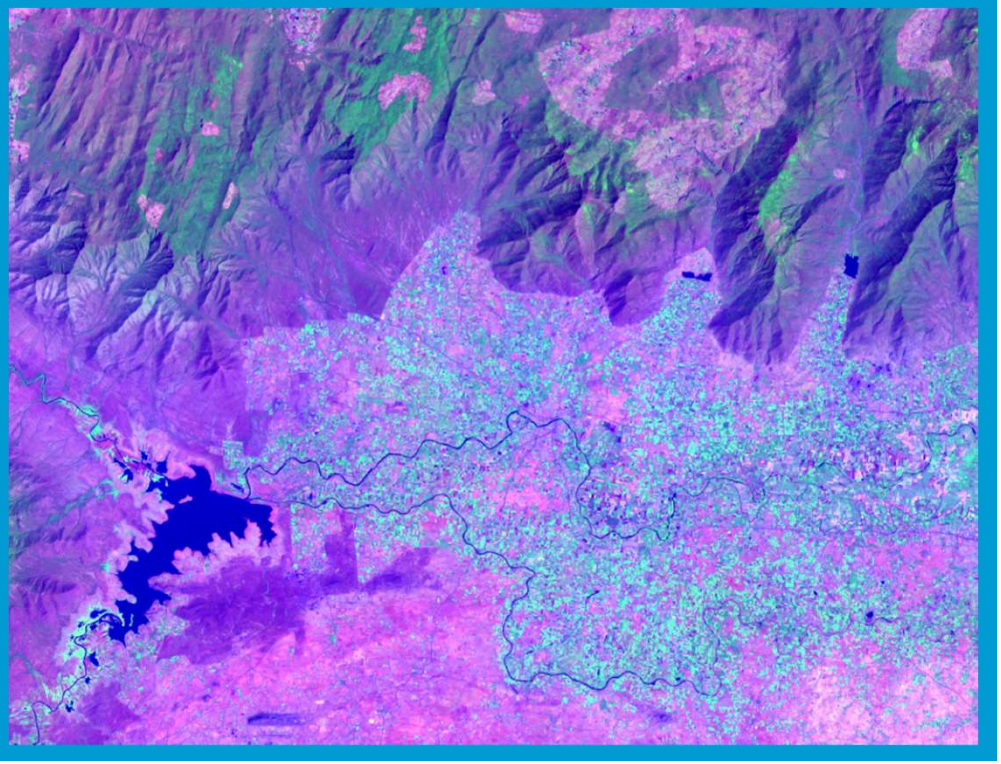
"Improved Water Allocation for Agriculture in the Arab Region"

Technical meeting

26-27/09/2022

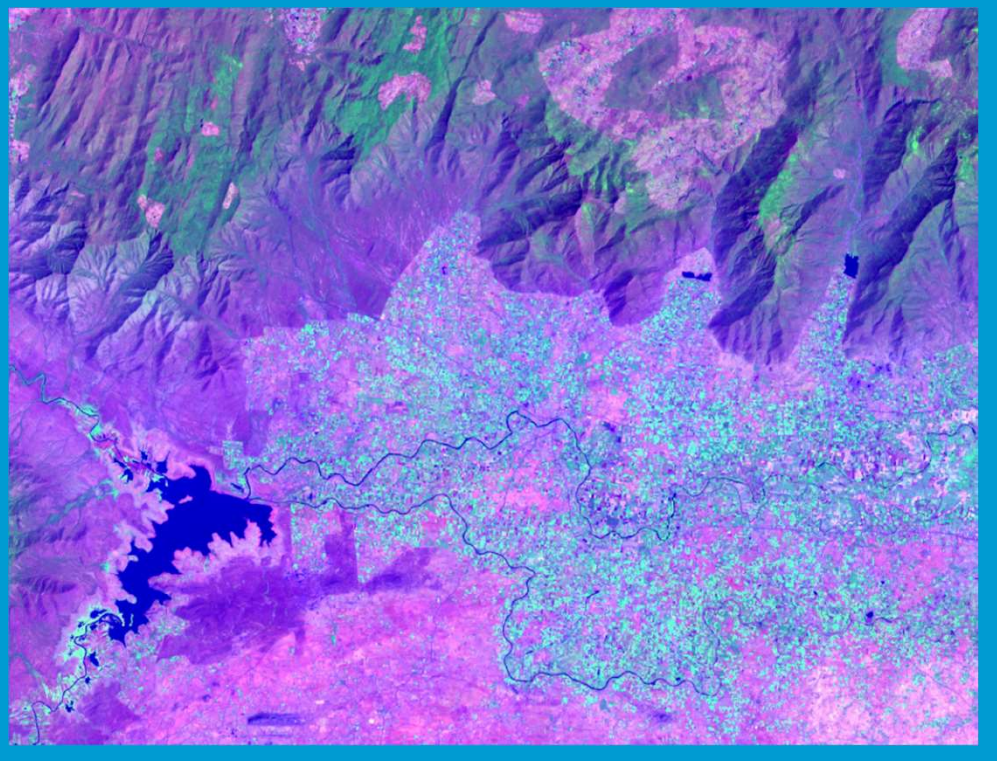
Water Accounting



Dr. Salvadore Elga

We cannot plan and manage

what we do not measure



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Session 1: Water Accounting Principles and examples from past applications

What is Water Accounting?

What can I do with Water Accounting?

How can WA+ support IWRM?

What types of Water Accounting Systems exist?

The WA+ is a WA system based on Remote Sensing data

Examples

What is water accounting?

Water accounting is a tool to support decision making

Name comes from financial accounting

Identification and tracking of sources of revenue and expenses

> *"Water Accounting makes sense of how much water is available and how to use it"*
>
> *"Water Accounting is the systematic **quantitative assessment** of the **status** and **trends** in water supply, demand, distribution and accessibility"*

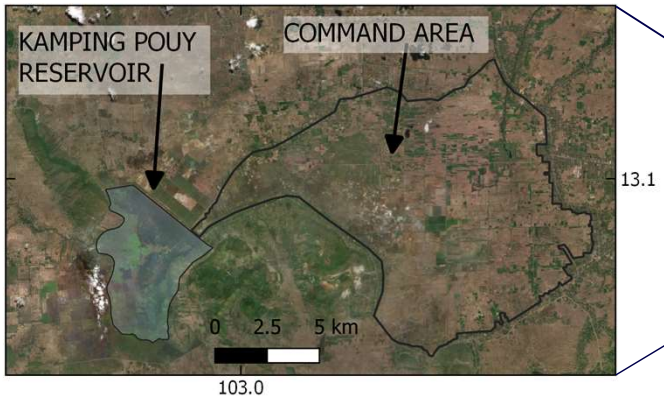
Definitions from: FAO, Water Accounting for Water Governance and Sustainable Development

Reporting system to translate data to useful information

What is Water Accounting

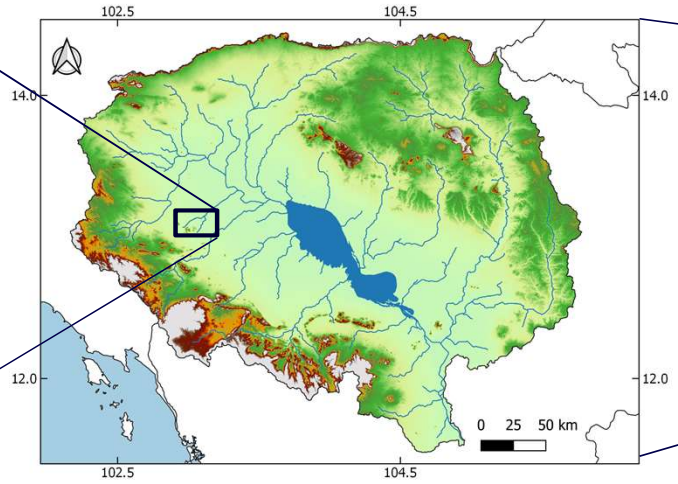
Water Accounting analyses water resources and their use in a specific geographical domain

Irrigation Scheme Level



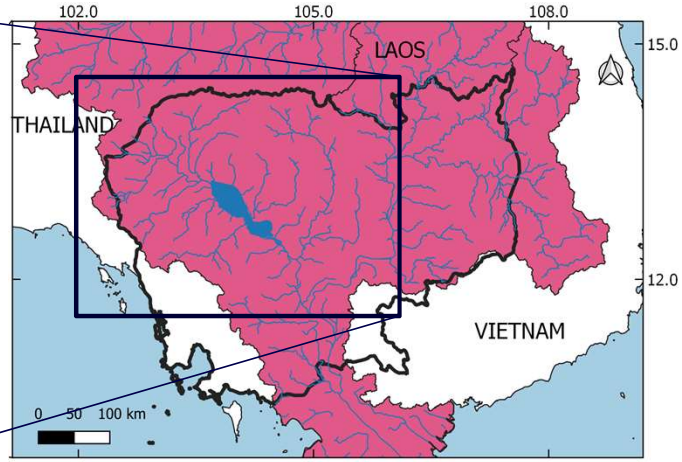
Bing VirtualEarth and data from the Irrigated Agriculture Improvement Project (Cambodia)

Basin Scale



Tonle Sap basin elevation, HydroSHED data

Country Scale



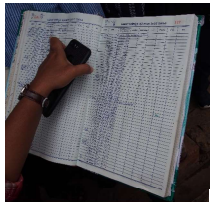
Cambodia and the Mekong river system

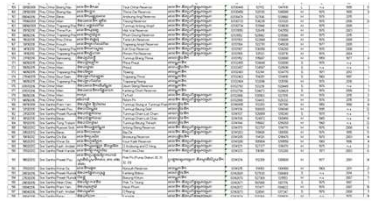
Water Accounting uses a three-step approach

