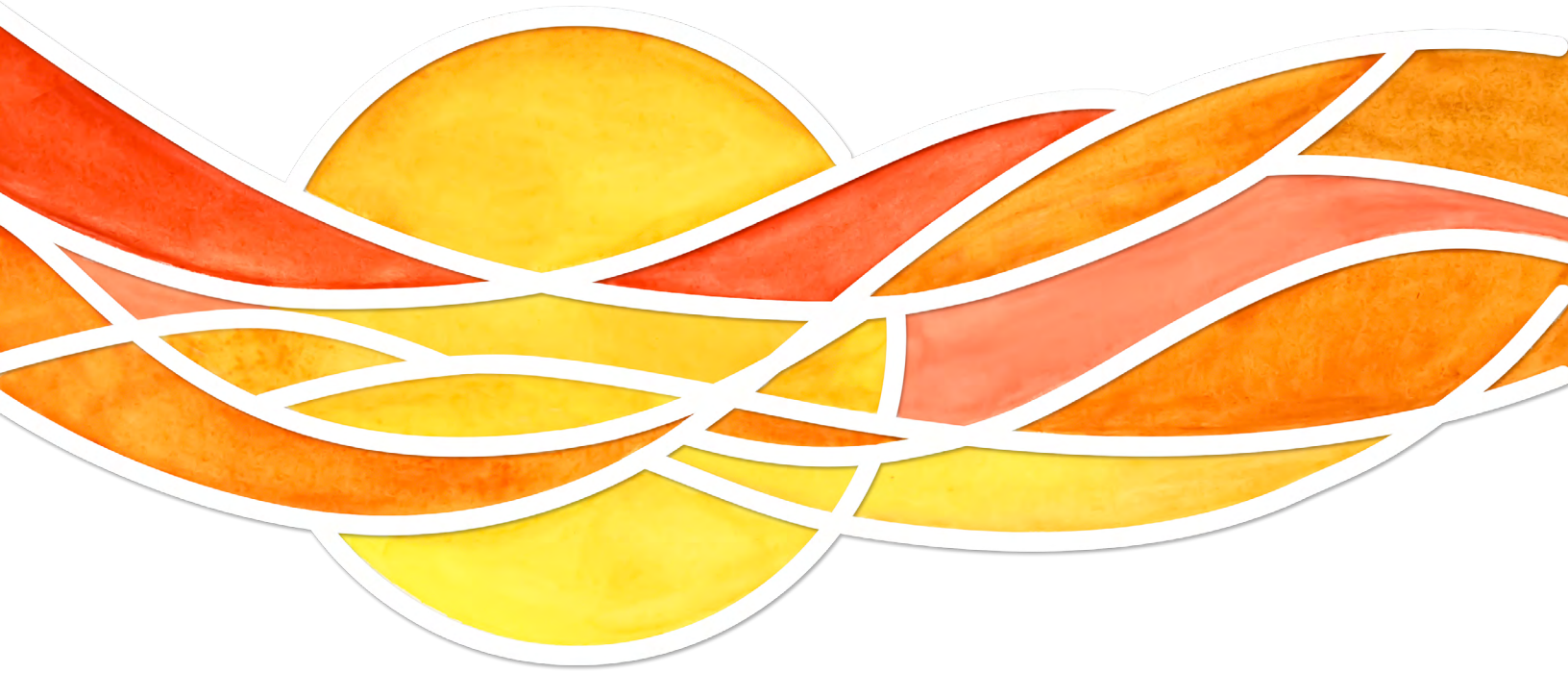


2024-2030

National Heat Strategy

This strategy is a product of the
National Integrated Heat Health Information System
and Interagency Working Group on Extreme Heat

Participating agencies in the National Heat Strategy for 2024-2030 include the following:

Message to the Reader

Heat is an urgent and increasingly severe problem for all parts of the United States. As the first ever National Heat Strategy, this document is designed to facilitate proactive coordination around heat planning, response and resilience across timescales [Appendix A] in line with the goals of the National Climate Resilience Framework to embed resilience into planning and management within the Federal government and across the nation. Together, these documents emphasize a collective approach to building resilience that prioritizes collaboration and implementation of sustainable, adaptable, and equitable solutions and investments that account for the complexity and inter-dependencies in our society.

The Federal agencies involved recognize the impact of heat on the health and well-being of humans, other animals and ecosystems, as well as the related economic and societal consequences. Heat falls across missions and mandates of the many federal agencies who have come together to chart a path forward for themselves and the country—a path that will better protect the people, ecosystems, animals, communities, and economy in the U.S. and abroad.

We recognize that our vision for a thriving, heat-resilient nation is all-encompassing and includes safety, health, and economic well-being across disciplines and timescales. Agencies and communities must work across sectors by sharing best practices and developing a strong support network to achieve this vision. Working in unity will maximize effectiveness and benefits to the public, including improved health and a more prosperous nation. Many communities and organizations are already doing essential work for heat resilience, and there is much we can learn from each other to expand upon these efforts.

We recognize that our vision for a thriving, heat-resilient nation is all-encompassing and includes safety, health, and economic well-being across disciplines and timescales.

Moreover, we recognize the many challenges our country faces in becoming more heat-resilient, including the fact that many populations are disproportionately affected by extreme heat. This includes but is not limited to: workers in hot environments, socioeconomically disadvantaged people, older adults, people with disabilities, people with chronic health conditions, people who are unhoused or poorly housed, communities of color, pregnant people, children, Tribal Nations, Indigenous communities, rural communities, members of the military, and more. Place and identity matter, and our differential vulnerability to heat has a profound impact on environmental justice. We seek to address this challenge through each of the goals outlined in the document.

This Strategy builds off the groundwork laid by the National Integrated Heat Health Information System since 2015, and it exemplifies the leadership of the Biden-Harris Administration's focus on building heat resilience through the Extreme Heat Interagency Working Group. This Strategy was developed through a series of focused strategic planning workshops. The National Heat Strategy introduces the challenges posed by extreme heat and climate change and an overarching approach to the problem, describes a series of Guiding Principles, and presents four Goals focused on communications, science, solutions, and support, each with underlying objectives. We are excited to build on this foundation over the coming years as we continue to work towards our shared mission and vision through the implementation of this Strategy.

Respectfully,
National Integrated Heat Health Information System (NIHHIS) and
Extreme Heat Interagency Working Group (IWG) Principals

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention
National Oceanic and Atmospheric Administration
Federal Emergency Management Agency

Introduction

The risks posed by extreme heat, to individuals, communities, and economic sectors, are a growing threat, with 2023 being the planet's warmest year on record and a 99 percent chance that 2024 will again rank among the top five warmest years. While communities have always experienced the effects of seasonal heat waves, climate change is making these events hotter, longer, more frequent, and more likely to occur in locations that are not acclimated and adapted to these changing conditions. The recently released Fifth National Climate Assessment describes the unequal impacts of extreme heat on disadvantaged communities and vulnerable people, including, but not limited to the elderly, children, pregnant people, people with chronic conditions, outdoor workers, and unhoused and poorly housed people. Extreme heat also poses a threat to terrestrial and aquatic ecosystems, which can have secondary effects on economic sectors including agriculture, aquaculture, and recreation.

