Water Accounting plus using remote sensing for monitoring SDG 6

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Remote Sensing data for monitoring SDG 6.4

- **SDG 6.4 Water use and scarcity**

Indicator 6.4.1 “Change in water use efficiency over time” ($/m^3)

Indicator 6.4.2 “Level of water stress” (%)

- Monitoring various components of the water balance (eg)
  - Precipitation
  - Evapotranspiration (i.e. total E)
  - Storage change (Grace)
  - Soil moisture (SWAP, ASCAT)
- Increasing temporal and spatial resolution data available
- Continuous data set for various water resources related data sets (P, ET) for 10+ years
- In last decades reliability of RS data has improved (various publications)

A TRIBUTE TO EDWARD P. GLENN (1947-2017): A LEGACY OF SCIENTIFIC ENVIRONMENTAL ASSESSMENT AND APPLICATIONS IN HYDROLOGICAL PROCESSES

Evaluation of WaPOR V2 evapotranspiration products across Africa

Can we trust remote sensing evapotranspiration products over Africa?

Imeshi Weerasinghe[1], Wim Bastiaanssen[2], Marloes Mul[2], Li Jia[3,4], and Ann van Griensven[1,2]

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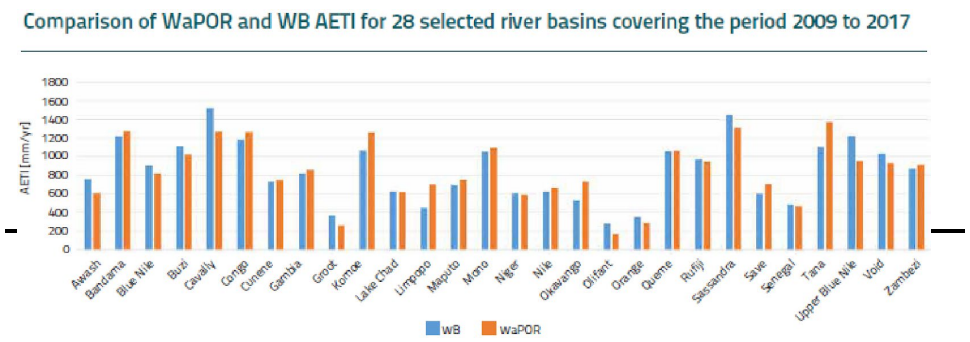
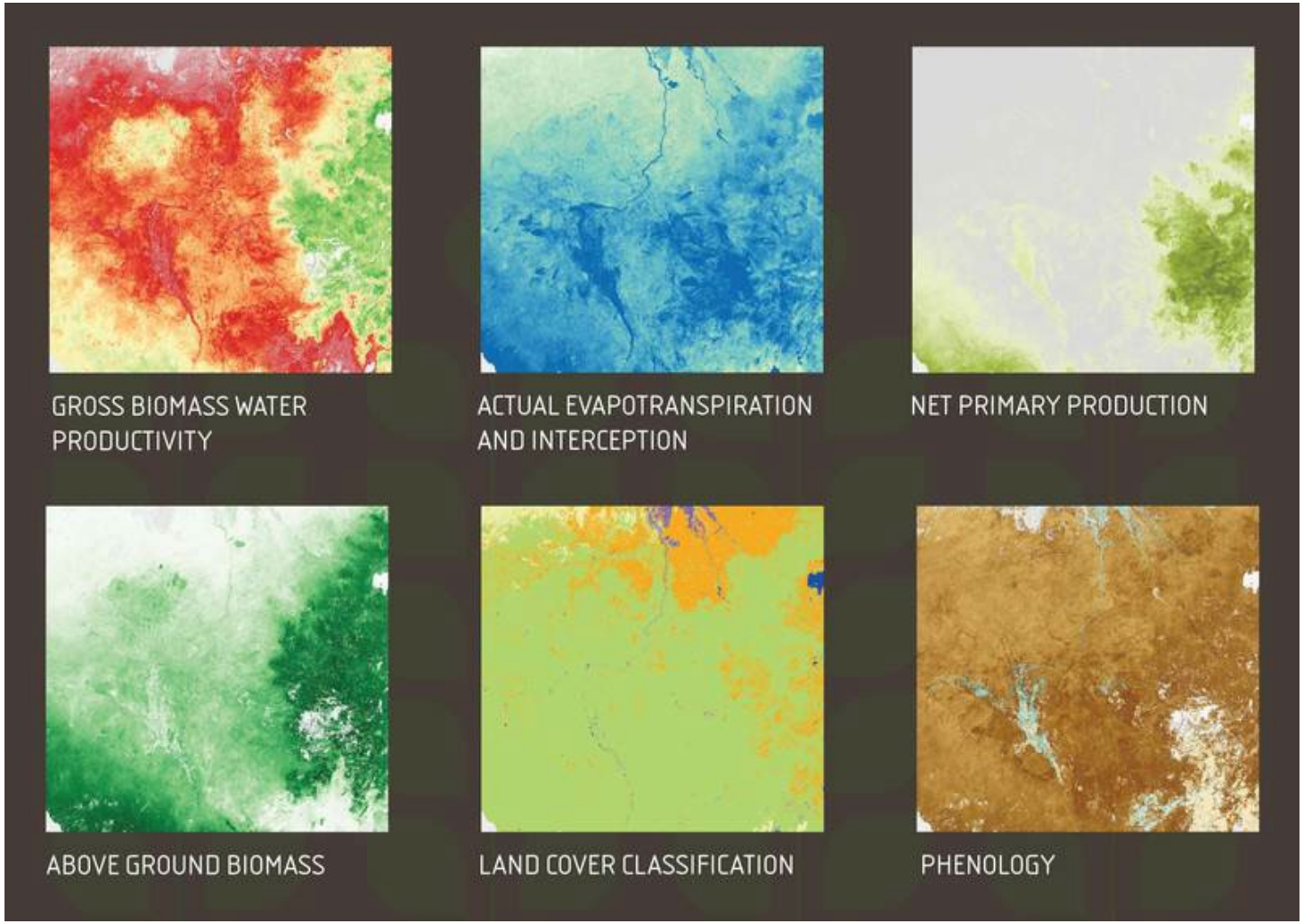
[2]IHE Delft Institute for Water Education, Delft, the Netherlands
[3]Chinese Academy of Sciences, Beijing, China
[4]Joint Center for Global Change Studies, Beijing, China

