Third Edition

RISK MANAGEMENT

Knowledge, Forecasting, Prevention, Protection, Planning, Preparedness

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CLIMATE CHANGE ADAPTATION STRATEGIES IN WATER MANAGEMENT

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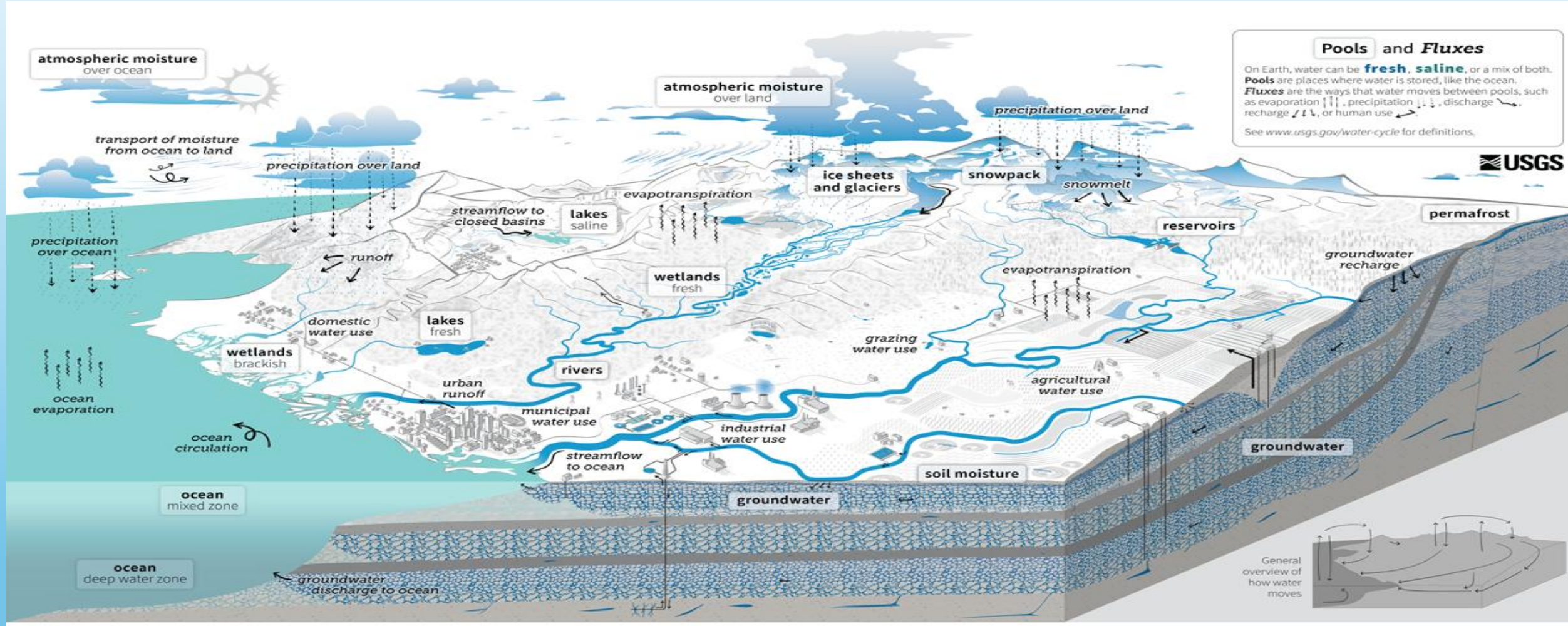
HALL OF CONCILIATION IN ASSISI

23rd July 2025

CLIMATE CHANGE ADAPTATION STRATEGIES IN WATER MANAGEMENT



The Water Cycle

The water cycle describes where water is on Earth and how it moves. Water is stored in the atmosphere, on the land surface, and below the ground. It can be a liquid, a solid, or a gas. Liquid water can be fresh, saline (salty), or a mix (brackish). Water moves between the places it is stored. Water moves at large scales and at very small scales. Water moves naturally and because of human actions. Human water use affects where water is stored, how it moves, and how clean it is.