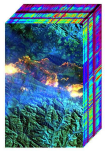
Data collection
gaps identification

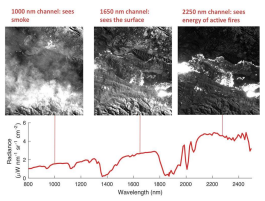
Data analysis
from data to information

Communication
making information available to stakholders

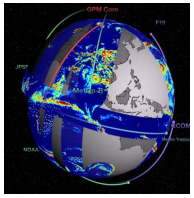


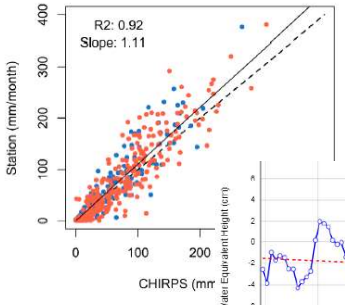


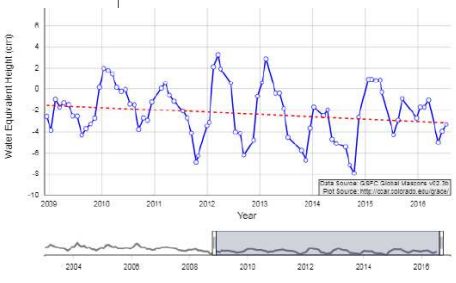




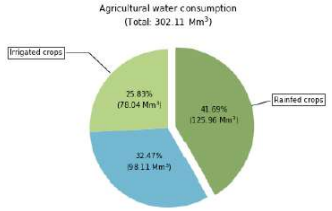
False color image from AVIRIS data cube acquired on Dec 5 2017. The front face shows: (red) active fires at 2250 nm; (green) surface at 1650 nm; and (blue) smoke at 1000 nm.







Crop												Agricultural water consumption	302.11
Cereals	Non-cereals				Fruit & vegetables			Oil-seeds	Feed crops	Beverage crops	Other crops		
15.28	3.64	17.54	-	-	5.85	55.49	-	28.16	-	-	-	ET rainfed	125.96
	Root / tuber crops	Leguminous crops	Sugar crops	Merged	Vegetables & melons	Fruits & nuts	Merged						
16.29	8.18	13.74	-	-	9.82	28.55	-	1.46	-	-	-	ET from rainfall irrigated	78.04
23.22	11.14	19.94	-	-	14.68	28.27	-	8.87	-	-	-	Incremental ET irrigated	98.11
39.51	19.32	33.67	-	-	24.50	56.82	-	2.33	-	-	-	Total ET irrigated	176.15



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Session 1: Water Accounting Principles and examples from past applications

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Examples

Water Accounting: A multi-stakeholders platform

Water managers

Farmers

Irrigation specialists

Mayors

Lawyers

Energy utilities

Environmentalists

Industry representatives

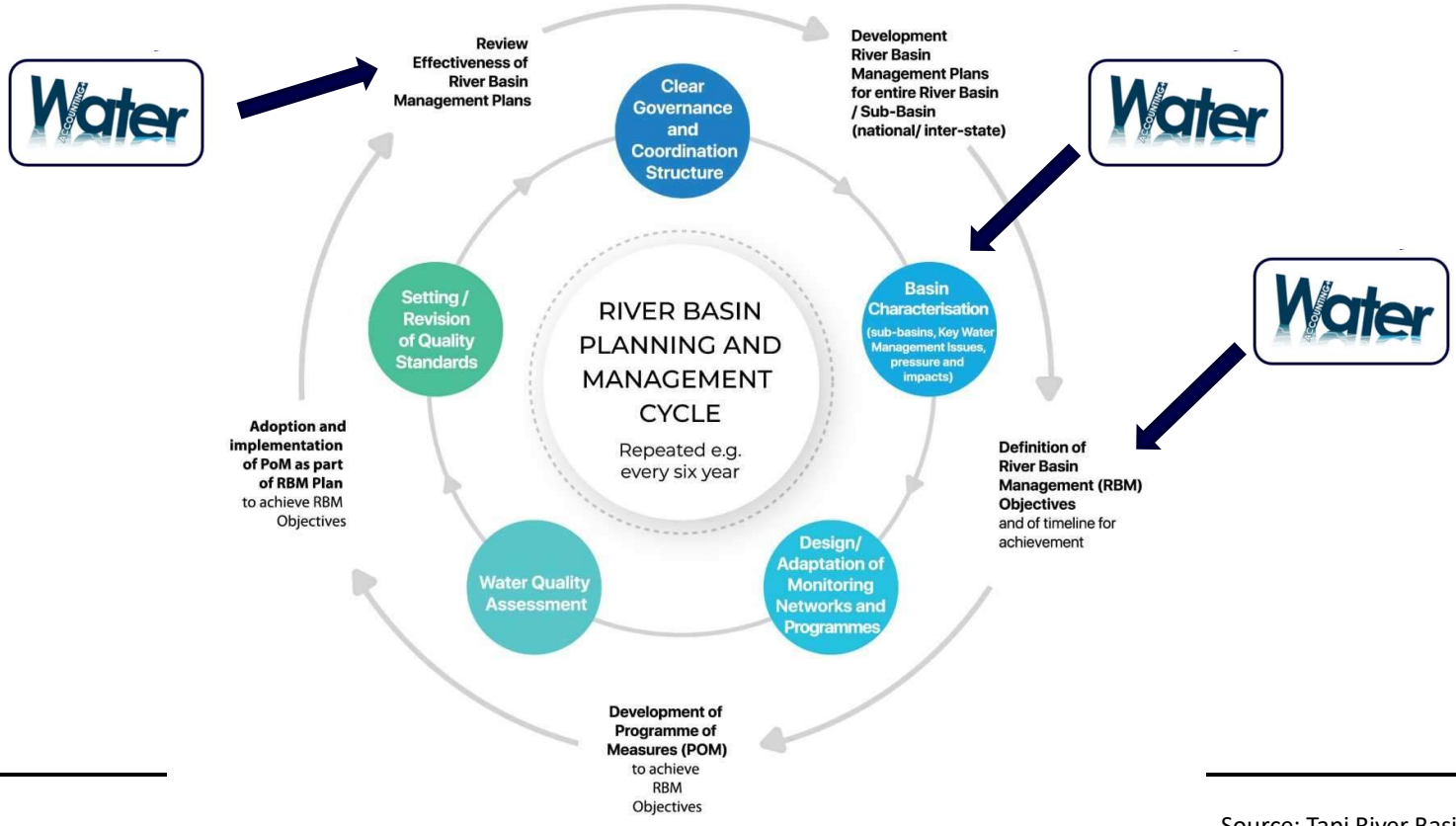
Data Democracy

Standardized Framework

River basin reports

Loucks, Daniel, P.; van Beek, Elco. Chapter 11 Water Resources Systems Planning and Management: An introduction to Methods, Models and Applications (https://ecommons.cornell.edu/handle/1813/2997)

Water Accounting is a tool for long-term planning



Source: Tapi River Basin Management Plan

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Examples

Main Differences between WA frameworks

Scale of application

Type of data used

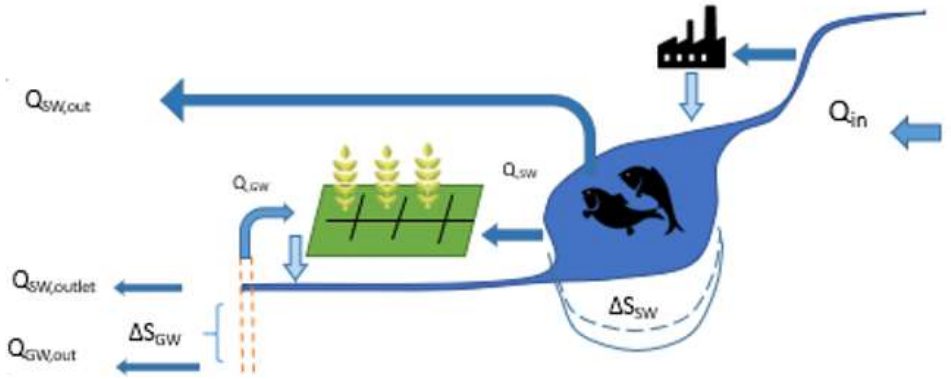
Overall approach: what are they tracking and how

Main Categories of WA frameworks

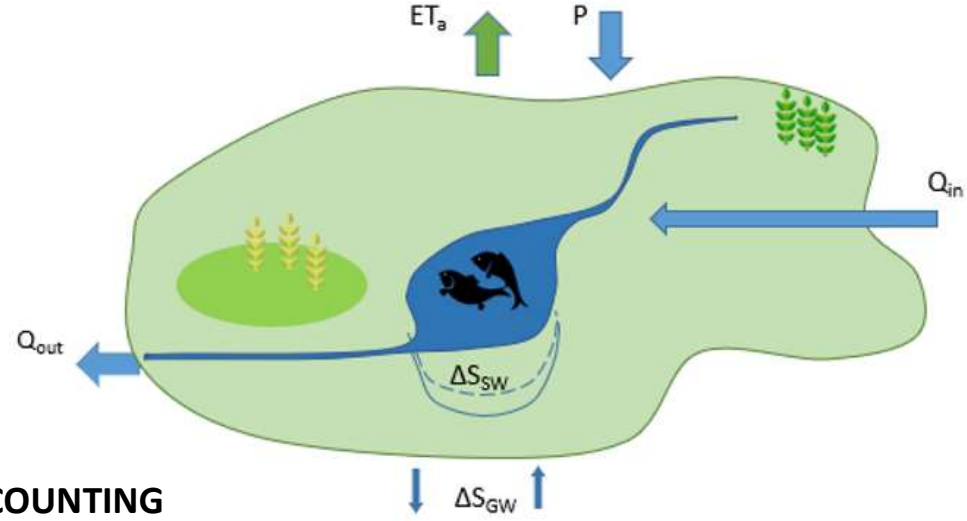
Two main categories:

