Welcome to the Webinar

Lauren Zielinski
IHE Delft Institute for Water Education

Jelle Beekma
Asian Development Bank

ADB Water, IHE Delft, and IWMI Webinar:
Improved Decision Making for Water Security using Water Accounting

Thursday, November 19, 2020

Rules for the Webinar

- **Please keep your video and audio turned off for the webinar**

- During the presentations, use the chat function to engage with the webinar
  - Introduce yourself: name, institute, country, sector
  - Ask questions: these will be presented to the panel during the Q&A session
    - Please indicate which speak you would like to address using @Name

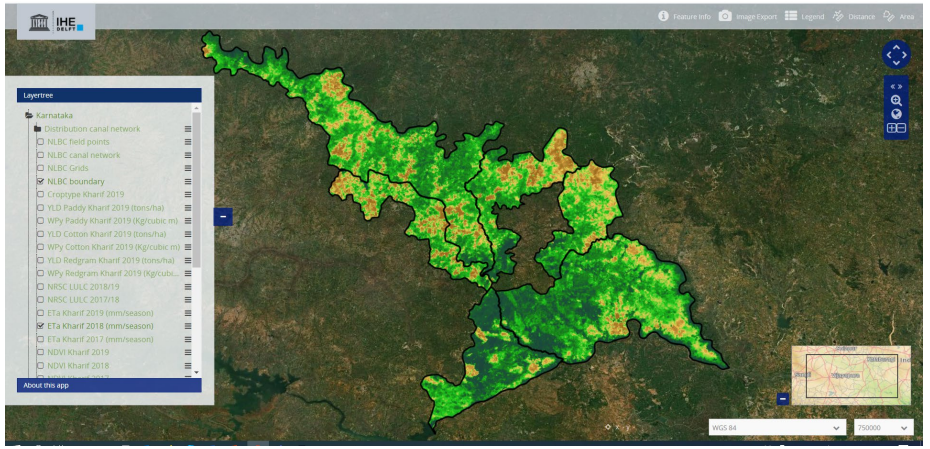
- During the Q&A session, you can continue to use the chat or you can now use the “raise hand” feature to ask a question. If called upon, you can turn your audio on to ask a question to the panel.

- After the webinar, a summary of the webinar & additional materials will be available on the ADB website

Agenda

Presenter	Topic	Time
Jelle Beekma, *Asian Development Bank*	Introduction to the ADB project	5 minutes
Dr. Elga Salvadore, *IHE Delft Institute for Water Education*	Water Accounting Principles	10 minutes
Dr. Marloes Mul, *IHE Delft Institute for Water Education*	Water Accounting for decision making	10 minutes
Dr. P.S. Rao, Advanced Centre for Integrated Water Resources Management (ACIWRM)	Vision for Water Accounting and Remote Sensing for Water Security	10 minutes
Lauren Zielinski, *IHE Delft Institute for Water Education*	Q&A session with expert panel	25 minutes

Blended Approach: Materials and capacity building

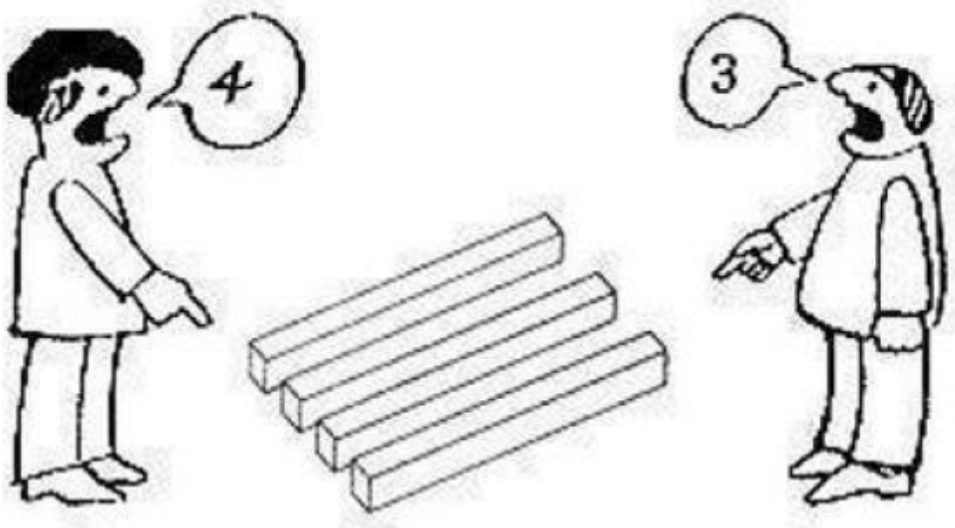


- Reports and short summary videos
- Online reference material
- Short training material and videos
- Online courses through IHE Delft OpenCourseWare (https://ocw.un-ihe.org/)
  - "Water Productivity and Water Accounting using WaPOR"
- Interactive data and result portal (under development by FAO): https://data.apps.fao.org/aquamaps/
  - Preview: http://waterinag.org/application/ADB-WP

- Will be posted to ADB Development Asia and wateraccounting.org, with notification sent to webinar participants

Objective

Why do we need such a system?



The need for an **independent**, **international standard** , **scientifically-sound** water accounting system that describe all water flows and stocks

Blended Approach: Water accounting/Water productivity

- Starting from strict protocols for water accounting and water productivity measurements to:
  - ➢ What is important information to guide investments;
    - Does the basin have sufficient water resources;
    - Can water distribution over the
    - Temporal variability of water availability;
    - Spatial variability of water availability;
    - Consistent differences in water consumption;
  - ➢ Low and high water productivity
    - Temporal and spatial patterns of productivity

Expanding Support to Water Accounting in River Basins and Water Productivity Measurement in Irrigation Projects

- First project was carried out in:
  - Cambodia
  - Karnataka
  - Madhya Pradesh
  - Indonesia
  - Pakistan
  - Sri Lanka
  - Vietnam
- Expansion focused on
  - Different approach and more investment focus;
  - New areas with limited data availability

Expansion of WA in basins & WP measurements in irrigation schemes, Water Accounting

Country	State/Basin	Project
India	Karnataka (K2, K3 and K4)	Karnataka Integrated and Sustainable Water Resources Management Investment Program - Tranche 2 (IND 43253-026)
Kazakhstan	Nura Sarysu river basin	Irrigation rehabilitation project (KAZ 50387-001) Postponed
Cambodia	Tonle Sap river basin	Irrigated Agriculture Improvement Project (CAM 51159-002)
Mongolia	Selenge river basin	Vegetable production and irrigated agriculture project (MON 51423-002)
Philippines	Mindanao river basins	Philippines: Mindanao Irrigation Development Project (PHP 53272-001)

Water Accounting Principles

Dr. Salvadore Elga

IHE Delft

ADB Water, IHE Delft, and IWMI Webinar:
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Water Accounting Principles: three questions in 10 minutes

What is Water Accounting (WA)?

What can I do with Water Accounting?

What types of Water Accounting Systems exist?

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

What is water accounting?

Water Accounting is a tool to support decision making

“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, accessibility and use”

Data collection
gaps identification

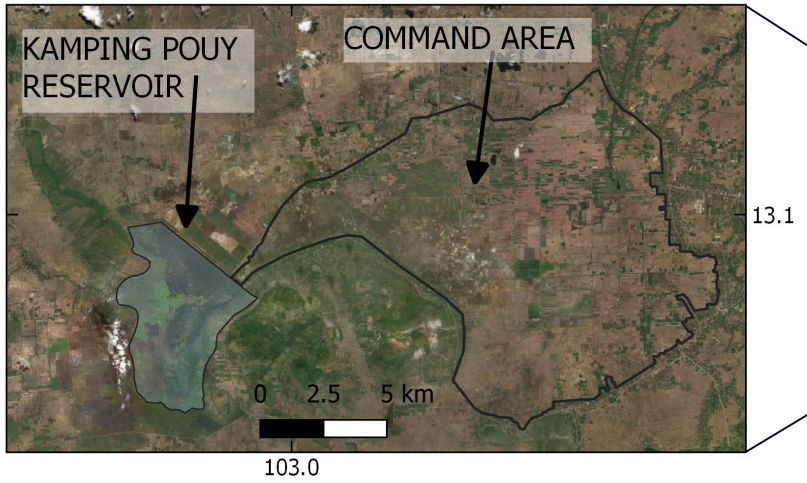
Data analysis
from data to information

Communication
making information available to stakholders

What is water accounting?

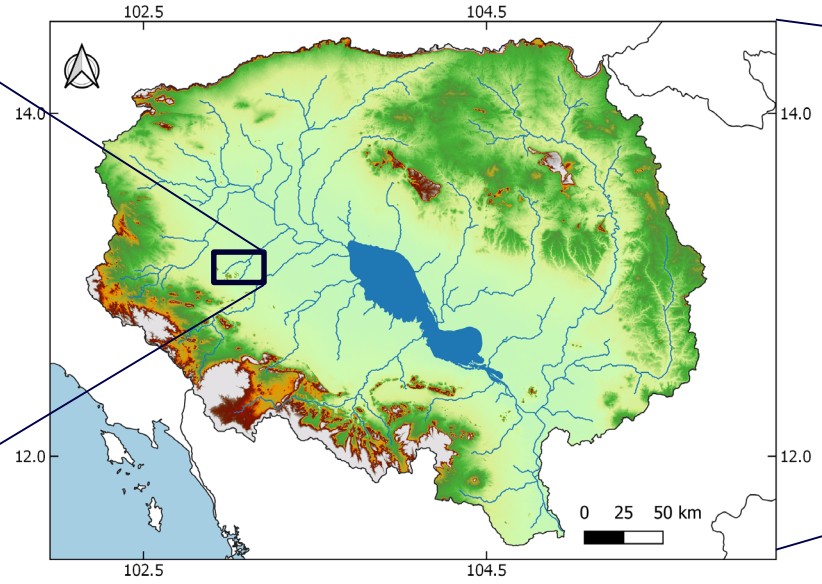
Water Accounting analyses water resources and their use in a specific geographical domain

Irrigation Scheme Level



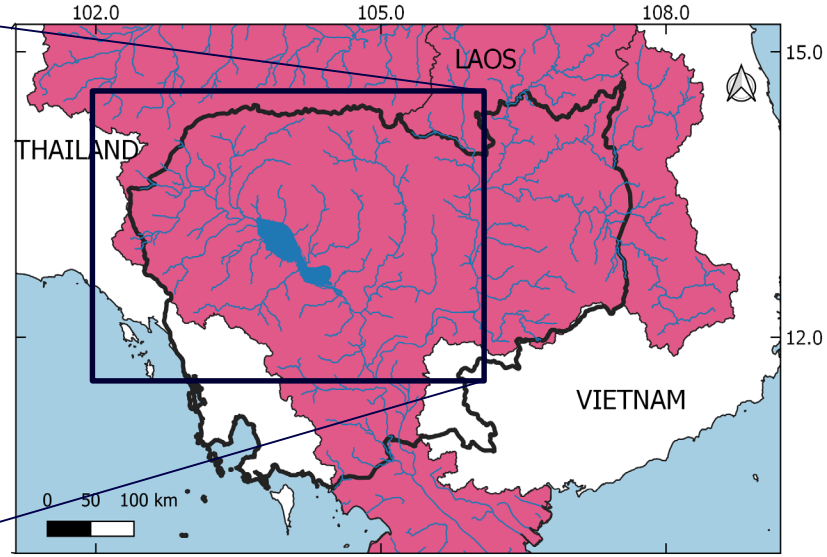
Bing VirtualEarth and data from the Irrigated Agriculture Improvement Project (Cambodia)

