Sustainable Development Goals from a Water Perspective: Progress and Challenges

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Water -core of sustainable development

Source: Vorosmarty et al.Ecohydrology & Hydrobiology. 2018 Dec 1;18(4):317-33

Consistent access to clean water and impact buffering from costly water-related extremes are key to reducing poverty worldwide.

Agriculture depends on sustainable and efficient water use to support a growing human population.

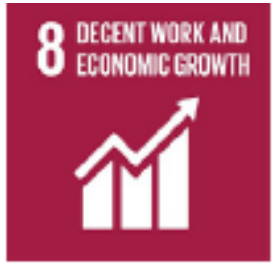
Well-functioning water system support high levels of water quality, improving various aspects of quality of life, such as reduced exposure to water-borne diseases in addition to cultural and spiritual well-being.

Educating a next generation of water stewards focuses the education system on twenty-first century problem solutions.

Improved water services can reduce gender inequality in household water collection and management, which in poor economies overwhelmingly fall to women and girls.

Healthy water system have an essential role in achieving human and environmental water security

Efficient water use in both renewable and nonrenewable energy systems reduces costs and improves the resilience of energy systems to climate change and its extremes.



Healthy water systems provide resource reliability supporting long-term economic growth; new investment in green and traditional engineering creates employment.

Water -Core of sustainable development

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Innovation in water technology can lead to advances in efficiency and economic development.

Rectifying imbalances in water services and sanitation, now unequally distributed among rich and poor countries of the world, is a major step toward equality generally.

Water resources in cities can be redesigned to improve residents' health and well-being.

Reducing water needs in production and consumption reduces threats to human water security and biodiversity.

Water management and efficient use play a fundamental role worldwide in climate mitigation and adaptation.

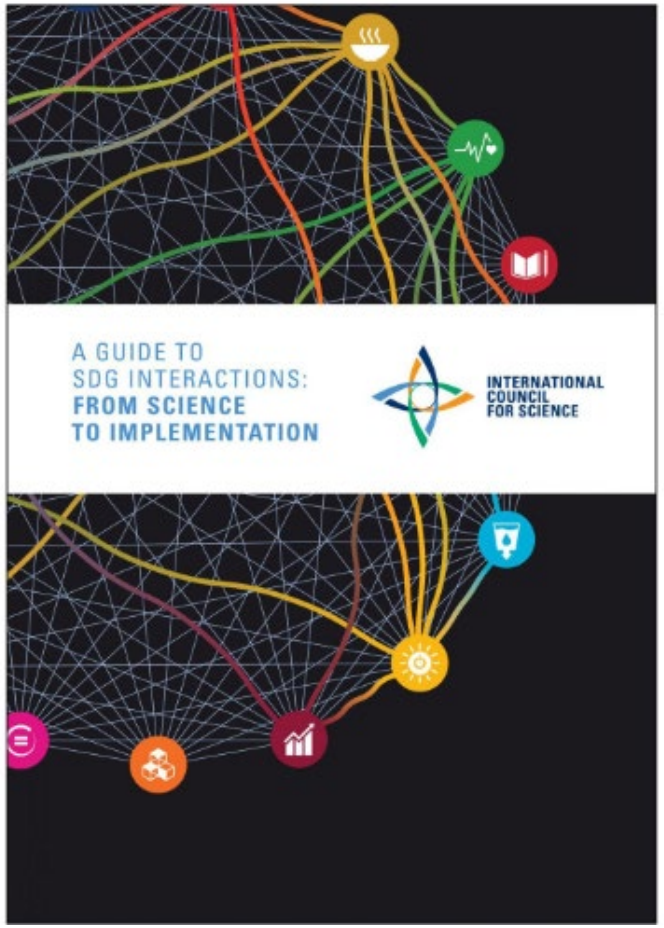
Improving water quality will reduce ocean pollution and sustain many important fisheries that have life cycles dependent on both freshwater and marine ecosystems.

Water demand from urban users and businesses can stimulate upstream water source protection through forest conservation and restoration measures.

Well-managed watersheds can reduce the impact of asymmetries in water endowments within and across national borders.

Role of Science

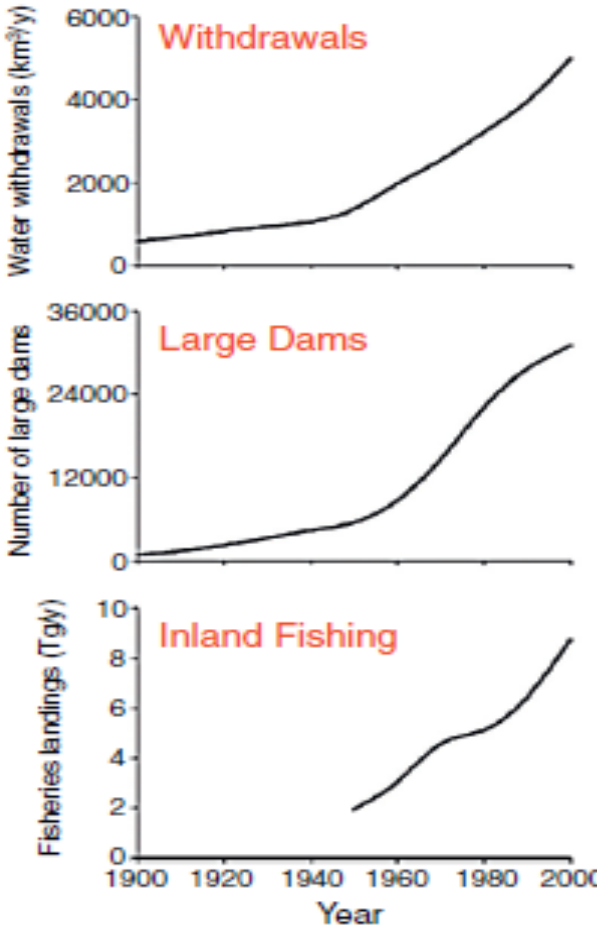
The SDGs recognize the need to mobilize science at multiple levels and across disciplines to gather or create the necessary knowledge and thus lay the foundations for practices, innovations and technologies needed to address global challenges today and in the future



How science can help in assessing SDG implementation?

How science can help in implementing SDG?

