

Levering anticipatory science diplomacy for the SDG

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Host: Denis Naughten

*Chair WGST
IPU*

What is GESDA



A very young Swiss independent private non-for-profit Foundation

A Swiss-led, Geneva based, Global Public Private Partnership as part of the Swiss Host-State policy

A Private Private Partnership with already 6 philanthropic Foundations

*The Goal given to us by our Founders
(Swiss & Geneva Governments)*

«**To develop an instrument of anticipation and action** by favoring **public-private partnerships of international scope**

➤ and **projects**

- to provide solutions to current and future technological challenges,
- turn them into **opportunities**
- and **widen the circle of beneficiaries of advances in science and technology»**



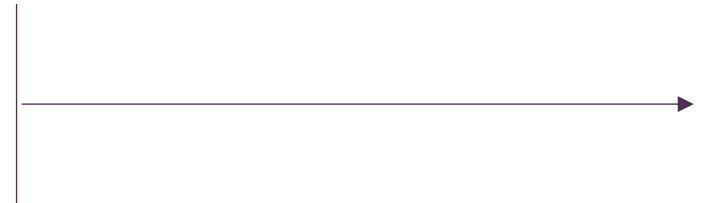
GESDA's methodology



Academic Forum

Academic Forum
Diplomacy Forum

Academic Forum
Diplomacy Forum
Impact Forum
Citizens Forum



Use the future to build the present

GESDA Science Breakthrough Radar 2022

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The GESDA 2022 Science Breakthrough Radar

Geneva Science and Diplomacy Anticipator's
Annual Report on Science Trends at 5, 10 and 25 years

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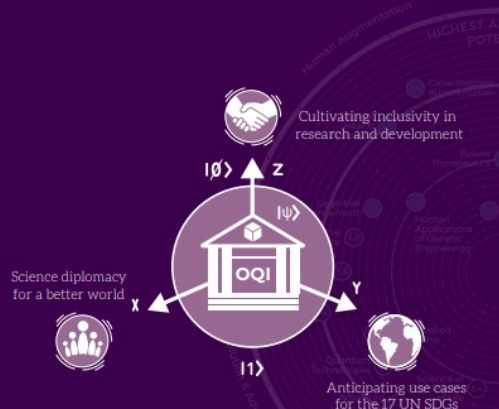
Use the future to build the present

Solution ideas

Solution Idea

Quantum Revolution & Advanced AI

Open Quantum Institute



Providing global and inclusive access to state-of-the-art quantum technology

Pipeline of Solution ideas



The Open Quantum Institute

Deep Dive



Global Science & Diplomacy Curriculum

Deep Dive



The NeuroTech Compass

Learn More



The Decarbonization Accelerator

Learn More


Solution Pathway

Science & Diplomacy

Global Science & Diplomacy Curriculum



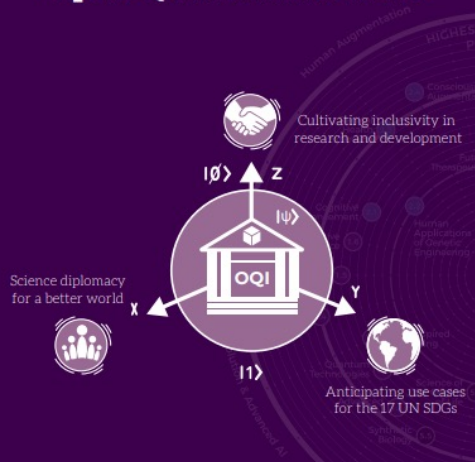
Leveraging future breakthroughs for the SDG



Solution Idea

Quantum Revolution & Advanced AI

Open Quantum Institute



Providing global and inclusive access to state-of-the-art quantum technology



In collaboration with:



Quantum for SDG Use Cases

Quantum computers, which are expected to be fully operational within 10 to 15 years, will have a transformative impact on our society and our planet, by solving currently insoluble problems. With its global community of academics, governments, and industry leaders, GESDA is convinced that action must be taken to anticipate the maturity of this technology and therefore proposed the idea of an "Open Quantum Institute".

One of the core missions of the Open Quantum Institute is to harness quantum computing to tackle the UN's Sustainable Development Goals (SDGs)!. Over the coming years we will be working with researchers, technology developers, UN stakeholders, diplomats, and policymakers from across the globe to come up with new use cases for the technology that can help solve some of the world's most pressing challenges.



Intergovernmental Organizations and NGOs

have been actively helping in defining possible Quantum for SDG use cases

 Global Alliance for Improved Nutrition	 International Committee of the Red Cross	 Periodic Table of Food Initiative
 SDG Lab	 UN Habitat	 UNFCCC
 World Food Program	 World Health Organization	

UN HABITAT

Return on Experience

Graham Alabaster

Head of Geneva Office (OIC)

Office of The Executive Director

UN Habitat



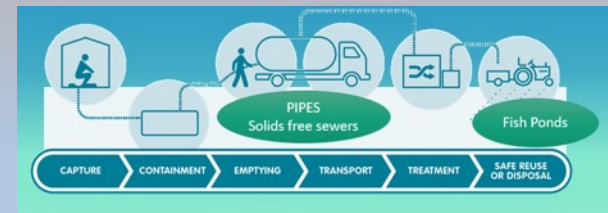
SDG 6 & Managing wastewater pollution as a practical example of Science & diplomacy

Dr Graham Alabaster
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18th February 2022

The Challenges: A Changing World

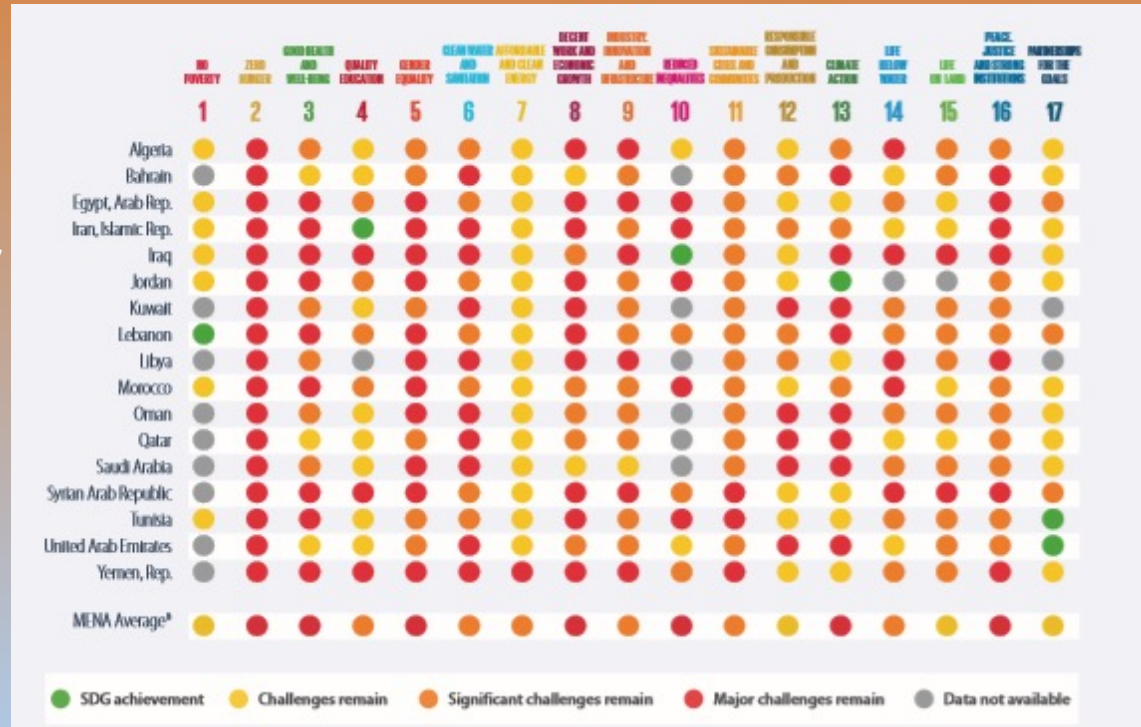
- Better understanding Urbanization and the inequity that results
- Extreme climate events & water stress and building resilient infrastructure and food systems.
- Water scarcity through source limitation or management (poor demand management)
- The lack of attention to sanitation and solid waste management and the contribution of water pollution to reduced source availability