WILEY



Remote Sensing data for monitoring SDG 6.4



- Other products available also providing benefits of water use (eg biomass production)
- Provides estimation of water consumption of largest water user (agriculture)
- Can be accessed near real time and used retrospectively
- More and more data sets are becoming open access (including FAO WaPOR with a user friendly portal)

→ how to translate this “big data” into information?

Water Accounting

- Definition:

"Water Accounting can be defined as the systematic acquisition, analysis and communication of data and information relating to stocks and fluxes of water in natural, disturbed or heavily engineered environments, within a geographical domain".

(adapted from Steduto et al., 2012; Batchelor et al., 2016)

Water Accounting Plus (WA+)

Developed by IHE Delft in partnership with IWMI and FAO

- Geographical domain: river basin
- Data acquisition
  - Open access remote sensing-based data bases
  - 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, graphs and indicators

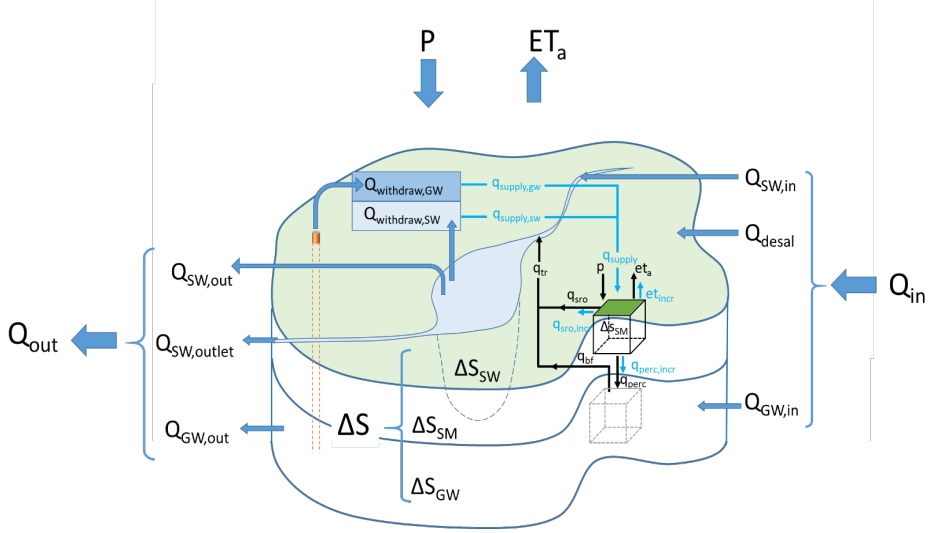
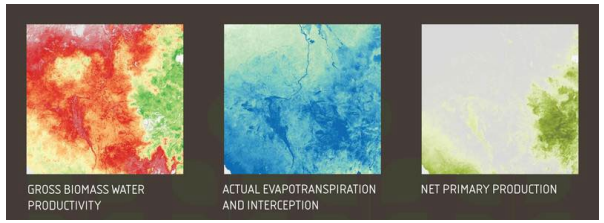


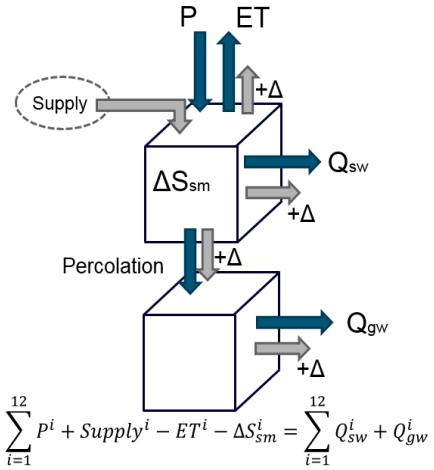
Figure Schematisation of fluxes calculated by WA+ (image created by IHE WA team)

