Climate Extremes and Transboundary Water Management

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Three Pillars

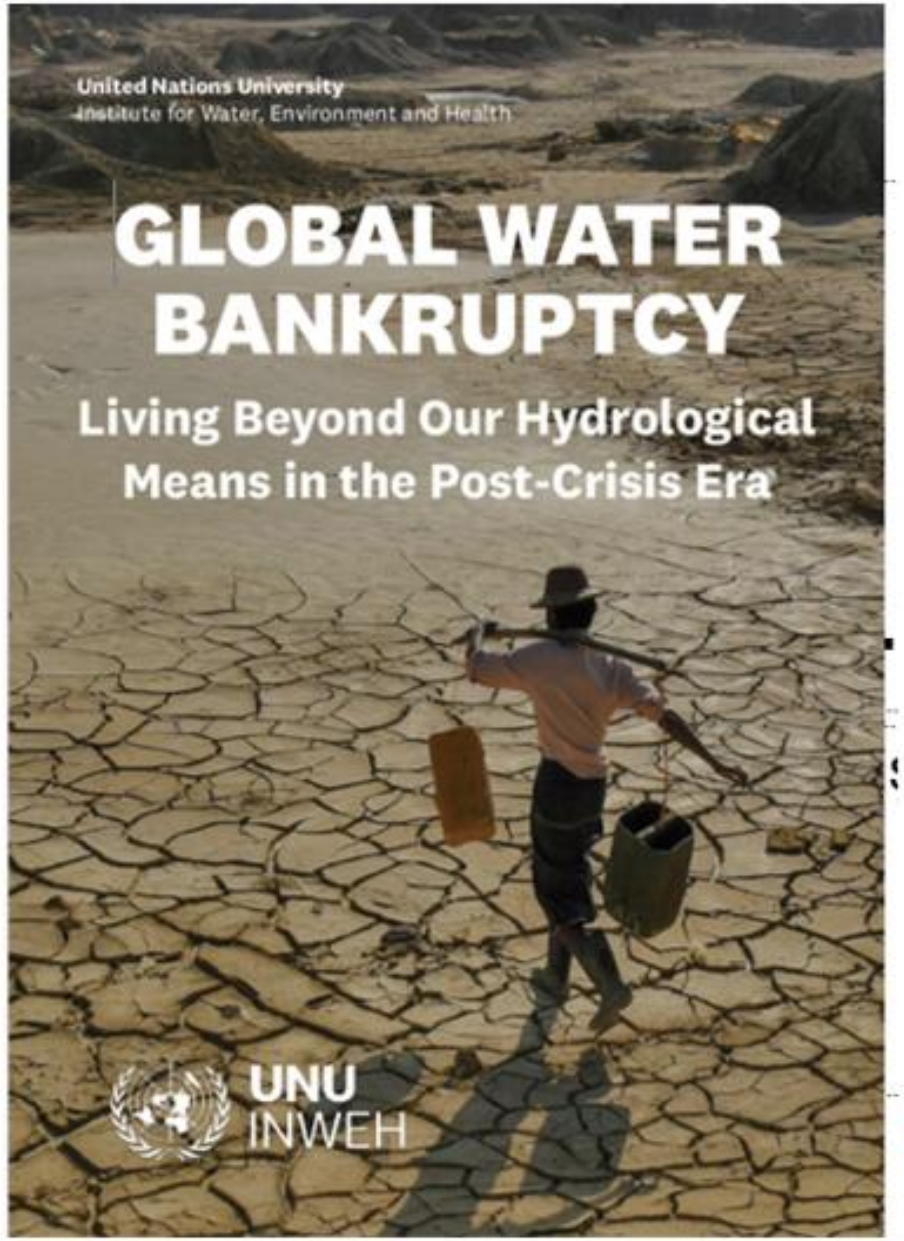
Uncertainties

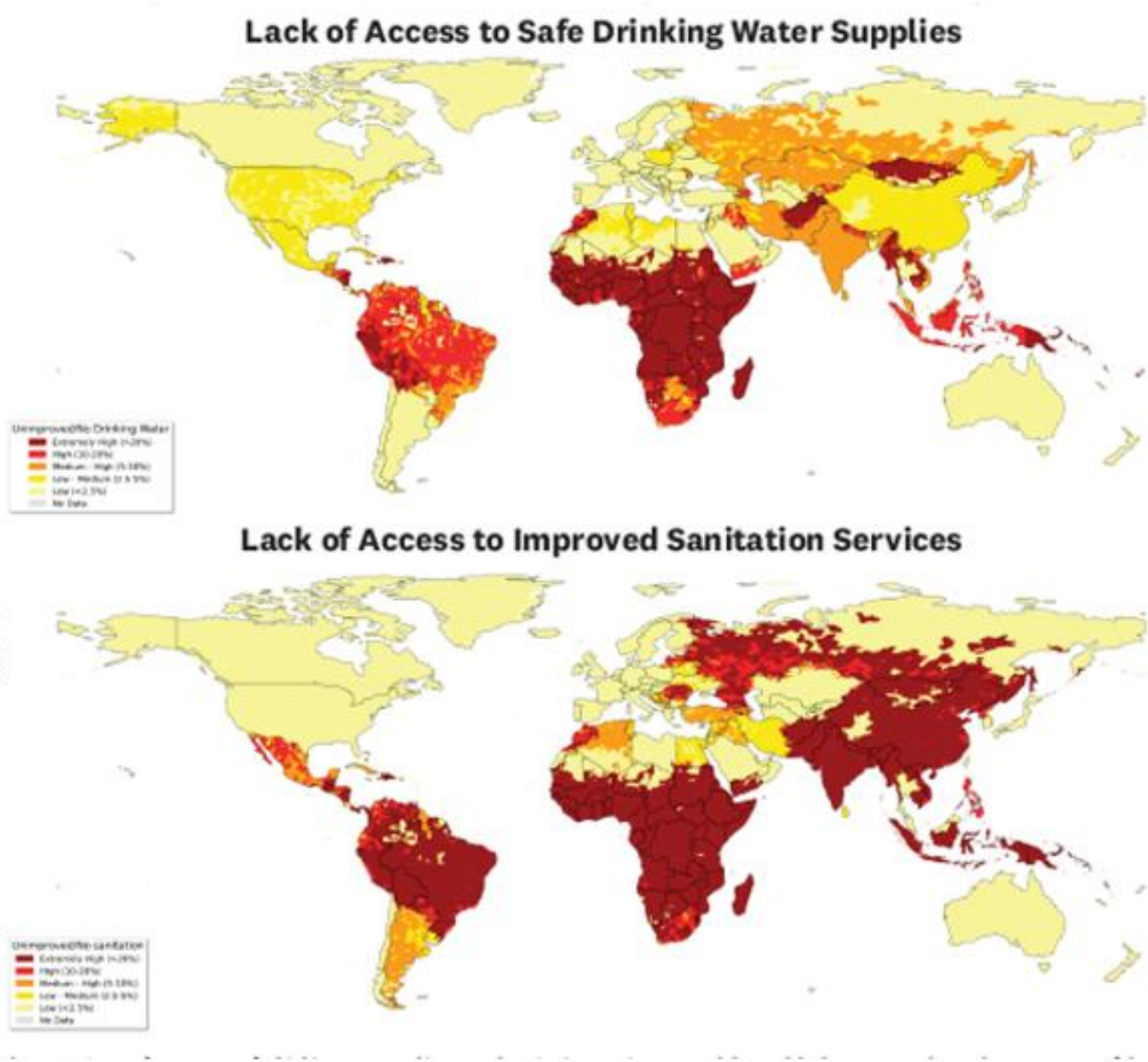
WEFE Nexus

Adaptive Water Management

