

WASH AND CLIMATE CHANGE ADAPTATION AND MITIGATION FOR HEALTH, 2023-2030

**ADDENDA TO THE WHO WASH
STRATEGY 2018-2023**

Draft



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Since January 2022, multiple extreme weather events have damaged homes and public infrastructure in Madagascar, leaving over 650,000 people without access to health care. © WHO/Henitsoa Rafalia.

1. Introduction

Despite the World Health Organization (WHO) identifying climate change as the biggest health threat facing humanity, the most recent WHO data¹ shows that the majority of countries have not addressed climate risks or introduced climate resiliency into water, sanitation and hygiene (WASH) policies and planning. As one of the cornerstones of public health, WASH is critical in supporting the transition from health vulnerability to resilience² in the face of climate change. This document takes stock of WHO's actions at the interface of WASH, climate change and health, with the aim to optimize future actions.

2. WASH, climate change and health

Climate change-induced risks and threats come from both extreme events – climate shocks – and slower-onset and long-term impact changes – climate stress. The changes in climate that have already occurred means there is an increasing frequency, and in some cases increasing severity, of extreme events – heatwaves, floods, droughts, wildfires, windstorms and associated storm surges – that cause illness, death and displacement of people, and disruption to services. Longer-term changes in average temperatures, precipitation and rising sea-levels will amplify threats that are already being felt.

Climate change and WASH are related in three broad ways.

- Access to WASH services and practice of hygiene behaviours are central to building health resilience to climate, and to help societies cope with extreme events and support their recovery in the long-term. They also support the ability to cope with slower-onset events by preventing disease and ensuring adequate hydration with increasing temperatures.



A man lights fire an incinerator as he prepares to incinerate waste from a vaccination site in the town of Bafilo, south of Kara, northern Togo. © WHO/Olivier Asselin.

- WASH services and behaviours are themselves threatened by climate change and must be resilient to support building wider community resilience and health resilience. Climate threats to WASH are substantial. Increased flooding will damage infrastructure, degrade catchments, and contaminate water supplies; floods will lead to overflowing pit latrines, tanks and sewers, and by-passing of wastewater treatment works as well as bring polluted runoff from agricultural land, cities and industries; droughts will reduce water availability and degrade source water quality; increasing temperatures will change consumption requirements to maintain a healthy hydration and may adversely affect wastewater treatment processes and damage infrastructure in melting permafrost regions; the retreat of glaciers will contribute to water scarcity³ ; wildfires will degrade catchments and water quality; and sea-level rise and storm surges caused by wind storms will increase threats of salinisation of water resources.
- The WASH and health sectors emit greenhouse gases directly and indirectly. For example directly through the operation of wastewater treatment plants and burning of health care waste, and indirectly through emissions associated with transport and manufacturing of relevant equipment and supplies.

WHO's vision is a world in which all peoples attain the highest possible level of health, and its mission is to promote health, keep the world safe and serve the vulnerable, with measurable impact for people at country level. Therefore, the primacy of public health underscores WHO's work on climate resilient WASH.

3. WHO's approach to date

WHO has concentrated on the building of climate resilient WASH services through integration of climate considerations and recommendations in various guidelines documents, tools and implementation approaches that were produced, specifically for climate resilient water and sanitation safety planning, climate resilient and environmentally sustainable health care facilities, assessments (and related monitoring) of climate change impacts on WASH services, and, to a much lesser extent, assessment of WASH-related climate change impacts on health (primarily in the WHO European region)⁴. Networks and platforms where WHO engages in the work above include the WASH and Health Alliance, WMO Water and Climate Coalition, and UN-Water Climate Expert Group.

Furthermore, the WHO's Climate Change and Health Unit (CCH) has focused on the following objectives in relation to the intersection between WASH, climate change and health:

- Integration of WASH considerations within relevant climate change and health risks policies and processes (e.g. Health components of National Adaptation Plans (HNAPs); and climate change and health vulnerability and adaptation assessments (V&A) and interventions (e.g. climate resilient and low carbon sustainable health care systems and facilities and climate-informed health early warning systems);
- Promotion of reliable access to WASH services as a critical requirement to WHO's approach to building climate resilient health systems; and
- Monitoring of WASH-related considerations within key climate change and health monitoring initiatives (e.g. WHO Health and Climate Change Global Survey⁵ and WHO UNFCCC Health and Climate Change Country Profiles)⁶.



Indonesia: water operators conducting regular monitoring in the catchment area during the water safety planning post facilitation assessment. © WHO/Indah Deviyanti.

Activities

The third edition of the WHO Guidelines for drinking-water quality, published in 2004, introduced the concept of integrated, preventive risk management through water safety plans (WSPs). Using health-based targets as a point of departure, WSPs provide a systematic approach towards assessing, managing and monitoring risks from catchment to consumer. It provides a way of structuring and applying tools, methods and procedures to move away from end-of-pipe measurements as the sole indicator of safe drinking-water management and applies a hazard analysis critical control points (HACCP) approach, referring to a series of actions to

be taken to ensure key control points within the drinking-water system are operating within acceptable limits to ensure safe drinking-water supply. WSPs follow the logical sequence of this chain and enable system-tailored hazard identification and risk assessment/management. Later they were complemented by sanitation safety plans (SSPs) and guidance was developed to support climate adaptation and resilience, to support the systematic assessment and management of climate risks through the WSP and SSP approach. In these safety plans, water and sanitation services are targeted to become climate resilient, which means becoming more resilient and better able to adapt to climate variability (as in too little, too much or too dirty water) and to climate change (e.g. higher frequency of extreme events or sea level rise).

The work of WHO and partners in e.g. the WASH and Climate Change Alliance, or through the Protocol on Water and Health (with UNECE), supports risk management and acts mainly on those aspects linking the environmental state to health impacts. Since publication of guidance on [climate resilient water safety plans](#) in 2017, WHO has supported countries in these risk management processes, as well as advocacy, technical capacity building and training programmes on implementation and auditing. The need to build climate resilience has been a significant driver for countries seeking support to introduce WSPs.

Climate considerations are included in the [Guidelines for drinking-water quality 4th edition, incorporating the first and second addenda \(2022\)](#), and supporting documents including: [Protecting surface water for health \(2016\)](#); [Toxic cyanobacteria in water, 2nd ed. \(2021\)](#); and [Domestic water quantity, service level and health, 2nd ed. \(2020\)](#).

Experience of piloting WSPs for the management of climate risks has led to the development of national policies and guidance to support development and implementation of urban and rural WSPs. Technical guidance and support from WHO, both direct and indirect, has led to enhanced uptake of water safety planning across all WHO regions. Technical support provided by WHO has resulted in wider application of climate resilient WSPs in, for example, Nepal, Bangladesh, Ethiopia, Ghana, India, Kuwait, Liberia, Mali, Senegal and Sri Lanka. The impacts of climate on water resources are also featuring in draft national water quality strategies in Mali and Madagascar.

For sanitation, WHO has made efforts to increase focus on SSPs as a tool to support local level risk assessments for climate resilience and support implementation of the [Guidelines on sanitation and health](#), which now integrate climate change in specific sections. Other aspects are explored in the draft discussion paper [Climate, sanitation and health](#), including local level vulnerability assessment and adaptation options.

In settings, there is a major push by WHO and partners to promote climate resilient and low carbon health care facilities, including resilient water and sanitation



Solomon Islands on clinic for screening people for undiagnosed NCDs and providing assessment and treatment services for those who have diagnosed NCDs. WHO has integrated climate change resilience and mitigation in WASH improvements and operations in HCFs, including surveillance and control of water supply. © WHO/Neil Nuia.

services and clean energy in health care facilities (HCFs) with the aim of protecting public health in a changing and unpredictable climate. Technical guidance on [Climate resilient and environmentally sustainable health care facilities](#) was published in 2020 to support an integrated approach to HCFs and promote interventions in the health sector including around WASH, sanitation and waste management that promote both resilience and low-carbon development but also looking at energy, infrastructure, technologies and products, and the health workforce. This guidance document has been used to develop regional and country-level guidance and improvement plans. Additionally, the second edition of [WASH FIT: A practical guide for improving quality of care through water, sanitation and hygiene in health care facilities](#), features climate change resilience and mitigation in WASH improvements and operations in HCFs, including surveillance and control of water supply.

