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Water and Climate Change: From Global Dynamics to Local Challenges

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Coping with the risks of climate change

Analyzing impacts of climate change risks on households, firms, and regions, and developing evidence-based insights and policy responses

For example:

Local/national level: Adaptation to climate change

Global/regional level: Impacts of trade, technological development and climate policies on CC risks ...

Investing in the transition to a climate-resilient economy

Analyzing investment behavior, financial regulation and climate policy shape investment in the low-carbon transition

For example:

Impact of reporting requirements on firms

Investment into power generation of different economic actors

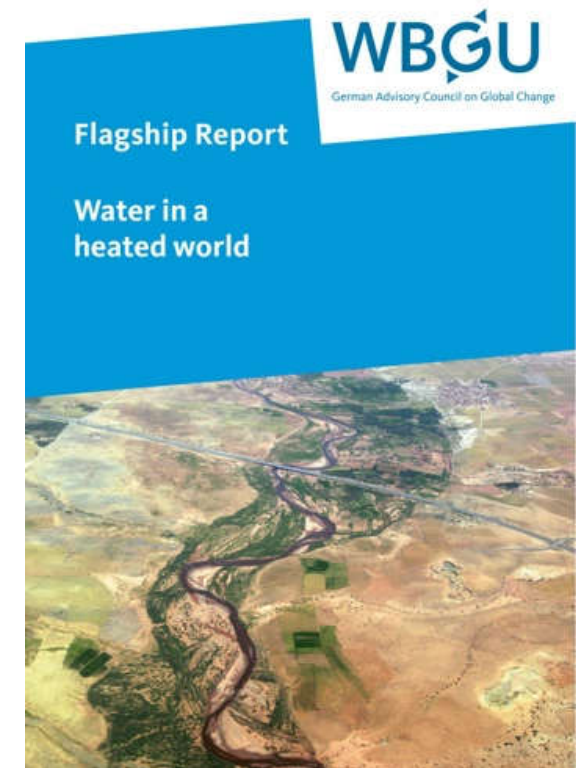
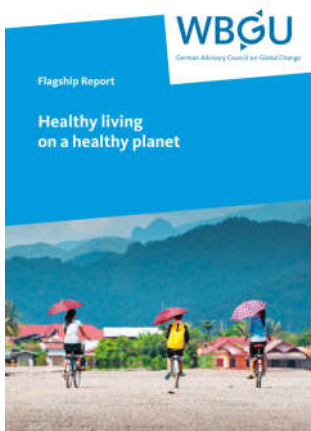
WBGU (Advisory Council Global Change)

Strategic long-term advice to the German Government

9 interdisciplinary members (+ Secretariat)

Appointed for 4 years

Latest Flagship report: Water in a heated world



WBGU

Global challenges and a climate-resilient water management

Regional water crises with a planetary dimension

Overexploitation of groundwater and climate change in the Central Valley (USA)



25%
of fruit and nut production in the USA originates from the Central Valley

10%
water losses are expected in the region by 2030

75%
of the wells have suffered a 1.5 metre lowering of the groundwater level 2018–2023

Central Valley

Increase in droughts and flash floods in the MENA region



6%
of the world's population live in the MENA region

only 1%
of global freshwater resources is available there

24%
decline in per-capita renewable freshwater availability between 2007 and 2018

