# Optimizing Water for Life

www.knowwiththeflow.org/Pages/waterart.htm

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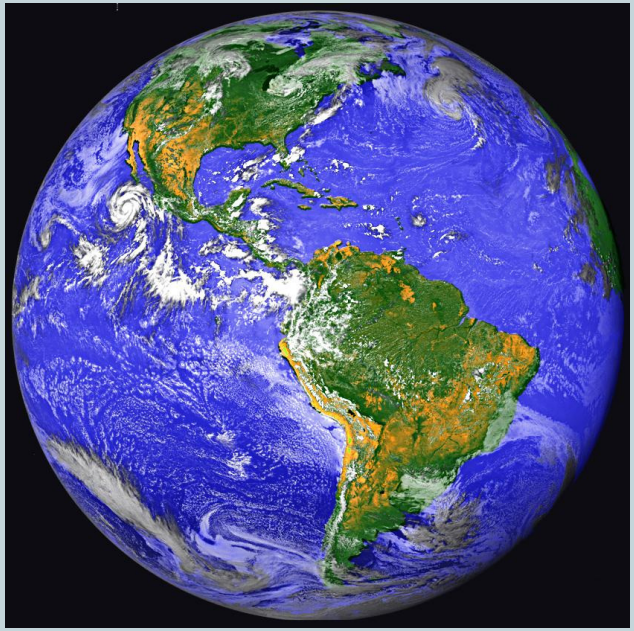

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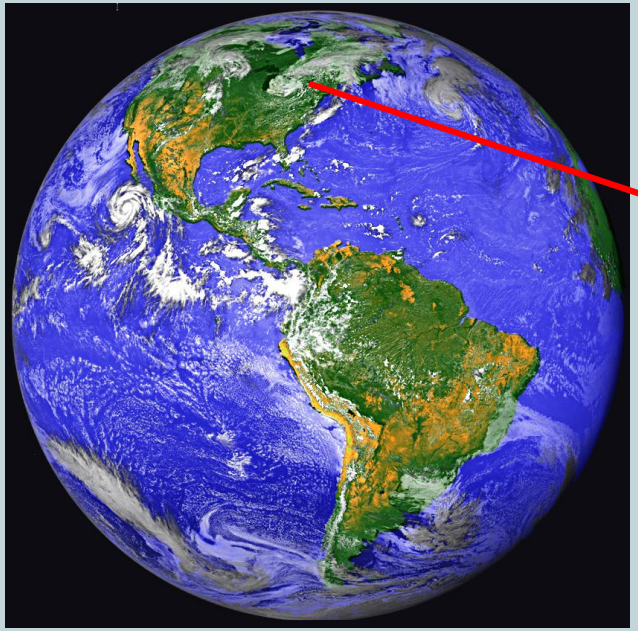