Water Accounting Plus

River basin level

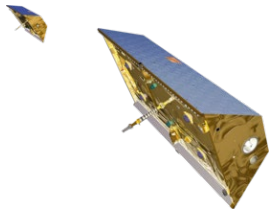
Remote Sensing data sets





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

Global data sets



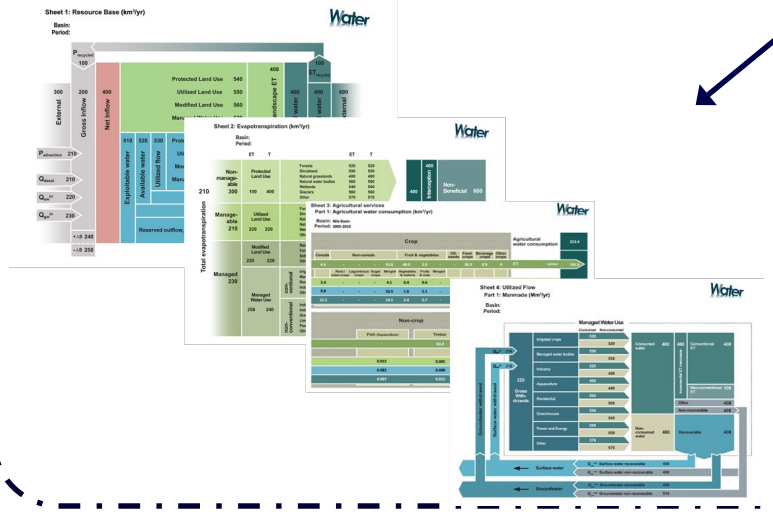
GRAND

WDPA

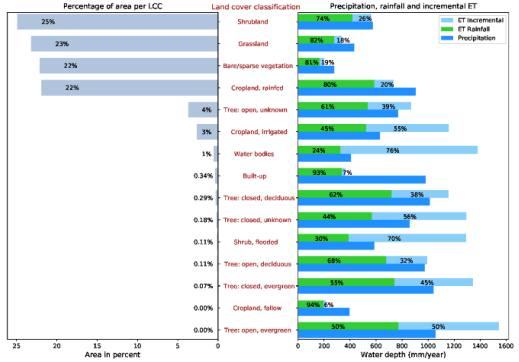
Grace

Ground measurements

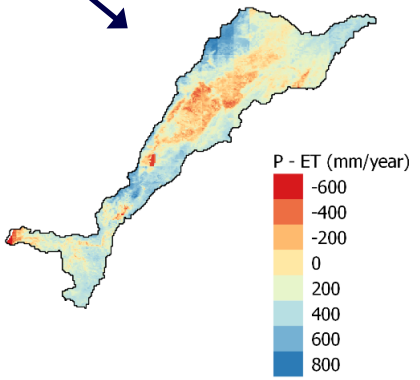
Sheets



Graphs



Maps



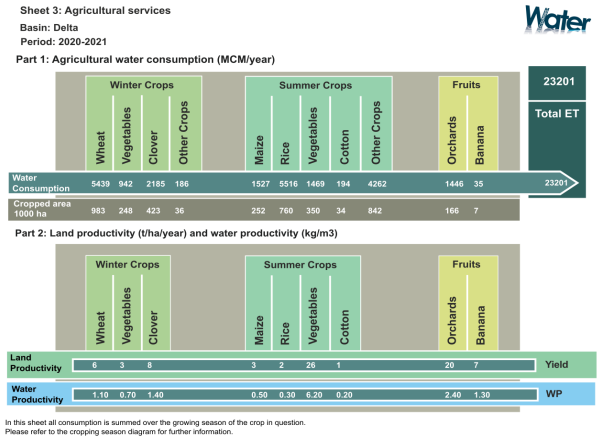
Indicators

- Exploitable water fraction
- Available water fraction
- Basin closure
- Managed fraction
- Beneficial utilization (productivity)

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

Agricultural Services (WA+ Sheet 3) scheme/ field level analyses

Reports water consumption, land and water productivity in agriculture

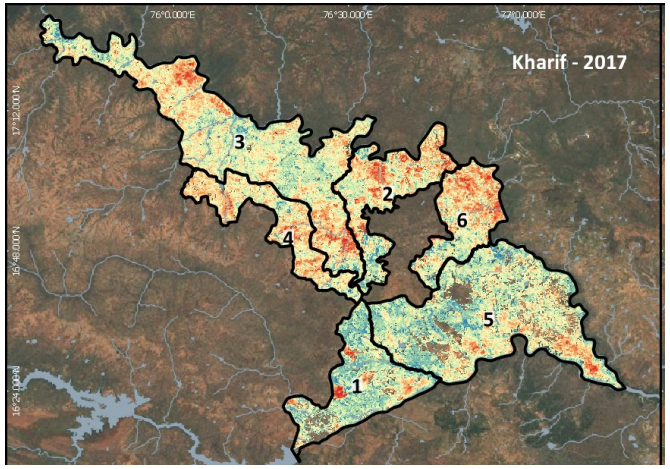


Crop water productivity is a **performance indicator** for **monitoring**, **evaluation,** and a **diagnosis tool** for **irrigation water management**

$$WP = \frac{(\text{yield} \uparrow)}{(\text{water} \downarrow)}$$

- Outputs derived from water consumed (kg or $)
  - Water consumed (ET)

- Differentiating green and blue water -- > identify rain or irrigation dependent



SDG 6.4 water use and scarcity

- SDG 6.4.1 Increase water use efficiency
  - Three sectors (agriculture, industries and services)

