

Center for American Progress

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THE CENTER FOR  
CLIMATE AND  
SECURITY



# The Arab Spring and Climate Change

A Climate and Security Correlations Series

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Edited by Caitlin E. Werrell and Francesco Femia

February 2013

Preface by Anne-Marie Slaughter



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# Preface

Anne-Marie Slaughter

Crime-show devotees will be familiar with the idea of a “stressor”—a sudden change in circumstances or environment that interacts with a complicated psychological profile in a way that leads a previously quiescent person to become violent. The stressor is by no means the only cause of the crimes that ensue, but it is an important factor in a complex set of variables that ultimately lead to disaster.

“The Arab Spring and Climate Change” does not argue that climate change caused the revolutions that have shaken the Arab world over the past two years. But the essays collected in this slim volume make a compelling case that the consequences of climate change are stressors that can ignite a volatile mix of underlying causes that erupt into revolution.

This volume of essays includes the following contributions:

- Troy Sternberg of Oxford University begins by investigating the connections between climate events in other parts of the world and social unrest in the Arab world. More specifically, he looks at drought conditions in China, subsequent global wheat shortages, and how those shortages may have influenced the Egyptian uprisings. In his own words, he paints a picture of “how a localized hazard became globalized.”
- Sarah Johnstone and Jeffrey Mazo of the International Institute for Strategic Studies investigate the vulnerability of the Middle East and North Africa region to fluctuations of food supply and prices both globally and locally, and how current and projected climatic changes interact with those phenomena. They conclude that, “The Arab Spring would likely have come one way or another, but the context in which it did is not inconsequential. Global warming may not have caused the Arab Spring, but it may have made it come earlier.”

- Francesco Femia and Caitlin Werrell of the Center for Climate and Security address the influence of climate change before social and political unrest developed into large-scale conflict in Syria—a country many analysts initially deemed impervious to the Arab Spring, also known as the Arab Awakening—the projected influence of climate change after the Arab Awakening in Libya, and possible water-security solutions for building climate resilience that may simultaneously enhance cooperation and aid in resolving conflict.
- Michael Werz and Max Hoffman of the Center for American Progress investigate how “security in one place is irrevocably linked to stability in distant regions.” Werz and Hoffman use the Arab Awakening as a backdrop to explore how a 21st-century security strategy must account for “transcendent challenges,” including the nexus between climate change, human rights, and migration.
- David Michel and Mona Yacoubian of the Stimson Center explore how the Arab world could transform the risks posed by climate-change factors into sustainable economic growth and job-creating opportunities. Michel and Yacoubian look specifically at how “greening” Arab economies by adopting innovative technologies and forward-leaning government policies can simultaneously bolster employment and mitigate environmental risks, “turning two of the region’s pre-eminent challenges into a significant opportunity.”

All of these authors are admirably cautious in acknowledging the complexity of the events they are analyzing and the difficulty of drawing precise causal arrows. But consider the following statements:

- “A once-in-a-century winter drought in China contributed to global wheat shortages and skyrocketing bread prices in Egypt, the world’s largest wheat importer.” (Sternberg, p. 7)
- Of the world’s major wheat-importing companies per capita, “the top nine importers are all in the Middle East; seven had political protests resulting in civilian deaths in 2011.” (Sternberg, p. 12)
- “The world is entering a period of ‘agflation,’ or inflation driven by rising prices for agricultural commodities.” (Johnstone and Mazo, p. 21)
- “Drought and desertification across much of the Sahel—northern Nigeria, for example, is losing 1,350 square miles a year to desertification—have under-



mined agricultural and pastoral livelihoods,” contributing to urbanization and massive flows of migrants. (Werz and Hoffman, p. 37)

- “As the region’s population continues to climb, water availability per capita is projected to plummet. ... Rapid urban expansion across the Arab world increasingly risks overburdening existing infrastructure and outpacing local capacities to expand service.” (Michel and Yacoubian, p. 45)
- “We have reached the point where a regional climate event can have a global extent.” (Sternberg, p. 10)

These assertions are all essentially factual. None of them individually might be cause for alarm. Taken together, however, the phenomena they describe weave a complex web of conditions and interactions that help us understand the larger context for the Arab Awakening. Indeed, as Johnstone and Mazo argued as early as April–May 2011, in an article written just at the outset of the Tunisian and Egyptian revolutions, it was already possible to see that climate change played a role in the complex causality of the revolts spreading across the region. They called it a “threat multiplier.”<sup>1</sup> It significantly increased the interactive effects—and hence the overall impact—of political, economic, religious, demographic, and ethnic forces.

This concept of a “threat multiplier” is a helpful way to think about climate change and security more broadly. In Syria, for instance, as Femia and Werrell tell us, a combination of “social, economic, environmental and climatic changes ... eroded the social contract between citizen and government in the country, strengthened the case for the opposition movement, and irreparably damaged the legitimacy of the Assad regime.” In Libya, according to the same authors, Qaddafi used oil revenues to finance the “Great Man-Made River Project,” one of the largest water engineering projects in the world—and quite unsustainable. Libya is 93 percent arid, and the aquifers it is draining for the project are shared by Egypt, Chad, and Sudan. Moreover, climate projections estimate that Libya’s “drought days” per annum will rise from more than 100 to more than 200—an enormous and potentially devastating increase. It is not difficult to see how these conditions multiply the threats already facing Libya’s fragile new government. On the other hand, Femia and Werrell outline a much more positive vision of how water-management projects could help bring otherwise-divided parts of Libyan society together.

Beyond individual countries, if we accept the conclusions of the authors collected here, then we must expect a continuing and increasing interplay between climate,

land, water, food, migration, urbanization, and economic, social, and political stress. Yet almost none of those issues shows up in a traditional course on international relations, which focuses far more on the traditional geopolitics of interstate relations, particularly the distribution of military and economic power among a handful of the most important states. Insecurity in this world is defined largely in terms of military threats posed by rising or declining powers; security dilemmas between rival states, which must assume worst-case motivations on one another's part; physical and virtual terrorist attacks; and denial of access to any of the world's common spaces—ocean, air, outer space, and, increasingly, cyberspace.

Yet intrastate violence, instability, and revolution all create their own turmoil. The geopolitical results of the Arab Awakening are felt in the political realignment of states such as Egypt following the political victory of the Muslim Brotherhood in recent elections, and the determination of states such as Saudi Arabia and Qatar to arm specific factions in the civil war in Syria as part of a proxy war with Iran. Moreover, violence and pervasive political uncertainty across the Middle East inflicts its own economic costs: unstable oil prices, streams of refugees and migrants to more developed countries, and the opportunity costs of investment forgone across a region that has served as a global crossroads since the beginning of human civilization.

It follows, as Werz and Hoffman conclude, that, “The United States, its allies, and the global community must de-emphasize traditional notions of hard security more suited to the Cold War and focus on more appropriate concepts such as human security, livelihood protection, and sustainable development.” Foreign policy initiatives focused on human-security issues offer ways to:

- Diminish distrust of the United States
- Bring together a wide range of civic and corporate partners, both in country and from abroad
- Transcend conflicts over resources such as water and grazing land among rival groups by creating avenues for constructive cooperation on issues including water management and crop adaptation
- Engage specific groups of a population such as women, youth, entrepreneurs, or religious communities

In response to this new emphasis on human security, Michel and Yacoubian detail a number of encouraging international initiatives to “establish networks of renewable energy projects linking Arab countries to each other and to export markets in Europe and Africa” and laying the foundations for green growth.

Former U.S. Secretary of State Hillary Clinton understood the value of this type of engagement from the very outset of her tenure. The first Quadrennial Diplomacy and Development Review in 2010 sought to develop and institutionalize new organizational structures and policy tools specifically designed to engage societies, as well as governments. Consider the creation of an under secretary for civilian security, democracy, and human rights replacing the under secretary for democracy and global affairs in the State Department. The new under secretary oversees five important bureaus, two of which—the Bureau of Counterterrorism and the Bureau of Conflict and Stabilization Operations—are newly created. The other three are the Bureau of International Narcotics and Law Enforcement, the Bureau of Democracy, Human Rights, and Labor, and the Bureau of Population, Refugees, and Migration. Each of these bureaus focuses on a different dimension of human security:

- Protection from violence in conflict-torn states and the rebuilding of state institutions
- Protection from the violence and corruption inflicted by global criminal networks in drugs, arms, money, people, and violent extremism
- Protection of basic human rights
- The meeting of basic human needs in times of migration and displacement

Within these bureaus and in offices reporting directly to the secretary of state can be found a host of new ambassadors and senior representatives for issues such as:

- Global empowerment of women
- Creation and maintenance of public-private partnerships
- Global youth issues
- Establishment of regional and global networks of entrepreneurs
- Outreach to Muslim communities around the world
- Support of civil society

The new Bureau of Energy Resources also focuses on energy security for the United States and its allies—a task that requires close coordination with the special representative for climate change.

These initiatives are far more than one secretary of state's whim. They build on a growing recognition beginning at the end of the Cold War that global problems, crises, and conflicts were resulting from a more complex and intertwined set of causes. Over the past two decades, the role of planetary changes—the human impact on climate, biodiversity, and natural resources, from water to fish to for-

ests—have exacerbated the perils of the human condition even as technological advances have created whole new worlds. Foreign policy, which has always been about advancing one nation’s interests and values with respect to those of other nations, is now increasingly about solving national, regional, and global problems that affect us all in myriad and often unpredictable ways.

“The Arab Spring and Climate Change” is a title that will still strike many readers as a very strange juxtaposition. But as the contents of this volume make clear, it describes the interplay of factors that will demand an increasing amount of our attention going forward.

# Chinese Drought, Wheat, and the Egyptian Uprising: How a Localized Hazard Became Globalized

Troy Sternberg

Chinese drought, global wheat prices, and revolution in Egypt may all appear to be unrelated, but they became linked by a series of events in the 2010–2011 winter.<sup>2</sup> As the world’s attention focused on protests in Egypt’s Tahrir Square, political and socioeconomic motives behind the protests were discussed abundantly, while significant indirect causes of the Arab Spring received little mention. In what could be called “hazard globalization,” a once-in-a-century winter drought in China reduced global wheat supply and contributed to global wheat shortages and skyrocketing bread prices in Egypt, the world’s largest wheat importer.<sup>3</sup> Government legitimacy and civil society in Egypt were upset by protests that focused on poverty, bread, and political discontent.

