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**CLIMATE CHANGE AND CONFLICT: THE RELATIONSHIP BETWEEN GOVERNMENT  
RESPONSE TO CLIMATE CHANGE AND CIVIL UNREST IN THE MIDDLE EAST  
AND NORTH AFRICA**

An honors paper submitted to the Department of Political Science and International Affairs  
of the University of Mary Washington  
in partial fulfillment of the requirements for Departmental Honors

Lydia Grossman  
May 2017

By signing your name below, you affirm that this work is the complete and final version of your paper submitted in partial fulfillment of a degree from the University of Mary Washington. You affirm the University of Mary Washington honor pledge: "I hereby declare upon my word of honor that I have neither given nor received unauthorized help on this work."

Lydia Grossman  
(digital signature)

05/01/17

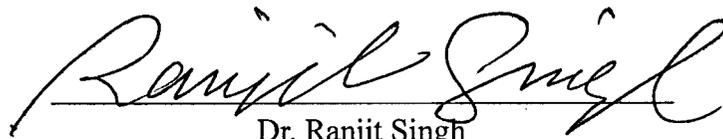
**Climate Change and Conflict:  
The Relationship Between Government Response to Climate Change and  
Civil Unrest in the Middle East and North Africa**

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Defended May 1, 2017

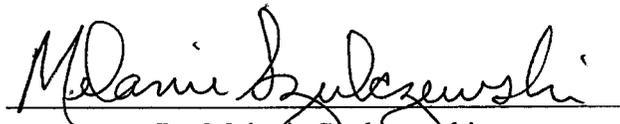
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CLIMATE CHANGE AND CONFLICT:  
THE RELATIONSHIP BETWEEN GOVERNMENT RESPONSE TO CLIMATE CHANGE  
AND CIVIL UNREST IN THE MIDDLE EAST AND NORTH AFRICA

Lydia Grossman  
May 1, 2017  
INAF 491H—Dr. Ranjit Singh

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## **Abstract**

In the past few decades, the Middle East and North Africa has experienced two seemingly disparate phenomena: the effects of anthropogenic climate change and a high degree of civil unrest. Though on the surface these two phenomena may seem completely separate, there is evidence that government response to climate change affects the level of civil unrest among populations in this region. This paper hypothesizes that there is a relationship between these two phenomena. The hypothesis is tested using the case studies of Syria, Jordan, Tunisia, and Sudan in a controlled comparison. This paper finds that effective government response to climate change lessens the intensity of civil unrest while ineffective or nonexistent government response increases the intensity of civil unrest.

## Literature Overview

### *Climate Change and Environmental Degradation in MENA*

Over the past several years, human-induced climate change has become a widely accepted and well-researched phenomenon among scientists across the world. The Middle East North Africa Region (MENA) has been the subject of numerous studies on the effects of climate change.<sup>1</sup> This region includes over 355 million people and is characterized by Arabic as the dominant language and Islam as the dominant religion, though the MENA countries encompass many different ethnic and linguistic groups.<sup>2</sup>

This region is characterized by a variance of maritime conditions and topographical features, which contribute to its diverse climate patterns. The largest portion of MENA is naturally water scarce and considered hyper-arid.<sup>3</sup> The MENA region has come to be considered a climate hotspot, where the effects of climate change are felt at a higher rate than the rest of the world.<sup>4</sup> As a predominantly water-scarce region, MENA countries have experienced environmental degradation and stress throughout their histories, but climate change has begun to exacerbate the existing environmental problems in this region. MENA is especially vulnerable to climate impacts on water resources, and droughts are a common trend in this region.<sup>5</sup> This section will examine the current literature on trends and future projections for environmental degradation and climate change in the MENA region.

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<sup>1</sup> For a map of all countries included in this region, see Appendix A.

<sup>2</sup> "World Bank Definition: Middle East and North Africa," *Worldbank.org, World Bank*, accessed March 29, 2017, <http://www.worldbank.org/en/region/mena>.

<sup>3</sup> Wilco Terink et. al., "Climate change projections of precipitation and reference evapotranspiration for the Middle East and Northern Africa until 2050," *International journal of climatology* 33, no. 14 (2013): 3056.

<sup>4</sup> Alex de Sherbinin, "Climate change hotspots mapping: what have we learned?," *Climatic Change* 123, no. 1 (2014): 23; "Climate Change and Impacts in the Eastern Mediterranean and Middle East: A Regional Assessment." *The Cyprus Institute* (2012): 4.

<sup>5</sup> Jeannie Sowers et. al., "Climate change, water resources, and the politics of adaptation in the Middle East and North Africa." *Climatic Change* 104, no. 3-4 (2011): 600.

One of the primary environmental implications of climate change is rising temperatures. On a global scale, surface temperatures have increased by approximately 0.6 °C in the period of 1951-2010.<sup>6</sup> This change has had impacts on all regions of the world. Research predicts that temperatures will rise further in the coming decades. Climate change scholar Jason Evans predicts that average temperatures in the Middle East will have risen by 1.41 °C by 2050, and 3.95 °C by 2100.<sup>7</sup> Another study by the Cyprus Institute concluded that temperatures will rise more significantly, up to 5 °C by mid-century.<sup>8</sup> Regardless of the exact number, scientists across the board are preparing for a significant temperature rise in MENA in the coming century. There are many environmental consequences to this temperature increase. MENA will experience an increase in hot days and nights per year of about two to four weeks, and heat waves will become more common (in recent years, the maximum temperature on the hottest days of the year was about 43 °C).<sup>9</sup> A recent study by the Max Planck Institute for Chemistry in Germany and the Cyprus Institute found that summer temperatures in MENA will be “increasing at a pace more than two times faster than the average pace of global warming.”<sup>10</sup> This study also concluded that if climate change continues at this pace, the Middle East could become “uninhabitable,” with summer temperatures reaching 46° C during the day, and heat waves occurring ten times more frequently than they do today.<sup>11</sup> This warming trend will affect human health, agricultural yields and livestock industries in the region.<sup>12</sup> This trend is expected to be most extreme over the

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6 Intergovernmental Panel on Climate Change, *Climate Change 2014—Impacts, Adaptation and Vulnerability: Regional Aspects* (Cambridge University Press, 2014): 6.

7 Jason P. Evans, "21st century climate change in the Middle East," *Climatic Change* 92, no. 3-4 (2009): 431.

8 Cyprus Institute, 2.

9 J. Lelieveld et al, "Strongly Increasing Heat Extremes in the Middle East and North Africa (MENA) in the 21st Century," *Climatic Change* 137, no. 1-2 (2016): 245.

10 Frangoul, Anmar. “Climate change could make North Africa and Middle East ‘uninhabitable’.” *CNBC*, May 4, 2016.

11 Frangoul.

12 Cyprus Institute, 3.

Levant, which includes Jordan, Syria, Lebanon, Palestine and Israel, and on the North African Coast.<sup>13</sup> Figure 1 shows the increasing daytime summer temperature in various MENA cities by the end of the century.

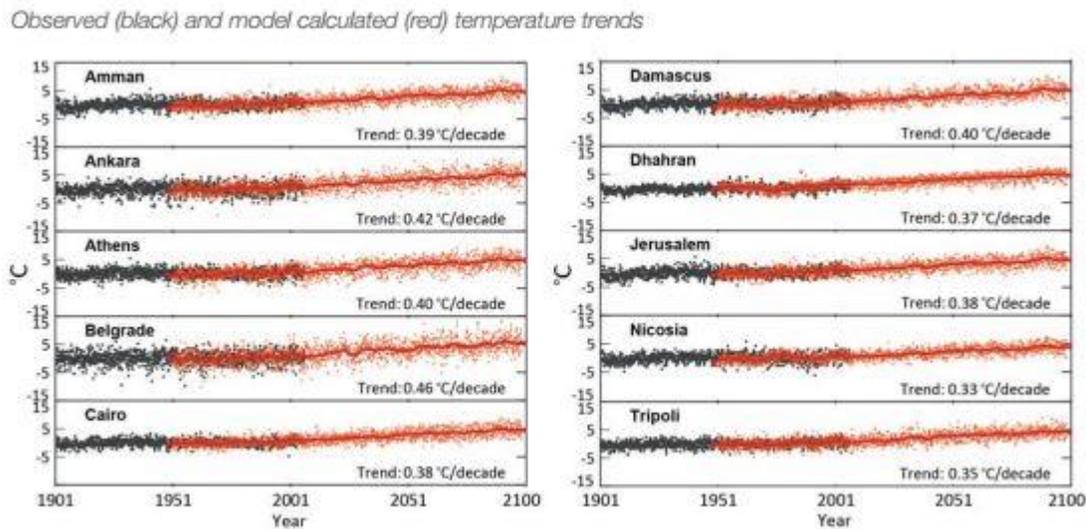


Figure 1. Observed and Projected temperature trends across the Eastern Mediterranean and Middle East Region. Source: Cyprus Institute.

Climate change will also impact water resources in the Middle East. Many states in the MENA Region have already begun to experience changes in precipitation levels due to climate change. The Levant region is currently experiencing the worst drought in 900 years as a result of climate change.<sup>14</sup> According to a NASA study, this drought, which began in 1998, was made worse by human-induced climate change.<sup>15</sup> Renewable water resources have become increasingly scarce since the onset of the 21st century, with decreasing rates of recharge. This is a result of changes in precipitation and evapotranspiration due to climate change as well as

<sup>13</sup> Cyprus Institute, 6.

<sup>14</sup> Benjamin Cook et. al., "Spatiotemporal drought variability in the Mediterranean over the last 900 years," *Journal of Geophysical Research: Atmospheres* (2016): 2060..

<sup>15</sup> Ellen Gray, "NASA Finds Drought in Eastern Mediterranean Worst of Past 900 Years," *National Aeronautics and Space Administration*, March 1, 2016.

population growth putting pressure on water resources. Figure 2 shows the projections for water availability per capita in MENA countries by the year 2025. According to data from the UN Food and Agriculture Organization, the MENA region has the world's lowest levels of actual renewable water resources per capita, at 55.43 m<sup>3</sup> as of 2014.<sup>16</sup> This marks an astounding decrease since 1962 when renewable water resources per capita were about 2,068 m<sup>3</sup> in the region.<sup>17</sup>

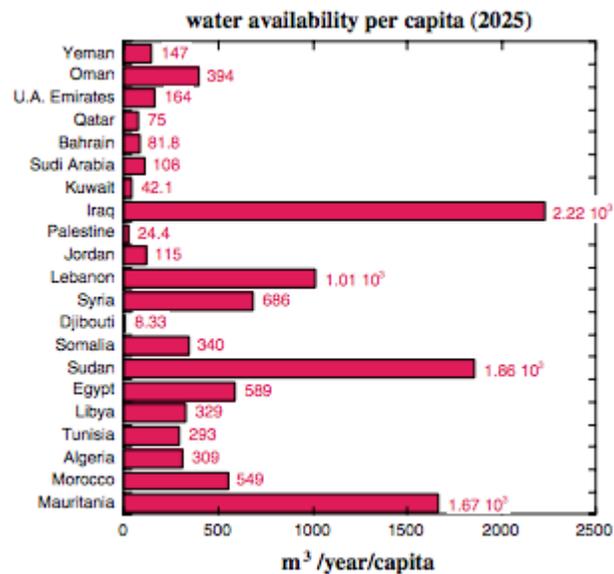


Figure 2. Projections for water availability per capita in 2025 in MENA countries. Source: Climatic Change (2011).

Extreme droughts such as the one the Levant is currently experiencing are expected to become more common in the remainder of the 21st century. The Cyprus Institute predicts that “overall rainfall is predicted to decrease by 20-30%” and “Mediterranean precipitation may significantly decrease in winter along the eastern Mediterranean coast by between 30-50%” by

<sup>16</sup> “Water is Focus of Climate Change in Middle East and North Africa,” *World Bank*.

<sup>17</sup> *World Bank*.

the end of the century.<sup>18</sup> Evans projects a decrease in precipitation of over 8 mm by the year 2050.<sup>19</sup> The overall decrease in precipitation will correspond with an increase in the frequency of droughts and other extreme weather conditions. The MENA region, which is already under significant water stress in an age of economic development and population growth, will face even greater water scarcity because of climate change. Many countries in the region, particularly those in the Persian Gulf, are expected to completely run out of renewable water resources by mid-century.<sup>20</sup> The Gulf States have already depleted much of their water resources because of development and urbanization—climate change will exacerbate this problem.<sup>21</sup> The decrease in water resources will affect human health, biodiversity, and agricultural productivity. On a related note, climate change is expected to increase the probability of desertification in MENA.<sup>22</sup> Desertification is a process in which drylands are persistently degraded, causing loss in arable land. Climate change has already caused increased desertification on a global scale, and the MENA region is especially vulnerable because of its natural aridity and proximity to desert.

Climate change is projected to have significant effects on agriculture in the MENA region. The increase in the number of hot days during the summer could lower the productivity of crops, especially major rainfed crops in the region such as cereal, fruits, and vegetables.<sup>23</sup> The increase in evapotranspiration and corresponding decrease in soil moisture could significantly reduce land suitability for agriculture.<sup>24</sup> The decrease in agricultural productivity as a result of

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<sup>18</sup> Cyprus Institute, 6.

<sup>19</sup> Evans, 426.

<sup>20</sup> Jonathan Chenoweth et. al., "Impact of climate change on the water resources of the eastern Mediterranean and Middle East region: Modeled 21st century changes and implications," *Water Resources Research* 47, no. 6 (2011): 9.

<sup>21</sup> Chenoweth, 1.

<sup>22</sup> Sowers et. al, 600.

<sup>23</sup> Cyprus Institute, 9.

<sup>24</sup> Cyprus Institute, 9.

climate change will directly affect the economic health and food security in the MENA region. Agriculture has traditionally played a key role in the economic development of MENA countries, with a large portion of the population employed in agriculture.<sup>25</sup> According to the World Bank, approximately 23.4% of the population in the broader region of MENA were employed in agriculture as of 2010, with some countries such as Morocco reaching 40% employment in agriculture.<sup>26</sup> A 2009 study found that climate change could result in up to a 39% decrease in rice production in MENA by 2050, along with decreases in production of wheat, maize, and millet.<sup>27</sup>

### **Climate Change and Conflict**

Climate change and environmental degradation are linked with regional conflicts and political unrest, particularly in water-scarce regions like the Middle East. Though a direct causal link between environmental degradation and political security threats is a contentious issue among experts, environmental factors are widely regarded as potential threat multipliers in these conflicts.<sup>28</sup> This means that while political and social factors may be the direct cause of unrest, environmental factors such as water shortages or reduced agricultural productivity can fuel and exacerbate these conflicts. A 2014 report by the Intergovernmental Panel on Climate Change (IPCC), commissioned by the United Nations, asserted that “climate change can indirectly increase risks of violent conflicts in the form of civil war and inter-group violence by amplifying well-documented drivers of these conflicts such as poverty and economic shocks.”<sup>29</sup>

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<sup>25</sup> John Dixon et. al., “Farming Systems and Poverty: Improving Farmers’ Livelihoods in a Changing World,” Washington D.C.: *Food and Agriculture Organization of the United States and The World Bank* (2001): 87.

<sup>26</sup> “Employment in Agriculture (% of total employment),” *International Labor Organization*, The World Bank (2010), <http://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?locations=ZQ>.

<sup>27</sup> Gerald C Nelson et, al., *Climate change: Impact on agriculture and costs of adaptation*, Vol. 21, International Food Policy Research Institute, 2009: 9.

<sup>28</sup> Balgis Osman Elasha, *Mapping of Climate Change Threats and Human Development Impacts in the Arab Region*, United Nations Development Program Bureau of Arab States (New York: UN, 2010): 26.

<sup>29</sup> Intergovernmental Panel on Climate Change, *Climate Change 2014–Impacts, Adaptation and Vulnerability: Summary for Policymakers* (Cambridge University Press, 2014): 20.

Environmental degradation can also have a direct impact on the economic health of a country, which can also play a key role in political unrest.<sup>30</sup> Many scholars argue that the consequences of climate change for political security depend more on the willingness and ability of governments to handle the social and financial burden of addressing environmental changes than the changes themselves.<sup>31</sup> Though a causal relationship has not been proven, the current literature asserts that climate change and climate-related disasters can have widespread implications for political and social issues such as migration, economic productivity, and public health. In regions like MENA that have weak governance and limited financial resources, consequences are especially tangible. Climate-related problems like water scarcity have historically led to regional conflicts in MENA, and the effects of climate change in the coming years only stands to exacerbate these issues.

The 2007 IPCC noted that climate hazards act as a stress factor that could induce security risks and violent conflicts.<sup>32</sup> The German Advisory Board on Climate Change asserted in a 2007 study that “climate change will draw ever-deeper lines of division and conflict in international relations, triggering numerous conflicts between and within countries over the distribution of resources, especially water and land, over the management of migration, or over compensation payment.”<sup>33</sup> Literature on the causal link between climate change and conflict is inconclusive, but there are many studies on climate change as a threat multiplier. One such report, jointly published by the European Commission and the High Representative for the Common and Foreign Security Policy, notes that climate change “threatens to overburden states and regions

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30 Lelia Croitoru and Maria Sarraf, *The Cost of Environmental Degradation: Case Studies from the Middle East and North Africa* (Washington, D.C.: World Bank, 2010): 1.

31 Jürgen Scheffran and Antonella Battaglini, "Climate and conflicts: the security risks of global warming," *Regional Environmental Change* 11, no. 1 (2011): 29.

