ICID•CIID

International Commission on Irrigation and Drainage (ICID)

Prof. Dr. Salvatore Grimaldi
President IAHS, Italy

Hydrological Change: Challenges and Solutions for Water Security

2nd Indo Global Irrigation Summit

24-25 June 2026, New Delhi India

Hydrological Change: Challenges and Solutions for Water Security

Salvatore Grimaldi

President of International Association of Hydrological Sciences

2nd Indo-Global Irrigation Summit
24-25 June 2026, New Delhi, India

ICID•CIID

International Association of Hydrological Sciences

100-year old
>12000 members

International Commissions on:
- Continental Erosion (ICCE)
- Coupled Land-Atmospher Systems (ICCLAS)
- Groundwater (ICGW)
- Human-Water Feedbacks (ICHWF)
- Remote Sensing (ICRS)
- Statistical Hydrology (ICSH)
- Snow and Ice Hydrology (ICSIH)
- Surface Water (ICSW)
- Tracers (ICT)
- Water Quality (ICWQ)
- Water Resource Systems (ICWRS)

Committees
- Early Career Scientists Committee
- Africa Regional Committee
- Latin America Regional Committee
- Pacific island Countries and Territories WG

2nd Indo-Global Irrigation Summit
24-25 June 2026, New Delhi, India

Activities and Initiatives
- Annual- biannual Commission Workshops
- Scientific Assemblies.
- **Hydrological Science Journal**
- Decades
- SYSTA program
- IAHS Academy

Working Groups
- Measurements and Observations in the XXI century (MOXXI)
- Citizen and Hydrology (CANDHY)
- History of Hydrology
- Unsolved Problems in Hydrology (UPH)

IAHS DECADES

PUB (2003-2012)
PANTA RHEI (2013-2022)

2nd Indo-Global Irrigation Summit

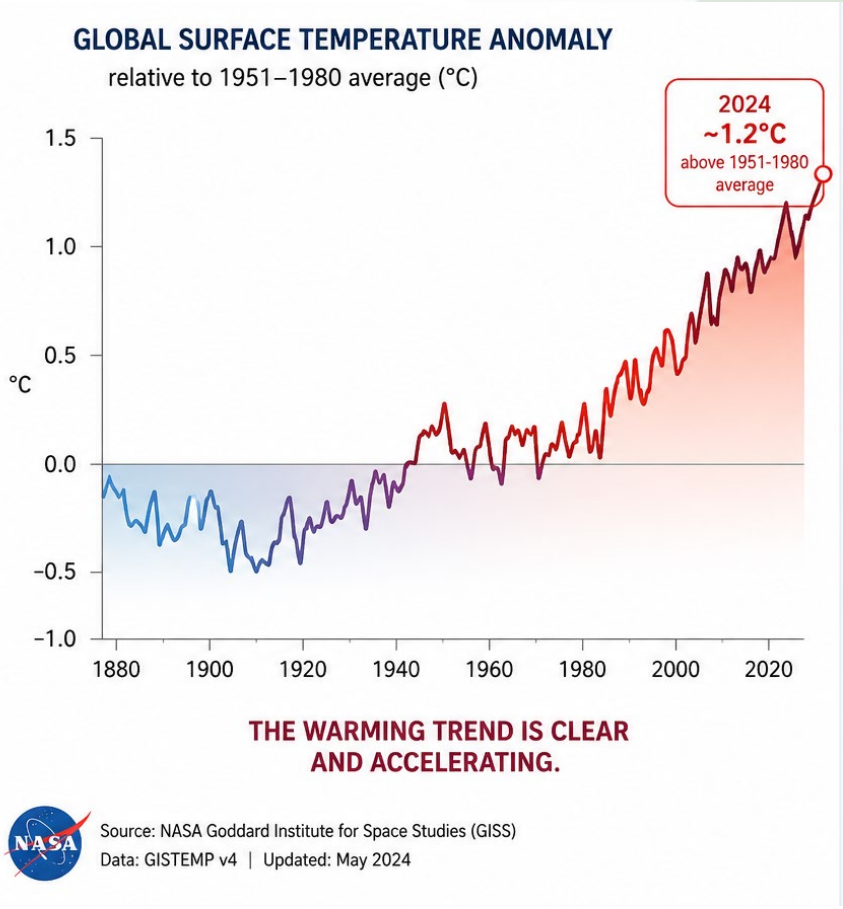
24-25 June 2026, New Delhi, India

ICID•CIID

WHAT IS THE MAJOR WATER CRISIS CHALLENGE ARE WE EXPERIENCING?