MENA-Region

Hindukusch-Karakorum-Himalaya



2 billion
people access their water from the region's river basins

200 million
people are already suffering from increased water stress

20% to 65%
glacier loss depending on climate scenario

Water scarcity in cities



> 933 million
urban dwellers today are affected by water shortages

30–50%
of the world's population will be affected by 2050

approx. 80%
growth in urban demand for water expected by 2050

São Paulo

Subsahara-Afrika



Chennai

Water pollution in Sub-Saharan Africa



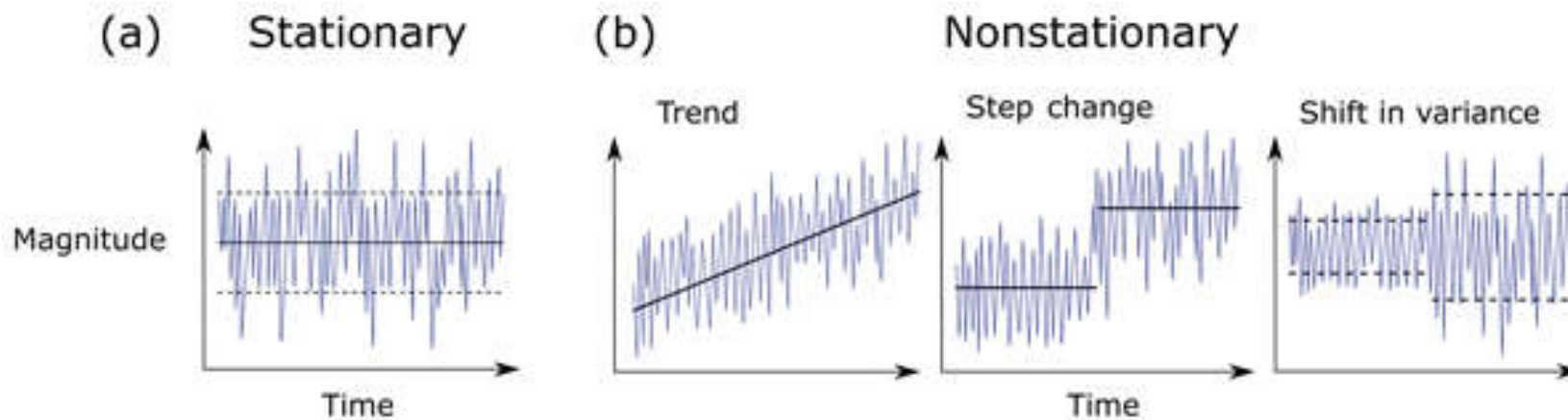
2.7 billion
people are today affected by water pollution

4.2 billion
is their expected number by 2100

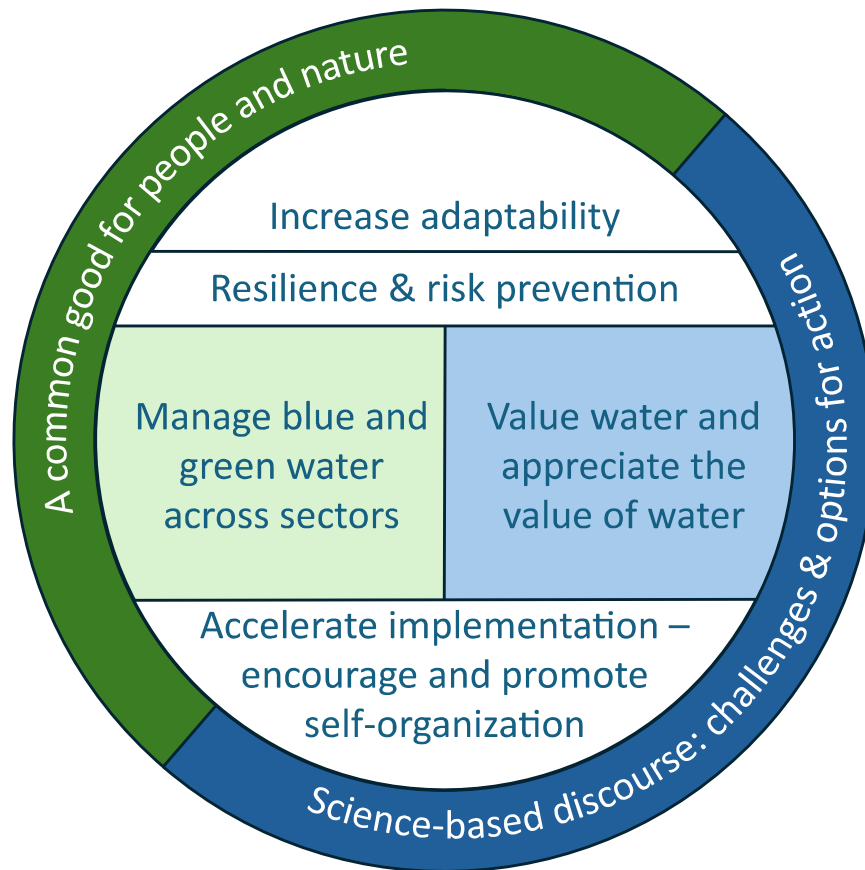
38%
of the world's population affected by organic water pollution will live in Sub-Saharan Africa in 2100

23.12.2025

New quality of risks and uncertainties



Climate-resilient and sustainable water management



Applied to...

- Ecosystems
- Agriculture
- Cities

Climate-resilient water management

Four criteria for water management in the development, selection, and implementation of measures

Water-related **effectiveness today and in the future**

Feasibility: technologies, finances, institutions, acceptance, etc.

