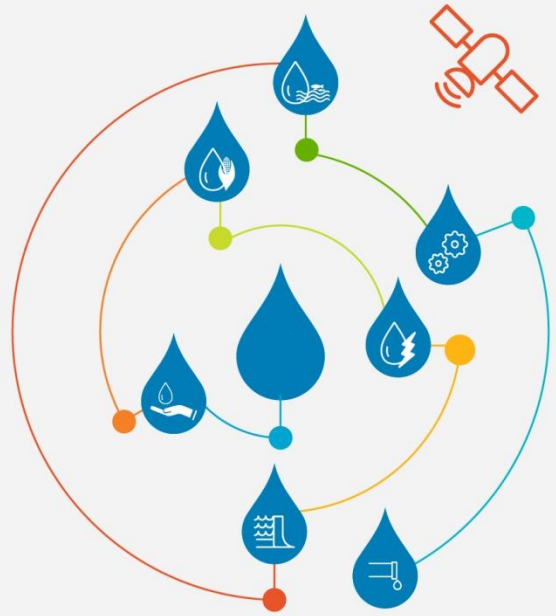
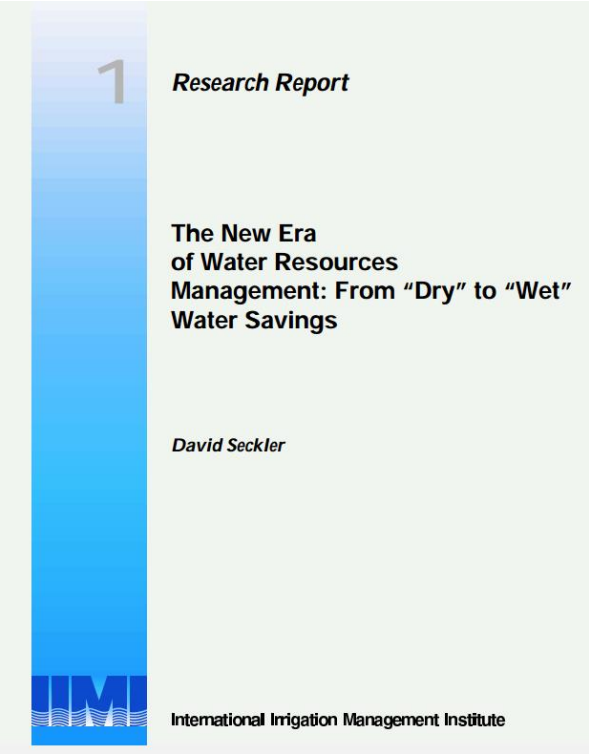
Evolving thinking on Agricultural Water Productivity: Objectives, Concepts and Contexts for Effective Water Conservation



Lisa-Maria Rebelo
International Water Management Institute
October 2-4, Manila

IWMI is a CGIAR Research Center and leads the: CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

Agricultural Water Productivity: Origins of the concept



- **Efficiency** is a "tricky" concept in the field of water (does not account for capture and reuse of water)
- Scope for **real water savings** often less than imagined
- **New concepts** needed to address the "**increasingly difficult problems** facing water management"
- **Water productivity:** guide strategies aimed at achieving *real* efficiency gains and *real* water savings

