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ISSUE BRIEF

WATER, SECURITY, AND CONFLICT

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HIGHLIGHTS

- A wide range of water-related risks undermine human well-being and can contribute to political instability, violent conflict, human displacement and migration, and acute food insecurity, which in turn can undermine national, regional, and even global security.
- Political instability and conflicts are rarely caused by any single factor, such as a water crisis. Instead, water crises should be seen as contributing factors to instability.
- While water risks have threatened human civilizations over millennia, today's global population growth and economic expansion—together with threats from climate change—create a new urgency around an old problem.
- We classify water and security pathways under three broad categories: diminished water supply or quality, increased water demand, and extreme flood events.
- Water risk is not only a function of hazards, such as extreme droughts and floods, it is also a function of a community's governance capacity and resilience in the face of natural hazards.
- No single strategy is sufficient to reduce water risk. Instead, multifaceted approaches will be needed.

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CONTENTS

- 2 Executive Summary
- 3 Introduction
- 4 Water in a Dynamic World
- 5 A Water and Security Classification System
- 8 Reducing Water-Related Risks to Global Security
- 10 Concluding Observations
- 11 Appendix A: Some Definitions
- 12 Endnotes
- 13 Bibliography
- 15 Acknowledgments

EXECUTIVE SUMMARY

Context

Water has played a key role in human security throughout history, but attention to water-related threats has been growing in recent years due to increasing water risks. Water demand has increased sharply in many regions of the world as a result of population growth and economic expansion. Water supply is expected to decline in the mid-latitude regions of the world because of climate change, which is also expected to alter the timing of water availability and increase the severity of drought and flood events. The destruction of natural habitat and the discharge of untreated municipal, industrial, and agricultural wastewater into our rivers and lakes is rendering much of our surface water and groundwater unusable. These increasing pressures on water resources are undermining water security and contributing to conflict, migration, and food insecurity in many parts of the developing world.

A water and security classification system: multiple water and security pathways. There are many pathways leading from water risk to water insecurity (which in turn may lead to conflict, migration, or acute food insecurity¹). Three general pathways include diminished water supply or quality, increased water demand, and extreme flood events. Each of these pathways includes subpathways, and multiple subpathways often coincide to undermine water security in a given watershed. A region's capacity to handle "water shocks" also influences outcomes. Water-related conflict,

migration, and food insecurity are much more likely if governance is weak, infrastructure is inadequate, and institutions are fragile.

Although water risks are growing worldwide, there are many risk-reducing options available to decision-makers. Some of these options include imposing water demand caps in water-stressed regions; replacing water-inefficient irrigation schemes with more efficient irrigation technologies (irrigation accounts for 70 percent of water withdrawals worldwide); planting water-efficient and drought-resistant crops; introducing social safety net programs; reducing global food loss and waste; reducing population growth rates; implementing urban water conservation measures; investing in wastewater treatment and reuse technologies; engaging in negotiation of watershed agreements; improving water data and information systems; investing in dams, dikes, and levees; protecting and restoring natural capital, including forests and wetlands; and helping countries strengthen their governance systems.

About This Paper

This paper summarizes our current understanding of water and security threats and their links to conflict, migration, and food insecurity. It is intended for professionals in the defense, diplomacy, and development fields. We review the key drivers behind growing water risk, describe and illustrate water and security pathways, and present approaches for reducing water-related risks to global security.

1. INTRODUCTION

1.1. Background

Water has long been a factor in security and conflict, going back to ancient times and continuing to the present day. Insufficient water due to prolonged drought has contributed to the collapse of civilizations (Iceland 2017). Access to water has been a trigger of conflict. Water has been used as a weapon and a tool of war. But pressures over water are growing, due in part to new factors, including rapid population growth, widespread environmental degradation, rising consumption from an expanding middle class in much of the global South, and human-induced climate change. These new pressures make it increasingly urgent that solutions to water tensions be found and implemented. This paper summarizes our current understanding of water and security threats and their links to conflict, migration, and food insecurity. It is intended for professionals in the defense, diplomacy, and development fields. We review the key drivers behind growing water risk, describe and illustrate water and security pathways, and present approaches for reducing water-related risks to global security.

1.2. Water as Both a Resource and National Security Issue

As background, this paper discusses a broad set of security issues and concepts. The concept of security has different meanings and connotations for different communities, and for the purposes of clarity, we provide in Appendix A a set of definitions of the terms used in this paper.

We define water security as the capacity of a population to

- safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socioeconomic development;
- ensure protection against waterborne pollution and water-related disasters; and
- preserve ecosystems, upon which clean water availability and other ecosystem services depend (adapted from UN-Water 2013).