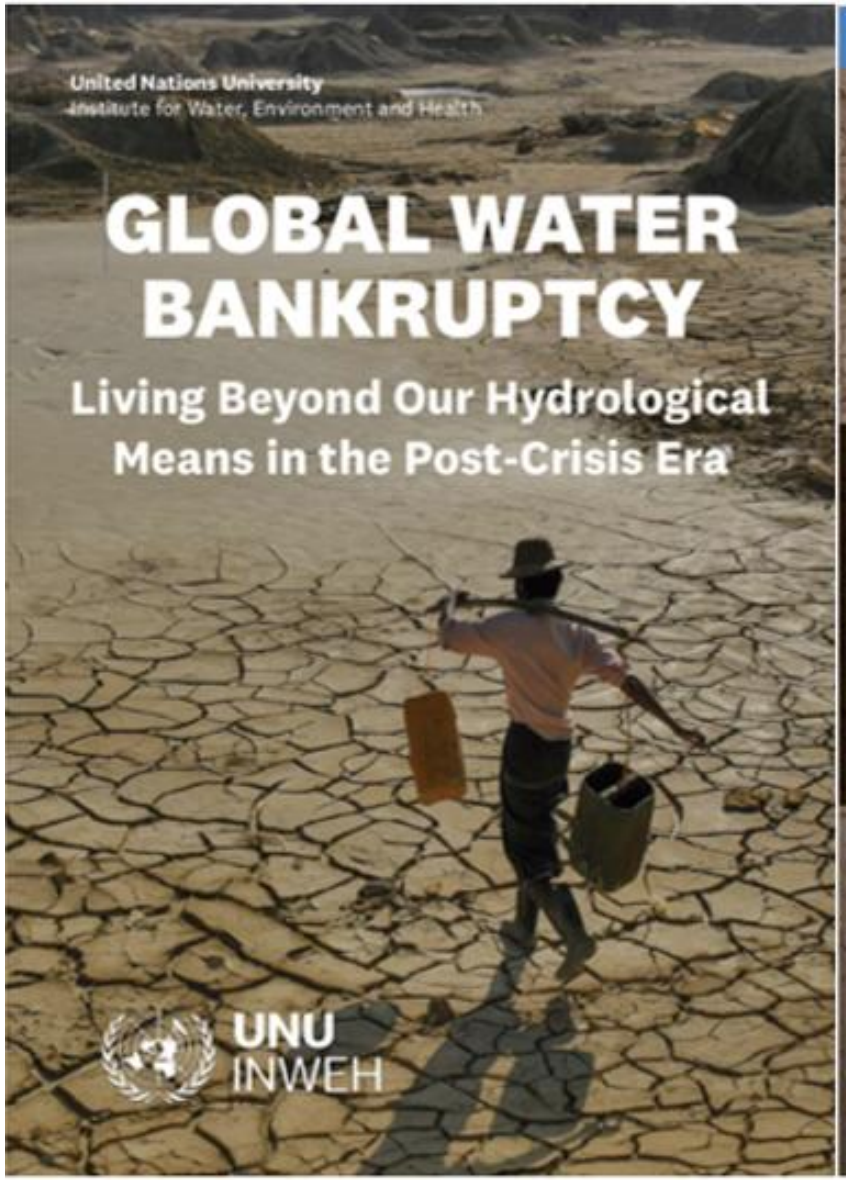
What has changed in 21st Century

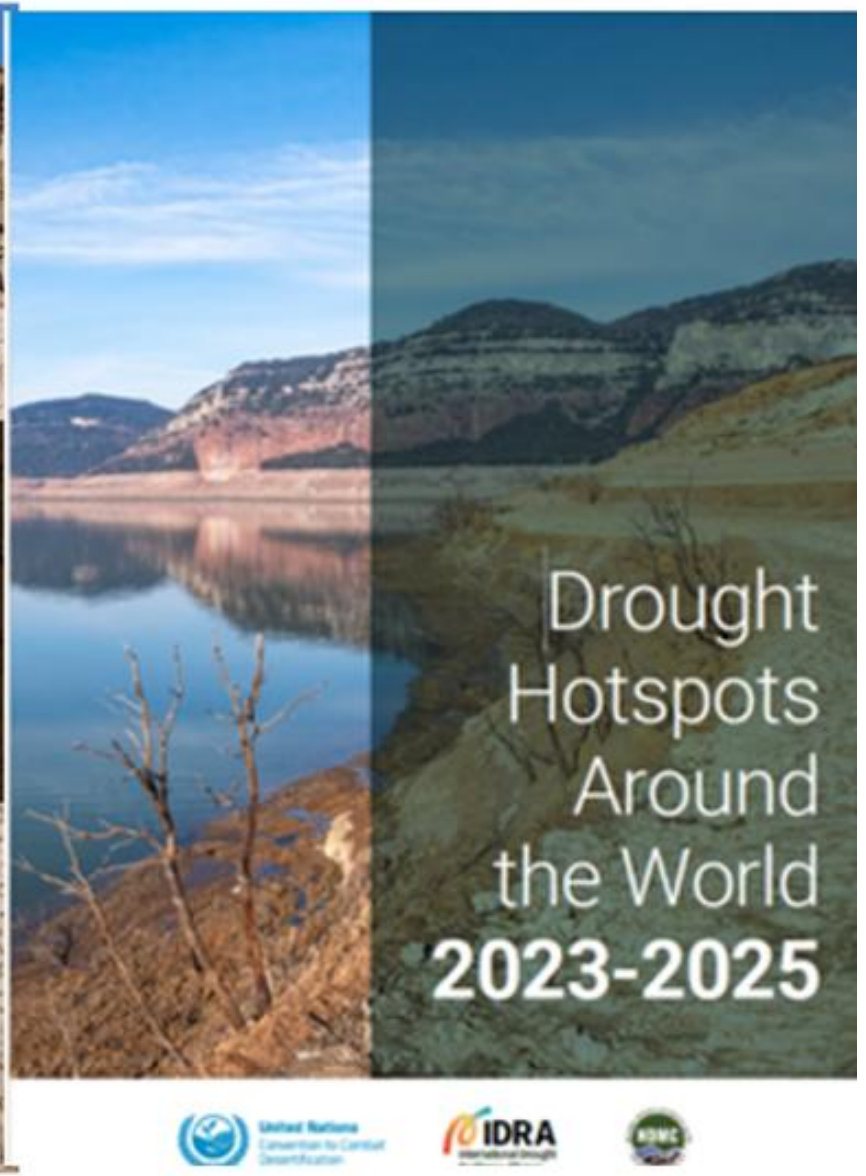
- International System
- Climate
- Technology
- National security approach
- Water management approach
- Transboundary Water Management approach
- ……


