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THE SLOW MOTION CRISIS

The Destabilizing Effects of Climate Change in
Turkey and Iraq Through 2050

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INTRODUCTION

My grandfather grew up in Baghdad in the 1930s in a neighborhood called Sinak, just a few blocks from the east bank of the Tigris River, deep in the heart of what was once called the Fertile Crescent. When my grandfather was a child, his uncle taught him and his brother to swim in the Tigris, using palm leaves as a makeshift floatation device to keep the boys safe from the depths of the massive river. But the vast, deep Tigris of my grandfather's childhood is slowly disappearing. River flow through the city has been cut in half, leaving the Tigris so shallow that grown men can stand waist-deep in the river at certain times of year while the kelek rafts so common in my grandfather's time now scrape the bottom of the river.¹

The changes to the Tigris over the past century are part of a larger story reshaping Turkey and Iraq, the two countries through which the river runs. Based on existing patterns and future scientific projections through 2050, Turkey and Iraq are both expected to see higher temperatures, decreasing precipitation, and more frequent drought. When combined with the projected increase in global food prices and demographic changes in each country over the next three decades, food insecurity is likely to increase in both countries, while rural farm incomes are likely to either decline or become more volatile. What is still unclear is whether these climatic and social changes will undermine the stability and security of Iraq and Turkey.

The relationship between climate change and security has received greater policy attention in recent years, spurred in part by the Paris climate agreement and the Syrian civil war,² but the relationship remains misunderstood and frequently mischaracterized. A changing climate does not directly cause violence, terrorism, or conflict, but it does affect our water resources, our food production, and our economic productivity in ways that put greater stress on the communities we live in and greater pressure on our governing bodies. A growing body of research shows that for weak and fragile states already struggling to care for and protect their citizens, the additional stress created by climate change can turn a tenuous peace violent.³

Instead of looking at each of these climatic effects separately or making a generalized statement about the climate-security relationship, we can learn more about the causal impact of climate change on instability and security by comparing the two closely-tied, but different case studies of Turkey and Iraq. Between now and 2050, the border region connecting Turkey and Iraq will experience similar temperature increases and precipitation decreases, but because of the different political, social, economic, and security dynamics on each side of the border, these changes to the climate will have vastly different implications for each country.

Whether Turkey and Iraq are made less stable and more violent by the long-run effects of climate change will depend on how both countries manage their ongoing governance and security challenges, whether their economies transition away from agricultural production, and what policies central and local governments take. Preventing the worst impacts of climate change on Turkish and Iraqi stability will require investing in more country-specific research, improving management of the river system, incorporating Kurdish communities into adaptation measures, and increasing urban food security.

The next few decades will test whether Turkey and Iraq will be able to manage and adapt to the challenges of a changing climate.

For these two populous, strategically important countries, the next few decades will test whether they will be able to manage and adapt to the challenges of a changing climate or whether these changes will overwhelm the capacity of local and national leaders.

PROJECTED EFFECTS OF CLIMATE CHANGE: HOTTER, DRIER, AND LESS PRODUCTIVE

It's Getting Hotter

The primary driver of change in Turkey and Iraq will be the significant increase in temperature. Mean temperatures in both countries are expected to increase by 3-5°C by 2050, with an average increase of 4.2°C in Turkey and 4.1°C in Iraq.^{4*} These temperature increases are nearly two and a half times the expected global average temperature increase across the same period.⁵

These similar temperature increases will impact Iraq much worse than Turkey due to Iraq's already hot climate. While the mean summer temperature in Turkey's capital Ankara will increase from 20°C (68°F) to 24°C (75°F), Iraq's capital Baghdad will face an increase from 37°C (99°F) to 41°C (106°F).