Ensuring a thriving nation, resilient to increased heat and heat waves aligns with the priorities of the Biden-Harris Administration's National Climate Resilience Framework. This first National Heat Strategy is framed within a broader national context to

1. align and strengthen Federal capacity, capabilities, and resources to ensure the nation is resilient to heat, and
2. foster engagement, collaboration, support, and joint activities among and with state, local, Tribal, and Territorial governments, and other non-Federal partners to build a heat-resilient nation and promote heat resilience globally.

A thriving heat-resilient nation is built on a foundation of both healthy people and economic and social well-being. This document is focused largely on the health (human, animal, ecosystem), economic (business, housing, workforce), infrastructure (power, water, food) and security (including crime, conflict, climate caused migration, and war) aspects of heat, to optimize and enhance awareness, coordination, resilience, and resources to address these critical extreme heat-related impacts for optimal benefit to society.

Mission

Reduce heat-related impacts by building a societal understanding of heat risks, developing science-based solutions, and improving capacity, communications, and decision-making to ensure a thriving, heat-resilient nation.

Vision

A thriving, heat-resilient nation

Guiding Principles

The following principles, in alignment with the National Climate Resilience Framework, provide context for this Strategy and will guide its implementation:

Proactive

Implement solutions that anticipate and address climate threats and impacts before damages occur. Prioritize activities and investments through risk-based approaches, including approaches that account for complex risks, like cascading impacts and concurrent events, as well as approaches that account for differences in vulnerability and response capabilities within and across communities.

Whole-System

Consider the ways in which communities and natural systems are interconnected, including recognizing that risks and impacts from climate change are borderless. Strive both to leverage synergies (e.g., when increased resilience of one community contributes to the resilience of others) and to avoid maladaptive activities (e.g., when efforts to increase resilience in one community impose harms on another).

Equitable and Just

Pursue solutions that address, and do not exacerbate, disparities between and within communities. Ensure that strategies respond to the needs of underserved and marginalized communities that have historically borne a disproportionate share of climate impacts and costs.

People-Centered

Position the well-being of individuals, families, communities, and society at the center of goals and solutions. Consider the needs and perspectives of all community members, including those that are most vulnerable and have been historically marginalized or disadvantaged.

Collaborative and Inclusive

Work across sectors to identify and pursue shared goals. Create pathways for all community members to be meaningfully involved in decision-making, and conduct active outreach to raise awareness of these pathways and address barriers to participation.

Durable

Implement solutions that serve current and future needs. Ensure that there is continuity of technical expertise and leadership as needed, including by enhancing or building community capacity to sustain and adapt solutions for the long term.

Multi-Benefit

Prioritize solutions, including nature-based solutions that enhance climate resilience, while simultaneously advancing other community, economic, and societal objectives.

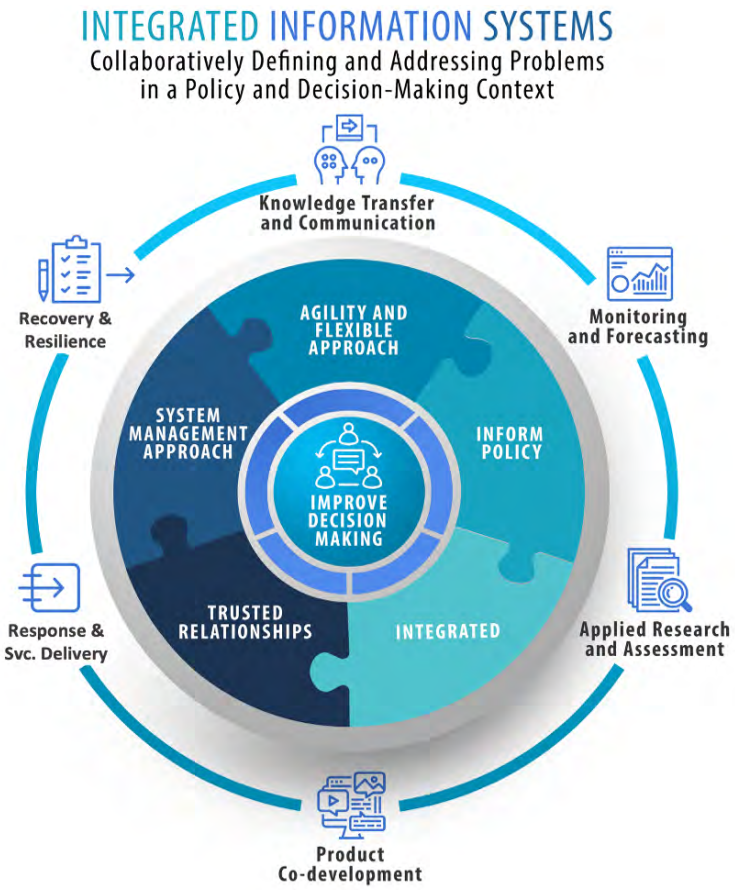
In addition, this National Heat Strategy will:

- Recognize the interconnectedness and impact of heat on human health, ecosystem health, and animal health
- Recognize that heat is increasingly becoming an intersectional and compounding environmental threat along with other climate stressors
- Acknowledge that heat has multi-sectoral impacts including on businesses and industries such as transportation, energy, and agriculture
- Anticipate, account for, and evaluate solutions including recognizing both unintended consequences and maximizing co-benefits
- Build and sustain mutually beneficial dialogue across Federal and non-federal partners to support co-development of science, services, and solutions
- Advance actions that communities can take that leverage existing communication or engagement methods or mainstream messaging into commonly available tools
- Utilize an integrated information systems approach which prioritizes sustained conversation and dialogue to understand decision-maker needs and context, which then helps drive the most relevant science, services, and support for heat resilience

NIHHIS is an Integrated Information System

The National Integrated Heat Health Information System (**NIHHIS**), is a focal point for collaboration between Federal agencies to address the challenge of extreme heat. Launched in 2015, NIHHIS is built on the Integrated Information System (IIS) model, a proven, whole-of-government organizational approach for enabling and strengthening capabilities to understand, manage, and mitigate societal risks from complex environmental hazards (e.g., heat, drought, floods). An IIS is designed to inform and improve the policy and decision-making landscape, connect and amplify existing programs and networks, and respond to emerging priorities in a rapidly changing climate.

Improving decision-making and service delivery through deep and sustained partnerships is at the core of everything that an IIS does. This system adds unique value through convening, integrating, and strengthening existing individual efforts—such as a specific data portal, a community of practice or learning network, federal research programs, early warning systems—in the context of a defined problem and hazard. An IIS can help a decision maker anticipate and identify a hazard, its associated compounding drivers, cascading impacts, and societal impacts, and brings together diverse perspectives and capabilities to find solutions to manage impacts and avoid them in the future.



Agency Roles in Addressing Heat

Working within their authorities and through their diverse programs, Federal agencies can play unique roles in supporting State, local, Tribal, and Territorial governments and other entities in preparing for and managing the effects of extreme heat. **It's important to note that this is not an exhaustive list, and many agencies have overlapping areas of responsibility.** Collaboration across these departments is crucial for a comprehensive national approach to extreme heat risk. Here is a breakdown of how various federal agencies and departments contribute to preparing for and addressing extreme heat risk:

Administration for Children and Families (ACF)

Through programs like the Low Income Home Energy Assistance Program (LIHEAP), ACF assists eligible low-income households with their heating and cooling energy costs, bill payment assistance, energy crisis assistance, weatherization, and energy-related home repairs

.

Administration for Community Living (ACL)

Provides subject matter expertise about the disability and aging aspects of extreme heat and engages with federally- funded state and local disability and aging entities.