INDICATORS	CUSTODIANS
6.1.1 Proportion of population using safely managed drinking water services	WHO, UNICEF
6.2.1 Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water	WHO, UNICEF
6.3.1 Proportion of domestic and industrial wastewater flows safely treated	WHO, UN-Habitat, UNSD
6.3.2 Proportion of bodies of water with good ambient water quality	UNEP
6.4.1 Change in water-use efficiency over time	FAO
6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	FAO
6.5.1 Degree of integrated water resources management	UNEP
6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation	UNECE, UNESCO
6.6.1 Change in the extent of water-related ecosystems over time	UNEP, Ramsar
6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan	WHO, OECD
6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management	WHO, OECD

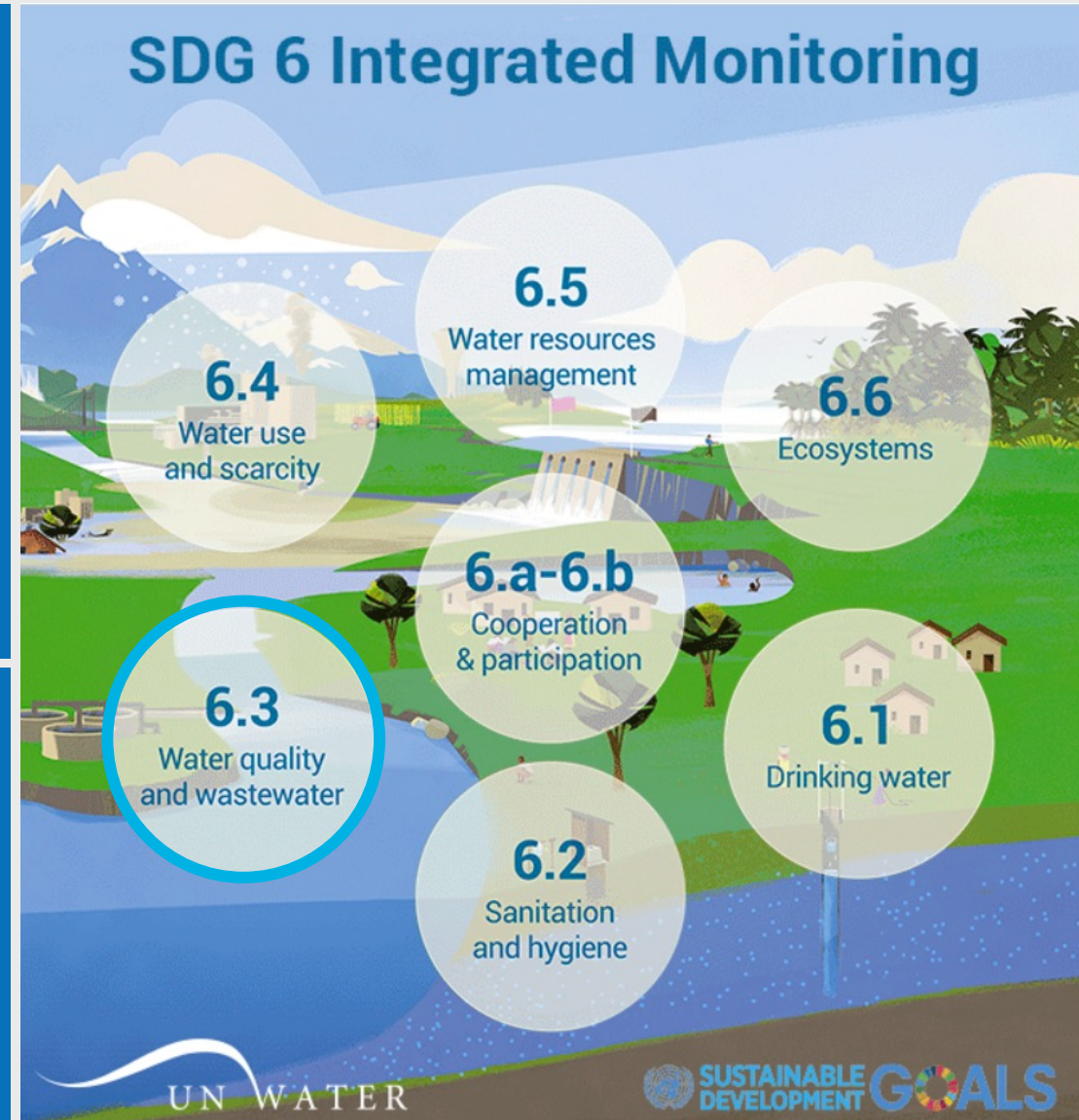
2019 SDG Dashboard for Middle East and North Africa



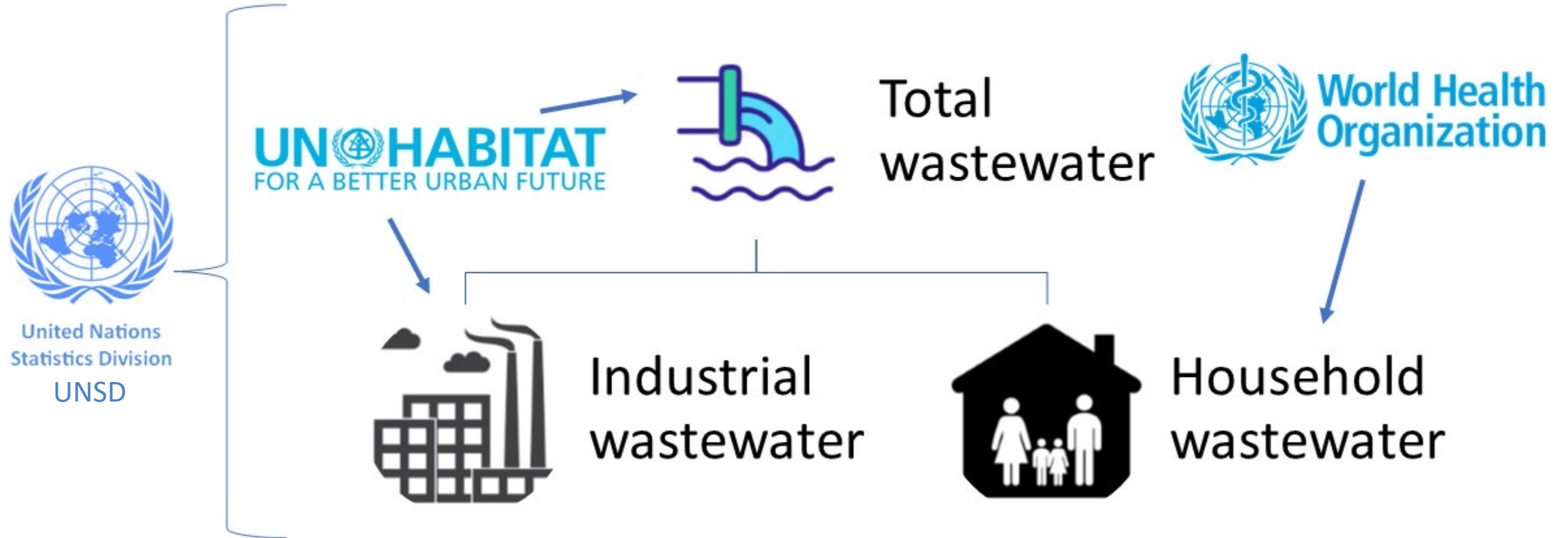
SDG Target 6.3: Indicators 6.3.1 and 6.3.2