Local Actions does not guarantee Global Sustainability



Human Uses and Pressures on Global Water is increasing

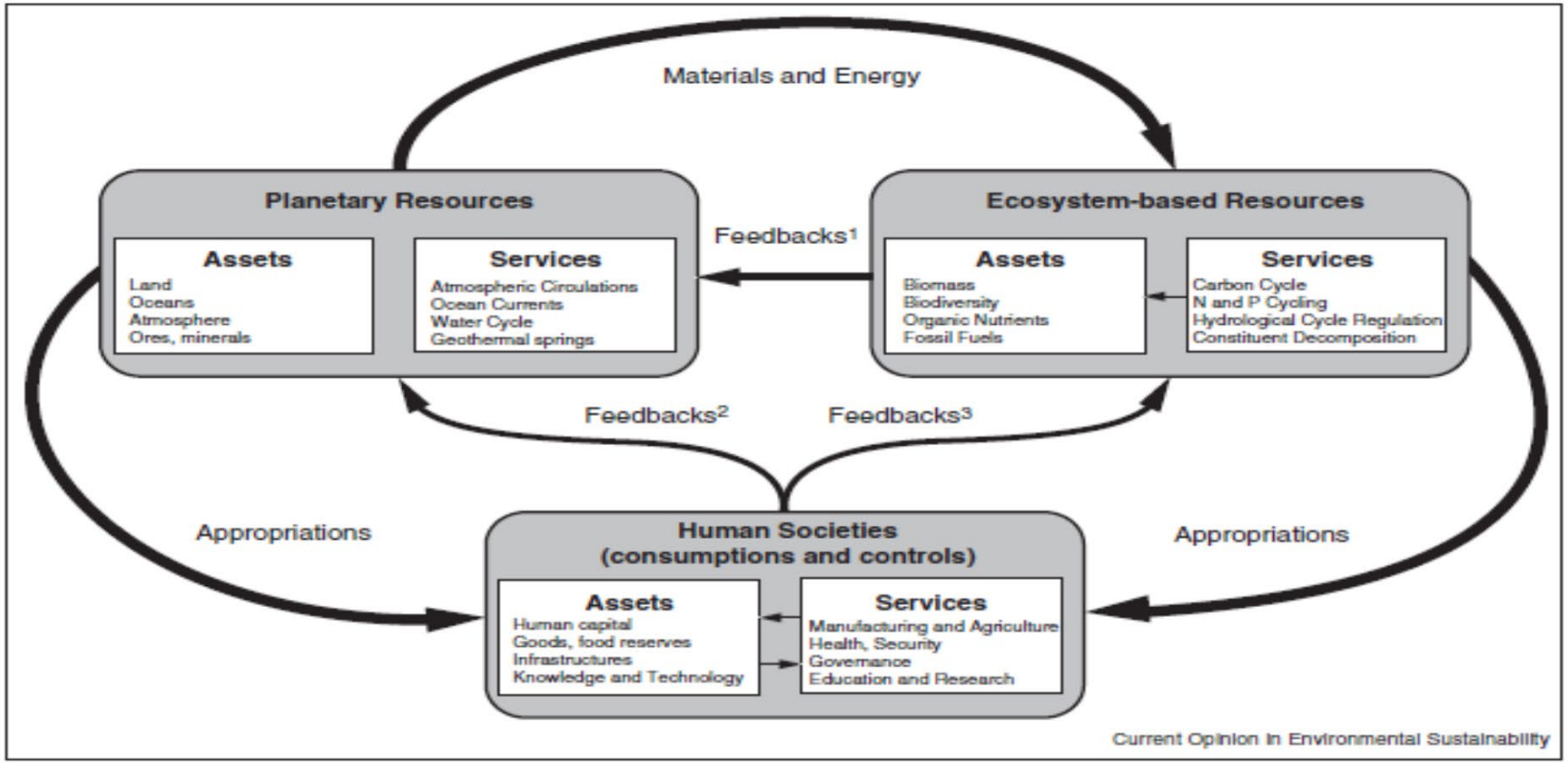
Vorosmarty et al Current Opinion in Environmental Sustainability 5, no. 6 (2013)

Bhaduri et al. Frontiers in Environmental Science 4 (2016): 64.

Superimposing the different elements of global change, the question thus arises of how sustainable human development can be ensured while safeguarding earth's vital life-support system on which the welfare of current and future generation depends?

Balanced Triangle of planetary and ecosystem-based resources and human societies

There is a risk of overlooking and neglecting global dynamics with large and possibly irreversible impacts on humans and nature if the focus of SDG implementation is only on local processes.



Can we guarantee that in SDG implementation the respective boundaries for planetary, ecosystem and societal services will not be violated?

"what can be done," "what can't be done," and **"what are the costs of inaction"** to implement water-related goals including social implications.

At the global level, appropriate risk metrics are needed to assess whether humans are in a safe and sustainable operating space of the global water system and still can meet their essential needs

Bhaduri et al. Frontiers in Environmental Science 4 (2016): 64.

Bogardi et al Current Opinion in Environmental Sustainability 4, no. 1 (2012): 35-43.

