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STRATEGIC SECURITY ANALYSIS

Water Security, Conflict and Cooperation

by David Michel

1 Introduction

Modern society depends on adequate supplies of clean fresh water. Water is vital for drinking, cooking and cleaning; for agriculture and industry; for generating power and ensuring public health and sanitation; for fisheries and forestry; and for maintaining essential ecosystems. There are no substitutes or replacements for water's most crucial uses. Yet growing populations, soaring demand, unsustainable consumption practices and mounting environmental challenges are exerting increasing pressure on the Earth's freshwater resources. While global population quadrupled over the course of the twentieth century, water use swelled sevenfold. Many regions now face severe water stress as rivers and groundwater aquifers (underground water supplies) begin to reach the limits of their renewable capacity. Global climate change threatens to increase the strains on the world's water supplies by shifting precipitation patterns, worsening extreme weather events and altering river flows in every inhabited basin on the planet.

Insufficient or unsafe water supplies can impair agriculture and impede industry, imperil public health, jeopardise livelihoods and compromise public safety. Where different countries or communities rely on the same water sources, many observers fear that impending shortfalls between rising demand and shifting supplies could foster heightened competition to secure increasingly scarce water resources. Open warfare between states struggling to en-

sure their share remains unlikely. But possible water conflicts may take many forms and pathways. Water policies implemented by one nation – such as building a dam or pumping from an aquifer – can affect supplies available to others, feeding tensions that might be as destabilising as overt violence. Tensions over water could also fuel confrontations within countries, spurring domestic unrest and potentially also involving surrounding regions. Refugees fleeing from natural catastrophes may spill into adjacent communities, straining local capacities and sparking civil strife.

Potential clashes over access to and the management of scarce water resources pose real risks to peace and prosperity for populations worldwide. Nonetheless, common claims on shared resources can also motivate collaboration mutual benefit. International treaties, river basin organisations, water users' associations and many other cooperative mechanisms established at local levels offer a range of tools for collective risk management, dialogue and dispute resolution. As sharpening demographic, environmental and socio-economic challenges increasingly strain global water supplies, policymakers must work to develop these cooperative resource governance mechanisms, effectively adapt and apply them to new challenges such as climate change, and extend them to regions where they are lacking in order to sustainably fulfil society's vital water needs.

KEY POINTS

- Growing populations and economies, unsustainable consumption practices and mounting environmental challenges exert increasing pressure on the world's freshwater resources. Many observers fear that shortfalls between rising demand and shifting supplies could foster sharpened competition among nations or communities attempting to secure increasingly scarce water resources.
- History furnishes little evidence of actual water wars, but violent international water-related confrontations do occur, and frictions over water can also fuel internal conflicts within countries.
- A range of indirect factors such as political institutions, economic conditions, and social perceptions affect the relationship between environmental pressures and conflict risks. Inequitable allocation of water development costs or benefits and lack of access to decision-making processes around water often generate conflict more than the unequal allocation of or inadequate access to the resource itself.
- International treaties and integrated water resource management approaches provide important tools for collective risk reduction and dispute resolution. Policymakers should further develop these cooperative governance mechanisms, effectively adapt them to new challenges such as climate change, and extend them to regions where they are currently lacking.

2 Under Pressure: Global Water Supply and Demand

Water is a renewable resource. However, the fresh-water supplies actually available to users around the world are not unlimited. Rainfall, snow and ice melt, and seepage between surface sources and groundwater regularly replenish rivers, lakes, and aquifers. For any given source, however, water renewals vary over time and place. River flows and lake levels rise and fall through wet and dry seasons. Ultimately, every watershed is only recharged by a finite amount of renewable water every year.

As human demands have grown, many water sources are being stretched to the limits of their renewable capacity. In several major river basins — including the Amu Darya, Ganges, Indus, Jordan, Nile, Tigris-Euphrates and Yellow — yearly water withdrawals nearly equal or even exceed long-term flow balances and ecosystem needs. Currently, 1.4 billion people live in river basins that hydrologists consider to be “closed”, meaning that, under prevailing practices, all their annually available renewable water is already committed to various human or environmental requirements, with little or no spare capacity left.

