

25
CELEBRATING 25 YEARS



UNITED NATIONS
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UNU-INWEH

Institute for Water,
Environment and Health



ANNUAL REPORT 2021

25



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ABOUT UNU-INWEH

UNU-INWEH is one of the United Nations University (UNU) institutes, an academic arm of the UN. The University's 13 research and training institutes are located in 12 countries and address a range of global development challenges. UNU-INWEH's primary focus is global water development challenges. Water is the entry point to all UNU-INWEH's activities, including environment and health. The Institute works to bridge the gap between the wealth of knowledge that exists on water resources, and the practical needs that political leaders and decision makers, particularly in low- and middle-income countries of the Global South, have.

UNU-INWEH's research has a diverse range of stakeholders, including politicians and policymakers in developing countries, concerned with water, health and environment issues; donors and implementing agencies; scientific community in water-related research institutions and academia; UN agencies and other international and regional organizations and networks; host country and national partners in Canada, media; and civil society.

UNU-INWEH was established in 1996, as a public service agency and a subsidiary body of the UNU. Its operations are secured through long-term host-country and core-funding agreements with the Government of Canada. The Institute is located in Hamilton, Canada; its facilities are supported by McMaster University.

UNU-INWEH is the only Institute in UNU that focuses entirely and solely on water issues. It is also the only entirely water-focused UN entity in Canada.



DIRECTOR'S SUMMARY

2021 was the year of the 25th Anniversary of UNU-INWEH. Over the years, the institute has engaged scores of international experts, established hundreds of partnerships worldwide, trained hundreds of young water professionals, produced hundreds of research and policy publications, generated hundreds of articles that featured on thousands of international media sites, and attracted tens of millions of funding dollars.



We took an account of stock of all these **achievements** showcasing significant scientific discoveries and policy-relevant findings during UNU-INWEH's first quarter century. This stocktaking exercise was enchanting. It showed active UNU-INWEH's involvement in defining and promoting water security concept, helping countries achieve water development targets, assessing the status and prospects of unconventional water resources to alleviate global water scarcity, supporting sustainable land and coastal zone management and biodiversity conservation, unpacking the triggers of environmental migration, harnessing the value of human waste, assessing vulnerability to water-related health risks and diseases, mainstreaming gender equality into water management, and much more.

The Institute is in the second year of its **Strategic Plan (2020-2025)** that focuses on four interconnected areas: accelerating the implementation of water-related SDGs, activating a technology revolution for water security in the Global South, advancing gender equality for effective water management; and managing water and climate-related risks and operationalizing water security. The Plan addresses some of the key water challenges that the world is facing and has strong roots in the past quarter-century work of UNU-INWEH.

UNU-INWEH celebrated its anniversary in a number of ways, not the least releasing two new major outputs – a synthesis of global knowledge on the state of ageing water storage dams and a free online tool that maps the extent of floods anywhere in the world.

The first overviewed dam ageing by world region and primary function and pointed that by 2050, most of humanity will live downstream of large dams built in the 20th century posing financial, environment and security risks.

The second, co-developed with nine partners - mostly from the Global South, generates instant, accurate maps of floods at a street-level spatial resolution and lets users plan future development - where to build or upgrade infrastructure or develop agriculture.

Both new products generated major attention from media and a range of stakeholders, and the later tool also received the prestigious Popular Science's "Best of What's New" award. Overall, in 2021, UNU-INWEH inspired over 900 media stories in 66 countries with potential reach of 3.5 billion people.

With the continuing support from our donors, partners and friends, UNU-INWEH staff continues its journey from strength to strength and is looking confidently into the next 25 years.

Vladimir Smakhtin
Director: UNU-INWEH
Hamilton, Ontario, Canada

MESSAGE FROM THE CHAIR OF THE INTERNATIONAL ADVISORY COMMITTEE

This year has been a year of continuity for both UNU-INWEH and for the International Advisory Committee (IAC). For the second year, we had to meet virtually rather than in person in Hamilton with the UNU-INWEH team. Like many organizations, we turned this impediment into an advantage by starting periodic video-briefings on major projects of the Institute. This gave the lead researchers the chance to present their work not only to members of the IAC but also to close research partners of the Institute in Canadian universities. We also welcomed the participation in our meetings of an observer from Global Affairs Canada. This has helped to ensure that the Institute continues to have visibility with its host government and major funder in an era when in-person events in Ottawa were not possible.