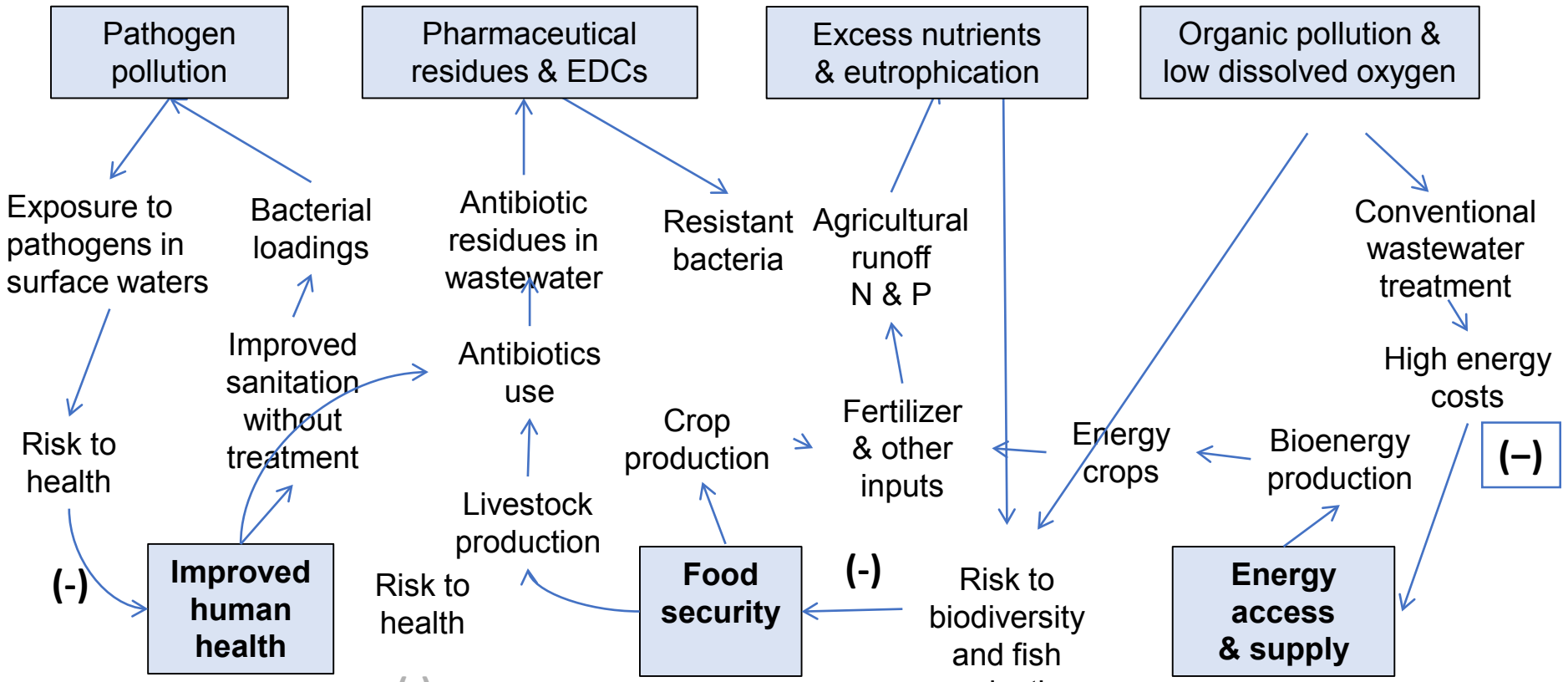
SDG implementation Challenge: Visible vs Less Visible Actions

- Accelerated pace at which SDG can be met
- For instance, the ambitious plans to reduce the number of people exposed to unclean drinking water while increasing the access to sanitation.
- “Visible” side of the water, such as installing taps and toilets, building reservoirs, drilling boreholes, and treating and reusing/recycling wastewater
- Some actions are much “less visible”—and far more challenging and complex. Yet, they underpin the more obvious elements of water management.

For instance, number people are exposed to pathogens through direct contact with polluted rivers, lakes and other surface water.

Can we capture the less visible side in SDG Implementation?

Assessing linkages -Water Quality



Source: Alcamo Current opinion in environmental sustainability 36 (2019): 126-140.

Rigorously Evaluate Linkages–

- Tools: Indicator system, systems diagrams, systems dynamics models, coupled models, integrated assessment models, scenario analysis, matrix analysis, … Identify critical linkages leading to key trade-offs
- Assess scope and intensity of key trade-offs – identify priorities , Identify strategies for transforming trade-offs to synergies
- Evaluate costs and policy options for achieving these synergies

SDG-related Challenges

1. Indicates what to achieve and when, but not how.
2. Indicators are mainly based on in-situ measurements or national statistics.
   -> Problem in countries with lack of data
3. Monitoring is designed for current and past times.
   -> “trial and error” instead of projecting the effectivity of different implementation plans
4. Framework does not account for trade-offs, linkage or synergies between targets.
5. Risk that countries report data or advances that cannot be corroborated.

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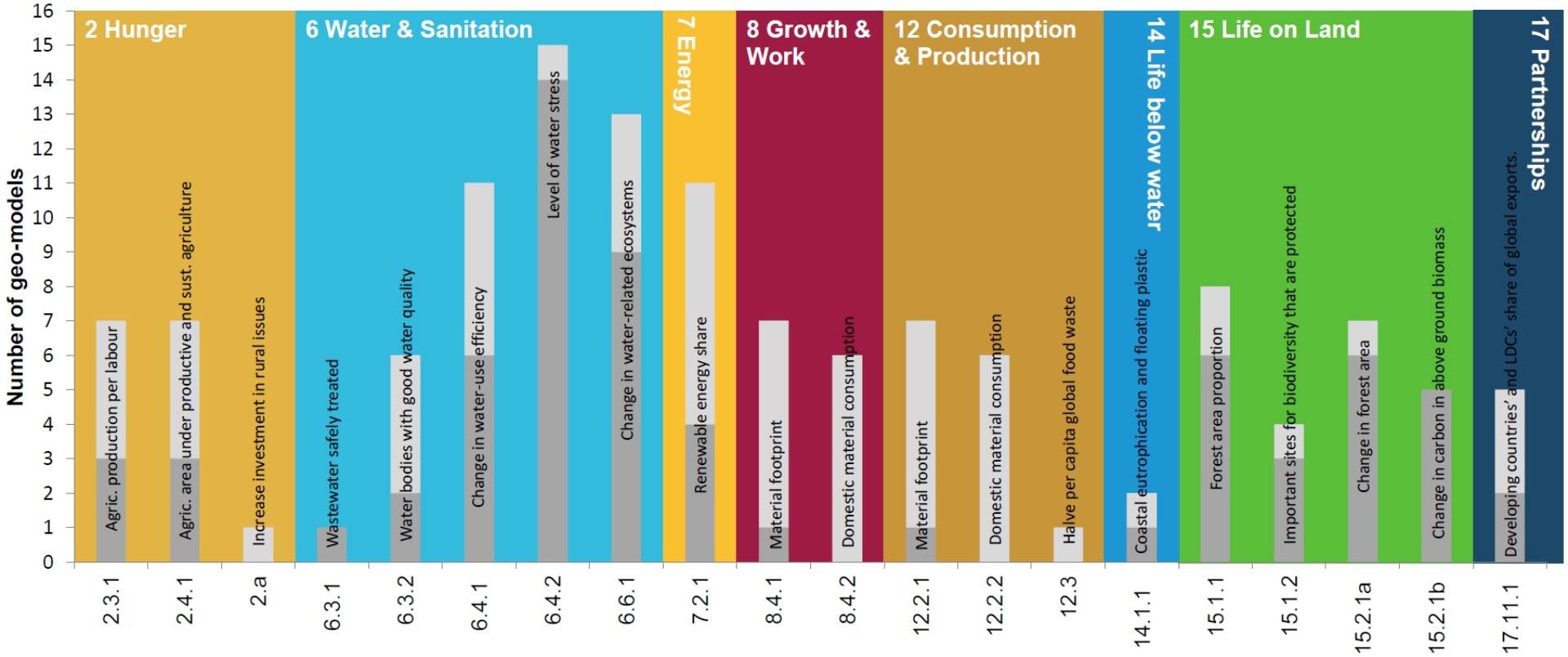
Data science and models can help countries to cope with these challenges