FLOW ACCOUNTING: tracking and accounting actual flows, deliveries, and abstractions focusing mostly on blue water in cross-sectoral context

DEPLETION ACCOUNTING: focusing on water consumption with a landscape prospective depleted water: ET, sinks, water in products

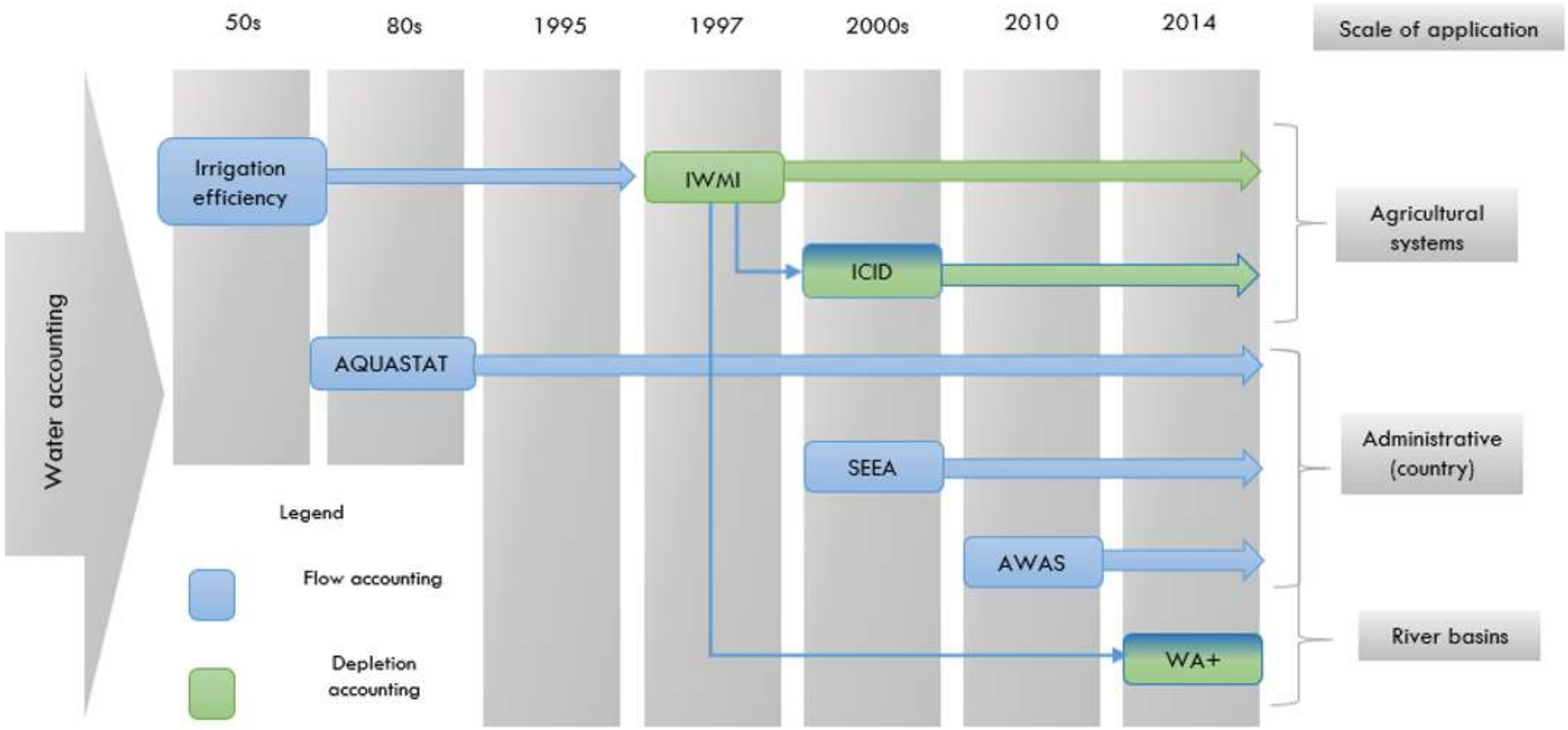


FLOW ACCOUNTING



DEPLETION ACCOUNTING

History of Water Accounting Frameworks



Water Accounting Plus (WA+)

Hydrol. Earth Syst. Sci., 17, 2459–2472, 2013
www.hydrol-earth-syst-sci.net/17/2459/2013/
doi:10.5194/hess-17-2459-2013

Hydrology and Earth System Sciences
Open Access

Water Accounting Plus (WA+) – a water accounting procedure for complex river basins based on satellite measurements

P. Karimi[1,2], W. G. M. Bastiaanssen[2,3], and D. Molden[4]

[1]International Water Management Institute, Battaramulla, Sri Lanka
[2]Faculty of Civil Engineering and Geosciences, Water Management Department, Delft University of Technology, Delft, The Netherlands
[3]eLEAF Competence Centre, Wageningen, The Netherlands
[4]International Centre for Integrated Mountain Development, Kathmandu, Nepal

IHE DELFT

IWMI International Water Management Institute

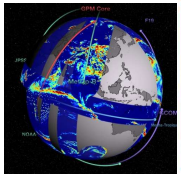
CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

UNESCO IHE DELFT

United Nations Educational, Scientific and Cultural Organization

World Water Assessment Programme

Remote Sensing



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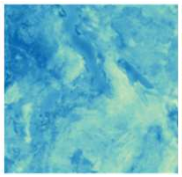
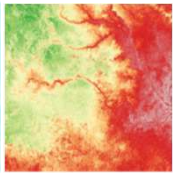
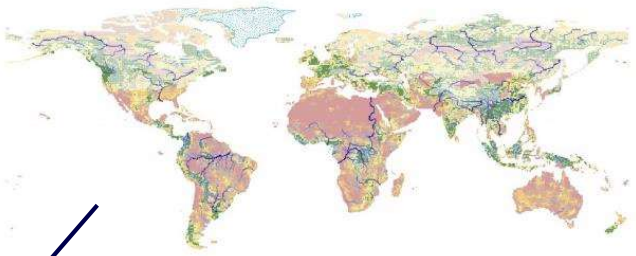


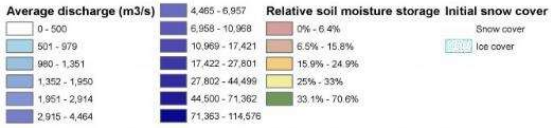
ET



Biomass

Global Datasets

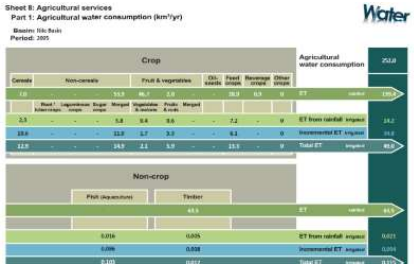




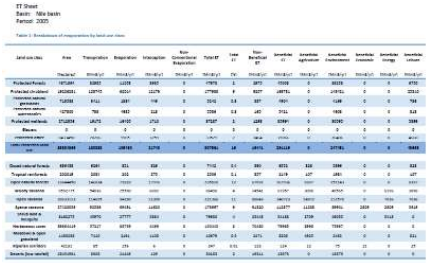
Ground measurements

Water

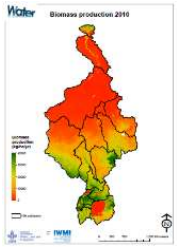
Sheets



Tables



Maps



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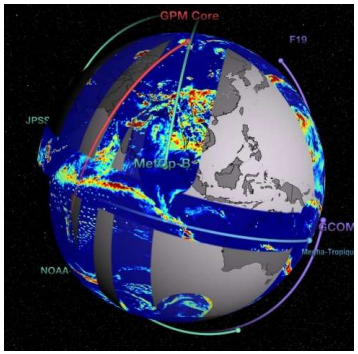
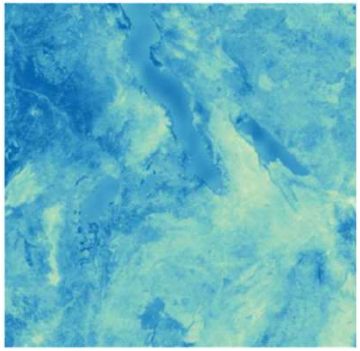
QGIS GitHub python

