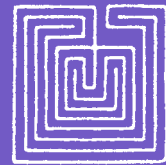


Dædalus

Journal of the American Academy of Arts & Sciences

Fall 2021

Water Security in Africa in the Age of Global Climate Change



Allen Isaacman, Muchaparara Musemwa
& Harry Verhoeven,
guest editors

with Matthew V. Bender · Leila M. Harris
Julie Livingston · Stephan F. Miescher
Jennifer L. Derr · Oscar Gakuo Mwangi
Jyhjong Hwang · Heinz Klug
Jackie King · Cate Brown



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“Water Security in Africa in the Age of Global Climate Change”

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Inside front cover: “Flow 54.” A reflection of semi-dry mud and the texture it creates. Mixed media on B3 Canvas, August 2021. Artwork © Tibian Bahari.

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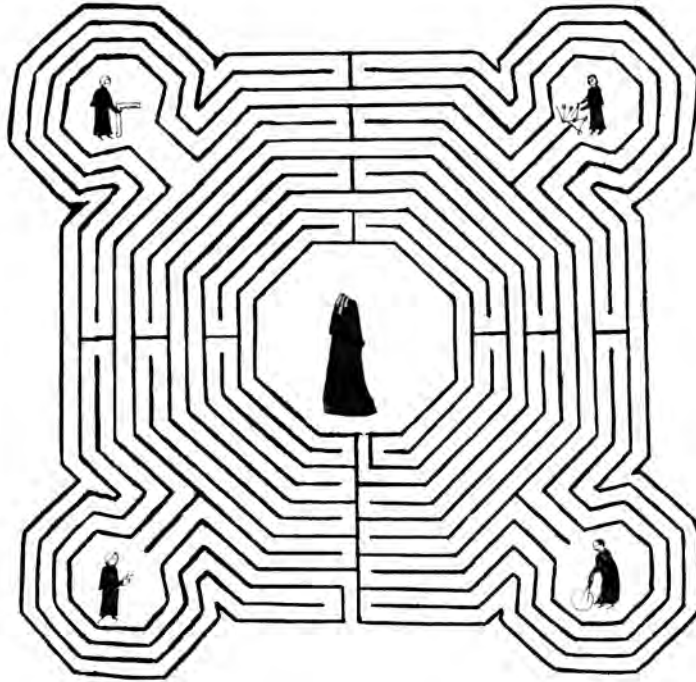
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Dædalus

Journal of the American Academy of Arts & Sciences



The pavement labyrinth once in the nave of Reims Cathedral (1240), in a drawing, with figures of the architects, by Jacques Cellier (c. 1550–1620)

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Major River Basins in Africa



Source: Modified version of map created by GRID-Arendal, 2013,
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Water Security in Africa in the Age of Global Climate Change

Allen Isaacman & Muchaparara Musemwa

This essay explores the multiple ways in which the nexuses between water scarcity and climate change are socially and historically grounded in ordinary people's lived experiences and are embedded in specific fields of power. Here we specifically delineate four critical dimensions in which the water crises confronting the African continent in an age of climate change are clearly expressed: the increasing scarcity, privatization, and commodification of water in urban centers; the impact of large dams on the countryside; the health consequences of water shortages and how they, in turn, affect other aspects of people's experiences, sociopolitical dynamics, and well-being, broadly conceived; and water governance and the politics of water at the local, national, and transnational levels. These overarching themes form the collective basis for the host of essays in this volume that provide rich accounts of conflicts and struggles over water use and how these tensions have been mitigated.

Water is both a prerequisite for all life and is crucial to economic and social transformations and stable societies. Neither the human nor the natural world can survive without water. Yet there are increasing concerns among scholars, state officials, and development experts about the alarming misuse of water, which has resulted in almost every major river being dammed and diverted, millions of people denied regular and equitable access to clean drinking water, a rise in waterborne diseases, and unpredictable flooding.

Because aquatic sources are unevenly and irregularly distributed within and between African nations, water has become a contested resource, increasingly privatized and commoditized. The inequities in the use and distribution of aquatic resources have become a source of intensified tension and conflict at local, national, and transnational levels. Consider Cairo's highly publicized warnings that if the construction of the Grand Ethiopian Renaissance Dam results in the diversion of an amount of water flowing into the lower Nile, it will forcibly retaliate against its southern neighbor.¹

Water scarcity in the Mekong Delta has precipitated renewed tensions between Cambodia, Vietnam, and China, while conflict has intensified between Mexico and the United States over control of the flows from the Rio Grande.²

The common refrain that “water is the source of life,” heard in traditional African proverbs and the desperate voices of environmental activists alike, is a clarion warning that we are on the precipice of major ecological crises, that is, unless we redouble our efforts and respond as urgently to this global challenge as we have, at our best, responded to the COVID-19 pandemic.

Climate change has seriously exacerbated these problems. The human-induced crisis – a result of greenhouse gas emissions principally through the unbridled burning of fossil fuels – has led to a heating planet that is threatening lives and livelihoods, particularly of poor people in Africa and other regions of the developing world.³ The poor have disproportionately borne the impacts of the climate crisis in the form of seasonal weather changes, soaring temperatures, and floods and droughts.⁴ Global concerns about the impact of climate change have thrown the spotlight on the availability of secure water sources in the face of frequent extreme weather conditions.⁵ Although climate change issues now seem to figure prominently on the agendas of several governments and major cities worldwide, most have generally treated climate change as “more of an ‘issue’ than a real ‘crisis.’”⁶ If the depredations of climate change did little to heighten the urgency for states and businesses around the world to find enduring solutions to the challenges of water scarcity, the unexpected virulent COVID-19 pandemic may just have provided the much-needed fillip for authorities to finally make certain that ample responses are put in place. When health officials underscored the centrality of water for washing one’s hands as one prerequisite in the prevention of the spread of the coronavirus, this exposed several countries’ ill-preparedness (from Zimbabwe and South Africa right through to the United States) to provide the most basic resource critical for the maintenance of the health and sanitation of their citizens, after decades of procrastinating to fix urban water infrastructure.⁷ But as Leila Harris elaborately discusses in her case study of Accra in this volume, even when and where the state has afforded infrastructure and public services, urban residents often experience them differentially. This harsh reality is true not only in Africa and other parts of the Global South, but also in highly developed nations like the United States.⁸ The water crises in Flint, Michigan, and the more recent shortages in Jackson, Mississippi, are cases in point.⁹

This issue of *Dædalus* explores the intensified policy debates and conflicts over water use as well as the efforts to mitigate these tensions. The contributors include scholars from Africa and the Global North who draw on insights from such diverse disciplines as anthropology, environmental studies, history, water engineering, political science/international relations, and law. Taken together, the essays in this issue focus on four critical dimensions of the water crises facing the African continent in an age of climate change: 1) the increasing scarcity, privatization, and commodification of water in urban centers; 2) the impact of large dams on the countryside; 3) the health consequences of water shortages and how they,

in turn, affect other aspects of people's experiences, sociopolitical dynamics, and well-being, broadly conceived; and 4) water governance and the politics of water at the local, national, and transnational levels.

Some of these issues were generated by wide-ranging conversations during the two-day colloquium on the theme "Water in Our Future," hosted by the American Academy of Arts and Sciences in Boston, Massachusetts, on June 19 – 20, 2019. Several scholars who participated in this meeting agreed to contribute to this volume and write reflective essays across a number of aspects of water security, including Jackie King (who had recently won the highly prestigious 2019 Stockholm Water Prize), Jennifer Derr, and Mucha Musemwa. We are delighted that other colleagues from Lesotho, South Africa, Zimbabwe, Belgium, Switzerland, Taiwan, and the United States agreed to contribute their research and lived experiences to our project.

While most of the contributors have recently conducted interdisciplinary fieldwork to determine how water scarcity has affected local communities across Africa, all of the contributors stress the importance of understanding the historical factors that have helped shape the current situation. Their investigations reveal that the end of European colonial rule did not mark a radical departure in the water history of the continent. While the power dynamics have shifted somewhat, colonial adulation of large development projects persists, as does the failure to recognize how these schemes often adversely affect the rural and urban poor.¹⁰

A water crisis sparked by climate change is threatening one-quarter of humanity.¹¹ A number of authoritative reports, foremost among them from the Intergovernmental Panel on Climate Change, have long concluded that climate change will have dire consequences the world over and will contribute to poverty, environmental degradation, and the further weakening of already fragile governments. The African continent, producing less than 4 percent of the world's greenhouse gases, has already borne the brunt of the externally induced effects of global warming;¹² many of its ecological systems have by now been ruinously transformed and are no longer of any significant value for its inhabitants.

This is, therefore, no longer an imagined possibility, but a lived reality of deleterious effects, especially with respect to access to water supplies, on the livelihoods of any number of people in sub-Saharan Africa. So, too, has water insecurity become an existential crisis for many Africans, although these daily realities hardly ever become headlines like the mega-water crises of Flint and Cape Town. Although the continent has large reserves of untapped water, aquatic resources are distributed unevenly. The major share of Africa's water resources lies in a few large basins such as the Congo, Niger, Nile, and Zambezi Rivers. At the same time, one-third of Africa's people live in regions susceptible to droughts and semi-aridity; intensifying climate change has put an additional 75 million to 250 million people at risk.¹³

Climate change, particularly rising temperatures and changing rainfall patterns, has had a multitude of immediate and far-reaching effects on water resources on the continent, on biophysical environments, and on peoples' daily lives. Among the most visible and deleterious effects of climate change are flooding, cyclones, droughts, drying up of rivers and lakes, and decreased quality of water. Soil erosion and reduced biodiversity have increased food shortages, led to the spread of disease, and exacerbated mass migration, which further compound the destructive effects of climate change in a negative feedback loop.¹⁴

In March and April 2019, for example, tropical cyclones Idai and Kenneth pounded vast areas of Malawi, Madagascar, Mozambique, and Zimbabwe. They are the most destructive tropical cyclones on record to have shaken Africa and the Southern Hemisphere/Southwest Indian Ocean, inflicting catastrophic losses of life and limb, including about 1,200 deaths and an estimated US\$2 billion in physical damage. This in a region that had already been experiencing long periods of endemic droughts, often leading to water scarcity (and food insecurity) of significant proportions in Zimbabwe, Namibia, Malawi, Mozambique, and Zambia. The 2015–2018 drought in Cape Town assumed legendary proportions as “Day Zero” – when dam water levels might fall past the threshold requiring a total shutdown of the municipal water supply – loomed large for residents.¹⁵ Nothing more vividly reveals the effects of global warming and drought than the desiccation of a large portion of Lake Chad, once among Africa's largest freshwater lakes, covering 45,000 square kilometers in 1960. Fifty years later, it has shrunk to one-quarter of that size.¹⁶

At the same time, urban water crises due to rainfall variability, as well as aging infrastructure and booming populations, are destabilizing the African continent from Accra to Cape Town and from Bulawayo to the edges of the Sahel. The shortages of potable water have brought to the fore the inadequacies of established water supply strategies, the glaringly unequal waterscapes, and the divisive party politics that all too often perpetuate and deepen the unequal provision of potable water to different classes of city residents.¹⁷

Climate change will continue to modify the hydrological cycle, alter seasonal patterns, and introduce extreme weather. Severe droughts and floods demand rethinking orthodox strategies of managing water in order to combat the ruinous effects of climate change across the African continent. At the same time, we need to be cognizant of Harry Verhoeven's warning (see his concluding essay in this volume) against conventional wisdom that attributes the water crises almost exclusively to climate change and fails to recognize the resiliency of communities across the continent and their ability to cope with and creatively adapt to changing weather patterns. Climatic impacts and interactions within ecosystems and human institutions remain deeply uncertain and only partially understood. And it is around this uncertainty that the essays in this collection try to articulate why global warming matters, but also how sometimes powerful interests draw on cli-

mate discourses to veil their own developmental failures or offensive political strategies, as Verhoeven warns.

This issue of *Dædalus* draws particular attention to the increasingly urban nature of the challenges Africa faces. Water shortages, whether the result of colonially entrenched patterns of accumulation, incompetence and mismanagement, climatic shifts, or other causes, have become particularly acute in many of the continent's booming centers, such as Lagos, Johannesburg, and Kinshasa. These cities are facing severe shortages of potable water. Urban residents rely on adequate supplies of water for cooking, bathing, and urban gardens, while industries must have regular water supplies to sustain production. Water scarcity has highlighted health vulnerabilities in impoverished populations; the rising incidence of cholera and dysentery resulting from frequent flooding and poor disposal of waste is of particular concern.¹⁸

Water scarcity, nevertheless, does not inevitably produce crisis, as sociologist Lyla Mehta has pointed out. Instead, embedded in crises of water are crises of power relations: "flows of water are also flows of power."¹⁹ Save for the most recent scholarship, which has begun to provide multiple and detailed meanings of scarcity, there is still a preponderance of popular literature that contains assertions that have dismally "failed to address relational and distributional aspects of water scarcity and their links with prevailing social power relations, which have a tremendous bearing on how water is used or abused."²⁰ As such, this issue of *Dædalus* seeks to unravel the often hidden yet significant inequities in access to water along the intersections of race, class, gender, and spatial/residential differentiation.

Embedded in the prevailing water scarcity discourse, especially as it relates to processes of urbanization, are critical characteristics designed to ensure the sustainability of the urban-construction project: namely, water commodification, marketization, and privatization schemes.²¹ Moreover, many African countries, like others in the developing world, have had to contend with the contradictions inherent in the International Monetary Fund's and the World Bank's neoliberal reforms. In response to these policies, several governments significantly reworked the legal and policy fields in the water sector to create conditions for market-propelled and donor-driven water privatization.²² Unsurprisingly, privatization and cost recovery have been received with contestation and protest, as they have been abysmally unsuccessful in providing low-income and poor residents with sufficient water supply services within their means. Clearly, the market-determined reforms within the water supply domain became one of the critical factors that helped create patterns of unequal access to water.

In many ways, therefore, there has been what geographer Diana M. L. Rivera, referring to the city of Bogota, has called a:

causal interconnection between the commercialization and transnationalization of the city's public multi-utility company as a strategy to be competitive in a globalized environment on the one hand, and the increasing number of households disconnected from the formal water supply networks particularly in low-income areas for non-payment of bills, on the other hand.²³

There is a striking resonance between what has transpired in many African cities, such as Johannesburg (Dube Township), Harare, Nairobi, and Lusaka. Unequal access to water for many citizens in African cities and rural areas is, quite often, aided by structures of governance shaped by neoliberal dictates and contradictory state development projects dating back to the colonial period.²⁴ Consider the situation in energy-starved South Africa. There the parastatal energy company, Eskom, received privileged access to water for its mammoth energy plants, whereas poor people living adjacent to the plants have regularly suffered from acute shortages, since most of the water coming from nearby dams is diverted to Eskom's facilities and nearby coal mines.²⁵

More citizens have attempted to navigate this complex situation by accessing water through multiple modalities, from expensive sachet and tanker truck water for drinking needs, to reliance on nearby vendors to fill local storage containers.²⁶ Many cities, from Accra to the Khayelitsha Township around Cape Town, are also seeking to navigate a "new normal" of nonstationarity of water sources, and highly variable precipitation and surface water runoff that challenge current infrastructures and assumptions related to secure water delivery.²⁷ This leads to fundamental questions about how the idea of water scarcity or water shortage informs ongoing governance practices, particularly when we recognize the many people who already live in a context of scarcity and uncertainty related to securing water for daily household needs.

Individuals, households, and communities have tried to adapt creatively to the shortage of potable water. Some have dug boreholes in search of clean water below Earth's surface. Others have built jo-jo tanks that they periodically refill with bottled water they have purchased. Both strategies, of course, require capital to which most urban poor do not have access.

One oft-suggested way of adapting to greater rainfall variability is the construction of ever bigger hydro-infrastructure. In the second half of the twentieth century, worldwide construction of large dams increased exponentially. From approximately five thousand in 1950, the number rose to exceed fifty thousand by the year 2000.²⁸

The international community has provided material, ideological, and discursive support for these mega-projects, which would supply badly needed energy to the continent. The World Bank lauded dam-building initiatives and remained

the largest financier of dams until the early 2000s, funding more than six hundred dam projects in ninety-three countries over the last half-century.²⁹ Many engineers, economists, state officials, and representatives of the dam industry celebrated these mega-projects as icons of development and proof of man's capacity to dominate the biosphere.

Africa was swept up in the "dams' revolution." European colonial governments initiated major hydroelectric as well as irrigation projects in the name of modernization and prosperity, especially in the "developmentalist" years after World War II.³⁰ African nationalist leaders of all political persuasions and their postcolonial successors followed suit with unbridled enthusiasm.³¹ During the second half of the twentieth century, African governments constructed more than one thousand dams, including twenty mega-projects such as the Akosombo Dam in Ghana, the Lagdo Dam in Cameroon, the Kanji and Bakolori Dams in Nigeria, the Kossou Dam in Côte d'Ivoire, and the Masinga Dam in Mozambique. By the end of the twentieth century, South Africa alone had more than 550 dams in operation.³² Hydroelectric dams in Africa may be among the most enduring colonial legacies. They persist in ways that laws or traditions or patterns of life do not. They stand fixed in the landscape, changing the world around them while they themselves prove stubbornly resistant to significant change.

As in other parts of the world, the construction of large dams in Africa often had deleterious consequences. Mega-dams at Kariba, Aswan, Akosombo, and Cahora Bassa flooded hundreds of thousands of hectares of fertile farmland.³³ Thousands upon thousands of farmers, old and young, poor and rich, women and men, were displaced as a result. The Aswan Dam alone uprooted 120,000 people in Egypt and Sudan, while more than 80,000 Ghanaians were compelled to abandon communities adjacent to the Volta River; in the area of the Kariba Dam, 57,000 Gwembe Tonga were left homeless.³⁴

In these and many other cases around the continent, the physical, social, and cultural worlds of displaced peoples were turned upside down. People located downriver from the dams also found their livelihoods in peril and critical natural resources degraded. Damming permanently alters a river's flow regime, particularly the timing and extent of flooding along its banks. This disruption jeopardized long-established agricultural production systems that depended on seasonal flooding to enrich alluvial soils. The destruction of downriver fishing industries, an increase in waterborne diseases, erosion of the shoreline and coast, degradation of aquatic ecosystems, and declines in riparian animal and plant life occurred as a result of dams across Africa. Among the conclusions of a highly influential report by the World Commission on Dams in 2000 was that "in too many cases an unacceptable and often unnecessary price has been paid to secure these benefits [of dams], especially in social and environmental terms, by people displaced, by communities downstream, by taxpayers and by the natural environment."³⁵

After a short hiatus in the construction of hydroelectric projects following the scathing conclusion of the report by the World Commission on Dams, governments, with the support of bilateral and occasionally multilateral partners, began building dams with a newfound zeal, much of it owing to the emergence of new financiers, as the essay by Jyhjong Hwang in this volume evidences. Over the last fifteen years, dozens of major projects have been completed, or are under construction, in Sudan, Ethiopia, Rwanda, and Tanzania.³⁶ In Ghana, the Bui Dam across the Black Volta was finished in 2013.³⁷ Construction on another project, the Pwalugu Dam on the White Volta, began in April 2020.³⁸ There is also renewed interest in building the massive Grand Inga Dam in the Congo, which, proponents argue, could provide cheap energy to a vast region stretching from South Africa to Southern Europe.³⁹

But even with the most sophisticated technology of the time, dams do not always function as engineers predict. Hydrologists and engineers have in recent years expressed concern about the stability of the aged walls of the Kariba Dam. If the dam walls break – which is debated as much locally as in international newspapers – about three million residents will lose their homes, livestock, and possibly their lives.⁴⁰ At the time of its construction in the late 1950s, it attracted worldwide attention as the largest infrastructure project of its kind. Today, Kariba has resurfaced as a symbol of the unintended consequences of megalomaniacal infrastructure projects.⁴¹ After more than sixty years in operation, it has aged to fragility. Over decades of operation, the water coming out of the sluice gates has carved out a deep underwater plunge pool; if it gets too big, the dam's foundation will be washed out. If the dam breaks, 40 percent of the electricity capacity of twelve countries in Southern Africa would be destroyed.⁴² The recent collapse of dams in India and Brazil, which left a toll of death and destruction, is a powerful warning of what might occur at Kariba or other dam sites in Africa.⁴³

Seventy percent of the earth embodies water, yet a significant part of the global population regularly experiences dire challenges of accessing clean potable water because water resources are unequally apportioned. In sub-Saharan Africa alone, 29 percent of the population suffers from lack of access to clean and nearby water resources, let alone electricity, with women and girls bearing the brunt of water collection from distant places.⁴⁴ This unequal access to water and hydroelectricity raises critical questions about notions of scarcity, water governance, and the politics of water.

Issues of water shortages and distribution are embedded in specific biophysical landscapes, historical contexts, and fields of power. The rationale for privileging White settlers in relatively water-abundant Rhodesia over their rural Black counterparts was far different from the state strategy of building big irrigation projects in Egypt and the Sudan at the expense of the rural and urban poor.⁴⁵ As previous-

ly noted, government officials promoted large hydroelectric projects deemed essential for industrial and rural development in countries as diverse as Ghana and Mozambique.⁴⁶ In both countries, women, who often had to spend two to three hours a day fetching water, and young children, who are particularly susceptible to waterborne diseases, have paid the heaviest price.

The politics of water are not only critical at the local and national levels but affect transnational relations as well. South Africa's effort to appropriate water from the Lesotho Highlands and from neighboring Namibia has been a source of growing tension. Control of aquatic resources has, at times, strained relations between Egypt, Ethiopia, and Sudan. Some of the most highly publicized dams in Africa – the Aswan High Dam, the Kariba Dam, and the Lesotho Highlands Water Project – also cut across territorial frontiers, precipitating competing water claims.⁴⁷ Since Burkina Faso built the Bagre Dam upstream on the White Volta in 1992, spilling during the rainy season has caused devastation to riverine communities.⁴⁸

Mega-water projects, often couched in terms of advancing cooperation between countries in harnessing water and energy, regrettably leave or promise to leave local people more impoverished than before. In his recent essay, "Killing the Holy Ghost: How the Musina-Makhado SEZ Will Parch the People of Zimbabwe," journalist Kevin Bloom exposes how a deal struck between the Pretoria and Harare governments, through the Zimbabwe–South Africa Joint Water Commission, with financial and other help from Beijing, seeks to develop the R145 billion (US\$9.6 billion) Musina-Makhado Special Economic Zone (SEZ) industrial project on the banks of the Limpopo River. It would have its own 3,300-megawatt coal-fired power station, as if planners were oblivious to the effects of global warming. The project will draw water from the Tokwe Mukosi Dam in Zimbabwe, built 250 kilometers from the South African border. It was built to provide irrigation and electricity for the sugar plantations as well as African peasants and small-scale farmers to alleviate water scarcity problems in the semi-arid Masvingo Province. Bloom notes that the draft Environmental Impact Assessment (EIA) concedes that climate change will have detrimental effects for both Zimbabwe and the SEZ, which intends to siphon water from Zimbabwe for its operational requirements. While the EIA report states that water will be drawn from the Tokwe-Mukosi, it is silent on the thousands of Zimbabwean locals who were displaced when the dam breached during a disastrous flood in 2014, resulting in a litany of alleged state-sponsored abuses documented by Human Rights Watch.⁴⁹ Only time will tell how water destined for the SEZ in South Africa will undermine water security for Zimbabwean farmers and their sugar plantations.

The contributors to this issue of *Dædalus* share the concern that without local, national, regional, and global commitments to creating more equitable access to water, the effects of water insecurity on the urban and rural

poor will continue to be devastating. The authors drill down on the deleterious effects of water scarcity on the daily lives of farmers and urban dwellers, women and men, old and young, across the African continent. Their research highlights the vulnerability of the underclasses whose voices have long been silenced by those in power and their economic allies, whose dreams of development would only benefit themselves. The authors raise the troubling question: development for whom?

In her essay, “Everyday Experiences of Water Insecurity: Insights from Under-served Areas of Accra, Ghana,” Leila Harris shows how the urban poor in Accra live through the “everyday” occurrence of nonavailability or scarce provision of water. She stresses that water scarcity and insecurity are not impending crises exacerbated by climate change, but have long been a challenging reality for many. Based on long-term multi-sited and multi-method research, Harris focuses on regulatory challenges and risks associated with a fixation on built infrastructure, as opposed to the ongoing realities of water insecurity experienced by marginalized communities and concomitant effects on social life. The experiences of the urban poor in Ghana are evident in metropolises throughout the continent.

Over the last three decades, Zimbabwe has been in the throes of economic collapse and the resultant breakdown of social services. One distinct marker of this deterioration has been the worsening provision of water and sanitation services in Zimbabwe’s urban centers. Mucha Musemwa, in “Urban Struggles over Water Scarcity in Harare,” examines how urban residents in Harare have had to contend with water shortages dating back to the colonial era, but which manifest in increasingly acute forms today. This scarcity is situated in a region with relatively good rainfall. Since independence in 1980, the ruling Zimbabwe African National Union–Patriotic Front (ZANU-PF) party has regularly blamed the perennial contemporary water crises on the economic sanctions imposed on Zimbabwe and on twenty-first-century global warming. By contrast, Musemwa documents that scarcity lies in the environmental, historical, and structural injustices occasioned by colonial segregationist architects of the Rhodesian settler society in the late nineteenth and twentieth centuries, as well as the woeful governance track record by the postcolonial ZANU-PF state. As water shortages have increased, inequalities between residents have deepened and struggles between urban residents and politicians over access to water have intensified. In the process, residents have had to resort to protests against urban authorities and have turned to creative, but usually unreliable and unsafe, ways of obtaining water for survival.

Matthew Bender explores the interrelationship between water access, resiliency strategies, and the impending climate crisis in contemporary Tanzania in his essay “Water for Bongo: Creative Adaptation, Resilience & Dar es Salaam’s Water Supply.” He approaches his subject from a historical lens, asking how the history of water access resiliency, in both rural and urban Tanzania, can inform strate-

gies for mitigating future shortages. Bender contends that in much of the country, users have long developed creative strategies for managing periodic scarcity. In addition to technologies like irrigation canals, boreholes, and cisterns, they have also adopted practices such as multiple sourcing. This is true for urban spaces as well, like the fast-growing metropolis of Dar es Salaam, where the lack of reliable, affordable, public water has encouraged users to rely on their own ingenuity for water provision. Bender's essay indicates the potential for these strategies to inform present and future water planning, and to address impending water scarcity due to climate change. In the process, it also challenges the divide between rural and urban that has long shaped water planning.

In her comparative essay on water scarcity and health in urban Africa, Julie Livingston demonstrates that water is the cornerstone of public health. She, like Bender and Musemwa, reveals that many of Africa's largest cities have unreliable water supplies and this shortage is escalating as a result of the urban boom. Clean water is essential for healthy food preparation but urban residents often have no alternative but to consume contaminated water, which causes recurring illnesses and heightened morbidity. Many postcolonial governments have made efforts to improve access to potable water the cornerstone of their public health policies. Nevertheless, a wide array of waterborne illnesses persist, including cholera and typhoid. They disproportionately affect the most vulnerable urban residents: babies, the elderly, and the destitute. The commodification of water has simply highlighted the sharp economic divides between those who can purchase bottled water and those who cannot.

The spread of debilitating, and sometimes deadly, waterborne diseases has been further exacerbated by the dam revolution throughout the African continent. The mammoth Aswan Dam and the integrated system of irrigation canals constructed to promote cotton cultivation and year-round agriculture are cases in point. In her essay on parasitic diseases, "The Dammed Body: Thinking Historically about Water Security & Public Health," Jennifer Derr documents how the building of Egypt's Aswan Dam in 1902 precipitated a dramatic increase of schistosomiasis. Based on household studies, researchers estimate that approximately 60 percent of peasants who farm adjacent to the canals came to suffer from the disease. The canals proved to be the ideal habitat for the tiny freshwater snails that carried the parasites. In addition, cultivators were also infected with hookworm in large numbers, as a result of the increase in the moisture level of the soil. The dam had other indirect effects on the health of the riverine population. As diets shifted toward corn as their basic foodstuff, because its growing cycle mimicked that of cotton, many suffered from pellagra, which results from an overreliance on the grain.

In his essay "Ghana's Akosombo Dam, Volta Lake Fisheries & Climate Change," Stephan Miescher shifts the angle of vision to the countryside to ex-

plore the effects of the Akosombo Dam and the recently completed Pwalugu Dam on water use and water security for people living along the Lower Volta River. In the 1950s and 1960s, the promoters of Ghana's first dams, Akosombo and Kpong, emphasized the need for generating electricity to modernize and industrialize the new nation.⁵⁰ The planners of the Pwalugu Dam have embraced a different rhetoric of water management under increasingly difficult circumstances. Due to climate change, the northeast and upper-east regions, where Pwalugu is located, have endured droughts that have devastated local agriculture. The new dams will enable the establishment of an irrigation scheme covering an area of 24,000 hectares to produce rice and maize as well as provide water supply during the dry season, while also offering flood control.

The massive Cahora Bassa hydroelectric project was completed on the Mozambican stretch of the Zambezi River in 1974, the year before the end of Portuguese rule. Allen Isaacman in "Cahora Bassa Dam & the Delusion of Development" documents how from its inception, the hydroelectric project, designed to provide cheap energy to apartheid South Africa, had a catastrophic effect on the lives of the approximately half-million people who depended on the river and its delta for their livelihood and for the tens of thousands who were forcibly relocated when the dam's lake was created. Despite the traumatic history of Cahora Bassa, the postcolonial government is committed to a colonial-era plan to build a second dam approximately 60 kilometers downriver from the first one. In many respects, Mphanda Nkuwa, as the dam project is called, looks like a replay of the colonial past. The postcolonial state of Mozambique justifies the dam in language largely unchanged from the days of Portuguese rule. The overarching economic imperative driving the dam is the same: cheap energy for South Africa. According to environmentalists, Mphanda Nkuwa is being pushed through without proper impact studies. And as with Cahora Bassa, decisions on Mphanda Nkuwa have generally occurred behind closed doors. Impacted communities have had little meaningful say in what is to befall them. The Mozambican government has deferred the start-up date for the new project, depending on external funding most likely from China and a commitment from the South African government to purchase the bulk of the electricity. In the process, farmers living near the proposed dam site have been in suspended animation for nearly two decades as the state periodically pursues these negotiations.⁵¹

Mozambique is not the only African state seemingly wedded to grandiose visions of hydrodevelopment: the Nile Basin is not only home to Egypt but also to Sudan and Ethiopia, which have launched ambitious dam programs of their own. For decades, Ethiopia has been coined by natural scientists and its own bureaucracy as "Africa's water tower" because of the extraordinary levels of rainfall that land on its northern, central, and southern highlands. Harry Verhoeven's essay, "The Grand Ethiopian Renaissance Dam: Africa's Water Tower, Environmen-

tal Justice & Infrastructural Power,” analyzes the Grand Ethiopian Renaissance Dam (GERD), which since the start of the project in 2011 has escalated tensions in Northeast Africa and challenged Egypt’s historical hegemonic position in the basin. The GERD was and is intended to help expand the reach of the Ethiopian state, domestically and internationally: its reservoir is not only supposed to hold record quantities of water, but it is also intended to help provide the foreign currency necessary to help the nation industrialize and for the state to deliver public services to Africa’s second-largest population. Yet, as so often is the case with mega-projects, the GERD has been politically disruptive not only to riparian neighbors such as Egypt, but it has also altered the balance of power in Addis Ababa itself. Verhoeven explores how the project has intensified internal conflict among the ruling party leadership and fanned ethno-regional differences between the winners and losers of economic development. The project that was supposed to bring all Ethiopians together under a nationalist banner of environmental justice has been weaponized by elites jockeying for power in ways that threaten the survival of Ethiopia.

The stakes of the nexus between domestic state-building and redrawing international relations are not as existential and prone to violent escalation in Southern Africa, but they are nonetheless crucial to questions of human security and political influence. The Lesotho Highlands Water Project transfers water to South Africa under prescribed terms set out in the project’s treaty. Climate change has, however, adversely affected water resources in Lesotho, thereby threatening water transfer to South Africa. Oscar Mwangi’s essay, “Hydropolitics versus Human Security: Implications of South Africa’s Appropriation of Lesotho’s Highlands Water,” examines the relationship between climate change, hydropolitics, and water security in the context of South Africa’s appropriation of Lesotho’s water. Using securitization theory as a framework, Mwangi argues that climate change and its impacts upon water in Lesotho are real but that the country’s political elite has sought to instrumentalize the specter of environmental hazards to enforce the unpopular commodification of water. So-called existential threats are constructed on the basis of diplomacy rather than domestic socioenvironmental concerns.

Whether in the reform of South Africa’s water laws or in the work of the World Commission on Dams or through the declarations of the World Water Congress – such as the Melbourne Declaration in 2000 – governments, nongovernmental organizations, and social movements have repeatedly constructed sets of principles designed to frame the governance of water resources. Beginning with the creation of the “Water Law Principles,” issued by the Department of Water Affairs and Forestry as the Mandela government’s first step to water law reform in post-apartheid South Africa, and continuing with the work of the World Commission on Dams and subsequent international declarations, Heinz Klug, in “Between Principles & Power: Water Law Principles & the Governance of Water in Post-Apart-

heid South Africa,” explores how these appeals to principle have attempted to shape the governance of water in Southern Africa and beyond. From the delivery of water services to the management of transboundary water resources, the gap between the principle, practice, and politics of water grows ever wider. Finally, his essay draws attention to the relationship between water law reform, the framing of the international legal regime, and the impact of the dramatically changing hydrological environment across Southern Africa.

The rapidity with which the international context of water resources development in Africa is changing is also the focus of Jyhjong Hwang’s essay in this collection, “An Offer You Can Refuse: A Host Country’s Strategic Allocation of Development Financing.” She stresses the transformative role played by Chinese development finance, especially in the last twenty years as the World Bank and other multilateral donors have tightened conditionality pertaining to support for big dam and other development projects. Hwang’s essay nonetheless goes beyond arguing that China’s “no questions asked” policy is leading to a resurgence of environmentally troubling projects.⁵² Drawing on an incisive case study from Liberia under the government of Ellen Johnson Sirleaf (2006 – 2018), she highlights the importance of African agency and the ability of African governments such as Johnson Sirleaf’s to shape the design and outcome of development projects to a degree that much of the extant literature continues to underestimate. Her conclusion is thus optimistic: new sources of donor funding might be leveraged for more inclusive use of and deliberation over water resources in an era of growing scarcity.

The final section in the volume poses the question: how can we do a better job of building dams in ways that are sensitive to the poor and their ecological environments and include them as equal partners in all future projects that impact their livelihoods? Jackie King and Cate Brown in “Africa’s Living Rivers: Managing for Sustainability” shed light on new thinking that is emerging in support of responsible dam development and what new considerations must be made to move away from the destructive path of the high modernist era when dams were built without due regard to proper environmental impact assessments. King and Brown stress that the massive global building program of dams and other water infrastructure in the last century were meant to support water security, food security, and new sources of energy. The decisions to construct were made primarily on engineering, economic, and political grounds – social and ecological inputs at that stage were at best rudimentary and often missing. The hidden costs of development were not understood at the time but have emerged ever more strongly over the last thirty years. They observe that rivers are degrading and dying; hundreds of millions of people in developing countries who depend on healthy rivers for their livelihoods are suffering or at risk; and wildlife are failing as their watery destinations disappear. Some countries and global funders are still tied to the

“business as usual” approach, perhaps through a lack of awareness of what is now possible in terms of new kinds of information. They may still see the environment as a commodity to be used at will, rather than as our essential support system that is increasingly and ever more rapidly degrading. The new call to “leave no one behind” is not working. We need to move from a mindset of entitlement and exploitation to one of respect, equity, and balance.

New thinking is emerging, encapsulated in “the ecosystem approach” or “nature-based solutions.” Such an approach requires that the management of human needs be based on a deep understanding of the natural resources being exploited. Specialists such as river ecologists and resource economists are bringing new thinking and methods into water planning and management, and properly costing out water developments alongside the benefits presented by developers and funders. This is not to halt development but to help governments make more informed and balanced decisions, and to empower all stakeholders to better understand what the future could hold and negotiate for the future they want.

In his conclusion to this issue of *Dædalus*, Harry Verhoeven, in “Climate & Water in a Changing Africa: Uncertainty, Adaptation & the Social Construction of Fragile Environments,” reflects on not only a changing climate and changing understandings of water security, but also on an Africa in transformation: how do its evolving political structures, economic networks, and social compacts influence its relationship to the environment, locally and globally? Synthesizing the key insights from the essays in this collection with his own analysis, Verhoeven argues that the dominant thinking about climate change and water security continues to be simplistically preoccupied with ideas of Africa as a victim of exogenous (and nefarious) transformation. This bypasses the long track record of many of Africa’s populations dynamically adapting to extremely difficult circumstances and various African imaginaries of what climate and water security entail. It also fails to think through questions of political participation and social contestation, including the troubling ways in which African forms of knowledge about the environment have historically been marginalized and the continent has been integrated in global circuits of accumulation and power. How various African populations experience the interplay between science, authority, and institutions was and is central to explaining the discontents with “development” and “adaptation” in the twentieth and early twenty-first centuries, and they will remain significant going forward. This imperative, Verhoeven writes, entails

the need to listen to, critically engage with, and foreground African ideas about climate and water in all their diversity and multilayered complexity. There is no scenario in which African societies adapt successfully to climatic change and do not simultaneously radically reimagine both their relationship with the outside world and with each other, including the institutions of control and exclusion at home.⁵³

This collection of essays is by no means an exhaustive treatment of the important subject of water security and water in Africa in the age of climate change. All the contributions focus on local lived social, ecological, and economic realities, as well as domains of power in several countries on the African continent. The constraints of space have made it impossible for us to explore related topics such as the state of Africa's forests, the economics and politics of desalination, and the so-called blue economy.⁵⁴ But it is our earnest hope that the topics and debates covered herein will trigger interest in the other dimensions we were unable to attend to as we continue to reflect on the implications about "Water in Our Future" in Africa in the face of climate change.

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Urban Struggles over Water Scarcity in Harare

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This essay counters the growing tendency in current scholarship to attribute nearly all the enduring water scarcity problems to climate change. Focusing on Harare, Zimbabwe's capital city, this essay contends that recurrent water crises can only really be understood within the contentious, long, and complex history of water politics in the capital city from the colonial to the postcolonial period. Although the colonial and postcolonial states in Zimbabwe had very different ideological and racial policies, for various reasons, neither was willing nor able to provide adequate supplies of water to the urban poor even as water was abundant in the city's reservoirs. It posits that while the colonial government racialized access to water by restricting its use by urban Africans, the postcolonial government failed to change the colonial patterns of urban water distribution and did little to increase water supplies to keep pace with a swiftly growing urban population and a geographically expanding city.

In 1980, Zimbabwe became independent after ninety years of colonial rule. President Robert Gabriel Mugabe's government inherited an unequal society in which access to critical natural resources had been determined by race, gender, geography, and other markers of segregation by the colonial regime. One such vital resource distributed along racial and residential lines was water. Successive colonial governments deemed controlling water allocation within the city as a potent way to give form and content to segregation between Europeans and Africans in Harare. Spatial planning ensured that water supply distribution networks and patterns would manifest the often contradictory race and class relations between colonizer and colonized. Although Mugabe's government inherited a solid urban water supply system, the infrastructure was designed to serve primarily White settlers while Africans living in segregated and overcrowded townships received limited amounts of water and sanitation services. Rectifying the vestiges of colonial resource inequalities became one of the formidable challenges the socialist-oriented Zimbabwe African Nationalist Union–Patriotic Front (ZANU-PF) government had to contend with.

While the Zimbabwean government was never found wanting when it came to making commitments to several national and international organizations on

improving water and sanitation access for its citizens, four decades after independence, the inherited unequal distribution patterns of water and sanitation remain deeply entrenched among residents of Harare. Simultaneously, the city's water infrastructure has progressively deteriorated, resulting in rampant water shortages and poor water quality, inducing deleterious epidemiological consequences, such as the 2008 and 2018 cholera outbreaks. Since the early 2000s, reports with headlines such as "Typhoid Spreads amid Water Shortage" or "Zimbabwe: Untreated Sewage Makes Its Way into Drinking Water" have been common.¹ These headlines may appear sensational, but the realities in Harare's high-density townships confirm the extent to which the twin problems of water scarcity and poor sanitation are a living reality. Yet it is too tempting to want to ascribe the city's enduring water troubles to climatic vicissitudes given the preeminence of climate change concerns in contemporary global discourse. The water scarcity problems that the ordinary residents of Harare have experienced renders it an ideal exemplar of a city whose two-decades-old water crisis has much less to do with climate change than a range of anthropogenic factors that have undermined the successful provision of water by both the central government and the local urban authority.

This essay contends that water shortages in Harare were not caused by climate change or environmental shocks and can only really be understood within the long and complex history of water politics. Put somewhat differently, although the settler state and the postcolonial state had very different ideological and racial politics, for various reasons, neither was willing nor able to provide adequate supplies of water to the urban poor. While the colonial government racialized access to water by circumscribing its use by urban Africans, the postcolonial government failed to fundamentally transform the colonial patterns of urban water distribution and did little to increase water supplies to keep pace with a rapidly growing urban population and a geographically expanding city. As water shortages have proliferated, so too have inequalities deepened between residents and urban struggles intensified over access to water. In the process, residents have protested against the urban authorities and found imaginative ways to obtain water for survival.

Established in 1890 on the present site of Africa Unity Square (formerly Cecil Square), Salisbury (renamed Harare in 1980) – the capital of colonial Zimbabwe – served the administrative and commercial interests of Cecil Rhodes's British South Africa Company following its seizure of Mashonaland and Matabeleland, both of which merged to become Southern Rhodesia (hereafter, colonial Zimbabwe). Because water was always going to be a pivotal resource to the economic development of Harare, it is important to describe the city's catchment and its hydrological, climatic, relief, and physiographic features. From the city's inception, its water supplies were shaped by the interplay between these fea-

tures as they had a bearing on how much rainfall the area received and how, in turn, water was to be acquired and distributed throughout the city. Therefore, the question of procuring sufficient water provisions for the city has persistently remained on the agenda of successive municipal administrations.

Harare lies on a watershed in the Mashonaland region of the northeast high veld of Zimbabwe. On the climatically marginal southwest end of the same plateau is Bulawayo, the country's second-largest city. Harare sits at an altitude of 1,550 meters above mean sea level, which gives it a reasonably warm temperature.² The northeast highland side of Harare comprises the divided watershed between the headwaters of the Mukuvisi, the Umwindisi, and the Gwebi Rivers. This watershed stretches from the northeast to the southeast and crisscrosses a number of rock formations.³ Rainfall drops east to west with the eastern mountains receiving 100 centimeters (40 inches) of rain annually, while Harare receives 81 centimeters (32 inches) and Bulawayo only 61 centimeters (24 inches); here seasonal shortages of water are commonplace.⁴ The summer rainfall season lasts from November to March. This is usually followed by an intermediate season when both rainfall and temperatures decrease, giving way to a cool, dry season stretching from mid-May to mid-August. Three distinct factors made water storage in and around Harare costly and challenging during the early development and subsequent growth of the city: 1) its elevation atop the main watershed of the country's high veld, with the small local streams; 2) long, dry seasonal spells; and 3) an eight-month minimal or irregular streamflow and high rates of evaporation. The combined effect of these factors elicited intermittent restrictions on water supplies during the city's development.⁵ Within Harare, the northern and eastern areas of the city are prone to more rainfall than the southwest side.⁶ It is therefore not a coincidence that Europeans allocated for themselves areas for suburban development in the higher lands, while areas with the lowest relief were designated for industrial development and for the African townships of Harari (renamed Mbare in 1982) and Highfield, that is, "downstream and downwind" of the city center and suburban areas.⁷ The predominance of ancient crystalline rocks rather than sedimentary formations around and beneath Harare accounted for the small aquifers hardly large enough to sustain sizable water yields to cater to the increasing water needs of the growing urban population.⁸

Early White settlers in Harare depended on the water within the urban catchment. They obtained their potable water from the small stream, Mukuvisi, on whose banks the city had initially been located. This source was boosted by ground water springs (*zvitubu*), wells, rainwater collected from rooftops, and (for those who could afford them) boreholes.⁹ By 1911, 3,479 Europeans, 6,400 Africans, and 339 Asians and Coloreds¹⁰ were living in Salisbury.¹¹ As Harare expanded, its water needs escalated. The initial sources soon became inadequate, and White rate-payers pressed the municipal council to develop reliable water supplies. At the be-

ginning of the twentieth century, they raised concerns about the sanitation and health dangers associated with the prolonged usage of groundwater and the widespread utilization of bucket and pit latrines.¹²

Demographic growth and adverse topographical features, highlighted above, compelled the city authorities to resort to water storage initiatives and to turn away from dependency on groundwater. Since water for urban uses was derived from rainfall, the city lost the bulk of its water through uncontrolled runoff or from what simply vanished into the depths of the earth during the annual dry seasons, causing regular water shortages. These shortages led to plans to construct large-scale reservoirs. Thus, the first ever dam for Harare, Cleveland Dam, was built in 1913, seven miles to the east on the headwaters of the Mukuvisi River, with a capacity of 200 million gallons.¹³ With the establishment of the Cleveland waterworks, it became possible for city authorities to dispense water through pipes to the European suburbs, businesses, and industrial sites.

Intensified water uses for domestic, industrial, and urban construction as well as recurring droughts revealed that the Cleveland Dam could not always guarantee sufficient water.¹⁴ The council therefore built the 600-million-gallon Prince Edward Dam on the Manyame River. This ensured a more reliable water supply for White residents until the immediate aftermath of World War II when an even bigger dam, forming Lake Mcllwaine, was built on the Hunyani River southwest of the city.¹⁵ A gigantic water purification plant – the Morton Jaffray Waterworks – was constructed in 1954 on the Hunyani River adjacent to the lake.¹⁶ By the early 1970s, Lake Mcllwaine was meeting 95 percent of Harare’s water requirements.¹⁷ It was not until the mid-1980s when the preexisting Darwendale Dam, downstream of the Hunyani River, was enlarged and connected to the purification plant.¹⁸

Guaranteed water supplies allowed the rapid development of several upper-income European residential suburbs in the northern and northeastern areas of the city, such as Highlands, Borrowdale, Malborough, and Alexandra Park. Splendid houses, fitted with water pipes inside and outside, with at least one bathroom and toilet, were built on more than one-acre stands with large, manicured, well-watered gardens. Most White homeowners had their own swimming pools, which earned Harare “the dubious honor as the city with the greatest density of swimming pools in the world.”¹⁹ As British novelist David Caute writes in *Under the Skin*, “by 1963 one out of every five families in Salisbury had installed its own swimming pool.”²⁰ Even though these suburbs had low population densities, the single-story detached houses had extraordinarily spacious living conditions. On average, such dwellings had four-to-five rooms and often housed 3.6 persons – reflecting, in the words of geographers George Kay and M. Cole, “a way of life that is expensive to obtain and maintain,” adding that “the material environment of the northern suburbs provides no place for the poor.”²¹ Due to the colonial state’s policy of racial and urban residential segregation, the northern suburbs were no place

for Africans regardless of class status unless they were domestic workers allowed to live on their premises in the “boys” *kia*.²²

Development scholar Irene Mudeka captures this disparity between European and African conditions quite well as she underscores the centrality of differential access to water:

Urban planners ... set up European suburbs such as Mount Pleasant, Vainona, Queensdale, Hatfield and Bluffhill among others and endowed them with permanent, durable, brightly lit and beautiful homes of low density and with a myriad of entertainment venues, restaurants, baths, parks as well as other trappings of civilization. Unlike the African shanty townships which relied on very limited communal water taps, the European suburbs also enjoyed clean piped water systems installed all the way from Cleveland and Seke Dams.²³

The asymmetrical provision of water between European and African residential places generated fundamentally distinct environmental outlooks, the former spectacularly green all year round and the latter unkempt and green only when the summer rains fell. Thus, a deeply divided colonial city for Europeans and Africans emerged along racial, spatial, and income lines. What was typical of the European side of the city – that is, privilege and affluence – was a far cry from the African townships created through deprivation and White paternalism.²⁴

To put the latter point into perspective, it is worth emphasizing that since 1890, the colonial state practiced a “Native Policy” of racial, economic, cultural, political, territorial, and spatial segregation. This policy was later codified into law as the Land Apportionment Act (1930), which formalized the set-aside towns and industrial areas as exclusive domains of European occupation. Simultaneously, it allocated all the unwanted, often ecologically depressed, urban land for the controlled habitation of Africans, though that land remained European-owned.²⁵ In the first decades of colonial rule, African residential places were provided with meager resources and amenities on the rationale that African migrants were temporary sojourners and were only in the city to minister to the needs of the White man. When done, they were expected to return to their rural homes. There was, therefore, no need to provide them with all the essentials of a civilized life.²⁶ This is the basis on which the creation of African townships needs to be understood. Alongside the racial and territorial division of land, the colonial state instituted the 1927 Water Act (later revoked by the 1976 Water Act) and conferred all water rights to the segregationist state. Access to water rights were now affixed to land ownership.²⁷ Because Africans had been dispossessed of their lands, they were automatically ineligible for water rights in urban (and rural) areas where they now lived on European-owned land. Thus, by law, Africans in Harare’s townships had no rights to water. Whatever access they had was at the “mercy” of the city council and the state.

Africans arriving in Harare in pursuit of employment were moved to Mbare, the first formal secluded residential area earmarked for Africans in 1892. They were subsequently moved in October 1907 to the site where Mbare presently stands. Located five miles southwest of the town center and on the banks of the Mukuvisi River, the township bore all the hallmarks of segregation: it was located in unpleasant surroundings, that is, adjacent to the town's animal slaughtering post; in proximity to the city's sanitary facilities, which oozed pungent odors; and below the burial ground for White people, though concealed from view by a strip of trees.²⁸ On the fifty-acre site, the council constructed from round, corrugated tanks an assortment of fifty Kaytor huts with thatched roofs, and a brick barrack of four rooms. African residents soon christened the huts "Ma Tank."²⁹ By 1914, the number of Kaytor huts had risen to 156, and by the middle of the 1920s, the township consisted of 247 huts housing an estimated population of 760 people.³⁰ Around the same time, the state dispensed with the Kaytor huts. In Highfield, the state built the unpopular *misana yenzou* (appeared like elephant backs) four-roomed brick houses as African migration to the city increased after World War II. More housing for Africans was provided between 1952 and 1976, as the government, municipality, and, to some extent, employers agreed to maintain stable labor supplies in the city as opposed to migrant labor. Several townships such as Mufakose, Kambuzuma, and Dzivarasekwa were built farther away from the city center and European suburbs but were close enough to places of work. The typical "small, box-like" houses were built "within individual plots, with a consequent lack of sizable open spaces for informal recreation, amenity and cultivation."³¹ A pervasive characteristic in all the townships was that these houses were regularly congested. Kay and Cole note that in 1969, about 97 percent of Harare's African population was accommodated in 65,070 houses comprising 162,130 rooms, thus an average of 1.7 people per room.³² The average home in the African township had four rooms divided into two bedrooms, a living room, and a kitchen. Flows of water into these townships were controlled by the state. From Mbare to Highfield, "water distribution to Africans was parsimonious," asserted historian Eshmael Mlambo.³³ Neither piped water nor bathrooms were provided within these houses, leaving families to their own devices.³⁴ Where the state provided rudimentary amenities, these were often linked to security and social control considerations with a view to keeping African behavior within the gaze of the colonial state: "Water pipes as well as electricity cables are always strategically placed so that any African insubordination could quickly be dealt with. In cases of strikes or political demonstrations, water and electricity in the homes is cut off until the protesters give in," states Mlambo.³⁵ This is not surprising. The colonial state always regarded African townships as "cradles of African nationalism,"³⁶ just as its successor, the postcolonial state, was to label some urban centers as the "dissident cities," justifying their surveillance at all times.³⁷

For sanitation and ablution necessities, Africans were to be content with using communal latrines. Unsurprisingly, many Africans found living conditions in the townships both oppressive and depressing. No one found these realities an affront to African dignity more than Bradfield Jacob Mnyanda, a Mfengu immigrant from South Africa and long-time resident of Mbare in the 1940s. Mnyanda rose to become the highest-ranking Black official in the Southern Rhodesia Native Affairs Department. He provided the first documented critique of the colonial state's Native Policy in his 1954 classic text, *In Search of Truth: A Commentary on Certain Aspects of Southern Rhodesia's Native Policy*. He was determined to galvanize the consciousness of his White readers to the exasperations and racial and environmental injustices piled upon, especially, the educated African elites, who were forced to live cheek-by-jowl with their poor brethren in degraded environmental settings no European would have tolerated: "Compared with the Europeans, even in the case of advanced Africans, urban native housing which, *inter alia*, includes latrines, dance and social halls, is poor in quality and in quantity."³⁸ Top on his mind was also the differential access to water, though surprisingly focused on swimming baths, which were plentiful in White suburbs: "it may be pointed out that while in almost each of our leading towns provision has been made a European public swimming bath, no similar arrangement exists for Africans in any part of the colony."³⁹ Of course, even if individual Africans from the elite class could have afforded private swimming baths, there was no space for them to build one given the tiny stands and limited water supplies available to them. Mnyanda was advocating for equal treatment with Whites as he clamored for the provision of the same public swimming baths in African townships as there were in European spaces. Mnyanda was understandably riled by the perennial unhygienic condition of the communal latrine in most townships in the colony:

The common latrines – which are in use in most urban native locations, townships or compounds – are kept in an extremely insanitary condition, possibly because the habits of many of their users are primitive in the extreme. These communal latrines are a menace to the health of the people and a disgrace to the Colony.⁴⁰

Mnyanda, however, extolled the Harare municipality for building individual latrines in the newest section of Mbare, "for an individual latrine can be kept clean because it is the sole responsibility of the tenant using it; whereas, in the case of the communal latrines, the attitude of many less advanced African people is that: 'everybody's business is nobody's business.'"⁴¹

Like Mnyanda, Lawrence Vambe, a Zimbabwean journalist, produced a similar sharp-tongued analysis of urban conditions for Africans in his 1976 classic, *From Rhodesia to Zimbabwe*, in which he documents the lived experiences of the different classes of Africans in Harare's townships and how the blunt instrument

of racial and residential segregation homogenized them. Vambe expresses how the African elite, Black moguls, and others

were forced to go to Harare (Mbare), the Highfield Village Settlement and the Mabvuku Township, where they were tenants just as all the other Africans, and they occupied the same confined, crowded houses, surrounded by muddy roads, communal lavatories and huge piles of smelling rubbish, that were left uncollected for weeks on end.⁴²

If anything, his book is an aide-mémoire documenting how little had changed twenty-two years after Mnyanda's first exposé.

In 1980, four years after the publication of Vambe's book, Zimbabwe attained independence and with it came the ruling party's promise to transform people's lives by eradicating "the long-term legacies of colonial resource inequalities."⁴³ In the exhilarating moment of gaining self-rule, a ZANU-PF-controlled city council took over the administration of the city's affairs and inherited a functioning modern water supply system.

Satisfied that 99 percent of urban areas enjoyed reliable access to water and that its loyalists were now in firm control of Harare's affairs, the central government turned to the previously neglected rural areas where only 40 percent of the populace had access to safe water,⁴⁴ partly in appreciation for the support the rural populace had rendered to the ruling party's guerrilla army and also to begin to uplift their downtrodden lives.⁴⁵ During this period, municipal authorities were left to manage the delivery of urban water and sanitation services to the sprawling cities with rising population figures following the annulment of colonial urban influx controls. In the case of Harare, between 1980 and 2001, the successive municipal councils were dominated by councilors and mayors who were members of the ruling party.⁴⁶ These authorities were too loyal to ZANU-PF leaders to have challenged the government on water issues despite the visible indicators that, sooner rather than later, the city's water infrastructure would begin to buckle under immense pressure from the growing urban population,⁴⁷ lack of constant repairs at a time when the economy was also shrinking due to a mid-1980s global recession, unequal terms of trade, the drought in 1982–1983, and pressure from the International Monetary Fund (IMF) and the World Bank on the government of Zimbabwe to renounce its socialist programs and liberalize the economy to allow free-market competition.⁴⁸ By the end of the 1990s, Harare started to endure grave water shortages, which the Harare city council attributed to the 1991–1992 severe drought and also correctly to the increased consumption levels of Harare's growing population.⁴⁹

Though the city council singled out only these two factors, the plausible causes were rooted in a general culture of maladministration at Harare Town House (the City of Harare headquarters), which resulted in the lack of proper maintenance

of the once-reliable water and sanitation infrastructure and a general degeneration of services that undermined the previously ambient outlook of the city.⁵⁰ In 2003, historian Martin Meredith characterized the decay in this way: “Harare was now more noted for debris on the sidewalks, cracked cement paving, broken street lights, potholes, uncollected refuse, and burst pipelines.”⁵¹ This was not a groundless view, for long-time residents of Harare held consonant views emanating from living through and witnessing urban decay. One such resident, I. L. Makumbe from Glen View 3 township, yearned for the past when Harare was hailed as “the best city in Africa. It was always clean.” He acknowledged that the city council always undertook its responsibilities seriously – it collected garbage in a timely manner and water shortages were rare – but “now there is no water: the taps and toilets have run dry. It’s terrible.”⁵²

These conditions triggered several revelations in the media about alleged corruption and mismanagement at Harare Town House. Solomon Tawengwa, who was appointed in 1995 as the mayor of Harare on a ZANU-PF ticket and pledged to wipe out all fraudulent activities in the municipality, was relieved of his duties in 1999 on allegations of flagrant maladministration.⁵³ Instead of holding elections to appoint a new mayor, the ZANU-PF government appointed the Harare Commission, chaired by Elijah Chanakira, former secretary of higher education, to run the city’s municipal affairs. When both presidential and municipal elections were finally held in March 2002, the new opposition party, the Movement for Democratic Change (MDC), won control of all major urban and small municipalities as it had done in the parliamentary elections. This was, in fact, the second political embarrassment that befell ZANU-PF. The first humiliation was when all of the urban constituencies voted all MDC members into Parliament, winning fifty-seven seats against sixty-two seats for ZANU-PF – a signal that it was losing urban political influence.⁵⁴ This downfall presaged trouble for the MDC as the ruling party sprung into ruthless action calculated to do only two things: “regaining control of institutions of local governance, and getting re-elected into council and parliament.”⁵⁵ It did not take much time before state interference with the day-to-day operational matters of the Harare city council intensified as the minister of local government, under whose jurisdiction the municipalities fell, became ZANU-PF’s watchdog over municipal matters and did everything in his power to stymie the growing influence of the MDC among the residents of Harare. By diminishing the influence of the MDC, ZANU-PF hoped that it would enhance its own importance without competition and tighten its control over Harare’s civic matters by salvaging territory lost to the opposition.⁵⁶ The first casualty of this strategy was the new MDC mayor, Elias Mudzuri. Upon seeing signs that he was moving swiftly to repair broken infrastructure and dilapidated amenities, resurfacing roads, restoring street lights, fixing water leaks, and having meetings with international donors to bring investment and aid to Harare, the minister of local government, Ignatius

Chombo, fired him in April 2003 on trumped-up charges of ineptitude.⁵⁷ Instead of allowing the MDC-controlled council to appoint a replacement from among its ranks, the minister decreed that he be replaced by a ZANU-PF functionary, Seke-sai Mawavarara, to head another commission like the Chanakira Commission.⁵⁸ Whereas the earlier commission had been appointed as a stopgap measure between then and the next municipal election, the second one was specifically intended to obstruct the MDC's influence and to repress Harare's growing prominence as the opposition's citadel. This marked the beginning of a trend by the ruling party of playing dirty and disruptive games to smudge any chances of political success for the MDC. Such tactics would have far-reaching ramifications for the water supplies of Harare and other MDC-controlled cities in the country as ZANU-PF sought to reclaim its lost political supremacy by any crude means necessary.

Acting on the pretext that it wanted to reestablish the lost "Sunshine City's" preeminence,⁵⁹ the commission, at the behest of central government, launched the now ill-famed "Operation Murambatsvina" (Restore Order) to destroy all illegal structures that had blemished parts of the city. The operation left hundreds of thousands of women, men, and children homeless and without access to food, water, sanitation, or health care. They were ordered to leave the city and return to the rural areas from whence they had presumably come.⁶⁰

Government critics were quick to see this blitz as an attempt by the government to conceal the fundamental question of urban decline under successive ruling party-dominated councils, as a report in the *Financial Gazette* summed it up:

Residents have been forced to dump litter in open spaces, posing a serious health hazard that had been boiling underneath as a result of the population explosion and the mushrooming of squatter shacks, now home to over 500,000 people. Raw sewage is also flowing in some suburbs.... Water supplies to swathes of Harare have largely been erratic with the eastern suburbs of Mabvuku, Tafara, Msasa Park and Greendale being the worst affected.⁶¹

State interference in the operational affairs of the city council created political and administrative crisis conditions that left the Harare municipality unable to focus competently on the residents' environmental concerns. On grounds that it intended to rescue Harare's deteriorating water and hygiene services, central government hatched another plan to appropriate what had historically been the city council's responsibility over water distribution, sanitation, billing, and revenue collection – provided for in the 1976 Water Act.⁶² Purporting that it was changing from supply- to demand-centered water-governance measures, the government annulled the 1976 Water Act and replaced it with the Water Act of 1998. The

new act also provided for the creation of a state water corporation, the Zimbabwe National Water Authority (ZINWA), to supervise the implementation of the new water-sector reforms sanctioned by both the IMF and World Bank, which underscored that water needed to be treated as an economic good and to be sold at a profit rather than as a “social good” whose cost of production was borne by the state. In 2005, the Cabinet ordered all urban municipalities to surrender all water-supply and sanitation functions, revenue-collection systems, and their engineers to ZINWA. Because Harare and other municipalities were financially dependent on water tariffs for the maintenance of water infrastructure and for the provision of social services to residents, this action naturally robbed the MDC council of much-needed revenue and led to its severe incapacitation. In 2006, under the supervision of the docile commission, ZINWA wrested the administration of water and sanitation from the Harare municipal council.

