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UNU-INWEH

Institute for Water,
Environment and Health



ANNUAL REPORT 2022



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Environment and Health**

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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-INWEHs 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, Ontario, 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.



Photo: Vladimir Smakhtin

DIRECTOR'S SUMMARY

In the past year, UNU-INWEH started a few new projects that strengthened and diversified the Institute's work under the strategic directions of "Advancing gender equality for effective water management" and "Managing water- and climate-related risks for improved water security". The Institute initiated a global assessment of the role of women in various components of the water sector- aiming to actually unpack and quantify that role by countries, particularly in the Global South.



UNU-INWEH undertook a global study on large reservoir storage losses due to sedimentation and illustrated that about a quarter of the existing global storage will be lost in the next 25 years, thus identifying an almost invisible global challenge with potentially very significant development implications. There has been also a good progress in examining the current global status of knowledge on antimicrobial resistance as it relates to natural water bodies.

The Institute released a new comprehensive book that summarises the current status of knowledge on alternative, new or underutilised sources of water (i.e. "unconventional water resources") that countries can develop to alleviate growing water scarcity. The book aims to change the conventional thinking on how much water is available to a nation and how it can be managed. It represents the most comprehensive source of information on alternative sources of water supply to date and is the summary of UNU-INWEH continuous work in this area over the past 5 years. The Institute also completed a comprehensive assessment of the bottled water sector, the full report on this will be released in early 2023.

UNU-INWEH published a first-ever country-wise comprehensive quantitative assessment of water security of the 54 African UN member states. The analysis has been very explicit about the unacceptably low levels of national water security throughout the continent and also – about similarly low levels of water data availability – regardless of all the international efforts in this regard particularly since the beginning of the "SDG era" in 2015. UNU-INWEH is now expanding its work to the entire globe aiming to complete this global water security assessment by the time of the high-level UN Water Conference in March 2023 in New York.

It is also important to recall in this context that UNU-INWEH, together UNDESA, co-leads the UN-Water Task Force on the implementation of the Water Action Decade (2018-2028). In this capacity, UNU-INWEH contributed significantly through 2022 to the preparation of this high-level Conference, particularly through co-coordinating global consultation on the themes of the five interactive dialogs that will form the key part of this landmark global water Event in 2023.

Despite the pandemic in the previous years, UNU-INWEH remained in a solid financial state due to continuing support of the Canadian Government. The Institute also received two new grants in 2022 - through UNEP and UNECE - that further strengthened its financial stability. UNU-INWEH remained highly visible in the international media: in 2022, there have been some 780 online news articles making reference to UNU-INWEH's work, captured in 18 languages across 68 countries, reaching out to an estimated 2.9 billion readers.

Since late 2021, a few new staff members joined UNU-INWEH, including Dr Zeineb Bouhlel (communication and research associate), Dr Charlotte MacAlister (senior researcher: Water security), and Dr Mir Matin (Senior Researcher: water resources). Their complementary skills and experiences strengthen the overall program, and we welcome our new colleagues to the Team.

The 2022 was my last year with UNU-INWEH: I retire from the international public service in January 2023. It was a privilege and a pleasure working for UNU for over 6 years. I have no doubts that UNU-INWEH will continue playing its critical role in transforming the global water sector by challenging its status quo, identifying and informing the UN and its member states of the emerging global water risks and trends, and supporting developing countries in their progress towards water-related SDGs.

Vladimir Smakhtin
Director: UNU-INWEH

MESSAGE FROM THE CHAIR OF THE INTERNATIONAL ADVISORY COMMITTEE

In 2022, the Institute has continued to produce high quality, policy-oriented research - both in areas where it has been an international leader - such as its work on unconventional water sources - and in the new areas identified in the current Strategic Plan, relating to the role of women in water security and the water dimensions of water and climate risks. I am particularly pleased that the Institute has been able to publish the first ever comprehensive assessment of water security in each African country. Its work as a co-lead for the UN Water Task Force and in preparation for the High-Level UN Conference on Water next March demonstrates the Institute's continued value to the United Nations system. I am also delighted that UNU-INWEH's research has been widely cited this past year by international media - as in previous years.



