



COMPILATION OF STRATEGIC HEALTH PLANS

The WHO-WMO HEALTH, ENVIRONMENT AND CLIMATE SCIENCE TO SERVICES MASTER PLAN reflects the scope of the World Health Organization (WHO) and the World Meteorological Organization (WMO) Framework Collaboration Agreement and includes three parts:

- (1) *Overview;*
- (2) *Interagency Work Plan (see [INF. 5.5 \(Cg-18\)](#));*
- (3) *A 10-year Implementation Plan developed in 2021–2022 by the WHO and the Commission for Weather, Climate, Water and Related Environmental Services and Applications (SERCOM) joint study group on Integrated Health Services (see [Resolution 16 \(EC-76\)](#)) responding to the request of [Resolution 33 \(Cg-18\)](#).*

WHO-WMO HEALTH, ENVIRONMENT AND CLIMATE SCIENCE TO SERVICES MASTER PLAN ([Cg-18/INF 5.5](#))

SECTION 1: OVERVIEW

1.1 Background

Environmental conditions, including weather and climate extremes, water-related health risks, exposure to hazardous chemicals and radiation, and air pollution cause 23% of global deaths each year. Droughts contribute to many adverse health outcomes, through their impacts on food security and nutrition, decreased access to safe and sufficient water and sanitation, as well as increased airborne contaminants. Flooding and windstorms are both directly associated with human mortality, and indirectly impact health through damage and disruption of critical healthcare services and water and sanitation infrastructures, and increased risk of injury and infectious diseases. Extreme temperatures, both cold and hot, increase the risk of death and illnesses, cause damage to the brain and other vital organs, contribute to a loss of work productivity, and can affect air quality, and disease transmission. All extreme weather and climate events are associated with an increased burden on medical services and negative ramifications on mental health, and ongoing and emerging health emergencies, such as COVID-19. Water generally affects health through availability and access to sufficient and safe drinking water, sanitation, and water-related diseases. Poor air quality is associated with deaths and diseases from lung cancer, stroke, heart disease, and respiratory diseases. Exposure to airborne sand and dust can trigger an increase in asthma and other respiratory complications. Exposure to solar radiation is associated with increases in sunburn and skin cancer and cataracts. Outdoor workers in agriculture, forestry and aquaculture, construction, waste collection, trade and services are particularly vulnerable to the health effects of climate change and environmental pollution, such as heat or colds stress, air pollution, exposure to increased surface ozone, solar radiation and unfavourable climate conditions. Climate change is altering human exposure to extreme weather events and affecting ecosystem services that populations depend on to sustain healthy environments and populations.

The mandates of WMO and WHO complement each other and appeal to the two agencies to work closer together to increase the generation and application of knowledge to better manage

the risks related to weather and climate extremes, climate change, water, and atmospheric and environmental conditions. The WHO as the specialized UN agency for health, provides technical support to Ministries of Health; and can articulate the requirements of the health sector related to the weather, climate, hydrological and atmospheric composition information, while WMO can tailor its services to address these requirements.

Ongoing activities throughout the WMO community are currently contributing to the management of health risks and improving related health outcomes. Approximately 80 National Meteorological and Hydrological Services (NMHSs), and some Regional Climate Centres (RCCs), report some level of collaboration with the health sector. However, at WMO, these activities are not well integrated into a supported package of health-related weather, water, climate, and environmental services, and greater impact could be achieved through a more comprehensive and integrated approach, both across WMO programmes as well as through partnerships with other health-focused organizations. At WHO, and across the health community at large, climate, weather, and environmental observations, research, services, which could enhance programming and decision-making across a range of programme areas but are not effectively or systematically used. Development of WMO integrated health science and information services requires much closer dialogue and collaboration between communities, sharing of infrastructure and common delivery mechanisms, as well as dedicated capacity development, and norms and standards to accompany the co-design of services. Strategic and joint efforts between WHO and WMO are necessary to accelerate the societal benefit of climate, weather, water, and environmental science and services.

1.2 THE INSTITUTIONAL CONTEXT

This Master plan is a three-part strategy to operationalize the objectives of the WHO-WMO Collaboration Framework on Climate, Environment and Health (2018), and the eighteenth session of the World Meteorological Congress [Resolution 33 \(Cg-18\)](#).

In 2018, WMO and WHO signed a Collaboration Framework on Climate, Environment and Health (i.e., Memorandum of Understanding) committing the WHO and WMO to work more closely together to protect health from the risks of extreme weather and climate events, pollution of air and water, and global climate change. Under this agreement, the WHO and WMO have agreed to work collaboratively and where appropriate, jointly, to:

- (1) Promote the alignment of relevant policies and raise awareness of environmental and climate-related risks and solutions to protect human health;
- (2) Promote the generation and application of scientific evidence;
- (3) Establish appropriate technical mechanisms and partnerships to facilitate the development, delivery, access to and use of data and tailored information products on weather, climate, and environmental hazards to health;
- (4) Develop and disseminate technical and normative guidance, scientific publications and tools, and other actions to support capacity development;
- (5) Monitor progress on the access and use of reliable and relevant weather, climate, water and environmental information.

To advance this agreement, the [Resolution 3 \(EC-70\)](#) requested the development of a joint interagency work plan to assist the WHO and WMO, along with their respective Member States, to improve health outcomes and enhance the management of weather, climate, water, and atmospheric related risks to human health, through the development, promotion and increased application of relevant and credible weather, climate, hydrological, and atmospheric science and operational services.

The WHO-WMO Master Plan for Health, Environment, and Climate Science to Services¹ was developed and endorsed by [Resolution 33 \(Cg-18\)](#) to guide the first five years of this agreement (2019–2023) with technical and strategic priorities for joint collaboration². However, no clear mechanisms or financial requirements for how those goals should be achieved were developed at that time.