The ongoing academic and institutional debate about these definitions will continue to result in redefinitions and refinements, and we look forward to that discussion.

1.3. Environmental Threats as National Security Issues

Fresh water is vital for all economic and social activities, from the production of food and energy to the maintenance of natural ecosystems that provide basic services for humans. Yet freshwater resources are limited, unevenly distributed in space and time, increasingly contaminated or overused, and poorly managed. These constraints, coupled with growing populations and economies, are putting more and more pressure on water, even in regions where natural water resources were previously considered abundant. Such pressures increasingly have political and security implications.

These concerns are not new. Beginning in the late 1970s and early 1980s, researchers concerned about international security and conflict began to shift their focus from

realpolitik and superpower politics, as the Cold War waned, to an evaluation of other threats to national and international stability, such as energy security, transboundary environmental pollution, conflicts over water resources, climate change, and other environmental threats (Brown 1977; Ullman 1983; Myers 1986; Mathews 1989; Gleick 1989a; Gleick 1989b; Gleick 1990; Homer-Dixon 1990).

The fundamental concept, now widely accepted, is that political instability and violence, especially at the local or regional level, do not have purely political roots but are influenced by economic, demographic, and social factors that are themselves sensitive to resource and environmental conditions (see, for example, Barnett and Adger 2007; Hsiang et al. 2013; Ratner et al. 2013).

As an example of an early discussion of this issue, the concept of “environmental security” was a central topic at a November 1991 symposium at the U.S. National War College, “From Globalism to Regionalism: New Perspectives on American Foreign and Defense Policies.” More recently, the U.S. Office of the Director of National Intelligence (DNI), working with the broader U.S. intelligence community, released an analysis of global and regional water security issues that concluded the following:

- During the next 10 years, water problems will contribute to instability in states important to US national security interests. Water shortages, poor water quality, and floods by themselves are unlikely to result in state failure. However, water problems—when combined with poverty, social tensions, environ-

mental degradation, ineffectual leadership, and weak political institutions—contribute to social disruptions that can result in state failure.

- The lack of adequate water will be a destabilizing factor in some countries because they do not have the financial resources or technical ability to solve their internal water problems. In addition, some states are further stressed by a heavy dependency on river water controlled by upstream nations with unresolved water-sharing issues.
- A water-related state-on-state conflict is unlikely during the next 10 years. Historically, water tensions have led to more water-sharing agreements than violent conflicts. However, we judge that as water shortages become more acute beyond the next 10 years, water in shared basins will increasingly be used as leverage; the use of water as a weapon or to further terrorist objectives also will become more likely beyond 10 years (DNI 2012).

Since the publication of the DNI report in 2012, the world has witnessed destabilizing conflict and migration.² In 2015, over 1 million refugees streamed into Europe, precipitating political crises within and among European Union (EU) member states.³ Most of the refugees came from Syria, Afghanistan, Iraq, and northern Africa. In May 2017, a German government report warned that up to 6.6 million migrants were waiting to cross into Europe from Africa and the Middle East, including refugees from Syria and Iraq, but also economic migrants from Libya, Niger, Chad, Nigeria, Bangladesh, Guinea, Côte d'Ivoire, and Gambia.⁴ This prolonged migration crisis—

influenced in part by water scarcity—has had profound political impacts in Europe (Iceland 2017). The brunt of the growing global refugee crisis, however, has been borne not by European and other global North countries, but by global South countries themselves. In 2017, the global forcibly displaced population grew to 68.5 million individuals. Of these 25.4 million were refugees, 40.0 million were internally displaced people, and 3.1 million were asylum seekers.⁵

2. WATER IN A DYNAMIC WORLD

Even in a static world, conditions in many watersheds would result in tensions over water resources. Yet the world is not static—it is experiencing dynamic and rapid changes in demographics and environmental conditions. Populations are growing rapidly and shifting from rural to urban centers, economies are expanding or changing their focus, and the impact of a changing climate is beginning to be felt—all this adds additional pressures on the world's freshwater resources (Stocker et al. 2013). While there are opportunities for fundamental changes in policy and strategy that can reduce water-related tensions (and these are discussed in this brief), most of the current changes appear to be worsening these tensions rather than reducing them.