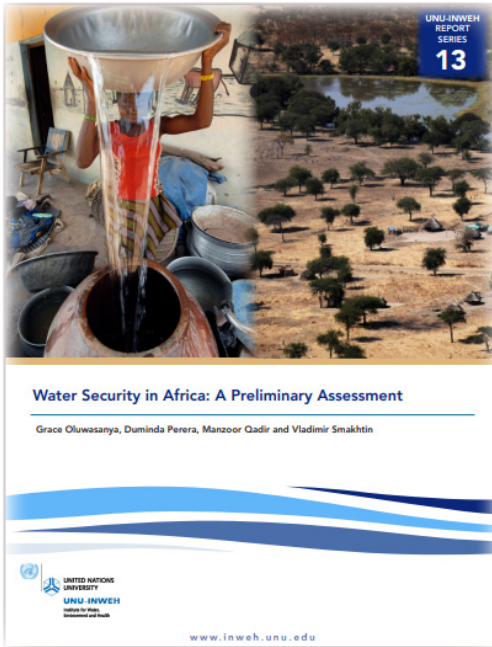
Institutionally, UNU-INWEH is in good shape: it has been able to recruit talented new staff in its key areas of work and it has further diversified its sources of funding. While the travel restrictions and disruptions caused by COVID-19 again prevented the International Advisory Committee from meeting in person this year, we were able to stay in touch with the Institute's work via electronic means. The International Advisory Committee members look forward to resuming in-person contact with UNU-INWEH and its staff in Hamilton in 2023.

The 2022 is the year of transition as it is both my last year as the Chair of the International Advisory Committee and the Vladimir Smakhtin's final year as the Director of the Institute. I would like to take this opportunity to salute his dedication to then Institute and its global mission and the high level of professionalism he has shown in all aspects of managing UNU-INWEH, its staff, its research program and in advancing its global reputation. He leaves UNU-INWEH with a very strong foundation for both of our successors to build upon.

*Michael Small
Chair: UNU-INWEH International Advisory Committee
Fellow, Morris J. Wosk Centre for Dialogue
Simon Fraser University
Vancouver, British Columbia, Canada*

YEAR HIGHLIGHTS

Unpacking and quantifying water security of UN member states



UNU-INWEH released a report that summarizes the results of a **first-ever assessment of water security in 54 countries in Africa**. Water security of each country was evaluated in terms of 10 complementary and interdependent numerical measures mostly related to SDG6 indicators. These include access to drinking water, sanitation and hygiene, water availability, efficiency, quality, infrastructure, governance, water-related risks and variability. Water security of each country was scored on a scale from 1 to 100. The assessment revealed that levels of water security in Africa overall are unacceptably low. Not a single country or subregion has yet achieved the highest level of 'model' or even the reasonably high 'effective' stages of national water security. Except for Egypt, all country scores are lower than 70. Only 13 of 54 countries reached 'modest' levels of water security in recent years and over a third have the lowest levels of

water security under even a reasonably generous lowest acceptable threshold score of 45 adopted in this assessment. Egypt, Botswana, Gabon, Mauritius and Tunisia make the top five most water-secure countries in Africa at present, yet with only modest absolute levels of water security achieved. Somalia, Chad and Niger appear to be the least water secure. The report also points that there has been little progress in water security in most African states over the past 5 years. The number of countries that made some progress (29) is close to the number of those that made none (25).

This assessment aimed to create a quantitative starting point and a platform for subsequent discussions with national, regional and international agents. In this context, UNU-INWEH brought the key messages of the report to the attention of all water-centric ministries in all African countries, and the Institute is currently in the process of collecting the feedback. It is anticipated that as this quantitative tool develops further it will generate targeted policy recommendations and inform decision-making and public-private investments toward achieving higher water security in Africa. The assessment received significant global attention in printed and electronic media, such as The New York Times, Xinhuanet, U.K. Times, The Times – South Africa, Yahoo News, ReliefWeb, AllAfrica, and M.S.N. News, among others, with coverage in 8 languages and 34 countries along with over 220 stories and highlights in online news sites with potential online reach around 1.1 billion people.