32 Scheffran and Battaglini, 27.

33 Scheffran and Battaglini, 28.

which are already fragile and conflict prone.”<sup>34</sup> A report commissioned by the UN Development Program Bureau of Arab States found that the environmental stresses of climate change are likely to exacerbate the existing animosities in the Arab region, especially in countries suffering from political instability.<sup>35</sup> Ellen Messer of Oxfam America asserts that “climate change will transform resource bases and so produce conflict (i.e., competition) over access to land, water, and other resources.”<sup>36</sup> The spectrum of interpretations differ when it comes to whether this phenomenon leads to violence or cooperation; and whether the root cause of such violence is environmental or political.<sup>37</sup>

One prominent area of study in the realm of environmental security is the study of water conflicts. The concept of water conflicts is particularly relevant to the MENA region, and there have been many studies of political and social uprisings that are rooted in disputes over water resources. Access to water becomes a national security risk when demand for water outweighs supply; and in regions with little to no renewable water resources left, there is significant potential for social discontent that could escalate into an armed conflict. Experts cite the Arab-Israeli disputes over access to water resources in the Jordan River Basin as an example of how environmental factors can exacerbate existing ethnic tensions.<sup>38</sup> Population growth and economic development are occurring in MENA at the same time as climate change, which has significant implications for demand for water resources. Between 1950 and 2000, the population of the

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<sup>34</sup> European Commission, “Climate Change and International Security: Paper from the High Representative and European Commission to the European Council,” March 14, 2008: 1.

<sup>35</sup> Elasha, 36.

<sup>36</sup> Ellen Messer, “Climate Change and Violent Conflict: A critical literature review,” *Oxfam America: Research Backgrounders* (2010): 6.

<sup>37</sup> Messer, 6.

<sup>38</sup> Miriam Lowi, *Water and Power: The Politics of a Scarce Resource in the Jordan River Basin*, (Cambridge: Cambridge University Press, 1995): 19.

MENA region increased from around 100 million to around 380 million.<sup>39</sup> Population increased by 3.7 times during this time period, surpassing all other world regions.<sup>40</sup> Thus, many countries in the region entered the 21<sup>st</sup> century with rapidly increasing demand for water and rapidly decreasing supply. This combination of climate change and economic development poses a significant security challenge for the MENA countries.<sup>41</sup>

Water scarcity also has implications for agricultural activity, which can also act as a threat multiplier. Both rainfed and irrigated agriculture are dependent on the climate, and a hotter, drier season could mean drastically reduced agricultural productivity. Oxfam's Ellen Messer found that climate change will "push populations dependent on rainfall or irrigated agriculture to the brink of fierce competition for productive resources."<sup>42</sup> As precipitation levels and renewable water resource levels drop because of climate change, researchers note that populations dependent on agriculture will find themselves in economic crisis--a stepping stone to migration, unrest, and protest.<sup>43</sup> Drago Bergholt and Paivi Lujala found the occurrence of droughts, which are predicted to become more common because of human-induced climate change, have a negative relationship with economic growth, a factor which typically exacerbates political and social tensions in countries with weak governance and agriculture-dependent economies.<sup>44</sup> Additionally, some studies have found that food insecurity as a result of reduced agricultural productivity can lead to violence, evidenced by the "food riots" that have occurred in

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<sup>39</sup> Farzaneh Roudi, *Population Trends and Challenges in the Middle East and North Africa*, (Washington, D.C.: Population Reference Bureau, 2001): 1.

<sup>40</sup> Ibid.

<sup>41</sup> Peter H. Gleick, "Water, drought, climate change, and conflict in Syria," *Weather, Climate, and Society* 6, no. 3 (2014): 332.

<sup>42</sup> Messer, 12.

<sup>43</sup> Messer, 12.

<sup>44</sup> Drago Bergholt and Paivi Lujala, "Climate-Related Natural Disasters, Economic Growth, and Armed Civil Conflict," *Journal of Peace Research* 49, no. 1 (2012): 16.

the Arab Spring countries and many African countries in the period of 2007-2008.<sup>45</sup> Arab Spring protesters in Jordan, Yemen, and Tunisia waved baguettes in the air to express frustration with the sharp increase in food prices that resulted in part from extreme weather across the globe.<sup>46</sup> Increases in food prices also led to food riots in many African countries in 2007 and 2008; a clash between protesters and police in Mozambique left several dead and over 100 injured in February 2008.<sup>47</sup> Oli Brown and Alec Crawford found that food insecurity is a pertinent threat in the Middle East Levant region because of pressures put on governments in the region to adapt to reduced agricultural yields.<sup>48</sup>

Climate change is also projected to have impacts on migration patterns. Brzoska and Frölich note that climate migration is considered one of the main security risks of global warming.<sup>49</sup> Many of the environmental effects of climate change could force or encourage migration. Robert McLeman argues that various climate change-related events, whether it be a natural disaster or a drought, can influence human migration.<sup>50</sup> Henrik Urdal found that the increases in migration as a result of climate change can lead to “higher pressures on resources in areas of destination and subsequently to resource competition.”<sup>51</sup> Brown and Crawford identified climate-induced migration as a security threat, noting that “shifting rainfall patterns, spreading desertification and falling agricultural productivity are likely to undermine rural livelihoods,

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<sup>45</sup> Jürgen Scheffran et. al., "Climate change and violent conflict," *Science* 336, issue 6083 (2012): 870.

<sup>46</sup> Sarah Johnstone and Jeffrey Mazo, “Global Warming and the Arab Spring,” *Survival: Global Politics and Strategy* 53, no. 2 (2011): 11.

<sup>47</sup> Julia Barazneva and David R. Lee, “Explaining the African Food Riots of 2001-2008: An Empirical Analysis,” *Food Policy* 39 (2013): 29.

<sup>48</sup> Oli Brown and Alec Crawford. "Rising Temperatures, Rising Tensions," *Climate change and the risk of violent conflict in the Middle East. Winnipeg: International Institute for Sustainable Development* (2009): 2.

<sup>49</sup> Michael Brzoska and Christiane Fröhlich, "Climate change, migration and violent conflict: vulnerabilities, pathways and adaptation strategies," *Migration and Development* 5, no. 2 (2016): 191.

<sup>50</sup> Robert A. McLeman, *Climate Change and Human Migration: Past Experiences, Future Challenges* (Cambridge: Cambridge University Press, 2013): 1.

<sup>51</sup> Clionadh Raleigh and Henrik Urdal, “Climate Change, Environmental Degradation, and Armed Conflict,” *Political Geography* 26, no. 6 (2007): 677.

worsen job prospects in rural areas and accelerate migration to urban areas.”<sup>52</sup> This migration is projected to cause significant pressures on urban area services, potentially fueling resentments among existing urban populations.<sup>53</sup> Research suggests that climate change-induced migrants have already played a significant role in regional conflicts in the MENA region, particularly the onset of the Syrian Civil War.<sup>54</sup> The significance of this concept to the region will be examined more closely in later sections of this thesis.

Another significant aspect of the literature on climate change’s effects on political unrest is the emphasis on the role of governance and mitigation strategies in addressing the security threats of climate change. Most studies do not conclude that climate change or environmental degradation will necessarily lead to violent conflict, and this is in large part due to the role of government mitigation. Literature suggests that the chance of violent conflict or political uprising can be decreased by strong preparation and mitigation efforts for the effects of climate change.<sup>55</sup> Schyns and his colleagues found that in water-stressed countries, the government can mitigate a potential water crisis through various techniques such as changing production and consumption patterns and modifying agricultural techniques to reduce water demand.<sup>56</sup> The German Advisory Council on Global Change states that the main cause of water crisis today is poor management of available resources.<sup>57</sup> The 2014 IPCC report found that the impacts of climate change on societies depend on three non-climate related factors: socioeconomic

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<sup>52</sup> Brown and Crawford, 3.

<sup>53</sup> Brown and Crawford, 3.

<sup>54</sup> Gleick, 331.

<sup>55</sup> Messer, 7.

<sup>56</sup> Joep F. Schyns et. al., "Mitigating the risk of extreme water scarcity and dependency: The case of Jordan," *Water* 7, no. 10 (2015): 5710.

<sup>57</sup> Hans Joachim Schellnhuber et. al, *Climate Change as a Security Risk*, German Advisory Council on Global Change (Sterling, VA: Earthscan, 2008): 80.

pathways (level of economic and human development), adaptation and mitigation actions, and governance.<sup>58</sup>

There is strong evidence to suggest that wealthier, more developed nations, such as the United States and Western European nations, are generally capable of avoiding climate change-related conflicts, while less developed nations are more vulnerable because they do not have the monetary resources and advanced technology to adapt to extreme climatic changes.<sup>59</sup> Halvard Buhaug states that “economically developed and politically stable societies are well able to handle and adapt to conceivable environmental conditions.”<sup>60</sup> Thus, they are able to mitigate the conditions that could lead to a climate-related conflict. Regions are significantly more likely to experience climate conflict if they are already “conflict prone,” which Brzoska and Fröhlich define as regions with extreme resource scarcity, regions with high levels of conflict, or regions with exclusive identities.<sup>61</sup> Mearns and Norton further explain the characteristics of a vulnerable region, saying that “countries that are characterized by other conflict-promoting features-- notably, poor governance, large populations with polarized subgroups, social inequalities, a violent neighborhood, and a history of violence--are plausible candidates for climate-induced conflict.”<sup>62</sup>

Even in less developed nations that could be considered conflict prone, the government’s reaction to climate change can either exacerbate or reduce the risk of an uprising. Scott Greenwood found that Jordan, a highly water-stressed country, was able to prevent a large scale uprising after years of drought through a government-sponsored system of water access that

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<sup>58</sup> IPCC 2014, 3.

<sup>59</sup> Raleigh and Urdal, 675.

<sup>60</sup> Halvard Buhaug et al., "Implications of climate change for armed conflict," *Social dimensions of climate change: Equity and vulnerability in a warming world* (2010): 81.

<sup>61</sup> Brzoska and Fröhlich, 203.

<sup>62</sup> Buhaug, 81.

relies primarily on patron-client links.<sup>63</sup> Similarly, Niger experienced numerous climate-related disasters in 2010 that devastated agricultural output, but was able to avoid large-scale protests after the government set up a cabinet-level ministry to control food prices and implemented a massive aid operation.<sup>64</sup> On the other hand, mismanagement of water and land resources by the Syrian government contributed to political unrest prior to the civil war.<sup>65</sup> Experts emphasize the importance of environmental governance in the coming years as a way to mitigate potential conflicts, but also recognize the difficulty in implementing environmental policies in unstable and impoverished regions. A UNDP Bureau of Arab States report asserted the need for the Arab states to implement climate change adaptation strategies related to good governance, human resources, institutional structures, public finance, and natural resource management in order to prevent further socioeconomic and security impacts.<sup>66</sup> Since many states in MENA suffer from instability and conflict, implementation of such strategies could prove extremely difficult.

### **Argument Overview and Methods**

Before delving into the relationship between climate change, government response, and civil unrest, it is important to understand why this relationship matters. As climate change continues to disrupt the environment in the coming years, understanding its implications for civil conflict is vital. As mentioned earlier, climate change is predicted to worsen in the near future, and if there is indeed a relationship between climate conditions and conflict, this could have enormous consequences for global security. It is also important to understand the complexities of both the effects of climate change and the existence of civil unrest in the Middle East. While

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<sup>63</sup> Scott Greenwood, "Water insecurity, climate change and governance in the Arab world," *Middle East Policy* 21, no. 2 (2014): 141.

<sup>64</sup> Barazneva and Lee, 35.

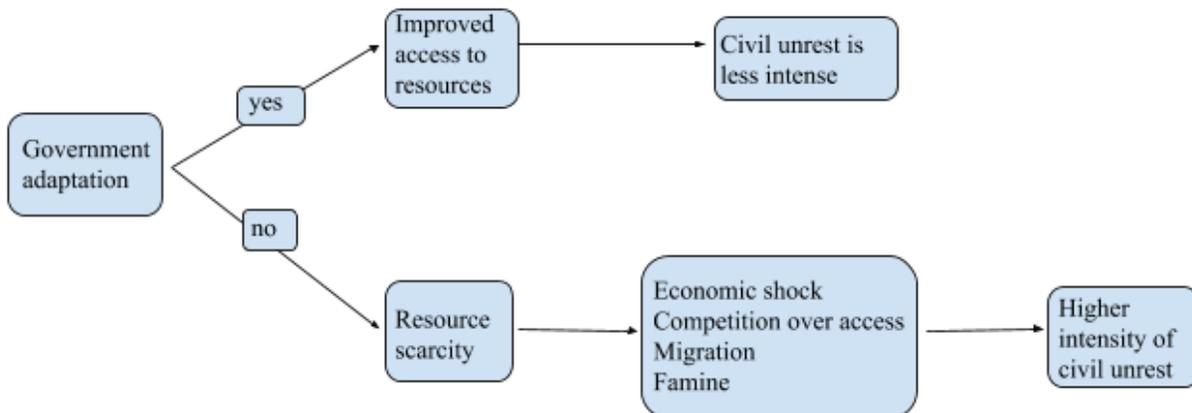
<sup>65</sup> Ulrika Åkesson and Knud Falk. "Climate Change in Syria—trends, projections and implications," *Sida's Helpdesk for Environment and Climate Change* (2015): 5.

<sup>66</sup> Elasha, 31.

there is no simple explanation of climate-related conflict in the Middle East, this thesis will address how government response to climate change can prevent or exacerbate the intensity of civil unrest.

### *Hypothesis*

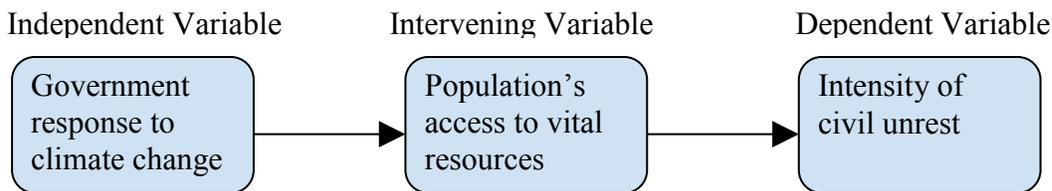
**Argument Flow Chart**



With climate change as an antecedent condition, government response acts as an independent variable, with the intensity of civil unrest as the dependent variable. As shown in the diagram above, citizens' access to vital resources constitutes the intervening variable. This is an important component of the argument because when a significant portion of the population does not have access to vital resources such as food, water, and income, a humanitarian crisis can occur, which is a primary driver of civil unrest. In MENA, climate change puts a strain on natural resources, notably water and agricultural output. The government response to these conditions determines how resource scarcity will affect their populations. There are varying degrees of government response to climate change that each have different effects on the population. Absence of government adaptation efforts can result in intense resource scarcity, which in turn leads to competition, migration, financial crisis, and other factors that directly increase civil unrest. Government adaptation strategies, like importing water to offset a drought or adjusting food

prices during a global wheat shortage, can appease discontent populations and prevent the outbreak of violence. Some government environmental policies not only fail to address the impacts of climate change, but actually make them worse, such as implementing agricultural quotas that prioritize unsustainable agricultural practices. These types of policies can also lead to migration, famine, competition, and other socioeconomic problems that fuel civil unrest.

### **Explanation of Variables**



#### *Climate Change*

In this study, climate change is the antecedent condition that activates the hypothesis. The causal relationship between government response to climate change and intensity of civil unrest only exists in the context of a country affected by climate change. The effects of climate change, discussed earlier in this thesis, serve as catalysts for government response to environmental problems. Climate change acts as an antecedent condition in this study because it has manifested itself throughout the region of MENA. The effects of climate change—namely drought, temperature increase, and desertification—are the conditions that all regional governments are responding to, thus activating the causal mechanisms that lead to civil unrest.

#### *Government Response to Climate Change*

Government response to climate change acts as the independent variable in this relationship. Government response to climate change is a broad category, but here it refers to any specific government actions meant to lessen or mitigate the environmental or social impacts of climate change, as well as policies that relate to the environmental degradation. The success or

failure of government response to climate change is what will activate a chain of events that can lead to civil unrest in MENA. As mentioned in Section I, there are many factors that can lead to civil unrest in this region. However, in this study of climate change-induced conflict, government response is the independent variable. There are several intervening variables that follow from the independent variable to influence the intensity of civil unrest, the dependent variable.

#### *Access to vital resources*

The relationship between government response to climate change and civil unrest lies in the population's access to vital resources, which here constitutes the intervening variable. This is the mechanism that is closely related to level of government response and will cause the dependent variable, the intensity of civil unrest. Vital resources include food, water, shelter, and livelihood. These are resources needed for every human to meet their basic needs. As climate change often leads to resource scarcity (of land, water, and agricultural output), it falls on the government to offset this scarcity and ensure its population has access to vital resources. If the efforts to mitigate climate change are successful, then populations will be able to meet their basic needs and correspondingly, avoid an increase in civil unrest. If, however, the government does not respond to climate change or is unsuccessful in mitigation, populations will not be able to meet their basic needs and may face competition over resources or a humanitarian crisis, which in turns leads to unrest on a significant scale.

#### *Approach*

The above hypothesis will be tested using case studies in a controlled comparison. This thesis will analyze the cases of Syria, Tunisia, Jordan, and Sudan, looking specifically at these countries in the past ten years in which climate change has had clear demonstrable effects. Conducting these case studies will serve two purposes: first, to test the importance of the

antecedent condition, climate change. Second, to test the hypothesis itself, relating government response to the intensity of civil unrest.