Last summer, extreme temperatures in Baghdad and Basra, Iraq reached a staggering 51°C (124°F) and 54°C (129°F) respectively, the hottest temperatures

*Projections are based on the A1B climate scenario, which takes a middle of the road approach that assumes rapid economic growth, global population peaking mid-century, and the introduction of new, more efficient technologies and uses the late 20th century as a benchmark.

ever recorded in the Eastern Hemisphere.⁶ Unlivable days like this are only going to become more common in the region due to the effects of climate change.⁷ Additionally, maximum temperatures are expected to increase even more, ranging between 3.7-4.7°C by mid-century, making the hottest days in each country even worse than before.⁸

It's Getting Drier, Too

Precipitation is also projected to change by 2050 due to a combination of factors, including local temperature increases and global changes in weather patterns. In both countries, precipitation is projected to decline nationwide, by 11 percent in Turkey and 3 percent in Iraq. But these national changes mask significant variation within each country. For instance, the southern Anatolian coast and Kurdish-majority southeastern Anatolia are projected to see a 20 percent decline in precipitation while northeastern Anatolia is projected to see a 15 percent increase in precipitation.⁹ Similarly, precipitation in the Shia-populated southeastern region of Iraq is projected to increase by more than 20 percent, while the northern Kurdish region will see a 15 percent decline in precipitation.¹⁰

As a result of precipitation changes in Turkey, river flow from the Tigris and Euphrates rivers—the main source of agricultural irrigation in both eastern Turkey and northern Iraq—is projected to decline by 10 percent.¹¹ River flow losses in Iraq could end up even higher if Turkey withdraws more water from the rivers to make up for the lack of precipitation—a cause of tension between the two countries due to the lack of an international agreement on managing access to the Tigris.¹²

Less Freshwater for a Growing Population

When combined with population growth, climate change will significantly decrease renewable freshwater per capita. In Turkey, water per capita

is projected to decline by 28 percent to 2,108 cubic meters per person, pushing the country close to water stress levels in 2050.¹³ Iraq's population is expected to double by 2050, and as a result Iraqi renewable freshwater per capita is projected to decline by a staggering 59 percent to just 407 cubic meters of water per capita, pushing the country to severe water scarcity levels.¹⁴

Climate change will also create extreme variation in the distribution of water throughout the year as periods of drought become more frequent and longer, while periods of rainfall become more intense. This is particularly true for Kurdish-majority areas throughout eastern and southeastern Anatolia such as Van and Muş, which will become more arid and experience more frequent droughts.¹⁵ Though few good projections are available for mid-century drought frequency, one study projects droughts in south and southeastern Anatolia will occur 10 to 20 percent more frequently by the end of the century.¹⁶

The combination of higher temperatures, less water, and greater frequency of droughts will have an uneven, but largely negative effect on agricultural production in Turkey and Iraq.

Less Water Means Less Wheat

The combination of higher temperatures, less water, and greater frequency of droughts will have an uneven, but largely negative effect on agricultural production in Turkey and Iraq. Some crops will benefit from milder winters that may lengthen the growing season by one month, but this positive effect is likely to be canceled out by a similar increase in the number of extremely hot days in the summer.¹⁷ In some cases, crop yields may slightly increase in average years, but the increase in droughts, heavy rain, and extreme temperatures