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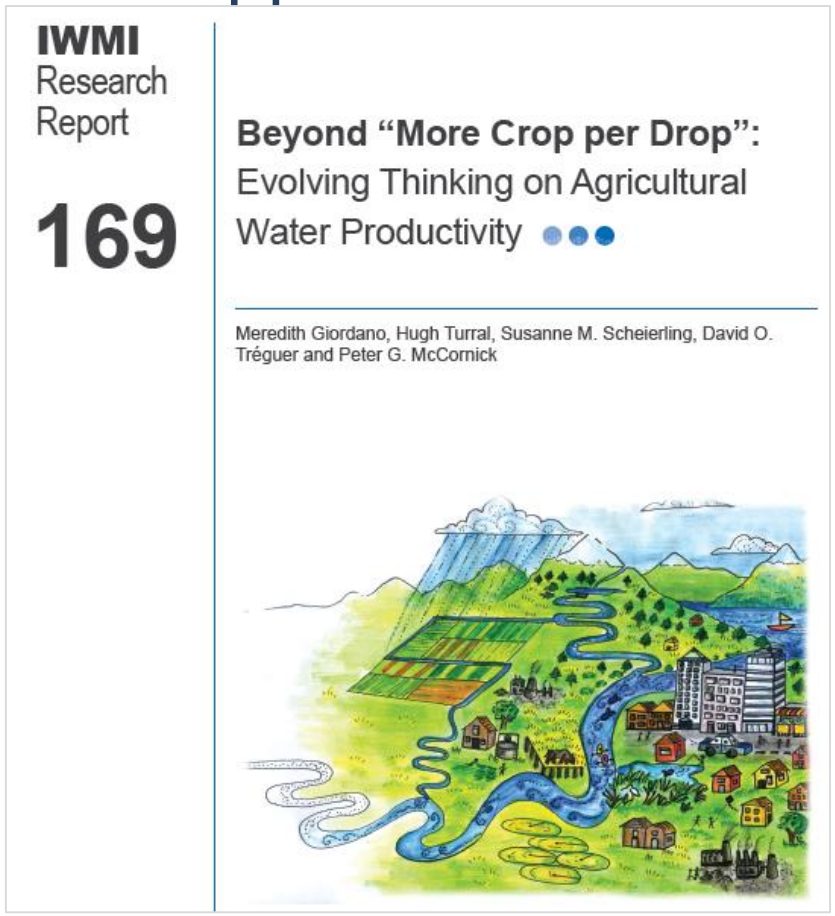
Agricultural Water Productivity: Origins of the concept

1996-2017: > 300 journal articles, reports and other documents on water productivity:

Methods, tools and applied research in diverse settings



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Lessons learned : **Define concepts carefully**

Water productivity: Output (kg/$/kcal) per unit of water use (water withdrawn, applied or consumed)

Terms and Definitions

Source: Scheierling and Treguer 2018, based on Young 2005

- **Water Withdrawal** (or Diversion)
  Amount of water removed from a surface or groundwater source

- **Water Application** (or Delivery)
  Amount of water delivered to the place of use, e.g., the farm

  Conveyance Loss
  Difference between water withdrawal and application

- **Water Consumption** (or Consumptive Use, Depletion, Evapotranspiration)
  Amount of water that is actually consumed by the use

  Return Flows
  Difference between water withdrawal and consumption

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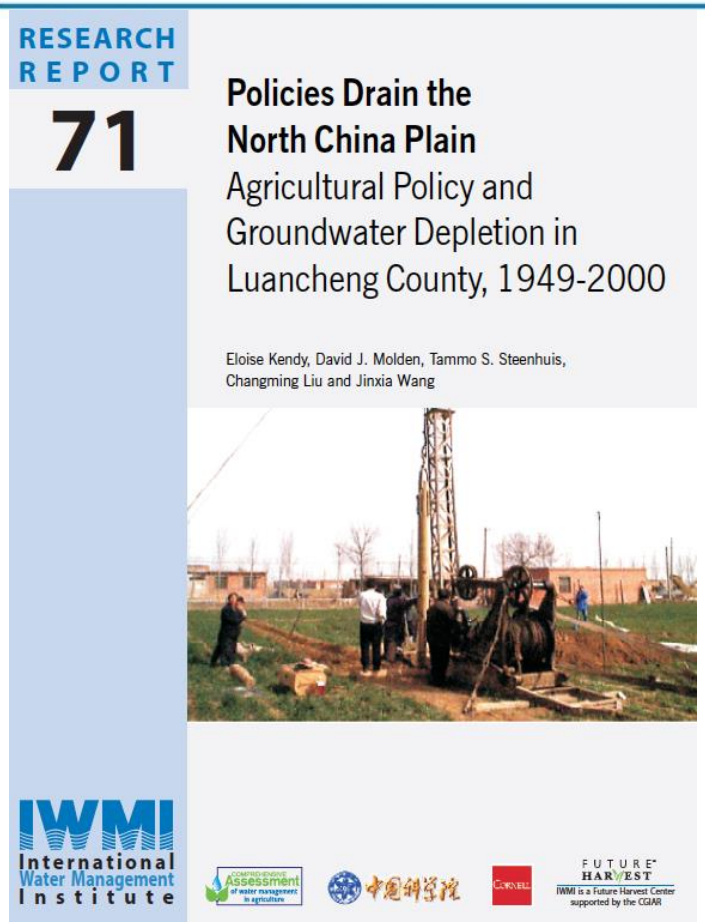
Define concepts carefully