Regional efforts to promote climate resilient HCFs include developing national standards for clean and green health care facilities (all regions), piloting assessment indicators of resilient HCFs and training (WPRO); advocacy toolkits and training packages on climate resilient HCFs (under development in SEARO and developed as an app in English, French and Spanish in PAHO); tools with minimum standards and indicators for emergency preparedness for health facilities (PAHO); and promoting WASH FIT analysis (EMRO, EURO and PAHO).

There are opportunities to better integrate and streamline the risk management approaches described above to simplify and clarify for field-level use, e.g. integrating key WSP and SSP steps into WASH FIT for greater water quality risk management in HCFs without requiring a separate WSP or SSP. Climate considerations have also been streamlined into the draft revised water safety plan and sanitation

safety plan manuals; additional guidance is also being developed based on needs identified through WSP auditing including guidance notes on accessing and integrating climate information for WSPs; auditing WSPs for strengthened climate resilience; and climate vulnerability and adaptation assessments in the WASH sector. Climate is also being considered in the forthcoming updated small water supplies guideline, including in the sanitary inspection forms.

On monitoring, climate change indicators have been integrated into GLAAS 2021/2022 country surveys to monitor inclusion of climate change preparedness approaches in national planning and local risk management of WASH; the GLAAS Report will be published in late 2022.

To date, the efforts on assessing health effects of climate change or measuring disease burden related to WASH, be the diseases water-washed, hygiene-related issues, plus water-based issues (e.g. cyanobacteria), and vector-borne diseases, have been limited. The IPCC notes⁷ the key risks related to waterborne disease for mostly low- and middle-income countries (Africa and Asia); small islands; and globally for Vibrios to be:

Increase in the occurrence and intensity of waterborne diseases such as Vibrios (particularly V. cholerae), diarrheal diseases, other waterborne gastrointestinal illnesses

Substantial changes in temperature and precipitation patterns, increased frequency and intensity of extreme weather events (e.g., droughts, storms, floods), ocean warming and acidification

Large increases in exposure, particularly in areas with poor sanitation, flood-prone areas, and favourable ecological environments for waterborne disease pathogens

Poor hygiene conditions, lack of clean drinking water and safe food, flood and drought prone areas, vulnerabilities of water and sanitation systems

Improved water, sanitation and hygiene conditions and better surveillance system. Improved personal drinking and eating habits, behaviour change

Integration of WASH within WHO's CCH programme and opportunities for increased action

2021 was a very important year for the health community in addressing climate change. For the first time in the United Nations Framework Convention on Climate Change (UNFCCC) negotiations, a formal health programme was promoted by the UK as President of the Conference of the Parties (COP).

The COP26 Health Programme included a total of four Health Initiatives, including on climate resilient and low carbon sustainable health systems. As of today,

a total of 60 countries have committed at Minister of Health level, to strengthen the climate resilience and lower the emissions of health systems. The summary of countries and its commitments can be found [here](#).

As a follow-up to these commitments the UK and WHO have established a WHO-led platform, the “[Alliance on Transformative Action on Climate and Health](#)” (ATACH), to build on this momentum and advance action on climate change and health at country level. The ATACH aims to support countries in the implementation of their COP26 commitments as a first priority. Given the importance of e.g. maximizing health co-benefits of mitigation action, the aim is to broaden the scope of the ATACH as soon as possible.



[Home](#) / [Initiatives](#) / Alliance for Transformative Action on Climate and Health



The implementation of these commitments (including HNAPs, V&As, facilitation of access to climate change funding for health, and climate resilient and low carbon sustainable health care systems and facilities) constitutes an opportunity for WHO to promote access to reliable WASH services at health care facility level and the integration of WASH considerations within the implementation of country commitments (e.g. HNAPs, V&As, and climate resilient and low carbon sustainable health care systems and facilities).

Prior to the COP26 Health programme and the establishment of the ATACH, the implementation of the CCH programme has resulted in:

- Advocacy: WASH featured in WHO Global Conferences on climate change and health; WASH featured in WHO's led high level events on climate change and health at COPs. WASH promoted within the COP26 Special report on climate change and health.
- Evidence and monitoring: WHO's global monitoring of health and climate change has strengthened since 2015 with the introduction of the WHO health and climate change global survey, a triennial survey that tracks health sector response to climate change across areas such as governance, research and evidence, implementation and finance. Since 2015, WHO in partnership with the UNFCCC also works with national governments to develop health and climate change country profiles, detailing national level climate hazards, health risks and actions to build climate resilient and sustainable health systems.
- Country support: strengthened collaboration between Ministries of Health and Ministries of Water and Sanitation for the integration of WASH consideration within HNAPs (e.g. Bangladesh, Nepal, Mozambique, Ethiopia, Malawi and Tanzania), V&As and the promotion of WASH within WHO's integrated approach to build climate resilient and low carbon sustainable health care facilities and systems including its adaptation by WHO Regions (e.g. SEARO, WPRO and PAHO).

4. WHO WASH-climate-health 2023-2030 focus areas

Building on the above, WHO will leverage its comparative advantage of health leadership and advocacy, normative standard setting, monitoring and research, and strategic partnership to pursue work in the areas articulated below.

4.1 Monitoring of climate resilient WASH and of the integration of WASH within climate change and health initiatives and processes

While work has progressed in promoting the management of climate-risks through water safety planning, there remains limited understanding of the resilience of WASH services. As noted by Howard et al, understanding and improving resilience requires reliable data in at least six domains: WASH infrastructure, the environmental setting (catchment), WASH management, community governance and engagement, institutional support and supply chains⁸. Measurement of climate resilient WASH will likely include the inclusion of process-oriented, enabling environment indicators, ideally paired with WASH output measurement. There are likely many indicators appropriate to the local or project level that are too specific to be scaled up to national and global monitoring.

As a co-custodian for the SDG indicators on monitoring of access to WASH services and the WASH enabling environment, WHO is positioned to advise, facilitate or participate in soliciting inputs, reviewing and compiling existing tools and methods for collecting data on climate and WASH, producing an inventory of tools and measures, developing gap analysis, producing a conceptual framework, recommending actions such as piloting new indicators or data collection methods, and reporting regularly.

Priority activities - GLAAS

- ◇ Build in additional questions on climate-resilience in country and External Support Agency surveys and include an expanded climate analysis in future GLAAS reports.
- ◇ Contribute to systematic landscaping on how different countries/ sectors around the world define/monitor resilience and what actions are being taken.
- ◇ Progressively integrate resilience assessment information in to WASH accounts over the longer-term.
- ◇ Progressively contribute to a programme of activities with existing partners such as UNICEF to deliver resilience assessments and to use the evidence to consider outcome as well as process indicators.

Priority activities - JMP

- ◇ Review if and how climate resilience is included in water, sanitation and hygiene monitoring.
- ◇ Identify existing data sources and tools for assessing climate resilience in the context of water, sanitation, and hygiene.
- ◇ Identify critical gaps in climate resilience measurement needs in the context of the SDG WASH targets.
- ◇ Collect additional data from households: seasonality of water supplies, multiple uses of water, and on-site sanitation storage overflow events.
- ◇ Collect additional data from utilities, service providers and governments about extreme weather events and impacts on treatment plants, and about frequency and magnitude of combined sewer overflows.
- ◇ Enhance monitoring of on-site sanitation and wastewater.