Water Accounting Plus (WA+): using RS for water resources management

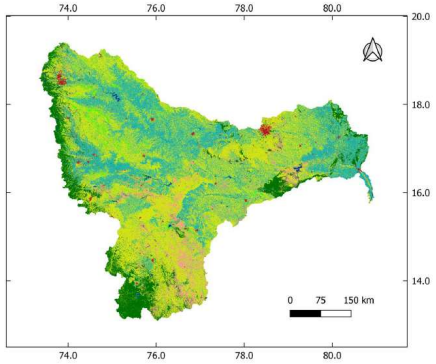
Rainfall



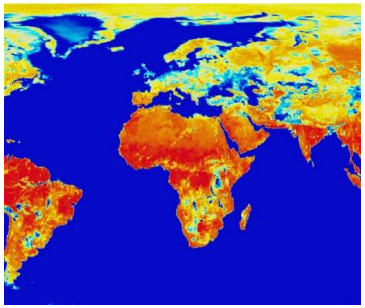
Evapotranspiration



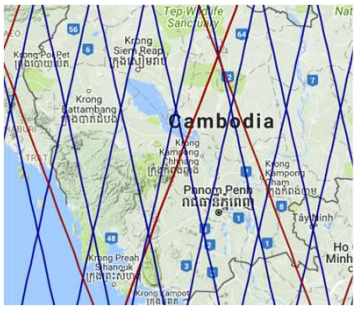
Land use



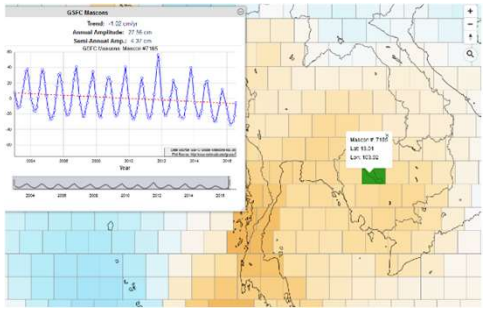
Soil Moisture



Water Levels



Groundwater

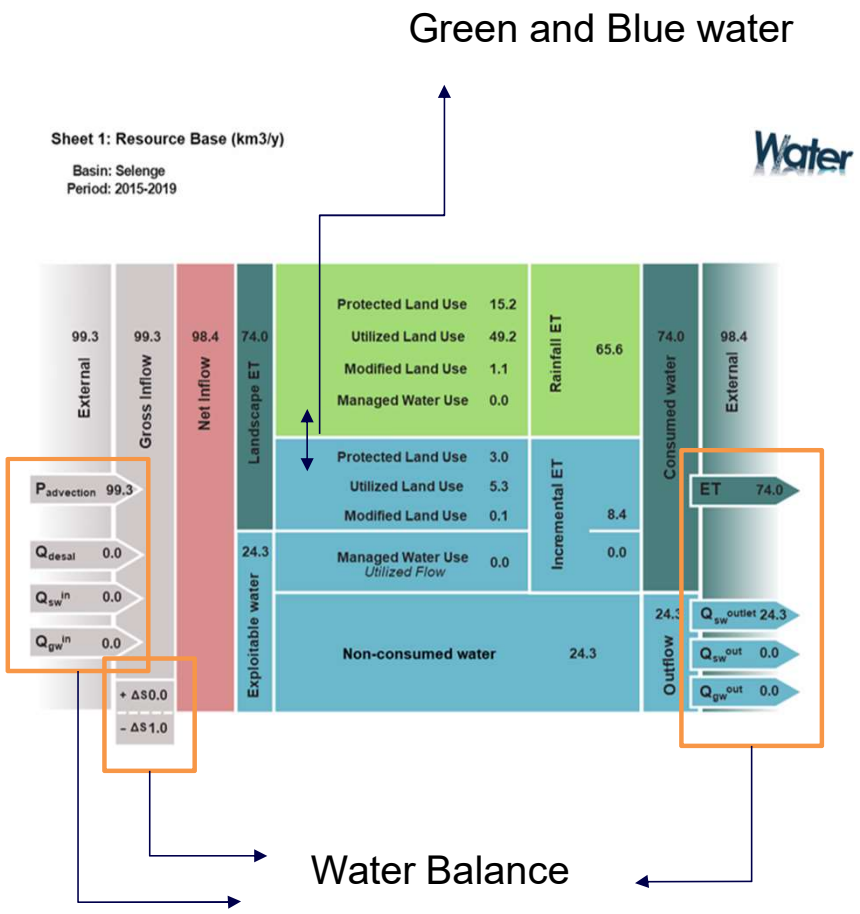


Rainfall, GPM: NASA Goddard Space Flight Center from Greenbelt, MD, USA [Public domain]
Evapotranspiration, and biomass WaPOR: FAO, IHE-Delft.WaPOR quality assessement
Soil Moisture, SMAP: NASA/JPL-Caltech/GFSC. https://www.jpl.nasa.gov/spaceimages/details.php?id=PIA18057

WA+: Sheet 1
Resource base

General overview at river basin scale of

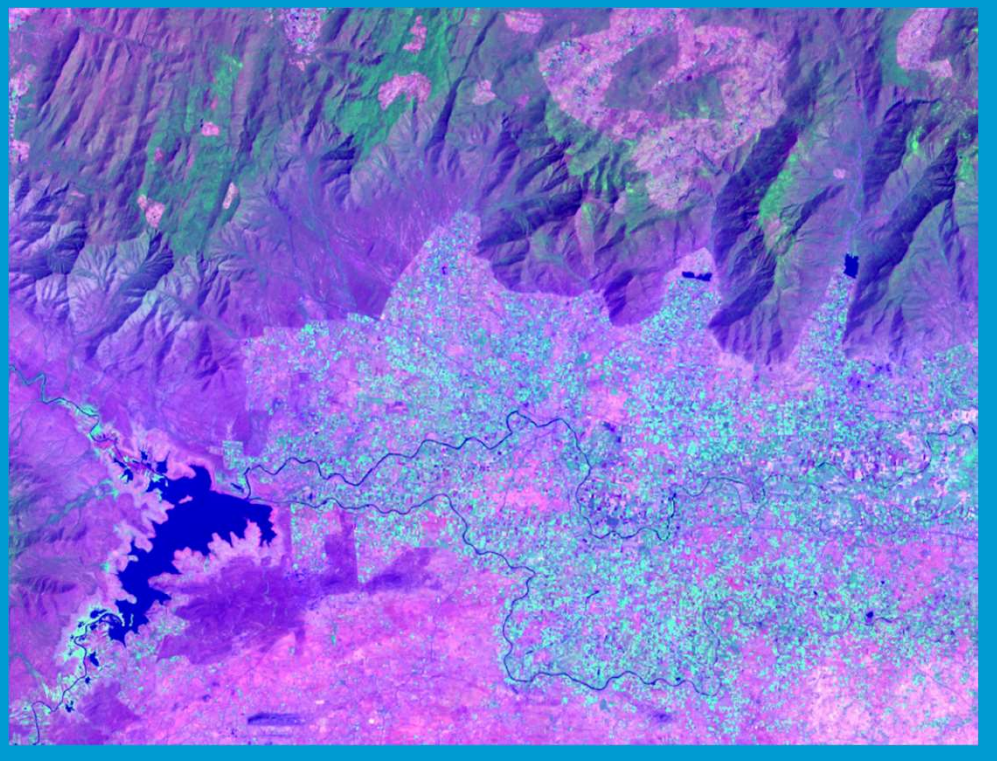
- water availability vs water consumption
- exploitable flows
- manageable vs unmanageable flows
- over-exploitation
- green and blue water



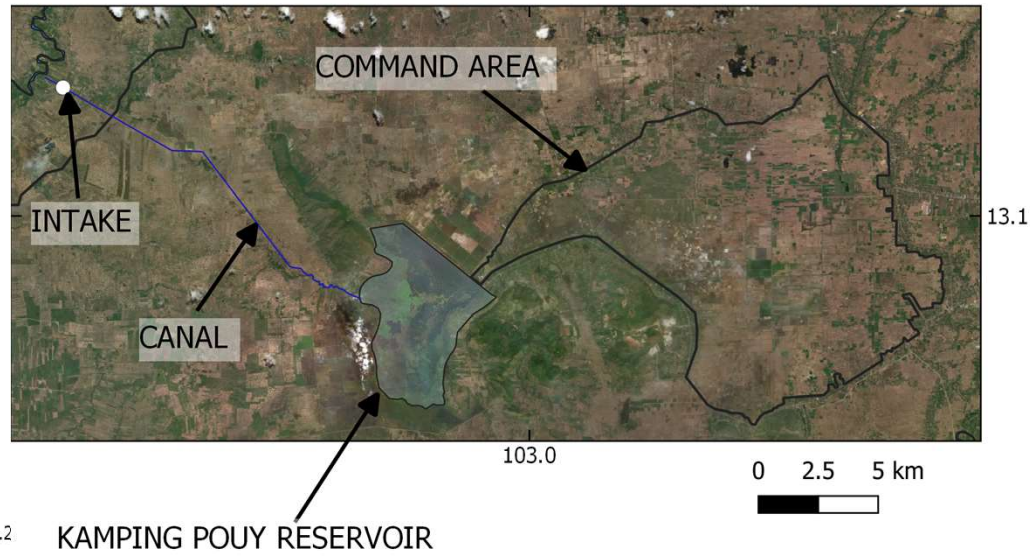
Examples of the application of WA+ in irrigated areas