The selected cases will reflect John Stuart Mill's "method of difference," in that all cases share general characteristics but differ greatly in the value of the independent variable of government response.<sup>67</sup> The case selection for this study seeks to identify the differences in government response to climate change and thus reveal the causal mechanisms relating to civil unrest. If the hypothesis is correct, the cases in which there is no government effort to offset climate change, we should see a greater intensity of civil unrest. Likewise, in countries where the government did make a successful effort to offset climate change-induced resource scarcity, we should see less extreme resource scarcity, and thus less intensity of civil unrest.

This paper will look at Syria, Jordan, Tunisia, and Sudan because they share broadly-similar characteristics in terms of culture, geography, political system, and the environmental impacts of climate change. In all four of these countries prior to the Arab Spring, we can see a non-democratic political system, large Arab populations, a patriarchal social system, the existence of some level of political discontent, a mid- to low-range Human Development Index, and similar climate change effects (namely drought, temperature increase, and desertification). This is also a region in which there has been a great deal of civil unrest within the last ten years (though not in all four countries), which correlates with the increase in climate change's effects. Methodologically, these cases are suitable for examining the effects of government adaptation to climate change on civil unrest or lack thereof.

While the occurrence of civil unrest is a complex phenomenon, comparative case studies will allow a focused examination of the causal relationship between government response and

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<sup>67</sup> Stephen Van Evera, *Guide to Methods for Students of Political Science* (Cornell: Cornell University Press, 1997): 57.

civil unrest in a region greatly affected by climate change. This method of analysis will illuminate how government response to climate change creates a chain of reactions that can either lessen or exacerbate civil unrest. Another advantage of the case study method is that it allows us to move beyond theory and look at the actual effect of climate change governance and its implications. There is considerable literature that theorizes the implications of climate change for conflict, but the most effective way to test this is to examine tangible examples. These four countries have all experienced significant social and environmental impacts due to climate change, so they constitute an ideal set of studies to test the role of government response in violent conflict.

### *Limitations*

While this thesis seeks to be as clear and explanatory as possible, there are limits to the above research approach. As previously mentioned, the dependent variable of civil unrest is not monocausal. There are many reasons why civil unrest has occurred in the Middle East, and this can be traced back to an array of social, economic, and political factors that stand alone from environmental stressors. These factors occur even when the population does have sufficient access to vital resources. Thus, it is difficult to make any sort of broad generalizations about unrest in the Middle East. This does not make the above hypothesis invalid, but it is important to keep in mind that there are other factors affecting the dependent variable. Another limitation lies in the fact that climate change is a relatively recent phenomenon, so data regarding government response to climate change (particularly in less developed regions such as the Middle East), is still limited. Much remains unknown about the broader implications of climate change, so this is a field that will continue to require further research as climate change intensifies in the future.

## Case Study: Syria

One of the most recent and well-documented incidences of conflict in the Middle East is the Syrian Civil War. Beginning in 2011 as part of the Arab Spring, the Syrian Civil War has caused massive civilian casualties and severe damage to the infrastructure of many cities, as well as a mass outflow of refugees. While the uprising was caused by several complex and interrelated social, political, and economic factors, there is a great deal of evidence to suggest that climate change played a role in exacerbating these factors. This case study will explore the effects of climate change in Syria, how these effects contributed to unrest, and how the Syrian government's response only intensified climate change-induced resource scarcity. This paper's hypothesis suggests that government response to climate change affects the intensity of civil unrest because of its determination of citizens' access to vital resources. This case study will evaluate each variable and determine whether or not the case of Syria is congruent with this thesis' hypothesis. The first section will discuss the effects of climate change in Syria, namely the severe drought and how it impacted agriculture.

### *Climate Change in Syria*

The climate of Syria experiences a great deal of hydrologic variability, meaning it is difficult to predict climate patterns, year-to-year rainfall, and water availability.<sup>68</sup> Though the country is no stranger to drought, Syria experienced an extended severe drought from 2006 to 2010 that contributed to agricultural failures, economic hardships, and population displacement.<sup>69</sup> NASA placed a broader timeline on this drought, marking its initial onset in 1998 and noting that it has been the worst drought to affect the region in 900 years.<sup>70</sup> The length

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<sup>68</sup> Gleick, 332.

<sup>69</sup> Ibid.

<sup>70</sup> Gray.

and severity of the drought suggests that human-induced climate change was an underlying cause. Syria was not the only country affected by this drought, but it was one of the hardest hit countries. According to a study sponsored by the UN Office for Disaster Reduction, Syria was one of the countries most vulnerable to drought in the Arab region, measured based on frequency and length of drought in the period of 2000-2010.<sup>71</sup> In addition to the drought, Syria experienced a significant increase in surface temperature throughout the last century, likely the result of anthropogenic climate change.<sup>72</sup> The increase in temperature corresponded with an increase in evaporation, which harmed winter crops such as wheat that relied on soil moisture.<sup>73</sup>

The severe drought had several societal implications, but one of the primary sectors affected was agriculture. Comprising about 20% of total GDP and employing 33% of the population, agriculture was a major sector of the Syrian economy, and it was especially vulnerable to environmental changes.<sup>74</sup> Agriculture in Syria is also largely reliant on rainfall, with 71% of total agricultural areas consisting of rainfed crops.<sup>75</sup> The agricultural season relied on rainfall at specific points in the cycle, so the severe, extended drought (which encompassed multiple growing seasons) had devastating effects on agricultural output. Two primary crops, wheat and barley, were especially affected by the drought. In the 2007/8 season, in which the drought was especially severe, 75% of farming families suffered total crop failure, and wheat and barley production decreased by 47% and 67% respectively compared to the previous year.<sup>76</sup>

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71 E. Erian, Bassem Katlan, and Ouldbdey Babah, "Drought vulnerability in the Arab region," *Special case study: Syria, Global assessment report on disaster risk reduction*, Geneva: United Nations International Strategy for Disaster Reduction (2010): 14.

72 Colin P. Kelley et. al., "Climate change in the Fertile Crescent and implications of the recent Syrian drought," *Proceedings of the National Academy of Sciences* 112, no. 11 (2015): 3241.

73 Ibid, 3243.

74 "Syria," *The World Factbook*, Central Intelligence Agency, 2017, <https://www.cia.gov/library/publications/the-world-factbook/geos/sy.html>; Kelley et. al, 6.

75 Kelley et. al, 16.

76 Ibid, 27.

Figure 3 shows the normalized difference vegetation index in 2008, which shows the amount of vegetation compared to normal. This shows that the majority of the country experienced significant vegetation loss in 2008. The effects of the agricultural failure in the 2007/8 season were felt throughout the country, as Syria had to import wheat for the first time in 15 years.<sup>77</sup> Even in the following season in which rainfall levels recovered in parts of the country, farmers again suffered widespread crop loss due to an outbreak of yellow wheat rust, a fungal disease which spread rapidly due to the prolonged drought in the previous seasons.<sup>78</sup> The environmental degradation caused by the drought and temperature increase had a number of social implications. The following sections will explore the effects the drought and crop failure had on the Syrian population.

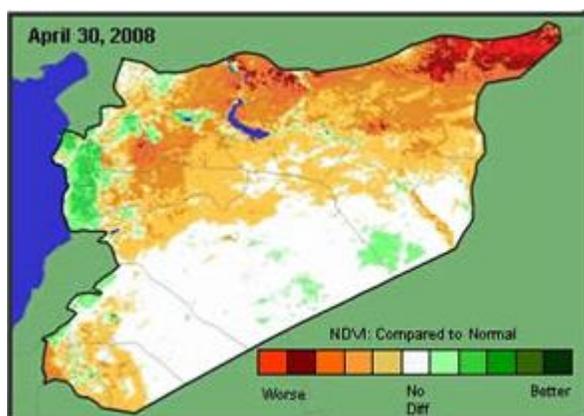


Figure 3. Vegetation Index in Syria, 2008. Source: USDA

### *Social and Economic Implications of Climate Change*

The devastation of crops and livestock during the drought was significant to Syrian society because agriculture accounted for 25% of the gross domestic product and employed 40%

<sup>77</sup> Francesca De Châtel, “The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution,” *Middle Eastern Studies* 50, no. 4 (2014): 524

<sup>78</sup> De Châtel, 525.

of Syria's workforce before the Arab Spring of 2011.<sup>79</sup> The governorates most affected by the drought were those that employed a large population in rainfed agriculture: Al-Hasakah, Ar-Raqqa, Aleppo, and Dier ez-Zor.<sup>80</sup> These areas, which are all located in the northeastern part of the country, were already vulnerable to agricultural failures because they exhibited the highest proportions of rural and urban poverty.<sup>81</sup> The UN estimated that the drought directly affected about 1.3 million people, and 800,000 of those were severely affected, meaning their assets and sources of livelihood were significantly degraded.<sup>82</sup> As the drought extended for multiple seasons, growers were less and less able to cope as their incomes dropped severely—upwards of 90% after the 2006 drought.<sup>83</sup> Livestock herders also suffered from the drought: young livestock mortality rate rose by up to 30%, mating rates decreased by 60%, and many herders were forced to slaughter or sell their remaining livestock at reduced prices.<sup>84</sup> The devastation of crops and livestock, coupled with the Syrian government response discussed below, created a large population that had very few options for livelihood in their hometowns.

The drought and agricultural failures displaced a majority of the families who lived in northeast Syria. With a large portion of the population already living in poverty, the failure of agriculture pushed many families to move to urban areas in hopes of finding a new means of gaining income. While UN agencies estimated that the drought caused at least 300,000 people to move from the northeast region, some studies put the number of displaced people much higher, up to 1.5 million people.<sup>85</sup> The UN estimated that in the governorates of Hassakeh and Deir ez-

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<sup>79</sup> Erian et. al, 26.

<sup>80</sup> Ibid, 16.

<sup>81</sup> De Châtel, 525.

<sup>82</sup> United Nations Office for the Coordination of Humanitarian Affairs, *Syria Drought Response Plan 2009-2010* (2009): 4.

<sup>83</sup> *Syria Drought Response Plan 2009-2010*, 4.

<sup>84</sup> Ibid, 27.

<sup>85</sup> De Châtel, 527; Kelley et. al, 3242.

Zor, as much as 60-70% of the population deserted their home villages.<sup>86</sup> It is likely that these numbers were even higher in reality since no comprehensive study of internally displaced persons was ever conducted.<sup>87</sup> Rural migrants primarily moved to the outskirts of Syria's major cities, including Aleppo, Damascus, Daraa, Deir es-Zour, Hama, and Homs.<sup>88</sup> The result was the formation and expansion of makeshift tent settlements in the suburbs of the cities. These encampments were illegal and usually lacked clean water, sanitation services, and electricity.<sup>89</sup> The mass migration of rural families added economic stress to Syria's cities, which were already burdened with rapid population growth, high unemployment, corruption, and inequality.<sup>90</sup> From 2002 to 2010, Syria's urban population increased from 8.9 million to 13.8 million—more than a 50% increase in less than ten years.<sup>91</sup> These cities would become the site of some of the earliest political unrest in Syria leading up to the Arab Spring.<sup>92</sup> The next section will examine the independent variable, Syrian government response to climate change, and its effects.

### *The Role of Syrian Governance*

While the drought was devastating to crop yields and livestock in Syria, it alone was not wholly responsible for the mass movement of internally displaced persons to cities in the years leading up to the Arab Spring. The drought was exacerbated by years of poor water management and resource exploitation, along with the Bashar Al-Assad regime's neglect of the rural to urban migration crisis. The devastation of rural livelihoods was the culmination of environmental

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<sup>86</sup> De Châtel, 527.

<sup>87</sup> Ibid.

<sup>88</sup> Gleick, 334.

<sup>89</sup> De Châtel, 527.

<sup>90</sup> Kelley et. al, 3242.

<sup>91</sup> Ibid.

<sup>92</sup> Gleick, 335.

stress, unsustainable use of resources, and the failure of the regime to counteract the environmental and humanitarian crises that had been building up for years before the drought.

The government's harmful environmental policies began years before the 2006-10 drought. Exploitation of Syria's natural resources can be traced back to the regime of Hafez Al-Assad. In the 1970s and 1980s, Hafez Al-Assad used policies of land redistribution, subsidies for agriculture, and encouragement of higher agricultural production to garner rural support for the regime.<sup>93</sup> These policies encouraged rural residents to exploit the country's water and land resources without regard to conservation.<sup>94</sup> Despite the naturally limited renewable water resources in the country, the regime implemented a vast expansion of irrigation systems that relied on groundwater throughout the 1980s and 1990s.<sup>95</sup> These systems made groundwater cheaper to pump and more accessible as a means of irrigation.

By the time Bashar Al-Assad came into power, rural farmers had grown to rely on subsidies for water-intensive crops implemented by his father, including subsidies for the diesel fuel that was used to pump groundwater used to irrigate crops.<sup>96</sup> Throughout the 20th century and into the early 2000s, the Syrian government encouraged the use of traditional flood irrigation, which was extremely water intensive and significantly less efficient than modern irrigation methods such as drip and sprinkler irrigation.<sup>97</sup> By the time of the 2006/7 growing season, groundwater resources had been severely depleted due to years of overpumping.<sup>98</sup> Many other natural water resources also dried up or significantly diminished, including the Khabur

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<sup>93</sup> Kelley et. al, 3241.

<sup>94</sup> Ibid.

<sup>95</sup> De Châtel, 532.

<sup>96</sup> Gleick, 334.

<sup>97</sup> Ibid, 335.

<sup>98</sup> Åkesson and Faulk, 7.

River in the Hassakeh governorate and the Balikh River in the Raqqa governorate as a result of years of unsustainable water management.<sup>99</sup>

Adding to decades of water mismanagement, the Bashar Al-Assad regime decided to implement policies of economic liberalization that would prove disastrous to rural farming families. These liberalization policies were short sighted and failed to consider the economic realities in rural areas. In 2008 and 2009, Assad abruptly cancelled several subsidies to farmers, which resulted in sudden price hikes in animal feed, diesel fuel, and fertilizer right before the growing season.<sup>100</sup> While the cancellation of subsidies made sense from a strictly environmental point of view (subsidies encouraged overpumping of groundwater), farmers were left with no social safety net, and the policy came after the 2006/7 season when the drought had caused total crop failures for many families.

The combination of drought, desertification, and cancellation of animal feed subsidies also led to nearly 60% of small-scale cattle farmers losing their entire herds.<sup>101</sup> In implementing these liberalization policies, the Assad regime did not account for the massive losses farmers had already experienced, and failed to adequately address the economic devastation faced by a significant portion of the population. In an attempt to alleviate the humanitarian crisis, the government did issue two drought appeals requesting economic aid in conjunction with UN agencies in 2008 and 2009, but received only a fraction of the aid requested.<sup>102</sup> The failure of these appeal efforts is likely related to the government's attempt to downplay the humanitarian crisis on the international stage.<sup>103</sup> As the migration crisis ensued, the regime neglected to put

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<sup>99</sup> Wagiha Mhanna, "Syria's Climate Crisis," trans. Anthony Goode, *Al Monitor*, December 4, 2013.

<sup>100</sup> De Châtel, 532.

<sup>101</sup> Mhanna.

<sup>102</sup> De Châtel, 527.

<sup>103</sup> *Ibid*, 528.

any social safety measures in place to offset the economic strain on cities, which were already economically depressed and strained by recent influxes of Iraqi refugees.<sup>104</sup> The government especially neglected the urban peripheries, where most rural migrants settled and the site of growing discontent before the Arab Spring—the informal settlements were denied any access to social services or economic relief efforts in the cities.<sup>105</sup> The government’s long term environmental policies only exacerbated the effects of the drought, and as a growing portion of the population was left without a means of income, the regime only further isolated them by implementing economic liberalization policies.

### *Civil Unrest in Syria*

As this case study has now discussed the background of climate change and water policy in Syria leading up to the Arab Spring, this section will look at the beginning of civil unrest in Syria and evaluate its intensity. Clearly Syria has experienced a high degree of civil unrest and violent conflict since the dawn of the Arab Spring, but this section will examine the roots of civil unrest, particularly during the 2011 uprising, to better understand how they may relate to the other variables.

The Syrian Uprising began in 2011 as a series of seemingly disparate events and acts that coalesced into a broader nationwide movement for freedom.<sup>106</sup> The popularity of this movement country-wide and the speed at which it took place suggests that Syrians experienced a high degree of civil unrest prior to the outbreak of protests. The spark of uprising did not begin in one of Syria’s urban centers, but rather, the small provincial town of Daraa, after several teenagers

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<sup>104</sup> Francesco Femia and Caitlin Werrell, “Syria: Climate Change, Drought, and Social Unrest,” *The Center for Climate and Security*, February 29, 2012, <https://climateandsecurity.org/2012/02/29/syria-climate-change-drought-and-social-unrest/>.

<sup>105</sup> Kelley et. al, 3242.