- Increasing competition for groundwater (growing industry/focus on food self-sufficiency)
- Water saving technologies introduced to improve "irrigation efficiency"
- 1970-2000: groundwater pumping rates declined > 50%, irrigation efficiency improved
- But, groundwater levels continued to decline

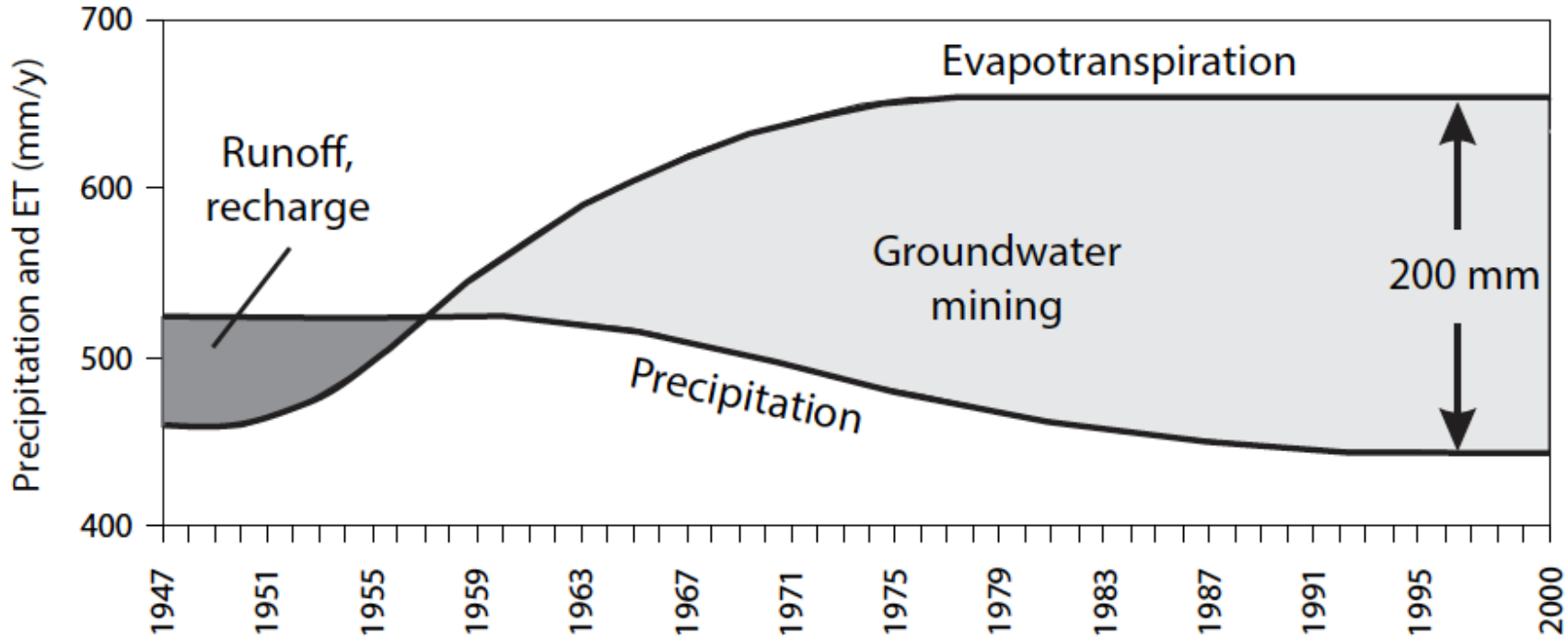
Why? Focus was on reducing water applications, not water consumption

Lesson: Productivity and efficiency concepts require clear definition when applied to complex problems in water management.