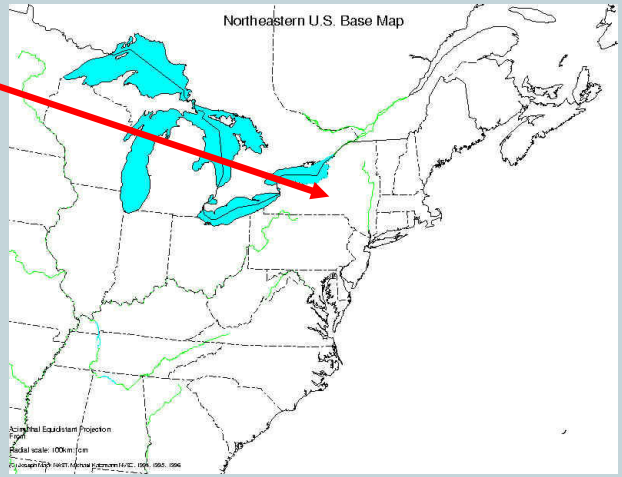

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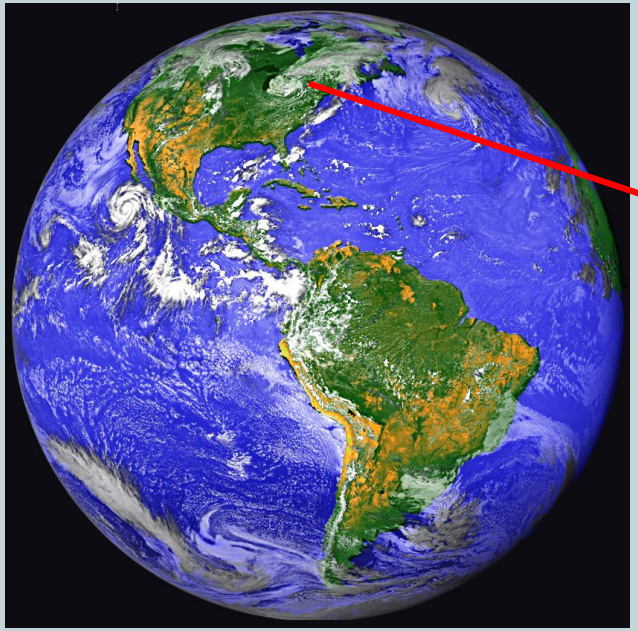

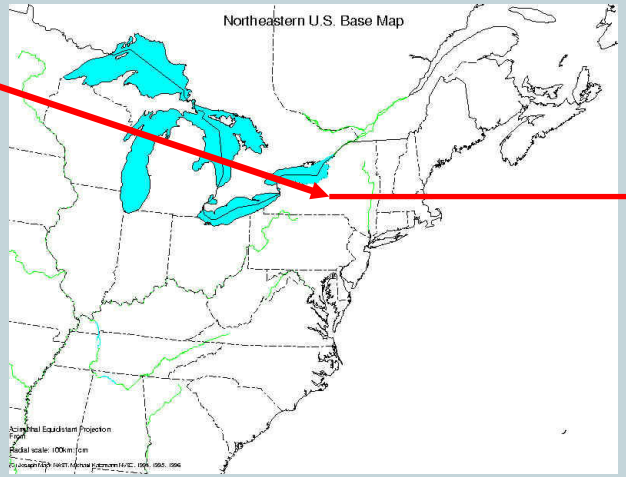


# Optimizing Water for Life

## Water:

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

# Optimizing Water for Life

**QUESTION:**

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

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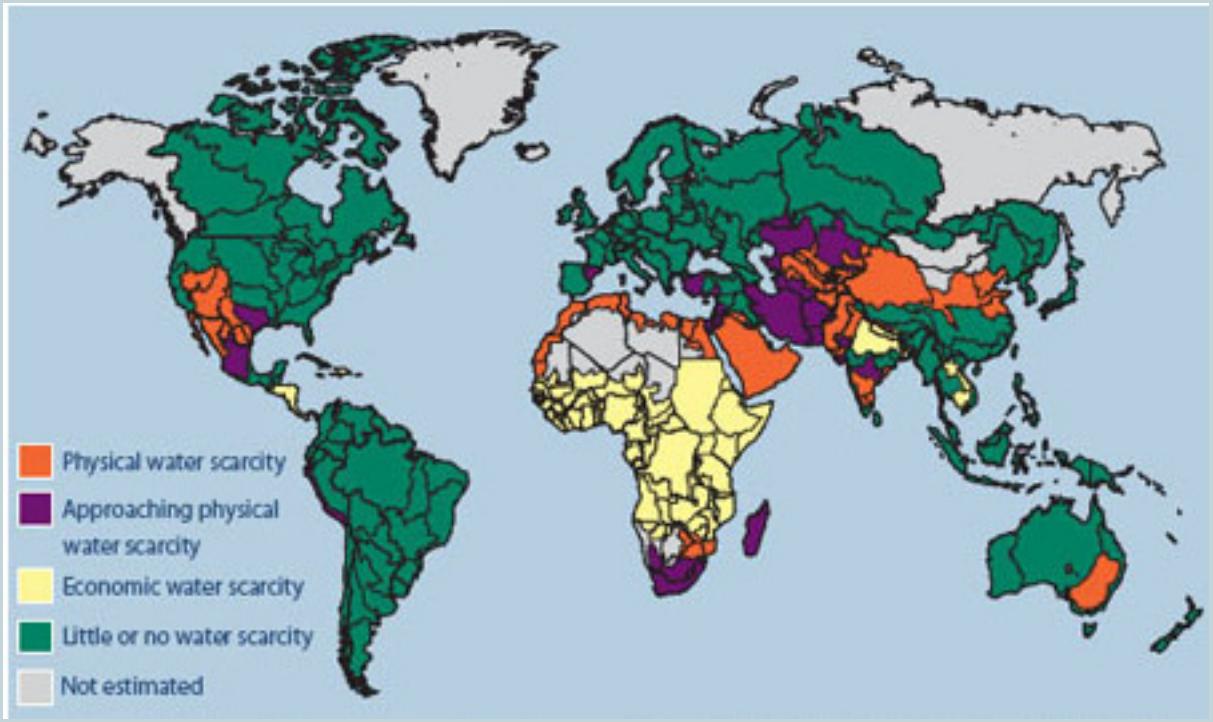