2.1. Demographics

Populations are growing very rapidly, especially in Middle Eastern countries, Africa, and parts of southern Asia. These demographic trends contribute to pressures on water resources. For example, Syria saw a fourfold increase in population from around 5 million in 1962 to approximately 20 million at the start of the

In 2017, the global forcibly displaced population grew to 68.5 million individuals.

civil war in 2011. Over this same period, Iraq's population rose from approximately 8 million to nearly 40 million. Nigeria's population expanded from 45 million in 1960 to nearly 190 million today. India has grown from 450 million people in 1960 to over 1.3 billion people today. More than half the world's population now lives in urban areas, and the United Nations estimates there are nearly 30 megacities with populations exceeding 10 million (PRB 2018). These population increases put far greater pressures on fixed water resources and infrastructure, and these pressures are likely to continue in coming years (FAO 2016a).

2.2. Economic Growth

The middle class in many global South countries is expanding very rapidly. As per capita incomes rise, people tend to demand more energy, goods, and services, and to consume more meat-intensive diets. This in turn leads to an increase in per capita water "footprints"—a measure of the amount of water required to produce the suite of goods and services consumed by an individual (Hoekstra and Mekonnen 2012). Because most human water use is for agricultural irrigation, and because a substantial fraction of global grain production goes to feed animals, a

shift to more meat-intensive diets greatly increases global demand for water (and other natural resources) and can also put upward pressure on global food prices (Liu et al. 2008; Brueckner et al. 2018). On the other hand, economic growth also offers strong positive benefits, including a reduction in poverty, improvements in human health, and increased local capacity to mitigate crises.

2.3. Climate Change

State-of-the-art climate science indicates that impacts on water resources from human-caused climate changes will include alterations in precipitation patterns (such as declines in rainfall in the mid-latitude regions of the world and changes in snowfall and snowmelt dynamics), increased water losses from higher evaporation driven by rising temperatures, and effects on water quality. Observational evidence indicates that many of these changes are already happening (Allen et al. 2014; USGCRP 2014), and can lead to worsening pressures on water resources by altering water supply, demand, and quality, and by worsening the consequences of extreme events such as floods and droughts.

3. A WATER AND SECURITY CLASSIFICATION SYSTEM

3.1. Water and Security Pathways

Numerous recent water events have contributed to social and political insecurity—from large-scale chronic water stress and record-breaking drought in the Middle East, to devastating floods in South Asia, to local saltwater intrusion into aquifers that provide for urban water supply, such as in Jakarta.

While water-related security events may begin as localized crises, some have spillover effects that can threaten national, regional, and global stability. When these events occur in transboundary river basins, they can precipitate disputes (or cooperation) between upstream and downstream countries (e.g., India and Pakistan over the Indus River; or Ethiopia, Sudan, and Egypt over the Blue Nile; or Turkey, Syria, and Iraq over the Tigris and Euphrates).

Water problems do not necessarily lead to conflict, migration, or acute food insecurity. We acknowledge the opportunities for improved negotiation, communication, and cooperation that characterize many water challenges. This makes it even more vital that we understand and identify those water-related issues that do lead to security threats and that we develop effective strategies for addressing them.

There are many ways to categorize causal factors behind water and security threats (see, for example, de Bruin et al).⁶ Three general pathways include the following:

- Diminished water supply or quality
- Increased water demand
- Extreme flood events

Each pathway has subpathways, some of which we list here, including recent examples for each:

- Diminished water supply or quality from

DROUGHT:

- **Drought in failed states or drought that contributes to state failure** (e.g., Somalia, 2010–12).⁷ Nearly 260,000 people died during the famine that hit Somalia

from 2010 to 2012. Severe drought and its consequences contributed to state failure in Syria beginning in 2011 (Gleick 2014).

- **Drought in countries that can influence global grain and food prices** (e.g., Russia and other countries around the world, 2010).⁸ In 2010–11, food prices spiked due in part to droughts in Russia, Ukraine, China, and Argentina and torrential storms in Canada, Australia, and Brazil (Mitchel 2008; Dillon and Barrett 2016). The Middle East and North Africa region is one of the top food importers of the world and is thus highly vulnerable to changes in food supplies and food prices. Some experts believe that the 2011 food price spikes played a role in the Arab Spring (d'Amour et al. 2016; Werrell et al. 2015).

WATER CONTAMINATION:

- **Water rendered useless by industrial pollution or human wastes** (e.g., São Paulo, ongoing).⁹ São Paulo's Billings Reservoir is considered far too polluted to use for public water supplies. The reservoir's dismal condition worsened the problems of a two-year drought that reduced water supplies in São Paulo's primary water system, Cantareira, to dangerously low levels. At the drought's most critical juncture, officials were forced to contemplate the once unthinkable prospect of the Cantareira sys-

tem running dry—a scenario that would have left nearly half of the metropolitan region’s 20 million residents without reliable water.