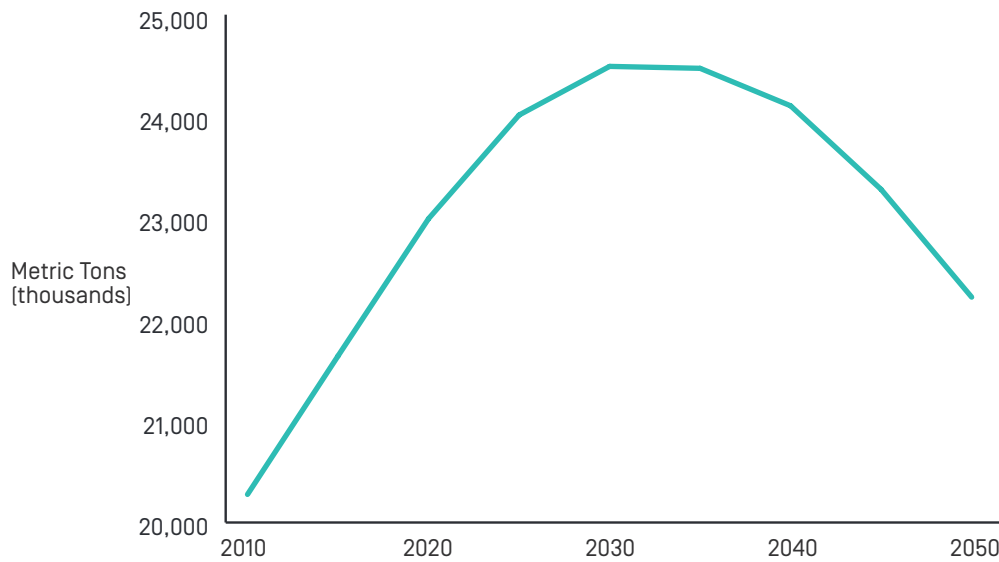
will exacerbate the risk of widespread crop failure from year to year.

Even assuming improvements in farming practices, use of fertilizers, and overall agricultural efficiency, corn yields are projected to decline by 41 percent while wheat production is projected to increase by just 9 percent nationwide in Turkey. Wheat in particular will see sharp changes as efficiency improvements increase Turkish wheat production

by 21 percent peaking around 2030 before the negative effects of climate change begin to cancel out these technical improvements, leading to a 9 percent decline in production from 2030 to 2050.¹⁸

Iraq is projected to see a similar inverted-U pattern as Turkey, with wheat production peaking slightly later in 2040 before declining slightly to 2050, a net 16 percent gain in wheat production from 2010.¹⁹

Figure 1 | Turkish Wheat Production, 2010-2050



Source: International Food Policy Research Institute under pessimistic CSI A1B scenario

ECONOMIC AND SOCIAL IMPLICATIONS: LOWER INCOMES, HIGHER COSTS, AND URBAN MIGRATION

Decreasing Economic Productivity

Recent studies show that increasing temperatures produce sharp declines in labor supply and labor productivity at average annual temperatures above 20-30°C (68-86°F).²⁰ Even with projected temperature increases, this is unlikely to have a significant effect on the Turkish economy by midcentury due to its relatively moderate average annual temperature—for instance, even with significant temperature increases, Ankara’s mean summer temperature will still only be 24°C (75°F).²¹ But in Iraq, average annual temperatures will be much higher. For instance, Baghdad’s mean summer temperature is project to rise to 41°C (106°F), well above the range where labor productivity begins to decline. As a result, GDP per capita in Iraq in 2050 is projected to be 50 percent lower than it would be without climate change.²²

Increasing the Percentage of Disposable Income Spent on Food

While these climatic changes drag down income growth, they will also lead to greater expenses in the form of higher food costs for Turkish and Iraqi citizens—particularly those individuals living in urban areas. Global food prices are expected to increase significantly due to population growth, a larger middle class, limited availability of arable land, and declining crop yields due to climate change, with wheat prices rising by 59 percent, maize by 106 percent, and rice by 78 percent from 2010 to 2050.²³

At the same time as global food prices are increasing, Turkey is projected to transition from one of the world’s biggest exporters of cereals to one of the world’s biggest importers on an absolute basis due to its growing population and stagnating crop yields.²⁴ As a result, daily food supply is expected to decline by nearly 10 percent, pushing average Turks toward a food deficit.²⁵ Inflation, driven primarily by higher energy and food costs, is already one of the

Table 1 | Food and Water Statistics

	Turkey	Iraq
Renewable Freshwater per Capita [m ³ /capita]	2,928 m ³	998 m ³
Agriculture as Share of GDP	8%	5%
Employment in Agriculture	20%	23%
Daily Food Supply [kcal/capita]	3680 kcal	2489 kcal
Daily Food Deficit [kcal/capita]	N/A	188 kcal
Food as Share of Disposable Spending	20%	35%

Source: World Bank, Food & Agriculture Organization Statistic Division, CIA World Factbook, Turkish Statistical Institute, World Food Program

top economic concerns for Turks, and that situation will only become even more relevant as Turkey becomes a net cereal importer.

