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The future of irrigated agriculture under environmental flow requirements restrictions

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PICO Navigation

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OVERVIEW

- Context
- Concept of Environmental flow
- Modelling Framework in GLOBIOMs
- Future global land-use

My background

- Double Master degree in agriculture engineering (EIP, Toulouse and Wageningen, NL) - Internships in farms, research institutes and public government
- Research Assistant organic agriculture (Wageningen, NL)
- Project coordinator land degradation for ICARDA (Morocco) and Wageningen (NL)
- Since 2012: PhD at ESS, Wageningen (NL)
- YSSP 2014 – IIASA (AT)
- Since Sept 2015: research assistant ESM-WAT (IIASA, AT)

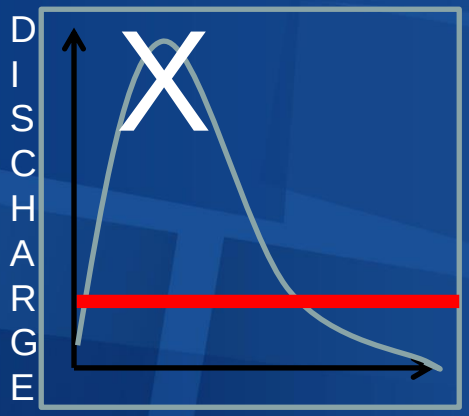
July - September, 1989

October 5, 2008

35 % loss in global freshwater species
(Living planet index report, 2010)

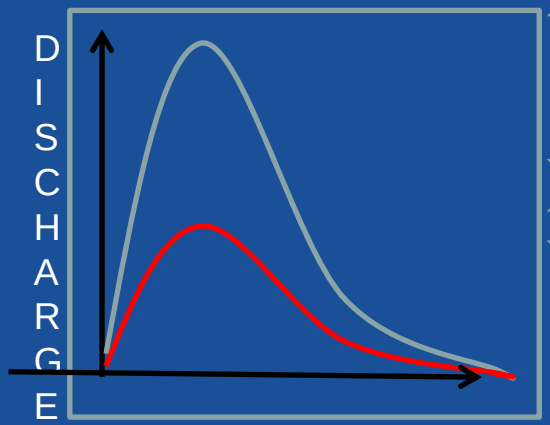
ENRIONMENTAL FLOW CONCEPT

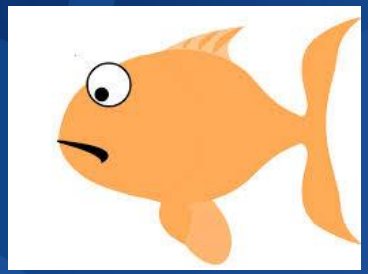
Environmental flows describe the **quantity, quality and timing of water flows required to sustain freshwater and estuarine ecosystems** and the human livelihoods and well-being that depend on these ecosystems (The Brisbane Declaration, 2007).

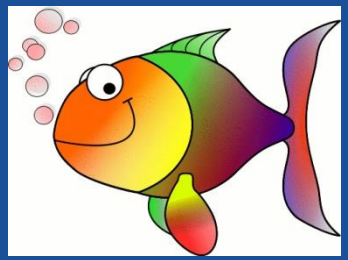


VMF method (Pastor et al. 2014)

- High flow requirements = 30% monthly flow
- Intermediate flow requirements = 45% monthly flow
- Low flow requirements = 60% monthly flow







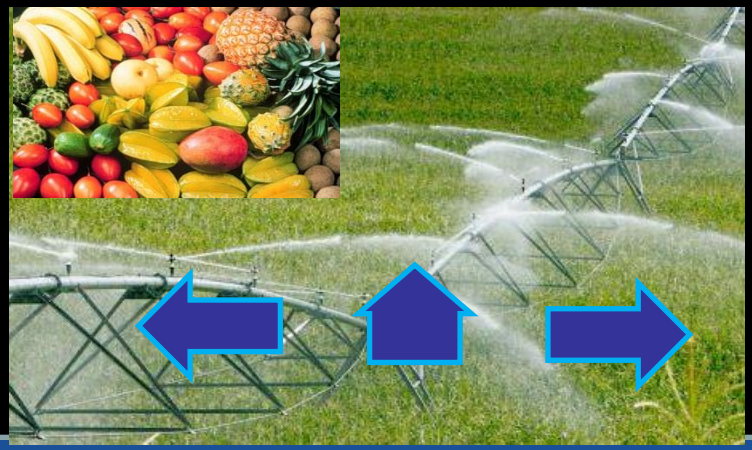
Pastor, A. V., Ludwig, F., Biemans, H., Hoff, H., and Kabat, P.: Accounting for environmental flow requirements in global water assessments, Hydrol. Earth Syst. Sci., 18, 5041-5059, doi:10.5194/hess-18-5041-2014, 2014.

