

FRESHWATER SCARCITY AND HYDROPOLITICAL CONFLICT: BETWEEN THE SCIENCE OF FRESHWATER AND THE POLITICS OF CONFLICT

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On October 8, 1978, only a few short weeks after the formalized establishment of peaceful relations between Israel and Egypt, Israeli Foreign Minister Moshe Dayan was interviewed on the popular American political talk show *Face the Nation*. Nearing the final minutes of the interview and having exhausted the broader discussion of the actual logistical implementation of the Camp David Accords, Dayan, with remarkable political foresight, suggested a more fundamental problem plaguing the relations between his nation and its Arab neighbours. He asserted that within the region of the Middle East, "water is probably more valuable than land, because you can't do much with land without water, and anyone drilling for water in one place is affecting the water in the other place."¹ Perhaps unbeknownst to his audience that day, Dayan's message was a veritable forewarning of the expected pattern of future conflict within the turbulent Middle East. Indeed, even on the eve of a most historic peace treaty between two deeply-entrenched and protracted rivals, Dayan's thoughts ultimately rested not on the mending of international fences but on the nature and causes of future conflict within the region, and on the increasing interconnection between the natural environmental and regional stability.

¹Moshe Dayan, "Face the Nation," *Israel Ministry of Foreign Affairs*. Available from <http://www.mfa.gov.il/MFA/Foreign%20Relations/Israels%20Foreign%20Relations%20since%201947/1977-1979/204%20Interview%20with%20Foreign%20Minister%20Dayan%20on%20CBS%20t>. Accessed on May 9, 2004.

At the dawn of the twenty-first century, environmental challenges, including widespread soil leaching of the American Midwest, over-population of the Indian Subcontinent, AIDS and malaria epidemics in West Africa, air pollution in Southeast Asia, deforestation in Latin America, water scarcity in the Middle East, global warming, and massive worldwide species extinction, are having an increasingly significant impact on the nature of international politics. As Robert D. Kaplan has stated, "man is challenging nature far beyond its limits, and nature is now beginning to take its revenge."² The scope, nature, and social consequence of nature's 'revenge' remains central to the emerging study of enviro-politics.

Bridging the boundaries of disciplinary study, environmental variables have crossed-over from their origins within the schools of biology, chemistry, and ecology, and have entrenched themselves in the domains of political science, economics, and International Relations (IR).³ Over the past two decades, questions regarding the natural environment and environmental degradation have been coupled to political evaluations regarding social, economic, and political stability.⁴ Of the various worldwide enviro-political variables, freshwater scarcity is currently perhaps the most salient environmental issue. Simply put, and quite beyond the narrowed scope of political and economic stability, biological life itself is intrinsically dependent on the availability of freshwater.⁵ Without it, life on earth could have developed or survived. Peter H. Gliek, the director of the Global Environment Project at the Pacific Institute for Studies in

²Robert D. Kaplan, "The Coming Anarchy," *Atlantic Monthly* 273/2 (February 1994): p. 54.

³Norman Myers, *Ultimate Security: The Environmental Basis of Political Stability* (Washington, DC: Island Press, 1996), pp. 151-204, and John J. Rogers and P. Geoffrey Feiss, *People and the Earth: Basic Issues in the Sustainability of Resources and Environment* (Cambridge, UK: Cambridge University Press, 1998), pp. 63-65.

⁴Myers, *Ultimate Security*, pp. 32-39.

⁵Lief Ohlsson, "The Role of Water and the Origins of Conflict," in *Hydropolitics: Conflict over Water as a Development Constraint*, Leif Ohlsson, ed. (London, UK: Zed Books, 1995), pp. 3-5.

Development, Environment, and Security in California, claims that "human well-being, ecosystems health and functions, even economics and politics all depend on how much, when, and where water is available."⁶ Our desire for water is insatiable and universal, its impact absolute. Not surprisingly, severe and fundamental ecological and social problems arise when the availability of freshwater becomes insufficient, restricted or limited in use, geographically unevenly distributed or polluted. Underlying these assumptions then is a general belief that freshwater's role in the development of this century will be as important as oil was to the development of the preceding one.