The situation is even more extreme in Iraq, where net cereal imports are expected to triple by 2050 due to the country’s dramatic population growth, making an already food insecure population even more dependent on foreign agricultural production.²⁶ The average Iraqi already faces a food deficit four times the Middle Eastern average and spends 35 percent of their disposable income on food—one of the highest levels in the world.²⁷ In the face of higher prices and increased imports, Iraqis will be forced to spend an even greater share of their stagnating incomes on food to prevent this food deficit from growing even larger.

Destabilizing Rural Farm Incomes

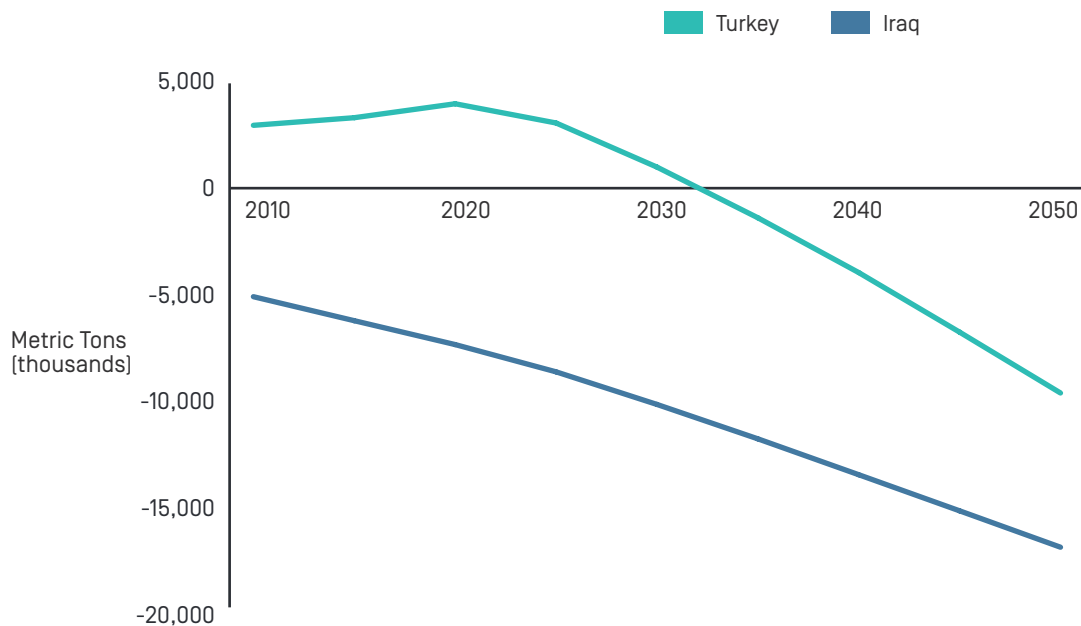
Farmers and rural households in Turkey and Iraq are also likely to be hurt by climate change economically. The overall impact of changing global food prices, local agricultural production, and net cereal trade on rural farm incomes isn’t entirely clear, particularly in the major agricultural areas of eastern Anatolia or northern Iraq, but case studies in other countries suggest that agricultural

incomes are likely to decline on net.²⁸ Country-specific studies for Turkey and Iraq are necessary to make that statement more confidently, but even if farmers can sell their crops at higher prices on average, greater variability in the climate in the form of heavy rains and more frequent droughts increases the chance of boom and bust periods for local farmers. This is particularly true for small-scale farmers, which are prevalent in Turkey. In 2006, 79 percent of agricultural holdings in Turkey were less than 10 hectares, which highlights the disproportionately high percentage of small-scale farmers in the country despite the liberalization of the agricultural sector.²⁹ These are the farmers who are most likely to see their incomes hurt by increasing droughts and higher temperatures.