United Nations University
Institute for Water, Environment and Health
GLOBAL WATER BANKRUPTCY
Living Beyond Our Hydrological Means in the Post-Crisis Era
UNU
INWEH


Lack of Access to Safe Drinking Water Supplies
Lack of Access to Improved Sanitation Services

WB &UN Reports (2025-2026)





Climate has changed ?

Observed Changes

- Global temperature increase: +1.2°C
- More frequent heatwaves
- Increasing atmospheric moisture
- Altered precipitation patterns

Consequences

- Hydrological uncertainty
- WEFE security challenges
- Infrastructure vulnerability

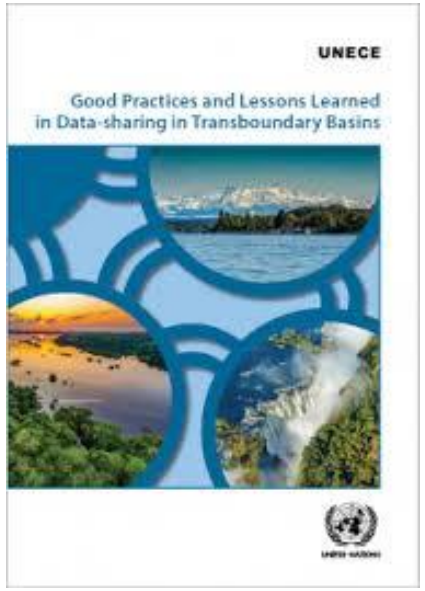
Future Outlook

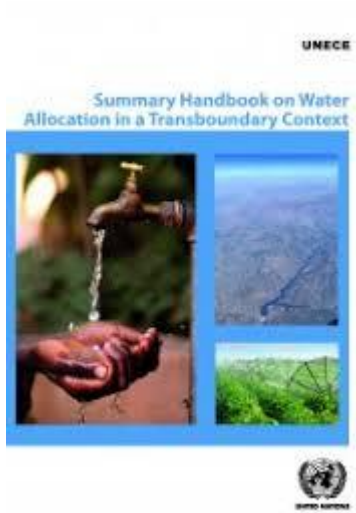
By 2050

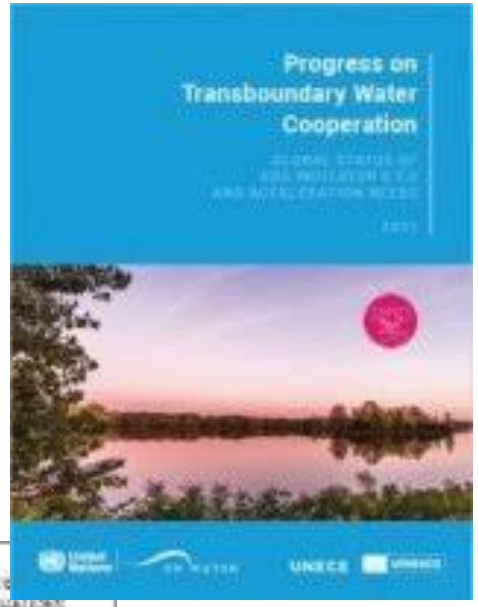
- More frequent extremes
- Higher water demand
- Greater uncertainty
- Increased adaptation costs

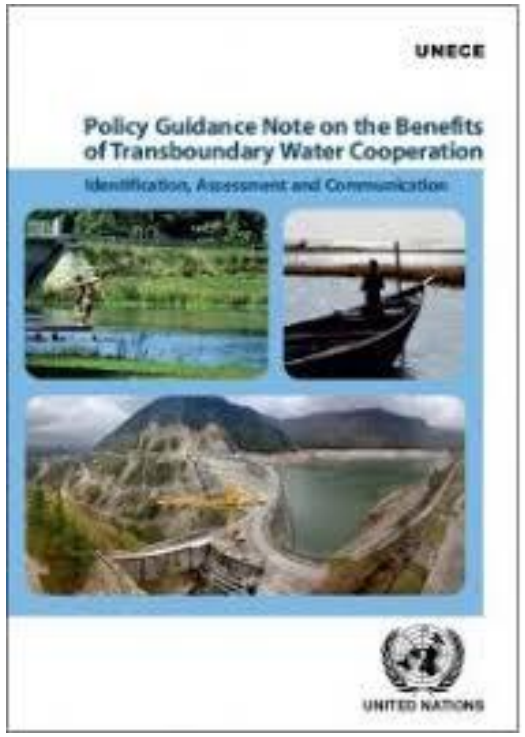
Strategic Response

- Climate-resilient transboundary water governance.