The politics of water, or hydropolitics, is quickly becoming a subject of crucial importance within the general field of environmental politics and conflict studies. Yet the subfield as a whole remains at a nascent stage. Whereas scientific and environmental studies continue to predict the very real likelihood of severe global water scarcity in the next half-century, the political ramifications, both in terms of state security and international stability, and the general linkages between global environmental changes and political and state security, are not as clearly understood. Both practical and theoretical questions abound, and while much of the scientific evidence regarding global environmental change and water scarcity currently exists, there is a general knowledge-deficit regarding the political, military, and security parts of the enviro-political equation. According to Thomas Homer-Dixon, political predictions regarding environmental change and the general "literature on the specific connections between environmental change and acute conflict is surprisingly thin" and severely limited in scope.⁷

⁶Peter H. Gleick, *The World's Water 2000-2001: The Biennial Report on Freshwater Resources* (Washington, DC: Island Press, 2000), p. 9.

⁷Thomas F. Homer-Dixon, "On the Threshold: Environmental Changes as Causes of Acute Conflict," *International Security* 16/2 (Fall 1991), p. 81.

Nonetheless, the emerging trend of global environmental degradation continues to add credence to the view that water scarcity, among other environmental challenges, will necessarily become intrinsically important in the political arena. Peter Gleick argues that "the focus of security analysts must now be *when* and *where* resource-related conflicts are most likely to arise, not *whether* environmental concerns can contribute to instability and conflict."⁸ The environment is no longer a benign factor: it has become both the fundamental lynchpin to our political and economic successes and a potential Achilles Heel to their continued collective development.

Continued research and theory construction, along with both qualitative and quantitative application, is necessary if we are to accurately identify and properly approach the coming era of the environment. In the following pages then, I propose to evaluate and assess hydro-political conflict and map the interface currently developing between water scarcity and political crisis and conflict. The paper discusses the politics of conflict over water in a manner that highlights several key components that represent the underpinnings of a model for studying international conflict over freshwater resources. To this end, the paper itself is presented in two sections. Part one is a discussion of the political ramifications that stem from the scientific characteristics of freshwater in order to understand the linkages between freshwater and political behaviour and international conflict. Part two then advances a foundational construct for a general hydro-political conflict model that can be used to evaluate and test the basic assumptions of the hydro-conflict nexus.

⁸Ibid., p. 83.

The Politics of Water Conflict: Water as High Politics

The fact that water is *the* most vital resource for all life, its intrinsic value is worth much more than the world's largest gem, its want more salient than oil or steel, and its need more fundamental than any other element on earth. Because we, as merely intelligent animals, physically die without it, and because our social, political, and economic systems are dependent on its sustainable use, the global allocation of water, the location, depth, and purity of its reservoirs, and the amount that is made available for consumption quickly become questions of human, community, state, and systemic survival and conflict. "We are creatures of water," writes Leif Ohlsson, "dependent not only on ingesting water daily, even hourly, to keep up the flow of life through our bodies, but also on safeguarding the flow of water through the structure of the societies we have built and through the biosphere making up our only basic life-support system."⁹ Freshwater resources, especially in cases where there is less to be divided among various interested parties, that is, in cases where it is scarce, are fundamental to the continued well-being and development of a state's economic and political institutions. When less water is available, all forms of economic activity (from agricultural to industrial) are potentially threatened, which has obvious ramifications for political stability and military security. Accordingly, under certain conditions of resource pressure and water scarcity, freshwater becomes an issue of high politics for the state, a resource of vital political importance.

To understand how hydropolitics might affect the stability of future political systems, we must evaluate how salient water issues will become in the coming decades. In other words, we need to evaluate and answer a fundamental question: "Is

⁹Ohlsson, "The Role of Water and the Origins of Conflict," p. 3.