Iraqis will be forced to spend an even greater share of their stagnating incomes on food to prevent this food deficit from growing even larger.

Such changes are likely to disproportionately affect the Kurdish communities of Turkey and Iraq due to their greater dependence on agriculture for economic growth and jobs. Agriculture represents

Figure 2 | Net Cereal Trade, 2010-2050



Source: International Food Policy Research Institute under pessimistic CSI A1B scenario

an estimated 18 percent of the Kurdish economy and employs 35 percent of Turkish Kurds in the northeastern, central-eastern, and southeastern Anatolian regions of Turkey, roughly double national averages.³⁰ In Iraq, though the three governorates that make up the Kurdistan Regional Government, or KRG, are less agriculturally-dependent than the country as a whole, the Kurdish peshmerga also control large parts of Ninevah, Kirkuk, and Diyala, three of the four largest wheat-producing regions of the country, and home to large Kurdish populations.³¹ The Ninevah governorate is the single most important agricultural region of Iraq, supplying 20 percent of the country's wheat and 32 percent of its barley.³² It is these Kurdish regions of Turkey and Iraq that are projected to face the greatest temperature and precipitation changes over the next three decades and also have the greatest number of rural farmers whose incomes are likely to be disrupted by climate change.

Potential for Increased Climate-Induced Migration

The negative economic impact of climate change on rural farmers has the potential to encourage greater rural to urban migration, putting greater pressure on major cities. Rural families often use migration as a hedging strategy, a way of diversifying income by sending one family member to a nearby city. As rural incomes decrease from stagnating crop yields, families are in theory more likely to migrate to urban areas for economic opportunity, but this trend isn't always consistent. More granular analysis shows that climate change has highly localized effects on migration with rural families in some countries trapped by their worsening economic conditions in the face of the high costs of migration.³³ Though it's possible that declining rural incomes will encourage rural to urban migration, projecting the effect of climate change on Turkish and Iraqi migration patterns will require more country and region-specific research than currently exists.

If increased rural to urban migration does occur, major cities such as Istanbul and Diyarbakir in Turkey or Mosul and Erbil in Iraq will face greater pressure to house, employ, and feed this growing population. So far, the massive construction boom in Turkish cities has largely ensured reasonable housing availability even as Istanbul's population has more than doubled in the past quarter-century, but the potential for increased climate-induced migration may push housing availability to its limits in Istanbul and other major Turkish cities.

In addition to the scale of migration, the other major challenge will be the pace of migration. Migration at a consistent, predictable pace will be a difficult, but manageable task. However, if increasing droughts and extreme weather lead to forced, sudden, and unplanned migration, then managing this transition will be much more difficult and put greater strains on Turkish and Iraqi cities as new migrants struggle to gain access to affordable housing, social services, and employment.