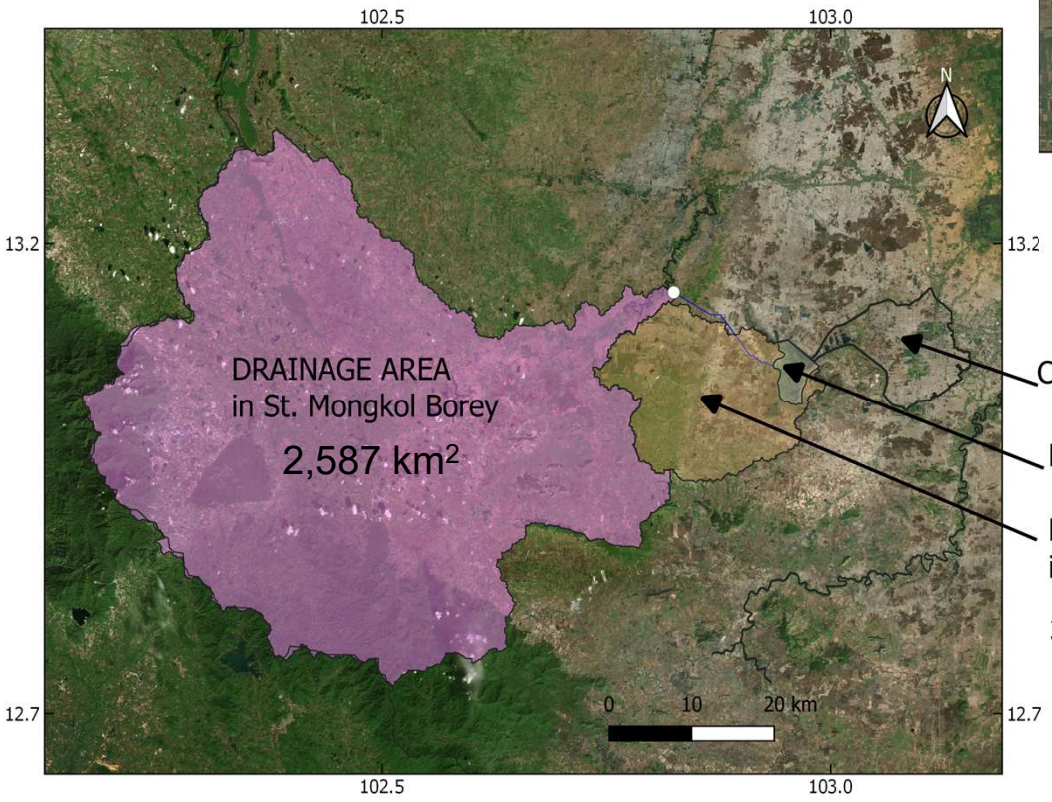
Results from a recent

ADB funded project



Case Study 1: Kamping Puoy Irrigation Scheme in Cambodia

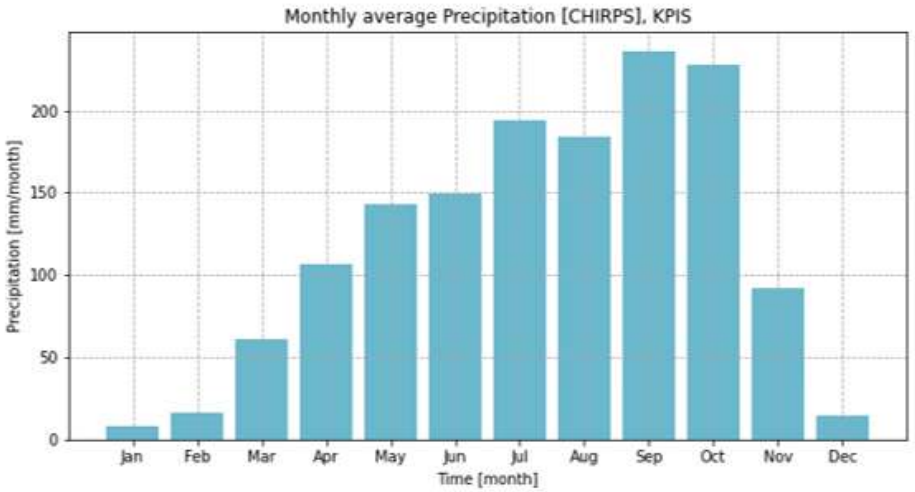




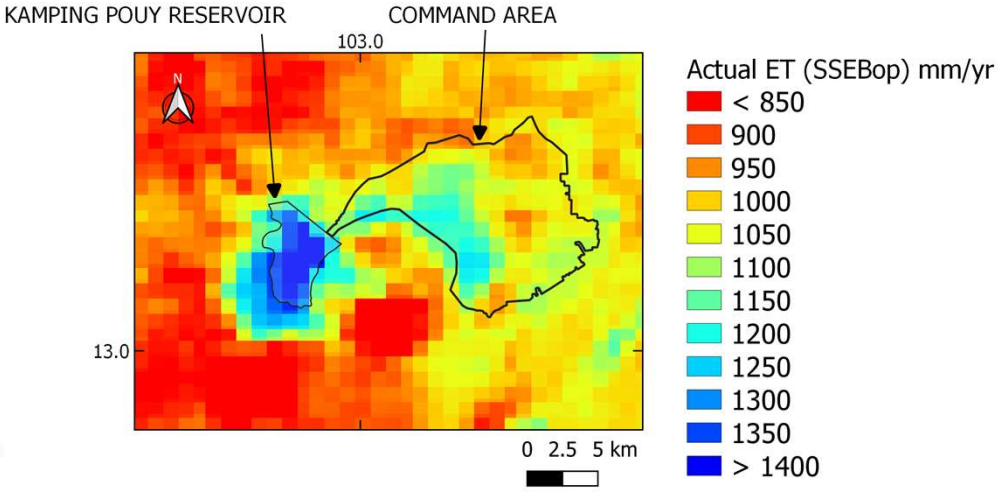
Maximum storage capacity 139 Mm^3

Remote Sensing Data

Precipitation over command area:
1,432 mm/year



Actual Evapotranspiration over command area:
1,065 mm/year

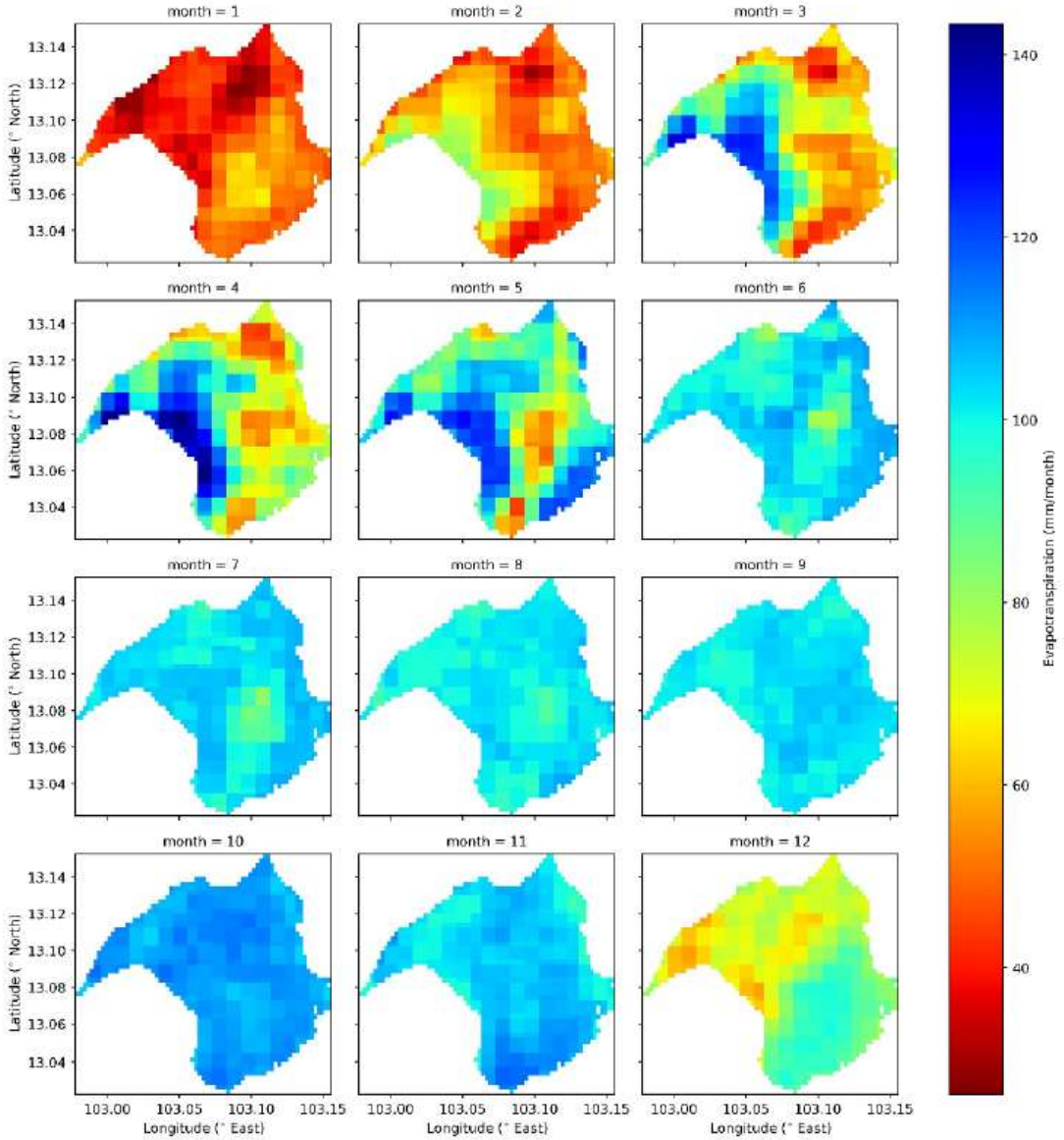


Seasonal variation of water consuption

Spatial variations between head and tail:

- head areas consume up to 1,200 mm/yr
- tail areas 900 mm/yr
- Also visible in dry months (Feb, Mar, Arp)

→ areas located close to the main canal receive more water than the tail end section which might have inadequate water supply.



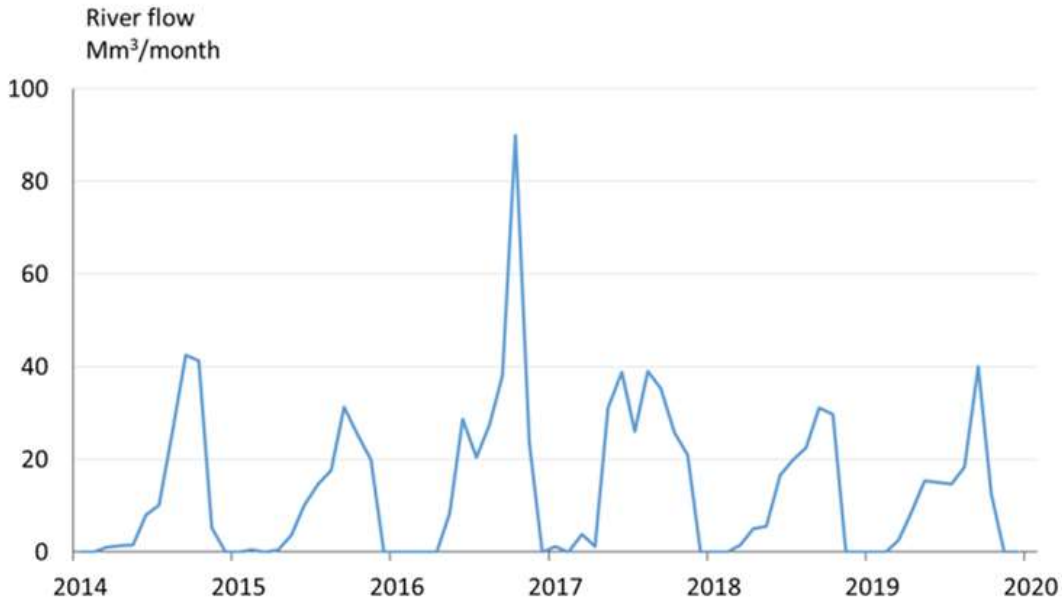
Water Availability

The water generated in Sangker sub-basin could in average be sufficient to reservoir.