THE DOMINANT NARRATIVE

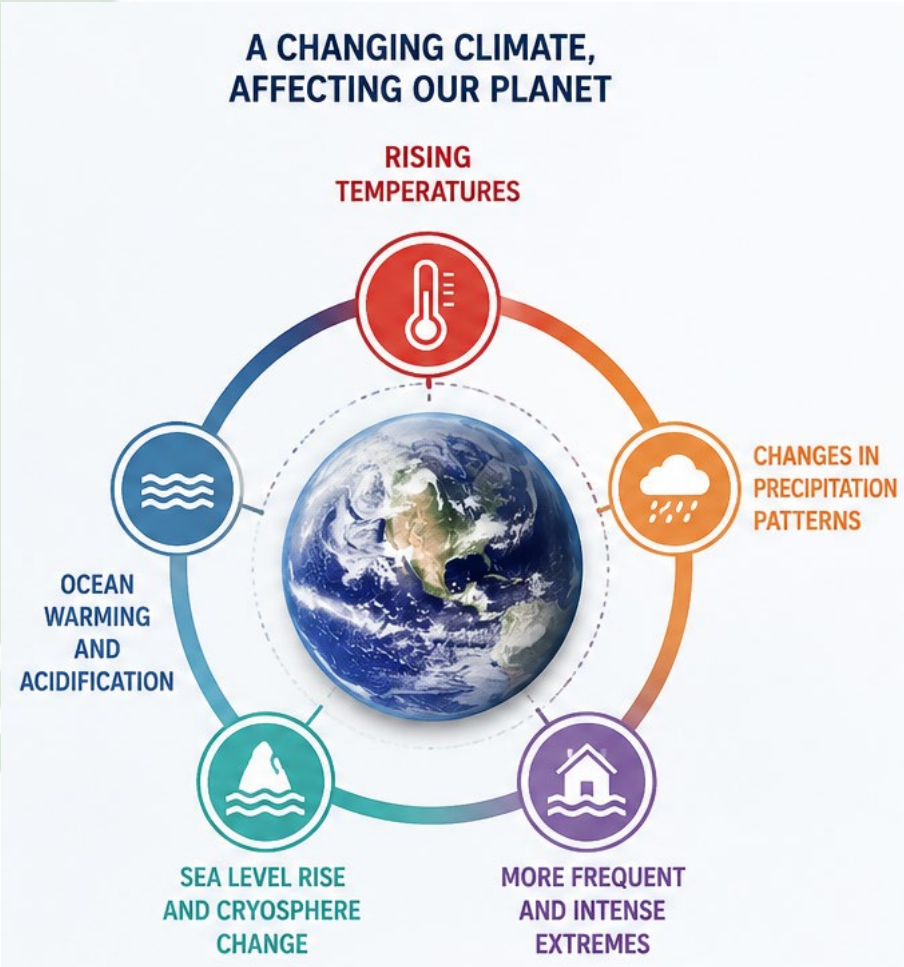
WATER CRISIS → **CLIMATE CHANGE**



ARE YOU AGREE?

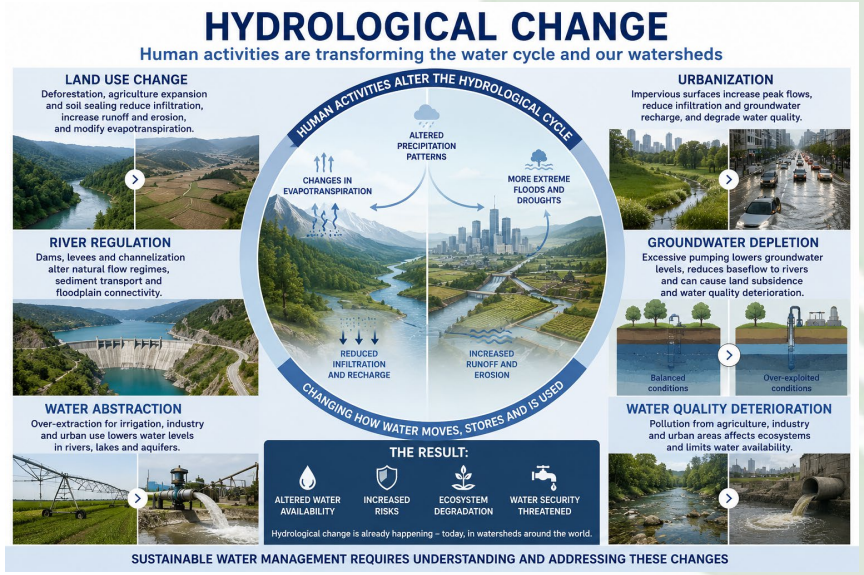
THIS NARRATIVE IS TRUE.