A tale of climate disaster, market forces, and authoritarian regimes helps to unravel the complexity surrounding public revolt in the Middle East. This essay examines the link between natural hazards, food security, and political stability in two developing countries—China and Egypt—and reflects on the links between climate events and social processes.

The aforementioned citizen protests in Egypt represented political and economic dissatisfaction, including the high cost of food—recall the days of waving bread as a protest symbol.<sup>4</sup> Bread provides one-third of the caloric intake in Egypt, a country where 38 percent of income is spent on food.<sup>5</sup> The doubling of global wheat prices—from \$157/metric ton in June 2010 to \$326/metric ton in February 2011—thus significantly impacted the country’s food supply and availability.<sup>6</sup>

The world wheat harvest was affected by changing weather patterns in 2010 that led to supply shortages. Climate factors curtailed wheat production in Russia (down 32.7 percent) and Ukraine (down 19.3 percent) due to drought, heat waves, and fires, while cold and rainy weather in Canada (down 13.7 percent) and

excessive rain in Australia (down 8.7 percent) resulted in reduced global wheat supply and major price increases. At the same time China's wheat production fell 0.5 percent, while wheat consumption in the country increased by 1.68 percent.<sup>7</sup>

### Eastern China's wheat-growing region



Source: Troy Sternberg, "Chinese drought, bread and the Arab Spring," *Applied Geography* 34 (2012): 519–524.

China, the largest wheat producer and consumer in the world, experienced drought in its growing eastern region in November 2010.<sup>8</sup> Fears of potential crop failure and the specter of historical famines—most recently in 1958–1961—led the Chinese government to purchase wheat on the international market to compensate for losses from drought.<sup>9</sup> A fraction (6 percent to 18 percent) of annual global wheat production is traded across borders, so any decrease in world supply contributes to a sharp rise in wheat prices and has a serious economic impact in countries such as Egypt, the largest wheat importer in the world (9.8 million metric tons in 2010).<sup>10</sup>

Climate conditions put market pressure on international wheat prices, which were further exacerbated by a lack of precipitation in China. This threatened the 2010–2011 winter wheat crop—a crop that accounts for 22 percent of the country's harvest. Examination of the drought record at 12 sites in China's eastern wheat belt—including Shandong, Henan, and Anhui provinces, with a combined population of more

than 300 million—using the Standard Precipitation Index, or SPI, which tracks the dramatic extenuation of drought in China's eastern region. (see Table 1) The index examines precipitation anomalies at selected meteorological stations to identify the spatial and temporal extent of drought.<sup>11</sup>

With data from the China Meteorological Administration, the SPI was used to calculate drought on a monthly timescale. The findings documented extreme drought across the region, reaching once-in-a-century levels. Drought severity affected domestic and agricultural water supply, closed parts of the Yangtze River to shipping, dried reservoirs, and reduced hydropower generation, prompting a strong government response to the disaster.<sup>12</sup> The rarity of the event contributed to its potentially

**TABLE 1**  
**Drought in China's eastern region, at one- to six-month timescales**

SPI drought values: Greater than -1 is mild; greater than -1.5 is severe; and greater than -2 is extreme

Site	Month timescale					
	1	2	3	4	5	6
Anqing	-0.9	-0.6	-1.4	-3	-2.5	-2.9
Anyang	-0.5	-1.2	-2.1	-0.9	-1.2	-1.7
Bengbu	-1.6	0.01	-1.1	-1.7	-1.1	-1.6
Bozhou	-1.4	-2	-3	-1.3	-1.5	-2.1
Dongtai	-1.9	-0.7	-1.8	-2.6	-2	-2.6
Huoshan	-0.7	-1	-2	-3	-2.7	-3.2
Jinan	-0.8	-1.3	-2.1	-0.6	-0.8	-1.3
Laohekou	-1.3	-1.5	-2.1	-2.2	-2.3	-2.6
Nanjing	-1.3	-0.9	-1.9	-2.9	-2.5	-2.9
Wuhan	-1.2	-1.3	-1.9	-3.3	-3.1	-3.3
Xinyang	-1.7	-2.6	-2.7	-1.7	-1.9	-2.3
Zhenzhou	-0.9	-1.7	-2.7	-1	-1.2	-1.8
	a. through January 31, 2011			b. through April 30, 2011		

Note the extent of drought at all sites throughout the region.

Source: Troy Sternberg, "Chinese drought, bread and the Arab Spring," *Applied Geography* 34 (2012): 519–524.

significant agricultural and socioeconomic impact and prompted dramatic photographs of Chinese Premier Wen Ji Bao watering the wheat fields with a garden hose and military rocket launchers “shooting the clouds” to bring rain.<sup>13</sup>

## Discussion

The 2011 extreme drought in the Chinese wheat-growing region exemplifies how a regional climate event can have both a regional and a global impact. Potential wheat crop failure contributed to a series of government actions that influenced economic and political conditions in other regions of the world. China's drought-mitigation effort—including \$1.9 billion in new water infrastructure and the purchase of wheat from external markets—contributed to the skyrocketing cost of wheat for importing countries.<sup>14</sup>





A farmer walks past his dried-up wheat cropland at Liuhe village in Tongzhou district in Beijing, China.

Beijing declared an emergency across China's north, where 3.46 million people still lack adequate drinking water and winter wheat crops are withering in the worst drought in five decades.

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This is particularly pertinent to Egypt, a country that spends 3 percent of its gross domestic product on wheat subsidies and that experienced the 1977 “bread intifada” that killed 77 people and the bread riots in 2008.<sup>15</sup> Higher wheat prices affected the cost and availability of bread in Egypt, influenced citizen protests, and indirectly led to regime change in Egypt. This chain of events and actions highlight how government effectiveness—or lack thereof—in two autocratic regimes resulted in opposite outcomes and reflects how in today’s interconnected world, natural hazards can influence economic (price), political (government stability), and human (food supply) systems on an international scale.

## Climate

As stated above, we have reached the point where a regional climate event can have a global extent.<sup>16</sup> Impact is no longer limited to physical damage at a disaster’s epicenter. Rather, it can also be social and economic, as hazards



affect globalized systems. Recent disasters, including tsunamis in Asia and volcanic eruptions in Iceland, reflect the cross-border effect of natural hazards. Hydrometeorological disasters predominate today and occur at a greater rate than geophysical events.<sup>17</sup> Future shifts in climate patterns (cooling or warming), seasonality (fluctuation in precipitation/temperature patterns and occurrence), intensity, and volatility can significantly impact the environment, agriculture, water supply, and livelihoods.

In this study, a series of droughts and rain episodes in one region in 2010–2011 had economic and then political effects thousands of miles away. Such unfolding progressions are more commonly evaluated when events affect oil prices, famine, migration, or terrorism—for example, conflict, the Iraq war, drought in the Horn of Africa—but similar scenarios are likely to be repeated as climate volatility, expanding populations, and competition for resources disturb global markets and possibly national stability.

## Geography

The geography of the two countries contributes to their dependence on climate factors, as both Egypt and China are predominantly arid nations. Egypt's climate limits its ability to expand grain production to satisfy the requirements of an expanding population. Throughout the Nile region, there is competition for farmland and water between urban centers and agrarian interests, as well as between high-value exports crops such as flowers and mangoes, and staple foods such as wheat. Failing to meet domestic demand left Egypt exposed to external forces (climate, economics) and reliant on changing international commodity markets.

China's western and northern regions are predominantly drylands—the country's large population and agricultural production is centered in the eastern and southern regions. Currently this area has enough land, water, and technology for domestic wheat production to be self-sufficient in most years. Yet water resources are concentrated in the south and strong finances and continued government effort are required to develop agricultural resources elsewhere and mitigate the hazards of such reliance on a single growing region.

Both countries' governments have attempted to balance agriculture, finances, and food supply with public needs. In 2011 China succeeded, while the former Egyptian regime failed.

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## Future implications

The effect of climate hazards on wheat production in 2010–2011 is a striking case of how hazards, agriculture, economics, and politics can become intricately linked. As protests spread across North Africa and the Middle East, it is interesting to consider the percent of income spent on food and the average age of the world's major wheat-importing countries per capita. (see Table 2)

One instantly notes that the top nine importers are all in the Middle East; seven had political protests resulting in civilian deaths in 2011.<sup>18</sup> Households in the countries that experience political unrest spend, on average, more than 35 percent of their income on food supplies.<sup>19</sup> This contrasts starkly with developed countries such as the United States and the United Kingdom, in which households spend less than 10 percent of income on food. Conditions reflect the dependence of Arab nations on imported food and their vulnerability to fluctuating global commodity markets.

As global wheat prices doubled, pressure on domestic bread prices increased in the region and influenced public dissatisfaction with governments. High commodity imports, low income levels, and the percentage of earnings spent on food combine to affect food and social security. Two Middle Eastern countries not experiencing protests—Israel and the United Arab Emirates—have high income per capita, a low percentage of income spent on food, and the ability to adjust and adapt to changing food prices and supply. Population growth is an additional factor: While China's median age is 34.2 years, more than half the population in several Middle Eastern and North African countries, including Egypt and Syria, is under age 25.<sup>20</sup>

In China the poverty rate has fallen to reach 13 percent over the past 30 years as a result of the country's rapid economic development,<sup>21</sup> while poverty rates in Egypt were estimated at 25 percent in 2010 to 2011 by the official Egyptian Central Agency for Public Mobilization and Statistics, and in reality may be higher.<sup>22</sup> Moreover, China has \$3 trillion in foreign reserves that enable the government to spend as much as is needed on commodities—wheat, in this case—or invest in drought-alleviation measures in affected regions. In contrast, the Egyptian system has been less capable of perceiving and meeting basic needs of its population. Whereas in 2010 a vast majority of the Chinese (84 percent) were highly optimistic about the future, most Egyptians (73 percent) expressed great pessimism with the country's direction prior to former President Hosni Mubarak's fall.<sup>23</sup>

TABEL 2

### Percent of income spent on food and average age per-capita of the top wheat-importing countries

2010 Wheat imports per capita			Per capita		Age
Rank	Country	Metric tons (in '000s)	Income (in U.S. dollars)	Food - percent of income	Percent under 25 years
1	UAE	370.659	47,400	8.7	31.1
2	Libya	242.803	12,062	37.2	47.4
3	Israel	238.968	27,085	17.6	43
4	Jordan	173.611	4,435	40.7	54.4
5	Algeria	101.439	4,477	43.7	47.5
6	Tunisia	89.330	4,160	35.6	43.2
7	Yemen	86.843	1,230	45	65.5
8	Egypt	81.284	2,771	38.8	52.4
9	Iraq	76.701	2,625	35	60.6
10	Cuba	70.503	5,000	n/a	34.6

Source: Troy Sternberg, "Chinese drought, bread and the Arab Spring," *Applied Geography* 34 (2012): 519–524.