<sup>106</sup> Salwa Ismail, "The Syrian uprising: Imagining and performing the nation," *Studies in Ethnicity and Nationalism* 11, no. 3 (2011): 539.

were arrested for writing anti-regime graffiti on their school wall. Daraa had been strained in the preceding months by the influx of internal refugees from the northeast who had lost their livelihoods due to drought and the government's lack of provisions. Though the direct spark was the arrest and poor treatment of the teenagers by the regime, protests were also fueled by economic frustrations, and inspired by popular protests in Tunisia and Egypt.<sup>107</sup> The fact that protests began in Daraa suggests that the humanitarian crisis caused by drought played into the intensity of civil unrest in the country. The economic effects of Assad's liberalization policies, including cancellation of subsidies, were also a source of discontent within society. Because his liberalization efforts mainly benefited the elites while the struggles of the urban poor increased, the original protests called for a decent standard of living in addition to fair treatment by police and greater political freedoms.<sup>108</sup>

As the movement progressed and the regime cracked down violently on the peaceful protestors, the message became more direct, calling for the fall of the Assad regime.<sup>109</sup> The regime continued to resist public pressure and violently crush protests, until the movement turned into a fully fledged rebellion and civil war.<sup>110</sup> In the years since the uprising began, the civil war has claimed an estimated 470,000 lives, decimated major cities like Aleppo and Homs, and forced nearly 5 million people to flee the country as refugees.<sup>111</sup>

### *Conclusions from the Syrian case*

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<sup>107</sup> Ismail, 539.

<sup>108</sup> "Syrian President Bashar al-Assad: Facing down rebellion," *BBC*, October 21, 2015.

<sup>109</sup> Ismail, 539.

<sup>110</sup> Jeremy M. Sharp and Christopher M. Blanchard. "Armed conflict in Syria: Background and US response." Washington, D.C.: Library of Congress Congressional Research Service, 2013.

<sup>111</sup> Priyanka Boghani, "A Staggering New Death Toll for Syria – 470,000," *PBS*, February 11, 2016, accessed February 26, 2017, <http://www.pbs.org/wgbh/frontline/article/a-staggering-new-death-toll-for-syrias-war-470000/>; United Nations High Commissioner for Refugees, "Syria Regional Refugee Response," accessed February 26, 2017, <http://data.unhcr.org/syrianrefugees/regional.php>.

This case study has demonstrated that the events in Syria support this paper's hypothesis that government response to climate change affects the intensity of civil unrest. The antecedent condition of climate change was clearly present in the years leading up to the Syrian uprising, causing a severe, prolonged drought that devastated the country's agricultural sector. Yet it was not simply the drought that caused the humanitarian crisis in the northeast and mass movement of rural families to the cities. The severity of the crisis was largely because of the government's long history of unsustainable environmental practices which encouraged inefficient use of water and overpumping of limited groundwater resources. Environmental problems in Syria existed for years before the extreme drought of 2006-10, and the government's unsustainable policies intensified the effect of climate change-induced drought on the agricultural sector. More immediately, the government exacerbated the environmental crisis by implementing liberalization policies that were ill-timed and failed to consider the livelihoods of families living in rural areas. Government policies not only neglected to address issues of climate change, but they actually made the situation worse by depriving families who relied on the environment any alternative access to vital resources when the drought caused their crops and livestock to fail.

### **Causal chain of events**

*Climate change + Unsustainable policies of Assad → severe drought → rural loss of livelihood → neglect of Assad regime → mass migration and economic stress → high degree of civil unrest*

While the uprising in Syria was the culmination of a variety of complex and interrelated political, economic, and social factors, the drought and the subsequent failure of the government to alleviate the humanitarian crisis played a definite role in exacerbating the tensions that led to the widespread anti-regime protests. The popular demonstrations called for major regime change, condemning poor economic policies and corruption. These protests were not directly fueled by

climate change itself, but rather the failure of the government to adapt to climate change as well as other political and economic changes that drove protesters into the streets.

### **Case Study: Jordan**

The Hashemite Kingdom of Jordan is another complex case regarding the effects of climate change and government response on civil unrest. Jordan shares basic characteristics with many of its neighbors in the region, including the other countries examined in this paper. The Kingdom of Jordan is non-democratic, has a predominantly Arab and Muslim population, has a relatively low gross domestic product, and high unemployment.<sup>112</sup> As we will see later in this study, Jordan is poor in water resources and has experienced many effects of climate change in the past several years. However, unlike some of the other cases examined in this paper, Jordan has remained a relatively stable state in the past several decades. Despite sharing many characteristics in governance with other Arab nations, Jordan did not experience the Arab Spring to the same extent as many of its neighbors. While there were protests in Jordan calling for political and economic reforms, King Abdullah II survived the movement unscathed. The popular demonstrations were relatively peaceful throughout, and the protests died down as King Abdullah promised reforms and a path to democracy.<sup>113</sup> This case study will examine how Jordan experienced climate change, how the government responded to environmental degradation, and the relationship with Jordan's relatively low intensity of civil unrest.

#### *Climate Change in Jordan*

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<sup>112</sup> "Jordan," *The World Factbook*, Central Intelligence Agency, 2017, <https://www.cia.gov/library/publications/the-world-factbook/geos/jo.html>.

<sup>113</sup> "Arab Uprising: Country by country - Jordan," *BBC*, December 16, 2013.

The climate of Jordan is naturally arid and semi-arid, and climate change has only worsened water scarcity. Jordan is the fourth poorest nation in the world regarding water resources, and it is the most water-stressed country in the Arab region.<sup>114</sup> Precipitation is highly variable across different regions of the country; portions of the northwest receive upwards of 300 millimeters of rainfall per year while the largest portion of the country in the south and east receive less than 100 millimeters of rainfall per year.<sup>115</sup> Like Syria, Jordan was hit with a severe drought in the early 2000s that lasted over multiple seasons and devastated agriculture.<sup>116</sup> A 2015 study found that from the years 1995 to 2013, Jordan experienced a decrease in rainfall of an average of 1.2 millimeters each year.<sup>117</sup> Another study found that since the year 1970, Jordan has faced frequent non-uniform periods of drought that have increased in length and severity, including one extreme drought that lasted for two consecutive years in 1999-2000.<sup>118</sup> In its Second National Communication (SNC) to the UN Framework Convention on Climate Change, Jordan reported a decrease in precipitation by 5-20% in the majority of the country over the 45 years preceding 2009.<sup>119</sup> This is significant because Jordan relies mainly on precipitation for maintaining the country's internal water resources.<sup>120</sup> Decline in rainfall is also linked with a decline in the recharge rates of underground aquifers, which lowers groundwater availability.<sup>121</sup>

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<sup>114</sup> Greenwood, 141; Muhammad Bundokji, "Climate Change, Arab Spring and the Hashemite Kingdom of Jordan," *Climate Diplomacy*, December 22, 2015.

<sup>115</sup> Dorte Verner, *Adaptation to a Changing Climate in the Arab Countries : A Case for Adaptation Governance and Leadership in Building Climate Resilience, MENA Development Report* (Washington, D.C.: World Bank, 2012): 51.

<sup>116</sup> Hana Namrouqa, "Drought threatens water supply, crops – officials," *Jordan Times*, February 11, 2014.

<sup>117</sup> Kazi Rahman et. al, "Declining rainfall and regional variability changes in Jordan," *Water Resources Research* 51, no. 5 (2015): 3828.

<sup>118</sup> Mohammed Al-Qinna et. al, "Drought analysis in Jordan under current and future climates," *Climatic Change* 106, no. 3 (2011): 438.

<sup>119</sup> The Hashemite Kingdom of Jordan, *Jordan's Second National Communication to the United Nations Framework Convention on Climate Change*, United Nations Framework on the Convention of Climate Change, 2009: 20.

<sup>120</sup> World Health Organization, "Climate Change Adaptation to Protect Human Health: Jordan Country Profile," <http://www.who.int/globalchange/projects/adaptation/en/index5.html>.

<sup>121</sup> Greenwood, 144.

The SNC also reported increasing trends in the annual maximum temperature by between 0.3 and 1.8°C, while the annual minimum temperature increase of between 0.4°C and 2.8°C since 1965.<sup>122</sup> Jordan also experienced a decrease in relative humidity over the 45-year period along with an increase in evaporation.<sup>123</sup> Climate change is expected to continue to have effects in Jordan, and the country anticipates a further rise in average temperature, especially during the warmer months of the year, and an increase in precipitation variability, though the exact effects of this are difficult to project.<sup>124</sup>

The effects of climate change in Jordan thus far have mainly impacted the country's water supply and its agricultural sector. The climate change-induced periods of drought and temperature increase have combined with rapid population growth and other anthropogenic pressures on the environment to result in serious environmental degradation throughout the country, including of surface water. The Jordan River, which flows through Jordan into the Dead Sea, now constitutes little more than a trickle by the time it discharges into the Dead Sea.<sup>125</sup> This has contributed to a significant drop in the water levels in the Dead Sea.<sup>126</sup> The flow of the Jordan River was never particularly substantial, and it has now been significantly depleted due to massive withdrawals for irrigation, population growth, and drought.<sup>127</sup>

#### *Social and Economic Implications of Climate Change in Jordan*

Similar to other cases, climate change has many social and economic implications in Jordan. Competition over scarce water resources has contributed to transboundary conflicts with

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<sup>122</sup> *Jordan's Second National Communication*, 20.

<sup>123</sup> *Jordan's Second National Communication*, 86.

<sup>124</sup> *Ibid*, 21.

<sup>125</sup> Schyns et. al, 5707.

<sup>126</sup> *Ibid*.

<sup>127</sup> Gidon Bromberg, "Will the Jordan River Keep Flowing?," *Yale Environment* 360, September 18, 2008.

Israel, and to this day many Jordanians blame the water scarcity on Israel.<sup>128</sup> As climate change continues to exacerbate water scarcity in the region, it is likely that tensions with Israel will remain high. Water scarcity also poses internal difficulties for the population, especially because of Jordan's rapidly increasing population and recent influx of Syrian refugees. The demand for water resources has only increased as water availability has diminished. A 2015 study found that groundwater consumption in Jordan is nearly double the groundwater recharge rate.<sup>129</sup> The overdraw of groundwater lowers the water table and increases salinity in the remaining groundwater, making it unusable. Out of Jordan's twelve aquifers, the Jordanian Ministry of Water and Irrigation estimates that ten are being over-exploited.<sup>130</sup>

The agricultural sector uses the largest portion of groundwater resources in Jordan, so it is especially affected by climate change and its impacts. Climate change has added to a vicious cycle of water degradation and consumption for agriculture in Jordan. Climate change coupled with population pressures has led to reductions in quantities of surface water and high rates of water pollution, which has forced many farmers to rely exclusively on groundwater resources.<sup>131</sup> This adds to the problem of over-exploitation of Jordan's scant groundwater resources. Climate change-induced drought has also increased reliance on irrigation for agriculture, putting further pressure on groundwater. It is important to note that Jordan's agricultural sector is much smaller than many of its neighbors—agriculture accounts for only 4.2% of the GDP and employs only

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<sup>128</sup> Peter Schwartzstein, "Biblical Waters: Can the Jordan River Be Saved?" *National Geographic*, February 22, 2014.

<sup>129</sup> Schyns et. al, 5724.

<sup>130</sup> Ali Subah, "Introduction," Jordan Ministry of Water and Irrigation: Groundwater Resources Management, <http://www.mwi.gov.jo/sites/en-us/SitePages/MWI%20BGR/Introduction.aspx>.

<sup>131</sup> Elizabeth Whitman, "Jordan's Farmers Struggle to Weather Climate Change," *Inter Press Service*, November 5, 2013.

2% of the population.<sup>132</sup> Thus, the social implications of agricultural failures in Jordan were more limited than countries such as Syria.

Climate change also poses a risk to human health in Jordan, primarily because of water scarcity. The World Health Organization projected that water scarcity and its secondary effects constitute the highest priority threat to health in Jordan, and linked lower per capita water consumption with more incidences of diarrhea.<sup>133</sup> The severe water scarcity is also encouraging reuse of wastewater as an alternative water source, especially for agricultural purposes.<sup>134</sup> This poses a number of concerns for public health, including an increase in intestinal diseases and increased exposure to toxic chemicals for farmers, communities, and consumers.<sup>135</sup>

Jordan's resource scarcity and the onset of climate change have major implications for the economy. With water resources declining so rapidly, Jordan imports a large share of its water. This is both in the literal sense that it relies on shared water resources with neighboring countries, and in the sense of virtual water imports, which consist of all water consumption associated with producing imported goods. When including virtual water resources, Jordan imports 86% of water resources, and has become very reliant on foreign imports of water-intensive commodities such as wheat.<sup>136</sup> Jordan relies on imports for other needs as well, notably food and energy.<sup>137</sup> Climate change has also affected Jordan externally, with the global rise in food prices in 2010. While the sharp price increase was due to a combination of factors, climate change played a definite role; Russia and the Ukraine, who export about a third of the world's

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<sup>132</sup> *The World Factbook*.

<sup>133</sup> World Health Organization, "Climate change adaptation to protect human health: Jordan Country Profile."

<sup>134</sup> *Ibid*.

<sup>135</sup> *Ibid*.

<sup>136</sup> Schyns et. al, 5713.

<sup>137</sup> Bundokji, 2015.

wheat, suffered major crop failures in 2010, causing a price hike.<sup>138</sup> As Jordan is a major importer of cereals, Jordanians felt the effects of the price increase acutely.<sup>139</sup>

### *The Role of Jordanian Governance*

The Hashemite Kingdom of Jordan has taken a fairly active role in addressing climate change—or at least in expressing concern over climate change—in the past several years. King Abdullah, along with other government leaders, has noted the importance of climate policy, especially on the international stage. Jordan has signed onto multiple international agreements, including the Kyoto Protocol and the United Nations Framework Convention on Climate Change, and worked with international organizations to draft and implement environmental adaptation projects.<sup>140</sup> In a 2015 speech at the United Nations Climate Change Conference, King Abdullah spoke of the importance of addressing climate change in Jordan:

If global climate change continues on today’s trajectory, the challenges will increase exponentially. These harsh realities are why Jordan has been integrating energy and environmental approaches into a sustainable, long-term national development strategy. In 2013, we were the first in our region to produce a comprehensive, forward-looking National Climate Change Policy.<sup>141</sup>

Despite Jordan’s prominent role in the international struggle against climate change, the government has also historically played a role in creating the environmental degradation and water scarcity that it is now battling. Climate change has combined with unsustainable environmental practices to create the challenging situation facing Jordan. While the Jordanian people and government are still facing many challenges due to climate change, this section will

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<sup>138</sup> Emiko Terazono, “Climate extremes inflate food prices,” *Financial Times*, April 10, 2014.

<sup>139</sup> Johnny McDevitt, “Jordanians protest against soaring food prices,” January 14, 2011.

<sup>140</sup> The Hashemite Kingdom of Jordan Ministry of Environment, *The National Climate Change Policy of the Hashemite Kingdom of Jordan 2013-2020*, United Nations Development Program (2013): 8.

<sup>141</sup> “Climate Change cannot be addressed in isolation – King,” *Jordan Times*, November 30, 2015.

demonstrate how the Jordanian government has taken steps within their means to prevent the kind of humanitarian crisis that has potential to occur in cases of extreme resource scarcity.

Historically, the Jordanian political system has used environmental policies to boost economic growth and garner support for the regime. Since the establishment of the country in 1921, Jordanian governance has used access to water as a political tool; access to free water and cheap land was given to rural families as a means to pursue a livelihood in agriculture in exchange for regime support.<sup>142</sup> Thus, over time the regime garnered a significant base of support in rural areas. This patron-client system continued over time along with government subsidies for food, energy, and water that rural families rely on to maintain their standard of living.<sup>143</sup> While this was an effective method of securing political support, it also increased exploitation of the country's naturally scarce water resources, and created the mentality among farmers that water is a "free resource."<sup>144</sup>

The government further encouraged the growth of agriculture in the 1970s with the establishment of the Jordan Valley Authority (JVA), a development program for agriculture in the area.<sup>145</sup> The JVA implemented modern irrigation techniques such as drip irrigation, plastic-tunnel technologies and sprinkler irrigation, which was more water-efficient than traditional flood irrigation.<sup>146</sup> The implementation of modern technology increased the efficiency of irrigation in the Jordan Valley from 40% to nearly 75%.<sup>147</sup> After the success of this program, the government tried to implement similar programs in other rural areas in the north over time, but

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<sup>142</sup> Greenwood, 141-142.

<sup>143</sup> Ibid, 142.

<sup>144</sup> Chantal Demilecamps and Wael Sartawi, *Farming in the Desert: Analysis of the Agricultural Situation in Azraq Basin* (Deutsche Gesellschaft für Internationale Zusammenarbeit, 2010): 20-21.

<sup>145</sup> Greenwood, 143.

<sup>146</sup> Ibid.

<sup>147</sup> Ibid.

these programs promoted unsustainable use of groundwater and well-drilling, since groundwater is the only source of irrigation for many areas outside the Jordan Valley.<sup>148</sup>

As the water scarcity in Jordan increases with over-exploitation of groundwater and the onset of drought, the government implemented a groundwater control law in 2002 to reduce groundwater extraction rates and promote water conservation.<sup>149</sup> However, this law was heavily influenced by farmers and agricultural interest groups, resulting in relatively loose restrictions and weak enforcement mechanisms.<sup>150</sup> In more recent years, after the severe drought of 2006-10 and the onset of the Arab Spring, the government of Jordan implemented more concrete actions to address climate change. In 2010, Jordan implemented a water and environmental protection program including law enforcement mechanisms, which the World Bank notes as significant since it is the “first of its kind in the region.”<sup>151</sup> In 2013, Jordan launched a National Climate Change Policy for 2013-2020, aimed at lowering the nation’s emissions of greenhouse gases as well as securing “that the people and the economic, social and natural systems in Jordan will not suffer from climate change impacts.”<sup>152</sup> Jordan is also currently working with the USAID Water Reuse and Environmental Conservation project to improve industrial water management, prevent pollution, and promote wastewater management and reuse.<sup>153</sup>

While the government has been fairly outspoken about addressing climate change, especially in the international community, they still face many challenges in addressing the social and economic implications of water scarcity, especially in the coming years as climate

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<sup>148</sup> Ibid.