“By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially

- Indicator 6.3.1 “Proportion of wastewater safely treated”
- Indicator 6.3.2 “Proportion of bodies of water with good ambient water quality”

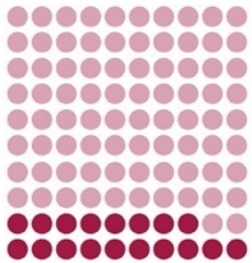


Custodian Agencies responsible for SDG 6.3.1 monitoring






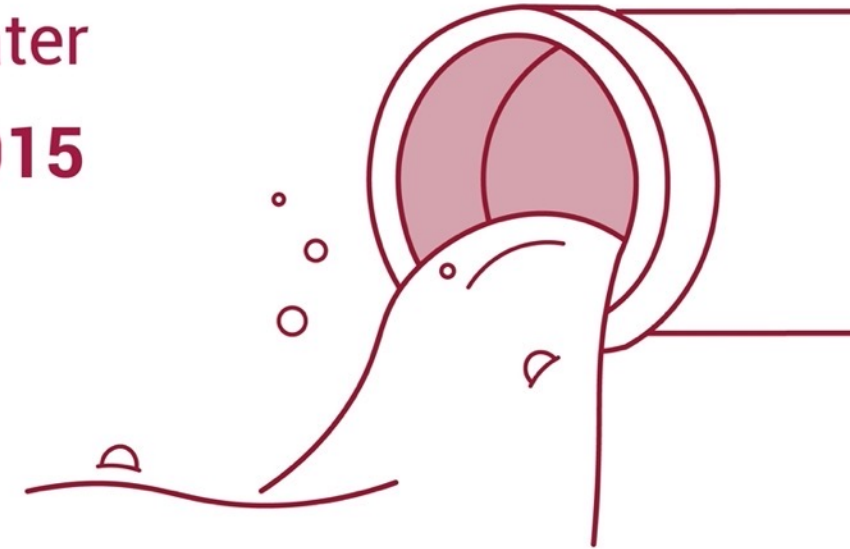
SDG 6.3.1 WASTEWATER



Only
42
countries

reported statistics on wastewater generation and treatment in **2015**

These **limited data** suggest that about a $\frac{1}{3}$  of total or industrial wastewater **received treatment** before discharge



Challenges of wastewater monitoring

- Wastewater «safely treated» is a critically complex indicator
- Comprises Domestic, Commercial, Industrial (hazardous and non-hazardous) components, both sewerage and from on-site.
- Some places still use combined sewerage
- Difficulties with definitions «collected» «treated» «generated»
- There are many micro pollutants for which the threats are really not known! AMR, POPs, Pharmaceutical residues

Contaminating wastewater through illegal and toxic discharges is commonplace



From:

- Commercial wastewater
- Uncontrolled Industrial & agricultural discharges
- Hazardous waste discharges

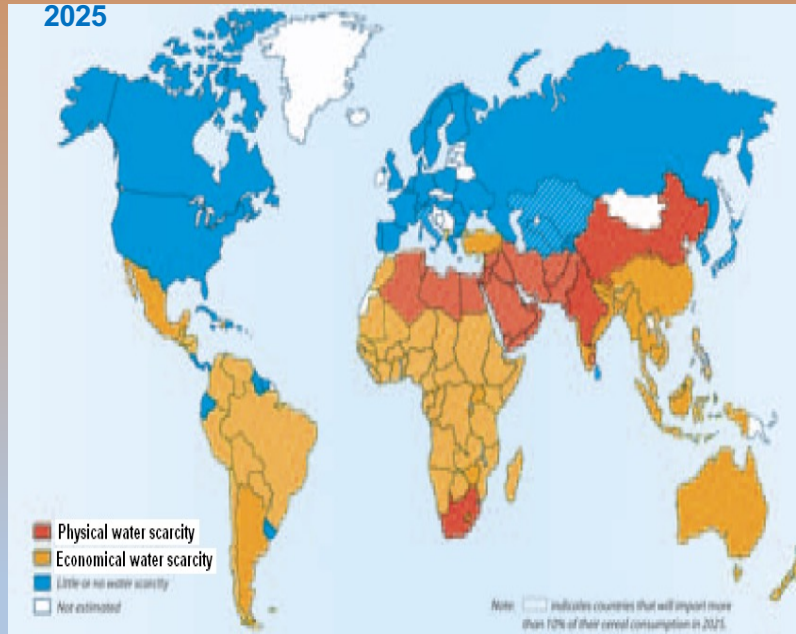
But why is this about inequity ??? Many of the poor will only have access to on polluted water

We MUST urgently address all sources of pollution

PERHAPS ONE OF THE BIGGEST THREAT COMES FROM Anti-Microbial Residues Animal & Human sources