## Conclusion

Throughout history, bread protests and food riots have contributed to political and social change—think of the French and Russian Revolutions. In the last decade alone, food-related uprisings led to government change in Haiti (in 2008),<sup>24</sup> while violent protests over food prices in Cameroon left 24 people dead and led to 1,500 arrests (also in 2008);<sup>25</sup> this process was again evident in the Middle East in 2011. Potential wheat, rice, or other food shortages will continue to affect food prices and will challenge leadership across the globe, as occurred in the Arab Spring. After recent events in Tunisia, Egypt, Libya, and Yemen, is there a possibility of further wheat price increases affecting civil society in other countries?

Drought is the natural hazard with the greatest spatial and temporal extent, as a protracted decrease in precipitation can occur in any region. Its importance lies in the potential number of people affected and its link to agricultural production and water resources in much of the world. Other disasters may disturb food supply or social order *in situ*—such as floods in Pakistan and Australia or the Sichuan or Haiti

earthquakes—with some potential regional effect. Yet it is the indirect influence of climate events and disasters on water, food, and populations that give such disasters an international scope. In 2011 drought in China (a natural hazard) influenced bread prices and availability (food security) and indirectly affected social unrest and governance in the Middle East (political stability), exemplifying the globalization of drought. We will realize how interconnected the world has become if climate hazards one day disrupt global agriculture, energy, or water systems.

*Troy Sternberg is a British Academy postdoctoral research fellow in the School of Geography at Oxford University.*

# Global Warming and the Arab Spring

Sarah Johnstone and Jeffrey Mazo

Was climate change one of the causes of the wave of popular protests, uprisings, civil wars, and regime change that began sweeping the Arab countries of the Middle East and North Africa region in late 2010? When we first posed this question in a commentary in *Survival* in April–May 2011, we acknowledged that the question initially looked absurd.<sup>26</sup> Surely myriad long- and short-term social, economic, political, and religious drivers of anger and dissent lay at the root of the unrest.

But, as we argued, the early events of what came to be called the Arab Spring offered a textbook example of what analysts mean when they talk of complex causality and the role of climate change as a “threat multiplier.”<sup>27</sup> The wave of protests across the region, feeding on one another, might have broken at any other time over the past few decades.<sup>28</sup> Why, then, did they happen when they did? Many different sets of events and circumstances might have been sufficient to set it off. Any particular set would have been unnecessary, since another could have sufficed. But in the distinct chain of events that led to the Arab Spring, climate change played a necessary role, even if it was obviously an insufficient trigger on its own.

A proximate factor behind the unrest was a spike in global food prices, which in turn was due in part to the extreme global weather in 2010–2011. This was not enough to trigger regime change—we have seen food-price spikes and food riots before—but it was a necessary part of this particular mix.

Our intention in 2011 was not to embark on a rigorous empirical study but rather to flag the numerous solid indicators pointing in the same direction across the region. Demonstrators waving baguettes on the streets of Tunisia, Jordan, and Yemen illustrated the problem even before the U.N. Food and Agriculture Organization declared in March 2011 that global food prices were at an all-time high. The agency’s announcement followed an earlier warning in January 2011 that its food-price index had risen past some of the highs that sparked riots

in 2008.<sup>29</sup> Indeed, the global cost of wheat had been climbing since summer 2010, when drought and bushfires laid waste to crops in Russia, Ukraine, and Kazakhstan—all leading global wheat exporters. The global prices of sugar, maize, soybeans, and vegetable oils had also risen over the same time period.<sup>30</sup>

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## 2010: A bad year for farmers

In February 2011 wheat was trading at \$8.50 to \$9 a bushel, compared to around \$4 in July 2010.<sup>31</sup> This surge in prices took analysts by surprise: In its January 2010 World Agricultural Supply and Demand Estimates report, the U.S. Department of Agriculture predicted higher global wheat production and lower prices.<sup>32</sup> The International Grains Council was similarly optimistic about supply.<sup>33</sup> But in August 2010 estimates began to be adjusted downward, as adverse weather wiped out crops worldwide.<sup>34</sup>

In spring 2010 record rainfall in Canada, the world's second-largest wheat exporter after the United States, cut Canada's harvest by nearly a quarter.<sup>35</sup> Then drought beset Russia, Ukraine, and Kazakhstan. Bushfires across Russia slashed the country's yearly wheat harvest to approximately 60 million tons, down from 97 million tons in 2009.<sup>36</sup> In August Russia—the world's fourth-largest wheat exporter accounting for roughly 14 percent of the global wheat trade—responded by imposing an export ban on wheat, barley, and rye, as fears of domestic price spikes or shortages increased.<sup>37</sup> There were also limitations on grain exports from Ukraine, another major global supplier.<sup>38</sup>

Forecasts were reduced elsewhere as well. Drought and dust storms that began in spring 2010 in western China lasted into 2011, threatening nearly 7 million hectares of winter wheat and other crops.<sup>39</sup> The United States began to suffer similar “winter kill” from storms in late January 2011.<sup>40</sup>

Southern-hemisphere harvests were hit by a severe La Niña weather event, with drought in Argentina starting to affect soybean and maize crops, while torrential rains reduced up to half of Australia's 2010–2011 wheat crop to animal-feed quality.<sup>41</sup> Overall, the U.S. Department of Agriculture forecasted that 2010–2011 global wheat production, at 645 million tons, will fall below global consumption rates, at 655 million tons, forcing the world to dip into its existing 177-million-ton inventories.<sup>42</sup>

Meanwhile, sugar prices hit a 30-year high in 2011, as Cyclone Yasi raged across northeastern Australia in February, affecting one of the world's largest producers.<sup>43</sup> Following poor weather in other top-growing sugar regions in Brazil and Pakistan, the cyclone pushed sugar to 33 cents per pound, compared to 17 cents seven months prior.<sup>44</sup>

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## Bread and protests

The Middle East and North Africa region is particularly vulnerable to such fluctuations in food supply and prices. With little arable land and scarce water supplies, it imports more food per capita than any other region, accounting for 25 percent to 50 percent of domestic consumption in some Middle Eastern and North African nations. By tonnage, it is the world's largest cereal-importing area, and it is a major customer for Russian grain. According to International Grains Council figures, Egypt—Moscow's largest customer—received only 1.6 million tons of Russian wheat in the last six months of 2010, compared to 2.8 million tons in the same 2009 period.<sup>45</sup> The region has seen major food riots before,<sup>46</sup> and booming population growth and changing diets have contributed to its growing food insecurity.<sup>47</sup>

While some academics have sought to demonstrate direct causal links between higher food prices and political unrest historically,<sup>48</sup> it is important not to overstate the case in respect to the recent Arab Spring. We agree with experts in Tunisia and Egypt and World Bank President Robert Zoellick, who all described food prices as an “aggravating factor” in the turmoil rather than the principal cause.<sup>49</sup> “This is not only a bread riot,” insisted Omneia Helmy, deputy director of research at the Egyptian Center for Economic Studies in Cairo, where popular demonstrations ousted the Mubarak regime on February 11, 2011. “In Egypt, the 2008 food-price crisis never went away. If it was only about that, this revolution would have happened sooner. This is about justice, democracy, equality, political freedom.”<sup>50</sup>

Abdolreza Abbassian, a senior economist at the U.N. Food and Agriculture Organization, agreed: “If you look at the people who have been at the forefront, many students and middle-class, they are not starving.”<sup>51</sup>

Nevertheless, rioting in Algeria in early January 2011 was a direct response to widespread unemployment and higher prices for sugar, oil, and other staples.<sup>52</sup> The government's move to reduce the cost of staple foods only quelled the

violence temporarily, and there were further demonstrations in February.<sup>53</sup> In inflation-hit Tunisia, protesters waved baguettes symbolically but also chanted that they could endure poverty as long as they were rid of President Zine El Abidine Ben Ali and his ruling Constitutional Democratic Rally party. He fled the country on January 14, 2011.<sup>54</sup>

Protests in Egypt were principally aimed at President Mubarak's regime. But Egyptian families at the time were spending an average of 40 percent of their income on food;<sup>55</sup> overall food-price inflation was 20 percent<sup>56</sup>; and the price of some individual commodities such as tomatoes had increased tenfold in recent years.<sup>57</sup> Helmy said that about 40 million (of the total 83 million) Egyptians relied on ration cards, and that the country's bread-subsidy system was riddled with corruption.

None of this is to diminish the factors other than weather or climate change behind the food-price rises. On the demand side, a fast-growing world population and rising living standards in developing countries such as China, India, and Brazil have placed greater strain on the system. Another significant demand-side pressure has been the increasing use of crops such as corn and sugar to produce biofuels.

On the supply side, growth in agricultural productivity has been in steady decline since the mid-1990s, when the Green Revolution fueled by technological advances in farm machinery, chemicals, and irrigation petered out.<sup>58</sup> The steady rise in oil prices has increased transport costs and farmers' expenditure on nitrogen-based fertilizer, and it contributes to a greater demand for biofuels.<sup>59</sup>

Finally, there is continuing debate about the extent to which financial speculation in commodities pushes up prices, and whether the fall in the dollar has had an effect on global food prices because commodity prices are generally quoted in that currency. When looking at what caused the Arab Spring, as Abbassian put it, "I know that 'many factors' is not an eye-catching answer to the question. However, it is the most accurate."<sup>60</sup>

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## Climate change's role

In a summer 2011 article in *The Washington Quarterly*, there was an important reality check on the emerging consensus of self-selecting analysts—ourselves included—of the climate-security nexus.<sup>61</sup> Bruno Tertrais, a senior research fellow at the Fondation pour la Recherche Stratégique in Paris, suggested three problems with our argument:





- There was no evidence that the 2010 weather events were sufficiently extreme to be only attributable to climate change.
- Other factors besides weather were at play (as we acknowledged) in the food-price spikes.
- We offered no evidence that food prices played a “necessary” role in the Arab Spring.