Priority activities – Global Monitoring Programme on Health and Climate Change

- ◇ Review and revise WHO health and climate change global survey for coverage of climate resilient WASH indicators and consider case study or special focus on WASH in future reports.
- ◇ Review and strengthen climate resilient WASH content in country profiles, particularly through collaboration with GLAAS and JMP programmes and other partners.
- ◇ Collect additional data on WASH commitments and monitoring in Nationally Determined Contributions (NDCs) through our health in NDCs assessments or by collaboration with partners conducting WASH related analysis in NDCs. Progressively integrate into ATACH monitoring function in future.
- ◇ Ensure the ATACH monitoring function includes relevant data on WASH integration within relevant policies (e.g. HNAP, healthy NDCs) and implementation mechanisms (e.g. climate resilient and low carbon health systems and facilities).

4.2 Integrating climate resilience into WASH interventions and risk management

Drinking-water is one of the main exposure routes for water-borne diseases, together with hands-mouth contact or via food. Other routes include water contact through e.g., bathing, farming, laundry, or floods. Certain chemicals and some pathogens may pass from the contaminated water and soil system into/onto crops and affect food safety. Some disease pathways involve exposure to contaminated soil, such as hookworm and other soil-transmitted helminths. Poorly managed water and sanitation facilities can create breeding sites for flies, mosquitoes, and other vectors of diseases such as trachoma, lymphatic filariasis and viral diseases. Exposure to vectors is influenced by housing, behaviour, but also level of income and access to preventive health care.

WHO will build upon the encouraging level of global WSP uptake through more targeted future support at regional and country level, especially for small systems. Lessons learned from its work on WSPs including the integration of climate resilience, will inform the development of additional resources.

WHO will continue to state its clear position on the primacy of sanitation for public health protection, elaborate criteria of how climate resilient sanitation systems look like and how they can be improved and promote safe water reuse and consider what other interventions may be necessary and warranting high priority from WHO.

Drinking-water and recreational water quality and safety

Collectively, ensuring safe drinking-water, sanitation and hygiene interrupt disease transmission pathways, particularly for water-related diseases. However, WASH systems themselves are vulnerable to contamination including as a result of extreme events and require management of risks throughout the supply chain, e.g. through water safety planning. As of February 2022, based on WHO HQ-led monitoring, 64 countries have water safety planning policies, the result of significant time and resources invested by WHO. Many of these include the active integration of climate change considerations as articulated in the forthcoming second editions of the WSP manual and the WHO EURO WSP field guide (to be published in 2022), which integrates climate resilience throughout. As well, in many WHO regions, capacity building around WSPs has emphasized climate resilience aspects be fully integrated in all steps. Still, it remains difficult for effective WSPs



Treatment works inspection at Chandpur Paurashva treatment plant, Bangladesh. © WHO/Payden.

to be put in place for small systems and other resource limited settings.

Though more research is needed to improve understanding of the increasing impact of global climate change on recreational water environments and water quality, it is generally understood that climate change can impact sewerage infrastructure and wastewater treatment plants, often sited close to sea level, causing discharges of inadequately treated human excreta into surface waters and nearby recreational areas. In some water bodies, extreme climate events could cause increased blooms of harmful algae (cyanobacteria) and other water-based pathogens during periods of low flow and warm weather. Climate change impacts on recreational water will certainly vary locally, depending on the hydrological characteristics of a water body, and potential local scenarios should be considered as part of an Recreational Water Safety Plan⁹.

Priority activities

- ♦ Working with partners, promote support mechanisms for WSP teams to access local (for planning purposes), district or national climate expertise (including by linking them to national meteorological agencies and disaster risk reduction colleagues, whom often have the greatest knowledge and capacity in-country).
- ♦ Finalize global guidance to support the practical integration of climate change in water safety planning (post-Q3 2022), WSP auditing for strengthened climate resilience, conducting climate vulnerability and adaptation assessments in the WASH sector, and update the WSP guidance for small supplies to integrate climate resilience
- ♦ Support implementation of WHO's small water supplies guideline including sanitary inspections.
- ♦ Target more future country support using updated WSP global training package for organized piped supplies.
- ♦ Work with partners to promote the use of water safety planning to inform and articulate a clearer, more coherent narrative in order to mobilize climate finance for WASH and infrastructure improvement.
- ♦ Support national governments to incorporate aspects of climate resilience/adaptation into national water policy and planning.
- ♦ Plan for a systematic review and update of the GDWQ so that the 5th edition more comprehensively includes climate considerations throughout (rather than the stand-alone climate section), including in guidance on parameter selection, WSPs and surveillance and to inform the update of risk assessments.
- ♦ Support the use of system assessments which include identification of hazards and hazardous events for recreational waters, considering seasonality and predicted local climate change scenarios.

Sanitation and wastewater

Overall understanding of the impact of climate change on sanitation, and how these impacts may be best managed, is less well developed¹⁰ than for water supply. However, existing guidelines and tools, including WHO Guidelines on sanitation and health, Climate resilient sanitation safety planning and Sanitary inspection packages offer routes for managing the threats to sanitation and the public health risks that arise from impacts of climate change. As a priority WHO will continue to promote, strengthen and mainstream aspects of climate resilience in WHO sanitation guidance and tools, with a focus on strengthening the use of climate data, making the case for climate financing for sanitation and incorporating lesson from implementation into future edition of WHO documents and sector approaches.

Sanitation, particularly safe use of wastewater and sludge, offers important opportunities to increase resilience in other sectors – particularly in agriculture though reliable supply of water and nutrients in increasingly water insecure areas and to the energy sector though energy recovery from methane and dried sludge. WHO will continue to promote safe use of wastewater with an updated lens of climate resilience and update guidance and tools focusing primarily on intersectoral coordination and policy coherence needed for risk management and safety along the sanitation chain though to food production and consumption.



Wastewater treatment plant, Tunisia. © WHO/Diego Rodriguez.

Sanitation is associated with greenhouse gas emissions (GHG), particularly methane. As part of thrust to reduce GHG emissions, the chain of wastewater collection and treatment, including local systems, should also be addressed. Energy generation from sludge, sewage, or solid waste may support local energy transitions, contribute to circularity, and generate revenue for water supply and sanitation services.

Climate mitigation measures should not compromise core public health protection principles. While focusing primarily on sanitation adaptation, WHO will investigate trade-offs of adaptation for sustainable services, mitigation and local contextual factors in technology, favouring low emissions technologies and management options as much as possible¹¹.

There will also be a continuing focus on ending the practice of open defeca-

tion. Though the global average reduction in open defecation appears to be on track to eliminate the practice, much of the progress in eliminating open defecation is being driven by gains in a few high population countries. Open defecation remains a persistent inequality, with nine out of ten open defecators living in rural areas, and poorer people much more likely to practice open defecation. In addition, more frequent or more intense storms or cyclones can damage or destroy latrine superstructures, conveyance pipes, power supplies etc, potentially resulting in increased slippage to open defecation and disruptions to pumping and treatment facilities¹².

Priority activities

- ◊ Continually advocate sanitation as a human right and a public good that needs rapid acceleration with climate resilient solutions to meet SDG targets and support health goals.
- ◊ Strengthen climate change aspects in the Guidelines for sanitation and health particularly in relation to adaptation of the enabling environment, technologies and local risk assessment acknowledging the trade-offs of adaptation, mitigation and local contextual factors in technology and management options.
- ◊ Promote and support implementation of climate resilient SSPs, synthesize and share learning in particularly in relation to using climate risk assessment to justify climate related investment in improvement identified in SSP (and overall alignment with the WHO approach to build climate resilient and low carbon health care facilities).
- ◊ Support national governments to incorporate aspects of climate resilience/adaptation into national sanitation policy and planning.
- ◊ Promote, and possibly update, the safe use of wastewater to support resilience to climate induced water and nutrient scarcity in agriculture.
- ◊ Increase membership of sanitation regulators in RegNet and support regulators to develop climate sensitive regulation through cross-learning and WHO technical guidance (e.g. on setting standards for wastewater and sludge treatment)
- ◊ Encourage partners to use climate resilience as a driving principle to integrate SSPs (and WSPs), especially at local level (where implementing actors are the same).
- ◊ Partner internally (i.e. WHO CCH unit) and externally (i.e., WASH and Climate Change Alliance, ATACH, WMO Water and Climate Coalition, UN-Water Climate Expert Group) to make use of evidence, story lines, to engage in COP and elsewhere.
- ◊ Work with partners to promote the use of sanitation safety planning to inform and articulate a clearer, more coherent narrative in order to mobilize climate finance for WASH and infrastructure improvement.