Average yearly flow 163 Mm^3/year

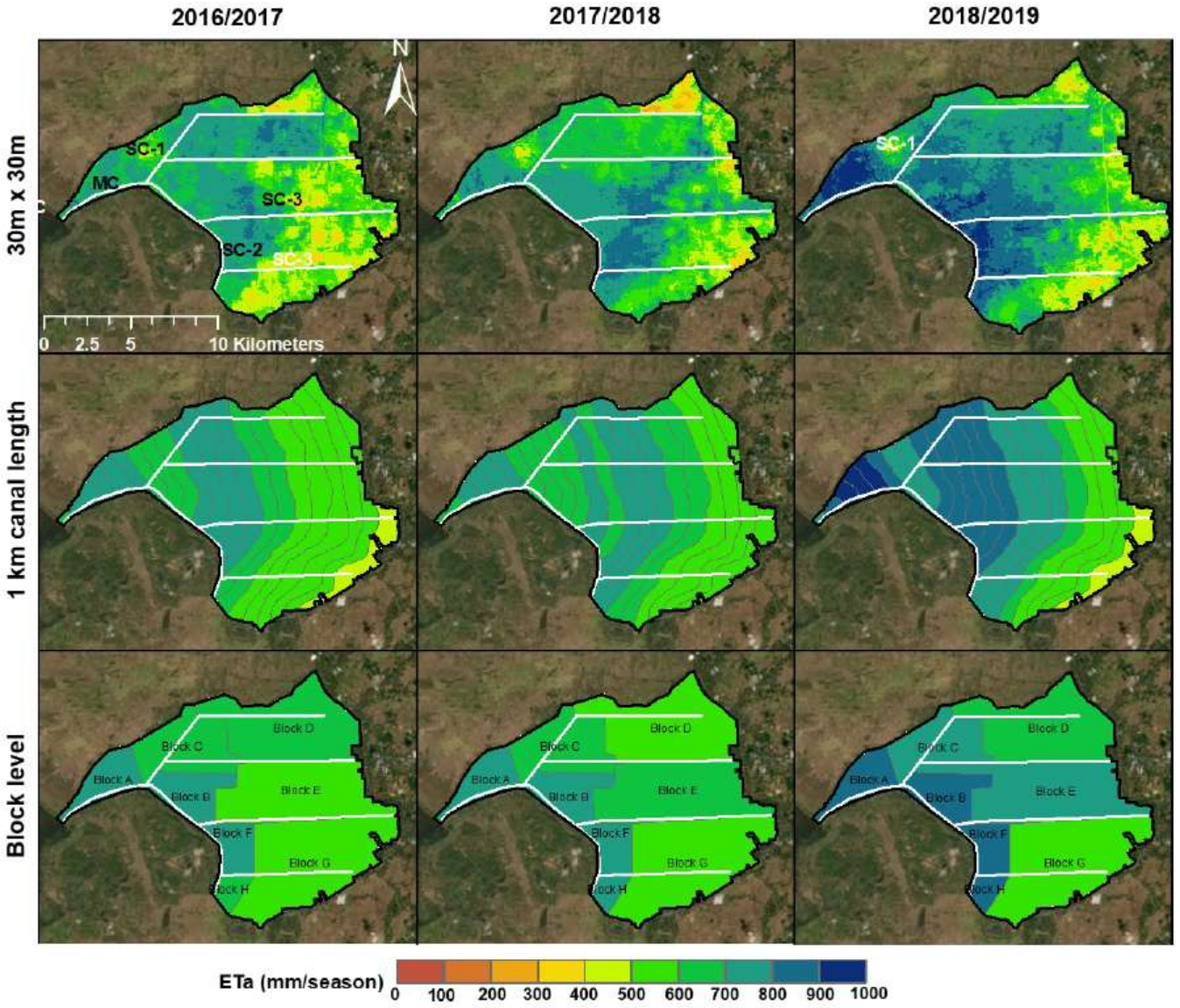
Downstream needs should be considered.

During dry years river flow in Sangker is not sufficient (130 Mm^3/year)