Protestors hold bread as they face riot police officers during a demonstration against the Constitutional Democratic Rally in January 2011.

ASSOCIATED PRESS/CHRISTOPHE ENA

But individual events can never be unambiguously attributed to climate change by definition, and the severe weather of 2010–2011 is exactly what we should expect to happen with increasing frequency as the world’s temperature warms. There is, moreover, increasing confidence that weather extremes over the past decade are linked to anthropogenic global warming—for example, one calculation derives an 80 percent probability that the July 2010 heat record in Moscow would not have occurred in the absence of such warming.<sup>62</sup>

Climate change and its impact on weather are, of course, insufficient on their own to cause conflict or unrest, let alone on the scale that has occurred and is still occurring in the Arab world. But the argument has never been that climate change—or indeed any environmental driver—is a necessary cause of conflict. Rather, it is a necessary component of a particular and contingent concatenation of circumstances that led to the observed outcome. The fact that other circumstances might have led to the same outcome is beside the point. Climate change has been a threat multiplier in the sense that it was a necessary component of any number of possible scenarios, each of them sufficient to have led to the sort of unrest we are now witnessing in the Middle East and North Africa region.

The debate over the link between environmental factors and conflict is unlikely to be resolved soon, but there are good *a priori* reasons to think that the link is real, and the evidence to the contrary is unpersuasive.<sup>63</sup> Although climate-induced conflict has tended in the past to involve global or regional cooling rather than warming, as Tertrais points out, the post-industrial warming that the world has already experienced is historically unprecedented, and we are headed further into uncharted territory. Theoretical considerations also suggest that the sociopolitical effects induced by projected warming over the medium term will be similar to those experienced by past societies facing climate change.<sup>64</sup>

What is clear is that environmental factors are only one—and are rarely the decisive—contribution to a complex interaction of other political, social, and economic factors underlying conflict. This also illustrates the difficulty of translating the concept of climate change as a threat multiplier into concrete policy advice. The very complexity and multiplicity of the possible paths of which climate change is but a small part makes prediction impossible. Any role that climate change plays in certain events can only be discerned after the fact, and its increased contribution to threats cannot be quantified. But the resources that states outside the region might need to draw on, whether for evacuation of nationals caught in the crossfire, military intervention, humanitarian assistance, or political and diplomatic capital—time and attention at the expense of other interests—is not negligible.

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## Conclusion

In the complex mix of environmental, political, economic, and trade factors influencing global food security, analysts seem sure of one thing: The world is entering

a period of “agflation,” or inflation driven by rising prices for agricultural commodities.<sup>65</sup> Key drivers of higher food prices such as population increase and the nutrition transition to diets higher in sugar, fats, and proteins are unlikely to abate. The United States, the European Union, and Brazil are unlikely to change their biofuel policies.

With the poorest countries being the most vulnerable to rising food prices, the World Bank is concerned about possible unrest in Central America and the Caribbean—particularly in El Salvador, Haiti, Grenada, and Jamaica.<sup>66</sup> Abbassian thinks the Central Asian countries of Kyrgyzstan and Tajikistan are in a precarious position, as well as African states such as Uganda, Mali, Niger, and Mozambique, which had food riots in September 2010.<sup>67</sup> Nomura’s Food Vulnerability Index, which assesses the impact of food-price fluctuations controlling for relative wealth and the share of food in household consumption, puts Asian countries such as Bangladesh and Sri Lanka at the top of its list, alongside Middle East and North Africa countries already affected.<sup>68</sup>

Some might argue that to the extent it may have contributed to the flowering of democracy and departure of despots in the Arab world, the potential of climate change to foster unrest need not always be a bad thing. But fledgling democracies with weak institutions might find it even harder to deal with the root problems than the regimes they replace, and they may be more vulnerable to further unrest as a result. The events in Egypt as of June 2012 appear to bear this out. Climate change may increase the probability that events such as those we are seeing in the Middle East and North Africa will happen elsewhere in the world.

The Arab Spring would likely have come one way or another, but the context in which it did is not inconsequential. Global warming may not have caused the Arab Spring, but it may have made it come earlier.

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# Climate Change Before and After the Arab Awakening: The Cases of Syria and Libya

Francesco Femia and Caitlin Werrell

The Arab Spring—which, in the public discourse, morphed into the Arab Awakening as social unrest continued well beyond the spring of 2011—has a multitude of ultimate and proximate causes. Most of those causes are not yet fully understood, particularly as the phenomenon is recent and ongoing. Analysts have, however, begun to piece together a picture of the social, economic, and environmental factors at play in this unrest, and climate change is entering that picture.

As others in this volume have gone to great lengths to make clear, no one has made a case for the idea that climate change alone caused this movement for change. But it is increasingly clear that global and regional climatic changes have played a role in multiplying stress in the region, and that the consequences of climate change will have to be properly addressed by the affected governments, as well as the international community, as these Arab nations rebuild.

In this chapter, we explore two case studies. The first look at Syria illustrates the role climate change and subsequent environmental stresses might have played in the Middle East in the run up to Syria's own revolution. The second look at Libya addresses the role that climate change in North Africa, as well as related stresses, are likely to play in a new Libya, highlighting the possibility of action on climate change and water security as a tool for conflict resolution and peace building.

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## Syria: Climate change, drought, and social unrest

Syria's current social unrest is, in the most direct sense, a reaction to a brutal and out-of-touch regime and a response to the political wave of change that began in Tunisia in the early months of 2011. But this is not the whole story. The past few years have also seen a number of significant social, economic, environmental, and



Syrian refugee children carry a bucket of water as they walk at Atmeh refugee camp, in the northern Syrian province of Idlib, Syria.

ASSOCIATED PRESS/HUSSEIN MALLA

climatic changes in Syria that have eroded the social contract between citizen and government in the country, strengthened the case for the opposition movement, and irreparably damaged the legitimacy of the Assad regime. If the international community and future policymakers in Syria are to address and resolve the drivers of unrest in the country, they will have to better explore and address these changes.

### ‘Out of the blue’

A number of international pundits characterized the Syrian uprising as an “out of the blue” case in the Middle East—a change they did not see coming. Many analysts, right up to a few days prior to the first protests, predicted that under President Bashar al-Assad, Syria was “immune to the Arab Spring.”<sup>69</sup> The seeds of social unrest, however, were right under the surface. And not only were they there, but they also had been reported on—although largely ignored—in a number of forms.



## Water shortages, crop failure, and displacement

From 2006 to 2011 up to 60 percent of Syria's land experienced, in the terms of one expert, "the worst long-term drought and most severe set of crop failures since agricultural civilizations began in the Fertile Crescent many millennia ago."<sup>70</sup> According to a special case study from last year's United Nations' 2011 Global Assessment Report on Disaster Risk Reduction, of the most vulnerable Syrians dependent on agriculture—particularly in the northeast governorate of Hassakeh (but also in the south)—"nearly 75 percent ... suffered total crop failure."<sup>71</sup> Herders in northeast Syria also lost around 85 percent of their livestock,<sup>72</sup> affecting 1.3 million people.

The human and economic costs of such shortages are enormous. In 2009 the United Nations and the International Federation of Red Cross and Red Crescent Societies reported that more than 800,000 Syrians had lost their entire livelihood as a result of the droughts.<sup>73</sup> By 2011 the aforementioned Global Assessment Report estimated that the number of Syrians who were left extremely "food insecure" by the droughts sat at about 1 million. The number of people driven into extreme poverty is even worse, with a U.N. report from last year estimating 2 million to 3 million people affected.<sup>74</sup>

This led to a massive exodus of farmers, herders, and agriculturally dependent rural families from the Syrian countryside to the cities.<sup>75</sup> In January 2011 it was reported that crop failures—particularly of the Halaby pepper—just in the farming villages around the Syrian city of Aleppo led "200,000 rural villagers to leave for the cities."<sup>76</sup> Moreover, in October 2010 *The New York Times* highlighted a U.N. estimate that 50,000 Syrian families migrated from rural areas just in that year, "on top of the hundreds of thousands of people who fled in earlier years."<sup>77</sup> In the context of Syrian cities coping with influxes of Iraqi refugees since the U.S. invasion in 2003, this migration has placed additional strains and tensions on an already stressed and disenfranchised population.<sup>78</sup>

## Climate change, natural-resource mismanagement, and demographics

The reasons for the collapse of Syria's farmland are a complex interplay of variables, including climate change, natural-resource mismanagement, and demographic dynamics.

A National Oceanic and Atmospheric Administration study published in October 2011 in the *Journal of Climate* found strong and observable evidence that the recent prolonged period of drought in the Mediterranean littoral and the Middle East is linked to climate change.<sup>79</sup> On top of this, another of the agency's studies found worrying agreement between observed climate impacts and future projections from climate models.<sup>80</sup>

A recent model of climate-change impacts on Syria conducted by the International Food Policy Research Institute, for example, projects that if current rates of global greenhouse-gas emissions continue, yields of rain-fed crops in Syria may decline “between 29 and 57 percent from 2010 to 2050.”<sup>81</sup> Other studies also forecast a grim dry picture: On a scale of wetness conditions, where “a reading of -4 or below is considered extreme drought,” a 2010 report by the National Center for Atmospheric Research shows that Syria and its neighbors face projected readings of -8 to -15 as a result of climatic changes in the next 25 years.<sup>82</sup> Such readings would be devastating and unprecedented.

Moreover, the climate-change and drought problems are compounded by poor governance. The Assad regime has, by most accounts except its own, criminally combined mismanagement and neglect of Syria's natural resources, which has contributed to water shortages and land desertification.<sup>83</sup> Based on short-term assessments during years of relative plenty, the government has heavily subsidized water-intensive wheat and cotton farming and has encouraged inefficient irrigation techniques.<sup>84</sup> In the face of both climate- and human-induced water shortages, farmers have sought to increase supply by turning to the country's groundwater resources, with Syria's National Agricultural Policy Center reporting an increase in the number of wells tapping aquifers from “just over 135,000 in 1999 to more than 213,000 in 2007.” This pumping “caused groundwater levels to plummet in many parts of the country, and raised significant concerns about the water quality in remaining aquifer stocks.”<sup>85</sup>

On top of this, the overgrazing of land and a rapidly growing population have compounded the land-desertification process.<sup>86</sup> As previously fertile lands turn to dust, farmers and herders have had no choice but to move elsewhere, starve, or demand change.