there really an emerging shortage of usable global water?" The short answer is yes. Water scarcity is becoming a more severe issue and will increasingly play a major role in determining and shaping interstate relations in the coming century by shifting the issue of freshwater availability and use into the realm of high politics. There are perhaps two major indicators that help strengthen this assertion, the rising global population, and the increasing need for water in food production and economic development. Indeed, the amount of water available for consumption is really a matter of how many people are clamoring for that one specific source. Population is therefore a critical variable in determining future water shortages and scarcity. In 1850, there were 1 billion people living on Earth, roughly the number of citizens of modern-day China. As of July 2004, the Earth's total population was estimated at 6.38 billion, a number increasing at a general rate of over 100 million per year.¹⁰ While authors cite various population projections for 2050, most agree that by mid-century, approximately 9 or 10 billion people will inhabit the planet, most of the growth taking place in the so-called developing areas of our current political system.¹¹ Compounding the obvious problem of simple global overpopulation is the fact that much of the developing world, where a possible doubling of populations in the next fifty to a hundred years is predicted, is already in a current state of water stress.¹² Adding more people will obviously only increase the current problem and heighten the potential for further water shortages, scarcity, and conflict in these areas. Borrowing from the ecologist, every species has its own 'carrying capacity,' that is, an upper numerical population limit that

¹⁰Rogers and Feiss, *People and the Earth*, p. 13.

¹¹Gleick, *The World's Water*, p. 67.

¹²Marq de Villiers, *Water* (Toronto, ON: Stoddart Publishing, 1999), p. 360.

its environment can support.¹³ As the human population continues to expand, so too will the amount of energy we will utilize, the acreage of land we will develop, and the water resources we will consume. Our 'ecological footprint' becomes ever larger.¹⁴ Repeating a Malthusian dictum, at some point in the near future, the Earth's ability to provide the human population with an adequate supply of freshwater will cease. The consequences of such a development will be nothing short of spectacular.

The second indicator of the coming global water crisis is closely related to population growth and human carrying capacity. It involves calculating and assessing how much of the global water resource will be needed to feed the future burgeoning population¹⁵ and determining how much water will be allotted to sustaining economic growth and national development. It is essential to reiterate that as populations increase and national economies develop and modernize so too do the demands and expectations of the average citizen. Food and economic development are interconnected because, history has shown, inhabitants of richer countries tend to consume more food than those living in poorer countries.¹⁶ The Food and Agriculture Organization of the United Nations (FAO) predicts that by 2030, total demand for agricultural products will be 60 percent higher than they are today (85 percent of that total stemming from the developing regions of the globe), which will require a 14 percent

¹³Rogers and Feiss, *People and the Earth*, pp. 26-27.

¹⁴Edward O. Wilson, *The Future of Life* (New York, NY: Vintage Books, 2002), pp. 23, 27.

¹⁵Lester Brown, an influential American environmentalist and founder of the Washington think tank Worldwatch Institute, predicts an emerging "gastronomical Armageddon," claiming that in every year since 2000, global grain stockpiles have run severe deficits. The magnitude of current stockpile exhaustion is so critical that an enormous food crisis "is almost inevitable." See Martin Mittelstaedt, "The Larder is Almost Bare," *The Globe and Mail* (May 22, 2004), p. F9.

¹⁶For instance, in terms of caloric intake, inhabitants of poorer regions currently consume approximately 2,190 calories a day, compared to 3,345 calories per day for those living in developed and wealthier regions. See Gleick, *The World's Water*, p. 67.

increase in irrigated water use and a 13 percent increase in the amount of arable land.¹⁷ These figures employ the prescribed FAO minimum caloric intake that is required for a healthy and productive life, which is currently set at approximately 2,250 calories per person per day. Assuming this daily requirement remains the same, feeding 9 billion people will require the production of approximately 21 trillion consumable calories per day, quite a jump from our current net caloric production of approximately 14 trillion calories per day.¹⁸ Moreover, these figures are based on the minimum required caloric intake and do not take into consideration the desired caloric intakes of the wealthier populations of rising economic powers. If the coming generation of wealthy Asians consume as much as the current North American generation, these figures will be much higher. In any event, future agricultural demands will surely require increased water use and further resource exploitation. In sum, freshwater resources, especially in the case where scarcity becomes a salient issue, are becoming questions of high politics considered vital to the continued survival of the state and are thus influencing the probability of conflict over remaining resources.

The Politics of Water Conflict: Water and Basin-Wide Interdependence

As states industrialize and modernize, as their economies grow and their populations expand, so too does their overall demand for potable freshwater. Global water consumption over the past 300 years has risen by 35 percent, half of that

¹⁷United Nations Food and Agriculture Organization, "FAOSTAT." Available from <http://faostat.fao.org/faostat/collections?version=ext&hasbulk=0&subset=agriculture>. Accessed on May 2004.