SECURITY AND STABILITY IMPLICATIONS: THE CASE OF THE KURDS

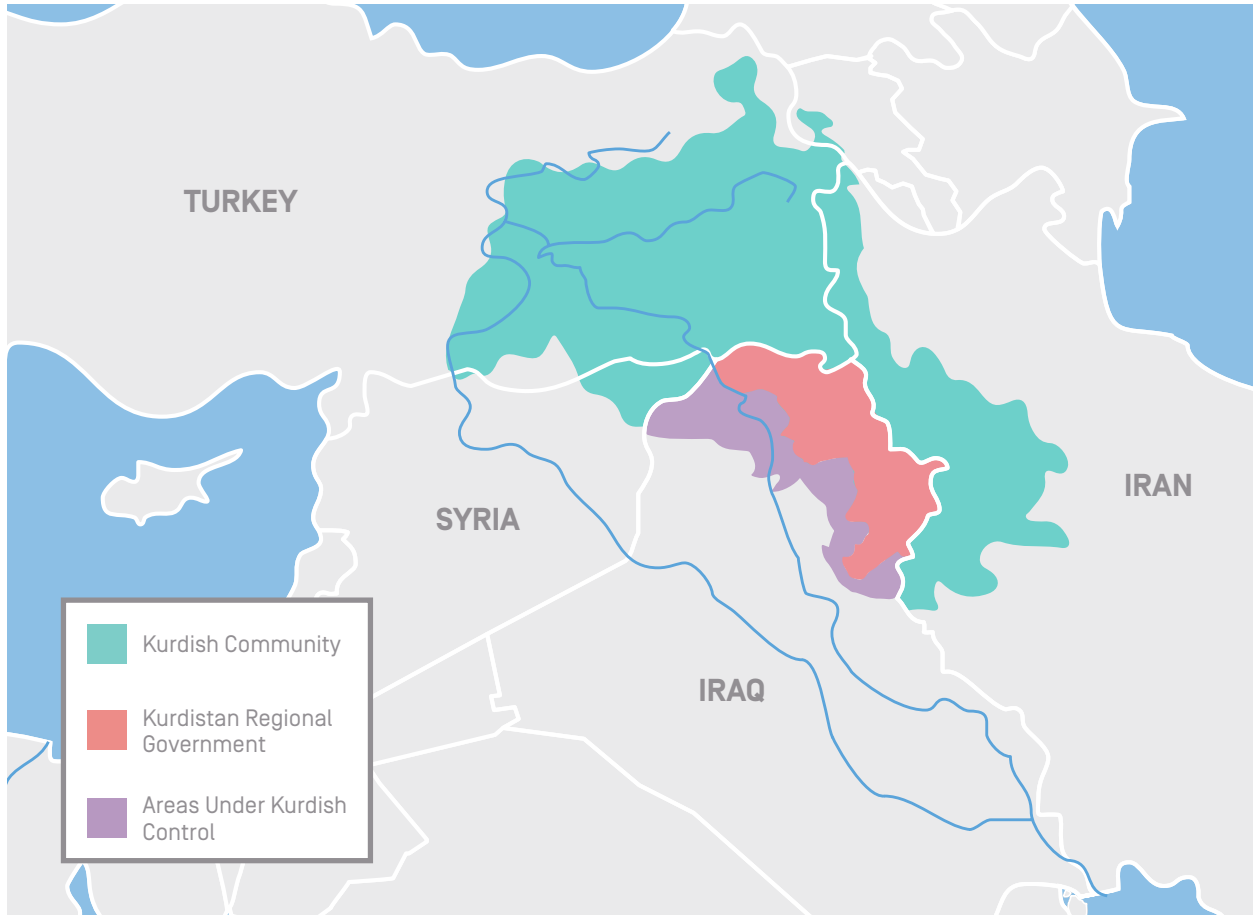
Raising the Chances of Conflict

The combination of lower incomes, greater food insecurity, and added pressure on urban communities could potentially lead to increasing conflict in Turkey and Iraq. There is growing evidence that climate disasters, such as the droughts or extreme heatwaves that are projected to increase in both Turkey and Iraq, are correlated with armed conflict in ethnically fractured states. A recent study found that one in four armed conflicts in ethnically fractured states significantly coincided with a climate disaster.³⁴ Another study found that even temperature increases alone can lead to both greater interpersonal conflict, such as assault or murder, and greater intergroup conflict, such as

riots, political violence, or wars, though the causes for this relationship are not fully understood.³⁵ Ultimately, the biggest factor in the security of both countries will be the underlying social, economic, and political conditions, and the extent to which the effects of climate change undermines each of them.

Looking at the security landscape of both countries and comparing it with the areas where climate change is projected to be most powerful, the most likely source of potential future instability is the Kurdish communities in southeastern Turkey and northern Iraq due to their geographic location, large reliance on the agricultural sector, and tenuous relationships with the central governments of Ankara and Baghdad.