Scale and context matter

The local shallow aquifers are replenished by rainfall/runoff and depleted by water consumption (ET)

FIGURE 6. Annual evapotranspiration, precipitation and groundwater recharge/mining in Luancheng County, China (1947-2000).



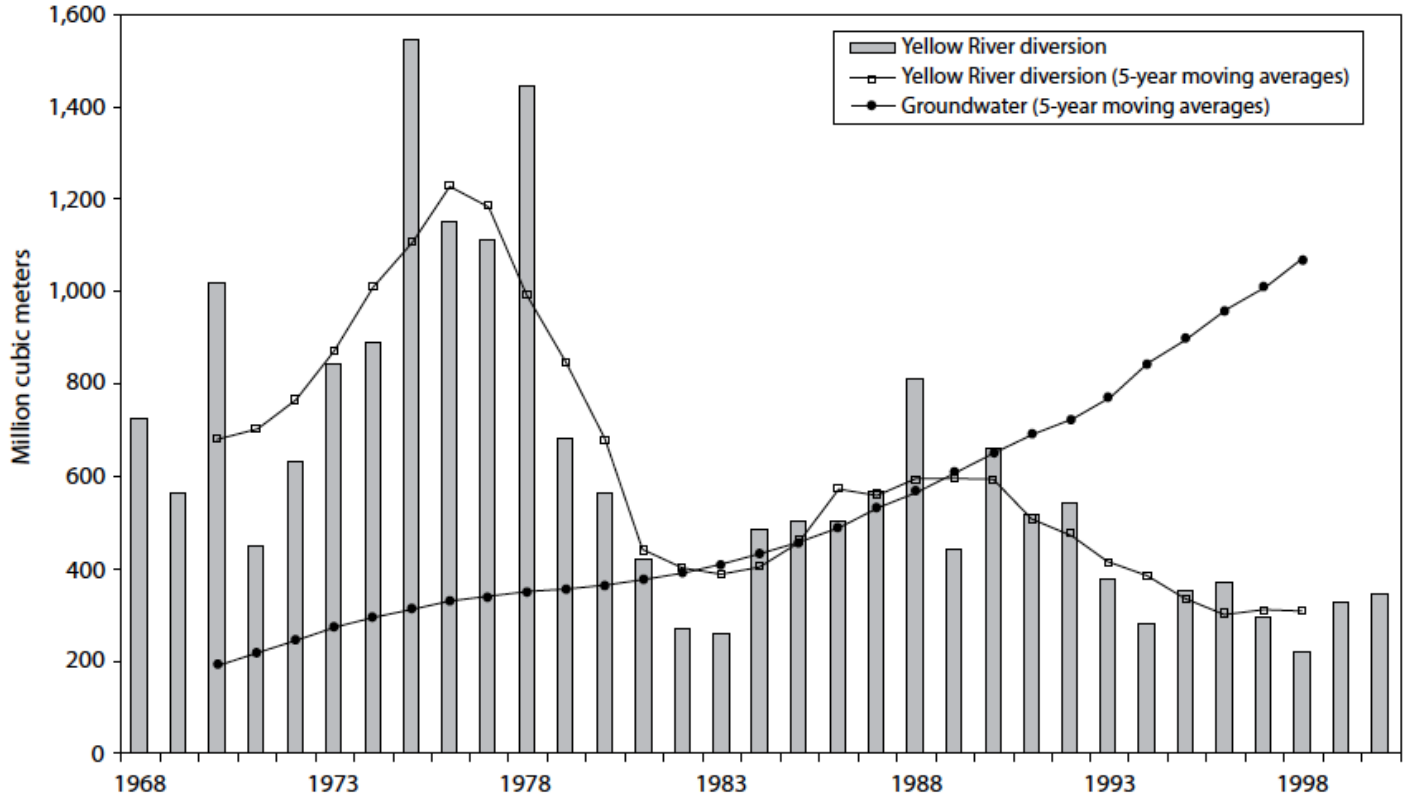
Source: Based on Kendy et al. 2003.