## Internal displacement, rural disaffection, and political unrest

Massive internal displacements from rural to urban centers and significant discontent among agriculture-dependent communities are ill-explored factors of social and political unrest in Syria.

Rural-urban population movements throughout the course of the recent droughts have placed significant strains on Syria's economically depressed cities, which incidentally have their own water-infrastructure deficiencies.<sup>87</sup> The poor have been forced to compete with other poor communities—not just for scarce employment opportunities<sup>88</sup> but also for access to water resources. According to Damascus-based expert Francesca de Châtel, Syria has experienced a “huge deterioration of [water] availability per capita,” partly as a result of a crumbling urban infrastructure.<sup>89</sup>

Furthermore, the role of disaffected rural communities in the Syrian opposition movement has been prominent compared to their equivalents in other Arab Spring countries.<sup>90</sup> Indeed, the rural farming town of Dara'a was the focal point for protests in the early stages of the opposition movement in 2011<sup>91</sup>—a place that was especially hard hit<sup>92</sup> by five years of drought and water scarcity and got little assistance from the Assad regime.<sup>93</sup>

The degree to which internal population displacement and rural disaffection are driving unrest has been difficult to study given the continuing instability, but available evidence suggests that the influence of this phenomenon may not be insignificant.

## Looking ahead

The Assad regime's brutally violent suppression of the opposition movement is rightly the main focus of attention for an international community attempting to halt or lessen the humanitarian disaster unfolding in Syria. Stopping the slaughter of innocent people is unquestionably the necessary first step. But a more well-rounded assessment of the dynamics of opposition in the country, including the possible social, environmental, and climatic drivers of unrest, will help policymakers and opinion leaders fashion more responsible actions.

In the short term, stopping the violence and enhancing the likelihood of legitimate government will require an intelligent assessment of the needs and demands of the opposition movement, including those involving access to and management of vital natural resources such as food, water, and arable land. In the long term, addressing the full gamut of Syria's societal, environmental, and climatic ills will be critical for ensuring a resilient, free, and conflict-proof nation—one that can constructively engage in the international community.

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### Libya: Addressing climate change and water security creates opportunities for conflict resolution

Libya Hurra, or “Free Libya,” was one of the main rallying cries for the Libyan opposition in 2011, which—with NATO assistance—toppled the brutal 40-year reign of former President Moammar Qaddafi.<sup>94</sup> But almost two years after Qaddafi's downfall, the new government of Libya—despite the conclusion of relatively free and fair parliamentary elections (the first since 1952)<sup>95</sup>—continues to face the problem of reconciling the many different “free Libyas” envisioned by different publics and addressing the allegations of some not-so-free practices.

In March 2012 the eastern region of Cyrenaica, with its capital in Benghazi—the heart of the anti-Qaddafi movement—declared itself a semiautonomous region,<sup>96</sup> prompting major protests in both Benghazi and Tripoli.<sup>97</sup> Despite recent successes by Libya's new central government, armed militias still roam the country, and the capacity of the government in Tripoli to keep them in check has been called into question.<sup>98</sup> Indeed, the city of Misrata has been described as a virtual “armed city-state”<sup>99</sup> in opposition to the central government. Furthermore, reports of human rights abuses committed against suspected Qaddafi sympathizers, including black African migrants from sub-Saharan Africa,<sup>100</sup> abound.

Though the successful national elections may ease some of these tensions over territory and power, they are not likely to go away easily. But while the Libyan government currently seeks in earnest to address these conflicts, it may be the less overtly political issues such as climate change and water-resource management that hold the key to building unity.



## Signs of forward thinking, yet dangers of neglect

The enormous hurdles facing Libya's national unity—which are not entirely unexpected after the collapse of a regime that was in power for four decades—have not kept the nation's government from at least attempting to address issues that exist outside the traditional framework of postconflict reconstruction such as climate change. In December 2011, for example, the interim Libyan government sent representatives to the U.N. climate conference in Durban, South Africa, to promote a project called “The Libyan Climate Change Initiative,”<sup>101</sup> proposing to finance solar and wind power projects with oil revenues, though the project received mixed reviews.

Despite this seemingly proactive approach, there remains a danger that some critical natural-resource challenges that Libya faces—ones that are very relevant to postconflict reconstruction—will fall by the wayside during this period of instabil-

Libyans fill containers with water in Tripoli, Libya in 2011.

ASSOCIATED PRESS/FRANCOIS MORI

ity and uncertainty. In this context, two critically important questions are, how will a new Libyan government manage the country's water resources, and will the effects of climate change be incorporated into how it does so?

### The question of water and cooperation

As we detailed in a previous report,<sup>102</sup> Libya must soon address certain resource issues, particularly that of water availability, if the country is to sit on a stable foundation. Incidentally, questions of water management can often help facilitate cooperation between conflicting factions, thus helping in the process of national reconciliation.

One such area of potential cooperation involves correcting the unsustainable excesses of the Qaddafi regime. Libya's new leaders and the Libyan parliament will likely agree to focus on righting Qaddafi's many wrongs, and it will be important to note that Qaddafi's iron hand extended far beyond his chilling disregard for human rights and into the realm of natural-resource management. The regime implemented massive, yet ultimately unsustainable, projects to extract the country's finite resources—water in particular.

Qaddafi's oil-financed Great Man-Made River Project,<sup>103</sup> for example, identified as one of the largest water-engineering projects in the world, continues to function. But in Libya, a country that is 93 percent arid,<sup>104</sup> it is unclear how long this project can be sustained. Libya's primary source of water is a finite cache of "fossilized" groundwater,<sup>105</sup> the remnants of a more verdant Pleistocene-era past. Present-day demand for groundwater, primarily for use in irrigating crops,<sup>106</sup> has severely stressed this supply, and coastal aquifers have been progressively invaded by seawater.<sup>107</sup> According to the "Nubian Aquifer Project," a joint initiative of the International Atomic Energy Agency, the U.N. Development Programme, and the World Bank's Global Environment Facility, overextraction by Libya from the Kufra sub-basin—which Libya shares with Egypt, Chad, and Sudan—has also led to "reduced water levels and the drying up of desert lakes linked to oases."<sup>108</sup>

In this context, a new Libyan government will, for the sake of its legitimacy and viability, need to address the fundamental issues of delivering a sustainable supply of water to its growing population, and of managing the complex problems associated with sharing such a supply with other nations. This is a question that, if answered well, can help bring the country together.

## Projections for climate change and drought

Enter climate change, which also presents a threat to Libya's water availability. While decreasing water availability is not the only predicted impact of climate change, it is a major one. According to a recent report by Joshua Busby and others at the University of Texas, Austin, climate-change projections for Libya are set to yield some bitter fruit—or lack thereof. The report notes that from the present day to the middle of this coming century, some of the wettest and most-populated areas of Libya along the Mediterranean coast will likely experience increases in drought days from the current 101 days to a whopping 224 days.<sup>109</sup> Doubling drought days is a serious problem, particularly if one is heavily reliant on nonrenewable groundwater. These findings have also been confirmed by a major National Oceanic and Atmospheric Administration study in the *Journal of Climate* from October 2011,<sup>110</sup> which found that climate change is already responsible for prolonged drought in Libya's most-populous areas on the coast—observations consistent with future projections from climate models.

While Libya is by no means the country most vulnerable to climate change in North Africa—see the Sahel and the Horn of Africa<sup>111</sup>—climate change-induced impacts on drought patterns in Libya and much of the Mediterranean littoral are projected to be some of the most dramatic.<sup>112</sup> Additionally, given uncertainties about the stability of a new government, Libya will need to prepare for the possibility of greater vulnerability to its infrastructure in the future. Such a dire threat to Libya's water security should serve to instigate cooperation between Libya's currently conflicting voices.

## Regional implications

Libya's vulnerabilities may also extend well beyond its borders. Libya already extracts an extensive amount of groundwater, for example, from the Nubian aquifer. If climate change-induced drought reduces water availability, and the Libyan government responds by drawing more water from the Nubian aquifer, this could cause tension with bordering countries such as Egypt, Chad, and Sudan, all of which share the aquifer's waters.<sup>113</sup> Given the current political and economic instability of all four governments sharing the aquifer, this is a potential security issue that cannot be ignored. Agreement on avoiding this potential for regional conflict could be another unifying objective for Libya's competing factions.



## A unified and resilient Libya

The dawn of a new Libya presents a unique opportunity to create a political tradition of good governance in the country—one that is transparent, respects human rights, holds free and fair elections, and enacts economic policies that work for all Libyans. It is also an opportunity for Libyans to transition not just to a post-Qaddafi era but also to a new era of resilience—one that uses its finite resources wisely and adapts itself to a changing climate. The potentially destabilizing impacts of this unprecedented shift in the global climate, particularly for countries and regions in transition that share essential natural resources, should not be underestimated. Climate change may not be high on the agenda in Libya today, but it should not remain off the table for too long—particularly as doing something about it and the challenges it presents to important issues such as water availability can potentially help Libya in its search for unity.

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## Conclusion: What's next for Syria and Libya?

The proximate and ultimate causes of the Arab Awakening will be a subject of study for decades and perhaps centuries to come. Analysts, however, are beginning to map out the social, economic, and environmental variables that led to unrest, and climate change is part of the story. As nations emerge from this period of revolution and reform, global and regional climatic changes and the subsequent impacts on resource security will also remain a looming problem that must be addressed if new governments are to succeed and maintain staying power.

In Syria, climate change may have acted as a stress multiplier, exacerbating existing environmental and social stresses that fed into discontent, population movements, and revolution. The brutal Assad regime still stands in the way of progress. In Libya, addressing dire climate-change projections and problems of finite water resources will need to be a central priority of the new government and could even offer a chance to peacefully resolve current and future conflicts.

In short, climate change has played an important role in the region and will continue to play an important role in the future. Addressing climate change must, therefore, be part of any new government's quest for both legitimacy and survival.

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# Climate Change, Migration, and Conflict

Michael Werz and Max Hoffman

The end of the Cold War unleashed arrested development potential in emerging countries previously frozen by the superpower confrontation and ushered in a new global arrangement. The traditional strategic geometry, wherein distinct nation-states or blocs of nation-states vied for influence, has faded from significance in a rapidly changing globalized world. While state-level interaction is still central to the world order, many of the largest challenges facing the global community—from climate change and migration to terrorism, from trafficking to disease, and from resource conflicts to food security—transcend international borders.