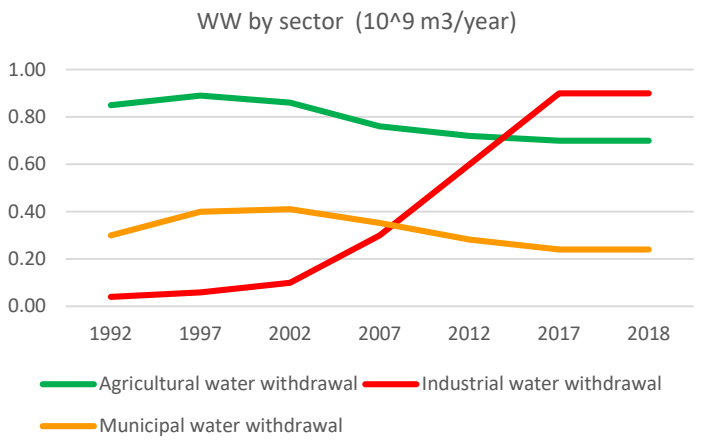
$$WUE = A_{we} x\ P_A + M_{we} x\ P_M + S_{we} x\ P_s$$

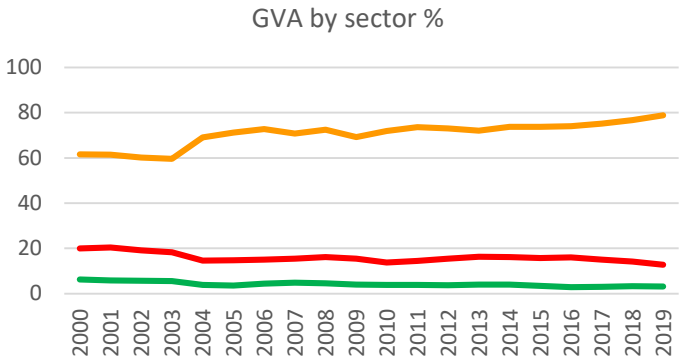
  - Economic indicator ($/m^3)

- Type of data currently used (not always obtained each year):
  - Aquastat
  - National statistics data / country estimates

Providing results at national level/ missing spatial variability

- Example Lebanon





Agriculture — Industry + services

High — Low

$

Low — High

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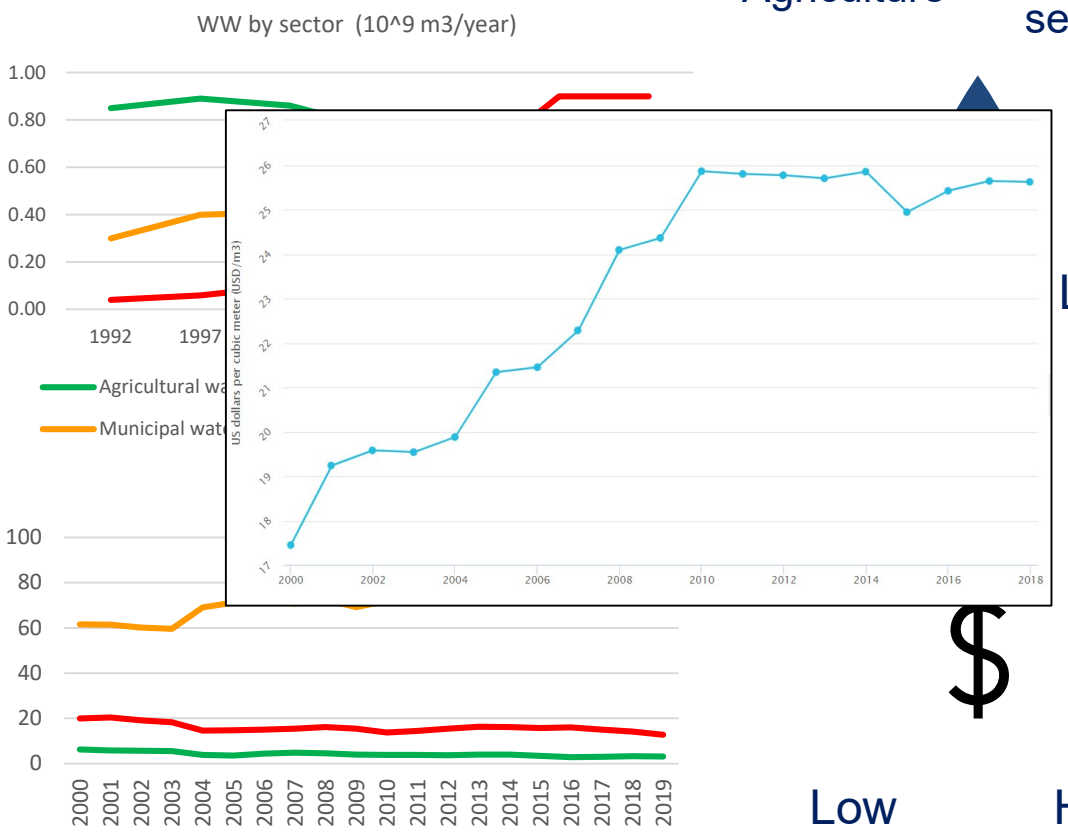