Basin Scale



Tonle Sap basin elevation, HydroSHED data

Country Scale



Cambodia and the Mekong river system

Water Accounting Principles: three questions in 10 minutes

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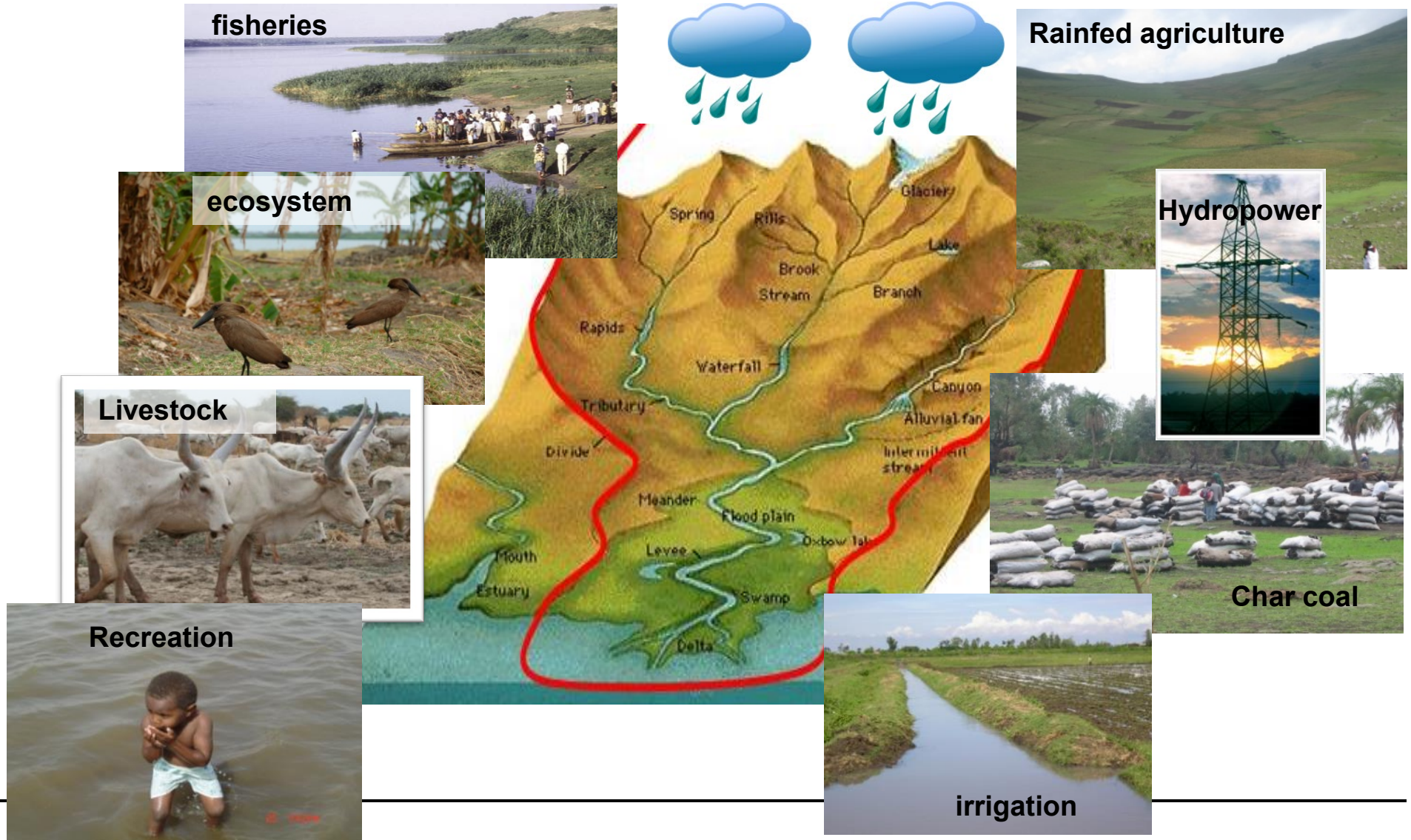
The WA+ is a WA system based on Remote Sensing data

How much is the water use? Which sector is consuming how much?

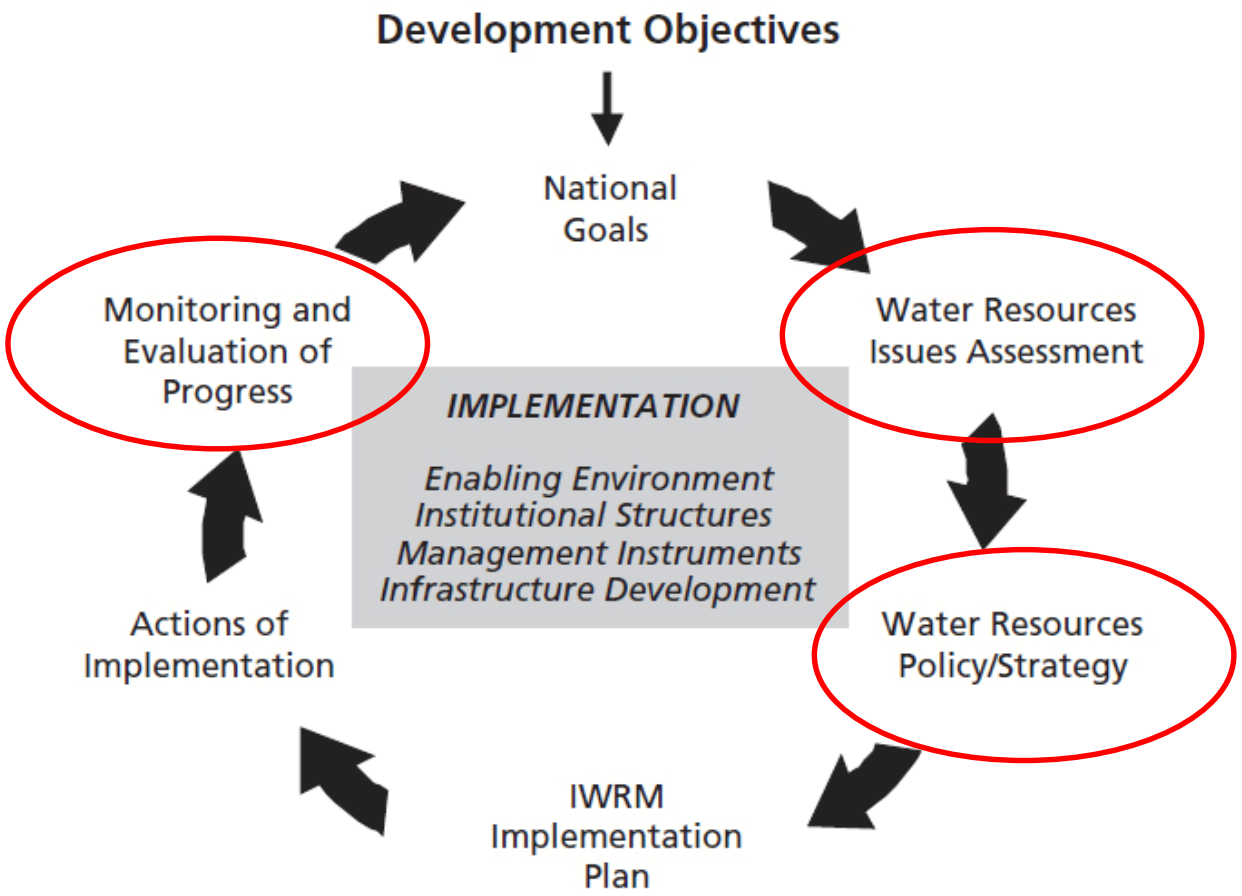
Demand v.s. Supply

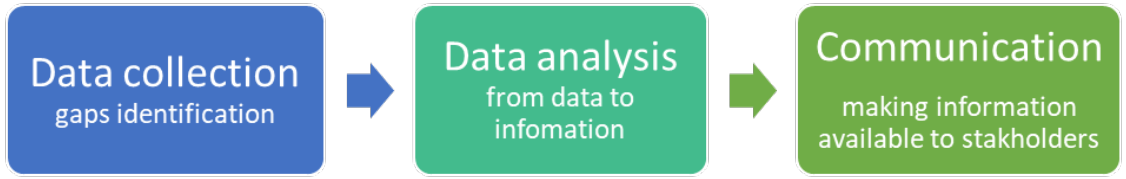
Consumptive

Non-consumptive use



Water Accounting is a long-term planning tool





https://www.un.org/waterforlifedecade/iwrm.shtml

Water Accounting Principles: three questions in 10 minutes

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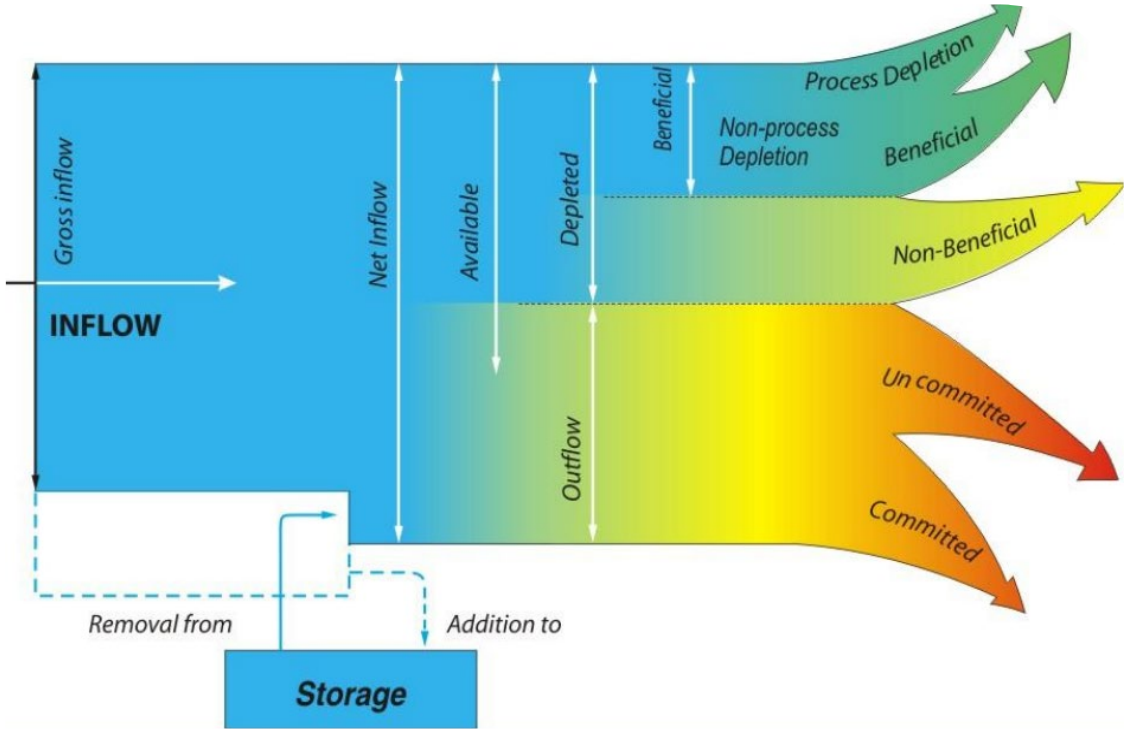
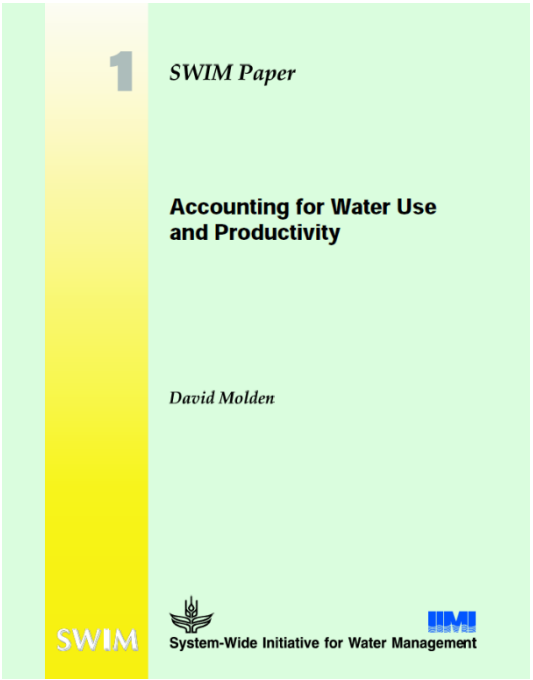
Water Accounting framework examples: IWMI WA

1997: International Water Management Institute (Dr. David Molden)