But there is only limited understanding of this transformation among national leaders, and many still try to interpret this new reality through the dated categories of the 20th century. It is important to acknowledge that security in one place is irrevocably linked to stability in distant regions, and thus can no longer be guaranteed through military might or economic clout alone. In the 21st century, security will be defined more broadly than has been the tradition—and will be guided by the ability to compel collective action to address fundamental transnational problems within a rapidly changing environment.

A second consequence of these new global connections is that emerging societies will increasingly play a defining role in geopolitics, as well as in the international economy. The industrialized democracies that carry most of the burden for global stability and development aid will have to manage a new *modus vivendi* in which they are one of many major forces steering the economic and strategic dialogue. In other words, the West must revisit and restructure its security and development policies, adapting them to a new environment while coping with imminent budget austerity in order to gracefully manage the multilateral challenges we face.

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## Climate change, migration, instability, and the Arab Spring

The nexus between climate change, human migration, and instability constitutes just such a transcendent challenge. The conjunction of these undercurrents was most recently visible during the Arab Spring, where food availability, increasing food prices, drought, and poor access to water, as well as urbanization and international migration contributed to the pressures that underpinned the political upheaval.

[Briefly, a note on causality: It is important to emphasize that the relationship between these three factors is not a matter of direct causality or inevitable progression, but rather can be described as a complex pattern of overlapping stressors with the potential to undermine social stability or national security. It would be overly simplistic to argue that climate change caused the Arab Spring, but it is equally important to point out that important contributing causes and accelerants of unrest had their roots in climate change and human mobility.]

Half a decade ago the United Nations concluded that anthropogenic climate change was observable in shifting air and ocean temperatures, in the widespread melting of snow and ice, and in rising sea levels.<sup>114</sup> The major scientific indicators have not improved over the past five years. Climate change is real, it is visible, and even immediate global action—a forlorn hope—could not completely mitigate its effects. As a result, much of the Middle East and North Africa will face drier winters, diminishing freshwater runoff, and dwindling groundwater resources as the century progresses.<sup>115</sup> Overall, approximately 250 million people in Africa are projected to suffer from water and food insecurity during the 21st century, and coastal agricultural zones around the Mediterranean will face erosion and salinization of freshwater sources.<sup>116</sup> These changing environmental conditions will likely increase pressure on traditional livelihoods such as farming, fishing, and herding, rendering them unsustainable in the most-affected areas.

As demonstrated in earlier chapters of this volume, these repercussions were felt extensively across the Mediterranean littoral in the years leading up to the Arab Spring. World Bank data underscore the stress caused by dwindling renewable freshwater resources and rapid population growth: In 2009, for example, Libyans had access to only 95.8 cubic meters of renewable freshwater resources per capita, and Syrians had access to just 356 cubic meters per capita. These per-capita water figures were down significantly from 2002 and were below the Arab world's average of nearly 400 cubic meters, were well below the global average of 6,258 cubic meters, and very short of the U.N. scarcity level of 1,000 cubic meters.<sup>117</sup>



Moreover, as highlighted by Francesco Femia and Caitlin E. Werrell in the previous chapter of this volume, Syria suffered from devastating droughts in the decade leading up to the rebellion, with the country's total water resources cut in half between 2002 and 2008.<sup>118</sup> The drier winters hit the top wheat-growing regions of the eastern Mediterranean country hardest, exacerbating the crisis.<sup>119</sup> Yemen, too, suffered from dwindling water resources and clashes over illicit wells.<sup>120</sup> The Federation of American Scientists predicted that Yemen's capital city, Sana'a, could empty its freshwater aquifers by the end of the decade and linked water scarcity and internally displaced people to some of the violence in the country.<sup>121</sup> And Algeria saw repeated violent protests over soaring food prices which drew on the anger and desperation of large numbers of young unemployed urban residents—many of whom moved to cities in the wake of deteriorating agricultural conditions and the armed conflicts of the 1990s.<sup>122</sup>

Deteriorating environmental circumstances have historically driven people to turn to migration as an adaptive mechanism, and it is more than likely that the stresses of climate change will increase human mobility around the world going forward. Even if most climate migrants—people displaced by the slow or sudden onset of climate change—move only short distances, these shifts have the potential to alter political dynamics, increase ethnic tensions, or provoke clashes over resources.

As mentioned previously in this volume, a similar reaction was displayed in Syria, where the devastating impact of prolonged drought on agricultural livelihoods drove an estimated 50,000 Syrian families to migrate from rural areas to cities in 2010 alone.<sup>123</sup> In 2002 more than 30 percent of Syrians were employed in the agricultural sector; by 2010 agricultural workers represented less than 15 percent of Syria's overall workforce.<sup>124</sup>

Similar trends were at work in Northern Africa. Tunisia saw its rural population begin to decline in 2010, despite growth in the overall population, and the rural population is projected to decline by nearly half a percentage point between 2010 and 2015.<sup>125</sup> While drought and environmental degradation are not the only contributing factors, substantial rural dislocation within such a short period of time has significant consequences.

For one, the ranks of the urban unemployed increase due to rising numbers of migrants from rural areas, which can create anger or disillusionment, particularly when food prices rise and freshwater becomes scarcer. Social and health care services can be strained and infrastructure overwhelmed by large numbers of



Men, who used to work in Libya and fled the unrest in the country, carry their belongings as they walk during a sand storm in a refugee camp at the Tunisia-Libyan border, in Ras Ajdir, Tunisia in March 2011. More than 250,000 migrant workers left Libya for neighboring countries, primarily Tunisia and Egypt, in a three-week span.

ASSOCIATED PRESS/EMILIO MORENATTI

such new arrivals. Additionally, the influx of new groups of people can potentially heighten ethnic, religious, or tribal tensions when diverse groups are thrust together in tight quarters amid dwindling resources.

The added stress of migration can develop not only within the affected countries themselves but at a regional level as well. Libya's large immigrant population, for example—nearly 700,000 foreigners were living in the country in 2010, constituting more than 10 percent of the total population—includes many sub-Saharan and Sahelian migrants.<sup>126</sup> While migrants are influenced by a matrix of motivations—including economic opportunity created by Libya's strong growth in the past decade—drought, water scarcity, desertification, or other forms of environmental degradation also contributed directly or indirectly in many migrants' decision to relocate. Indeed, Libya stands at the end of well-established migratory routes linking sending countries such as Nigeria, Niger, Burkina Faso, and Mali to the Mediterranean coast and Europe.

Drought and desertification across much of the Sahel—for example, northern Nigeria is losing 1,350 square miles per year to desertification—have undermined agricultural and pastoral livelihoods and have contributed to and complicated these migratory routes.<sup>127</sup> In the Libyan uprising, many migrants were caught up in the fighting, and the perception that Qaddafi relied on immigrants from sub-Saharan and Sahelian Africa as mercenaries led to mistreatment and reprisals by revolutionary fighters. Additionally, many sub-Saharan African migrants arrived in the oil-rich country looking for work and are seen as having “taken” jobs from the Libyans, raising tensions and weakening the social fabric. Syria’s challenges with migration have taken a different form, coping with the presence of more than 1 million Iraqi refugees residing in Syria who fled Iraq after the U.S. invasion in 2003.<sup>128</sup>

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### Climate and environmental change as a multiplier of instability

The purpose of this chapter is not to argue that all migrants are driven by environmental conditions, nor to say that the influx of migrants is an inevitable cause of conflict. Longstanding political grievances, ethnic and sectarian mistrust, and economic marginalization were driving forces during the upheaval of the Arab Spring. But climate change contributed to high food prices and shortages, which were a central grievance. Water scarcity and illegal water use angered those on the margins. The balance of traditional rural society was upset and livelihoods were undermined—incrementally and suddenly—by drier winters, changing rainfall patterns, depleted wells and aquifers, drought, and desertification. Changing environmental conditions contributed to and accelerated migratory flows, which swelled marginalized urban populations and brought diverse tribal, ethnic, and religious groups into close contact while straining states’ capacity to cope with the needs of the populace.

Northern Africa is only one of many examples where the nexus of climate change, migration, and conflict multiplies the pressure on governments in vulnerable regions around the globe. Human migration driven by environmental degradation, the social conflict caused, in part, by this migration, and competition for more scarce resources all add complexity to existing and future crisis scenarios. For this reason, it is important that governments plan to address these new threats.

Environmental degradation, the movement of people from rural areas to already-overcrowded cities, and rising food prices exacerbate the cumulative effects of long-term economic and political failures in a number of vulnerable regions of

the world. Indeed, just such a complex crisis has developed in Mali over the past two years, when longstanding ethnic divides between north and south, political grievances based on historical marginalization and abandonment in the face of drought, and the return of Tuareg men with weapons and training from the Libyan conflict have combined to create a volatile situation. Understanding the nexus of climate change, migration, and security will be critical to understanding future complex crisis scenarios and developing effective policy responses.

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### A new approach to security

Given the shape of these challenges, a new approach is necessary. The United States, its allies, and the global community must de-emphasize traditional notions of hard security more suited to the Cold War, and should focus on more appropriate concepts such as human security, livelihood protection, and sustainable development. These new approaches offer cost-effective and proactive means to reduce the risks of conflict and improve global security. Particularly in regions such as the Middle East and North Africa, where the United States is often mistrusted, focusing on basic human security offers a constructive, unthreatening, and smart way to interact strategically with new and existing governments, improve lives, and help protect American interests along with democratic livelihoods.

Many of the traditional tools of international policy built up over the past half-century, however, are ill-suited to these tasks. Military force and existing modes of security cooperation are blunt instruments with which to address the complex problems facing a newly decentralized world. The traditional institutional divisions between defense, diplomacy, and development make it difficult to find practical solutions to problems that require cohesive responses. But understanding of these shortcomings is improving, and institutional reforms are underway—for instance, through the implementation of the U.S. State Department’s Quadrennial Diplomacy and Development Review.<sup>129</sup>

This path for reforming institutional arrangements and broadening the so-called toolbox for U.S. foreign engagement should be supported and expanded. Managing the complex consequences of this intersection is daunting, but the United States and its allies should use this as an opportunity to formulate a blueprint for collective action and 21st century foreign policy.