Geo-models can simulate more than 20 indicators of 8 different SDGs



„Geo-models“: hydrology, vegetation, land use, land surface, agent-based models, integrated assessment models. Fader ert al

Source: Fader et al. Frontiers in Environmental Science, 6(NREL/JA-6A50-72168)

Number of geo-models that can simulate the *official* indicators

Number of geo-models that can simulate *alternative* SDG indicators

Trade-offs and synergies between targets

- Quantitative approach to estimate potential trade-offs between targets of SDG 2 (hunger), 6 (water) and 7 (energy)
- Based on a business-as-usual development and accounting for:
  - competition for natural resources,
  - synergies in infrastructure needs and
  - consequences (benefits and risks) for regulating and provisioning ecosystem services.
- Flexible approach:
  - Can be performed for regions, countries or ecosystems,
  - Can be adapted to other scenarios,
  - Can be applied for analyses of targets from other SDGs.

Source: Fader et al. Frontiers in Environmental Science, *6*(NREL/JA-6A50-72168)

Trade-offs and synergies between targets

	6,1	6,2	6,3	6,4	6,5	6,6	6.a	6.b	2,1	2,2	2,3	2,4	2,5	2.a	2.b	2.c	7,1	7,2	7,3	7.a	7.b
6,1		1	2	2	3	1	1	2	0	0	0	1	3	3	-1	1	2	2	2	3	2
6,2	1		2	2	3	1	1	3	0	1	1	1	3	3	-1	1	2	2	2	3	2
6,3	2	2		2	3	2	1	3	2	2	2	2	3	3	0	1	2	3	2	3	2
6,4	2	2	2		3	2	1	3	2	2	2	2	3	3	0	1	2	3	2	3	2
6,5	3	3	3	3		2	2	3	3	3	3	3	3	3	0	1	3	3	2	3	3
6,6	1	1	2	2	2		2	1	-1	-1	-1	0	2	2	-1	1	2	1	2	2	1
6.a	1	1	1	1	2	2		2	0	0	0	1	2	2	-1	1	1	2	2	2	1
6.b	2	3	3	3	3	1	2		1	2	2	2	3	-1	3	1	3	2	2	3	3
2,1	0	0	2	2	3	-1	0	1		-1	-1	0	3	1	-1	-1	1	1	1	3	-1
2,2	0	1	2	2	3	-1	0	2	-1		-1	0	3	1	-1	-1	1	1	1	3	-1
2,3	0	1	2	2	3	-1	0	2	-1	-1		0	3	1	-1	-1	1	1	1	3	-1
2,4	1	1	2	2	3	0	1	2	0	0	0		3	3	0	1	2	2	2	3	1
2,5	3	3	3	3	3	2	2	3	3	3	3	3		3	0	1	3	3	2	3	3
2.a	3	3	3	3	3	2	2	-1	1	1	1	3	3		-1	0	3	3	2	3	2
2.b	-1	-1	0	0	0	-1	-1	3	-1	-1	-1	0	0	-1		-1	-1	-1	-1	0	-1
2.c	1	1	1	1	1	1	1	1	-1	-1	-1	1	1	0	-1		1	1	1	1	0
7,1	2	2	2	2	3	2	1	3	1	1	1	2	3	3	-1	1					
7,2	2	2	3	3	3	1	2	2	1	1	1	2	3	3	-1	1	3				
7,3	2	2	2	2	2	2	2	2	1	1	1	2	2	2	-1	1	2				
7.a	3	3	3	3	3	2	2	3	3	3	3	3	3	3	0	1	3				
7.b	2	2	2	2	3	1	1	3	-1	-1	-1	1	3	2	-1	0	2				

4 = indivisible	(-4) = cancelling
3 = supporting	(-3) = restricting
2 = reinforcing	(-2) = counteracting
1 = enabling	(-1) = constraining
0 = consistent	

Source: Fader et al. Frontiers in Environmental Science, *6*(NREL/JA-6A50-72168)

Trade-offs and synergies between targets

- More synergies than trade-offs (165 vs. 26)
- Good design (median = +2 & no strong trade-offs)
- 59 “supporting” interactions vs. only “constraining” trade-offs (-1)
- SDG 6 (water)
  - **124 synergies vs. 8 trade-offs**
  - has the most supportive and reinforcing influence
- SDG 2 (end hunger)
  - 26 trade-offs vs. 106 synergies
- Targets 7.a (cooperation for clean energy), 2.5 (genetic diversity) and 6.5 (IWRM) -> highest averages of interactions (~+2.6)