¹⁸Gleick, *The World's Water*, p. 67.

increase occurring in the four decades since 1960s.¹⁹ In the United States alone, arguably the most generally developed and prosperous entity in the current political system, per capita daily water intake has risen an astounding 75 percent over the same period of time.²⁰ As populous developing states such as China, India, Turkey, and Indonesia continue to seek economic and industrial parity with their developed counterparts, this increasing rate of global water consumption is likely to rise exponentially. Per capita water demand and consumption will surely rise, even though global per capita water availability is expected to fall within the same period of time. These opposing and intrinsically incompatible forces, between increased water demands under conditions of decreased water availability, will necessarily have a very grave impact on future stability. The end result is that states, in reality the political and economic institutions that constitute the state, will become dependent on the remaining freshwater stocks in their region for their continued survival. However, states are and will be critically dependent on the same, commonly-shared resource; each state is trapped in a situation of 'collective basin interdependence.' One state's use of the shared resource affects the others in the system, so that hydropolitical relations are often discussed as a zero-sum game whereby one state's gain is understood as another's loss. As discussed, water use depends on the number of individuals that draw from a given source and the level of industrialization of a given region, making population increases and economic development acute political dilemmas in areas where water resources are already scarce.²¹ Increases in water divergence, the

¹⁹Mostafa Dolatyar and Tim S. Gray, *Water Politics in the Middle East: A Context for Conflict or Cooperation?* (London, UK: Macmillan Press, 2000), p. 6.

²⁰Harry Clay Blaney, *Global Challenges: A World At Risk* (New York, NY: New Viewpoints, 1979),p. 82.

²¹*Ibid.*, pp. 86-87.

construction of dams, or any general increase in resource use by upstream riparian actors may be perceived as threats to the national security of those adversely affected downstream. Leif Ohlsson comments that "so long as more water in the hands of one country is perceived by another as a loss of the same amount...conflict over and violent annexation of common water resources is a viable strategy."²² Thus, river basins should be considered interdependent "common resources" and not the exclusive property of any one state for cooperative inter-state behavior to develop. Indeed, Falkenmark remarks that "if a state ignores this principle and behaves as if it had full sovereign jurisdiction over the water while it was temporarily flowing through its territory, such behaviour will only lead to dispute."²³ But under zero-sum calculations, collective perceptions of basin-wide cooperation are less than likely.

Arguably, the language of interdependence, collective action, and collective security can be easily employed in a political discussion regarding international freshwater systems. Transnational river basins retain, by the very nature of their natural development, a degree of interdependency. Likewise, or perhaps as a consequence, the most viable freshwater resource management strategies also involve collective calculations for basin-wide water extraction. In both cases, it is clear that international river basins pose a unique political problem for the riparian states that share their banks. While it is not intrinsically evident that riparian interdependence necessarily leads to either conflict or cooperation, the perception of freshwater dependency coupled with the critical nature of water resource utility, will likely strain interstate riparian

²²Ohlsson, "The Role of Water and the Origins of Conflict," p. 22.

²³Malin Falkenmark, "Fresh Waters as a Factor in Strategic Policy and Action," in *Global Resources and International Conflict: Environmental Factors in Strategic Policy and Action*, Arthur H. Westing, ed. (New York, NY: Oxford University Press, 1986), p. 100.

relations. How these strains are dealt with internationally, especially within an evolving political system in which resource scarcity is expected to increase, remains a critical point for further academic study.

The Politics of Water Conflict: Water and the Problems of Ownership

Water's naturally high viscosity creates another hydropolitical problem. Water's movement from high to low ground, from runoff and rain into the drainage systems that empty into the seas, makes water's viscosity a problem for resource ownership, management, and control.²⁴ All of the world's major river basins, as a byproduct of naturally occurring geographic variables such as valleys and mountain ranges, cross imagined political boundaries and anthropogenic divisions. In total, 261 major international river basins exist globally, with 145 states having some part of their territory within a given internationally shared river system.²⁵ This is a phenomenally large number which has compounding political consequences. For instance, the Danube River Basin of Central Europe crosses 17 national frontiers, the Nile River Basin of North Africa crosses 10 borders, the Amazon Basin of Latin America crosses eight, and the Mekong River Basin of Asia crosses six.²⁶ In each case, the political behavior of riparian neighbours is often intertwined with issues regarding their shared river systems, in the aforementioned zero-sum calculation. Essentially, water's ability to flow creates a riparian problem of water ownership and sovereign water rights. As illustrated by Ohlsson, "what happens at [a river's] source will reverberate all through its

²⁴Thomas Dunne, "Description of Runoff Processes," in *Perspectives on Water: Uses and Abuses*, David H. Speidel, Lon C. Ruedisili and Allen F. Agnew, eds. (New York, NY: Oxford University Press, 1988), p. 66.