The Collaboration Framework and its Master Plan help WHO and WMO to enhance dialogue, develop common strategic and technical agendas; and identify and establish the required mechanisms to accelerate cooperation in the priority thematic areas at global, regional, and national levels. It leverages the complementary mandates and resources of both WHO and WMO for more ambitious approaches and investments to address health risks associated with extreme weather and climate events, and long-term climate change (including improved access and use of weather and climate data for risk assessment, generation of evidence, adaptation planning, and application of tailored science and services); as well as enhance the observations, monitoring, forecasting and management of water-related and environmental health risks, such as solar radiation, hazardous air quality and ecological change. It also seeks opportunities to promote health co-benefits of climate change adaptation and mitigation; and address the needs of populations highly vulnerable to environmental and climatic changes, such as those in urban areas, Low-and Middle-Income Countries, and Small Island Developing States (SIDS).

This master plan provides high-level alignment and synergies, building on and complementing existing WHO and WMO mechanisms and initiatives. It recognizes the decades of interagency collaboration, existing mechanisms, and mutual commitments of both WHO and WMO to support their Member States to implement the Sustainable Development Goals (e.g. SDG 3 and 13); the Sendai Framework for Disaster Risk Reduction (DRR); the United Nations Framework Convention on Climate Change (UNFCCC); the Paris Agreement (e.g. Article 7 on adaptation) and the Global Framework for Climate Services (GFCS), the Convention on Long-Range Transboundary Air Pollution and other relevant environmental conventions under which protection of human health is a recognized priority. It also acknowledges the WHO's role in supporting global scale capacity development, including through implementation of the International Health Regulations (2005), as well as existing mechanisms for collaboration and implementation such as the WHO/WMO Joint Office for Climate and Health; the SERCOM joint Study Group on Integrated Health Services; the Global Platform on Air Quality and Health; the Global Heat Health Information Network; the InterSun Programme; the Alliance for Transformational Change in Climate and Health, and the International Network for Multi-hazard Early Warning Systems, among others.

While existing bilateral and multilateral structures established over the last ten years set the stage for global institutional collaboration between the health and climate sectors, these are insufficient to meet the desired targets. Consideration for new mechanisms, innovative approaches, and full engagement of the broad range of technical partners in national and subnational governments, the private sector, academia, and multilateral networks is critical for scaling the development and application of climate, weather, and environmental sciences for improved planning, preparedness, and resilience in the health sector. [Resolution 33 \(Cg-18\)](#) requested an implementation and resource plan which outlines new approaches and mechanisms for the 2023–2033 and was endorsed at [Resolution 16 \(EC-76\)](#).

¹ Eighteenth World Meteorological Congress (Cg-18). <https://public.wmo.int/en/eighteenth-world-meteorological-congress-cg-18>

² WHO/WMO Joint Workplan and Integrated health Services. <https://community.wmo.int/meetings/whowmo-joint-workplan-and-integrated-health-services>

1.3 Alignment of Existing Priorities and Programmes

The WHO, at all levels, provides support to its Member States to:

- (1) Prevent, detect, prepare for, respond to, and recover from the health risks associated with extreme weather events and climate variability, including outbreaks of infectious diseases and risks to essential public health services and infrastructure;
- (2) Strengthen the resilience of health systems, and environmental determinants of health such as water, shelter, sanitation and hygiene, food and nutrition security, to climate variability and to long-term climate changes;
- (3) Assess the health impacts of air pollution and promote actions that reduce the burden of diseases associated with air pollution and other health consequences of actions that also contribute to climate change.

At the WHO, the thirteen General Programme of Work (GPW13), approved by Member States in 2018, will be implemented over the period 2019–2023. It includes climate change and environmental change as a global programme of work (GPW) priority. To articulate this priority, a new comprehensive global strategy on health, environment and climate change was approved by the World Health Assembly (May 2019.) This proposed Master plan and existing WHO programmes include the main thematic areas of collaboration on environment and health between WMO and WHO (i.e., climate change, emergencies, extreme weather, air pollution, radiation, disease control, and water and sanitation). The GPW13 also includes a specific priority platform on climate change and health in SIDS and other vulnerable States.

Furthermore, the GPW includes a broader goal on providing an additional one billion people with better protection from health emergencies. Several new mechanisms and initiatives including a new comprehensive framework for health emergency and disaster risk management are being strengthened to support countries and partners to prepare for, prevent, respond to and recover from all hazards that create health emergencies, including disasters caused by extreme weather and climate events.

The WMO supports its Members States to:

- (1) Enhance their technical capabilities to observe and forecast the state of the climate, oceans, hydrosphere, atmosphere and cryosphere;
- (2) To develop capacity and research to optimize the production and dissemination of weather, climate, hydrological and related environmental services for the improvement of the wellbeing of societies of all nations, including enhanced management of weather and climate-related emergencies.

The WMO Strategic Plan 2024–2027, [Recommendation 11 \(EC-76\)](#), reflects priorities to better serve societal needs by delivering authoritative, accessible, user-oriented and fit-for-purpose information and services. Notably actions which focus on:

- (1) Strengthening national multi-hazard early warning/alert systems and extend reach to better enable effective response to the associated risks;
- (2) Broadening the provision of policy- and decision-supporting climate information and services;
- (3) Developing hydrological services for sustainable water management and adaptation;

- (4) Enhancing the value of and innovate in the provision of decision-supporting weather information and services; Strategic Objective 3, to Advance Targeted Research, by leveraging leadership in science to improve understanding of the Earth system for enhanced services;
- (5) Notably, enhance the science-for-service value cycle ensuring scientific and technological advances improve predictive capabilities and analysis through the WMO Information System.

Health is characteristically a cross-cutting issue for WMO. Health impacts occur across timescales and as a result of population exposure to variable conditions of the atmosphere, hydrosphere, and biosphere. The needs of the health community also call for seamless science to services approach, as user-needs span data and information to applications and capacity building. Health is an existing priority area under WMO programmes and initiatives, such as the GFCS, the Global Atmosphere Watch (GAW), cross-cutting Urban Services, DRR Programmes, and the Global Data Processing and Forecasting System (GDPFS). The Health sector is a key partner to NMHSs at national level and a relevant sectoral partner to many WMO programmes. However, the health sector remains formally unsupported by WMO technical commissions and implementing mechanisms.