UNECE
Good Practices and Lessons Learned in Data-sharing in Transboundary Basins


UNECE
Summary Handbook on Water Allocation in a Transboundary Context


Progress on Transboundary Water Cooperation
UNECE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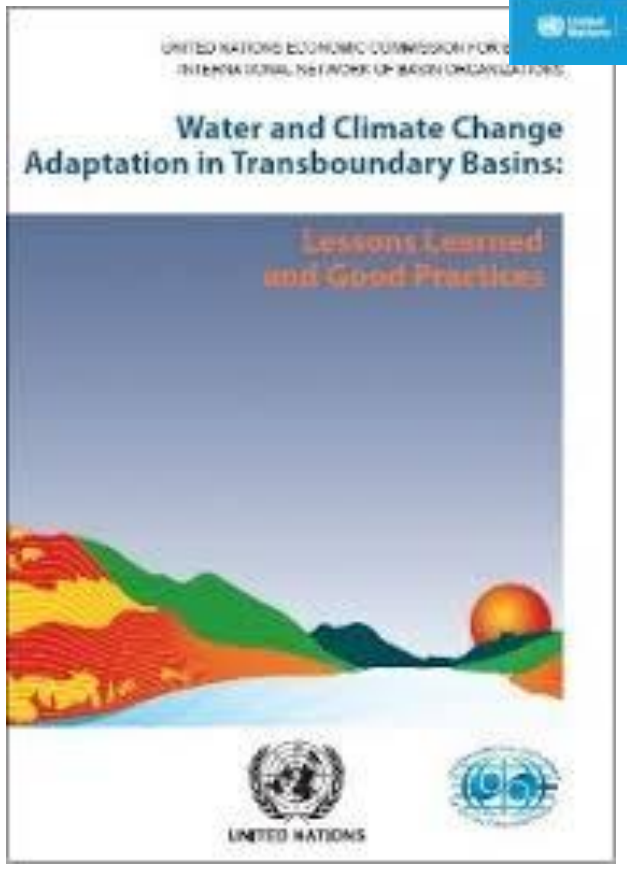
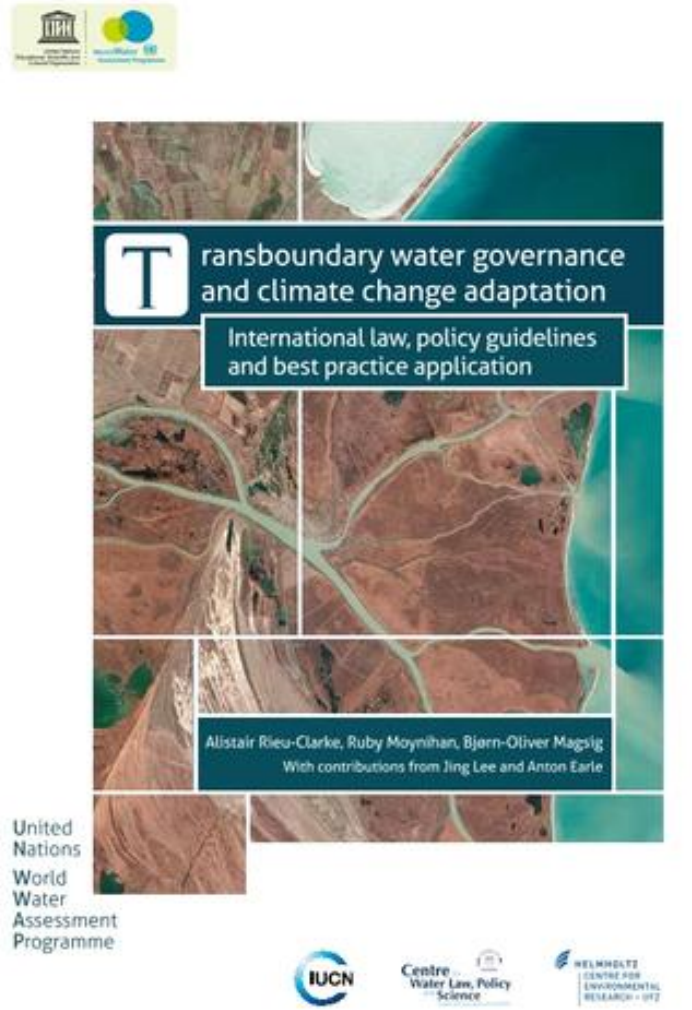
Policy Guidance Note on the Benefits of Transboundary Water Cooperation
Identification, Assessment and Communication
UNITED NATIONS


Water and Climate Change Adaptation in Transboundary Basins:
Lessons Learned and Good Practices
UNITED NATIONS


Transboundary water governance and climate change adaptation
International law, policy guidelines and best practice application
Alistair Rieu-Clarke, Ruby Moynihan, Bjørn-Oliver Magsig
With contributions from Jing Lee and Anton Earle
United Nations World Water Assessment Programme
IUCN
Centre for Water Law, Policy and Science
Technical Paper

Climate Change and Transboundary Water Allocation

To respond to changing conditions, including but not limited to climate variability and change, transboundary water allocation agreements and other arrangements should be adaptable.

New transboundary water allocation agreements and other arrangements need to be designed to be adaptable in the medium and long-terms to changing hydrological, climatic and other related factors (socioeconomic, geographical, cultural, etc.).

Existing water allocation agreements and other arrangements, or adopted subsidiary instruments, may need to be revised to be able to respond to changing conditions.

Adaptive capacity can be integrated into transboundary allocation systems and institutions to respond to changing conditions, impacts and opportunities. Examples of this include applying allocations in percentages instead of absolute amounts, periodic reviews and using objective thresholds (e.g. persistent low precipitation) as a basis if exceptional deviations from agreed allocations are needed.

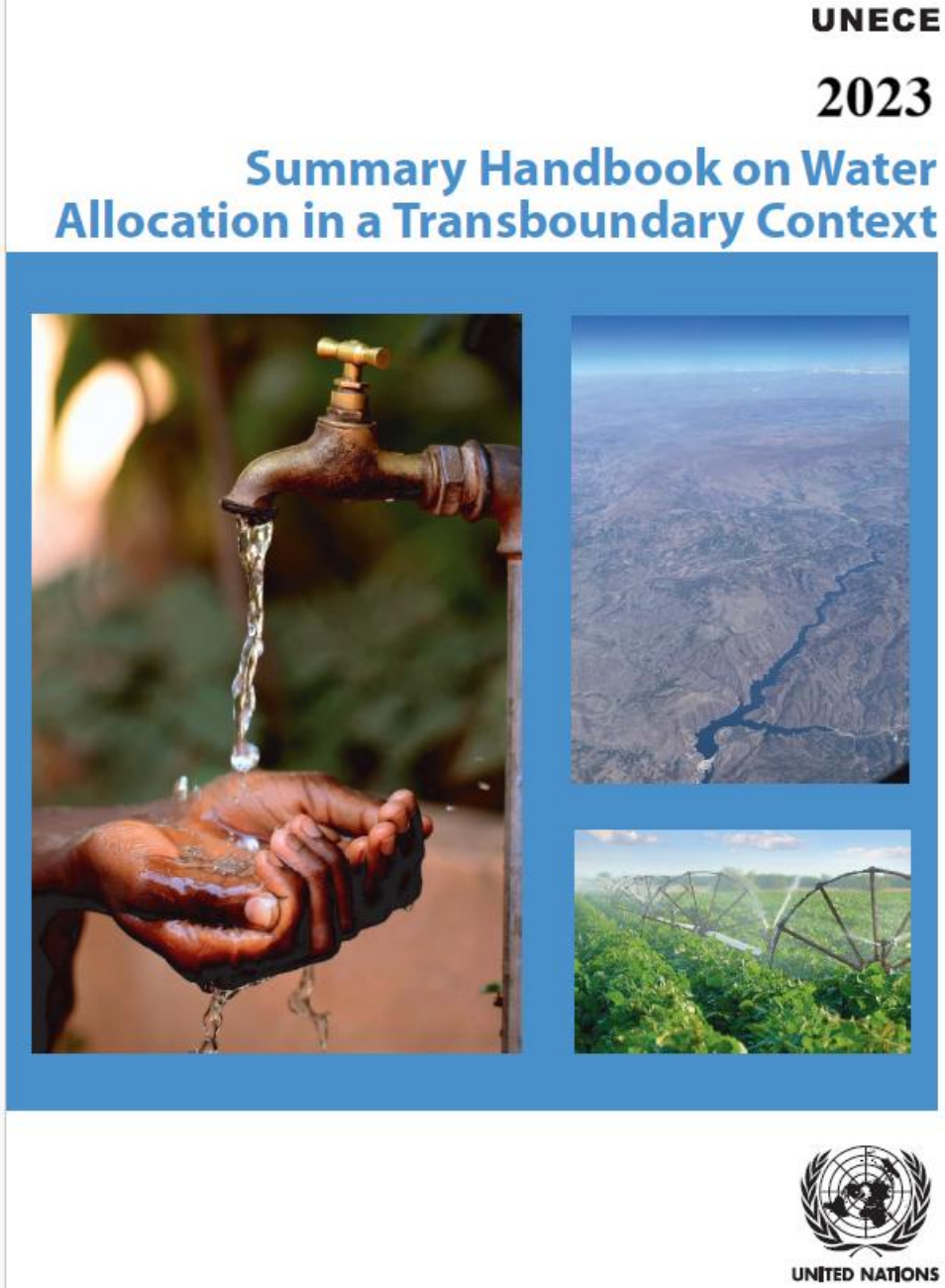
a. **Climate change must be approached as a cross-cutting challenge to effective allocation**. It is a potential risk multiplier that may necessitate adjustment of existing—and careful drafting of any new—transboundary water allocation agreements and arrangements.