UNU-INWEH is currently finalizing a similar water security assessment for all UN member states and is aiming to release it prior to the **UN Water Conference** in March 2023.

Promoting unconventional water resources and technologies for water-scarce areas

Manzoor Qadir
Vladimir Smakhtin
Sasha Koo-Oshima
Edeltraud Guenther *Editors*

Unconventional Water Resources



 Springer

In response to global water scarcity, UNU-INWEH consistently examines and promotes a range of unconventional water resources (beyond rain and river flow), which can be combined to bring new water for human consumption and agricultural production systems. In 2022, UNU-INWEH published a comprehensive **book** on the subject matter in partnership with UNU-FLORES and FAO. The book offers a credible analysis of all major types of unconventional water resources in terms of their biophysical aspects along with related policy, institutional, economics, gender, and environmental trade-offs. It covers over 10 various unconventional sources of water under the five major groups of harvesting water from air and on the ground, tapping offshore and onshore deep groundwater, reusing water, moving water physically and developing new water. The book engaged some 35 top global experts and received major media attention through over 290 articles on news sites, coverage in 42

countries and in 11 languages, reaching some 940 million potential readers. The book aims to change the conventional thinking on how much water is available to a nation and how it can be managed. It represents the most comprehensive source of information on alternative sources of water supply to date.

Scrutinizing bottled water in the context of sustainable development



UNU-INWEH carried out a comprehensive analysis of facts and perceptions about bottled water. Analysis includes, first, the geography, structure and trends of the global bottled water market. It is shown that bottled water current total sales are around 300 bill US\$ and volume exceeding 470 billion liters, almost half of these numbers is due to the combined markets of USA, China and Indonesia. The top 50 largest national markets were further analyzed and ranked by their sales both total and per

capita. Analysis further indicates that in most developing countries, bottled water sales, while relatively small at present, are stimulated primarily by the lack or absence of a reliable public water supply. Bottled water can almost eliminate, in certain cases, the role of the state in water provision and slow down the needed water infrastructure development. Based on extensive literature review, it is shown that there have been numerous cases of inorganic, organic and microbiological contamination of hundreds of bottled water brands of all bottled

water types, which constitutes strong evidence against the misleading perception that BW is an unquestionably safe drinking water source. Examples of the impacts of bottled water procurement on groundwater have also been identified. In addition, scattered information on plastic pollution associated with bottled water has been collated and it was estimated that the industry currently generates around 25 mill tons of plastic waste per year globally, which is not recycled. These and other details of the analysis are summarized in the report that will be released in early 2023, essentially raising the question of how the bottled water industry contributes (or not) to the achievement of sustainable development goal (SDG) 6.1 - universal access to safe drinking water – and other SDGs.

Identifying creeping global water-related risks: water storage losses to sedimentation

UNU-INWEH completed a global assessment of water storage losses due to sedimentation of large reservoirs. The assessment was done for over 47,000 large dams in 150 countries, for three different time horizons: 2022, 2030 and 2050. It revealed the significant actual loss of storage since the peak of large dams' construction in the middle of the 20-th century: by now, major regions of the world already lost 13-19% of their initially available water storage capacity. The assessment further pointed to the likelihood of additional storage losses of around 25% from today to 2050 and ranked countries in terms of the magnitude of their water storage losses. It further warned that storage losses to sedimentation will not be offset by the newly built dams, as their construction at present dropped dramatically in the last few decades. Decreasing capacity of reservoirs due to sedimentation, coupled with major decreasing trend in dam construction at present threatens water supply in many countries - within the existing generation.