- **Saltwater intrusion in aquifers** (e.g., Jakarta, ongoing).¹⁰ Excessive groundwater pumping along coastlines is contributing to saline contamination of many freshwater aquifers, which are vital for cities such as Jakarta.

DAMMED/DIVERTED WATER:¹¹

- **River alteration by dams, in the absence of political agreement** (e.g., Ethiopia, ongoing).¹² Ethiopia’s construction of the Grand Ethiopian Renaissance Dam—Africa’s largest—is already straining relations between Ethiopia and Egypt. Some 85 percent of the water that flows into Egypt originally falls as rain in the Ethiopian highlands and feeds the Blue Nile.
- **Water diversions in the absence of agreement** (e.g., Kenya, ongoing). The once extensive Lorian Swamp fed by the Ewaso Nyiro River in Kenya has historically provided sustenance for pastoralists. People fleeing conflict in Somalia took refuge in the area until recently, forming the world’s largest refugee camp. “However, the swamp is now a source of out-migration, since

diversions of water upstream for intensive horticulture, combined with over-abstraction of groundwater beneath the swamp have caused it to desiccate” (Madgwick et al. 2017).

LOSS OF NATURAL CAPITAL:

- **Landscape degradation** (e.g., Ethiopia).¹³ In many parts of the world, overgrazing and removal of trees have left landscapes barren and degraded. Without vegetation cover, topsoil is lost. Land becomes cracked and covered by hard crust, and is unable to retain rainwater. The Tigray region of northern Ethiopia is a case in point. Land degradation once forced many to emigrate, but the land—and its people—have come back following 20 years of restoration efforts, including closing the land to grazing; building gabions (mesh cages filled with rocks) in chasms to slow the flow of rainwater and to build up the earth behind them; and planting trees to slow the destructive velocity of surface water when it hits the valley.
- Increased water demand due to
 - **Chronically stressed irrigated areas** (e.g., Syria, 2011). Syria’s food self-sufficiency policies led to a dramatic increase in food production beginning in the 1960s, but these policies were not sustainable, as they

required more water than is available on an average annual basis. This led to dramatic overexploitation of groundwater and falling groundwater levels. When Syria’s worst drought in recorded history hit in 2006 to 2011, Syria was vulnerable and unprepared. The result was the migration of up to 1.5 million farmers and their families from the countryside to Syrian cities. This was a destabilizing factor—one among many—that played a role in the timing and severity of Syria’s civil war, which began in 2011 (Femia and Werrell 2013; Gleick 2014; Kelley et al. 2015; Iceland 2017). It is important to emphasize that this conflict was fed by a complex array of social, political, and economic factors and made worse by ineffective and inappropriate water resource governance.

- **Chronically stressed urban areas** (e.g., Cape Town, ongoing).¹⁴ Cape Town, a city of four million people, faced the risk that its municipal water system would have to be shut down in mid-2018 (“Day Zero”). While rains eventually pushed back that threat, the crisis was precipitated by a growing population, a severe three-year drought, lack of alternative sources of water supply, and responses that were only partially effective.¹⁵

□ **Rising water and land pressures in rainfed areas** (e.g., Darfur, 2003). Many factors influenced the Darfur conflict, including resource scarcity driven by prolonged drought conditions and desertification, together with population growth. This in turn precipitated a decline in food availability and unsettled long-standing agreements between nomadic herders and sedentary farmers (Iceland 2017).¹⁶

■ Extreme flood events

□ **River floods, flash floods, and coastal storm surges can affect human health and safety** (e.g., South Asia, 2017).¹⁷

In August 2017, devastating rainfall across South Asia led to more than 1,200 deaths and directly affected more than 40 million people in northern India, southern Nepal, northern Bangladesh, and southern Pakistan.

□ **Floods can affect industrial production and the global economy** (e.g., Thailand, 2011).¹⁸ Thailand's worst flooding in half a century produced economic damages of roughly \$46 billion (World Bank 2011). The automotive and electronics industries were hit hard, and global supply chains for some key products were disrupted for months.

These pathways sometimes operate in combination to produce a crisis. For example, there were multiple droughts and floods in large grain-exporting countries in 2010, which together cut food production and helped trigger a global food price spike. In the Syria example, drought exacerbated the problems of chronically high water demand and poor agricultural policies.

It is also often the case that slow-onset and rapid-onset events converge to produce a crisis. For instance, heavy water pollution in São Paulo compounded the effects of a devastating drought to produce a water scarcity crisis in 2015. Understanding the multiple pathways and timelines at work in a crisis will help decision-makers to better tailor their responses.