Opportunities for strengthening health applications to address health sector needs for climate, weather, water, and atmospheric science and services exist in both WMO Technical Commissions and other bodies, such as the Research Board. [SERCOM](#) established the Study Group on Integrated Health Services to advise WMO on priorities and mechanisms to best meet the societal needs of the health sector until 2024. The technical commissions and Research Board, can further establish appropriate areas of work and mechanisms to facilitate more systematic involvement with the health community and facilitate WMO Members to implement holistic approaches to:

- (1) Promote service-oriented culture in all relevant application areas including a customer focus, quality management, understanding of the value and socioeconomic benefits;
- (2) Share best practices and develop harmonized methodologies for user engagement including identification of requirements and establishment of feedback mechanisms with users necessary for continuous improvement of services;
- (3) Develop methodologies for impact-based products and services in all application areas, innovative service delivery methods and integrated platforms;
- (4) Ensure harmonization of requirements for competency and qualification of personnel involved in service delivery;
- (5) Develop common methodology for verification and validation of information and service delivery as part of quality management;
- (6) Build through appropriate studies and projects a better understanding of the economics of service delivery, cost-recovery mechanisms, commercial and market elements, and develop respective guidance to Members;
- (7) Seek the engagement of service providers from private sector and academia;
- (8) Promote global and regional partnerships, including building upon existing partnerships and networks among communities of practice among the service areas, which are beneficial for WMO Members.

1.4 Responding to Needs and Opportunities

Climate change is adversely affecting the mental and physical health of people globally and presents the greatest global health risk. According to the Intergovernmental Panel on Climate Change, Sixth Assessment Report, climate change and related extreme events are poised to significantly increase ill health, premature deaths, and suffering in both the near- and long-term, without substantial mitigation and adaptation³.

- (1) Population exposure to **heatwaves** will continue to increase with additional warming, with strong geographical differences in heat-related mortality without additional adaptation. **Urban areas**, which represent a majority and growing proportion of the global population are particularly affected and vulnerable;
- (2) Poor ambient **air quality** is responsible for seven million deaths annually. Wildfires, sand and dust, pollen, and pollution are exacerbated by climate change;
- (3) In 2019, the global magnitude of **climate-sensitive diseases** was estimated at 39 503 684 deaths and 1 530 630 442 disability-adjusted life years⁴. Climate-sensitive food-borne, water-borne, and vector-borne disease risks are projected to increase under all levels of warming without additional adaptation;
- (4) Climate change is projected to exacerbate **malnutrition** with one million additional cases of moderate to severe stunting in children under five years of age, by 2030, under Regional Climate Prediction (RCP) 8.5, in forty-four countries alone⁵;
- (5) Health care contributes to **4.4% of global net emissions** of greenhouse gases, which ranks it as the fifth largest emitter on the planet, if health care were to be a country⁶;
- (6) Moreover, climate hazards such as extreme heat, precipitation, drought or flooding activate cascading risk pathways with a sequence of secondary, causally connected events that can disrupt critical healthcare and public health infrastructure, vital for a functional society.

These stark findings inform the prioritization of four grand challenge areas of this Implementation Plan. Adapting to accelerating and dynamic environmental health risks which are amplified by climate change calls for a coordinated approach across sectors to build capacity that can integrate skills, people, data, and knowledge for enhanced and agile decision-making.

The health sector currently underutilizes available climate, weather, environmental science and technology in how it does business and makes programmatic and financial decisions. Specific approaches to integrate weather, climate, and environmental services with public health practice can address this predicament. In the face of climate change, integrated climate, weather, and environmental services are an indispensable tool for health surveillance, outbreak investigations, health risk assessments, health services delivery, research, policy, long-term planning and programmatic decision-making.

³ Intergovernmental Panel on Climate Change. Climate Change 2022: Impacts, Adaptation and Vulnerability. The Working Group II contribution to the IPCC Sixth Assessment Report. <https://www.ipcc.ch/report/ar6/wg2/>

⁴ GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2020 Oct 17; 396(10258):1204–1222. doi: 10.1016/S0140–6736(20)30925–9.

⁵ Lloyd, 2018: A Global Level Model of the Potential Impacts of Climate Change on Child Stunting via Income and Food Price in 2030. *Environmental Health Perspectives*, 126(9), 097007, doi:10.1289/ehp2916.

⁶ Health Care Without Harm Climate-smart health care series. Green Paper Number One (2019). <https://noharm-global.org/documents/health-care-climate-footprint-report>

Climate services, and climate-informed health decision tools, have been identified in many National Health Adaptation Plans as key to support public health prevention efforts. As part of this process, climate science is essential to inform health vulnerability and adaptation assessments to understand local risks and local opportunities. Climate services have also been used for selected forecasting tools, integrated climate-health surveillance, creation of health observatories, climate-related forecasting (floods, heat waves) and impact-based early warning systems for vector-borne diseases and heat and cold waves. However, today, these approaches remain examples, rather than mainstreamed approaches. These activities are fundamental to building the adaptive capacity of the health sector. Unfortunately, Ministries of Health report they remain the most underfunded and difficult to implement⁷.

Harnessing weather, climate, and environmental services will advance resilience by the health sector to climate, extreme weather, and hazardous air quality. Moreover, it will open important pathways to contribute to meeting multiple targets of the SDGs, the Sendai Framework, and the Paris Agreement. Regrettably, there remains a strong silo between the health community and other sectors, and a mismatch between supply and uptake of climate, weather, and environmental services in public health. Available science and services are often developed independently from health decisionmakers and therefore tend to be underutilized, inaccessible, unaffordable, and out of context.