Note: ET = evapotranspiration.

Lesson: ...sarily result

Know your objective

FIGURE 8. Water use trends in the Liuyuankou Irrigation System, Henan Province, China (1968-2000).



Source: Based on Molden et al. 2007a.

Agricultural water productivity and savings: policy lessons from two diverse sites in China

David Molden[*a], Dong Bin[b], Ronald Loeve[c], Randolph Barker[a] and T. P. Tuong[d]

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COMPREHENSIVE Assessment of water management in agriculture

Research Report 10

Cities versus Agriculture: Revisiting Intersectoral Water Transfers, Potential Gains and Conflicts

François Molle and Jeremy Berkoff

Lesson: Interventions need to be aligned with the objectives and incentives of various decision makers.

Implications for future research and policy

"by 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity, and substantially reduce the number of people suffering from water scarcity." (SDG 6.4)

- First time, **efficient water use has gained prominent place** in international development agenda
- Water productivity has **focused attention on critical water scarcity issues** (*real* water savings)
- Consider as part of **larger suite of metrics and approaches** to address water scarcity and achieve broader development goals

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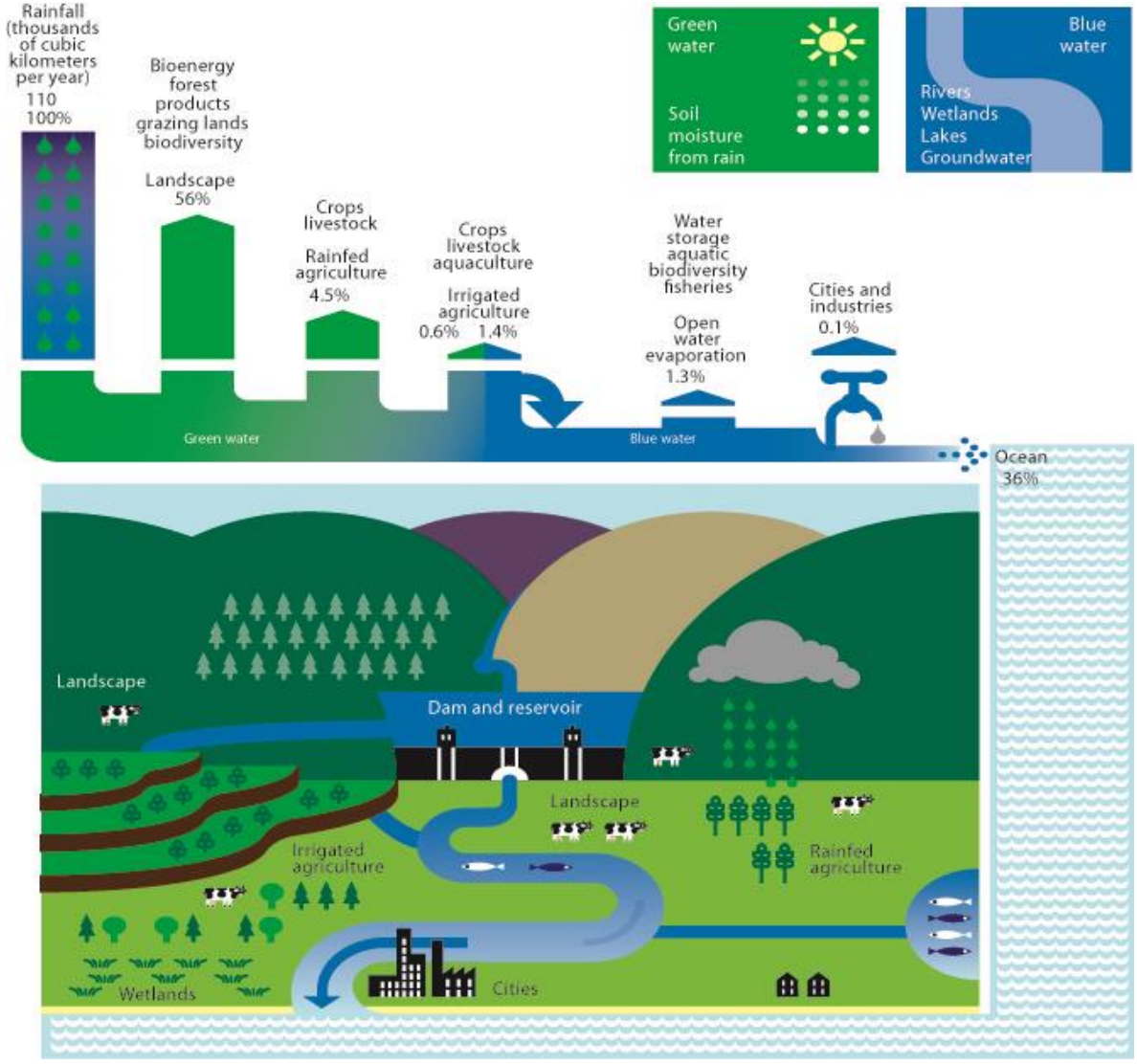
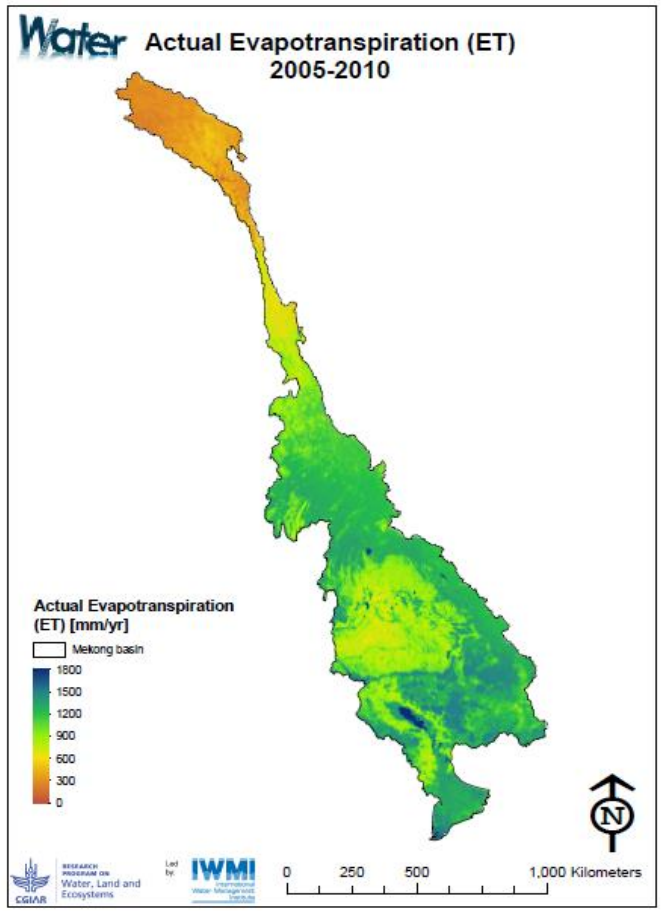
Water Accounting: an indicator framework to address water scarcity and sustainable use