Harare residents, now accustomed to persistent water shortages, pipe bursts, and overflowing sewers in several townships, initially welcomed ZINWA in the fervent hope that it would resolve their pesky water problems. But after two years of ZINWA’s leadership, the residents of Harare had not reaped any significant benefits from the new parastatal as the state had claimed. Despite raising water rates for the residents on the presumption that this would enable it to meet its operational costs, water did not flow through the pipes and taps of most households. During this period, waterborne diseases, especially cholera, broke out regularly, for example, in Mabvuku and Tafara.⁶³

Before long, most Harare residents sympathetic to the MDC were quick to awaken to the ruling party’s political maneuverings and intentions.⁶⁴ As ZANU-PF intensified its strategy, forms of social protest began to surface. The first form of enduring social and political protest against ZANU-PF’s control of Harare’s municipal affairs has been MDC supporters consistently ousting it from power. From the municipal elections of 2002 until today (2021), ZANU-PF has failed to regain control of the urban municipalities. As a government, the ruling party has remained alienated from the urban people because of its dismal failure to tackle the very issues that saw it booted out of power in the first place: that is, the major service-delivery questions affecting them, and top of the list was frequent water shortages and poor sanitation. As urban studies scholar Amin Kamete notes, elections became one of the few remaining opportunities for the people to vent their indignation in an era in which democratic space was increasingly circumscribed by an insecure ruling party.⁶⁵ In between elections, residents protested the ruling party’s conduct. On March 20, 2007, for example, one hundred residents besieged Harare Town House calling for the dismissal of the commission that had been administering the city’s affairs for about twenty-seven months.⁶⁶ The residents also called for new municipal elections. Some of the protesters were members of a social movement organization called the Combined Harare Residents’ Associ-

ation (CHRA). Based in Harare and founded in 1999, CHRA has been involved in sustained struggles to advocate for the concerns of Harare's residents and "ensure enhanced civic participation in local government."⁶⁷ The CHRA chairperson leading the protest remarked: "Today, CHRA occupied the steps of Town House to send a clear message to the regime that Harare belongs to us, the residents of Harare. We will continue to demonstrate and hold other peaceful campaigns against the illegal commission until elections are held in Harare. VIVA CHRA!"⁶⁸ They demanded the ousting of the Harare commission after twenty-seven months of waning municipal governance services: "Roads are falling into a state of disrepair and water and electricity and refuse collection are becoming increasingly erratic."⁶⁹

The residents' disenchantment at the commission's lethargic performance was compounded by the news that ZINWA had taken over all water distribution responsibilities from the MDC-controlled councils. The residents, once again, represented by the CHRA, whose branches were in both low-density and high-density townships such as Mabvuku, Kuwadzana, Kambuzuma, Mufakose, and Highfield, clamored for the revocation of the capture of their duly elected council's responsibility, arguing that the move

further exposes the evil agenda of the regime towards urban citizens, particularly those living in Harare. . . . The takeover of our water infrastructure is evil, unjustified and illegal since there is no memorandum of understanding between the parties involved, and no mandate from residents.⁷⁰

It was not lost on the membership and executive of the CHRA that the government's justification for ZINWA's takeover was insubstantial and that the real reason was that the water crises emanated from the successive ZANU-PF councils' lackluster performance: "water woes arise from a combination of bad policies, partisan political interference, technical and financial problems . . . the water system belongs to Harare . . . it must be returned to its rightful owners [since] ZINWA does not own our water."⁷¹ Jabusile Shumba, CHRA senior programs officer in charge of advocacy, bluntly stated, "In all fairness, the coming of ZINWA heralded a new era . . . that of water shortages."⁷² It seems that regular protests were not viable as the ZANU-PF regime became increasingly repressive, especially following the passage of the Public Order and Security Act (2002), which prohibits public gatherings construed to have political connotations.⁷³ These protests did very little to reign in the ruling party's tactics of undermining and attacking a democratically elected local authority, and the water crisis problems confronting the city's residents continued as the Harare municipality was rendered nearly dysfunctional.

ZINWA's inability to mitigate the residents' chronic water shortages and cumulative sanitation problems cleared the way for a massive outbreak of cholera in August 2008 (which lasted until the first quarter of 2009);

by that date, the urban water supply in Harare had all but collapsed. The disease struck at a critical time when the country's economy was in a moribund state and had no resources to contain the outbreak. As a result, the epidemic ravaged Harare's townships, leading to high levels of morbidity and mortality and leaving in its wake several social, environmental, and political ramifications until the international community intervened. Cholera decimated at least 4,000 people and no less than 100,000 people fell ill, the majority of whom resided in the high-density areas of Harare, namely, Budiriro, Glenview, Kuwadzana, and Dzivarasekwa. In these townships, "the lack of water, sanitation facilities, information about the epidemic, healthcare services, all contributed to the ferocious nature of the epidemic," concluded a Human Rights Watch (HRW) report.⁷⁴ Amid Harare's water crisis and a dilapidated urban environment, cholera found perfect conditions to blossom and spread from the townships to the peri-urban areas and beyond. Some of these townships were built by the colonial state with few civic amenities and rudimentary water and sanitation systems and have continued over the postcolonial years to enjoy no more resources than they had before. Others – that is, Budiriro (which ironically means progress/achievement/success) and Kuwadzana ("to get along") – were built by the postcolonial state in the same areas where the colonial state had established African townships. Strikingly, even though northern suburbs, such as Greendale, Avondale, Vainona, and Borrowdale, had also experienced water cuts on a daily basis, the residents were not infected with cholera. They had better alternatives to the poor-quality water that ZINWA was pumping into urban homes. E. Doro, a resident of Borrowdale West, confirmed this fact: "Most residents prefer to use their safer borehole water because they do not trust City Council or ZINWA water and their fears have certainly been supported by the recent cholera outbreak in greater Harare, which was essentially a ZINWA water-related epidemic."⁷⁵

The unequal spread of the disease speaks to the continuing consequences of the colonial and racial segregation of urban space and how this shaped access to water and sanitation services provisions in Harare since independence. The major cause of cholera was unquestionably tied to perennial water shortages and sewer bursts leaking raw sewage, which forced people in the townships to resort to using contaminated water sources such as streams and shallow wells dug out of desperation. A woman from Mufakose identified only as Jane told a Human Rights Watch investigation team: "We're used to flowing sewage, it happens so often. I often see kids playing in the sewage, which is why I carry my children on my back. It becomes really smelly and there are flies everywhere and you feel like you want to run away from your home. Raw sewage is not meant to be seen." Her disgust was shared by other people interviewed by the HRW.⁷⁶

The epidemiological emergency was the culminating point of a growing political and economic crisis-in-the-making since 2000. For most of this period, Zim-

babwe experienced hyperinflation, an economic meltdown, the government's abuse of human rights against members of the opposition party, and a high unemployment rate, while Robert Mugabe and his party faced increasing international isolation due to, among other things, the violent land reform program that ejected White farmers from their farms.⁷⁷ Thus, the epidemic in many ways became a clear manifestation of the inability of the state and the local urban authorities to provide access to clean water and proper sanitation services.

A major political development in 2009 that promised to bring back economic recovery and hence the rehabilitation of Harare's water and sanitation infrastructure was the rapprochement between ZANU-PF and the MDC that resulted in the formation of a Government of National Unity (GNU). Notwithstanding the continued tensions between the two parties, the GNU gave hope for peace and development to both citizens in Zimbabwe as well as the international community. Aid began to flow into the country, and for the five years of the GNU's existence, the country stabilized economically and attention was paid to the restoration and improvement of water and sanitation infrastructure. In 2009, ZINWA was ordered to stop discharging its responsibilities to urban areas after four years of poor administration of the city's water supplies. For all its attempts to restore and stabilize water supply and sanitation services with help from several donors and governments, the impact of the GNU's initiatives was short-lived when the coalition between ZANU-PF and the MDC ended in 2013. Instead, ZANU-PF pushed for elections in the hope that it would win and govern the country and the urban areas without a partnership with the MDC. As the election campaigns gathered momentum, the ZANU-PF government, presumably scared that the MDC would, once again, win municipal elections and continue to govern municipalities including Harare as it had done since 2000, intruded into municipal operation matters. This time, without consulting the urban councils, the minister of local government, Ignatius Chombo, issued a directive to all municipalities to set aside all the residents' municipal debts. This move was intended, firstly, to cast the ZANU-PF government as a "pro-poor" and caring people's party unlike the MDC and, secondly, to liquidate urban councils' finances, thus crippling their capacity to deliver services to their ratepayers and trigger dissatisfaction against the majority MDC councilors.

While ZANU-PF went on to win the parliamentary and presidential elections, it once again lost in the municipal elections. The minister of local government intensified his interference in the operations of the Harare city council, once again dominated by an MDC majority of councilors, until the Mugabe government was overthrown in a military coup in November 2017 that installed his former deputy, Emmerson Mnangagwa, who he had removed.⁷⁸ All the economic gains that were becoming evident between 2009 and 2013 were quickly wiped out as ZANU-PF, now in control of the state, became more intolerant, and investors and donors simply withdrew their support for reforms. The period was characterized by

a decline in economic growth, a severe liquidity crisis, and a lack of foreign investment.⁷⁹ The water and sanitation services in Harare were once again caught up in this economic downturn. The Human Rights Watch 2013 report on Harare's "troubled water" was more to the point when it asserted that "water and sanitation conditions for the millions of people who live in high-density areas remains almost the same as it was in 2008," and hinted that "typhoid, another waterborne disease, continued to pose a serious threat to the health of Zimbabweans, underscoring the need for the government of Zimbabwe to provide these most basic services to its population."⁸⁰ Within a year of President Mnangagwa's seizure of power from his former mentor, Harare was hit by another cholera epidemic in September 2018, and by November 21, 2018, 10,202 cases of cholera and fifty-five confirmed deaths had been registered.⁸¹ The same two high-density suburbs – Budiro and Glen View – that had been the hotbeds of the 2008 – 2009 cholera epidemic were, once again, the centers of this latest outbreak. Once more, the second major outbreak of cholera within a decade laid bare the depth of lingering inequalities in Harare and the extent to which its residents' hopes of ever accessing good-quality potable water remained a pipe dream. The response from a government that was still crippled by international sanctions and grappling with how to inject life into a moribund economy was too slow. Local and international NGOs and donors rushed to the aid of government.

In spite of commitments and public assertions by cabinet ministers and officials at various government levels to resolve the water and sanitation infrastructure problems the City of Harare and other cities and towns were facing and "often referencing the cholera crisis as a tragedy that cannot be repeated,"⁸² the two outbreaks of this deadly waterborne disease have shown that access to clean water for the urban residents of Harare remains a perennial challenge.

For all its pronouncements as a self-defined avowed revolutionary government that had liberated the oppressed rural and urban African masses from the yoke of colonialism and committed itself to the radical transformation of their lives by improving their access to water, a central resource to the survival of the urban poor, why did the Zimbabwean government fail to fulfill this commitment? While the colonial policy of racial segregation led to differential, regulated, and inadequate access to water for Africans in colonial Harare, an array of interlocking factors is behind the reasons why the government of Zimbabwe has not fulfilled its objectives. Upon the assumption of power, the Zimbabwean government spent the first two decades of independence paying little attention to the creeping problem of urban population increase and failed to appreciate the importance of augmenting water supplies and repairing or introducing new water infrastructure. The government began to face myriad political and economic crises, which significantly included the ruling party's political survival from the late 1990s, and financial resources to repair, maintain, and guarantee regular

water flows to the residents of Harare since 2000 simply dried up. Consequently, “the neglect of urban areas, however, proved to be short-sighted and later on came to haunt the state,” as Manzungu and colleagues have noted.⁸³ There was already a lack of resources to improve urban water supplies following the fiasco of the IMF and World Bank–sanctioned Economic Structural Adjustment Programme (ESAP) that the Zimbabwean government embraced between 1990 and 1995, which led to massive rates of unemployment.⁸⁴ Instead of opening up the economy to market forces, the economy shrunk.⁸⁵ Whereas prior to the introduction of ESAP, the state had been supporting residents with low-cost urban water supplies, this program obliged the state to abandon the treatment of water as a “social good” and compelled it to treat it as an “economic good.” That way, the state could recover costs of delivery and purification and generate some profit. What followed, hot on the heels of the ESAP debacle, was “the cataclysmic decline of the Zimbabwean economy” as historian Brian Raftopoulos has characterized it.⁸⁶ On November 14, 1997, the Zimbabwe dollar “lost 74 per cent of its value within a four-hour period,” following the government’s two surprise decisions: 1) to make large payments to liberate war ex-combatants; and 2) to involve the Zimbabwean army in the struggles of the Democratic Republic of the Congo. This had a massive and negative knock-on effect on the country’s savings and financial systems such that “after 2000, the economy spiraled rapidly into a world record decline.”⁸⁷ By 2008, Zimbabwe’s hyperinflation had soared to the height of 230 million percent and severely eroded people’s paychecks, returns and dividends, earnings, and savings.⁸⁸ One upshot of hyperinflation was that the government was forced to use the U.S. dollar in all financial dealings. With depleted foreign savings, the government lacked the foreign currency to acquire water purification chemicals for the city. It did not help that at such a time of dire need, the Zimbabwean government lost international donors and potential investors following its infamous Fast-Track Land Reform Program meant to return land to Black people. The contentious politics between ZANU-PF and the MDC also contributed to the water crises in Harare and the ruling party’s failure to provide water to the urban residents. Ever since ZANU-PF’s serial loss of municipal elections to the MDC in urban areas from 2000 onward, it has adopted a disruptive political strategy of interfering with the operations of the Harare city council. The ruling party has treated the MDC as its archenemy since its formation in 1999, its rising popularity in urban areas, and the threat it posed to ZANU-PF when it nearly won a majority in the 2001 parliamentary elections. That the MDC has been winning all or the majority of the municipal elections in urban areas since 2000 has been a thorn in the ruling party’s flesh.⁸⁹ In response, the ZANU-PF government orchestrated a disruptive and, at times, vicious and violent agenda to frustrate the MDC’s popularity and effectiveness. Thus, it singled out control over water as the most effective instrument to cripple the MDC-led city council. Rather than spending time work-

ing jointly with the city council to come up with water development projects, the central state elected to circumscribe the activities of the MDC council in order to cast it to the urban populace as incompetent and not worthy of being voted back into power. But as urban voters kept returning the MDC council in all elections, so too did ZANU-PF intensify its authoritarian assaults. In the process, the political fight with the Harare municipal council, including the appointment of ZINWA as the urban water governing institution, and the dismissal of mayors and councilors achieved only one thing: the creation of perennially inadequate and erratic water and sanitation services, resulting in poor-quality water delivered through municipal taps to urban residents. It is without question that the outbreak of the cholera epidemic that decimated four thousand people, mostly in Harare, was easily linked to these deleterious conditions. All in all, as the ruling party's political fortunes and hopes to win back the hearts and minds of urban voters progressively waned, its interest in ever resolving their genuine grievances around water and sanitation also diminished as it employed tactics that alienated it from the people rather than endeared it to them. Herein lies the ZANU-PF government's complete failure to provide water for its urban people.

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Water for Bongo: Creative Adaptation, Resilience & Dar es Salaam's Water Supply

Matthew V. Bender

Global climate change poses a serious threat to the water supplies of the world's cities. This is perhaps no truer than for Dar es Salaam, the largest city and commercial capital of Tanzania. What was eighty years ago a small town of a mere forty thousand residents is today the world's second-fastest growing city, with a population of more than six million. This growth has come despite a history of racist, colonial urban development and the inadequacy of its formal water supply, which services a fraction of the needs of its residents. This essay examines the development of Dar es Salaam's anthropogenic waterscape, or water infrastructure, and argues that the city's tremendous growth has come despite its inability to provide basic services. In the absence of reliable public water, its residents have adapted creatively, developing their own solutions in a way that has drawn on knowledge and practice from rural areas as well as new urban-centered strategies. This history of creative adaptation, and its benefits and drawbacks, provides a useful framework for thinking about the meaning of resilience in Africa's urban centers in an era of increasing climate uncertainty.

Dar es Salaam, the seaside commercial capital of Tanzania, has recently become Africa's fifth-largest city.¹ Just eighty years ago, the city was a small coastal town with a mere forty thousand residents, an afterthought compared with cities such as Lagos and Johannesburg. Since the 1960s, population growth rates averaging 5 percent have pushed the city to the forefront of Africa's burgeoning urban centers. Now the world's second-fastest growing city, Dar is on track to become a megacity – with a population exceeding ten million – before 2030. One of the most striking aspects of Dar's rise is that it has come without the benefits of much formal planning. Like many cities in the Global South, a large percentage of its population, roughly 70 percent, live in informal settlements. Furthermore, the city has been among the world's worst when it comes to formal water access. Nearly 80 percent of residents lack access to piped water in their homes or plots. For those fortunate to have these private

connections, quality is questionable, reliability is poor, and twenty-four-hour availability is rare. The city's growth has come, in many ways, despite the poor availability of water.

Global climate change poses a serious threat to the water supplies of the world's cities. This is especially true for African cities such as Dar es Salaam, which have experienced high rates of population growth amid endemic poverty and histories of racist, colonial urban development. The term "resilience" has become popular in the literature to describe the process of preparing urban spaces and their populations for the challenges that will inevitably come from higher temperatures, rising sea levels, and lower precipitation. Yet as some scholars have noted, the term itself is poorly defined, existing definitions are inconsistent and underdeveloped, and the expression has not adequately taken into account the question of context: resilience for whom and to what, when, where, and why?² The case of Dar es Salaam adds an additional question to these interrogations of the term. If resilience is inherently about the need for adaptation, how do we account for, and possibly leverage, the long history of adaptation shown by urban dwellers? Might part of the solution to developing a more resilient Dar es Salaam lay in its past?

This essay proposes an answer to these questions by analyzing the history of Dar es Salaam's anthropogenic waterscape. This term refers to the human-built water infrastructure of the city: the amalgamation of formal and informal waterworks, both surface and subsurface resources, and the social structures that manage them. This essay argues that the history of the city's development is one of creative adaptation in the face of inadequate provision of public services. The lack of adequate water service (as well as other amenities) dates to the city's founding as a segregated space under colonial rule and was perpetuated by post-colonial policies that favored rural over urban development. Dar es Salaam's water system, designed from the start to provide water unevenly, has not scaled to meet the needs of new users, and has become increasingly unreliable to existing ones. Yet the ineffectiveness of Dar's formal water system has not hindered urban growth. Rather, urban communities have employed a number of strategies to ensure sufficient water to survive, if not thrive. The most recent of these approaches is private vending, which provides the predominant supply of water to the rich as well as to the poor. This spirit of adaptation is embodied in the city's nickname, Bongo, a term that implies cunning and street smarts. While these innovations have allowed the city to grow astronomically, they have not come without drawbacks, such as high cost, low rates of consumption, and related health impacts. Dar's changing waterscape, a case study in urban adaptation, thus indicates a need to rethink notions of resilience in a way that recognizes the long history of Africa's urban populations adapting to difficult and changing circumstances.

The uneven development of Dar es Salaam's anthropogenic waterscape owes much to the city's colonial origins. Dar is a relatively young city, born in the mid-nineteenth century just before the onset of colonial rule. In 1862, Sultan Majid of Zanzibar chose a small fishing village named Mzizima as the site for a new town that would be a hub for plantation agriculture and long-distance caravan trading.³ Centered on a large natural harbor, it was named Dar es Salaam, a name likely derived from the Arabic for "Harbor of Peace."⁴ In the late 1880s, the town came under the control of the German East Africa Company and, on January 1, 1891, became the capital of German East Africa. Under German control, the town grew rapidly as a center of colonial and military administration. Its commercial fortunes came more slowly, but with the completion of the Central Line of the railway in 1914, Dar es Salaam emerged as the most economically important town in the colony.

As a coastal town, Dar es Salaam was defined by its natural waterscape. Its predominant maritime feature, and reason for being, was its natural deep-water harbor. The rest of its coastline blended sandy beaches and mangrove swamps. While a number of small freshwater streams passed through on their way to the ocean, the town did not feature a major river or large lake. Rainfall was one of the most abundant sources of freshwater. As for much of the coast, rain fell in a bimodal pattern, with a long season from March to May, and a shorter season spanning October and November. This meant that freshwater availability was highly uneven, with periods of alternating abundance and scarcity. The most abundant source of freshwater was the Dar es Salaam Quaternary Coastal Aquifer, lying underneath the region.⁵ By the turn of the century, this source of groundwater had become the primary source of drinking water for the burgeoning town, made available through springs and man-made boreholes.

Like most colonial cities, Dar es Salaam developed as a segregated urban space. The town's initial footprint consisted of three concentric zones: a commercial and administrative core, surrounding shamba fields, and outlying villages.⁶ These divisions reflected not only the use of the land, but also the people who lived there (ruling class, unfree labor, and peasant). With the town's swift growth at the turn of the century, the Germans developed a formal plan for urban development in 1914. According to historian James Brennan, the German Building Code called for the city to be divided into three zones based on racial categorization: one for Europeans, one for Asians, and one for Africans.⁷ Each zone would be developed according to different building and sanitary standards. The plan remained on the drawing board due to the onset of World War I. In 1916, German East Africa came under the effective control of the British, and after the war, it became the Tanganyika Territory, a League of Nations Mandate under British administration. The new government largely adopted the plan developed by the Germans, using building and sanitation codes to create a Dar es Salaam with three areas: a

Zone I for European residences, a Zone II for government and commercial buildings and Asian residences, and a Zone III for “native” quarters, separated from the other two zones by a three-hundred-yard sanitary “neutral zone.”⁸ Conformity to building standards, rather than legalistic segregation, proved the main tool for building this divided urban landscape.

The city’s segregated development can be seen in the making of its anthropogenic waterscape. For its first fifty years, it lacked a public water supply. Rather, urban dwellers relied on unprotected surface resources, cisterns, and boreholes. The uneven nature of development and the absence of regulation, combined with the lack of sewerage, meant that water quality was questionable even in the wealthiest neighborhoods. In 1919, the town opened its first public water system. The Gerezani works consisted of four wells from which water was piped to users primarily in Zones I and II.⁹ This small scheme proved vulnerable to seepage and salt-water intrusion, and quickly proved inadequate in terms of scalability. In 1951, the city commissioned a new supply at Mtoni, just south of the city.¹⁰ Like its predecessor, this system mainly supplied neighborhoods in Zones I and II, as well as limited areas in Zone III. In the late 1950s, the city augmented Mtoni by developing a new supply from the Ruvu River, 65 kilometers to the west. This represented the first time the city procured water from the rural periphery. The Upper Ruvu works, designed with a capacity of 18,000 cubic meters of water per day, consisted of an intake, a treatment facility, and a cast-iron transmission pipe that carried water to the city.¹¹ Though the system produced some water meant for formal African areas, such as Kariakoo and Ilala, the bulk of the water went to commercial and government users, as well as residents of European and Asian neighborhoods such as Upanga, Oyster Bay, and Msasani.¹²

African residents of Dar es Salaam were for decades a second thought when it came to the city’s water infrastructure. This mirrored the history of urban planners neglecting formal planning in areas designated for African settlement, a pattern common in many African colonial cities. The decision to prioritize Zones I and II had an impact not only on the service area, but also on consumption. Figures for the city’s Public Works Department show that between 1933 and 1938, Africans consumed just 3 – 4 liters of water per day, compared with 140 – 195 liters for Europeans and 34 – 65 liters for Asians.¹³ Despite this, the African population of the city grew substantially over the first half of the century. Whereas the European population rose from one thousand to five thousand between 1940 and 1957, and the Asian population from under nine thousand to more than thirty thousand, the African population grew from 34,750 to 93,363.¹⁴ This occurred in part from the rising population within Zone III, but more so due to the incorporation of polities beyond the formal boundaries of the city: peri-urban villages, such as Mikoroshoni and Buguruni, as well as informal settlements. These communities became thriving population centers without the benefits of formal planning or public goods.

In the early 1960s, Tanganyika gained independence, and Dar es Salaam emerged as the political and commercial capital of the new nation of Tanzania. Rather than improving the water situation, the first decades of independence exacerbated the problem. Much of this owed to explosive population growth. Before 1961, the city had a relatively slow growth rate of 2.6 percent per annum.¹⁵ Since independence, the rate has averaged in excess of 5 percent. According to urban development scholars Peter Siebolds and Florian Steinberg, the 1960s and 1970s saw the highest rates of growth, with an average of 16.6 percent per annum from 1967–1973 and 24 percent from 1974–1976.¹⁶ In terms of overall population, the city grew from 128,000 residents in 1957 to 151,000 in 1963 and 800,000 in 1978.¹⁷ The period also saw a shift in racial demographics. Between 1957 and 1967, the African population of the city rose from 93,363 to 272,821, mostly due to rural-urban migration.¹⁸ Meanwhile, both the Asian and European populations shrank, from 29,986 and 4,479 to 29,192 and 3,547, respectively. As time passed, the city became predominantly African yet highly diverse, with a population comprised of dozens of ethnicities. It also remained young, with over three-quarters of its residents under the age of thirty-five, and it had a rising proportion of women to men (from 42 percent in 1957 to 46 percent in 1978).¹⁹ The majority of the city's growth occurred along the four main arterial routes into the city: Bagamoyo Road, Morogoro Road, Pugu Road, and Kilwa Road.²⁰ These new settlements formed a mosaic consisting of peri-urban villages enveloped by urban expansion such as Manzese and Segerea, formally planned residential areas such as Kijitonyama and Sinza, and informal settlements such as Ubungo and Makongo.²¹

Amid this explosive growth, the city suffered from the development priorities of the new government, which privileged rural areas. Julius Nyerere, the first president of Tanzania, and the ruling party, the Tanzania African National Union (TANU), felt that the country's future lay in transforming rural areas into the heart of development. In 1967, the government issued the Arusha Declaration, which laid out an ambitious economic policy called *Ujamaa*.²² Through *Ujamaa*, Nyerere aimed to recreate the economy along the lines of African socialism, with cooperative villages becoming the locus of agricultural export production. This new policy led to the redirecting of resources to rural areas, most notably through a villagization scheme known as *Ujamaa Vijijini*, which established new planned villages throughout the country complete with schools, health clinics, water, and electricity.²³ As an incentive for people to relocate, the government's newly created Water Development Department embarked on a massive rural water development program, the Rural Water Supply Program. Furthermore, the government promised to provide water to rural users for free. The Free Water Policy became a cornerstone of rural development policy in the 1970s.

By comparison, urban areas received much less attention. For Dar es Salaam, the most significant water project during the period was the development of a

third water supply, the Lower Ruvu system. Commissioned in 1976, this scheme tapped the Ruvu River 22 kilometers downstream of the existing Upper Ruvu works, around 55 kilometers northwest of the city.²⁴ From there treated water was pumped to storage reservoirs at University Hill, from which secondary distribution lines brought it to users, mostly in the wealthier northwest part of the city. Aside from this project, and some expansion of the existing Upper Ruvu works, the city made little investment in extending the formal water supply, and almost none in maintenance. While other African states stressed rural development as well, few regarded urban spaces with as much contempt, or starved them of resources, as did Tanzania.

The TANU government made other changes that negatively affected Dar. In 1973, the government announced plans to move the national capital to Dodoma, which led to the commitment of vast resources to develop what was essentially a brand-new city.²⁵ This followed a year after TANU embarked on a program of “decentralization,” whereby it reorganized the structures of local governance inherited from the colonial administration. For Dar, this resulted in the abolition of the town council and its replacement with three district councils: Ilala, Kinondoni, and Temeke.²⁶ This fragmented city governance made it difficult to deal with problems (such as water provision) requiring coordination at the city or regional level. At the same time, the national government replaced local taxes with a direct government tax, which gave it more control over city finances. For a four-year period, the three municipal budgets were essentially frozen. This starved the city of needed resources, in particular for infrastructure maintenance, which resulted in the deterioration of the water system. The government reversed course in 1977 with the creation of a Water Board for the city, and again in 1981, with a new parastatal called the National Urban Water Authority (NUWA).²⁷ However, these initiatives did little to solve for the systemic problems that had been created.

These changes had the effect of stifling infrastructure development in Dar es Salaam at the same time that the city was experiencing exponential growth. The lack of resources allocated to formal water development resulted in systemic problems. For one, urban planners did not have the resources to expand the system to reach the growing base of potential users. Users in the wealthier, northern neighborhoods of the city received better access to the infrastructure improvements than others. Second, the fracturing of city governance and the lack of resources contributed to a maintenance crisis. Older parts of the system experienced more frequent failures due to breakage and corrosion. Lastly, payment collection became less efficient, due in part to poorly staffed offices, but also to the lack of desire of residents (in particular, recent migrants from the countryside) to pay for unreliable water. This reflected a problematic divide in the nation’s water policy, whereby urban users had to pay for a resource given to rural residents free of charge.

How do we explain Dar es Salaam's rapid growth in the absence of an adequate public water infrastructure? The answer lies in creative adaptations made by the city's residents, particularly those in the poorest neighborhoods. Since the early years of the city, African populations relied on their own ingenuity to procure water for their homes and businesses. The knowledge and practice that informed these strategies owe much to the rural origins of most of the population, and the influx of rural knowledge remains a part of the city's growth. Environmental historian Emily Brownell points out how the city's population has continuously brought the rural into the urban. By drawing on resources, ideas, and practices from the rural, these urban populations engaged in "an ongoing process of negotiating the opportunities and struggles of the city through seeking the relief of rural resources rather than a finite transition from the village."²⁸ Though Brownell does not focus specifically on water, it is a good example of the process she describes. In most African neighborhoods, residents developed local strategies for procuring water that drew upon knowledge and practices employed in rural areas. This enabled them to remain resilient in an urban landscape with uneven and inadequate provision of services.

A key strategy adopted throughout these communities was multiple sourcing. In rural areas of the country, such as Kilimanjaro, communities developed multiple-source water economies by which they procured water from different locations, for different purposes, over the course of the year.²⁹ This practice acknowledged environmental factors such as seasonal variability and the unpredictability of rainfall, where certain streams and springs, as well as rainwater catchment, might be available at only certain times of the year. It also reflected the role of personal preference, where users preferred water with certain characteristics (taste, salinity, turbidity) for certain tasks, and made trade-offs based on the distance required for fetching water.

Multiple-sourcing allowed urban users to make use of a range of sources available to them, both naturally occurring and man-made, and also to incorporate new kinds of sources as they became available. In the first half of the century, African neighborhoods had access to up to four types of sources: streams, springs, captured rainfall, and boreholes. In choosing sources, users made decisions based on quality, availability, and the amount of labor required in fetching water (which could consume hours per day). Typically, women organized this work, and therefore held the role as arbiters of the household water supply. Both women and children engaged in the work of fetching water, using either clay pots or metal jerrycans. Boreholes were often the most desirable source, as they generally provided cleaner, more reliable water and could be dug closer to homes, thus requiring less work to fetch. Therefore, neighborhoods tended to be dotted by shallow wells, dug by individual users or as partnerships among several households. By the 1950s, public taps, or standpipes, became more common in formalized African neigh-

borhoods. While these proved popular among some users, they did not outright replace other sources of water. Rather, they became part of a menu of options of which users took advantage.

In the past two decades, private water vending has become a prominent part of Dar es Salaam's anthropogenic waterscape. This involves water that is resold by a private entity to end users. As noted by UNDP Senior Water Advisor Marianne Kjellen, this can take many forms.³⁰ The most basic consists of an individual or business selling water from their private water connection or borehole. Others involve home delivery, carried by hand, carts, bicycles, or tanker trucks. As much as 50 percent of the population relies, at least in part, on private vending to secure water. It provides not only for users in poorly serviced formal and informal neighborhoods, but also wealthier households dissatisfied with their tap water service. The proliferation of vendors, many of whom are local entrepreneurs, embodies the notion of Dar es Salaam as Bongo, a city of residents whose resilient spirit enables them to thrive despite the odds. And it has a number of benefits. It has allowed for urban growth not constrained by the limitations of formal infrastructure. This is reflected in the physical shape of the urban sprawl, which follows transportation routes rather than water infrastructure. It also has eased people's dependence on the formal water infrastructure with its poor track record of reliability. And it is generally better quality than unprotected surface resources such as streams, which have become less clean and reliable over time.

There are significant drawbacks, however. Foremost, private water is expensive. The cost for water from vendors can be as much as thirty times the price of water from a piped connection.³¹ Actual prices vary dramatically depending on location and whether fetching is involved. Kjellen, in a 2000 study on water vending, notes a going rate of 20 Tanzanian shillings (TSH) per 20-liter jerrycan for water fetched by the user directly from a vendor.³² Prices rise steeply for water delivered to one's home. The price for vendor-delivered water averages TSH100 per jerrycan, or TSH5 per liter. Neighborhoods closest to pipe infrastructure, such as Temeke, have lower average prices (TSH50 – 70), while those further away (such as Kiwalani), or at higher elevation (parts of Ubungo), have prices ranging from TSH150 – 200. Furthermore, prices vary depending on supply and demand and therefore spike during times of heightened scarcity, such as a drought or a breakage in the vendor's supply. On the whole, these prices do not compare favorably with those of public sources. Kjellen notes that people collecting from public standpipes typically pay TSH10 – 20 per jerrycan (TSH0.5 – 1 per liter), while those with direct connections to the public water supply (who pay a flat rate) average TSH0.3 per liter.³³ The pattern that emerges is that users in the poorest neighborhoods pay the highest rates for their water, and likewise spend the most time per day fetching it.

Another drawback tied to cost is the relatively low rate of consumption for the city's poorest households. Geographer Sarah Smiley's 2016 study of urban wa-

ter availability and reliability notes that lower-income African neighborhoods in the city have an average consumption rate of just 29 liters per person per day,³⁴ whereas a UNDP report from 2016 found that residents in Oyster Bay, home to many diplomats and expatriates, use an average of 166 liters.³⁵ This represents almost a six-fold increase for users in wealthy neighborhoods. The much lower rate of consumption in poorer neighborhoods can be attributed to the high cost of water as well as the time and effort needed to fetch it. Given the premium paid for delivered water, and the labor burden of procuring water from distant sources, many households have no choice but to make do with smaller quantities of water.

Low rates of consumption, in turn, contribute to other problems. According to the World Health Organization, between 50 and 100 liters of water per person per day are required to ensure that basic needs are met.³⁶ Many neighborhoods in Dar average well below this, with implications for hygiene and sanitation such as infrequent bathing and cleaning. This exacerbates the health risks already inherent in private water. Most vendors are unregulated, and many procure water from wells that are not registered or tested for quality. Given the lack of improved sanitation or sewerage in most neighborhoods, many water sources are prone to contamination, especially during the rainy seasons, when floodwaters often overrun poorly protected sources. This raises the potential for disease outbreaks. According to environmental scholar Caroline Kihupi and colleagues, the city has experienced localized outbreaks of cholera every year since 1974, with a case fatality rate averaging 10.5 percent.³⁷ And a recent study by urban planner Tumpale Sakijege, based on research in the city's Goba settlement, notes a connection between private vending and outbreaks of typhoid, diarrhea, and dysentery.³⁸

Perhaps the biggest drawback to private vending is the extent to which it represents the commodification of a basic human right, the high cost driven by necessity rather than by design. Users pay inflated sums for a vital resource that, at least in theory, should be available at a much lower cost. It is an ironic outcome of the *Ujamaa* era. Whereas Nyerere's government attempted to decommodify water in rural areas by making it free, it essentially encouraged its commodification in urban areas, not merely by allowing water utilities to charge for it, but by underserving the population and giving them little option but to resort to private vendors who charge for it by volume. While there are many examples of people resisting the commodification of water, through creating illegal connections to the piped network or stealing from public taps, there is nonetheless widespread dependency on expensive, purchased water. The uneven commodification of the resource, which most impacts the poorest, therefore perpetuates social inequities that have long been part of the city's history.

Despite the drawbacks of private water vending, it has become a cornerstone of Dar es Salaam's multiple-source water economy. In many ways, it embodies the resilient spirit of Bongo. Despite the uncertainties and hardships associated with

procuring water, people have made it work. The opportunities associated with urban living simply outweigh the drawbacks. And several studies have shown that, despite the challenges, human development indicators are better for urban populations in Tanzania than for rural ones. Nonetheless, the water situation in Dar es Salaam is far from optimal, and the city's growth raises the question of how much longer these systems will be sustainable.

Meanwhile, the national and municipal governments have addressed the city's water supply issues largely through attempts at redeveloping the formal infrastructure. This has been a struggle. Decades of underinvestment in capacity, amid population growth and the nation's near economic collapse in the early 1980s, have resulted in a piped water supply both unreliable and unable to service many neighborhoods. In 1991, the Japan International Co-operative Agency (JICA) released a study on a proposed rehabilitation of the city's water system that highlighted the numerous problems.³⁹ It noted that the water supply was in "very bad condition – insufficient water supply, low pressure, deteriorated facilities, [and] leakage from pipelines." Some of the specifics were particularly damning. Only 30 percent of the system's water was actually consumed through registered connections, meaning that 70 percent of water was unaccounted for through leakage (35 percent) and illegal connections (29 percent). Few new pipes had been laid since the 1970s, except for a proliferation of narrow-gauge PVC connections to end users that were prone to breakage. The Mtoni works, in particular, was plagued by the worn-out condition of the facilities and a shortage of intake water. JICA's plan proposed a redevelopment of the existing works, with the overall goal of covering 80 percent of the city's existing population with 27 liters of water per capita per day, as well as a reform of NUWA to make it self-sufficient through collection of fees and arrears. Notably, the plan did not expand the footprint of the system, but rather called for the development of a long-term strategy to address the city's growing population.

Though many of the plan's elements were implemented, the system remained plagued by underfunding and poor management, amid growing demand for water. The Tanzanian government sought additional funding from the World Bank and, in the late 1990s, managed to negotiate a long-term rehabilitation loan. The loan included a number of conditionalities, reflecting a broader push by the development community to encourage structural change in Tanzania and other African states. Under pressure from the World Bank, in 1997, the Ministry of Water Affairs transformed NUWA into a new entity, the Dar es Salaam Water and Sewer Authority (DAWASA), and it began developing a plan to privatize the utility. The general thinking was that a private utility could succeed in revenue collection and system rehabilitation in ways that the parastatal had failed. In August 2003, as its population passed 2.5 million, the city leased its water supply to City Wa-

ter Services, a joint venture between British, German, and Tanzanian companies, for a period of ten years.⁴⁰ City Water assumed management of DAWASA, with the stated aims of improving revenue collection and rehabilitating infrastructure. Within months, the water situation in the city worsened, with a combination of new breakages, delayed repair and redevelopment projects, tariff increases, and unpopular shutoffs for nonpayment. Less than two years after its inception, the privatization came to an abrupt end with the termination of the City Water contract, the deportation of company leadership, and the filing of multiple lawsuits. The government handed the water supply over to two new parastatals: a reconstituted DAWASA to distribute water and handle payments and DAWASCO (Dar es Salaam Water and Sewage Corporation) to manage infrastructure. The failure of privatization in Dar mirrors the experience of other African cities, notably Johannesburg and Cape Town, where these programs resulted in skyrocketing prices and poorer service.

In the years since the renationalization of the water supply, the performance of DAWASA has been mixed. By some measures, it has made progress in extending the reliability, reach, and quality of piped water. The number of residents with access to piped water within 200 meters of their homes has increased to 75 percent.⁴¹ Hundreds of millions of dollars have been invested by the World Bank and NGOs to improve water infrastructure. And partnerships between community-based organizations and NGOs have led to the improvement of water supplies in a number of informal communities. Yet studies indicate that serious challenges remain. For example, a 2012 survey of users conducted by Tanzanian NGO Twaweza found that 76.9 percent of the city's households lacked access to water via a tap inside their home or plot.⁴² And research by Smiley has shown that accepted standards for availability (distance to an improved water supply) and reliability (whether or not water is regularly available) do not adequately reflect the lived experience for many people in Dar.⁴³ Perhaps the most daunting problem is the continued population growth of the city, which effectively keeps pushing back the goal line.

Looking forward, Dar es Salaam faces a number of challenges related to its water supply. Global climate change poses some of the most daunting. According to a 2018 report by the United States Agency for International Development, Tanzania ranks as the twenty-sixth most vulnerable country to climate risks.⁴⁴ The report projects a number of changes to the climate by the year 2050 that include increased average annual temperatures of 1.4 to 2.3 degrees Celsius, increased duration of heat waves and dry spells, increased frequency and intensity of heavy rainfall, and a rise in sea levels of between 15 and 42 centimeters by the 2050s. These changes will in turn threaten agriculture, ecosystems, energy production, infrastructure, and human health, as well as the availability of water resources.

Dar es Salaam's waterscape illustrates the depth and interconnected nature of these challenges. Climate change will exacerbate rainfall seasonality, producing more intense dry periods and more intense rainfall events during the rainy periods. For the Ruvu watershed, the result will be a heightened risk of pollution from heavy rainfall during the rainy seasons, but an overall decrease in runoff that will increase water stress to the city as well as to Morogoro, Kibaha, and Dodoma. The reduction in available clean surface water will force a greater reliance on groundwater, which is itself under threat. Over the past several decades, the aquifer under Dar es Salaam has been threatened by saltwater intrusion, resulting from overextraction of fresh water.⁴⁵ Rising sea levels will exacerbate this phenomenon, leaving many existing boreholes with water too salty for consumption, limiting the viability of new boreholes, and forcing populations away from low-lying areas that are prone to flooding or lack access to drinking water. The problems posed by climate change dovetail with the challenge of continued population growth. If its current rate holds (around 5 percent per annum), the population will reach 13.4 million by 2030. By 2050, it could exceed twenty million. The city's growth will likely be exacerbated by the negative impacts of climate change in rural areas, resulting in even greater rural-urban migration, which could increase the service gap at the same time that urban planners are trying to narrow it. This is a problem faced by other African cities as well, including Lagos, Kampala, Nairobi, and Maputo.

How does one build a modern water infrastructure for a city that has a history of uneven development and is growing faster than pipes can possibly be laid? Part of the answer lies in leveraging Bongo's history of creative adaptation in the face of urban challenges. The city has grown by leaps and bounds despite the fact that its government has been unable, and at times unwilling, to provide adequate, safe, and reliable water to its people. It has done so through local initiative and with the knowledge and practice generated by local communities in response to the challenges they face. Despite the many drawbacks of these solutions, they embody the Bongo spirit of flexibility and dynamism.

Yet the solutions cannot be strictly local. The tandem of climate change and population growth will continue to strain existing water sources, necessitating large-scale projects that will bring in more water from the countryside. The best prospect for successful water development seems to be at the intersection of the formal and informal, the large-scale and community-based. While much of the World Bank's funding has targeted the formal water supply, some of the most impactful developments (such as community boreholes in informal settlements) have been done by partnerships between local communities and NGOs. In some areas, local Water User Associations have been developed to facilitate local engagement with the water supply. These groups have the ability not only to lead to more relevant development projects, but also to change community perceptions

of water supplies (such as discouraging illegal connections and encouraging compliance with payment schemes). In short, the best strategy may be for the Tanzanian government, the World Bank, national development agencies, and NGOs to direct more resources to community projects that draw on local knowledge and expertise, while investing in a modern, flexible, scalable water infrastructure.

Dar es Salaam encourages us to think more deeply about the place of local knowledge and expertise in the development of urban resilience strategies. For over one hundred years, the city has grown and expanded despite the lack of adequate public services, largely through the adaptability, initiative, and dynamism of its people. The need for water, a necessity of life, exemplifies the extent to which communities thrived against the odds. Urban dwellers built a dynamic, thriving urban life without the benefit of the expansive, formal water infrastructures common in the cities of the Global North. Despite the drawbacks of these solutions, they nonetheless represent a capacity for local innovation that should be part of urban resilience strategies. While the challenges posed by climate change are indeed serious, they can be made more manageable by leveraging not only new innovations but also the city's spirit of creative adaptation.

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Everyday Experiences of Water Insecurity: Insights from Underserved Areas of Accra, Ghana

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At least half of Accra's residents do not enjoy safe, secure, and affordable access to water on a regular basis. Focused on underserved communities in and around urban Accra, this essay highlights the meanings and importance of water insecurity for residents' daily lives. In particular, this essay extends beyond the well-established ways that the lack of safe and affordable access conditions poor public health outcomes, to a broader understanding of well-being informed by residents' own experiences of irregular and insecure access to water. This essay thus seeks to broaden understandings of water insecurity beyond the basic and minimum access required for daily needs, and to consider broader social-contextual dynamics, such as reported experiences of stress or conflict, that residents face daily in negotiating water insecurities.¹

The availability of water is a concern for some countries. But the scarcity at the heart of the global water crisis is rooted in power, poverty and inequality, not in physical availability.

—United Nations Development Programme²

Based on biophysical characteristics, including average rainfall, most parts of Ghana generally would not be considered water stressed, though the situation is expected to intensify in the decades to come.³ In 2010, Ghana halved the proportion of people without basic access to water, achieving the Millennium Development Goal (MDG) related to water access a full five years prior to the 2015 target date.⁴ This was certainly an achievement worth noting given the importance of water security for public health, educational attainment, and other development goals.⁵ Yet even given this context, water insecurity is a reality for many living in Ghana, including in and around the capital city of Accra.

That water security is vital for public health is undeniable. In fact, water insecurity and associated diarrheal disease remain the biggest contributors to death and ill-health across the globe, are critical to a range of public health issues such as the care of those sick with HIV/AIDS or other illness, and have been suggested to be key to the spread or intensity of outcomes associated with COVID-19 during the ongoing pandemic.⁶ For Ghana, estimates suggest that up to 70 percent of the disease burden is linked to lack of access to safe water.⁷ Even when available, people might nevertheless turn to unsafe sources if water is unaffordable, as occurred during the high-profile cholera outbreak in KwaZulu Natal, South Africa, in 2000.⁸ Yet apart from the clear importance of water insecurity for bodily and public health, or linkages to other development goals, how else might water insecurity affect the lives and experiences of the nearly one billion people who live with this reality?

This essay focuses on this question with specific reference to the daily lived experiences of those navigating water insecurity in and around urban and peri-urban areas of Accra, Ghana. In so doing, the essay makes several contributions. First, the discussion allows us to consider the importance of water insecurity “beyond the pipe,” attending to the complex social dynamics related to water insecurity that exceed common metrics regarding infrastructure, distance to a water source, or minimum daily water requirements. Second, the analysis highlights that water insecurity and stress are not only impending and anticipated realities associated with climate change but are *already* a part of the lived reality for many millions of people around the globe (as well as for approximately half of the residents of Accra). Third, building on recent discussions regarding the need to reframe water security to consider diverse aspects of well-being, and broader sociocontextual considerations, the essay focuses on the ways that water insecurity affects diverse aspects of everyday life and sociopolitical experience.⁹ Attending to these aspects of well-being beyond bodily and public health, evidence provided documents social conflict, self-reported worry, lack of affordability, and diverse practices and negotiations required to secure water for household needs. These contributions, considering the experiences of water insecurity, how it connects to daily experiences and well-being, and how it invites us to attend to interactions and dynamics apart from fixed infrastructure and numbers of pipes and spigots, are all important reframings for ongoing policy and academic debates regarding how to extend safe and affordable water access to the poor and underserved communities, or how to engage communities more fully in water-related decision-making and governance.¹⁰ This challenge is especially important given commitments to the human right to water by the United Nations,¹¹ as well as ongoing efforts related to the Sustainable Development Goals (notably SDG 6: “Ensure Access to Water and Sanitation For All” by 2030), in addition to the ongoing focus on participatory water governance (per the Dublin Principles and other policy goals).¹²

To begin, it is important to consider some of the ways that water insecurity is frequently assessed in policy contexts concerning efforts to achieve the Human Right to Water (HRW), the earlier MDGs, and the current SDGs (especially SDG 6). The standardized metrics that inform these efforts generally track the presence or absence of pipes, physical distance to access points, or basic quality parameters.¹³ While important, this approach is limited. First, such metrics – such as whether an “improved” source exists or whether residents have access to a minimum of 40 or 50 liters per day – do not always give useful information as to whether the water is safe, reliable, or adequate for diverse users and their needs in varied cultural contexts.¹⁴ Reliance on these metrics can in turn reinforce a focus on infrastructural and technocentric pathways to redress water insecurity: that is, build more connections or work to extend access in middle-income areas where residents might be more likely to pay for services. This is at times referred to as incentivizing the “low-hanging fruit”: extending access for middle- and high-income areas and charting progress toward these targets, rather than extending access to those most in need, where building the infrastructure, or ensuring payment of bills, may be more intractable. Related to this, others have argued for the need to move away from country-level or population-wide averages to focus precisely on the most impoverished or most vulnerable.¹⁵

Some analysts have also emphasized the myriad ways that common indicators fall short, revealing little regarding whether water is safe, affordable, or delivered in a manner that is contextually appropriate. With respect to quality, an analysis of the water safety (defined as the likelihood that water is not contaminated) of 1,500 households in five selected low-income areas of Accra found that only 4.4 percent of residents had access to safe drinking water, quite a different number than the nearly 40 percent estimate according to the World Health Organization definition of “improved water.”¹⁶ As such, there is a clear need to investigate issues of water insecurity, or the uneven progress toward the HRW, in ways that attend to the patterns of insecurity, as well as issues of quality, affordability, or how that water insecurity is navigated, in addition to the specific meanings that communities or individuals might attach to that insecurity (in terms of its importance for livelihoods, cultural or spiritual practices, or embodied labors).

Here, I seek to investigate water insecurity beyond the pipe, that is, apart from the spigots, taps, and distance from homes that are typically tracked by these policy goals. Instead, I aim to consider what water insecurity means for people’s daily lives. What meanings circulate related to water insecurity and the human right to water, especially as this is experienced unevenly in different locales? For the often estimated one-half of residents in and around Accra without access to the piped water network, what does this mean for how they navigate the complex landscape of insecurity, or how they relate to each other?

My conceptual framework understands water insecurity as much more than something that is important for our bodies, but that has broader relevance for our lives, including senses of self and community. As such, there is an imperative to attend to the ways that water insecurity, or the inequities associated with uneven implementation of the human right to water, is felt, embodied, lived, and invested with meaning. This approach is informed by critical discussions of the human right to water, analytical and policy debates regarding inequity and water governance, as well as recent discussions regarding everyday embodied experiences of water insecurity for households and individuals.¹⁷ Approaching the HRW and water insecurity in this way also helps to foreground key issues regarding gender, caste, class, or other axes of difference and linked theories of equity and water justice.¹⁸ As such, it is a critical component of efforts to repoliticize debates about water (in)security, including the context-specific implementation of the HRW and associated efforts to extend water access or engage communities in water governance.¹⁹ Considering household water insecurity experiences, the approach seeks to address how lack of water access, quality, and reliability affects considerations important for individual and communal well-being, including senses of belonging or emotional welfare (most often experienced as the opposite: that is, feelings of marginality, exclusion, stress, or worry).²⁰ I provide a few starting points to consider also how lived experiences of water insecurity and variable access to basic services might impinge on other dimensions of sociopolitical lives. For instance, recent work highlights how water insecurity or relative inequities encroach on citizen subjectivities, community conflict, or shifting state-society dynamics.²¹

In the past decades, scholars have pushed for a more expansive theorization of what might be included in the idea of the “human right to water,” moving beyond notions of basic access to water to include productive uses (such as for agriculture or livelihoods), involvement in decision-making over water-related concerns for affected communities, or broader recognition of the cultural, spiritual, and historical roles water might play for different communities (that is, particularly for Indigenous communities).²² As several contributions to this issue of *Dædalus* highlight, recent work on water security has similarly emphasized the importance of relational conceptualization, moving beyond access and the physical resource to include broadened relational understandings of the capabilities and hydrosocial relations that give rise to water-related well-being, development, and justice.²³

With such reconceptualization, water access is not necessarily the focus in and of itself, but rather attention should be given to broader and sustained hydrosocial processes that can enable water flows, quality, uses, and distribution in order to support well-being in line with notions of human capability, development, and flourishing.²⁴ As such, we can consider complex social and institutional or normative arrangements important for conditioning whether and how households

and individuals are able to secure access to safe and affordable water, particularly in times of scarcity.²⁵ These might include practices and norms related to water sharing, property rights, or familial and social networks that contribute to specific forms of water-related resilience and vulnerability (in line with social capital and social infrastructure discussions).²⁶ These issues are often as important, if not more so, than seasonality, changing precipitation patterns, or other concerns related to the physical availability of water.²⁷ And yet the threat of increasing variability and hydrological or meteorological scarcity due to climate change, among other factors, makes an understanding of these diverse aspects of water insecurity and resilience all the more apposite.²⁸ With the anticipated intensification and unpredictability of water stress across many regions of sub-Saharan Africa, and indeed across the globe, these social and cultural coping mechanisms, or attributes associated with resilience, will be key to mitigating the impact of these stressors and related catastrophic events (such as floods, drought, or storms).²⁹ Given that this reconceptualization focuses much more on the social and cultural context, rather than on water in a material or abstract sense, the reorientation toward a relational understanding of water security is also amenable to context-specific understandings of what might constitute justice, or specific ways that water might be meaningful for flourishing in a particular community.³⁰

The following case study draws on a decade of multi-sited, multi-method (qualitative, quantitative, and community-based), and multi-investigator work on water access, narratives, and citizenship with a focus on the most underserved communities of Accra, Ghana. The data highlighted draw primarily on fieldwork conducted by the author and several scholars associated with the EDGES (Environment and Development: Gender, Equity, Sustainability) collaborative at the University of British Columbia, working with local research assistants with support from colleagues at the University of Ghana-Legon (similar research was also undertaken in Cape Town, South Africa).³¹ All told, we conducted hundreds of interviews with residents, a dozen focus groups, feedback sessions with members of Local Water Boards, and two surveys (one involving 243 respondents in Ashaiman and Teshie conducted in 2012, and another involving 200 households in Ga Mashie and Madina, implemented in 2014), and produced a participatory video project on water and sanitation involving activists, local councilors, and residents in the coastal community of Teshie (see Figure 1).³²

By way of background, it is important to note that the water system of urban Accra was privatized with a five-year contract granted to Aqua Vitens Rand Limited (AVRL) for the operation and management of Accra's water system from 2006–2011, a requirement of World Bank loan conditionalities. While the privatization of the system was stalled due to some initial corruption and considerable local resistance, it eventually went forward with the

Figure 1
Greater Accra Metropolitan Area



Source: Map produced by Eric Leinberger, University of British Columbia Cartography Lab.

agreement that the AVRIL consortium would operate on a not-for-profit basis.³³ Nonetheless, the transfer raised significant concerns related to democracy, sovereignty, and transparency. In 2011, just days before our first fieldwork season in Accra, the Ghanaian government decided not to renew AVRIL’s contract, citing, among other reasons, failure to improve the situation of nonrevenue water, as well as criticisms related to not involving local NGOs and other stakeholders in decision-making (thus highlighting concerns of procedural justice and participatory governance).³⁴

While newspaper headlines from the past several years have highlighted impending water crises in high-profile cases, such as that associated with “Day Zero” in Cape Town, concerns related to water insecurity are not new among residents and neighborhoods in Accra.³⁵ For them, and others across the globe, water insecurity is not only part of some anticipated future associated with climate change or rising populations, but is already a key part of their present reality. The situation of water and sanitation access across Ghana remains highly variable, despite the country-wide target of achieving “sustainable water and basic sanitation for all by 2025” (five years in advance of the SDG target). For all practical purposes,

this would mean that “*all people* living in Ghana have adequate, safe, affordable and reliable access to a basic level of water service, practice safe sanitation and hygiene and that water resources are sustainably managed.”³⁶

At present, however, different parts of the country (notably across rural-urban gradients), or various sections of the greater Accra region, remain uneven in terms of water and sanitation services, quality of water, or affordability. This variability is linked to income, location or geography, new migrant status, or home ownership, among other axes of inequality.³⁷ In part, variegated water access can be directly traced to legacies of infrastructure and development during the colonial period, histories that served to condition uneven infrastructure and water flows. It is clear that these patterns have persisted since independence, fueled in part by ongoing political instability. Indeed, the country has been unable to keep pace with migration to the city from rural areas or from nearby countries, or with its growing debt, among other challenges.³⁸ Policy scholar Kweku Ainuson indicates that two-thirds of low-income residents of Accra do not have access to piped water in their homes, compared to 12 percent among wealthier households.³⁹ The analysis by researchers Ayisha Mahama and colleagues in 2014 provided evidence that in Accra, the significant determinant of homeowners’ access to improved drinking water was income, while education, income, and location of the household were significant for access to water for other domestic uses. Compared with recent migrants to the city, Indigenous people and people from mixed areas were less likely to have access to improved water for other domestic purposes (see our comparison between new migrant communities of Madina and Indigenous areas of Ga Mashie below).

Based on our survey conducted in 2012 in the Indigenous community of Teshie and the mixed new migrant community of Ashaiman (both underserved urban and peri-urban areas near Accra, see Figure 1), affordability, access, and quality remain key concerns.⁴⁰ Sixty-eight percent of our respondents across both settlements, for instance, suggested that they do not consider water to be “affordable.” Linked with this, nearly half of respondents in Ashaiman and Teshie relied on water vendors or other intermediaries associated with increasing sachet water consumption.⁴¹ Some research has estimated that poor or low-income households in Accra spend between 58 – 91 percent of their after-tax household income on water, often at least ten times more than their counterparts with access to piped systems as part of the municipal network.⁴² Suggesting that this is a long-term persistent challenge, earlier work from the 1990s by Rudolf Amenga-Etego and Sara Grusky estimated that a significant proportion of residents in Accra lived on less than \$1 per day, and may have paid as much as one-quarter of their income (or more) to meet daily water needs.⁴³

Our follow-up qualitative research (in Teshie, Ashaiman, Madina, and Ga Mashie) also revealed the extent to which access to piped water networks does

not guarantee water security, whether due to irregular service (that is, linked to a rationing schedule that was long used to coordinate water delivery to varied parts of the city, given overall supply deficits), lack of access to storage facilities (especially among the relatively impoverished, who are unable to afford tanks and storage for the home), or in relation to quality and taste concerns (see the discussion below of hard water and taste concerns with newer water supplies to Teshie following the installation of a desalinization plant to serve that community).⁴⁴ In peri-urban migrant areas of Ashaiman and Madina on the outskirts of the city, for instance, the absence of any piped supply from the municipal system managed by GWCL (Ghana Water Company Limited, the entity responsible for water delivery to urban areas throughout the country) means that residents are paying for water to be trucked in by tanker, and as sachets, paying much more per unit compared with other parts of the city with more regular piped access.⁴⁵ Residents in various neighborhoods are forced to navigate creatively an ever-changing patchwork of sources to meet their daily needs, from boreholes to sachets, as well as water storage, often having to compromise water quality, spending significant time to seek out water, and/or paying a considerable portion of their income to secure this basic need.⁴⁶ For instance, one estimate suggests that residents in low-income and slum settlements of Accra who rely on vendors often pay up to eight times the regulated price for water.⁴⁷

Work in the Indigenous settlement of Ga Mashie (with piped infrastructural service) and Madina (off of the piped network at the time of the research in 2013) showed that 94 percent and 72 percent of survey respondents, respectively, experienced interruptions in water supply on a weekly basis, in part due to the rationing schedule, as well as gaps in vendor services.⁴⁸ Residents in these communities also highlighted quality and taste concerns (such as in Teshie). From the 2012 survey, we also learned that a majority of residents in Ghana disagree that it is easy to get water (64 percent), agree that they spent significant time accessing water (over 60 percent), and disagree that water is always available (72 percent).⁴⁹ Such examples provide further evidence of the need to look beyond the pipe or beyond common metrics focused on infrastructure or improved access to consider the ways that uneven water access and quality impinge on individual and community health, well-being, or experience.⁵⁰

Encouragingly, it is noteworthy that Teshie (widely considered one of the most underserved locales in Accra) is now the beneficiary of a recent desalinization plant, adding considerably to the overall supply of water for the metropolitan area (though residents note taste and hardness concerns, as well as inadequate infrastructure to deal with the enhanced supply).⁵¹ With this new technology and augmented supply, GWCL now suggests that demand for water in the metropolitan area no longer outstrips supply, noting that daily scarcity might be less likely in some areas of the city, lessening the need for rationing schedules that have long

been relied on by the city's water purveyors.⁵² As of January 2018, however, the new desalinization plant was taken off-line due to disputes over the contract with the private companies managing the facility.⁵³ Together with the failures associated with the previous AVRIL contract, this example raises concerns for water security given the reliance on the Public Private Partnerships (PPPs) that were engaged to build and operate the plant, considering the at times inherent incompatibilities between private interests and achievement of the HRW.⁵⁴ Recent evidence suggests that cut-offs and rationing nonetheless continue, which has been a particular concern during the COVID-19 pandemic.⁵⁵

Apart from quality, affordability, reliance on vendors, and relationship to rationing, our collective work also sought to highlight meanings of water insecurity, how it is narrated in people's daily lives, how it reveals important emotional and affective realities, or what these daily negotiations mean for senses of citizenship, for community and sociopolitical dynamics, or for future resilience and vulnerability.⁵⁶ On meanings, being able to enjoy enhanced water security was associated by some broader notions of development or freedom. In Ashaiman, a community with many recent migrants from rural areas, as well as from Nigeria and other surrounding countries, the settlement is one of the fastest-growing areas of Accra. Located on the outskirts of the city and generally not connected to the municipal network, several residents noted that they would be "free" and "free from suffering" if they could have better access to water. One middle-aged woman in a newer area of the community noted a preference for enhanced government service provision "so we will be free."⁵⁷ Others also connected the issue to global gradients across the North and South in terms of who is able to enjoy such access, or not. As one resident commented in response to a question from the North American researcher about water in the community: we "would like our lives to be like Americans . . . as for water you don't have to suffer to get it. Am I lying?"⁵⁸

This sense of freedom is likely linked with the considerable effort, and creativity, that is expended in the daily "chase" for water, as documented among those living without piped connections in Ashaiman. Work led by environmental studies scholar Megan Peloso in these neighborhoods highlights the innovative ways that people use to meet their daily needs through a host of mechanisms.⁵⁹ Even as there were clear disadvantages, including higher rates per unit compared with those who received water through the price-regulated municipal piped network, many residents also expressed distinct benefits of this flexible approach, such as avoiding large water-payment debts (given the monthly billing cycle of GWCL), being more careful with water usage since it does not flow freely, and being able to decide when to purchase water given fluctuating prices (though, arguably, this would not be required with the Public Utilities Regulatory Commission—regulat-

ed water pricing).⁶⁰ For instance, surrendering to the billing technology of water meters requires a great deal of trust because of the inability of residents to monitor or negotiate the usage and associated bills. The bill is issued, and one simply must pay. As a seventy-two-year-old man remarked: “If you have a meter, you cannot ‘talk anything about that’ ... as in, if there is measurement, the assessment is done, your bill is given to you and you pay.”⁶¹ This was a significant concern for many because they felt that GWCL was not responsive (or present) in their community, and it was difficult to know how or where to raise concerns or to complain.⁶² Indeed, overall lack of trust in the government was clear from our 2012 survey data, with 54 percent of respondents suggesting they do not trust the government.⁶³

Regarding emotional and affective experiences of insecurity, 79 percent of our 2012 survey respondents said that they worry about water “sometimes” or “often,” connecting water insecurity to stress and other aspects of mental well-being.⁶⁴ Other stressors included conflict in the home and in the community more generally. Data collected in underserved areas suggested that some might wait for water for up to eight hours or more, and that conflict often broke out in such lineups.⁶⁵ Others highlighted household and intracompound conflicts regarding who would pay significant water bills. For instance, data collected in 2014 by environmental studies scholar Elizabeth Dapaah in Ga Mashie and Madina showed that 68 percent of survey respondents reported fighting at water-collection points; in the Indigenous coastal community of Ga Mashie, 85 percent of respondents reported such conflict. Ironically, those in Ga Mashie – an area of the city with piped water access, presumably with high-quality water available at the lowest cost per unit through the network – nonetheless preferred to buy water daily from vendors, in part to avoid conflicts in residential compounds regarding bill payment. As one local leader in Ga Mashie expressed regarding the preference for water from vendors, as well as the fact that many households had been cut off from the system due to failure to pay bills, “in most compound houses there were conflicts on water management so they disconnect and they buy outside ... people prefer buying from vendors so they have their peace.”⁶⁶ In such instances, intracompound conflict, including difficulties determining who in an extended family should pay for what share of the water bill, had the effect of making many residents in Ga Mashie less water secure: they pay more for water on a per-unit basis than they would have if they had been able to access water through the network, and they are perhaps also more vulnerable to shortages and cut-offs during times of scarcity.