Tackling scarcity means demand for wastewater reuse will grow

Bluewater scarcity by 2025



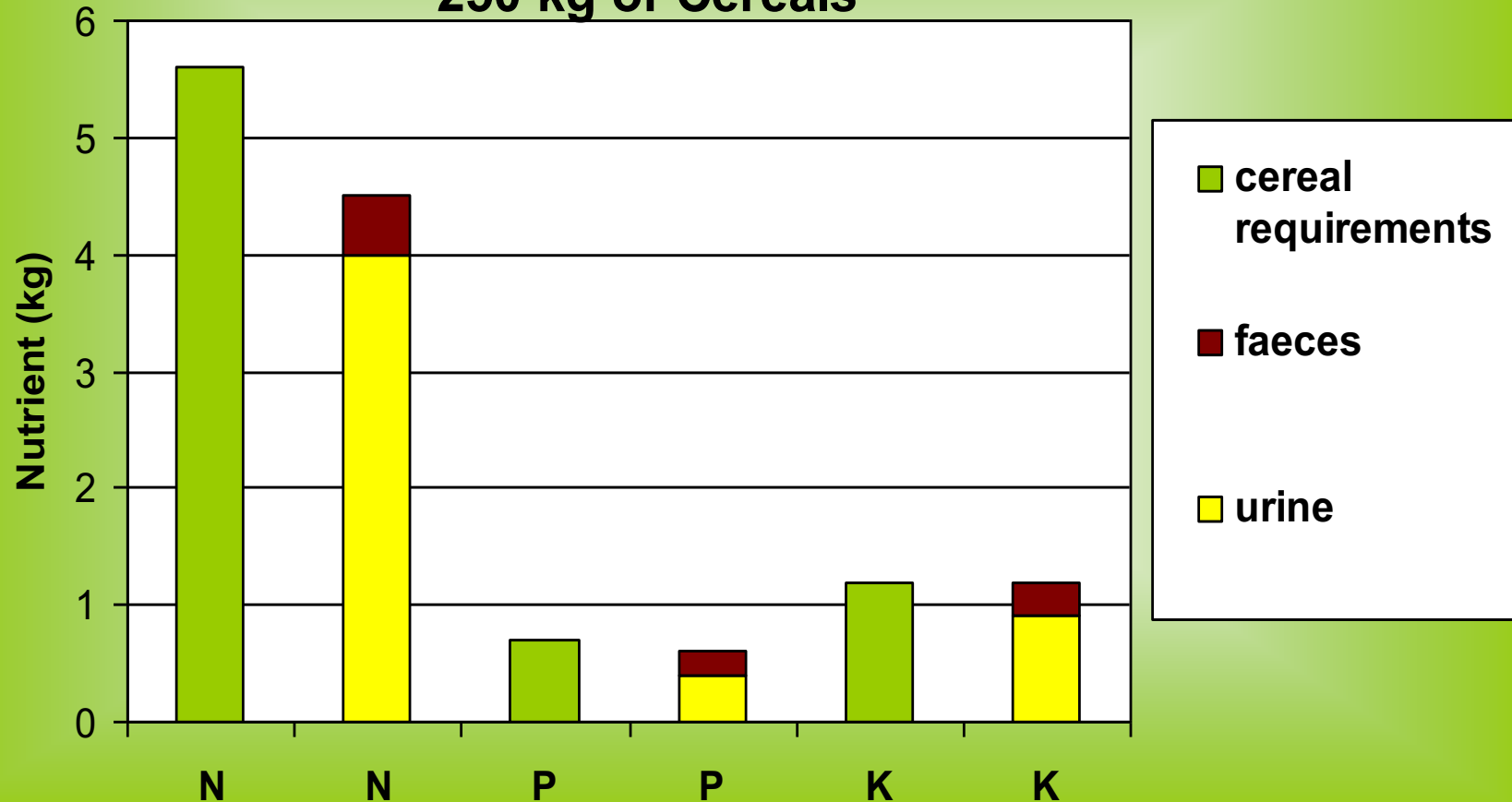
Drivers:

- To capture both water and nutrient scarcity good sanitation business models will be needed
- Population growth/ urbanisation leading to increasing demand for food in cities

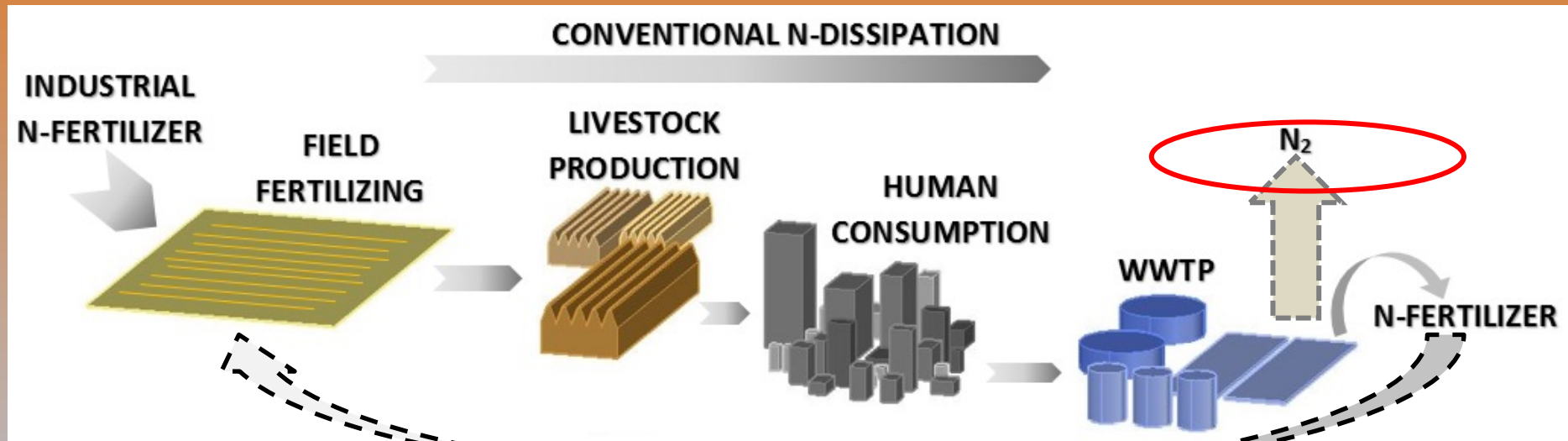
No provision exists so far for a “reuse indicator” but can be made through local level indicator adaptation

Fertilizer Potential of Human Excreta

Fertilizer Equivalence of Yearly per Capita Excreted Nutrients and Fertiliser Requirements for Producing 250 kg of Cereals



The broader picture :Conventional N dissipation



- Currently, around **40 MJ/kg N** are used to produce **N-fertilizer** via the Haber-Bosch process (with 4 to 8 tons of CO₂-eqv per ton N fertilizer produced) 3% of the worlds energy production
- The **same amount of primary energy** (ca. 45 MJ/kg N) is used in wastewater treatment for **dissipating reactive nitrogen conversion** (NH₄⁺) to N₂

This is worth revisiting!