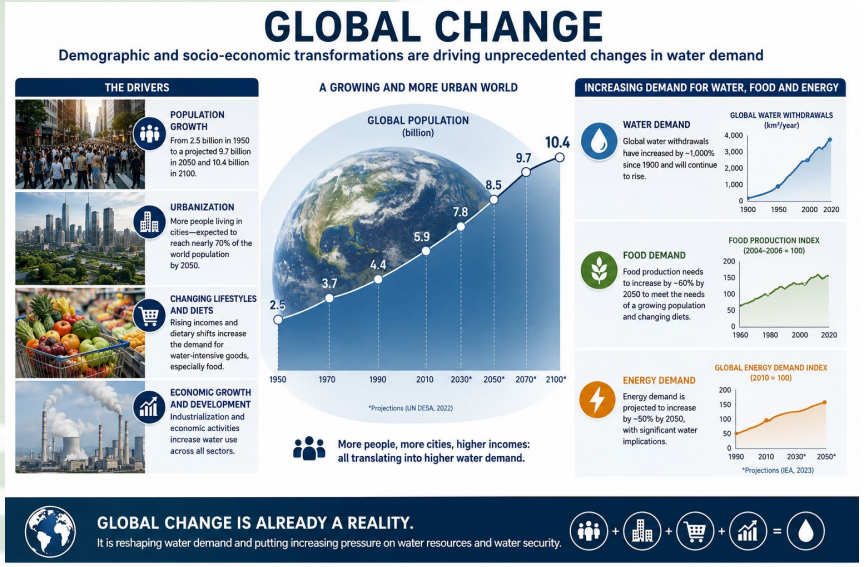
BUT IT IS INCOMPLETE.



I AM NOT QUESTIONING CLIMATE CHANGE OR THE CREDIBILITY OF FUTURE CLIMATE SCENARIOS.

MY POINT IS THAT CLIMATE CHANGE IS ONLY ONE COMPONENT OF BROADER CHANGES THAT ARE ALREADY OCCURRING TODAY—NOT FUTURE SCENARIOS, BUT PRESENT REALITIES—WITH PROFOUND IMPLICATIONS FOR WATER SECURITY.





2nd Indo-Global Irrigation Summit

24-25 June 2026, New Delhi, India

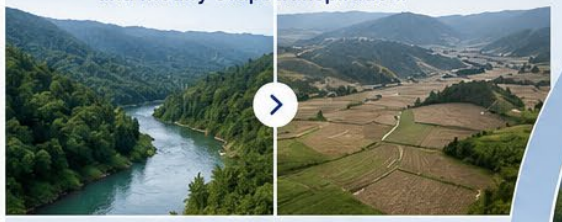
ICID•CIID

HYDROLOGICAL CHANGE

Human activities are transforming the water cycle and our watersheds

LAND USE CHANGE

Deforestation, agriculture expansion and soil sealing reduce infiltration, increase runoff and erosion, and modify evapotranspiration.



RIVER REGULATION

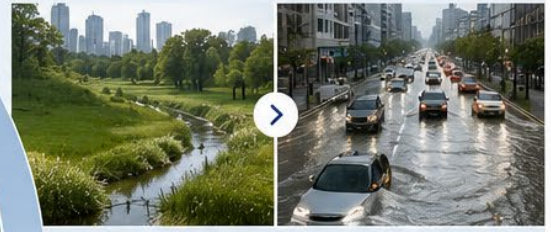
Dams, levees and channelization alter natural flow regimes, sediment transport and floodplain connectivity.

WATER ABSTRACTION

Over-extraction for irrigation, industry and urban use lowers water levels in rivers, lakes and aquifers.

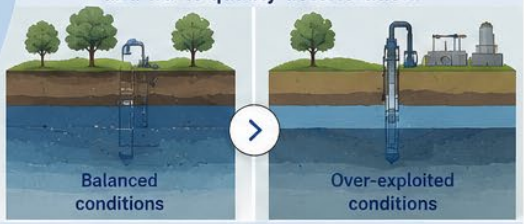
URBANIZATION

Impervious surfaces increase peak flows, reduce infiltration and groundwater recharge, and degrade water quality.



