

Optimizing Water for Life



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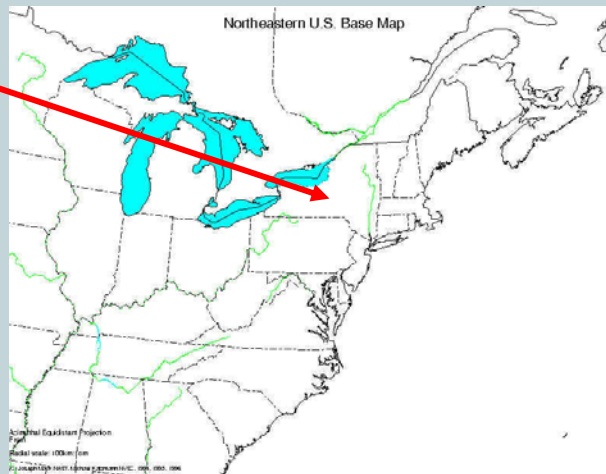
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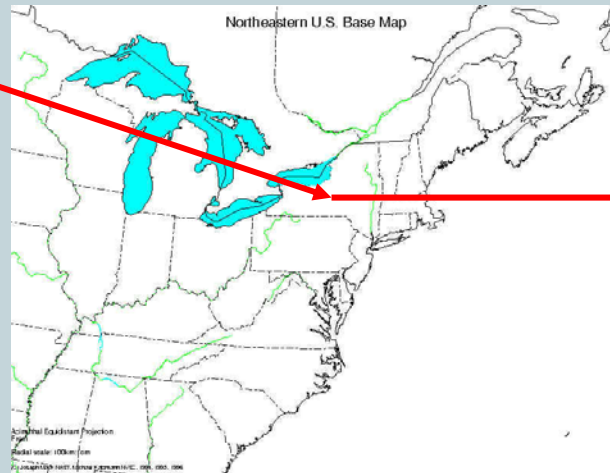
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Water:

- essential for life
- essential for food
- essential for environment
- essential for sanitation, health
- essential for the economy

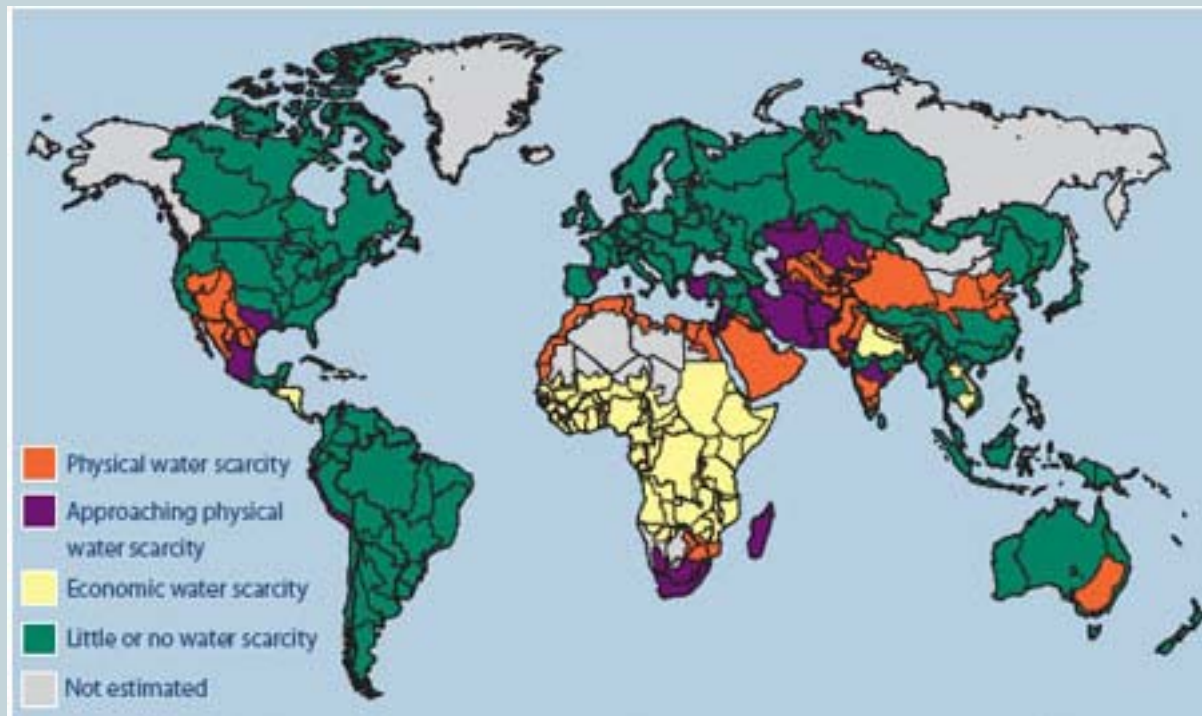


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QUESTION:

How do we optimally allocate water for food, environment, sanitation and economy when there is not enough?

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Physical scarcity: Demand > 75% of available supply

Economic scarcity: Potential users lack access to supply

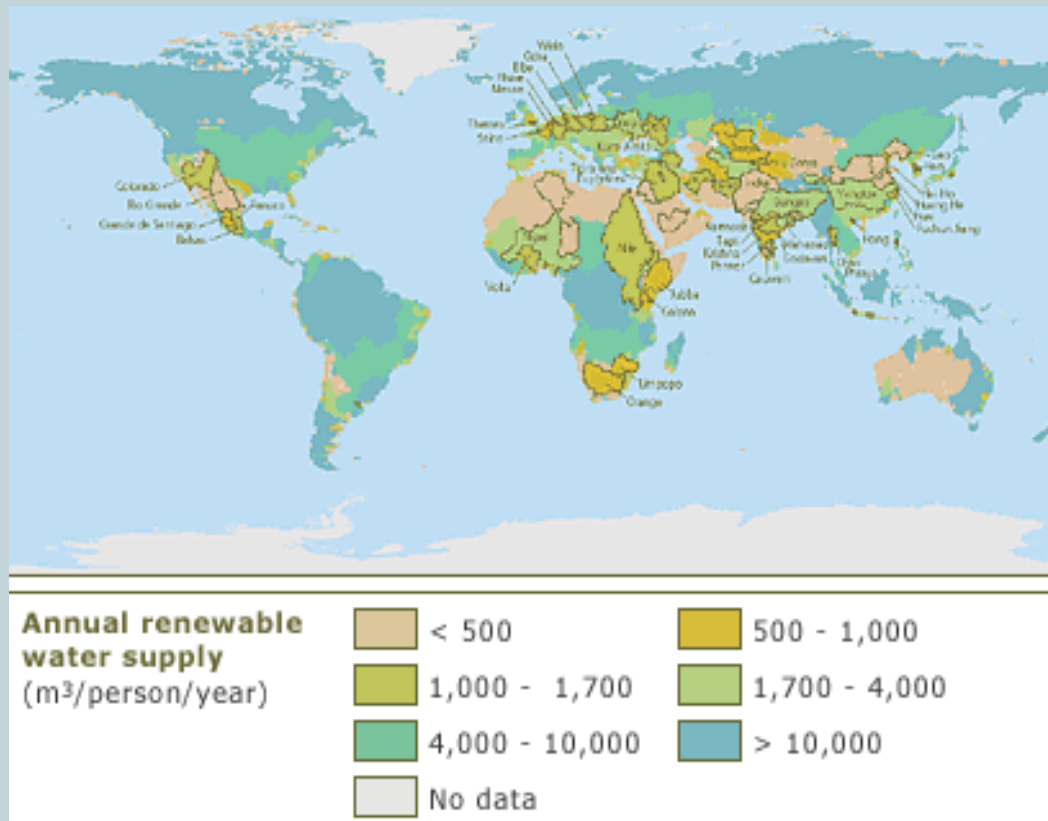
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Current trends:

- 40% of world's population now living in water scarce regions – and increasing.
- millions of deaths every year due to malnourishment and water-related disease – and increasing.
- political conflict over scarce water resources,
- increasing rates of extinction of freshwater species, and degradation of aquatic ecosystems.
- continued destruction of wetlands.
- dams have seriously altered the flow of roughly 60% of the world's major river basins.

(earthtrends.wri.org/updates/node/264).