Multiple benefits: Climate, biodiversity, health, social issues, economy

Avoiding maladaptation and unintended consequences



Source: www.bochier.de

Financing climate-resilient water management

Estimated **investment required** by 2030 (2050): US\$6,700 (22,600) billion

Global average **cost-benefit** ratio: 3.4 and 6.8 for drinking water supply in urban and rural areas, respectively

Making water-related **risks transparent** in order to mobilize (private) investment

Make the water sector more attractive through **more stable sources of income** (water pricing)

Increasing the cost burden on polluters and users (pesticide taxation)

Promote alternative financing approaches (blended finance, water funds, etc.)

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Challenges of local (flood) adaptation

Challenges for local adaptation in a decentralized system

- Adaptation often small-scale
 - Tailored to regional and local circumstances
 - Existing legal divisions of responsibility in the multi-level system
- Content challenge: assessment of climate risks and adaptation measures
 - Finance challenge: high financing requirements
 - Adaptation vs. state aid: moral hazard problem

Possible financing instruments

Financing preventive climate adaptation

- New funding program design
- New joint task for climate adaptation
- Reform of financial relations between the federal government, states, and municipalities
- (Local) climate adaptation levies
- Local climate adaptation funds

Financing climate damage / damage protection

- Climate-resilient debt clauses
- Catastrophe bonds
- Resilience bonds
- Parametric insurance
- Mandatory insurance (natural hazards)
- The state as (re)insurer

Flooding and insurance in Germany

July 2021

Extremely heavy rainfall led to local flash floods, extreme flooding, and landslides

Roughly **85,000 people and 10,000 firms** affected

Damages amounted to more than **€40 billion** (€11.5 billion of which were insured)

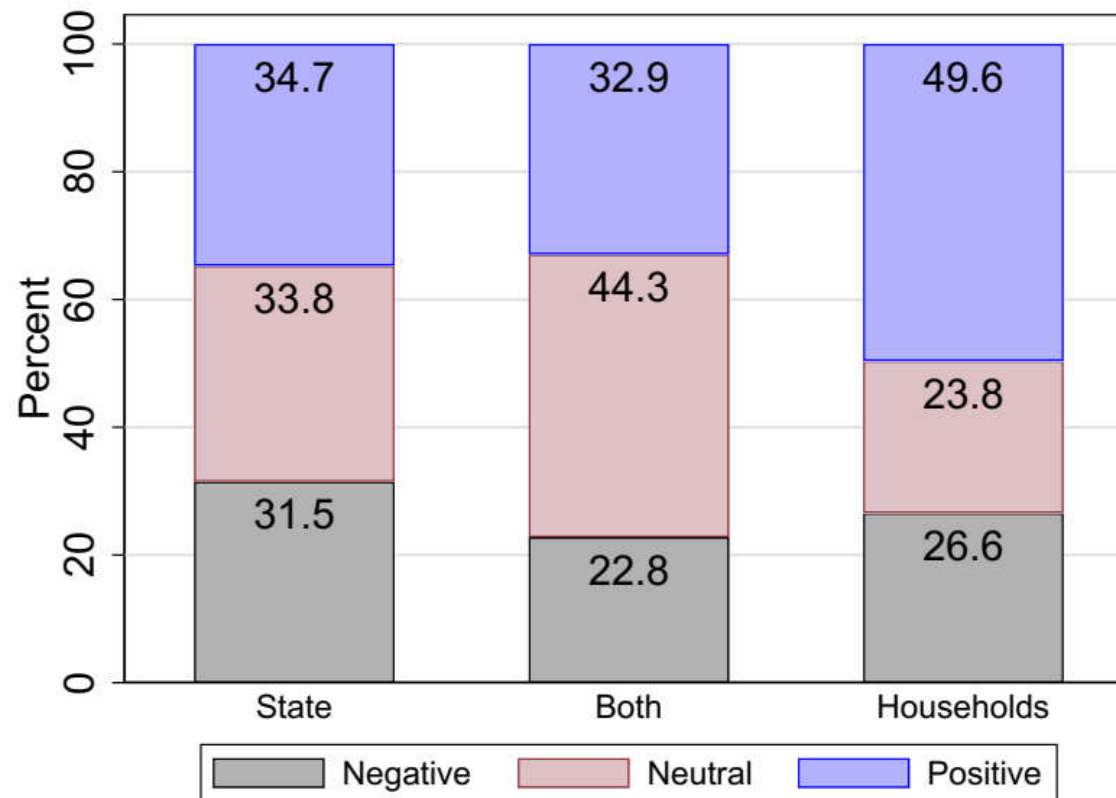
Emergency fund of the German government of €30 billion (about 1% of GDP)