<sup>149</sup> Greenwood, 144.

<sup>150</sup> Ibid.

<sup>151</sup> Verner, 172.

<sup>152</sup> *The National Climate Change Policy of the Hashemite Kingdom of Jordan 2013-2020*, 9.

<sup>153</sup> Turi Fileccia et. al, *Jordan: Water Along the Food Chain* (Rome: Food and Agriculture Organization of the United Nations): 48.

change worsens and Jordan's population continues to put pressure on scarce resources. Jordan is already facing economic stress, and does not have ample resources to use to adapt to a changing environment, so the government will face an uphill battle in achieving their climate goals in the near future.

### *Intensity of Civil Unrest in Jordan*

Jordan has experienced some forms of civil unrest in the past decade, but it did not experience near the upheaval that many Arab countries did during the uprisings of 2011. The protests that took place in Jordan in early 2011 were largely in response to economic stagnation and rising food prices in the country. The Jordanian demonstrators called for the resignation of the prime minister and other political reforms, but in the early protests they did not call for the fall of the entire regime.<sup>154</sup> The demonstrations did have some effects in governance: the prime minister Samir Rifai resigned, parliamentary elections were held two years early, and King Abdullah promised some governmental reforms. There is still some debate regarding why the Arab Spring did not take as strong of a hold in Jordan as in other countries, and why Jordan has remained stable in the midst of its neighbors falling into conflict. The answers to these questions are complex, but one factor is that the intensity of civil unrest was simply not as strong as in other nations. This can be attributed to a number of factors, including that the government was less repressive than in neighboring countries. However, it is also significant that the government was able to maintain water access during times of drought and climatic change.

### *Conclusions from the Jordanian Case*

This case study has examined the antecedent condition of climate change in Jordan along with the variables of government response to climate change and intensity of civil unrest. The

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<sup>154</sup> Alexandra Sandels, "JORDAN: Thousands of demonstrators protest food prices, denounce government," *Los Angeles Times*, January 15, 2011.

Jordanian case is interesting because prior to the Arab uprisings of 2011, Jordan resembled many of its neighbors, including in terms of the effects of climate change. Jordan experienced the same drought as Syria and is naturally even more water poor than the other Arab countries. However, it had a remarkably different experience with the popular demonstrations of 2011 than its neighbors, and the monarchy of Abdullah II remains intact today without making any major sacrifices in political power. Even the protests that did occur often did not express the same “fall of the regime” message that was the motto of the other movements. The explanation for this is complex, but the events in Jordan support this paper’s hypothesis that government response to environmental degradation affects the intensity of civil unrest. The above analysis of Jordanian governance found that Jordan has taken a much more active role in addressing climate change than any of its neighbors. And while environmental policy has historically contributed to the extreme water scarcity Jordan now faces, the government began to address the overconsumption of water years before the drought reached its most severe point. The government also publicly recognizes the difficulty that water scarcity is posing on the population and has sought to relieve the social impacts by working with international organizations to implement mitigation and adaptation plans. Jordan has also maintained some social safety nets in the face of rising food prices, including the continuation of some subsidies and a great deal of international aid. Jordan has, thus far, managed to avoid major conflict or humanitarian crises caused by water scarcity.

This case leaves many questions for the future of the country. Jordan has by no means solved its water crisis. The government has recognized the precarious state of its water resources and expressed intentions to implement more efficient water management and conservation techniques in the coming years as part of its climate change policy. However, Jordan is also facing a myriad of economic and social challenges that could complicate water conservation

efforts. The massive influx of refugees and Jordan's high young adult population is putting even greater pressure on water resources. The government of Jordan is also facing pressures to cancel subsidies on fuel and food given the rise in global prices, which, if implemented, will pose a challenge for Jordanians who rely on these subsidies.<sup>155</sup> As climate change continues to affect both Jordan's internal water resources and the prices of imported goods, the government will have to remain active in adapting to the environmental, social, and economic implications of climate change.

### **Case Study: Tunisia**

Tunisia is an interesting case study of climate change and civil unrest, because although it shares many characteristics with the other cases, it also had a different experience in the 2011 Arab uprisings than most of its neighbors. Tunisia is one of the few Arab countries that saw an uprising that led to a relatively peaceful transition in power that has maintained stability, albeit somewhat precariously, to the present. While the events of the 2010-2011 uprising suggest a high degree of civil unrest existed in Tunisia, there is not a great deal of literature to suggest that this was directly influenced by climate change. Climate change did have an effect on Tunisia prior to 2011, but the regime of Ben Ali actually took some measures to address its impact on food prices and the environment. Still, the massive civil uprisings that took place in Tunisia called for the fall of the regime. Though there is no scholarly consensus on a link between climate change and the Arab Spring in Tunisia, climate change remains a highly relevant issue for Tunisia today, and Tunisia's new constitution is one of few in the world to explicitly mention the importance of climate protection.<sup>156</sup> This case study will analyze the effects of climate change in Tunisia, its

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<sup>155</sup> Tamer Al-Samadi, "Jordan Could Face Massive Protests if Food and Fuel Prices Rise," *Al-Monitor*, October 15, 2012.

<sup>156</sup> Caitlin Werrell and Francesco Femia, "Tunisian Constitution Charts a Course to a Climate Resilient Future," *The Center for Climate and Security*, March 14, 2014.

social and economic implications, possible impacts on civil unrest in the 2011 Arab Spring, and the role of Tunisian environmental governance before and after the uprising.

### *Climate Change in Tunisia*

Like its North African neighbors, Tunisia is naturally sensitive to climate change because of its semi-arid climate and its proximity to the desert.<sup>157</sup> Similarly, Tunisia experiences high annual precipitation variability, ranging from 800 mm per year in the north to 150 mm per year in the South.<sup>158</sup> This variability is in part due to Tunisia's climatic diversity, with a Mediterranean climate in the north, a semi-arid region in central and east Tunisia, and arid desert in the south.<sup>159</sup> The effects of climate change in Tunisia have been fairly congruent with global and regional trends. A World Bank study found that throughout the 20th century, the mean annual temperature in Tunisia rose by 1.4°C, with most of that increase occurring since the 1970s.<sup>160</sup> Some localities experienced even greater warming, such as the capital of Tunis, where average temperatures rose by about 3°C over the course of the 20th century.<sup>161</sup> Because of Tunisia's natural precipitation variability, it is difficult to determine overall precipitation trends, but the World Bank estimated a 5% decline in precipitation since the 1950s.<sup>162</sup> Climate change's effects on precipitation have varied across the country—Western Tunisia in particular has experienced declining rainfall, while Eastern Tunisia has seen a decline in spring rainfalls but an overall increase in winter rainfalls (winter is usually fairly dry in this region).<sup>163</sup> Tunisia was hit

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<sup>157</sup> Oussama Zouabi and Nicolas Peridy, "Direct and indirect effects of climate on agriculture: an application of a spatial panel data analysis to Tunisia," *Climatic Change* 133, no. 2 (2015): 301-302.

<sup>158</sup> Republic of Tunisia Ministry of Environment and Sustainable Development, *Intended Nationally Determined Contribution of Tunisia*, United Nations Framework Convention on Climate Change (2015): 3.

<sup>159</sup> Dorte Verner, ed., *Tunisia in a Changing Climate* (Washington, D.C.: The World Bank, 2013): 24.

<sup>160</sup> *Ibid.*, xviii.

<sup>161</sup> *Ibid.*

<sup>162</sup> *Ibid.*

<sup>163</sup> *Ibid.*, 30.

by a prolonged drought, the worst in centuries, in 1999-2002 which was part of the larger drying trend to hit the Middle East and North Africa region in the early 2000s.<sup>164</sup>

Another notable effect of climate change in Tunisia is sea level rise. Sea levels in the Mediterranean basin have been rising at an average of 3.1 millimeters per year since 1992, which has caused increased soil salinization in coastal regions of Tunisia.<sup>165</sup> Groundwater levels are also affected by climate change and other forms of environmental degradation. Tunisia's renewable freshwater resources, most of which are in the form of groundwater, have been steadily declining in the past several decades. According to data from the World Bank, renewable water resources have gone from 963 to 381 cubic meters per capita since 1962.<sup>166</sup> The decline and deterioration of groundwater resources is due partly to climate change, but more so to unsustainable withdrawals to meet agricultural and population needs. The quality of groundwater has declined along with the quantity. Aquifers in coastal Tunisia have deteriorated significantly due to salinization, which is caused by sea level rise and overpumping.<sup>167</sup> Current groundwater extraction rate in shallow aquifers is 97% of the annual recharge rate and 73% of the annual recharge rate in deep aquifers. This unsustainable use of groundwater is only exacerbated by climate change, which both slows the recharge rate and in the event of drought, creates greater demand for groundwater. In turn, lowered groundwater levels are more vulnerable to climate change impacts such as drought and sea level rise-induced salinization.

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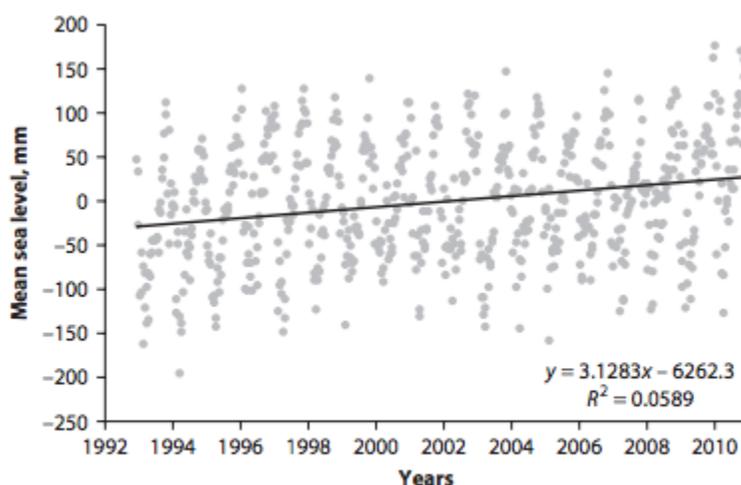
<sup>164</sup> Ramzi Touchan et. al, "Long term context for recent drought in Northwest Africa," *Geophysical Research Letters* 35, no.13 (2008): 3.

<sup>165</sup> Verner, 33.

<sup>166</sup> World Bank, "Renewable internal freshwater resource per capita (cubic meters): Tunisia," The World Bank Group (2016), <http://data.worldbank.org/indicator/ER.H2O.INTR.PC?locations=TN>.

<sup>167</sup> N. Gaaloul, "The Role of Groundwater During Drought in Tunisia," In *Climatic Changes and Water Resources in the Middle East and North Africa* (Berlin: Springer Berlin Heidelberg, 2008): 243.

Extreme weather events have also increased in Tunisia as a result of climate change. The North African region has seen an increase in warm nights and days per year, and an increase in the number of days with heavy rainfall.<sup>168</sup> This corresponds with a general increase in variability of weather and precipitation because of climate change (see Figure 4). Though there is not enough data to infer trends, there have been several notable incidences of fatal flash floods in the country since 1986.<sup>169</sup> In the past several years, Tunisia has experienced prolonged periods of drought alternating with periods of floods.<sup>170</sup>



Source: University of Colorado Sea Level Research Group; <http://sealevel.colorado.edu/content/regional-sea-level-time-series>.

Figure 4. Mean Sea Level Change in the Mediterranean, 1992-2011.

### *Social and Economic Implications of Climate Change*

Like most of the MENA region, Tunisia experiences natural water scarcity because of its arid and semi-arid climate. With an increase in extreme weather events such as droughts and a decrease in overall precipitation, Tunisia has faced higher water scarcity in the past few years,

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<sup>168</sup> Verner, 32.

<sup>169</sup> Ibid.

<sup>170</sup> Gaaloul, 251.

though not on the scale of countries in the Levant region.<sup>171</sup> Similar to other cases, water scarcity has immediate implications for the agriculture industry. In Tunisia, agriculture accounts for 11% of the Gross National Product (as of 2012), and employs 18% of the labor force.<sup>172</sup> Though this is not as high as in some cases, it is significant because agriculture is highly dependent on precipitation and agriculture consumes the largest percentage of the country's water resources.<sup>173</sup> Of Tunisia's total agricultural area, 88% is rain-fed, making it vulnerable to changes in precipitation.<sup>174</sup> The main crops in Tunisia are cereals (78%), olives (4%) and tomatoes (4%).<sup>175</sup> Cereal and olive production are particularly sensitive to rainfall. A 2015 study found that a 1% decrease in rainfall led to a .79% decrease in cereal production and a 1.01% decrease in olive production.<sup>176</sup> Most of Tunisia's food exports come from rain-fed agriculture, in particular fruit and olives, which represent 60% of total food exports.<sup>177</sup> The production of cereals is also significant to Tunisian society because, as of 2010, internal production accounted for a significant portion of Tunisia's consumer needs for wheat and barley.<sup>178</sup>

Droughts have already posed a challenge for agriculture in Tunisia. An FAO report from 2001 reported that the severe drought that began in 1999 caused overall agricultural output to decline by 4.9% and cereal production to decline by 43%.<sup>179</sup> The erratic precipitation patterns

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<sup>171</sup> Janpeter Schilling et. al, "Climate change, vulnerability and adaptation in North Africa, with focus on Morocco," *Agriculture, Ecosystems and Environment* 156 (2012): 16.

<sup>172</sup> Zouabi and Pridy 303; Schilling, 18.

<sup>173</sup> Gaaloul, 247.

<sup>174</sup> Raoudha Mougou et. al, "Climate change and agricultural vulnerability: A case study of rain-fed wheat in Kairouan, Central Tunisia," *Regional Environmental Change* 11, no. 1 (2010): 138.

<sup>175</sup> Zouabi, 303.

<sup>176</sup> Ibid, 310.

<sup>177</sup> Ibid.

<sup>178</sup> Monsour, 138.

<sup>179</sup> Food and Agricultural Organization of the United Nations, *The State of Food and Agriculture 2002: Near East And North Africa* (Rome: FAO, 2002).

caused by climate change also pose a challenge for agriculture; the alternating periods of drought and flooding cause soil erosion and damage to crops and buildings.<sup>180</sup>

Not only does climate change affect local crop yields in Tunisia, but it also affects imported foods. Tunisia is a net importer of most food items, so it is also vulnerable to the effects of climate change in other parts of the world.<sup>181</sup> Though the Tunisian government has put in place some safety measures to stabilize food prices during global food crises, it is still affected by global changes in food prices. A 2010 drought in Russia—one of the main global exporters of wheat—caused a global spike in food prices that was felt acutely in the North African region where wheat is mostly imported.<sup>182</sup> According to data from the Food and Agriculture Organization of the United Nations (FAO), the Food Price Index—a measure of monthly change in international prices for a basket of food commodities—rose from 160.3 in 2009 to 229.9 in 2011.<sup>183</sup> This was even more pronounced in the food price index for cereals, which rose from 170.2 in 2009 to 240.9 in 2011.<sup>184</sup>

However, this global change did not affect Tunisian consumer food prices to the same extent as some other countries. The most pronounced food price increase in Tunisia actually occurred in 2008 when rice prices rose in response to a global price hike (which is also thought to be heavily influenced by drought in rice-producing countries, notably Australia). In response to this price spike, riots broke out in the town of Redeyef.<sup>185</sup> Following this, rice prices remained high but most other food staples maintained a steady price, even in during the global food crisis

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<sup>180</sup> Gaaloul, 251.

<sup>181</sup> Verner, 60.

<sup>182</sup> Emiko Terazono, “Climate extremes inflate food prices,” *Financial Times*, April 10, 2014.

<sup>183</sup> Food and Agriculture Organization of the United Nations, “World Food Situation: Food Price Index,” *FAO*, updated February 3, 2017, <http://www.fao.org/worldfoodsituation/foodpricesindex/en/>.

<sup>184</sup> *Ibid.*

<sup>185</sup> Berazneva and Lee, 30.

in 2010-2011.<sup>186</sup> However, an influx of refugees from Libya (which was more directly impacted by the food crisis) and the national economic slowdown led to increased food insecurity in parts of Tunisia in 2010 and 2011.<sup>187</sup>

Climate change also poses a risk for human health in Tunisia. According to an IPCC report, climate change can increase the incidences and range of leishmaniasis, a parasitic disease that has become a significant problem in North Africa in recent years.<sup>188</sup> Outbreaks of the disease have already become more frequent in Tunisia, and it emerged as an epidemic in 1991. Because leishmaniasis outbreaks are associated with associated with decreasing rainfall and higher minimum temperature, climate change is making North Africa more susceptible to spreading diseases.<sup>189</sup> Other diseases such as malaria and dengue fever are expected to resurge due to climate change.<sup>190</sup>

### *The Role of Tunisian Governance*

The Tunisian government both before and after the revolution took some steps to address the social and economic impacts of climate change. In response to three serious droughts that occurred between 1987 and 2002, the Zine El Abidine Ben Ali government incorporated water resource management plans into its Five-Year development plans in in 1987, 1992, and 2002. These plans emphasized more sustainable water use, including the implementation of treated wastewater in irrigation.<sup>191</sup> Though this did not prevent exploitation of groundwater resources, the Five-Year plans did prioritize maintaining sources of clean water for agricultural use. Tunisia

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<sup>186</sup> FAO, "Food Price Monitoring and Analysis Tool," *FAO Global Information and Early Warning System*, <http://www.fao.org/giews/pricetool/>.