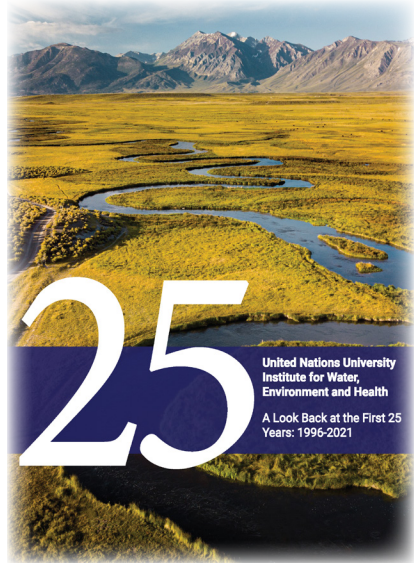
As the scale of the global climate crisis becomes more evident, it has become even more important for governments around the world to manage water resources effectively for human health, development, and environmental protection. Against this backdrop, the importance of UNU-INWEH's work in providing science-based tools for water monitoring and water management has never been greater. The members of the International Advisory Committee take great pride in the Institute's achievements. We celebrated its twenty-fifth anniversary this year, knowing that it has a secure financial foundation and a clear strategic direction for the next five years.

*Michael Small
Fellow, Morris J. Wosk Centre for Dialogue
Simon Fraser University
Vancouver, British Columbia, Canada*

YEAR HIGHLIGHTS

A look back: 1996-2021

An **account of stock of UNU-INWEH achievements** and **media highlights** over the first 25 years showcase significant scientific discoveries and policy-relevant outputs. UNU-INWEH's role in shaping water security concept, findings that burning the world's annual human waste output could yield the equivalent of \$9.5 billion in non-renewable natural gas, that every day, about 2,020 hectares of irrigated land worldwide becomes unfarmable because of salty soil, that by 2050 tens more countries in the Global South will be water scarce if no action is taken immediately, that wastewater produced globally is comparable with the Niagara river annual flow and has enormous potential to provide water, fertilisers and energy - and many others were literally ground breaking and are essentially classical now. They have shaped thinking on global water development – in some cases, for years - with multiple subtle and explicit policy influences – from individual countries to UN processes.



Assessing potential risks of ageing water storage infrastructure



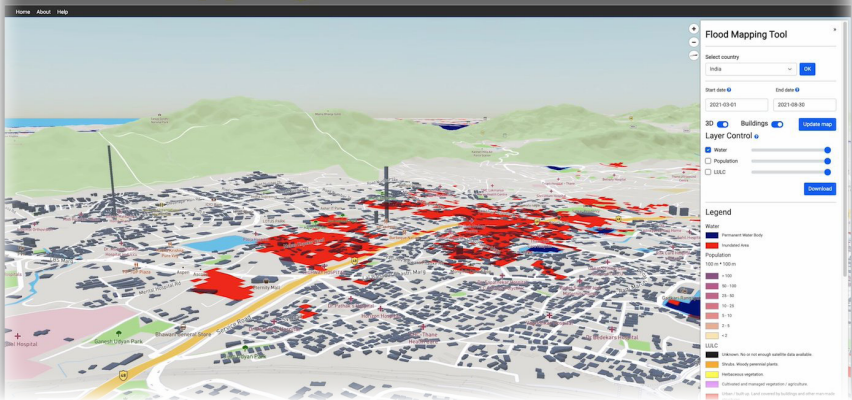
A first ever synthesis of the global knowledge on the **state of large water storage dams** provided an overview of dam ageing by world region and primary function—water supply, irrigation, flood control, hydropower, and recreation. The study pointed to the risks associated with such ageing - including risks to human safety, increased cost of maintenance and mounting environmental concerns, indicating that by 2050, most of the

humanity will live downstream of large dams built in the 20th century. It also showcased a few examples of large dams' removal – a relatively new but emerging phenomenon. The follow-up paper summarized **dam removal impacts** on local economy and industry, culture, history and heritage, property value, recreation, aesthetics, and disaster avoidance from identified studies worldwide. It demonstrated that these impacts vary between developed and developing nations and pointed to the need to explicitly consider the impacts on all stakeholders who could be positively and negatively impacted by dam removal. The findings from these analyses have been highlighted in a range of media worldwide, including **The Guardian**, **The Daily Mail**, and **CTV News**, among others, with a total of almost 400 media stories in 45 countries and in 14 languages, with potential online readership of around 2 billion people. UNU-INWEH continues working on various aspects of water storage, including sustainable water storage planning in river basins quantification of global water storage losses due to sedimentation, and others.

Mapping past floods' extent to mitigate flood risks

A **free online tool for mapping historical floods anywhere in the world** generates instant, accurate maps of floods with support from Google and MapBox. It lets users adjust variables to help locate gaps in flood defences and responses, and to plan future development, for example, where to build or upgrade infrastructure, or develop agriculture. The tool can show the flood-safe locations for housing and industry as well as help improve overall urban planning. The tool was developed in partnership with 10 research organizations - primarily from the Global South - and was tested on floods in Australia, Bangladesh, Canada, Cambodia, India, Malawi, Mozambique, Sri Lanka and Thailand that occurred in 2011-2018. The tool generates flood maps at a street level i.e. 30-meter spatial resolution. An upcoming version for more commercial uses - under development at UNU-INWEH at present - will offer building-level resolution. The details of the methodology and results have been published in an **open-access peer-reviewed paper**.