3.2. The Role of Governance in Water Security

Most water crises do not end in conflict, migration, or acute food insecurity. Instead, people muddle through until the crises recede. Some crises even generate cooperation among local or regional parties. Understanding why water crises lead to adverse outcomes in some places and better outcomes in others will help inform strategies for reducing the risks of conflict. Why, for example, did Syria sink into civil war following a record-breaking five-year drought, while Jordan and Lebanon avoided strife following that same drought (Adams et al. 2018)? This requires integrating analyses of meteorological and resource-related events with the diverse social, political, and economic dynamics at play.

We can postulate—based on research conducted by Wolf and his colleagues (2003) on transboundary basins—that when rapid change, either on the institutional side or in the physical system, outpaces the institutional

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THE WATER CONFLICT CHRONOLOGY

The issue of water and security is receiving more attention because of the growing evidence that natural resource degradation is a root cause of conflict, migration, and acute food insecurity. Numerous scholars are now researching these and related issues (e.g., the links between climate change and conflict). We need to better understand the links between water and security to diagnose problems early and propose timely and effective solutions. In an ongoing effort to better understand the connections between water resources, water systems, and international security and conflict, the Pacific Institute initiated the Water Conflict Chronology^a project in the late 1980s to track and categorize events related to water and conflict. The Pacific Institute not only continually updates this event database but is also working on an analysis of the context, history, data, and especially recent trends related to water and conflict. This database and other similar ones are crucial for developing a water and security early warning system (more on that further on in this brief).

Note: ^a The Water Conflict Chronology is available at www.worldwater.org/water-conflict/. Source: Gleick 2018.

capacity to absorb that change, the stage is set for possible water insecurity. Therefore, when we go looking for water insecurity, we need to be on the lookout for large-scale water-related change and low capacity to handle such change (this is what the Water, Peace, and Security [WPS] consortium is attempting to do via the development of a near real-time global early warning system for potential water-related threats to human security—more on this further on in this brief).

3.3. Water as a Weapon or Casualty of Conflict

The examples above illustrate the notion of water as a trigger of (possible) conflict. But water can also be a weapon or casualty of conflict. The majority of entries in the Pacific Institute's Water Conflict Chronology (see Box 1) over the past several decades has been in the latter two categories, with extensive destruction of civilian water systems in areas experiencing conflict, war, and violence.

This has been especially apparent in the context of the continuing violence in the Middle East, where numerous cases of the use of water as both targets and weapons of conflict have been reported. Built water infrastructure in the form of water and wastewater plants, pumping stations, and dams has been attacked. Water has been used as a weapon through both deprivation and intentional flooding. The UN Secretary General reported in 2016 that occupying and controlling major dams on the Tigris and Euphrates Rivers was an explicit tactic of the Islamic State (IS) (United Nations 2016; Vishwanath 2015), and in a video it released, IS explicitly called

for the use of water as a weapon (von Lossow 2016). The Syrian government has been accused of cutting off water supplies to regions under rebel control and of reducing flows or cutting dam releases during battles with the IS or rebel groups. In some cases, water has been used to improve political relationships in the region, with the IS providing additional hydroelectricity and water for areas under its control (Vishwanath 2015). The use of water as a tool of conflict in the region also includes explicitly targeting civilian water systems critical for supplying safe water, as well as sanitation and irrigation systems that support the agricultural sector, thus worsening the dislocation and forced migration of communities. Dozens of such attacks have occurred in Yemen with dire consequences, including a massive outbreak of cholera (Balakrishnan 2017).

4. REDUCING WATER-RELATED RISKS TO GLOBAL SECURITY

4.1. Multipronged Approach Needed

A variety of options are available to reduce water-related security risks. Some of these options include imposing water demand caps in water-stressed regions; replacing water-inefficient irrigation schemes with more efficient irrigation technologies (irrigation accounts for 70 percent of water withdrawals worldwide); planting water-efficient and drought-resistant crops; introducing social safety net programs; reducing global food loss and waste; reducing population growth rates; implementing urban water conservation measures; investing in wastewater treatment and reuse technologies;

engaging in negotiation of watershed agreements; improving water data and information systems; investing in dams, dikes, and levees; protecting and restoring natural capital, including forests and wetlands; and helping countries strengthen their governance systems.