Hand washing station at the Banta border post on the Guinea/Liberia border. © WHO/Ahmed Jallanzo.

Accelerating and sustaining hygiene in community settings

Hygiene and hand hygiene in particular are key elements of WASH interventions. These involve raising awareness of the water-health-environment links, so that people are more likely to change their behaviour and use the available water and sanitation facilities appropriately. This has the potential to enhance health benefits; the risks of diarrhoeal diseases are reduced by 47% if communities have appropriate hand-washing practices. Increased water availability, regardless of its quality, supports hygiene as more water can be used for bathing, washing clothes and cleaning of dwellings and utensils.

Improved hygiene has a positive impact on louse-borne diseases, eye and skin infections and other water-washed diseases, in addition to reducing faecal-orally transmitted diseases. This impact can be further enhanced by providing additional facilities, such as laundry sites or convenient slabs for cleaning household utensils. This also reduces exposure to water-based diseases such as schistosomiasis.

Priority activities

- ♦ Ensuring that upcoming WHO Guidelines on hand hygiene in community settings address increasing climate-related risks (e.g. water scarcity and increasing importance of hand hygiene as a first line of defense when other barriers fail).
- ♦ Promote the importance and influence of the Hand Hygiene for All partnership, and evidence-based recommendations emanating from the partnership.
- ♦ Hygiene promotion, based on understanding of multiple transmission pathways, with increased awareness of community, and supported by adequate services (e.g., for hand washing and laundry).

4.3 Building climate resilient WASH in health care facilities

WHO's work on ensuring resilient WASH in health care facilities will remain a priority but shift from a focus on normative guidance to assessments and actions at country levels. For other public settings (i.e. transportation hubs in cities, markets), WHO will rely upon its normative role to define guidelines and minimum standards of service, deploying tools and approaches (i.e. Hand Hygiene for All, HH4A) where useful as a vehicle for wider engagement with partners engaged in these settings, such as UN-Habitat.

Furthermore, as a response to the Health Programme promoted by the UK as President of the 26 Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC) 60 countries around all WHO Regions, have committed to strengthening climate resilience and low carbon sustainable health systems. There is a lot of momentum now to move to the implementation of these commitments. Given this commitment and momentum to building climate resilient and low carbon sustainable health systems, and the newly established Alliance on Transformative Action on Climate and Health, combined with the evidence from many LMICs that there is very limited progress, WHO will continue to push for action on developing resilient and environmentally sustainable WASH in HCF and other public places.

This will include a focus on health care waste. While the issue of health waste has existed for a long time, COVID-19 has forced the world to reckon with the gaps and neglected aspects of the waste stream and how we produce, use, discard, and in some case reuse our health care resources, across the life cycle. Today, 30% of healthcare facilities (60% in the least developed countries) are not equipped to handle existing waste loads, let alone the additional COVID-19 load. This potentially exposes health workers to needle stick injuries, burns and pathogenic microorganisms, while also impacting communities living near poorly managed landfills and waste disposal sites through contaminated air from burning waste, poor water quality or disease carrying pests. As part of overall efforts to support climate resilient health care facilities, WHO's 2022 report [Global analysis of health care waste in the context of COVID-19](#) laid out a set of recommendations for integrating better, safer and more environmentally sustainable waste practices.



The waiting area at the Karagehusian Primary Health Centre in Beirut, Lebanon, on 26 July 2022. © WHO/Natalie Naccache.

Priority activities

- ◇ Linked to the COP26 commitment, advocate for countries to strengthen climate resilient and low carbon health systems and facilities, including conducting health vulnerability and adaptation assessments at health care facility level (See [Checklists to assess vulnerabilities in health care facilities in the context of climate change](#))
- ◇ Shift from a focus on normative guidance to assessments and actions at country levels, for HCFs, but keep normative focus for other settings.
- ◇ Place emphasis in securing long-term investment and commitment from health sector budgets and to ensure that resilient WASH in HCF is integrated within, and seen as, a health sector issue and not a WASH sector alone issue.
- ◇ Promote and support WSPs (and SSPs) in WASH in HCF/WASH Facilities Improvement Tool (WASH FIT).
- ◇ Encourage the shared use of common climate information for WSP, SSP and WASH in healthcare facilities purposes, especially at local level (where implementing actors are the same).
- ◇ Define criteria of what a climate resilient and low carbon WASH service in HCFs looks like, for different types of HCFs.
- ◇ Define, with partners and ministries representing other sectors (housing, commerce, transportation), guidelines on minimum standards of service in different settings, including public places like markets and transportation hubs.
- ◇ Collect, review and share ongoing assessments on climate change risks to health care facilities and their WASH and energy systems, by subregion, including recommended actions. This will also be promoted for the other components of the WHO integrated approach to building climate resilient and environmentally sustainable health care facilities (i.e. infrastructure, technologies and products and health workforce).
- ◇ Support at country level implementation of recommendations from the Global analysis of health care waste in the context of COVID-19.

4.4 Expanding research on the influence of climate change on WASH-related health outcomes

The IPCC¹³ has reported that more people would experience water scarcity and floods (high confidence) and identified WASH failure due to climate change as an emergent risk (medium confidence) leading to higher diarrhoea risk. In addition, it projected the risk from droughts, heavy precipitation, water scarcity, wildfire damage and permafrost degradation to be higher at 2 C warming

than 1.5 C (medium confidence) and all these could potentially impact water quality and WASH services. Further, the IPCC noted waterborne diseases result from complex causal relationships between climate, environmental and socio-economic factors that are not fully understood. Exacerbating the above further will be regional variability and impact of these wider issues of water security on health. The threats posed by floods and their impacts on infectious and non-communicable disease, are also widespread and would hit differently across the WHO regions. To take one specific example, there are very limited studies about the impacts of global climate change on hydration level¹⁴.

WHO will commission research that goes beyond the traditional review of impact of climate change on waterborne diseases (notably diarrhoea) to understand the wider WASH-related health impacts and endpoints and to generally improve understanding of the linkages between climate, WASH and water-related health outcomes.

WHO will also call for increased research on water quality security and health to improve the evidence and understanding of how climate variables influence safe drinking-water delivery and reliability considerations, and the implications of these changes on health¹⁵. Further, WHO will review evidence on climate impacts on sanitation and the degree to which climate resilient SSPs can mitigate these risks.

Priority activities

- ◇ Model how WASH-related disease burden are likely to change, considering climate scenarios, and potentially through the development and use of a dynamic QMRA-climate-sanitary condition model.
- ◇ Analyse the likely climate impacts on the quality, coverage and reliability of WASH service provision.
- ◇ Improve characterization of how climate change will influence occurrence of water quality contaminants of emerging concern (e.g. AMR, PFAS etc).

4.5 Strengthening environmental surveillance, forecasting and early warning

Environmental surveillance (e.g. wastewater monitoring) has a role to play alongside epidemiological surveillance (see Appendix) as an early warning signal in the detection of new or re-emerging outbreaks as an indicator of trends in disease prevalence, or where relevant, in detection of pathogen variants of concern. Environmental surveillance can complement disease risk mapping to identify vulnerable areas and risk groups, inform and monitor the effectiveness of response and relief efforts, as well as identify research needs and eval-

uate control strategies. Such surveillance can become powerful when linked to existing early warning systems.