GROUNDWATER DEPLETION

Excessive pumping lowers groundwater levels, reduces baseflow to rivers and can cause land subsidence and water quality deterioration.



WATER QUALITY DETERIORATION

Pollution from agriculture, industry and urban areas affects ecosystems and limits water availability.

THE RESULT:

ALTERED WATER AVAILABILITY | INCREASED RISKS | ECOSYSTEM DEGRADATION | WATER SECURITY THREATENED

Hydrological change is already happening – today, in watersheds around the world.

SUSTAINABLE WATER MANAGEMENT REQUIRES UNDERSTANDING AND ADDRESSING THESE CHANGES

ICID•CIID

GLOBAL CHANGE

Demographic and socio-economic transformations are driving unprecedented changes in water demand

THE DRIVERS

POPULATION GROWTH

From 2.5 billion in 1950 to a projected 9.7 billion in 2050 and 10.4 billion in 2100.

URBANIZATION

More people living in cities—expected to reach nearly 70% of the world population by 2050.

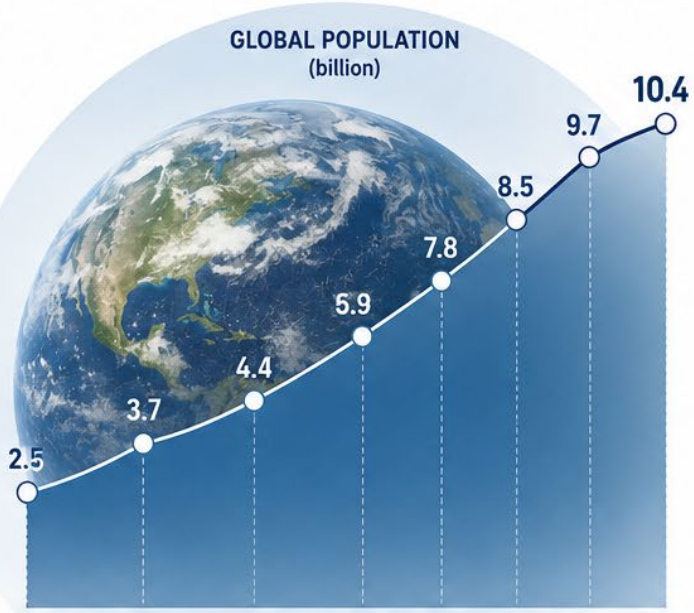
CHANGING LIFESTYLES AND DIETS

Rising incomes and dietary shifts increase the demand for water-intensive goods, especially food.

ECONOMIC GROWTH AND DEVELOPMENT

Industrialization and economic activities increase water use across all sectors.

A GROWING AND MORE URBAN WORLD

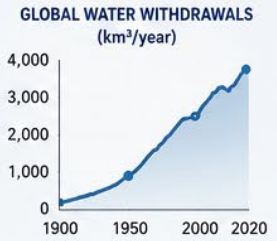


More people, more cities, higher incomes: all translating into higher water demand.

INCREASING DEMAND FOR WATER, FOOD AND ENERGY

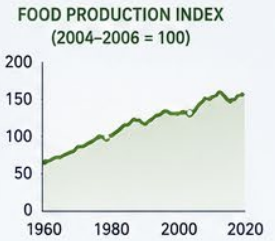
WATER DEMAND

Global water withdrawals have increased by ~1,000% since 1900 and will continue to rise.



FOOD DEMAND

Food production needs to increase by ~60% by 2050 to meet the needs of a growing population and changing diets.