Administration for Strategic Preparedness and Response (ASPR)

Provides the health care and public health sector with technical assistance to prepare for extreme heat and supports SLTT public health and medical response and recovery efforts.

Agency for Healthcare Research and Quality (AHRQ)

Provides data on most emergency department visits and hospitalizations in the United States, including visits related to the health consequences of extreme heat. Supports research on the intersection of climate change and healthcare, including extreme heat.

Centers for Disease Control and Prevention (CDC)

CDC tracks heat-related illnesses and conducts translational research on heat-related topics that supports the development of heat early warning systems and online data-driven dashboards. Provides heat health safety information and builds capacity across local health departments to prepare and respond to heat events.

Environmental Protection Agency (EPA)

Conducts science and research into the impacts of heat on health, infrastructure, economies and the environment, and offers guidance, assistance, and funding to reduce heat islands and protect people from extreme heat, including Community Change Grants that can help create or upgrade community-level resilience hubs.

Federal Emergency Management Agency (FEMA)

Encourages individual and community preparedness and resilience with strategies, guidance, and hazard mitigation assistance to better address anticipated extreme heat events. Provides hazard mitigation capability and capacity building activities to support preparedness and resilience to extreme heat. Activities could include strengthening building codes, considering extreme heat in hazard mitigation planning development, and using project scoping to explore potential hazard mitigation actions to address extreme heat.

Food and Drug Administration (FDA)

FDA has several roles related to heat, including food safety, medical devices, and guidance documents. For example, the FDA has provided advice about medical devices that have been exposed to high levels of heat or humidity, as many may not function correctly.

General Services Administration (GSA)

Manages federal buildings and promotes energy-efficient cooling systems.

National Institute for Occupational Safety and Health (NIOSH)

NIOSH conducts research and makes recommendations for the prevention of work-related heat injury and illness.

National Institutes of Health (NIH)
Funds and conducts research and training on heat-related health impacts.

National Oceanic and Atmospheric Administration (NOAA)
Provides weather forecasts and heat warnings, and supports earth systems observations, research, and modeling to improve heat forecasts and research on impacts. NOAA houses the NIHHIS program within the Climate Program Office.

Occupational Safety and Health Administration (OSHA)
Ensures that employers meet their obligations under the OSH Act to provide a safe and healthy workplace including: developing and enforcing safety standards, developing heat safety guidance products and messaging, and responding to reports of occupational heat-related illnesses and fatalities.

Office of Climate Change and Health Equity (OCCHE)
Helps coordinate heat-related activities across HHS and develops heat-related information, resources, and tools for physicians, public health officials, and the general public.

Substance Abuse and Mental Health Services Administration (SAMHSA)
Leads public health efforts to advance the behavioral health of the nation and has a lead role in national disaster behavioral health preparedness, mitigation, response, recovery, and resilience across all aspects of behavioral health systems. As such, SAMHSA develops resources to raise awareness and address the unique health impacts of extreme heat in the lives of people experiencing a range of mental health and substance use conditions.

U.S. Agency for International Development (USAID)
Provides development and humanitarian assistance for US Missions and communities abroad to manage and mitigate the effects of extreme heat. USAID is also strengthening America's leadership overseas, including by convening global stakeholders to advance heat-related resilience efforts and reducing heat risk for U.S. workers abroad.

U.S. Census Bureau
Provides publicly available data on demographics that can help identify populations most impacted by extreme heat. Can also provide custom tabulations, model-based estimates and technical assistance addressing stakeholder measurement needs.

U.S. Department of Agriculture (USDA)
USDA is identifying ways to help the agriculture and forestry sectors, USDA's workforce, and communities nationwide, manage the growing impacts of extreme heat within its current authorities and by leveraging existing programs. Examples include planting millions of trees in disadvantaged communities to provide shade and reduce the heat island effect, ensuring safe recreational experiences across more than 150 national forests where individuals can find refuge from the sun, developing communication materials and research to help farmers and ranchers manage the effects of extreme heat on their crops and livestock, and deploying USDA's disaster assistance efforts when appropriate.

U.S. Department of Defense (DOD)
Is committed to reducing the effects of extreme heat on military installations and defense communities. DOD is preparing for the increasingly hotter environment, by increasing military resilience through the reduction of the effects of heat island amplification, implementation of best practices to improve operational effectiveness, and the establishment of a resilience framework with tangible actions to reduce the impacts of extreme heat.

U.S. Department of Energy (DOE)
Supports research and innovation to develop energy-efficient cooling technologies for appliances, homes, businesses, and vehicles.

U.S. Department of Health and Human Services (HHS)
HS provides for effective healthcare and human services and fosters scientific advances to protect everyone in the United States from the impacts of heat.

U.S. Department of Homeland Security (DHS)
Provides protection for critical infrastructure and emergency management support for extreme weather events to include heat emergencies.

U.S. Department of Housing and Urban Development (HUD)
Provides financial assistance, guidance, and other resources for HUD-assisted properties and communities to invest in strategies to reduce energy costs and improve the thermal comfort and heat resilience of buildings and neighborhoods.

U.S. Department of the Interior (DOI)
Interior manages public lands and implements heat safety measures as appropriate for visitors, employees, and volunteers.

U.S. Department of State (DOS)
Advances efforts to address extreme heat risks in U.S. foreign policy and humanitarian aid efforts.

U.S. Department of Transportation (DOT)
Supports efforts to ensure transportation systems function during extreme heat and considers heat impacts on infrastructure.

U.S. Department of Veterans Affairs (VA)
Ensures the VA enterprise is prepared to assess, address, and prevent heat-related impacts on Veterans, the VA workforce, and VA infrastructure. Supports research on heat-related health effects, with a focus on populations most vulnerable to harm

U.S. Geological Survey (USGS)
Carries out science on heat, such as mapping changes in urban heat island effects over time using remote sensing data, and examining the role of vegetation types and other land cover types in modifying urban surface air temperatures.

Executive Summary

Key messages about extreme heat:

- Extreme heat is increasing in the U.S., and climate projections indicate that extreme heat events will be even more frequent and intense and longer in duration in the coming decades.

- Heat-related deaths and illnesses, after staying steady or declining for decades, have risen dramatically in the past four years, indicating a failure of adaptation and urgent need to act.

- Extreme heat does not affect all people equally. We must pay special attention to populations that are especially at risk from heat-related illness.

- The response to an extreme heat event is typically a collaborative effort between state, local, Tribal, and territorial governments (SLTT), as well as the private sector, nonprofit organizations, and community groups within their jurisdictions.

- The National Integrated Heat Health Information System (NIHHIS) and Extreme Heat Interagency Working Group (IWG) improve coordination of federal agencies in responding to extreme heat across a wide span of time scales.

Through the goals and objectives outlined in the Strategy, the federal government is taking a unified approach to align and strengthen Federal capacity, capabilities, and resources to ensure the nation is resilient to heat. In addition to working across Federal agencies, the Strategy also outlines goals to foster engagement, collaboration, support, and joint activities among and with state, local, Tribal, and territorial governments and other non-federal partners to build a heat-resilient nation and promote heat resilience globally. The Strategy recognizes that working in unity will maximize effectiveness and benefits to the public, including improved health and a more prosperous nation.