Monitoring of flows and quality of surface water, groundwater and wastewater helps to identify potential threats to water availability and quality, and subsequently undertake remedial action. Microbial water quality monitoring has undergone a tremendous transition in recent years, with novel molecular tools beginning to offer rapid, high-throughput, sensitive and specific detection of a wide spectrum of microbial pathogens that challenge traditional culture-based techniques. High-density micro-arrays, quantitative real-time PCR (qPCR) and pyrosequencing are emerging rapidly as tools of pathogen detection and discovery. Such tools not only detect presence, but also provide insight into quantities, i.e. actual pathogen load. Recently with the COVID pandemic, progress has been made in monitoring of viruses in wastewater. Wastewater surveillance is cost-effective, particularly when compared to human epidemiological surveillance, and efficient as an early warning system. The various tools could be expanded beyond standard faecal indicators (usually *E. coli*) and SARS-CoV-2 and include other indicators such as *Legionella*, *Mycobacterium* or norovirus. In some countries these provide a much better representation of microbial contamination.

Besides monitoring, the application of hydrological and water quality modelling tools calibrated against existing monitoring data can provide an effective way of quantifying total catchment pollutant loads to the water system. The complete model framework could be further applied as a management tool to help evaluate the collective impacts of potential strategies for reducing pollutant inputs to the water system and steer future management objectives. The combination of big data management and water quality models also allows water quality practitioners to develop forecast and early warning system of water quality deterioration of water system, parallel to such systems for forecasting of floods or tsunamis.

Priority activities

- ♦ Continue to provide guidance on technologies, methods and interpretation of data associated with environmental surveillance, including monitoring of source water and wastewater.
- ♦ Support capacity development for improved water quality lab facilities and testing equipment.
- ♦ Support integration of WASH-related climate sensitive disease surveillance to existing early warning systems where applicable;
- ♦ Investigate how big data management and water quality models could allow water quality practitioners to develop forecast and early warning systems of water quality deterioration in water systems, parallel to such systems for forecasting of floods.

4.6 Controlling the spread of climate/water-influenced vector-borne disease

The environmental pressures change the state of water quantity, water quality, and ecology, of groundwater and surface water. Emission runoff and saltwater intrusion not only deteriorate chemical and biological water quality, but also change the ecosystem, which in turn impacts water availability and may affect habitat for vectors such as mosquitoes, snails, flies, ticks, and rats. Lower water quality also means less available water and higher treatment costs. Several of these environmental and climate effects may be cascading. For instance, high nutrient loads into surface water bodies combined with higher temperature may lead to harmful algal blooms, particularly cyanobacteria. Droughts followed by inundations may create myriads of organically polluted vector breeding sites, or, plastic waste, resulting from industrial processes high in greenhouse gas emissions combined with poor solid waste¹⁶ management, and worsened with floods and typhoons, may contribute to chemical pollution, create additional vector habitat and provide both substrate and transport for pathogenic or microbial-resistant bacteria.

Environmental vector control, therefore, has an important role to play in the prevention of malaria, dengue fever and other vector-borne diseases. Construction, operation and maintenance of water and sanitation facilities should include measures to reduce vector breeding. Various options of larval source reduction are available for integration into the design of the facilities, thus reducing the need for additional vector control measures later. A related measure, which could be integrated into household hygiene campaigns, is the removal or regular emptying of household containers to reduce mosquito breeding. This is particularly relevant in urban areas with high incidence of dengue fever. However, as all water-based investments, nature-based solutions and other (urban) climate adaptation measures have the potential to increase vector habitat.

In rural areas, separate basins for watering animals reduce the risk of contamination of water points with manure, though these have to be carefully constructed to reduce trampling around such troughs and creating of hoofprint puddles (ideal potential breeding sites for *Anopheles* mosquitoes). If possible, provisions for other productive uses of water, such as irrigation of home gardens or small businesses, can support livelihoods and thus increase the ability to pay for protective health care.

Priority activities

- ♦ Provide guidelines for considering health dimensions in design, construction and operation of WASH facilities to prevent vector-borne disease spread.
- ♦ Promote screening and (bio)monitoring of harmful waste exposure in target populations accompanied with environmental monitoring (e.g. of water, soil, air).

4.7 Integrating WASH within climate change and health policy and implementation processes

Most actions aimed at health effects of poor water and sanitation reside in the traditional curative health domain that is focused on diagnosis and treatment of diseases and other health effects - after they have occurred. WHO supports national ministries of health that in turn deliver health services to the population, complemented by substantial private sector involvement (e.g. private clinics, hospitals, pharmacies, laboratories, private practitioners, pharmaceutical and (para-)medical industry). Improved health services, with more health workers and increased access for all, including vulnerable groups, will also increase coverage of diagnosis and treatment. Diarrhoea and malaria are the most important water-related causes of death in children under five, but diagnosis may be challenging. In the case of diarrhoea, the exact disease or pathogen cannot always be determined, while for malaria other causes of fever may complicate the picture. However, rehydration therapy (with safe water) and improved hygiene are straightforward no-regret options to reduce mortality from diarrhoea – both are targeted with WASH services. In many countries, malaria diagnosis and treatment are delivered via specialized (so-called ‘vertical’) control programmes, which sometimes have environmental components as well. Integration of, or at least coordination between, environmental health and WASH will help reduce fragmentation and increase effectiveness. WHO could play an important advocacy role in this process.

However, human health cannot be protected and promoted only by the health sector; it depends on efforts by other sectors such as food and agriculture, energy and urban planning. The active involvement of these sectors in NAP development and implementation will make them more effective. Strategies such as building climate resilient health systems and developing low carbon sustainable health systems have already been integrated into the health chapters of National Adaptation Plans¹⁷ and the stand-alone health National Adaptation Plans (HNAPs)¹⁸.

Another reason for stronger inter-sector collaboration is that most of the WSP and SSP teams are from the Ministry of Health, whereas the implementation of climate resilient plans is often done by Disaster Risk Reduction (DRR) or IWRM programs. As many teams from the health sector lack the necessary climate and hydrological experience, adequate support mechanisms should be in place for WSP and SSP teams to access local, district, national and international data and expertise. This includes data and information on climate and weather, as well as background on national and regional climate vulnerability assessments.



Zamora, Spain: Amelia takes water from her well to irrigate her garden. Recent wildfires devastated her town's surroundings and destroyed several houses in other neighborhoods. Climate change makes it more likely for droughts and wildfires to happen. © WHO/Sebastian Liste.

In addition, WHO will support engaging around governance and policies, including laws to reduce submissions, legal requirements for Health Impact Assessments, human rights-based approaches, demographic policies, and DRR strategies. Collaboration between and within institutions needs to be strengthened to integrate disaster and climate risk management into national policies and practices. This would include the clear identification of climate-related disaster risks, the design of specific risk reduction measures and an improved and routine use of climate risk information by planners, engineers and other decision makers.

These efforts will find a broader context in the emerging convention, or agreement, requested by Member States during the 74th World Health Assembly to strengthen pandemic prevention, preparedness and response. The new accord could represent a global commitment to work together, as an international community, to help prevent disease outbreaks from impacting individuals, communities, countries and the world in the same way as the COVID-19 pandemic did. It would aim to build resilience to pandemics; support prevention, detection and responses to outbreaks with pandemic potential; ensure equitable access to pandemic countermeasures; and support global coordination through a stronger and more accountable WHO¹⁹.