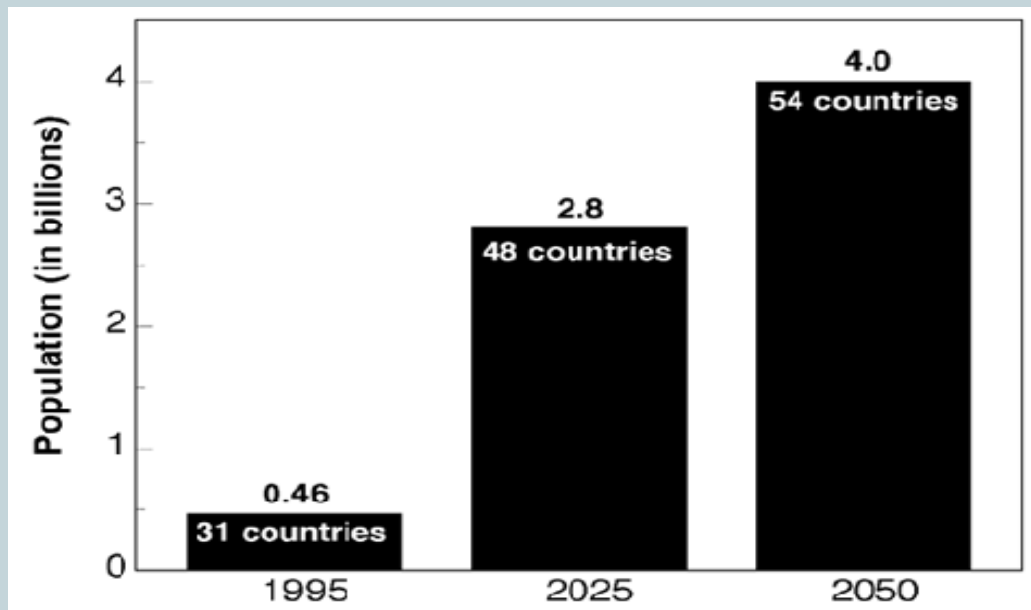
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Available water supplies per person per year by 2025

(earthtrends.wri.org/updates/node/179).

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Populations in water stressed countries from 1995 to 2050.

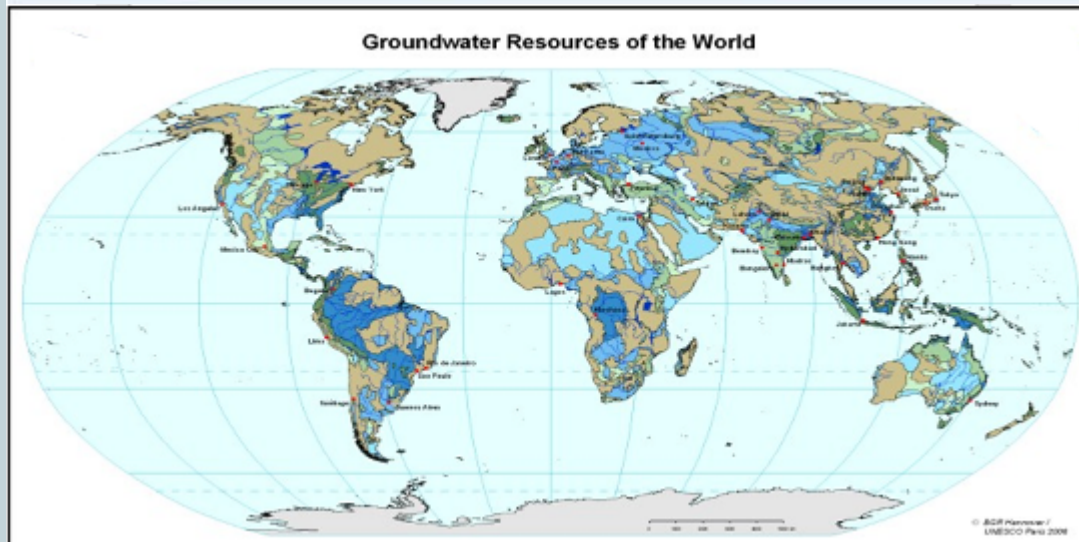
www.infoforhealth.org/pr/m14/m14print.shtml

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Freshwater Sources:



**Major river
basins and
groundwater
aquifers in the
world.**



**Other source:
Desalination**

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Water Hot Spots:

- Near East and North Africa
- Gulf States
- Sub-Saharan Africa
- Parts of India, China, and the United States
- Belgium, the United Kingdom, Poland, Singapore
- Central Asia Aral Sea Basin: Turkmenistan, Uzbekistan, Kazakhstan, Kyrgyzstan, and Tajikistan
- Turkey, Syria, Iraq
- Spain

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Water Hot Spots:

- Spain



The New York Times

June 3, 2008

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Water Allocations:

What criteria should be used?