Key Messages in the National Heat Strategy:

Goal 1: Communication, Outreach, and Education

Understand needs and perceptions, expand awareness, and inspire action to address the impacts of heat by:

- Engaging across all levels, including communities, sectors, Tribal Nations, Indigenous communities, and state, local, and territorial government agencies
- Engaging with trusted advocates to promote heat resources in a coordinated, culturally appropriate, and accessible manner
- Enhancing accessible communication of impacts, including impact on health, the economy, the environment, healthcare costs, critical infrastructure, and more
- Expanding opportunities for education, training, and knowledge sharing at all levels

Goal 2: Science

Advance understanding of heat and its impacts to develop science-based services and solutions for enhanced resilience by:

- Understanding, assessing, and prioritizing existing challenges and gaps in tools, practices, and research to inform future collaboration, science, services, and solutions
- Increasing participation and collaboration with non-federal partners such as academics, industries, international partners, and more
- Conducting research to advance the understanding of heat's current and future impact on health, the economy, the environment, infrastructure and the built environment, population demographics, migration, disasters, conflict, and compounding and cascading impacts
- Enhancing and expanding current monitoring, observation, and data collection, and developing new approaches for monitoring and reporting on heat-related data

Goal 3: Solutions

Improve and facilitate an integrated approach with access to heat information, services, and solutions to support international, national, state, local, territorial, Tribal, and individual actions by:

- Conducting assessments to identify at-risk populations, systems, and infrastructures to inform resilience strategies
- Establishing heat early warning systems that are accessible to all
- Adopting safety measures to prevent and reduce heat-related illness and injury through policies, standards, regulations, and strategies
- Increasing planning and decision making at all levels to inform development of heat-related guidance, training, tools, funding opportunities, and best practices
- Providing resources to support community enhancement and maintenance of human, natural, and built infrastructure for heat management across timescales. [Appendix A]

Goal 4: Support

Solidify NIHHIS to ensure continuity as the primary integrated federal source for heat-related health information and solutions by:

- Strengthening NIHHIS and the Extreme Heat Interagency Working Group to bring diverse disciplines and perspectives together to advance societal resilience to heat
- Enhancing interagency coordination and collaboration to identify critical gaps in available resources and information, and facilitate action
- Strengthening partnerships or leveraging existing relationships with state, local and Territorial partners, as well as private and academic sectors to co-produce, provide, and communicate information, planning, tools, and services to improve heat-resilience.
- Strengthening Tribal Nation-to-Nation engagement and collaboration with Tribal Nations and Indigenous communities

GOAL 1

Communication, Outreach, and Education

Understand needs and perceptions, expand awareness, and inspire action to address the impacts of heat

Engagement at All Levels

1. Develop or leverage deep partnerships to understand the local and unique contexts and needs of each community[1] or sector[2], including co-exposure to other climate and environmental stressors, to identify heat risks and challenges, and define opportunities to inform decision-making and action.

2. Engage communities, especially those most disproportionately affected, to understand the impacts of heat and develop strategies based on their unique contexts to reduce the behavioral and physical health burdens imposed by the impacts of heat.

3. Engage communities, sectors, Tribal Nations, Indigenous communities, and state, local, and territorial government agencies, U.S. military installations, and businesses in actions and programming to address the broad impacts of heat (i.e., health, economic, social, and environmental).

4. Engage with Tribal Nations and Indigenous communities to learn from and support their strategies in addressing heat and its impacts, as well as to develop shared strategies based on their contexts.

5. Ensure that communication is authentic, understandable, accessible[3], culturally and linguistically competent, and provided in plain language to reach the broadest population and maximize impact.

Tailored Messaging

6. Develop a central repository of core heat-related accessible messaging that can be shared widely across governmental and nongovernmental partners and can be tailored for specific audiences.

7. Engage trusted advocates, local leaders, faith-based organizations, community organizations, schools and childcare providers, employers and worker representatives, public health agencies, healthcare organizations, and the media to conduct messaging and outreach campaigns in various languages and contexts across the nation.

1 FEMA defines community as:

1. A group of people living in the same locality and under the same government, or a political subdivision of a state or other authority that has zoning and building code jurisdiction over a particular area.
2. A political entity that has the authority to adopt and enforce floodplain ordinances for the area under its jurisdiction.
3. A network of individuals and families, businesses, governmental and nongovernmental organizations and other civic organizations that reside or operate within a shared geographical boundary and may be represented by a common political leadership at a regional, county, municipal or neighborhood level.
4. Any State, or area or political subdivision thereof, or any Indian tribe or authorized Tribal organization or Alaska Native village or authorized native organization, which has authority to adopt and enforce floodplain management regulations for the areas within its jurisdiction.

2 The Cybersecurity and Infrastructure Security Agency identifies 16 critical infrastructure sectors whose assets, systems, and networks, whether physical or virtual, are considered so vital to the United States that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof. cisa.gov/topics/critical-infrastructure-security-and-resilience/critical-infrastructure-sectors

3 Section 508 of the Rehabilitation Act (29 U.S.C. 794d), as amended in 1998, is a federal law that requires agencies to provide individuals with disabilities equal access to electronic information and data comparable to those who do not have disabilities, unless an undue burden would be imposed on the agency. The Section 508 standards are the technical requirements and criteria that are used to measure conformance within this law. More information on Section 508 and the technical standards can be found at section508.gov

8. Develop and implement a comprehensive strategic communications plan to raise awareness of both acute and chronic term heat-related health risks, promote informed decision-making, and combat disinformation for all, particularly for disproportionately affected populations.

9. Develop and implement a whole-of-government annual heat communications campaign appropriate for both heat season and non-seasonal heat events.

10. Provide actionable and relevant community and individualized messaging and public education campaigns to plan for and respond to near and long-term heat events.

11. Engage communities with environmental justice concerns, advocates, workers, and other disproportionately affected populations to facilitate protective actions and identify and address barriers.

12. Engage non-traditional partners [i.e., art, culture, museum, entertainment, sports, public lands (county, state, and national parks and forests), futurist sectors and influencers] to apply innovative and compelling approaches to convey heat risk, impacts, and solutions, and empower action.

13. Engage with industry, technology, and agriculture sectors to develop and implement communications to spur protection of manufacturing, infrastructure, transportation and similar sectors and their workforce from the effects of heat.

14. Coordinate with Tribal Nations and Indigenous communities, and Federal, state, local, territorial government agencies to promote their available heat resources in a coordinated, culturally appropriate, and accessible manner. Accessible information requires the use of plain language, easy-to-read formats, accessible information and communication technology, and effective communication such as auxiliary aids and services.

Communication of Impacts

15. Enhance communications before, during, and immediately after extreme heat events to educate on the standalone, compounding, and cascading nature of climate change and heat impacts with real-world examples.

16. Enhance accessible communications on heat preparedness, hazard risk reduction, and adaptation to promote heat resilience.

17. Communicate the current, projected, and differential costs of heat, including lost wages and productivity, ecosystem and wildlife impacts, health impacts, healthcare costs, business and critical infrastructure losses, and deaths.

18. Develop consistent messaging on how federal agencies collect, report, and share heat health information.

Education

19. Develop heat curriculum and engagement opportunities for schools, educational institutions, and informal and place-based educational settings (e.g., national parks, senior centers, and community-based organizations) to promote lifelong heat resilience.

20. Expand opportunities for trans-disciplinary heat health training at all levels, including but not limited to: the collegiate levels including internships, fellowships, postdoctoral, early career programs, and lifelong learners; high school and afterschool programs; camp counselors; athletic leaders; CPR trainers; lifeguards; AmeriCorps service members; service members and medics; U.S. military personnel; workers and employers; businesses and more.