Water Balance Approach

Water depletion





Source: http://www.iwmi.cgiar.org/Publications/SWIM_Papers/PDFs/SWIM01.PDF

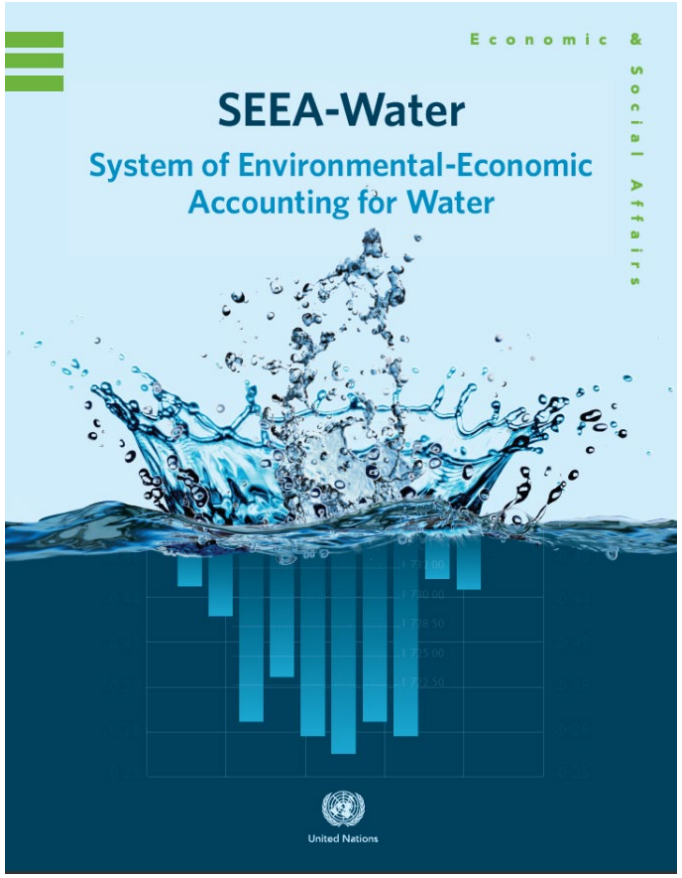
Water Accounting framework examples: SEEA-Water

System of Environmental-Economic Accounting for Water

Integrated approach

Water related statistics

Link between environment (water) and economy

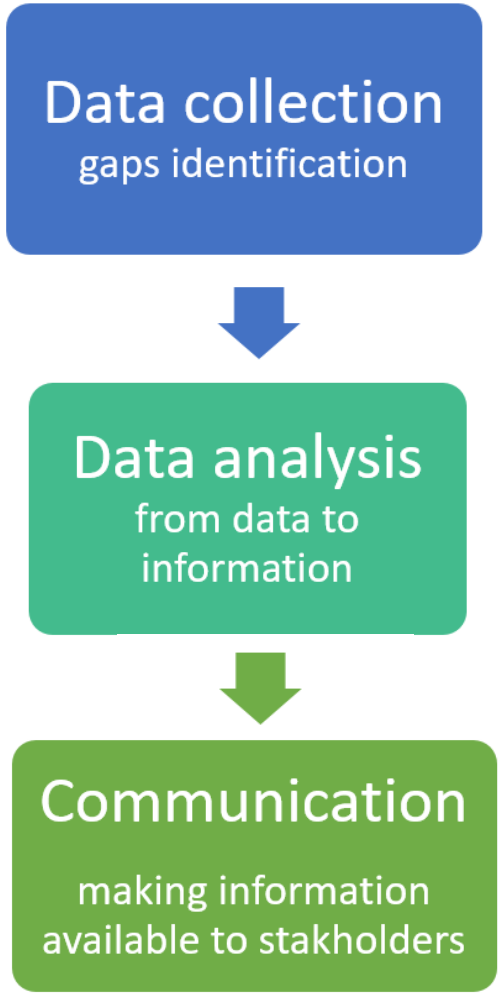


https://unstats.un.org/unsd/publication/seriesf/Seriesf_100e.pdf

Water Accounting Plus (WA+)

Developed by IHE Delft in partnership with IWMI and FAO

- Geographical domain: river basin
- Combination of flow and depletion accounting
- Data acquisition
  - Open access spatial data bases and remote sensing data
  - Other open access data and information
  - Validated using ground observations and literature values
- Data analyses
  - Standardized analyses
  - Using open access programming tools and scripts (python, QGIS)
- Reporting
  - Standardized sheets, maps, tables and graphs



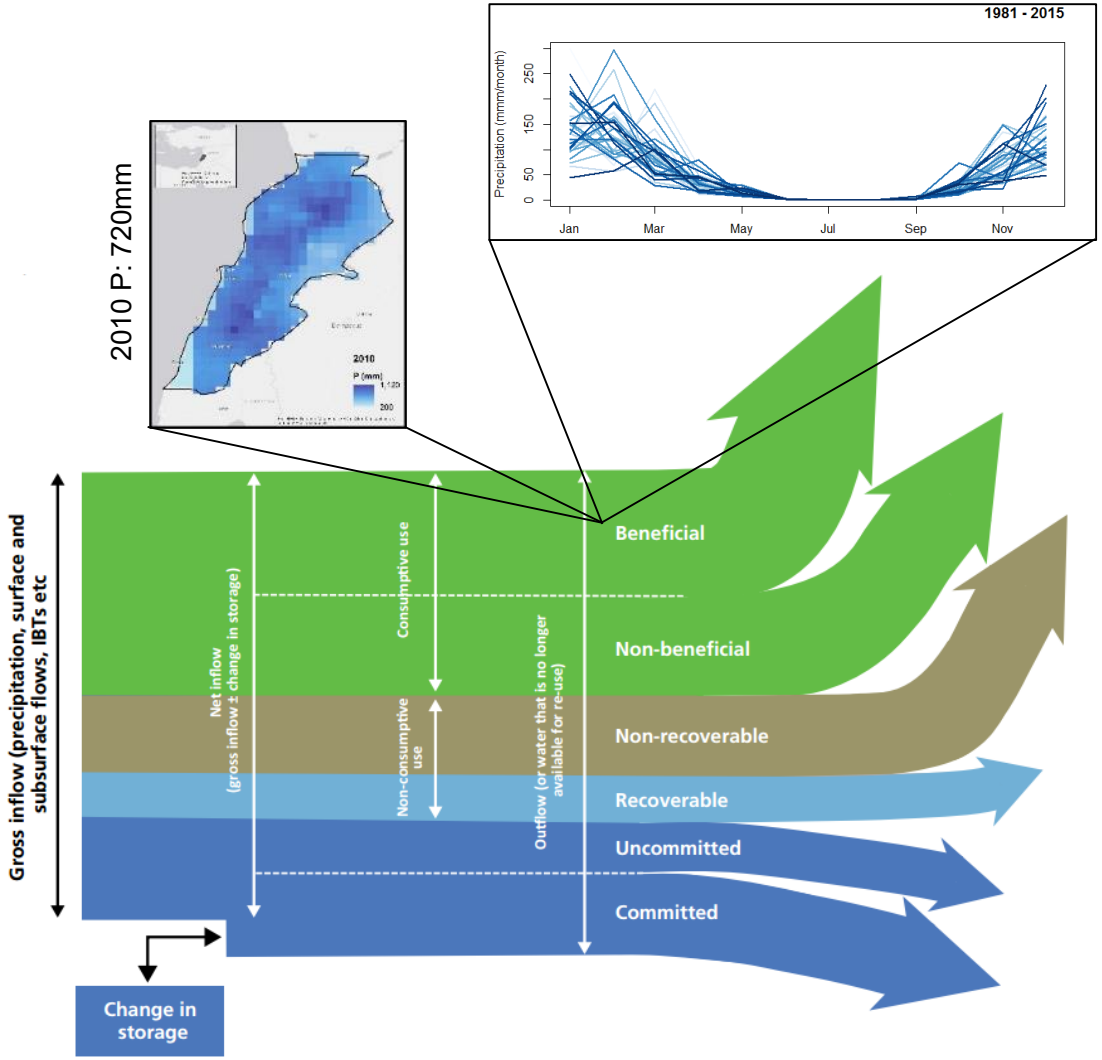
Water Accounting Plus (WA+)

WA+ attempts to make WA

scalable

spatially explicit

temporally detailed



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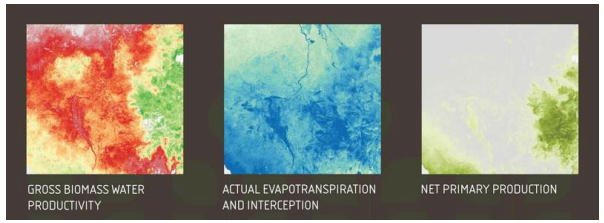
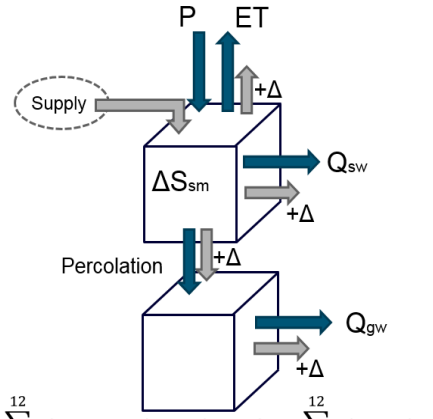
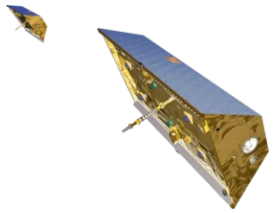
Remote Sensing data sets





$$\sum_{i=1}^{12} P^i + Supply^i - ET^i - \Delta S_{sm}^i = \sum_{i=1}^{12} Q_{sw}^i + Q_{gw}^i$$