**Physical scarcity: Demand > 75% of available supply**

**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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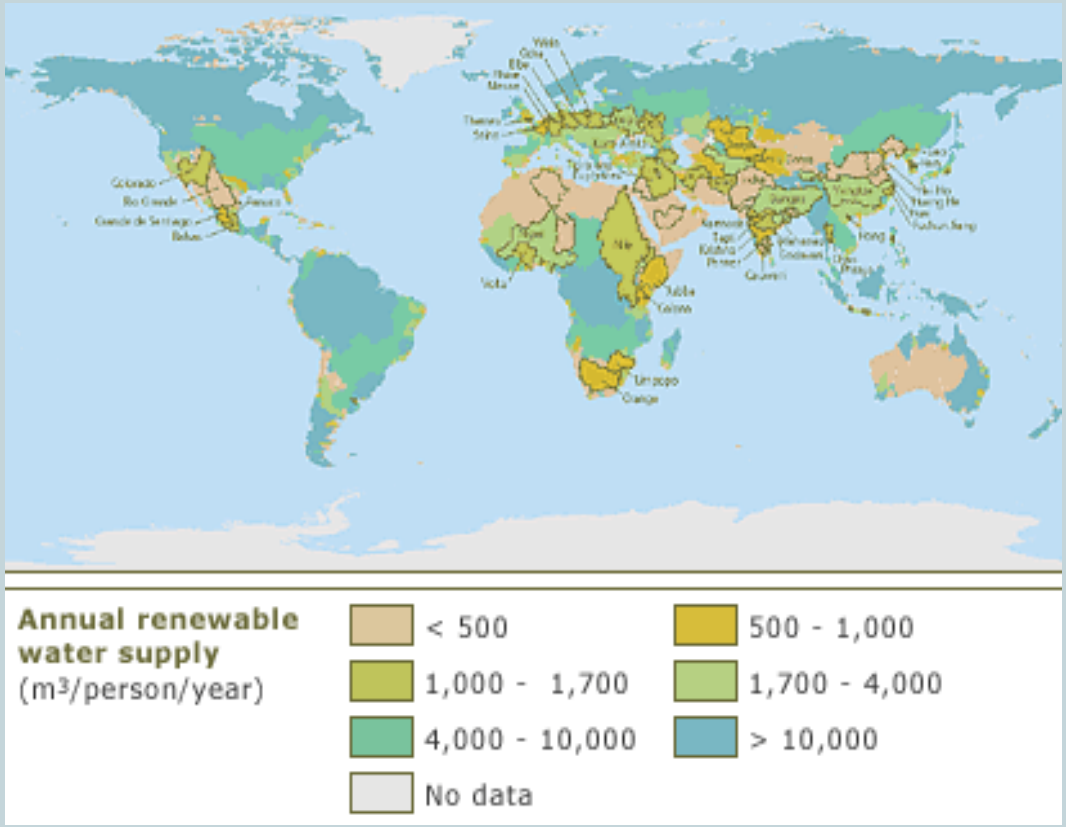