Financial, political, or institutional obstacles reduce the feasibility of implementing these tools. The limited organizational uptake of climate services in the health sector, is also due to technical and non-technical obstacles, such as lack of awareness of available resources and knowledge of how to interpret and use climate information. Barriers to a seamless integration of climate services by the health sector, for example, include basic discrepancies in the spatial scale of climate data, that does not match the administrative boundaries relevant to the health sector-rendering the information unusable without investments in further processing. The temporal scale of climate data might not match the needs of the health sector either, by providing data that are not actionable. The timing and accessibility of climate and environmental data is another crucial aspect that can impede timely data uptake by the health community. Discrepancies between administrative planning cycles and climate projections might not lend themselves to the integration of climate services into public health plans.

Uncertainties and lack of credibility in climate projections can also hinder the use of climate data by health authorities. These systemic impediments to the integration of climate services into the health sector call for an institutional Implementation Plan with far-reaching implications for public health impacts from climate change. Addressing the underlying challenges of data interoperability, climate literacy, and human resource capacity are thus fundamental goals of this plan.

In preparation for this masterplan, a background report and expert team synthesized multiple reviews and experiences (2016); barriers and challenges identified through case studies⁸, needs and priorities identified in recent commitments; as well as policy and planning processes⁹. Furthermore, through WMO's preliminary engagements with the WHO and health sector, a range of unmet needs have been identified and reported which span regions,

⁷ WHO, 2021 Climate and Health Country Survey

⁸ WHO-WMO Climate Services for Health Fundamentals and Case Studies (2018)

⁹ These include (i) the implementation of the Health Exemplar of the GFCS, including priorities identified for implementation (2017); (ii) the continual planning process to identify the "global goods" and technical support that WHO will provide to countries to achieve the thirteenth Global Programme of Work Goals; (iii) collaboration agreements on specific issues, e.g. the commitments by WMO to the first WHO Global Conference on Air Pollution and Health in October 2018; (iv) technical consultations with the Global Heat Health Information Network, reflecting global and regional priorities for the management of extreme heat; and (v) WHO and WMO support for the implementation of health emergency and disaster risk management, as included in the Sendai Framework for (DRR) (2015–2030) and the International Health Regulations (2005); and other international reports produced by WHO and WMO that accompany international agendas.

programmes, hazards and timescales; including the need to support NMHSs capacities to become more effective service providers to this sector (Integrated Health Services – Progress of WMO to support global health [EC-70/INF. 4.3 \(1\)](#)).

Furthermore, since 2016 both WHO and WMO have monitored the availability and use of climate information and services for the health sector (Lancet Countdown on Climate and Health, 2017–2022). In 2022, 77% of the WMO Members report working with the health sector, albeit a majority of these engagements are not service related but remain at a preliminary engagement and scoping level. A complementary WHO country survey monitors the use of climate information for health surveillance and early warning. Further mapping and monitoring of WHO and WMO member capacities and resources remains important to improve our understanding of current capacities and types of collaboration, needed not only for climate and multi-hazard early warning systems, but also air quality, solar radiation, and hydrology related risks.

Since 2019, seventy NMHSs have nominated a WMO Integrated Health Focal Point serving as the entry point for health-related activities at national level ([Resolution 33 \(Cg-18\)](#)). Additional nominations from WMO Member States that do currently not have a Focal Point remain critical to ensure effective climate services for health delivery and coordination.

In response to these needs and opportunities, a “user-driven” and “needs based” perspective has been presented to focus on the most pressing gaps for developing the capacity of WHO and WMO member states and partners across societies to improve health risk management and protection from climate, weather, water, air quality and other environmental risks.

1.5 VISION AND THEORY OF CHANGE FOR HARNESSING CLIMATE SERVICES FOR HEALTH PROTECTION

The Implementation Plan is grounded in a Theory of Change. The joint leadership and implementation of the proposed mechanisms and actions by both the WMO and the WHO are critical to achieving **“better health and wellbeing for people facing existing and emerging extreme weather events, climate change, and environmental risks through the effective integration of climate, environment, and health science and services across the world”**. This Implementation Plan envisions the pathway of change (see Figure 1 below) including four key transformational steps.



Figure 1. Theory of Change for Climate Science and Services for Health

Pathway Step 1: Implementation of key strategies and activities

Critical health risks caused by population exposure to climate change, extreme weather, and environmental conditions are complex, interactive, and cascading. Success of this

Implementation Plan will require integrated and hybrid mechanisms that can leverage the combined science, intelligence and capacity of many relevant sectors and actors. The proposed key strategies and activities cover six foundational areas which support the grand challenge areas, including, inter alia:

- (1) Develop a WHO-WMO Climate, Environment and Health Programme to support joined up policies and coordination mechanisms at all levels;
- (2) Develop transdisciplinary climate and health education and training, and strengthen institutional capacity of technical support units and Focal Points;
- (3) Improve communication skills of meteorological, climate, environment, and health actors and use of innovative tools and platforms;
- (4) Set up a systematic process to identify research gaps and priorities;
- (5) Tighten the climate and health science policy interface;
- (6) Enhance data integration and interoperability, and raise awareness of the requirements and gaps for investment;
- (7) Improve monitoring and evaluation mechanisms of the performance, effectiveness and cost-effectiveness of climate services;
- (8) Scope key needs, actions and mechanisms of the Grand Challenge areas;
- (9) Ensure dedicated resources and support functions.