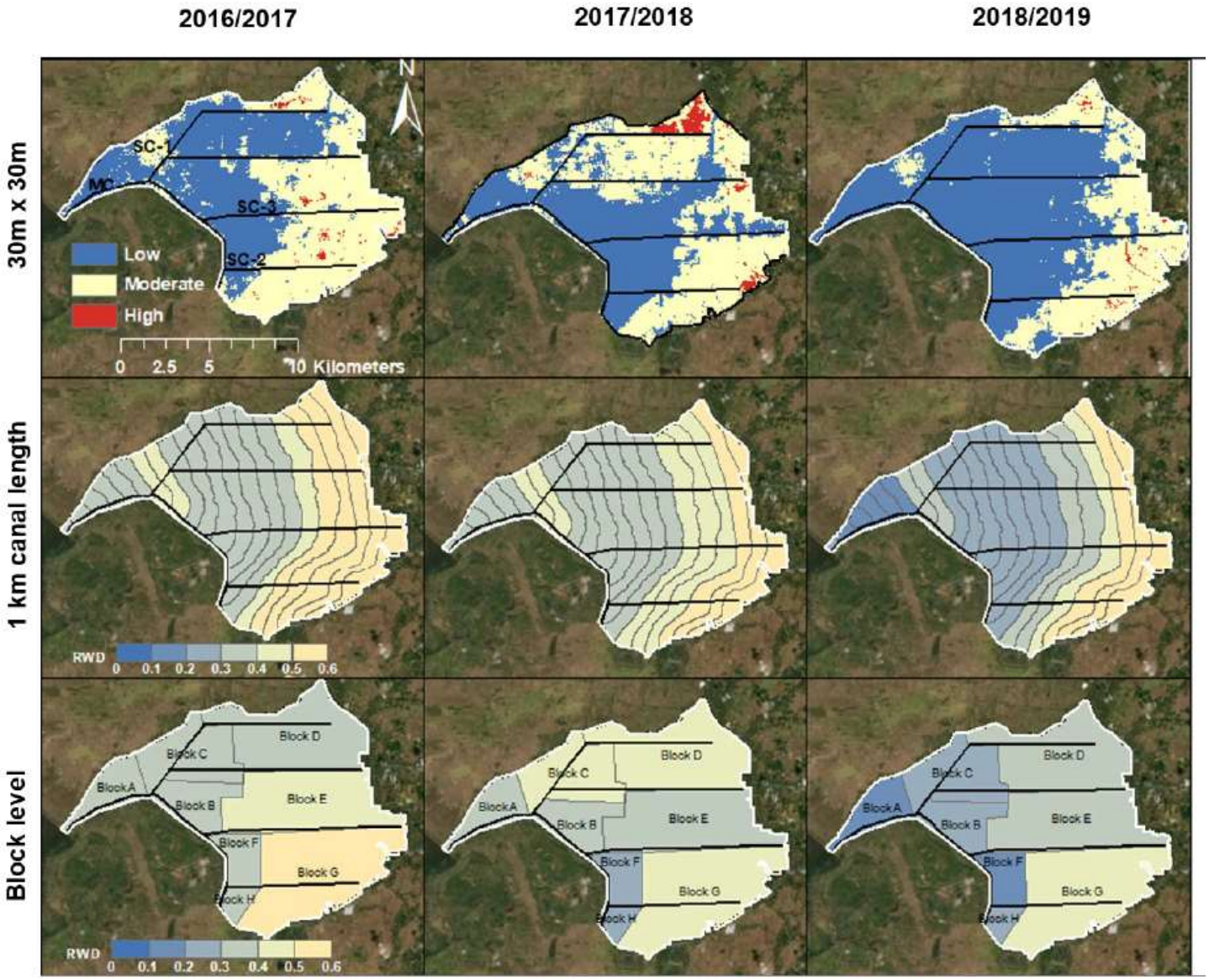
Detailed Water Productivity analysis

Seasonal water consumption



Detailed Water Productivity analysis

Relative Water Deficit



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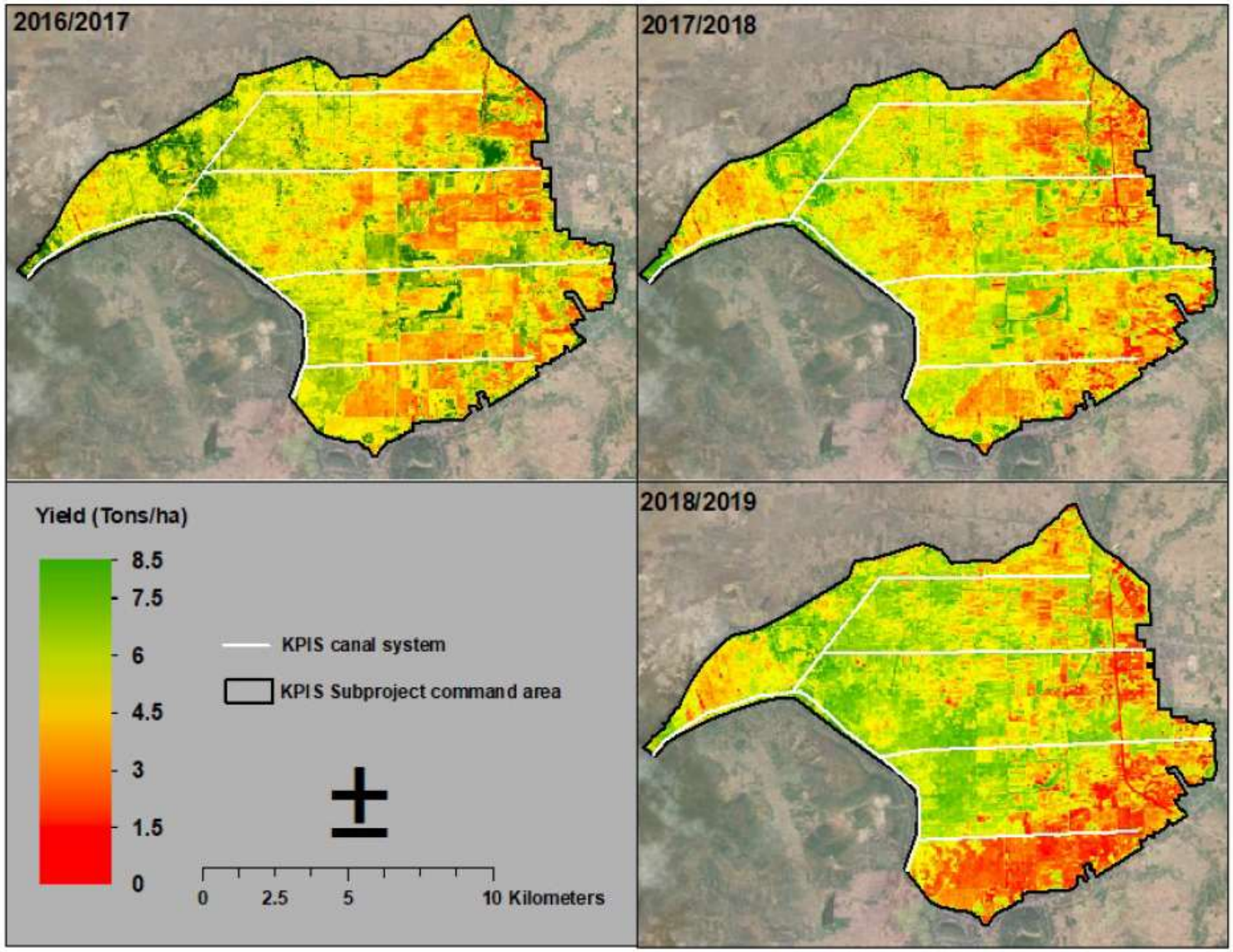
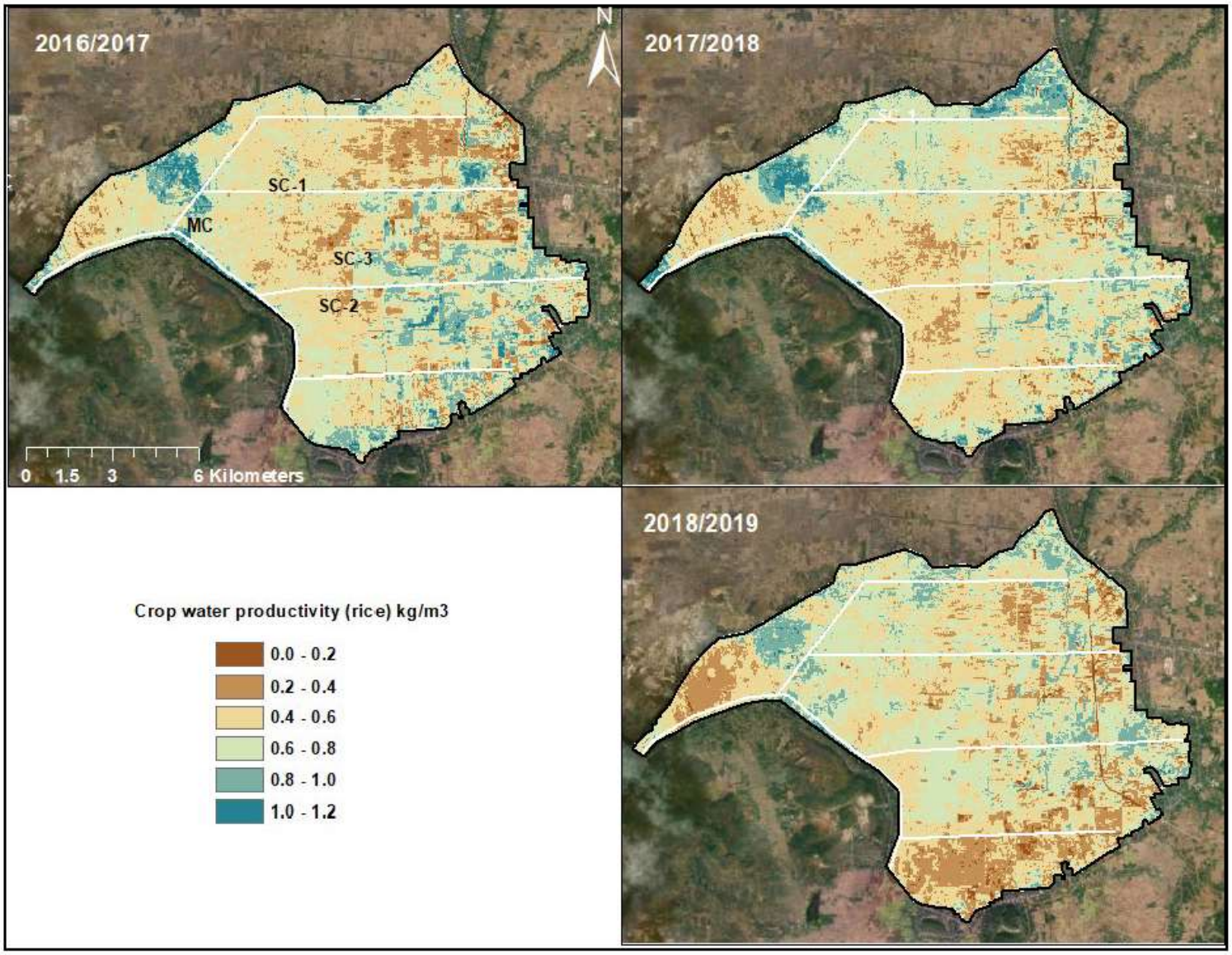
Detailed Water Productivity analysis