²⁵Gleick, *The World's Water*, pp. 27-29.

²⁶*ibid.*, pp. 219-238.

course until it reaches the ocean...problems at the mouth may be unsolvable if you cannot control what happens at the source, and developments on the upper part cannot be made without considering effects further downstream."²⁷ This hydropolitical dilemma is further muddied by international legal interpretations regarding freshwater ownership.

Water rights and water ownership represent important variables underpinning water conflict and cooperation because, especially in cases where water resources become increasingly scarce, blurred legal interpretations leave little room for conflict resolution and management. Robin Clarke writes:

All countries that rely on water originating outside their territory are dependent, in the absence of treaties, on the goodwill of upstream countries. Goodwill can not be guaranteed, especially under conditions of scarcity...This insecure situation is intensifying as water scarcity increases, and control over the national water supply often becomes a political issue...As water has become increasingly scarce, countries have not hesitated to take action to ensure their own supply, even at the expense of downstream countries. Such actions make international disputes inevitable and [increase the] likelihood of armed conflict.²⁸

Where water is a transnational resource, easing these political tensions involves solving the dilemma between resource ownership and political jurisdiction.²⁹ Mostafa Dolatyar and Tim S. Gray contend that "as we move from local [or domestic] to international resources, international law is necessary to achieve the peaceful resolution of problems and advance prevention of conflicts."³⁰ However, settling water rights and establishing an international legal framework for resource and water conflict management is indeed a very difficult, and quite possibly, an unfeasible task. To

²⁷Ohlsson, "The Role of Water and the Origins of Conflict," p. 22.

²⁸Robin Clarke, *Water: The International Crisis* (London, UK: Earthscan, 1991), pp. 93-94.

²⁹"The lack of settled water rights," explain Dolatyar and Gray, "is the root cause of the water crisis, and a frequent source of dispute." See Dolatyar and Gray, *Water Politics in the Middle East*, p. 34.

³⁰*ibid.*, p. 35.

understand why, one need only note the contrasting and incompatible doctrines regarding water rights that are currently employed by states and understand the damaging impact the lack of one clear doctrine of water rights has on the construction of an acceptable international legal framework for water resource allocation and regional water management.

The complexities that continue to plague the language and legal understanding of water rights has resulted in the simultaneous establishment of various political doctrines and theories of water rights, each defining the criteria for access and use of water resources in different and altogether incompatible ways. While five doctrines of water rights exist, two are most often cited by political leaders. The first, the absolute territorial sovereignty model, also known as the Harmon Doctrine, is based on the notion that every sovereign state has the right to the full utilization of all freshwater resources that flow within its territorial boundary.³¹ Reflective of the realist paradigm prevalent in IR, the doctrine assumes the intrinsic right of a state to "adopt all measures deemed suitable to its national interests in regard to water courses within its territory, irrespective of their effects beyond its borders."³² The second, the absolute territorial integrity doctrine, is the direct opposite of the Harmon Doctrine and emphasises the integrity of the river basin as a whole rather than the property of any one state. It favours a policy of water rights in which "a lower riparian states claims the right to the continued, uninterrupted (or natural) flow of the water from the territory of the upper riparian (basin) state."³³ As such, no riparian actor has the right to singularly alter the

³¹Ibid., p. 37.

³²Jon Martin Trolldalen, *International Environmental Conflict Resolution: The Role of the United Nations* (Washington, DC: World Foundation for Environment and Development, 1992), p. 79.