Pathway Step 2: Paradigm change in approaches and good practices

In order to accelerate the success of multisectoral actors to generate, provide, and apply climate-weather-environmental intelligence to health policy and practice decisions; it is critical to clarify and enhance shared understandings, principles, and approaches. Based on lessons learned and identified needs, the deployment of seven good practices is critical to change ways of working toward more optimal outcomes. For example, for more sustainable impacts the health community strongly suggests an evolution away from notions of “user-interface platforms” toward “co-production of integrated systems”. These good practice principles are outlined in the Conceptual Framework for Integrated Information Systems ([SERCOM-2/INF. 5.10\(3b\)/Figure 2](#))



Figure 2. Integrated Climate and Health Science and Service Framework Overview

Pathway Step 3: Outcomes represent transformation in the climate-environment-health nexus

The implementation of the activities and good practices will lead to near-term outcomes which respond to critical needs, including, inter alia:

- (1) Increased understanding of climate risks to health;
- (2) Strengthened mandates, enabling institutional architecture at all levels;
- (3) Enhanced climate, weather, environment, and health data interoperability and ease of use;
- (4) Tested approaches and models for integrated data systems and climate service pipelines;
- (5) Enhanced transdisciplinary and intergenerational learning and knowledge exchange;
- (6) Impactful communication skills and tools for co-development, behavioural change and policy;
- (7) Systemic understanding of research, data, and knowledge needs and priorities;
- (8) Rigorous monitoring and evaluation for better analysis, accountability and learning;
- (9) More sustained partnerships between climate and health actors at all levels, and communities of practice;

- (10) Equitable access to scientific evidence;
- (11) Equitable availability, access, and use of climate data.

Pathway Step 4: Long-term systemic impacts for climate vulnerable populations

Over ten years, through the implementation of this plan, an enabling science policy interface for climate, environment, and health science and services will be reinforced to deliver sustainable and long-term benefits, reaching beyond the climate, environment, and health interface. Including, inter alia:

- (1) Enhanced health system capacity and resilience to climate, extreme weather and hazardous air quality episodes;
- (2) Transdisciplinary career paths and cohorts are equipped with the necessary knowledge and tools to support health adaptation and mitigation efforts;
- (3) Measurable cost-savings of evidence-based anticipatory action, justify upfront investments;
- (4) Reduced impact of climate, weather and poor air quality on health outcomes, health systems, and societies at large;
- (5) Better protection of vulnerable populations results in reduced negative health outcomes;
- (6) Universal access to climate services to protect health;
- (7) Mainstreaming climate and health services involving all relevant sectors and actors;
- (8) Significant co-benefits for health and related sectors;
- (9) Good practices in health sector approaches influence more equitable, ethical, and quality use of climate, weather, and environmental services in other sectors;
- (10) Adaptive capacity increased in health systems with integrated climate information systems;

1.6 VALUE PROPOSITION

The usefulness of climate services in public health is undisputed, both economically and socially. Climate services are indispensable for emergency preparedness, early warning, and programmatic interventions, as a means to protect the health of the public. Climate services are an integral part of DRR, intended to minimize the impact of climate hazards on public health and society at large. Early warning systems for heat waves, implemented through heat health action plans, can reduce casualties from extreme heat. Early warning systems have also been operationalized to monitor and forecast floods, droughts, forest fires, and infectious diseases. Moreover, there are tremendous benefits from the exploitation of climate services by other end users in different sectors that have co-benefits for public health. For example, climate services have been used to improve the robustness of food security and management of urban air quality.

Expanding the use of climate services for public health purposes has enormous potential. Vulnerable groups in society are often more at risk from adverse health impacts from climate hazards and would benefit greatly to have access to alerts from early warning systems. However, currently, equitable access to climate data is not assured and threatens to increase inequalities, both between countries and within. Regrettably, the most climate vulnerable groups in society often have the least appropriate coverage of climate data from ground stations to

enable climate-informed decision-making. This inadequacy of climate data availability and access is a contributing factor to future vulnerability of climate risks and can exacerbate health inequality.

Climate services are an integral part of public policy, both nationally and internationally. Projecting climate change impacts in the future is essential for long-term planning and evidence-based policy making. Without scientifically grounded forecasts about possible futures, policymaking would be deprived of its foundation, and incapable of developing rational strategies.

Thus, addressing barriers to climate and meteorological data availability, access, and use by the health sector has the promise to enhance climate resilience. The intent is to make climate services widely and freely available to end users, both in low and high-income countries. Such universal access to climate services will be particularly beneficial to less well-resourced communities and will have far-reaching implications for public health. The benefits will advance prevention, emergency preparedness, and public policy with tangible health gains. Making climate services accessible to the public health community will generate tremendous cost-savings in the long-run which will justify any upfront investments.

SECTION 2: INTERAGENCY WORK PLAN (Cg-18/INF 5.5)

The 2019–2023 interagency work plan will expire at the end of 2023 and be updated as appropriate under the 2023–2033 Implementation Plan for advancing integrated climate, environment and health science and services and relevant mechanisms.

SECTION 3: SUMMARY OF THE IMPLEMENTATION PLAN FOR ADVANCING INTEGRATED CLIMATE, ENVIRONMENT AND HEALTH SCIENCE AND SERVICES 2023–2033 (SERCOM-2/INF 5.10(3a))

3.1 OVERVIEW

This Implementation Plan for Advancing Climate, Environment and Health Science and Services was prepared by the Study Group for Integrated Health Services, as part three of the Master Plan. It outlines select approaches, mechanisms, and engagement opportunities for sustainable transformation in how the global health sector understands, accesses, and uses climate, weather, and environmental science and services. This INF summarizes the structure, and additional details of the anticipated activities and mechanisms for the 2023–2033 period.

The final implementation and resource plan, including proposed terms of reference for new and key mechanisms will be presented to SERCOM-3 in 2024 following a peer review process.

This ten-year plan is organized according to three dimensions and uses a nexus approach to allow flexibility and tailoring of approaches and activities as relevant to local and regional contexts. Six foundational support areas propose actions and mechanisms to lead transformational change in climate, weather, environment and health science, services, and policy. These include Policy and Coordination; Human Resource Development; Communications; Research; Operational Services; and Monitoring, Evaluation, and Learning.