- **Water for human consumption**
- **Water for the environment (ecosystems)**
“Environmental flows”
- **Water for economic activities**

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Water Allocations:

What criteria should be used?

A case study →

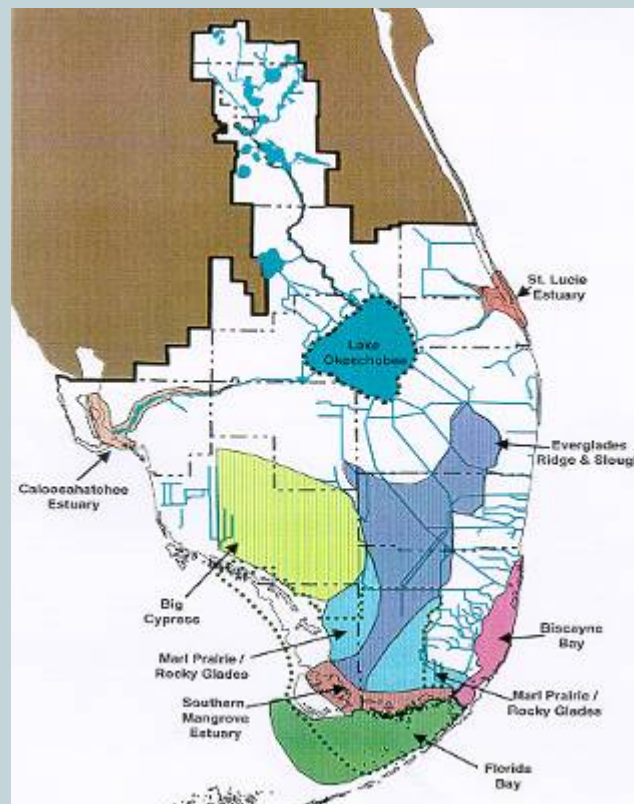


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Water Allocations:

What criteria should be used?

A case study →



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Water Allocations:

Estimating Ecosystem Impacts and Requirements

- Flow regimes
- Sediment, Organic matter, Nutrients, Pollutants,
- Thermal and light characteristics
- Interactions among the mix of species in the ecosystem

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Water Allocations:

Estimating Ecosystem Requirements

- Identify measures and indicators of ecosystem health
- Identify relationship between hydrologic attributes and those ecosystem measures and indicators
- Model and simulate alternative water management policies to predict expected impact on ecosystem health

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Water Allocations:

Estimating Ecosystem Requirements

- **Habitat Suitability Indicators**
- **Environmental Flow Assessments via ecosystem response model:**
 - a biophysical module – the physical environment
 - a social module – the social environment
 - scenarios of hydrologic changes physical and social impacts
 - an economic module to estimate costs and benefits.

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Water Allocations:

Estimating Ecosystem Requirements

Computer based
simulation
modeling



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Water Allocations:

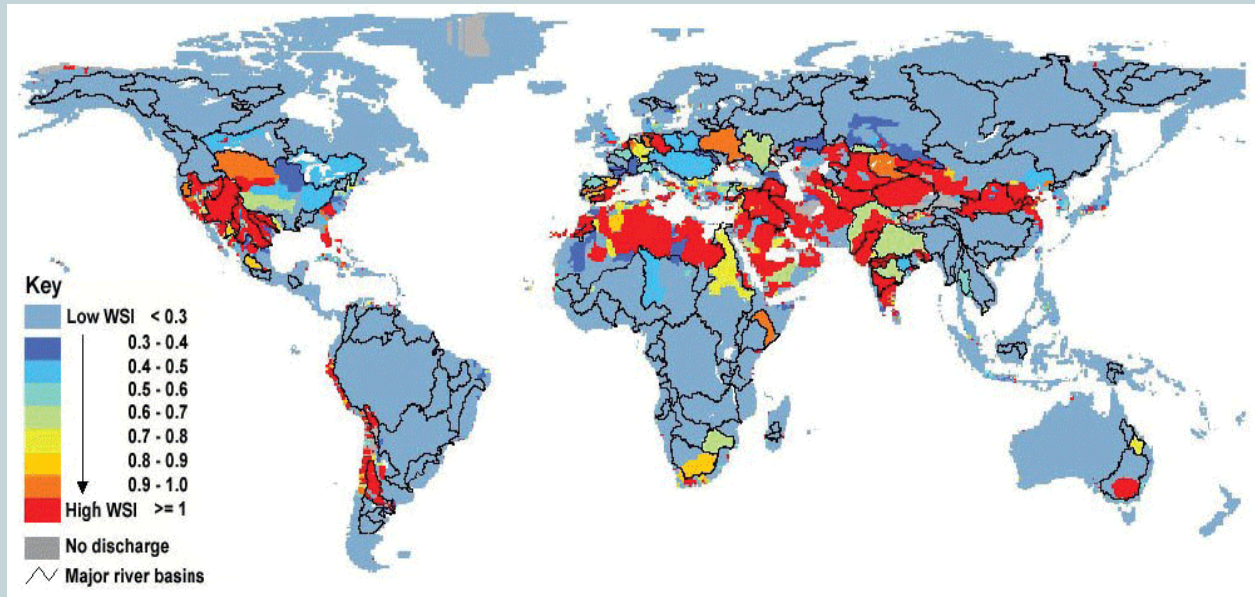
Estimating Ecosystem Requirements

Expert judgment



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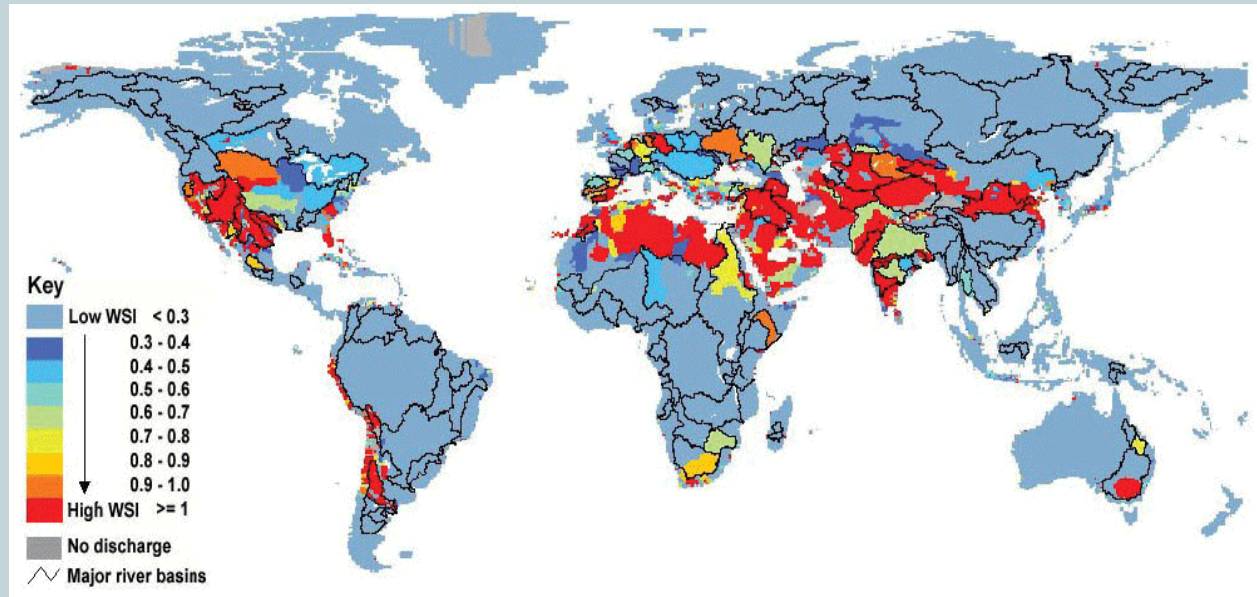
Water Allocations:



Current Water Stress Indicator Map showing regions where environmental flow needs are not being met.

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Water Allocations:



- Changes in climate will impact hydrologic regimes
- This in turn will impact aquatic and terrestrial ecosystems.

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Water Allocations:

- Human consumption
- Environmental flows
- Economic uses

A political process involving:

- Stakeholders
- Science
- Monitoring and adapting



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Thank you