Groundwater increasingly faces the same pressures as surface water. The amount of water taken from aquifers has ballooned in recent decades, accounting for one-quarter of global freshwater use and half the world’s drinking water. Withdrawals in many regions now exceed natural rates of replenishment, progressively exhausting groundwater supplies. Unsustainable overuse of aquifers worldwide is probably more than 160 billion cubic metres annually — twice the annual flow of the Nile. Counting surface and groundwater resources together, one global assessment found that 1.8-2.9 billion people currently live in areas where total water withdrawals exceed locally available renewable supplies for four to six months of the year, and half a billion people live in areas where demand exceeds renewable supplies all year round.¹

Humans significantly strain freshwater systems not only by the resources they extract from them, but also by the contaminants they put into them. Agriculture, industry and municipal waste pollute water supplies with synthetic chemicals, toxic metals and microbial pathogens that degrade water quality, damage ecosystems and compromise human health. Most of the wastewater that human activities produce is dumped back into rivers, lakes and oceans untreated. At the household level, despite substan-

tial progress in expanding water services to excluded populations, 663 million people still do not have access to an improved water source and 2.4 billion lack improved sanitation facilities.

Stresses on world water resources will worsen in the near future. The Earth will add another 2.4 billion inhabitants by 2050, reaching 9.7 billion people. Global water demand will climb in tandem with population and economic growth. The Organisation for Economic Cooperation and Development calculates that world water use will jump by 55 per cent by mid-century, driven by a 400 per cent surge in demand from manufacturing, a 140 per cent rise in water withdrawals for electricity production and a 130 per cent increase in domestic needs. According to these projections, 3.9 billion people — 40 per cent of the global population — will then inhabit river basins suffering severe water stress, including nearly all of Central and South Asia, the Middle East, and much of China and North Africa.²

Continuing climate change compounds to the challenges confronting decision-makers. Global warming will accelerate the hydrologic cycle. As temperatures increase, so does the atmosphere’s ability to hold water, increasing precipitation and evaporation and upsetting fundamental hydro-meteorological mechanisms. Elemental weather patterns such as the onset of the monsoon and the El Niño-Southern Oscillation may shift or falter. Risks of flood, drought and extreme storms are projected to rise. Simultaneously, climate change may increase water demand as higher temperatures and more variable precipitation patterns generally increase water use for crop irrigation. Such impacts could scramble the seasonal availability and geographical distribution of crucial water supplies worldwide. By 2050, the combined effects of socio-economic pressures and climate change could push an additional 1-1.3 billion people into conditions where their water needs will consistently outpace the available surface water supplies.³

1 M.M. Mekonnen and A.Y. Hoekstra, “Four Billion People Facing Severe Water Scarcity”, *Science Advances*, Vol.2(2), 2016, <http://advances.sciencemag.org/content/2/2/e1500323.full>

2 Organisation for Economic Cooperation and Development, *Environmental Outlook to 2050*, Paris, OECD, 2012.

3 A. Schlosser et al., “The Future of Global Water Stress: An Integrated Assessment”, *Earth’s Future*, Vol.2(341), 2014, 341-361.

3 Water security and conflict risks

The United Nations defines 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 socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.⁴

If people do not have secure access to sufficient supplies of clean fresh water, the consequences can be severe. Two-fifths of the world's entire labour force work in heavily water-dependent sectors like agriculture, mining and fisheries. Rising water insecurity endangers these livelihoods and the economies they support. Water-related disasters can be especially damaging. Droughts cut crop yields and curb energy production. Floods destroy capital and infrastructure. One detailed study concluded that for every additional 1 per cent of a nation's territory experiencing drought in a given year, gross domestic product (GDP) growth declines by 2.7 per cent, while a 1 per cent increase in the area experiencing flooding trims the GDP growth rate by 1.8 per cent.⁵ Unsafe water supplies and insufficient sanitation annually cost sub-Saharan African countries 5 per cent of GDP in health-related costs and lost economic production.