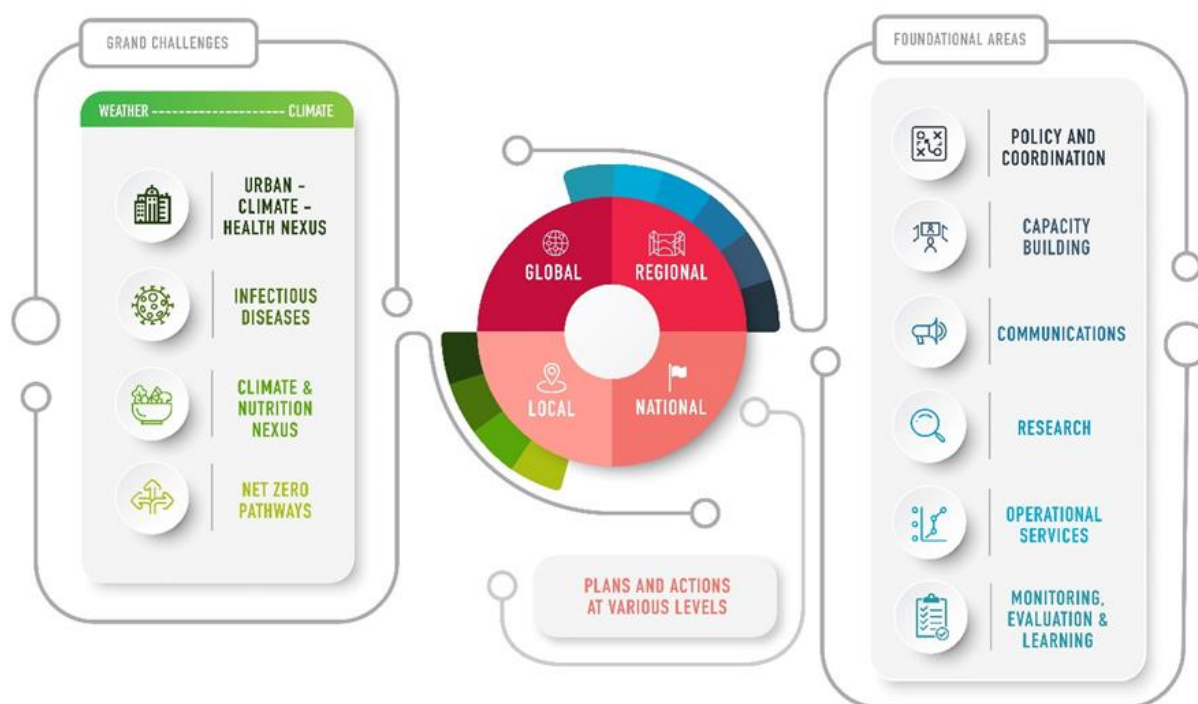


Figure 3. Three dimensions of the Implementation Plan

Focus is placed on four grand challenges in response to multiple vulnerabilities of urban populations, the sensitivity of infectious diseases to climate, risks to food security and nutrition, and climate adaptation and mitigation needs within the health sector itself. These grand challenges cover many but not all health issues affected by climate and environmental changes. This Implementation Plan envisions both top-down and bottom-up actions which take different approaches at local, national, regional, and global level. Other climate, environment, and health-related priorities may be addressed through specific place-based plans at national or regional levels. Similarly, actions related to the foundational support areas may also vary from region to region according to needs. It is intended that new and existing mechanisms will be networked to optimize resources and enhance capacity and action at all levels.

Three implementation phases of three years each will follow an inception year in 2023. This Implementation Plan is further divided into phase one (years two to four), phase two (years five to seven) and phase three (years eight to ten). Additional activities will be developed during subsequent phases. Key to the success of the Implementation Plan will be monitoring, evaluation, and learning; leveraging existing and new institutional partnerships; as well as joined up extrabudgetary resource mobilization.

Note: Activities and Mechanisms described herewith are not in all cases directly aligned. More than one mechanism may be responsible for implementation, and in other cases the action may be to create the mechanism. Full details of each activity and proposed terms of reference for mechanisms will be provided in the final version.

POLICY AND COORDINATION

Goal: To support effective and sustained collaboration between the climate and health communities and other relevant stakeholders through joined up policies and coordination mechanisms.

Solution Statement: Policies and coordination mechanisms are the foundation of enabling environments for effective governance able to develop and align relevant policies and approaches, promote collaboration and coordination, and generate sustained commitments to solutions that promote and protect human health. Global strategic plans, coordination and technical support mechanisms are proposed to guide and support actors to develop similar structures and strategies at national and regional levels. These joined up approaches can also help tighten the science policy interface to strengthen evidence-based decision-making.

PROPOSED ACTIONS	POSSIBLE SUPPORTING MECHANISMS
(1) Implementation Plan for Advancing Integrated Climate and Health Science and Services 2023–2033, 3-year workplans (Note: This plan).	Based on discussions with Members and Partners.
(2) National and regional health strategies, units and programmes (embedded in NMHSs/RCCs) with strengthened mandates, workplans and coordination mechanisms that align actions to support national priorities for addressing climate, health, emergency, environment issues.	WMO-led leveraging and strengthening implementation capacity of NMHSs / RCCs, and other implementing partners.
(3) Joint national and regional strategies for integration of health and climate science and services.	National coordination mechanisms Leveraging and strengthening existing mechanisms and capacity of NMHSs/RCCs/ ministry of health (MOH) and partners to tighten science policy interfaces and develop applied sciences.
(4) Health and Climate Science, Technology, and Research Plan (WHO-led).	Based on discussions with Members and Partners.

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HUMAN AND INSTITUTIONAL RESOURCE DEVELOPMENT

Goal: To ensure that adequate human, institutional and community skills and abilities are available to enhance the development, optimal use and sustainability of climate, weather, and environmental science and services in the health sector.