The broader picture : Environmental burdens

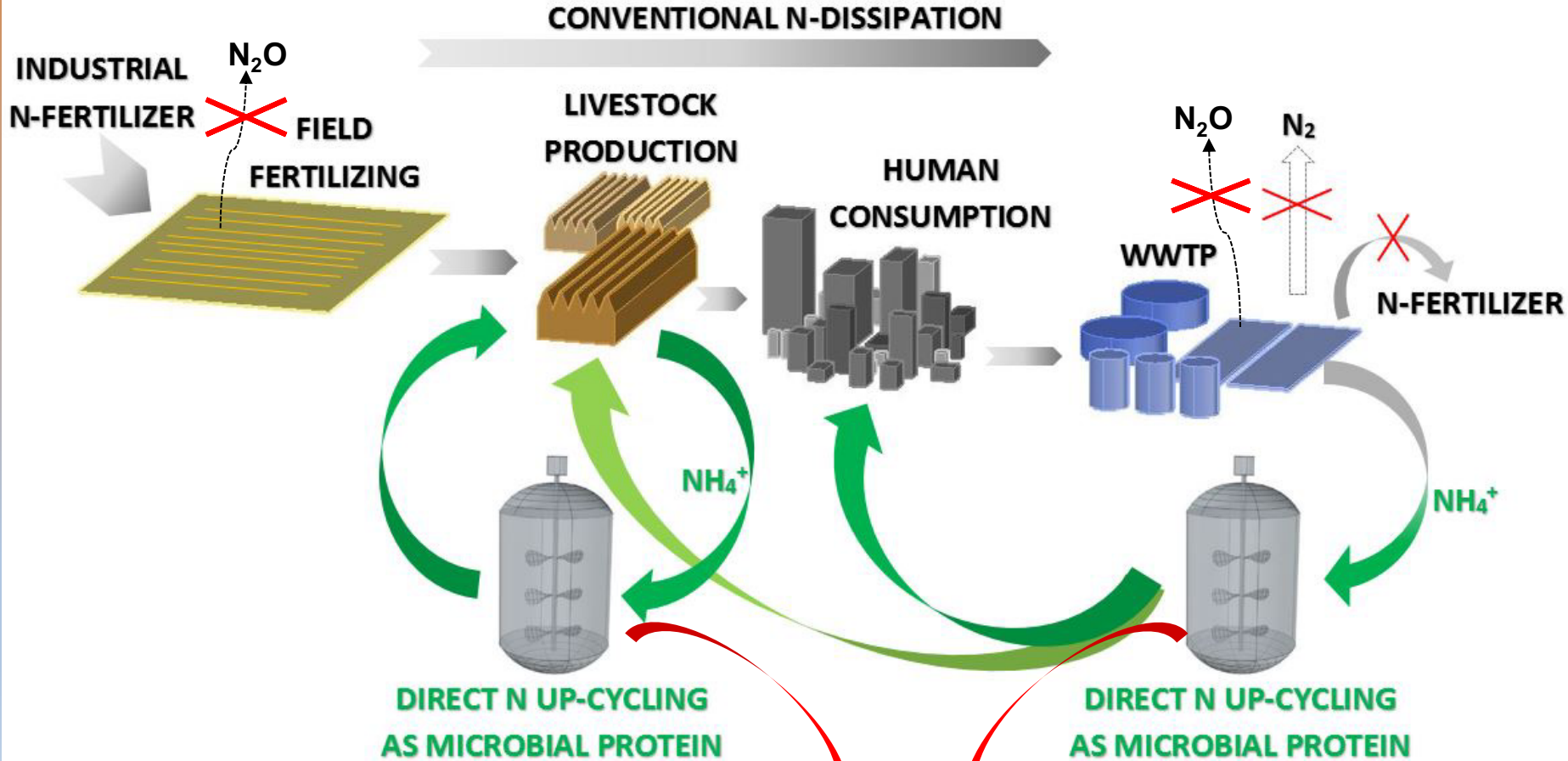
Conventional Edible Protein (dry weight – dw)

- **The conventional feed/food chain:** 2 ha of land → **1 ton of edible animal protein dw** per year (pork, chicken, beef, carp) (*FAO, Alexandratus and Bruinsma 2012*)
- Related **fresh water consumption** per 1 ton edible animal protein dw: ca 50 000 m³
- Related **CO₂ production** per 1 ton of edible animal protein dw produced: ca 100 ton
- Related chemical N-fertilizer production for protein production through **Haber-Bosch process accounts for 3%** of world energy demand (of which more than 80% is just lost through the feed/food chain!!!)

Edible protein has a VERY heavy environmental footprint; this production is under pressure

POWER TO PROTEIN- PROMIC

“Short track up-cycling of used nitrogen to new feed and food protein will help to feed the world”

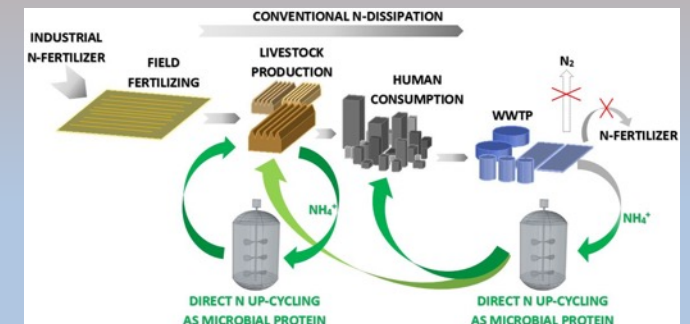


Source: Matassa et al., Article accepted EST

PROTEIN !

Conclusions

- Science and diplomacy need to come together to tackle the joint challenges of water pollution and food production as these topics are only loosely connected
- The theory for both nitrogen capture and removing priority pollutants exists, but must be up-scaled
- The complex processes involved (both physical and biological) need the help of Science (and in particular Quantum Computing) to fast-track practical solutions in cooperation with GESDA:
 - (i) Reducing & Removing antibiotic residues in wastewater
 - (ii) Recycling Nitrogen more efficiently



Result: Less use of scarce resources, less pollution, One Health!

Back up slides





Home



The GESDA 2022 Science Breakthrough Radar[®]

Geneva Science and Diplomacy Anticipator's Annual Report on Science Trends at 5, 10 and 25 years

In partnership with: **FONDATION POUR GENÈVE**

Trends

What is cooking in the labs?

Augmented Reality 1.5
Brain inspired Computing 1.3
Science of the Cosmos of Life 1.2
Human Applications of Genetic Engineering 1.1

Taking the Pulse of Society

Why does it matter?

Circular Economy
Blockchain Technology for Supply Chains
Digitalization of Jobs
Sustainable Energy

Opportunities

So... what can we do about it?

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Use the future to build the present

About the Science Breakthrough Radar

A Swiss foundation with global reach and a private-public partnership working from Geneva, GESDA was started in September 2019 to develop and promote anticipatory science and diplomacy for greater impact and multilateral effectiveness.

The Science Breakthrough Radar is:

- a new tool for multilateralism, informed discussions, and concerted action
- a single point of entry to catch up with the unprecedented pace of science and technology
- a factual basis for eye-opening reflections on the impacts of future scientific discoveries for people, society and the planet
- an interactive, evolving instrument

Scientific Platform	Emerging topics in the 2021 edition that will be updated and enhanced	New emerging topics extended into full briefs	New invited contributions
1 Quantum Revolution & Advanced AI	1.1 Advanced AI 1.2 Quantum Technologies 1.3 Brain-inspired Computing 1.4 Biological Computing	1.5 Augmented Reality 1.6 Collective Intelligence	<ul style="list-style-type: none"> • Digital Humanities and Art Techs • AI for Science
2 Human Augmentation	2.1 Cognitive Enhancement 2.2 Human Applications of Genetic Engineering 2.3 Radical Health Extension 2.4 Consciousness Augmentation	2.5 Organoids 2.6 Future Therapeutics	<ul style="list-style-type: none"> • Xenobots and Computer-Designed Organisms
3 Eco-Regeneration & Geoengineering	3.1 Decarbonisation 3.2 World Simulation 3.3 Future Food Systems 3.4 Space Resources 3.5 Ocean Stewardship	3.6 Solar Radiation Modification 3.7 Infectious Diseases	<ul style="list-style-type: none"> • Polar Resources • Coral and Ocean Renewal
4 Science & Diplomacy	4.1 Science-based Diplomacy 4.2 Advances in Science Diplomacy	4.3 Digital Technologies and Conflict 4.4 Democracy-Affirming Technologies	<ul style="list-style-type: none"> • The Challenges and Opportunities of Sustainable Finance
5 Knowledge Foundations	5.1 Complex Systems Science 5.2 Future of Education 5.3 Future Economics	5.4 The Science of the Origins of Life 5.5 Synthetic Biology	<ul style="list-style-type: none"> • The Philosophical Lens • The Geopolitical Lens • The Future of Peace and War • Futures Literacy • How Machine Learning is Transforming Regional Economic Development