	6,1	6,2	6,3	6,4	6,5	6,6	6.a	6.b	2,1	2,2	2,3	2,4	2,5	2.a	2.b	2.c	7,1	7,2	7,3	7.a	7.b
7,3	2	2	2	2	2	2	2	2	1	1	1	2	2	2	-1	1	2	2	2	3	2
7.a	3	3	3	3	3	2	2	3	3	3	3	3	3	3	0	1	3	2	3	3	2
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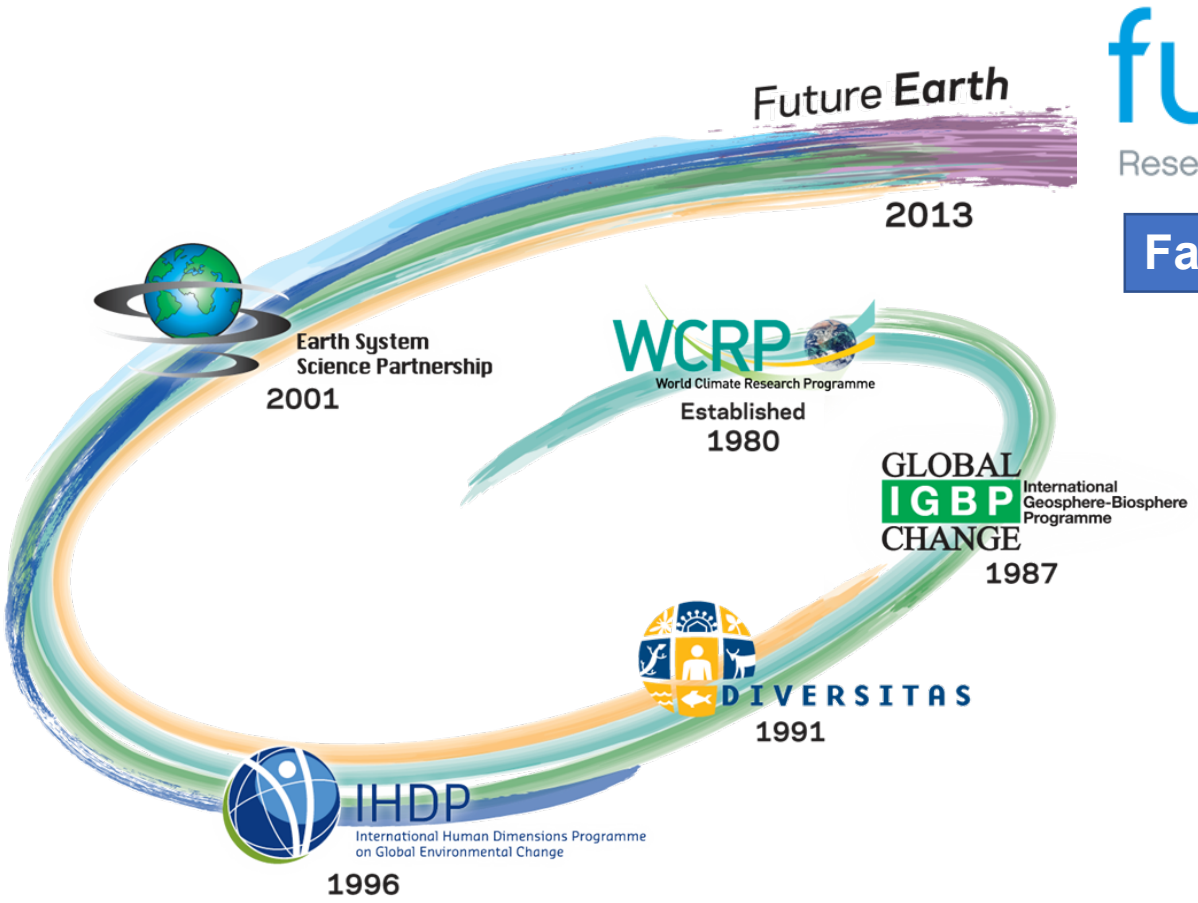
Research, innovation, and collaboration can transform the world toward sustainability



futureearth

Research. Innovation. Sustainability.

Facilitate and amplify research

Convene and mobilise networks

Spark and promote innovation

Turn knowledge into action

Water Future Objective:

Support the implementation of freshwater water related sustainable development through the integrating research, stimulating innovation, and building capacity .

waterfuture
Sustainable Water Future Programme

Water Future Vision:

Water Future, through its partnerships with a large number of researchers and stakeholders, work together to harvest and synthesize authoritative sound and a scientific knowledge base to achieve the Sustainable Development priorities associated with water.