   Impacts of climate change on future demands and flows should also be anticipated and used to inform the negotiation of allocation arrangements.

   Transboundary allocation arrangements need to factor in the increased uncertainty and inter- and intraannual variability of precipitation and run-off to cope with increasing frequency and extremity of drought and flood events.

   Making transboundary allocation arrangements climate resilient requires strong coordination mechanisms between and among different levels of governance, sector policies and stakeholder groups.

Source : “HANDBOOK ON WATER ALLOCATION IN A TRANSBOUNDARY CONTEXT” UN Geneva 2021



MAIN MESSAGES

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Climate Extremes and Transboundary Rivers

Shared River Basins at Risk

- Syr Darya Basin
- Amu Darya Basin
- Nile Basin
- Indus Basin
- Euphrates-Tigris Basin

Challenges

- Increased variability,
- Competing demands,
- Hydropolitical tensions.
- Water securitisation

Question Comes ! How to achieve climate-resilient transboundary water governance?

- Transboundary Water management must become:
- ✓ Flexible
- ✓ Adaptive
- ✓ Data-driven
- ✓ Cooperative
- ✓ Climate-resilient

Technology will help us

New Technologies

- Remote Sensing
- Artificial Intelligence
- Big Data
- Digital Twins
- Smart Monitoring Systems

Benefits

- Early warning
- Better forecasting
- Real-time management

Climate-Resilient Reservoir Operations can help us !