Priority activities

- ♦ Using the ATACH governance mechanism recently established, WHO will aim to up-case the effective integration of WASH within the implementation of the COP26 health commitments for climate resilient health systems (e.g. HNAPs, V&As, and funding opportunities).
- ♦ Furthermore, WASH considerations will also be promoted for the implementation of national commitments to low carbon sustainable health systems (i.e. establishment of baseline information on health systems/facility emissions; and development of improvement plans for low carbon health systems).
- ♦ The ATACH monitoring function will ensure relevant data on WASH integration within relevant policies (e.g. HNAP, healthy NDCs) and implementation mechanisms (e.g. climate resilient and low carbon health systems and facilities) is gathered.
- ♦ As part of the overall WHO engagement within the UNFCCC negotiations, WHO will promote the integration of WASH in relevant advocacy opportunities (e.g. high-level side event on climate change and health; special reports on climate change and health; and the WHO-led Health pavilion).
- ♦ Advocacy could be expanded towards integration of WASH and health into national level climate adaptation (or resilience) strategies. Health Impact Assessments are commonly part of environmental assessments required by governments and financing organizations when large water (infrastructure) projects are planned.

4.8 Integrating WASH within Integrated Water Resources Management (IWRM)

Integrated Water Resources Management (IWRM) has been defined as “a process which promotes the coordinated development and management of water, land and related resources, in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment”. This includes investments in water infrastructure and management to meet water demands and needs for flood management, drought resilience, irrigation, energy security and ecosystem services. This includes rules and regulations for allocation, demand management and spatial planning. The natural unit for IWRM is a river basin or watershed, which does not always coincide with administrative or political boundaries. IWRM strives at managing surface water (including storm water) and groundwater in an integrated manner for all purposes and users²⁰. Addressing these dependencies and interactions between WASH and the broader catchment, together with their uncertainties, is crucial to achieve water security and sustainable water and sanitation services. E.g. protection of the upper watershed leads to more reliable and cleaner water supply, while proper wastewater management offers opportunities to increase food security, particularly around cities, and reduces environmental impacts downstream. Effective IWRM is based on the active involvement of multiple sectors such as water, energy, and agriculture, across sectors, scales, and governance levels. This has the potential to reduce fragmentation, which could be strengthened by the inclusion of additional sectors such as climate, housing, and health.

Addressing the dependencies and interactions between WASH and the broader catchment through IWRM, together with their uncertainties, is crucial to achieve water security and sustainable water and sanitation services, e.g. protection of water quality and quantity the upper watershed leads to more reliable and cleaner water supply, while proper wastewater management offers opportunities to increase food security, particularly around cities, and reduces environmental impacts downstream. Effective IWRM is based on the active involvement of multiple sectors such as water, energy and agriculture, and across sectors, scales and governance levels. It has the potential to reduce fragmentation, which could be strengthened by the inclusion of additional sectors such as climate, housing and health. At local levels, IWRM could be applied by providing multipurpose water services that consider all local water sources and all intended uses, thus aiming not only at improving human health, but various other benefits as well.

Increasingly, water quality aspects are taken into consideration as well, for instance via upstream ecosystem management, reduction of emissions from industry, or downstream wastewater treatment. Wastewater management systems are designed to prevent waterborne pollutants from contaminating surface or groundwater sources. As water scarcity increases, more communi-

ties and wastewater utilities are considering wastewater as a commodity with potential for resource recovery and reuse, especially in agriculture (where education of farmers on safe use is critical), but sometimes with considerable health risks. Similarly, sludge could be turned into fertilizer or energy. Storm-water runoff results from precipitation as it flows over land or impervious surfaces and includes pollutants and toxins that can impair waterways. Storm-water systems include traditional grey infrastructure, such as storm sewers, as well as green or nature-based infrastructure. Where solid waste streams may affect groundwater or surface water quality, local authorities may bring these aspects into IWRM as well.

IWRM can be made more climate resilient by addressing climate risks in planning and decision making²¹ and including dedicated measures, such as rain-water harvesting, or by implementing nature-based solutions. Nature-based solutions (NbS) are “actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits”²². As such, the implementation of NbS aims at enhancing the ecosystem services provision and addressing societal challenges²³, for instance by using mangrove trees for flood protection, natural wetlands for water storage, or ecological conservation and restoration. Nature-based solutions have the capacity to improve both water quantity and quality, and thereby increase resilience to climate variability and climate change. Investments in nature-based solutions help to safeguard and maintain ecosystems that are vital for food and water supplies, protect against natural disasters and provide goods and services key to human well-being and economic development²⁴. However, as all water-based investments, nature-based solutions and other (urban) climate adaptation measures have the potential to increase vector habitat.

Priority activities

- ♦ **Develop assessment tools for new IWRM and WASH interventions, as well as specifically for climate adaptation of WASH. For small systems, the tools have to be participatory as these are commonly managed by the users themselves.**
- ♦ **Support countries to conduct Health Impact Assessments; IWRM at river basin and local levels, addressing climate risks in planning and decision making and including nature-based solutions and rainwater harvesting.**
- ♦ **Stimulating the involvement of the health sector in planning and implementation of IWRM at transboundary and national levels, e.g. through WHO’s regional offices.**

5. WHO's WASH-climate-health activities in context

Understanding the impacts of climate change on WASH resilience requires a broader assessment of determinants, which can be informed by a Driver-Pressure-State-Impact-Response (DPSIR) Framework. This can help visualize cause-effect relations from political and environmental drivers to health impacts in people, with potential responses that can be targeted at each level – many responses are already taken by WHO, or potentially could be taken by WHO with partners, and by intra-sectoral and extra-sectoral stakeholders. By accounting for exposure, the framework can be further adapted to environmental human health, creating a Driving Force-Pressure-State-Exposure-Effect-Action Framework (DPSEEA). This is a necessary step to link the environmental state to health impacts. A dedicated version of the DPSEEA framework can provide more insights into the broader context and causal links between climate change, WASH, and health impact (Figure 1), with WHO's WASH contributions circled in red (i.e. WSPs and SSPs, monitoring) and blue (i.e. WASH disease prevention role when deployed in HCFs) below.

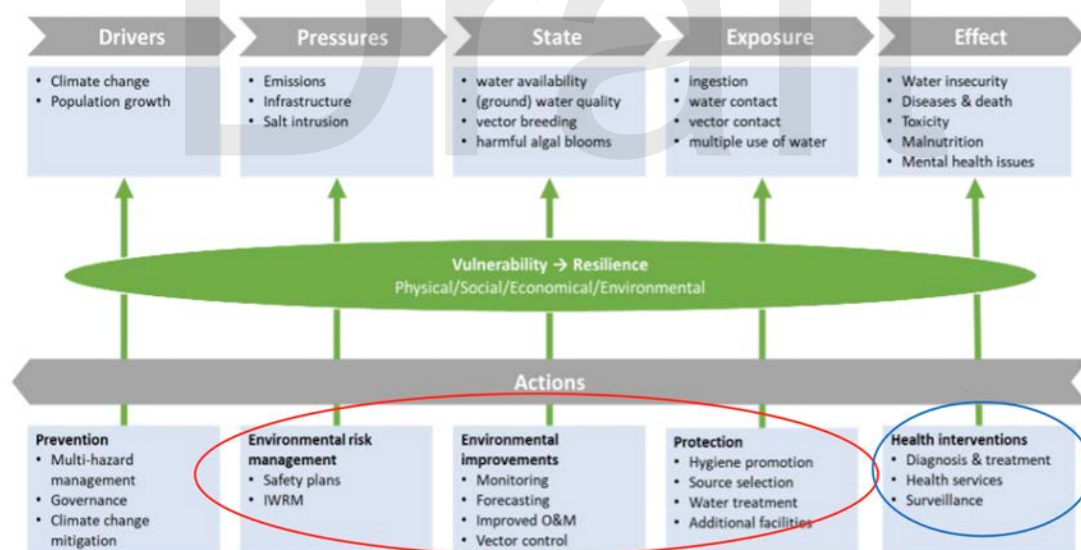


Figure 1. Draft DPSEEA framework for understanding the broader context and causal links between climate change, water sanitation and hygiene (WASH), and health impact (source: Deltares). Note some actions, such as water and sanitation safety plans, may contribute to multiple categories, i.e. environmental risk management and protection.