KEY FACTS

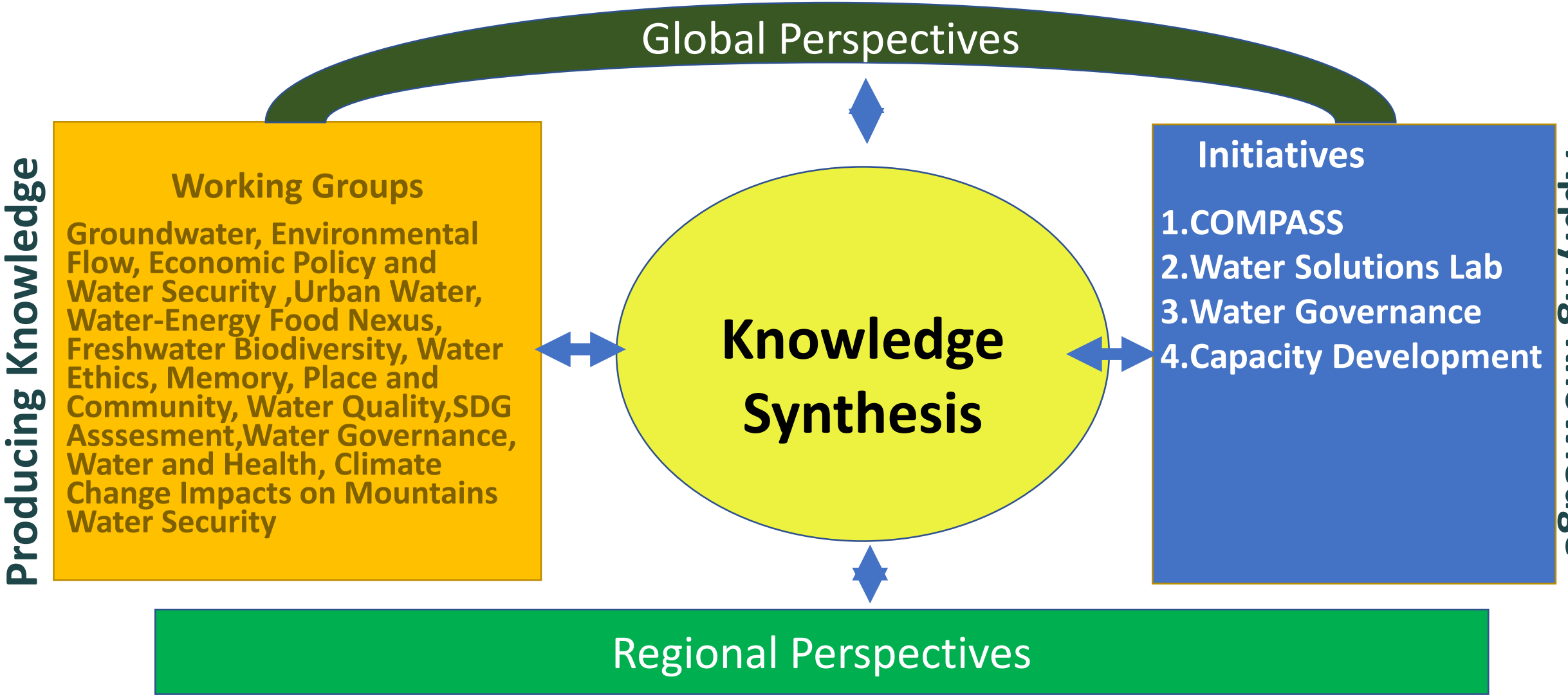
13 International Working Groups

202 Organisations

550 Core Researchers

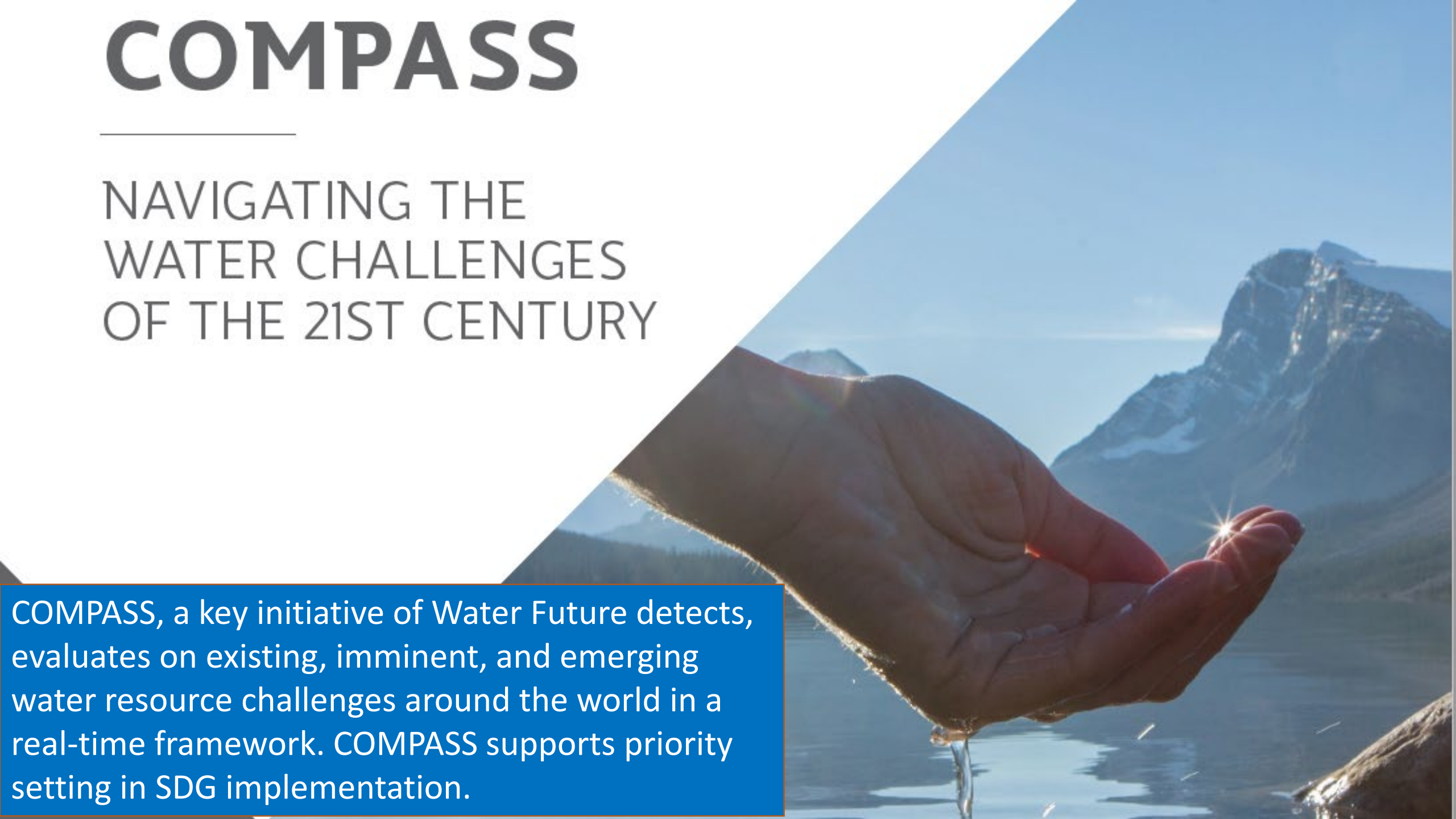
5650 Network of Scientists, Policy Makers

A Scientific, Policy Relevant, and Solution Oriented Global Water Research Programme for Sustainable Development


Global Perspectives
Producing Knowledge
Working Groups
Groundwater, Environmental Flow, Economic Policy and Water Security ,Urban Water, Water-Energy Food Nexus, Freshwater Biodiversity, Water Ethics, Memory, Place and Community, Water Quality,SDG Asssesment,Water Governance, Water and Health, Climate Change Impacts on Mountains Water Security
Knowledge Synthesis
Initiatives
1.COMPASS
2.Water Solutions Lab
3.Water Governance
4.Capacity Development
Applying Knowledge
Regional Perspectives

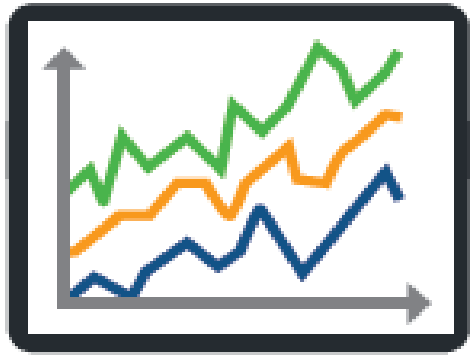
COMPASS

NAVIGATING THE WATER CHALLENGES OF THE 21ST CENTURY



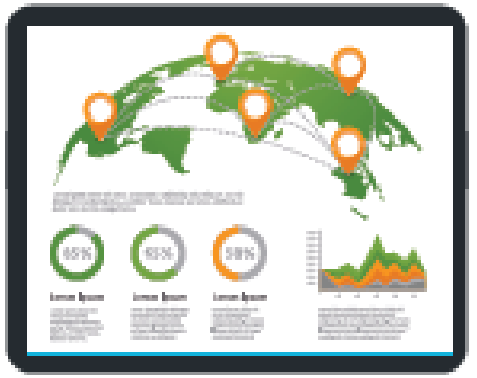
COMPASS, a key initiative of Water Future detects, evaluates on existing, imminent, and emerging water resource challenges around the world in a real-time framework. COMPASS supports priority setting in SDG implementation.