Pools store water. 96% of all water is stored in **oceans** and is saline. On land, saline water is stored in **saline lakes**. Fresh water is stored in liquid form in **freshwater lakes**, artificial **reservoirs**, **rivers**, and **wetlands**. Water is stored in solid, frozen form in **ice sheets** and **glaciers**, and in **snowpack** at high elevations or near the Earth's poles. Water vapor is a gas and is stored as **atmospheric moisture** over the ocean and land. In the soil, frozen water is stored as **permafrost** and liquid water is stored as **soil moisture.** Deeper below ground, liquid water is stored as **groundwater** in aquifers, within cracks and pores in the rock.

Fluxes move water between pools. As it moves, water can change form between liquid, solid, and gas. **Circulation** mixes water in the oceans and transports water vapor in the atmosphere. Water moves between the atmosphere and the surface through **evaporation**, **evapotranspiration**, and **precipitation**. Water moves across the surface through **snowmelt**, **runoff**, and **streamflow**. Water moves into the ground through infiltration and **groundwater recharge**. Underground, groundwater flows within aquifers. It can return to the surface through natural **groundwater discharge** into rivers, the ocean, and from **springs**.

We alter the water cycle. We redirect rivers. We build dams to store water. We drain water from wetlands for development. We use water from rivers, lakes, reservoirs, and groundwater aquifers. We use that water to supply our **homes** and **communities.** We use it for **agricultural** irrigation and **grazing** livestock. We use it in **industrial** activities like thermoelectric power generation, mining, and aquaculture. The amount of water that is available depends on how much water is in each pool (water quantity). It also depends on when and how fast water moves (water timing), how much water we use (water use), and how clean the water is (water quality).

We affect **water quality**. In agricultural and urban areas, irrigation and precipitation wash fertilizers and pesticides into rivers and groundwater. Power plants and factories return heated and contaminated water to rivers. Runoff carries chemicals, sediment, and sewage into rivers and lakes. Downstream from these sources, contaminated water can cause harmful algal blooms, spread diseases, and harm habitats. **Climate change** is affecting the water cycle. It is affecting water quality, quantity, timing, and use. It is causing ocean acidification, sea level rise, and more extreme weather. By understanding these impacts, we can work toward using water sustainably.