Figure 3 | Kurdish Communities in the Middle East



Feeding the Fire of the Turkish-PKK Conflict

Since the early 1980s, the Turkish central government has fought an intermittent war with the PKK, or Kurdistan Workers Party, a militant Kurdish separatist group advocating independence for Turkey’s 14 million Kurds.³⁶ The conflict has gone through many chapters, and after a recent period of relative calm and rapprochement, the war has unmistakably re-escalated over the past two years.³⁷ The negative impact of climate change on rural farm incomes will disproportionately hurt Kurdish farmers in southeastern Turkey, which could in turn inflame existing Kurdish-Turkish tensions, especially because a key base of PKK support

comes from small-scale farmers who resent central government policies that favor large landholders.

One potential example of this is how the Turkish government may respond to declining water availability and stagnating crop yields. One option for the Turkish government is to bolster large-scale agriculture through the expansion of the 22-dam Güneydoğu Anadolu Projesi (Southeastern Anatolian Project), or GAP, along the Tigris and Euphrates rivers. Increasing the number of dams to improve large-scale irrigation farming may support agricultural production on the whole, but is likely to hurt small-scale Kurdish farmers and may worsen tensions with the Kurdish community—not to mention the tension this will

cause with downstream communities in Syria and Iraq. Additionally, the dams frequently flood major Kurdish heritage sites, such as the ancient city of Hasankeyf, and are frequently planned without consultation with the local Kurdish community. Kurdish-Turkish tension isn't guaranteed to increase over the next three decades, but the significant potential exists due to both the projected effects of climate change and the government's likely response to it.

Undermining Iraqi-Kurdish Governance

The stability implications of climate change in Iraqi Kurdistan are less clear. As in Turkey, the 6.5 million-person Kurdish community in Iraq has long had a volatile relationship with the Iraqi central government in Baghdad, culminating in 1988 with Saddam Hussein's use of chemical weapons to massacre 50,000 Iraqi Kurdish civilians.³⁸ But unlike the Kurdish community in Turkey, the Iraqi Kurds have since gained significant local autonomy by

establishing the Kurdistan Regional Government, or KRG, and therefore regained responsibility for the well-being of its population from the central government in Baghdad.

However, it is exactly this autonomy that hangs in the balance, as two divergent scenarios emerge as a result of the effects of climate change. One possibility is that the projected economic damage to rural farmers in northern Iraq will lead to a greater push for Kurdish independence based on the argument that the KRG needs complete control over its finances and regional economy to address these challenges. But it's just as feasible that the KRG would need to lean more heavily on Baghdad for economic support and food assistance. The declining economic fortunes of the region could ultimately undermine the political authority of the KRG and deepen existing political divisions between the ruling Kurdish Democratic Party and the opposition Patriotic Union of Kurdistan, potentially weakening the strong governance that has kept the KRG more stable than the rest of Iraq for much of the past decade.

The most likely sources of potential future instability are the Kurdish communities in southeastern Turkey and northern Iraq due to their geographic location, large reliance on the agricultural sector, and tenuous relationships with the central governments of Istanbul and Baghdad.

POLICY RECOMMENDATIONS: MANAGING CHANGE AND ADAPTING TO THE FUTURE

Because policy choices play such a large role in enhancing or mitigating the destabilizing effects of climate change, how policymakers at the local, national, and international level prepare for projected temperature and precipitation changes will be a crucial determinant in whether Turkey and Iraq are more or less stable in 2050. Four key issues should be at the top of the agenda for the Turkish and Iraqi governments, as well as major stakeholders in the region, such as the United States and the European Union.

First and most immediate is the need for more country-specific research on the impacts of climate change on farm incomes and migration patterns in Iraq and Turkey. Though a large body of research exists on the impact of climate change on migration and farm incomes, these general trends are not predictive of country and community-specific effects. More country-specific research is needed on these two issues in Turkey and Iraq, including a dynamic computable general equilibrium model for the net effect of changing crop yields, greater exposure to drought, and higher global prices.³⁹ U.S. and European governments should support grants for and encourage research by academic experts to conduct this Iraq and Turkey-specific research.