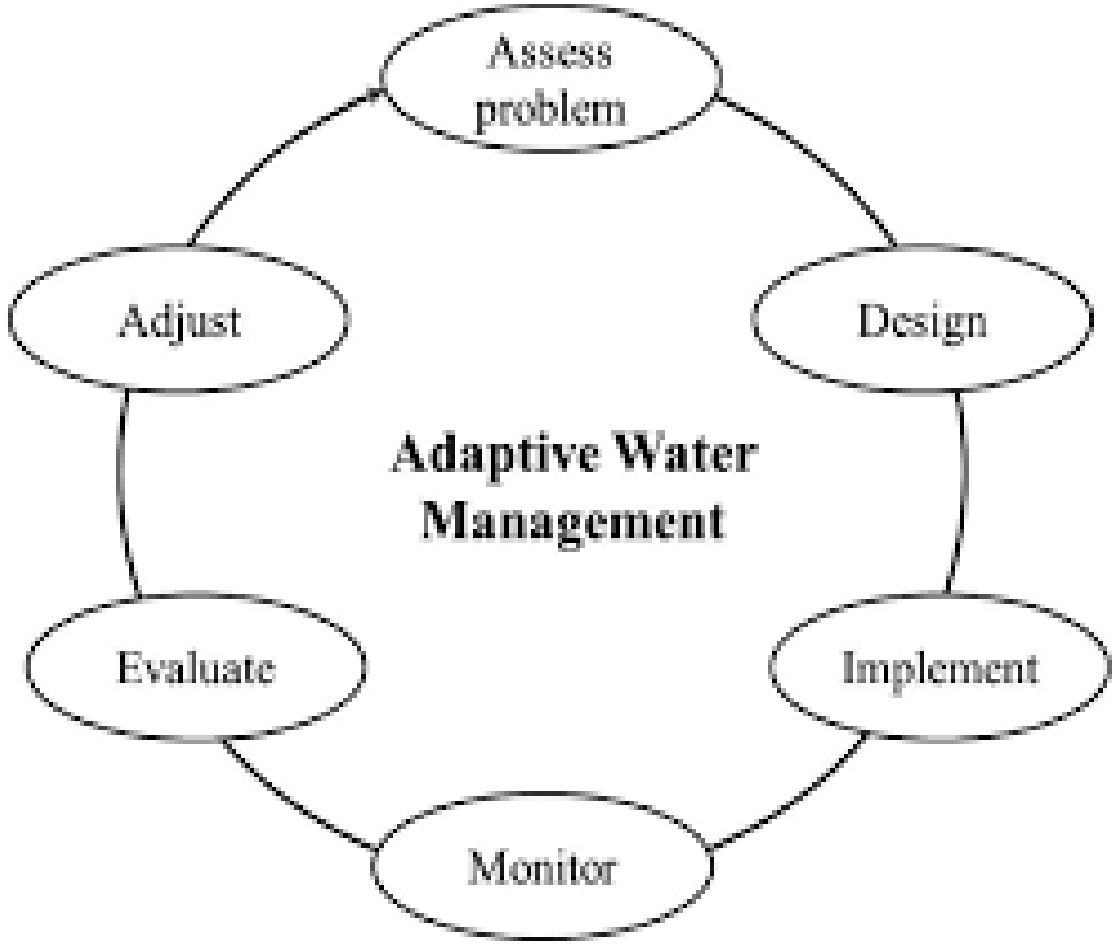
New Requirements

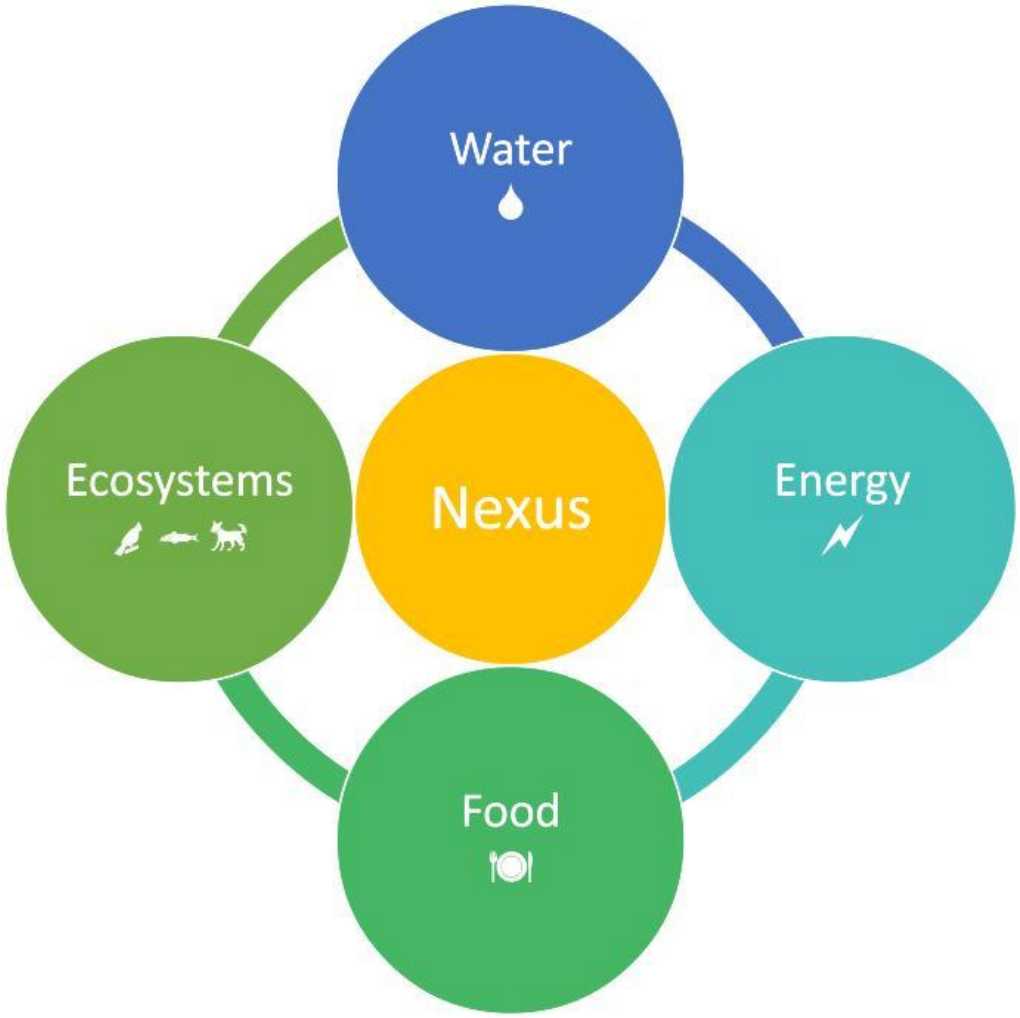
- Dynamic operating rules
- Seasonal forecasting
- Multi-purpose optimization
- Flood-drought balancing