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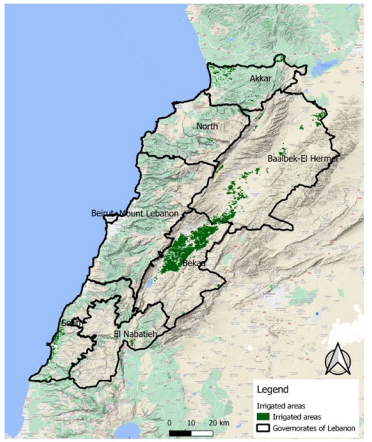
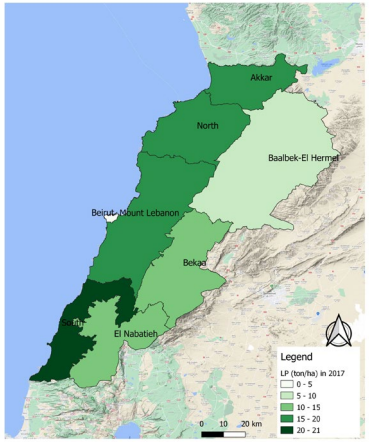
Providing results at national level/ missing spatial variability

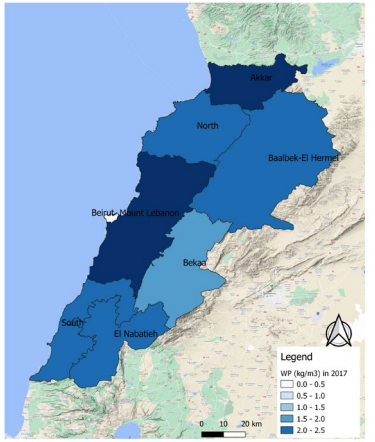
- Example using FAO WaPOR database



Irrigated areas



Land productivity



Water productivity

Provides

- Agricultural water use efficiency ton/m^3 for irrigated areas

Testing translation to $/m^3

- Using national data or data available in Aquastat
- Using detailed crop information

