

Water Resilience

Definitions, Characteristics, Relationships to Existing Concepts, and Call to Action for Building a Water Resilient Future

Water is a nexus issue tied to energy, agriculture and food security, industry, human health, biodiversity and ecosystem health, peace and stability, human rights, and many other priorities. Water is also central to meeting the United Nations' Sustainable Development Goals (SDGs) by 2030. However, we face a global water crisis marked by growing competition for freshwater resources, rapidly deteriorating water quality, poor and declining ecosystem health, unprecedented biodiversity loss, and a failure to meet basic water and sanitation needs. This crisis is exacerbated by population growth, unsustainable consumption patterns, and, increasingly, climate change.

The Pacific Institute is globally recognized for its thought leadership on water. This reputation is built upon more than 30 years of water-related research to identify innovative solutions and influence policy and practice for the public and private sectors. Moving forward, the Pacific Institute is significantly scaling its reach and impact to address mounting water challenges.

The Pacific Institute's 2030 goal is to catalyze the transformation to water resilience in the face of climate change.

In this brief, the Pacific Institute presents a working definition of “water resilience.” The concept of water resilience has emerged recently in response to growing recognition of a more variable and uncertain future. While climate change is a primary driver of the emerging focus on water resilience, the concept responds to a wide range of environmental, social, economic, and political pressures on water.

The definition of water resilience in this brief informs the Pacific Institute's 2030 organizational goal and related work. Additionally, this definition may also help advance understanding and achievement of water resilience by businesses, governments, NGOs, policymakers, and other water policy and practice actors beyond the Pacific Institute.

DEFINING WATER RESILIENCE

The Pacific Institute defines “water resilience” as the ability of water systems to function so that nature and people, including those on the frontlines and disproportionately impacted, thrive under shocks, stresses, and change.

DEFINING RELATED TERMS

Water systems: People depend on the ecological integrity of natural systems. Thus, the Pacific Institute defines the term “water systems” to include both the natural and built environments, as well as the social and governance systems that support them.

Function: Likewise, the Pacific Institute defines the term “function” to include the provision of services to people, as well as the processes and structures that maintain the natural environment. The Pacific Institute sees the need to build resilience for both people and nature. Here, we recognize nature as a key stakeholder.

Stresses and shocks: “Stresses” refer to chronic events or long-term trends affecting system processes and functions, whereas “shocks” refer to sudden events affecting system processes and functions. These stresses and shocks may, for example, include population growth, urbanization, rising temperatures, toxic spills, heat/cold waves, droughts, and wildfires. While water systems are designed or adapted to handle some degree of stresses and shocks, they now face more regular and intense disturbances and a more variable and uncertain future that require new strategies and approaches to ensure long-term functioning.

THREE DIMENSIONS OF RESILIENCE

There are three dimensions of resilience:

1. **Persistency:** The ability to maintain functions and structures and return to a stable state or pre-shock conditions after a disturbance as quickly as possible;
2. **Adaptability:** The ability to adjust functions and structures as gradual and predictable disturbances change over time; and
3. **Transformability:** The ability to fundamentally shift or evolve functions and structures as hard-to-predict shifts occur.

SIX CHARACTERISTICS OF RESILIENT WATER SYSTEMS

Resilience is non-binary and falls along a spectrum. Importantly, a system or system component can never be fully resilient. However, the more resilience characteristics a system and system components comprise, the more resilient the system will be. The Pacific Institute finds that resilient water systems and system components are often comprised of a combination of six characteristics:

1. **Robust:** System performs reliably and effectively under a wide range of conditions;
2. **Redundant:** System has spare capacity intentionally created to accommodate disruption, extreme pressures, or surges in demand;
3. **Flexible:** System can be altered and adapted in response to potential disturbances or adjusted to take advantage of opportunities;
4. **Integrated:** System has components that are linked and coordinated;
5. **Inclusive:** System has mechanisms for broad consultation and engagement of diverse individuals and communities, including those who are on the frontlines of climate change impacts or disproportionately impacted; and
6. **Just and equitable:** All people and the environment within the system are provided with just and equitable treatment and protection.

COMPLEMENTARITY OF WATER RESILIENCE, SECURITY, AND SUSTAINABILITY

This brief focuses on defining water resilience. However, water systems must be resilient *as well as secure and sustainable* to ensure that all people and the environment have the water they need to thrive, now and in the future. Water security and water sustainability were both conceptualized during the late 20th Century, while the concept of water resilience has emerged more recently, largely, but not entirely, driven by recognition of the water-related impacts of climate change.