Climate change will make matters worse. Without significant policy changes to adapt to global warming, the World Bank has calculated that by 2050, water-related climate impacts could depress GDP growth by 6 per cent across much of Africa, Asia and the Middle East.⁶ More troubling than the economic impacts is the human toll. According to the World Health Organisation, almost 10 per cent of the annual global disease burden and more than 6 per cent of deaths result from inadequate water and sanitation.⁷

Given the stakes of inadequate water supplies, countries could well be expected to vigorously protect their access to vital freshwater supplies. Policymakers, commentators and the press frequently worry that water has become the "new oil" and warn of the danger of "water wars" as vulnerable nations scramble to seize control of essential water resources. Yet historically, no modern state has ever officially declared war on another over water. On the contrary, countries that rely on the same water supplies seek to collaborate more often than finding reasons for conflict due to their shared resources. A comprehensive review of some 2,500 state-to-state interactions over water from 1948 to 2008 showed that cooperative events (such as technical exchanges) outnumbered conflictive incidents (such as reducing water flows to another country) by two to one. No such interaction resulted in a formal war.⁸

History furnishes little evidence of outright water wars, but nevertheless supplies considerable reason for concern. Although past interstate water-related interactions did not result in wars being formally declared, they do indicate water-related warfare. Researchers counted over three dozen violent military encounters over water supplies, including 21 "extensive war acts" entailing full-scale battles, territorial invasions or massive bombings. Further episodes have occurred since the study period of 1948-2008. In 2011, for example, during an ongoing drought, Iranian forces crossed into Afghanistan to release water from an irrigation canal diverting water flows out of the Helmand River before it enters Iran, exchanging fire with Afghan troops in the process.⁹

Beyond recording individual events, researchers have tried to quantify systematic relationships between water stress and conflict. Their efforts have provided mixed results. Some statistical studies suggest that water scarcity increases the likelihood of violent interactions that do not reach the level of formally declared wars between states sharing river basins.

4 UN Water, *Water Security and the Global Water Agenda*, Hamilton, Ontario, UN University Institute for Water, Environment and Health, 2013, p.1.

5 C. Brown et al., "Is Water Security Necessary? An Empirical Analysis of the Effects of Climate Hazards on National-level Economic Growth", *Philosophical Transactions of the Royal Society, A*, Vol.371(2002), 2013, <http://rsta.royalsocietypublishing.org/content/371/2002/20120416>

6 World Bank, *High and Dry: Climate Change, Water, and the Economy*, Washington, DC, World Bank, 2016, p.vii.

7 A. Prüss-Üstün et al., *Safer Water, Better Health: Costs, benefits and sustainability of interventions to protect and promote health*, World Health Organization, Geneva, 2008.

8 Shira Yoffe et al., "Conflict and Cooperation over International Freshwater Resources: Indicators of Basins at Risk," *Journal of the American Water Resources Association* (October) 2003; Lucia de Stefano et al., *Updating the International Water Events Database (revised)*, UN World Water Assessment Programme, Paris, UNESCO, 2009.

9 Kerry Hutchinson, "Water Wars," *The Middle East*, (January/February) 2012.

STRATEGIC SECURITY ANALYSIS

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Other studies report that water scarcity and extreme variations in rainfall increase the risks of civil conflict within states. Still other research, however, finds weak or no correlations between changing water availability and violent confrontations. Even the most exacting of these quantitative analyses, however, face the problem of gaps and shortcomings in the data they use, and results often vary according to the different models being applied, making it difficult to draw general, clear-cut conclusions from the lack of consensus on the issue.¹⁰

Few sophisticated analysts argue that resource scarcity or environmental changes directly cause conflict. Rather, a range of indirect factors such as political institutions, economic conditions, and social perceptions mediate between environmental strains and conflict risks. The effects of water stresses interact with other intervening factors – such as international rivalries, poor governance and economic inequalities – to create a combination of circumstances that may cause conflict.

A number of potentially combustible international water disputes, for example, involve non-state actors, where water insecurity is one element in a larger complex of regional antagonisms. In the Tigris-Euphrates Basin, upstream Turkey has long pursued a programme of dam construction for water storage, irrigation and hydropower. Downstream Iraq and Syria perceive Turkey's projects as persistent sources of insecurity, giving Ankara leverage over their water supplies. Throughout the 1980s and 1990s, Syria wielded support for the rebel Kurdistan Workers Party (PKK) in their fight against the Turkish government as a counterweight Turkey's potential ability to manipulate Euphrates water flows. In 1987, the two countries signed dual protocols by which Turkey expressly guaranteed Syria an annual average minimum flow in the Euphrates while Damascus pledged to cease supporting the PKK. Nevertheless, Turkey frequently failed to comply with these protocols and Syria resumed backing the Kurds, causing a series of crises. Only in 1998, under threat of armed intervention by Turkey, did Damascus finally agree to the Adana security accord, banning the PKK from operating in Syria. Similarly, in the Indus river basin, Pakistani militant groups such as Lashkar-e-Taiba – responsible for the November 2008 Mumbai terrorist attacks – alternately accuse India of withholding river flows destined

for Pakistan or of releasing waters to exacerbate flooding; implicitly menacing violent reprisals. Some Indian analysts, in turn, advocate that Delhi should condition continuing cooperation over the Indus on Islamabad's willingness to crack down on domestic extremists.