COMPASS Product Suite



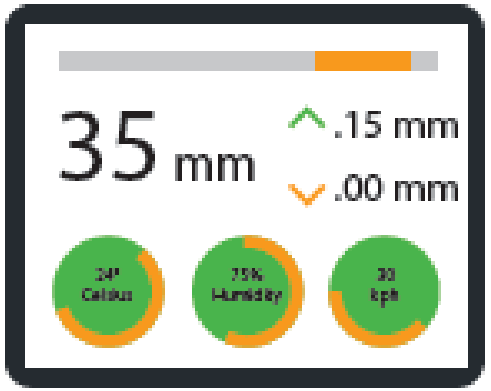
Water State Index

Medium Term Water Trend

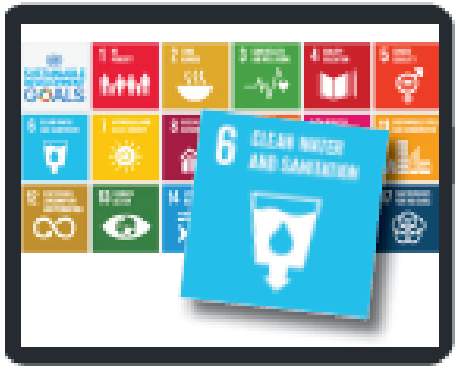


Business Intelligence Report

Annual State of Resource Report Cards



Six Months Water Outlook



SDG Report Cards

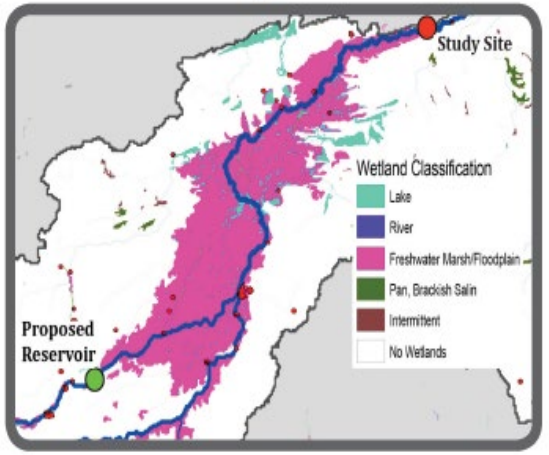
waterfuture
Sustainable Water Future Programme

VALUE of COMPASS

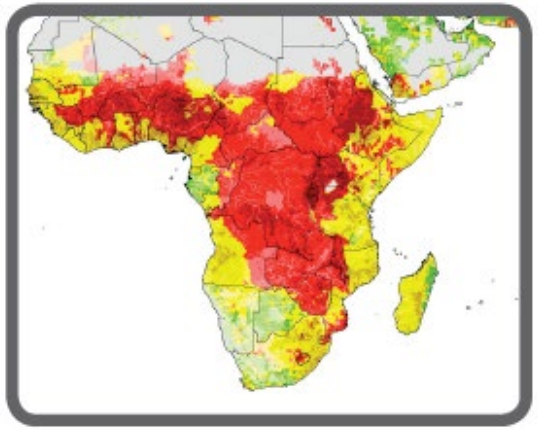
waterfuture
Sustainable Water Future Programme

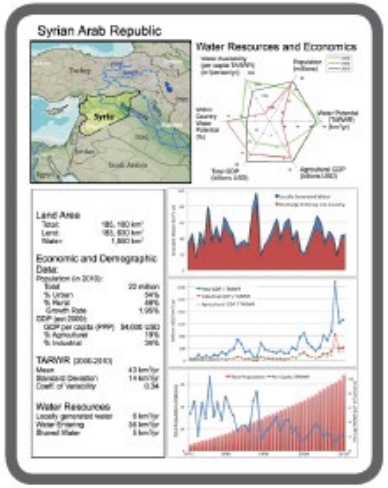
- Forecasts emerging water stress, water pollution problem and identifies risks hotspots.
- Diagnose the causes of the water scarcity and pollution problems of a region in real time whether it is physical or governance related.
- Predict the role of Green Infrastructure spatially at a much finer scale that can reduce the threat to human water security.
- Track in SDG Progress and Implementation.

Natural Capital Trade-Off Analysis



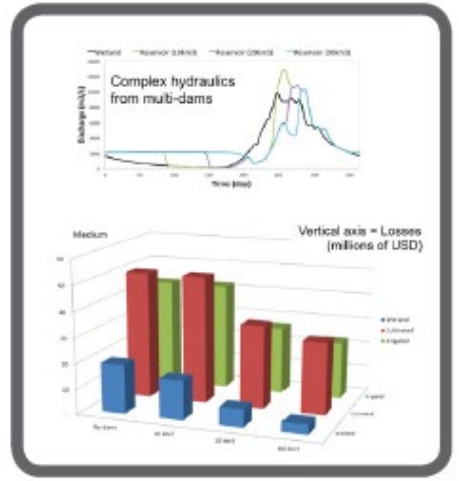
Diagnosing Emerging Patterns of Water Stress