Rice yield



Detailed Water Productivity analysis

Rice crop water productivity



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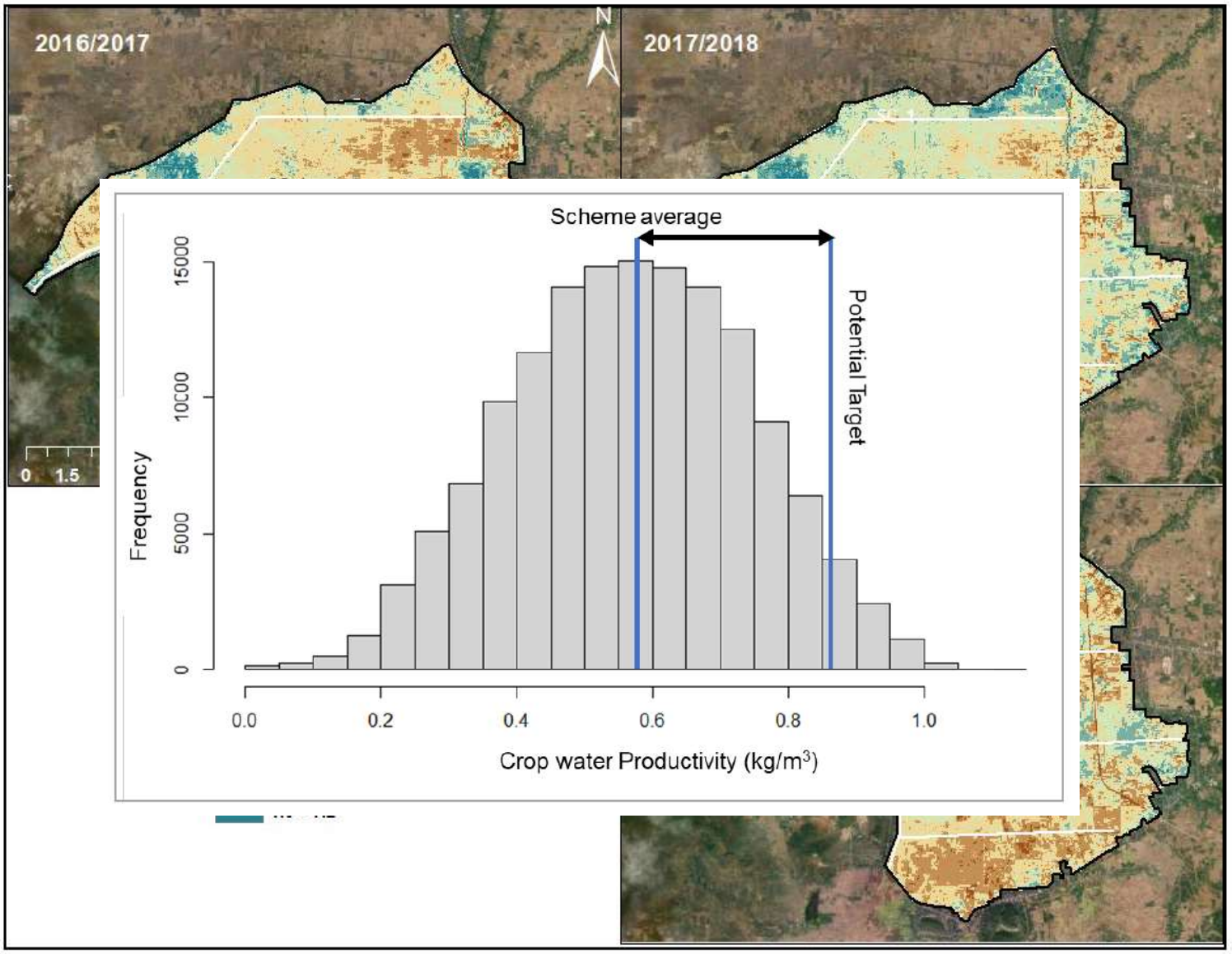
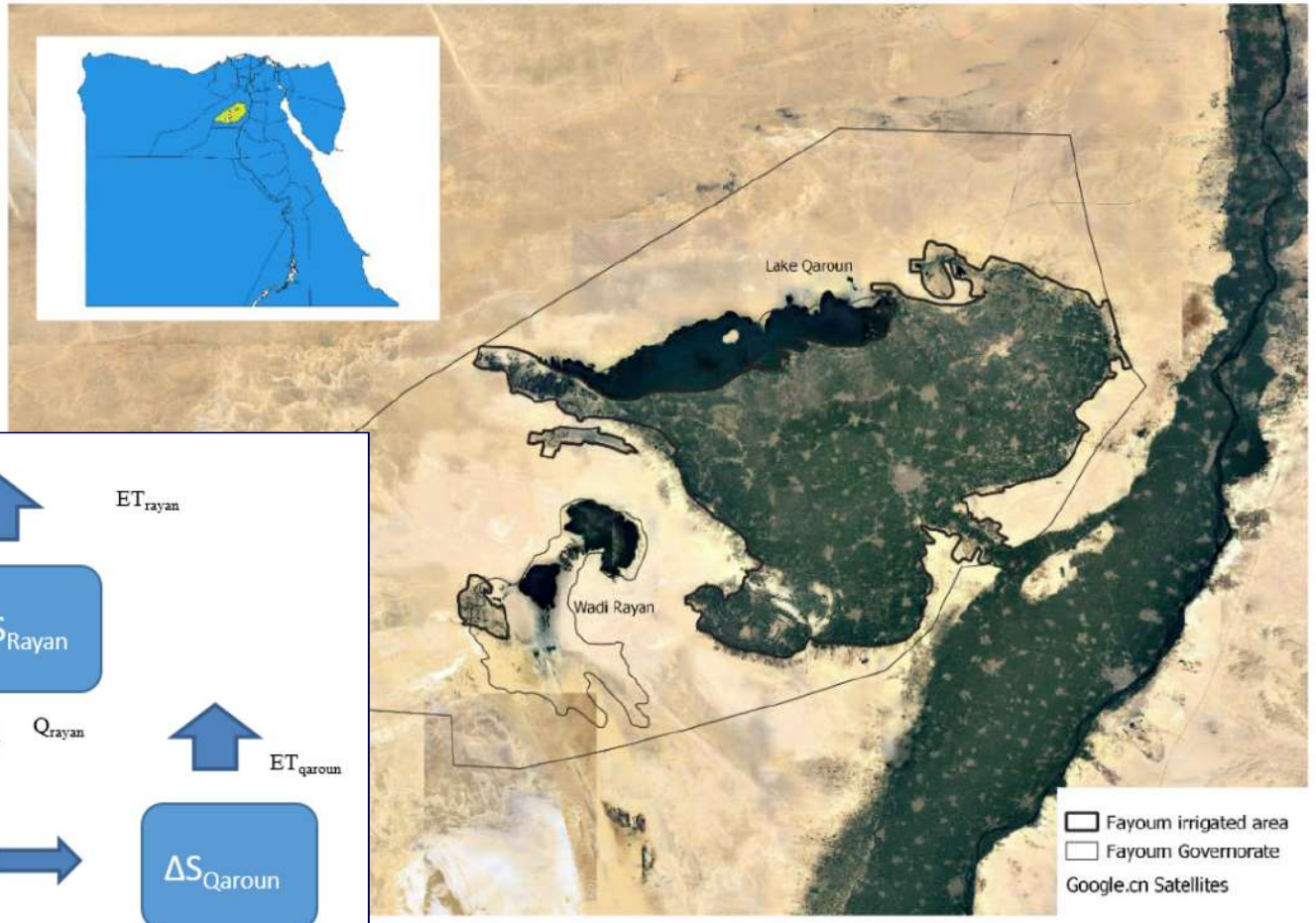
Detailed Water Productivity analysis

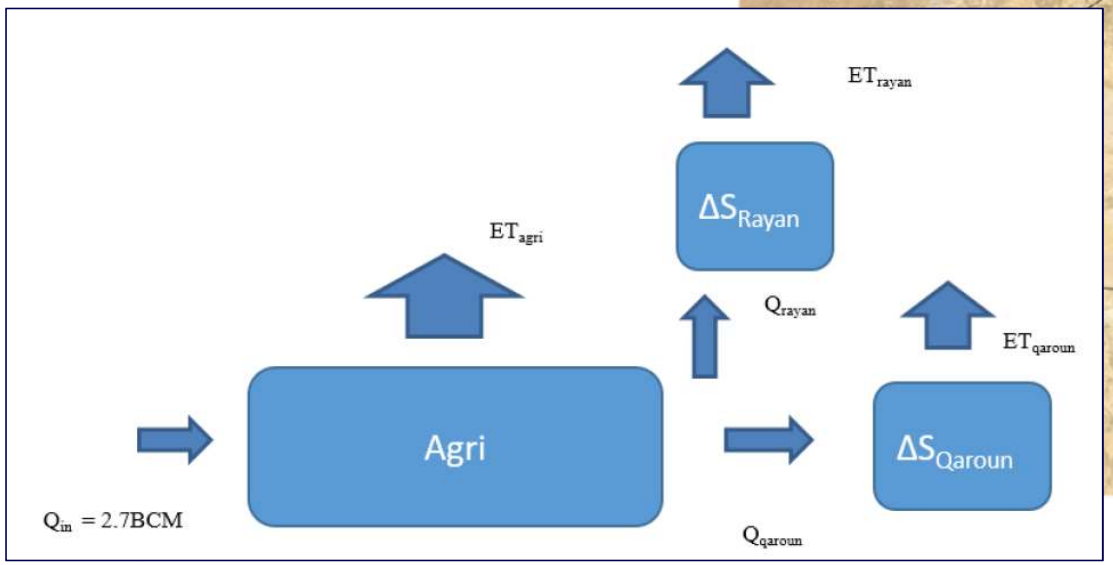
Rice crop water productivity



Case Study 2: Fayoum in Egypt

Case Study 2: Fayoum in Egypt

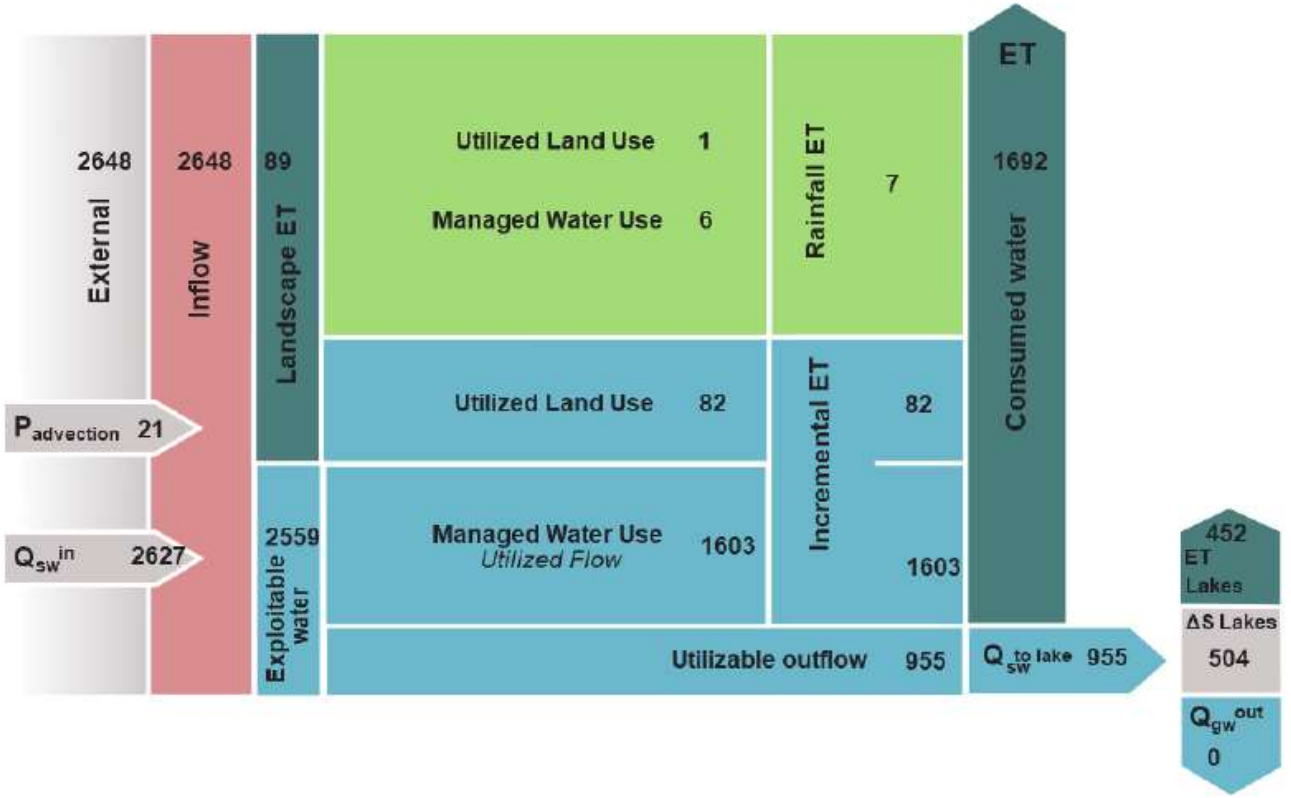




Sheet 1 adaptation to the Fayoum case

Sheet 1: Resource Base (MCM/y)

Basin: Fayoum
Period: 2009



https://wapor.apps.fao.org/home/WAPOR_2/1