Global data sets



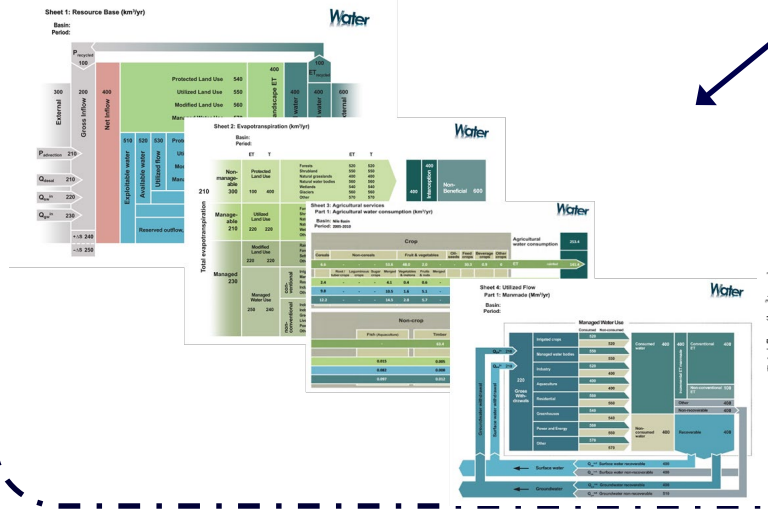
GRAND

WDPA

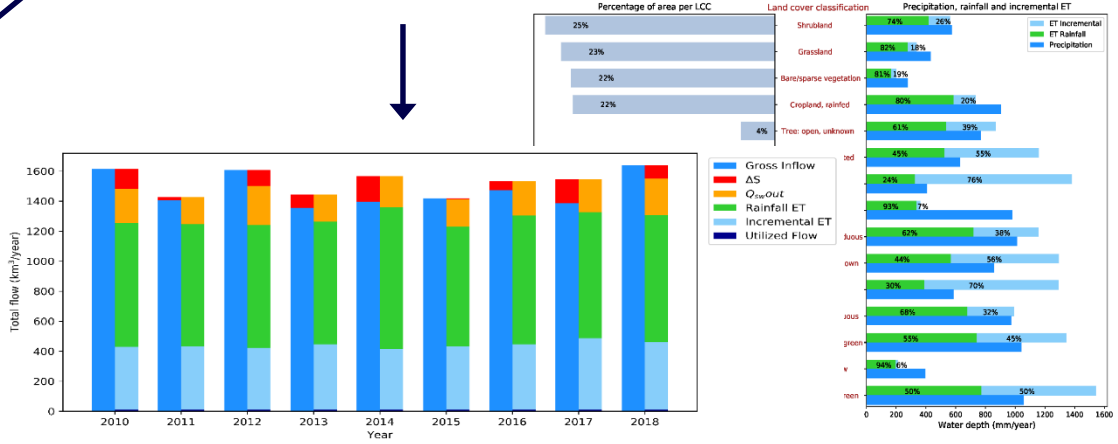
Grace

Ground measurements

Sheets



Graphs



Maps

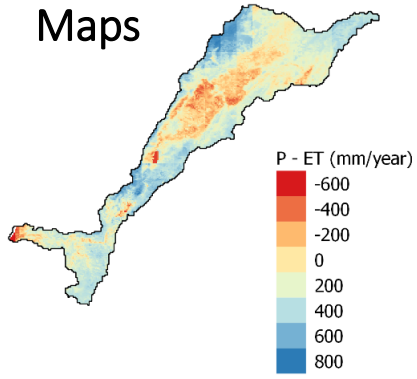
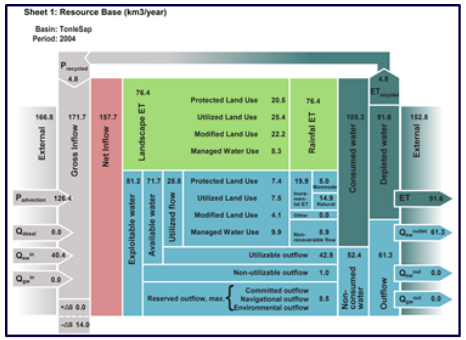
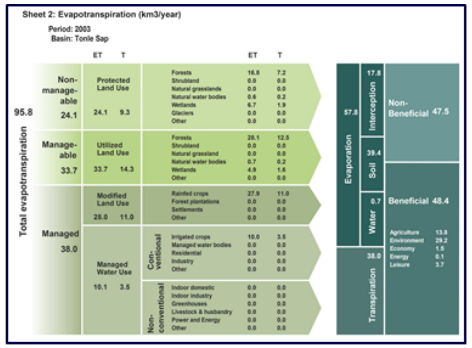
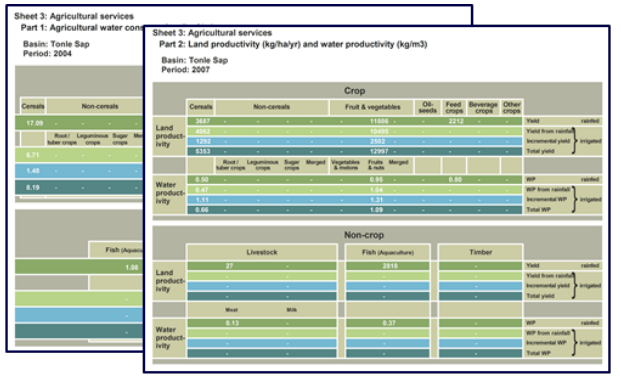


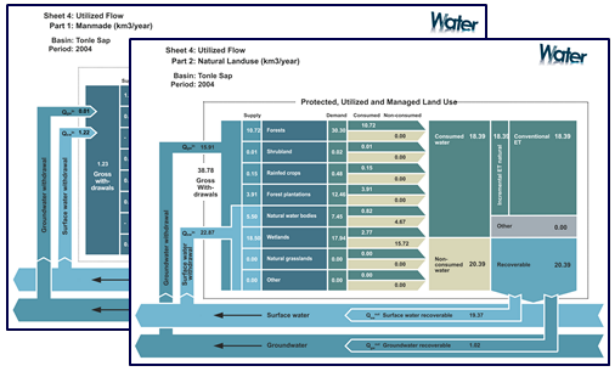
Figure Water Accounting overview (this figure/graph is created using images from FAO and IHE Delft, 2019; 2020)

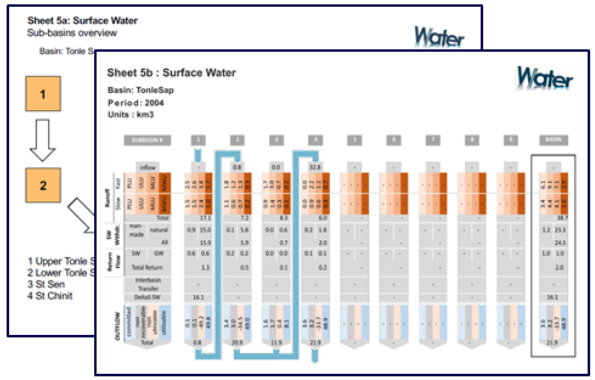
Water Accounting Plus (WA+): outputs

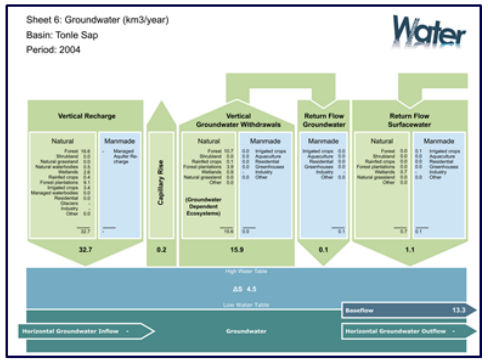












Finger diagram → thematic accounting sheets

Tailor-made to the case study

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Water Accounting Plus (WA+): outputs

- General overview at river basin scale of
  - Over-exploitation,
  - Manageable vs unmanageable flows
  - Exploitable flows,
  - Reserved flows,
  - Utilized and utilizable flows
- Discern between landscape ET (by rainfall) and incremental ET (by natural and manmade withdrawals)
- Discern ET for different land use classes with different management strategies
- Track surface and groundwater fluxes
- Track water supply and return flow

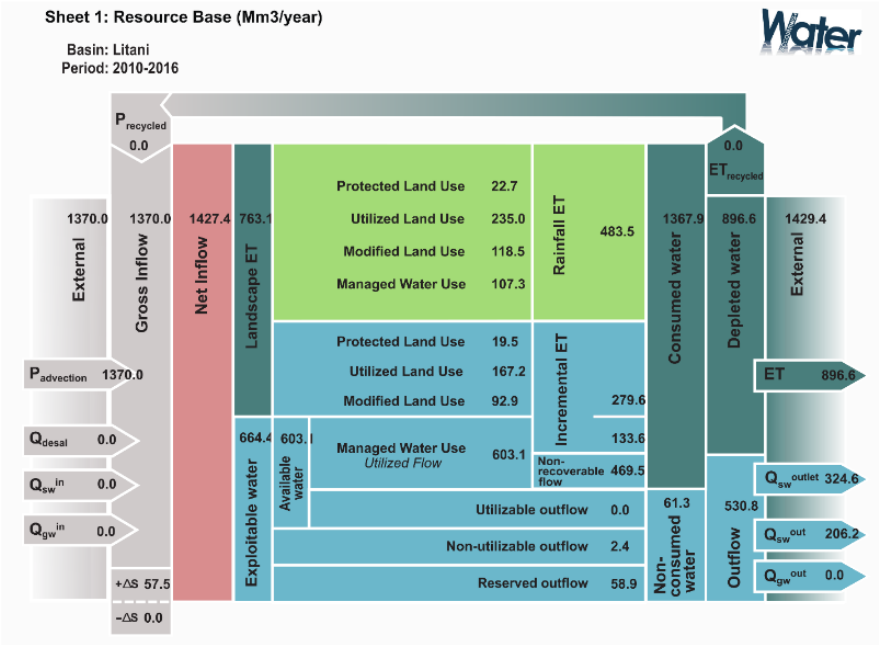

Figure WA+ Sheet 1 (FAO and IHE Delft, 2019)

References:

FAO 2018. Water Accounting for Water Governance and sustainable development (http://www.fao.org/3/I8868EN/i8868en.pdf)

Batchelor, C., Hoogeveen, J., Faurès, J.M. and Peiser, L., 2017. Water accounting and auditing. A sourcebook. *FAO Water Reports (FAO) no. 43*.

FAO and IHE Delft, 2019. Water Accounting in the Litani River Basin. FAO Water Accounting Series report, Rome, Italy (http://www.fao.org/3/ca6679en/ca6679en.pdf)
Steduto, P., Faurès, J.M., Hoogeveen, J., Winpenny, J. and Burke, J., 2012. Coping with water scarcity: an action framework for agriculture and food security. *FAO water reports*, *16*, p.78.

UN Water, Global Water Partnership (2007) UN-Water and Global Partnership (GWP) Roadmapping for Advancing Integrated Water Resources Management (IWRM) Processes.

Water Accounting for decision making

Marloes Mul
Associate Professor of Water Resources Management

IHE Delft Institute for Water Education

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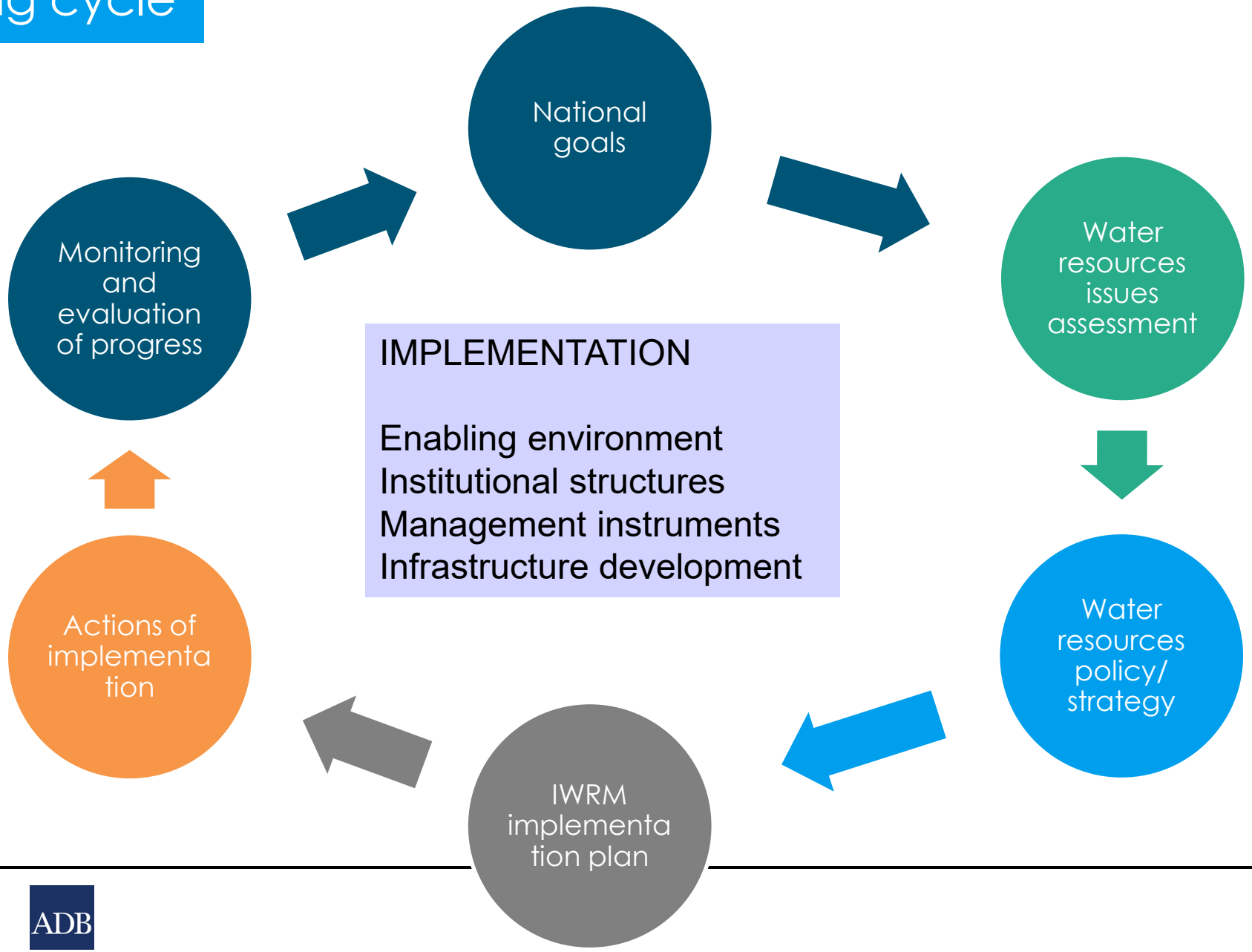
Thursday, November 19, 2020

IWRM Planning cycle



Water resources management plans

Based on

- Water availability estimations:
  - rainfall and stream flow gauges
  - hydrological modelling (rainfall - runoff)
- Water demand estimations:
  - Empirical estimations
  - Databases

- Observation network is declining (often with large data gaps, quality of data)
- Point based data
- No data on actual consumption