<sup>187</sup> FAO, "North Africa Brief," *FAO Global Information and Early Warning System*, March 11, 2011. <http://www.fao.org/es/GIEWS/english/shortnews/nafria110311.pdf>, 4.

<sup>188</sup> *Intended Nationally Determined Contribution of Tunisia*, 16.

<sup>189</sup> *Ibid.*

<sup>190</sup> *Ibid.*

<sup>191</sup> Gaaloul, 225.

has also been ahead of most other North African countries in terms of technological capabilities, which has increased the viability of irrigation and water management systems.<sup>192</sup>

The Tunisian government has maintained fairly tight controls on water resources since independence. The Tunisian Water Code of 1975 centralized water management under the control of the government and did away with community self-management of water resources.<sup>193</sup> With the help of foreign investment, the government developed an extensive system of dams, water improvement systems, and irrigation systems in the 1970s and 1980s.<sup>194</sup> These advancements made water management more efficient and sustainable. Overall, Tunisia has developed a much more robust system of water infrastructure that has, thus far, prevented any major crisis from occurring because of climate change.

In more recent years, the government of Tunisia has acknowledged the importance of addressing climate change on the international stage. In 2007, Tunisia hosted an international conference on environmental investment and a conference on climate change strategies in Africa and the Mediterranean.<sup>195</sup> Ben Ali's regime signed several international agreements on climate change and enacted numerous regulations, but some speculate that his environmental policy was more for show than a genuine effort to protect the environment.<sup>196</sup> Tunisia ratified the United Nations Framework Convention on Climate Change in 1993 and the Kyoto Protocol in 1992.<sup>197</sup> Despite these agreements, Eric Goldstein, research director for the Middle East and North Africa

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<sup>192</sup> Schilling, 18.

<sup>193</sup> Jennifer Hill and Wendy Woodland, "Contrasting Water Management Techniques in Tunisia: Towards Sustainable Agricultural Use," *The Geographical Journal* 169, no.4 (2003): 350.

<sup>194</sup> Ibid, 350.

<sup>195</sup> Tunisia Ministry of Environment, "Environmental Policy," updated February 27, 2017, <http://www.environnement.gov.tn/index.php?id=65&L=1#.WM8nJhLysyc>.

<sup>196</sup> Eric Goldstein, "Tunisia's legacy of pollution confronts democratic politics," *openDemocracy*, May 23, 2014. <https://www.opendemocracy.net/arab-awakening/eric-goldstein/tunisia%E2%80%99s-legacy-of-pollution-confronts-democratic-politics>.

<sup>197</sup> Tunisia Ministry of Environment, "Climate Change," updated February 27, 2017, <http://www.environnement.gov.tn/index.php?id=26&L=1#.WORK71UrKUK>.

at Human Rights Watch, speculated that government-owned heavy industry operated outside of environmental regulations with no consequences throughout Ben Ali's rule.<sup>198</sup>

The government that replaced Ben Ali's regime, implemented in 2014, has continued to emphasize environmental protection. With the adoption of a new constitution in 2014, Tunisia became one of few countries in the world to mention climate change in their constitution, stating in article 45 that "The state guarantees the right to a healthy and balanced environment and the right to participate in the protection of the climate."<sup>199</sup> Though this is a significant step on the domestic and international stage, it remains to be seen if implementation of this constitutional provision will be effective in protecting Tunisian environment and population from the growing threats of climate change.<sup>200</sup> The Tunisian Ministry of the Environment and Sustainable Development has created multiple strategic action plans for adaptation to climate change, primarily in the realm of agriculture, public health, and tourism; however, they currently lack the "funding, information, awareness, and communication" at both the public and leadership levels to fully implement these plans.<sup>201</sup>

### *Civil Unrest in Tunisia*

Tunisia played a central role in sparking the Arab Spring of 2011, and it has been one of the only countries to see a peaceful transition to democracy that has continued to the present. There is no question that civil unrest was very high in Tunisia leading up to the uprising; after a street vendor named Mohamed Bouazizi set himself on fire in December of 2010, protests erupted in his hometown and quickly spread throughout the country. These protests called for the

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<sup>198</sup> Ibid.

<sup>199</sup> Tunisia Const., Art. 45.

<sup>200</sup> Kharunya Paramaguru, "Tunisia Recognizes Climate Change in Its Constitution," *TIME*, January 29, 2014, <http://science.time.com/2014/01/29/tunisia-recognizes-climate-change-in-its-constitution/>.

<sup>201</sup> Tunisia Ministry of Environment, "Climate Change."

fall of the Ben Ali regime.<sup>202</sup> The story that spread rapidly across the country was that Bouazizi self-immolated after being humiliated and abused by the police when they took away his produce cart. This story encapsulated the grievances of many Tunisians against the government.

Frustrated with political corruption, economic stagnation, and police abuse, Tunisians used Bouazizi as the rallying cry for anti-regime protests throughout the country.

Over the course of the next month, President Ben Ali attempted to quell the protests first by police crackdowns and later by making some concessions of power; however, his attempts were futile. Less than a month after Bouazizi's self-immolation, President Ben Ali stepped down and fled the country. The revolution in Tunisia set off protests throughout the Arab World. The reasons for the massive protests that occurred are complex, but many note that prolonged economic stagnation and the extremely repressive policies of the Ben Ali regime combined to form nationwide discontent and desire for change. The transition has been messy, but Tunisia has maintained fairly high levels of political expression and democratic freedoms.<sup>203</sup>

#### *Conclusions from the Tunisian Case*

The Tunisian case does not offer as clear of a message on the link between government response to climate change and civil unrest. While civil unrest was clearly very high in Tunisia, the connection to climate change remains a topic of debate. While the global food crisis triggered by climate change-induced crop failure in Russia did have a limited impact on Tunisia, the government did not see the same rise in food prices as much of the rest of the region, thanks in part to government price stabilization efforts which managed to keep wheat prices relatively

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<sup>202</sup> Jared Malsin, "Why the Arab Spring Has Not Led to Disaster in Tunisia," *TIME*, December 18, 2015. <http://time.com/4154134/arab-spring-tunisia-anniversary/>.

<sup>203</sup> Ibid.

stable.<sup>204</sup> The Tunisian government purposely lowered prices of food staples such as sugar, milk, and bread in the midst of widespread protests on January 13, 2011, but this failed to placate the uprising.<sup>205</sup> Tunisia has a history of food riots in rural areas, and some believe that the Ben Ali regime was actually too quick to dismiss the 2011 uprisings as a food riot, underestimating the extent of discontent in society.<sup>206</sup>

It is likely that though Tunisia experienced enough civil unrest to topple a regime, it was due more to issues of political discontent and economic stagnation than crises caused by climate change. The Tunisian government has showed willingness to address environmental issues on the international stage, and they have implemented more environmental protection policies than most of its neighbors. This, combined with greater water management infrastructure meant that drought and other climate change impacts did not cause a humanitarian crisis like the one in Syria. This, of course, does not prevent other political, social, and economic factors from creating discontent. However, further research is required on the influence of food price changes on civil unrest before the 2011 uprising.

The Tunisia case also poses many questions for the future. Tunisia has by no means solved its water scarcity problem, and as climate change continues to worsen, the country will likely face even more pressure on scarce resources. In 2016, a persistent drought hit several regions of Tunisia, causing widespread agricultural losses and putting pressure on the country's new water reservoirs. Protests have already occurred in rural areas, with some protesters trying to

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<sup>204</sup> Ariana Eunjung Cha, "Spike in global food prices contributes to Tunisian violence," *Washington Post*, January 14, 2011.

<sup>205</sup> Richard Cincotta, "High Food Prices An Unlikely Cause for the Start of the Arab Spring," *New Security Beat*, April 7, 2014.

<sup>206</sup> Rami Zurayk, "Use your loaf: why food prices were crucial in the Arab Spring," *The Guardian*, July 16, 2011.

disrupt the flow of water to the capital.<sup>207</sup> The government will have to put environmental policies at the top of its priorities as climate change continues to disrupt rural livelihoods and pose difficulties for ensuring access to resources throughout the country.

### **Case Study: Sudan and South Sudan**

In 2011, South Sudan became the world's newest state. After decades of bloody civil war, South Sudan finally gained independence from Sudan. Though Sudan's ethnic violence has existed since independence in 1955, it is one of the clearest cases of a "climate conflict." The main focus of this case study will be on the region of Darfur, which was both highly affected by climate change and the area of some of the worst violence in the civil war from 2003-2005. Darfur gained international attention in the early 2000s as the site of a devastating humanitarian crisis caused by war and malnutrition. Darfur differs from the cases of Syria, Jordan, and Tunisia in a few ways: only 27 of the 80 tribes in Darfur identify as Arabs, and governance before the creation of South Sudan was so weak that it had virtually no control over the situation in Darfur. However Sudan shares other characteristics with the other cases, including a history of colonialism, a non-democratic regime, and low economic development.<sup>208</sup> The case of Darfur is important to understanding how climate change, government response, and civil unrest interact because it shows one of the most stark examples in history of how climate affects conflict. Even with the creation of two independent states, climate change continues to threaten the stability and livelihoods of the Sudanese people. This case study will examine how climate change affected

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<sup>207</sup> Bouazza Ben Bouazza and Mehdi El Alem, "'We are thirsty' say Tunisians as drought creates tensions," *Associated Press*, September 24, 2016.

<sup>208</sup> "Darfur Destroyed," Human Rights Watch (New York: Human Rights Watch, 2004), <https://www.hrw.org/report/2004/05/06/darfur-destroyed/ethnic-cleansing-government-and-militia-forces-western-sudan>.

Sudan before 2011, how the government responded to the crisis, and the extent of climate-induced civil unrest before and after the creation of South Sudan.

### *Climate Change in Darfur*

Darfur lies in the West of formerly united Sudan. Before the split, Sudan was the largest country in Africa and encompassed a few distinct climatic zones: 29% of territory is a desert, 19% classified as semi-desert, 27% as low rainfall savannah, 14% as high rainfall savannah, 10% as flood region, and less than 1% as mountain vegetation.<sup>209</sup> Darfur includes four of these climatic zones, with desert and arid climate in the north, and savannah in the south.<sup>210</sup> Similar to other countries in the Middle East and North African region, Sudan experiences naturally high levels of precipitation variability which has become more extreme with the onset of climate change. In the past century, Sudan has experienced numerous severe prolonged droughts. Studies as early as the 1980s concluded that the Darfur region was becoming drier. One of the most devastating droughts occurred from 1980-1984 and resulted in mass displacement and famine.<sup>211</sup> Darfur has continued to experience a steady decrease in precipitation levels which has caused desertification in many parts of the region.<sup>212</sup> According to data from the UNEP, Darfur experienced a significant reduction in average annual rainfall from 1975 to 2005, in some regions as much as 34%.<sup>213</sup> Though climate records in the region have only been kept since 1917, it is likely that this scale of climate change is almost unprecedented in the history of the

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<sup>209</sup> Younes Abouyoub, "Climate: The Forgotten Culprit. The Ecological Dimension of the Darfur Conflict," *Race, Gender, and Class* 19, no. 1/2 (2012): 155.

<sup>210</sup> Ibid, 157.

<sup>211</sup> Ibid.

<sup>212</sup> Ibid.

<sup>213</sup> United Nations Environment Program, *Sudan Post-Conflict Environmental Assessment*, (Nairobi: UNEP, 2007): 60.

region.<sup>214</sup> See Figure 5 for a map of temperature and precipitation change in the region as of 2011.

Because of its location on the fringes of the Sahara desert and on the edge of the climate zones appropriate for growing rainfed crops, Darfur is extremely vulnerable to climate change and environmental degradation. Desertification is one of the primary threats of climate change. This has led to large swaths of formerly agricultural land transformed into infertile flat lands with little vegetative cover. A 2007 UNEP report found that three distinct desertification processes were underway: climate change-induced conversion of land types from semi-desert to desert, degradation of existing desert area, and land-type conversion from human activities such as overgrazing and deforestation.<sup>215</sup> The combination of these processes has led to desertification becoming “Sudan’s greatest environmental problem” in the height of the civil war in the early 2000s.<sup>216</sup>

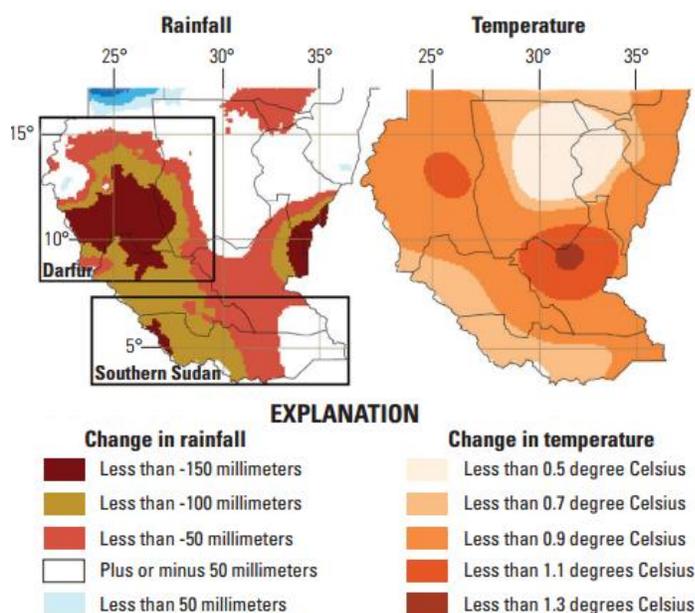


Figure 5. Observed and projected temperature and rainfall changes, 1960-2009.  
Source: U.S. Geological Survey, <https://pubs.er.usgs.gov/publication/fs20113072>.

<sup>214</sup> Ibid.

<sup>215</sup> Ibid, 62-63.

<sup>216</sup> Ibid, 62.

Another adverse effect of climate change in Darfur is the increase in frequency of extreme weather events such as floods. Though Darfur generally experiences frequent water shortages, flash flooding has become more common, resulting in land erosion and destruction of infrastructure and agriculture.<sup>217</sup> A UNEP study in 2007 found that “17 percent of Ganati (1,420 ha), 25 percent of El Zouma (200 ha) and 30 percent of El Ghaba (1,215 ha) cooperative societies in Northern state have been swept away in flood peaks.”<sup>218</sup>

It is important to note that some of the environmental degradation in the Darfur region is man-made. Deforestation has been an especially devastating occurrence in Darfur for the environment, because it accelerates land and water degradation and exacerbates the effects of climate change.<sup>219</sup> Overgrazing and other unsustainable land use practices has contributed to the environmental degradation and resource scarcity in Darfur.

#### *Social and Economic Implications of Climate Change*

As stated earlier, Darfur’s environment is naturally vulnerable to climate change because of its proximity to the desert and reliance on crops that are sensitive to rainfall. Unfortunately, the population of Darfur is also very vulnerable to climate change. Livestock and agriculture are the two pillars of Darfuris’ livelihoods and for the region’s economy. Though there are many distinct rural social units in Darfur, livelihoods can be separated into three main categories: sedentary crop-rearers, nomadic pastoralists, and owners and workers on mechanized agricultural schemes.<sup>220</sup> The first two livelihoods are largely divided by ethnic group or tribe—sedentary farmers mostly identify as black African and the pastoralists mostly identify as Arabs. In Darfur,

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<sup>217</sup> Ibid: 66.

<sup>218</sup> Ibid, 66.

<sup>219</sup> Abouyoub, 156.

<sup>220</sup> UNEP (2007): 81.

small-scale subsistence agriculture is the primary form of agriculture. Thus, income and food security in Darfur are both inextricably linked with the environment.

Drought and desertification because of climate change in the past century has had a number of harmful effects on agriculture and livestock. Though there are no formal records to document the losses of these small-scale farming groups, a UN report estimated that 465,000 households in Darfur would be in need of food assistance due to crop failure in 2005.<sup>221</sup> In the years leading up to the early 2000s, the effects of climate change were more acute in the Darfur region than most of the world, and this led to lower yields and loss of arable land. As drought and desertification led to shrinking rangeland in the northern Darfur, nomadic Arab herders were also affected. Most pastoralists adapted to the loss of rangeland by moving their herds south and seeking more fertile land in regions traditionally occupied by sedentary crop farmers.<sup>222</sup>

One of the most devastating implications of drought and crop failure in Darfur was famine. Since Darfur had experienced multiple severe droughts in the late 20th century, it was no stranger to famine. The deadliest famine came after the drought of 1980-1984, and resulted in the death of around 176,900 Darfurians.<sup>223</sup> Another drought year occurred in 2000-2001, leading to famine in parts of the region.<sup>224</sup> With the onset of the bloodiest part of the civil war in 2003, famine became especially severe due to the combination of crop failures with village razing and other war activities. Food insecurity has become a nearly constant aspect of society in Darfur, even now that the war has ended.

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<sup>221</sup> United Nations, *Work Plan for the Sudan*, (Khartoum: United Nations Resident, 2005): 99.