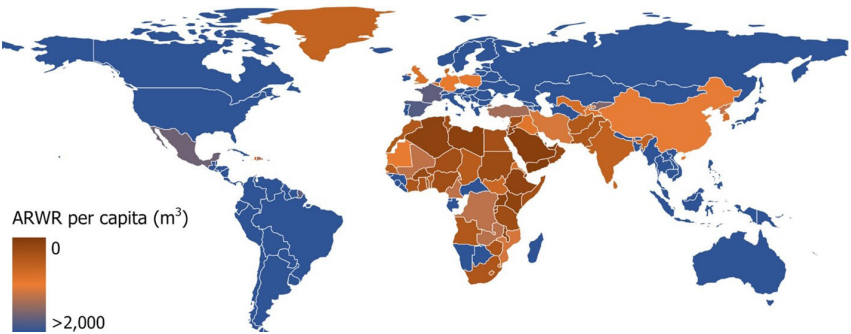
Flood Mapping Tool (floodmapping.inweh.unu.edu)



The tool received the **Best of What's New award** of the **Popular Science** (USA). Popular Science has reviewed annually since 1988 thousands of products in search of the top 100 innovations —breakthrough products and technologies that represent a significant advancement in their 10 categories: Aerospace, Automotive, Engineering, Entertainment, Gadgets, Health, Home, Personal Care, Security, and Sports & Outdoors. The UNU-INWEH global flood mapping tool was honored under "security" category.

Evaluating the challenge of increasing global water scarcity

Projected water availability in 2050



The Institute carried out a **global assessment of water availability at a country level**, with a focus on population dynamics. The analysis suggests that population growth alone – even without consideration of such significant global issues as climate change or water quality deterioration - will lead to an unprecedented and widespread drop in water availability per capita. It also points that this will happen within the next few decades. By 2050, 87 countries (many of them water-rich now) out of 180 considered will become water scarce - having per capita water availability below 1,700 cubic meters per year, and the number of countries with absolute water scarcity - per capita water availability under 500 cubic meters per year - will almost double, from 25 today to 45. Africa will become the main hotspot of water availability, if the issue of water access is not resolved by then. The study pointed to the need to explicitly consider population trends in policy and implementation plans for SDG 6. The **subsequent op-ed** further advocated for solutions to this emerging challenge, including the need to raise the attention to yet underdeveloped and unconventional water sources and options.

Unpacking unconventional approaches in water management



Together with Utrecht University (Netherlands), UNU-INWEH undertook an in-depth **analysis of the national data on wastewater treatment**. The study concluded that about 50% of global wastewater is treated, rather than the previous estimate of 20%. Untreated wastewater release is the major global health and environmental concern, and SDG indicator 6.3.1

explicitly aims at halving the global untreated wastewater by 2030. Despite this promising finding, the authors warned that treatment rates in developing countries of the global South are still very low. The authors also highlighted potential opportunities for creative reuse of wastewater streams that could help to finance improved wastewater treatment practices.

The Institute also led the **comprehensive analysis of fog water collection's research history** since 1980, in partnerships with scientists from Canada, UK and Germany. Analysis reveals that recent years have witnessed a sharp increase in research related to technological developments in fog collection systems. There is also an increased focus on associated policy and institutional aspects, economics, environmental dimensions, capacity building, community participation, and gender mainstreaming. Fog water collection practice has also increased over time with emerging examples worldwide, notably from Canary Islands, Chile, Colombia, Eritrea, Ethiopia, Guatemala, Israel, Morocco, Namibia, Oman, Peru, and South Africa. While small-scale by nature, fog water collection systems play progressively increasing role in local water supplies.

In addition, based on the water quality data representing arid and semi-arid regions around the world, another comprehensive **analysis proposed revised irrigation water quality guidelines** for assessing soil permeability problems. Revised water quality guidelines should help practitioners assess the suitability of given water more accurately and will guide fit-for-purpose options and associated management strategies to ensure the sustainability of irrigated agriculture. This is an important tool as the use of marginal-quality waters increases to meet the challenge of freshwater scarcity.

Raising the attention to Water, Sanitation and Hygiene in the COVID-affected world



Photo: Gonzalez Farran / UNAMID

In 2021, UNU-INWEH has significantly enhanced and diversified its water and health research. UNU-INWEH scientists argued for **ways to improve COVID monitoring systems in the Global South** through wastewater, and for the need for **measures to protect global water resources from antimicrobial resistance**. They also provided an overview of key health frameworks that have shaped the water, sanitation, and hygiene (WASH) sector since 1958, indicating that WASH absence results in severe health consequences ranging from biological harm to adverse mental health. Another review examined the various negative **health consequences of climate change**.