Given that many in Ga Mashie had piped connections, but those connections were not operational given billing or maintenance concerns, residents instead had to rely on complex social relationships with vendors, neighbors, and extended family to secure water.⁶⁷ For instance, complicated landlord-tenant relationships, or extended kin and familial groups, made some of these social networks

(and associated entitlements) fragile, rather than allowing those living in these neighborhoods to be more secure (as we might have otherwise anticipated given the presence of pipes and of demographically homogeneous populations with many extended kin networks). Drawing on an entitlements approach, the analysis demonstrates that even with pipes coming directly to their homes, households in Ga Mashie had higher senses of worry, stress, and community conflict in comparison with counterparts living in other areas of the city without piped connections, notably in the demographically mixed recent migrant community of Madina.⁶⁸ A lack of correspondence between local leaders' perceptions of water issues, and those of the residents in those communities aggravated by insecurity, along with topographic considerations, made the drilling of boreholes less possible in coastal areas of Ga Mashie. The counterintuitive result in Ga Mashie was that this ethnically homogenous community with piped infrastructure was in some ways likely to be more vulnerable and less resilient to acute water shortage compared with the mixed neighborhood of Madina (which lacked piped infrastructure but had more well-established vending relationships).

Examining issues related to engagement and water governance in other ways as well, we found limited evidence of resident involvement: among our 2012 respondents in Ghana, only 21 percent suggested they were engaged in community activities, beyond religious gatherings or sports. This number was only 12 percent among female respondents. Other work tested statistically whether senses of enfranchisement associated with water services, or senses of marginality associated with inaccessible or poor-quality water, was linked to community engagement.⁶⁹

Results suggest that water access and quality are indeed significant predictors of community engagement, albeit in opposite directions (access has a negative relation and quality a positive one).⁷⁰ As water access improved, residents were less likely to be involved in the community. This was particularly true for men (whose responses drove the interaction), as women's engagement was not linked to variabilities of water access. Interestingly, the opposite was found for water quality: as water quality improved, residents were more likely to be involved in community governance (but in this case, it was female respondents who drove this overall trend). As such, for the Ghanaian respondents, men's probability of engagement diminished with water access (while for women it was relatively constant). Yet women's probability of engagement increased with water quality (while men remained relatively stable).⁷¹ Of note, trust in government was also positively correlated with community engagement.

Participatory governance is important, not only for equity goals (involving people directly in decisions that affect them), but it is also often theorized as critical to fostering better adaptive governance and, as such, greater resilience in relation to climate change, water insecurity, or similar challenges.⁷² In

Accra, as elsewhere, participation is promoted as a means to improve water security, water governance, and resilience in the face of climate change. For instance, the World Bank has highlighted “participation and engagement” as the key theme of an urban water project in Ghana, while the Global Water Partnership has emphasized the need to promote Water User Associations across the country.⁷³ As discussed by human geographers Cynthia Morinville and Leila Harris, Local Water Boards (LWBs) have been established in various parts of the city as mechanisms to promote participatory engagement in water-related decision-making, at times also taking on a direct role in water provision and infrastructural development. While the LWBs have some clear benefits – such as involving local youth, women, and others from the community in decision-making related to water and sanitation and facilitating communication between the communities and GWCL – there are also clear limitations of the model to date. One LWB chairperson noted:

There is a lot of collaboration because they (GWCL) know us, we also know them. They call us, we call them. We have meetings concerning water related programs in the community. So for instance, when they were doing the pipe laying they had to disconnect a particular group line and these community members came here to complain to us. I also called GWCL to lodge the complaint and they came and rectified it.⁷⁴

In terms of less desirable aspects of the LWBs, the analysis revealed shortcomings, including the fact that LWBs generally rely on volunteer labor and must navigate multiple levels of governance, a complex institutional landscape (such as international NGOs), and challenges associated with external influences (for instance, having to meet donor goals and timelines). Both the analysis of LWBs and consideration of participatory governance possibilities in Ashaiman (where no such institutional entity exists) emphasized the importance of informal mechanisms of community engagement, including those unsanctioned by, and potentially crowded out by, readily identifiable water institutions. For instance, several well-being-focused neighborhood groups already exist in Ashaiman. As such, it might be counterproductive to focus on building new water-related institutions (especially given time and resource considerations). Peloso and Harris thus argue that perhaps it is more suitable to consider the ways that water might be included under the broader remit of well-being, rather than endorsing a siloed approach in which water is seen as distinct from community concerns (reflecting and echoing broader debates regarding concepts such as hydrosocial relations in lieu of viewing water as separable from its social context, as with notions of modern water).⁷⁵

All told, our 2012 survey also suggested that there is not, at present, much in the way of broad participation in water governance, even as many respondents suggested that they might be interested in being more involved. Eighty-six percent of respondents in the survey mentioned that they had never participated in water management groups or committees, and nearly all said “no such committees”

exist, even as we were aware of at least one LWB in Teshie at the time. However, 57 percent of respondents suggested that they “wish they could participate more in community meetings,” with 67 percent agreeing that they feel that they have something to offer. It is possible that there is recognition among residents regarding the importance of participation, even as there might be constraints or little in the way of opportunities for such engagement.

Even with some progress on bulk water supply, or extending access to some impoverished neighborhoods, there are, nonetheless, profound and lasting concerns related to daily experiences of water insecurity, how water shortages differentially affect households and communities, and how those with limited financial or social resources might be less able to navigate these circumstances. And while there might be interest in enhanced engagement in governance, there appear to be significant obstacles to doing so.

What do insights related to the everyday lived realities of water insecurity suggest for broad debates regarding the human right to water and its uneven implementation, among other efforts to overcome water insecurity? How might this aid ongoing efforts to extend water access to underserved communities, or to engage these communities more meaningfully in water governance?

To respond to these questions, we can consider the practical ways that difficulties addressing monthly bill payments in large compound households represent a barrier for residents, leading them to pay more for water on a per-unit basis, and potentially worsening their vulnerability in moments of water-related stress. Recall that residents with piped infrastructure (for example, in Ga Mashie) were nonetheless vulnerable to affordability and quality concerns, and highlighted significant conflict over water and other issues that affected their daily lives. Evidence from Ga Mashie and Madina also showed that water-sharing is practiced, a phenomenon that has recently been documented as significant globally, with the potential to help communities navigate water stress, disaster events, and similar conditions.⁷⁶ From Ashaiman, we learned that residents prefer some aspects of the informal water landscape and have existing community governance practices that should likely not be supplanted with formal water governance institutions imposed by external actors. Without familiarity with these day-to-day realities, we might miss opportunities to strengthen some beneficial social practices, or in turn might aggravate aspects of the contextual realities that contribute to lack of access to safe and affordable water for all. Attention to lived realities and how people navigate these complexities supports the argument that solutions for communities must transcend technical factors to include a range of social, institutional, natural, and infrastructural considerations.⁷⁷

The discussion of everyday realities of water insecurity in urban Accra also lends force to the argument that we need to highlight equity more fully in discussions regarding water infrastructure, or goals such as the Human Right to Water. How water insecurity is experienced will necessarily differ depending on social context, including caste, class, gender, and a host of other considerations. Aspects of water insecurity experienced in Accra help to attend to the socially and contextually specific responses to ongoing water challenges, and give weight to the claim made by ecologist Flora Lu and colleagues that “despite the gravity of the water crisis, our theoretical and analytical models do not adequately explain inequitable water access and distribution, nor how equity might be achieved.”⁷⁸ While affordability is especially of concern for lower-income households, we need to continue to unpack equity dimensions related to ethnicity and gender that explain patterns of water insecurity – or its uneven outcomes. Accomplishing this requires careful and sustained engagement with debates of justice, fairness, and ethics.⁷⁹

Attending more adequately to the social, contextual, and everyday dimensions of water insecurity shows that relationships, norms, and other practices are of critical importance. As the work in Ashaiman and Ga Mashie illustrate, it is necessary to consider the advantages and disadvantages of various forms of water provision, given their complex articulation with other social and institutional factors. Notably, in Ashaiman at present, access to the piped network is not viewed as being singularly advantageous, since there are clear perceived disadvantages (such as avoiding large bills or concerns regarding the unresponsiveness of GWCL to community needs). In Ga Mashie, the presence of pipes is insufficient to ensure water security; complex socioconflictual dynamics and hydrosocial vulnerabilities remain. Indeed, these concerns are particularly acute in moments of water stress. All told, it is important to provide water and associated infrastructure in ways that remain attentive to these realities.

As Peloso and colleagues note:

We must at once keep a focus on longer term goals of universal, safe and affordable water access, while acknowledging that a myopic and singular focus on connectivity to a centralized utility service oversimplifies the complex experience of water insecurity for millions of residents across the globe. Achieving the goal of universal water access necessitates that we fundamentally rethink our understanding of water as a material.... Doing so reorients our focus from water pipes and infrastructure to the social relationships that are necessarily entangled with water access and security.⁸⁰

If we add to this work the challenge of more effectively engaging marginalized communities in water governance, it is clear there is much more to do.

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ENDNOTES

- ¹ Elements of this discussion have been reproduced from previously published works, with permission, including excerpts from Leila Harris, "Equity and Justice: Water Access in Underserved Areas of Accra, Ghana," in *L'accès à l'eau en Afrique: vulnérabilités, exclusions, résiliences et nouvelles solidarités*, ed. David Blanchon and Barbara Casciarri (Nanterre, France: Presses Universitaires de Paris Ouest, 2020), 199–212.
- ² United Nations Development Programme, *Beyond Scarcity: Power, Poverty, and the Global Water Crisis. Human Development Report 2006* (New York: United Nations Development Programme, 2006), 2, <http://hdr.undp.org/en/content/human-development-report-2006>.
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- ⁴ Of note, progress toward achievement of the MDGs was uneven across regions, with failures to achieve the goal in parts of Africa and Asia, as well as variability between the rich and the poor, and between urban and rural areas, all concerns that highlight equity challenges associated with the uneven implementation of the HRW and similar goals. See Ayisha Matuamo Mahama, Kwabena Asomanin Anaman, and Isaac Osei-Akoto, "Factors Influencing Householders' Access to Improved Water in Low-Income Urban Areas of Accra, Ghana," *Journal of Water and Health* 12 (2) (2014): 318–331. See Births and Deaths Registry, Ministry of Local Government and Rural Development, "Ghana–Ghana Annual Statistical Report on Births and Deaths–2013, Second Round" (Accra: Ministry of Local Government and Rural Development, 2014), <https://www2.statsghana.gov.gh/nada/index.php/catalog/86> (accessed April 7, 2021).
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- ⁶ Justin Stoler, Joshua Miller, Alexandra Brewis, et al., "Household Water Insecurity Will Complicate the Ongoing COVID-19 Response: Evidence from 29 Sites in 23 Low- and Middle-Income Countries," *International Journal of Hygiene and Environmental Health* 234 (2021): 113715.
- ⁷ Rudolf Nsorwine Amenga-Etego and Sara Grusky, "The New Face of Conditionalities: The World Bank and Water Privatization in Ghana," in *The Age of Commodity: Water Privatization in Southern Africa*, ed. David McDonald and Greg Ruiters (London and Sterling, Va.: Earthscan, 2005), 275–290.
- ⁸ Patrick Bond and Jackie Dugard, "Water, Human Rights and Social Conflict: South African Experiences," *Law, Social Justice and Global Development Journal* 11 (2008): 1–21.
- ⁹ See Wendy Jepson, Jessica Budds, Laura Eichelberger, et al., "Advancing Human Capabilities for Water Security: A Relational Approach," *Water Security* 1 (2017): 46–52.

- ¹⁰ Ibid. ; and Farhana Sultana, “Suffering for Water, Suffering from Water: Emotional Geographies of Resource Access, Control and Conflict,” *Geoforum* 42 (2) (2011): 163–172.
- ¹¹ “On 28 July 2010, through Resolution 64/292, the United Nations General Assembly explicitly recognized the human right to water and sanitation and acknowledged that clean drinking water and sanitation are essential to the realisation of all human rights. The Resolution calls upon States and international organisations to provide financial resources, help capacity-building and technology transfer to help countries, in particular developing countries, to provide safe, clean, accessible and affordable drinking water and sanitation for all.” United Nations Department of Economic and Social Affairs, “The Human Right to Water and Sanitation,” https://www.un.org/waterforlifedecade/human_right_to_water.shtml (last updated May 29, 2014). See also Heinz Klug, “Between Principles & Power: Water Law Principles & the Governance of Water in Post-Apartheid South Africa,” *Dædalus* 150 (4) (Fall 2021).
- ¹² “The Dublin Statement on Water and Sustainable Development,” International Conference on Water and the Environment, January 31, 1992, Dublin, Ireland, available from United Nations Documents, <http://www.un-documents.net/h2o-dub.htm> (accessed April 6, 2021).
- ¹³ Mahama et al., “Factors Influencing Householders’ Access to Improved Water in Low-Income Urban Areas of Accra, Ghana.”
- ¹⁴ “Improved sources” generally include tap water in a dwelling, public standposts, boreholes, tubewells, protected wells and springs, rainwater, packaged water including bottled water or sachets, or delivered water from tanker trucks and small carts. Their recent methods also include safe management parameters. See WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, “Facility Types,” <https://washdata.org/monitoring/methods/facility-types> (accessed April 12, 2021); and Mahama et al., “Factors Influencing Householders’ Access to Improved Water in Low-Income Urban Areas of Accra, Ghana.”
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- ¹⁷ See, for example, Farhana Sultana and Alex Loftus, *The Right to Water: Politics, Governance and Social Struggles*, 1st ed. (New York and Abingdon.: Oxon, Earthscan, 2012); Oriol Miroso and Leila Harris, “Human Right to Water: Contemporary Challenges and Contours of a Global Debate,” *Antipode* 44 (3) (2012): 932–949; Karen Bakker, “The Commons Versus the Commodity: After Globalization, Anti-Privatization and the Human Right to Water in the Global South,” *Antipode* (2007): 430–455; HWISE Network, “Household Water Insecurity Experiences (HWISE)–Research Coordination Network (RCN),” *HWISE Network*, <https://hwise-rcn.org/> (accessed April 7, 2021); Sultana, “Suffering for Water”; Leila Harris, “Hegemonic Waters and Rethinking Natures Otherwise,” in *Practicing Feminist Political Ecologies: Moving Beyond the “Green Economy,”* ed. Wendy Harcourt and Ingrid Nelson (London: Zed Books, 2015), 157–181; Lucy Rodina, “Human Right to Water in Khayelitsha, South Africa–Lessons from a ‘Lived Experiences’ Perspective,” *Geoforum* 72 (2016): 58–66; and Alex Loftus, “Water (In)Security: Securing the Right to Water,” *The Geographical Journal* 181 (4) (2015): 350–356.

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- ¹⁹ Loftus, "Water (In)Security"; and Sultana and Loftus, *The Right to Water*.
- ²⁰ Jepson et al., "Advancing Human Capabilities for Water Security"; Sultana, "Suffering for Water"; and Amber Wutich and Kathleen Ragsdale, "Water Insecurity and Emotional Distress: Coping with Supply, Access, and Seasonal Variability of Water in a Bolivian Squatter Settlement," *Social Science & Medicine* 67 (12) (2008): 2116–2125.
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- ³¹ Specifically, the work highlighted here was conducted by Cynthia Morinville, Megan Peloso, Elizabeth Dapaah, and Crystal Tremblay, all EDGES affiliates, working together with local research assistants and with the support of Dr. Akosua Darkwah, Dr. Jacob Songsore, and other colleagues at the University of Ghana-Legon.
- ³² More details on this multi-sited, multi-investigator effort undertaken by the EDGES research collaborative at the University of British Columbia can be found online (www.edges.ubc.ca), including links to associated survey instruments, reports, and publications. All relevant original and published works are cited throughout, as appropriate.
- ³³ See Ian Yeboah, “Subaltern Strategies and Development Practice: Urban Water Privatization in Ghana,” *The Geographical Journal* 172 (1) (2006): 50–65; and Amenga-Etego and Grusky, “The New Face of Conditionality” for discussion of resistance movements that opposed the initial privatization.
- ³⁴ Marieke Adank, Bertha Darteh, Patrick Moriarty, et al., *Towards Integrated Urban Water Management in the Greater Accra Metropolitan Area: Current Status and Strategic Directions for the Future* (Accra: SWITCH Accra, 2011).
- ³⁵ Jackie King and Cate Brown, “Africa’s Living Rivers: Managing for Sustainability,” *Dædalus* 150 (4) (Fall 2021); and Megan Peloso, Cynthia Morinville, and Leila Harris, “Water Scarcity beyond Crisis: Spotlight on Accra,” *International Journal of Urban and Regional Research* (2018), <https://www.ijurr.org/spotlight-on/parched-cities-parched-citizens/water-scarcity-beyond-crisis-spotlight-on-accra/> (accessed April 12, 2021).
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- ⁴⁰ See www.edges.ubc.ca for more detail on methods, survey instruments, and other information. Leila Harris, Lucy Rodina, Emma Luker, et al., “Water Access and Governance

in Accra, Ghana and Cape Town, South Africa: 2012 Survey Data Report” (Vancouver: EDGES, 2016), www.watergovernance.ca; www.edges.ubc.ca. Both Ga Mashie and Teshie can be considered older, largely Indigenous communities along the coast, while Madina and Ashaiman are generally newer settlements of the Greater Accra region with more mixed populations of in-migrants from other parts of Ghana and nearby neighboring countries.

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- ⁴² Issac Asante-Wusu and Ian E. A. Yeboah, “Geography of Water Insecurity in Three Localities in the Accra-Tema Region, Ghana,” *African Geographical Review* 39 (4) (2020): 308–323; and Keziah Illidge, “A Systematic Literature Review on Water Access and Governance in Accra Public Health Theses” (M.Ph., Georgia State University, 2019), https://scholarworks.gsu.edu/iph_theses/669/ (accessed April 12, 2021).
- ⁴³ Amenga-Etego and Grusky, “The New Face of Conditionality,” 283. As they note based on earlier work conducted in 2003 in Madina, Sukura, Mamobi, Nima, and Ashaiman, households spend between 18–25 percent of their income on water alone.
- ⁴⁴ Crystal Tremblay, with ISODEC and Leila Harris, “Water Is Life,” participatory video on the water situation in Teshie (2016), available at www.edges.ubc.ca.
- ⁴⁵ Megan Peloso and Cynthia Morinville, “‘Chasing for Water’: Everyday Practices of Water Access in Peri-Urban Ashaiman, Ghana,” *Water Alternatives* 7 (1) (2014): 140–159; and Dapaah and Harris, “Framing Community Entitlements to Water in Accra, Ghana.” Even if many households do not have in-home or in-compound piped access, if the neighborhood overall is connected, often these residents will access water through neighbors who vend water from the piped system.
- ⁴⁶ See Peloso and Morinville, “Chasing for Water.”
- ⁴⁷ Justin Stoler, John R. Weeks, and Günther Fink, “Sachet Drinking Water in Ghana’s Accra-Tema Metropolitan Area: Past, Present, and Future,” *Journal of Water, Sanitation and Hygiene for Development* 2 (4) (2012). In combination with estimates provided above, there are widely varying estimates of water affordability. Many in Accra pay much more than the recommended 5 percent of income that is generally associated with notions of affordability (such as from the World Health Organization).
- ⁴⁸ Dapaah and Harris, “Framing Community Entitlements to Water in Accra, Ghana,” 30.
- ⁴⁹ Harris et al., “Water Access and Governance in Accra, Ghana and Cape Town, South Africa.”
- ⁵⁰ See, for example, Dapaah and Harris, “Framing Community Entitlements to Water in Accra, Ghana.”
- ⁵¹ Tremblay, “Water Is Life.”
- ⁵² Author interviews with EDGES, 2015.
- ⁵³ Nathan Gadugah, “Water Company Shuts Down Teshie Desalination Plant,” *MyJoyOnline.com*, <https://www.myjoyonline.com/water-company-shuts-down-teshie-desalination-plant/> (accessed March 20, 2018).

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- ⁵⁷ Interview, 2012, cited in Peloso and Morinville, "Chasing for Water," 128.
- ⁵⁸ Interview, June 15, 2012, cited in *ibid.*
- ⁵⁹ As reported in Peloso and Morinville, "Chasing for Water."
- ⁶⁰ The Public Utilities Regulatory Commission is responsible for oversight of water quality and pricing, among other issues related to public utilities.
- ⁶¹ Interview cited in Peloso and Morinville, "Chasing for Water," 131.
- ⁶² *Ibid.*
- ⁶³ Harris et al., "Water Access and Governance in Accra, Ghana and Cape Town, South Africa."
- ⁶⁴ Wutich and Ragsdale, "Water Insecurity and Emotional Distress," for example, highlights stress and other emotional-affective aspects of the lived experiences of uneven access to water.
- ⁶⁵ Dapaah and Harris, "Framing Community Entitlements to Water in Accra, Ghana."
- ⁶⁶ Cited in *ibid.*, 32.
- ⁶⁷ *Ibid.*; and Sultana, "Suffering for Water."
- ⁶⁸ Drawing on the work of Sen and colleagues, entitlements refer to the "Bundle of ownership rights, endowments, assets, economic and social that individuals and households draw on to enable 'sufficient access to resources,'" discussed in Dapaah and Harris, "Framing Community Entitlements to Water in Accra, Ghana," 27.
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- ⁷² Cynthia Morinville and Leila Harris, "Participation, Politics, and Panaceas: Exploring the Possibilities and Limits of Participatory Urban Water Governance in Accra, Ghana," *Ecology and Society* 19 (3) (2014): 36.

- ⁷³ As discussed in Megan Peloso and Leila Harris, “Pathways for Participatory Water Governance in Ashaiman, Ghana: Learning from Institutional Bricolage and Hydrosocial Perspectives,” *Society and Natural Resources* 30 (12) (2017): 1491–1506. It is of interest to note that these organizations also push for water-related institutions to focus on water-related goals, rather than addressing broad welfare goals. The authors speak to this tension, and instead suggest it might be meaningful to support, and enhance, existing institutions rather than aiming to replace them with narrow water-focused use groups. See also Morinville and Harris, “Participation, Politics, and Panaceas”; and Peloso and Harris, “Pathways for Participatory Water Governance in Ashaiman, Ghana.”
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- ⁷⁵ Peloso and Harris, “Pathways for Participatory Water Governance.”
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Water Scarcity & Health in Urban Africa

Julie Livingston

Water is the cornerstone of public health. Yet many people living in Africa's cities face serious challenges obtaining an adequate supply of clean water. This situation, which poses significant public health concerns, promises only to grow in magnitude in the coming years as rapid urbanization and climate change meet head-on to further constrain urban water provision. This essay explores the relationship between water supply and health in urban Africa through the lens of water scarcity and health as political relationships as much as environmental or technical phenomena. By bringing infectious diseases like cholera and chronic ailments like kidney disease into the same frame of analysis, this essay also directs attention beyond the overwhelming public health focus on microbial contamination to emergent forms of water-related illness and injury that proceed unchecked.

In 2014, as global attention was focused on the Ebola epidemic escalating in Guinea, Liberia, and Sierra Leone, residents of Accra, Ghana, found themselves facing an older and more familiar foe. In June of that year, a ten-year-old girl was brought to the Ussher Polyclinic with severe diarrhea, which was soon confirmed by laboratory tests to be positive for cholera. Soon another case was confirmed: a fifty-three-year-old man who presented at Maamobi Polyclinic in a different neighborhood of Accra.¹ By August, as the epidemic reached its peak, Ghanaian authorities reported fifty-four confirmed cholera deaths in the city with hundreds of new cases each day, stressing the health system.² Meanwhile, commuters, traders, and other travelers carried the disease beyond the metropole and cases were detected throughout much of the country and beyond its borders.³ By the time the outbreak was finally contained in January 2015, nearly 29,000 cases and 243 deaths had been recorded.

According to Ghanaian public health experts, the index cases for the epidemic were in neighborhoods they described as “unhygienic and unclean,” with reliance on public latrines and open defecation in some places.⁴ Experts from the Disease Surveillance Department of the Ghanaian Health Service who went to investigate found that “the water supply system in these areas also had visible leakages in the pipes suggesting possible water contamination, since there was evidence of vis-

ible disposal of untreated sewage into open drains.”⁵ Lacking proper drainage, sewage and other refuse were dumped into the sea and gutters. “Continuous water supply was another major problem in these areas. They mostly depend on the sachet water as the safest source of drinking water.”⁶ Ghanaian epidemiologists established that those with cholera had been six times more likely to have drunk sachet water – that is, water packaged in 500 milliliter plastic pouches by private sellers and purchased on the street – than those without the disease.⁷ It was only many weeks into the outbreak, when the government finally succeeded in providing safe water and toilets, that the epidemic began to subside.

A decade prior to the 2014 cholera outbreak in Ghana, anthropologist Sherine Hamdy sat in a dialysis ward in Tanta, Egypt’s fifth-largest city. She was there researching an epidemic of a different nature, though one also related to dirty water. Tanta’s dialysis patients were suffering from chronic kidney failure, the visible tip of a broad epidemic of kidney disease. For those lying tethered to the machines, dialysis was exhausting and time-consuming, but it was also iatrogenic. In the clinics where Hamdy worked, between 70 and 80 percent of patients had contracted Hepatitis C via the dialysis machines. Patients in these clinics blamed toxic drinking water and contaminated food for their ailments. They pointed to the dumping of pesticides and chemical runoff into the Nile.⁸ This was an etiology echoed in the popular press, in which many authors pointed to the government’s failure to properly regulate, monitor, and control industrial pollution, resulting in high rates of heavy metal and chemical contamination and attendant disease.⁹ Indeed, some of the worst offenders were government-owned firms.¹⁰

These two epidemics begin to suggest the scope and contours of the relationship between water and well-being in urban Africa. Water is the cornerstone of public health. Yet many people living in Africa’s cities face serious challenges obtaining an adequate supply of clean water. This situation, which poses significant public health concerns, promises only to grow in magnitude in the coming years as rapid urbanization and climate change meet head-on to further constrain urban water provision.

The African continent has been urbanizing rapidly – a process that shows no signs of slowing. The sheer number of city dwellers has risen steadily over the past several decades as has the number and size of cities. In 2015, Dakar was home to as many people as the entire nation of Senegal had been only a half-century earlier.¹¹ By 2015, an estimated 567 million Africans – more than half the total population of the continent – were urbanites. Demographers project that within the next three decades, nearly one billion additional people will reside in Africa’s cities.¹² Meanwhile, changing rainfall patterns and rising temperatures contribute to the challenge of providing adequate water for these rapidly growing populations. Already the number of cities with unreliable water supply and

chronic shortages is rising. Water is a primary human need, yet it can carry microbial pathogens like cholera, typhoid, or *E. coli*, or be contaminated with pesticides, heavy metals, industrial chemicals, or other toxins, resulting in substantial bodily harm.

The experience of water-associated disease or injury is bleak. Diarrhea can be shameful, especially for people who must share communal toilets or who have no choice but open defecation. It can also be terrifying. Watching a child grow listless with dehydration. Feeling the water squeezed out of one's body at an alarming rate. Listen to how Mr. Madida, who suffered with cholera during an epidemic in South Africa in 2000, recalls that experience: "The hair still stands on its end and you feel the blood rush through all parts of the body each time when one thinks about that situation."¹³ Kidney disease, bladder cancer, and liver disease are no less frightening and no more comfortable; they just grind a person down in a different way over a longer period of agony, asking families to marshal different resources to care for their people.

A few preliminary figures help sketch the disturbing extent of these experiences. Tainted water is responsible for a significant amount of morbidity and mortality among urban Africans. Severe diarrheal disease accounts for some 600,000 deaths a year in sub-Saharan Africa, the majority of which afflict children and the elderly.¹⁴ It is the third-leading cause of disease and death among African children under the age of five, a situation that public health authorities have long understood as an expression of the quality of water and sanitation.¹⁵ Diarrheal disease is an umbrella term for disease caused by a range of waterborne pathogens including cholera, typhoid, amoebiasis, giardiasis, rotavirus, and *E. coli*. Other endemic waterborne afflictions include Hepatitis A and schistosomiasis, for which 11.7 million people in Africa were treated in 2008.¹⁶ Schistosomiasis has historically been seen as a rural affliction, as Jennifer Derr documents in her contribution to this issue of *Dædalus*.¹⁷ Yet in recent years, "rapid and disordered urbanization" has seen an expansion of the disease in urban areas.¹⁸ Meanwhile, Tanta was not unique. A recent review names chronic kidney disease as a "substantial health burden" on the continent.¹⁹ African epidemiologists note both rising rates of bladder cancer as well as an ongoing shift from the prevalence of subtypes caused by chronic schistosomiasis to those fostered by exposure to industrial chemicals.²⁰

The current epidemiological moment is a complex one. On the one hand, African cities are grappling with outbreaks of cholera and typhoid, endemic diarrheal disease, and other problems that arise from inadequate or broken water and sanitation systems, as happened in Accra in 2014. On the other hand, there are rising rates of debilitating disease and injury that are associated with chemical pollution, heavy metal poisoning, and other side effects of industrial water contamination like we saw in Tanta. This division is a false one. Health effects are tentacular and cascading. Chronic kidney disease can lead to Hepatitis C via dialysis as

witnessed in Tanta. Repeated bouts of childhood diarrhea can exacerbate chronic malnutrition. The money spent purchasing water cannot be spent on necessary medications. The money spent purchasing medications for water-related disease cannot be spent purchasing nutritious food or adequate shelter. And as these two epidemics illustrate, the divide between urban and rural is porous. The city and its hinterland cannot be fully separated. Accra's cholera outbreak was quickly carried upcountry. Tanta's dialysis ward gathered poor patients from rural communities beyond Tanta to lie on machines next to factory workers from the city. Rural water pollution from the industrial use of chemical fertilizer moves up the Nile to Cairo. Even if city dwellers are drinking properly treated water, fish, grain, and vegetables laden with heavy metals and chemical pollutants harvested from downstream irrigation channels are carried to Cairene markets.

This essay explores the relationship between water supply and health in urban Africa through the lens of water scarcity and health as political relationships as much as environmental or technical phenomena. Anthropologist Nikhil Anand describes a kind of urban "belonging enabled by social and material claims made to the city's water infrastructure" that he calls "hydraulic citizenship."²¹ South African scholars Michela Marcatelli and Bram Buscher use the term "liquid violence" to describe the biopolitical condition in which "some people are systematically left without sufficient water."²² This biopolitical formulation is helpful for thinking about water and health together. Liquid violence flows through social and economic hierarchies, distributing water upward and cascading harm to those at the bottom. Water shortages plague cities like Kinshasa, Democratic Republic of the Congo, located on the banks of one of the world's largest rivers, or Harare, Zimbabwe, where, as Muchaparara Musemwa shows in this issue, once robust water infrastructure has fallen into disarray, undermining any sense that water distribution is a straightforward expression of supply. Meanwhile, as climate change directly challenges supply in cities like Cape Town, South Africa, Gaborone, Botswana, or Dar es Salaam, Tanzania, the health effects of scarcity are not evenly distributed. Across the continent, wealthy, middle-class, and poor urbanites consume water at radically different scales, with negative health outcomes concentrated among the poor and working class. By bringing infectious disease like cholera and chronic ailments like kidney disease into the same frame of analysis, this essay also directs attention beyond the overwhelming public health focus on microbial contamination to emergent forms of water-related illness and injury that proceed unchecked. Just as Derr shows how endemic schistosomiasis became the assumed cost of development in mid-twentieth-century Egypt, in the twenty-first century, we might say the same for kidney disease and cancer. Africa is an enormous and diverse continent, and this discussion does not pretend to be comprehensive, but instead maps the contours of a complex situation affecting hundreds of millions of people.

Water distribution is a political phenomenon. It is shaped through technical practice and operates within environmental limits, but the choices over whether and where to lay and maintain pipes as well as regulations governing pollution and their enforcement are determined by political and economic interests. Among residents of African cities, not everyone experiences political recognition through the pipes; the burden of water-related illness falls disproportionately on poor and working-class people. Liquid violence manifests in the fact that some people live in a state of chronic water shortage, even as others in their same cities do not. As several authors in this issue elucidate, the causes of these inequities are complex and varied.²³ They range from mismanagement to corruption to budgetary and political pressures around cost recovery to the ongoing infrastructural legacies of colonial-era segregation and the technical challenges posed by the rapid growth of informal settlements sited some distance from the water mains. These dynamics are exacerbated by global climate change and pollution, which threaten water supply, a situation that promises to increase in the coming years.

Urban agglomerations on the continent range in scale from megacities with populations in the several millions like Lagos, Kinshasa, or Cairo to smaller secondary cities like Bulawayo, Kumasi, or Kisumu. Spontaneous growth means that many cities are over-spilling their administrative boundaries with peri-urban settlements emerging apace, sometimes engulfing previously rural villages. Across the urban landscape, cities draw from a range of water sources from rivers and dams to springs and wells, and residents rely on an array of procurement options that are determined by available infrastructure and service provision. In any African city, there are residents with piped water and indoor plumbing, and hotels with swimming pools, as well as people who must queue to collect or purchase water in small quantities for carefully rationed domestic use. Meanwhile, decades of urbanization have outstripped formal planning and service provision even as older infrastructure has fallen into disrepair.

Some two-thirds of urban Africans reside in informal settlements where municipal infrastructure has deteriorated or is lacking altogether, and where the costs of purchasing water are paradoxically higher than in more affluent neighborhoods.²⁴ Spontaneous population growth is especially concentrated in these underserved areas. For example, in the Kenyan capital of Nairobi, the UN estimates that informal settlements account for 75 percent of urban growth.²⁵ These neighborhoods are the most challenged in terms of water access in a city where “84 percent of higher and middle income households have access to a piped water connection,” compared to only 36 percent of households in low-income neighborhoods.²⁶ Local water activists remind us that informal is a political designation, a manifestation of hydraulic citizenship as much as one marking the age of a particular neighborhood, and that the problems of liquid violence are long-standing. The Mathare Social Justice Center contends that:

By being marked as “informal,” and intentionally maintained like this, our home areas, particularly those called “slums,” are largely neglected by the government through the denial of basic rights and infrastructure. Even though, for example, Mathare has been around for close to 100 years, there is still no sufficient piped water infrastructure, or adequate housing and sanitation provisions.²⁷

Development experts had long recognized access to “improved water” – provided through systems that protect it from contamination, making it safe for drinking and other uses – as a cornerstone of public health and poverty alleviation. African governments and their international partners metricize improved water access as an index of economic and social development. Over the past half-century, various strategies and policy trends have been tried to increase access, resulting in a complex and diverse patchwork of policy and infrastructure across African cities. Municipal water systems have expanded in some cities. In others, like Harare or Kinshasa, they have broken down or contracted, sometimes with disastrous effects.²⁸

The first decade or so of the twenty-first century saw an extensive push for the liberalization of water services in many African cities. This rendered water an “economic good” under a policy vision that emphasized cost recovery for utilities.²⁹ Yet improved financing for water utilities did not necessarily result in an increase in coverage among low-income consumers.³⁰ Activists and community groups in some cities rejected further commercialization of water and popular protest succeeded in derailing outright privatization, as in the case of South Africa described later in this essay.³¹ In some cities, public-private partnerships were set up. But private companies often concentrated service in wealthier neighborhoods, where they could expect better returns.³² In yet other sites, there are community partnerships with publicly run utilities. For example, in Lilongwe, Malawi, a Water Users Association model was developed in 2006, based on “‘partnerships of necessity’ among overstretched, cash-starved [Water Boards], water-bill delinquent and poor peri-urban communities, and key NGOs in the water sector.” In this arrangement, the water boards license the community-based water users’ associations to operate the communal water kiosks. The water boards supply the water and provide technical assistance. This program resulted in gains in water supply, improved maintenance, and better financial management.³³

Across this array of arrangements in cities throughout the continent, even in sites with improvement in shortages and service, interruptions continue to plague systems for improved water procurement. One woman in Lilongwe, Malawi, described to researchers an experience common to many in cities across the continent.

I wake up very early in the morning, sometimes around 5 am. Because some days I have to wait a long time at the kiosk, for up to 1 hour, before it is my turn to fetch wa-

ter. Sometimes I wait for that long and I still come home without water because the water stopped flowing or it was time for the water kiosk attendant to close the kiosk.³⁴

Even when improved water is theoretically available, many people find themselves relying, in part, on unimproved sources.

Between 1990 and 2015, access to improved water in sub-Saharan African cities increased from 83 to 87 percent. Yet 94 percent of the richest quintile enjoyed access compared to only 64 percent of the poorest quintile.³⁵ In 2017, the World Bank narrowed the criteria for safe water, changing the standard from improved to specifically piped water. Yet in 2017, only 61 percent of all people in sub-Saharan African cities had access to piped water. Moreover, analysts caution that these numbers are likely inflated. First, they are calculated by geographic proximity to an improved source and fail to account for many factors that constrain access, like extensive wait times (of several hours) at water points or irregular supply.³⁶ According to African Utility corporations, nearly one-fifth of public standpipes are broken, though independent estimates put the figure at 58 percent.³⁷ Even those with a piped connection usually have intermittent flow into their taps. Second, piped water is not necessarily safe to consume. When tested at the point of collection, microbial contamination was often found in improved water sources.³⁸ And even if potable at collection, water quality begins to degrade or may become contaminated during transport and storage in open containers. Yet unreliable water connections cause people to store quantities of water for times when the taps are dry. Meanwhile, testing remains rare for heavy metals, chemicals, and other nonmicrobial industrial contaminants, like those that Tanta's dialysis patients suspect as having damaged their kidneys. Still many African cities rely on "high vulnerability" aquifers.³⁹

In any given city, residents may get their water from multiple sources. Municipal water systems are fragmented and partially privatized, with services arising ad hoc, and require people to combine strategies and modes of procurement and use. A water utility may officially provide water free to residential consumers, but be plagued with broken pipes, power blackouts, and other problems that require people to find other sources. As Matthew Bender documents in this issue, "multiple sourcing" is a crucial and long-standing strategy for households in Dar es Salaam.⁴⁰ There, as in many African cities, a single household might at various times send daughters to queue at a municipal tap for bulk water collection, collect rainwater in cisterns, and buy bottled water from a neighborhood vendor for drinking. Development scholar Florent Bédécarrats and colleagues give a sense of the heterogenous hydroscape that has developed as formal municipal services have fallen into disrepair or failed to keep pace with urban growth and a mosaic of improvisational initiatives emerges.

The gaps left by the main water utility have led to an increase in the number of alternative operators, both formal and informal. . . . These systems can be private or com-

munity-managed. They may depend on a third-party operator for their raw water or produce it independently. . . . Examples of this are the small-scale private operators in Maputo that provide water to their neighborhoods via “spaghetti” networks: flexible polyethylene pipes laid directly on the ground and fed from 40 m deep boreholes. . . . In Kisumu, Kenya, water supply to slums is ensured by associations. In Ouagadougou, the national public utility delegates the service for informal settlements to small operators.⁴¹

This complex situation is difficult to fully apprehend. Mapping the scope and scale of both water access and illness are challenging and indeed self-referential. Epidemiological systems are uneven and stretched on the continent. Much disease goes unreported, as do many deaths. An epidemic of cholera like that described in Accra in 2014, given the acute and terrifying nature of the disease and its potentially rapid spread, draws the attention of the health service and its counting apparatus. Yet most of the estimated 1.4 million cholera cases in Africa each year go unreported, posing a problem for epidemiological surveillance.⁴² Epidemiologists report that in 2017, there were 739,5000 cases of typhoid in Eastern Africa, and that sub-Saharan Africa accounts for 12 percent of typhoid globally. But these figures do not correspond to actual human beings diagnosed with typhoid, since many countries do not actively surveil the disease.⁴³ And for those who do, they most likely do not see all cases.

The figures for much water-related infections therefore, like those for childhood diarrhea, are necessarily generated through multifactorial models. These models use small cohort studies, as well as data on water and sanitation, to project cases of diarrhea or typhoid.⁴⁴ This is not to say that they should not be taken quite seriously. It is clear that the problems associated with waterborne pathogens are present and pressing. The smaller localized studies are telling. In 2006, the Chadian Department of Health surveyed residents of the capital N’ djamena. Among households surveyed, they found only 61 percent of households had access to improved water, and that 27 percent of children under the age of five had suffered from diarrhea in the two weeks prior to being surveyed. Among babies six to eleven months, that figure rose to 40 percent.⁴⁵ But scaling up to large population data requires multifactorial modeling. Therefore, when access to improved water increases, rates of diarrhea and typhoid decrease, regardless of what may actually happen on the ground. Meanwhile, data on water and sanitation are often partial and open to manipulation or misinterpretation. As noted above, the presence of a standpipe does not necessarily mean that the standpipe is functioning. Thus, the figures have to be understood as political technologies in their own right.

Beyond infectious ailments, the situation grows far more opaque. There are enormous gaps in knowledge about the scope and scale of urban water-related

illness and injury. A historical association of waterborne disease with microbial contamination has meant inattention to the relationship between water supply and the new epidemiology of cancer, kidney disease, and other chronic, if deadly, ailments on the rise in urban Africa.⁴⁶ These problems are more difficult but no less urgent to trace. Kidney disease cannot solely be attributed to exposure to polluted water; it is also, for example, related to rising rates of diabetes and hypertension. But recent studies have shown that although these comorbidities are the most common risks associated with chronic kidney disease “in middle-income and high-income countries,” in low-income contexts like much of urban Africa, “environmental and occupational exposure to pollutants remain common causes of kidney disease.”⁴⁷ Yet many studies of kidney disease in Africa fail to acknowledge the question of environmental and occupational exposures, much less take up these factors as an object of study.⁴⁸ One group of epidemiologists mapping the rising tide of kidney disease on the continent points to this problem: “Larger-scale epidemiological studies are needed to examine many potential but currently unmeasured urban risk factors including contaminated water supplies.”⁴⁹

Nor should one imagine chronic kidney disease the only pathology associated with pesticide, chemical, and heavy metal contamination of the water supply. Bladder and other cancers, liver disease, neurological damage, Parkinson’s disease, and congenital abnormalities are all associated with consumption of industrially contaminated water. People who experience these forms of contamination may correctly suspect and theorize their relationship to injury, as Sherine Hamdy found in Tanta’s dialysis ward.⁵⁰ Yet epidemiological surveillance and the associated clinical and laboratory capacity necessary for accounting for these conditions and tracing levels of contamination have not kept pace with pollution, masking the extent of injury and obscuring culpability.

Within this unstable archipelago of service provision, many people, particularly those living in informal settlements, find themselves facing difficult decisions with serious secondary health effects. Imagine having to choose between purchasing clean water or using untreated water from a river or shallow well in order to save that money for rent. Imagine caring for children with repeated bouts of acute diarrhea while also having to queue two hours to procure the water necessary to bathe and otherwise clean up after them. Water scarcity threatens hygiene, which carries serious negative health consequences. The same neighborhoods that lack regular water access are often those that also lack adequate sanitation. Even so, sanitation is less easily purchased as a stopgap solution than water.

A look at packaged water helps to elucidate the negative secondary health effects of water scarcity. Bottled water, tanker trucks, and sachet water are all considered improved sources, and are increasingly important sources of drinking wa-

ter. As supply interruptions increase due to water shortages and aging infrastructure, and as people move into neighborhoods that lack adequate water, a market in packaged water has stepped into the breach. In Ghana in 2008, a government study found that while 16.8 percent of urban households relied on packaged water as their primary source of drinking water, within a decade, this had risen to 53.6 percent.⁵¹ Yet as Accra's cholera epidemic makes clear, even improved water, like that purchased in sealed plastic sachets, can carry deadly pathogens. Recent studies of sachet water samples have found *E. coli*, fecal coliforms, protozoa, salmonella, and other pathogens.⁵² Even when safe to drink, packaged water carries secondary health effects. One study reported that water sachets, along with similar bags used for ice cream, contribute 85 percent of the 270 tons of plastic waste produced in Ghana each day. "The accumulation of plastic clogs water drainage pathways and exacerbates flood conditions in low-lying neighborhoods. For many low-income neighborhoods, flooded drains ultimately lead to increased risk of exposure to untreated sewage, animal waste, and runoff from urban agriculture."⁵³

Any assessment of the health impact of packaged water must take into account the burden its cost places on households that already face difficult choices in providing for basic needs. Due to the patchwork and ad hoc nature of services, water pricing is regressive in many cities, costing poor people much more than their wealthy neighbors. Water from private vendors is much more expensive than provided by formal utilities, yet it is the poor who must rely most heavily on this market. In the small Nigerian city of Yenagoa, environmental scholars Odafivwotu Ohwo and Abel Abatuto found that households "spent an average of N4,500 (\$22.60) per month" buying water from private vendors. This was approximately one-quarter of the monthly minimum wage.⁵⁴ In a different study in Lagos, Ohwo documents how consumers in poor neighborhoods, which are further from the water mains, pay as much as four times the price for water as those in wealthy neighborhoods.⁵⁵ In the Malawian capital, Lilongwe, residents of informal settlements pay "at least twice as much for water as those in high-income urban neighborhoods."⁵⁶ In Nairobi, consumers pay ten times as much for vendor-delivered water than for water piped into private homes.⁵⁷

Poor households have very little elasticity in their budgets. Even a subtle rise in the price of water, whether packaged or delivered by other means, has the potential to create scarcity among the poor with cascading negative health effects, while often failing to discipline the consumption habits of those with money to spare. Consider, for example, the case of South Africa, where access to water is enshrined as a human right in the constitution, where the legacy of apartheid continues to structure differential access to water, and where social movements demanding water underscore that poor people understand clearly the place of hydraulic citizenship in the politics of water scarcity and distribution.⁵⁸ In the 2000s, as part of the implementation of the 1998 Water Act, new policies shifted from flat-rate

charges to metered billing. Utilities disconnected many township customers who were in arrears, and water utilities began installing prepaid water meters, which would shut off taps until payments were made. These measures focused on cost recovery from and rationalizing use by poor Black communities, rather than progressive policies that would recover costs from and rationalize or even limit ongoing excessive water consumption in wealthy, predominantly White households or commercial endeavors.

In 2000, authorities in rural KwaZulu-Natal, South Africa, introduced a fee for water, causing impoverished residents who lacked coins for the metered tap to turn instead to unimproved water sources. A cholera epidemic soon emerged and spread. Within eight months, hospitals, clinics, and rehydration centers had treated more than 82,000 cases.⁵⁹ By the time it was over, 265 people had died.⁶⁰ In the epidemic's wake, the government began a free basic water policy that gave each household a guaranteed minimum of 6 kiloliters of water a month, above which they would have to pay. Yet as researchers from South Africa's Municipal Services Project point out, this policy was not enough to prevent a water-associated typhoid outbreak in 2005 in the peri-urban town of Delmas, just outside the industrial belt of the East Rand. There, poorly managed sanitation affected water quality. These researchers also found that in rural KwaZulu-Natal, many people were still living with continuing cycles of water-related disease due to cost and service interruptions. In some cases, the free basic minimum was only intermittently provided.⁶¹

Township residents protested the meters and, in 2008, in the Phiri neighborhood of Soweto, a group of activist residents took the city of Johannesburg to court, arguing that the policy violated their constitutional rights. The case was won, and then reversed on appeal, though in its wake, the city of Johannesburg raised the monthly minimum per household. But for purposes of this discussion, the examples brought by the plaintiffs suggest the extent of secondary effects. In the most tragic case, two children burned to death in their shack as neighbors bailed water from a ditch because they were unable to coax water from the meter, which had shut off for lack of credit. Another plaintiff explained that she cared for a relative with AIDS who was stricken with diarrhea. After the installation of the meter, she could not afford enough water to properly bathe her patient and launder her bed linens and clothing, an impossible situation.⁶²

Even when a basic minimum is provided, commodification shifts the moral economy of water, further undermining an ethos of care and collective responsibility among neighbors. Take, for example, the findings of a study conducted in Khayelitsha, a large township in Cape Town, where shack dwellers live among formal dwellings. Approximately two-thirds of households have access to piped water either inside the home or at a tap in the yard. Researchers found that residents became unwilling to share water with neighbors once they had their own

tap. When researchers asked shack dwellers about asking for water from neighbors when the communal tap was broken or dry, many expressed discomfort and some cited past conflicts. One woman said, “she can only ask for very small amounts of water, because there is general sense in the community that payment for water will commence in the near future.” Another noted, “It is not easy, but we still ask because we need the water. Maybe we go ask them with a bucket, but you cannot ask for a lot or more than a bucket. . . . They say they pay for the water. They rent this water so you must come with a small bucket to pour water in for you.”⁶³ This kind of erosion of resource-sharing among neighbors further strains already fragile safety nets upon which people rely in times of illness. Such nets are especially important in contexts where chronic illnesses like HIV/AIDS or chronic kidney disease require sustained caregiving over many weeks, months, and even years.

The metering and pricing policies were not enough to prevent a water shortage crisis in Cape Town in 2018, as several years of severe drought steadily drained and ultimately threatened to collapse the city’s water supply. This culminated in a municipal crisis, with a looming threat of a “Day Zero” when the water would cease. Severe use restrictions were put in place, and water consumption dropped significantly. Yet as anthropologist Steve Robins shows, wealthier residents were able to drill wells and boreholes to supplement their supply, while poor and working-class residents could not. Antiprivatization activists in the city had long pointed to inequities of consumption, suggesting the poor were hardly the cause of water scarcity. Researchers from the University of Cape Town found that to be the case: “in 2017, informal settlements had used a mere 4.7 per cent of the total water available, compared to middle-class suburbs, which accounted for roughly 70 per cent of domestic water used.”⁶⁴

As this essay has described, urban water scarcity is a complex phenomenon encompassing environmental, technical, political, and economic arrangements, which concentrate illness and harm among the poor and working class. Looking ahead, anthropogenic climate change threatens to increase the number of people in Africa’s cities vulnerable to the cascading health effects of water scarcity. Cape Town’s experience reminds us that these vulnerabilities will not be equally distributed. Across the continent, many cities find surface water supply challenged by an escalating drought cycle and increasing temperatures that accelerate evaporation, as happened in Cape Town. Though the rains have returned to southwest Africa and the dams are currently full, scientists caution this is a temporary reprieve and predict the drought cycle to return, part of a projected trend of a “drying sub-Saharan Africa.”⁶⁵ Anthropogenic changes are complex, as is the relationship between urbanization and climate change. Escalating drought cycles drive rural families from the land and into the cities, part of the tide of ur-

banization and the growth of informal settlements. Urbanization, in turn, means more people are consuming water, increasing demand and pressuring supply.

Urbanization is also terraforming in ways that negatively affect supply. In cities that rely primarily on groundwater, as former farmland and bush are cleared for dense settlement, groundwater recharge is slowed.⁶⁶ But water scarcity cannot only be understood by a simple turn to quantity. Unchecked industrial contamination of aquifers and rivers also threatens water supply over the long term. In the mining area of Johannesburg, for example, many of the aquifers are “clogged up with acid mine drainage,” rendering them unusable.⁶⁷ In Thiaroye on the Dakar peninsula, nitrate from septic systems has polluted the shallow aquifer, which is tapped for drinking water.⁶⁸ In Kisumu, anti-inflammatory, antibiotic, and psychiatric drugs, as well as the antiretroviral nevirapine, are now present in ground water.⁶⁹ Across the African urbanscape, while the threat of diarrheal disease remains high, the damaged kidney may be a sentinel for another source of water scarcity: anthropogenic pollution.

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Cahora Bassa Dam & the Delusion of Development

Allen Isaacman

On December 6, 1974, two pressure-driven steel gates of the Cahora Bassa Dam, each weighing 220 tons, stopped the mighty Zambezi River in its course. After five years of toil by more than five thousand workers, the construction of Mozambique's Cahora Bassa was complete. At the time, it was the fifth-largest dam in the world. The hydroelectric dam was the last megaproject constructed in Africa during the turbulent era of decolonization. Through the voices of peasants and fishermen, displaced by the dam and the workers who built it, this essay analyzes the far-reaching social, political, and ecological consequences of Cahora Bassa. It also explores the devastating impact on riparian life downriver from the dam, which dramatically reduced the annual inundation of the floodplain that supported hundreds of thousands of farmers as well as fish, birds, and mammals.

When completed in December 1974, the final year of Portuguese rule over Mozambique, the Cahora Bassa Dam attracted considerable attention. Hydrologists, engineers, and economists heralded its technical complexity and its potential to transform life for millions in the Zambezi River valley. Built in a remote corner of the Portuguese colony, it was at the time the fifth-largest dam in the world. Its completion confirmed that nature could be conquered and biophysical systems transformed to meet the needs of humankind. One after another, the late colonial state (1965–1975), the socialist state (1975–1987), and the neoliberal state (1987–2020) all celebrated this great achievement as part of their different development narratives. Governments of very different ideological perspectives operating in very different global economies found the dam hugely appealing. Whether Portuguese or Africans have held the reins of state power, the dam has symbolized the ability of science and technology to control nature and ensure human progress. To the degree that official versions of Cahora Bassa's history have become the dominant narrative, critical voices continue to challenge the interpretative authority of the state and question the social and ecological consequences of the hydroelectric project.

The optimistic official forecasts have not been realized. As in the case of many large hydroelectric projects in the Global South, the Cahora Bassa Dam precipitat-

ed disruption in the lives of the rural poor, exacerbated by global climate change.¹ The history of Cahora Bassa raises the troubling question of development for whom? Put somewhat differently, who benefits and who loses from such a massive project?

In 1965, when Portugal proposed a dam at Cahora Bassa, colonial officials envisioned that numerous benefits would flow from the US\$515 million hydroelectric project and the managed environment it would produce. These included the expansion of irrigated farming, increased European settlement and mineral output, improved communication and transportation throughout the Zambezi River valley, and reduced flooding in this zone of unpredictable and sometimes excess rainfall.² According to Overseas Minister Joaquim da Silva Cunha, Lisbon's objective was "to tame the wild river and transform it into a valuable tool for progress . . . for the betterment of the indigenous peoples who are an integral part of the Portuguese nation."³ As a follow-up to this technological triumph, Portuguese planners envisioned building a second dam 60 kilometers south of Cahora Bassa at Mphanda Nkuwa.

Military realities on the ground, however, forced Lisbon to drastically narrow this vision. Because of a growing threat from anticolonial guerrillas known as FRELIMO (The Front for the Liberation of Mozambique), Cahora Bassa became a security project masked as a development initiative.⁴ Both South Africa's apartheid regime and the Portuguese state viewed the dam and its connected lake as a buffer that would block the advance of FRELIMO and, by extension, its ally the African National Congress (ANC), which was committed to overthrowing White minority rule. In return for Pretoria's assistance against FRELIMO, in 1969, Portugal agreed to export to South Africa the vast majority of the energy that Cahora Bassa would generate at a fraction of the world price. With this agreement, the purpose of Cahora Bassa, whose original functions were to include the provision of hydroelectric power to stimulate agriculture and the control of flooding, was effectively reconfigured to be both a source of cheap energy for South Africa and a barrier to prevent the advance of "terrorist forces."⁵ The energy generated would be transmitted to the apartheid regime using the innovative high-voltage direct-current (HVDC) method rather than the conventional alternating-current method. This new technology, however, precluded its use by Mozambican consumers since Mozambique lacked the capacity to convert HVDC to alternating current. Controlling the output of Cahora Bassa was the first phase of Pretoria's ambitious plan to integrate all dams in Lesotho, Angola, Namibia, Zambia, and Zimbabwe into one centralized power grid. "In this way, South African planners hoped to 'capture' the region and become its 'natural' engine and powerhouse."⁶

From the moment the dam's massive steel gates closed to restrict water flows in 1974, South Africa's needs dictated the timing, frequency, duration, and mag-

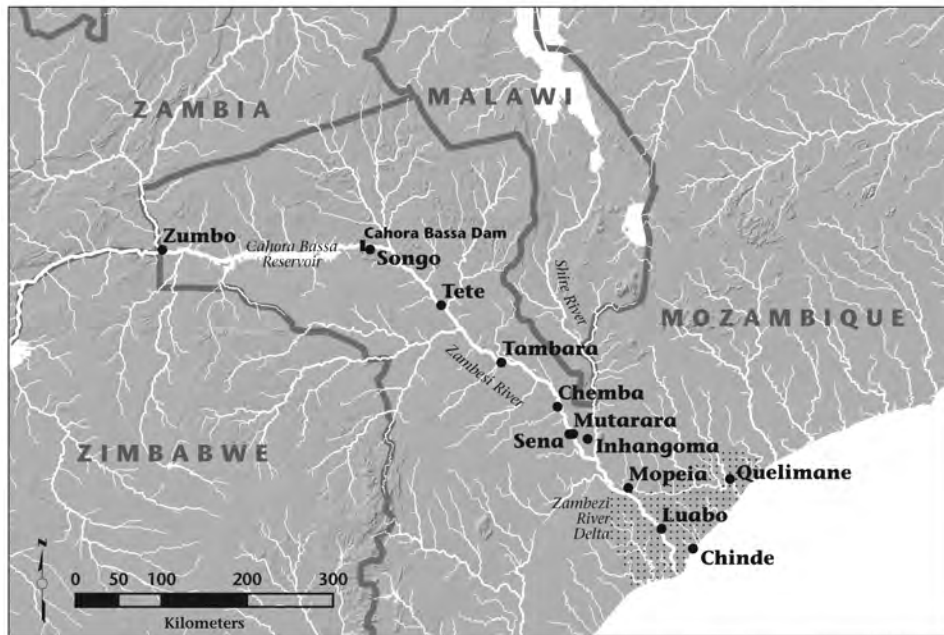
nitide of water released from the dam. Cahora Bassa became the largest dam in the world constructed for the specific purpose of exporting energy.⁷ Over one million peasants living downriver adjacent to the floodplains felt the hydroelectric project's devastating economic and ecological consequences as did fifty thousand peasants whose fertile homelands were inundated by the massive lake formed behind the dam walls.

Three hydrological factors are critical to understanding the rationale for constructing the dam in its relatively vulnerable geographic position. First, although the Cahora Bassa Dam and reservoir are contained entirely within Mozambican territorial boundaries, the vast bulk of the Zambezi drainage basin, the third-largest river system in Africa, lies outside of the country. Since Mozambique is at the end of the stream, it is dependent on its neighbors for access to the river's water. Second, there are only a few locations in the Zambezi basin suitable for reservoirs or hydroelectric plants. In most of the basin, located on the Central African plateau, the waters flow slowly through low plains and swamps, providing few potential sites for dams. Third, and most relevant for this discussion, was the pronounced seasonality of Zambezi flows and the serious impact of annual floods on the riverine communities and their natural habitats as well as for the European sugar plantations located near the mouth of the river. Indeed, flood control was one of the presumed advantages of building the dam and containing massive flooding, which had occurred sporadically.⁸

Contrary to popular perceptions, seasonal flooding did not have deleterious effects. Waters from the flooding river typically inundated the banks of the Zambezi during the rainy season from December through March. When the waters receded, they left a rich deposit of nutrients along the shoreline. In lowland areas, this spillover often extended over a several-kilometer stretch of land. Peasants throughout the valley considered these rich dark *makande* soils of the floodplains to be the most desirable agricultural sites in the region. Beatriz Maquina, an elderly woman who had farmed her entire life, stressed that the "*makande* land located near the banks of the river always gave us good production. We cultivated a great deal of sorghum as well as some corn."⁹ All the elders with whom we spoke distinguished *makande* from the more common sandy, rocky *ntchenga* soils, which did not retain water and were difficult to farm.¹⁰

Given the low and irregular rainfall in the Zambezi valley, access to the *makande* river-fed soils was critical to ensuring household food security. Much of the Tete district and the Lower Zambezi valley has a semi-arid climate and savanna-like environment. The average annual rainfall in much of Tete is only 600 millimeters. Droughts occur regularly, often with devastating consequences to the crops. Without *makande* lands, peasant households faced the prospect of periodic crop failures on a regular basis and, even in the best years, little likelihood of producing

Figure 1
Map of the Zambezi River Basin Showing Geopolitical Boundaries and Reservoirs



Source: University of Minnesota Cartography Laboratory.

a second annual crop. This vulnerability was true downriver as well, where rainfall was more appreciable, but still erratic.