21. Provide training to advance knowledge of heat impacts and capacity in communicating, preparing for, and responding to the health impacts of heat, with a focus on emergency managers, service members and medics, first responders, U.S. military personnel, public health professionals, healthcare providers (including long-term services and support staff, behavioral health providers, family caregivers, and nursing home staff), social service agencies and staff, land and water managers, urban and regional planners, and climate scientists.

22. Provide training to advance knowledge and capacity in communicating economic and non-health impacts of heat on multiple sectors, businesses and employers, including those which then cascade into human impacts.

GOAL 2

Science

Advance understanding of heat and its impacts to develop science-based services and solutions for enhanced resilience

Advance understanding of heat and its impacts to develop science-based services and solutions for enhanced resilience

Research Approaches and Priorities

1. Understand, assess, and prioritize existing challenges and gaps in current tools, practices, and research to inform future collaboration, science, services, and solutions.

2. Make funding opportunities for heat research more equitable, accessible, sustained, collaborative, and interconnected with funding for heat action.

3. Promote trans-disciplinary, participatory, community science, application-oriented, innovative, translational, indigenous, and "open science" research, methods, knowledge and best practices to address the complexity of heat challenges, particularly on disproportionately impacted populations.

4. Collaborate with international partners on research and evidence generation to share and leverage lessons learned from around the world and to develop world-class heat solutions, strategies, tools, and guidance.

5. Partner with industry including small businesses, unions and technical associations to evaluate risks, and identify and implement solutions to issues associated with manufacturing, agriculture, transportation, infrastructure, and utilities (water, electricity, etc.)

Science and Research

6. Conduct research on heat-related lived experiences, risk perceptions, barriers, communications preferences, and motivations to take action to reduce risk, particularly among disproportionately affected groups.

7. Conduct research to improve understanding, modeling, and prediction of the physical mechanisms of extreme and chronic heat, such as climate variability, predictability, attribution, and interactions with other hazards such as drought, fire, and air quality.

8. Conduct research to understand and evaluate heat reduction solutions in the built environment such as specific clothing and personal protective equipment, use of cooling shelters, and programs/policies including requirements for breaks, provision of shade and water. This research could draw from chemical and material science approaches to reduce heat absorption, engineering, design, social sciences, and architectural approaches, and associated policy and economic studies.

Health Impacts

9. Advance understanding of physical, behavioral, and mental health impacts of heat, both acute and chronic, across different populations, life stages, geographies, and spatial and temporal scales.

10. Advance understanding, including the most relevant form of thresholds, that trigger individual behavior and institutional intervention and responses.

11. Assess availability and equitable access to health information and resources, including consideration of preventative, acute and chronic care for both extreme heat events and sustained increased temperatures.

Economic Impacts

12. Quantify the current and projected economic costs of extreme heat on businesses and the workforce, including lost wages and productivity, and impacts to healthcare costs, innovation, and health impacts including deaths.

13. Quantify the current and projected economic costs associated with the impacts of increased extreme heat on individuals and households, including health, wellbeing, livelihoods, energy insecurity, and cost of living.

14. Quantify the current and projected economic costs associated with the impacts of increased and extreme heat on infrastructure and manufacturing processes.

15. Quantify the economic cost and risks from extreme heat on food systems and natural ecosystems that support them at different scales (industrial, local, subsistence), including agriculture and fisheries, labor, storage, shelter, production facilities, transportation, and other supply chain aspects.

Ecological Impacts

16. Understand and project heat-related impacts on marine and terrestrial ecosystems, including, but not limited to food and forest systems, disease vectors, organisms, and habitats, to sustain existing sensitive populations of plants and animals and mitigate negative impacts.

17. Understand and quantify heat-related ecosystem changes as they directly or indirectly affect human health, including disease vectors, air and water quality, expanding habitats of venomous wildlife and poisonous vegetation, allergens and molds, etc.

Infrastructure and the Built Environment Impacts

18. Understand and project heat-related impacts on green [4], gray [5] and blue [6] infrastructure and related compounding or cascading effects and their impact on health. This includes studies of heat-related impacts on the degradation of materials and increased energy use in buildings.

19. Conduct applied research to advance climate predictions and tailored information to inform urban and regional design, architecture, and planning as well as infrastructure investments, including the intensity, duration, and frequency of varying heat measures and indices, and the urban heat island effect.

4 In 2019, Congress enacted the Water Infrastructure Improvement Act, which defines green infrastructure as "the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters."

5 Gray infrastructure is traditional stormwater infrastructure in the built environment such as gutters, drains, pipes, and retention basins.

6 Blue infrastructure refers to water infrastructure in the built environment such as rivers, lakes, streams, ponds, and stormwater.

Community-Driven Relocation and Demographic Impacts

20. Understand and project the heat-related drivers and impacts of community-driven relocation and demographic shifts to better prepare for, manage, and build heat resilience and support just transitions.

21. Understand the heat-related drivers and impacts of complex location-based, cultural, and community effects for those that do not, or cannot, migrate to better prepare and manage those impacts.

22. Understand heat drivers and impacts on economy, location of agriculture, manufacturing, transportation, business and related impact on social stability and availability of necessary goods and services.

Compounding and Cascading Impacts

23. Advance science to improve understanding of the impacts of heat combined with other hazards and their compounding and cascading effects.

24. Develop advanced modeling methods that can represent the complex interactions of people, places, businesses, infrastructure, the environment, supply chains, and other elements in planning, preparedness, response, and recovery scenarios.

Disasters, Migration, and Conflict Impacts

25. Research strategies to integrate heat emergency considerations within disaster preparedness, response and recovery capabilities at the state, local, Tribal and territorial levels, including personal protective equipment effectiveness.

26. Improve methods and data to quantify the present and future human health and socioeconomic effects of extreme heat events including cascading infrastructure failures.

27. Conduct coordinated rapid response research[7] to better understand on-the-ground situations and actions before, during, and after extreme heat events.

28. Conduct research on the societal implications of heat on trust, crime, conflict, aggression, civil unrest, hardships including mass migrations, and war to inform solution development and response in the U.S. and abroad.

Decision and Implementation Science

29. Build quantitative and qualitative evidence for effective actions to reduce heat impacts including benefit-cost analysis.

30. Improve understanding of the processes, constraints, and requirements for decision-making to reduce heat impacts including user-specific scenarios.

7 Rapid response research projects are quickly deployed scholarly interventions in pressing political, social, and cultural crises.

31. Support research translation and scaling of effective actions to reduce heat risk.

32. Establish demonstration projects, testbeds, and other experimental approaches based on local context and decision-maker needs to transition research to implementation.

Data, Monitoring, and Observations

33. Develop and promote shared and open monitoring, observing, and data integration and storage protocols and approaches for improved access, understanding, and interoperability.

34. Develop new techniques for calibrating, validating, quality assuring, and integrating novel and disparate heat-related observations (e.g., crowdsourced data, social media data).

35. Enhance and expand environmental monitoring, observing, and data for thermal comfort variables (including internal comfort, as well as thermal comfort in the home and at workplaces) to improve predictions, exposure assessment, and evaluation of the effectiveness of heat-impact reducing actions. [Appendix B]

36. Collect and integrate heat impact (e.g., syndromic surveillance[8]) and vulnerability data (retrospective, real-time, and forecasted/predicted) across populations to inform design, prioritization, implementation, and evaluation of indicators, solutions, and strategies.