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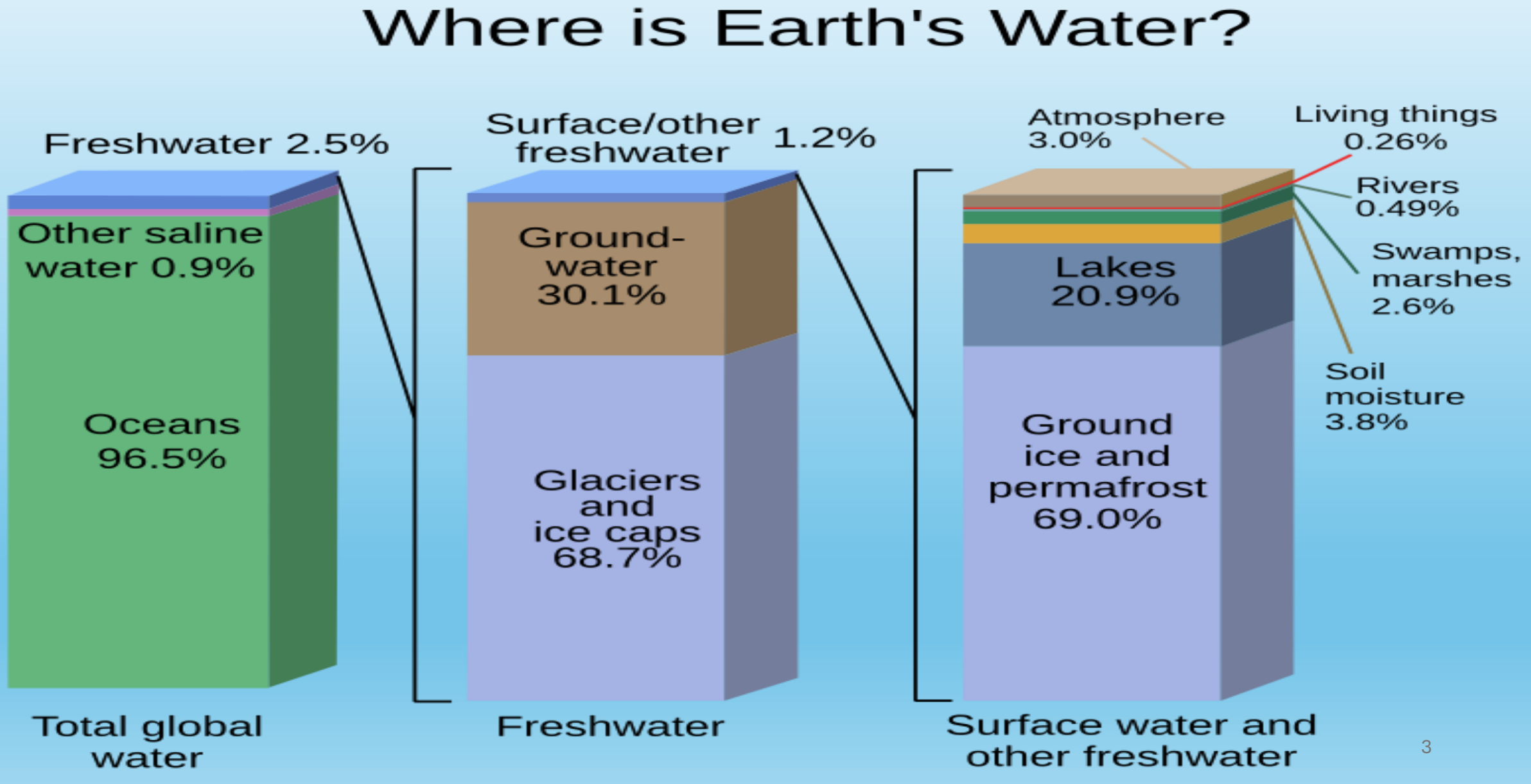

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In France, global warming is increasing on average with the first significant effects:

- Lower annual average rainfall, especially in the South
- Increased evapotranspiration

  ➔ decrease in renewable water (-14% from one decade to the next)
- More frequent and intense extreme episodes
- Droughts, heat waves, multi-year droughts, reduction in the snowpack and glacier surface with consequences on the flows of watercourses and infiltration to groundwater
- Severe thunderstorms with heavy precipitation

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Water Resources Management and Climate Change

The management of water resources impacts almost all aspects of society and the economy, including food, production and security, domestic water supply and sanitation, health, energy, tourism, industry and the functioning of ecosystems.

Climate change is one of the main driving forces of change for water resources management, together with demographic, economic, environmental, social and technological forces

In a context dominated by worsening food security and malnutrition, increased energy shortages, spread of diseases, humanitarian emergencies, growing migration, increased risk of conflict over scarce land and water; and escalating ecosystem degradation, improved and integrated management of water and land resources becomes critical to sustainable development

Climate change impacts on water resources management issues have to be addressed urgently and adequately. Otherwise, progress towards achieving poverty reduction targets, the Goals, and sustainable development in all their economic, social and environmental dimensions will be jeopardized.

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Adapting to Climate Change

Thus far, policy response to climate change has been dominated by the need for mitigation. Although these measures can slow down climate change, they will not halt or reverse it. Because the effects of climate change are inevitable in the short and medium term, adaptation needs to be addressed with the same urgency as mitigation.

Water management, based on integrated and systemwide approaches, is the key to climate change adaptation

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Adapting to Climate Change

- Planning and applying **new investments** (for example, reservoirs, irrigation systems, capacity expansions, levees, water supply, wastewater treatments, ecosystem restoration).
- Adjusting **operation, monitoring and regulation practices** of existing systems to accommodate new uses or conditions (for example, ecology, pollution control, climate change, population growth).
- Working on **maintenance, major rehabilitation and re-engineering** of existing systems (for example, dams, irrigation systems, canals, pumps, rivers, wetlands).