Evaluating gaps in research on water and antimicrobial resistance

UNU-INWEH examined the critical knowledge and governance gaps in Anti-Microbial Resistance (AMR) - a global health issue, linked to human antimicrobial misuse and abuse, food production, and broader environmental contamination. In 2015, the World Health Organization developed guidance to combat AMR in accordance with a One Health framework considering human, animal, and environment sectors of planetary health. UNU-INWEH's [review of 25 National Action Plans to combat AMR](#) found that global and national stewardship primarily focuses on mitigating antibiotic use in the human and animal sectors, overlooking environmental drivers, particularly – natural water bodies. The findings highlight the need to broaden the scope of water-related AMR concerns beyond water, sanitation, and hygiene (WASH) infrastructure for water supply and wastewater treatment, and account for “environmental waters” in AMR development and dissemination, particularly



in low-income countries where half a billion people rely on environmental waters to meet daily needs. A companion bibliographic review, classified over 12,600 records from 1990 to 2020 thematically in order to highlight **AMR research prioritization and gaps**. It specifically assessed water-related gaps as water is recognized as both a primary environmental dissemination pathway and key means of intervention. The review found

that themes related to plant, wildlife, and environmental-related AMR threats—in particular, the role that natural waters play in AMR development, transmission, and spread—are under-prioritized as compared to human and food animal health concerns regardless of geographic region or income level. Further prioritization of these themes is needed to strengthen the environmental dimension of One Health AMR responses and systemically protect human health worldwide.

Quantifying and promoting water and gender interlinkages for sustainable development

As part of its 2020-2024 Strategy, UNU-INWEH started an initiative to assess the numbers and roles of women in the various components of the global water sector by country. This work is strongly quantitative and aims to provide numerical evidence for transformative gender inclusion policies throughout the water sector in the Global South. The focus is on national and regional levels in low-and middle-income countries. UNU-INWEH designed an on-line survey aiming to collect data on several specific indicators, largely stemming from the **UNESCO-WWAP toolkit on sex-disaggregated water data**. Accordingly, UNU-INWEH established a collaboration on this initiative. The survey has been disseminated globally through various channels, including some 150 UN Resident Coordinators in countries.

UNU-INWEH has also been invited and subsequently joined the UNESCO WWAP-led global coalition on water and gender and a “**Call for Action to Accelerate Gender Equality in the Water Domain**”. This unique multi-stakeholder initiative has the scope to promote concrete actions on this topic and provide a common platform to showcase these worldwide efforts at the UN 2023 Water Conference in New York.



In October 2022, UNU-INWEH co-organized (together with WaterAid, and Canadian coalition on climate and development) a webinar **Women and Water: On the frontline of climate change**. The webinar was inspired by the concern that as stewards of water, women and girls confront the impacts of climate change every day, and yet lack decision making power to influence climate finance commitments to water security. These impacts are deepening the devastating impact of widespread gender inequality in changing climate. The webinar involved over 400 participants with high level speakers from the North and South, including Government Ministers from Madagascar and Mozambique, and representatives of the African Development Bank. The webinar included two presentations from UNU-INWEH staff and involved UNU-INWEH staff as moderators. It also produced a **Joint Statement** endorsed by many agencies with an appeal to governments and organizations participating in COP27 in Egypt. The Statement stressed the importance of hearing the voices of women and girls in policy discussions, the bridging of the gap between global climate discussions and locally led adaptation initiatives, and prioritizing WASH in global climate financing agreements.

Expanding collaboration with national policy actors to achieve water-related SDGs

UNU-INWEH provides continuing and consistent normative support, training and advisory services to various policy and planning organizations in countries in the Global South in their efforts to achieve national water-related SDG targets. UNU-INWEH's flagship tool – SDG 6 Policy Support System (SDG-PSS) – provides an online platform to help create evidence on the enabling environment of SDG 6 at the national level. The tool can be used in countries even with limited data. By the end of 2022, the tool was available in 6 languages: Arabic (being the addition in 2022), English, French, Spanish, Portuguese, and Korean. In 2022, UNU-INWEH released several summaries capturing project's progress in countries most actively using the PSS tool: **Brazil, Costa Rica, Republic of Korea, Pakistan, and Tunisia**. By November 2022, there was a total of 54 national organizations in the Global South (in 34 countries) that have been exposed to UNU-INWEH PSS tool, of which 37 were national agencies and ministries, and 17 - research organizations. The total number of such organizations and countries is increasing every year. A regional Asian in-person workshop to promote experiences on how PSS supports national progress towards SDG6 targets was held in November 2022 in Daegu, Korea. It brought together representatives from 13 countries, or which 5 countries were new to the initiative. With new countries joining, the total number of countries receiving UNU-INWEH support through SDG PSS has increased to 39. UNU-INWEH is aiming to bring the number of participating countries to 50 by the end of 2023.