**Available water supplies per person per year by 2025**

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

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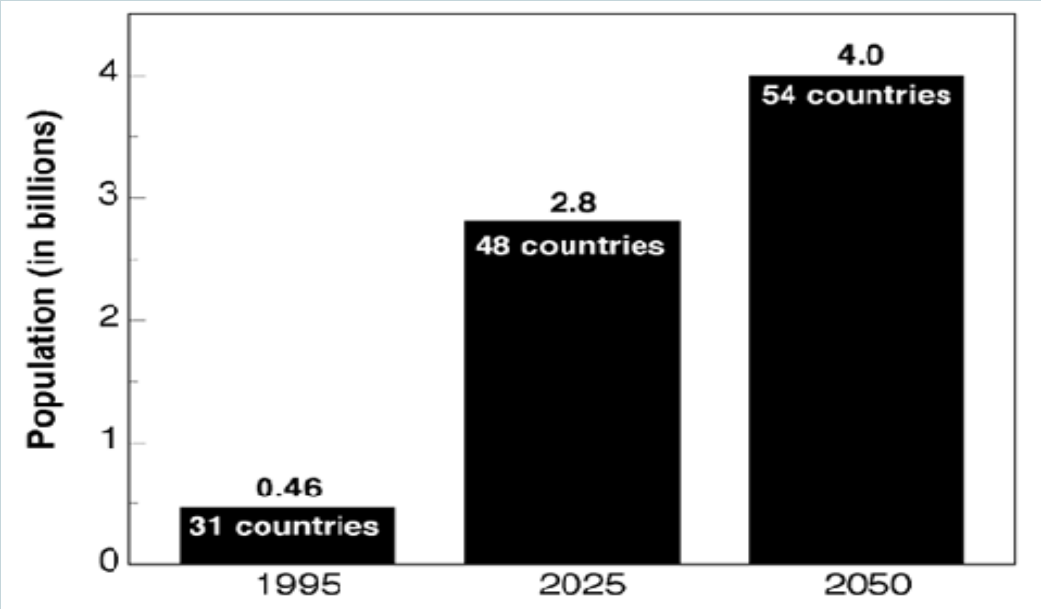


**Populations in water stressed countries from 1995 to 2050.**

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

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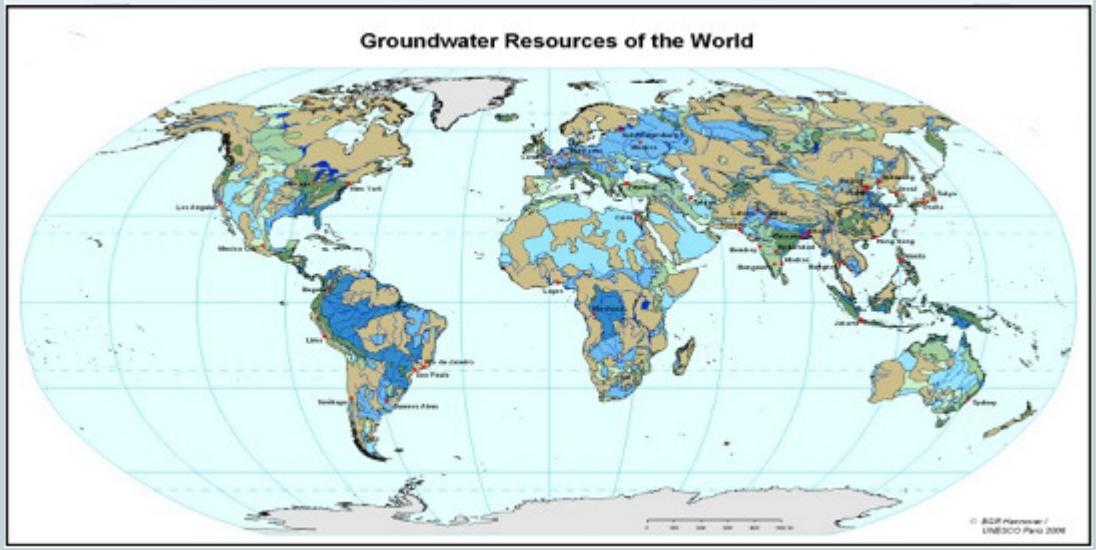
## Freshwater Sources:


**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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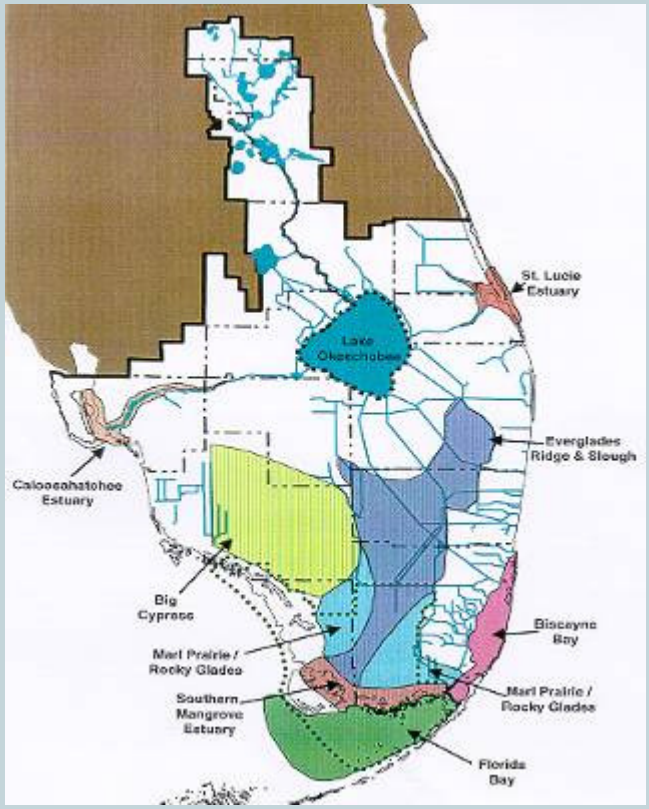
## Water Allocations:

**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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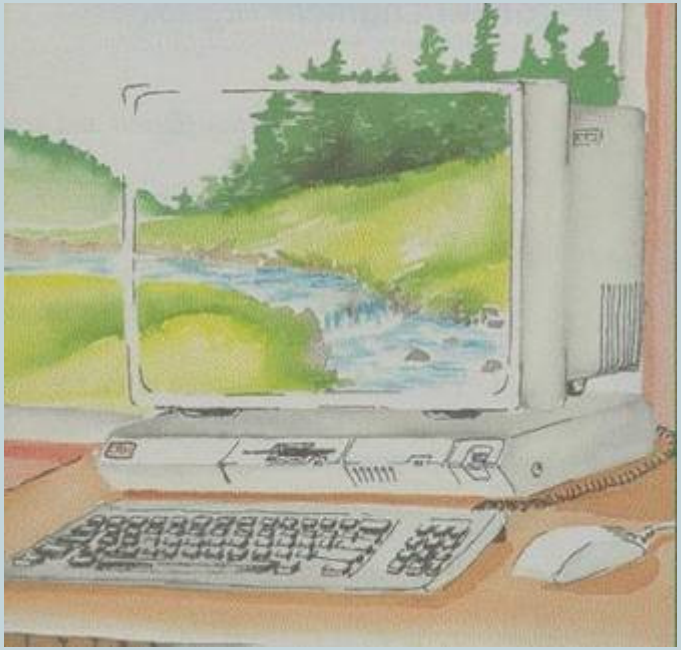
## Water Allocations:

### Estimating Ecosystem Requirements

Computer based simulation modeling



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## Water Allocations:

### Estimating Ecosystem Requirements

Expert judgment

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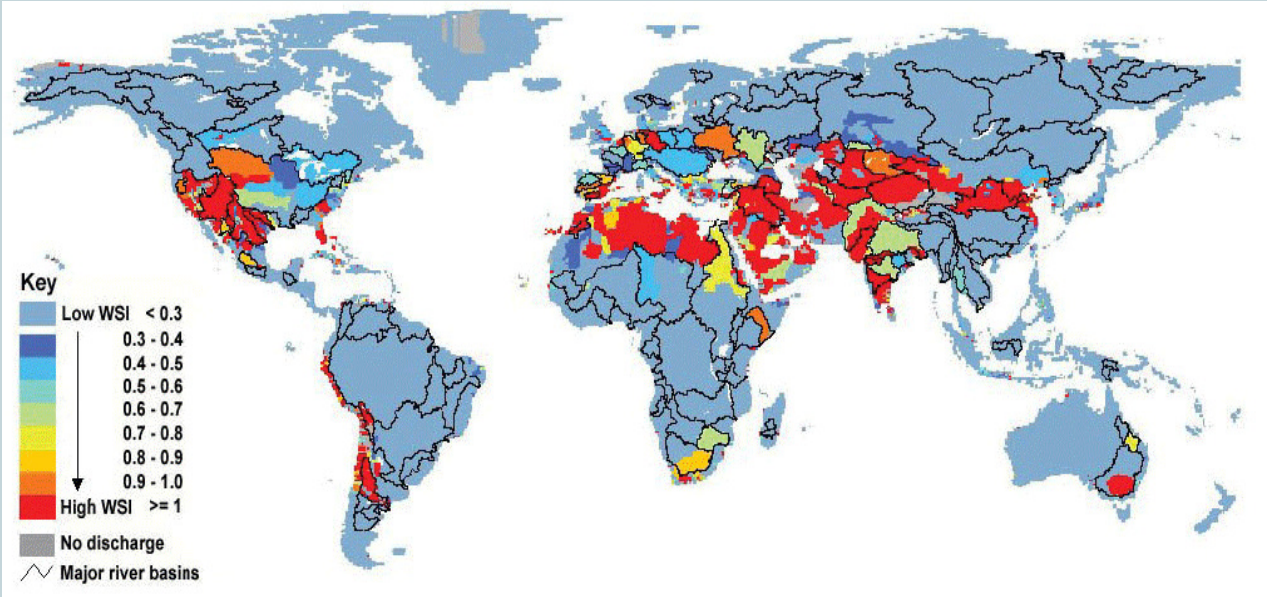
## Water Allocations:




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

(http://www.cgiar.org/enews/june2007/story_12.html)

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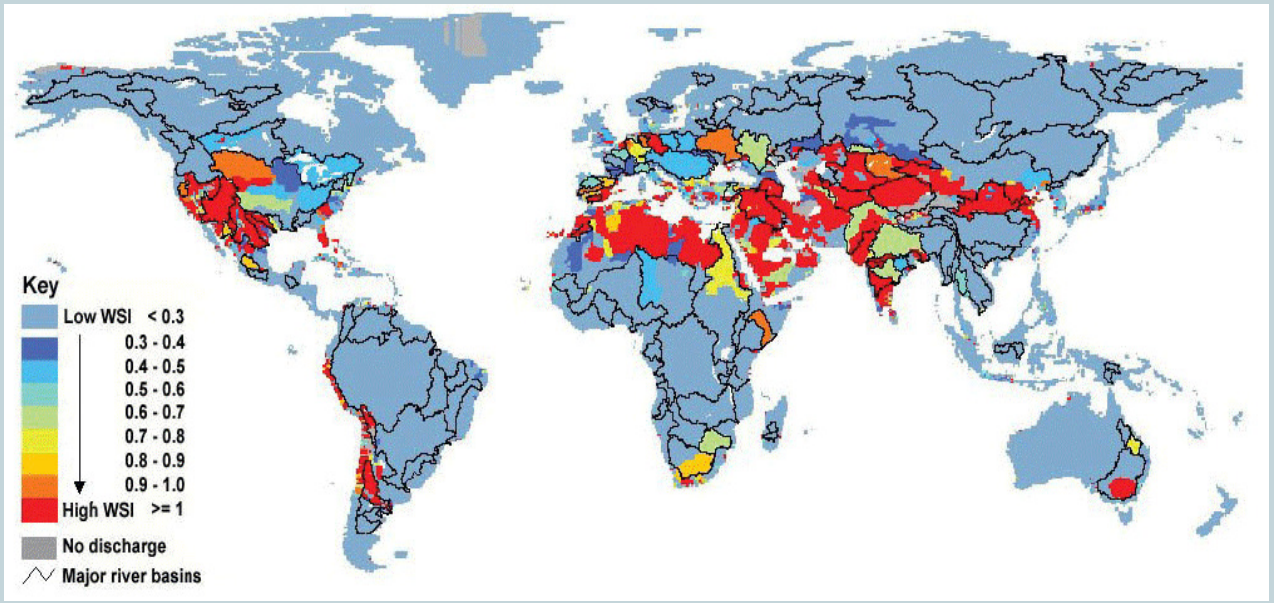
## Water Allocations:




- 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