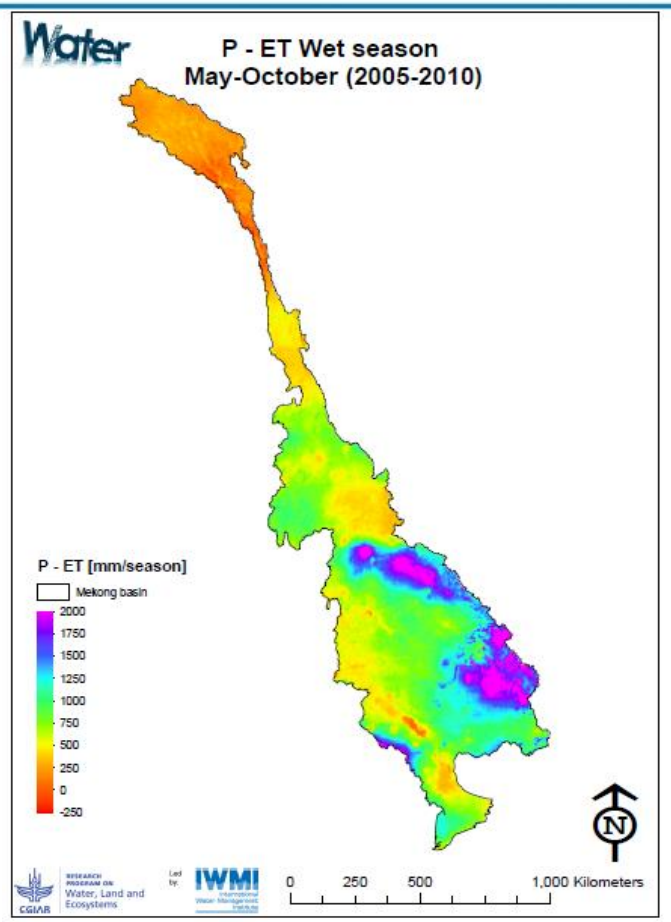


- An independent water resources assessment for data scarce areas
- An indicator framework which supports decision making related to water use and availability
- Enables quantification of simple indicators: water balance, water use, and water productivity

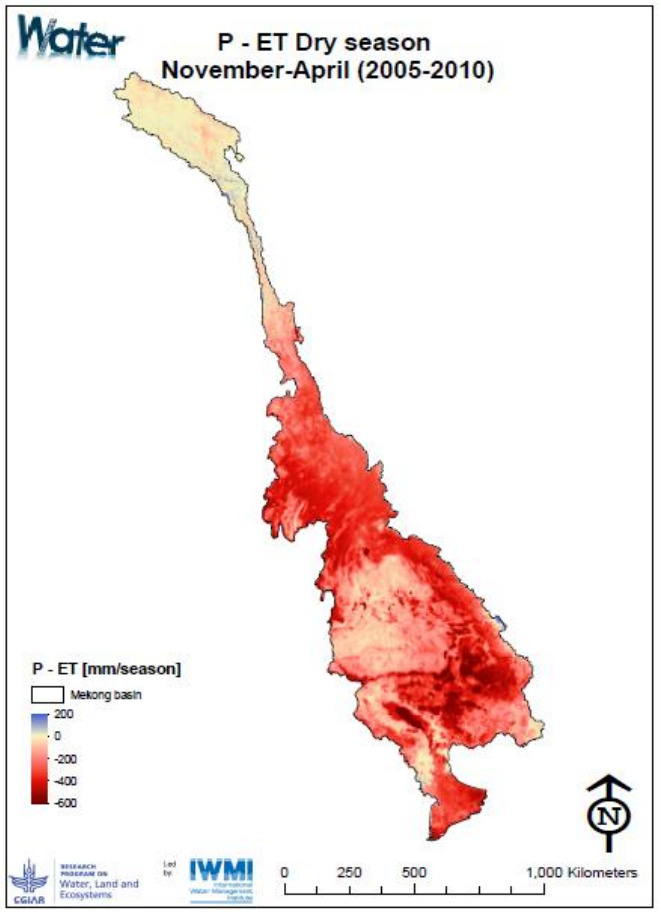
Water Accounting: an indicator framework to address water scarcity and sustainable use



Actual ET



Water yield



Water withdrawal

Developments in water accounting, remote sensing, modeling aim to lessen the impact of data limitations

Conclusions

- A focus on agricultural water productivity has brought **greater attention to critical water scarcity issues** and possible strategies to address them
- Tools such as **water accounting** are fundamental to understand how water is used and re-used within and across sectors at different scales
- **Reliance on single factor metrics** in multi-factor and multi-output production processes **can mask the complexity** of agricultural systems and the trade-offs required to achieve desired outcomes
- Important to consider water productivity as **one of many indicators to be monitored** (rather than a variable to be maximized)

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