No single strategy is likely to work consistently or broadly across regions and problems, but some fundamental principles and guidelines can be useful. Most broadly, whether or not problems with water or extreme climate events are likely, strong resource management strategies provide resilience—the ability to recover from disruptions or stresses. For water resource management, key strategies include those related to Goal 6 of the United Nations Sustainable Development Goals (SDGs), such as ensuring access for all to water, sanitation, and hygiene; expanding nontraditional sources of supply; improving water-use efficiency; and reducing demand; and using more effective water management approaches, including smart economic and pricing strategies, community engagement, and conflict resolution. These approaches have been synthesized in descriptions of a “soft path for water” (see, for example, Gleick 2002 and Gleick 2003). An application of these kinds of strategies could have reduced the role that water played in the recent Syrian civil war: more efficient agricultural water use would have permitted greater food production and the retention of rural jobs; policies to more effectively manage variable supplies could have lessened the economic costs of the drought. The Pacific Institute and WRI are planning a follow-up paper to develop a “solutions framework” that can be used to address the multiple water

and security pathways identified previously in this brief, along with specific strategies that can be applied at scale.

4.2. International Law

A separate set of strategies related to diplomacy, law, international agreements, and security policies can also be central to risk reduction. At a global scale, efforts to develop fundamental principles for transboundary watershed management have led to the drafting, adoption, and ratification of the 1997 UN Convention on the Law of Non-navigational Uses of International Watercourses. This convention establishes standards and principles for best practices around joint basin management, data sharing, and conflict resolution, and while not universally accepted, the fundamental concepts in the convention are widely respected. Broader international humanitarian laws, including the 1977 Protocols to the Geneva Convention, set rules and standards for the protection of civilians and critical infrastructure—like water supply and irrigation systems—during conflicts.

4.3. Agreements among Nations in Shared Basins

The long history of cooperative transboundary water agreements on specific rivers or for distinct watersheds, described extensively by Wolf and colleagues (2003), provides tools and models for nations that want to share water resources (Wolf 1997; Giordano et al. 2014; Subramanian et al. 2014). Indeed, part of the problem in the Middle East region is the lack of such specific agreements on levels of withdrawals, seasonal standards for river flows, and rules to govern management of large

dams and other infrastructure. For example, there is no agreement allocating the waters of the Tigris and Euphrates river basin among the key parties, no functional multinational council where disputes concerning the watershed can be heard, and no comprehensive data collection or sharing of basic water conditions. When feasible, efforts to initiate or restart negotiations on such agreements would be valuable.

4.4. The Water, Peace, and Security Project

Many water-insecure countries lack the expertise and financial resources required to improve their water security. The Water, Peace, and Security (WPS) project is designed to assist water-insecure countries by providing them with technical expertise. This initiative is being undertaken by World Resources Institute (WRI), IHE-Delft, Deltares, the Hague Center for Strategic Studies, Wetlands International, International Alert, the Pacific Institute, and Oregon State University, and is supported by the Netherlands Ministry of Foreign Affairs. The project has the following four components:

■ Understand.

- Develop an online near real-time global early warning system for potential water-related threats to human security (to be hosted on WRI’s new Resource Watch¹⁹ platform).
- Implement on-the-ground rapid assessments to verify and further research the threats and identify possible interventions.

■ Mobilize.

- Conduct outreach to global “3D” audiences (diplomats, defense, and development experts), as well as to national governments of global South countries where we identify threats.

■ Support.

- Provide training and capacity building—and share information on effective solutions and best practices—to help global South countries cope with current and future crises and avert potential destabilizing conflict, migration, or acute food insecurity.

■ Dialogue.

- Convene water dialogues among key stakeholders at international, national, and/or subnational levels, to try to defuse tensions and pave the way for solutions.

Key outputs of the “Understand” component of the project include the following:

- Development of actionable sources of data, analysis, and visualizations

- Identification of key global hotspots and drivers of water insecurity

- Development of preliminary recommendations for reducing water insecurity, tailored to specific identified hotspots

Armed with this information, we will work to mobilize national and international support for water risk-reducing measures.

4.5. Effective and Legitimate Governance Systems Are Crucial for Success

There are many things we can do right now to help vulnerable countries improve their water security (see, for example, Iceland 2017). The greatest challenge we face, however, is not technical but political. Many countries that are prone to water insecurity also lack adequate political and governance structures. Without an effective or legitimate state, technical measures alone will likely fail.²⁰

5. CONCLUDING OBSERVATIONS

Concerns over the current state of water resources worldwide have led the United Nations, the World Economic Forum, the European Union, the United States, and other governmental and nongovernmental organizations to highlight the importance of water-related threats to global security and the need to develop strategies to manage water resources more effectively. In part this reflects the vital importance of water for human and environmental health and for the health of local and regional economies. But it also reflects a long history of political tensions and violence associated with poor water policies and management.