SDG 6.4 water use and scarcity

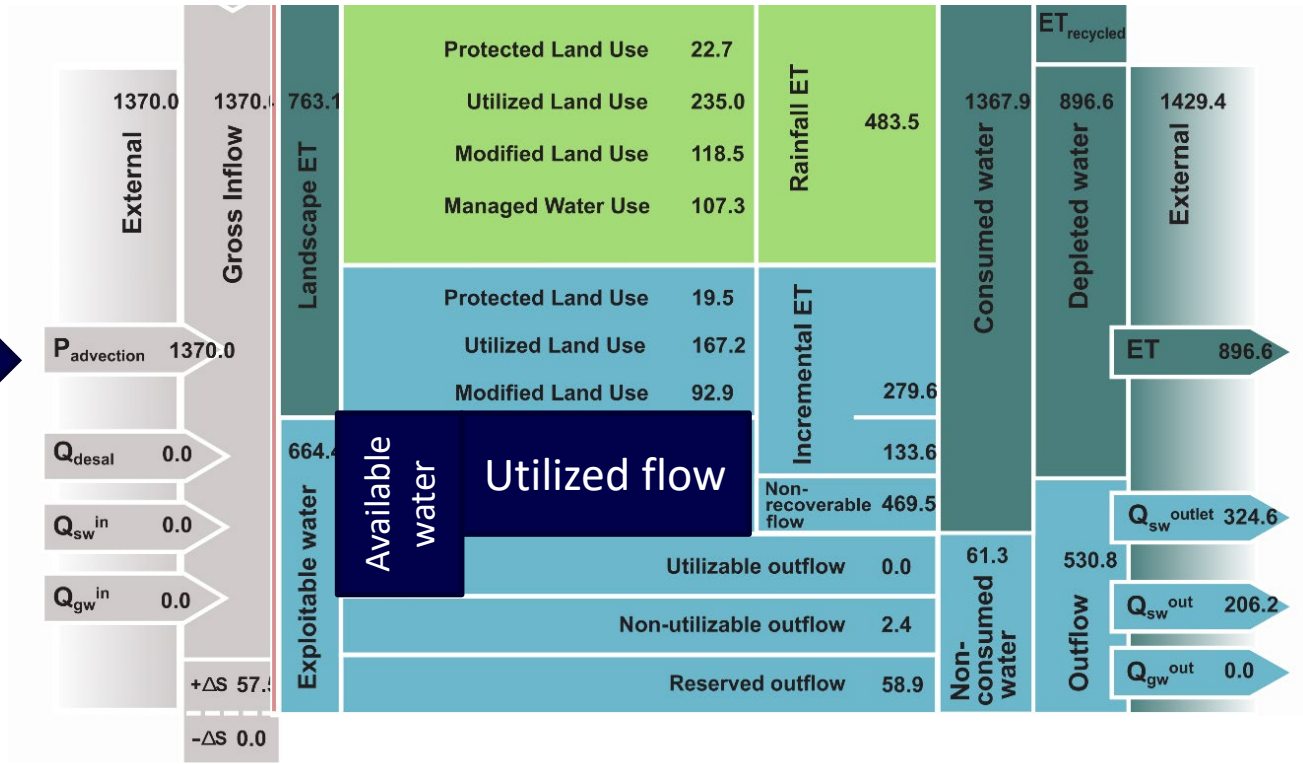
- SDG 6.4.2 Water scarcity

  Stress (%) = TFWW / (TRWR - EFR) * 100

  - TFWW: total freshwater withdrawn (km^3/year)
  - TRWR: total renewable freshwater resources (km^3/year)
  - EFR: Environmental flow requirement (km^3/year)

- Data sources:
  - Aquastat
  - National statistics data / country estimates
  - Globwat model[1]

- Similarity with WA+ indicators (eg)
  - Basin closure



Calculated at basin scale (not national)

SDG 6.4 water use and scarcity

- SDG 6.4.2 Water scarcity

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Directly using remote sensing & open source data[1]:

- ET blue as a proxy for TFWW
- P – ET_a as a proxy for TRWR
- EF from IWMI GEFIS