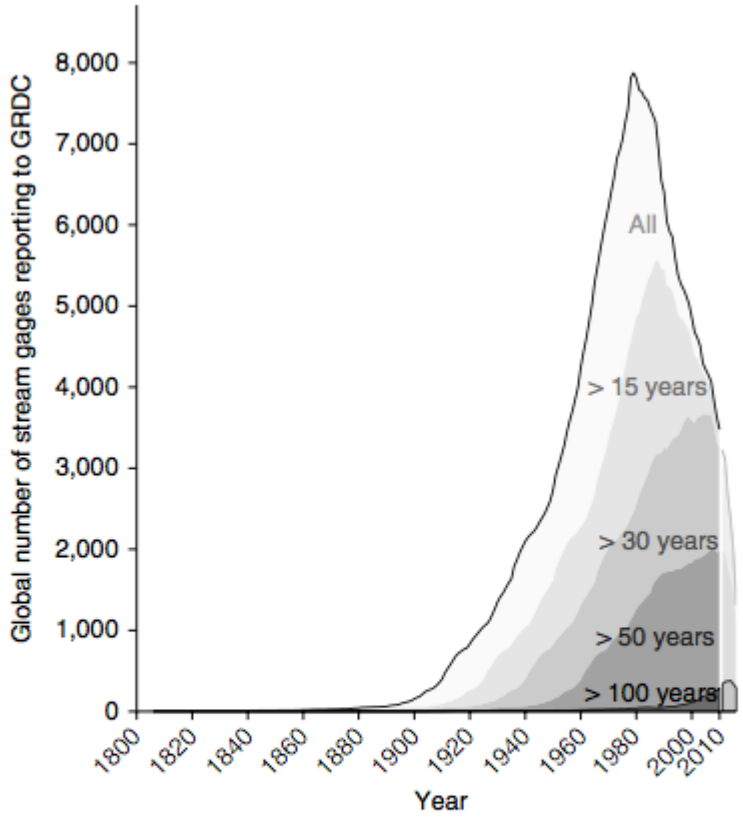
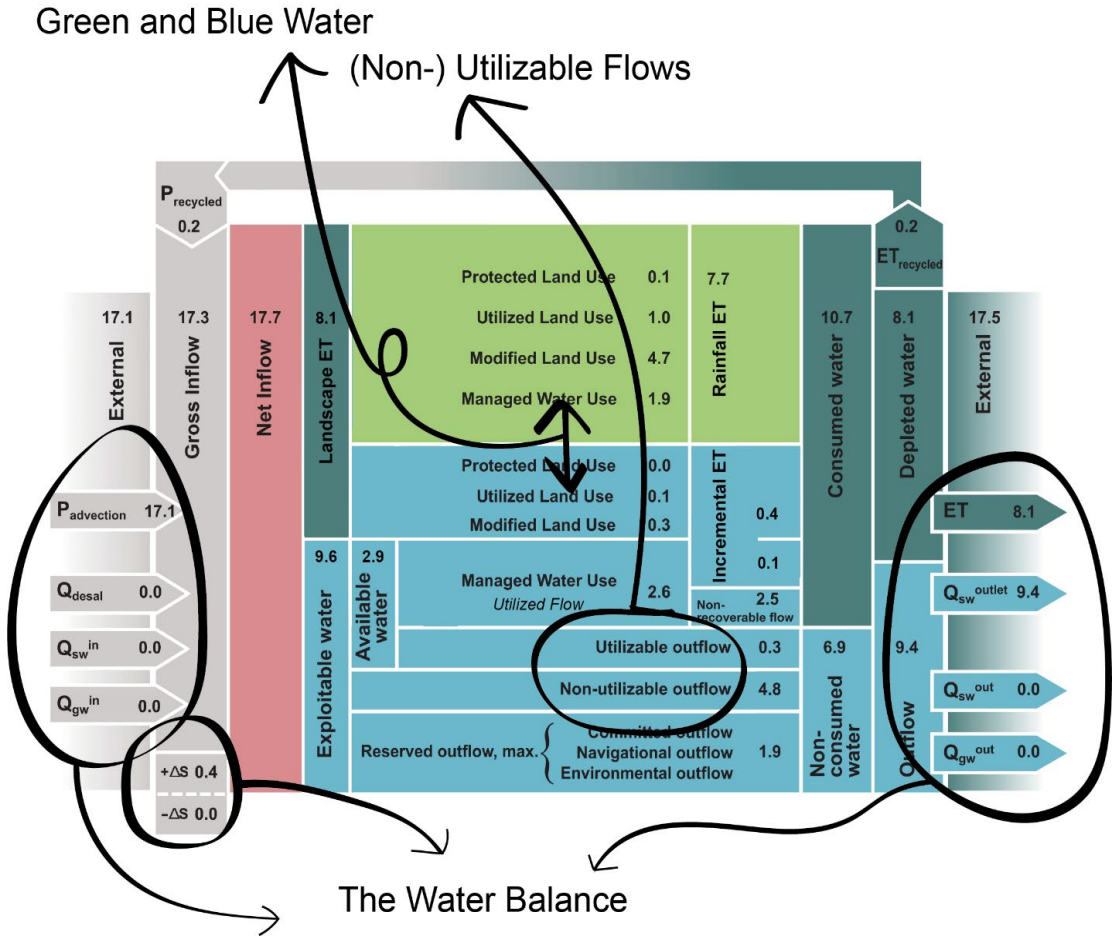


Fig. 1 | Global trends in streamgaging stations reporting to the Global Runoff Data Centre. We classified stations by age class (length of the discharge record, in years). The number of reporting stations peaked in 1979 and decreased sharply thereafter. Comparisons to 2010 (white vertical line) accounts for lags in data reporting, but trends to the present-day are shown.

Ruhi, A., Messager, M.L. & Olden, J.D. Tracking the pulse of the Earth's fresh waters. *Nat Sustain* **1,** 198–203 (2018).

Water Accounting Plus outputs - basin level

- General overview at river basin scale (Sheet 1) of
  - Water availability vs water consumption,
  - Exploitable flows,
  - Manageable vs unmanageable flows
  - Reserved flows,
  - Utilized and utilizable flows
  - Over-exploitation,
  - Green and Blue ET



Water Accounting Plus outputs- basin level

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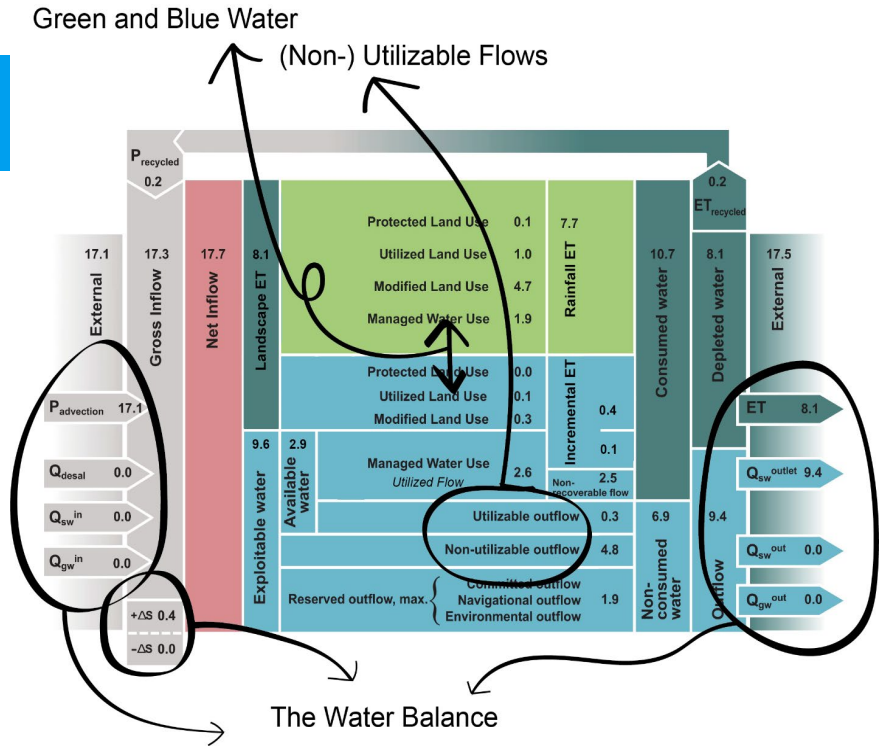
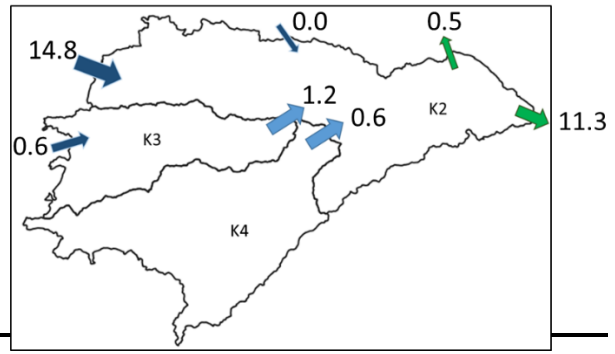
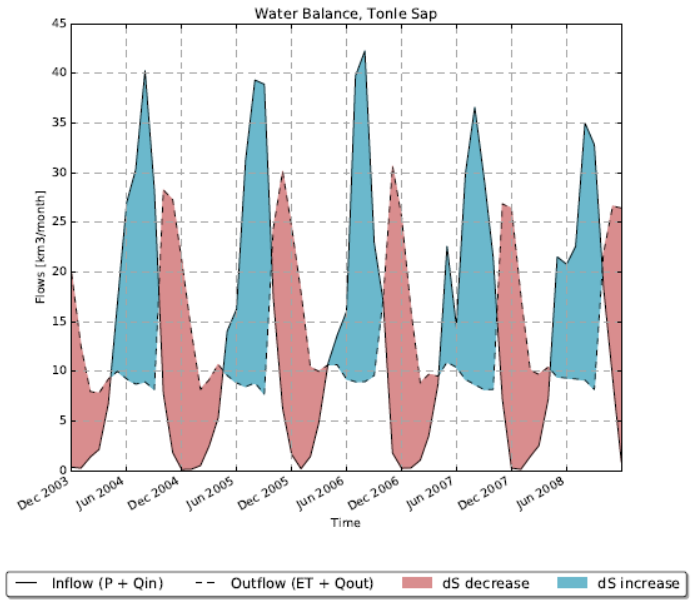
  - Reserved flows,
  - Utilized and utilizable flows
  - Over-exploitation,
  - Green and Blue ET
- In the form of
  - WA+ fact sheets
  - Indicators
  - Graphs