6. Means of implementation

This strategy will be implemented in multiple ways: within WHO through augmentation of existing WASH and Climate Change and Health work plans at all levels of the Organization; via WASH and health partnerships, alliances and mechanisms that are existing or emerging; to the extent possible, with sector planners, policy makers and experts outside of WASH and health -- particularly national ministries such as those responsible for agriculture, energy, environment, land use planning, and waste; and in continuing dialogue with donors, to support alignment and additivity vis-à-vis their own climate change strategies.

Political will, financial resources and sufficient human resources with relevant expertise and experience at the interface of WASH, climate change and health is necessary to implement priority actions described in Section 4. Within the WHO Environment, Climate Change and Health Department, which includes the units for WASH and for Climate Change and Health, increased coordination and collaboration on WASH and climate change will improve the effectiveness and cost benefit of country technical support. WHO will map countries to assess country level resources (environmental health staff), relevant WHO networks, other local WASH and climate change resources, and planned activities. Routine virtual (and occasional face-to-face) meetings involving headquarters, regional office and country office staff support the alignment and efficiency of programme delivery at country level, allow for sharing of regional and country specific aspects (i.e. regional approaches on early warning systems), and support capacity and technical skills across the Organization through, for example, bespoke WASH, climate change and health training modules, including several under development. The core support will be provided around the kinds of [climate change and health](#) and [WASH and health guidance](#) found in the recently published [Compendium of WHO and other UN guidance on health and environment](#).

There are multiple mechanisms, partnerships and alliances through which WHO could share its programmes and experiences, seek like-minded partners (including for those areas which are not historic WHO strengths or which are emerging²¹), and generate enthusiasm, narratives and momentum, including for securing climate financing. The aforementioned Alliance for Transformative Action on Climate and Health is one forum for cooperation. It works to realize the ambition set at COP26 to build climate resilient and sustainable health systems, using the collective power of WHO Member States and other stakeholders to drive this agenda forward at pace and scale; and promote the integration of climate change and health nexus into respective national, regional, and global plans. In addition, WASH sector initia-

tives include the UN-Water Task Force on Climate Change, the UNECE Task Force on Water and Climate, and another alliance -- the Alliance for Climate, Health, and WASH. The Alliance²² meets regularly and is a good opportunity for the different members to check with each other's plans and thinking, to do some thinking of the broad challenges in WASH and climate change, and to look ahead to further cooperation. It also allows space for discovery of the potential relevance of partner initiatives, such as the WaterAid Resilient Water Accelerator, to WHO programming.

Moving from vulnerability to resilience will also demand that further financial investment is made for WASH, climate change and health. As the IPCC notes: 'ensuring access to climate resilient 'WASH' infrastructure and practices represents a key adaptation strategy that can protect beneficiaries against water-related diseases induced by climate change (high confidence).' This is true of both rural and urban contexts. With its own relatively modest WASH and CCH budget for activities, WHO will continue to rely on its recognized roles in leadership, normative guidance, capacity building and country support, monitoring and research to catalyse greater climate-sector sourced financial flows, for example from the Green Climate Fund (GCF) to the WASH sector for implementation at the national level under Member State leadership. WHO and partners could work in this effort with Sanitation and Water for All, which has climate financing a key component of SWA Strategic Objective 3 that calls for attracting new investments to the sector. The GCF itself has eight Strategic Impact Areas, many of which link to WASH and therefore could support GCF in its aim for a minimum of 50 percent of the fund allocation to particularly vulnerable countries, including Least Developed Countries, Small Island Developing States, and African States.

Actions	Guiding/advising partners	Implementers	Illustrative Examples
Prevention - Multi-hazard management - Policies - Climate change mitigation	- GIDRM: Global Initiative on Disaster Risk Management - Green Climate Fund - GCA - International Financing Institutions/public development banks - UNDP - UNFCC - UNISDR - WHO - WMO: The World Meteorological Organization	National - Ministry of Planning - National Board for Disaster Management - National Meteorology, Climatology, and Geophysical Agency	Global Water Security & Sanitation Partnership (GWSP) of the World Bank -- supporting the reduction of GHG emissions from the water sector, promoting renewables in sanitation, irrigation, water resources management, and water supply investments.
Environmental risk management - IWRM - Nature-based solutions - Safety plans - Climate change adaptation	- GWP (Global Water Partnership) - IN-MHEWS: International Network for Multi-Hazard Early Warning Systems - IWA - UNFCC - UNICEF - WHO - WWF	National - Ministry of Health - Ministry of Environment / Nature - Ministry of Marine Affairs - Ministry of Public Works - Water Authority - Met and Hydrological Services Transboundary - River basin authority	IWA's Climate Smart Utilities initiative is supporting utilities to strive towards achieving carbon neutrality while adapting to climate change. ATACH
Environmental improvements - Monitoring - Forecasting and early warning - Improved O&M	- IWA - WFD (Water Framework Directive) - WHO - WMO - UNEP - UNESCO (Guideline for groundwater monitoring)	National - Environmental Protection Agency - Ministry of Environment / Nature - Water Authority	The GWP-UNICEF climate resilient WASH framework offers guidance on climate risk assessments and appraising options to address prioritized risks. It also proposes a comprehensive list of indicators at the national and sub-national level that can be used to monitor adaptation measures.
Protection - Hygiene promotion - Water treatment - Source selection - Vector control	- CDC (Guidelines) - RBM - UNICEF - WHO	National - Ministry of Environment / Nature - Ministry of Health Local - Community - Local authorities - Schools / education institute Private sector - Water treatment company Regional - PAMCA (Pan African Mosquito Control Association) - AMMREN (African Malaria Research Network)	
Health interventions - Surveillance - Treatment - Health services - Climate resilient and low carbon sustainable health systems and facilities	WHO	National - Health institute - Ministry of Health - Statistical Agency Private sector - Health care facilities - Pharmaceutical industry	Advocacy and promotion of integration of environmental health aspects in National Ministries of Health 'vertical' programmes for malaria and other diseases.

Annex 1: Defining resilience

IPCC, the Intergovernmental Panel on Climate Change, defines resilience as “The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation.” The IPCC definition of adaptation is “The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.”

Although both terms are sometimes used interchangeably, they are different. In relation to health systems, WHO considers that “resilience relates to the capacity of the system itself to cope with and manage health risks in a way that the essential functions, identity and structure of health systems are maintained. While health adaptation seeks to moderate harm or exploit beneficial opportunities, the preservation of a certain level of quality and sustainable performance of the system itself is not ensured”. The incorporation of a climate resilient approach to health and water systems contributes to ensuring the performance of the system and therefore to sustainability and maximization of value for money of health and water investments. However, when the magnitude of climate-induced changes or shocks is significant, maintaining system resilience may not always be possible, and the system may collapse or fail. WHO guidance promotes adaptation (or control) measures that strengthen the resilience of the water system itself. Increasing the adaptation and resilience of water supply systems to climate change risks requires long-term planning for continuing access to freshwater sources; managing water demand among competing needs; reviewing the resilience of the supply system itself; addressing policy needs, such as for water storage and flood control; implementation of control measures to ensure water quality (and quantity); and improving operation and maintenance to ensure continued effectiveness of control measures.