Solution Statement: Scaling up climate science and services for health requires strong infrastructural, institutional, and human resource capacity at multiple levels. Developing transdisciplinary learning and career paths within the climate-environment-health professional nexus can ensure young professionals today are being trained in appropriate skills and concepts from both climate and health domains and have impactful careers ahead. Transdisciplinary and skilled professionals with defined job mandates are critical to address the complex nexus of health challenges posed by climate change. This emerging workforce will be able to speak a common language and understand impacts on both sides bridging key gaps between the climate and health communities. Job descriptions are an important instrument to craft new roles and responsibilities. Technical support, learning, and community building across this cadre of professionals (fellows, secondments, focal points) can help develop the next generation of experts who are better prepared to problem solve around environmental challenges, as well as climate adaptation and mitigation in the health sector.

PROPOSED ACTIONS	POSSIBLE SUPPORTING MECHANISMS
(1) Develop approach, application, validation, and review process for identified Centres, following WHO Collaborating Centre Model.	WHO-WMO Technical Support Facilities/Centres of Excellence serving as technical support units and implementing partners in countries and regions.
(2) WMO Integrated Health Focal Points engagement and communities of practice (engagement, communication, and community of practice development) into a support and coordination mechanism.	WHO-WMO Climate and Health Joint Office in consultation focal points and collaborating partners.
(3) Climate and Health Competency Framework for strengthening transdisciplinary training and education curricula with core skills and competencies.	Implementation mechanism to be determined, may include Contractors/WMO Training Centres/ Consortium of Climate and Health Education.
(4) Climate and Health (Biometeorology) Literacy Skills Programme.	Climate and Health Science Training partnership/network , linking to WHO

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	Academy, other training focused partners.
(5) Science-Policy Fellowship Program for Health and Climate with transdisciplinary applied job placements in RCCs, NMHSs, MoH or other relevant institutions, including training modules; collaborate and synergize with the WMO Fellowship partners and programme .	WMO Fellowship Programme, Collaborating partners and governments.
(6) Transdisciplinary career development support programme.	NMHSs/RCCs Technical Focal Points Cohort and Secondment Programme to Health agencies and partners, WMO Fellowship Programme, Collaborating partners and governments.
COMMUNICATION	
<p>Goal: To support decision-making and behaviour change by members of the public, civil society partners, and Government, by more effectively communicating the health risks of climate, available science and evidence-based solutions.</p>	
<p>Solution Statement: Raising awareness of the health impacts of climate change and adaptations available to protect people, communities and health systems is a critical requirement for preparing for a warming world. Climate and health science and services professionals (e.g., public health officials, health care system planners, community health professionals, meteorologists, climate scientists) play a leading role in local to national efforts to prepare for impacts through adaptation and are important partners in efforts to reduce Greenhouse Gases (GHG) emissions, including by transitioning to low carbon health systems. Stakeholders within the health community are varied and play multiple functions as a target audience for partnership and communication. These health actors however provide a core climate change communications function for many audiences, for example, to the public through weather alerts and warnings, to community stakeholders to raise awareness of the need to protect vulnerable populations from growing risks, and to Government decision makers about projected health impacts to help plan future responses. By creating a global task team of experts, a climate science and health communication plan, a corresponding communication toolkit and partnerships, and guide the online platform www.climahealth.info and other dissemination channels, barriers in communication can be reduced to improve capacity and impact.</p>	

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PROPOSED ACTIONS	POSSIBLE SUPPORTING MECHANISMS
<p>(1) Develop a Strategic Communications Engagement, and Uptake Plan including:</p> <ul style="list-style-type: none"> (a) A NMHSs Health Focal Point (and Health sector Climate Focal Point) Engagement Plans; (b) A climate and health science communication toolkit to address communication bottlenecks; (c) Monitor and communicate opportunities to leverage relevant outreach through events and partners; (d) Scope and develop repository of climate change and health communications guidance and case studies. 	<p>Establish and sustain Climate and Health Editorial/Communications with Experts, based on discussions with Members and Partners.</p>
<p>(2) Climate and health science communication toolkit to address communication bottlenecks.</p>	<p>Based on discussions with Members and Partners.</p>
<p>(3) ClimaHealth.info Portal to promote and disseminate available technical, learning, and engagement resources.</p>	<p>Based on discussions with Members and Partners.</p>
RESEARCH	
<p>Goal: To strengthen climate, environment and health research activities by facilitating data availability, access, and use by the research community; and addressing structural barriers to technical problems that hamper the use of climate services and research outputs.</p>	

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Solution Statement: A systematic mapping exercise of the global research effort on health impacts from climate change revealed a predominance of evidence from high-income and upper middle-income countries and an underrepresentation of evidence from central Asia, north and central Africa, and South America¹⁰. Moreover, there is an underrepresentation of evidence on the social determinants of climate impacts on health and on intervention options to attenuate health impacts. There is also a need to build the evidence base for climate change adaptation and mitigation strategies in order for governments to devise policy strategies to minimize effects of climate change on public health. These discrepancies in empirical evidence are a direct consequence of the differential availability of research support, climate data by region and socially vulnerable groups. A new mechanism to identify and monitor the needs of the research community, devise strategies to address existing limitations and impediments in applied climate and health research, and advocate on their behalf for financial and technical resources is needed.

PROPOSED ACTIONS

POSSIBLE SUPPORTING MECHANISMS

(1) Set up systematic process for a **State of Climate and Health Research and Science monitoring** including regular synthesis every 3 years, in relation to the Monitoring Evaluation and learning Mechanisms **and the grand challenge areas**.

(2) **Climate, Environment and Health Global Research Conference** to identify research priorities and link with global policy needs; synergize with development of WHO Climate and Health Research Agenda.

Research and Data Expert Team, in coordination with the WHO-led Scientific and Technical Advisory Group (STAG) and GAPHTAG, other research mechanisms, contractors, and collaborating partners.

OPERATIONAL-TECHNICAL SERVICES

Goal: Develop and deliver responsive integrated climate, weather, environmental and health services and systems through increased collaboration and good practices between health, climate and other relevant communities.