Water insecurity may contribute to internal frictions within states more frequently than fights between them. Tensions surrounding water resources availability, access and development – especially when they are accompanied or oriented along ethnic, religious, or other social or cultural fault lines – can stir grievances that may animate civil strife or separatist unrest. In arid northern Mali, for example, the long-running rebellion among the Tuareg minority initially arose in part from the perceived indifference or inability of the distant central government to aide Tuareg regions plagued by recurrent drought in the 1970s and 1980s. Bamako eventually dampened the revolt with peace negotiations and promises of development, but assistance from the central government proved slow, drought persisted and the north remained marginalised. Tuareg grievances continued and the rebellion eventually broke out again. Similarly, in the oil-rich Niger River Delta, ethnic rebel groups regularly cited the chronic contamination of their communities' water and land by the oil industry among the reasons motivating their attacks on international oil installations and their waging of guerrilla war against the Nigerian state. In Myanmar, the military regime launched multiple mega-dam programmes in restive ethnic areas, pushing thousands of people into forced labour or forced relocations. On more than one occasion, ethnic rebel forces have battled government troops for control of dam construction sites, seeking to block projects seen as dispossessing local populations and exporting the expropriated water resources (in the form of hydropower) to neighbouring countries.

Destabilising water conflicts can also erupt among local users, well below the state level and out of the media headlines. In West Africa's Niger Basin, for example, changing rainfall patterns have pushed

10 For overviews of the research in this and the preceding paragraph, see T. Bernauer et al., "Environmental Changes and Violent Conflict", *Environmental Research Letters*, Vol.7(1), 2012, <http://iopscience.iop.org/article/10.1088/1748-9326/7/1/015601>; Special Issue: Climate Change and Conflict, *Journal of Peace Research*, Vol.49(1), 2012, <http://jpr.sagepub.com/content/49/1>. toc; P.M. Link et al., "Conflict and Cooperation in the Water-Security Nexus: A Global Comparative Analysis of River Basins under Climate Change," *WIREs Water*, Vol.3(495), 2016, <http://onlinelibrary.wiley.com/doi/10.1002/wat2.1151/full>

migratory herders ever further south in search of grazing grounds, into agricultural lands cultivated by sedentary farmers. As crowding around wells and riverbanks has intensified, violent altercations often overwhelm the traditional agreements that previously ordered access to water and arable land. In the early months of 2014, over one thousand people were killed in such encounters in central Nigeria alone – more than perished in the attacks of the armed group Boko Haram then preoccupying the international community.

Finally, as well as contributing to hostilities, water can become a tool of conflict. Currently in the Tigris-Euphrates region, the Islamic State of Iraq and Syria (ISIS) employs water infrastructure as instruments of war, using dams it controls to flood or cut water and power supplies to areas it aims to control.

As these examples suggest, the links between water and conflict follow complex, context-dependent pathways. Contingent causal connections operative in one case may not apply in others. Strains on shared water resources may fuel water “security dilemmas” in which measures taken by one group to bolster its own water security – building a dam, sinking a well – are perceived to undermine the water security of other groups by disrupting the water supplies available to them.¹¹ Inequitable allocation of the costs and benefits of water development and inadequate access to decision-making processes around water often loom larger in engendering conflict than unequal allocation of or inadequate access to the physical resource itself.

4 Improving Cooperative Water Governance

Fresh water is a shared resource, ignoring borders. The world counts more than 400 transboundary lakes and aquifers and 286 transboundary river basins spanning 151 countries. A similar hydrological web links communities at the sub-national level. Growing pressures on these collective resources will increasingly demand that policymakers at all levels pursue greater efficiencies, identify priorities and negotiate trade-offs among contending claims on water use. To do so, the effective management of shared water supplies will require strengthening collaboration across states, sectors and stakeholders.