New factors, including rapid population growth, widespread environmental degradation, the growth of the middle class in many global South nations, and human-induced climate change contribute to water security risks and make it increasingly urgent that solutions to water tensions be found and implemented. These solutions include diplomatic, economic, and management approaches as well as the application of new technologies for monitoring and using water. There are many things we can do to reduce water-related risks, but it is vital for local, national, and international leaders to take decisive action before crises erupt, while conditions still permit us to act.

APPENDIX A: SOME DEFINITIONS

Many terms in the field of water and security studies are bandied about without concrete definitions. We therefore offer some definitions for how we use specific terms.

HUMAN SECURITY: This term generally refers to overall human health and well-being, including economic and social conditions conducive to a positive quality of life. It includes “people’s freedom from want and freedom from fear”²¹ and the security of individuals from threats that include disease, poverty, violence, and human rights abuses.

WATER SECURITY: Capacity of a population to

- safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socioeconomic development;
- ensure protection against water-borne pollution and water-related disasters; and
- preserve ecosystems, upon which clean water availability and other ecosystem services depend (adapted from UN-Water 2013).

Water insecurity contributes to human insecurity, either directly (e.g., farmers do not have access to sufficient water to support livelihoods) or indirectly (e.g., drought leads to food price spikes, which hurts the urban poor; and drought leads to violent clashes between farmers and pastoralists over increasingly scarce resources).

NATIONAL SECURITY: The condition of peaceful governance and the absence of violent conflict for a formal state. The concept of national security also refers to the role of national governments in providing security for citizens and institutions.²²

GLOBAL SECURITY: A broader set of conditions of mutual safety, lack of violence, and a positive quality of life for groups of states and the international community. Global security “includes military and diplomatic measures that nations and international organizations . . . take to ensure mutual safety and security.”²³

WATER CONFLICT: There are three categories of water-related conflicts:

- Where access to, or control of, water is a “trigger” or a contributing factor in a conflict.
- Where water or water systems are used as “weapons” or “tools” during conflicts, such as when water is intentionally released from a dam for a military purpose, or when water systems are cut off to apply political or military pressure.
- Where water or water systems are unintentional or intentional “casualties” of conflicts, including where water systems are targeted during wars or conflicts.

These categories are described in more detail in the comprehensive Water Conflict Chronology of the Pacific Institute (described in Box 1 of this brief), which identifies over 550 different water conflict events throughout history.

WATER EVENT: A situation in which water risk materializes and contributes to political, economic, or social insecurity. Water events include water conflicts, but they also include events such as water-related migration and famine.

How large does an event have to be to be considered a “water event”? Does it have to be large enough to affect a village, a city, a country, or the whole world? Researchers need to know the answer to this question to conduct quantitative studies. The section on water and security pathways provides selected examples of what we consider “water events.” They range from events that affect pastoralist societies and cities, to whole countries, to the whole world.

WATER RISK: A combination of both the probability and the consequences of a water-related event (Schulte 2014).

It is also important to break “risk” down into its component parts. Risk is often seen as a function of the following three variables:

- **Hazard.** This is the process or phenomenon that causes harm; a drought or flood, for example.
- **Exposure.** This refers to the people, infrastructure, or other tangible assets located in the hazard-prone area.

- **Vulnerability.** These are the conditions making people more or less susceptible to the impacts of the hazard. For example, wealthy people can migrate out of an area suffering from a bad drought, whereas poor people are less able to do so (for additional details see UN-OOSA 2017).²⁴

One cannot focus only on the physical problem, such as prolonged drought. One also needs to assess society’s readiness for the drought and its ability to respond once it arrives. Some societies and institutions are much better prepared for hazards than others, either because they take measures to reduce exposure (e.g., they don’t grow thirsty crops in drought-prone areas), or because they are less vulnerable to the ravages of drought (e.g., because they are covered by crop loss insurance).

RESILIENCE: “The capacity of individuals, communities, institutions, businesses, and systems . . . to survive, adapt, and grow, no matter what kinds of chronic stresses and acute shocks they experience. Shocks are typically considered single event disasters, such as fires, earthquakes, and floods. Stresses are factors that pressure a [community] on a daily or reoccurring basis, such as chronic food and water shortages, an overtaxed transportation system, endemic violence or high unemployment. [Community] resilience is about making a [community] better, in both good times and bad, for the benefit of all its citizens, particularly the poor and vulnerable.”²⁵