Second, a stronger regional mechanism for managing Tigris and Euphrates water supplies needs to be established. Given the reliance of Turkey, Iraq, and Syria on water from the Tigris and Euphrates for agricultural irrigation, any change to the flow of the rivers could have profound economic, social, and security implications in the region. A mechanism for joint management of the river basin and water supply is needed to limit the potentially destabilizing effects of new dam construction or agricultural practices. This mechanism could take the form of a trilateral treaty, additional memorandums of understanding building on the 2009 agreement between Turkey and Iraq, or reviving and making permanent the Joint Technical Commission.⁴⁰ Any mechanism for managing the rivers must include contributions from the Turkish Kurdish community and the Kurdistan Regional Government of Iraq given that they are most likely to be directly affected by river flow changes. This will be a politically difficult task given the limited incentives for Turkey to give up its current upstream advantages in river management, and it is here that the European Union, the United States, and regionally active Arab states will be most needed to bring these parties together.

Third, greater investment in adaptation measures for the Kurdish communities of both Iraq and Turkey is needed. Kurdish-majority regions on both sides of the Iraqi-Turkish border will be among the most affected by climate change. How the Kurdish communities in Iraq and Turkey respond to a changing climate, and in turn how the governments in Ankara and Baghdad respond to the Kurds will be one of the major determinants of social stability in each country. The Turkish and Iraqi governments can help limit the likelihood of increased tensions with the Kurdish community in the future by supporting climate adaptation efforts, such as reforming land ownership policies, developing crops and farming practices better suited for future temperature and water conditions, and ensuring economic opportunities outside of the agricultural sector. Though it would be best if this support came directly from the central governments in Turkey and Iraq, this seems unlikely given current political dynamics. Instead, this investment will likely need to come from international venues such as the Green Climate Fund or the UN's Adaptation Fund.

Fourth and finally, local and national governments must build more sustainable and resilient urban food security. Turkey and Iraq will become more exposed to major changes in global food prices as both countries become more urban, less invested in agriculture, and more reliant on food imports. Most Turkish and Iraqi citizens will spend an even greater percentage of their disposable income on food as prices steadily increase over the next few decades. If incomes don't rise concurrently, many Iraqis and Turks will face food shortages and declining real incomes. Simply expanding food assistance programs or food subsidies without addressing underlying vulnerabilities will put a significant strain on government finances. Instead, local, regional, and national leaders must work now to build more sustainable and resilient urban food security by modernizing agricultural practices, expanding urban farming, diversifying diets, and reducing food waste.

CONCLUSION

As the world continues to warm over the next three decades, climate change will put greater and greater pressure on fragile states like Turkey and Iraq, acting as a drag on efforts to improve their economic, social, and security future.

The challenges posed by climate change will come in the form of both long-term trends, as well as

short-term shocks. While the multi-decade changes in temperature, crop yield, precipitation, and migration patterns will be difficult to manage, it will often be the sudden, unexpected shifts that are the most destabilizing; the extreme heatwave, crop failure across an entire region, an endless drought, or the mass migration of whole communities to the city in search of better economic prospects.

These effects will be uneven and unexpected, different from country to country and community to community. As researchers and policymakers look to the future, it's critical to not only look at how the country as a whole is affected, but how particularly vulnerable communities like the Kurds are hit by climate change, as this can disproportionately alter a country's security dynamics.

For fragile states like Turkey and Iraq, improving their governance, legitimacy, economic performance, and security are the most important ways to insulate them from the potential dangers

of climate change. Though the security challenge posed by climate change will impact all countries, these changes will disproportionately affect the most vulnerable, the weakest, the most fractured, and the least governed nations.

What Turkey and Iraq will look like in 2050 cannot be known, but they will likely both be significantly weaker in a world with runaway climate change than a world without it. How they and the world prepare today for the climate challenges of the next three decades could decide their political, economic, and security future.

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