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Adapting to Climate Change

Making modifications to **processes and demands** for existing systems and water users (for example, rainwater harvesting, water conservation, pricing, regulation, legislation, basin planning, funding for ecosystem services, stakeholder participation, consumer education and awareness).

Introducing new **efficient technologies** (for example, desalination, biotechnology, drip irrigation, wastewater reuse, recycling, solar panels).

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Adapting to Climate Change

Managing Uncertainty Uncertainty should not be a reason for inaction:

Managing Increasing Variability : Greater climatic variability calls for comprehensive risk management planning, including disaster risk reduction

Drinking Water Supply and Sanitation :The world is on track Development Goal targets for drinking water, but not for sanitation)

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Adapting to Climate Change

Agriculture : Climate change is expected to impact both rainfed and irrigated agriculture, including feed and fodder for livestock.

Water and Health : Climate change will influence human health through water-related impacts of various kinds

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Adapting to Climate Change

Ecosystems :Services provided by ecosystems support livelihoods and economic development

Water-related Hazards : Society needs to adapt to the full range of water-related hazards that will accompany climate change

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WHICH SOLUTIONS AND PROPOSALS

Integrated management at the scale of watersheds; Conditions for sustainable development:It is therefore at the scale of the major river basins that this integrated management of water resources must be organised, through consultation and decision-making tools, and by setting up appropriate economic instruments.

Agriculture and food: from the green revolution to the blue revolution: Situations of overexploitation of water resources are directly linked to agricultural use.

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WHICH SOLUTIONS AND PROPOSALS

Energy: The second factor in the globalization of the Water Debate Access to energy resources as a key to development,:

Drinking water and sanitation; Global commitments for essential services: Water and sanitation services are also at the heart of the global water debate

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WHICH SOLUTIONS AND PROPOSALS

Which funding for water services?: Water services are in fact part of a kind of hard core of public services linked to vital needs

Private Involvement and Public Accountability in Water Services

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WHICH SOLUTIONS AND PROPOSALS

Financing of needs: insolvent in the short term

At the centre of global debates: Governance: The notion of governance plays a central role

THE EUROPEAN CONTEXT

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EU PROPOSALS for better water management

- **The 2021 EU Strategy on Adaptation to Climate Change**
- **the communication plan for the safeguarding of Europe's water resources**
- **EU Floods Directive,**
- **The new regulation on minimum requirements for water reuse, adopted in 2020,**
- **Water Reuse Regulations (2023)**

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EU ACTIONS for better WATER management

Improve the knowledge base

Supporting investment and financing

Supporting implementation

Creation of a Mission "Adaptation to Climate Change and Societal Transformations (Adaptation Indicators and Sets of Indicators)

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PROGRAMME INTERREG MED NEXT II

Development and Implementation of a Forest Fire and Flood Prevention and Early Warning System: Acronym: ACTIF

CONSORTIUM

ALGERIA, FRANCE and ITALY

Objectives

Promote climate change adaptation, disaster risk reduction and resilience, taking into account ecosystem-based approaches to forest fires and floods

CLIMATE CHANGE ADAPTATION STRATEGIES IN WATER MANAGEMENT

PROGRAMME INTERREG MED NEXT II

Development and Implementation of a Forest Fire and Flood Prevention and Early Warning System: Acronym: ACTIF

Objectives

- Establishment of a Prevention and Early Warning System for the population concerning two major natural risks: Forest Fires and Floods
- Establish a plan for the protection and resilience of populations, particularly vulnerable populations in the face of two major natural risks: Forest Fires, Floods
- Carry out training for elected officials as well as teachers from schools, colleges and high schools for the dissemination of the culture of risk and resilience
- Develop communication, awareness-raising and training actions for the resident population, tourists and operators
- Carry out training for Citizen Rescuers among the population capable of calling for help, provide first aid and survival gestures, implement the measures provided for in the Territorial Safeguarding Plan
- Carry out test exercises in each of the Communities or Public Entities that are Members of the Consortium to validate the provisions concerning the Early Warning of populations, the Resilience Plans, the training provided as well as the information of the populations concerned

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QUESTIONS and ANSWERS

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CONCLUSIONS