Food production

Environmental flows

Previous land-use assessments

Agriculture = 70%



Household & Industries = 30%

Leftovers for Nature or "**Environmental flows**"

Previous land-use assessments

"Environmental flows"

Agriculture

Household & Industries

CONCEPTUAL FRAMEWORK

- Climate
- Soil
- Land use

INPUT

Water availability/EFR simulated by LPJmL (Lunt-Potsdam-Jena model)

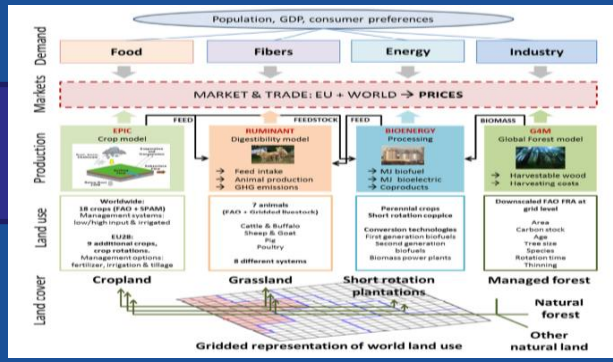
- Limited irrigation supply from surface waters
- Restricted by "environmental flows"

INPUT

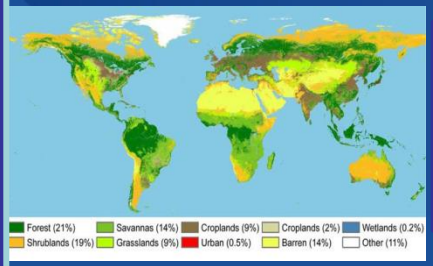
- Population
- GDP
- Consumer preferences

INPUT

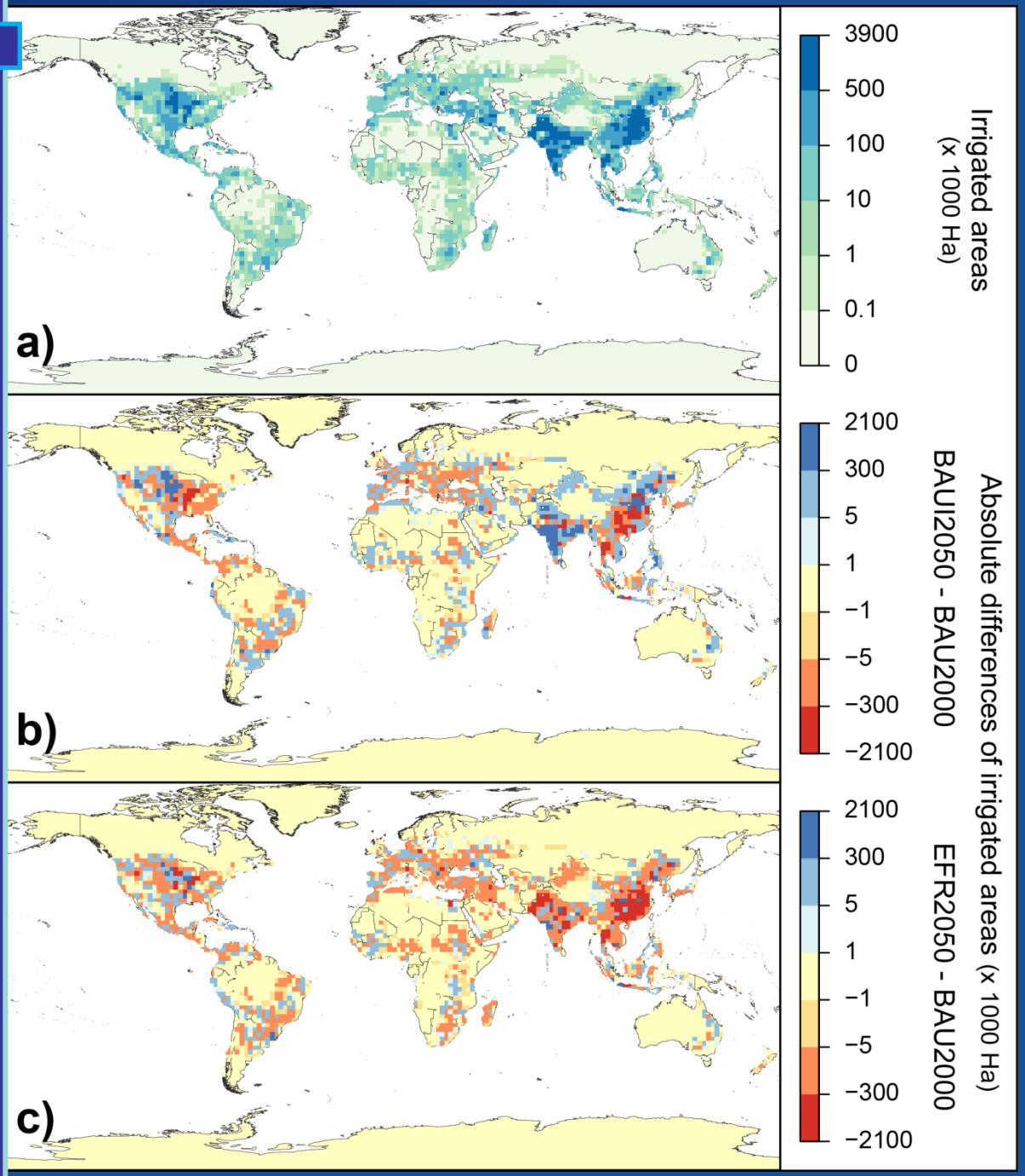
GLOBIOM (Global Biosphere Optimization Model)



Expected OUTPUT



Land-use scenarios for agriculture
(including water availability and "environmental flows")



a) Irrigated area in 2000

Relative change by 2050:

b) +23% without EFRs

c) -20% with EFRs

Total agriculture area expansion (Mha)

→ + 20% increase

→+ 100Mha more rainfed area with EFRs

In 2000, food prod coming from 40% of irr. Area vs 20%

Conclusion

- Rivers have been heavily altered
- Environmental flow are not satisfied in many part of the world during dry periods and conflict with irrigated agriculture
- With EFRs implementation, irrigated area would have to be reduced by 20%