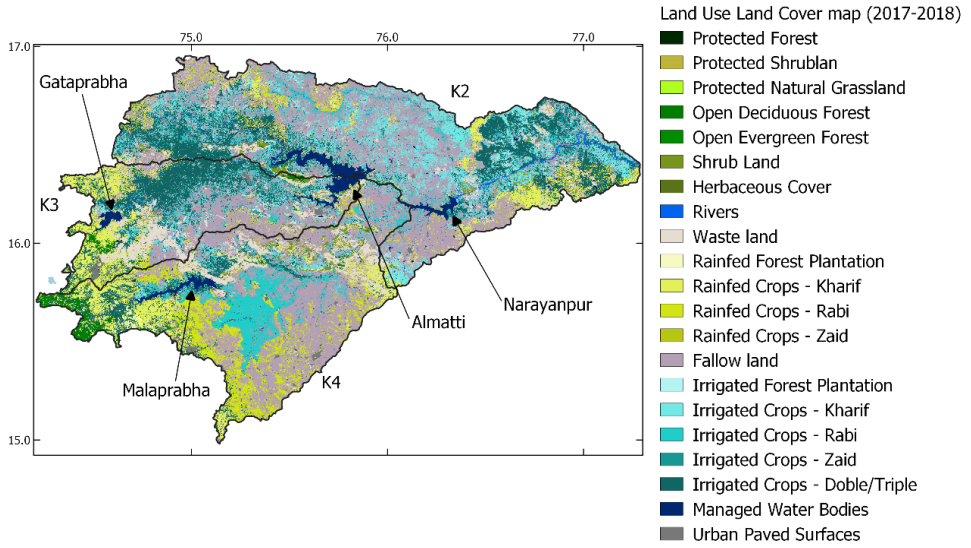


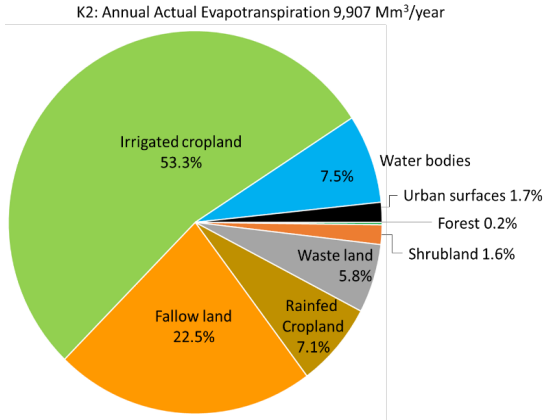


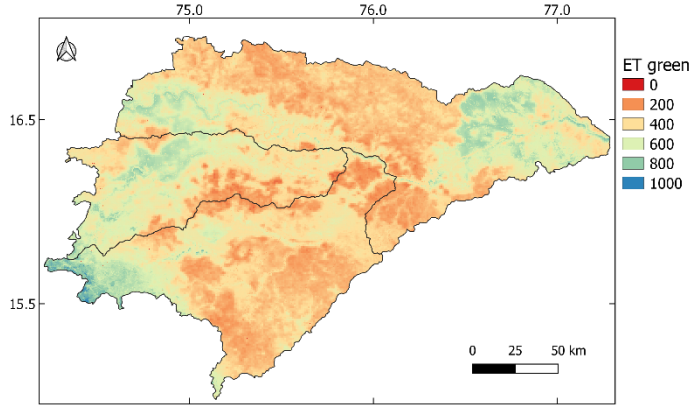


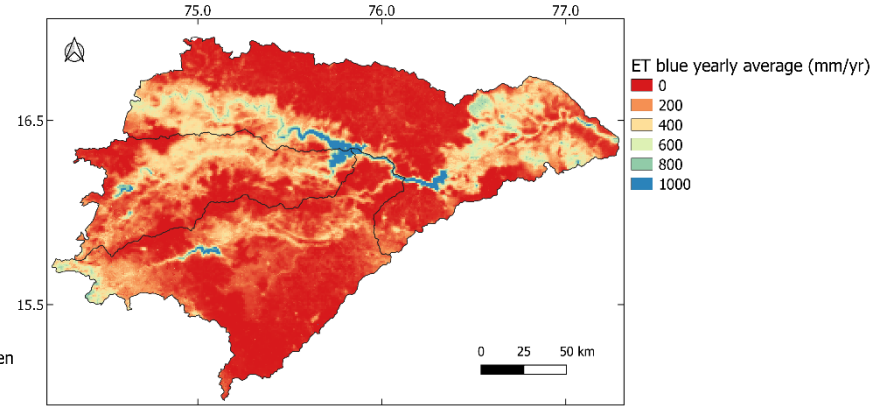
Water Accounting Plus outputs – spatial analyses

- Discern ET for different land use classes with different management strategies
- Discern between landscape ET (by rainfall) and incremental ET (by natural and manmade withdrawals)
- Track surface and groundwater fluxes
- Track water supply and return flow









Opportunities and limitations for using RS data for WRM&P

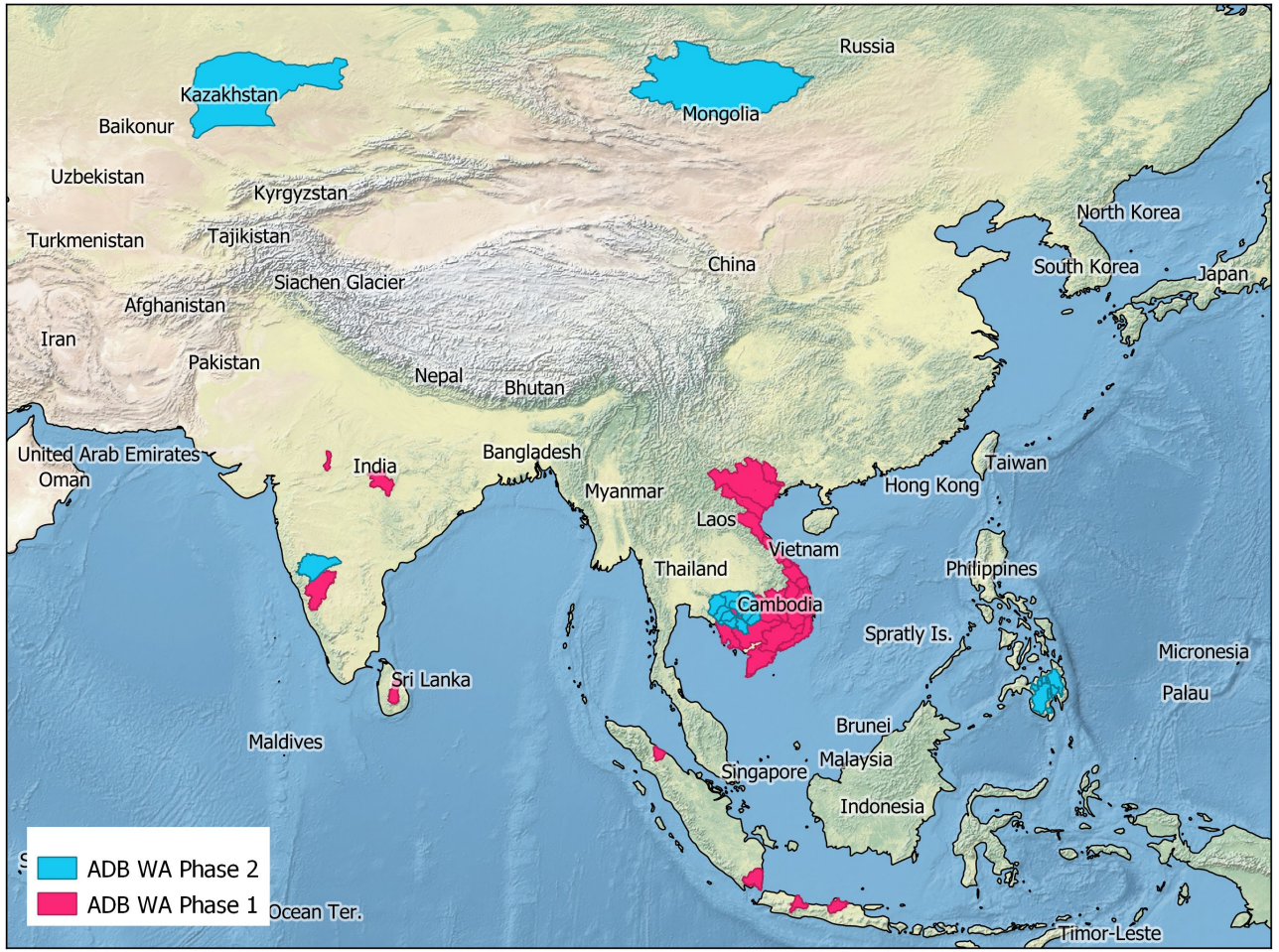
- In last decade reliability of RS data for WRM has improved significantly
- Continuous data set for various water resources related data sets (P, ET) for 10+ years
- Provides estimation of water consumption of largest water user (agriculture)
- Provides spatial information

But

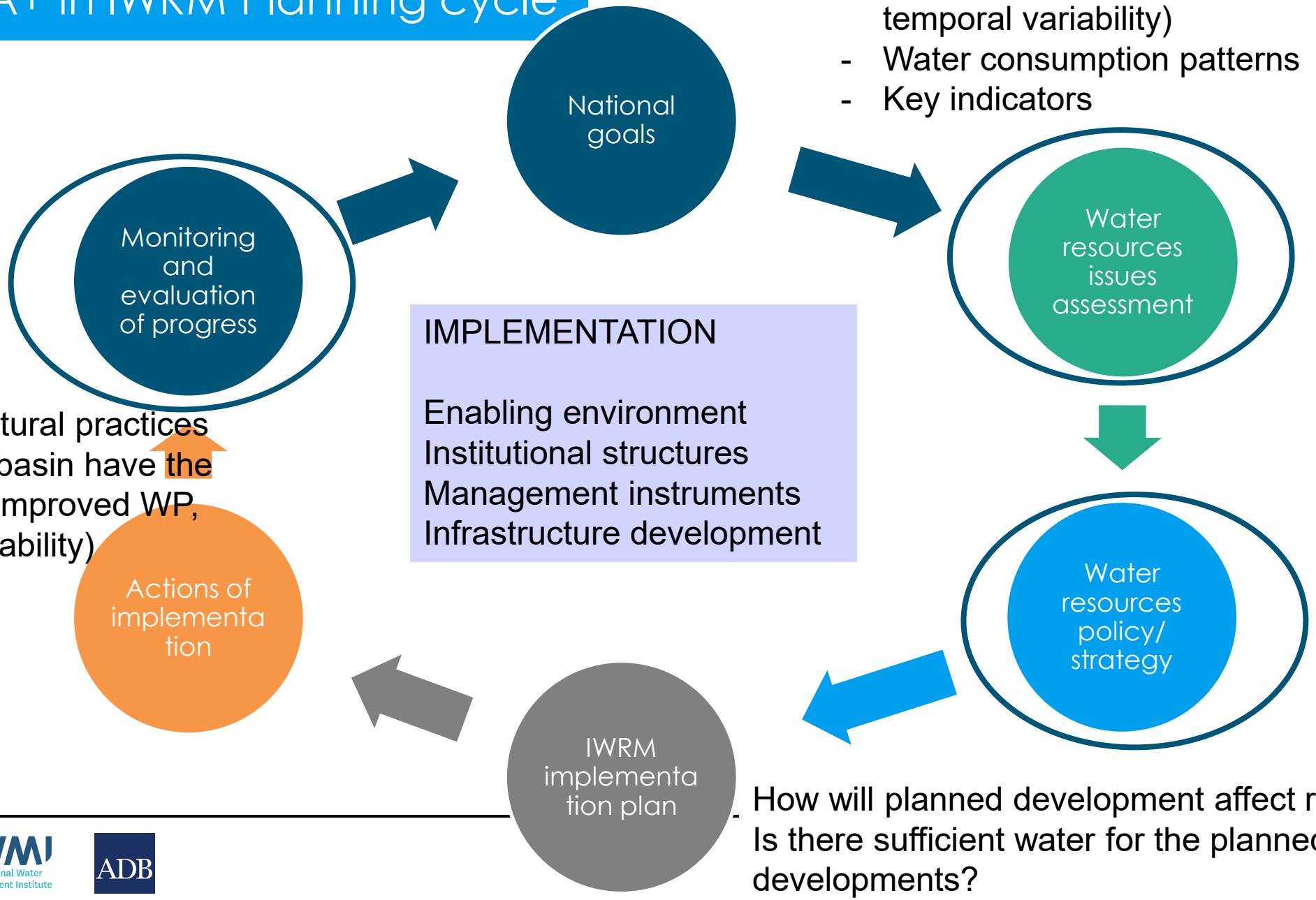
- Need for adjusting hydrological models for incorporating water consumption data
- Requires ground validation data
- Long time series missing (>30 year) needed for trend analyses
- Methodology for scenario assessments (eg climate change etc) to be developed
- Water quality not well presented

Example ADB case studies

- Phase 1 (2017-2018)
  - Cambodia
  - Vietnam
  - Indonesia
  - India (2 regions)
  - Sri Lanka
- Phase 2 (2019-2020)
  - India – Karnataka
  - Mongolia - Selenge
  - Cambodia - Tonle Sap
  - Philippines - Mindanao
  - Kazakhstan – Nura Surya



Role of WA+ in IWRM Planning cycle



What is the current state of the basin?

- Available water resource (incl spatial and temporal variability)
- Water consumption patterns
- Key indicators

How will planned development affect resources
Is there sufficient water for the planned developments?

Do improved agricultural practices implemented in the basin have the required result (eg, improved WP, increase water availability)

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Asian Water Development Outlook 2020 (draft)

- Key Dimension 2 Economic water security

"ADB members need to continue investing in water resource systems that provide the needed services to cope with socio-economic, demographic growth and climate change pressures towards further improving economic Water Security".

- Enhance water resources monitoring, measurement and data availability.
- Improve water productivity.
- Ensure adequate storage and distribution mechanism, while promoting Integrated Water Resources Management (IWRM) and investing in climate change adaptation and resilience.