Peasant cultivation of river-fed land constituted a critical feature of the complex and highly adaptive indigenous agronomic system. Drawing on a rich repertoire of farming practices, born out of years of trial and error and detailed micro-ecological knowledge, local communities creatively adapted to the uneven soil quality, fluctuations in rainfall, and challenges of flooding. Carlos Soda Churo, who was forced to relocate because of the dam, described, in some detail, farming practices prior to the impoundment:

Before Cahora Bassa each family had several fields. The number and size varied depending on strength of a person and the size of his family. The land near the river was very good. It was called *makande*. When the river rose and then receded in June, the area that had been covered with water was very good for farming. There we first planted maize. We cultivated beans in the same field as the maize. Beans needed something

to rest on and the maize stalks served well. Nearby we cultivated a second small plot with sweet potatoes, tomatoes, cabbage and more beans. We harvested our gardens in September and October before the rains and flooding. By November we were working in our larger fields away from the river. On the *ntchenga* soils we planted sorghum, which does not require as much water. The mixed *ntchenga-makande* soils were better for maize, which needs more moisture than sorghum. Some people planted peanuts in their maize fields. We harvested these crops in June and July and then returned to our gardens.¹¹

Churo's account underscores three important features of the indigenous agronomic system. First and foremost, the food production systems of local agriculturalists coevolved with the seasonal cycle of the river's flood patterns. Decisions regarding the spatial and temporal patterns of food production, including selection of the most appropriate crops and amounts planted, with reference to the season and different micro-ecological zones, were finely tuned to changes in the river's discharge rates as well as variations in soils and sunlight. Second, intercropping was an effective labor-saving device since several crops could be tended simultaneously. Cultivating peanuts in maize fields had the added advantage of restoring badly needed nutrients to depleted *ntchenga* soils. Finally, households spent most of the year engaged in agricultural production in order to minimize labor bottlenecks and to ensure an adequate supply of food.

The free-flowing Zambezi provided sustenance to riverine communities in two other important respects. Before Cahora Bassa, approximately sixty species of fish inhabited the river.¹² Elders recalled that the Zambezi provided a large catch, which they consumed.¹³ Fish were a major source of protein. The river also attracted large herds of impala, gazelle, elephants, buffalo, and eland from the nearby forests to water on the banks of the Zambezi and adjacent wetlands, where they became prey for skilled hunters.¹⁴ Game was an integral part of the local diet. Peasants also consumed meat in larger amounts at important social occasions and at rituals propitiating the ancestor spirits. All of this changed, however, with the construction of Cahora Bassa.

Colonial planners stressed that the long-term benefits of the dam would far outweigh any short-term inconveniences in the lives of the riverine communities. Despite such assurances, Cahora Bassa had immediate, multiple, and far-reaching consequences for the displaced communities whose homelands and farms were flooded to create the massive lake behind the dam. The most immediate effect was the permanent inundation of 2,700 square kilometers of highly productive floodplains effectively used by peasant communities for centuries. As Masecha residents Pezulani Mafulanjala, Maurício Alemão, and Bernardo Tapuleta Potoroia recalled, "All the crops grown on the *makande* had a good supply

of water and nutrients. In some lowland areas the river deposited sediments on banks for 2 – 3 kilometers from the river.”¹⁵

Yet it was not simply eviction from their homes and ancestral lands that proved so devastating. Unlike other powerless groups around the world displaced by hydroelectric schemes, the Zambezi peasants were herded into strategic hamlets with few basic amenities. These *aldeamentos* were an integral part of Portugal’s broader counterinsurgency program designed to cut FRELIMO off from its rural base. Mafulanjala, Alemão, and Potoroia remembered what happened the day they were told to move:

They came and told us that the water was going to rise and that we would have to leave. ... Among us there were people who complained and did not want to move. They were very angry because they had fields and houses here and their whole life was here. But they had no choice.¹⁶

Although colonial authorities initially claimed that only 25,000 Africans would be displaced, by the end of 1973, the number had jumped to over 42,000.¹⁷

The displaced peasants lived in mud and wattle huts laid out in a grid enclosed by a barbed wire fence. The peasants were effectively held captive. Their only access to the outside world was through a checkpoint manned around the clock by local militia.¹⁸ The lands surrounding their villages were rocky, hard to work, not very fertile, and often far from the strategic hamlets. They stood in sharp contrast to the lands left behind.¹⁹ The arid conditions and absence of rain-fed lands dramatically reduced agricultural yields. So too did the colonial policies that limited each household to one small plot, typically less than a hectare in size. Government agronomists, by discouraging intercropping on the grounds that it created “messy” fields, also exacerbated low productivity.

Food shortages were not the only problem these uprooted communities experienced. As in other dam projects in Ghana, Egypt, and Sudan, sickness and death rates increased markedly, especially among the very young and very old.²⁰ Inadequate rural diets, combined with problems caused by poor sanitary conditions regularly exacerbated by heavy rains in January and February, left rural communities reeling from cholera. In *aldeamentos* located near Lake Cahora Bassa, waterborne parasitic illnesses such as schistosomiasis and malaria posed new health threats. The commonly held explanation for these misfortunes – that the flooding of sacred shrines and burial sites had alienated powerful royal ancestor spirits (*mhondoro*) – underscores the sense of cultural obliteration and vulnerability experienced by the uprooted peasants.²¹

The inundated floodplain habitats also constituted some of Mozambique’s most diverse ecosystems. The dry savanna near the river had supported numerous trees whose leaves would fall and act as natural fertilizer upon decomposition. The diversity of tree species in the region is provided by the accounts of people

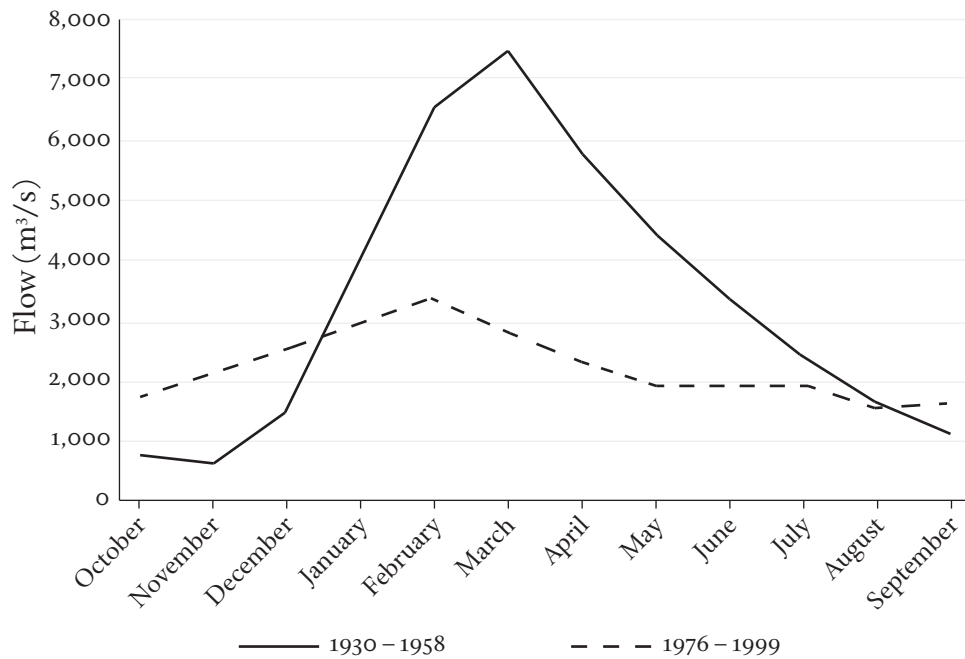
who, during times of drought, would forage for wild fruit.²² These riparian ecosystems also supported substantial numbers and types of animal species, including elands, bush pig, buffalo, nyasa, gazelle, elephant, and rhinoceros.²³ Despite the government's much vaunted plan (termed "Noah's Ark") to protect wildlife, officials did little.²⁴ The effects were devastating. Residents Bento Estima and Joseph Ndebvuchena remembered that

After the flooding began many animals were stranded on Tanzwa and Manherere which are islands in the Zambezi. Some died on these islands because they could not get enough food. As the water kept coming higher, many animals were swept away if they couldn't swim to the other side of the river.²⁵

In addition to the permanent inundation of ecologically important riverine lands, the decision to fill the Cahora Bassa reservoir at a breakneck pace also had far-reaching consequences for human communities and ecological systems downstream. Despite the hydrologic fact that the portion of the river below Cahora Bassa was highly dependent on the main channel for continued flows, dam operators refused to allow compensatory releases through the dam during the filling of the reservoir. The flow rate of less than 60 cubic meters per day for over three months had catastrophic results below the dam. The river was stopped in December precisely when the annual inundation of floodplains for agricultural production typically occurred. This was also a time when many fish species of the Lower Zambezi begin to spawn in adjacent floodplains. With the closure of the dam and discharge reduced to 10 percent of its average flow, the fish were stranded as flood waters receded. Local farmers who depended on fish for supplemental protein harvested them in large numbers during this period, placing further pressure on fish populations.²⁶

In April, with construction of the dam and turbines almost complete, engineers employed by Hidroelétrica de Cahora Bassa (HCB; the Portuguese company managing the dam) discovered a small defect in one of the turbines deep in the water of the almost full reservoir. Without any warning or consultation, they opened the turbines and sluice gates to full capacity and delivered an unnatural coursing of floodwaters downstream from the dam. Numerous small-scale farmers, at the time residing close to the river's edge to take advantage of the fertile soils, lost significant numbers of cattle and small poultry, and, in many cases, almost lost their lives. By May and early June, the gates of Cahora Bassa were being opened and closed on a daily basis, timed to the power generation schedules of HCB engineers. At no time in the first six months of the dam's operation were the waters of the reservoir stagnant, and the pattern was "that of a vast mass of raw floodwater in constant, though very slow, motion down the dam."²⁷ The transformation of the river's annual cycle from a punctuated, highly seasonal flow regime that supported farming to one characterized by unpredictable flows that rotted maturing crops was complete (see Figure 2).

Figure 2
Pre-Kariba and Post-Cahora Bassa Mean Flows of Zambezi River at Mutarara



Source: Richard Beilfuss and David dos Santos, "Patterns of Hydrological Change in the Zambezi Delta, Mozambique," Working Paper No. 2, Program for the Sustainable Management of Cahora Bassa Dam and the Lower Zambezi Valley, 2001, fig. 2-61.

On June 25, 1975, six months after the dam was completed, Mozambique gained its independence. With state power, Frelimo's socialist government was theoretically positioned to launch policies that, over time, might transform Mozambique's distorted economy and reduce its dependence on the apartheid regime.²⁸ Cahora Bassa figured prominently in the state's new socialist agenda. Mozambican state planners, committed to social engineering, were confident that the hydroelectric project would play a pivotal role in developing the Zambezi valley and improving the lives of millions of Mozambicans across the country who lacked electricity. Together with the organization of a network of state farms and communal villages, Cahora Bassa would, in the Marxist parlance of Frelimo, be instrumental "in the socialization of the countryside." In my discussion with President Samora Machel, he was adamant that:

We cannot irrigate without energy. The electrification of the central area of the north and of the south of our country is fundamental for us to be able to meet the needs of agriculture. We must domesticate the “white elephant” Cahora Bassa. This “elephant’s” ivory – electricity and irrigation – should go to our agriculture and industry. . . . Within the next decade the north bank power station [at Cahora Bassa] must begin functioning and numerous dams must be built for irrigation and electrification.²⁹

Domesticating the “white elephant” was not an easy task. Under the 1974 Lusaka Peace Accord, Lisbon assumed responsibility for the massive debt incurred in building the dam. Until it was repaid, Portugal, rather than the Mozambican state, retained effective control over Cahora Bassa.³⁰ That Mozambique’s total energy requirement was less than 10 percent of the dam’s output further complicated Frelimo’s efforts to harness the hydroelectric project for domestic purposes. Moreover, the cash-starved nation lacked the capital to develop the agricultural and industrial sectors that could utilize the cheap energy.

Despite these constraints, the government undertook several economic initiatives so that Cahora Bassa would not simply be a source of cheap energy for apartheid South Africa. In 1978, it began building power stations to provide energy from the dam to the provincial capital Tete and the nearby coal mines at Moatize, the largest in the country. Most important, state planners envisioned a second set of power lines and substations on the northern bank of the Zambezi River to provide cheap energy to the densely populated provinces of Zambezia and Nampula and other parts of northern Mozambique. Both were major food-producing zones and the source of most of the country’s cotton, tea, and sugar for export. In 1980, the government signed a multimillion-dollar agreement with France and Italy to begin the first phase of the project, which was to be completed two years later.³¹

Before most of these projects could get underway, South Africa intensified its destabilization campaign, effectively paralyzing these efforts. Within six months of Mozambique’s independence in 1975, South African security forces working with their Rhodesian counterparts had created RENAMO (Mozambican National Resistance) and trained and armed the insurgents. Between 1976 and 1979, Mozambique suffered from more than 350 RENAMO and Rhodesian attacks. Although the dam was left unscathed, anti-FRELIMO forces regularly targeted regions adjacent to Cahora Bassa and periodically sabotaged power lines and substations.³² With the fall of the Rhodesian government in 1980 and the independence of Zimbabwe, the apartheid regime transferred RENAMO headquarters and bases from Rhodesia to the Transvaal, a northern province of South Africa adjacent to Mozambique. Pretoria provided RENAMO with large supplies of war matériel, including rockets, mortars and small arms, critical logistic support, and instructors. This was part of a broader campaign that South African security forc-

es orchestrated to destroy Mozambique's infrastructure, paralyze the economy, and bring the African-led socialist nation to its knees.³³

Cahora Bassa's power lines were a particularly inviting target. At first glance, such a strategy might seem counterproductive since the pylons transported energy to South Africa. But set within Pretoria's broader destabilization strategy designed to punish Mozambique for its support of the ANC, it made perfect sense to military planners. After all, FRELIMO had placed great importance on Cahora Bassa's potential to transform the countryside. Paralyzing the hydroelectric scheme underscored the country's vulnerability.

The results of the attacks on power lines were both predictable and devastating. The Mozambican government lacked the capacity to protect the four thousand pylons that cut across 900 kilometers of remote country. As early as 1981, RENAMO forces had dynamited pylons, reducing electricity exports by 50 percent. This pattern was repeated on a regular basis. Guerrillas destroyed power lines and towers and mined the adjacent areas, making it virtually impossible for the government to repair them. By 1988, 891 pylons had been destroyed and that number doubled again over the next three years.³⁴ The cost of repairing the power lines was estimated at US\$500 million – almost three times the total value of Mozambican exports. RENAMO's campaigns in Tete and Zambezia provinces, moreover, had effectively blocked plans to develop the Zambezi valley and electrify the northern part of the country. The dam remained a white elephant.

In addition to paralyzing Cahora Bassa and destroying many other strategic targets, RENAMO initiated a reign of terror throughout the riverine zone, particularly in areas considered loyal to the government. Among the most vulnerable communities were the peasants who had been displaced by the dam and herded into hamlets during the colonial period. With independence, the barbed wire surrounding their villages was taken down and the guards were removed, leaving them defenseless. Since their original homes were under water, most had little alternative but to remain where they were. According to resident Vernácio Leone:

When RENAMO would come into a village, they would call all the people together. Then they would go into the house and steal all that was inside. They ordered the people back into their homes and set them on fire. People elsewhere heard these stories, so when RENAMO was coming, they would flee to Estima (an administrative center).³⁵

Peasants downriver from the dam suffered similar abuses from marauding bands of RENAMO guerrillas.

It is hardly surprising that thousands of peasants who survived these attacks experienced food shortages and malnutrition. Many starved. Death rates from yellow fever, tuberculosis, and malaria soared. Throughout the region, the social fabric of society was destroyed.³⁶

It is difficult to distinguish the environmental and social disruptions that the dam precipitated from those caused by the war, and the extent to which they were interconnected. What is certain is that the construction of Cahora Bassa adversely affected the livelihoods of hundreds of thousands of peasant households and irrevocably altered the biophysical relations of the Lower Zambezi from the reservoir to coastal regions. According to a United Nations report, “Cahora Bassa has the dubious distinction of being the least studied and possibly least environmentally acceptable dam project in Africa.”³⁷

With the construction of Cahora Bassa, the lifeblood of the floodplains, delta, and estuary regions was placed in the hands of the Portuguese-dominated HCB, who had agreed to sell more than 80 percent of the electricity. The consequences have been profoundly negative. Flows that once reached rates of 28,000 cubic meters per second during the flood season and averaged 2,000 – 3,000 centimeters during the rest of the year were eliminated and replaced with flow rates of 900 centimeters that varied little from month to month (see Figure 2).³⁸ A leading scientist concluded that erratic and mistimed discharges have been “catastrophic” for downstream wetlands, where vegetative growth and animal populations depended on annual flooding that brought nutrients and sediments.³⁹ By 1996, the geomorphology of the Lower Zambezi itself – formerly a wide river system with “open mosaics of marsh, pond, oxbows and shallow wetlands” – had been converted to a system with “choked wetlands, tree and bullrush encroachment along margins,” and impoverished marshlands. The overall result is less diverse, less productive riverine ecosystems.⁴⁰ A disinterest in the downstream hydrological effects spurred by the dam also reflected a tacit disregard for the peasant and fishing communities for whom the floodplain system was a critical resource. According to the current director of the Zambezi Valley Authority:

Pre-dam lifestyles [*sic*] of hundreds of thousands of local residents were dependent on annual flooding which sustained a diversified production system that incorporated flood recession agriculture, livestock management, fishing, gathering and hunting. Flooding was especially important for providing otherwise unavailable grazing during the latter months of the dry season and for maintaining the productivity of the riverine fishery.⁴¹

The impacts on riverine fish populations are especially pernicious, due to the apparent loss of biological diversity and to the drastic reduction of an important food source for riverine communities. While information concerning the dam’s effects on other aspects of downstream floodplains is sketchy, the impacts on fish have almost certainly been devastating. According to engineer Richard Beilfuss, who has worked in the region, “Villages correctly attribute . . . a drop in the productivity of their fishery to dam construction.”⁴²

Even the predicted benefits of the dam in terms of downstream flood control did not materialize. A massive flood in 1978 resulted in over forty lost lives, left 200,000 homeless, and destroyed more than 60,000 hectares of crops. In 2000 – 2001, and again in 2007 – 2008, thousands of homes and fields were destroyed by the raging river. This devastation stands in stark contrast to the claims made in early documents of Cahora Bassa projects, touting the period of “total control” over discharges that the dams would usher in.⁴³

Some of the most far-reaching and difficult-to-measure ecological impacts of large dams have occurred in the delta and estuary zones of impounded rivers, where there has been a marked reduction of biological diversity, simplified landscapes, and continued threats to ecologically and economically important biota. The delta region’s vast populations of large mammals have been devastated by the effects of the dam. Before the dam, the floodplain supported large herds of Cape buffalo, waterbuck, zebra, and reedbuck. The desiccation of the floodplain made the region accessible to commercial poachers as well as to RENAMO and government soldiers. Consequently, the buffalo population declined by upwards of 90 percent and other mammal species, including zebra, hippopotamus, and waterbuck, and several bird species have experienced similar reductions.⁴⁴

The adverse effects of Cahora Bassa extend to the mouth of the Zambezi. The sharp decline in silt transported downriver has hampered the Zambezi’s important delta-building function.⁴⁵ As deposition of silt decreases with unknown implications for the coast’s vulnerable communities of natural vegetation, the estuary is subject to greatly increased wind and sea erosion. This in turn almost certainly generates negative impacts on the estuarine fisheries that evolved under more stable conditions and depended on the annual flooding cycle that brought nutrients and sediments. Mangrove forests and shrimp fisheries, critical elements of the delta and estuarine system, have been particularly degraded at least in part if not wholly by the altered character of Zambezi flows. The full effects of the decrease in sediment transfer to the Zambezi delta on the coast’s mangrove ecosystems are little known, although a recent survey showed that only a single channel of the Zambezi exhibited healthy mangroves. Throughout the rest of the coastal region, there are large gaps in the mangrove forest with evidence of dried-out areas, dead mangroves, and severe coastal erosion.⁴⁶

What is also clear are the devastating effects of the reduced wet season water flows of the Zambezi on Mozambique’s strategic shrimp industry. The Sofala Bank, a broad and shallow shelf just outside the mouth of the Zambezi, is the site of a productive shrimp fishery that is one of Mozambique’s most important sources of foreign currency. Since the early 1980s, catches of the coastal fisheries’ two most important shrimp species (*Penaeus indicus* and *Metapenaeus monoceros*) have declined substantially due to both environmental factors and increasing fishing effort. There is a high degree of correlation between wet season river runoff and

the abundance of these economically important shrimp species. The dam at Cahora Bassa both reduces the amount of water discharged by the river and alters the seasonal pattern of runoff. After the dam's completion, the wet season runoff was reduced by about 40 percent.⁴⁷ Significant decreases in the amount of water released, particularly during the onset of the flood seasons when shrimp normally migrate toward the ocean, could drastically reduce the shrimp population by impeding an important stage in their life cycle.⁴⁸ This would be disastrous for commercial shrimping operations that depend on continued shrimp production. For local fishermen as well as for the impoverished nation hard-pressed for foreign currency, this loss of shrimp revenue is highly significant.

The construction of Cahora Bassa sounded a death knell for this particular set of socioecological relations by regulating the river. Flow rates became much lower than normal during the former flood season and much higher than normal during the dry season. Moreover, the river was subject to erratic, unseasonal flooding caused by dam operators' manipulation to generate hydroelectricity.⁴⁹ The consequences led ecologist Bryan Davies, who had periodically worked in the valley for the past three decades, to conclude that the Lower Zambezi "has been abused to a degree that has, fortunately, few parallels anywhere else in the world."⁵⁰

Twenty-five years after independence, it was no longer tolerable that Portugal still owned and operated the dam. From Maputo's perspective, Portugal's continued ownership of the dam, the sale of electricity to South Africa at a fraction of the market value, and the need to re-import some of that exported electricity were colonial artifacts that subverted Mozambique's political and economic sovereignty and national security.⁵¹ Cahora Bassa was a living symbol of a violent and oppressive past. Songo, the small city that served the dam, remained a Portuguese enclave in the heart of Mozambique, with European managers and workers retaining many of their past privileges and almost all 850 Mozambican workers stuck in low-wage positions.⁵² One worker summed up their shared sense of anger and alienation this way: "As time goes on we feel more marginalized. . . . We feel like foreigners in our own country."⁵³ Strike threats and periodic work stoppages reported in the media were powerful reminders of how little had changed.⁵⁴

The lack of electricity in the countryside powerfully underscored this extreme neocolonial reality. Even after transmission lines were rehabilitated and the dam began producing electricity again at full power in 1998, the Portuguese company HCB continued to pay little attention to Mozambique's domestic energy requirements.⁵⁵ Instead, these developmental needs were held hostage to HCB's search for new markets in the larger energy-starved region, where it could command higher prices than the energy sold locally.⁵⁶ Elsewhere I have detailed how Frelimo then began a vigorous campaign to reclaim Cahora Bassa, proposing several

plans that would reduce or erase the debt and transfer its sovereignty from Lisbon to Maputo.⁵⁷ Lisbon rejected all of them, provoking a strong nationalist reaction.⁵⁸ As a leading newspaper stressed, “the continuation of the present situation makes Mozambique look like a country too weak to defend its own interests,” making expropriating the dam a “national imperative which all of Mozambican society should unconditionally support.”⁵⁹ In 2007, under increasing pressure from Mozambique, joined by South Africa’s ANC government and other African nations, Lisbon reluctantly agreed to relinquish control of the dam for the price of US\$950 million.

Throughout these negotiations, Frelimo resurrected the colonial idea of building a second dam at Mphanda Nkuwa, which could supply South Africa and thus decrease the profitability of Cahora Bassa, making it of little value to Lisbon.⁶⁰ Once planning for Mphanda Nkuwa got underway, however, it took on a life of its own. By the time Cahora Bassa passed into Mozambican control, Frelimo had decided that two dams on the Mozambican stretch of the Zambezi were better than one. Mphanda Nkuwa was no longer a means of pressuring Portugal by creating competition for Cahora Bassa; instead it had become useful in itself, both to help electrify the countryside and to generate badly needed hard currency by selling energy to neighboring countries. Post-apartheid South Africa was a particularly attractive market; the ANC government faced a serious energy shortfall.⁶¹ The extension of power lines into low-income areas and shanty towns along with increased demands for energy from the service and financial sectors and mining sorely taxed its energy infrastructure and required South Africa to look beyond its borders for cheap and secure energy.⁶² A new dam on the Zambezi to supplement Cahora Bassa’s output was the obvious choice.

The colonial-era plan for Cahora Bassa had envisioned construction of a dam at Mphanda Nkuwa, located downriver, halfway to the city of Tete. It is named for the mountain that juts into the Zambezi River, creating a narrow choke point that colonial engineers considered an ideal site for a dam. A 2002 government feasibility report enthusiastically endorsed the project.

Unlike its predecessor, the new dam would be developed as a “run of river” scheme, which would not disrupt the flow of water downriver and would only require that 260 households be relocated. Moreover, the displaced families would “be brought into the market economy as commercial fishermen with access to water, a school and a hospital.”⁶³ In short, much like the original justification for Cahora Bassa, the new dam would stimulate development.

The Mozambican government organized an Investors Conference for the Mphanda Nkuwa Hydroelectric Project. More than two hundred state officials, consultants, and representatives of large energy companies, contracting companies, equipment manufacturers, and investment banks descended on Maputo in May 2002. The meeting’s intent was clear: to mark the official launch of the proj-

ect and to invite investors to prequalify as participants in the dam's construction, which was expected to begin in 2004 or 2005.⁶⁴ The dam would generate roughly 1,300 megawatts, about two-thirds the output of Cahora Bassa.

The planning of Mphanda Nkuwa represented a new assertion of Mozambican sovereignty over the Zambezi River, and possible financial gains for government officials overseeing the project. In harnessing the river for Mozambique's economic interests, Frelimo chose to narrowly define what those interests were and whose interests it would consider. While it would make big decisions about the fate of the communities along the Zambezi, the state demonstrated little interest in seeking meaningful input from those communities themselves. This top-down approach to governance – one in which Maputo effectively asserted a monopoly on wisdom and power – tends to characterize megadevelopment projects, particularly those involving dams.⁶⁵

South African, Brazilian, and Chinese investors all expressed considerable interest in the project.⁶⁶ In April 2006, as part of Beijing's ongoing efforts to expand its influence in Africa, the Export-Import Bank of China signed a US\$2.3 billion Memorandum of Understanding with the Mozambican government to finance the Mphanda Nkuwa Dam.⁶⁷ The preliminary agreement covered the cost of the dam, the power station, and the transmission line from Tete to Maputo. Despite the initial optimism, negotiations with the Chinese and Brazilian firms stalled. For all the hoopla, multivolume studies, and a slick multicolor prospectus, the Mozambican state was not able to obtain firm commitments from foreign investors. The project languished for more than a decade.

Opposition from public interest and environmental groups and foreign scientists intensified because the state failed to consult in a meaningful way with riverine communities and because hydrological studies showed that Mphanda Nkuwa would have deleterious ecological and economic consequences.⁶⁸ For its part, Mozambican authorities attempted to discredit international critics of Mphanda Nkuwa by characterizing them as irresponsible opponents of development. Mechanical engineer Sérgio Elísio, who worked with Unidade Técnica de Implementação dos Projectos Hidroeléctricos (UTIP), a government regulatory body established in 1996, distinguished the government's position from the World Commission on Dams: "We do not agree with all of the standards of the World Commission on Dams. We have our own laws. The WCD has a single agenda: To stop all development of dams. The U.S. has some 7,000 dams. We have one and we want to have two."⁶⁹ Even some who were aware of the damage created by Cahora Bassa supported the plan to build Mphanda Nkuwa. "We already ruined everything [with Cahora Bassa] so we might as well get the added value of a new dam," said a retired structural engineer formerly involved in the planning of Mphanda Nkuwa.⁷⁰ In September 2020, the government signed an agreement with a consortium that includes a Brazilian company. Mphanda Nkuwa's fate is still uncertain.

The legacies of the hydroelectric project live on. The citizens of Mozambique have not, as yet, derived significant benefits from the massive hydroelectric project on the Zambezi River. Despite official plans calling for the electrification of the countryside, almost a half-century after independence, the power grid from Cahora Bassa reaches only 30 percent of the population, primarily in urban areas and provincial and district capitals. Of this number, it is estimated that only half are actually on the grid because the cost for most of the rural poor is prohibitive.⁷¹ Almost 80 percent of the energy Cahora Bassa produces is either exported to South Africa or used to fuel MOZAL, a massive foreign-owned aluminum smelting company in which the Mozambican state holds only a 4 percent investment.⁷² The dam generates about US\$280 million per year, but the state has invested little in the affected region. Income from energy sales has not been spent locally for schools or health clinics, or to stimulate industry or training.

Rather than promoting local or regional economic development or sustainable livelihoods, the dam robbed Mozambique of precious energy, since harnessing the river's flow regime to meet the needs of the South African state deprived rural communities in the Zambezi valley of the life-sustaining nutrients that had supported agricultural production and local ecosystems for centuries. While the natural energy of the river was transformed into an export commodity, the vast majority of Mozambique's population has had little or no access to this critical resource.

Climate change has further subverted the planners' original prediction that the dam would be a powerful weapon to increase irrigation and agricultural production. Instead, it has intensified hazardous conditions for the inhabitants of the river valley. Between 1960 and 2006, average annual rainfall has decreased at a rate of 3 percent per decade, but the proportion of rain falling in heavy rain years has increased by a similar amount. The results have been longer periods of drought and shorter, but more intense, rainfall leading to recurring droughts and periodic massive flooding, soil erosion, food shortages, and disease. Every decade since the construction of the dam has seen massive floods, displacing thousands of households and inundating much of the most valuable farmlands. In 2000, when Mozambique experienced its worst flood in more than half a century, more than a half-million citizens were displaced, many of whom lived adjacent to the Zambezi River.⁷³

Global warming has contributed in another way to these extreme events. The Zambezi, which flows into the Indian Ocean, is also subject to increased threats of cyclones owing to the warming of the ocean. In 2019, cyclones Idai and Kenneth devastated the river valley and threatened the structural integrity of the Cahora Bassa Dam. Planners were forced to consider a rapid discharge of rainwater, which would have compounded the problems of flooding downriver. Although this last-ditch effort did not prove necessary, more than 400,000 people were left homeless.

Too often forgotten in the discourse on water, development, and national security are the people whom large dams are purported to help. This essay has explored the deleterious socioeconomic and environmental changes brought about by the Cahora Bassa Dam and South Africa's destabilization campaign in an era of rapid climate change. The essay is part of an alternative history of Cahora Bassa, which argues that the historical memories and lived experiences of these riverine communities must figure prominently both in any scholarly analysis of the effect of Cahora Bassa and any new initiatives to remedy the situation. That serious consideration is being given to building a new dam at Mphanda Nkuwa, fifty miles downstream from Cahora Bassa, suggests that lessons of the past have not been learned. Decolonizing development and using the nation's resources to deliver materially better lives to all Mozambican citizens remains the challenge.

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- ⁴ As is standard practice, I use the capitalized term “FRELIMO” to refer to the liberation movement and lower case “Frelimo” to indicate the political party in the postindependence period.
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¹² P. B. N. Jackson and K. H. Rogers, "Cabora Bassa Fish Populations Before and During the First Filling Phase," *Zoológica Africana* 11 (2) (1976): 377.

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¹⁵ Interview with Pezulani Mafalanjala, Maurício Alemão, and Bernardo Tapuleta Potoroia, Masecha, Mozambique, May 25, 1998.

¹⁶ *Ibid.*

¹⁷ This figure includes Africans relocated downriver at Caia. It is difficult to determine the actual number since there was a great deal of secrecy surrounding the forced villagization program.

¹⁸ Interview with Mafalanjala et al.

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- ⁵⁵ That year, South Africa received 850 megawatts (60 percent) of the dam's generated electricity. Of the remainder, the Portuguese firm designated 400 megawatts for Zimbabwe and only 200 megawatts (about 14 percent) for Mozambique's electricity utility. To make matters worse, HCB refused a request from Frelimo to redirect unused energy to a proposed aluminum smelter in Beira, Mozambique's second-largest city. "Still No End in Sight for Cahora Bassa Tussle," *AllAfrica*, April 6, 1998; and *Engineering News* [South Africa], June 18, 1999.
- ⁵⁶ Isaacman and Isaacman, *Dams, Displacement, and the Delusion of Development*.
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- ⁶² *Ibid.*

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- ⁶⁴ República de Moçambique, *Mphanda Nkuwa Hydropower Project Development Prospect*, 4.
- ⁶⁵ For a discussion of the politics of development and its impact on the ground, see, for example, Peter Vandergeest, Pablo Idahosa, and Pablo S. Bose, eds., *Development's Displacements: Ecologies, Economies, and Cultures at Risk* (Vancouver: UBC Press, 2007); Lyla Mehta, ed., *Displaced by Development: Confronting Marginalisation and Gender Injustice* (New Delhi: SAGE Publications India, 2009); Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley: University of California Press, 2002); and Scott, *Seeing like a State*.
- ⁶⁶ Interview with Madalena Dray, environmental manager of Hidroeléctrica de Mphanda Nkuwa, Maputo, Mozambique, March 11, 2010.
- ⁶⁷ *Notícias*, April 22, 2006; and “China Exim Bank Grants Loan for Hydroelectric Dam in Mozambique,” *MacauHub*, April 4, 2006. By 2008, China had pulled its financing.
- ⁶⁸ James Morrissey, *Livelihoods at Risk: The Case of the Mphanda Nkuwa Dam* (Maputo: Justiça Ambiental, 2006).
- ⁶⁹ Interview with Maguigy and Elísio.
- ⁷⁰ Interview with anonymous engineer, Cape Town, South Africa, March 18, 2011.
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Ghana's Akosombo Dam, Volta Lake Fisheries & Climate Change

Stephan F. Miescher

In Ghana, the Pwalugu Dam in the Upper East is in the final planning stage. Whereas promoters of Ghana's first dams emphasized the need for generating electricity to modernize and industrialize the new nation, the planners of Pwalugu have focused on water issues. Due to climate change, droughts have had a devastating impact on local agriculture. The dam's primary purpose is an irrigation scheme and flood control. This essay historicizes these concerns by revisiting the Akosombo Dam, Ghana's largest hydroelectric dam, completed in 1965. The discussion juxtaposes personal recollections of dam-affected communities with reports by administrators, biologists, and social scientists. The essay draws on government records, scientific studies about Volta Lake, and oral histories. Ultimately, it argues, builders and administrators of the Akosombo Dam failed to address most water issues, despite ample knowledge about their existence. One hopes that these shortcomings will not be repeated in the Pwalugu project.

Over the last fifteen years, as several contributions to this issue of *Dædalus* note, Africa has experienced a resurgence of dam-building, with several major projects under construction or nearing completion.¹ In Ghana, the Bui Dam across the Black Volta was finished in 2013.² The Pwalugu Dam on the White Volta is in the final planning stage with construction by Sinohydro soon to begin. In the 1950s and 1960s, the promoters of Ghana's first dams emphasized the need for generating electricity to modernize and industrialize the new nation. The planners of the Pwalugu Dam have embraced a different rhetoric. Water issues have moved to the foreground. Due to climate change, the Northeast and Upper East Regions, where Pwalugu is located, have endured droughts with a devastating impact on local agriculture.³

At a stakeholder meeting in 2019, the Volta River Authority (VRA) promised that Pwalugu would address water security. Its primary purpose would be an irrigation scheme covering an area of 24,000 hectares that would produce rice and maize as well as provide a water supply during the dry season and flood control. Since Burkina Faso built the Bagre Dam upstream on the White Volta in 1992, spilling during the rainy season has caused devastation to riverine communities. Elec-

tricity generation at Pwalugu, through a hydroelectric plant with an installed capacity of 60 megawatts and a related 40-megawatt solar project, would be secondary. Pwalugu's reservoir, the stakeholders learned, would be small, only 135 square miles. Still, with a nod to a global discussion, VRA officers emphasized that Pwalugu would increase the generation of renewable energy capacity and thus enhance Ghana's commitment to the United Nations Convention on Climate Change.⁴ At the sod-cutting ceremony in November 2019, President Nana Akufo-Addo foregrounded water security. He stated that the dam would "avert the perennial flooding caused by the spillage of the Bagre Dam." The large irrigation project, which should benefit fifteen thousand farmers, would mean a change from the northern regions' current agricultural pattern, in which farm work comes to a halt during the dry season. "Irrigation," the president added, "remains a key strategy to achieve food security, the eradication of poverty and generation of rural employment." The president emphasized the potential for aquaculture (fish farming) in the Pwalugu reservoir. He reminded his audience that the older hydroelectric dams, Akosombo and Kpong, were planned with irrigation schemes that did not materialize. The story of Pwalugu "[would] be different."⁵ The president said nothing about displacement and other social impacts of the dam. According to recent media reports, 4,200 people would be displaced by the Pwalugu multipurpose dam.⁶

This essay historicizes concerns about water use and climate change in connection with the Pwalugu Dam by revisiting the Akosombo Dam, Ghana's first and largest hydroelectric scheme that was completed as part of the Volta River Project in 1965, with an installed capacity of (now) 1,000 megawatts. Akosombo created a vast reservoir, Volta Lake, which covers, when full, an area of 3,275 square miles and extends 250 miles to the north. The lake not only transformed the Volta Basin's ecology but displaced eighty thousand people and created new inland fisheries. What were the social and ecological impacts of this large dam project, both upstream and downstream? How did the communities impacted by the dam experience these changes? What have been the conceptions of water usage and climate change since the 1960s, and how have they impacted public discourse and policies?

The planners of the Volta River Project produced detailed studies about the dam's ecological and social impacts in the Volta Basin where the flooding would occur and in the Lower Volta, the downstream area that would be severely affected by the river's changed flow pattern. When the project was implemented in the early 1960s, these concerns were tossed aside. This discussion juxtaposes personal recollections of dam-impacted communities with reports by administrators, biologists, social scientists, and other experts. The essay draws on the VRA archive, scientific studies about Volta Lake, and oral histories. Ultimately, it argues, the builders and administrators of the Akosombo Dam failed to address most wa-

ter issues, despite ample knowledge about their existence. One hopes that these shortcomings will not be repeated in the Pwalugu project.

The Volta River Project, which straddles the colonial and postcolonial divide, was at the center of agendas concerning modernization, development, and nationhood in Ghana during the 1950s and 1960s. Conceived in the interwar period for the benefit of the metropole, the project was reshaped during the final years of British colonial rule. In 1915, Australian geologist Albert Kitson had the idea of harnessing the Volta River to process local bauxite into aluminum. In 1938, South African engineer Duncan Rose used Kitson's plan and formed a company to secure bauxite and dam concessions in the Gold Coast (colonial Ghana). During World War II, the rising demand for aluminum generated interest in the Gold Coast's bauxite. After the war, multinational companies and the British government became interested in creating an integrated aluminum industry in the Gold Coast, fitting with Britain's colonial development initiatives. When Kwame Nkrumah's government of the Convention People's Party came to power in 1951, it moved the Volta project to the center of its modernization agenda.⁷

The Preparatory Commission, formed under the auspices of the British and Gold Coast governments, endorsed the scheme that included a hydroelectric dam at Ajena, an alumina plant and smelter at Kpong, and miles of railway tracks.⁸ Initially, the advocates of the Volta project expressed little concern about its environmental and social impact. They considered the Volta Basin to be mostly uninhabited and grossly underestimated the number of people who would be affected. A confidential report in 1951 stated that "the reservoir would inundate very little of economic value" and that only 18,000 people would be displaced.⁹ The Preparatory Commission provided a correction. It suggested that 62,000 people living in the Volta Basin would have to be resettled. Whereas the commission recommended monetary compensation for the loss of buildings, land, and tree crops, people were "expected to resettle themselves" over a period of four years prior to the flooding.¹⁰

In its investigations, the Preparatory Commission focused on the fisheries of the future Volta Lake. It anticipated a catch "vastly in excess" of the current production on the Volta River and its tributaries. An ample fish supply would address the "protein deficiency" in the nation's diet. E. B. Worthington, a colonial fisheries expert, forecasted for the lake a yield of 18,000 tons of fish per year. He expected that it would take years for the lake to realize its potential.¹¹ Unresolved issues included the stocking of fish, attracting fishers willing to move to the lakeside, the provision of "stouter river craft," and organizing marketing efforts. The commission anticipated that trained personnel would be required for the lake's "effective development." Many of these issues would be resolved without government interference.¹²

In the mid-1950s, about one thousand Tongu fishers operated in the area from the dam site to the heads of the future lake. They were part of a migratory economy that connected the Lower Volta with the upper parts of the river and its tributaries. Upstream economic activities “were an integral part of livelihoods in the Lower Volta,” as social scientist Dzodzi Tsikata has argued.¹³ Tongu fishers, according to the Preparatory Commission, migrated north for the catching season in the first half of the year. The majority maintained connections with their hometowns and returned to the Lower Volta with the onset of the floods in June or July. The upstream fishing communities – the fishermen and their families – included about six thousand people during the dry season, and half that number during the annual flood. They lived in small, scattered villages, built with the “most rudimentary structures.” Their annual catch was 8,000 pounds of fish. The commission anticipated that these communities would relocate to their hometowns during the filling of the lake. Once the lake had formed, they would return and settle on its edges.¹⁴

The seasonal variations of water flow shaped the livelihoods of Lower Volta communities and their migrations. The Volta’s annual floods not only replenished about four hundred fishing channels and ponds but irrigated the farms along the river and creeks.¹⁵ While river and creek fishing was a male activity, clam fishing was exclusively conducted by women. The commission estimated the annual value of the clam catch at about £25,000. A later study increased the figure to £100,000.¹⁶ The commission assumed that the clam industry would not be much impacted by the dam. Economist Rowena Lawson later urged the government to transplant the clam beds to creeks since the loss of the clam industry would “seriously affect the livelihood” of 2,500 women.¹⁷

The commission recommended an allocation of £500,000 to cover the government’s commitment for the Lower Volta. This amount included funds for additional enquiries, for widening and restoring creeks, and for paying compensation of £350,000 for the lost fisheries in creeks and ponds. The commission argued that any decline in fishing channels “would be insignificant compared to the eventual increase [in fisheries] anticipated for the lake area.”¹⁸ This optimistic prediction did not materialize. Instead, as Tsikata’s study has documented, the Lower Volta experienced a dramatic decline in livelihood. Creek and clam fishing were among the “more spectacular casualties of the Volta River Project.” My research in Mepe, once a center of clam fishing, confirmed this assessment.¹⁹

The Preparatory Commission addressed the anticipated public health problems of the new lake. British medical experts identified four water-related diseases: malaria, *trypanosomiasis* (sleeping sickness), *onchocerciasis* (river blindness), and *schistosomiasis* (bilharzia). The commission expected a higher incidence of malaria, since two different *Anopheles* mosquitos would find breeding places at the lake margins. The commission was less certain whether trypanosomiasis would

increase, possibly through lake transport, since its carrier, the tsetse fly, was more common in the north. It suggested clearing vegetation at major landing sites and inoculating fishers and boatmen. Onchocerciasis, transmitted through the bite of the blackfly, was widespread above and below the dam site. Damming the Volta would flood the blackfly's breeding grounds in the inundated area. During construction, spraying with DDT was expected to protect workers from onchocerciasis. Urinary schistosomiasis, a chronic disease, was widespread in the Volta delta and upstream from the future dam, with a high infection rate among migrant fishermen. The commission anticipated that the lake would become infested with its vector snail and proposed a Lakeside Health Section within the VRA to study these diseases. While the Volta project would cover the cost of health and sanitation issues caused by the formation of the lake, it would not cover the health of migrants settling on the lakeside for economic reasons. Their needs remained the responsibility of the government; the VRA would merely provide technical information and act as paid agent for control measures.²⁰

The Preparatory Commission endorsed the Volta River Project. Following Ghana's independence in 1957, Aluminium Limited of Canada, the main corporate sponsor, withdrew. But the Cold War came to the project's rescue. The U.S. government saw in the Volta scheme an opportunity to assert its influence in Africa. In 1958, President Dwight Eisenhower and Prime Minister Nkrumah agreed to update the engineering reports and explore the potential of private U.S. funding. The following year, Kaiser Engineers proposed a more modest and cheaper version of the project. The Kaiser report suggested a larger dam at Akosombo, an aluminum smelter that merely refined imported alumina at Tema, and a five-hundred-mile transmission grid to connect cities and mines of southern Ghana with Akosombo. The report deferred the production of alumina from Ghana's bauxite, thus suspending the original plan for an integrated aluminum industry. Kaiser Engineers, eager to cut costs, ignored the dam-impacted communities. In late 1961, after prolonged negotiations with Kaiser Aluminum, which would operate the future smelter, the World Bank, the United States, and the United Kingdom, Nkrumah finally secured the funding for the Volta River Project.²¹

Dam construction began in 1961 before concrete steps toward resettlement were undertaken. The VRA, the state agency established to build the Akosombo Dam, became responsible for resettlement. The planners, abandoning the Preparatory Commission's call for self-help, developed strategies of how to "improve" the lifestyles of the dam-affected people. In 1963, Nkrumah assured the National Assembly that people's relocation would provide them "with new villages with better communal facilities and better farming methods."²² The *Seven-Year Development Plan*, the blueprint for the country's modernization, considered resettlement "an exercise in positive economic development" to trans-

form “the lives of the people involved.”²³ The government would introduce new forms of farming and fishing. Resettlement would contribute to Ghana’s anticipated transition from tradition toward modernity. By 1963, the VRA had launched the construction of fifty-two townships designed to propel the “backward” dwellers from 739 villages into modernity. The resettlement towns were seen as “bridgeheads of modernisation in a sea of rural backwardness and underdevelopment.”²⁴

Most experts considered the evacuation, as well as the planning and construction of the fifty-two resettlement towns in such a short period, a tremendous achievement.²⁵ Regardless of the size of their previous homes, each household received the one-room “core house” that was supposed to be the beginning of a larger compound house.²⁶ But many settlers were unable to complete their houses. Although the envisioned mechanization of resettlement agriculture contained “good ideas,” as former resettlement officer E. A. K. Kalitsi commented, such “grandiose planning” failed.²⁷ The desertion of resettlement towns could not be halted.

Press reports and VRA publicity material claimed that there was an orderly and well-organized move into the resettlement towns.²⁸ Interviews that I conducted in Amate revealed a different experience. Resettlement, especially the evacuation, was traumatic and often chaotic. In October 1964, 2,063 inhabitants of the cocoa town of Worobong in the Afram Plains were relocated to Amate, with over 1,800 settlers from thirty-eight other villages. The new town with 621 houses was located in a forest whose canopy had once provided shade for cocoa farms.²⁹ Adwoa Fosuaa, then a thirty-year-old mother, recalled the evacuation day. Lorries arrived and took the people from Worobong to Amate, where the houses were unfinished with wet cement.³⁰ The houses did not include kitchen and bathing facilities. Some settlers completed their houses right away; most did not have the means to do so.³¹

People shared haunting images about the displacement. Resident Janet Obenwaa recalled joining a canoe after the flooding. When paddling to the site of Worobong, they could only recognize the tips of coconut palms rising from the town. Everything else had been submerged. Yet surveying the water, to their horror, they noticed floating caskets washed out from their graves, as well as ante-lopes, grasscutters, and snakes desperately trying to reach the shore.³² Since the settlers had lost their crops, the World Food Program agreed to feed them with food that was strange to them, like yellow corn, corned beef, and luncheon meat. “It was a sad story,” Fosuaa recalled. “Some people cried until their eyes turned red.” Men drowned their sorrows in alcohol.³³

The VRA devolved its responsibilities to other government units in December 1965. Local councils would now provide services to the resettlement towns. They faced an enormous task that included water supply, sanitary facilities, food inspection, cemeteries, recording of births and deaths, market stalls, lockup shops, schools, streets, and feeder roads. Although the towns’ markets, as the VRA exec-

utive secretary opined, could become a revenue source “with little bit of investment,” it was far from clear how local authorities would have the means to pay for these new responsibilities.³⁴

The local councils were unable to deliver. Access to clean drinking water and sufficient farmland remained perennial issues. In Amate, a fallen tree damaged the pump house. Seventeen months later, still no water flowed from the standpipes.³⁵ Visiting VRA officers recorded evidence of failing water pumps, tensions among settlers, and insufficient acreage of farmland in the years after the flooding. Yet the bureaucratic language does not capture the sense of loss and agony the settlers experienced. There was a large exodus from the resettlement towns. Sociologists E. K. Afriyie and David Butcher estimated that by 1968, only 38.7 percent of the original settlers remained. People left because of shortage of farmland, insufficient housing space, and other livelihood challenges. The promised scheme of mechanized agriculture had failed.³⁶

A changing climate meant less rainfall and more hardship for the settlers. A pioneering study conducted during lake formation found no conclusive evidence about significant changes in monthly rains but noted a “tendency towards decreasing rainfall amounts” near the resettlement town of Kete-Krachi.³⁷ Yet residents in Amate observed transforming weather conditions long before climate change became a global issue. They noted fewer rains, stronger winds, and growing difficulties to plant crops like plantains and cocoa. In the 1970s, the military regime of Ignatius K. Acheampong, as part of its Operation Feed Yourself, launched an irrigation project that allowed Amate settlers to grow large fields of tomatoes, onions, and peppers. For a while, farmers did well, and some people returned. Kwaku Atuobi Yiadom recalled how his mother harvested eighty-six boxes of tomatoes in one year.³⁸ The irrigation system lasted for about eight years. Two decades later, the government continued to post an irrigation manager in Amate, drawing a salary while watching over the defunct project, much to the chief's dismay. The manager of the broken irrigation scheme blamed the “illiterate villagers” for its failure.³⁹

These days, Amate, with its large number of abandoned houses and poverty, resembles a ghost town. Many core houses remain unfinished. These abandoned and incomplete houses, according to anthropologist Thomas Yarrow, are a reminder of the “unrealized possibilities and promises” of modernization in resettlement towns. They provide vivid evidence of a future that might have been.⁴⁰ In Amate, the situation is more complicated. According to several elders, the flooded cocoa town of Worobong was more “modern” than what they had in Amate. In resettlement, they experienced a reverse modernization.

The scientific study of Volta Lake, and its ecologies and fisheries, is intimately linked with the career of Letitia Obeng, the country's first woman scientist. In a 2014 interview, she recalled how she became a “water per-

son.” After receiving her bachelor’s degree in zoology from the University of Birmingham in 1952, Obeng taught at the University College of Science and Technology in Kumasi. She obtained a master’s degree from Birmingham in 1961 and then a Ph.D. from the University of Liverpool in 1964. For her dissertation, she studied the blackflies that transmit the parasitic worm that causes onchocerciasis. She returned to Ghana just as Volta Lake was forming and looked for opportunities to study the new lake. Aquatic research was then a marginal scientific endeavor. Receiving support from Nkrumah, who was always curious about the latest trends in science, Obeng founded the Institute of Aquatic Biology in 1965.⁴¹

The Institute of Aquatic Biology was built on the findings of the Preparatory Commission. The fast pace of dam construction had made it difficult to pursue most of the enquiries the commission had suggested.⁴² Obeng’s scientific agenda received a big boost in 1968, when the VRA launched the Volta Lake Research Project (VLRP) with support from the United Nations Development Programme. Obeng became VLRP’s Ghanaian comanager.⁴³ The initiative enabled foundational research on Volta Lake, such as its biological changes, impact on public health, and the emergence of fisheries. Volta Lake became a well-known case study for new scholarship on man-made lakes. Funding for lake research dried up in Ghana in the late 1970s and little was published for two decades.⁴⁴ What were some of the findings of these early attempts to study the waters of this vast lake?

With the closure of the Akosombo Dam in May 1964, the riverine condition of the Volta River gradually transformed into a lacustrine one. The rotting of submerged vegetation caused an oxygen deficiency that killed fish. Fisheries officer John Adjetey had recommended in vain that at least the main areas of resettlement along the lakeshore should be cleared of trees and other vegetation in order to improve the conditions for fish to live and spawn.⁴⁵ Fortunately, the oxygen deficiency did not last long. An initial survey recorded that herbivorous *Tilapia* species, particularly *T. galilaea*, *T. nilotica*, and *T. zillii*, had increased in abundance in areas with plenty of plankton. *Chrysichthys* (catfish), a bottom feeder, was caught in small quantities around Akosombo in 1964, becoming the dominant species by 1966. The carnivorous *Lates niloticus* (Nile perch), a high-priced fish, showed “marked increase in population” around Kpando and Kete-Krachi.⁴⁶ Unlike the Preparatory Commission’s forecast, fish-stocking was not necessary. Rather, there was a “boom in the fish population after the initial adverse ecological changes that affected some fish,” as Obeng noted.⁴⁷ *Tilapia* species were prolific and multiplied rapidly due to ample food.

Catches showed a steady increase from 3,000 metric tons of fish in 1964 to a peak of 62,000 tons in 1969, and then a decline and stabilization around 40,000 metric tons.⁴⁸ VLRP scientists argued that the explosion of the fish population was typical for new reservoirs. After the initial peak, a decline followed and then the population would stabilize. They found “no indication of overfishing.” The scien-

tists admitted that precise knowledge of fish stock in such a large lake remained “unattainable.” What they offered were mere estimates and guidelines for management decisions.⁴⁹ Their estimates were based on statistical extrapolation from landed catches at major marketing centers.

When the water began to rise in 1964, Tongu communities did not return to the Lower Volta as the Preparatory Commission had anticipated but stayed on the lake. The VRA had provided limited housing in resettlement towns for about 1,200 fishers and their families. Most fishers were not interested. In Amate, Tongu fishers never took possession of their allocated “core houses.” Instead, they moved to the lakeside and established the village of Nketepa, which quickly became a market center.⁵⁰ Without state guidance, many Tongu fishermen migrated from the Lower Volta to the lakeshore. What for some had been an annual migration took an increasingly permanent form. One study, carried out in 1969–1970, located 950 fishing villages and estimated that about 20,000 fishers with 12,500 canoes were operating on the lake. Around 60,000 people were living in these fishing communities. Most of these villages were only accessible by water and had no government services such as schools, post offices, or clinics. The male population exceeded the female population, and few people were above fifty years old.⁵¹

By 1970, Tongus still dominated the fishing communities, although some fishers were Anlo Ewes and Dangmes from Ada and Ningo. A typical fishing unit consisted of a master fisher (*adela*) who owned his flat-bottomed canoe of about six to nine meters in length. Half of the fishers had a junior assistant (*adegbovi*) to bail water. Most fishers possessed over a dozen multifilament nylon gill nets. To set these nets, they tied the head rope between the branches of two submerged trees. The lack of tree clearing on the lake prohibited fishing with moving gear. During the main season, when the rains brought turbid water, an *adela* left with his *adegbovi* at dawn to visit his nets. Following a gendered division of labor, Tongu men fished while women did the processing—smoking and salt-drying—and selling of fish. While a married fisherman assigned these roles to his wife, a single *adela* depended on his mother, sister, or female friend. Profits were shared annually between the *adela* (57.2 percent), his wife (28.6 percent), and the *adegbovi* (14.3 percent). After the lake had filled, fishers could earn high incomes, about 700 cedis (US\$686) per canoe in 1970. The initial boom allowed some *adegbovis* to purchase their own gear. Tongus who used to work on cocoa farms or in construction, or had become teachers and clerks, returned to fishing and migrated to the lakeside. Fishers invested profits into their hometowns, building houses and opening shops, as well as into their children's education, before purchasing commodities like radios and sewing machines.⁵²

Eager to increase productivity, the VLRP carried out experimental field trials that showed how monofilament nets caught twice the amount than multifilament nets. Introducing such improved nets had other benefits. More *adelas* would em-

ploy *adegbovis* year-round and apprentice them in the art of fishing. Since the latter's profit share would increase, he could acquire his own gear sooner. Higher catches would make the use of larger boats and outboard motors more economic. In the mid-1970s, the Volta Lake Research and Development Project launched a program introducing monofilament nets.⁵³ Fishing communities, however, did not evolve in such linear fashion as anticipated. Rather, the changing lake conditions demanded a complicated adjustment of livelihood strategies with profound gendered implications.

Tsikata conducted extensive research in three fishing communities across the southern part of Volta Lake. Initially, the first wave of Tongu migrants focused on fishing, fish processing, and trading. They exchanged fish for foodstuff with their hosts. After a few years, when they experienced food shortages, they adopted drawdown agriculture on the banks of the lake. Once this area was no longer sufficient, they expanded their farms on higher ground with rain-fed agriculture. This changed the relationships with their host communities, as Tsikata has noted, "transforming many migrants from independent fishermen into tenant farmers." With the decline of fish stock in the 1980s, the original Tongu migrants and their children turned to farming and rearing of cattle, goat, and sheep. Women shifted to farming and trading for their livelihood. Men who mainly fished moved to the lake's more remote parts with larger stock.⁵⁴

The second wave of migrants from coastal areas had the technology and experience to operate more successfully on the open lake. The Dangme fishing company proved to be a suitable work unit. Each company consisted of a male head who owned fishing equipment and a boat, adult male fishing assistants hired on contract, children doing related work like net fixing, and women responsible for fish processing. Such companies could purchase outboard motors that increased their reach, allowing them to fish all year. Fishing assistants rarely earned enough money to buy their own boats and gear. By the 1980s, the Dangme and the Fanti had become the main fishers on Volta Lake. Some Tongu who had done well branched out into other activities like operating transport boats, among them Louis Acorlatse, a leader of fishers at Kpando Torkor.⁵⁵

Male-centered migration from the Lower Volta to the lakeside created gender inequality. While in the Lower Volta women had generated their own income through clam fishing and trading, in lakeside fishing villages, they remained dependent on men for whom they worked processing fish. In the long run, women had little to show for their efforts and few investments to support themselves in old age. Only in marketing centers like Kpando Torkor did some women have more success in making livelihoods as fishmongers. But success in trading was frequently not sustainable, particularly if women made investments in male businesses like transport, as was the case for Damali, an elderly woman interviewed by Tsikata. Damali moved to Kpando Torkor with her husband in the mid-1960s and

bought with her considerable profits from trading two transports boats operated by relatives, a car for her grandson, and cows looked after by a cousin. By 2000, Damali had lost these investments.⁵⁶

Migrating Tongus, and later Dangmes and Fantes, established the lake's fishing industry without state intervention, which resulted in poor infrastructure, no pipe-borne water, and a lack of government services in lakeside settlements. Migrants stayed connected with their hometowns, where their children were schooled, and participated in family affairs. Those who could afford it put up houses, looked after kin, and contributed to development associations. With the lake's economic decline, migrants' ability to support relatives and children in the Lower Volta decreased. Still "hometowns retained their value," as Tsikata noted. They served "as places of ritual importance, a source of cheap labor, a refuge in times of crisis and a place to retire to or be buried at."⁵⁷ Migrants' eagerness to maintain hometown connections countered the sense of remaining strangers in relation to host communities on the lakeside.

Fishers' outmigration from the Lower Volta also had public health implications. The migrating Tongu fishers carried schistosomiasis that became a serious health hazard for the new lakeside communities. The Preparatory Commission had noted that urinary schistosomiasis was prevalent among "migrant fisher folk" who moved along the Volta River. The commission recommended building resettlement towns at least one mile back from the lake's 280-foot contour and equip them with clean pipe-borne water and latrines to minimize any needs for accessing the lake and thus the risk of contamination.⁵⁸ The proposed survey about the health of the population in the lake area was not executed, which limited knowledge about the changing health conditions in the lakeside communities and resettlement towns.