Facts and Figures

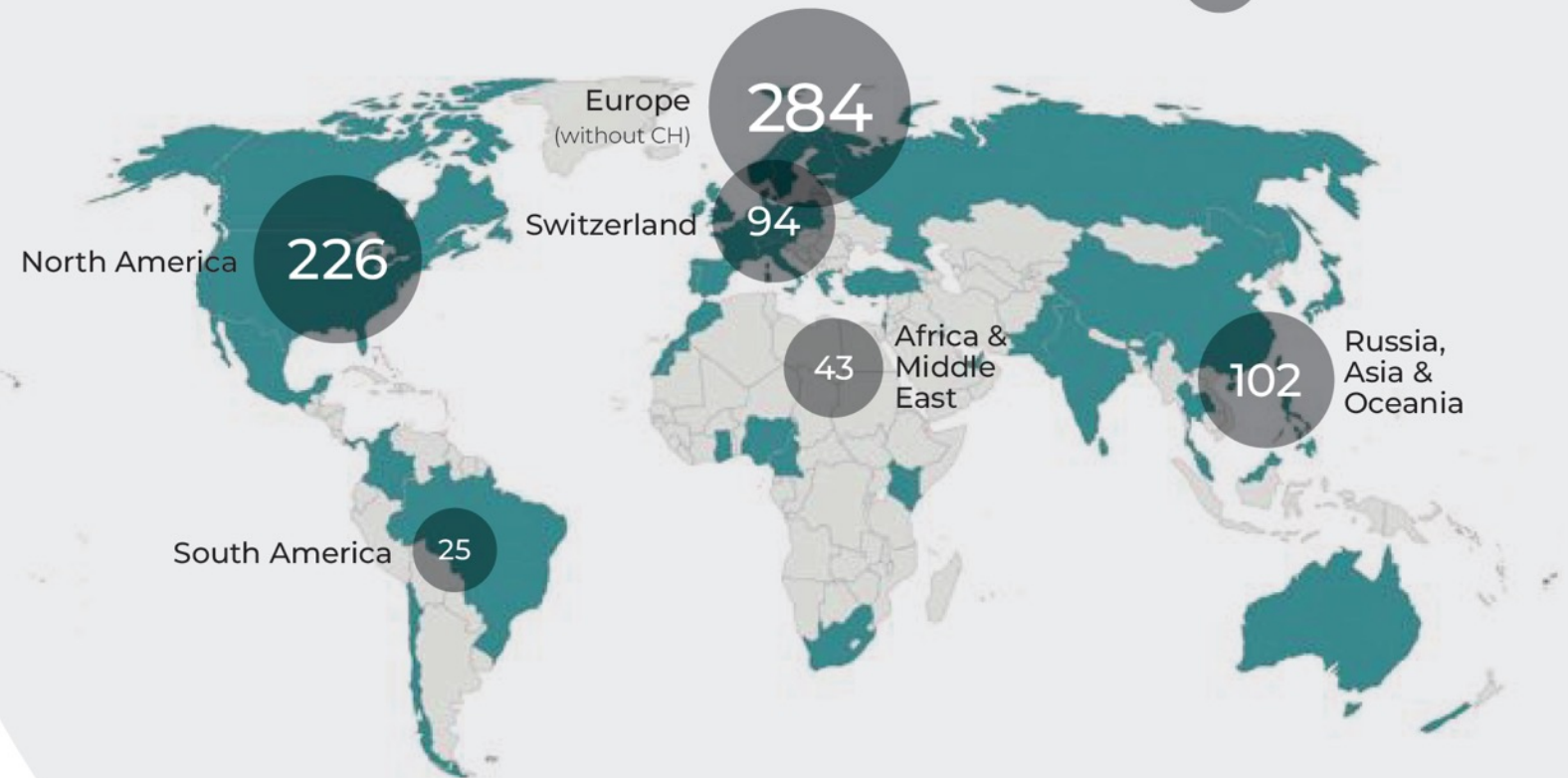
The Science Breakthrough Radar comprises 5 scientific platforms, 37 emerging topics and 336 breakthroughs at 5, 10 and 25 years of interest for science.

It contains 2 lenses on philosophy and geopolitics on 3 fundamental questions about the future of humanity debated by 21 scholars from philosophy, social sciences, humanities and geopolitics More than 1,100 scientists were involved in creating its first two editions

- 543 scientists from 53 countries in 2021
- 774 scientists from 70 countries in 2022

It includes analysis of 11 million social media posts in order to take the pulse of society on what people do and say about the various scientific platforms.

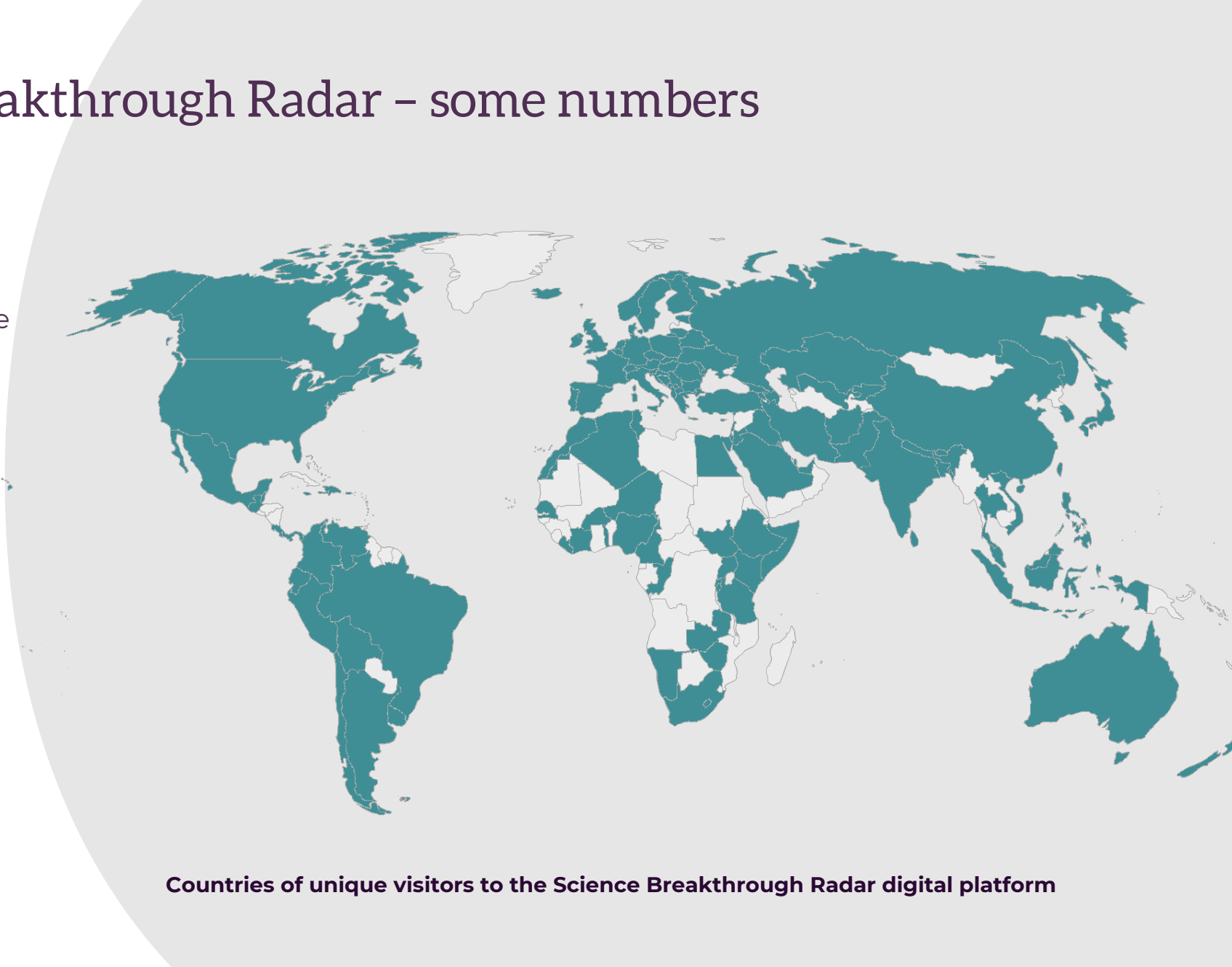
Countries of host institutions of contributing scholars via surveys, workshops and interviews 774