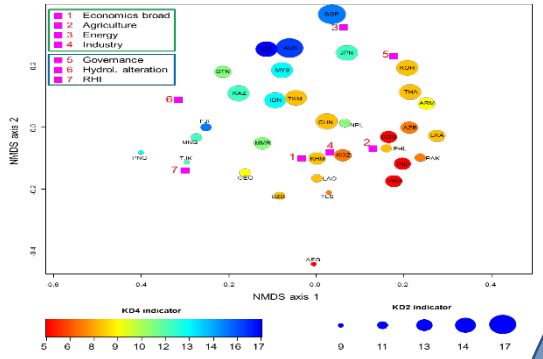


National Water Report Cards

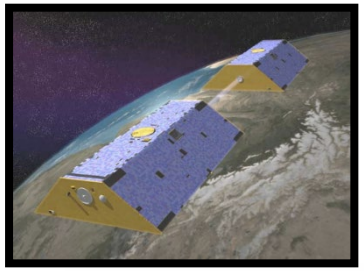
Asset Loss Assessment



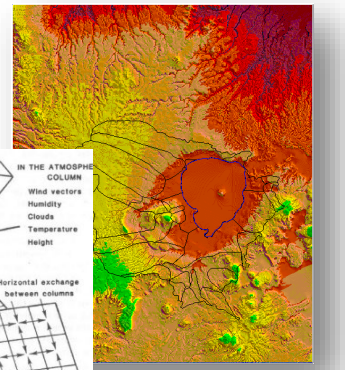
Geo- referenced Socio Economic Data

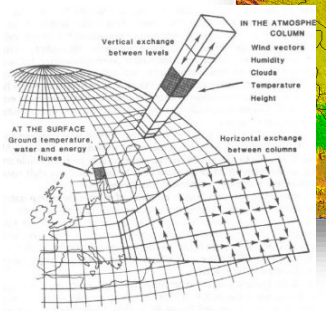


Satellite Data



Global Climate and Hydro Models





Knowledge Synthesis and Assessment

Catchment Model

In-Situ Observations

SDG Report Card

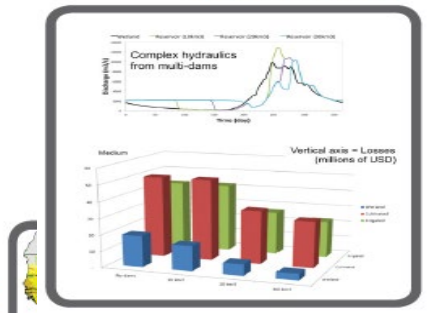
Water Future Index

Business Intelligence Reports

Six-Month Water Outlook

Inform

Asset Loss Assessment



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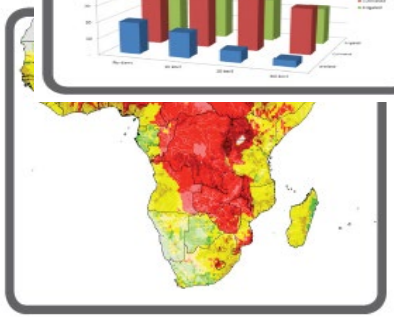
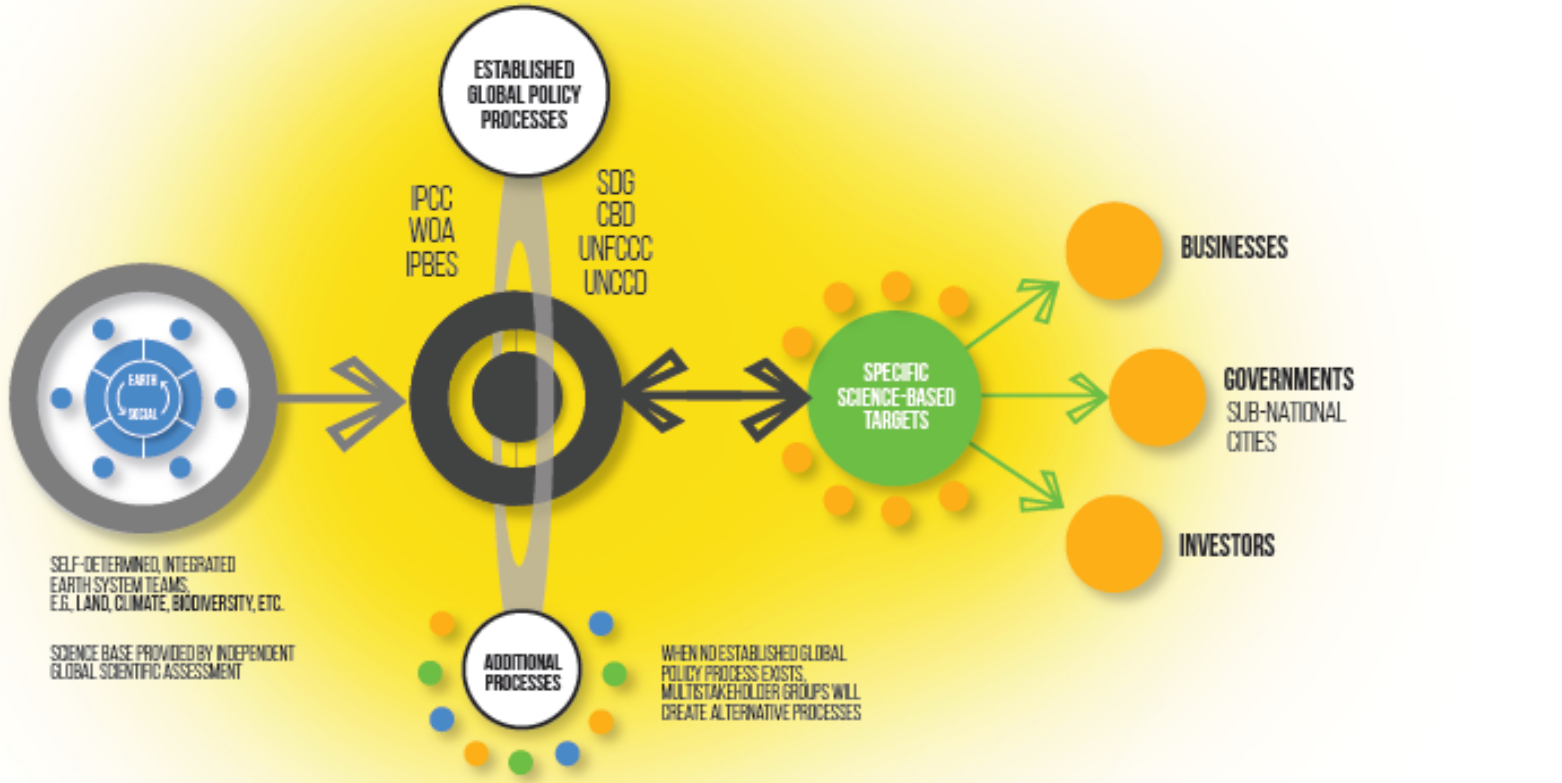


EARTH TARGETS PLATFORM



EARTH COMMISSION

IDENTIFY METRICS, ASSESS RISK, & DEFINE RANGES

OVERALL SCIENCE-BASED TARGETS PROCESS

ASSESS, OPERATIONALIZE, & COORDINATE PROCESS

SCIENCE-BASED TARGETS INITIATIVE

TRANSLATE, DEVELOP METHODS, CREATE DATA ARCHITECTURE, PROMOTE, ENGAGE, & MOBILIZE

- SCIENCE
- CIVIL SOCIETY, THINK TANKS, ACADEMICS, & CONSULTANTS
- STAKEHOLDERS & IMPLEMENTERS
- INTEGRATION & FACILITATION

1. LIFE-SUPPORTING SDGS

Propose a locally and societally relevant target in line with the life-supporting SDGs

Joint framing of research with stakeholders

2. INTERLINKAGES

Embed the target with the full SDG framework to identify barriers and levers to achieving the Earth target

3. LEVERS OF TRANSFORMATION

Identify key other prerequisite targets without which the Earth target will fail

Co-production of knowledge with stakeholders

4. PATHWAYS

Build integrated pathways with the key identified levers of transformation that include cross-scale interactions and SDG interlinkages

5. DEBATING

Bring the outputs to public debate, to explore implications for society and decision makers etc.

Dialogue with stakeholders and co-dissemination of relevant results

Further information

http://www.water-future.org

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Future Earth International Conference: Towards a Sustainable Water Future

Bangalore, India
24th-27th September 2019

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