Expected Outcomes

- Improved water security
- Reduced disaster risks

Paradigm Shift towards AWM+ WEFE Nexus





Adaptive Water Management

Traditional Approach

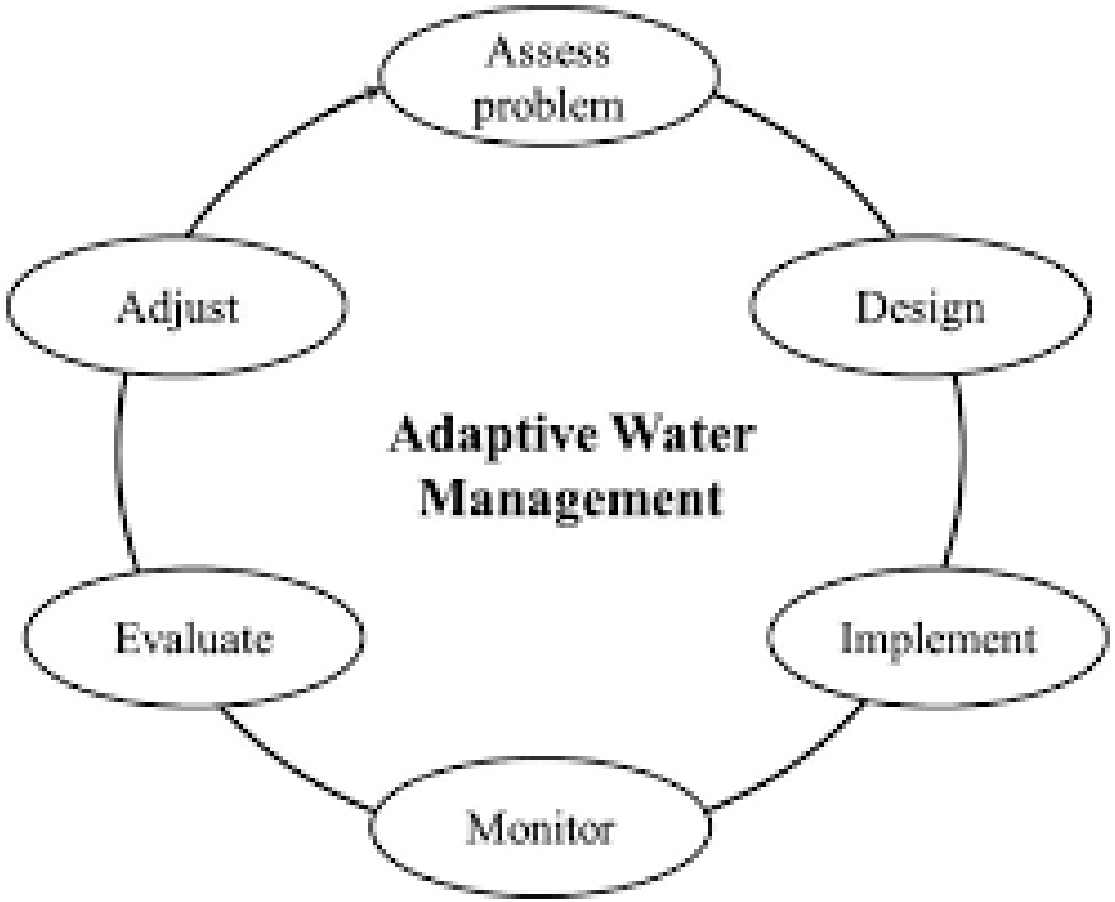
- Predict → Plan → Build

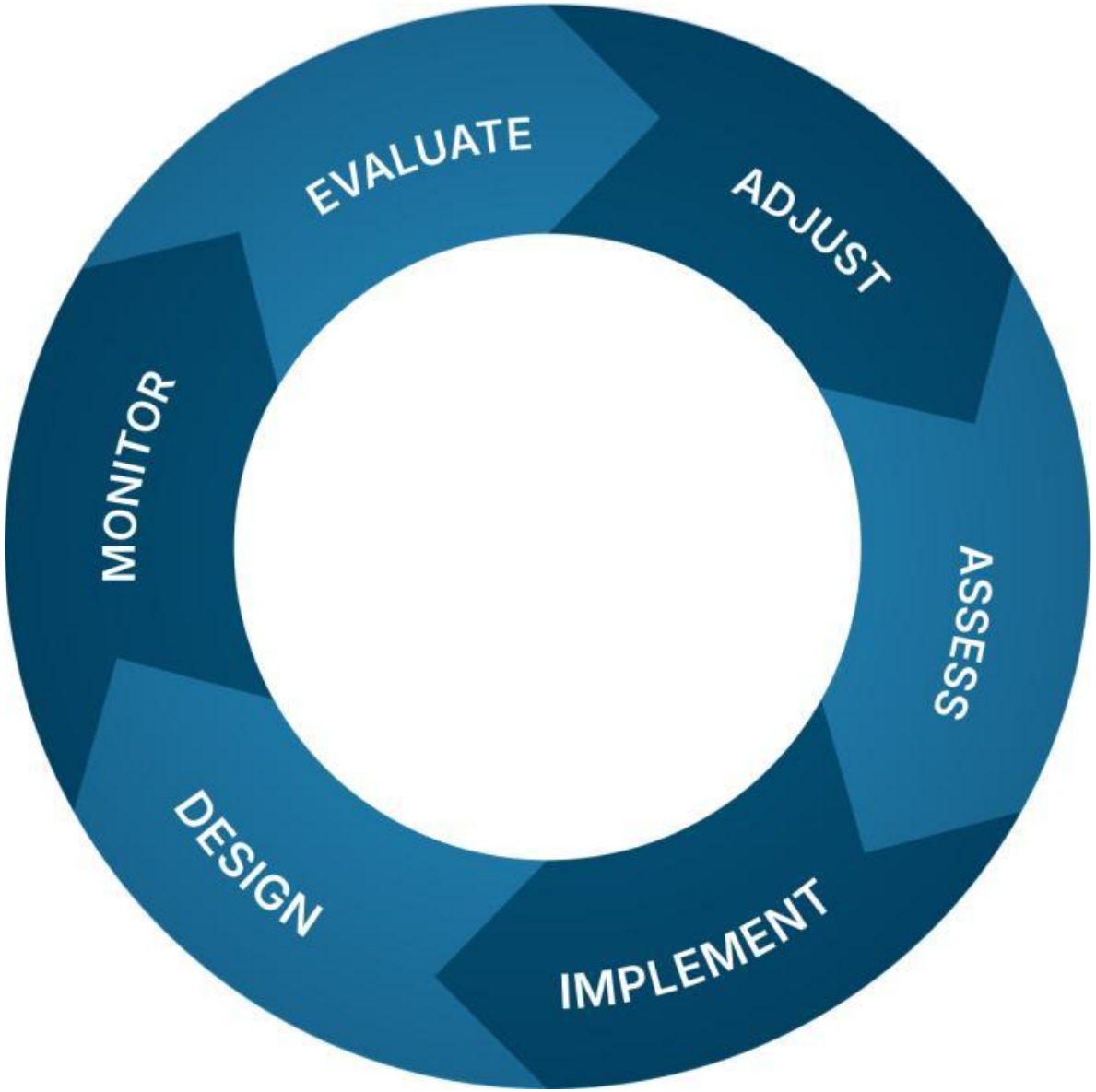
Adaptive Approach

- Monitor → Learn → Adjust

- **Core Principle**
- **Managing uncertainty** rather than attempting to eliminate it.

Adaptive W.M


Assess problem
Design
Implement
Monitor
Evaluate
Adjust
Adaptive Water Management

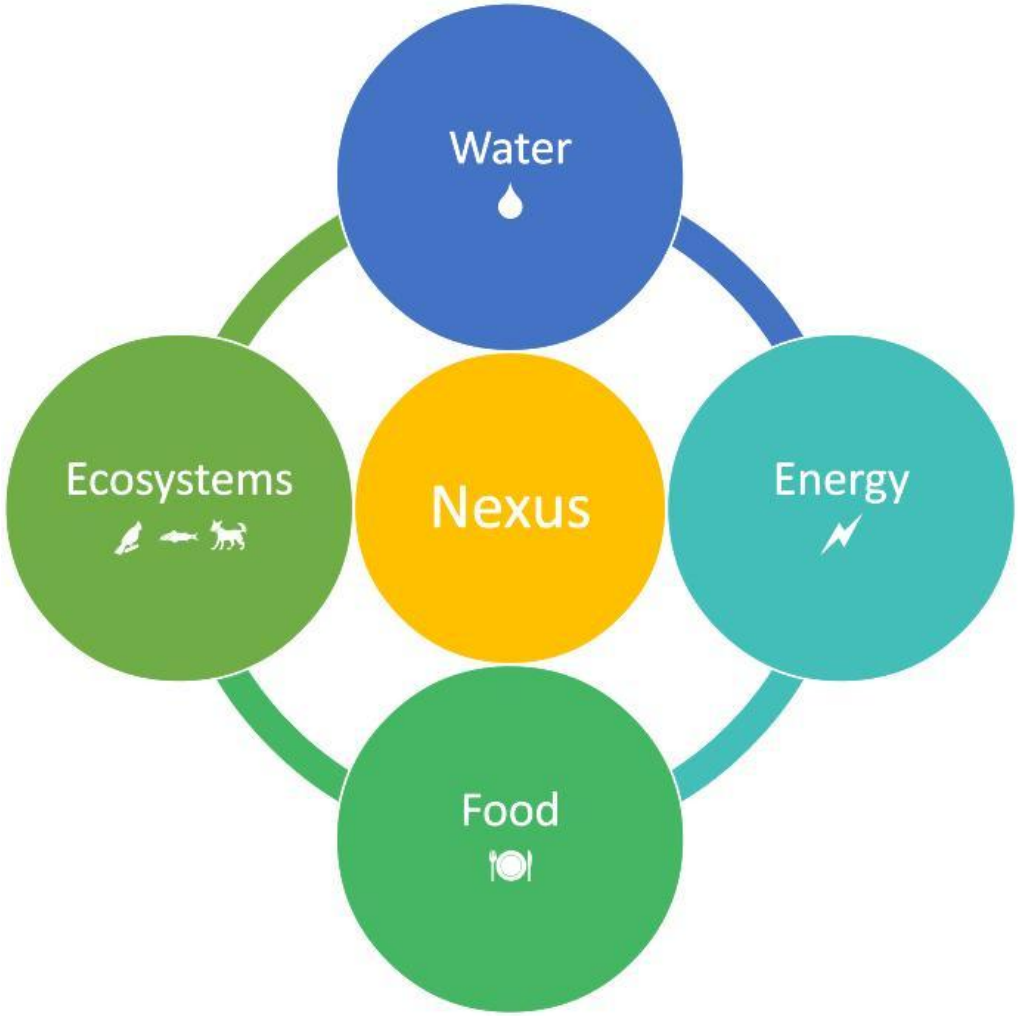

EVALUATE
ADJUST
ASSESS
IMPLEMENT
DESIGN
MONITOR

Adaptive ?