ENDNOTES

1. Or any number of additional negative outcomes for human security, such as loss of wealth or income, declining health, etc.
2. Some types of migration represent beneficial adaptation responses. We are concerned here with destabilizing migration.
3. For more information on the migrant crisis, see BBC News, March 4, 2016. <https://www.bbc.com/news/world-europe-34131911>.
4. For additional information on this leaked German Government report, see the *Telegraph* (London), May 23, 2017.
5. For more on forced displacement, see *UNHCR Global Trends*. <http://www.unhcr.org/global-trends2017/>.
6. The de Bruin et al. report has helped shape our thinking about the pathway approach. http://www.pbl.nl/sites/default/files/cms/publicaties/3039%20Linking%20water%20security%20threats%20to%20conflict_DEF.pdf.
7. For more on Somalia's drought, see Voice of America (VOA), January 17, 2018. <https://www.voanews.com/a/un-half-of-drought-hit-somalia-needs-aid-in-2018/4211838.html>.
8. For a discussion of the nexus of climate change, food supply, and instability in the Middle East, see *Scientific American*, March 4, 2013. <https://www.scientificamerican.com/article/climate-change-and-rising-food-prices-heightened-arab-spring/>.
9. For more on Brazil's water quality problem, see Circle of Blue, August 12, 2016. <https://www.circleofblue.org/2016/south-america/brazil-rio-sewage-one-many-water-challenges/>.
10. For more on seawater intrusion in Jakarta, see *Jakarta Post*, June 7, 2013. <http://www.thejakartapost.com/news/2013/06/07/seawater-intrusion-grows-capital.html>.
11. "Water grabs," or other similar actions would also belong in this category.
12. For more on growing international tensions resulting from the new dam on the Nile, see BBC News, February 24, 2018. <https://www.bbc.com/news/world-africa-43170408>.
13. For more on land restoration in Ethiopia, see the *Guardian* (Manchester, UK), June 21, 2017. <https://www.theguardian.com/global-development-professionals-network/2017/jun/21/land-restoration-in-ethiopia-this-place-was-abandoned-this-is-incredible-to-me>.
14. On Cape Town's emergency water restrictions to avert the "Day Zero" disaster, see CNN, February 1, 2018. <https://www.cnn.com/2018/02/01/africa/cape-town-water-crisis-intl/index.html>.
15. Beginning in 1999, Cape Town's water demand leveled off, the result of successful demand management initiatives; see <https://www.greencape.co.za/assets/Water-Sector-Desk-Content/CoCT-WCWDM-presentation-Z-Basholo-Western-Cape-Water-Forum-160204-2016.pdf>. While more could still be done to reduce inefficient use and unaccounted for water, the city's efforts to drastically curtail water use during the current crisis were a key factor in staving off Day Zero.
16. Some scientists (e.g., Kevane and Gray, 2008) dispute this theory, arguing that "data on rainfall patterns only weakly corroborate the claim that climate change explains the Darfur conflict that began in 2003." On the other hand, we know that water has been a root cause of many conflicts in this region going back decades. A study that examined the causes of over 40 conflicts in Darfur from 1930 to 2000 indicates that "competition for pastoral land and water has been a driving force behind the majority of local confrontations for the last 70 years" (UNEP 2007).
17. For more information on this South Asian flood event, see the *Guardian* (Manchester, UK), August 30, 2017. <https://www.theguardian.com/world/2017/aug/30/mumbai-paralysed-by-floods-as-india-and-region-hit-by-worst-monsoon-rains-in-years>.
18. For more on this flood event in Thailand and the country's hard-hit tech sector, see *PRI Global Post*, December 16, 2011. <https://www.pri.org/stories/2011-12-16/tech-world-still-shudders-after-thai-floods>.
19. Resource Watch is available at <https://resourcewatch.org/>.
20. Nisha Krishnan, WRI, personal communication, May 2018.
21. Derived from Franklin Delano Roosevelt's "Four Freedoms Speech" (technically the 1941 State of the Union address). Adapted by other authors to address economic and development issues. See also, Newman (2010) and Tadjbakhsh and Chenoy (2007).
22. For a definition of "national security," see Wikipedia: https://en.wikipedia.org/wiki/National_security.
23. For a definition of "global security," see Rand Corporation: <https://www.rand.org/topics/global-security.html>.
24. Risk can also be seen as "consequence" times "likelihood," where: (i) "likelihood" is the probability of occurrence of an impact that affects the environment, and (ii) "consequence" is the impact if an event occurs. <http://www.perseus-net.eu/site/content.php?artid=2204>.
25. Adapted from 100 Resilient Cities' definition of resilience. <http://www.100resilientcities.org/FAQ/>.

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ABOUT PACIFIC INSTITUTE

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Our Vision

We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our Approach

COUNT IT

We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT

We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

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We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.

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