37. Improve data reporting, collection, sharing, and access for heat-related disability, illnesses, disease, and deaths, including chronic and acute health impacts, while respecting Tribal data sovereignty.

38. Develop and implement monitoring and reporting regarding heat impacts on infrastructure, industry, etc.

8 Syndromic surveillance provides public health officials with a timely system for detecting, understanding, and monitoring health events. By tracking symptoms of patients in emergency departments—before a diagnosis is confirmed—public health officials can detect unusual levels of illness to determine whether a response is warranted.

GOAL 3

Solutions

Improve and facilitate an integrated approach with access to heat information, services, and solutions to support international, national, state, local, territorial, Tribal, and individual actions

Improve and facilitate an integrated approach with access to heat information, services, and solutions to support international, national, state, local, territorial, Tribal, and individual actions.

Heat Resilience Information

Integrated Information Portal

1. Establish and maintain heat.gov as the central federal information hub that is accessible, including by people with disabilities, for curated, timely, integrated heat-health data, information, tools, and services [9] to enhance individual, community, and economy-wide resilience.

Assessments

2. Provide guidance, tools, and datasets to support community monitoring and assessment of heat risk, mitigation, and adaptation services and solutions. [Appendix C]

3. Conduct sustained national-level assessments of the elements of heat risk to inform resilience strategies. [Appendix D]

4. Expand the international heat resilient cities pilot program [10] and learn from the results of the existing pilots, such as in Brazil, Sierra Leone, and Chile.

5. Conduct assessments using best available data to identify at-risk populations in need of access to cooling resources and environments (e.g. unhoused, congregate or low-income housing, or others without means to cool home or workspaces) to inform resilience strategies and resource allocation.

6. Conduct assessments using best available data to identify at-risk systems and infrastructure (such as transportation, manufacturing, agriculture, utilities, energy, etc.) to inform resilience strategies.

7. Conduct whole-of-government preparedness exercises for heat events and cascading events to ensure readiness and inform long-term resilience.

8. Assess the performance and impact of programs and initiatives designed to support the National Heat Strategy goals and mission

Planning and Decision-Making

9. Gather and produce input from interested parties to inform development of heat-related guidance, training, tools, funding opportunities, and best practices for integrated planning and effective heat impact reducing actions and adaptation decision-making for urban, rural, industrial and agricultural environments.

10. Facilitate place-based [11] community support and capacity building to successfully implement high-impact, tailored heat resilience solutions, including the development of heat action plans and equitable access to grants.

9 Adapting a services definition from the **Opportunities for Expanding and Improving Climate Information and Services for the Public—A Report to the National Climate Task Force** report, services can be defined as scientifically-based, usable information and products that enhance knowledge and understanding about the impacts of heat on potential decisions and actions.

10 **research.noaa.gov/article/ArtMID/587/ArticleID/2998/Lessons-from-heat-mapping-in-two-tropical-cities**

11 A place-based approach is about understanding the issues, interconnections and relationships in a place and coordinating action and investment to improve the quality of life for that community.

11. Support the creation of heat action plans or integration of heat into existing hazard mitigation, emergency preparedness, and community resilience plans.

12. Expand heat-health data collection training for health care practitioners, medical societies, hospitals, public health professionals, U.S. military medics, and other healthcare providers including community health organizations to improve the quality and consistency of morbidity and mortality data.

13. Expand awareness of heat risk reduction resources and heat-health awareness for health care delivery services, including long-term services and support staff, family caregivers, and nursing home staff.

14. Create targeted engagement, planning, and decision guides for disproportionately impacted populations such as older adults, youth, Tribal Nations and Indigenous communities, veterans, service members, people with disabilities including people with service and support animals, people with lower incomes, people experiencing homelessness, individuals with medical conditions, people with mental health or substance use disorders, individuals with pre-existing behavioral health conditions, power-reliant individuals, and individuals requiring chronic medical and behavioral medications or health equipment.

15. Implement a framework to identify solutions for those that are unhoused, poorly housed, or have insecure housing, and support physically accessible housing, affordable housing, affordable energy, and air conditioning for both daytime and nighttime, recognizing that this may also address the need for improving resilience and capacity in the nation's electric grid.

16. Improve access to information on quality and cost-effective housing, affordable energy, and the sustainment and restoration of energy during heat events to keep people, including the most disproportionately impacted, safe.

17. Recommend strengthening the adoption and enforcement of building codes and standards and energy efficiency codes and standards that support passive survivability of building occupants and building systems during extreme heat events that coincide with (or cause) power outages and reduce stress on the nation's electric grid

Early Warning Systems

18. Collaborate with Federal partners to codify the National Weather Service Outlook/Watch/Warning/Advisory heat system as the official national standard.

19. Provide translated forecast, risk assessments, tools, and policy guidance for heat-impacted sectors, ecosystems, and wildlife to inform better decision-making.

20. Empower communities to act on alerts and forecasts to protect populations at the greatest risk of heat-health impacts and those that are underserved and disproportionately impacted.

21. Ensure that such alerts are across diverse platforms and media, and are accessible in multiple languages and by people with disabilities.

22. Ensure alerts available and publicized to industry, business, agriculture, transportation, and infrastructure sectors.

Safety Measures

23. Increase awareness and adoption of safety measures to prevent and reduce heat-related illnesses and injuries, including impacts to durable health-related equipment, particularly for those who are disproportionately impacted by extreme heat, such as older adults, Tribal Nations and Indigenous communities, workers, children, athletes, and people with disabilities.

24. Provide resources and strategies for strengthening industry response for hotter ambient temperatures and more extreme temperatures, as well as worker safety standards, to keep workers safe and our economy healthy.

25. Initiate policies and standards to protect workers, particularly at-risk migrant and immigrant workers, outdoor workers, and workers in hot environments, from increased extreme heat events.

26. Consider regulations to prevent heat-induced or -exacerbated environmental, safety, and economic risks in the industrial, commercial, utility, infrastructure, transportation and agriculture sectors.

Infrastructure Solutions

27. Prioritize budgetary resources and work with key stakeholders to plan, design, and demonstrate replicable, community-scale projects that explore innovative clean energy solutions to mitigate the impacts of extreme heat in low-income and disadvantaged communities

28. Provide resources to support community enhancement and maintenance of human, natural, and built infrastructure for heat management across timescales [Appendix A].

29. Engage utility and other infrastructure partners to identify needed infrastructure improvements and inform implementation of improvements to ensure effective and equitable delivery of services with reliability and continuity of operations, especially energy grid capacity and safety in high heat events.

30. Encourage technological development and adoption of energy-efficient cooling systems such as heat pumps or networked geothermal systems that are implemented at a neighborhood scale.

31. Integrate urban heat island solutions, networks, and tools across the federal government to encourage and accelerate grant applications and implementation to maximize impact and protect more people in urban environments.

32. Support greater access to natural areas/greenspaces for people, animals, and wildlife to both escape heat and experience associated benefits including improved physical and mental health.

Improve and facilitate an integrated approach with access to heat information, services, and solutions to support international, national, state, local, territorial, Tribal, and individual actions.

Wildlife and Ecosystem Solutions

33. Sustain green infrastructure and habitat at a scale to ensure biodiversity and ecosystem resilience to extreme and sustained heat.

34. Provide broad, structural, landscape-level solutions [12] to avoid loss of indigenous plants and wildlife due to extreme and sustained heat

35. Maintain and restore migratory corridors and heat stations (e.g. refuges for animals to shelter from heat) to support migratory species and reestablish ecosystems to preserve biodiversity, food supply, and prevent zoonotic disease.