2021 GESDA Science Breakthrough Radar – some numbers

(status 2022.08.22)

- **1'370** new visitors per month
- **47' 971** Radar page views
- By **13'723** unique visitors
- From **142 countries**, with most visits are
 1. Switzerland
 2. United States
 3. United Kingdom
 4. France
 5. Australia
 6. South Africa
 7. The Netherlands
 8. Germany
 9. Finland
 10. Canada
- **1 min 28** Average time spent on the site
- **Most watched emerging topics**
 1. Advanced AI
 2. Quantum Technologies
 3. Cognitive Enhancement
 4. Decarbonisation
 5. Futures Literacy
 6. Biological Computing

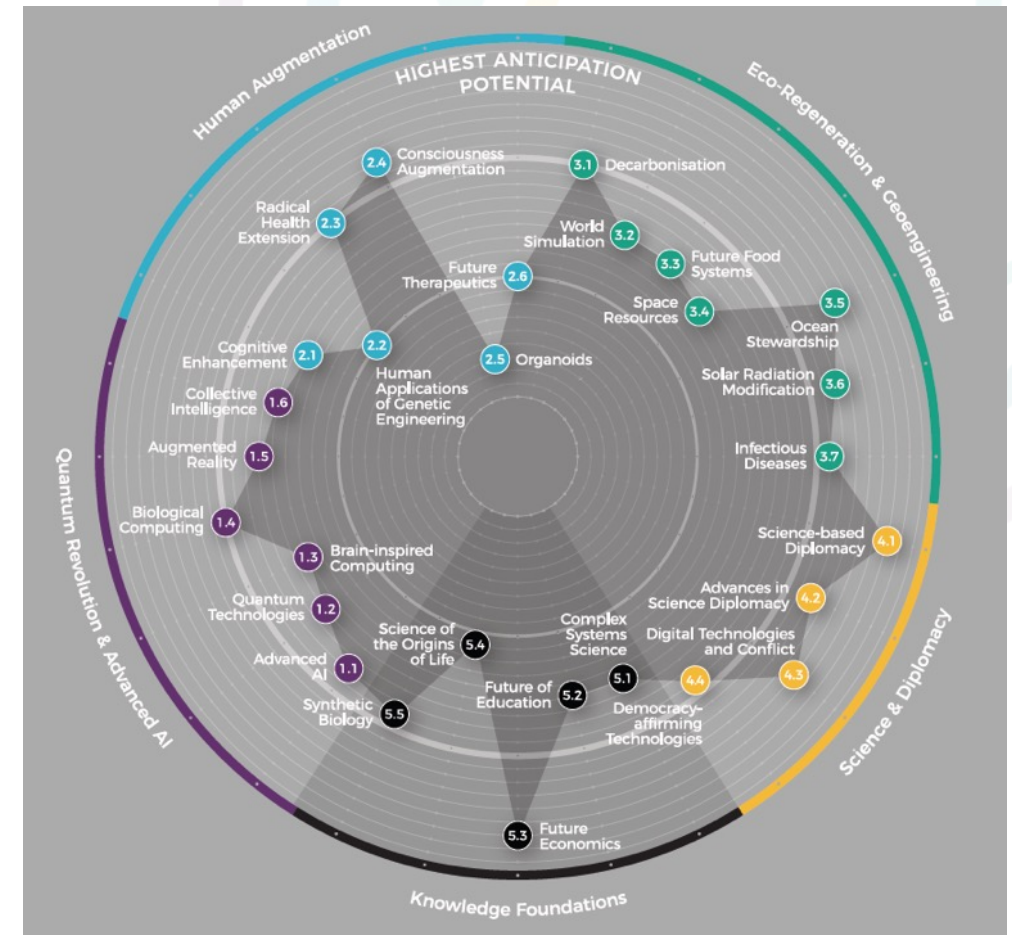


Countries of unique visitors to the Science Breakthrough Radar digital platform

Towards the 2023 GESDA Science Breakthrough Radar

Enhance the GESDA Science Breakthrough Radar:

- Expand the community of contributing scientists, especially from underrepresented backgrounds and geographies
- Review and deepen existing scientific emerging topics
- Pivot towards a continuous updating and rolling mode
- Engage in strategic partnerships with academic institutions globally to increase quality and reach
- Provide actionable entry doors to navigate the radar for diplomats, policy-makers, scientists and citizens, including youth



The 'pulse' of society...

1. Who are we?

New scientific discoveries are radically changing the nature of how we perceive ourselves as human beings. Advanced synthetic biology and gene-editing techniques have the potential to modify the biological fabric of our bodies. Advances in cognitive neurosciences, brain-machine interfaces and neural technologies may provide access to our inner thoughts in the near future and allow others to steer our behaviours. The power of quantum technologies and advanced artificial intelligence might provide new understanding of conscience and the origins of life.


What does it mean to be human in the age of robots, gene editing and augmented reality?





Mark Hunyadi
Professor for Moral, Social and Political Philosophy,
Université Catholique de Louvain


"Homo technicus". There is one thing that is extraordinarily striking under the effect of technological development, namely that until very recently, philosophy was obsessed, one can say, by the question of distinction between man and animal.