UNU-INWEH synthesized how risk is conceived of, modelled, and mapped in studies of infectious water, sanitation, and hygiene (WASH) related diseases. The **review published in 2021** focuses on spatial epidemiology of cholera, malaria and dengue to offer

recommendations for the field of WASH-related disease risk mapping. Its recommendations can be used as a guide for developing spatial epidemiology models in tandem with public health officials and to help detect and develop tailored responses to WASH-related disease outbreaks that meet the needs of vulnerable populations.

Together with five other UN agencies, the Institute joined a **UNICEF**-led project on “Food-water-energy nexus support to post-COVID Recovery in Central Asia, the Middle East and Africa”. From 2022, the Institute will be developing a Policy Support System whereby health and water professionals can collaborate and work jointly to ensure no or minimal impact on water-related development in the pandemic emergency response situations. This activity will involve testing and rolling out the tool in several UN Member States in the above region over subsequent 3 years.

In Canada, UNU-INWEH was invited to submit a written brief to the House of Commons’ Standing Committee on Foreign Affairs and International Development in the context of its study on “Vulnerabilities created and exacerbated by the COVID-19 pandemic, particularly in fragile, conflict or crisis situations”. The Committee studies matters related to international affairs, including Canada’s foreign policy and development assistance. UNU-INWEH developed and submitted the **brief focusing on water aspects of the problem**.

Supporting UN Processes



The President of the General Assembly at the General Assembly High-Level Meeting on Water, 2021

In 2021, the General Assembly (GA) set the dates (March 2023), structure and protocol for the High-level UN Conference on the Midterm Comprehensive Review of the Implementation of the Water Action Decade (2018-2028). This is the second such conference after Mar del Plata (1977) and it will take place at UN HQ in New York. The GA Resolution indicates, amongst others, that the 2023 Conference will comprise five 3-hour interactive dialogues. The co-hosts of the Conference - Tajikistan and the Netherlands, requested UNDESA and UN-WATER to develop a background paper on the possible themes of these interactive dialogues. A more detailed paper for each dialog will then be developed in 2022.

The UN-Water Task Force (TF) on the Water Action Decade Implementation - co-coordinated by UN DESA and UNU-INWEH – was tasked to develop this draft. The TF includes over 20 UN-Water members and partners. The paper is complete and is going through final UN-Water Review before submission to the co-Hosts of the Conference. UNU-INWEH will continue co-coordinating the TF in 2022 and will provide further support to the preparation of the 2023 Conference – as may be required. This may be, potentially, a significant influence, as the TF can influence how discussion at the high-level Conference in March 2023 will go and what outcomes can be achieved.

CAPACITY DEVELOPMENT

The collaborative (UNU-INWEH-McMaster University) graduate certificate programme – **Water Without Borders** - was presented online for the second year in a row – similarly to many other programs worldwide. The program is done in tandem with a graduate degree programme from any faculty at McMaster University, examines water issues across geopolitical or disciplinary boundaries, extends over two-semesters and includes problem-based learning and writing a mini-paper on a water-related topic relevant to UNU-INWEH work. In the fall 2021, it attracted 23 new students.

In 2021, UNU-INWEH revised its short-term training options and unified them under one – **Internship – programme**. Internships are open for recent graduates or final-stage graduate program students regardless of the trainee location in the world: it can be in-person, or remote. UNU-INWEH provides interns a chance to work in an international environment and experience first-hand the operations of the United Nations. Interns interact with staff members of diverse nationalities and contribute towards UN water research and training projects conducted globally or in developing countries. In 2021, UNU-INWEH hosted 10 trainees from 5 countries - all joined the team remotely - of which 6 were female, and 20% was from the Global South.



From mid-2021, UNU-INWEH online **Water Learning Center** (WLC) offers eight courses/ programs with durations from 3 hours to several weeks. They include Integrated Water Resources Management (revised and added in 2021), Global Water Security, Big Data Analysis for Water-related Applications, Water and Migration (in English and French, the later added in 2021), Water and Health, Mangroves Ecosystem, Unconventional Water Resources, and a short training course (in three languages) for SDG 6 Policy Support System. WLC is designed to ensure primarily self-paced learning in specific focused areas. Some courses are designed for already practicing water professionals, others can form part of a larger program offered by Universities. In 2021, around 5000 students from 128 countries enrolled in WLC courses, with a completion rate of 27% (industry global standard is 25%). The course “Big Data Analysis for Water-related Applications” (18 hours) has been the most popular one in 2021 with over 1700 enrollees.

This course introduces the participants to Earth Engine Code Editor platform, explores some basic programming concepts, Earth Engine data structures and methods, functions, and algorithms, and implementation of surface water detection algorithm.

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