11 For a classic discussion of security dilemmas, see R. Jervis, “Cooperation under the Security Dilemma”, *World Politics*, Vol.30(2), 1978, pp.167-214, <http://www.sscnet.ucla.edu/polisci/faculty/trachtenberg/guide/jervisecdil.pdf>.

In transboundary river basins, international treaties offer important tools for dialogue and conflict management among riparian nations sharing the river. The International Freshwater Treaties Database identifies 481 legally binding accords concerning water as a consumable resource (as distinct from treaties focusing on navigation or border demarcation, for instance). Yet despite their number, international agreements cover less than half the world’s transboundary river basins. Moreover, many existing treaties do not cover all the basin riparians. Many treaties lack appropriate mechanisms adapted to emerging management challenges, such as dispute resolution procedures or provisions for changing water availability. Few treaties address groundwater, water quality or minimum environmental flows.

Besides individual, basin-specific treaties, the international community has also concluded the UN Convention on the Law of Non-Navigational Uses of International Watercourses. The 1997 convention, which entered into force in 2014, enshrines several important norms, including the equitable and reasonable utilisation of water resources, not causing significant harm, notification and information exchange, environmental protection, and consultation and peaceful dispute resolution. At present, however, only one-third of river basins in Europe, one-quarter of basins in North America, and less than one-fifth of basins in Africa, Asia, and South America possess agreements formally guided by these principles.¹²

Beyond international law, water policymakers have gradually forged new water management paradigms in order to promote more holistic water resources development principles that are applicable to both transboundary and internal river basins. Typically termed “integrated water resources management”, these approaches advance several key principles. First, policymaking should be participatory and transparent to ensure public commitment and the legitimacy. Second, policy must be scientifically informed and evidence-based to be effective. Authorities should produce and share timely, consistent and comparable water data to guide resource management. Third, policy must be adaptable to meet climate threats that will evolve in uncertain ways over lengthy periods of time. Most importantly, policymaking must recognize the river basin as a hydrological unit and manage water at functionally appropriate scales within integrated governance

12 United Nations Environment Programme, *Transboundary River Basins: Status and Trends*, Nairobi, UNEP, 2016.

STRATEGIC SECURITY ANALYSIS

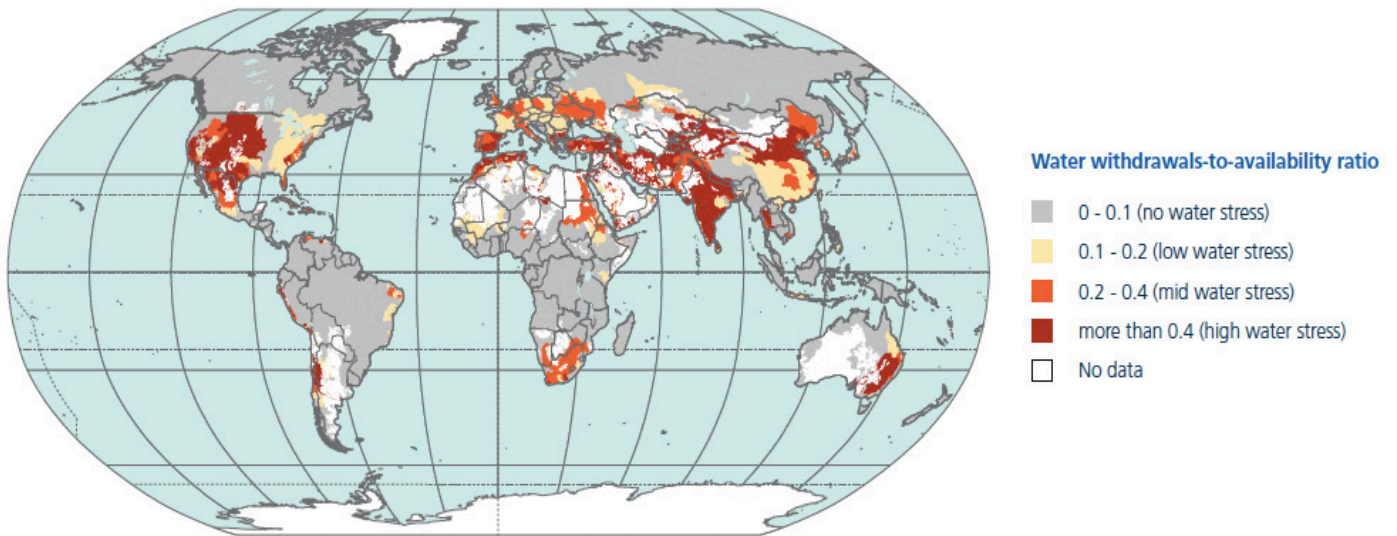
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systems. Where political or sectoral boundaries nest within or intersect in various scales across the river basin, management practices should foster multi-level cooperation among all users. Global surveys of management practices, however, report that although many countries have formulated integrated policy frameworks, actual implementation lags, especially in developing nations.