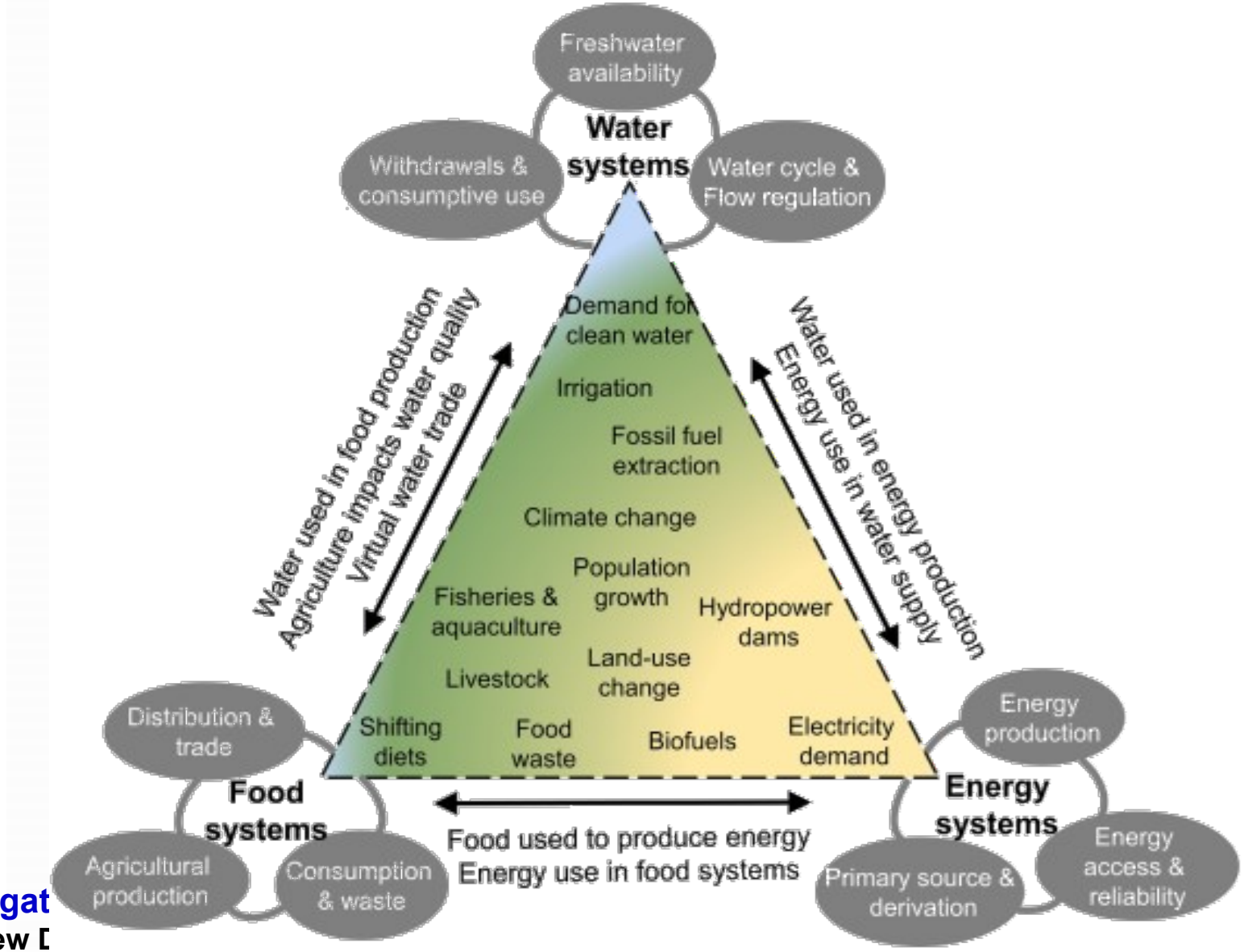
ENERGY DEMAND

Energy demand is projected to increase by ~50% by 2050, with significant water implications.

GLOBAL CHANGE IS ALREADY A REALITY.

It is reshaping water demand and putting increasing pressure on water resources and water security.

ICID•CIID



d'Odorico et al, 2018 Rev. of Geophysics

The key question is:
how can we manage this change to protect water security?

Society is not asking only for better explanations.

Society is asking for usable knowledge, operational tools, adaptation pathways, risk reduction strategies, and practical solutions.

This is the reason why IAHS has adopted the motto **Science for Solutions**.

Four major scientific priorities for water security:

1) **Better understanding of change**. Not only climate change, but also hydrological change and global change. We need to understand how human transformations are modifying catchment behaviour and water availability.

2) **Better prediction under changing conditions**. Many of our models are still based on the assumption that the past is a reliable guide to the future. But in changing basins and changing societies, this assumption is increasingly fragile.

3) **Solutions that are adapted to local contexts**. There is no universal solution for water security. What works in one basin, one irrigation system, or one institutional context may not work elsewhere. This is why local knowledge and engagement are essential.

4) **Stronger links between science, policy, and practice.** The gap between scientific knowledge and practical implementation remains too large. In many cases, the problem is not that knowledge does not exist. The problem is that knowledge does not reach the places where decisions are made, or it does not arrive in a form that can be used.

This is where scientific and professional associations have a crucial role.
Associations such as IAHS and ICID are not only networks of experts. They are bridges.

2023 HELPING 2032

INTER-ASSOCIATION PANEL ON WATER SCIENCE FOR POLICY

unesco

2nd Indo-Global Irrigation Summit

24-25 June 2026, New Delhi, India

ICID•CIID

Thank You