Solution Statement: Sustained partnerships between climate and health actors can effectively translate and implement climate science and service systems for health. However, climate services cannot be developed without first integrating core data, knowledge, and

¹⁰ Berrang-Ford L, Sietsma AJ, Callaghan M, Minx JC, Scheelbeek PF, Haddaway NR, Haines A, Dangour AD. Systematic mapping of global research on climate and health: a machine learning review. The Lancet Planetary Health. 2021 Aug 1; 5(8): e514–25.

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information from both the health and meteorological communities in a seamless and streamlined manner. Dedicated technical units, working groups, and institutes at national, regional, and global levels need to be strengthened with capacity, resources, and coordination. A co-creation and co-development process can lead technical partners to understand needs and create climate information products with sufficient quality, reliability, usability, suitability, and responsiveness to support actions such as risk assessment, integrated surveillance, early warning, sectoral policy, communication, and other community and health system actions.

PROPOSED ACTIONS	POSSIBLE SUPPORTING MECHANISMS
(1) TOR/specific tasks of the Data Expert Team TBD.	Based on discussions with Members and Partners.
(2) Raise awareness of the requirements and gaps for investment/advocate for an Intermediary Funding Body and Climate Data Support Facility/Provider that makes climate services from ground stations and satellites available to researchers.	Based on discussions with Members and Partners.
(3) Data and Climate Service Pipelines Demonstration Projects.	Based on discussions with Members and Partners.
(4) Climate and Health Data Integration Toolkit.	Based on discussions with Members and Partners.
(5) Integrated Systems R&D for Nexus area applications (e.g., Heat Health End-to-End Early Warning Systems (EWS), air quality services, drought and health monitors, infectious disease forecasts, climate and air quality projections).	NMHSs/RCCs, Centres of Excellence, Collaborating partners.

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MONITORING AND EVALUATION

Goal: Provide evidence on the performance, effectiveness, and cost-effectiveness of climate services to save lives and reduce climate-related health risks.

Solution Statement: Current data collection mechanisms on the access and use of reliable and relevant weather, climate, water and environmental information significantly lacking in precision, rigour, and scope. New mechanisms are needed to assess progress being made and needs being met. Global monitoring of changing climate vulnerability and risks is left largely to the research community and provides often limited evidence to policy makers. More extensive evaluation methods and practice are needed to learn and inform how to use climate information more efficiently for behaviour change, risk management, and population preparedness. A rigorous Monitoring, Evaluation, and Learning Framework will help guide this work to better track, learn, and iteratively improve the approaches being deployed to support the health community address climate and environmental risks.

PROPOSED ACTIONS

POSSIBLE SUPPORTING MECHANISMS

Develop a Monitoring, Evaluation, and Learning Framework to support the analysis and learning to Advance Integrated Climate Science and Services for Health.

Appropriate technical bodies, WHO-WMO Climate and Health Joint Programme, collaborating partners and entities.

Strengthen accountability and monitoring systems, monitor and report on an agreed cadence (two or three years) the availability and use of climate information products and services for the health sector.

Mechanisms TBD, collaborating Members and partners, ClimaHealth.info data dashboard and portal

Monitor health risks and the impacts of climate on health outcomes and systems (e.g., improved metrics, monitoring systems, advocacy).

Support more rigorous evaluation of climate services for health, including EWS, climate-informed surveillance systems, and vulnerability and adaptation assessments, starting with methods and pilots in multiple regions.

Develop systematic documentation of associated health and socioeconomic

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benefits of the use of climate science and services in the health sector.

3.2 GRAND CHALLENGE AREAS OF CLIMATE, ENVIRONMENT, AND HEALTH

The grand challenges in climate, environment, and health respond to some of the most pressing climate and environmental risks to health: Extreme heat, poor air quality, water scarcity, infectious diseases, food security, and disrupted and dysfunctional health services. Initial examples and ideas have been outlined for the thematic areas but full workplans will be further developed with the appropriate partner and expert communities during the inception year of this plan.

Health and Urban Nexus

(Extreme weather events, Heat, Fire, Air Quality, Ultraviolet (UV), Water stress)

Capacity development and scale up of interventions to understand, forecast and address cascading risks of extreme heat; including interconnections of fire, air quality, water, and UV related health risks into heat EWS and action plans, promotion of evidence-based actions, and risk and impact monitoring of heat-related impacts.

Global Heat Health Information Network for learning, building capacity, and sharing information on extreme heat, health, and urban services.

Develop appropriate activities with the WHO-led GAPH-TAG, and WMO-led GAW on Air Quality and Health.

Integrated data platforms for urban settings in order to improve urban data access and use, urban modelling capabilities and resolution challenges. Institutionalize collaborations between health services and appropriate science and advisory bodies, to enhance adaptation, mitigation, and risk management action plans.

Infectious diseases

Task team on Infectious Diseases to define the approach and implementation mechanisms required.

Training programme for a cadre of epidemiologists and health practitioners equipped to integrate met/climate services and health services.

Assess the use of climate services for health as part of the **health capacities including for the implementation of the International Health Regulations (IHR) 2005 and OneHealth approaches.**

Enhancing anticipatory action on infectious diseases with longer lead times, through actions such as creating data pipelines to be used by infectious disease epidemiologists and climate scientists for monitoring and modelling disease risk, use of machine learning technologies.

Phase 2 – Health, Nutrition and Droughts (livelihoods, food system nexus)

Collaborate with the **Integrated Drought Management Programme** to scope needs, guidance, opportunities, and critical impact points for improved health and nutritional outcomes in the climate, drought, food systems, health and livelihoods nexus. (Establish a joint task team (TT) with Integrated Drought Management Programme (IDMP) on Health).

Phase 2 – Climate resilient and net-zero health systems

Collaborate with the WHO-led Alliance for Transformative Action on Climate and Health (ATACH) to define climate science and service support to enable net-zero transitions in the health sector, including energy dependent public health goods and services such as health facilities, water and sanitation infrastructure, cooling and refrigeration, housing, and transport. (Establish a TT on Health with SERCOM-SG Energy).