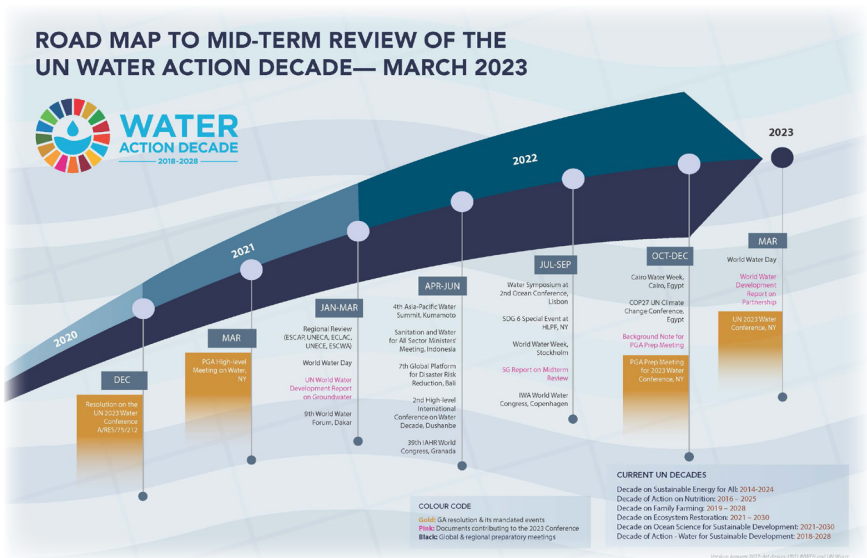
Participants of the regional SDG6 workshop in Daegu, Korea, November 2022

Supporting UN Processes

Throughout the year, UNU-INWEH was actively involved in UN-Water action in preparation of the UN Conference on the midterm Review of the Implementation of the Water Action Decade – the Conference to be held in New York in March 2023. UNU-INWEH co-coordinates (together with UN DESA) the UN-Water Task Force (TF) on the Water Action Decade Implementation; the TF includes over 20 UN-Water members and partners. The 2023 Conference will be the landmark global water event - the second such conference after Mar del Plata (1977). The key component of the Conference is the series of five 3-hour interactive dialogues. In 2022, a series of global stakeholder consultations was held, and UN-Water TF coordinated inputs from all UN agencies to help distill the themes for these interactive Dialogs. The five themes that were finally endorsed by the hosts of the Conference – Tajikistan and the Netherlands - are:

1. Water for Health
2. Water for Sustainable Development
3. Water for Climate, Resilience and Environment
4. Water for Cooperation and
5. Accelerating the implementation of the objectives of Water Action Decade of 2018-2028

All five Dialogs will have background concept papers that will describe the global status and progress in each selected theme and formulate guiding questions for dialog participants and speakers. UNU-INWEH and UNDESA coordinated the UN-Water system-wide efforts to develop a concept paper for Theme 5.



CAPACITY DEVELOPMENT

UNU- INWEH is an active participant of the **UN-Water SDG6 Capacity Development Initiative (CDI)**. The CDI has been motivated by the SDG 6 Global Acceleration Framework launched in 2020. The Initiative aims to respond to requests from countries assisting them in undertaking a water capacity gap assessment, and operates at intersectoral, inter-ministerial and multi-stakeholder level. It helps the UN Member States in the preparation of national water capacity development plans.

UNU-INWEH continues offering its long- and short- term teaching and training programs. The collaborative (UNU-INWEH - McMaster University) graduate certificate program – **Water Without Borders** - graduated over 20 students in summer 2022 and attracted another 20 in the fall 2022. The program examines water issues across geopolitical and disciplinary boundaries, extends over two-semester and includes problem-based learning and writing a mini-paper on a water-related topic relevant to UNU-INWEH work.