<sup>222</sup> Helen Young et. al, *Darfur - Livelihoods Under Siege* (Medford, MA: Feinstein International Famine Center, 2005): 26.

<sup>223</sup> Mohamed Babiker Ibrahim, "Drought, Famine, and Disaster Management in Darfur, Sudan," *Famine and Food Policy Discussion Paper 4* (Washington, D.C.: International Food Policy Research Institute, 1990): 29.

<sup>224</sup> Young et. al, 26.

Another major implication of climate change impacts on Darfur was internal displacement. The occurrence of drought and desertification in the north forced many herders to move to other regions in search of fertile land for grazing.<sup>225</sup> Camel herders in particular have been gradually moving southwards into the Nuba mountains region since the 1980s.<sup>226</sup> This pushed the pastoralists into areas where sedentary subsistence farmers typically lived and operated, creating significant tensions and land competition issues. The loss of arable land for agriculture has also caused internal displacement of some Southern Darfurians. With the escalation of civil war, the quantity of internally displaced persons (IDPs) climbed to over five million in 2007.<sup>227</sup> The UN estimated that 90% of IDPs had lost their livestock due to environmental problems and conflict.<sup>228</sup> The IDP crisis created environmental problems in itself, including deforestation, over-extraction of groundwater, and water pollution around IDP camps.<sup>229</sup>

### *The Role of Sudanese Governance*

Though Sudan's government was very dictatorial throughout the civil war, it was never able to exercise meaningful control over the conflict. Likewise, governance failed to address the issues of climate change and land degradation that were compiling before escalation of the conflict. The ministry of environment was quite weak, and the efforts they made were mostly in response to pressures for food security, which meant prioritizing large-scale (and short-sighted) mechanized agricultural operations without regard to sustainability. Additionally, most environmental administration and legislation duties fell on individual state governments, and

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<sup>225</sup> Abouyoub, 158.

<sup>226</sup> UNEP (2007): 87.

<sup>227</sup> UNEP (2007): 32.

<sup>228</sup> "Work Plan for the Sudan," 99.

<sup>229</sup> UNEP (2007): 111.

state governments in the South and Darfur have “virtually no environmental administration or capacity whatsoever.”<sup>230</sup>

The Sudanese government also failed to address land competition issues that naturally arose from drought in the years from independence to civil war. In the decades before independence, the Anglo-Egyptian condominium over Sudan from 1899-1955 worked with local leaders to establish the principle of Native Administration over land in the Darfur region.<sup>231</sup> This allowed the sedentary tribes and Arab pastoralists to continue customary land tenure rights, which was a fairly effective way of preventing conflict between these two groups over land.<sup>232</sup> Traditionally, leaders from farming tribes and pastoralist nomadic groups had a system that gave different tribes rights over certain lands while allowing negotiation with pastoralists if they needed to pass through or were in search of more grazing land. However, the Sudanese government dissolved Native Administration in 1971; it would later be reinstated but never effectively. This undermined customary land tenure rights. The government also undermined the traditional system with the Unregistered Land Act of 1970, which gave ownership of any unregistered land to the government.<sup>233</sup> The government further ignited land competition issues with the Emirate Act of 1995, which gave preference to pastoralists in the area of Dar Marsalis, which was traditionally occupied and farmed by the Masalit tribe.<sup>234</sup>

Contrary to popular belief, pastoralists and sedentary farmers were not perpetually in conflict; in fact, the traditional land tenure system allowed both groups to negotiate with each

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<sup>230</sup> Ibid, 296.

<sup>231</sup> Jon Unroh and Musa Adam Abdul-Jalil, “Land rights in Darfur: Institutional flexibility, policy and adaptation to environmental change,” *Natural Resources Forum* 36 (2012): 278.

<sup>232</sup> Ibid.

<sup>233</sup> Ibid, 280.

<sup>234</sup> Ibid, 281.

other on land rights.<sup>235</sup> However, government land policies exacerbated tensions and in some instances created them. With the progression of climate change, government policies provided rural farmers and nomads with no means to adapt and coexist peacefully; rather, pastoralists infringed on southern areas and there were no mechanisms for peaceful negotiation.

### *Civil Unrest in Darfur*

It is clear from the events of the civil war that Darfurians experienced high levels of discontent leading up to the peak of the violence in 2003. Civil unrest in Sudan is a complex issue, and a lot of it goes back all the way to creation of an independent Sudan in 1955. At this time, Sudan encompassed a variety of ethnic, cultural, and linguistics groups, which can be broadly divided into Arabs in the north and black Africans in the south (though these identities are based more on cultural history than genetic differences). In the years after independence, the government was dominated by northern Arabs, who attempted to unify the country through forced Arabization and Islamization policies.<sup>236</sup> This is what initially led to the formation of Southern rebel groups fighting for independence. As the years progressed, the regime of Gaafar Nimeiry was able to appease the South with a policy of regional autonomy, which he later revoked, thus reigniting civil war.<sup>237</sup>

Though the Southern rebel movement existed from the 1980s on, the most active part of the civil war was from 2003-2005. Darfur was at the heart of this surge in violence—two southern rebel groups, the Sudanese Liberation Army and the Justice and Equality Movement, launched an uprising in the Darfur region in response to “what they saw as government-

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<sup>235</sup> Ibid, 278.

<sup>236</sup> Francis M. Deng, *War of Visions: Conflict of Identities in the Sudan* (Washington, D.C.: The Brookings Institution, 1995): 11.

<sup>237</sup> Richard Cockett, *Sudan: Darfur and the Failure of an African State* (New Haven: Yale University Press, 2010): 38.

sponsored seizures of their farmland by nomadic Arab herders.”<sup>238</sup> Armed Arab militias, known as the Janjaweed, responded to the uprising with extremely violent attacks on villages, apparently supported by the Sudanese government.<sup>239</sup> Significantly, the Janjaweed recruited mostly from tenure-less former camel herders in northern and western Darfur.<sup>240</sup> The violence in this region would later be characterized as genocide against the black Sudanese in the region.<sup>241</sup> The conflict resulted in an estimated 300,000 deaths, and many more victims of sexual violence and internal displacement.<sup>242</sup>

The war officially ended in 2005 with the signing of peace accords between the government and opposition group the National Democratic Alliance.<sup>243</sup> By 2006, the government had also reached a deal with the Sudanese Liberation Army in Darfur. Some sporadic fighting continued, and in 2011, South Sudan gained independence through a popular referendum.<sup>244</sup> However, civil unrest still continues in both Darfur, where violence and hunger remain prevalent, and South Sudan, which has not entered a civil war of its own.

### *Conclusions from the Sudan and South Sudan Case*

The crisis in Darfur is one of the most dramatic examples of how climate change can affect conflict. In this case, the independent variable of government response to climate change was virtually nonexistent—the Sudanese government lacked the administrative capacity to address serious environmental threats such as drought, and their land policies following independence actually served to exacerbate competition between ethnic groups in Darfur. While

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<sup>238</sup> Esther Pan, “AFRICA: The Darfur Crisis,” *Council on Foreign Relations*, September 20, 2004.

<sup>239</sup> Ibid.

<sup>240</sup> Alex De Waal, ed., *War in Darfur and the Search for Peace*, (Boston: Global Equality Initiative, 2007): 75.

<sup>241</sup> Pan.

<sup>242</sup> “UN: 460,000 displaced in Darfur this year,” *Al-Jazeera*, November 14, 2013.

<sup>243</sup> De Waal, 199.

<sup>244</sup> “Sudan profile - Timeline,” *BBC News*, January 10, 2017. <http://www.bbc.com/news/world-africa-14095300>.

there were existing cultural divides between the Arab nomads in northern Darfur and the sedentary black farmers in southern Darfur, this did not necessitate the existence of civil unrest and conflict. In fact, traditional land tenure systems that existed in the region for decades before colonialism were fairly effective at facilitating peaceful coexistence, even in the event of droughts. However, this case clearly demonstrates how climate change, and poor environmental policies, can serve to fuel civil unrest and, in this instance, violent conflict. The events in Darfur show a direct linkage between climate change and conflict, as shown below.

*Failure to address climate change+poor land policies→famine, land competition→high level of civil unrest (particularly of sedentary tribes)→violent conflict*

In a 2007 article for *The Washington Post*, U.N. Secretary-General Ban Ki-moon asserted the connection of the Darfur conflict to climate change, stating:

It is no accident that the violence in Darfur erupted during the drought. Until then, Arab nomadic herders had lived amicably with settled farmers... But once the rains stopped, farmers fenced their land for fear it would be ruined by the passing herds. For the first time in memory, there was no longer enough food and water for all. Fighting broke out. By 2003, it evolved into the full-fledged tragedy we witness today.<sup>245</sup>

While the existence of unrest in Darfur and the subsequent civil war has more roots than just climate change, it offers a clear example of direct impact climate change governance can have on unrest and conflict in general. Though the worst point of this crisis has passed, climate change will likely continue to influence unrest in this region. As climate change continues to shrink the arable land in Sudan, there is potential for further conflict if the government fails to address environmental changes. Seeing as governance in Sudan and even more so in South Sudan remains weak, climate change will likely cause more crises in the future.

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<sup>245</sup> Ban Ki-moon, "A Climate Culprit in Darfur," *Washington Post*, June 16, 2007.

## Conclusions

In the Middle East and North Africa, climate change has many implications for social, economic, and political systems. Though the direct effect of climate change is environmental, the government response to these environmental effects plays a role in determining the extent of climate change-induced resource scarcity. Most countries in MENA are naturally prone to climatic changes such as drought and desertification, so the influence of anthropogenic climate change has resulted in more frequent, severe, and prolonged extreme climatic events. Because of this, many populations in the MENA region are affected by climate change—through changes in the productivity of farmland, changes in food prices, availability of water and land, and more. As the case studies of Syria, Jordan, Tunisia, and Sudan demonstrated, the way the government responds to environmental degradation can dramatically change the effects of climate change on the population.

In Syria, the government created a strong dependency of farmers on subsidies for water-intensive crops and animal feed; only to suddenly cut these subsidies after the worst drought in 900 years. In Jordan, the government attempted to respond to their natural resource scarcity by promoting more efficient farming techniques and importing water-intensive foods to offset agricultural deficiencies. In Tunisia, the government responded to climate change by adopting some adaptive farming techniques and taking an active role in stabilizing food prices. In Sudan, the government increased the population's vulnerability to climate change by nationalizing land tenure and failing to respond to drought and ensuing famine. Though this thesis only examined four case studies, much of the Middle East is facing similar issues, both in terms of the effects of climate change and its implications in society.

It is not climate change *per se* that directly fuels civil unrest, but rather the changes in the population's access to vital resources that increases or decreases the intensity of civil unrest. This suggests that governments must take an active role in addressing environmental problems to ensure that their population has sufficient access. Without access to water, food, and income, a humanitarian crisis is likely to occur, which often leads to a high degree of civil unrest. As climate change continues in the coming decades, countries in MENA are going to face many challenges in ensuring access to vital resources. With events such as drought and desertification, agricultural adaptations will be needed to offset the decline in arable land and rainfall.

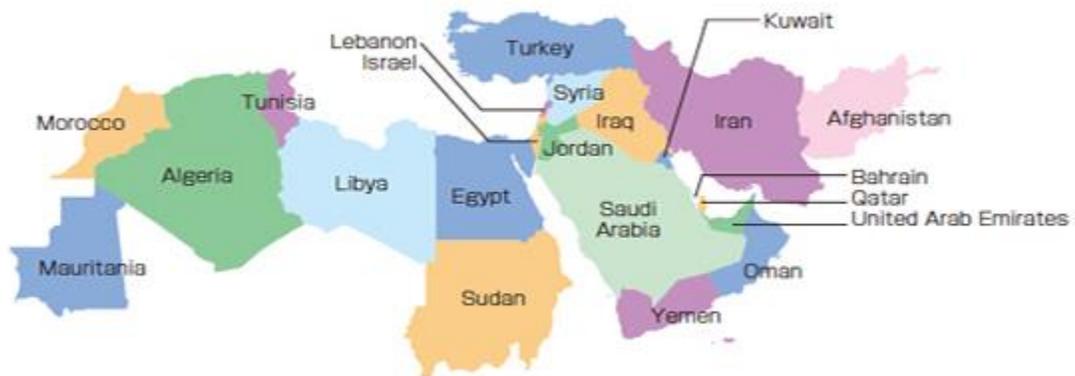
The MENA region has experienced a great deal of civil unrest in the past few years. The world has watched as much of this unrest has resulted in violence and civil war, which has had a massive death toll and created a refugee crisis that has had effects far beyond just the MENA region. This thesis has concluded that while government response to climate change is not the sole factor in creating civil unrest, it is *a* factor. As the effects of climate change continue to play out in the coming decades, the region is likely to face even more societal consequences. If governments do not effectively work to offset these environmental changes, the world may see more climate-fueled crises similar to what happened in Syria and Darfur. It is important that governments in the MENA region prioritize climate change to protect not only their environments, but also their populations.

It is also important for policymakers in the West to recognize the importance of addressing climate change. This thesis has shown that countries in the MENA region, who have contributed relatively little to climate change, have experienced its effects more directly than the West. As the main contributors to climate change, the West has indirectly caused many of the crises that less developed nations are now facing. Though this might not seem like a topic of

immediate importance to lawmakers, the significant implications of climate change on the MENA region will affect the U.S. and Europe directly. Instability in the MENA region has already posed a number of challenges for global security. The U.S. has been involved in the affairs of the Middle East for decades, and this is unlikely to change in the coming years. The Syrian Civil War has become an issue of global concern as the humanitarian crisis grows more dire and refugees seek asylum in Europe and the U.S. The Middle East is a key security interest for the U.S. and Europe, and the stability of this region has been a widely discussed problem for Western states and international organizations.

This paper has shown that adapting to climate change can be vitally important in ensuring the wellbeing of societies in this region. As climate change continues in the coming years, this could have massive implications for the overall stability of MENA countries. Given that many of these countries do not possess the economic means to implement advanced climate change adaptations, it is important that climate change adaptation becomes a top priority in the foreign policy of the West and in the actions of international organizations. Climate change governance is not simply an issue of environmental protection—it is also an issue of global security, and neither governments in the Middle East nor those in the West can afford to ignore it.

## APPENDIX A

*Map 1: Map of the Middle East and North Africa Region*

Source: Japan Cooperation Center for the Middle East

## Bibliography

- Åkesson, Ulrika, and Knud Falk. "Climate Change in Syria—trends, projections and implications." *Sida's Helpdesk for Environment and Climate Change*. Gothenburg: Swedish International Development Cooperation Agency, 2015.
- Abouyoub, Younes. "Climate: The Forgotten Culprit. The Ecological Dimension of the Darfur Conflict." *Race, Gender & Class* (2012): 150-176.
- Al-Qinna, Mohammed, Nezar Hammouri, Mutewekil Obeidat, and Fayez Yacob Ahmad. "Drought Analysis in Jordan under current and future climates." *Climatic Change* 106, no. 3 (2011): 421-440.
- Al-Samadi, Tamer. "Jordan Could Face Massive Protests if Food and Fuel Prices Rise." *Al-Monitor*. October 15, 2012.
- "Arab Uprising: Country by Country." *BBC*. December 16, 2013.
- Abouyoub, Younes. "Climate: The Forgotten Culprit. The Ecological Dimension of the Darfur Conflict." *Race, Gender, and Class* 19, no. 1/2 (2012): 155.
- Babiker Ibrahim, Mohamed. "Drought, Famine, and Disaster Management in Darfur, Sudan." *Famine and Food Policy Discussion Paper 4*. Washington, D.C.: International Food Policy Research Institute (1990).
- Berazneva, Julia and David R. Lee. "Explaining the African Food Riots of 2001-2008: An Empirical Analysis." *Food Policy* 39 (2013): 28-39.
- Bergholt, Drago, and Paivi Lujala. "Climate-related natural disasters, economic growth, and armed civil conflict." *Journal of Peace Research* 41, no. 1 (2012): 147-162.
- Bernauer, Thomas, Tobias Böhmelt, and Vally Koubi. "Environmental changes and violent conflict." *Environmental Research Letters* 7, no. 1 (2012): 015601.
- Boghani, Priyanka. "A Staggering New Death Toll for Syria – 470,000." *PBS*. February 11, 2016. Accessed February 26, 2017. <http://www.pbs.org/wgbh/frontline/article/a-staggering-new-death-toll-for-syrias-war-470000/>
- Bouazza, Ben and Mehdi El Alem. "'We are thirsty' say Tunisians as drought creates tensions." *Associated Press*. September 24, 2016.
- Bowles, Devin C., Colin D. Butler, and Neil Morisetti. "Climate change, conflict and health." *Journal of the Royal Society of Medicine* 108, no. 10 (2015): 390-395.
- Bromberg, Gidon. "Will the Jordan River Keep Flowing?" *Yale Environment* 360. September 18, 2008.