Annex 2: Environmental health surveillance activities for water quality and sanitation, plus some elements from chemical safety, health care facilities and climate change

Environmental issue	Environmental health surveillance
Drinking water	Routine water quality surveillance of households, schools, and health care facilities. Can include monitoring of physical, biological, chemical and radiological parameters Health surveillance to confirm safety of the drinking water Surveillance as a component of Water Safety Plans
Sanitation	Surveillance to target sanitation services to settings with high disease burden and support outbreak prevention efforts Surveillance and local risk assessments to prioritize improvements and manage system performance Surveillance as a component of Sanitation Safety Plans
Recreational water	Surveillance of: • microbial quality of coastal and fresh recreational waters using indicator values for intestinal enterococci; • harmful algal blooms in freshwater using indicator values for cyanobacterial biomass and cyanotoxins; • other hazards (beach sand, chemicals, other microbial hazards, nuisance); • swimming pool physical and chemical parameters; • recreational water illnesses. Surveillance as a component of Recreational Water Safety Plans
Hygiene	Surveillance of hand-washing facilities in public places (e.g., schools, health care facilities)
Chemicals in air, drinking water, and soil	Surveillance to determine potential exposures and health burdens. Selected chemicals of concern include arsenic, asbestos, pesticides, dioxin and dioxin-like substances, mercury, and lead (particularly prenatal and children's exposures)
Health care facilities	Assessment of the environmental health impact, sustainability, and climate-resilience of health care facilities, including water and sanitation services, energy emissions, waste management, and material use (e.g., mercury thermometers, radiation) Surveillance to detect antimicrobial-resistant strains of microorganisms in the environment
Climate change	Assessments and surveillance of extreme weather events, temperatures, water availability and quality, etc. Surveillance of climate-related disease Development of integrated monitoring systems allowing collection and analysis of data on environmental hazards, socioeconomic factors, and health outcomes

Annex 3: WHO HQ WASH, climate change and health-related guidelines, guidance, reports, manuals technical documents, training material and toolkits

WASH evidence and monitoring

- [UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water \(GLAAS\) 2022 report \(December 2022\)](#)
- [The measurement and monitoring of water supply, sanitation and hygiene \(WASH\) affordability: a missing element of monitoring of sustainable development goal \(SDG\) targets 6.1 and 6.2 \(2021\)](#)
- [UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water \(GLAAS\) 2019 report \(2019\)](#)

Drinking-water quality and safety

- [State of the world's drinking water \(October 2022\)](#)
- [Water safety plan manual 2nd edition \(November 2022\)](#)
- [Guidelines for drinking-water quality: Fourth edition incorporating the first and second addenda \(2022\)](#)
- [Guidelines on recreational water quality: Volume 1 coastal and fresh waters \(2021\)](#)
- [Toxic cyanobacteria in water, 2nd ed. \(2021\)](#)
- [Domestic water quantity, service level and health \(2020\)](#)
- [Safer water, better health \(2019\)](#)
- [Climate resilient water safety plans: Managing risks associated with climate variability and change \(2017\)](#)
- [Protecting surface water for health \(2016\)](#)

Sanitation

- [State of the world's sanitation: An urgent call to transform sanitation for better health, environments, economies and societies \(2020\)](#)
- [Discussion paper: Climate, sanitation and health \(2019\)](#)
- [Guidelines on sanitation and health \(2018\)](#)

WASH in health care facilities and schools

- [WASH FIT: A practical guide for improving quality of care through water, sanitation and hygiene in health care facilities. Second edition \(2022\)](#)
- [WASH FIT manual for trainers \(2022\)](#)
- [Global analysis of health care waste in the context of COVID-19 \(2022\)](#)
- [Checklists to assess vulnerabilities in health care facilities in the context of climate change \(2021\)](#)
- [WHO guidance for climate resilient and environmentally sustainable health care facilities \(2020\)](#)
- [Global progress report on WASH in health care facilities: Fundamentals first \(2020\)](#)

Integration of WASH and other health programmes

- [Ending the neglect to attain the sustainable development goals. A Global Strategy on Water, Sanitation and Hygiene to Combat Neglected Tropical Diseases 2021–2030 \(2021\)](#)

Climate change and health

- [Health and climate change country profiles \(2021/2022\)](#)
- [Measuring the climate resilience of health systems \(2022\)](#)
- [2021 WHO health and climate change survey report \(2021\)](#)
- [COP26 special report on climate change and health: the health argument for climate action \(2021\)](#)
- [Climate change and health: vulnerability and adaptation assessment \(2021\)](#)
- [WHO country support on climate change and health - Visual guide \(2021\)](#)
- [Quality criteria for the evaluation of climate-informed early warning systems for infectious diseases \(2021\)](#)
- [Compendium of WHO and other UN guidance on health and environment \(2021\)](#)
- [Climate change and health research: Current trends, gaps and perspectives for the future \(2021\)](#)
- [Health in national adaptation plans: review \(2021\)](#)
- [Quality criteria for health national adaptation plans \(2021\)](#)
- [WHO global strategy on health, environment and climate change \(2020\)](#)
- [Health in National Determined Contributions \(NDCs\): a WHO review \(2020\)](#)
- [Technical series on adapting to climate sensitive health impacts: undernutrition \(2019\)](#)
- [Global climate change and child health: training for health care providers \(2019\)](#)
- [Operational framework for building climate resilient health systems \(2015\)](#)

Endnotes

- 1 GLAAS 2022 Report, forthcoming.
- 2 See Annex 1 for a definition of resilience.
- 3 Water scarcity also becomes, increasingly, a security issue, as transboundary waters account for 60 per cent of the world's freshwater flows.
- 4 See Annex 2.
- 5 WHO (2021). [WHO health and climate change global survey](#).
- 6 WHO (2015-2022). [WHO UNFCCC health and climate change country profiles](#).
- 7 Table 7.3, page 1107 in [Climate Change 2022: Impacts, Adaptation and Vulnerability](#)
- 8 The [How tough is WASH framework for assessing the climate resilience of water and sanitation](#)
- 9 See Recommendation 2 from the WHO [Recreational water quality guidelines](#).
- 10 See discussion paper on [Climate, sanitation and health \(2019\)](#).
- 11 i.e., using biogas block-type thermal power stations to cover their energy needs and the needs of the community; wastewater heat pumps; use of enclosed digesters to prevent fugitive methane emissions, etc.
- 12 See Discussion paper: [Climate, sanitation and health \(2019\)](#).
- 13 See Chapter 4 in [Climate Change 2022: Impacts, Adaptation and Vulnerability](#).
- 14 e.g. hydration in relation to kidney problems, general health status, heat stress etc. (hydration may not be the ultimate outcome - in pastoral areas people may prioritize livestock even when water supply is low, with unknown livelihood impacts).
- 15 i.e. source protection, water supply design, operation, management and technology.
- 16 Solid waste refers to any type of garbage, trash, refuse or discarded material. It can be categorized according to where the waste is generated, for example as municipal solid waste, health care waste and e-waste. Over 2 billion tons of municipal solid waste are produced annually. Poor waste collection leads to environmental and marine pollution and can block water drains. Resulting flooding and other standing waters in waste items favour cholera and vector-borne diseases such as malaria and dengue.
- 17 See Review: [Health in National Adaptation Plans \(NAPs\)](#), International Institute for Sustainable Development.
- 18 [Quality criteria for health national adaptation plans](#).
- 19 See [Intergovernmental Negotiating Body](#).
- 20 In the past decades there has been quite a critical discussion of the principles, feasibility, and application of IWRM. In this document a general and pragmatic approach is taken, without going into details of governance and legal entities.
- 21 Such as this strategy's Focus Areas 4.5 – 4.8.
- 22 Participants include the Alliance for Global Water Adaptation, Bill & Melinda Gates Foundation, Bristol University, Foreign, Commonwealth & Development Office (UK), Global Water Partnership, International Federation of Red Cross And Red Crescent Societies, International Water Management Institute, Stockholm International Water Institute, SNV (Netherlands), Sanitation and Water for All, UNDP, University of Technology Sydney, Water.org, WaterAid, WHO, WMO and the World Bank.

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