Acknowledgements

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Vision for Water Accounting and Remote Sensing for Water Security

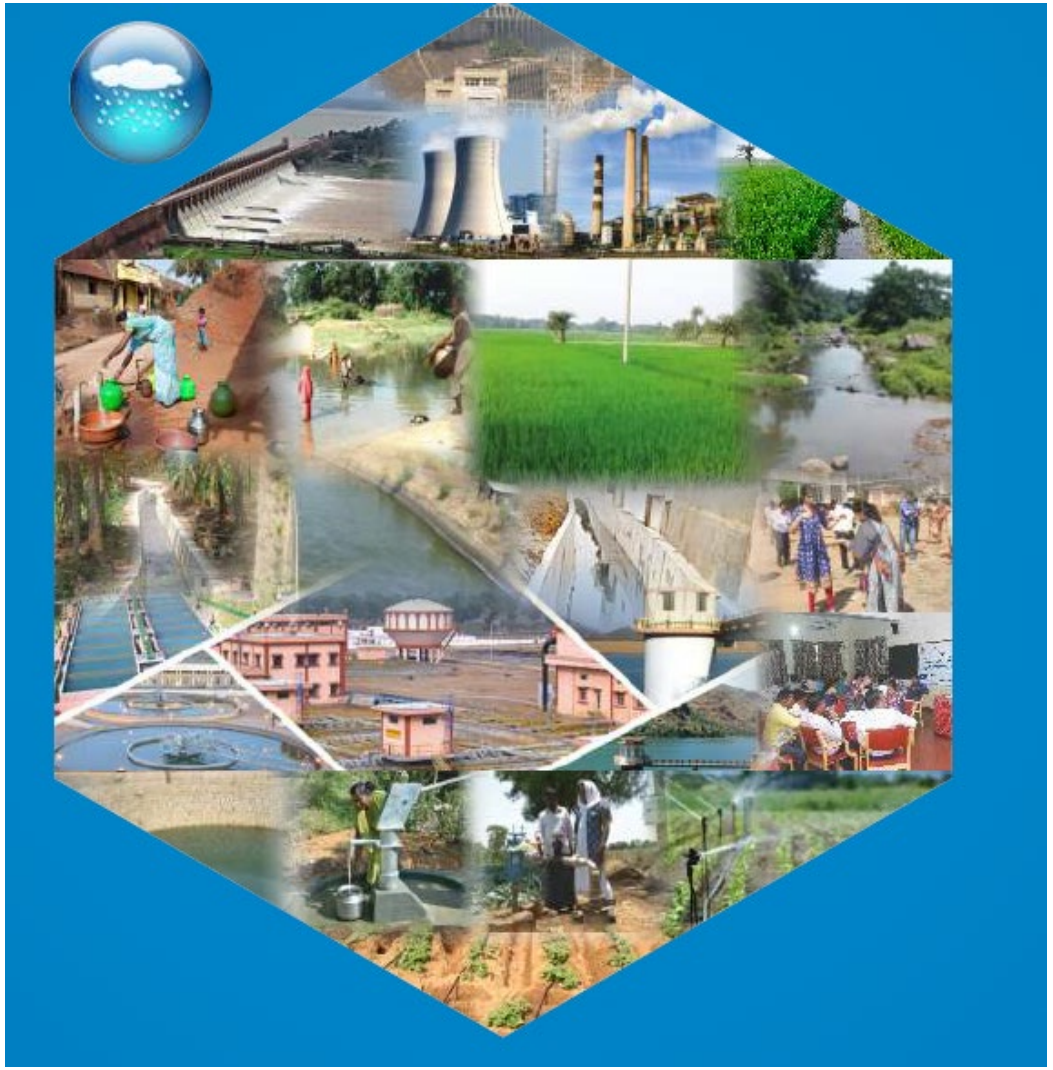
Dr P. S. Rao

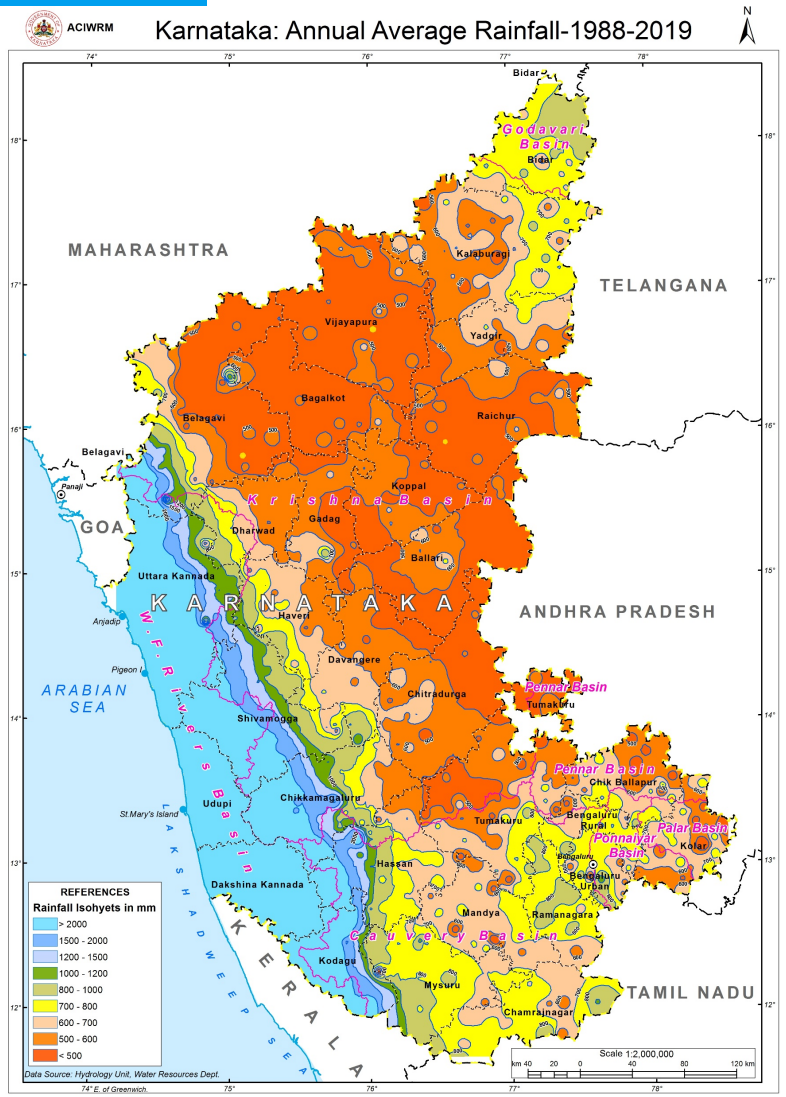
Advanced Center for Integrated Water Resources Management (ACIWRM)
Water Resources Department
Government of Karnataka, India

ADB Water, IHE Delft, and IWMI Webinar:
Improved Decision Making for Water Security using Water Accounting

Thursday, November 19, 2020

KARNATAKA STATE – 7 Basins – Krishna & Cauvery





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New State Water Policy

GOAL

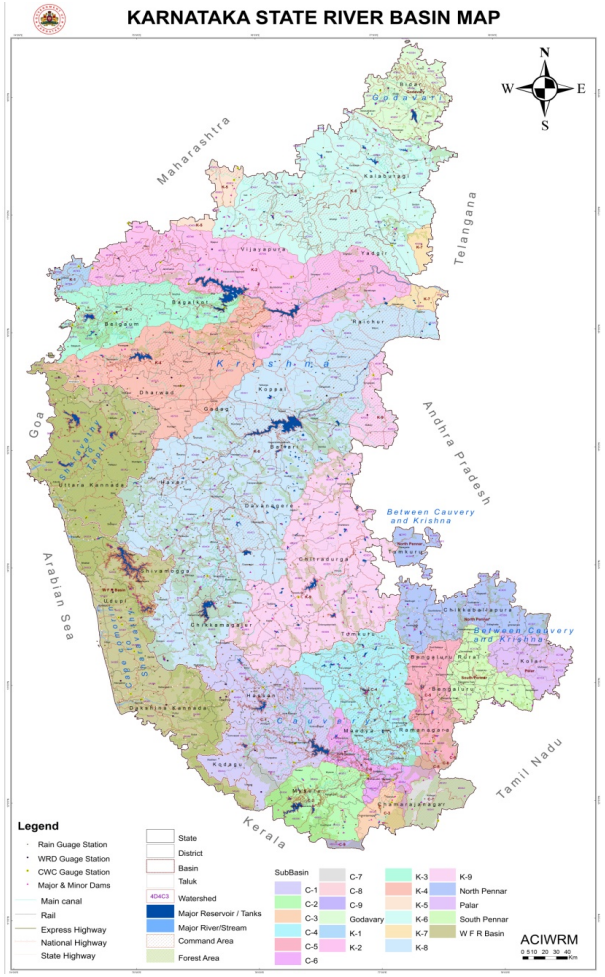
- ***is to facilitate the water security and optimal utilisation of the State's water resources for health, food, energy, environment and other societal purposes***

Current scenario

- Stressed water resources
- Increasing demand and competition from various sectors
- Need for Integrated approach for Water Resources Management (IWRM)
- Water Security – The Key for Food and Economic security

Water Accounting & Remote Sensing Tools – Karnataka's Journey

- ADB supported program – KISWRMIP – 2014
- Partnership with IHE, Delft, The Netherlands – 2016
- Introduction workshop on Water Accounting & RS tools - 2017
- Capacity Building of WRD Engineers by IHE faculty
  – 2017 / 2018 / 2019
- Water Accounting of Tungabhadra sub-basin - 2018
- Creation of ET maps for Karnataka State for 2000 – 2014 (15 yrs) – first time ever
- Water Accounting of other sub-basins (K2, K3 & K4) in Krishna sub-basin in Karnataka State – 2019 / 2020



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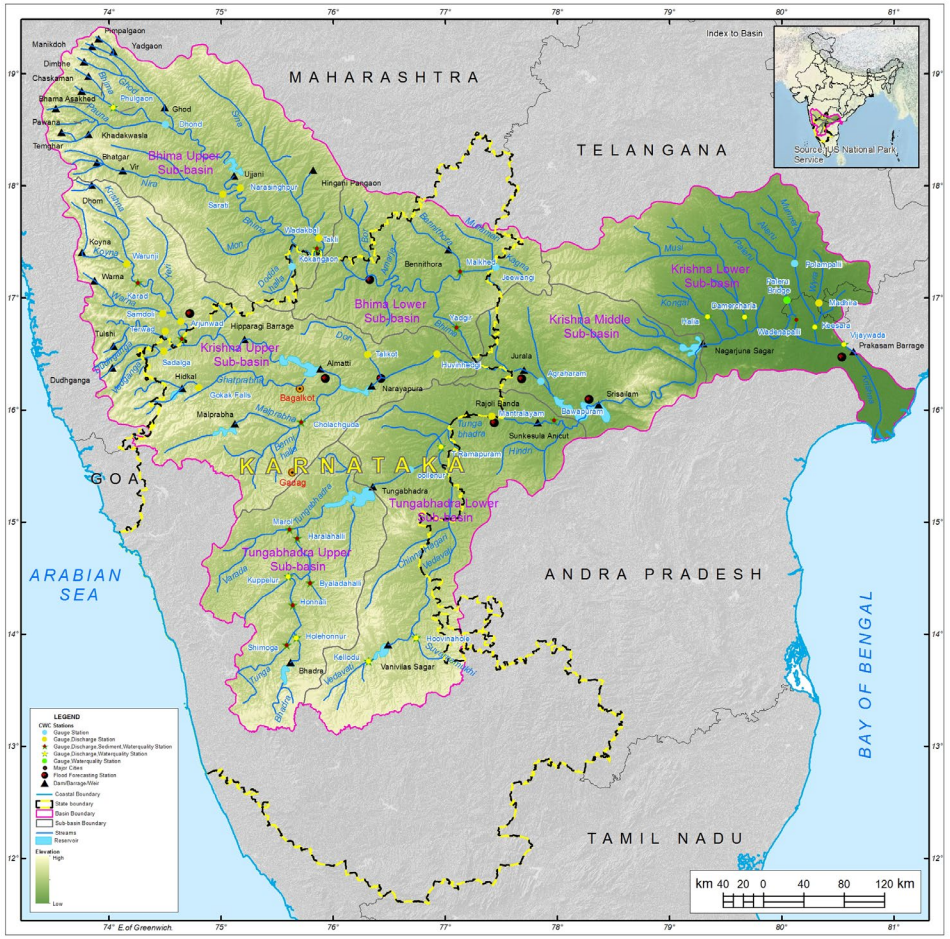
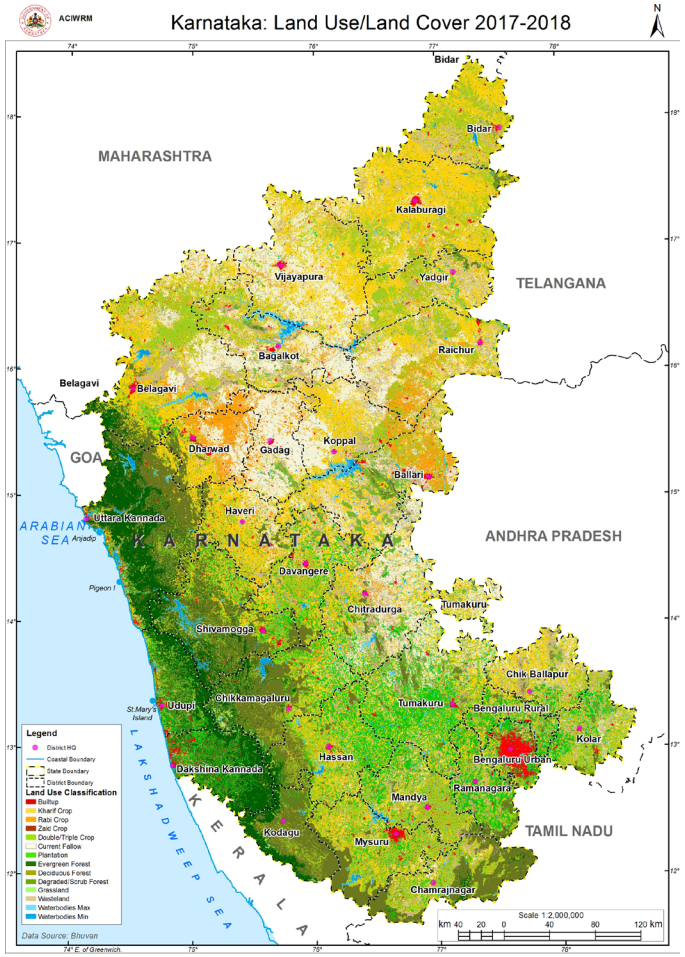
Water Accounting & Remote Sensing Tools – Karnataka's Journey