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## Domestic and international obstacles

The ability of the United States to address these issues and provide the necessary international leadership is complicated by domestic climate-change skeptics, particularly in Congress, who reject the overwhelming consensus of the global scientific community and policymakers in virtually every country in the world. This doubt, in the face of all evidence, has not prevented the State Department, the U.S. Agency for International Development, and the U.S. Department of Defense from moving forward with initiatives to address the effects of climate change, from preparing for impacts to facilities, and from forecasting likely crisis scenarios. But the lack of serious support from Congress will affect funding for these priorities and cannot be circumvented indefinitely.

On the international level, political differences between nations weaken the ability of multilateral organizations such as the World Bank or regional development banks to focus on the nexus of climate change, migration, and conflict in an effective way. The United Nations is poorly equipped to take collective action outside of a case-by-case basis where consensus among specific members has been achieved. Expecting the organization to tackle the nexus of climate change, migration, and conflict is therefore unrealistic. This is particularly true given the likelihood that future conflicts are unlikely to be clearly defined as being caused by climate change or migration. Concerted action by the G-20 is not much more realistic due to its focus on economic and financial issues, compounded by the diversity of member-states' interests, which prevents the development of effective political measures.

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## Conclusion: A blueprint for sustainable security in the region

Yet the response to the nexus of climate change, migration, and security—particularly in the Middle East and North Africa—offers a test case, an opportunity to form a blueprint for sustainable security. Managing these issues in conjunction with the nascent governments in Tunisia, Egypt, and Libya could provide for a new context within which regional civilian institutions could work on these issues with support from military alliances, if necessary.

In addition, there are opportunities for emerging democratic powers, including Brazil, Turkey, or South Africa, to lead a rethinking of global policy and foster the creation of sustainable security apparatuses capable of mitigating, adapting, and reacting to the increasingly challenging effects of climate change and human migration.

Within the United States, a more forward-looking understanding of security could allow for a badly needed rebalancing of the division of resources between the military and nonmilitary instruments of international policy. The challenges presented by transnational problems and new geopolitical arrangements provide an opportunity for a fresh progressive approach to global interaction.

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# Sustaining the Spring: Economic Challenges, Environmental Risks, and Green Growth

David Michel and Mona Yacoubian

The Arab Spring marks a watershed moment for the Middle East and North Africa region as it embarks on a new era of historic change. Yet the exhilaration and expectation that first accompanied the popular revolts have since yielded to more sober assessments of the deep and complex challenges embedded in these ongoing transformations. In particular, the region faces significant economic tests—the Arab countries must create tens of millions of jobs over the next decade to meet the needs of their expanding labor force, while also rebalancing their economies toward more inclusive and sustainable development. Less apparent but equally worrying are the myriad environmental threats that could also derail the Arab transitions. Even as still-nascent regimes endeavor to strengthen their economies and ensure public services, acute stresses related to water scarcity, food security, climate change, and increasing urbanization can undermine productivity, compromise public health, sap the natural resource base, and endanger the livelihoods and welfare of vulnerable populations around the region.

Substantial economic and environmental strains now weigh on the nations of the Arab world, but creative strategies to address these pressures could both unlock sizable potential for economic growth and job creation, and help mitigate mounting risks to essential ecosystems and natural resources, turning two of the region's pre-eminent challenges into a significant opportunity.

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## Economic challenges

From Tunisia to Egypt, Libya, Jordan, Bahrain, and beyond, 16 of 22 countries in the Arab world have experienced some form of popular unrest since late 2010. Many intertwined political, institutional, and governance failings spurred these varied protests. On the eve of revolution, governments across the Middle

East and North Africa were among the world's poorest performers in terms of legitimacy and accountability.

According to the “Worldwide Governance Indicators,” a dataset maintained by the World Bank, in 2010 Egypt ranked in the bottom 14 percent of 215 countries and territories surveyed on measures of accountability, freedom of expression, and public participation in government. Libya ranked in the bottom 2 percent, Syria in the bottom 5 percent, and Tunisia in the bottom 10 percent.<sup>130</sup> Similarly, assessments undertaken by Freedom House for the 2007–2010 period gauging public accountability, civil liberties, rule of law, anticorruption efforts, and government transparency scored Egypt, Libya, Syria, and Tunisia alike in the lowest one-third of all countries evaluated.<sup>131</sup>

But grave economic deficiencies also drove the uprisings. For decades prior to the Arab Spring, the Arab economies stagnated. Between 1980 and 2004 real GDP growth per capita in the Middle East and North Africa countries—that is, economic growth per person adjusted for inflation—rose an anemic 6.4 percent, amounting to less than 0.5 percent per year over the entire 24 years. In Asia, by comparison, real GDP per capita jumped about 4.5 percent annually during the same time period.<sup>132</sup>

Yet even as the Arab economies stalled, job demand steadily swelled. Propelled by annual population growth rates of 2 percent or more, the Arab nations' labor force increased some 3 percent per year on average from 1995 to 2005, bringing more than 4 million new entrants into the labor market every year. Employment opportunities could not keep up with the demographic trends. While reliable time-series data are lacking, the existing evidence suggests unemployment has been climbing since the 1980s in many Arab countries, including Algeria, Egypt, Jordan, Morocco, Syria, and Tunisia.<sup>133</sup> From 2005 through 2010 annual unemployment averaged 10.5 percent in the Middle East and 10.2 percent in North Africa—the highest levels of any regions in the world and considerably above the global average of 5.9 percent. And by 2010, 9 percent of the Egyptian labor force was idle. In Morocco, 9.1 percent of the country was unemployed; in Syria, 8.6 percent; and in Tunisia, 13 percent.<sup>134</sup>

Arab unemployment hits younger workers especially hard. For the six years preceding the Arab Spring (from 2005 to 2010), the jobless rate for those ages 15 to 24 averaged 25.4 percent across the Middle East and 24.3 percent in North Africa—again by far the highest levels of any regions in the world and double the





global average of 12.4 percent.<sup>135</sup> In 2010 unemployment among those ages 20 to 24 stood at 27.6 percent in Egypt, 20.8 percent in Syria, and 29.7 percent in Tunisia.<sup>136</sup> Indeed, more than 83 percent of all unemployed Egyptians that year were between the ages of 15 and 29. Nearly 70 percent of unemployed Tunisians and more than 75 percent of jobless Syrians fell into the same age group.<sup>137</sup>

A significant mismatch between the skills young workers possess and the qualifications modern economies require has exacerbated the unemployment crisis. The globalized economy increasingly demands workers who are trained in the so-called STEM disciplines—science, technology, engineering, and mathematics.<sup>138</sup> But the Middle East and North Africa states produce relatively fewer students in these fields than many other rising developing nations. Around the region, science, technology, and engineering programs represent 22.6 percent of university enrollments on average, compared to 30.8 percent in Asia. Science, technology, and engineering fields make up merely 10 percent of all enrollments in tertiary

Protesters demonstrate against the level of unemployment in Tunis in May 2012.

ASSOCIATED PRESS/HASSENE DRIDI

education in Egypt and about 18 percent in Morocco and Tunisia. For reference, in Malaysia, they account for 40 percent of university enrollments, and account for 32 percent of tertiary enrollment in Mexico and Chile.<sup>139</sup>

Contrary to trends in much of the rest of the world, jobless rates in many Arab countries increase with educational attainment. Among young men in Egypt, the worst unemployment levels afflict university graduates. In Tunisia, 40 percent of university graduates are out of work versus 24 percent of nongraduates.<sup>140</sup> In Morocco, unemployment strikes 61 percent of young workers with a secondary-school education or above, but only 8 percent of those without.<sup>141</sup> Tellingly, surveys around the region reveal that only a third of young people believe their education adequately prepares them for the job market, while businesses judge that just a third of new graduate employees are ready for the workplace.<sup>142</sup>

The imbalances and inertia of the Arab economies have stifled their ability to generate sustained economic opportunities for their citizens. As the 21st century ushered in “the rise of the rest,” the Middle East and North Africa region managed annual average GDP growth of 4.7 percent from 2000 to 2010 but still lagged every other developing world region except Latin America.<sup>143</sup> Even this pale success achieved only paltry employment improvements. Although the Arab countries weathered the global financial crisis relatively well, and the jobless rate ticked down only slightly from 2003 to 2007, this incremental progress began to falter in 2008 and reversed in 2011.<sup>144</sup> The job creation that did occur typically favored older, established workers, while new labor-market entrants frequently found themselves pushed to vulnerable or unstable work in the informal sector, feeding perceptions of “jobless growth.”<sup>145</sup>

Contemporary surveys attest that soaring prices, lack of economic opportunities, and dissatisfaction with employment prospects all figured among the principal frustrations fueling the public disaffection that led to the popular protests. In polls conducted as the uprisings were unfolding, youth across the Arab world named unemployment and the rising cost of living as the two greatest challenges facing the region.<sup>146</sup> A number of Arab regimes have responded with reform initiatives, but many of these are expensive and ill-targeted or come at the cost of further economic distortions.<sup>147</sup> Subsequent surveys reveal varying degrees of optimism for the future but confirm that economic preoccupations remain among the public’s primary concerns after the Arab Spring.<sup>148</sup>

Answering these expectations will place exceptional demands on the Middle East and North Africa region’s abilities to reform and reinvigorate its economies. Calculations

by the League of Arab States and the U.N Development Programme suggest that the Arab nations will need to create 33 million new jobs by 2015 and 51 million by 2020 in order to keep up with population growth and aging. To supply that many openings, the region's heretofore sputtering economies would have to grow by a sizzling average of 7.6 percent per year just to maintain their current unemployment rates.<sup>149</sup>

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## Environmental risks

At the same time that they confront these considerable economic challenges, multiple overlapping environmental risks weigh on the Middle East and North Africa nations. Water scarcity poses a perennial threat to economic vitality and social welfare across the Arab world. Home to more than 7 percent of the world's population, the region is endowed with less than 1.5 percent of the world's renewable freshwater supply. Water managers typically judge annual water availability of less than 1,700 cubic meters per person as posing a significant constraint on socioeconomic development. Taken together, the Middle East and North Africa countries possess annual renewable water resources of 1,274 cubic meters per capita, making the region the most water stressed in the world.<sup>150</sup> Individually, annual renewable water supplies in most Arab countries are considerably less, amounting to 706 cubic meters per person in Egypt, 438 cubic meters in Tunisia, 151 cubic meters in Jordan, 110 cubic meters in Libya, and just 7.3 cubic meters in Kuwait.<sup>151</sup>