Migrating fishers infected with schistosomiasis extended the boundaries of the disease. The formation of the lake with its slow-moving water created a perfect environment for the vector snail *Bulinus*. The spread of aquatic plants, not foreseen by the planners, provided the snail with an ideal habitat. Weeds like water lettuce and bull rush quickly covered the flooded woodlands in the Afram arm, while hippo grass spread around Yeji forming "sudd islands" in association with other plants.⁵⁹ Initially, researchers focused their investigations on the vector snail's distribution and association with aquatic plants. When the VRA established the VLRP, the lake's health hazards became one of its primary concerns. One study showed that on the lake's western shores, the incidence of schistosomiasis among children under the age of ten had risen to 90 percent. On the eastern shore, infection rates were lower. Obeng suggested that the steep lakeshore prevented the growth of weeds. Snail hosts were also found in the mud and browsing on rocks.⁶⁰ Infection rates rose rapidly along the Afram, reaching nearly 100 per-

cent by 1968 for children aged four to sixteen in Asuboni and in the resettlement towns of Amate and Mpam.⁶¹ A VLRP survey of 140 villages mapped the prevalence of urinary schistosomiasis, with infection rates between 75 and 100 percent in the Pampram, Afram, and Sene arms and around Yeji. This study remained unpublished; the VRA was reluctant to make the problem known.⁶²

The other major health concern was onchocerciasis, or river blindness. As anticipated by the Preparatory Commission, the lake's flooding eliminated the breeding sites of its vector *Simulium damnosum*. Yet on the Asukawkaw River, one of the lake's eastern tributaries, the prevalence was high, reaching 90 percent among people over fifteen years old. Downstream from Akosombo, the Senchi and Kpong rapids formed another *Simulium* breeding ground until the Kpong Dam was built in the late 1970s. The VRA sought to control onchocerciasis through the spraying of DDT and spilling at Akosombo, which was only an option prior to the 1970s drought. The lake flooded the riverine forests that had been the breeding ground of the tsetse fly. The feared transmission of trypanosomiasis, or sleeping sickness, from the north through lake transport did not happen. Malaria and schistosomiasis, however, remained endemic. By the 1970s, there had been some improvements in resettlement towns, with the establishment of health posts and easier access to outside facilities. But the sixty thousand fishers living in isolated villages remained exposed to riverine disease; their situation had "worsened."⁶³ The health hazards of Volta Lake drew international publicity. When a 1972 BBC documentary reported on "the other side" of man-made lakes in Africa, the segment on Volta Lake addressed waterborne diseases. The Ghana High Commission in London objected to this reporting and urged the VRA to contain such negative publicity.⁶⁴ By the 1990s, Ghanaian officials acknowledged the lake's unresolved health challenges. L. K. A. Derban, former director of VRA Health Services, painted a bleak picture about the prevalence of urinary schistosomiasis. Effective measures to control its vector snail by eliminating aquatic weeds had not been introduced. Rather, the migration of fishers to the lake's remote corners had led to an increase in areas where infection rates had been low. A long-term campaign would require surveillance and treatment of patients, combined with "effective sanitary measures" that included an efficient disposal system for human excrements, a safe water supply, "adequate bathing and washing facilities," and a program to control snails and aquatic weeds at landing stations. Since boat-landing sites had become useless due to the ongoing drought, fishers and their children had "frequent water contact to fish and swim." Intestinal schistosomiasis, previously unknown, appeared in the Lower Volta, which Derban interpreted as an indicator of poverty and poor living conditions.⁶⁵

Since the late 1980s, the VRA has strengthened its efforts in aquatic weed control, particularly in the Kpong head-pond, where the weeds threatened the intake of the generating station. During such exercises, people were screened and treat-

ed for schistosomiasis.⁶⁶ The VRA commissioned the boat *Onipa Nua* in 1990 to deliver free medical service and public health education to fishing communities and other lakeshore dwellers. Every year, the *Onipa Nua* visited between seventeen and eighty-six lakeside villages.⁶⁷ Yet these efforts remained merely palliative, since the disease cycle of schistosomiasis had not been broken. That would require not only treating human carriers, controlling weed and vector snails, and limiting people's contact with lake water but changing people's sanitary habits by providing them with urinals, latrines, and clean water.⁶⁸ It is a high bar but one that could be achieved. Education outreach and proper sanitary facilities could stop the disease. Although snails will always live in the water and people will continue having contact with the lake, radically reducing the numbers of parasites would bring real change.⁶⁹

The damming of the Volta River at Akosombo had a fundamental impact on Ghana. Downstream, with the end of the annual floods, water disappeared from the Lower Volta. The drying up of small streams and ponds resulted in migration and transformed livelihoods. Upstream, the formation of a massive lake displaced eighty thousand people in the Volta Basin. The VRA launched a resettlement program that sought to provide housing in fifty-two townships with modern amenities for the displaced people. The outcome was different from what the planners had promised. Water pumps broke down, land clearing for settler agriculture remained insufficient, and irrigation projects like the one at Amate were short lived. Unable to make a living, many residents abandoned the resettlement towns. The anticipated modernization did not happen.

This essay has tracked Volta Lake's ecologies and fisheries since the closing of the Akosombo Dam in 1964. Although the Preparatory Commission had extensively studied the project's impact on the flood basin and the Lower Volta, the commission failed to anticipate many consequences. The swift migration of Tongu fishers to the lakeside, followed by Fantes, Anlos, and Dangmes, unfolded without state guidance. Fish-stocking was unnecessary. Instead, fishers adapted to the lake's changing ecology and adjusted their livelihoods. They established their own settlements with no or limited state services. Lakeside communities had to live with waterborne diseases.

Since the early 1960s, Ghanaian scientists have explored the ecology of Volta Lake. With funding and support from intergovernmental agencies, they turned Volta Lake into one of the best-studied man-made lakes in the Global South. By the late 1970s, this knowledge production slowed to a trickle. Two decades later, when funding resumed, the scholarly and political context had changed. While experts had earlier suggested policies to expand the lakes' fisheries, the focus had shifted to stock management. Concerns about overfishing and sustainability moved to the foreground.⁷⁰

Drought has become a recurrent issue for Volta Lake. Ghana experienced the first of several energy crises in 1983. They were the result of climate change that brought declining rainfall in the Volta Basin, the catchment areas of Volta Lake, which drains the Black and White Volta and Oti Rivers systems in northern Ghana, Burkina Faso, Togo, and Benin. Rising temperatures produced higher evaporation. Poor rainfall and increased evaporation resulted in lower water levels and a reduction of power generation at Akosombo.⁷¹ Electricity shortages challenged the notion of Akosombo as a secure power supply. The planners had not foreseen such a situation. They were more concerned with future floods as they had experienced them during the dam's construction. Kaiser Engineers designed the Akosombo Dam with twelve floodgates.⁷² What are the future projections? A recent study analyzing global climate models predicts that the Volta Basin will become warmer and slightly wetter during 2011 to 2040 compared to 1981 to 2010. Some areas, however, will become warmer and dryer during the same period, and warmer temperatures will mean more evaporation.⁷³

Over the last decade, Ghanaian scientists, government officials, and local stakeholders have addressed some of the adverse issues of hydroelectric dams. They conducted a study to re-optimize the operations of Akosombo and Kpong for the Lower Volta. The proposal sought to re-create seasonal floods by operating the dams in a way that mimics natural flow regimes. During the rainy season's peak inflows, dam operators would significantly increase hydropower generation. Higher outflow from Volta Lake would replenish streams and ponds in the Lower Volta and wash out aquatic weeds. Yet re-operation would require expensive investments in alternative power supplies and transmission capacity. Moreover, downstream communities have adjusted to the postdam regime over the last fifty years. Since they experienced the negative impacts of the VRA spilling large quantities of water at Akosombo in 2011, they are now "reluctant to accept and adapt to the restoration flows." Instead, the study recommended alternative forms of weed control and increased irrigation that would enable lucrative dry-season vegetable farming to improve livelihoods.⁷⁴

It is encouraging that these discussions about mitigating dams' water challenges are taking place in Ghana. One hopes that such insights with attention to impacted communities will be considered during the building of the Pwalugu project, and that the shortcomings of Akosombo will not be repeated.

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The Dammed Body: Thinking Historically about Water Security & Public Health

Jennifer L. Derr

This essay traces the historical relationship between the construction of the Nile River and the prevalence of disease in Egypt in the long twentieth century, with an eye to the relevance of this history to other regions on the African continent impacted by the construction of large dams. Beginning in the second decade of the nineteenth century and stretching through the 1970s, the Nile River underwent a dramatic process of transformation. Two large dams – the 1902 Khazan Aswan and the Aswan High Dam – were constructed on the river. Networks of perennial irrigation canals facilitated the practice of year-round agricultural production and the High Dam provided electricity. The remaking of Egypt’s riparian ecologies also had important implications for the health of Egypt’s population as these ecologies were associated with new landscapes of disease and approaches to biomedical treatment.

On March 30, 1977, the legendary Egyptian singer and actor ‘Abd al-Halim Hafiz died at the age of forty-seven from complications of a chronic and severe parasitic infection. Few stars in Egypt have been as beloved as ‘Abd al-Halim. His musical career was tightly intertwined with the rule of Egyptian President Gamal Abdel Nasser (1954 – 1970) and the politics of that period. Young, charismatic, and inspired, Nasser was fiercely anticolonial and populist. ‘Abd al-Halim helped give voice to these politics. While he sang of love and longing, a subset of his music championed the nation and the struggles of its ordinary citizens. When Egypt’s “nightingale” died, the crowds who thronged the streets of Cairo for his funeral were so distraught that it is rumored at least one woman jumped from her balcony to her death in despair.¹

While ‘Abd al-Halim Hafiz lived an extraordinary life, he died the most ordinary of deaths. Born in 1929 in the village of al-Halawat in the Nile Delta, the singer was orphaned and grew up poor before moving to Cairo and attending the Academy for Arab Music. When he was a child, ‘Abd al-Halim was infected with the *Schistosoma mansoni* parasite, which causes the disease schistosomiasis, the complications of which led to his death. In 1937, Rockefeller Foundation parasitologist James Allen

Scott estimated that approximately 60 percent of Egypt's population was infected with the parasites that cause schistosomiasis.² Despite the fame and fortune that he attained in his lifetime, 'Abd al-Halim became a victim of the same disease that afflicted millions of Egypt's rural poor in the twentieth century. His body, like all of ours, had a past, one that had been shaped by the material environment in which he came of age, the class structures that determined how he interacted with the world around him, and Egypt's position in a global capitalist economy.

Egypt's schistosomiasis epidemic had roots in the agricultural ecologies of the dammed Nile River.³ The country's history of dam construction is among the earliest and most storied on the African continent. Its first modern dam, Khazan Aswan (anachronistically, the Aswan Low Dam), was completed in 1902. In its time, it was the largest masonry dam in the world. Khazan Aswan was raised twice, once by the British authorities who occupied the country and again by the quasi-independent Egyptian government that was in place between World Wars I and II. In 1960, after the unfolding of a Cold War melodrama, construction began on the hydroelectric Aswan High Dam, which in its time represented a mark of progress for Nasser's regime and those seeking to throw off the yoke of colonialism in other corners of the globe.

That the parasites that cause schistosomiasis thrive in the ecologies of dammed rivers was a lesson learned first in Egypt. Khazan Aswan transformed the landscape and practice of agriculture and in the years that followed its completion, ever larger numbers of patients arrived at hospitals and clinics bearing the marks of severe schistosomiasis infection.⁴ During World War I, scientists mapped the life cycle of the parasite, definitively linking it to the practice of perennial irrigation, which had been enabled by the damming of the Nile.⁵ Knowledge of this relationship in no way thwarted the erection of other dams on the river; similar constructions were built in Sudan at Sennar (1926) and Jabal Awliya' (1937). As the twentieth century progressed, dams proliferated across the African continent. Predictably, in many places, their construction meant a dramatic increase in the numbers of those suffering from schistosomiasis.⁶ Today, approximately 240 million people are infected with this disease. The World Health Organization estimates that at least 90 percent of those requiring treatment for schistosomiasis live in Africa.⁷ Schistosomiasis is not the only common trait linking dammed regions of the continent. In the middle decades of the twentieth century, a shared ethos of high modernism that championed the power of science and technology propelled these projects in colonies and independent states alike, displacing millions and leaving river systems marked by degraded water quality, the emission of greenhouse gases from reservoirs, reductions in the diversity of life in riparian ecosystems, and downstream soil erosion.

In this essay, I chart the history of dams and disease in twentieth-century Egypt with an eye to what we might learn from this historical arc in an era of in-

tensifying environmental transformation. As the effects of climate change accumulate, some argue that dams might serve as a form of protection during years of drought and flood and a relatively “clean” way to produce energy.⁸ This argument is reflective of a broader approach that believes solutions to climate change will come in the form of big technologies that reshape our environments and protect us from the spiraling effects of ongoing damage. Twentieth-century Egyptian history serves as a potent reminder that environmental interventions are also bodily, one manifestation of which is disease, as Julie Livingston’s contribution to this issue of *Daedalus* describes from a number of different angles.⁹ This history also demonstrates that disease never falls equally on a population as its distribution and its effects are inevitably structured by questions of race, class, and geography. This was as true of schistosomiasis in twentieth-century Egypt as it is with respect to the ongoing COVID-19 pandemic.¹⁰

Neither does the comparison of similar forms of technology across time and space reveal the complexities of their embeddedness and experience. While a shared body of environmental effects has often marked the construction of dams in Africa, a closer look demonstrates that technology is not determinative in its form but rather functions as a material manifestation of specific political economies and technologies of rule, a point highlighted by Allen Isaacman in this volume in his discussion of the decades of controversy that have surrounded the Cahora Bassa Dam.¹¹ Comparisons can obscure what is necessarily particular, unforeseen, and unfamiliar. In Egypt as elsewhere on the African continent, current threats to water security and the impact of proposed solutions are specific, contextual, and more complex than a simple function of environmental change. The histories of climate change will be those of social hierarchy, global capitalism and its local forms, and approaches to governance. As Egypt’s trajectory demonstrates, change will not (only) be experienced at the scale of the globe or even that of the nation but also through individual bodies that exist in different sets of relations with a physical world.

One history of ‘Abd al-Halim Hafiz’s early death might begin in the southern Egyptian town of Aswan. In 1898, it was there that construction began on the first modern dam built on the Nile River, Khazan Aswan. Thirty-seven meters tall, when it was complete, it formed a reservoir that could store 980,000,000 cubic meters of water and transformed Egypt’s agricultural landscape.¹² For millennia, Egyptian agriculture had depended on the annual Nile flood, which cultivators had channeled into large basins where it soaked and fertilized the soils in which crops were sown. Egypt’s major produce had consisted of crops like wheat, which farmers planted following the evacuation of floodwaters, tended during winter, and harvested in spring.¹³ Other crops grew during summer and the season of the flood but as they had to be watered by hand or animal,

the surface area that they covered was more limited. Following the completion of Khazan Aswan, an irrigation frontier divided Egypt. Perennial irrigation and year-round agricultural production predominated in the Nile Delta and the northern portion of the Nile Valley while the southern regions of Egypt's Nile Valley continued to practice basin irrigation.¹⁴ In those regions that were perennially irrigated, irrigation canals and drains replaced basins. These waterways helped to sever with the relationship of agriculture to the temporality of the flood. By 1912, 3.3 of Egypt's 5.3 million cultivable acres were perennially irrigated.¹⁵ Plots of land that had once grown a single crop grew two and sometimes three each year; these crops included cotton, sugarcane, and maize, whose widespread cultivation was impossible with basin irrigation.

Khazan Aswan was built by the British during their occupation of Egypt (1882 – 1923). During this time, Egypt developed a colonial economy characterized by the dominance of cash crop agriculture, cotton in particular, the consolidation of agricultural land in the hands of the elite, and the continued impoverishment of the rural working classes. The roots of this economy can be traced to earlier in the nineteenth century and the policies introduced by the country's Ottoman rulers.¹⁶ When the occupation began, the Ottoman-Egyptian government's deep debt was one pretense cited as a justification for British control of Egypt.¹⁷ The spread of perennial irrigation not only promised to fill state coffers with the land tax revenues; a large proportion of Egypt's cotton production flowed to textile mills in the north of England, further fueling British enthusiasm for the dam.¹⁸ Large landowners were also eager to increase the productivity of their estates, the cultivation of lucrative cash crops in particular.

While the completion of Khazan Aswan was a boon to Egypt's ruling classes and colonial officials alike, it was those who labored in agriculture who experienced its construction and environmental impacts most intimately.¹⁹ During the late nineteenth and early twentieth centuries, the majority of Egypt's population lived in the countryside and farmed the land. Some cultivated their own small plots; many worked for wages or as sharecroppers on large cotton-producing estates owned by the Egyptian elite. The introduction of perennial irrigation and year-round production meant more work for the countryside. It also entailed new forms of environmental contact. Laborers from rural Egypt excavated the canals and drains that carried water to and from crops year-round and cleared canals each winter of the silt that threatened to clog them. No longer performed by the energy of the flood, irrigation became the work of cultivators who waded in canals to channel water into the pulleys and Archimedean screws that helped lift water to the fields.²⁰

The water that filled irrigation canals and drains was teeming with life. In addition to human beings, the *Schistosoma haematobium* and *Schistosoma mansoni* parasites that cause schistosomiasis thrived in the slow-moving freshwater. So did

the two species of tiny freshwater snails, *Biomphalaria alexandrina* and *Bulinus truncatus*, that serve as the parasites' intermediate hosts. The eggs of *Schistosoma* parasites exit the human body in urine and feces, hatching in freshwater. When this water also contains their intermediate mollusk host, the parasites undergo a series of organismal transformations that enable them to penetrate unbroken skin and infect a human body. Rural populations writ large were vulnerable to infection as most villages lacked easy access to water and canals became sites at which to wash, fetch water, and play. Men were particularly vulnerable to repeat and severe infections with *Schistosoma* parasites. From their teenage years, the work of irrigation saw them wading in the water that filled canals during the time of the year in which the parasites were most infective.²¹ While *Schistosoma haematobium* and *Schistosoma mansoni* are endemic in Egypt, rates of infection in regions practicing basin irrigation were quite low, hovering around 5 percent.²² The introduction of perennial irrigation caused the prevalence of the disease to skyrocket, averaging 60 percent nationwide and climbing as high as 90 percent in some regions.²³

Parasites thrived also in the soils of Egypt's new agricultural landscape. Before the construction of the dam and the spread of perennial irrigation, soil had dried and cracked in the dry season that followed the harvest of crops and preceded the arrival of the flood. Perennial irrigation meant the near continuous presence of water on the land, which increased its moisture content. These changed conditions proved conducive to the life cycle of *Ancylostoma duodenale* parasites, which cause one form of hookworm disease.²⁴ The eggs of these parasites exit the human body in feces and, on soil with the right moisture and nutrition, the parasites hatch and transform, descending a short distance into the soil to await a new human host. As most Egyptians who lived in the countryside went barefoot, they were infected with the organism through their feet. While hookworm is endemic in Egypt, the spread of perennial irrigation altered the regional distribution of the parasite as well as the prevalence of infection among the population.²⁵ In the early twentieth century, the visible marks of hookworm infection were the most common cause disqualifying recruits for the Egyptian army.²⁶ By the middle of the 1930s, Scott estimated that five million of Egypt's twelve million inhabitants suffered from the disease.²⁷

The spread of perennial irrigation throughout large portions of the countryside also changed the diets of rural populations. Historically, Egyptians had relied for sustenance on grain crops that included barley, millet, and wheat.²⁸ By the early twentieth century, corn had replaced other traditional grains to become a staple in rural diets, especially in the Nile Delta. It was also one of Egypt's top-ranking exports. The crop's growing season resembled that of cotton, meaning that as perennial irrigation spread, so did the cultivation of corn.²⁹ It was also durable, and its kernels easily stored. Finally, corn required less labor than other staple grain crops, important traits when considering the extended calendar of labor associat-

ed with perennially irrigated agriculture and the prevalence of sharecropping and agricultural wage labor in the countryside.

The shift to a reliance on corn also had a grave impact on human health. By the early twentieth century, the symptoms of the disease pellagra were widespread in rural communities in the Nile Delta. Pellagra results from a niacin deficiency, which can be caused by an overabundance of corn in the diet. (Corn contains a form of niacin that human beings cannot digest unless the grain is properly prepared.)³⁰ The appearance of pellagra has historically been common among impoverished communities who lack access to dietary diversity. In Egypt, the disease resulted from changes in patterns of agricultural production that were linked to perennial irrigation as well as the widespread poverty that marked the country's colonial economy. While numbers charting the prevalence of pellagra are more difficult to come by than those measuring schistosomiasis and hookworm, some of its symptoms were visible and the subject of frequent comment by physicians of the period.³¹

In the regions of Egypt whose agricultural ecologies were transformed by the construction of Khazan Aswan and the subsequent spread of perennial irrigation, the prevalence of disease helped to produce new normative habitations of the human body. Those who lived in the countryside of the Nile Delta and northern central Egypt were likely to suffer the symptoms of schistosomiasis, hookworm, or pellagra; many suffered a combination of these maladies. While sparse, historical evidence suggests that rural communities understood the diseases of perennial irrigation not as systemic but rather through their individual symptoms.³² To inhabit a rural body in the agricultural ecologies supported by the dam – especially a laboring body – included different combinations of a wide variety of physical symptoms. Some were seasonal, a photosensitive rash that appeared in spring for example. Fatigue, fever, aching, and cough were common as were digestive difficulties that included abdominal pain, vomiting, diarrhea, blood in the urine, flatulence, constipation, and weight loss. Children suffered severe anemia, stunted growth, and, in particular, difficulty concentrating. Severe and advanced cases could be marked by cancer of the bladder, high blood pressure through the liver, an enlarged spleen, the build-up of fluid in the abdomen, swollen areas in the esophagus and digestive tract that could rupture and bleed, and disorders of the nervous system that caused memory loss, depression, and eventually dementia. While urban populations and the elite were much less likely to suffer these problems, for the vast majority of the Egyptians who lived in the countryside, the environment produced by the construction of Khazan Aswan and the spread of perennial irrigation had deep and sustained effects on their health.

The year 1928 is another possible point from which one might begin an explanation of 'Abd al-Halim's early death. It was that year that the interwar-period Egyptian regime began a project to heighten Khazan Aswan

and enlarge its reservoir and the surface area of land that it irrigated and, by extension, the proportion of Egypt's population who suffered the diseases that were embedded in this landscape. The regime that made this choice was not controlled by foreign powers but rather comprised of the Egyptian elite. In 1919, a revolt protesting the continued British occupation had erupted. By 1922, Egypt had renegotiated its relationship with the colonial power and while Britain continued to exercise a decisive role in the country, its government was firmly in the hands of Egyptian elites.³³ Under this regime, Egypt's economy continued to rely heavily on export-oriented, cash crop agriculture (cotton in particular), and the social relations of the countryside persisted much as they had during the occupation.

Control of the Nile River was an important tenet of Egyptian nationalism. Before World War I, the British had begun construction on the Gezira scheme in Sudan, an agricultural region that they hoped would be one of the largest cotton-growing areas in the world.³⁴ In 1919, when the war had ended and the British sought to construct irrigation works in their possessions to the south of Egypt, a heated debate flared concerning the impact these works would have on the quantity of Nile water available to Egypt. In what would prove an enduring problem, Egypt felt its vulnerability as the furthest downstream country. When the British completed the Sennar Dam, which helped to water the Gezira scheme, tension between the countries intensified and, in an attempt to stake its claim to the Nile, Egypt invited an international commission to assess the safety of raising Khazan Aswan.³⁵

The commitment to a dammed Nile River set the country on a particular path. Egyptian political officials not only understood the Nile River as an important feature of their landscape, culture, and history, but national development was also associated with a dammed Nile and water-intensive agriculture.³⁶ While British authorities had made almost no effort to address the epidemic of disease that raged in the countryside, during the interwar period, national development was paired with public health outreach. Hookworm and schistosomiasis were of particular interest. Effective treatment for the former had existed since the late nineteenth century; that for schistosomiasis had been introduced to Egypt around the period of World War I. Beginning in the 1920s, the Egyptian Public Health Department established treatment centers for schistosomiasis and hookworm in Egypt's cities and throughout the towns of the countryside. While the month-long treatment regimen for schistosomiasis caused considerable discomfort, even pain, by the 1940s, approximately 400,000 patients were treated for schistosomiasis each year in these clinics.³⁷

Despite treatment, large numbers continued to suffer from schistosomiasis. Even when they were cured of the disease, the vast majority were reinfected with their return to rural life and labor. The lack of infrastructure in Egyptian villages meant that irrigation canals continued to occupy a prominent role in village life, and for cultivators, there was no way to avoid the physicality of irrigation and the

threat of parasitic infection that it posed. While physicians and political officials alike acknowledged that the efficacy of treatment was limited, there was no suggestion that the dam or the patterns of agricultural production that it supported might be undone. A particular archetype of national development had been normalized: like the heightening of the dam, mass treatment demonstrated scientific and bureaucratic sophistication, furthering the cause of national development.

In 1952, a group of junior army officers orchestrated a popularly supported coup that forced the Egyptian monarchy from power. Two years later, one of these young officers, Gamal 'Abd al-Nasser, became Egypt's president. Under his leadership, Egypt became a populist authoritarian state, animated by Nasser's fiercely anticolonial politics. Before the coup, Egyptian politicians had debated the prospect of replacing Khazan Aswan with a hydroelectric dam; the project became a priority in the early days of Nasser's presidency.³⁸ For funding, Egypt first negotiated with the United States and Great Britain. When Nasser refused to bow to the political conditions attached to the aid – specifically to back down from his conflict with Israel and position Egypt as a quiescent Cold War client state – each country in turn withdrew its support.³⁹ The Soviet Union stepped in with an offer of financing and soon after, in July of 1956, Nasser nationalized the company that administered the Suez Canal, announcing his intention to use its profits to fund the construction of a new dam on the Nile. In an attempt to corral Nasser's ambition and quash his regional influence, Britain, France, and Israel attacked Egypt, withdrawing their forces from Egyptian territory only after pressure from the United States. While the war was a military defeat for Egypt, Nasser emerged a hero for his willingness to stand strong in the face of neocolonial aggression. In 1958, Egypt and the Soviet Union agreed on the terms of financing and, in 1960, construction on the High Dam began.

The potential of the Aswan High Dam to transform Egypt figured prominently during Nasser's rule (1954 – 1970). The period of its construction witnessed the implementation of reforms that sought to lift Egyptians from poverty and address the dramatically unequal distribution of wealth that had marked the time of the British occupation and that of the interwar period. The era of Nasser's rule saw the implementation of several land reforms, the championing of the rural poor, an endeavor to end the country's dependence on export-oriented agriculture, and the development of Egypt's industrial sector. However, like the regime he had helped topple, Nasser understood the performance of technological mastery and environmental claim-making as central to nationalist development. This time, it was not water for cotton but electricity to power Egyptian industry and light the countryside that fueled enthusiasm for the dam.

When construction was ongoing, Nasser's regime prepared for the possibility that an increase in the prevalence of schistosomiasis would follow the dam's com-

pletion.⁴⁰ During the 1950s and 1960s, schistosomiasis treatment was linked to investments in rural public health. Between 1951 and 1963, the state budget devoted to health care nearly quadrupled.⁴¹ The number of rural health care units also increased, from 382 before the coup to 1,525 by 1965.⁴² These rural health care units complemented the existent network of clinics devoted to the treatment of parasitic diseases. Schools were also sites of treatment as the rates of infection among children were high and their attendance at school was more predictable than that of adults at clinics.⁴³

As many Egyptians were farmers, public health officials wrestled with the seemingly intractable problem that reinfection represented. One approach treated the environment in which schistosomiasis was rooted with chemicals in an endeavor to root out disease. This strategy, one form of what public health officials conceived of as “vector control,” garnered the support of the World Health Organization and governments in the Global North seeking to promote their (national) chemical companies and pharmaceuticals. In Egypt, large field experiments were organized to test the efficacy of different chemical compounds that killed snails in reducing the prevalence of disease. Despite the enthusiasm that surrounded them, in Egypt, chemical agents never became the total solution that many had hoped. When considering the impossibly complex networks of canals and drains that extended from the Nile, their cost was too high as was their toxicity.⁴⁴

In 1961, ‘Abd al-Halim Hafiz began performing the song “Hikayat Sha’ab” (story of a people), which told the story of the Aswan High Dam as a rejection of Egypt’s colonial past and a celebration of the path of national self-sufficiency. That ‘Abd al-Halim sang the song while suffering a disease linked to the ecologies of the dammed Nile might have produced an air of tragedy, even irony, but in the singer’s performance, there is only a sense of pride and steadfastness. Many Egyptians, including those at the highest levels of state, continue to believe that the country had no choice but to build the dam and that the benefits that have flowed to Egypt as a result have been considerable. The conversion of the countryside to perennial irrigation was complete. The cessation of the annual Nile flood in Egypt and the accumulation of its waters in Lake Nasser ended the threat posed by high floods and enabled the successful mitigation of drought. Most important, the dam generates power, which in the 1970s, was used to electrify large swaths of the countryside and fuel Egyptian industry. Neither did the completion of the Aswan High Dam exacerbate the schistosomiasis epidemic. From the 1950s, studies indicated that widespread treatment, the construction of civilian infrastructure, public health outreach, and urbanization had chipped away at the high numbers of those suffering from disease and caused rates of infection to decline.⁴⁵

In the years after the Aswan High Dam was completed, it became evident that the dynamics of schistosomiasis infection in Egypt had changed but not as anti-

pated. When Khazan Aswan was built, *Schistosoma haematobium* had been endemic throughout Egypt while *Schistosoma mansoni* had been confined to particular regions of the northern Nile Delta. By the 1970s, this was no longer the case.⁴⁶ *Schistosoma mansoni* had spread into new territories, eventually becoming the more common cause of disease.⁴⁷ It is likely that this migration began decades before the High Dam was built. When he conducted his nationwide survey in the 1930s, Scott wondered whether *Schistosoma mansoni* had begun to move beyond its historically endemic territories. Residing in the intestinal system, the species produces a slightly different set of symptoms and sometimes a more severe form of disease than *Schistosoma haematobium*. While the geographies of infection shifted, the profile of who was most vulnerable did not. Among the rural poor, men fell ill in greater numbers than women and rates of infection were highest from childhood through the early years of adulthood.⁴⁸

In the past several decades, the transmission of schistosomiasis has been eliminated or greatly reduced throughout the Middle East and North Africa.⁴⁹ Its prevalence is highest in Yemen, which has been destroyed by a Saudi bombing campaign and is wracked by civil conflict. As of 2014, there were approximately 12.7 million individuals infected with schistosomiasis in the Middle East and North Africa, about 10 million of them in Egypt and Yemen. In 2016, estimates placed the nationwide rate of infection in Egypt at 0.2 percent of the population.⁵⁰

This tremendous reduction can, in large part, be attributed to the development of a new and effective oral therapy, Praziquantel, in the 1970s. As patients no longer needed to submit themselves to lengthy courses of injections, treatment could be administered on a large scale and indiscriminately, especially to high-risk populations like children who had not been tested for the presence of the disease. The use of this drug, in conjunction with snail control efforts, health education, and sanitary infrastructure improvements, allowed Egypt's government to gain the upper hand over an epidemic that had haunted the country for almost a century. Other less intentional developments also likely altered the course of the disease. In the 1980s, crayfish were introduced in the Nile Delta for aquaculture and spread rapidly. These creatures happen to prey on the species of snails that serve as the intermediate hosts for *Schistosoma* parasites.⁵¹ In recent years, the end of schistosomiasis in Egypt has finally come into view. In 2016, the Egyptian government announced a plan in cooperation with the World Health Organization to eliminate schistosomiasis by 2020.⁵² At the time of writing, the results of this endeavor had not yet been announced.

While the Aswan High Dam did not have the anticipated effect on the landscape of environmental disease in Egypt, the harms that have flowed from the dam's construction have been considerable. Nearly 100,000 members of Egypt's Nubian community – and a larger number in Sudan – were displaced and much of the territory that was historical Nubia was decimated. Many were moved to a settlement

in the town of Kom Ombo, relatively distant from the Nile and the life ways that had once sustained them.⁵³ The dam's reservoir, Lake Nasser, flooded a number of archaeological sites in Egypt and Sudan. Some, like Abu Simbel, were moved to other locations. Others were gifted to museums abroad and a handful are submerged in the waters of the lake.⁵⁴ The effects of the High Dam on the riparian environment have also been substantial.⁵⁵ Deprived of adequate sediment, Egypt's northern coastline has eroded; a significant quantity of agricultural land has disappeared; the soil is no longer as productive as it once was; and commentators have long debated the impact of the dam on fish populations in the Mediterranean Sea.

One wonders whether large dams like the Aswan High Dam are one of the great postcolonial traps, destined to pit those who are concerned about their environmental effects and cultural erasures against those who are seeking resources and national development according to the terms that came to predominate in the twentieth century. As the construction of large dams accelerates, many governments find themselves faced with a set of dilemmas resembling those confronted by the Egyptian regime more than sixty years ago. In the short term, agricultural productivity, protection from the variability of floods, and the provision of electricity are attractive prospects. So is the national pride and political favor that attaches to the construction of infrastructure. However, this thirst for resources and development often produces a skewed vision of the cost of dam construction, one that omits the significant price of damage to the environment, public health programs, and the civilian infrastructure necessary to mitigate their effects.

In Egypt, the long history of damming the Nile has also produced consumption habits and expectations that are ill-suited for a world in which resources are ever scarcer. Two of Egypt's most important crops – rice and sugarcane – are both water intensive. Recently, the government has made moves to limit rice cultivation, these policies landing hardest on the farmers who grow the crop. Neither is there a deep history of water conserving irrigation.⁵⁶ The current controversy in Egypt that surrounds the construction of the Grand Ethiopian Renaissance Dam (described in Harry Verhoeven's essay in this issue of *Dædalus*) is in part rooted in the government's long-standing concern about the vulnerability produced by its position on the Nile and the tiny amounts of rain that fall in its fields each year.⁵⁷ It also stems from the reality that the government will be forced to confront the country's water poverty, which the long history of the dammed Nile has allowed it to avoid.

How Egyptians will experience a future that will be further freighted by the challenges of climate change, among them water security, will, like the country's history of dams, be shaped by questions of political economy and the technologies of power. Khazan Aswan was built under a colonial regime to support a form of agricultural production that served the interests of the British Empire, on the one hand, and Egypt's wealthy landowners, on the other. Its goods flowed to these classes while poverty and parasites molded the bodies of the agricultural working

classes. The Aswan High Dam was imagined as an escape from the geopolitical relationships and material constraints of the past. And yet, like the dam that preceded it, it was a manifestation of environmental authoritarianism. Not only did the government dictate the pathways of water, power, and displacement; it mandated the chemical treatment of human bodies and the environment in order to combat the harms that flowed from the dammed Nile. The strategies that Egypt's current regime deploys to respond to climate change will be similarly shaped by its aggressive authoritarianism, the absence of legitimate channels through which to express dissent, and the interests of the ruling classes, the military primary among them.

If there are lessons to be learned, it is the intractable relationship of human and environment health and the persistent influence of social and economic structures in shaping these terms. History accretes in the body. On global as well as local scales, this accretion is structural as much as it is environmental. A narrow interpretation of Egypt's twentieth-century history would read the historical relationship between dams and disease as a specific warning. But a dam or any piece of environmental infrastructure is not a thing apart but rather a part of a complex human/nonhuman environment and a system of global power structures. 'Abd al-Halim Hafiz inhabited a body that was emblematic of a particular era of Egyptian history. It was a body born into a political economic environment that had been shaped by colonialism; it came of age and met its end during an era in which the damming – of the Nile River and the bodies of many Egyptian citizens – were fundamental tenets of postcolonial national modernity. 'Abd al Halim accepted these inevitabilities, so much so that his voice was the voice of the hope and promise that attached to the High Dam. There exist countless historical examples of the structural-environmental relationships that expose human bodies to harm, and they are at present multiplying. Climate change is being lived differently depending on differentiations of race, class, and geography. As we debate the technological interventions that might mitigate its effects, it is important to remember that technologies themselves are not salient categories of analysis across time and space. Moreover, if our solutions to climate change imagine an environment that is analytically and materially distinct from human bodies, we will continue to be surprised, sometimes horrified, by the costs borne by these bodies, especially the most vulnerable among them.

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- ¹ For video footage of the funeral, see “Egypt: Thousands of Mourners Turn Out for Funeral of ‘Halim’ Renowned Egyptian Singer, Abdel-Halim Hafez,” *Reuters*, April 3, 1977, <https://reuters.screenocean.com/record/652571> (accessed February 15, 2021).
- ² James Allen Scott, “The Incidence and Distribution of the Human Schistosomes in Egypt,” *American Journal of Epidemiology* 25 (3) (1937): 578, 610, cited in Jennifer L. Derr, *The Lived Nile: Environment, Disease, and Material Colonial Economy in Egypt* (Stanford, Calif.: Stanford University Press, 2019), 105.
- ³ There is a robust historiography charting the ecological and social effects of damming the river in Egypt. See, for example, Habib Ayebe and Ray Bush, *Food Insecurity and Revolution in the Middle East and North Africa: Agrarian Questions in Egypt and Tunisia* (New York: Anthem Press, 2019); Jessica Barnes, *Cultivating the Nile: The Everyday Politics of Water in Egypt* (Durham, N.C.: Duke University Press, 2014); Ray Bush, *Counter-Revolution in Egypt’s Countryside: Land and Farmers in the Era of Economic Reform* (London: Zed Books, 2002); and Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley: University of California Press, 2002).
- ⁴ Derr, *The Lived Nile*, 118–119.
- ⁵ Robert Leiper, *Researches on Egyptian Bilharziosis: A Report to the War Office on the Results of the Schistosomiasis Mission in Egypt, 1915* (London: John Bale, Sons and Danielson, 1918), 3.
- ⁶ See, for example, V. R. Southgate, “Schistosomiasis in the Senegal River Basin: Before and After the Construction of the Dams at Diama, Senegal and Manantali, Mali and Future Prospects,” *Journal of Helminthology* 71 (2) (1997): 125–132; John M. Hunter, “Inherited Burden of Disease: Agricultural Dams and the Persistence of Bloody Urine (Schistosomiasis hematobium) in the Upper East Region of Ghana, 1959–1997,” *Social Science & Medicine* 56 (2) (2003): 219–234; Abiola Fatimah Adenowo, Babatunji Emmanuel Oyinloye, Bolajoko Idiat Ogunyinka, and Abidemi Paul Kappo, “Impact of Human Schistosomiasis in Sub-Saharan Africa,” *Brazilian Journal of Infectious Diseases* 19 (2) (2015): 200–201; and Susanne H. Sokolow, Isabel J. Jones, Merlijn Jocque, et al., “Nearly 400 Million People Are at Higher Risk of Schistosomiasis Because Dams Block the Migration of Snail-Eating River Prawns,” *Philosophical Transactions of the Royal Society B: Biological Sciences* 372 (1722) (2017): 1–12.
- ⁷ World Health Organization, Regional Office for Africa, “Schistosomiasis (Bilharzia),” <https://www.afro.who.int/health-topics/schistosomiasis-bilharzia> (accessed March 1, 2021).
- ⁸ The notion that dams are a clean form of energy is much contested. See, for example, Yves T. Prairie, Jukka Alm, Jake Beaulieu, et al., “Greenhouse Gas Emissions from Freshwater Reservoirs: What Does the Atmosphere See?” *Ecosystems* 21 (5) (2018): 1058–1071.
- ⁹ Julie Livingston, “Water Scarcity & Health in Urban Africa,” *Daedalus* 150 (4) (Fall 2021).

- ¹⁰ This argument and the data that support it regarding COVID-19 are widespread. See, for example, Matthew A. Raifman and Julia R. Raifman, “Disparities in the Population at Risk of Severe Illness from COVID-19 by Race/Ethnicity and Income,” *American Journal of Preventive Medicine* 59 (1) (2020): 137–139; L. Ebony Boulware, “Race Disparities in the COVID-19 Pandemic—Solutions Lie in Policy, Not Biology,” *JAMA Network Open* 3 (8) (2020); and Cary P. Gross, Utibe R. Essien, Saamir Pasha, et al., “Racial and Ethnic Disparities in Population-Level Covid-19 Mortality,” *Journal of General Internal Medicine* 35 (10) (2020): 3097–3099.
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- ¹² William Willcocks, *The Assuan Reservoir and Lake Moeris: A Lecture Delivered at a Meeting of the Khedivial Geographical Society, Cairo, 16 January 1904* (London: Messrs. E. and F. N. Spon, 1904), 7–8; and Murdoch MacDonald, “Aswan Dam: Protection of Downstream Rock Surface, and Thickening and Heightening,” *Minutes of the Proceedings of the Institution of Civil Engineers* 194 (1913): 261.
- ¹³ Alan Mikhail, *Nature and Empire in Ottoman Egypt: An Environmental History* (New York: Cambridge University Press, 2011), 11.
- ¹⁴ Select regions of southern Egypt had access to perennial irrigation provided by the Egyptian Sugar Company. See Derr, *The Lived Nile*, 75–98. For a discussion as to the notions of value and practices of ownership linked to this frontier, see *ibid.*, 57–59.
- ¹⁵ Terje Tvedt, *The River Nile in the Age of the British: Political Economy and the Quest of Economic Power* (New York: I. B. Taurus, 2004), 91.
- ¹⁶ For a discussion of the evolution of land tenure regimes and the social relations of the countryside during the nineteenth century, see (in English) Raouf Abbas and Assem El-Dessouky, *The Large Landowning Class and Peasantry in Egypt, 1837–1952*, ed. Peter Gran, trans. Amer Mohsen and Mona Zikri (Cairo: American University in Cairo Press, 2012); Kenneth Cuno, *The Pasha’s Peasants: Land, Society and Economy in Lower Egypt, 1740–1858* (New York: Cambridge University Press, 1992); Roger Owen, *Cotton and the Egyptian Economy, 1820–1914: A Study in Trade and Development* (London: Clarendon Press, 1969); Alan Richards, *Egypt’s Agricultural Development, 1800–1980: Technical and Social Change* (Boulder, Colo.: Westview Press, 1982); and Helen Rivlin, *The Agricultural Policy of Muhammad Ali* (Cambridge, Mass.: Harvard University Press, 1961).
- ¹⁷ Robert Tignor, *Modernization and British Colonial Rule in Egypt, 1882–1914* (Princeton, N.J.: Princeton University Press, 1966), 113.
- ¹⁸ Derr, *The Lived Nile*, 47–49.
- ¹⁹ In addition to the health effects described in this essay, see also Mitchell, *Rule of Experts*, 19–53.
- ²⁰ Derr, *The Lived Nile*, 100–103.
- ²¹ *Ibid.*, 107.
- ²² Scott, “Incidence and Distribution,” 610.
- ²³ *Ibid.*, 578, 610.
- ²⁴ A. Abdallah, “Ancylostomiasis in Egypt,” in *Expert Committee on Helminthiasis (Soil-Transmitted Helminths)* (Geneva: World Health Organization, 1963), 4–5.

- ²⁵ Muhammad Khalil, "The Pail Closet as an Efficient Means of Controlling Human Helminth Infection as Observed in Tura Prison, Egypt, with a Discussion on the Source of Ascaris Infection," *Annals of Tropical Medicine and Parasitology* 25 (1) (1931): 44; and Abdallah, "Ancylostomiasis," 4–5.
- ²⁶ Fleming Mant Sandwith, *Medical Diseases of Egypt* (London: Henry Kimpton, 1905), 245.
- ²⁷ James Allen Scott, "The Prevalence and Distribution of Hookworm in Egypt," *American Journal of Hygiene* 26 (3) (1937): 455–505.
- ²⁸ Mikhail, *Nature and Empire in Ottoman Egypt*, 10–11.
- ²⁹ Richards, *Egypt's Agricultural Development*, 83.
- ³⁰ A New World crop, corn had been subjected to the process of nixtamalization in Central and South America, in which it was soaked in an alkaline solution, washed, and hulled before it was eaten. One effect of nixtamalization was to render the nutrients in corn more biologically available to the human body.
- ³¹ Fleming Ment Sandwith, "Pellagra When Considered from the Point of View of a Disease of Insufficient Nutrition," *Transactions of the Royal Society of Tropical Medicine and Hygiene* 9 (1) (1915): 10.
- ³² Derr, *The Lived Nile*, 114.
- ³³ Egyptian elites had long played important roles in the structures of government. When the British occupied Egypt in 1882, the Ottoman-Egyptian state possessed a developed bureaucracy and ministerial system. This state structure was left in place during the occupation, with British officials appointed to direct and staff the upper echelons of the different ministries.
- ³⁴ For more detail, see Victoria Bernal, "Colonial Moral Economy and the Discipline of Development: The Gezira Scheme and 'Modern' Sudan," *Cultural Anthropology* 12 (4) (1997): 447–479; Tony Barnett, *The Gezira Scheme: An Illusion of Development* (New York: Routledge, 2019); and Maurits W. Ertzen, *Improvising Planned Development on the Gezira Plain, Sudan, 1900–1980* (New York: Springer, 2015).
- ³⁵ Tvedt, *The River Nile in the Age of the British*, 145–146.
- ³⁶ Derr, *The Lived Nile*, 61–73.
- ³⁷ *Ibid.*, 138.
- ³⁸ See Chapter 3, "Shifting Lines of Power: Egyptian Business Groups and the Electrification Schemes of the 1920s and 1930s," in Robert Vitalis, *When Capitalists Collide: Business Conflict and the End of Empire in Egypt* (Berkeley: University of California Press, 1995).
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- ⁴² *Ibid.*, 219–222.

- ⁴³ Egyptian Ministry of Public Health, *Annual Report* (1951): 155; and “Report on the 5th (last but one) Big Blanketing (Spring 1971) of the Irrigation and the Drain System of the Fayoum with Bayluscide,” Bilharzia Control Project, Fayoum Egypt/German Team, Archives of the Parasitology Collection, World Health Organization, schisto1-emro-egypt 1970–1971, 6.
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- ⁴⁶ *Ibid.*, 430.
- ⁴⁷ Rashida Barakat, Hala El Morshedy, and Azza Farghaly, “Human Schistosomiasis in the Middle East and North Africa Region,” in *Neglected Tropical Diseases: Middle East and North Africa*, ed. Mary Ann McDowell and Sima Rafati (New York: Springer, 2013), 30–31; and Thomas G. Strickland, “Liver Disease in Egypt: Hepatitis C Superseded Schistosomiasis as a Result of Iatrogenic and Biological Factors,” *Hepatology* 43 (5) (2006): 916.
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The Grand Ethiopian Renaissance Dam: Africa's Water Tower, Environmental Justice & Infrastructural Power

Harry Verhoeven

Global environmental imaginaries such as “the climate crisis” and “water wars” dominate the discussion on African states and their predicament in the face of global warming and unmet demands for sustainable livelihoods. I argue that the intersecting challenges of water, energy, and food insecurity are providing impetus for the articulation of ambitious state-building projects, in the Nile Basin as elsewhere, that rework regional political geographies and expand “infrastructural power” – the ways in which the state can penetrate society, control its territory, and implement consequential policies. The Grand Ethiopian Renaissance Dam should be understood as intending to alter how the state operates, domestically and internationally; how it is seen by its citizens; and how they relate to each other and to their regional neighbors. To legitimize such material and ideational transformations and reposition itself in international politics, the Ethiopian party-state has embedded the dam in a discourse of “environmental justice”: a rectification of historical and geographical ills to which Ethiopia and its impoverished masses were subjected. However, critics have adopted their own environmental justice narratives to denounce the failure of Ethiopia’s developmental model and its benefiting of specific ethnolinguistic constituencies at the expense of the broader population.

The Grand Ethiopian Renaissance Dam (GERD) is Africa’s biggest infrastructure project, and it has been controversial since its launch in April 2011. With construction on the Blue Nile near the Ethio-Sudanese border nearing completion, the more than two-kilometer-long structure with a capacity of more than 6,000 megawatts intends to both physically and politically redraw the Nile Basin. Ethiopia is known as “Africa’s water tower” because of the extraordinary precipitation volumes that land on its northern, central, and southern Highlands.¹ However, the unpredictability and variability of that rainfall have left it unable to leverage these formidable resources as planners have long dreamed. The problem of “Africa’s water tower” resembles that of the continent as a whole:

the paradoxical story of . . . adequate renewable water resources, but unequal access because water is either abundant or scarce depending on the season or the place. Water is the most crucial element in ensuring livelihoods since more than 40 per cent of Africa's population lives in arid, semi-arid and dry sub-humid areas and about 60 per cent live in rural areas and depend on farming for their livelihoods.²

To Ethiopia's political leadership and its bureaucratic-scientific apparatus, the country's intractable poverty and international marginalization are a direct result of a failure to harness its hydropotential and build the dams, reservoirs, and irrigation systems required to actualize its water tower destiny. However, to millions of people living downstream, rhetoric of the GERD as the anchorage of a resurgent Ethiopia that determines the flow of the river instills existential concerns about their own water and food security.³

The hopes and fears engendered by the GERD cannot be understood separately from the global political economy of the environment and Africa's unique, historically contingent place within it. Since decolonization in the 1950s and 1960s, Africa's share in the world economy – whether measured by income, trade volumes, or investment flows – has shrunk.⁴ While independence engendered aspirations of industrialization and economic self-determination (including the ability to use the continent's formidable natural resources for rapid development), the majority of African states have only become more dependent on the whims of the global economy and aid flows: their position as providers of primary products has largely been reinforced, at clearly disadvantageous terms of trade.⁵ This enduring marginalization provides the background for why observers from within and without are so fearful of the impact on Africa of global climatic changes and, in particular, worsening water and food insecurity. It is perhaps the most glaring demonstration of environmental or climate injustice that the youngest continent (60 percent of the population is below the age of twenty-five) is also the one that has historically least contributed to the industrial emissions of greenhouse gases yet is likely the one that will be hardest affected by meteorological shifts and least financially capable of responding to dislocation.⁶

Much of the scholarly and policy literature on the political effects of global warming, especially in the Nile Basin and the Sahel, echoes long-standing ideas of the environment as an exogenous variable overwhelmingly influential in shaping human behavior and institutions (and their breakdown) in an impoverished, peripheral Africa.⁷ Such environmental determinism is characteristically pessimistic about the ability of Africans to weather the worsening storm(s): climate change portends intercommunitarian conflicts in which pastoralists and cultivators wrangle for scarce land or water as state authority disintegrates and the specter of interstate warfare as declining resource endowments force regional rivals to secure their survival at each other's expense.⁸ The Nile Basin is frequently cited

as a case in point.⁹ As the region's ecology becomes (even) more volatile and unpredictable, Ethiopia and Egypt face clear incentives to see the river in zero-sum terms and to secure whatever they can to boost their respective water security.¹⁰ In such analyses, the GERD is the trigger of intersecting conflagrations as both states are threatened by massive internal challenges while clashing over whether Egypt should be guaranteed historical user rights in the form of specific volumetric quantities of Nile water or whether a different water regime of (nonvolumetric) "equitable distribution" should govern basin relations.¹¹ Speculation about the outbreak of regional conflict, with Ethiopia and Egypt at its center – and Sudan being pulled in on the side of Addis (as appeared to be happening between 2013 and 2017) or Cairo (as has been perceived to be the case between 2019 and 2021) – remains rife, both in and outside the region. The Nile seldom fails to feature in discussions of how climate change and water scarcity will, now and in the future, tear apart fragile societies.

The environmental determinism of "climate conflicts" and "water wars," however, obfuscates the complex interplay between political imaginaries and practices in the registry of African elites, in the Nile Basin as elsewhere, as they navigate the inequities of global environmental politics. Rather than fatally weakening fragile structures, I argue in this essay that the intersecting challenges of water, energy, and food insecurity are providing a new impetus for the articulation of ambitious state-building projects that rework regional political geographies and expand the ways in which the state can penetrate society, control its territory, and implement consequential policies.¹² Contrary to the ubiquitous assumption (especially in an age of calamitous climate change) that African elites neither have the capacity nor the will to engage in meaningful state-building, the GERD reflects the renewed ambition of incumbents to expand what sociologist Michael Mann termed "infrastructural power."¹³ Through this prism, the GERD can be understood as an instrument of social and spatial control intended to increase the state's administrative capabilities (such as to bend the river to its will and organize labor in more productive activities) and to redraw relations between those who dominate the state and those whose allegiance it seeks. Infrastructural power underlines not only the importance of the territorial structuration of authority and the relative autonomy of political and bureaucratic elites in regulating social relations, but also the ways in which infrastructure projects like dams are intended to change how the state operates, domestically and internationally, and how it is seen by its citizens.¹⁴

The latter point – the question of state identity and legitimacy and how environmental narratives impact them – will be explored later in this essay. If, following philosopher Martin Heidegger, we consider language as constitutive, then the dam is not just a biophysical rupture in river management or how Ethiopia's peripheries interact with the political-economic core, but it is also meant

as a speech-act:¹⁵ to create discursively a new social order that changes how people (should) relate to and act with each other, their environment, the party-state, and the outside world. Discourses around the GERD and the transformation of the Ethiopian state, citizenry, and environment can be approached as rival story-lines of environmental justice intended to (de)legitimize the emergent political economy and its various constituencies and blind spots. Drawing on primary documents and a decade of interview material, I argue that the Ethiopian People's Revolutionary Democratic Front (EPRDF) – the ruling coalition between 1991 and 2019 – consistently promised that the GERD would rectify the historical injustice of Egyptian “hydro-hegemony”¹⁶ and concomitant Ethiopian underdevelopment. The EPRDF envisaged both the construction of the GERD and its operation as ushering in a rekindled state-society and regional context in which a reborn Ethiopian nation engages with its resources and its neighbors in a qualitatively different (“more just”) fashion. However, critics of the EPRDF see this approach to the GERD as emblematic of the failure of its developmental model and its rapacious, extractive tendencies that benefit specific economic and ethnolinguistic winners at the expense of Ethiopia's broader population.

To appreciate the genesis of the GERD and why constructing the dam became utterly central to the political calculus and identity of the EPRDF, the leadership's interpretation of Ethiopian history and its understanding of infrastructural power are crucial. Here I dissect the ideological underpinnings of EPRDF dam-building by placing the GERD in a broader historical context as the party-state has attempted to reshape Ethiopia internally and externally. Later, I also briefly discuss how the dissolution, rechristening, and reorganization of the ruling bloc as the Prosperity Party (since late 2019) under the aegis of its new leader Abiy Ahmed has impacted the Ethiopian state's relationship with this vision of the dam, infrastructural power, and environmental justice.

The EPRDF emerged from the Ethiopian civil war when a coalition of four ethnically based parties was forged to capture Addis Ababa in May 1991. The alliance was a relatively late creation (1988 – 1989) of the Tigray People's Liberation Front (TPLF) as it moved out of its Northern heartlands and imagined how it might wield governmental power and pacify a fragmenting Ethiopia, where dozens of ethnic groups were deeply divided over how (or whether) to live together in one state. The TPLF, founded in 1975, had its origins in two different sociological milieus.¹⁷ On the one hand, the movement was the political heir to the 1943 Woyane rebellion in Tigray, which sought regional autonomy from imperial rule but was bloodily suppressed by Emperor Haile Selassie, who was perceived by the Tigrayan aristocracy as creating an absolutist empire controlled by and for the Amhara.¹⁸ On the other hand, the TPLF was founded by young people who participated in the Ethiopian student movement – a diverse group of individuals that agreed on sev-

eral interrelated propositions: that the root cause of Ethiopia's horrific poverty was the imperial-feudal system; that the Abyssinian empire was built on ethno-regional divide-and-rule, in which the dozens of "nationalities" that populated the territory were denied their right of self-determination; and that only a righteous vanguard could create a socialist society in which both the nationalist and economic contradictions of imperial Ethiopia would finally be dissolved.¹⁹

The TPLF's roots forced its leadership to balance its Leninist vanguardism with the recruitment of peasants driven to take up arms by poverty and nationalist narratives passed from one generation to another of historical greatness and the contemporary humiliation of Tigray.²⁰ The TPLF called itself "Woyane" too and posited that Ethiopia's central challenge was to make the double transition from empire to nation-state and from feudalism to a state-led economy. Because the diverse groups on the Ethiopian territory shared little else than their destitution and rejection of imperial-feudal expansionism and assimilationism, only socialist egalitarianism was argued to have the answers.²¹ Phrased in Mann's lexicon, the TPLF's diagnosis was that the state's infrastructural power (that is, the ability not just to control the territory but to shape state-society relations) would remain weak as long as it centralized authority on behalf of the Amhara elite and governed through indirect rule and tributary mechanisms so beloved of empires everywhere. The TPLF dismissed the imperial and capitalist modes of state-building because they were economically exploitative ("internal colonialism") and because they failed to provide a territorial organization of power that recognized the fundamental equality of all nations, nationalities, and peoples living in Ethiopia. Cracking one would help unknot the other, claimed TPLF Chairman Sebat Nega (1979 – 1989): "Resolving the nationality question means the upper-class of feudalists, imperial officials or oligarchs can't play on ethno-nationalist sentiments to distract the population from the real core-periphery problem."²²

This ideological understanding of infrastructural power informed the ambitious project that the TPLF, through the EPRDF, launched after overthrowing the military dictatorship of Mengistu Hailemariam. Such "illiberal state-building"²³ comprised three pillars to realize the intended transitions from empire to nation-state and from backward quasifailed state to order and prosperity. First, the Ethiopian state would abandon any top-down assimilation policies and recognize the sovereign right to self-determination (up to possible secession) of all nations, nationalities, and peoples in the territory, echoing Stalin's approach to the nationalities question in the Soviet Union.²⁴ Through the system of ethnic federalism, the administrative grid was redrawn to allow the major ethnolinguistic groups to govern themselves in ten federal regions and two chartered cities and for people to speak their own languages in their dealings with the government.²⁵ The TPLF/EPRDF believed that unwinding the imperial legacy would give its broader agenda unprecedented legitimacy.

Second, Ethiopia's new leadership instituted *abyotawi* (revolutionary) democracy, which because of its practice of democratic centralism, heavily qualified how much freedom Ethiopians would be given to express themselves vis-à-vis their government.²⁶ The omnipotence of the EPRDF's Central Committee and Executive Committee was necessary to maintain policy cohesion and an optimal utilization of scarce resources as a desperately poor Ethiopia sought to survive after hitting rock bottom in 1991. The centrality of a trade-off between state-building and political liberalization was also echoed by political scientist Samuel Huntington during his 1993 visit to the post-civil war country; the material conditions for facilitating (liberal, representational) government simply did/do not exist, in this logic.²⁷ According to Sebhat Nega,

liberal democracy with our class structure and our surrounding enemies [the hydro-hegemon Egypt, military-Islamist Sudan, ultra-confrontational Eritrea, and Somali jihadists] would have been suicidal. . . . It would mean oligarchic government and national disintegration. . . . Democratic centralism was necessary: it is collective leadership and individual responsibility.²⁸

Revolutionary democracy is all about infrastructural power, as Huntington pointed out.²⁹ The single, hierarchically structured party, as Mann reminds us, is the instrument of choice of those who believe state power can only come from the party-state's autonomy from civil society and its ability to penetrate it at will.³⁰

The third pillar of the TPLF/EPRDF party-state has been the "developmental state." Often described as an attempted emulation of the "tiger" economies of South Korea, Vietnam, and China,³¹ the impetus for the Ethiopian economy's spectacular expansion in the twenty-first century is heavily shaped by the leadership's obsession with the double transition. Although the Woyane's origins stem from long-standing Tigrayan imaginaries of self-rule within (or Tigrayan dominance of) the Ethiopian state, the Central Committee has been controlled by Marxist-Leninist-minded individuals for whom too much ethnolinguistic fervor reflects what philosopher Friedrich Engels termed "false consciousness." The TPLF/EPRDF had assumed that ethnic federalism would draw the sting from the transformation from empire to nation-state and reconcile the different nations, nationalities, and peoples with each other; however, the 2005 elections and subsequent violence offered a rude awakening. Especially in urban centers, voters re-embraced unitary nationalism as the oppositional Coalition for Unity and Democracy denounced the Woyane government's institutionalization of "ethnic divisionism," favoring Tigrayan political and economic interests amidst rapid societal change.³² This setback led the party-state not only to double down on revolutionary democracy, but also drove it to re-intensify its ideological axiom: only through a transformation of the material conditions of people (the substructure, in Marxist vocabulary) can durable changes in political identity (superstructure) crystallize.³³ State-driven, rapid econom-

ic growth would, the leadership believed, save both the country and the party;³⁴ it would be both cause and effect of an expansion of infrastructural power in Ethiopia.

This then is the context in which dam-building, and especially the construction of the GERD, would become a linchpin of the EPRDF's long-term political-economic stratagem. "Every spare cent has been directed to infrastructure and energy," noted Finance Minister Abraham Tekeste (2016 – 2018).³⁵ The TPLF had been created in the wake of famine in the 1970s and had never ceased to talk about the rural poor, but now the developmental state declared a veritable "war against poverty." Prime Minister Meles Zenawi redefined Ethiopia in the world by setting this domestic war at the heart of his external outlook: "our foreign relations and national security policy and strategy can only have relevance if it contributes to the fight against poverty."³⁶ Long-serving Minister of Information Bereket Simon concurred, "Poverty and backwardness are the number one enemy. We need full mobilization, war footing."³⁷ The "securitisation of development"³⁸ helped of course to re-legitimize revolutionary democracy, or as one TPLF politburo member put it: "The Ethiopian government has one priority: development. A hungry man will not be interested in party politics. We can address all human rights and democratic questions through development."³⁹

The developmental state has made an extraordinary push by African standards to transform agricultural and industrial productivity to simultaneously boost food security, wages, tax revenue, and exports. "Agricultural Development Led Industrialization" and the "Growth and Transformation Plans" have guided massive investment in public education and primary health care, combined with a big leap in infrastructure.⁴⁰ The party-state's war on poverty has been waged through the paving of thousands of kilometers of roads and railroads; the construction of dozens of airports, transport terminals, and dryports; and a program that envisages more than twenty big dams irrigating and powering the transformation of productivity, including Africa's biggest: the GERD.