³³Ibid., p. 79.

flow of an international river. Clearly, both theories focus on diverging interpretations of water rights and subsequently assign different political obligations to riparian actors. The political difficulty stems from the fact that each doctrine, if it were to be interpreted into international law, would necessarily benefit one riparian state over another. Consider the following: downstream states generally reject the doctrine of absolute territorial sovereignty because it allows for the unabated use of the resource by upstream neighbours, while those upstream reject the doctrine of absolute territorial integrity because it unduly limits their sovereign ability to act as they wish and allocates rights to downstream states without imposing corresponding duties.³⁴ The basic problem, according to Dolatyar and Gray, is that riparians "who make contentious claims over shared rivers...always assert the particular legal theory which best justifies their demands, using it more as a bargaining ploy than as an objective, detached legal argument."³⁵ Self-interest seemingly continues to dictate state action. Reaching legal and institutional agreement that suits all states involved in a riparian dispute is thus exceedingly difficult. As such, the existence of separate doctrines only further obscures how international river basins and the responsibilities of their adjoining states are interpreted by international law and international institutions. As a result, the muddied waters of international water rights have a disquieting impact on the ability of the international community to establish institutional means to contend with emerging interstate water conflict.

³⁴Ibid.

³⁵Dolatyar and Gray, *Water Politics in the Middle East*, 37.

The Politics of Water Conflict: Water and the Economization of Security

Are water resources really entering the realm of 'high politics?' Our discussion so far seems to indicate that states are increasingly becoming aware of the growing relationship between natural resources and ecological health and one, their political power vis-à-vis others; two, the strength and vitality of their economies; and three, the general well-being of their citizens. Indeed, the natural environment, freshwater resources included, and national security is linked indirectly by an intervening relationship that emphasises the intricate connection between economic health and environmental health. Simply, national security in the future will increasingly hinge on economic strength and international competitiveness that itself depends on the continued and unimpeded access to natural resources. Thus, a decline in the overall amount or hampered access to vital natural resources will weaken a state's economic productivity and reduce political and military strength. Such developments further destabilize interstate and regional relations as competition for continued access to increasingly scarce resources intensifies.

The emerging importance of economic power in international relations is aptly termed the 'economization' of state security. Michael T. Klare explains:

The defining parameters of power and influence have changed since the Cold War's demise. Whereas, in the past, national power was thought to reside in the possession of a mighty arsenal and the maintenance of extended alliance systems, it is now associated with economic dynamism and the cultivation of technological innovation. To exercise leadership in the current epoch, states are expected to possess a vigorous domestic economy and to outperform other states in the development and export of high-tech goods. While a potent military establishment is still considered essential to national security, it must be balanced by a strong and vibrant economy.³⁶

³⁶Michael T. Klare, *Resource Wars: The New Landscape of Global Conflict* (New York, NY: Henry Holt and Co., 2001), 7.

Obviously, economic strength has many historic links to state power - the greater the industrial base of a given state, the more able it was to produce military hardware, the more force it was able to employ on the battlefield, and so on - but the difference today rests in the direct link between economic, financial, and industrial strength and national and military security. According to the 1999 Strategic Assessment review, "a more nuanced interpretation of the shift in power relations [since the end of the Cold War] is that to a greater degree than before, *national security depends on successful engagement in the global economy.*"³⁷ Within a system of international "gloeconomic competition," writes Michael Mastanduno, "the key concept for understanding great power competition is not security but scarcity."³⁸ Herein rests the true connection between the environment, economic well-being, and political stability. If state security is increasingly tied to economic prowess while economic health is itself linked to ecological health, then the potential for conflict over increasingly limited amounts of vital economic resources will likely escalate in the near future.

Mineral ores, petroleum, and natural gas seem to represent the most fundamental scarce resources involved in the above enviro-political equation. However, as argued above, freshwater, as an absolute variable, is also an intricate foundational input for all of the leading industrial processes, underpinning modern industrial society and state security.³⁹ For instance, in highly industrialized states such as Germany, Japan, the United States, and the United Kingdom, industrial water use represents

³⁷Emphasis in original. The Pentagon's Institute for National Strategic Studies, "Economic Globalization: Stability of Conflict," 1999 Strategic Assessment. Available from <http://www.ndu.edu/inss/Strategic%20Assessments/sa99/02.pdf>. Accessed on July 2004.