12 A "landscape approach" is a term used to describe collaborative initiatives in specific places that span multiple sectors and go beyond the scale of individual farms, forest management units and protected areas.

GOAL 4

Support

Solidify NIHHIS to ensure continuity as the primary integrated federal source for heat-related health information and solutions

Solidify NIHHIS to ensure continuity as the primary integrated federal source for heat-related health information and solutions

Foundational Underpinnings

1. Integrate NIHHIS into other federal initiatives to improve coordination and implementation.

2. Facilitate access to all federal heat resources by reducing administrative burdens.

3. Strengthen the NIHHIS organization, staffing, and infrastructure across the federal government to ensure program sustainability and mission performance.

4. Harmonize relevant funding streams on heat.gov and additional federal platforms and make funding paths more discoverable, accessible, and coordinated to increase efficiency, and to identify and close gaps.

5. Leverage the NIHHIS and Extreme Heat Interagency Working Group to bring diverse disciplines and perspectives together to advance societal resilience to heat.

Interagency Coordination and Collaboration

6. Utilize a whole-of-government approach to identify critical gaps in available resources and information, and facilitate action steps across partnerships to address identified gaps.

7. Formalize and sustain an interagency governance structure to ensure effective integration, collaboration, and innovation.

8. Fully integrate all federal partners into efficient, effective, and coordinated interagency planning and response for extreme heat events.

9. Share between agencies efforts to establish metrics for monitoring and evaluation and utilize the metrics to evaluate success of the National Heat Strategy.

10. Identify federal agency mandates and missions to optimize integration opportunities in implementing the National Heat Strategy.

11. Identify agencies' heat-relevant programs and components and assess for internal and interagency communication and coordination gaps.

12. Formalize and leverage existing mechanisms to facilitate interagency coordination and collaboration.

13. Ensure relevant Federal agency budget requests complement each other, and coordinate the execution of funding in furtherance of the NIHHIS mission and strategies.

14. Enhance cross-federal capacities and contributions to NIHHIS to respond to national heat challenges (e.g. details and rotational programs).

15. Leverage existing interagency working groups at the national and international scale, as well as interagency partnerships at the regional scale.

National Communication and Engagement

16. Regularly brief the Administration, Congress, and leaders on the progress and challenges of NIHHIS and heat resilience for the nation.

17. Improve federal interagency communication, at both the senior leader and staff levels, on the mission impacts of extreme heat.

18. Establish a process to solicit and integrate non-federal input into this heat strategy.

19. Collaborate with partners, including community- and faith-based organizations, with a focus on disproportionately impacted and underrepresented communities to contribute diverse capabilities and capacities to measurably advance research and identify solutions to reduce heat risk.

20. Strengthen Tribal Nation-to-Nation engagement and collaboration with Tribal Nations and Indigenous communities to provide and co-produce information, planning, tools, and services to improve heat resilience.

21. Strengthen international engagement and collaboration to provide and co-produce information, planning, tools, and services to improve heat resilience.

22. Strengthen partnerships or leverage existing relationships with state, local and territorial partners to co-produce, provide, and communicate information, planning, tools, and services to improve heat resilience.

23. Build partnerships with the private, non-profit, and academic sectors to leverage data, networks, and audiences to co-produce, provide, and disseminate information, planning, tools, and services to improve heat resilience.

Appendix A *Heat Risk Reducing Decisions Are Made at All Timescales—Examples*

MONTHS TO A YEAR IN ADVANCE

Planning

- Establishing and regularly updating heat action plans
- Running heat tabletop exercises to test existing plans and fix issues
- Developing programs that encourage people to check on neighbors, friends, and family during disasters such as heat waves
- Seasonal and interannual predictions to determine the likely timing and intensity of upcoming heat events medium-term)

DURING HEAT EVENTS

Responding

- Closing outdoor recreation facilities (excluding outdoor pools, splash pads, etc.) during heat events and opening resilience hubs and cooling centers
- Amplifying broadcasts and warnings alerting people to high temperatures and immediate actions they should take to stay safe
- Surveillance and monitoring of the progression of heat events and impacts

YEARS TO DECADES IN ADVANCE

Long-term Adaptation and Resilience

- Reducing urban heat islands through tree canopy and cool surfaces
- Updating policies, programs, and laws to include heat, such as home energy efficiency and subsidy programs
- Reducing and preventing homelessness and inadequate housing
- Building resilience hubs in communities for people to get air conditioning, water, and social cohesion during heat events

PRE-HEAT SEASON AND DURING

Preparing

- Conducting public heat awareness education and communication campaigns (e.g., social media campaigns, infographics, flyers, and webinars teaching people to recognize the signs of heat-related illness, etc.)
- Equipping emergency response depart-ments and healthcare facilities with resources needed to keep people and infrastructure safe during heat events (pre-positioning assets)
- Predicting monthly and weekly predictions and weather forecasts to determine the likely timing and intensity of upcoming heat events

AFTER HEAT EVENTS

Recovering

- Organizing hotwashes and debriefs to evaluate how previous heat response efforts went
- Conducting studies that measure the effectiveness of heat response efforts and developing ideas to improve these efforts in the future
- Taking mitigating actions and best practices to implement ahead of the next heat event

Appendix B *Factors Affecting Human Thermal Exposure and Comfort*

Radiant Energy
from the sun, but also reflected or absorbed and reemitted from surfaces

Wind
carries air that may have different temperature and humidity, but also speeds up evaporative cooling