This penchant for record-breaking megaprojects is all the more striking because, during the 1980s, the TPLF drew many of its recruits from the victims of massive development interventions (such as villagization and forced resettlement)⁴¹ and advocated local self-sufficiency and micro-infrastructure. This dramatic pivot toward large-scale infrastructure like dams is explained by the party-state's frustration with what it felt was the slow pace of organic transformation threatening its state-building project. Sebat Nega opined that

When we entered Addis in 1991, there was no middle class. We developed instruments to develop one – easy credit, provision of land, dams, electricity. . . . But this so-called middle class is not investing, just seeking rents in hotels and restaurants. We will have to continue the hard work of stopping oligarchic behaviour like corruption and laziness which threatens Ethiopia.⁴²

In bureaucratic circles, frustrations concerning an insufficient response to the developmental state's investments are extended to smallholder peasants who continue to be seen as reluctant modernizers failing to pick the fruits of government infrastructure or actively opposing change: "In this country, small is not beautiful. The larger the project, the lower the aggregate environmental cost. But the Ethiopian peasant is very conservative."⁴³ Reflecting its Leninist self-image as a vanguard implementing the arduous task that history has bestowed upon it, the EPRDF wagered that, despite soaring debts and a worsening balance of payments, infrastructure like the GERD will eventually repay itself and reward its workers and engineers-cum-soldiers for their sacrifice. Ethiopian civil servants were instructed to "voluntarily" forgo one month's worth of salary for the dam annually; the developmental state's rationale for such "short-term hardship" has remained consistent, as GERD project director Simegnew Bekele (2011–2018) underlined: "We are waging a war on poverty and the dam is our weapon."⁴⁴

For ideological and opportunistic reasons, the post-1991 ruling party thus saw its authority as contingent on the expansion of the state and an aggressive developmentalism that would materially remake Ethiopia. From an infrastructural power perspective, the more than 6,000 megawatts that the GERD should produce are vital. Its construction in an impossibly remote location (a stone's throw from Sudan, but half-a-day drive from the nearest town and separated from Addis Ababa by 500 kilometers and some of Africa's most formidable mountains) echoes that of other irrigation, electricity generation, and transportation projects in peripheral regions where the state has historically been minimally present and treated with hostility.⁴⁵ Such "hydro-agricultural state-building"⁴⁶ through power stations, sugar plantations, and transmission lines administratively expands the remit of the state, but also underlines its authority and ability to shape the lives of all its citizens and serves symbolically and physically to tie together the entirety of the territory.⁴⁷ This attempted switch from "frontier governance" of peripheral regions into a "governance frontier" crucial to the remaking of the polity is also important in the context of the external dimension of sovereignty.⁴⁸ The GERD's location means that it is inherently cheaper to export the electricity generated there to immediately adjacent (and flat) Sudan and South Sudan, as well as to states further afield, than it is to transport it over the Ethiopian highlands to the central grid. The EPRDF/TPLF leadership has long believed that antagonistic relations with its neighbors (and the global reputation of the Horn of Africa as war-torn more broadly) have held landlocked Ethiopia's growth potential back for decades. Borderland projects like the GERD prospectively offer a fundamentally different way of relating to other basin states. In the words of TPLF veteran ambassador and State Minister for Foreign Affairs Berhane Gebre-Christos (2010–2015), "Infrastructure is qualitatively changing the relations in the re-

gion – for people and for governments. It is the most decisive factor for regional integration.”⁴⁹

The GERD is thus not only meant to power the growing consumption of Ethiopia’s nascent industries and its emergent urban and rural middle classes, but to usher in the next phase of the developmental state: its integration in a growing region.⁵⁰ Meles Zenawi made protecting the developmental state from external instability and helping the region accept Ethiopia’s “benign” hegemony the cornerstone of his foreign policy doctrine, especially in the years preceding his death in 2012.⁵¹ The EPRDF leadership internalized the belief that Ethiopia’s potential can only be realized if its neighbors, with their access to the sea and thus to global markets, also see a marked improvement in their economic outlook and establish durably peaceful relations with Addis. The GERD’s massive power-generating capacity is an explicit offer to share Ethiopia’s growth and resources with the region in exchange for hard foreign currency and coupling its neighbors’ economies to it. While scholars and technocrats have, for the most part, been enthusiastic about the dam’s environmental and economic potential – it is often noted that the “GERD demonstrates the possibility of addressing the scarcity of food, water and energy in a developing region by exchanging water and energy, based on their marginal productivity across the basin states”⁵² – its most important payoff was always political in the eyes of Meles.⁵³

The possibility of simultaneously revolutionizing Ethiopia’s historically troubled neighborly relations and building a new political economy through the GERD domestically tantalized the EPRDF/TPLF. It also offered the possibility of enhancing the narrative that the party-state had launched in the wake of the 2005 election debacle to counterbalance the perception that “Woyane rule” fragmented a pan-Ethiopian identity and crystallized regional differences. In response, the EPRDF cannibalized the language of inclusive democracy, penetrated its cadres deeper into local administrative structures, and portrayed itself as the carrier of a uniquely Ethiopian form of governance and progress that all could or should take pride in.⁵⁴ The GERD became the national flagship project, not only because of its material importance to Ethiopia’s megawatt production, energy exports, and broader foreign relations but also because of its ability to unite the country behind a colossal effort that everybody, no matter one’s local politics, could or should support by virtue of being an Ethiopian.⁵⁵ No expenses were spared to mobilize the masses, and initiatives to champion the dam were designed for every constituency: Ethiopians have been encouraged to show their support through lotteries, beauty pageants (seeking “beautiful GERD ambassadors”), a football cup, SMS contests, athletic events (“run for progress and dignity”), church sermons (reminding believers that the Ghion – Blue Nile – is Ethiopian/Kushitic according to the Book of Genesis),⁵⁶ and much more. When Meles Zenawi died in 2012, his passing led to a collective outpouring of grief that turned to martyrial mobili-

zation: “Meles! Your promises will be kept; the G[E]RD will be realized through public participation!!!” became the tagline of the *Ethiopian Herald*, the country’s main Anglophone propaganda outlet. The image of the late prime minister pointing his finger prophetically in the direction of both the GERD and the Blue Nile’s onward flow into Sudan has been ubiquitous in government offices and roadside billboards.

The imagery created around the GERD was embedded in the EPRDF discourse around the celebration of the new Ethiopian millennium (2007) and was expanded over the next decade.⁵⁷ This narrative underlined that the party-state had resolved the old nationalities question and that a new Ethiopia was emerging, admired by the outside world because of its developmental state, with the GERD as its pinnacle achievement. Not coincidentally, the dam’s first name was the “Millennium Dam” and later renamed *Hidassie*, which in Amharic means to make something new out of the old, a Renaissance. In early TPLF/Woyane ideology, such a term would have been blasphemous, not only because it is Amharic (the language of the imperial-feudal “occupier”) but because it suggests that Ethiopia is not an artificial recent invention (“a prison of nations and nationalities” in the parlance of Walleligne Mekonnen and the Ethiopian student movement), but a much more ancient reality worthy of reinvention. The GERD has featured prominently on Ethiopia’s new “Nations, Nationalities and People’s Day” (celebrated since 2006) and “Flag Day” (2008), annual celebrations intended to underscore the EPRDF’s commitment to unity in diversity through ethnic federalism and the modernization agenda of the developmental state.⁵⁸ This striking ideological pirouette, which celebrates the “Renaissance/Hidassie” of a dormant heroic nation, also explains why the GERD is showcased in tourist brochures, on a par with world famous landmarks of macrohistorical importance such as Axum, the Ne-jashi mosque, the *jugol* of Harar, and the rock-hewn churches at Lalibela.

The nationalism galvanized by the dam dovetails with expanding state infrastructural power. The EPRDF long relied on output legitimacy – the belief that economic performance generates popular acquiescence in authoritarian systems⁵⁹ – and the ability of the GERD to provide infrastructural “spectacle” to impress domestic and external audiences is invaluable in this regard.⁶⁰ But the EPRDF has also insisted that the GERD provides it with input legitimacy as “participation” is a key discourse the party-state spins around the dam’s construction. This is not only visible through the myriad GERD beauty contests, tombolas, and sports competitions but through the direct participation of Ethiopians in this “100%” Ethiopian-financed project. Government employees have not only taken a collective pay-cut, but GERD bonds have been keenly pushed by the regime and are one of the only assets available to ordinary Ethiopian savers in a context of financial repression and high inflation. In the words of State Minister of Foreign Affairs Markos Tekle (2018 – 2020), “As Ethiopians, we are now personally linked to the

GERD through our payments and bonds... We have a direct stake in this working out. Imagine if it does not!"⁶¹

The stakes of the "dam-building as the new nationalism" approach are high. Meles Zenawi originally conceived of the national mobilization of capital and legitimacy as strengthening regional integration. As he said at the GERD's official commencement:

Among the concerns we factored in when we made the decision to build the Nile Dam with our own resources, was to avoid any negative consequences for our neighbours and indeed to offer positive benefits for all of them. I would dare to say that nothing can provide a better testimony of our deepest commitment to forge a lasting partnership between all the Nile Basin riparian countries than the building of the Millennium Dam.⁶²

But nationalism thrives more comfortably on zero-sum narratives of historical enmity and humiliation. In an Ethiopia preoccupied with its war against poverty and Malthusian narratives of scarcity, this has led to a framing of the Nile dispute with Egypt in deeply moralizing terms of (environmental) justice as the rationale for the dam's construction.

What constitutes "environmental justice" is debated in a sprawling literature spanning the last four decades, but several key themes stand out: inequities in representation and ownership that determine who (does not) benefit(s) from production and consumption patterns; intersecting dynamics of class and identity politics that shape how people experience environmental (in)security; and the need to historicize inequality and geography, especially the role of colonialism, imperialism, and racism in structuring power and natural landscapes.⁶³ These are also the themes that infuse the Ethiopian discourse of "distributive justice" around the Nile,⁶⁴ which was launched by the party-state but has been taken over and radicalized by civil society, Diaspora activists, scholars, and ordinary people who otherwise have little interest in geopolitics. The standard narrative posits that Ethiopia was made to suffer because of the "historical injustice" of "colonial treaties" that reserved the lion's share of waters for the downstream riparians Egypt and Sudan (often described as Arab in this context) at the expense of the "starving" upstream countries (described as African); the injustice continues to this day because international financial institutions and local and global allies of Cairo have thwarted Ethiopia from getting access to finance, expertise, or legal recourse to change the unfair status quo.⁶⁵ The use of moral, racial, and historical categories echoes, unsurprisingly, tropes of classical Ethiopian historiography: the exceptional character of the Ethiopian polity owing to its physical isolation and the unrelenting struggle against climatic variability; the country's serial abandonment and betrayal during the period

of the European Scramble for Africa and the Italian invasion of 1935; and Ethiopia's self-image as the voice of Africans and the African Union standing against all forms of racism and imperialism.⁶⁶

Ethiopian Foreign Minister Tedros Adhanom (2012 – 2016) summarized the environmental (in)justice argument:

Despite contributing so much to the river, Ethiopia uses virtually none of it. . . . Egypt takes 75% of the Nile waters. . . . Essentially, the states endowed with this natural resource have never been able to use it; the lower riparian state, Egypt, has had, and essentially still does have, almost total use of the benefits of the river. One reason for this unbalanced share of the Nile waters lies in colonialism . . . [another major factor is] the refusal of the international financial institutions to provide assistance. Indeed, during the Mubarak era, Egypt worked hard to prevent Ethiopia's efforts to develop its water resources by persuading international donors to not fund projects related to the Nile River.⁶⁷

Endless op-eds, news bulletins, blogs, social media posts, and hashtags (such as #ItsMyDam) repeat the same message, but in considerably less diplomatic and more muscularly patriotic terms. Prime Minister Abiy Ahmed stated, "The reason why we put huge emphasis on this dam is because it is a symbol of our sovereignty and unity."⁶⁸ GERD mobilization meetings often sport the self-explanatory slogan: "There was grave injustice in the past . . . but the dam is changing history." Partly rooted in actual bitter historical experience, partly constructed as contemporary hyperbole by political Svengalis, the point here is not to concur with or dispute the validity of this framing but to highlight why the languages of environmental justice and nationalism have intersected so powerfully in the case of the GERD.

The EPRDF's casting of its flagship project as a symbol of environmental (in)justice and national pride resonated deeply with potent experiences and myths embedded in the DNA of the modern Ethiopian state. It has been a highly efficacious tool for mobilization. Ethiopians are deeply divided over just about any policy pursued by the ruling party since 1991, but the GERD appears to be the one issue around which a consensus exists. Yet the overt politicization of the dam, the environmental justice discourse, and the GERD's instrumentalization for domestic purposes as incumbents seek to shore up their legitimacy have also generated heavy blowback for the government.

The party-state's lament about unfair, historically anchored patterns of ownership and consumption of natural resources such as the Nile and the nefarious role played by outsiders in sustaining (neo)colonial political and financial asymmetries reverberated with Ethiopians. However, to many citizens, it is an analysis that should be extended to Ethiopia's internal context as well. The EPRDF state-building project has been experienced by many as deeply

disempowering. In the Oromia, Gambella, and Somali regional states, especially, it has often been seen as pursuing the same objectives of placing wealth and power in the hands of a privileged (mostly Tigrayan/highlander) minority at the expense of the rights and resources of the country's demographic majority.⁶⁹ The government's partnership with foreign investors and international donors has, in this alternative narrative of nationalism and environmental justice, led to the expropriation of huge amounts of land, forests, and water and transferred them from one ethnic group to another.⁷⁰ Such extractive patterns to buttress the control of the state apparatus and expansion of infrastructural power by some groups are reminiscent of the aggressive expansionism through which the Ethiopian empire was formed in the late nineteenth and early twentieth centuries.⁷¹ Seen from this perspective, "Woyane rule" has not been the historical rupture the TPLF imagined, but a continuation of processes of subjugating, excluding, and "punishing the periphery" through internal colonialism of those who have long seen the Ethiopian state as their principal enemy.⁷²

The contestation of the EPRDF's remaking of national identities and the political economy has been continuous since May 1991 and included both peaceful disobedience and violent revolt. It peaked with the disastrous 2005 elections and then escalated to a whole different level between 2014 and 2018. The controversy around the Addis Ababa Master Plan – which became a symbol for the transfer of resources from the Oromo countryside to the Woyane elite in the cities, without meaningful consultation or compensation – lit a fuse as hundreds of thousands of citizens took to the streets, attacked government forces, and burned foreign investments.⁷³ The EPRDF responded by declaring a state of emergency and highlighting the extraordinary macroeconomic growth and spectacular improvements in aggregate incomes and public service delivery during its tenure. As the protesters refused to back down, the party admitted that the developmental state needed to improve its performance but it rejected the activists' framing that its political-economic model was systemically violent and a paradigmatic case of environmental injustice.⁷⁴

EPRDF state-building also came under fire from unexpected corners, as the flames were fanned from within the party-state. Ambitious local and regional party bosses, squeezed between the leadership's democratic centralism and the grievances of young Ethiopians in their communities, simultaneously helped organize the unrest while seeking to blackmail the still TPLF-dominated federal alliance into giving them more resources and authority to nip the protests in the bud. This new generation of politicians, especially in Oromia, did not hesitate to play the role of both pyromaniac and fire brigade and ultimately used the muscle of the street to take over key party organs, culminating in the rise of the hitherto barely known Abiy Ahmed to EPRDF Chairman and Prime Minister of Ethiopia in early 2018. Abiy and his allies, such as head of the Oromia regional executive Lemma

Megersa, wasted no time in renaming the EPRDF the “Prosperity Party” and settling scores with the old Woyane, blaming its corruption for bringing Ethiopia to the edge of the abyss and echoing the language of the protesters about the exploitation of Oromo resources and bodies.⁷⁵

The confrontation between the TPLF, which retreated to its Tigray garrison, and Abiy escalated further when the prime minister began questioning Ethiopia’s grandest ever development project (and Meles’s *enfant chéri*), the GERD, and its role in EPRDF state-building. Not only did the new leader display considerable disinterest in the dam early on and seemed to downplay the very idea of a developmental state and the role of infrastructure, but he also launched a frontal attack on the GERD’s main builders. The Metals and Engineering Corporation (METEC), a military-industrial conglomerate run by TPLF officers, had been tasked with installing the turbines for the dam, one of many assignments the party-state had entrusted METEC with as it attempted to emulate the Asian example of fostering national champions that work hand in glove with political decision-makers in building a developmental state.⁷⁶ Yet while Abiy’s mediatized humiliation of corrupt METEC executives (who were blamed for overpromising and underdelivering) successfully aroused public anger against the TPLF and Tigrayans more broadly, the prime minister played a risky game. This became obvious when GERD project director Simegnaw Bekele was found dead under suspicious circumstances in Addis Ababa morning traffic and Abiy, with whose inner-circle Simegnaw entertained increasingly tense relations, refused to cut short his trip to the United States. Owing to EPRDF propaganda, Simegnaw had become a national hero to many Ethiopians who had been astonished to hear the prime minister, mere days before the engineer’s unexplained death, second-guessing the very dam for which they had sacrificed so much. One cabinet minister captured the disbelief within the party-state and quietly concurred with protesters who denounced Abiy during Simegnaw’s funeral:

METEC is a money laundering machine and those Woyane used it for themselves, not for the country. But all politicians, including Abiy’s allies, sat on the board of its projects. More than anything, the PM was crazy to denounce the dam, Ethiopians can’t understand that. It is not just Meles’ project, it is so much more than that, maybe the only thing we can all agree on! And he decides to play politics with that one we all paid so much for? Just imagine the consequences – the reputation of our country, the anger of the people. . . . And the Sudanese will feel betrayed of course.⁷⁷

The observation about a sense of betrayal among Ethiopia’s regional partners highlights the ways in which the escalating nationalist rhetoric around the GERD and the growing weaponization of the dam in Ethiopia’s domestic politics have come at a heavy international price, too: whereas Meles hoped that national mobilization of capital and political support around the theme of environmental jus-

tice would facilitate the forging of a regional integration regime, the opposite has happened. In the early years of the project, Egypt was largely isolated and reeling from instability following the Arab Spring while Ethiopia's ascendancy seemed unstoppable as it created facts on the ground month after month, a trend symbolized by Sudan (Egypt's historical ally in the Nile Basin) unequivocally endorsing the GERD in 2012 – 2013. Yet as nationalist fervor around the GERD swelled, so did ethnopolitics and the contestation of the "new" political economy inside Ethiopia. While squabbling party bosses did not hesitate to use the dam in their struggles over power (including questioning its design, production capacity, and safety features), Sudan watched with incredulity and indignation from upstream. One of Sudan's top water bureaucrats of the last twenty-five years expressed bitter disappointment:

When I heard the new Ethiopian leader tell his young people that the dam probably would not be safe or not work for another ten years, I became so speechless. It took me years to persuade people in Khartoum that the dam has more advantages for us than even for the Ethiopians themselves. And then their new leader questioned everything. ...It's so terrible, how can we make regional cooperation work like that?⁷⁸

Many in the region, including in Sudan,⁷⁹ had come to accept the arguments put forward by Meles and Ethiopian officials about the GERD as a regional integration project *par excellence*. As Abiy Ahmed quickly grasped the dam's popularity in Ethiopia in 2019 – 2020, he further upped the nationalist rhetoric; the breakdown in regional trust is unmistakable and forms the background to the dangerous spike in bellicose rhetoric between Egypt and Ethiopia (and, in late 2020/early 2021, between Ethiopia and Sudan). Negotiations around the dam remain gridlocked and international sympathies have shifted back toward Cairo, which has flipped Ethiopia's rhetoric by stressing the environmental injustice of depending on one source (the Nile) for 97 percent of freshwater consumption and being at the mercy of upstream Ethiopian dam-builders. In view of this changed regional outlook, Ethiopian planners at the time of writing this essay (summer/autumn of 2020) no longer envisage the GERD at the center of regional integration and basin-wide energy markets but rather as the biggest source of domestic power generation and symbol of fragile unity amidst mounting internal fragmentation.

As global warming intensifies and underscores the highly unequal capacity of societies to respond to greater climatic variability, this essay has echoed other scholars in emphasizing the inadequacy and possibly counterproductive effects of infrastructure-led technocratic responses to water insecurity and poverty reduction.⁸⁰ Flows of water are flows of power, as geographer Erik Swyngedouw reminds us,⁸¹ and the often vacuous use of the language of resilience risks depoliticizing the rights and privileges enjoyed by some in (but not neces-

sarily from) Africa and the debts and duties burdening others.⁸² A widening body of knowledge, much of it in political anthropology, demonstrates the socio-economic,⁸³ epidemiological,⁸⁴ and ethnic/racial⁸⁵ consequences of the deliberate manipulation of water supply systems; such insights help anchor debates about water security in the broader environmental justice literature.⁸⁶ This essay has sought to complement such perspectives on studying political authority from below with an in-depth case study of the role of water in state-building designs in Ethiopia, analyzing how and why environmental justice narratives, the expansion of state infrastructural power, and the rekindling of national identities intersect as climate change intensifies.

Ethiopia, Africa's second-most populous country and perhaps the closest partner China (another ferociously enthusiastic dam-builder and funder)⁸⁷ had on the continent until about 2018 – 2019, is an intriguing polity to be investigating these connections. Ethiopia's transition from empire to nation-state remains incomplete and the legitimacy of the state and its infrastructural power remain fiercely contested.⁸⁸ As I have shown, hydro-infrastructure – spearheaded by Africa's most gargantuan dam – was identified by the EPRDF as central to the next chapter of its revolutionary project. The party-state believed it would both finally solve the nationalities question and end the environmental injustice of Ethiopia's poverty and international marginalization. The material sinews of infrastructural power woven through the GERD and the discursive framing and societal mobilization around the megaproject underline the party-state's sweeping domestic and regional ambitions, belying assumptions that Africans are passive victims of global warming and do not engage in ideologically driven state-building. As climate change has been hitting Africa's water tower particularly hard, the GERD was intended to nonetheless produce a stronger Ethiopia and a transformed region, both more integrated and, as such, better positioned to deal with rainfall variability and rising temperatures. The evidence presented here suggests that the dam is indeed significantly reshaping the way Ethiopians see themselves, their region, and their environment, but often in (painfully) familiar ways. Whether that makes them more or less resilient in confronting ecological upheaval remains a source of deep division, among Ethiopia's neighbors and at home.

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Hydropolitics versus Human Security: Implications of South Africa's Appropriation of Lesotho's Highlands Water

Oscar Gakuo Mwangi

The Lesotho Highlands Water Project, which exports water to South Africa, has enhanced the unequal structural relationship that exists between both states. Lesotho, one of the few countries in the world that exports water, has transformed from one of the largest sources of labor for South Africa to a water reservoir for South Africa. Though the project provides mutual strategic economic and political benefits to both riparian states, its construction has negatively affected environmental and human security in Lesotho. Due to hydropolitics, environmental threats in Lesotho caused by the project's construction are overlooked. These threats, which have devastating effects on resettled communities and the country's ecosystem, also constitute a threat to domestic and international security. The desire to prevent interstate conflict and maintain cooperation between the two riparian states further enhances the lopsided interstate relationship.

Lesotho is one of the few countries in the world that exports water. The colossal Lesotho Highlands Water Project (LHWP), which began in 1998, is a multiphased initiative that cost an estimated US\$1 billion. It consists of a complex network of tunnels and dams that divert water from the mountains of Lesotho to South Africa. By 2008, more than 4.8 billion cubic meters of water were transferred to South Africa. When completed, the LHWP is projected to deliver more 2 billion cubic meters of water annually. The project, hailed as a major engineering feat – which it is – generates badly needed hard currency and hydroelectricity for Lesotho.¹ But there is another side to this story. The project has precipitated widescale environmental damage and human suffering, which proponents of the LHWP have understated or overlooked in the name of development.

The LHWP is unique in a second respect. South Africa's apartheid government effectively imposed the long-planned scheme after it helped remove Lesotho Prime Minister Joseph Jonathan in a 1986 coup that installed military officers

favorable to the project. In this sense, it was an early warning of water wars, in which powerful states pressure their weaker neighbors for access to this increasingly scarce resource. It also reflects South Africa's long history of expanding its tentacles of empire in search of water, and energy derived from water, throughout the region. The Cahora Bassa Dam in Mozambique, as discussed by Allen Isaacman in this issue of *Dædalus*, is a case in point.² British economists and engineers conceived of that project in the 1950s. They argued that the sale of large amounts of "unused" water would provide an additional source of income to the impoverished kingdom, which relied on the export of labor to the mines and farms of the apartheid regime for most of its hard currency. The flow of labor dated back to 1859. By 2000, more than 58,000 Basotho were in South Africa.³ Their wage remittances were essential for the survival of the rural poor they left back home.

From a narrow hydraulic perspective, the Lesotho Highlands Water Project seemed to make sense. Lesotho is located entirely within the Senqu-Orange River basin whose major catchments in the country are the Senqu, Makhaleng, and Mohokare Rivers. The total area of all these catchments is 40,843 square kilometers.⁴ Groundwater resources provide an additional 0.5 million cubic kilometers per year.⁵ Lesotho's natural renewable water resources are estimated at 5.23 million cubic kilometers per year, far exceeding its water demand. It is projected that, even today, Lesotho uses well under 5 percent of its available water. In sharp contrast, South Africa has had a long history of water shortages, which have only been exacerbated by the post-World War I urban and industrial booms. The four major river systems (the Senqu-Orange River basin, Limpopo River basin, rivers draining into the Indian Ocean, and rivers draining from the Fold Mountains into the Atlantic and Indian Oceans), taken together, plus renewable surface water, groundwater resources, and water entering South Africa yield a mean annual runoff of 49,200 million cubic meters.⁶ This figure is insufficient to meet the growing needs of more than 50 million people. Decreased rainfall, attributed to climate change, and increased water pollution have exacerbated the shortage of potable water.

Despite these complimentary interests and initial enthusiasm from leaders of both nations, growing political tension between Lesotho and the apartheid regime stalled negotiations on the proposed LHWP. Under the rule of Chief Leabua Jonathan, Lesotho tried to balance its dependence on its powerful southern neighbor and public sympathy for the African National Congress (ANC), which sought to overthrow the White-settler regime. At the same time, Lesotho maintained diplomatic relations with Pretoria and entered into a number of bilateral agreements. Jonathan opened his country's borders to political dissidents escaping South Africa. More important, he allowed the ANC to maintain a limited presence in the Highlands, where they mounted periodic crossborder raids against South Africa.

Tensions increased in December 1985 with the deaths of thirteen White South Africans killed by explosives allegedly planted by Lesotho-based ANC fighters.⁷ Over the next two decades, the Lesotho ruler, under growing pressure from the Organization of African Unity and the broader international community, increasingly spoke out against the abuses of apartheid. Jonathan also expressed increased reluctance to proceed with negotiations on the transfer of water, although he did agree to a feasibility study in 1983. By 1985, he was publicly articulating strong reservations about the economic and environmental costs of the LHWP. To ensure his nation's sovereignty, he insisted that his government should retain exclusive control over the project and determine the amount of water exported to South Africa. Pretoria rejected both demands.⁸

For the apartheid regime, the situation was becoming intolerable. ANC freedom fighters had captured the imagination of millions of South Africans and water scarcity was posing serious challenges to its plans for industrial growth.⁹ In December 1985, Pretoria ratcheted up the pressure, imposing an economic boycott on the land-locked country and intensifying anti-ANC activity raids inside Lesotho. This economic and political instability precipitated a bloodless military coup in Lesotho on January 20, 1986. South Africa immediately recognized General Justin Lekhanya's military government, many of whose members had a relationship with South African security forces, and lifted economic sanctions.¹⁰ For its part, the junta quickly restored relations with South Africa and expelled ANC militants, prompting many critics to condemn Lekhanya's regime as a puppet government. Within nine months, it resumed negotiations on the transfer of water, and Lesotho succumbed to most of South Africa's demands. In return for increasing amounts of water at the end of each phase of the project, Lesotho was to receive modest annual payments and assistance in constructing the project and hydroelectric stations. The new military authorities and South Africa signed the LHWP Treaty on October 24, 1986, thus formally establishing the policy of the commodification of Lesotho's water.¹¹

In essence, two illegitimate governments, the apartheid and military governments of South Africa and Lesotho, respectively, signed an international treaty concerning a transboundary resource. The close timing between the military coup in January 1986 and the signing of the treaty in October the same year has led several scholars to conclude that there was a direct linkage between the two events and that the military coup was, in fact, a South African sponsored "water coup."¹² Whatever the case, it is clear that Lesotho became further entrapped in South Africa's tentacles of empire. The treaty spelled out how the Senqu-Orange River and its tributaries would be diverted to supply the water needs of South Africa. It stipulated the design, construction, operation, storage capacity, and maintenance of the five dams in the Lesotho Highlands and the 200 kilometers of tunnels connecting the two countries and defined the annual minimum quan-

tities of water to be transferred to South Africa. The text also affirmed that the treaty will be reviewed at intervals of twelve years, calculated from the date it was signed.¹³ Over the next eight years, the partners initiated a series of feasibility studies to determine the economic, environmental, and social impact of the project.

The end of apartheid and democratic multiparty elections in 1994 gave new impetus to the LHWP. The new ANC government, which had previously criticized the initiative as an “apartheid project,” eagerly embraced the agreement and called for increased cooperation between the two riparian states. On January 22, 1998, King Letsie III of Lesotho and President Nelson Mandela of South Africa inaugurated Phase 1A of the project, emphasizing its political and economic significance. The World Bank, the African Development Bank, the Development Bank of South Africa, and a number of European commercial banks and export agencies funded the project. Five years later, Phase I of the project was completed. Phase II was launched on March 27, 2014, by King Letsie III of Lesotho and President Jacob Zuma of South Africa.¹⁴

For South Africa, the economic and political benefits of the LHWP have been immediate and far-reaching. The flow water helps to sustain the vast industrial centers and urban residential areas in and around Johannesburg and the densely populated Gauteng province. Lesotho’s water cools the country’s massive Eskom power stations in Mpumalanga; maintains Sasol, the country’s integrated chemical and energy company; and keeps the Free State gold mines operational. It also helps sustain a number of southern towns in the Limpopo province, the platinum mines in the northwest, including the diamond mines, and the residents of Kimberley. When South Africa experiences periodic droughts or requires additional water, emergency supplies are transferred through the tunnels to the Caledon River, the Eastern Cape, and the southern Free State through the BloemWater network. In short, Lesotho has become South Africa’s principal water reserve, or a domestic water colony (just as Cahora Bassa has become a much-needed source of cheap energy).¹⁵

The high priority that the post-apartheid government places on the LHWP is reflected in its willingness to intervene both politically and militarily in Lesotho’s domestic affairs to ensure political stability and a regular flow of water. The first incursion occurred just eight months after the inauguration of Phase 1A of the project in 1998.¹⁶ A postelectoral crisis in Lesotho, triggered by accusations of electoral fraud, fueled widespread civilian protest followed by an attempted mutiny in September 1998. At the request of Lesotho Prime Minister Pakalitha Mosisili, the South Africa Development Community (SADC) authorized a joint South African and Botswanan expedition to restore order and resolve the dispute. When these efforts failed on September 22, 1998, South African De-

fense Forces (SANDF) launched a major attack with the stated objective of restoring peace and stability.¹⁷ It is not inconsequential that one of the SANDF's first objectives was to secure control of the strategic Katse Dam, an area not controlled by rebel forces. In the skirmish that ensued, several soldiers of the Lesotho Defence Force guarding Katse Dam were killed. There was no justifiable military reason for the operation.¹⁸ The action was simply defended as necessary to protect Pretoria's water supply. The intervention also preserved the authority of Lesotho's leaders, who were increasingly dependent on the ANC government.¹⁹

Given South Africa's hydropolitical interests, it is not surprising that Pretoria intervened later when the government of Lesotho became embroiled in another political crisis. The ruling coalition, which was extremely unstable, fractured in 2014, precipitating intense interparty and intraparty struggles over who would control the reins of power. Much of the conflict centered on which ministries would direct the LHWP and oversee the multimillion-dollar second phase of the project. Prime Minister Thomas Thabane was accused by his coalition partners of unilaterally dismissing and appointing high-ranking state officials to oversee the LHWP.²⁰ At stake was control of a vast sum of money garnered through corruption and used to support a system of political and financial patronage. This was not a new phenomenon. Graft and highly publicized scandals surrounding the project dated back to the 1990s.²¹ Members of parliament proposed a motion of no-confidence in Thabane. He stopped the motion when King Letsie III granted him permission to suspend parliament. Tensions persisted. The SADC sent South African President Zuma and his Namibian counterpart to resolve the conflict. For Pretoria, the instability raised concerns about the long-term viability of the project. Under pressure from the two presidents, the competing factions resolved their differences. Looking back at the crises, the press secretary to the Lesotho prime minister stressed the extremely important role that Zuma played and why it was imperative that political stability be restored.

*The South African government wants to make sure that there is stability in Lesotho so that they can still continue to get quality water from us. They cannot look anywhere else but to us for water. They need our water.*²²

If South Africa was the obvious beneficiary of the LHWP, how did this massive development project enhance the prosperity of Lesotho? Clearly a portion of the political elite and their financial allies and supplicants benefited. Water has certainly been used by the entrenched elite for political gain. But beyond this narrow stratum, were the immediate short- or long-term advantages that Lesotho derived from the project met?

At first glance, the answer seems to be a qualified yes. At a national level, the water royalties increased, the dams supplied electricity for domestic use, and there was a dramatic expansion in the construction of roads, power lines, and oth-

er infrastructure. The project's contribution to the economic activity of Lesotho is estimated at 5.4 percent of the gross domestic product (GDP).²³ From January 1997 to December 2020, for example, the accumulated water delivery from Lesotho to South Africa was 16,401.3 million cubic meters. The revenue generated from the water was approximately US\$1.25 billion.²⁴ Predictably, the leaders of Lesotho heralded not only the economic benefits of the project, but also its strategic importance as a source of economic development and enhanced international standing as well as a symbol of modernity.²⁵ They and their South African counterpart hailed the project as a model of cooperation between the two riparian states.

One of the unintended consequences has been that the water royalties helped to fill budgetary gaps created by the sharp decline (by 43 percent) in the number of Basotho men working in South Africa, with a corresponding fall in remittances and, by extension, revenue for the Lesotho treasury.²⁶ Between 2005 and 2018, for example, these remittances declined from 35.6 to 15.6 percent of the GDP.²⁷ This narrative of mutually beneficial development obscures more than it reveals. While it is a symbiotic relationship, it is far from an equal relationship. Indeed, the treaty is one more marker of Lesotho's dependency on South Africa, which dates back to the end of the nineteenth century. It not only codified the unequal relations of power but infringes on Lesotho's sovereignty and control over its scarce resources. The unequal structural relationship and perceived economic and political values of water, including the patronage benefits of the LHWP, serve the parochial interests of Lesotho's leaders. Water is thus constructed as a valuable weapon that can be exploited for political gain.²⁸

One indicator of the unequal partnership is the rules governing the pricing and distribution of the flow of water, and what would seem to give it substantial bargaining chips is the 1986 agreement treaty. The treaty guaranteed minimal quantities of water that the mountain nation had to provide annually. South Africa also had the right to demand additional flows in times of drought. What is particularly revealing is that South Africa has managed to dictate the price it paid, which is considered well below market value. Once out of office, Prime Minister Thabane acknowledged this reality.

We are selling water to South Africa. But . . . the price of that water has not increased in a very long time? Which product in the world has maintained the same price over a 20-year period, more so when it is a rare and sought-after commodity and when the buyer has the money to pay more? We are actually subsidizing South African economy with our water. . . . How then are we going to make ends meet?²⁹

For the leadership of Lesotho, hydropolitics outweighed environmental and human security. The construction of the LHWP disrupted the daily life patterns of communities due to the loss of land, fuel resources, wild vege-

tables, medicinal plants, grasses, river sand, cultural activities, graves, religious sites, and adequate compensation. To meet Phase I of the LHWP, the government commandeered 1,900 hectares of arable land and 5,000 hectares of grazing land, which were subsequently flooded. The submerged land was among the most productive in the country. These rich alluvial soils, which had been enhanced by natural deposits of minerals from the rivers, produced the highest yields of agricultural products in the country. Approximately 2,345 households lost fertile fields in the submerged areas. Several thousand sharecroppers suffered a similar fate. The Mohale valley, which has been filled by the Mohale Dam, contains Lesotho's most fertile land. It is the only region in the country that produces an agricultural surplus. The loss of that land adversely affected local-level food security as two-thirds of the people living in the affected areas depend on locally produced crops. The inundation of winter pastures also made livestock-rearing much more difficult, leading to the deaths of large numbers of livestock.³⁰ The implementation of Phase II in the near future will result in the removal of an additional eight thousand people, pushing the total number of displaced to over thirty thousand.³¹

Springs also dried up in several villages located in the catchment area of the Katse Dam, thereby reducing the amount of fresh water available to communities.³² Women and young girls could no longer simply walk to the nearby river's edge to secure water for cooking and bathing. Instead, they had to travel greater distances to meet the daily needs of their households and communities. Displaced communities also lost trees and shrubs, wild vegetables, medicinal plants, and grasses, causing additional economic hardship. Prior to resettlement, many households sold firewood to supplement their family income. However, since very few trees grow outside inundated zones, community members lost important fuel-wood sales. The Highland communities also lost access to a variety of medicinal plants that were important for the treatment of several human illnesses, and they were no longer able to sell the surplus to healers serving Basotho in the lowlands. Craftspeople were adversely affected as well. Most of the leloli grasses, used to make baskets, were no longer accessible.³³ This was also true of the river sand, used primarily to forge bricks. Many local construction projects ceased, and local artisans lost work. To make matters worse, the compensation policy of Phase I of the LHWP was inadequate and poorly implemented. As a result, households reported a decline in their income and decreased financial security.³⁴ Malehana Motanyane, a seventy-year-old woman, put it best: she stressed that in the olden days, she and her neighbors had fertile fields, good pasture, and peace of mind, but "today it is different, we are poorer now than before [LHWP]." ³⁵ In addition to the deleterious economic consequences, the resettled communities suffered a profound cultural shock.³⁶ Many of their burial sites and religious centers were underwater, making it difficult to propitiate the ancestor spirits. Historically, consulting the ancestors was essential to ensure the fertility of land, cattle, and

women as well as the health and well-being of the region's rivers. Those whose ancestors' graves were relocated had to travel long distances to pay homage to the deceased.³⁷

Included in the litany of complaints are the traumatic social and psychological effects many of the displaced experienced. Elders complained of the diminished significance of kinship groups and social networks, strained family relationships, devalued belief systems, and a heightened sense of collective insecurity within their community.³⁸ One elder man captured this sense of collective anxiety: “[the dead ones] are going to rise up against us and say ‘You leave us here so we can be drowned by the water?’”³⁹ A study conducted on the sociopsychological impact upon the resettled community of the Molika-lika area displaced by the Mohale Dam concluded that those who had been moved felt anxious and extremely vulnerable in their new environment.⁴⁰ They also stressed that competition for the best available agricultural or grazing lands or for forest products intensified conflict within and between communities. In some cases, the scarcity of grazing lands led to pitched battles among herders.⁴¹

Both before and during each phase of the LHWP, state-appointed interdisciplinary teams of ecologists, hydrologists, biologists, engineers, social scientists, and construction company consultants generated lengthy reports assessing the potential impact of the project. They concluded that the environmental impact would be minimal and dismissed the critics' concerns.⁴² As was often the case in such large development schemes, these experts' projections proved wrong. The LHWP has caused massive environmental degradation, which has led to the destruction of natural resources such as soil, water, and various species of flora and fauna. Consider the far-reaching impact of project-related soil erosion. Rivers downriver from the dams became nutrient-starved since most of the minerals and other organic material in the water were blocked by the walls of the dams. To compensate, the waterways pulled rich alluvial soils from the shoreline, eroding the banks. Poor drainage systems along project roads meant that runoff from these ditches created wider gullies. This, in turn, forced farmers to plow against the hillside contour, further exacerbating the erosion. Due to the decrease in grazing lands in the Highlands, herds of livestock are now concentrated on a significantly smaller area, depleting the soils there as well.

Much of the most valuable flora, including wild vegetables, medicinal plants, and valued grasses, ended up underwater as well. The dietary effects on the resettled communities were significant. Households were no longer able to gather wild vegetables from the inundated areas, which were significant nutritional supplements to their starch-based diet. They now either eat fewer vegetables, or must travel longer distances to gather them. As previously noted, many of the 175 species of medicinal plants disappeared from the area completely or became so scarce that it is no longer viable to search for them, as is the case with the leloli grasses.⁴³

The LHWP has also threatened the survival of fish. The project was assessed as creating a potentially major threat to the survival of the Maloti minnow species. The planners of the LHWP failed to consider how the water-transfer tunnel linking Katse Dam on the Malibamatso River with the Mohale Dam on the Senqunyane River allowed the predatory Smallmouth Yellowfish to invade the Senqunyane River, threatening the total extinction of the Maloti Minnow, an important source of protein for local communities. There also has been a sharp decline in trout and other species that have escaped through the tunnels into South Africa.⁴⁴

Despite the decision of the government to ratify the United Nations Framework Convention on Climate Change, greenhouse gases emitted by the dams have contributed to global warming, which has already impacted water resources. Catchment yield has decreased while large and robust rivers have been reduced to mere trickles. Dams remain dry for most of the year. Global warming is also projected to have adverse impacts on regional freshwater resources not only in Lesotho but throughout the region. Water from the mountainous nations not only flows through South Africa but into Namibia, Botswana, and the Atlantic basin.⁴⁵ Some hydrological scenarios project that water-rich Lesotho will enter a period of scarcity by 2062.⁴⁶ Given the country's current population growth rate and its accompanying service-delivery requirements, some researchers have suggested grave water stress could be reached even earlier. The shrinkage of the supply could raise new tensions between Lesotho and her powerful neighbor and precipitate South African intervention once again.⁴⁷ Even if such a scenario does not take place, Lesotho will likely lose substantial water royalties, which help pay for many social projects.⁴⁸ These pessimistic projections are supported by current data. According to the Lesotho Highlands Development Authority, climate change effects, particularly drought, have forced the dam levels to operate at an almost suboptimal state, thereby adversely affecting water delivery and electricity-generation targets.⁴⁹ This was evident when, as of October 25, 2020, the Katse Dam, whose water storage capacity is 1,950 million cubic meters, was only 20.95 percent full, while the Mohale Dam, whose storage capacity is 946.9 million cubic meters, was only 20.54 percent full. Actual water deliveries to South Africa reduced from 63.0 million cubic meters in September 2020 to 54.1 million cubic meters in December 2020.⁵⁰

Like in other parts of Africa, hydropolitical realities enhanced the unequal structural relationship between postcolonial states while negatively impacting the health and well-being of thousands of Lesotho's citizens.⁵¹ Climate change has also begun to affect water deliveries to South Africa. These adverse effects are likely to have serious ramifications for both domestic and regional security. Political leaders in Lesotho need to reevaluate the strategic values they attach to the country's water resources and prioritize domestic environmental and human security needs. Lesotho's water should serve the nation and not a privileged elite or South Africa.

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ENDNOTES

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- ²² Ntsebeng Motsoeli, “SA Allays Fears over Water Project,” *Sunday Express*, August 4, 2014, <https://sundayexpress.co.ls/sa-allays-fears-over-water-project/> (emphasis added).
- ²³ Lesotho Highlands Development Authority, “Project Description,” <http://www.lhda.org.ls/lhdaweb>; and Lesotho Highlands Development Authority, “Project Benefits,” <http://www.lhda.org.ls/lhdaweb/about/ourStory>.
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- ²⁵ The term “sanctioned discourse,” in the context of integrated water resources allocation and management, was introduced by and associated with Tony Allan. For a detailed discussion of the term, see Tony Allan, “IWRM/IWRAM: A New Sanctioned Dis-

- course?” SOAS Water Issues Study Group Occasional Paper 50 (London: University of London, 2003).
- ²⁶ International Monetary Fund, “Kingdom of Lesotho,” IMF Country Report No. 19/113 (Washington, D.C.: International Monetary Fund, 2019); Central Bank of Lesotho, “Macroeconomic Statistics,” 2020, <https://www.centralbank.org.ls/index.php/statistics/macroeconomic-statistics>; and Lesotho Highlands Development Authority, “Water Sales.” The reduction in the number of migrants reduced the human suffering precipitated by their absence. Although this subject falls outside the scope of this essay, social scientists have long documented the deleterious impact on the flow of labor from the countryside, and the emotional suffering caused by the recurring separation of families, high rates of divorce, and increased gender and generational conflict.
- ²⁷ Colin Hoag, “Scratching About (*Fato-Fato*): Erosion, Governance, and the Commodification of Water in Lesotho” (Ph.D. diss., University of California, Santa Cruz, 2017).
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- ³¹ Amnesty International, “Lesotho Polihali Dam Construction Puts Nearly 8,000 People at Risk of Displacement,” February 6, 2020, <https://www.amnesty.org/en/latest/news/2020/02/lesotho-polihali-dam-construction-puts-nearly-8000-people-at-risk-of-displacement/>.
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- ³⁵ Lawrence Keketso, “The Mixed Blessings of the Lesotho Highlands Water Project,” *Mountain Research and Development* 23 (1) (2003): 7–10, [https://doi.org/10.1659/0276-4741\(2003\)023\[0007:TMBOTL\]2.0.CO;2](https://doi.org/10.1659/0276-4741(2003)023[0007:TMBOTL]2.0.CO;2).
- ³⁶ Hoover, “Pipe Dreams.”
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- ³⁸ Hoover, “Pipe Dreams.”
- ³⁹ Thabane, “Shifts from Old to New Social and Ecological Environments in the Lesotho Highlands Water Scheme,” 647.
- ⁴⁰ *Ibid.*, 633–654.
- ⁴¹ Oscar G. Mwangi, “Environmental Change and Human Security in Lesotho: The Role of the Lesotho Highlands Water Project in Environmental Degradation,” *African Security Review* 17 (3) (2008); Hoover, “Pipe Dreams”; and Susannah Ryan, “White Gold and

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- ⁴⁷ Oscar Gakuo Mwangi, "Climate Change, Hydropolitics, and Security in Lesotho," in *Climate Change and Natural Resources Conflicts in Africa*, ed. Donald Anthony Mwiturubani and Jo-Ansie van Wyk (Pretoria: Institute for Security Studies, 2010).
- ⁴⁸ Ibid.
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An Offer You Can Refuse: A Host Country's Strategic Allocation of Development Financing

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Hydropower projects are one of the leading energy sectors being developed in Africa. In the past two decades, this demand has been increasingly met by Chinese financing and Chinese contractors, creating an impression that host countries have no choice but to accept Chinese advances against their preferences. This essay demonstrates through the case study of the Mount Coffee hydropower project in Liberia that host countries strategically allocate financing from different sources to different projects, based on domestic development needs, administrative capacity, flexibility of financiers, and institutional memory between the host and the financiers. This essay also shows that concerns over Chinese contractors' environmental- and social-impact records reflect a combination of host enforcement, financiers self-sorting, and Chinese contractors' own perceptions of their comparative advantage. More broadly, this case study provides empirical observations of host countries' agency and strategic calculus in the financier-host relation, as well as the limits of China's role in Africa's hydropower sector.

As numerous contributions to this issue of *Dædalus* make clear, it is impossible to disentangle questions of water security from questions of infrastructure. Indeed, it is the weakness of Africa's infrastructure that explains, at least in part, the deep concerns over water scarcity and climate change. In 2009, the Africa Infrastructure Country Diagnostic project of the World Bank addressed the infrastructure gap, highlighting how water resource management crosscuts sanitation, agricultural production, and power supply:

Though water is vital for agriculture, only 5 percent of Africa's cultivated land is irrigated. Hydropower is also largely undeveloped in Africa; less than 10 percent of its potential has been tapped. Water for people and animals is vital for health and livelihoods, yet only 58 percent of Africans have access to safe drinking water.¹

Among these myriad challenges, the World Bank noted that "Power is by far Africa's largest infrastructure challenge, with 30 countries facing regular power

shortages and many paying high premiums for emergency power.” Approximately 40 percent of total infrastructure spending is associated with power, and about “one-third of power investment needs (some \$9 billion a year) are associated with multipurpose water storage for hydropower and water resources management.” In view of the large demand for power-sector investments, and even if Africa’s domestic financing can capture potential efficiency gains, “Africa would still face an infrastructure funding gap of \$31 billion a year, mainly in power.”² A 2021 report shows that only 11 percent of the technically feasible hydropower potential has been developed in Africa.³

However, hydropower projects (HPP) are coming under increasing scrutiny because of their social and environmental impacts.⁴ As essays in this volume by Jennifer Derr, Allen Isaacman, and Harry Verhoeven highlight in the diverse contexts of Egypt, Ethiopia, and Mozambique, the cost-benefit ratios of HPPs are greatly skewed in favor of powerful, vested elites.⁵ Newly created reservoirs can increase the energy output of HPPs, but they flood large tracts of land to the detriment of the local ecology and populations. The impact of changing hydrology is not limited to the immediate areas around the project, but also affects distant upstream and downstream regions. Very large hydropower projects can even influence surrounding climate and precipitation patterns.⁶

Partially in response to these concerns, the World Bank has been retreating in recent decades from financing large HPPs.⁷ The World Commission on Dams (WCD), organized by the World Bank and the World Conservation Union between 1997 and 2001, argued that while there are developmental benefits from HPPs, in “too many cases an unacceptable and often unnecessary price has been paid to secure those benefits, especially in social and environmental terms, by people displaced, by communities downstream, by taxpayers and by the natural environment.”⁸ Among the recommendations provided by the WCD are: more stringent social and environmental evaluation, maximizing existing HPPs instead of building new ones, more inclusive participatory processes for all stakeholders involved, and taking a basin-wide approach to evaluating project feasibility in order to reduce both ecosystem impact and transboundary political conflicts. African countries were thus faced with the challenge of balancing new standards from financiers on top of existing development demands and funding constraints.

Just as the World Bank, the then leading development finance institution, was pulling back from large HPPs, China moved rapidly into Africa’s infrastructure sector and became a new source of credit. Between 2000 and 2019, the Export-Import Bank of China (China Eximbank), China’s export credit agency and primary source of Chinese official development financing in Africa, committed at least US\$10 billion in loan financing to HPPs in Africa, spanning twenty-four projects in eighteen countries. This did not include their role in financing

transmission lines that accompany HPPs, nor their role in consortium financing for mega HPPs, such as the US\$4.1 billion Caculo Cabaça HPP in Angola, both of which increased their financing profile (see Table 1).

China is not the only emerging financier for HPPs in developing countries. The Export-Import Bank of India has financed Rwanda's Nyabarongo HPP; a consortium of Arab financiers, including the Arab Fund and the Islamic Development Bank, have financed Sudan's Roseires II HPP; and the Brazilian construction firm Odebrecht has undertaken multiple HPPs in Africa, particularly in Lusophone countries.⁹ Nonetheless, China still leads the pack both in terms of financing and contracting.

The flurry of projects that were financed in the new millennium formed part of the broader China-Africa engagement that traces its roots to the Non-Aligned Movement during the Cold War and has been scaled up dramatically since 2000. Following independence from European colonialism, nonalignment was a time when liberated African countries learned to balance two superpowers while seeking to maximize their strategic benefits and bolster their sovereignty. China responded to these African priorities with its foreign policy framework based on mutual noninterference, a commitment that (at least formally) still guides how Beijing engages the continent.

While there are no official figures of the influx of Chinese development finance into Africa, multiple sources have all pointed in the same direction. The World Bank's *Building Bridges* report covering 2000–2007 put the cumulative figure at US\$30 billion; the China Africa Research Initiative at Johns Hopkins University puts Chinese official loans for financing African projects in transportation, power, and communication alone at US\$48 billion between 2000–2014; and China AidData at William & Mary University puts the amount at US\$58 billion.¹⁰ The pattern is clear: Chinese financing in Africa, with infrastructure development as a leading sector, is now a significant and growing resource for developing countries (see Figure 1).

This influx of Chinese financing raised concerns, ranging from debt sustainability and governance to social and environmental regulations of the projects financed or contracted to Chinese actors. In March 2018, U.S. Secretary of State Rex Tillerson alleged that China's approach in Africa

encourages dependency using opaque contracts, predatory loan practices, and corrupt deals that mire nations in debt and undercut their sovereignty, denying them their long-term, self-sustaining growth. Chinese investment does have the potential to address Africa's infrastructure gap, but its approach has led to mounting debt and few, if any, jobs in most countries.¹¹

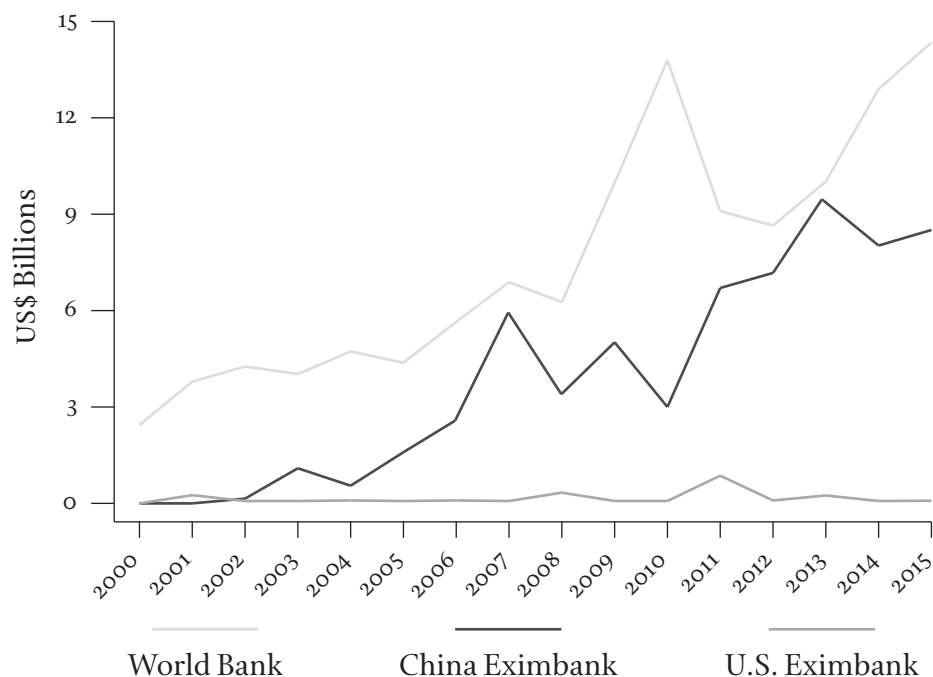
While this statement reflects the Trump administration's general hostility toward China, simplistic views from the media on Chinese financing in Africa

Table 1
China Eximbank–Financed HPPs in Africa, 2000 – 2019

Signing Year	Country	Project	Loan Amount, US\$ Millions
2003	Sudan	Merowe	\$608
2006	Equatorial Guinea	Djibloho	\$275
2007	Ethiopia	Finchaa-Amerti-Neshe	\$116
2007; 2012	Ghana	Bui and additional financing	\$750
2007	Zambia	Kariba North Expansion	\$316
2008	Gabon	Grand Poubara	\$318
2009	Cameroon	Mekin	\$53
2009	Ethiopia	Genale-Dawa III	\$270
2011	DRC	Zongo II	\$367
2011	Ethiopia	Gibe III	\$612
2012	Cameroon	Memve'ele	\$541
2012	Republic of Congo	Liouesso	\$105
2013	Côte d'Ivoire	Soubre	\$500
2013	Mali; Senegal	Gouina	\$248; \$146
2013	Nigeria	Zungeru	\$984
2013	Zambia	Lusiwasi Lower	\$183
2013	Zimbabwe	Kariba South	\$320
2014	Angola	Chiumbe-dala	\$112
2015; 2016	Benin; Togo	Adjarala	\$229; \$57
2015	DRC	Busanga	\$165
2015	Uganda	Karuma	\$1,445
2015	Uganda	Isimba	\$483
2018	Guinea	Souapiti	\$599
2018	Madagascar	Ranomafana	\$197

Source: Deborah Brautigam, Jyhjong Hwang, Jordan Link, and Kevin Acker, "Chinese Loans to Africa Database" (Washington, D.C.: China Africa Research Initiative, Johns Hopkins University School of Advanced International Studies, 2020), <http://www.sais-cari.org/data>.

Figure 1
World Bank, China Eximbank, and U.S. Eximbank Loans to Africa,
2000 – 2015



Source: Janet Eom, Jyhjong Hwang, Lucas Atkins, et al., “The United States and China in Africa: What Does the Data Say?” Policy Brief 18 (Washington, D.C.: China Africa Research Initiative, Johns Hopkins University School of Advanced International Studies, 2017), 4.

receive considerable coverage, with headlines such as “While We [British] Indulge our Victorian Urge to Give Alms to Africa, Beijing Is Pumping Black Gold” and “How China’s Taking Over Africa, and Why the West Should Be VERY Worried.”¹² In recent years, more nuanced studies have tackled the impact of Chinese development finance and contracting in Africa. The epithet of “rogue donor,” in which China flouts conditionality to finance dictators accused of abuses, along with the accusation of “debt trap diplomacy,” in which China supposedly offers unsustainably large loans to desperate borrowers to gain political leverage over them, have been challenged.¹³ Empirically rich field studies are emerging on the environmental and social impact (ESI) of Chinese-financed and Chinese-contracted projects in Africa, painting a complex and nuanced picture.

For instance, development scholars Keyi Tang and Yingjiao Shen have found that the Chinese-financed and Chinese-contracted Bui HPP in Ghana “has improved local urban households’ access to electricity and increased their ownership of electric appliances.”¹⁴ Public administration scholars Nancy Muthoni Githaiga and Wang Bing’s analysis of Kenya’s Mombasa-Nairobi Standard Gauge Railway, financed mostly with China Eximbank loans, indicated that the railway has had both positive and negative impacts: the project is associated with growth in the trade and construction sectors, but there are concerns about its sustainability and impact at the local level in terms of generating enough revenue to cover operation costs and loan repayment, its large external debt profile, and its opaque tendering process.¹⁵ Economist Bruno Martorano and colleagues have found that Chinese development assistance in social sector projects, such as piped water, can successfully improve households’ well-being, while assistance to other sectors, such as communication and transportation, does not exhibit significant results.¹⁶ Economist Axel Dreher and colleagues have pointed out that “Chinese development finance boosts short-term economic growth: an additional project increases growth by between 0.41 and 1.49 percentage points two years after commitment, on average.”¹⁷

More critically, Harry Verhoeven demonstrated that the choice of prioritizing quick project delivery to cement key partnerships in Africa is often a political one to keep governments in power, and in the case of the Merowe Dam and its dubious “associated projects” in Sudan, long-term economic sustainability and environmental and social impact all took a backseat.¹⁸ International Rivers, a nongovernment advocacy group, found that

China’s domestic policies have prioritized economic growth over the protection of the environment, with harrowing results. The Chinese government has set in place laws, regulations and institutions to protect the environment, but with limited success. China risks exporting its domestic environmental track record to other parts of the world through its foreign investment strategy. Its domestic environmental policies may even encourage China’s worst polluters to relocate their production to places like Africa.¹⁹

A key emerging observation is that much of the impact of Chinese finance and contracting is dependent on the host country’s agency and capabilities. China-Africa scholar Deborah Brautigam and Hwang found that China Eximbank

requires an environmental impact assessment (EIA) to be conducted, based on the host country’s environmental policies and standards. However, if the host country’s policies are not “complete” then the assessment should be based on China’s own standards or international practice. . . . If borrowers do not mitigate serious environmental and social problems caused by the project, China Eximbank reserves the right to stop loan disbursements and require early repayment. It is not known how strict China Eximbank has been in applying these guidelines.²⁰

International relations scholar May Tan-Mullins and colleagues observed that

Chinese dam builders usually attempt to adhere to the social and environmental policies and guidelines of the host country, in so far as they exist. In the absence of such policies and guidelines, Chinese dam builders will usually attempt to follow China's domestic policies and guidelines. The national host context therefore determines the quality of the impact mitigation of large dams. However, according to our interviewees, many of these guidelines are not enforced, are very general and need to be more sector specific.²¹

And development scholar Oliver Hensengerth's study of Sinohydro in Ghana's Bui HPP shows

that the contractual setting in which Chinese companies operate and the governance setting of the host country are the key factors in determining whether or not strict environmental protection measures are implemented in projects with Chinese involvement and whether Chinese firms apply international norms, the norms of the host country, or Chinese norms.²²

In a comparative study of two HPPs in Cameroon, one financed by the World Bank and one by China Eximbank, development scholars Yunnan Chen and David Landry also found that Eximbank is more inclined to leave the ESI enforcement to the host country, and does not pressure the host to alter enforcement practices as the World Bank does.²³ The 2015 Brookings report *Financing African Infrastructure* points out that even though the World Bank has "played a critical, though sometimes controversial, role in setting standards for investment design, evaluation, and implementation. . . . Ultimately, however, it is the African nations that must agree on the standards and principles that they will apply."²⁴

This essay will demonstrate through the case study of the Mount Coffee HPP in Liberia that host countries strategically allocate financing from different sources to different projects, based on domestic development needs, administrative capacity, flexibility of financiers, and institutional memory between the host and the financiers. More broadly, this case study provides empirical observations of host countries' agency and strategic calculus in the financier-host relation, as well as the limits of China's role in Africa's hydropower sector.

In 2012, Liberian President Ellen Johnson Sirleaf signed the first of a series of financing agreements, predominantly grants, followed by contracts, with financiers from Organisation for Economic Co-operation and Development (OECD) countries for the reconstruction of the Mount Coffee HPP. These signings occurred despite explicit interest from Chinese officials and Chinese companies to both finance and contract the project. The desire to fund and carry out the rehabilitation of the Mount Coffee HPP was supposed to demonstrate China's commitment to the newly reestablished Sino-Liberian diplomatic ties in 2003. The unexpected

setback for Beijing makes the Mount Coffee project a “hard case” for Chinese dominance in the sector: if Chinese financing and contractors are indeed dominating the African hydropower sector, how is it that China is not able to make headway into the Mount Coffee project despite explicit interest in it? OECD financiers and contractors were not the only partners available to Liberia, so the outcome of staying with OECD partners is not one of necessity, but one of choice. Mount Coffee is a rare case that demonstrates host country agency vis-à-vis financiers, but also shows the limit of financiers’ influence in development project financing.

In 1964, U.S.-based Stanley Engineering Company was contracted to carry out the design, specification, and supervision of a 34-megawatt hydropower station on the St. Paul River, 27 kilometers north of the Liberian capital, Monrovia. The project was funded by a mix of Western financiers: four different World Bank loans between 1970 and 1978 totaling US\$24 million, and two loans totaling US\$4 million from the German government. The project contained four vertical Francis turbines, three dam sections, ten flood control gates, and a 69 kilovolt substation and transmission line. Upon completion in 1967, the Mount Coffee HPP was Liberia’s largest source of electricity, supplying 35 percent of the country’s capacity.

The first Liberian Civil War broke out in 1989. In 1990, rebel forces led by Charles Taylor took control of the power station and ceased its power generation. Operators were prevented from entering the facility to open the spillway gates, causing the dam to overtop during the rainy season. Throughout the next fifteen years of civil war, the power station’s electrical, mechanical, and transmission equipment were looted.²⁵ When the democratically elected government of Ellen Johnson Sirleaf took office in 2006, they faced the challenge of rebuilding a country whose infrastructure had been destroyed by conflict. Electricity access was particularly dismal. Even before the decimation of the Mount Coffee project, only 13 percent of the population had access to electricity. By the time surveyors returned, only part of the dam and the steel pressure pipes remained.

The Mount Coffee project is a run-of-the-river hydropower project. This type of HPP takes advantage of a bend in the river that also straddles an elevation change. The geography allows the construction of a “shortcut” across the bend, through which water upstream of the bend travels down at a higher speed to propel the turbines installed at the bottom of the shortcut. Water exiting the turbines is fed back into the river downstream. Such a design alone does not require the flooding of large reservoirs and is therefore often considered as having a less nefarious ESI than projects that require damming and flooding. However, the output of run-of-the-river projects is generally more variable due to rainfall.²⁶

In November 2006, the U.S. Trade and Development Agency (USTDA), an independent agency designed to support “U.S. goods and services for priority development projects in emerging economies,” opened two grant lines for a

“Technical and Financial Feasibility Study for the Reconstruction and Expansion of the Mount Coffee Hydropower Facility in Liberia.” In May 2007, the Liberian government issued a tendering for feasibility studies for the rehabilitation and expansion of the project, with the support of a US\$400,000 grant from the USTDA. The tendering was then postponed and later reopened in September 2007 with a modified budget. The grant amount was also increased to US\$531,500. Only U.S. firms could bid for the project, per the agreement of grant projects funded by the USTDA. However, the contractor may utilize Liberian subcontractors for up to 20 percent of the grant amount.