- Brown, Oli, and Alec Crawford. "Rising Temperatures, Rising Tensions." *Climate change and the risk of violent conflict in the Middle East*. Winnipeg: International Institute for Sustainable Development (2009).
- Brzoska, Michael, and Christiane Fröhlich. "Climate change, migration and violent conflict: vulnerabilities, pathways and adaptation strategies." *Migration and Development* 5, no. 2 (2016): 190-210.
- Buhaug, Halvard, Nils Petter Gleditsch, and Ole Magnus Theisen. "Implications of climate change for armed conflict." *Social dimensions of climate change: Equity and vulnerability in a warming world* (2010): 75-101.
- Bundokji, Muhammad. "Climate Change, Arab Spring and the Hashemite Kingdom of Jordan." *Climate Diplomacy*. December 22, 2015.
- Cha, Ariana Eunjung. "Spike in global food prices contributes to Tunisian violence." *Washington Post*. January 14, 2011.
- Chenoweth, Jonathan, Panos Hadjinicolaou, Adriana Bruggeman, Jos Lelieveld, Zev Levin, Manfred A. Lange, Elena Xoplaki, and Michalis Hadjikakou. "Impact of climate change on the water resources of the eastern Mediterranean and Middle East region: Modeled 21st century changes and implications." *Water Resources Research* 47, no. 6 (2011).
- Cincotta, Richard. "High Food Prices An Unlikely Cause for the Start of the Arab Spring." *New Security Beat*. April 7, 2014.
- "Climate Change and Impacts in the Eastern Mediterranean and Middle East: A Regional Assessment." *The Cyprus Institute* (2012).
- "Climate Change cannot be addressed in isolation – King." *Jordan Times*. November 30, 2015.
- Cockett, Richard. *Sudan: Darfur and the Failure of an African State*. New Haven: Yale University Press (2010).
- Cook, Benjamin I., Kevin J. Anchukaitis, Ramzi Touchan, David M. Meko, and Edward R. Cook. "Spatiotemporal drought variability in the Mediterranean over the last 900 years." *Journal of Geophysical Research: Atmospheres* (2016).
- "Darfur Destroyed." Human Rights Watch. New York: Human Rights Watch (2004).  
<https://www.hrw.org/report/2004/05/06/darfur-destroyed/ethnic-cleansing-government-and-militia-forces-western-sudan>.
- De Châtel, Francesca. "The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution." *Middle Eastern Studies* 50, no. 4 (2014): 521-535.
- Demilecamps, Chantal and Wael Sartawi. *Farming in the Desert: Analysis of the Agricultural Situation in Azraq Basin*. Deutsche Gesellschaft für Internationale Zusammenarbeit (2010).

- Deng, Francis M. *War of Visions: Conflict of Identities in the Sudan*. Washington, D.C.: The Brookings Institution (1995),
- de Sherbinin, Alex. "Climate change hotspots mapping: what have we learned?." *Climatic Change* 123, no. 1 (2014): 23-37.
- De Waal, Alex, ed. *War in Darfur and the Search for Peace*. Boston: Global Equality Initiative (2007).
- Dixon, John, Aidan Gulliver, and David Gibbon. "Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World." Washington D.C.: *Food and Agriculture Organization of the United States and The World Bank*, 2001.
- Elasha, Balgis Osman. *Mapping of Climate Change Threats and Human Development Impacts in the Arab Region*. United Nations Development Program Regional Bureau for Arab States. New York: UN, 2010.
- "Employment in Agriculture (% of total employment)." *International Labor Organization*. 2010. The World Bank. <http://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?locations=ZQ>
- Erian, E., Bassem Katlan, and Ouldbdey Babah. "Drought vulnerability in the Arab region." *Special case study: Syria. Global assessment report on disaster risk reduction*. Geneva: United Nations International Strategy for Disaster Reduction (2010).
- Evans, Jason P. "21st century climate change in the Middle East." *Climatic Change* 92, no. 3-4 (2009): 417-432.
- Femia, Francesco and Caitlin Werrell. "Syria: Climate Change, Drought, and Social Unrest." *The Center for Climate and Security*. February 29, 2012. <https://climateandsecurity.org/2012/02/29/syria-climate-change-drought-and-social-unrest/>.
- Fileccia, Turi, Vasyl Hovhera, Inna Punda, and Stefania Manzo. *Jordan: Water Along the Food Chain*. Rome: Food and Agriculture Organization of the United Nations, 2015.
- Food and Agriculture Organization of the United Nations. "Food Price Monitoring and Analysis Tool." *FAO Global Information and Early Warning System*. <http://www.fao.org/giews/pricetool/>.
- Food and Agriculture Organization of the United Nations. "North Africa Brief." *FAO Global Information and Early Warning System*. March 11, 2011. <http://www.fao.org/es/GIEWS/english/shortnews/nafria110311.pdf>
- Food and Agricultural Organization of the United Nations. *The State of Food and Agriculture 2002: Near East And North Africa*. Rome: FAO (2002).
- Food and Agriculture Organization of the United Nations. "World Food Situation: Food Price Index." FAO. Updated February 3, 2017. <http://www.fao.org/worldfoodsituation/foodpricesindex/en/>.

- Frangoul, Anmar. "Climate change could make North Africa and Middle East 'uninhabitable'." *CNBC*, May 4, 2016. <http://www.cnbc.com/2016/05/04/climate-change-could-make-north-africa-and-middle-east-uninhabitable.html>
- Gaaloul, N. "The Role of Groundwater During Drought in Tunisia." In *Climatic Changes and Water Resources in the Middle East and North Africa*. Berlin: Springer Berlin Heidelberg (2008).
- Gleick, Peter H. "Water, drought, climate change, and conflict in Syria." *Weather, Climate, and Society* 6, no. 3 (2014): 331-340.
- Goldstein, Eric. "Tunisia's legacy of pollution confronts democratic politics." *OpenDemocracy*. May 23, 2014. <https://www.opendemocracy.net/arab-awakening/eric-goldstein/tunisia%E2%80%99s-legacy-of-pollution-confronts-democratic-politics>.
- Gray, Ellen. "NASA Finds Drought in Eastern Mediterranean Worst of Past 900 Years." *National Aeronautics and Space Administration*, March 1, 2016. <http://www.nasa.gov/feature/goddard/2016/nasa-finds-drought-in-eastern-mediterranean-worst-of-past-900-years>
- Greenwood, Scott. "Water insecurity, climate change and governance in the Arab world." *Middle East Policy* 21, no. 2 (2014): 140-156.
- Hashemite Kingdom of Jordan Ministry of Environment. *The National Climate Change Policy of the Hashemite Kingdom of Jordan 2013-2020*. United Nations Development Program, 2013.
- Hashemite Kingdom of Jordan. *Jordan's Second National Communication to the United Nations Framework Convention on Climate Change*. UNFCCC, 2009.
- Hill, Jennifer, and Wendy Woodland. "Contrasting water management techniques in Tunisia: Towards sustainable agricultural use." *The Geographical Journal* 169, no. 4 (2003): 342-357.
- Hussein, M. Ahmed, 2008. Costs of environmental degradation: An analysis in the Middle East and North Africa region. *Management of Environmental Quality: An International Journal*, 19(3), pp.305-317.
- Intergovernmental Panel on Climate Change. *Climate Change 2014—Impacts, Adaptation and Vulnerability*. Cambridge University Press, 2014.
- Ismail, Salwa. "The Syrian uprising: Imagining and performing the nation." *Studies in Ethnicity and Nationalism* 11, no. 3 (2011): 538-549.
- Johnstone, Sarah and Jeffrey Mazo. "Global Warming and the Arab Spring." *Survival: Global Politics and Strategy* 53, no. 2 (2011): 11-17.
- Kaniewski, David, Elise Van Campo, and Harvey Weiss. "Drought is a recurring challenge in the Middle East." *Proceedings of the National Academy of Sciences* 109, no. 10 (2012): 3862-3867.

- Kelley, Colin P., Shahrzad Mohtadi, Mark A. Cane, Richard Seager, and Yochanan Kushnir. "Climate change in the Fertile Crescent and implications of the recent Syrian drought." *Proceedings of the National Academy of Sciences* 112, no. 11 (2015): 3241-3246.
- Khan, Suhaib. "Warming Planet has Led to Catastrophe in the Middle East." *The Washington Report on Middle East Affairs* 35, no. 2 (2016): 33.
- Ki-moon, Ban. "A Climate Culprit in Darfur." *Washington Post*. June 16, 2007.
- Lelieveld, J., Y. Proestos, P. Hadjinicolaou, M. Tanarhte, E. Tyrlis, and G. Zittis. "Strongly Increasing Heat Extremes in the Middle East and North Africa (MENA) in the 21st Century." *Climatic Change* 137, no. 1-2 (2016): 245-260.
- Lowi, Miriam. *Water and Power: The Politics of a Scarce Resource in the Jordan River Basin*. Cambridge: Cambridge University Press, 1995.
- Malsin, Jared. "Why the Arab Spring Has Not Led to Disaster in Tunisia." *TIME Magazine*. December 18, 2015. <http://time.com/4154134/arab-spring-tunisia-anniversary/>.
- McDevitt, Johnny. "Jordanians protest against soaring food prices." January 14, 2011.
- Messer, Ellen. "Climate Change and Violent Conflict: A critical literature review." *Oxfam America: Research Backgrounders*, 2010.
- Mhanna, Wagiha. "Syria's Climate Crisis." Translated by Anthony Goode. *Al Monitor*. December 4, 2013.
- Mougou, Raoudha, Mohsen Mansour, Ana Iglesias, Rim Zitouna Chebbi, and Antonella Battaglini. "Climate change and agricultural vulnerability: a case study of rain-fed wheat in Kairouan, Central Tunisia." *Regional Environmental Change* 11, no. 1 (2011): 137-142.
- Namrouqa, Hana. "Drought threatens water supply, crops—officials." *Jordan Times*. February 11, 2014.
- Nelson, Gerald C., Mark W. Rosegrant, Jawoo Koo, Richard Robertson, Timothy Sulser, Tingju Zhu, Claudia Ringler et al. *Climate change: Impact on agriculture and costs of adaptation*. Vol. 21. Washington, D.C.: International Food Policy Research Institute, 2009.
- Pachauri, Rajendra K., Myles R. Allen, V. R. Barros, J. Broome, W. Cramer, R. Christ, J. A. Church et al. *Climate change 2014: synthesis Report. Contribution of working groups I, II and III to the fifth assessment report of the intergovernmental panel on climate change*. IPCC, 2014.
- Pan, Esther. "AFRICA: The Darfur Crisis." *Council on Foreign Relations*. September 20, 2004.
- Paramaguru, Kharunya. "Tunisia Recognizes Climate Change in Its Constitution." *TIME Magazine*. January 29, 2014. <http://science.time.com/2014/01/29/tunisia-recognizes-climate-change-in-its-constitution/>.

- Rahman, Kazi, Steven M. Gorelick, P. James Denny-Frank, Jim Yoon, and Bala Rajaratnam. "Declining rainfall and regional variability changes in Jordan." *Water Resources Research* 51, no. 5 (2015): 3828-3835.
- Raleigh, Clionadh, and Henrik Urdal. "Climate change, environmental degradation and armed conflict." *Political geography* 26, no. 6 (2007): 674-694.
- "Renewable internal freshwater resource per capita (cubic meters)." *World Bank*. <http://data.worldbank.org/indicator/ER.H2O.INTR.PC?end=2014&locations=ZQ&start=2014&view=bar>
- Republic of Tunisia Ministry of Environment. "Climate Change." Updated February 27, 2017. <http://www.environnement.gov.tn/index.php?id=26&L=1#.WORK71UrKUK>.
- Republic of Tunisia Ministry of Environment. "Environmental Policy." Updated February 27, 2017. <http://www.environnement.gov.tn/index.php?id=65&L=1#.WM8nJhLysyc>.
- Republic of Tunisia Ministry of Environment and Sustainable Development. *Intended Nationally Determined Contribution of Tunisia*. United Nations Framework Convention on Climate Change (2015).
- Sandels, Alexandra. "JORDAN: Thousands of demonstrators protest food prices, denounce government." *Los Angeles Times*. January 15, 2011.
- Scheffran, Jürgen, et al., eds. "Climate change, human security and violent conflict: challenges for societal stability." (2012).
- Scheffran, Jürgen, and Antonella Battaglini. "Climate and conflicts: the security risks of global warming." *Regional Environmental Change* 11, no. 1 (2011): 27-39.
- Scheffran, Jürgen, and Hans Günter Brauch. "Conflicts and security risks of climate change in the Mediterranean region." *The Mediterranean Sea* (2014): 625-640.
- Scheffran, Jürgen, Michael Brzoska, Jasmin Kominek, P Michael Link, and Janpeter Schilling. "Climate change and violent conflict." *Science* 336, no. 6083 (2012): 869-871.
- Schellnhuber, Hans Joachim et. al. *Climate change as a security risk*. German Advisory Council on Global Change. Sterling, VA: Earthscan, 2008.
- Schilling, Janpeter, Korbinian P. Freier, Elke Hertig, and Jürgen Scheffran. "Climate change, vulnerability and adaptation in North Africa with focus on Morocco." *Agriculture, Ecosystems & Environment* 156 (2012): 12-26.
- Schleussner, Carl-Friedrich, Jonathan F. Donges, Reik V. Donner, and Hans Joachim Schellnhuber. "Armed-conflict risks enhanced by climate-related disasters in ethnically fractionalized countries." *Proceedings of the National Academy of Sciences* 113, no. 33 (2016): 9216-9221.
- Schwartzstein, Peter. "Biblical Waters: Can the Jordan River Be Saved?" *National Geographic*. February 22, 2014.

- Schyns, Joep F., Arwa Hamaideh, Arjen Y. Hoekstra, Mesfin M. Mekonnen, and Marlou Schyns. "Mitigating the risk of extreme water scarcity and dependency: The case of Jordan." *Water* 7, no. 10 (2015): 5705-5730.
- Sharp, Jeremy M., and Christopher M. Blanchard. "Armed conflict in Syria: Background and US response." Washington, D.C.: Library of Congress Congressional Research Service, 2013.
- Sowers, Jeannie, Avner Vengosh, and Erika Weinthal. "Climate change, water resources, and the politics of adaptation in the Middle East and North Africa." *Climatic Change* 104, no. 3-4 (2011): 599-627.
- Subah, Ali. "Introduction." Jordan Ministry of Water and Irrigation: Groundwater Resources Management. <http://www.mwi.gov.jo/sites/en-us/SitePages/MWI%20BGR/Introduction.aspx>.
- "Sudan profile - Timeline." *BBC News*. January 10, 2017. <http://www.bbc.com/news/world-africa-14095300>.
- "Syrian President Bashar al-Assad: Facing down rebellion." *BBC*. October 21, 2015.
- Terazono, Emiko. "Climate extremes inflate food prices." *Financial Times*. April 10, 2014.
- Terink, Wilco, Walter Willem Immerzeel, and Peter Droogers. "Climate change projections of precipitation and reference evapotranspiration for the Middle East and Northern Africa until 2050." *International journal of climatology* 33, no. 14 (2013): 3055-3072.
- Touchan, Ramzi et. al. "Long term context for recent drought in Northwest Africa." *Geophysical Research Letters* 35, no.13 (2008).
- "UN: 460,000 displaced in Darfur this year." *Al-Jazeera*. November 14, 2013.
- United Nations. *Work Plan for the Sudan*. Khartoum: United Nations Resident (2005).
- United Nations Environment Program. *Sudan Post-Conflict Environmental Assessment*. Nairobi: UNEP (2007).
- United Nations High Commissioner for Refugees. "Syria Regional Refugee Response." Accessed February 26, 2017. <http://data.unhcr.org/syrianrefugees/regional.php>.
- Unruh, Jon, and Musa Adam Abdul- Jalil. "Land rights in Darfur: Institutional flexibility, policy and adaptation to environmental change." *Natural Resources Forum* 36, no 4 (2012): 274-284.
- Verner, Dorte. *Adaptation to a Changing Climate in Arab Countries: A Case for Adaptation Governance and Leadership in Building Climate Resilience: MENA Development Report*. Washington, D.C.: World Bank, 2012.
- Verner, Dorte, ed. *Tunisia in a Changing Climate*. Washington, D.C.: The World Bank (2013).

- “Water is Focus of Climate Change in Middle East and North Africa.” *World Bank*.  
<http://go.worldbank.org/87GRZ8H4B0>.
- Werrell, Caitlin and Francesco Femia. “Tunisian Constitution Charts a Course to a Climate Resilient Future.” The Center for Climate and Security. March 14, 2014.
- Whitman, Elizabeth. “Jordan’s Farmers Struggle to Weather Climate Change.” *Inter Press Service*. November 5, 2013.
- World Bank. “Renewable internal freshwater resource per capita (cubic meters): Tunisia.” The World Bank Group (2016).  
<http://data.worldbank.org/indicator/ER.H2O.INTR.PC?locations=TN>.
- The World Factbook* 2016-2017. Washington, D.C.: Central Intelligence Agency, 2017.
- World Health Organization. “Climate Change Adaptation to Protect Human Health: Jordan Country Profile.” <http://www.who.int/globalchange/projects/adaptation/en/index5.html>.
- Helen Young et. al. *Darfur - Livelihoods Under Siege*. Medford, MA: Feinstein International Famine Center (2005).
- Zarenistanak, Mohammad, Amit G. Dhorde, and R. H. Kripalani. "Temperature analysis over southwest Iran: trends and projections." *Theoretical and applied climatology* 116, no. 1-2 (2014): 103-117.
- Zouabi, Oussama and Nicolas Peridy. “Direct and indirect effects of climate on agriculture: an application of a spatial panel data analysis to Tunisia.” *Climatic Change* 133, no. 2 (2015): 301-320.
- Zurayk, Rami. “Use your loaf: why food prices were crucial in the Arab Spring.” *The Guardian*. July 16, 2011.