Students of shared water resources identify two crucial variables that determine the likelihood and intensity of potential conflict in a given river basin. One is the amount and rate of environmental and institutional change in the water system in ques-

tion. The second is the strength of the cooperative arrangements linking the riparians. As global warming imposes unprecedented impacts on freshwater supplies even as billions of new consumers inexorably raise demand, policymakers must significantly improve collaborative water governance capacities. Integrative multi-level cooperation provides the key to managing shared basins where the water security policies pursued by one nation can impact the resource risks perceived by others and uncoordinated resilience strategies may prove ill-suited to assure the sustainability of interdependent hydrological systems.

Figure 1: Annual average water stress based on withdrawals-to-availability ratio (1981-2010)



Source: UN World Water Assessment Programme, *UN World Water Development Report 2016: Water and Jobs*, Paris, UNESCO, 2016, 17, <http://unesdoc.unesco.org/images/0024/002439/243938e.pdf>

5 Conclusions

In the coming years, rising water stress, poor water quality and the mounting impacts of climate change may worsen diseases, sap economic growth, and limit food and energy production in many regions around the world. Policymakers, development agencies, the business community and civil society organisations alike increasingly recognise the potential threats to peace and prosperity posed by water insecurity. The World Economic Forum believes “water crises” to be among the most likely and the most impactful global risks of the next decade. Similarly, the US Intelligence Community Assessment of Global Water Security considers that water problems will contribute to destabilising key states and, “when combined with poverty, social tensions, environmental degradation, ineffectual leadership and weak political institutions – [will] contribute to social disruptions that can result in state failure”. Importantly, the intelligence community also anticipates that many water conflicts will not necessarily take the form of overt violence, but rather will see some states use water to exert leverage over their neighbours.¹³

Growing appreciation of the possible security challenges presented by pervasive strains on the Earth’s natural resources give policymakers powerful incentive promote sustainable water management practices. Yet framing water stress as a security risk causes dangers of its own. How actors define a problem shapes what they will do about it. Focusing states’ attention too strongly on possible water security threats to themselves could deflect energy and resources away from necessary cooperation with others and lead fearful governments to take protective actions that could aggravate the very insecurities they seek to avoid.

Nations that share water resources have so far largely succeeded not only in managing water conflicts, but have often been able to produce mutual benefits by establishing collective institutions. Recognising the wealth and resilience of cooperative arrangements governing shared waters furnishes a valuable corrective to undue apprehensions about looming water wars. Crediting these successes, however, must not prevent policymakers from identifying and acknowledging the potential dangers to international stability that water insecurities still pose. As growing demand and escalating environmental pressures render the integrated collaborative governance of water supplies increasingly important, too many basins lack institutional structures adapted to 21st-century challenges. Policymakers must strive to improve and extend cooperative institutions to prioritise sustainability of water resources and increase human security. Water politics is still politics. Thus, like all politics, it is, in the classic formulation of Harold Lasswell, a matter of who gets what, when, and how.¹⁴ Disagreements over these questions can generate conflict. Transparent, accountable, adaptable and cooperative integrated water governance approaches can provide the means to manage these conflicts peacefully and productively in order to ensure global water security for the 21st century.

¹³ World Economic Forum, *The Global Risks Report 2016, 11th Edition*, World Economic Forum, Geneva, 2016; US Office of the Director of National Intelligence, *Global Water Security*, Intelligence Community Assessment, Washington, DC, ODNI, 2 February 2012, iii, 3-4.

¹⁴ H.D. Lasswell, *Politics: Who Gets What, When, How*, New York, McGraw-Hill, 1936

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