U.S. interest in the project was neither coincidental, nor did it manifest itself in isolation. The United States had a long history of intervening in Liberia's politics, dating back to the end of the U.S. Civil War in 1865.²⁷ Relations with the United States soured during Charles Taylor's administration, who was perceived as an illegitimate warlord by Washington despite considerable domestic support, but improved when Ellen Johnson Sirleaf was sworn into office as the first elected female head of state in Africa.²⁸ Born of Indigenous parents but raised in an Americo-Liberian household, she later completed her master's degree in public administration at Harvard University. She continues to maintain a largely positive image in the West, eventually receiving the Nobel Peace Prize in 2011.²⁹

While the tendering for the rehabilitation of the Mount Coffee project was underway, in July 2007, the Economic and Commercial Office (ECC) of the Chinese embassy in Liberia translated a Liberian news article, which quoted the CEO of Liberia Electricity Corporation (LEC) in stating that the upgrade and repair of the Mount Coffee HPP and the accompanying Via Storage Reservoir upstream would cost about US\$500 million. A team of specialists (that is, Stanley Consultants) were already on the ground to explore the possibility of expanding the project to up to 100 megawatts. The ECCs are typically physically located within Chinese embassies but are under the jurisdiction of China's Ministry of Commerce. Part of the ECC's role is to facilitate Chinese businesses operating in foreign countries. Most of the press releases from Liberia's ECC cover signing of local contracts with Chinese companies, groundbreaking ceremonies of Chinese-contracted projects, or official visits by local and Chinese officials to Chinese-contracted projects. The articles that the ECC chooses to translate and publish are not a random selection; they only include events that they believe to be useful for Chinese contractors. Their interest in the Mount Coffee HPP was clearly commercial but should not (like that of the United States) be separated from broader bilateral considerations. Liberia has repeatedly changed its diplomatic recognition between China and Taiwan (see Table 2). The post-2003 reestablishment of relations was a great diplomatic success for Beijing, which was eager to maintain this relation with Sirleaf's government. At the time, only Senegal, Chad, Malawi, Gambia, São Tomé and Príncipe, Burkina Faso, and Eswatini

Table 2
Liberia's Cross-Straits Diplomatic History

Duration	Liberia's Diplomatic Relations
1957 – 1977	Taiwan
1977 – 1989	China
1989 – 1993	Taiwan
1993 – 1997	China
1997 – 2003	Taiwan
2003 – current	China

Source: Guillaume Moumouni, "China and Liberia: Engagement in a Post-Conflict Country (2003–2013)," in *China and Africa: Building Peace and Security Cooperation on the Continent*, ed. Chris Alden, Abiodun Alao, Zhang Chun, and Laura Barber (London: Palgrave Macmillan, 2018), 225–251.

still maintained relations with Taipei, and Beijing wanted to demonstrate the benefits of switching sides.

It is unclear who and how many bids were submitted for the feasibility study, but by the end of 2007, the LEC awarded the contract to the U.S.-based Stanley Consultants. This outcome was not surprising. Stanley Consultants was the original design engineer of the Mount Coffee HPP when it was first constructed in the 1960s. Stanley Consultants' recommendations included repairs for the dam, strengthening the turbine's anchors, and repairing the foundations of the powerhouse's building structure. Moreover, the Mount Coffee project's dependence on rainfall as a run-of-the-river project was problematic since it was meant to serve as Liberia's largest generating facility for years to come. Thus, Stanley Consultants developed the project to be compatible with a potential upstream storage facility, the Via Reservoir, to improve reliability and output in the future.

In September 2008, development officials from Japan, the Netherlands, Norway, Sweden, the United States, the United Nations, and the International Monetary Fund, as well as representatives from other international financial and donor institutions arrived in Liberia to attend the Liberia Reconstruction and Development Committee (LRDC) forum. The LRDC, a government-donor group, was created in 2006 after Sirleaf took office.³⁰ In the September meeting, Sirleaf expressed "dissatisfaction with the timeline between the process of commitments and implementation of the commitments." However, she welcomed discussions on the need for budgetary support to Liberia and acknowledged that the enduring challenge of corruption made it harder for Western donors to engage. Her

dissatisfaction with the slow progress was reiterated multiple times during the conference: “If you say, put it through our bidding process, I will say no. I’ll give it to who will build it; we are going to give it to somebody. If it’s got to be a private sector thing, we’ve got to get it done.” While she reiterated her support for the public bidding process, a condition required by all the financiers of the project, it was clear that priorities between the host and the financiers are often at odds.

Sirleaf’s frustration with the slow pace of the project’s construction, including the bidding process, did not go unnoticed. Missing from the LRDC meetings was China, which was just starting to ramp up investment activities in Liberia. In 2006, China signed a US\$5 million grant with Sirleaf, much of which went to the renovation of the Samuel Kanyon Doe (SKD) Sports Complex that was contracted to Hunan Construction Engineering Group.³¹ As the OECD delegation left Liberia, Sirleaf, accompanied by Chinese Ambassador Zhou Yuxiao and ECC counselor Liu Yun, met with representatives from Sinohydro, one of the most active contractors building HPPs in Africa. Sinohydro introduced their own studies of the Mount Coffee hydropower rehabilitation project. Sirleaf emphasized that the expansion of the mining and forestry industry created a large potential customer base for the Mount Coffee project and that the Liberian government would expedite the project.

At the time, Sinohydro had already won contracts for Ethiopia’s Tekeze HPP, jointly with another Chinese hydropower giant Gezhouba, as well as several other contracts, building its global reputation as the dominant player in the dam industry (see Table 3). Some of these projects, like Kariba North, were financed by China Eximbank, which, like the USTDA grant, required a Chinese contractor. But Sinohydro was capable of winning contracts for projects with non-Chinese financiers as well.

For China Eximbank financing, the host country is expected to “apply for the export credit before the EPC contract is signed, though they sign the loan agreement only after the EPC contract.” In other words, Chinese contractors must first compete for the contract before jointly applying for loan financing from Eximbank with their African hosts.³² The potential financing that a Chinese contractor can leverage is often a game-changer. Up until 2008, China Eximbank has provided concessional loans covering anywhere from 75 to 100 percent of project costs.³³

However, China was not the only financier in the game. In European Investment Bank’s 2009 annual report, Secretary General Amadou Diallo of the West African Power Pool (WAPP), of which Liberia is a member, stated that “the WAPP is highly interested in securing the support of the Trust Fund in developing future potential projects such as the rehabilitation/reconstruction of the 64 MW Mount Coffee hydropower Facility in Liberia and further interconnection and reinforcement projects as well as capacity building.”

Even though a single Eximbank loan could have covered the entire project, the government of Liberia pushed for a different financing model. Against the odds,

Table 3
Sinohydro-Contracted HPPs in Africa, 2000 – 2008

Signing Year	Country	Project	Contract Amount, US\$ Millions	Financier(s)
2002	Ethiopia	Tekeze	\$365	Government of the Federal Democratic Republic of Ethiopia
2007	Kenya	Sondu-Miriu – Sang’oro extension	\$65	Japan Bank for International Cooperation (85%); Kenyan Electricity Generating Company (15%)
2007	Zambia	Kariba North Expansion	\$420	China Eximbank
2008	Madagascar	Andekaleka Hydropower Project Unit 3	\$59	European Investment Bank (61%); Arab Bank for Economic Development in Africa (11%); Kuwait Fund (17%); OPEC (11%)
2008	Sudan	Roseires Phase II	\$505	Arab Fund (41%); Islamic Development Bank (15%); Government of Sudan (15%); Kuwaiti Fund for Economic Development (11%); Saudi Fund for Development (8%); OPEC Fund (6%); Abu Dhabi Fund for Development (5%)

Source: Author’s compilation; and Deborah Brautigam, Jyhjong Hwang, Jordan Link, and Kevin Acker, “Chinese Loans to Africa Database” (Washington, D.C.: China Africa Research Initiative, Johns Hopkins University School of Advanced International Studies, 2020), <http://www.sais-cari.org/data>.

it was able to overcome significant aid fragmentation, negotiating with multiple OECD financiers to patch together grants that greatly reduced the country's debt burden, and even renegotiated for supplementary grants. By December 2012, Liberia had secured a US\$64 million concessional loan from the European Investment Bank (EIB) (see Table 4).

Even as negotiations for a concessional loan with the EIB were underway, Liberia explored possible Chinese financing, and the Chinese did not give up the possibility of winning a large contract for their companies. During a meeting with Ambassador Zhao Jinhua in April 2012, Internal Affairs Minister Blamoh Nelson "named the rehabilitation and expansion of the Mount Coffee Hydro plant . . . which China could assist."

In July 2012, a ten-member delegation from China arrived, headed by Zhang Xiaoqiang, vice chairman of the National Development and Reform Commission, which is managed by the State Council of China. In her opening remarks, Sirleaf emphasized that it was time to "fast-track on the priority areas of job creation and infrastructure – of roads, power and ports." Zhang replied by highlighting the capacity of Chinese contractors to tackle the Mount Coffee project, proposing "that the Liberian Government and China should sign the relevant documents for Mount Coffee as soon as possible and discuss financial plans for cooperation." Instead, Sirleaf wanted the rice production project and the existing iron-mining project by China to move ahead. She said that there was already a partnership working to restore Mount Coffee, but she "encouraged the Chinese to engage in the bidding process for the manufacture of the turbines that would be needed, and also to consider a partnership for phase 2 of the hydroproject for upstream storage capacity," referring to a public bid on turbines and other equipment for Mount Coffee that opened in April and the Via Reservoir project upstream to Mount Coffee, recommended by Stanley Consultants to increase the project's capacity. However, Zhang emphasized that

because of the many demands, there was no time for negotiations that could take up to a year. He called for agreement on a priority project, like Mount Coffee, and to move quickly. If the two governments and relevant institutions could reach agreement, China could provide financial support, as well as the experts, and after two years Liberia would have power.

Nonetheless, Sirleaf maintained that "the first phase already had four important partners, namely, the World Bank, the United States, Germany and Norway. She pointed out that any company could bid on the phase 1 turbines, and with Chinese companies already on the ground, they would be in a good position."³⁴ Yet the bidding process for those turbines did not go China's way: it was ultimately Voith Hydro, a multinational engineering contractor based in Germany, that was awarded the contract in October 2013.³⁵ While there are many possible fac-

Table 4
Pre-Ebola Financing Arrangement for the Mount Coffee HPP

Signing Year	Financier	Type of Financing	Amount, Millions	US\$ Millions Equivalent, Unadjusted	Percentage of Total Cost
2010	EIB	Grant	€1.5	\$2	1%
2012	EIB	Loan	€50	\$64	29%
2013	Norway	Grant	NOK450	\$75	34%
2014	Germany	Grant	€25	\$32	15%
2014	Liberia	Budget	\$45	\$45	21%
Total \$218 million					

Source: Author's compilation.

tors behind this choice, one that stands out in particular was that Mount Coffee's original Francis turbines were supplied by the U.S. manufacturer Allis Chalmers in 1966 and 1971, and Voith Hydro subsequently bought out Allis Chalmers in 1986.

A major difference between Mount Coffee's contracting process and what Sinohydro is familiar with was that different components of the project were independently contracted. A second invitation to bid was issued in November 2013 for the rest of the project. There were clear signals from the Chinese EEC in Liberia encouraging Chinese companies to compete for this project: it was the only project whose bidding profile was translated on EEC's website. It is unclear if any Chinese companies participated in the bid, but ultimately no Chinese companies participated in the project. UK-based Dawnus Construction was awarded the contract for civil works; Austrian-based Andritz won the contract for the hydraulic steelwork and auxiliary systems; Swedish ELTEL was tasked with the transmission lines to Monrovia; the construction work camp contract went to a joint venture consisting of three Liberian companies; the Norwegian Norplan AS and the German Fichtner GmbH won the contract to serve as the owner's engineer in representing Liberia; the NCC, a subsidiary of the Saudi company Rezayat, was awarded the contract for substations; and the operations training and maintenance contract went to the Swiss company Hydro Operation International.³⁶ This group of international contractors formed the Project Implementation Unit of the Mount Coffee project. While Chinese companies could potentially compete for the Via Reservoir project, plans for that project have yet to be announced by Liberia.

In December 2013, the Mount Coffee rehabilitation project officially broke ground with great fanfare. However, by August 2014, the World Health Organization declared the Ebola outbreak in West Africa a public health emergency of international concern. Liberia was at the epicenter of the epidemic and would ultimately sustain over 4,800 deaths. With public health measures in place and travel restricted, the project faced growing costs. As budgets tightened throughout 2014 and 2015, along with underbudgeting and exchange rate fluctuations, Liberia faced difficulties in coming up with the necessary funds as the epidemic slowed construction and further increased cost. Liberia approached the OECD financiers for an increase in support, while adding the U.S. government to the list of financiers. Once again, despite the need to negotiate with multiple financiers to patch together a budget mostly made of grants, there was no indication that Liberia ever approached China for loan financing (see Table 5).

In the end, the project was completed without the involvement of Chinese contractors or financing. The first turbine went online in December 2016, and by 2018, all four turbines of Mount Coffee went online.

What explains Liberia's behavior that seems to sit so starkly at odds with popular discourses that paint China as a nigh-unbeatable competitor when it comes to infrastructure bids? Much of it is strategic allocation by Liberia: the unexpected willingness and capacity of the government of a low-income African country to defend its interests. "Strategic" here implies more than economic rationality; it refers to the weighing of political, social, and financial pros and cons over long time horizons.

The U.S. Millennium Challenge Corporation (MCC), which contributed the bulk of the financing for Mount Coffee, has explicit requirements for the economic, social, and environmental conditions for the project, as do EIB financing. In other words, while OECD financing tends to be grant-based or very concessional, there are only certain projects that Western financiers will fund. Construction of government buildings or stadiums generally cannot be financed through OECD mechanisms. In contrast, Chinese grants can support those types of projects; there is no formal process to apply for Chinese grants like there are for the U.S. MCC or EIB loans. The flood of Chinese grants after reestablishing diplomatic ties with Beijing makes it very clear that these are diplomatic tools. Whatever development impact these Chinese grants may generate is up to the recipient country to decide, with a preference to use Chinese contractors if possible. When China gave a US\$36 million grant in 2013, Ambassador Zhao Jianhua stated that "it's money for the projects that have been agreed upon which are being simultaneously worked on at the moment." Projects "agreed upon" by China and by the grant recipient country is a common description of how Chinese grants are used: "grant shall be utilized to implement projects agreed upon through consultation

Table 5
Post-Ebola Financing Arrangement for the Mount Coffee HPP

Signing Year	Financier	Type of Financing	Amount, Millions	US\$ Millions Equivalent, Unadjusted
2015	Millennium Challenge Corporation (U.S. MCC)	Grant	\$147	\$147
2015	EIB	Loan	€0	\$22
2015	Norway	Grant	NOK92	\$11
2015	Germany	Grant	€0	\$32
Total				\$434 million

Source: Author's compilation.

between the two governments” described a grant to Botswana in 2009, and an agricultural center in Nigeria was “agreed upon by the two sides during President Buhari’s state visit to China last April [and] is going to be fully funded as a grant project in this category.”³⁷ To a certain extent, the way Chinese grants are used by both China and the grant recipients is more like an allowance, with the only semi-rigid condition being that Chinese contractors are prioritized when possible.

Nothing stopped the Monrovia government from using Chinese grants to shore up financing for Mount Coffee in 2015, particularly when Liberia’s own contributions fell short. However, that might not have been the best approach since OECD financiers are more than willing to fill budget shortfalls for projects that qualify, while Chinese grants can be used to plug other budget shortfalls, especially for projects that are not financeable by the OECD. In other words, Chinese grants were more useful as a “slush fund” for Liberia. Even if China routinely practices “stadium diplomacy” to maximize its project visibility or to benefit Chinese contractors, it would be difficult to argue that the SKD renovation, repeatedly financed with Chinese grants, was forced upon Liberia.³⁸ In the decade immediately following the reestablishment of diplomatic relations, China’s priority was to demonstrate, to the few countries left who still had diplomatic relations with Taiwan, the benefits of establishing relations with Beijing; strong-arming Liberia into accepting a stadium renovation project would be counterproductive. A more likely explanation is that the demand from Liberia for the stadium was met by Chinese supply, which was simply not available from OECD financiers.³⁹

Since OECD financing has a comparatively higher grant element but is more restrictive in terms of environmental and social assessment (ESA) (and Chinese financing has a comparatively lower grant element but is more permissive in terms of ESA), the goal of the Sirleaf government was to maximize the grant element across projects with a range of ESA performances. In this strategic approach to financing, OECD financiers covered the high-ESA projects, while Monrovia uses Chinese financing to cover whatever OECD financiers were not willing to fund.

In doing so, Liberia has demonstrated that it is (almost) uniquely capable of negotiating aid fragmentation, patching together a variety of grants from multiple sources and holding multiple public biddings for each stage of the project. While time-consuming and politically not without risks, this approach can maximize grants and reduce the reliance on loans. Sirleaf has taken pride in Liberia as “a prime example of an African nation standing up to Chinese policies.” She further stated that “In Liberia, we’re trying to settle our huge debt problem. China wanted to provide some resources on the basis of sovereign guarantees. We said no, we can’t take your money on that basis.”

What makes this all the more remarkable is that there are very few if any financiers like China Eximbank and China Development Bank that can single-handedly offer financing in the millions if not billions of dollars. The single largest World Bank loan was awarded to France’s Monnet Plan in 1947 for US\$500 million (valued at US\$6.1 billion in 2021 terms). The China Eximbank financed the Standard Gauge Railway in 2013 with the Kenyan government for US\$3.6 billion. China’s willingness to tolerate considerable risks and go big means that what formerly would have required three or four financing agreements with multiple OECD financiers can now be financed by a single financier.

The streamlined service and financing provided by Chinese companies are attractive to host countries that have less capacity or willingness to actively manage donors and creditors. Chinese companies and official agencies often tout their vertically integrated service as a competitive edge abroad, not just to potential customers, but to their own domestic audience. The China Energy Engineering Corporation (CEEC) proclaimed in a press release in Chinese that “as the largest power utility company that supplies comprehensive services in China and in the world, CEEC’s whole supply chain and whole life cycle services are unique strengths when undertaking mutual cooperation in infrastructure development in Africa.” The *Economic Daily*, a China Communist Party publication, highlights (in Chinese) how the state-owned China Guodian Corporation’s De Aar Wind Farm project in South Africa offered comprehensive services, from the preliminary work of wind measurements, environmental assessment, and land leases, to bidding, financing, construction, installation, and final project inspection and acceptance.⁴⁰ Liberia, however, chose a resolutely different path, seeing merits in aid fragmentation (despite increasing direct and indirect transaction costs), if strategically managed.⁴¹

It is important to point out that Liberia's decision not to work with China on the Mount Coffee rehabilitation project did not imply a general snubbing of China, or its exclusion from many other important infrastructure projects. Since re-establishing diplomatic relations in 2003, a slew of grants were signed for a range of initiatives (see Table 6). The amount of the grants offered by China to Liberia is unusual considering what other African countries have received.⁴² Cumulative grant amounts from 2003 to 2015 exceeded US\$110 million. However, even when budgets were tightened in 2015 due to the Ebola epidemic, Liberia opted to request additional funding from existing financiers for the Mount Coffee HPP.

Are Chinese companies intrinsically incapable or unwilling to build high-ESA-performing HPPs, or do Chinese financiers have a penchant for low-ESA-performing projects? Past records show this is clearly not the case: Bankasoka and Gouina are run-of-the-river HPPs in Sierra Leone and Mali, respectively. Bankasoka was financed jointly by the UN Industrial Development Organization and the Chinese government and contracted to Hunan Construction Engineering Group Cooperation; Gouina was financed solely by China Eximbank and constructed by Sinohydro. Sondu-Miri in Kenya is another run-of-the-river HPP financed by Japan and contracted to Sinohydro. However, as the Mount Coffee case demonstrates, *ceteris paribus*, the host country chooses the better financing offers available, and that often means OECD financiers.

As Chinese financiers and contractors gain market share in HPPs in developing countries, concerns regarding funding practices and a disregard for the environmental and social impact of the projects will continue to be of relevance, independent even of the geopolitical developments that might also play into critiques of Beijing. But as this essay has shown, the question of who gets which contracts is more than a competition between cheap and easy Chinese financing and expertise versus more expensive but more socially and environmentally responsible Western assistance. The analysis presented draws attention to the agency of African states and their own strategic considerations as they play various development partners against each other. Indeed, competition in development financing allows us to observe formerly latent agentic behavior from the host country, independent of the preferences of the financiers (whether Western or Chinese). Prior to the 2000s, there were no meaningful alternatives to OECD creditors/donors, and discussions about host country agency vis-à-vis financiers were mostly a hypothesis without empirical data. The entry of China into the world of development finance allows us to observe host country agency in action, not unlike during the Cold War. The Mount Coffee story underlines that host government administrative capacity is crucial for strategic allocation of financing and, therefore, how seriously the concern over growing water scarcity in the age of climate change will be taken. The ability to navigate the comparatively more fragmented financing from OECD sources decreases the desirability of Chinese loan financ-

Table 6
Chinese Official Grants and Zero-Interest Loans to Liberia, 2005 – 2018

Signing Year	Type of Financing	Project	US\$ Millions Equivalent, Unadjusted
Dec. 2005	Grant	Agricultural equipment	\$1
Jan. 2006	Grant	Unknown	\$2.5 (CNY 20)
	Zero-interest loan	SKD Sports Complex renovation and other projects	\$5 (ten-year maturity, five-year grace, due 2021)
Oct. 2006	Grant	SKD Sports Complex renovation; Foreign Ministry building renovation	\$5
Nov. 2006	Grant	Renovation of national broadcasting (LBS) station	\$4
Dec. 2007	Grant	Fendell Campus of University of Liberia	\$20
Jul. 2009	Grant	Ministry of Health and Social Welfare building construction; purchase of anti-malarial drugs	\$10 (CNY 70)
Dec. 2009	Grant	Unknown	Not applicable
Apr. 2010	Grant	Unknown	\$9 (CNY 60)
	Grant	Medical supplies for Tappita Hospital	\$1.5 (CNY 10)
	Grant	Medical equipment for anti-malarial treatment center	\$0.2 (CNY 1.5)
	Grant	Anti-malarial drugs	\$1.4 (CNY 3)
Dec. 2010	Grant	Unknown	\$3 (CNY 20)
Mar. 2011	Grant	Fifty boreholes; installation of traffic lights	\$8 (CNY 50)
May 2013	Grant	Monrovia Vocational Training Center	\$10

Table continued on the following page.

Nov. 2013	Grant	SKD Sports Complex; Monrovia Vocational Training Center; ministerial building complex	\$36
Apr. 2015	Grant	Ebola medication	\$0.2
	Grant	LBS technical assistance	\$1 (CNY 6.5)
Mar. 2018	Grant	SKD Sports Complex; LBS, and National Clinical Reference Laboratory	Unknown

Source: Author’s compilation; and Deborah Brautigam, Jyhjong Hwang, Jordan Link, and Kevin Acker, “Chinese Loans to Africa Database” (Washington, D.C.: China Africa Research Initiative, Johns Hopkins University School of Advanced International Studies, 2020), <http://www.sais-cari.org/data>.

ing as a singular source for dam and irrigation projects. The empirical outcome that seems to associate Chinese financed and contracted projects with higher ESI is a case of self-selection; OECD financiers compete harder for a smaller range of high-ESI projects than Chinese financiers. Chinese contractors are interested in all contracts, both low- and high-ESI ones, and will accord similar efforts to winning both types of contracts. In contrast, OECD financiers have fewer projects that they can finance due to ESI concerns, and thus focus comparatively more of their capacity to accessing projects that are low impact only, including offering better grant-element financing. One implication from this observation is that asking China to finance more low-impact projects may only increase competition for projects that are already heavily competed after, with unclear benefits to the host country.

As far as Chinese contractors are concerned, their priority is to acquire contracts. The competition can sometimes turn ugly even between Chinese contractors.⁴³ If they can win high-ESA-performing contracts, fine; if not, they will take other contracts. While they are capable of taking high-ESA-performing projects, that is in fact not what the companies themselves consider to be their areas of comparative advantage.⁴⁴ In an article by researcher Lizhi Zhou at the State Grid Corporation of China’s South Africa office, it is argued that Chinese companies have clear advantages in development HPPs in Africa in two particular areas: 1) prodigious experience in planning, construction, and technical expertise, as well as management across these areas; and 2) construction costs are generally lower compared to that of contractors from other countries, “sometimes 20% – 30% lower than those from Western countries.”⁴⁵ This article was published in

Chinese, by the largest state-owned electric utility company in China, with Chinese companies as the intended audience.

This self-image of having high technical ability accompanied by low cost is shared by Chinese hydropower construction companies. State-owned Assets Supervision and Administration Commission issued a press release in 2006 highlighting Sinohydro's progress in African hydropower, particularly in the company's ability to streamline bidding, financing, and construction. The article further states that Sinohydro targets "large projects, large markets," particularly projects with a higher impact on the country or the region.⁴⁶ By the 2010s, interest in smaller HPPs among Chinese companies was also increasing. In an interview with experts at the International Center on Small Hydropower, a research group jointly managed by China's Ministry of Commerce and Ministry of Water Resources, they emphasized that small hydroprojects are uniquely suitable for Africa due to their low entry cost, and Chinese companies have technical and cost advantages in developing small African hydroprojects. In other words, the shift toward smaller projects is less a reaction to ESI concerns, and more a cost-reducing solution.⁴⁷ While the Chinese government is increasingly aware of the environmental impacts of their projects, the rhetoric remains that hydropower is a relatively cheap and clean energy source.⁴⁸

The case of the Mount Coffee HPP demonstrates that, despite the apparent power asymmetry between financiers and the host country, given sufficient competition in both financing sources and host country capacity, a host country can exercise agency to maximize their domestic and international interests. Not all offers need to be accepted. This is a different story than the one popularized in the Western media, where African states are either gullible or desperate enough to take any Chinese financing or investment coming their way, while comparatively cash-strapped OECD financiers wring their hands. This story ended with the host country allocating available financing the way they preferred, and in a way that is not preferred by either the OECD or Chinese partners. If Chinese partners had any say, they would get the contract if not also the financing opportunity for the Mount Coffee HPP; if OECD actors had any say, they would prefer that Liberia use the flexible Chinese grants on something other than stadiums. Yet competition in development financing and the Liberian government's own negotiating capacity meant that Liberia had the final say, and both the HPP and the stadium were financed.

Water security is a multisectoral challenge for developing countries, encompassing agriculture, health, and energy. However, understanding the future of water security is not just about highlighting why water security is important, or even which policies will best achieve that. It is also about understanding the domestic and international factors that permit or constraint the host countries' abilities to

respond and prioritize resources. These factors, being intimately tied to preferences and perceptions, are often only best known by the host countries themselves.

Given the importance of competition for host country agency, the gradual re-entry of the World Bank into HPPs since the WDC may prove beneficial in the long run. The World Bank's Dams and Development Project (DDP), particularly the fourth DDP forum in 2005, stressed the importance of moving on from "polarized discussion on whether to build dams or not to a more constructive discussion about how to build 'good' dams if they emerge as the best option." Competition cannot be achieved by replacing one monopoly with another, and having a competitive alternative to Chinese financiers and contractors will offer more choices for host countries to exercise their agency. The growing demand for small HPPs from host countries may be a chance for both OECD and Chinese actors to cooperate, combining stringent ESA and better financing terms with low cost and quick delivery.

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Between Principles & Power: Water Law Principles & the Governance of Water in Post-Apartheid South Africa

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Debates over the management and allocation of water in the postcolonial era, and in post-apartheid South Africa in particular, reveal that struggles over water resources in Southern Africa occur within three broad frames: the institutional, the hydrological, and the ideological. Each of these realms reflects tensions in the relationship between power and principle that continue to mark the governance of water. Each perspective offers a way to understand the use and the limits of law in the management of a country's water resources. The existence of explicit principles, whether as policy guidelines, constitutional rights, or in the language of regional and international agreements, provides two important resources for those who struggle for access to water. First, a vision of a more just allocation of this fundamental resource and, second, an articulation of common benchmarks to which states and governments might be held to account.

Southern Africa is a drought zone in which there is a regular oscillation between decades of wet and dry climates. This ecological pattern is exacerbated by a settler-colonial history in which the discovery of rich mineral deposits on the high plateau at the center of South Africa produced an industrial heartland at some distance from all the major rivers or other sources of water. Apartheid and the destabilization of the region by the defenders of White supremacy further exacerbated the uneven development that has left an infrastructural legacy of extreme racial and regional inequality. At the same time, the promise of a democratic South Africa, as envisioned by local and international interlocutors in the early 1990s, led many to assume that an opportunity to address the legacies of colonialism and armed conflict in the region was at hand.¹ One sign of this optimism was an embrace of the idea of principles, whether framed in the language of human rights or as the premise of negotiations or constitutional solutions. By the end of the 1980s, this adoption of principles became a feature of the democratic transitions in Namibia and South Africa. A significant legacy of this embrace was the application of principles to the reordering of South Africa's water laws.

This essay explores both the power of principles to reformulate existing legal distributions of water in South Africa as well as the limits of this practice in the transnational context of Southern Africa's water resources. On the one hand, principles served to justify domestic legal reform, while on the other hand, the idea of principles is central to international legal regimes addressing crossboundary waters, environmental sustainability, and climate change.² Legal principles in these contexts do not carry the force of law but rather shape the development and interpretation of legal formulations, agreements, and instruments, including constitutions, statutes, and regulatory processes. At the international level, two principles – equitable utilization and no significant harm – provide a broad framework for interstate cooperation and conflict resolution. But principles do not remain static, and the rise of neoliberalism and its seeming dominance in the post-Cold War era introduced countervailing principles of commodification.³ Thus, the embrace of principles was not confined to human rights, and the “triumph” of neoliberalism saw market-based principles enter debates over access to water, whether through notions of private efficiency over bureaucratic government services or in the costing of essential services justified by the principle of cost recovery.

If access to water in South Africa was historically based on statutory law, premised on the colonial dispossession of land and imported European rules of water law, the existing regional agreements were the product of both intercolonial relations and the apartheid regime's attempts to protect White rule through the establishment of uneven economic and security relations with the independent states in the region.⁴ By contrast, the emergence of a democratic South Africa, which coincided with the “triumph” of human rights principles at the end of the Cold War, promised, according to the statement of principles in the Harare Declaration adopted by the Organization of African Unity, that the country “shall respect the rights and sovereignty and territorial integrity of all countries and pursue a policy of peace, friendship and mutually beneficial co-operation with all peoples.”⁵ If appeal to principle, whether human rights or constitutional principles, served to enable the democratic transition, the new democratic government's resort to the elaboration of principles to justify legal reform, including in the regulation of water, allowed the drafters to give prominence to principles of need and equitable access. Yet at the same time, countervailing principles of beneficial use, efficiency, and cost recovery remained part of the debate.⁶ However, in the last decade, the crumbling of existing infrastructure and the impact of climate change – intensifying existing patterns of climate variability, with prolonged droughts and more intense cyclones – have exacerbated fears over the supply of water in South Africa and the region. On the one hand, there was the doomsday fear of “Day Zero,” which gripped the Cape Town metropolitan area in late 2017 when drought left area dams at dangerously low levels and, on the other hand, there is the increasing

intensity of cyclones out of the Indian Ocean – Idai and Kenneth in 2019 and Eloise in 2021 – producing severe flooding from Mozambique to the interior of the region.

Both national and international rules of law, based on principles of human rights and equitable distribution, formally govern the allocation of water in post-apartheid South Africa and the region. However, this essay will demonstrate that access to water in this drought-prone region remains in continuing tension between principle and power. This tension exists both in the formal agreements governing access to water between the member states of Southern Africa and in the practices of power that control how these agreements are implemented. This, however, is not simply a reflection of uneven national power since the same tension exists between the principles adopted to frame South Africa's post-apartheid water laws and the practices of governance over water that continue to determine access to water among communities and economic interests in South Africa.⁷ This essay will reflect on the potential for communities and even nations to deploy the principles of water law once adopted by Nelson Mandela's cabinet to argue for a more just distribution of this essential resource.

The allocation of water in Southern Africa is rooted in the region's history of settler-colonialism.⁸ This is a legacy that was founded on the dispossession of land and the adoption of rules of European law that benefited the settler regime. While initially based on individual decrees or *placaaten*, the early colonial government soon asserted the doctrine of *dominus fluminis*, giving the Dutch East India Company, as the governing authority, the power to control the allocation and use of water resources in the colony.⁹ However, within this legal regime, the hydrological distinction between perennial and intermittent streams inscribed a significant distinction between public and private waters, providing the first linkage between rights to land and access to water. The 1906 Cape Irrigation Act abolished this distinction, but by then, the introduction of the English law of riparian rights had established a more direct link between ownership of land and access to water.¹⁰

After two centuries of dispossession through war, occupation, and economic imperatives – primarily through the reliance on land for credit – the 1913 Land Act prohibited the African majority from holding property rights in all but 13 percent of the country's land mass. Thus, in the British-controlled settler-colonies of Southern Africa, the land rights of White settlers on riparian land became the common law basis for gaining priority rights to water. However, the belief that groundwater was independent of surface water and that a landowner's rights extended, within the bounds of the land, from the center of the earth to the heavens above meant that groundwater became the private property of the landowner. Given that access to water, especially in the dry interior of the country, relied pri-

marily on access to groundwater, a significant source of water was legally considered to be private property.¹¹ For example, as late as 1990, the Winterveld “squatter” area north of Pretoria, with a population of over 100,000 people, “had no public water supply,” so people had to purchase water, which could “be more than thirty times as expensive as urban water.”¹²

The adoption of the 1956 Water Act by the apartheid regime restricted the legal regime of water.¹³ This new statutory regime, which was devised to address the needs of an industrializing economy and the mining industry as well as expanding urban centers, empowered the state to override riparian rights by declaring “control areas” in which the allocation of water resources would be determined by the state. While the statute enabled the state to dictate the allocation of water, it also entrenched the riparian system outside of designated control areas and continued to recognize the private ownership of underground water. Significantly, the 1956 Act provided that the specific allocation of water according to the riparian rights of a property owner would be determined by the Water Court and while approximately 20 percent of riparian rights had been determined by the early 1990s, the vast bulk of water accessed by riparian owners was based on an informal recognition of their riparian rights by local water boards. In an economy dominated by mining and agriculture, approximately 60 percent of water is used by organized agriculture, 8 percent by mining and industry, and 27 percent for urban and domestic use.¹⁴ One legacy of one hundred years of deep-level mining is acid mine drainage, which threatens to pollute already limited water resources.¹⁵ Outside of agriculture, the bulk of water for industrial and urban users falls under the control of different state-regulated water institutions such as the Rand Water Board, which provides water to the country’s major metropolitan area with Johannesburg at its center.

Nelson Mandela appointed Kader Asmal as Minister of Water Affairs and Forestry in South Africa’s first democratic government. Asmal, a longtime anti-apartheid activist and member of the African National Congress (ANC) Constitution Committee who had taught international law at Trinity College in Ireland during his exile and would later chair the World Commission on Dams, immediately called for a review of the Water Act.¹⁶ The statute, he argued, perpetuated the connection between land rights and access to water, which privileged the White minority. The water review process, beginning in mid-1995, soon recognized that any new water law would need to incorporate a more modern understanding of the hydrology of water, especially the idea of a unified water cycle. The initial response from lawyers and administrators within the Department of Water Affairs was that the 1956 Act did not need reforming since it provided the state with adequate power to oversee the country’s water resources. This view was challenged by the new leadership, who decided that formulating and adopting a

set of principles was the best way forward. A process of information-gathering and debate within the department and with interested constituencies produced a set of water law principles by April 1996. These twenty-seven principles were included in the government's 1997 white paper and informed the drafting of the 1997 Water Services Act and the 1998 National Water Act.¹⁷

In his preface to the discussion document publicizing the principles, Asmal noted that "few aspects of our common life in South Africa can be more important than water." He argued that the "law should always be changing as we gain greater scientific understanding of our surroundings, as our economy and technology develops, and as our society changes."¹⁸ Calling for comments on the draft principles, Asmal stated that he knew "that a new water law will only be effective if it reflects the wisdom and enjoys the support of the majority of South Africans and is well understood by them."¹⁹ These statements reflected the ANC's electoral promises contained in its Reconstruction and Development Programme, which in its section on meeting basic needs argued that "a programme of affirmative action must address the deliberate marginalization from economic, political and social power of black people, women, and rural communities."²⁰ The document's section on water and sanitation noted that "more than 12 million people do not have access to clean drinking water and 21 million people do not have adequate sanitation."²¹ With this background, the document stated that the "fundamental principle of our water resources policy is the right to access clean water – 'water security for all'" and defined its "long-term goal [as providing] . . . every South African with accessible water and sanitation."²²

Asmal's preface, and its framing of the role the water law principles would play, reveals how principles, as the entry point to legal change, were understood in this period. The ANC had begun its constitutional campaign in 1988 by issuing a set of principles entitled "Constitutional Guidelines for a Democratic South Africa" and the democratically elected Constituent Assembly drawing up the country's final post-apartheid constitution was, by agreement of the parties, bound by thirty-four constitutional principles.²³ The power of principles lies in their ability to be both general enough to cover a broad field of issues, and ambiguous enough so that the contending parties could each imagine some version of their own preferences reflected in the principles. While appeal to principle has a long history in constitutional negotiations, the turn to principle in the water law review process reflected real concerns that vested interests would frustrate the needed changes being sought by Mandela's government.

While South Africa had held its first democratic election, the economically powerful White minority feared the changes that Mandela's government might embark upon to dismantle apartheid, which remained a geographic and economic reality. Thus, principles presented in the discussion document, and later adopted by Mandela's cabinet, sought to manage numerous potential points of conflict.²⁴

First, there was the claim by landowners that any change to water rights would violate their newly enshrined constitutional rights to property. This assertion of rights was based both on the continued recognition of riparian rights in the 1956 Act as well as the more specific claim of private property rights to groundwater. Second, with the creation of nine new regions, the question of how water should be governed remained fraught, even though the interim constitution of 1993 did not assign legislative competence over water resources to the provinces. Despite the implied allocation of legislative authority over water to parliament and the national government, the grant to provinces of primary authority to legislate over agriculture, environment, regional planning and development, soil conservation, and urban and rural development complicated the governance of water resources, even after it was reformulated into a system of cooperative governance in the final 1996 constitution. Finally, since South Africa's major water ways either begin or enter the oceans on the borders or even within the territories of neighboring nations, there was a need to articulate the principles that would guide the reform of these relationships, especially agreements that had previously been formulated within the context of the apartheid regime's policies of regional aggression and dominance. While these issues presented significant concerns for the reform process, the reliance on principles would keep them within the legislative process with very little, if any, public disagreement or protest.

The first issue facing the Water Review Panel was the assumption that the 1956 statute and the recognition of property rights in the new post-apartheid constitutional order would hamper any reallocation of water. If all existing claims to water rights had been recognized, it would have posed a significant constraint on land reform and other efforts to address the vast racial inequalities bequeathed by South Africa's history of colonialism and apartheid. To respond to this concern, the panel first considered and questioned the hydrological assumptions of the 1956 Act, especially the notion that groundwater was distinct from surface water. Instead, the panel focused on the "natural laws of the world we find ourselves in," arguing that the "water cycle is indivisible" in that water is "continuously moving ... [and] changing its state between a liquid, a gas and a solid."²⁵ Recognizing that in some circumstances it might be "trapped in rocks deep below the earth's surface," the panel argued that water "is continuously moving, even though in some cases it may move very slowly over millions of years."²⁶ The panel also pointed out that apart from the fact that "different parts of the cycle influence each other," human activity, especially technological developments such as "high yielding, deep level ground water pumps" and different land uses, has significant implications for the regulation of water and concluded that "as our understanding of the water cycle increases, so the law relating to water needs to be progressively amended to reflect what we know to be the physical reality."²⁷ Following these conclusions, the panel proposed its first principle: "in a relatively arid country such as South

Africa, it is necessary to recognize the unity of the water cycle and the interdependence of its elements, where evaporation, clouds and rainfall are linked to underground water, rivers, lakes, wetlands, estuaries and the sea.”²⁸

Acceptance of this first principle, grounded in hydrology rather than policy choices, gave the panel a basis to critique the 1956 statute and especially its recognition of “many different legal categories of water including the distinction between private and public water.”²⁹ Noting that the “different categories of water deny the physical reality that all water is inter-related” and, if these categories were to be maintained, they “would greatly hinder effective management,” the panel proposed three principles on the “legal aspects of water.”³⁰ The first of these legal principles stated that “all water, wherever it occurs in the water cycle, is a resource common to all, the use of which should be subject to national control” and thus “all water should have a consistent status in law, irrespective of where it occurs.”³¹ The second legal principle specified that “there shall be no ownership of water but only a right to its use,” and the third principle addressed the issue of riparian rights by arguing that “the location of the water resources in relation to land should not in itself confer preferential rights to usage.”³² Although the implication of these last two principles for legal reform was profound, the panel sought to limit any opposition by pointing out that while “there is a widespread public misconception that ‘private’ water is actually the property of the land owner . . . this is not true.”³³ Instead, the panel noted that while “people may have an exclusive right to the use of water, . . . it can never be ‘owned’ as it passes through a particular point on its continuous journey through the water cycle.”³⁴ Finally, on the question of the riparian principle, the panel stated that “there are many thousands of farmers and other people in the country who do not own riparian land and a fairer way of allocating water needs to be found.”³⁵

Having questioned the scientific basis of the existing law and proposed basic principles for legal reform, the panel then turned to the question of governance, proposing three sets of principles to address water resource management priorities, approaches, and institutions. The five principles defining the priorities of water resource management recognized three different dimensions to the issue of priority. First, a general objective “to achieve optimum long term social and economic benefit for society.”³⁶ Second, the concept of a reserve, whether to meet basic needs or to maintain ecological functions. And third, the principle that “international water resources, specifically shared river systems, should be managed in a manner that will optimize the benefits for all parties in a spirit of mutual cooperation.”³⁷ Of these three dimensions, the idea of a “reserve” was the most innovative and contained important implications for the prioritization of access to water.

The designation of a reserve required the division of the resource into three distinct categories. First, that a proportion of the water resource, defined as the

“quantity, quality and reliability of water required to maintain the ecological functions on which humans depend,” “should be reserved so that the human use of water does not individually or cumulatively compromise the long term sustainability of aquatic and associated ecosystems.”³⁸ Second, that “water required to meet peoples’ basic domestic needs should be reserved.” While the panel argued that these first two categories, which made up the reserve, “should enjoy priority of use,” the third category, containing all the remaining water (designated as utilizable water), defined what was available for all other uses.

The second set of governance principles focused on approaches to water resource management and began with the assumption that “where resources are limited and the competition is increasing, some party has to have oversight and custodianship over water.”³⁹ While denying that this meant that the “government is the legal owner of water,” the panel maintained that the government “is the overall manager of water.”⁴⁰ Thus, the first principle of governance was that “the national government is the custodian of the nation’s water resources, as an indivisible national asset, and has ultimate responsibility for, and authority over, water resource management, the equitable allocation and usage of water, the transfer of water between catchments and international water matters.”⁴¹ In carrying out this authority, the “development, apportionment and management of water resources should,” according to the second principle, “be carried out using the criteria of public interest, sustainability, equity and efficiency of use in a manner which reflects the value of water to society while ensuring that basic domestic needs, the requirements of the environment and international obligations are met.”⁴²

Turning to more specific aspects of water management, the principles noted that “water quality and quantity are interdependent and should be managed in an integrated manner.”⁴³ Furthermore, while “water resource development and supply . . . should be managed in a manner . . . consistent with broader environmental management approaches,” the “quality management options should include the use of economic incentives and penalties to reduce pollution” even as “the possibility of irretrievable environmental degradation . . . should be prevented.”⁴⁴ This turn to economic considerations is also reflected in the remaining principles on the approach to water management, with the panel stating that “the conditions subject to which water rights are allocated should take into consideration the investment made by the user in developing infrastructure to be able to use the water” as well as a requirement that “rights to the use of water should be allocated in good time and in a manner which is clear, secure and predictable in respect of the assurance of availability, extent and duration of use.”⁴⁵ Finally, the panel recognized that “land uses have a significant impact upon the water cycle” and thus the “regulation of land use should, where appropriate, be used as an instrument to manage water resources.”⁴⁶

The final set of governance principles proposed by the panel focused on water institutions. While the panel had clearly stated that the national government is the custodian of the nation's water, the essential institutional principle articulated by the panel asserted that the "institutional framework . . . should be self-driven, minimize the necessity for state intervention, and should provide for a right of appeal to or review by an independent tribunal in respect of any disputed decision made under the water law."⁴⁷ Management itself, whether in the development or apportionment of the "available water resources," the principles stated, "should, where possible, be delegated to a catchment or regional level in such a manner as to enable interested parties to participate and reach consensus."⁴⁸ Furthermore, the principles specified that "beneficiaries of the water management system should contribute to the cost of its establishment and maintenance."⁴⁹ While this inclusion of a cost-recovery principle was not challenged, the panel did signal that a proposed principle "relating to enforcement and quantification of water rights," which stated that "efficient enforcement is dependent on the speedy quantification of as yet undetermined water rights and the proper registration of all water rights, including existing rights . . . should take place systematically over as short a period as available finances will allow," had been objected to since it presumed a "specific approach to the future administration of water rights that may not in fact be chosen."⁵⁰

This tension over claims to "existing rights" was addressed in a separate principle that first recognized that "lawful existing water rights should be protected, subject to the public interest requirement to provide for the Reserve . . . [and when] reduced or taken away, compensation should be paid."⁵¹ However, the principle also made clear that an "existing right should not include a right which remains unquantified and unexercised at the time of the first publication of these principles."⁵² As the panel explained, "in introducing any new system, clear principles guiding the transition from what is currently in place to new arrangements have to be in place" and that the "exclusion of rights which have not been allocated or exercised at the time of the first publication of these principles is to prevent a rash of speculative developments in order to entrench or establish new rights or to attract compensation."⁵³

The final set of principles, while "distinct from the development and management of water resources," was a direct response to the incorporation of a right to water in South Africa's final constitution, which was being debated in the Constituent Assembly as the panel completed the draft water law principles.⁵⁴ South Africa's 1996 constitution makes two references to water. First, in an exception to the other provisions of the property clause, section 25(8) of the Bill of Rights provides that "no provision of [the property clause] . . . may impede the state from taking legislative and other measures to achieve land, water and related reform, in order to redress the results of past racial discrimination."⁵⁵ Second, section 27(1)

states explicitly that “everyone has the right to have access to,” among other social and economic benefits, “sufficient food and water.”⁵⁶ The panel articulated this guarantee in a principle stating that the “right of all citizens to have access to basic water services (the provision of potable water supply and the removal and disposal of human excreta and waste water) necessary to afford them a healthy environment on an equitable and economically and environmentally sustainable basis should be supported.”⁵⁷ While the panel qualified this principle by noting that “the question of rights to water supply is not the same as the right to the use of water,” it went on in two further principles to state that “water services should be provided in a manner consistent with the goals of water resource management” and that “where water services are provided in a monopoly situation, the interests of the individual consumer and the wider public must be protected and the broad goals of public policy promoted.”⁵⁸

To promote the principles and to address the concern of existing stakeholders, the Department of Water Affairs and Forestry organized a National Consultative Conference in October 1996 at which the constitutional and policy dimensions of the principles were debated.⁵⁹ By this time, while those who claimed water as a property right remained unhappy, it was becoming increasingly clear that the constitutional prerogative, combined with a more scientific understanding of water as a resource, meant that the shift from riparian rights and private claims to ground and surplus water to an administrative system of water allocation was a foregone conclusion. When the Department of Water Affairs and Forestry published its white paper on National Water Policy in 1997, the principles, with small modifications, were included, adopted by Mandela’s cabinet, and retitled “Fundamental Principles and Objectives for a New Water Law in South Africa.” The most significant change was that instead of beginning with the water cycle, which had justified a fundamentally new approach to water law, the principles now led with the “legal aspects of water,” which began with an overall statement that “The water law shall be subject to and consistent with the Constitution in all matters including the determination of the public interest and the rights and obligations of all parties, public and private” and that “while taking cognisance of existing uses, the water law will actively promote the values enshrined in the Bill of Rights.”⁶⁰ In a major legal reform, the Mandela government then proposed, and Parliament adopted, two new water laws: the 1997 Water Services Act and the 1998 National Water Resources Act.

A significant and rather counterintuitive aspect of the history of the water law principles is that they emerged out of a domestic process focused on addressing the legacies of apartheid and were subject to no obvious external influence even as its drafters drew on international experience.⁶¹ Furthermore, some may argue that when Kader Asmal was made Chair of the World Commission on Dams in 1997, these principles were already part of his own human rights approach to is-

sues of water resource management, informing his understanding of the complex issue of dams as expressed in his preface to the report.⁶² Thus, even as ANC macro-economic policy was responding to international economic pressures and shifting from the Reconstruction and Development Programme to the more neoliberal Growth, Employment and Redistribution policy, the water law reform process continued through the legislature based on the principles.⁶³ It was the implementation of the new water laws that brought criticism and legal challenges from activists, who argued that the government was not delivering on the political and constitutional promise of access to water.⁶⁴

While the principles adopted by both the water law reformers and the South African government provided a potentially enlightened and equitable vision for the allocation of precious water resources in Southern Africa, powerful interests, whether private or national, continue to drive the allocation and use of water resources a quarter-century later. On the one hand, the powerful mining industry continues to function in a separate realm, while agricultural interests allocate water in an unofficial market of local arrangements.⁶⁵ It is only in the rare case when government has attempted to intervene that there have been challenges to the new legal order.⁶⁶ This outcome may best be described as a function of two different dynamics. First, even among the reformers, as is evident from some aspects of the principles, there were tensions and contradictions in their vision of how water resources should be managed. While they could agree that rights to water were not property rights per se, the inclusion of imperatives such as cost recovery and local control introduced countervailing pressures. Presented as enhancing sustainable management of the resource, principles such as delegation to catchment or regional-level management and cost recovery also reflected an approach to management in which national authority would seek to delegate its power to local interests who were expected to resolve their conflicts and cover the costs of management despite the continued existence of vast inequities in resources and capacity at that level of governance. Second, the arid nature of the region and the structural inequalities between neighboring countries in the region mean that the imperatives of the region's most significant industrial and urban conglomeration, Gauteng province, seem to dominate regional arrangements, whether it is the need for water itself or electric power that has its own impact on the region's water resources.

Water managers in South Africa and academic critics have recognized that the ambitious policy goals of the new water laws adopted by Mandela's government are only partially reflected in the allocation and use of water today, producing a significant gap between the law on the books and the law in action.⁶⁷ From different perspectives, these analysts collectively identify elements they consider responsible for this gap, although they often disagree about the causes or possible

solutions needed to secure sustainable access to water. Reviewing the debates over the management and allocation of water in the postcolonial era reveals that struggles over water resources in the region occur within three broad frames: the institutional, the hydrological, and the ideological. Each of these realms reflects tensions in the relationship between power and principle that continue to mark the governance of water in South Africa. Each perspective offers a way to understand the use and the limits of law in the management of the country's water resources.

Hydrology served as the entry point for the reform of South Africa's water law in the post-apartheid era, making it possible to agree on a new set of principles that reflected a scientifically more valid understanding of the water resource. There is also wide agreement that the region, and particularly South Africa as the largest user of water in the region, is in a semiarid zone and that global climate change will impact water resources. There is, however, real debate about both the possible impact of climate change and whether the problem of access to water is an issue of scarcity or management. While most commentators emphasize scarcity, Mike Muller, the first post-apartheid Director-General of the Department of Water Affairs, argues that "South Africa's not yet confronting an absolute water shortage ... [rather] the extent of public panic suggests a disturbing level of ignorance about how water is made available and what needs to be done to ensure adequate and reliable supplies."⁶⁸ For Muller, "the key to ... water security is for government and citizens to understand and manage what the country has."⁶⁹

While concern over future water sources may dominate the hydrological debate, there is much greater consensus over the institutional failings that are blamed for the increasing cascade of problems, whether in the form of collapsing water systems, uncontrolled pollution, or the failure to provide the constitutionally promised water to meet basic needs. Most commentators argue that while the law itself might provide a good legal framework for the management of water resources, the lack of institutional capacity, especially at the local government level and in the water catchment institutions created by the law, continues to frustrate the achievement of the law's goals. As Barbara Schreiner, a former Deputy Director-General of Policy, and environmental economist Rashid Hassan argue, "there are major challenges in implementation arising ... from lack of capacity, over-ambitious and highly technical interpretation of policy, and the desire to do too much at one time."⁷⁰ Despite these difficulties, it seemed in the first decade of the new democracy that the state was making real progress, when the "proportion of households having access to clean water increased from 60% in 1996 to 85% in 2001," which translated to "about 3.7 million additional households gaining access to water between 1995 and 2003."⁷¹ However, as Muller noted in 2016, "the number of people whose taps no longer provide a reliable water supply grew by almost 2 million between 2011 to 2015," a failure he attributed to "state capture by a corrupt elite."⁷²

From an ideological perspective, debates over access to water and the management of water resources reflect the late-twentieth-century tension between neoliberalism and human rights. On the one hand, a fidelity to human rights, expressed in the constitutional protection of a right to sufficient water, saw a commitment in the principles to set aside a portion of the resource for basic human needs and the publication by the Department of Water Affairs of a guideline for the implementation by local authorities of free basic water.⁷³ On the other hand, the principles also provided that “beneficiaries of the water management system should contribute to the cost of its establishment and maintenance.” Even as the principles stated that “there shall be no ownership of water,” the recognition that there is a “right to its use” and that “beneficiaries . . . should contribute to the cost” provided space for those who continued to argue that the best way to manage water is through its commodification and the establishment of water markets. In the furtherance of this neoliberal perspective, South Africa’s Free Market Foundation published an extensive analysis of the allocation of water, concluding that the National Water Act, with its emphasis on the government serving as the “public trustee of the nation’s water resources” and giving the government “the power to regulate the use, flow and control of all water in the Republic,” meant that the “efficient use of water was unlikely to occur in the future.”⁷⁴ They concluded that it was “unlikely that water will be allocated efficiently, since uncertainty over institutional constraints will encourage power struggles and rent-seeking behaviour.”⁷⁵

Despite the existence of model policies and legislation, there is widespread agreement that there have been severe shortcomings in the implementation of the country’s post-apartheid water regime. As a result, subsequent ministers have sought to update government policies, such as the Free Basic Water policy and changes in the system of local government after 1999, to account for such developments.⁷⁶ However, when a new Minister of Water Affairs, Nomvula Mokonyane, suggested reforming the existing water laws, the response was that “South Africa needs good water management – not new water laws.”⁷⁷ Public criticism of the implementation of the existing law pointed out that “despite a great deal of talk,” the new institutions required for water management, while “provided for in existing legislation,” had “not yet been set up” and “even routine parts of the existing law had not been complied with.”⁷⁸ Most recently, the Department of Water Affairs has been restructured as part of a new Ministry of Human Settlements, Water and Sanitation under Minister Lindiwe Sisulu, and President Cyril Ramaphosa has announced that water infrastructure will be a significant part of the country’s new Economic Reconstruction and Recovery Plan response to the COVID-19 economic contraction.⁷⁹

The struggle for access to water in South Africa provides an important lens through which to view the relationship between the advocacy of principle, law, and the problem of power, whether in the context of institutions or

ideological competition. At the transnational level, a democratic post-apartheid state, following the principles it has endorsed, became a member of the Southern African Development Community (SADC), which has a regional water policy and strategy. In conformity with this new approach, South Africa ratified both the Revised SADC Protocol on Shared Watercourses and the 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses.⁸⁰ While these regional and international agreements commit participants to the “equitable and reasonable utilization” of shared water resources, the implementation is left to specific basin-wide agreements. Much like the principles, it is the interaction between these agreements and domestic law and practice that reveals the limits of the system. As international relations scholar Reginald Tekateka points out, the “tendency of the new domestic water laws is the devolution of water management to the lowest possible levels” and if domestic law does not effectively empower “authorities to regulate the allocation of water, it would not be possible to prevent water users from using as much water as they like with the possible result being that South African users use more water than allocated . . . as its agreed share.”⁸¹

These same tensions exist in the relationship between the principled commitment to provide sufficient access to water and its constitutional enshrinement. Even as the new democratic state first prided itself on expanding access to water, civil society and social movements went to court to argue that the state was failing to meet its constitutional obligations. Critics argued that despite the principles underlying the water laws, their implementation relied on a neoliberal cost-recovery model that failed to provide the basic needs guaranteed in the constitution and law, generating a new social movement that has resisted the imposition of these policies.⁸² While this ideological framing of the struggle over water often dominates debates, a closer examination reveals that the institutional and hydrological frames are equally significant. It has been the institutional failings, especially in the combination of devolving regulatory authority and a corresponding lack of local capacity to manage water resources, that have undermined the initial post-apartheid progress in the delivery of water services in the country.

Looking forward, the hydrological frame, which initially enabled a critique of the 1956 Act, will be central to the formulation of strategies to address climate change. While climate change is likely to exacerbate the region’s already highly variable climate patterns, extending periods of both severe drought and flood, the policy focus thus far seems to be on the possible competitive benefits of adaptation, by using the country’s natural endowments of sun and wind to accelerate a “green economy” into the future. Speaking at a meeting upon the release of a report by researchers at the South African Council for Industrial and Scientific Research, Blade Nzimande, Minister for Higher Education, Science and Technology, “said South Africa had a comparative advantage when it came to the production of renewable hydrogen and a unique competitive advantage in the production

of green powerfuels.”⁸³ The report acknowledged that the country’s “competitive advantages in the production of green hydrogen and associated powerfuels [would be] . . . based primarily on its wind and solar resources, which are superior to those in jurisdictions where demand [for powerfuels] is set to surge.”⁸⁴ While government and business imagine a prosperous export-oriented future based on abundant renewable electricity, it is the more immediate hydrological reality of uneven access to water that impacts the daily lives of most citizens.

The tension between principle and law inherent in the constitutional guarantee of access and the struggle for access were at the center of the most prominent water case to reach the courts in the post-apartheid era. Activists challenged the imposition of pre-paid meters used to recoup costs and called for the definition of a minimum core to the right to water. While the lower court issued an order declaring that the authorities were required to provide a minimum 50 liters of free basic water daily, the Constitutional Court upheld the local authority’s policy on the grounds that the city accepted its continuing obligation to progressively work toward achieving the rights of access to sufficient water. The court’s decision was premised on two arguments that go some way toward operationalizing the tension between principle and power that seems to pervade the governance of water, whether nationally or transnationally. First, the Constitutional Court argued that “fixing a quantified content might, in a rigid and counter-productive manner, prevent an analysis of context . . . [while] reasonableness places context at the centre of the enquiry and permits an assessment of context to determine whether a government programme is indeed reasonable.”⁸⁵ Second, that “ordinarily it is institutionally inappropriate for a court to determine precisely what the achievement of any particular social and economic right entails and what steps government should take to ensure the progressive realisation of the right.”⁸⁶ Instead, the court argued that “it is desirable as a matter of democratic accountability that [the government should first determine how to achieve these goals] . . . for it is its programmes and promises that are subjected to democratic popular choice.” Only if the government failed to act would the court be required to intervene.

In response to arguments by the litigants that the court’s failure to uphold their rights meant that it would be futile to bring socioeconomic cases to the courts, the court argued that on the contrary, the “case illustrates how litigation concerning social and economic rights can exact a detailed accounting from government and, in doing so, impact beneficially on the policy-making process” and that the city’s “continual revision of the policy [in response to the ongoing litigation] . . . improved the policy in a manner entirely consistent with an obligation of progressive realisation.”⁸⁷ It may be equally the case that the defining of principles of water law and management may not guarantee a more just distribution or access to water for the peoples of South or Southern Africa, however the existence of these principles, whether as policy guidelines, constitutional rights, or in the language

of regional and international agreements, provides two important resources for those who struggle for access to water. First, a vision of a more just allocation of this fundamental resource and, second, an articulation of common benchmarks to which states and governments might be held to account.

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Africa's Living Rivers: Managing for Sustainability

Jackie King & Cate Brown

Africa's human population is growing rapidly and is set to account for 40 percent of global numbers by 2100. Further development of its inland waters, to enhance water and energy security, is inevitable. Will it follow the development pathway of industrialized countries, often destructive of ecosystems, biodiversity, and river-dependent social structures, or can it chart a new way into the future based on global lessons of equity and sustainability? This essay tracks the global and African growth of the benefits and costs of water resource developments, explores the reasons for the costs, and offers insights on new scientific thinking that can help guide Africa to a more sustainable future.

Fresh water is a seriously limited and limiting resource. Of the 1.4 billion cubic kilometers of water on Earth, 97 percent is seawater with only limited potential for terrestrial use.¹ Two-thirds of the remainder is locked in ice caps and glaciers, and one-third is in liquid form, with most of this stored deep below the earth's surface in aquifers. The remaining liquid fraction, not much more than 200,000 cubic kilometers (0.014 percent of all water on Earth), is stored in freshwater ecosystems that occupy less than 1 percent of the earth's surface: rivers, lakes, deltas, floodplains, peatlands, swamps, lagoons, pans, bogs, seeps, and estuaries, among others.²

Most life on Earth depends on these inland waters, but they are degrading faster than any other kind of ecosystem due to the unprecedented scale of human interventions. As degradation continues and accelerates, their ability to support human endeavor falters and, in all too many cases, fails. In this century, there is a deepening understanding of the implications of this, and of our need to live in harmony with the natural world. Nowhere is this more important than for Earth's inland waters. This essay provides a global and African view of how and why they have degraded and offers a Southern African perspective on one way in which we could do better.