³⁸Michael Mastanduno, "A Realist View: Three Images of the Coming International Order," in *International Order and the Future of World Politics*, T.V. Paul and John A. Hall, eds. (Cambridge, UK: Cambridge University Press, 1999), p. 23.

³⁹Klare, *Resource Wars*, p. 213.

between 46 to 87 per cent of total freshwater use.⁴⁰ As these economies continue to grow (conventionally measured by the gross national product (GNP)) and other developing states such as India, China, Indonesia, and Brazil reach higher levels of economic production and per capita consumption (along with an increase in standard of living and a rise in the civilian demand for luxury-goods) the global demand for industrial water will necessarily increase.⁴¹ Accordingly, these developments will put increased pressure on the existing freshwater environmental-resource base, and may ignite interstate tension in areas where existing water resources are either limited in availability or shared by numerous users.⁴²

The potential for future conflict of this kind rests on the incompatibility of the existing processes of limitless economic growth and ecological survival. The process of industrialization and "the global economy," writes Karen T. Litfin, "confronts Earth's species and life support systems in a generally predatory mode."⁴³ Likewise, Homer-Dixon emphasises the existence of a "policy trade-off between economic growth and environmental protection...[which] encourages societies to generate present income at the expense of their potential for future income."⁴⁴ In an era of focussed on economic security, the economic-ecological trade off will only create greater environmental stress and degradation, as states continue to evaluate the vitality of their economies, and not the health of their forests and rivers, as a true measure of state security.

⁴⁰Ohlsson, "The Role of Water and the Origins of Conflict," p. 8.

⁴¹The 'American Dream' and the consumption patterns that accompany it are quickly becoming a model for the rising number of wealthy individuals in the developing areas of the world. See Norman Myers, "Consumption in Relation to Population, Environment and Development," *The Environmentalist* 17/1 (Spring 1997): p. 34.

⁴²Myers, *Ultimate Security*, p. 25.

⁴³Karen T. Litfin, "Environmental Security in the Coming Century," in *International Order and the Future of World Politics*, T.V. Paul and John A. Hall, eds. (Cambridge, UK: Cambridge University Press, 1999), p. 340.

⁴⁴Homer-Dixon, "On the Threshold," p. 97.

Bridging the Water-Conflict Gap: A Model For Studying Hydro-Conflict

In sum then, the political behaviour of states, along with the conflictual nature of interstate relations, is tightly interconnected with and influenced by freshwater resources. While international cooperation and peaceful interstate relations involving existing freshwater resources is possible, several inherent political characteristics regarding these resources seem to indicate that conflict, and not cooperation, is more likely to develop in a climate of environmental degradation and resource scarcity. Freshwater resource scarcity, the interdependent nature of basin systems, water's murky legal definition, and the emerging focus on economic security all seem to support the conclusion that an era of water crisis and war, rather than water cooperation and management, is likely developing.

Accordingly, this discussion has uncovered a preliminary foundation that can be used to establish a general theoretical model for the study of hydro-conflict and better understand riparian politics, while also testing the likelihood of emerging riparian conflict.

Such a model involves assessing four fundamental relationships prevalent to all international freshwater systems. A hydro-conflict model must consider:

(1) the current and projected levels of regional resource scarcity. Scarcity can be established by calculating the volumetric amount of water that is regionally available with the level of development and expected population growth (the resource use) of the region.

(2) the level of national dependency on the given resource of each riparian actor and the general level of riparian interdependency of the entire region. Dependency can be determined by understanding how inter-connected each riparian actor is to the resource use and with the well-being of the neighbouring riparian actors.

(3) the degree to which historic riparian disputes have been remedied through the establishment of regional cooperative regimes, along with an analysis of the breadth and inclusiveness of these institutions, their cooperative successes, and

expected longevity. This can be analyzed through a review of historical and future trends regarding regional riparian cooperation and basin-wide extraction plans.

(4) the degree to which water resources have become an issue of successful and continued economic development and national security, that is, how important water is to the economization of security. Establishing this involves an assessment of how vital water accessibility is intertwined with the economic development and national security of riparian agents.

Applying this model to the situation in various international basins would allow for a broader understanding of the interface emerging between freshwater resources and international conflict, while allowing for the development of a more systematic manner by which to address issues of freshwater resources from within IR and conflict studies.

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