Relative Humidity
humid air prevents evaporative cooling from sweat

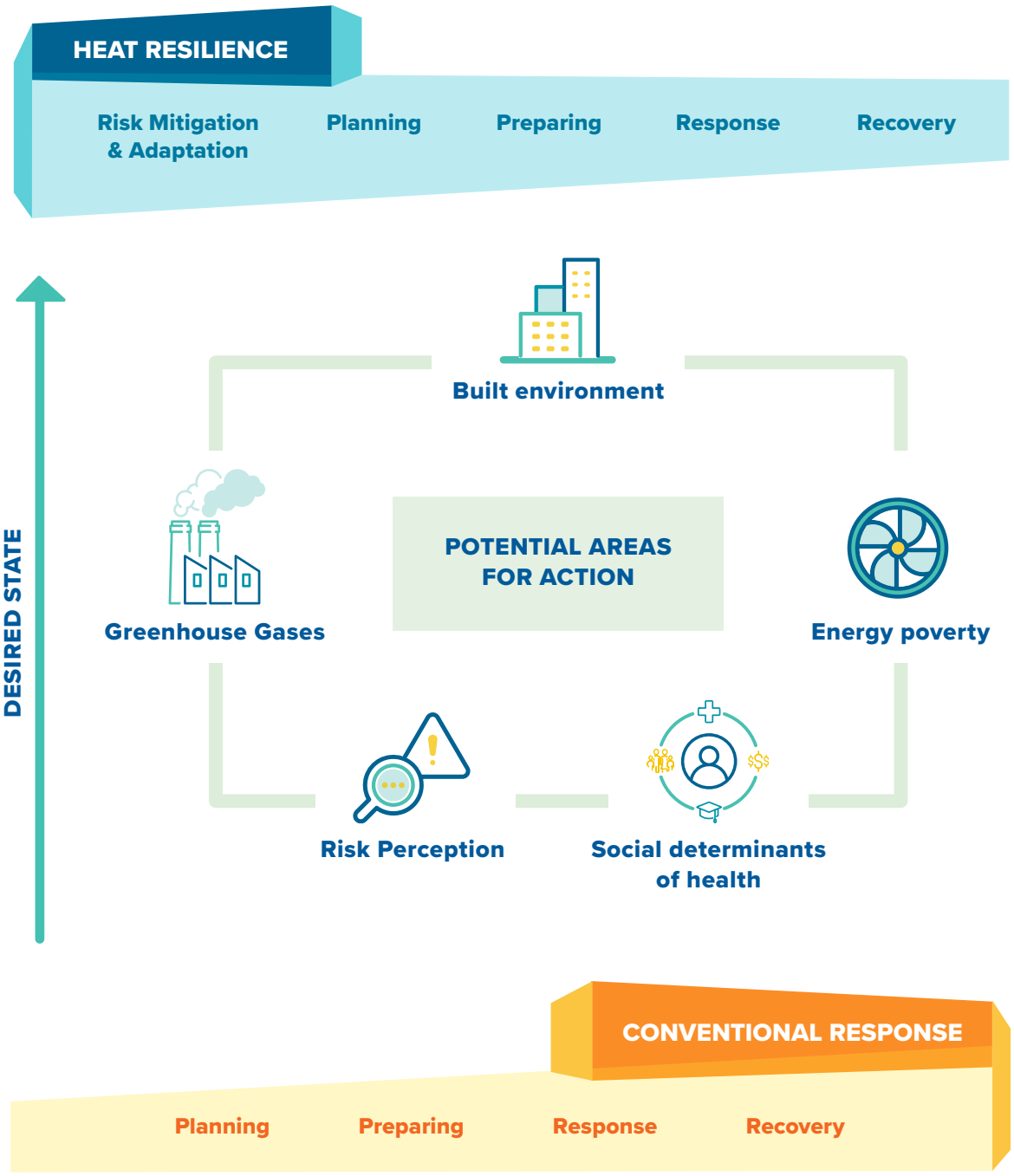
Air Temperature
is the average amount of heat energy in the air that our skin feels

Clothing
(and protective equipment) insulates the body, trapping heat

Metabolic Rates
(and exertion) generate internal heat

Appendix C *Long-term Heat Risk Reduction Through Resilience*

NIHHIS strives to build equitable resilience to heat by shifting effort from more reactive aspects of emergency management (response and recovery) to proactive risk mitigation and adaptation. By doing so, risk is reduced, requiring less of a response for every heat event, ultimately saving lives and resources.



Appendix D *Elements of Heat Risk*

Risk of Heat-related Impacts

The total risk of heat-related impacts is determined by the intensity of heat hazards, the level of exposure to heat, and various factors affecting vulnerability to heat. Reduction of any of these three components can reduce overall risk from heat.

Examples of risks from heat include health risks (morbidity, mortality), economic risks (reduced worker productivity, crop losses), and infrastructure risks (power outages, damage to railways and roadways, air transportation delays).

HAZARDS FROM HEAT

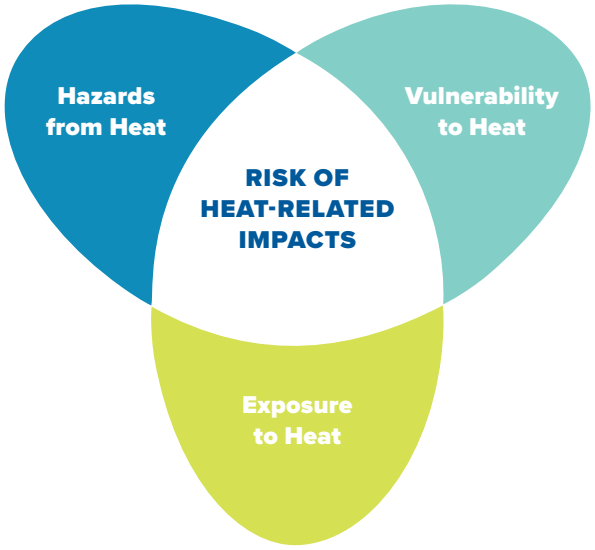
The intensity of heat hazards is determined by a myriad of physical drivers.

Examples of these heat hazard drivers include air temperature, humidity, wind, shade, sunlight, nearby green-space, and urban environments.

VULNERABILITY TO HEAT

Vulnerability to heat is determined by the sensitivity of individuals and communities to heat hazards and their ability to adapt to these hazards.

Examples of factors affect vulnerability to heat include personal factors (age, health, medication use, socio-economic status, water consumption) and factors affecting adaptive capacity of communities (healthcare infrastructure, preparation for heat response efforts).



EXPOSURE TO HEAT

The level of exposure to heat is determined by the presence and amount of time people or infrastructure spend in areas affected by heat hazards.

Examples of factors affecting heat exposure including the amount of time spent recreating or working outdoors, the amount of time spent in buildings without air conditioning, and the presence of infrastructure in sunlit vs. shaded areas.

Glossary of Heat and Health Terms

Heat
Thermal energy transferred to an object, raising its temperature. In the context of heat and health, “heat” refers to ambient air temperatures that can lead to adverse health effects and other impacts.

Extreme Heat
Unusually high temperatures that pose a significant health risk. The definition of "extreme" can vary depending on location and typical climate and is often based on percentiles of climatologically normal temperatures.

Heat Resilient
The ability of individuals, communities, and systems to prepare for, withstand, recover from, and adapt to the negative effects of heat.

Environmental Justice
The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. In the context of heat, it ensures all communities have the resources and support to cope with heat impacts.

Equity
The process of ensuring that everyone has the same opportunity for health, safety, and well-being. In the context of heat, it means recognizing that some communities face greater heat risks due to social determinants of health and taking steps to address those disparities.

Community
A group of people living in the same area who share common interests and concerns. In the context of heat and health, it refers to residents of a neighborhood, city, or region who may be impacted by heat together.

Nature-Based Solutions
Actions that utilize nature to address social challenges. Examples include planting trees for shade, creating green roofs to cool buildings, or restoring wetlands to manage water flow, which can all help mitigate heat impacts.

Sectors
Distinct parts of the economy or society. In the context of heat and health, this could refer to public health, education, business, agriculture, or infrastructure.

Open Science

The practice of making scientific data and research findings readily available and accessible to all. This allows for wider collaboration and development of solutions to heat-related health issues.

Infrastructure

The basic physical and organizational structures needed for the operation of a society or economy. There are three main types in the context of heat and health:

Green Infrastructure

Natural or semi-natural elements that provide environmental and societal benefits, such as parks, trees, and green roofs. These can help cool urban environments during heat waves.

Gray Infrastructure

Human-made structures like roads, bridges, and buildings. Traditional gray infrastructure can trap heat in urban areas, so heat-resilient planning may involve incorporating green features.

Blue Infrastructure

Natural and human-made water features like rivers, lakes, and stormwater management systems. These can help cool urban environments and manage flooding risks that can increase during heat waves.

Acknowledgements

This report was authored by Lynne Carbone and Associates, and supported by the individual feedback of many key partners across sectors and levels of government. This report was funded by the National Integrated Heat Health Information System and NOAA's Climate Program Office and designed by Luna Creative, lunacreates.com.

Special thanks to the NIHHIS Steering Committee members for their time, effort, inputs, and edits to the first version of the NIHHIS Strategic Plan, now the National Heat Strategy.

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