The world population stood at five million people in 8000 BC, one billion in 1800, and seven and a half billion in 2017. The UN predicts it will reach eleven billion by 2100 in what appears to be a slightly flattening trajectory.

ry.³ From 1970 to today, there has been a doubling of the world's human population, a fourfold increase in the global economy, and a tenfold increase in trade.⁴ All of this depends on fresh water. Africa, with about 9 percent of the world's freshwater resources, is a prominent part of this growth. It is a low- to medium-income continent with six of the world's fastest-growing economies.⁵ Its human population, presently 1.4 billion or 17 percent of global numbers, is predicted to reach 4.5 billion by 2100 (40 percent of global). Water resource development to meet this growth is inevitable and will take place under the scrutiny of Sustainable Development Goal 6 (SDG 6: clean water and sanitation) and SDG 15, which weakly addresses inland waters as a subsection of life on land. Moving along the development pathway a few decades behind more industrialized economies, Africa will face, perhaps more than any other region, a challenge to develop and manage its water resources without repeating the mistakes made by others.⁶ Can it learn from the past and proceed more carefully?

Water resource developments were originally designed to provide water as and where people needed it, and much of humanity has benefited from that. The middle to late-1900s was a great era of dam-building, leading globally to about 58,000 very large dams and hundreds of thousands of smaller ones providing better sanitation; water on tap in homes, gardens, and businesses; and food security from irrigated crops.⁷ Even with this scale of construction, two-thirds of the world's people presently face water shortages for at least one month a year, and almost two billion people live in areas at risk from severe water scarcity.⁸ Within Africa, sub-Saharan Africa, in particular, suffers from chronically overburdened water systems through increasing stress from fast-growing urban areas.⁹

There is presently a second major surge in dam-building, this time to generate electricity.¹⁰ Hydropower accounts for a significant and growing proportion of the electricity generated in Eastern and Southern Africa, representing, for instance, 90 percent of the existing supply in Ethiopia, Malawi, Mozambique, Namibia, and Zambia.¹¹ The Programme for Infrastructure Development in Africa estimates that total energy generation for the continent will need to continue to increase by 6 percent per year for the next few decades, and that large hydropower dams planned or under construction in Southern and Eastern Africa could double the present generating capacity. The pattern is mirrored globally, and clearly much more will be done to secure water, food, and energy for people, but at what cost?

That cost comes mainly in the form of the degradation of the donor river systems, a severe decline in species and habitat biodiversity, and impacts on the lives and livelihoods of those depending on healthy rivers. Rivers are living ecosystems that provide a range of services that we all benefit from: delivery of freshwater over vast landscapes; purification of used water; attenuation of floods by storage in floodplains; replenishment of groundwater that in turn supplies river flow in the dry season; stabilization of banks and coastlines; sequestration of carbon in

wetlands, thereby helping to keep the brakes on climate change; and supporting the life stages of a myriad of plants and animals. Through their natural functioning, rivers support hundreds of millions of people who live along their banks and depend on them directly for food, medicinal herbs, construction materials, firewood, grazing, and shelter, as well as those further away who also depend on them for resources such as fish. They are highly valued in human cultures through recreation; national symbols and borders; religious and spiritual upliftment; and inspiration for books, music, art, and photography. They are one of Earth's most valued and important ecosystems, and arguably the most vulnerable.

Rivers are now severely at risk from the scale of water resource development and dam-building already completed and presently underway. The diversity, health, and resilience of whole river systems are being detrimentally affected, with impacts spreading downstream, across national boundaries, and into oceans.¹² The likelihood of substantial knock-on effects into politics and human conflict is increasing. What exactly is happening?

Dams and abstractions of water from rivers alter the pattern of their flows to achieve benefits for people – that is their purpose. All dams fragment river systems, and all flow manipulations and water abstractions affect river ecosystems to greater or lesser extents. The more we intervene, the more rivers change, and different kinds of interventions alter them in different ways as the following few examples illustrate. A large dam that stores floods could stop downstream floodplains from flooding, with the loss of habitat and grazing for wildlife and livestock. On Zambia's Kafue Flats, for instance, the number of Kafue Lechwe (an antelope that is endemic to the Flats) declined from 110,000 in 1973 to fewer than 30,000 in 2015 as a result of, *inter alia*, reduced flood releases from the upstream Itezhi-Tezhi Dam.¹³ This is also of concern for Zambia's national herd, 20 percent of which is supported by the Kafue Flats. Reduced flooding of floodplains around other African river systems has resulted in a decrease in groundwater recharge and an increase in hot, dry-season wildfires.¹⁴

Dam walls stop upstream and downstream movement of species, such as fish moving upstream to spawning sites. If the fish do not reach the spawning sites, they do not produce the next generation of fish and so their numbers decline. Water released from dams in the dry season can wash away downstream plants and animals not adapted to higher-than-normal flows, such as juvenile fish, thereby disrupting their life cycles and reducing the number of fish.¹⁵ A reservoir kilometers long is as much a barrier as the dam wall creating it, and equipping dams with fish ladders to move the fish upstream past the dam wall may be unsuccessful, as fish become disorientated by the lack of flow in the still waters of the reservoir and may never find the upstream river to their spawning grounds.¹⁶

Releasing an even flow of water from a dam throughout the year can provide optimal conditions for some species to increase to pest proportions. Outbreaks of

blackfly in dammed stretches of the Orange River in South Africa, for instance, affected livestock so seriously that losses of up to US\$2.5 million per annum were experienced by farmers along one short section of the river as the flies attacked the cows and milk production failed.¹⁷

Dams hold back sediments moving down the river, leading to a loss in storage capacity of the reservoir, with more than 0.5 percent of the global volume available for water storage in reservoirs lost annually as sediments settle behind dam walls.¹⁸ The dams cause loss of riverine habitats and species as sediment-hungry water released from them erodes the downstream riverbed and banks.¹⁹ Such a change in sediment supply can also result in adjustments of the downstream channel, affecting country boundaries, such as occurred with the Ruo River on the border between Malawi and Mozambique and the Usuthu River between Mozambique and South Africa.²⁰

Peaking hydropower dams may abnormally and massively increase, in a single day, the range of flows experienced in the downstream river, washing away downstream habitats, plants, and animals. Hydropower dams are not green energy.²¹ Like all dams, they disconnect the flow of water, sediments, and life along rivers, degrading habitats, blocking migratory fish, and reducing gene pools and new generations of aquatic life.²²

Many dams are in areas relatively untouched by development until the last decade or so, targeting remote areas and river systems that supply water, food, and lifestyle support to local riparian people as well as orders of magnitude more people whose livelihoods depend on the downstream rivers, estuaries, and near-shore marine areas. These people rarely had, and many still do not have, a voice in the decisions regarding the development of their rivers, and commonly do not benefit from them.²³

Africa has a goodly share of large dams, most triggering widespread ecological and social concerns. For example, Kariba Dam, built in the 1960–1970s, controls 90 percent of the total runoff of the Zambezi River. It created the world's largest man-made reservoir but is now operating below par due to droughts and instabilities of the dam wall. Before construction, there was “barely any assessment of the potential ecological impact of the dam, much less the human costs.”²⁴ Downstream of Kariba, Cahora Bassa Dam, also built on the Zambezi in the 1970s, was seen by scientists at the time as the least-studied and possibly least environmentally acceptable dam project in Africa.²⁵ Presently under construction, the multi-billion-dollar Grand Ethiopian Renaissance Dam on the Blue Nile has triggered intense nationalistic fervor in both the upstream (damming) and downstream (impacted) countries (see Harry Verhoeven's essay in this issue of *Daedalus*).²⁶ Analyses of any ecological and social-impact assessments of the dam that may or may not have happened are completely overshadowed by political announcements. The Grand Inga Dam, on the Congo River in the Democratic Republic of Congo,

is located on the continent's second-largest river by length and the world's second-largest river by volume. Coming with an eye-watering price tag of more than US\$80 billion (including for transmission lines), it is a series of six dams: two now completed, one in the design phase, and the later ones dependent on available funding and markets. It could become the largest power station in the world, producing 40,000 megawatts of electricity, more than twice as much as Three Gorges Dam on the Yangtze in China, and perhaps providing more than one-third of all electricity produced in Africa. It has proceeded without any risk information being made public and with no major environmental or social studies as of 2019.²⁷

From little boys kept out of school to stop livestock wandering across a de-watered river²⁸ to an increase in waterborne diseases, from the collapse of a coastal prawn industry to the loss of clean drinking water, the list of the negative side of development continues to lengthen.²⁹ The details usually differ from river to river, and so understanding of what could happen is increasing slowly, one river at a time.

As flows, sediment loads, and species have been affected, rivers have also universally been used as disposal units for domestic and industrial waste; their sediments have been mined at industrial levels, destroying habitats for fish and other life forms; they have been contaminated with agricultural fertilizers and pesticides, reducing water quality that then needs costly purification; exotic species have been introduced that cause declines in native species and loss of ecosystem services; aquatic life has been overharvested so that stocks decline; and floodplains and banks that are an essential part of a river's continued healthy functioning have been encroached upon.³⁰

As a result, rivers and other inland waters are vanishing or drastically degrading globally at a higher rate than any other kind of ecosystem – three times faster than forests, for instance.³¹ The implications are profound for climate change, as these ecosystems are one of the most important tools in counteracting climate change, storing about three times as much carbon as other landscapes.³² Equally disturbing are the trends in species numbers. The 944 aquatic species assessed by the World Wide Fund for Nature (WWF) for its 2020 Living Planet Index have declined by an average of 84 percent, or 4 percent per year, since 1970, with one-third now threatened with extinction.³³ Across all land and ocean ecosystems, Africa recorded the second-highest level of biodiversity decline (65 percent) after Latin America and the Caribbean (94 percent), with habitat loss and overexploitation of species being the main drivers of decline. We would do well to heed the words of biologist Edward O. Wilson on the importance of biodiversity: “This is the assembly of life that took a billion years to evolve. It has eaten the storms – folded them into its genes – and created the world that has created us. It holds the world steady.”³⁴

Humans are changing the world's limnological landscape and the planet at an unprecedented and increasing rate; the world is indeed becoming more unstable. Extreme events are increasing in number – floods, droughts, pandemics – and the

present trajectory offers few solutions for sustainability. Climate change is adding a new layer of uncertainty and could further accelerate the degradation of the last half-century, but the details are uncertain.³⁵ In recent work on the Okavango River System in Southern Africa, for instance, predictions from thirty-six global climate models can be divided into two main groups: one predicts a wetter, hotter future for the basin and the other a drier, cooler future.³⁶

What has gone wrong? How has the laudatory work to provide water, food, and energy for all resulted in so much damage? We understand now that past water resource developments were designed, and decisions on development made, on engineering and economic criteria, prioritizing a narrow range of economic benefits.³⁷ Up to about the end of the last century, little or no consideration was given by most governments, developers, or funders to the ecosystems that provided the water: their nature, plants, and animals, and the myriad benefits they provided to society. The mindset was one of exploitation of an available resource; the drive was to meet the ever-increasing demand for water, food, and energy with little understanding or thought of the interconnectedness of natural systems and our dependence on them. Proclaimed costs of the developments tended to be limited to those linked to construction and operation of the infrastructure, providing highly attractive options focused on benefits such as increased food, jobs, and growth. But these attractive, cheap options were only cheap because the social, ecological, and physicochemical costs of degrading landscapes and river systems were ignored. Such costs tended to be the outcomes of water resource decisions rather than inputs to them, and they were often unexpected and distressing.

Why were the outcomes unexpected? Before the second half of the last century, ecological and social specialists tended not to be employed in major water resource management arenas. Most were working in academia and research institutions isolated from water-development decision-making processes. Ecologists did not have the equivalent of the hydrological, hydraulic, and economic models available to engineers and economists, and were not taught how to create and use such models. They did not have experience with the power of models or training to create detailed predictions of possible futures (scenarios). Social specialists did not receive descriptions of how river systems could change to help them understand the social implications and formulate their responses to development proposals. Without such contributions, decisions on dams and other major water developments were being made by “far too few for far too many.”³⁸

Thinking began to change as the global concern regarding the downside of the first era of massive water resource development become more vocal in the 1970–1980s, with popular articles such as “Damnation Comes to the

Darling” and books such as *When the Rivers Run Dry*, *Silenced Rivers*, and *Vanishing Waters*.³⁹ By the 1980s, river ecologists were shifting focus from species to ecosystems, acknowledging that species could not be conserved unless the environment that supported them was also conserved.⁴⁰ They started to study how ecosystems functioned and to develop ecosystem models. By the 1990s, the new scientific discipline of Environmental Flows (EFlows) had emerged in response to global concern over dying rivers and was gaining international attention by guiding water managers on how much water should remain in rivers targeted for development.⁴¹

In 1997, the World Commission on Dams was formed to investigate the global ecological, social, and economic impacts of large dams. Its chair, Professor Kadar Asmal, wrote in 2000 that in the last century, we collectively “bought, on average, one large dam per day and there have been precious few, if any, comprehensive, independent analyses as to why dams came about, how dams perform over time, and whether we are getting a fair return from our \$2 trillion investment.”⁴² The costs as well as the benefits were opening up to scrutiny.

From the turn of the century, this scrutiny has gathered pace and is upward and outward: moving past species conservation to focus on ecosystem management; from project-specific impacts on small sections of rivers, to the implications of developments for whole river basins and even the oceans they flow into; and from prescriptively recommending flows for a river, to a neutral approach of providing stakeholders with a range of potential future river conditions for their consideration.⁴³ Scientists are describing more and more effectively how everything is connected and what could happen with management interventions. Their models can stand shoulder to shoulder with the engineering and economic ones to provide new kinds of information, and they are becoming part of water management and decision-making teams.

What do we know now that we did not know fifty years ago? What was learned along the way? We know that to keep rivers healthy, aspects of all parts of their flow regimes must be retained – floods as well as low flows – each in the season when it would naturally occur. An arbitrary single-number minimum-flow release from a dam to keep a river wet is convenient for planning and design purposes, but there is no evidence that it will support the river ecosystem. Indeed, the body of evidence indicates the opposite, with an allocation of a minimum flow to a river providing false comfort that “the environment is being taken care of” when in fact it is not.⁴⁴

We know that experienced interdisciplinary teams are needed to populate the ecosystem models with data: hydraulicians; geomorphologists; fish, invertebrate, bird, reptile, amphibian, and mammal zoologists; botanists; aquatic chemists; microbiologists; climate-change modelers; and more. We know that the links to the social implications of a changing river need to be made, and so ecosystem models have to be extended to become ecosocial models that bring specialists in public and livestock health, social and cultural structures, resource eco-

nomics, and more into the team.⁴⁵ These teams can predict in detail how a river will change with water management plans and how this will affect the people dependent on its resources. Linked with the engineering and economic modeling, balanced descriptions of the predicted costs as well as the predicted benefits of a management plan are starting to replace the one-sided predictions of benefits from the past.

We know that the more interventions there are to natural rivers, the more their condition will change, increasingly affecting the huge numbers of people dependent on them. We understand that the choice of what that future condition should be is not a scientific one; there is no magic number that represents how much water to leave in a river in order to keep it healthy. Rather, it should be a decision of society, whereby stakeholders of all kinds from international to local groups are provided with understandable descriptions of possible futures, which they can then use to negotiate with their governments for the future they want for themselves and their children. In some cases, such as in national parks, it could lead to near-natural rivers retaining most of their flow; in other areas, where perhaps food production is a priority, it could lead to more water abstraction and rivers in consequently poorer condition, though not to the extent of becoming health hazards.

As Africa moves to further develop its water resources, it will be judged and hopefully guided by emerging thinking over the last decade on the need to adopt an ecosystem approach as explained by the Convention on Biological Diversity and Nature-Based Solutions.⁴⁶ These approaches address societal challenges such as climate change and water and food security, but they also recognize the need to base human activities on a scientific understanding of the organization and functioning of the natural world in order to limit damage to the planet. Such an approach resonates with the mission statements, goals, and objectives of water authorities, which usually include mention of “sustainability” in some form but without specifying what is meant by the term or how it will be achieved.⁴⁷ Common definitions of sustainable development along the lines of “to provide resources for present generations without compromising the needs of future generations” offer little practical guidance. How then do we measure success on the ground? It has been difficult in the past, a term easily used and then largely ignored, but the kinds of ecosocial models now available can help to put flesh on these aspirational bones.

South Africa has been a proud trailblazer since the 1980s of such thinking in the management of its water resources. It responded to the concern over its degrading rivers with early development of EFlows concepts and practices, and by writing protection of its inland waters into law.⁴⁸ Other Southern African countries followed suit, some writing new legislation triggered by scientific work and others moving ahead of legislation to begin protecting their rivers.⁴⁹

Differences emerged between the Southern African approaches to EFlows and that of more industrialized high-income countries.⁵⁰ The latter had already developed most of their water resources, and their people are supported by a safety net of salaries and social payments. Much of their EFlow focus initially was on protecting valued species such as game fish, but more recently, they have turned to rehabilitation of their degraded rivers, with recommendations of EFlows and more to achieve this.⁵¹

Southern Africa, by contrast, has a wealth of natural resources still in near-natural ecological condition, and there is good awareness of the close links across vast landscapes between river condition and peoples' livelihoods. Registering this and the emerging concern on degrading rivers, South Africa began the development of methods and concepts for guiding sustainable water resource developments in the late 1980s.⁵² These were along the lines of the ecosystem approach and nature-based solutions, although the terms themselves did not materialize for another decade or two.⁵³

By 1992, South Africa had developed and was applying the world's first holistic approach to determining flows for river maintenance: the Building Block Methodology (BBM).⁵⁴ This was a prescriptive method that recommended amounts of water for river maintenance, but it could not respond to queries of what would happen to different aspects of the river system or to people if those amounts were not provided. The BBM provided the data that drove recognition of the environment as one of only two entities with a right to water in South Africa's 1998 National Water Act, the other right being for basic human needs. All other uses of water in the country are controlled by permits, a situation now prevalent through most of Southern Africa. In adherence to the requirements of this act, a water allocation for ecosystem maintenance is now being determined for every major water course, wetland, estuary, and groundwater aquifer in South Africa, driven by a classification process that encompasses stakeholder input. Similar work is underway in other parts of the Southern African Development Community (SADC).⁵⁵

By 2000, South Africa had moved on, developing and applying DRIFT (Downstream Response to Imposed Flow Transformations), one of the first ecosystem models to provide a neutral, interactive approach that predicts the impacts of a range of possible water developments on rivers and their dependent people, for consideration by stakeholders.⁵⁶ Other kinds of predictive models are also being developed in South Africa and elsewhere, for example, in the United States, South America, Australia, Europe, and Asia.⁵⁷ Some have a link through to the social implications. For simplicity, we focus here on DRIFT as an example of an African model whose developers determinedly set out to address the realities facing water scientists as they began to contribute to water resource management: sparse data (because new kinds of methods and models require new kinds of data, not just in Africa but worldwide); limited time and money; and a business-as-usual iner-

tia among many dam-builders, international funders, and governments to engage meaningfully with new sustainability thinking.⁵⁸

The shift to the neutral, interactive, scenario-building DRIFT model attracted the attention of the World Bank, Asian Development Bank, International Union for the Conservation of Nature, World Wide Fund for Nature, United Nations Development Programme, Food and Agriculture Organization, Deutsche Gesellschaft für Internationale Zusammenarbeit (German Corporation for International Cooperation), and a number of other organizations and governments in Africa and Asia, who moved to employ it. DRIFT has been used, for instance, to aid basin-wide planning for major transboundary rivers, including hydropower in the Lower Mekong River (Thailand, Lao People's Democratic Republic, Cambodia, Vietnam); basin development of the Okavango River system (Angola, Namibia, Botswana); and resolution of a dam-related conflict in the Upper Indus River (Pakistan and India), where the Permanent Court of Arbitration in The Hague concluded that for an issue of the magnitude and importance of that under consideration, DRIFT was "an appropriate tool for estimating potential changes in the downstream environment."⁵⁹

In all cases, the outputs of the model predict in detail, for points along the river system, how the ecosystem would change and how people would be affected. This is done through use of a considerable list of indicators, each of which would change in a different way under each scenario. Physical indicators could include, for instance, depth of pools, bank erosion, extent of floodplain inundation, and aspects of water quality. Biological indicators could include individual species, such as tiger fish, fish eagle, elephant and *Anopheles* mosquitos; and groups of species, such as floodplain spawning fish, riparian trees, and much more. Social indicators could include household incomes, waterborne diseases, and access to potable water.⁶⁰ Scenarios themselves can be chosen based on management proposals other than dams, to explore the implications of harvesting natural resources such as sand and fish; enhanced management of the catchment; and control of poaching.⁶¹ Climate change is now a common part of such investigations, usually done by running all scenarios to show the implications of proposed management actions, and then running them again with climate change superimposed, so that the difference caused by climate change alone can be estimated.⁶²

At last, river managers, conservation agencies, riparian dwellers all along the system, and other stakeholders have the opportunity, through the range of models mentioned here and others, to obtain information that will help them understand the implications of a changing river, empowering them to voice their concerns or support. It has given decision-makers reason to pause and consider more comprehensively, eliciting quite profound feedback. A minister of the environment in Asia commented that he had never before understood the full implications of the decisions he made. A cabinet minister of a SADC country said, "We make de-

cisions we think are right, only to discover later that some are disastrous. I could not sleep if I did not take every chance to improve our decision making.” A design engineer for a SADC dam said that the model outputs had helped them chart a new way forward, understanding crucial environmental issues and putting in place mitigation that resulted in no significant loss of planned hydropower generation. The CEO of a River Basin Organization commented that he now saw rivers in an entirely different way and could not go on as before.

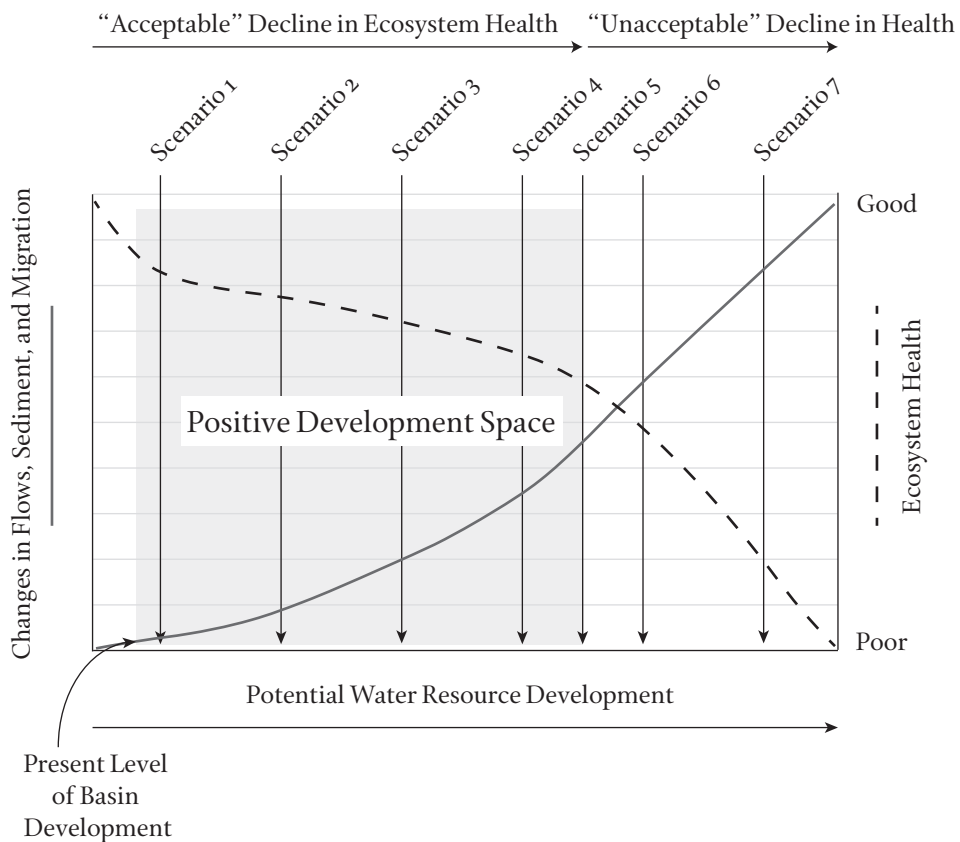
What can decision-makers do with the new information from specialists and the new stakeholder inputs? It is their prerogative to make the decision on a water management proposal, but as stakeholders gain access to more information, the whole process becomes more complex while potentially more open and equitable. As part of this process, how do we unpack the mystery of sustainable use and ensure it is adhered to? Sustainable is an adjective for something that can be sustained, that is, something that is “bearable” or “capable of continuing at a certain level.”⁶³ In this context, bearable suggests that it should be acceptable to people, and capable of continuing suggests that the natural inland waters that support humans should not be harmed to the point at which they can no longer do this. Thus, in water resource management, sustainable use can be seen as a trade-off that society negotiates and agrees on between what is gained and what is lost by development (or rehabilitation), a balance between water use and ecosystem conservation. The trade-off point could differ from basin to basin.

One approach that can aid this process is the concept of Development Space.⁶⁴ For a river or basin, the Development Space is defined as the difference between current ecological and social conditions in the basin and the furthest level of development-driven degradation of the river found to be acceptable to governments and other stakeholders. Negotiating this end point helps them to identify their “mark in the sand”: the future that they do not wish for. This, in turn, makes obvious how much development potential is left in their basin.

In support of this endeavor, DRIFT can be set up with a series of development scenarios, each of which describes in detail a point along the development/degradation pathway. Negotiations between and within countries can then identify the furthest acceptable point of decline in an ecosystem and dependent social conditions across the basin: the point at which costs are perceived to outweigh the benefits of development.⁶⁵ Once the Development Space has been agreed upon, negotiations can move on to how much of the space can be allocated to each country (in a transboundary river basin) or to each water-use sector (for a river within one country) (see Figure 1).

Where river systems are already heavily developed and degraded, the ecological and social consequences could be deemed now to be unacceptable, and the

Figure 1
 The Concept of Development Space, with DRIFT Scenarios Positioned to Predict Ecosystem Condition at Points along the Basin Development Pathway

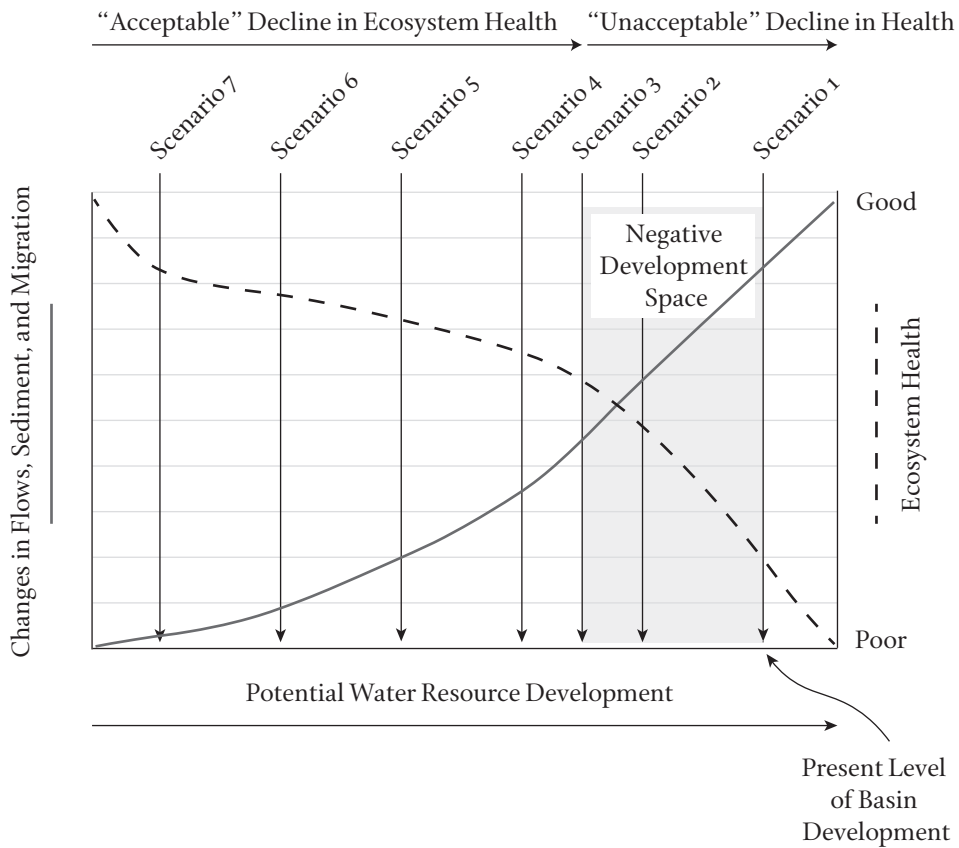


Source: Modified from Jackie M. King and Cate A. Brown, “Integrated Basin Flow Assessments: Concepts and Method Development in Africa and South-East Asia,” *Freshwater Biology* 55 (1) (2010): 127–146.

Development Space seen as negative. In such a situation, the same process could be used in reverse to plan what level of rehabilitation would be an acceptable trade-off between improved river condition and the cost of actions needed to achieve it (see Figure 2).

The process is in its infancy but, if the concept is to work, there is one caution. Having defined the end point of acceptable development, it should not be moved further to the right in later years as water demands increase. Instead, all innova-

Figure 2
 The Development Space Concept in Reverse for an Unacceptably Degraded River, Showing DRIFT Scenarios Placed to Predict Points along the Rehabilitation Pathway



tion should be to the left of that line. In other words, sustainability requires that we should learn to live within the limits we set.

In the last few years, the concept has been discussed in stakeholder meetings and consultations between transboundary countries and it is now moving to being applied. The member states of the Cubango-Okavango River Basin in Southern Africa, for instance, are currently embarking on setting the boundaries of the Development Space for their shared basin.⁶⁶ Their objective is to identify the point of greatest sustainable benefit, taking into account national development plans, the importance of the river system, and other relevant items.

Looking into the future, can the sustainability thinking and endeavor being developed by water scientists around the world guide us into a future in which the mindset changes from exploitation of inland waters to one of respect and caring management? In ways we can only begin to imagine, our future depends on this. The understanding is there; the skills are there; the technology is there; what to do and how to do it is known. What is not yet in place is a universal awareness and acceptance among governments, developers, and funders that this work can be done, and that it can help to open up the discourse on water developments leading to more equitable decisions. It can help countries plan for a sustainable future, moving from water grabs to wise stewardship, but only if there is the will to engage. Awareness is growing but it is almost literally one river at a time. Too often, the focus remains on the delivery of energy, food, and water, and the politics of water. As was written for the Darling River in Australia, “They did all the sums and added it all up, but they forgot about the river itself.”⁶⁷ We could add for African rivers “and its people.” The same is true for all too many rivers on Earth.

A large amount of water resource development will continue in Africa for water and energy security. Large dams continue to be seen by many as the way forward, despite their enormous negative impacts on river systems and people. If we are to work in harmony with our planet, then tinkering with impact assessments of these developments at the level of individual projects no longer makes sense, as the scale of development is affecting whole river basins. Rather, such assessments should be obligatory, transparent, basin-wide, holistic ecological-social endeavors that are done before decisions are made. They should provide all stakeholder groups with the best possible information on the consequences of different management options, addressing all three pillars of sustainable development: ecological integrity, social equity, and economic wealth. Decision-makers should give all three equal weight in their considerations and not subsume them into an economic bottom line. Particularly in Africa, with its increasing population and traditional reliance on river resources, all uses of river systems should be brought into decisions, and the concept of no net harm adhered to. Future decision-makers should not need to say, “I did not know this could happen,” because they have the opportunity now to acquire a more balanced set of information to work with, and to be able to explore more deeply the implications of their decisions.

AUTHORS' NOTE

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Climate & Water in a Changing Africa: Uncertainty, Adaptation & the Social Construction of Fragile Environments

Harry Verhoeven

Discussions of climate change and water security in Africa are often simplistic and indeed deterministic. They overlook not only ecological complexities but also the multitude of ways in which various population groups across the continent approach climatological variability, thereby challenging positivist modeling and external adaptation agendas. The current state of affairs for many often-silenced citizens is already one of hunger, uncertainty, and marginalization; the self-appointed lead actors on climate adaptation – states, markets, NGOs – have, from their vantage point, deeply troubling track records of dealing with people and their environments. For plenty of communities around Africa, it might therefore not so much be only the worsening climate that is increasingly exposing people to disease, displacement, and water insecurity, but the very policies adopted in the name of preparing for, and living with, worsening weather. This essay explores how understanding climate adaptation as a fundamentally social and political process points to possibilities for imagining and working toward futures with greater emancipatory potential. There is no scenario in which African societies adapt successfully to climatic change and do not simultaneously radically reimagine both their relationship with the outside world and with each other, including institutions of control and mechanisms of exclusion at home.

Africa is at the center of the global water predicament and climatic upheaval. Africa contains the greatest number of least-developed countries of any continent, the most woeful sanitation infrastructure, and the highest share of people in highly weather-dependent rural employment. It is here that, owing to global warming, crop yields are expected to decline most sharply; sea-level rises along the African littoral are already higher than planetary averages. Africa's pastoralist communities are the biggest on Earth and comprise about one-fifth of its population; weather variability defines the nomadic way of life, offering many rewards but, especially in an age of uncertainty, also existential risks. Increasingly erratic precipitation patterns are especially daunting considering no continent has less reservoir capacity for water storage. The continent remains the

most marginal emitter of greenhouse gases but has perhaps the greatest untapped potential for renewable energy sources: geothermal, wind, hydro, and, above all, solar power. This issue of *Dædalus*, with its broad, interdisciplinary focus, reflects the depth and breadth of these challenges and seeks to draw renewed attention to them.

Centering Africa in debates about climate and water and, conversely, centering water and climate in Africa-related discussions is a crucial but complex and fraught exercise. As this volume's essays from across scholarly disciplines underline, much conventional wisdom about these connections is ambiguous, nuanced, and, at times, simply wrong. Activist communications and historically embedded stereotypes frequently lead to misleading hyperbole, often of the alarmist type. The African Sahel, for instance, is often cited as the region of the world most vulnerable to climate change. Yet what simplistic tropes of a Malthusian crunch offer as *prima facie* evidence of the fragility of regional ecosystems and the communities that live and work in them reveals, on closer inspection, is a much more complex picture of dynamic intervention and resilience.¹ Many of the Sahel's peoples, like elsewhere on the continent, have extraordinary track records in managing the unpredictability of the seasons and have built a range of livelihood strategies that defy tropes of "fragile" societies "surviving" in environments considered "out of balance."² This is not to gainsay that the twenty-first-century extremes of the Anthropocene are posing unprecedented dangers to many of them. But it does imply that concepts, causal logics, and institutional responses need to be historically and spatially examined and situated in specific African contexts to a far greater extent than universalist conjectures and policy recipes usually allow – a message conveyed by all essays in this collection. Terms like vulnerability and resilience have become buzzwords, especially in discussions pertaining to African development, but are understood differently by very different people who relate often in unexpected ways to the models and mind maps that scientists and policy-makers operate with.³ For instance, as Stephan Miescher's essay describes for Ghana's Akosombo Dam and Allen Isaacman's essay highlights regarding Mozambique's Cahora Bassa Dam, infrastructure built to try to smooth out extreme weather events and render economic processes more resilient and predictable⁴ has in many places contributed to a greater exposure to the effects of climatic changes and paralyzing uncertainty, at the level of local communities and for macroeconomic growth strategies.

Generalizations about Africa, climate, and water frequently occlude as much as they clarify; cause-and-effect relations are often poorly evidenced and seldom put in context; and assumptions that are as ethically troubling as they are empirically faulty are rarely made explicit. Framings matter hugely. Climate change and water scarcity, in Africa and elsewhere, are not discrete phenomena that ac-

ademics (can) study in splendid isolation, but our understandings and representations of them are inextricably bound up with who we are and where we are.⁵ They are neither self-explanatory nor unself-interested and, contrary to positivist assertions, certainly not experienced as such by Africans (or anyone else) either. As geographer Mike Hulme noted, the hegemonic institutional and intellectual architecture for thinking about and acting upon climate reflects a highly specific paradigm of knowledge and authority; it thereby prioritizes some policy options, partnerships, and forms of intervention over others: “The construction of narratives around global warming remain strongly tied to roots within the natural sciences, to expectations of improving ‘predictions’ and to a problem-solution policy framing which claims both global reach and universal authority.”⁶

Indeed, an emerging literature reconstructs how Cold War–era sponsorship by state bureaucracies helped distill the hegemonic representation of climate change through computer models that merged the insights of distinct research programs in atmospheric physics, meteorology, and oceanography into an overarching, single abstract entity: *the* climate.⁷ The resulting determinist reading of the interactions between molecules and forces under Newtonian laws has given rise to ways of talking about and governing (the) climate that are singularly focused on mechanistically controlling tonnes of carbon dioxide equivalent. The “global regime complex for climate change”⁸ thus concentrates on taxation and subsidy instruments, on (quantifiable) carbon sinks, and on forms of geoengineering that all promise to control the levels of greenhouse gases in the atmosphere. In doing so, alternative conceptions of climate – and therefore also alternative conceptions of governance (such as those that emphasize nonlinearity and choose precaution over control) and alternative practical and strategic responses (such as redefining mitigation and adaptation) – have been obfuscated or marginalized. This also implies that the hard-wired proclivity to think, write, and represent in the positivist paradigm, while often done with the best of intentions, risks disempowering the very people and communities who have been on the receiving end of real, human-induced environmental changes for such a long time already.

These insights are well-illustrated by the work of Jennifer Derr and Julie Livingston, whose essays in this collection highlight why the question of waterborne diseases in the context of a changing climate is much more than the study – and control – of viruses and other microbes in conducive biophysical conditions. Prevailing positivist methodologies have failed to make the promised headway in addressing the enduring “enormous gaps in knowledge about the scope and scale of urban water-related illness and injury,” Livingston notes.⁹ They have been consistently baffled by the resilience and sometimes resurgence of pathogens and their devastating effects on different populations. Epidemiological models have been confounded, especially in diverse African milieus, precisely because they so often overlook the cultural, social, and political lives of epidemics and chronic suffering.¹⁰

These actual lived experiences of water insecurity and concomitant health hazards, as Leila Harris underlines in this volume in the Ghanaian context of Accra, are rarely investigated with the same vigor as bacterial or viral migrations. While rapid dissemination or the persistent lingering of viruses is often attributed to irresponsible cultural practices and troubling local habits (such as Ebola spreading as a result of burial rituals in Sierra Leone and Liberia)¹¹ or simply to the generic category of “abject poverty,” Livingston and Derr draw attention to the social relations and political-economic structures that explain how illness takes a multitude of forms and is distributed among different populations. This includes an awareness of how closely entwined the advancement of colonial authority and the monitoring and curing of the human body have historically been in Africa and how perceptions of science as the projection of state power and the capture of bodies still shapes an array of social groups’ perceptions of ills, medicine, and state institutions.¹² In her study of the Aswan High Dam and its role in Egypt’s twentieth-century schistosomiasis epidemic, Derr demonstrates how the human body bears witness to simultaneous experiences of lethal sickness and the political disposability of entire social classes: “when the state and your kidneys fail,” borrowing anthropologist Sherine Hamdy’s (in)famous phrase.¹³ From this emerges a powerful warning about the ways in which political elites seek to cover their own failings or crimes, as Muchapara Musemwa elaborates on in the context of Zimbabwe in this volume:

The water scarcity problems that the ordinary residents of Harare have experienced renders it an ideal exemplar of a city whose two-decades-old water crisis has much less to do with climate change than a range of anthropogenic factors that have undermined the successful provision of water by both the central government and the local urban authority.¹⁴

In Africa’s cities, it might not so much be only the worsening climate that is leading people to be increasingly exposed to a variety of new and old pathogens, but the very policies – cost recovery through water tariffs, new urban zoning laws, and resettlement schemes – adopted in the name of fighting water scarcity and preparing for bad weather.

The essays in this volume challenge the reader to think differently about the who, how, and why of the *problématique*, including reframing what the *problématique* itself is. It is vital to unpack the social construction of “climate change” and “water security” (and, for instance, their presumed linkages with disease), but of “Africa” as well, especially in relation to the former two. Grave worries about Africa’s climate and aridity – or, more correctly, rainfall variability – are not new, but have shaped external dispositions toward the social, economic, and political potential of the continent in the last three centuries.¹⁵ Story-

lines regarding Africa's erratic geography and natural resource base were central in explaining the waning and waxing of imperialist ambitions on and for the continent.¹⁶ They rested on dubious suppositions then and still often do so today. Contrary to what is suggested by the abundance of policy reports that evoke coming "climate conflicts" and "water wars" in Africa's drylands (without much empirical evidence or analytical cogency),¹⁷ Africa is neither the driest continent on Earth, nor does it contain the highest number of water-stressed states. Its aquifers contain an extraordinary amount of underground water and much of the modeling on Central Africa and the Sahel is undercut by the paucity of data, current and historical, which would be required to substantiate (even within a positivist methodology) the doom-laden language about desertification, the shrinking of arable land, and the impossibility of farming or herding of animals.¹⁸ Moreover, the preoccupation with absolute levels of rainfall or moisture content in African soils, important as these are, risk occluding the arguably even more crucial question of distribution of the water. Unlike the situation of many Middle Eastern countries where absolute water scarcity levels are far greater than in the vast majority of African states yet access is reliable and relatively broadly shared, hundreds of millions of Africans do not have access to clean drinking water. This is the case even when extant technologies and infrastructures are at hand to provide it: a distributional paradox that underlines the importance of unpacking the political-economic, historical, and social-ecological context in which the linkages between climate change and water security manifest themselves.

The long tradition of framing Africa through the lens of environmental determinism continues to lead much of the epistemic and policy community to approach the continent as a passive victim that may inadvertently be exacerbating its problems. While reference is usually made to how Africa's population is rapidly growing, average plot sizes in vulnerable regions are shrinking, and disease is spreading, the implicit assumption is one in which the numbers may change, but the trends (toward greater vulnerability) and the basic character of Africa – its weakness and fragility – do not. The essays in this issue provide a snapshot of why that characterization should be questioned. They make important suggestions for how to rethink the ways in which an Africa already in profound transformation might deal with soaring temperatures, rising sea levels, and increased rainfall variability.

Following the end of the era of decolonization and the Cold War, two key narratives, both of which heavily influence how climate change and water security futures on the continent are imagined, have dominated public discourse about Africa. The first storyline is resoundingly pessimistic and grounded in part in the postcolonial disappointments that were laid bare for all to see in the 1990s: in light of the Rwandan Genocide, the HIV pandemic, and state collapse in Somalia, Congo, and Sierra Leone, the possibility of liberal democracy and the Weberian

state itself in much of Africa was questioned;¹⁹ “failure” has become a key prism for approaching modern Africa.²⁰ The exacerbation of environmental challenges against the backdrop of population growth, grinding poverty, and withering institutions has led to a resurgence of Malthusian thought, emphasizing scenarios in which overpopulated communities are driven from their homes by drought and in which marginal lands and dwindling water holes are overexploited so that conflict and anarchical urbanization ensue. Malthusian predictions underpin much of the global conversation about health, climate, land management, and security – and nowhere more than in Africa.²¹

The second salient narrative emerged in the late 2000s to counter the doom-and-gloom storylines that have molded so much of how Africa has been represented and intervened upon in the last four decades.²² On the back of the continent recording one of its best economic growth performances between 2003 and 2011, “Africa Rising” has counterpoised that the continent is home to 900 million consumers and that it needs technology and foreign direct investment, rather than overseas development assistance or state intervention, to beat back the chaos.²³ New voices – many of them urban Nigerians, Kenyans, and Ghanaians, or diaspora returnees – emphasized Africa’s entrepreneurial instincts and the possibilities offered by digital advances to leapfrog crumbling infrastructure, a weak state, and resource scarcity by delivering transformational health, commercial, and environmental outcomes.²⁴ Capitalism and technology can create Africa anew – and for the better.

Despite the ostensible chasm between them, the two dominant narratives overlap considerably. Malthusian discourses that see Africa as a captive of demography and nature, and Africa Rising narratives that emphasize how technology makes capitalist modernity available to Africans share a preoccupation with a supply-side understanding of development and, indeed, climate. That is to say, they approach water, energy, and food security (and ultimately political stability) as predominantly determined by the total availability of resources in a particular social system. Supply constraints are the harbingers of dystopian crunches in the view of those who fear that biophysics and demography pose “limits to growth” (that is, a ceiling on how much can be produced), which we ignore at our peril in the face of escalating climatic changes.²⁵ Similarly fixated on the specter of chaos and dysfunctional institutions induced by scarcity, believers in a Schumpeterian Africa posit that technology transfer and the provision of foreign capital offer African entrepreneurs and African “smart cities,” such as Kigali and (parts of) Nairobi and Lagos, opportunities to escape the Malthusian trap by boosting aggregate availability of scant commodities: credit, housing, food, water, and so on.²⁶ The resultant prescriptions for policy are hence structured almost exclusively in function of shoring up (quantifiable) supply. This is a troubling nostrum with a woeful track record across the continent as Jackie King and Cate Brown remind us

in this collection. Nonetheless, its proponents maintain that Africa's fundamental problem is that there are too few resources.

In doing so, both these ways of imagining Africa neglect the vastly divergent historical experiences different people have with changing resource levels in their community and the differential meanings attached to scarcity by various social groups: the biophysical and the social are "coproduced"; one does not simply – as an independent variable – create the other.²⁷ Veteran observers of the ecosystems in which cultivators and pastoralists pursue their livelihoods have long warned that the simplistic preoccupation with availability masks complex and multilayered interactions between various communities and their surroundings. In the words of historian Sara Berry: "Generalizations about agricultural practices and performance in Africa are problematic not only because reliable quantitative evidence is scarce, but also because the data available rest on misleading or overtly restrictive assumptions about the social organization of rural economic activity."²⁸ The fixation with dams, irrigation canals, pipes, and mobile apps as a *deus ex machina* to solve availability constraints – rather than seeking to understand how environmental changes reflect reorderings of social relations, and social relations, in turn, manifest themselves in grazing pastures, dryland harvests, and the biochemistry of rivers – comes at a great cost. Leila Harris notes in her essay that the disinterest of supply-centered approaches in the quotidian strategies communities deploy to deal with water insecurity is as damaging in urban milieus as it is in agrarian Africa: "Without familiarity with these day-to-day realities, we might miss opportunities to strengthen some beneficial social practices, or in turn might aggravate aspects of the contextual realities that contribute to lack of access to safe and affordable water for all."²⁹

Malthusian and Africa Rising narratives virtually ignore political participation and social relations as determinants of how climate change is affecting Africa – the centrality of accessibility as opposed to availability.³⁰ They omit the importance of dynamic adaptation by African actors not only to climatic processes but simultaneously to representations, reimaginings, and institutionalizations of those processes. A perspective that highlights the latter does not consider supply (of water, food, technology, and so on) as a self-explanatory, neutral fact created by nature, states, or markets. Instead, it understands supply as a social relationship that is endogenous to various political orders: constructed by some people for some people and, thus, often the object of contestation and an instrument of domination.³¹ Doing so underlines the importance of distributional considerations and political struggle in the framing of "environmental" questions. Moreover, it draws attention to the array of nondeterministic and creative interactions African actors have among themselves and with their environments ("riskscapes");³² it reframes them as ingenious social agents, who actively rethink, reinterpret, resist, and reappropriate external forces that impact their relationship to water and cli-

mate locally. Shifting the focus to the lived experiences and ideas of African communities vis-à-vis their environments is thus crucial. As King and Brown state in their call for “living rivers” managed through intercommunitarian dialogue rather than scientifically objective decrees: “We understand that the choice of what that future condition [of how to deal with scarce water sources] should be is not a scientific one; there is no magic number that represents how much water to leave in a river in order to keep it healthy.”³³ The corollary then is that uncertainty and abandoning the myth of a positivist solution do not have to be negative but can instead lead to new forms of social living, shared meaning, and cooperation, especially at a time of seismic changes. The essays in this collection emphasize several of the profound transitions that disparate parts of Africa are wrestling with, but also the ways in which various communities, cities, and states make sense of a changing Africa and proactively situate themselves in a changing world.

One of the most important transformations underway in Africa – and of major importance to policy responses vis-à-vis climatic changes and water security³⁴ – is the urbanization of the continent, accelerating at a rate faster than anywhere else on the planet. Important swathes of East and Central Africa remain very rural but, especially in West and North Africa, most people now live in cities.³⁵ While some of that is attributable to the natural increase of the urban population, migration is driving much of the expansion, especially into burgeoning areas where housing is cramped and precarious and where adequate water and sanitation facilities are lacking: there is no continent where the percentage of citizens living in slums is higher than in Africa. This designation, as Livingston reminds us in her essay, has political repercussions. Compared to other city neighborhoods, informal urban settlements or “slums” receive demonstrably less investments and public services, which entrenches the tenuousness (or absence) of people’s basic rights; ironically but not coincidentally, the cost of purchasing water is higher in such settlements than it is in middle- and upper-class neighborhoods in most African cities. Africa’s expanding slums are not a transient phenomenon either produced by rapid urban economic growth (drawing in rural emigrants) or about to be transformed into safer, cleaner, and less precarious housing by market-driven development.³⁶ They are a structural and increasingly important feature of the political economy of the continent. The growth of vast informal urban settlements is occurring in parallel to accelerating levels of financial speculation, real-estate investment, and property booms that further accentuate the inequities of exclusionary growth models, whether in Lagos, Nairobi, or Kigali.³⁷

Matthew Bender’s essay on Dar es Salaam helps historicize the trajectory of urban growth in postcolonial Africa, but also challenges many of the Malthusian storylines (“climate refugees” overwhelming cities)³⁸ and neoliberal fantasies (“smart cities” that prevent urban anarchy and environmental hazards)³⁹ that

prevail in an era of intensifying climate change and “Africa Rising.” Most African cities were constructed under colonial rule as spaces stratified by race, class, and ethnicity; various forms of apartheid have been built into the fabric of much of urban life.⁴⁰ Segregation and the denial of political rights and of public services (such as access to clean water and protection against floods and storms) in expanding cities have gone hand in hand.⁴¹ Yet as Bender demonstrates for the continent’s fifth-largest metropole, Dar es Salaam offers not just a story of abysmal water governance and the rapid depletion of the aquifer under the city, but also one of extraordinary adaptation by urban dwellers to rapidly changing environmental, social, and economic circumstances: these experiences and forms of solidarity constitute an important reservoir of strategies to deal with twenty-first-century warming. This is a message at odds with the pessimistic tradition in political science that perceives of urbanization, especially in conjunction with health crises and environmental change, as a leading cause of political instability in the developing world, as famously propositioned by Samuel Huntington and still in vogue among political demographers.⁴² Yet as Bender concludes:

Dar’s changing waterscape . . . indicates a need to rethink notions of “resilience” in a way that recognizes the long history of Africa’s urban populations adapting to difficult and changing circumstances. . . . Urban dwellers built a dynamic, thriving urban life without the benefit of the expansive, formal water infrastructures common in the cities of the Global North . . . [and] represent a capacity for local innovation that should be part of urban resilience strategies.⁴³

Such insights align with scholarship that challenges the representation of the links between migration, urbanization, and climate as constituting an overwhelming crisis; instead it highlights mobility and participation in governance structures by residents of informal settlements as successful adaptation strategies.⁴⁴

In his contribution to this volume, Heinz Klug too grapples with the long shadow cast by historically entrenched unequal citizenship on the consumption and governance of water. He does so in the context of South Africa, which threw off the shackles of apartheid and embraced universal suffrage in 1994, as part of a “wave of democratization” that inspired hopes of an overhaul of antagonistic state-society relations around the continent.⁴⁵ Newly empowered electorates and the growth of a host of civil society organizations with local networks and global partners have powerfully pushed for universal access to clean drinking water and sanitation.⁴⁶ They have nonetheless failed to make the vision of water as a human right – and “water security for all” – a material reality as African states have been forced to undergo structural adjustment, facilitating the commodification of water in the form of privatization and cost-recovery practices. For Klug, debates over access to water and the management of water resources reflect the tension of our age between neoliberalism and human rights – a fault line that runs through the question of climate

change in all countries, from the world's richest to its poorest.⁴⁷ Extensive legal campaigns in which South African civil society invokes a set of powerful principles and rights to get the government to uphold water security for all are, in that sense, a precursor of struggles that will likely be waged across the continent to remind African states of their duties vis-à-vis their citizens as the world heats up further.

The state is, and will remain, central to climate change adaptation in Africa while, conversely, environmental questions will remain at the heart of postcolonial polities, as during colonialism and the first fifty years after independence. The social science literature of the late twentieth century was dominated by analyses that identified a potentially terminal crisis for Africa's "lame leviathans"⁴⁸ and the growing usurpation of state functions by the market, local civil society, international NGOs, and multilateral organizations.⁴⁹ In that interpretation, the provision of water to households and businesses, the drilling of boreholes, the running of desalination plants, and the drafting of national climate adaptation strategies would become increasingly the purview of GDF Suez, Oxfam, the World Bank, and WaterAid. Yet the African state has shown remarkable resilience in recent decades. It has found ways of taming various forms of external intervention and, by partnering with other actors, reasserting an important degree of sovereignty.⁵⁰ Developmental planning, schemes for rural transformation, and big infrastructure have been critical to that renewed prominence, as mounting empirical evidence, including the essay by Allen Isaacman in this volume, makes clear.⁵¹ Mozambique's Cahora Bassa Dam is often approached as a relic of colonial hubris, but the ruling Frelimo party has given it pride of place in both its socialist (until 1987) and postrevolutionary period. Today, the party has prioritized another megaproject, the Mphanda Nkuwa Dam, which is deeply unpopular among communities that are touted as its supposed beneficiaries. But as Isaacman notes, hydro-infrastructure of this sort is not about building a more consensual society or a participatory understanding of water security or climate change; it is about asserting Mozambican sovereignty on the Zambezi.

The reassertion of African statehood has thus gone hand in hand with another somewhat unexpected comeback. After virulent criticism by civil society in the 1980s and 1990s of so-called white elephants, it appeared as if big dams would no longer receive funding from international financial institutions, bilateral donors, or cash-strapped governments. But in the last two decades, African states have once again embraced hydro-infrastructure and tabled projects even more ambitious than those at the highpoint of postcolonial state-building of the 1960s and 1970s (see Stephan Miescher's essay in this volume). A key factor in that high-modernist resurgence has been the role of Asia:⁵² financially (the availability of development loans from Beijing, Delhi, and Tokyo, after Western funders began closing the spigots for dams); materially (the extensive know-how of Asian companies on how to

build and operate dams); and ideologically (the exemplar of East Asian state-led, centralized development instead of market-oriented *laissez-faire*). In her essay, Jyhjong Hwang zooms in on development finance through the lens of a Liberian case study. China's return to Africa after a hiatus of several decades and its scaling up of political and economic ties with almost all states on the continent has indeed provided African incumbents with options they simply did not have during the 1980s and 1990s.⁵³ Yet misperceptions continue to abound regarding exactly how Chinese actors seek to address Africa's infrastructure gap and how African elites leverage that interest strategically. Countering the oft-made assumption that Chinese companies can simply win ever bigger contracts by underbidding Western competitors and dropping all environmental and social safeguards, Hwang highlights that the decision-making of African governments around big hydro-infrastructure is much more complex than simple cost and conditionality considerations. Instead, she underlines how African decision-makers often perplex Chinese interlocutors by engaging in highly strategic management of different donors and development financiers for their own domestic political and international purposes.

Ethiopia, the state that has most often been associated with Chinese registries of development – from dams as anchors of water security over state-led investment to the indispensable role of the party-state – is a case in point.⁵⁴ Post-1991, Ethiopia has been a recipient of extensive Chinese loans, technical expertise, and party-to-party cooperation, which for fifteen years helped it to achieve extraordinary growth levels, a high degree of (apparent) political stability, and major progress on the Millennium Development Goals.⁵⁵ Simultaneously, Ethiopia has asserted itself as one of Africa's most vociferous voices in international climate governance, a reflection of its domestic track record in agricultural and water development and its advocacy of innovative proposals to mitigate global warming.⁵⁶ Harry Verhoeven's contribution to this issue rethinks the Grand Ethiopian Renaissance Dam (GERD), Africa's biggest contemporary infrastructure project. He argues that the interconnected challenges of water, energy, and food insecurity provided a new impetus for the articulation of ambitious state-building projects that rework regional political geographies and expand the ways in which the state can penetrate society, control its territory, and implement consequential policies. Yet while the post-1991 ruling Ethiopian People's Revolutionary Democratic Front (EPRDF) has indeed successfully expanded state infrastructural power, been internationally lauded for its climate diplomacy, and projected unprecedented regional influence, its use of the discourse of environmental justice to secure domestic and global support for the GERD had profoundly ambivalent effects. The language of justice and nation-building was seized upon by enemies from within the party-state and from without to expose the inequities produced by the state-building drive and to oust the incumbent vanguard. Opposition activists successfully mobilized around the expropriation of land, forests, and water that were part of the EPRDF developmen-

tal thrust. However, this mobilization and the dismantling of the ruling coalition further exacerbated fundamental and deadly antagonisms over the future of the country and its developmental model.⁵⁷ The Ethiopian case highlights the promise of articulating audacious political-economic reforms around water security and climate change adaptation as well as the perils of doing so.

What the impacts of human-induced climate change will be remains tentative in Ethiopia, as elsewhere in Africa. But that fundamental uncertainty often appears to be causing greater anxiety in extraregional actors – scientists, aid workers, corporate executives, geopolitical strategists – than it does among many Africans. It is important to recall that both from the standpoints of incumbent leaders and communities, the postcolonial condition has long been defined by the sense of being continuously unsettled.⁵⁸ That condition is informed not only by the particular subjectivities implanted by the colonial experience but also by endless fiscal, constitutional, environmental, territorial, and epidemiological crises competing for Africa’s attention and an unrelenting barrage of external narratives about the need to “develop” and “adapt” to a changing world. The challenges presented by twenty-first-century climate change might well be of a different order according to general circulation models. However, from the perspectives of many African actors, it is merely the latest addition to a long list of threats facing the continent, all of which are supposed to be addressed through a plethora of policies, programs, and projects implemented in partnership with anxious donors who perennially seem to be looking for the next problem. Precious little attention has been paid to the subjectivity of development – the expectations generated among people of not only material change but also of social relations reworked and the disappointments so often incurred along the way – and how social-psychological dynamics and social capital affect various forms of adaptation and mitigation, for instance in reducing emissions from deforestation and forest degradation.⁵⁹ This is of particular relevance because many old developmental priorities and instruments – anti-erosion measures, settlement of nomadic populations, dam-building – are currently being recycled under the umbrella of “climate change adaptation.”⁶⁰ As sociologist Andrea Nightingale has observed, “adaptation programs tend to co-opt well established development efforts (both programs and their specific interventions) and in the process, fail to promote transformative change.”⁶¹ Development and adaptation have a history, no matter how much one insists that today’s challenges are qualitatively different. That baggage underpins what African futures are imaginable for those Africans who should be the agents of change but are still often treated as its objects.

The essays assembled in this issue of *Dædalus* have enunciated the pathologies of adopting a view of water security and climate that is devoid of cultural context, history, and social relations. This is not to downplay the

extraordinary work done by natural scientists to make sense of complex atmospheric and hydrological processes. It is, however, to underscore the inadequacy of a positivist approach in confronting a set of challenges that is fundamentally about people's relationships not only with their natural environment but with each other.⁶² The corollary of that conclusion is that such an awareness does not have to lead to paralysis, but instead can usher in a different and more empowering politics of possibility: no condition is permanent, as the famous West African dictum goes. This entails reappreciating the productive potential of uncertainty in Africa: uncertainty does not have to lead to anxious isolation but can generate new forms of social life and collective action that reimagine potential futures and work toward them.⁶³ Put differently: of course, more weather stations and satellite readings are welcome to foresee tropical storms and protracted droughts across the continent. It is, of course, important to share best agronomic practices and introduce heat-resistant crops, especially in the Sahel and Southern Africa. And, of course, extant modes of production, transportation, and consumption of goods and services need to be rendered more efficiently through a set of essential technical tweaks and innovations. But equally important as all of that, and arguably even more vital, is the need to listen to, critically engage with, and foreground African ideas about climate and water in all their diversity and multilayered complexity. There is no scenario in which African societies adapt successfully to climatic change and do not simultaneously radically reimagine both their relationship with the outside world and with each other, including the institutions of control and exclusion at home.

For decades, high levels of uncertainty about environmental change and the language of fragile intercommunitarian relations have been instrumentalized by colonial and postcolonial power-holders to stifle debate, to limit the extent of consensual decision-making, and to render laws more restrictive for ordinary citizens. There is a real risk, already manifesting itself in the Horn of Africa and other key regions, that the omnipresence of discourses about water scarcity and *the* climate crisis will once more have those same disempowering effects. Political and economic elites are beginning to defend their privileges and authority by weaponizing the language of adaptation and invoking *the* climate to justify disruptive and disempowering policies: centralizing water and energy systems; problematizing migration and mobility; criminalizing creative informality in urban milieus; neglecting "economically unfeasible" smallholder agriculture; and so on. The real challenge is therefore not whether dykes can be fortified, desalination can be made more affordable, or irrigation pumps can more effectively target crops. It is whether climate change adaptation will come to mean the transformation of Africa's political and economic systems and of their asymmetric, violent imbrication in the global political economy.

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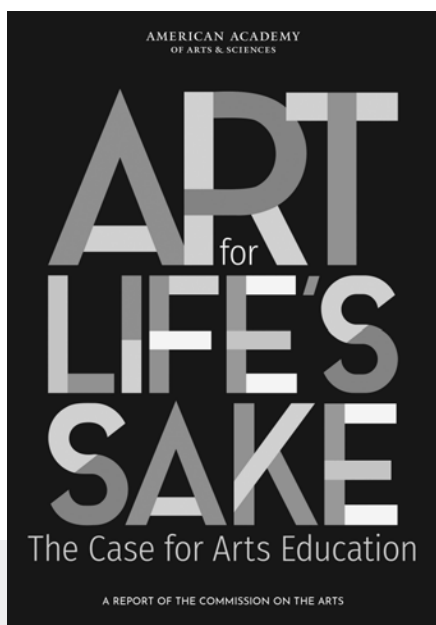
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