Water security: The term "water security" was originally conceptualized to acknowledge the risk of water scarcity fueling violent geopolitical and transboundary conflicts. While initially focused on water conflict, emerging frameworks have taken a more holistic, systems-based approach that includes water's role in providing ecosystem services, supporting biodiversity, increasing climate resilience, and underpinning sustainable development.

Water sustainability: The term "water sustainability" refers to the ability of a community or system to meet the water needs of the present without compromising the ability of future generations to meet their own needs. Water sustainability is broadly recognized as a long-term goal achieved by meeting economic, social, and environmental objectives for water that includes notions of inter- and intra-generational equity.

Water resilience: While there are numerous definitions of water resilience, all definitions explicitly mention shocks and stresses. While climate change is a driver of this new focus of resilience, these definitions typically conceive of stresses and shocks broadly to include environmental, social, economic, and political changes.

Policymakers and advocates often focus on water security and sustainability. The Pacific Institute strongly believes that the transformation to water resilience must build on these efforts to ensure resilience, security, *and* sustainability.

DYNAMICS BETWEEN WATER RESILIENCE, SECURITY, AND SUSTAINABILITY

There is growing recognition that actions taken in support of water resilience, water security, and water sustainability can support and build upon each other. However, without adequate planning, actions taken in support of these concepts also have the potential to conflict with one another. Three scenarios illustrate this potential:

Water systems may be secure, but not sustainable or resilient. A water system may ensure secure water access to its residents under current conditions, but it may adversely affect the environment and local economies. For example, importing water from one basin to another can provide a more secure water supply for the basin receiving the water. However, it may not be sustainable if it negatively impacts social-ecological systems in the source watershed and requires significant energy for pumping the water. In addition, if the infrastructure is not flexible under changing conditions, reliance on imported water may make the water system less resilient to stresses and shocks.

Water systems may be sustainable and secure, but not resilient. Sustainable systems can provide adequate water quantity and quality to support the local economy, communities, and the environment. However, a sustainable system under current conditions may not be able to withstand future unknown shocks and stresses. In Namibia, for example, groundwater aquifers are recharged during high rainfall years and drawn down during dry conditions. Monitoring the groundwater basin levels over time enables sustainable withdrawals that support local communities and the economy without negatively impacting the environment. However, during future prolonged droughts, there may not be enough water to adequately recharge groundwater aquifers. In addition, relying on a single water source increases the vulnerability of the system to stresses, such as water quality impairments to the aquifer.

Water systems may be resilient and secure, but they may not be sustainable. For example, a water system heavily reliant on seawater desalination and large constructed reservoirs may be resilient to drought but not sustainable (e.g., desalinated water is expensive and energy intensive to produce, and has significant adverse impacts on the marine environment). For this reason, water systems must be both sustainable and resilient to future shocks and stresses.

The Pacific Institute’s goal to advance water resilience recognizes this must be done in a way that complements water security and sustainability.

BUILDING WATER RESILIENCE IN PRACTICE

Water resilience will vary in different contexts. In some cases, water resilience will require substantial investment in water efficiency and reuse to reduce reliance on energy-intensive or unreliable water sources. In other cases, it may require integrating nature-based solutions with grey infrastructure. In *all* cases, water resilience must prioritize all stakeholders, including frontline communities and the environment. Frontline communities are those who typically bear a disproportionate burden of environmental and economic injustice and are impacted “first and worst” by environmental hazards. These communities, including people of color, lower income groups, those in rural areas, immigrants, and Indigenous Peoples, experience continuing injustice and face a legacy of systemic, largely racialized inequity that influences living and working places, quality of life, and economic opportunities.

While implementation will differ by context, the Pacific Institute’s work is focused on building water resilience alongside water security and sustainability through three programmatic areas: **water efficiency and reuse; nature-based solutions; and water, climate, and social equity.** Through these areas of work, the Pacific Institute aims to mainstream and operationalize key water management strategies in both policy and practice to build long-term water resilience.

CALL TO ACTION: BUILDING A WATER RESILIENT FUTURE

Recognizing the global water crisis exacerbated by climate change, the Pacific Institute urges water decisionmakers across the public and private sectors to commit to achieving water resilience by rapidly scaling solutions through policy and practice uptake. The Pacific Institute provides a range of tools and pathways to build a water resilient future.

CONTACT INFORMATION

More information about how the Pacific Institute can support the public and private sectors in this critical task is available at www.pacinst.org. Contact the Pacific Institute directly at info@pacinst.org.

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