BCI – Brain computer Interfaces

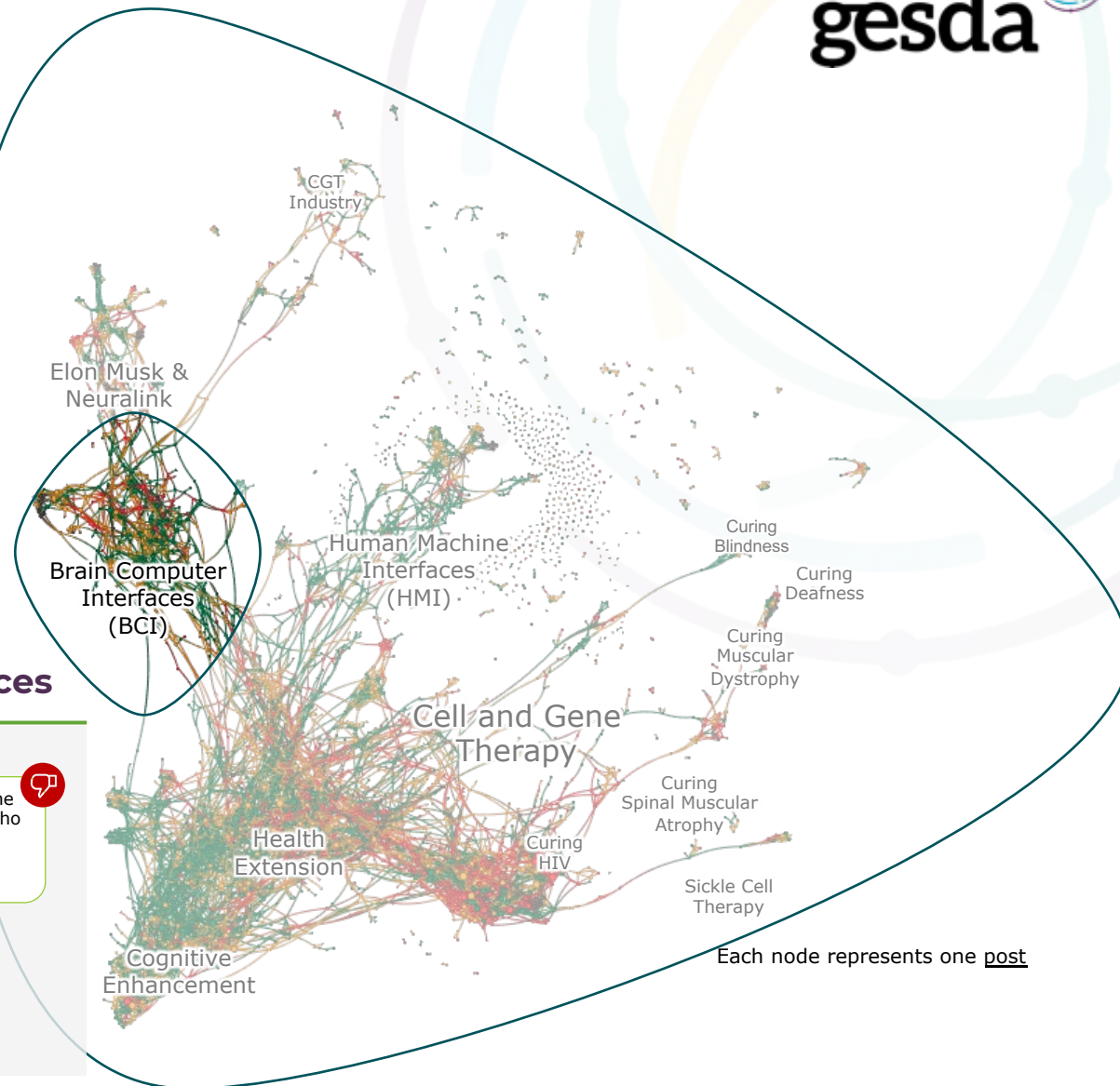
 "The future is cyborg: Kaspersky study finds support for human augmentation"

 "Just saw someone compare people who are scared by Neuralink to antivaxxers"

 "Majority of Europeans would consider human augmentation, study finds"

 "MIT scientists extremely skeptical of Elon Musk's creepy 'neuroscience theater'"

The GESDA 2021 Science Breakthrough Radar



Geneva Science and Diplomacy Anticipation Summit



16 topics of interest for diplomacy and society to accelerate the implementation of the 2030 Agenda of the United Nations & tackle global challenges

Overall Event	Advanced AI & Quantum Revolution	Augmented Human	Eco-regeneration & Geoengineering	Science & Diplomacy
<ul style="list-style-type: none"> ▪ Presentation of GESDA Science Breakthrough Radar 2021 ▪ High level Panel on the role of anticipation in Science Diplomacy ▪ Joint Public Event GESDA/Graduate Institute with Enrico Letta, President of the Institut Jacques Delors in Paris, Secretary General of the Democratic Party & former Prime Minister of Italy & member of GESDA Diplomacy Forum ▪ Side Event at Théâtre St-Gervais and Visit of CERN 	<ul style="list-style-type: none"> ▪ Opening Quantum for the Benefit of Humanity ▪ Co-developing Accessible Advanced AI 	<ul style="list-style-type: none"> ▪ Engineering Pathways for Radical Health Extension ▪ Negotiating the Boundaries of our Genetic Future ▪ Learning from the COVID-19 to Prepare the Response to the Next Systemic Crisis ▪ Do we need Neurorights? 	<ul style="list-style-type: none"> ▪ Utilizing Space Resources for collective prosperity ▪ Advancing Science for Ocean Stewardship ▪ Accelerating the Active Decarbonization of the Planet 	<ul style="list-style-type: none"> ▪ Reviving the Human Right to Science ▪ Designing an economic Compass for Sustainable and Resilient Societies ▪ Revitalizing Multilateralism through Anticipatory Science and Diplomacy ▪ Navigating the 21th century with Digital Empowerment ▪ Enriching Science with Citizen Voices and Values ▪ Bothering about scientific anticipation / why does it matter ? ▪ Catalizing Inclusive Growth through Anticipatory Science

16 topics of interest for diplomacy as discussed in Geneva from 7 to 9 October by the first Geneva Science and Diplomacy Anticipation Summit

Summit 2022 – Corner stones



- **Venue:** Campus Biotech, Geneva's Science Hub, home to GESDA, EPFL, UniGE, the Wyss Center and more.
- **Duration:** from 12 – 14 October 2022
- **Theme:** Use the Future to Build the Present
- **Programme:** Approximately 20 sessions focused on Science Anticipation, Solution Pathways and Political Endorsement of GESDA's workstreams
- **Objectives:**
 - Discover the second edition of GESDA's Science Breakthrough Radar®
 - Participate in GESDA's Anticipatory Situation Room and contribute to GESDA's Solution Pathways
 - Exchange with the political authorities in charge of multilateralism in Switzerland and abroad
- **Participants:** 1000 leaders from the globe's science and diplomacy communities connecting in person. Hybrid modalities will allow for additional online participation.

Geneva Science and Diplomacy Anticipation Summit

How to use incipient scientific disruption to respond more rapidly to the global challenges of the 21st century

Some numbers...

 **937 participants registered**

 571 onsite

 366 online

 **108 speakers and moderators**

 91 onsite

 Women 41 / Men 67

 33 countries

Onsite attendees per community