Insurance coverage

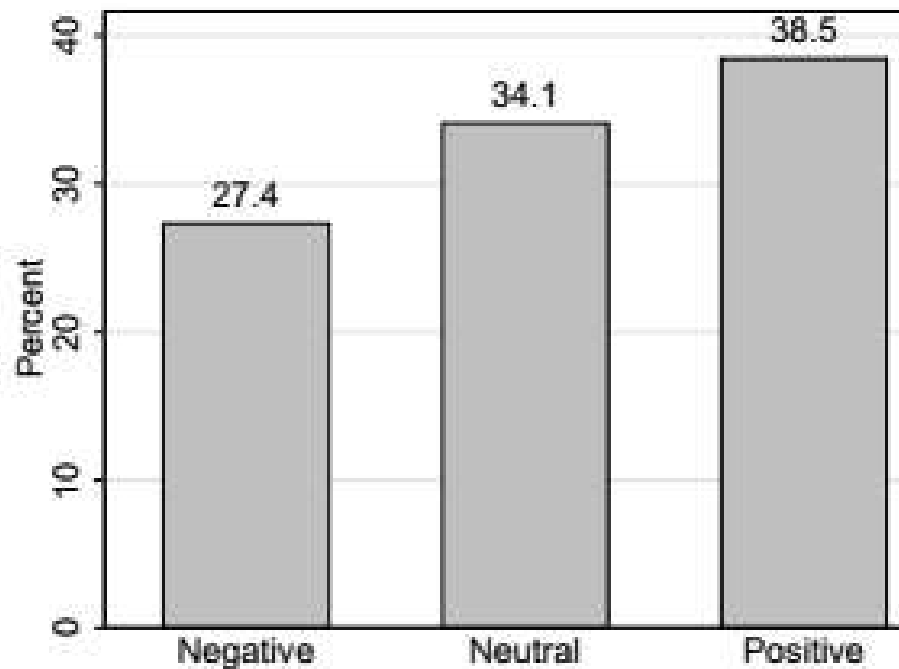
Increasing over time: 39% of all residential properties insured against natural hazards in 2016 (50% in 2021 and **54% in 2024**)

Penetration rates: vary across German states (**between 28% and 94%**)

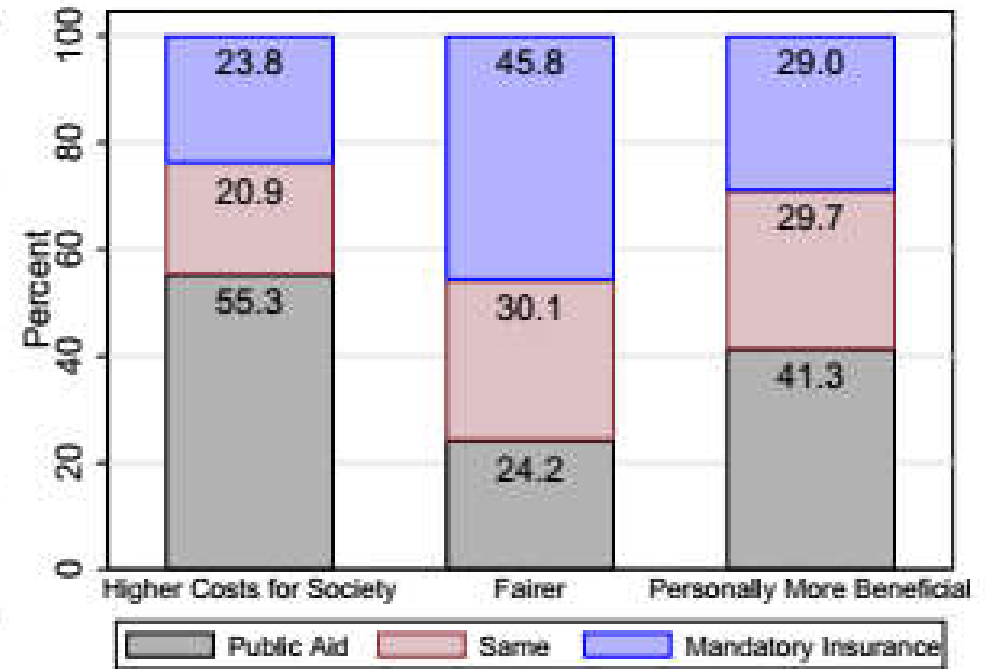
Who should be responsible for dealing with the consequences of flood events?



Views on mandatory insurance and state aid



(a) Assessment of mandatory insurance



(b) View about tradeoffs between public aid and mandatory insurance

Support for Mandatory Insurance by Insurance Status