In 2022, UNU-INWEH hosted 8 interns. UNU-INWEH **Internships** are open for recent graduates or final-stage graduate program students regardless of the trainee location in the world and can last 3-6 months. UNU-INWEH provides interns with a chance to work in an international environment and experience first-hand the operations of the United Nations.

UNU-INWEH's online **Water Learning Center (WLC)** now offers 11 courses/programs with durations from 3 hours to several weeks. The latest additions to the suite in 2022 were new courses on **WASH in Health Facilities**, **Active and Passive Satellite Data Analysis Using Cloud Computing for Surface Water/Flood Mapping** and **Spatiotemporal Drought Assessment by Leveraging Google Earth Engine Platform**. All new courses are of 10-14 hours duration and are either targeting healthcare professionals and community workers interested in improving WASH and environmental sanitation in healthcare facilities or introducing the participants to Earth Engine Code Editor platform and its water-related applications. Overall, in 2022, around 1300 students were enrolled in various WLC courses, with some 60% of students being from the Global South.



**WASH in
Healthcare...**

Available Now



**Active and Passive
Satellite Data...**

Starts: Dec 14, 2022



**Spatiotemporal
Drought...**

Starts: Dec 14, 2022

New courses on the online Water Learning Center added in 2022

UNU-INWEH staff is also actively involved as lecturers in other training and teaching events, such as (2022 examples) Dr Qadir's contribution to Master Program "Sustainable water management and governance in the natural and agricultural environments" hosted by the Mediterranean Agronomic Institute (CIHEAM) in Zaragoza, Spain, or Dr Taing's contribution to teaching the course on 'Behaviour science and advocacy' at IHE Delft (formerly UNESCO-IHE, the Netherlands).

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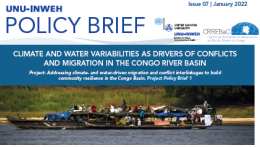
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Background

The Democratic Republic of Congo (DRC) is one of the most populated and least developed countries in the world. The DRC is also one of the most vulnerable to climate change, with high levels of poverty and a large population dependent on agriculture. The DRC is also one of the most conflict-prone countries in the world, with a long history of civil war and political instability. The DRC is also one of the most water-stressed countries in the world, with a large population dependent on agriculture and a large population dependent on water for drinking and sanitation. The DRC is also one of the most vulnerable to climate change, with high levels of poverty and a large population dependent on agriculture. The DRC is also one of the most conflict-prone countries in the world, with a long history of civil war and political instability. The DRC is also one of the most water-stressed countries in the world, with a large population dependent on agriculture and a large population dependent on water for drinking and sanitation.

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The Democratic Republic of Congo (DRC) is one of the most populated and least developed countries in the world. The DRC is also one of the most vulnerable to climate change, with high levels of poverty and a large population dependent on agriculture. The DRC is also one of the most conflict-prone countries in the world, with a long history of civil war and political instability. The DRC is also one of the most water-stressed countries in the world, with a large population dependent on agriculture and a large population dependent on water for drinking and sanitation. The DRC is also one of the most vulnerable to climate change, with high levels of poverty and a large population dependent on agriculture. The DRC is also one of the most conflict-prone countries in the world, with a long history of civil war and political instability. The DRC is also one of the most water-stressed countries in the world, with a large population dependent on agriculture and a large population dependent on water for drinking and sanitation.

Background

The Democratic Republic of Congo (DRC) is one of the most populated and least developed countries in the world. The DRC is also one of the most vulnerable to climate change, with high levels of poverty and a large population dependent on agriculture. The DRC is also one of the most conflict-prone countries in the world, with a long history of civil war and political instability. The DRC is also one of the most water-stressed countries in the world, with a large population dependent on agriculture and a large population dependent on water for drinking and sanitation. The DRC is also one of the most vulnerable to climate change, with high levels of poverty and a large population dependent on agriculture. The DRC is also one of the most conflict-prone countries in the world, with a long history of civil war and political instability. The DRC is also one of the most water-stressed countries in the world, with a large population dependent on agriculture and a large population dependent on water for drinking and sanitation.

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