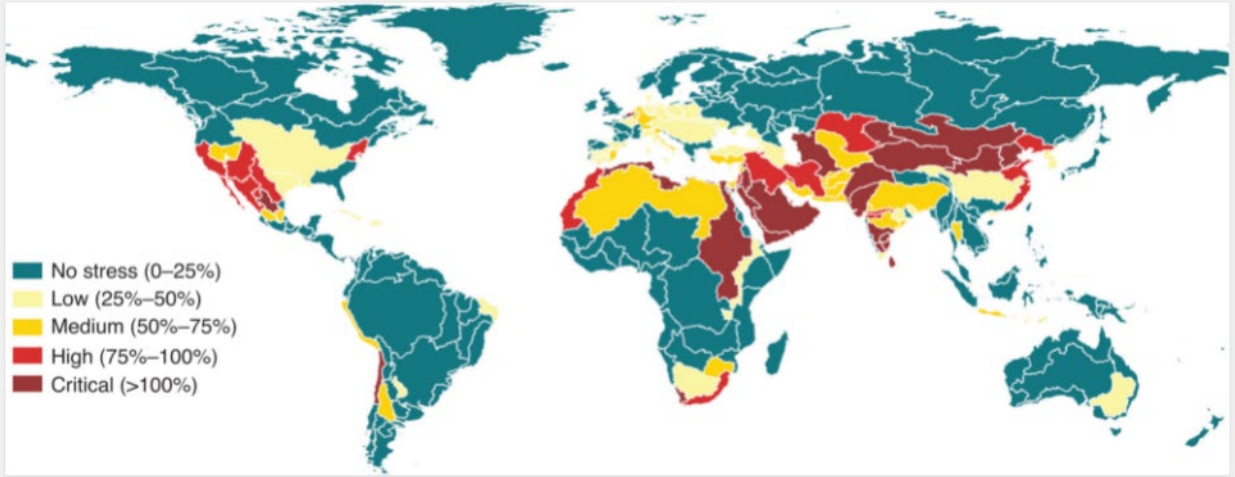
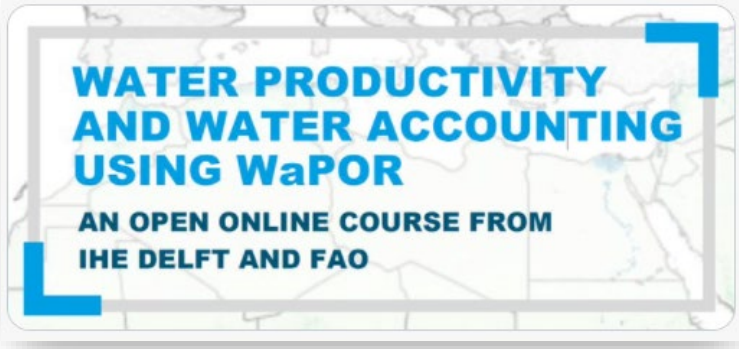


Figure 8

[1] Biancalani and Marinelli, 2021. Assessing SDG indicator 6.4.2 'level of water stress' at major basins level

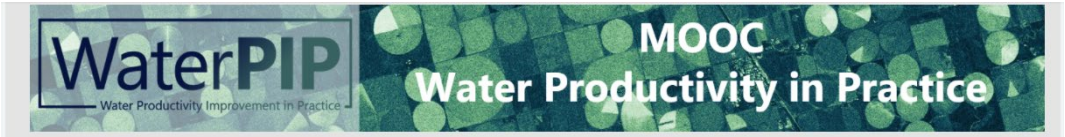
Available resources, scripts and training materials

Open course ware:



Available in English, French, and Arabic

Coming soon:



Water productivity:

Project website: http://waterpip.un-ihe.org/

WaterPIPproject

@waterpip_project

Email: waterpip_project@un-ihe.org

Water accounting:

Project website: http://wateraccounting.org/

IHE Delft - Water Accounting

@wateraccounting

Email: wateraccounting_project@un-ihe.org

Reports/ application and methodology description:

http://www.fao.org/in-action/remote-sensing-for-water-productivity/resources/publications/wapor-publications/en/

https://github.com/wateraccounting/WAPORWP

https://github.com/wateraccounting/WAPORWP

https://github.com/wateraccounting/WAPOROCW

DOI 10.5281/zenodo.3980715

Standardized protocol for land and water productivity analyses using WaPOR

Version 1.1

Project: *Water Productivity Improvement in Practice (Water-PIP)*
Prepared by IHE Delft
October 2020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Thank you for your attention!