With limited rainfall, several countries pump more water from rivers, lakes, and underground aquifers than nature replenishes. All told, Egypt's yearly freshwater withdrawals amount to 94 percent of its actual annual renewable water resources, while Libya withdraws an unsustainable 609 percent and Kuwait, 2,075 percent.<sup>152</sup> Many of the region's water sources are overexploited. Numerous river basins, including the Nile and the Tigris-Euphrates, are considered "closed" or are nearly so; all of their renewable flows are already being used to meet various human demands or to fulfill environmental requirements for maintaining vital ecosystems, with little or no spare capacity left over.<sup>153</sup>

Enduring demographic trends will further strain essential water supplies in the region's countries in coming decades. As the region's population continues to climb, water availability per capita is projected to plummet a further 50 percent by 2050.<sup>154</sup> Within countries, sizable populations already lack access to water services. While urban coverage from improved drinking-water systems tops 90 percent in most countries, rapid urban expansion across the Arab world increas-

ingly risks overburdening existing infrastructure and outpacing local capacities to expand service. In Amman, Jordan, for example, public tap water is rationed to a few hours on one day a week.<sup>155</sup>

Meanwhile, water losses from leakage and theft in many urban systems top 35 percent to 50 percent.<sup>156</sup> By the same token, urban uses generate substantial wastewater. One-fifth of domestic sewage in Egypt, half in Jordan, and 95 percent in Lebanon go untreated.<sup>157</sup> Rural areas are frequently less well-served than cities. Only 84 percent of rural inhabitants in Tunisia and 60 percent in Morocco enjoy improved drinking-water sources. Meanwhile, one in three rural Tunisians and nearly half of rural Moroccans do not have access to improved sanitation.<sup>158</sup>

Increasingly, the Arab world's water troubles intersect with concerns for its food supplies. Agriculture accounts for about 85 percent of water withdrawals around the region. Together with surging populations, rising incomes in the Arab countries as their economies grow will drive up food demand, boosting water demand as well. International trade can help meet these needs. Yet the Middle East and North Africa countries are already the world's largest net food importers, buying abroad half or more of the calories they consume.<sup>159</sup> This strategy has trimmed domestic water usage by easing agricultural requirements, but it has also rendered the importing countries vulnerable to global price fluctuations of staple crops and export restrictions imposed by other countries. Following the global food crisis of 2007–2008, for example, many countries across the region saw the cost of basic food items skyrocket, draining public budgets while contributing to the popular discontent that ultimately spurred the Arab uprisings. Because they are so import dependent, the Arab nations are especially vulnerable to such price shocks. In Egypt, for example, a 30 percent jump in food prices results in a 12 percent increase in poverty.<sup>160</sup>

Continuing global warming will exacerbate these water worries. Climate change threatens to significantly alter regional hydrological processes and precipitation patterns.<sup>161</sup> A few areas might receive additional rainfall, but most Arab countries' renewable-water resources could fall substantially, plunging 33 percent in Morocco and 98 percent in Jordan by 2050, according to some climate models.<sup>162</sup>

Recent evaluations undertaken for the World Bank project that total water demand in the region's countries will climb some 50 percent by mid-century, from 261 cubic kilometers today to 393 cubic kilometers in 2050.<sup>163</sup> But the same studies also indicate that annual available water supplies will decline by 12 percent under the average

climate-change projection, from 219 cubic kilometers to 194 cubic kilometers, creating a shortfall of 199 cubic kilometers. Under drier climate-change scenarios, the supply deficit could reach 283 cubic kilometers. Regional water supplies would then furnish less than half of projected requirements by mid-century.

Absent marked improvements in water management, unmet water demand could more than double in Jordan, while soaring seven-fold in Morocco and eleven-fold in Egypt. Crucially, though global warming will significantly stress regional water supplies, socioeconomic factors (population growth, rising demand) account for four-fifths of the projected water shortages, placing a premium on both climate-change adaptation and effective water-governance strategies.<sup>164</sup>

Rising pressures on natural resources and environmental systems in the region are already undercutting the wealth and welfare of Arab nations. According to the World Bank, the economic damages, productivity losses, and public-health impacts resulting from environmental degradation cost Arab countries dearly, amounting to an annual average of 2.1 percent of GDP in Tunisia, 2.4 percent of GDP in Jordan, 3.7 percent of GDP in Morocco, and a whopping 5 percent of GDP in Egypt.<sup>165</sup> Businesses and entrepreneurs have taken note. The World Economic Forum deems water scarcity perhaps the most fundamental risk weighing on the region's economic growth and social well-being.<sup>166</sup>

More importantly, Arab societies have taken note. As the Arab Spring took shape, public polls revealed that many citizens clearly considered the failure of their governments to protect the environment and deliver public goods such as safe water supplies to be pointed indicators of ineffective and unresponsive regimes. Indeed, “access to clean water” figured among the handful of issues that Arab youth labeled as their greatest concerns, even topping unemployment and the cost of living in several countries.<sup>167</sup> Not coincidentally, perhaps, the new Arab regimes appear to have noticed, too. Questioned about prospective theocratic tendencies—such as banning alcohol—under the new government, an Egyptian legislator retorted, “Forty million don't have sanitary water. Do you think that, in Parliament, I'll busy myself with people who don't have water, or people who get drunk?”<sup>168</sup>

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## Green-growth solutions

The Arab countries will have to surmount substantial economic challenges and environmental threats in the coming years. Imaginative approaches to meet these



risks, however, can also offer valuable opportunities. Appropriately designed and implemented, practical measures to alleviate environmental problems can simultaneously generate employment and spur economic innovation and development. Such so-called green-growth approaches can provide the strategic framework to effectively guide such policymaking.

Green-growth policies seek to make the processes of economic growth more environmentally friendly, more resource efficient, and more resilient without slowing them down.<sup>169</sup> Judicious sustainable development strategies can work to both diminish wasteful practices and environmental damages, preserving natural capital and freeing resources that can in turn be redirected to alternative productive uses. Similarly, the search for cleaner processes and resource efficiencies can stimulate technical innovations and new design methods and production practices that can invigorate new sectors and drive new employment.

The Arab world offers potentially fertile ground for such initiatives. For example, uncontrolled urbanization in the region's countries currently contributes to expanding the Arab world's already-intensive environmental footprint and increasingly encroaches on surrounding spaces, which leads to conflicts between urban and rural constituencies over scarce arable land, water, and other resources. The Arab Forum for Environment and Development figures that "greening" just one-fifth of the Arab world's construction stock and retrofitting buildings to enhance energy and water efficiency would create 4 million jobs and pay for itself in two to seven years by trimming costly resource consumption. It would also provide a practical platform for advancing more holistic urban planning and green infrastructure development.<sup>170</sup>

Renewable energy furnishes another promising avenue for unlocking such synergies. Geography and climate endow the Middle East and North Africa region with the world's greatest potential for solar power production, as well as abundant wind energy potential.<sup>171</sup> Particularly for those countries lacking their own oil and gas reserves, solar and wind could help fill their rising energy needs, while cutting air pollution and greenhouse gas emissions and lowering energy-import bills, freeing funds for other investments. Domestic renewable power projects could provide a substantial driver for enhancing the region's educational programs in science and technology, as well as make it an indigenous magnet for science, technology, engineering, and math graduates.

Large-scale development of renewables could also potentially ease pressures on freshwater supplies by furnishing a more environmentally friendly power source

to expand the region's seawater desalination capacities, which otherwise rely on highly energy-intensive technologies. One quarter of Saudi oil and gas production now goes to power local electricity and water production, and Saudi officials anticipate that share will rise to 50 percent by 2030. Across the region, electricity demand for desalination is projected to triple by 2030.<sup>172</sup>

Public officials and private firms alike increasingly recognize the environmental advantages and economic attractions of seizing such opportunities. Morocco, for instance, plans to install 2,000 megawatts of solar capacity in the country by 2020.<sup>173</sup> At the same time, several international initiatives, such as the German-led DESERTEC consortium and the recently announced English-Tunisian TuNur joint venture, aim to invest billions of dollars in the region to establish networks of renewable energy projects linking the Arab countries to one another and to export markets in Europe and Africa.<sup>174</sup>

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## Conclusion

The Arab transitions signal a historic moment for the region, marked by both promise and peril. Alongside the Middle East and North Africa region's prominent economic, security, and political challenges, multiple interconnected environmental problems threaten to reverse prospects for regional transformation. The intertwining challenges of climate change, water stress and food scarcity, and increased urbanization present a particularly thorny problem set. If unresolved, these environmental strains could tip the region toward an uncertain cycle of instability and economic stagnation, upsetting efforts to promote much-needed economic growth and reform. But with political will and foresight, the Arab nations can move to develop innovative policy solutions to the region's interconnecting environmental and development needs.

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# Conclusion

Caitlin Werrell and Francesco Femia

The world is changing politically, economically, and demographically. In the Arab world, previously stagnant governments are searching for a stable foundation on which to build their strength, resilience, and democratic institutions. All of this is occurring during a time of unprecedented climatic changes, which makes it all the more difficult to find that stable ground.

Events thousands of miles away—such as a severe drought in China and Russia and the attendant impacts on global food prices—place serious strains on people and governments in the Arab world, just as severe droughts more locally such as in Syria and the Sahel stress already-fragile and conflict-ridden societies.

In the Arab world, climate change has acted as a threat multiplier, exacerbating environmental, social, economic, and political drivers of unrest, including drought, water scarcity, food security, and migration, and it will likely continue to do so as the countries of the Middle East and North Africa region transition and change.

In this context, addressing the effects of climate change in the Arab world will be critical for ensuring the longer-term stability of the region and legitimacy of its respective governments. As Arab publics demand voice and representation, they will also demand that their governments provide them with the resources necessary not just for protection and survival but also for growth and prosperity. If mitigating climate change and adapting to its effects is not integrated into the policies and plans of new and existing governments, and if the international community does not assist in this endeavor, the social contract between citizen and government in the Arab world will likely not improve, and the stability and prosperity of the region may erode.

The pursuit of democracy, prosperity, and stability in the Arab world is intimately tied to its own natural resources, and those of nations on the other side of the

world. Climate change places a significant stress on those resources, but this climate and resource crisis can also serve as an opportunity for governments in the region, along with the international community, to reject the mistakes of the past. They can together help build freer, more sustainable, and more resilient societies—societies that are responsive to the winds of change, both social and natural, while still capable of finding stable ground to stand on.

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