- Adaptive Water Management is not about finding the perfect plan;
- **it is about continuously improving decisions** under changing and uncertain conditions.
- Therefore, in the 21st century, adaptive water management is becoming the fundamental management model for WEFE Nexus and transboundary water cooperation approaches.

WEFE(Water-Energy-Food-Environment) Nexus

- **Interconnected Systems**
- Water ↔ Energy
- Water ↔ Food
- Water ↔ Ecosystems
- Energy ↔ Food



The WEFE Nexus is an integrated approach that recognizes the interdependence of WATER-ENERGY-FOOD-ENVIRONMENT sectors.

Core Principle

- **"Managing interconnections rather than individual sectors."**

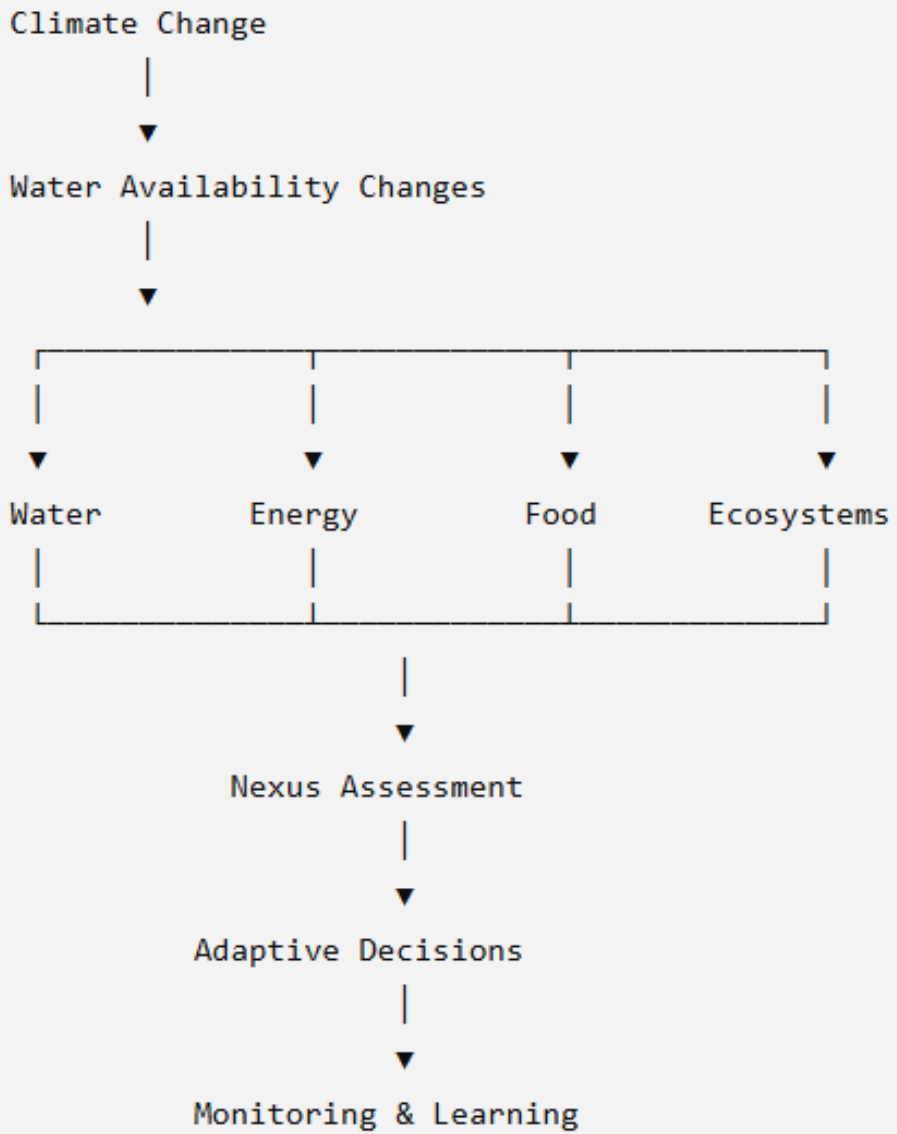
Why WEFE Nexus Matters in Transboundary Basins?

Shared river basins face:

- Competing water demands
- Upstream-downstream tensions
- Climate uncertainty
- Population growth
- Energy security concerns

Nexus Approach transforms competition into **cooperation.**

Adaptive Water Management and WEFE Nexus



Traditional Water Sharing vs Nexus Approach

Traditional Approach	WEFE Nexus
Water allocation	Benefit sharing
Sectoral planning	Integrated planning
Competition	Cooperation
Short-term	Long-term
Single objective	Multiple objectives

What does WEFE Nexus Provide

✓ Climate change increases interdependence among water, energy, food and ecosystems.

✓ Transboundary water management requires integrated solutions.

✓ WEFE Nexus provides a framework for cooperation and benefit sharing.

Policy Recommendations

What to do?

- Strengthen basin-wide **institutions**
- Develop WEFE-oriented planning tools
- Improve transboundary data sharing
- Promote **regional** **food-**electricity markets
- Integrate climate adaptation into basin planning
- Establish **benefit-sharing** mechanisms

How to do ?

Transboundary Basin –wide

- Adaptive Water Management
- WEFE Nexus
- Institutionalization
- Regionalisation

Final Messages

- "Future water security will depend **not on managing average conditions,** but on managing extremes and **uncertainties** .«
- Advance Technology will help us but not enough (Water is politics)
- We need paradigm shift on transboundary water management
- "The future of transboundary water management lies not in sharing water alone, but **in sharing the benefits** generated from water.«
- How to share benefit ? (WEFE Nexus +Adaptive Water Management)

Some WEFE Nexus Based Regional Transboundary Water Cooperation Models

- Türkiye –Iraq Water Framework Agreement (2025). Emerging WEFE-Oriented Cooperation
- Kambarata 1 Dam (Central Asia- Naryn River Basin) (2023)
- The most advanced WEFE Nexus-based cross-border collaboration model in the world today is in the **Senegal River Basin (OMVS).** **Senegal,Mali, Mauritania,Guinea** OMVS manages major infrastructure projects on rivers based on the principle of common ownership. Benefits from dams are shared among countries. The aim is not just water allocation;

Thank You

Dursun YILDIZ

HİDROPOLİTİK AKADEMİ