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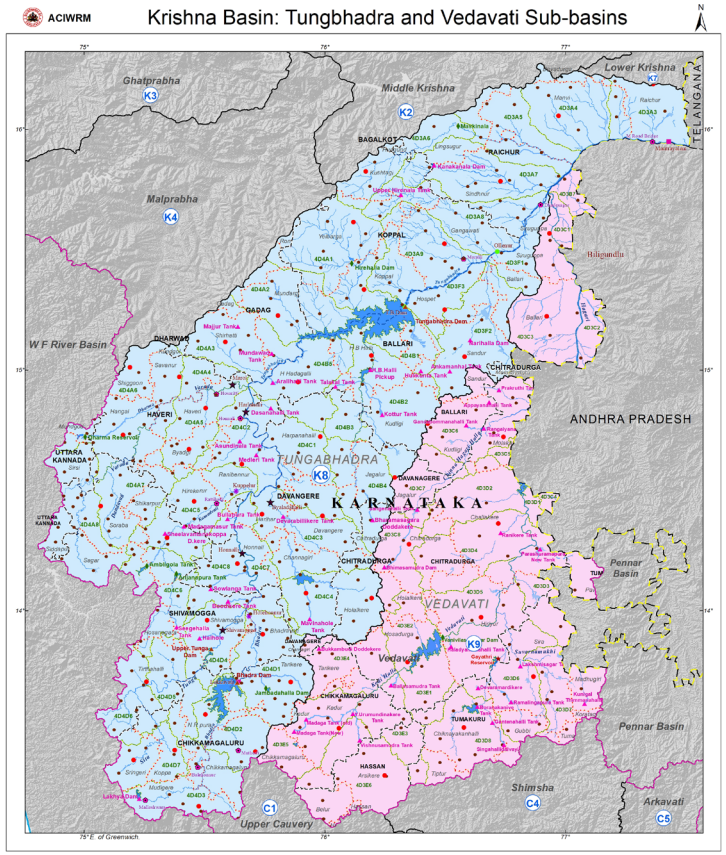
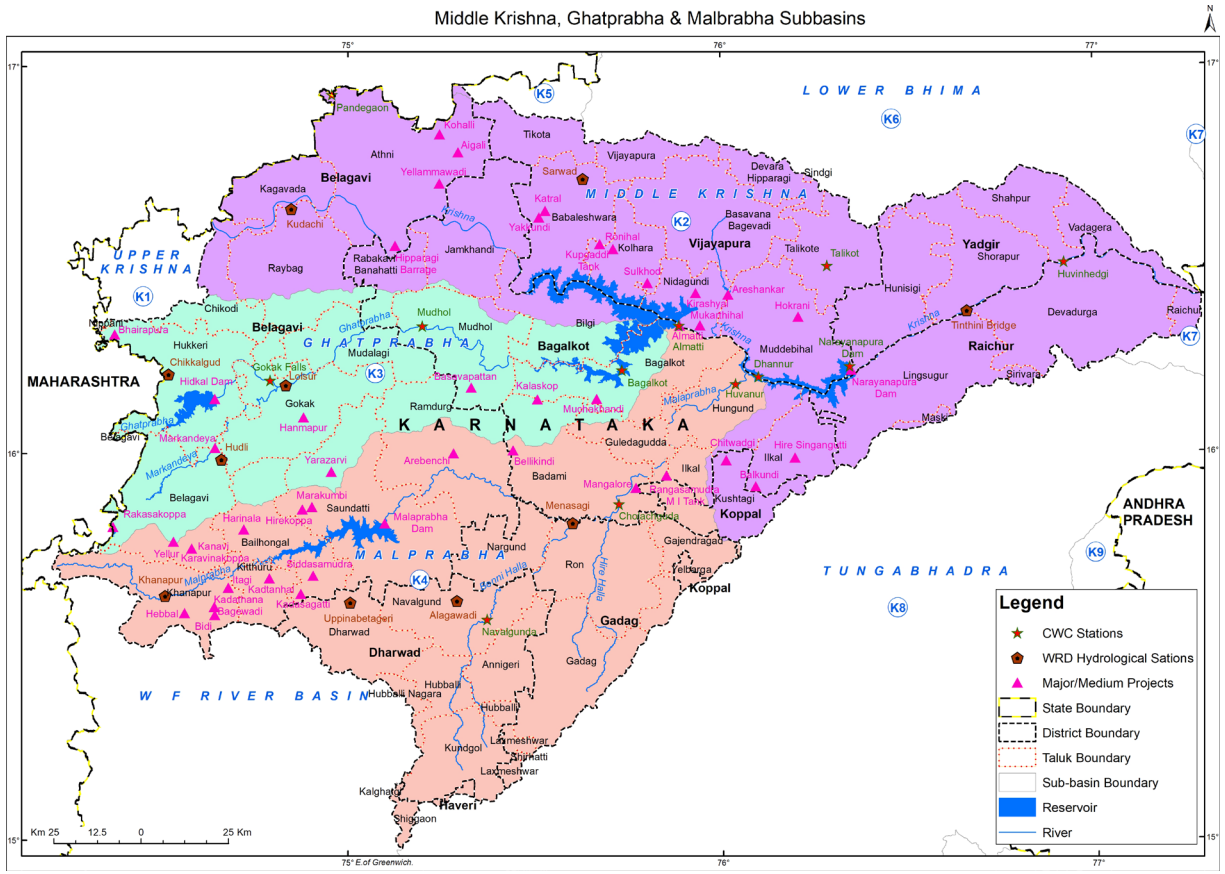
Water Accounting & Remote Sensing Tools – Karnataka's Journey



Sub-basin Name	Sub-basin Code	Drainage Area* sq.km	Percentage of Area	Population in Million
Upper Krishna	K1	821	0.72%	0.4
Middle Krishna	K2	15,829	13.93%	3.87
Ghatprabha	K3	6,833	6.02%	2.76
Malprabha	K4	11,780	10.38%	3.09
Bhima	K5	1,256	1.11%	0.27
Lower Bhima	K6	18,100	15.94%	4.13
Lower Krishna	K7	1,393	1.23%	0.38
Tungabhadra	K8	39,106	34.45%	10.07
Vedavati	K9	18,409	16.22%	4.13
	Total	1,13,528	100%	29.10

*Area based on GIS analysis.



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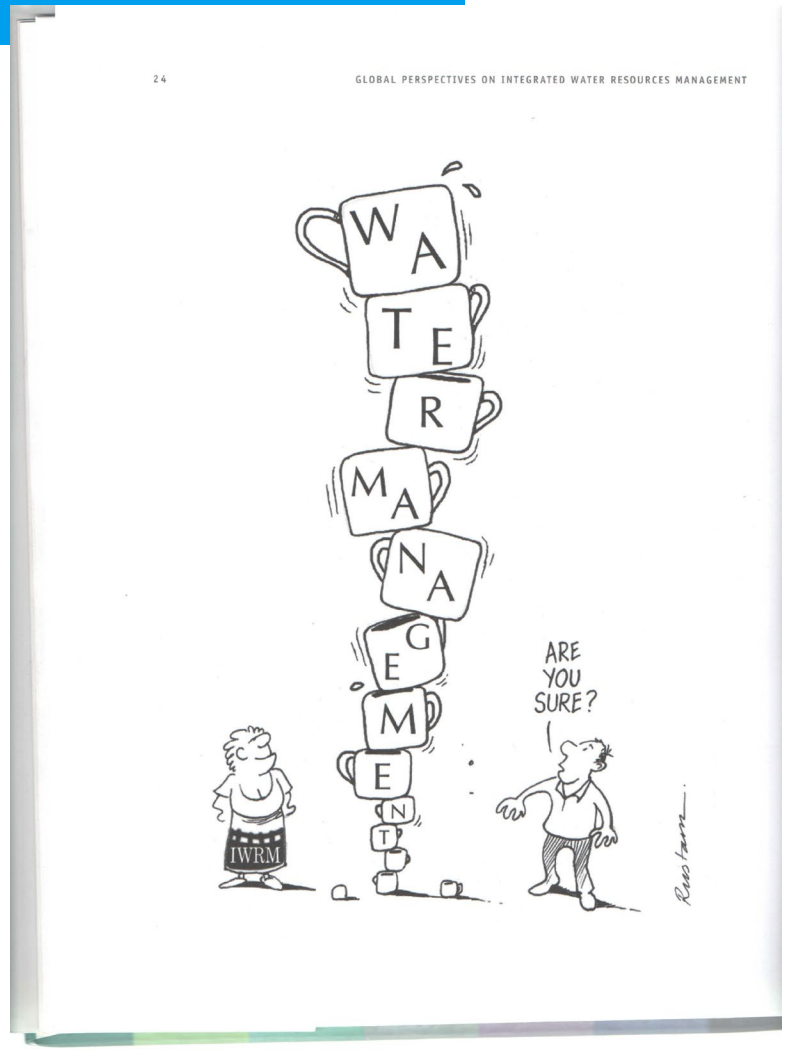
Water Accounting – Support for Water Resources Management ….. 1/2

- Understanding ET (Evapotranspiration) across various places (spatially) in the basin will provide new insights for better water resources management
- ET is the next important component to Rainfall in water cycle
- Availability of water in local areas across basin can be easily identified
- Inter-sectoral competion of water resources in a basin can be addressed with WA+ results
- On-farm water management can be facilitated better
- Outflows of the basin including groundwater can be better understood in real time and past years

Water Accounting – Support for Water Resources Management ….. 2/2

- Computation of the water yield generated from within Karnataka that can be allocated to expand irrigation systems (and for water allocation plans in general)
- Estimating amount of extra local water storage (small scale waterharvesting) needed to mitigate water shortage in dry and wet season
- Determine the impact of climate change on the blue water resources in general (diminished surface water and groundwater stocks) Improved water governance
- Monitoring impact of drought on agricultural production
- Assess environmental flow requirements for maintenance of flora / fauna
- Definitions of maximum allowable groundwater abstraction using spatial information on groundwater recharge



Water Accounting & Remote Sensing Tools – Future

- Need to build more capacity within WRD to use open source satellite data & Water Accounting tools
- Setup a dedicated team of WRD staff (within ACIWRM?) to prepare water accounts for each sub-basin, every year
- Facilitate capacity development in the private sector – to enable various departments/agencies to use the tools
- Prepare better communication products (about use of WA+ results) to the policy level and practicing engineers in the field
- Create capacity in every Chief Engineer (Zone) office for all large projects / sub-basins

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