

# EPICENTERS OF CLIMATE AND SECURITY: THE NEW GEOSTRATEGIC LANDSCAPE OF THE ANTHROPOCENE

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# CLIMATE, COFFEE AND SECURITY

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## INTRODUCTION

Many people view climate change as an abstract threat to other, faraway persons in the distant future. Take away their morning cup of coffee, though, and they may come to realize that climate change is happening here, now, to us. But the likely impacts and consequences of the threat climate change poses to coffee don't stop with a more expensive or less reliable cup of morning of coffee. Climate change's impact on coffee production could drive broader social and security risks, and disrupt the intricate and fragile relationship between coffee farming and economic, social, political and regional security.

Climate change will have a dramatic effect on the coffee market. One estimate suggests that half of the land suited to production of the Arabica beans that form the mainstay of the coffee trade will no longer be suitable for growing coffee by 2050.<sup>2</sup>As a crop, coffee is highly vulnerable to climate-related pests and diseases, with an outbreak of the fungal disease coffee leaf rust causing Guatemala, El Salvador and Honduras to declare national emergencies in 2013. As the climate changes, it will cause unpredictable shifts in exposure to pests and diseases that will complicate efforts to insulate the industry from climate impacts.

There is often an overlap between the areas where these adverse impacts are projected to be most severe and countries with the highest percentage of GDP derived from coffee exports. Many of these countries also face underlying security fragilities, such as a history of recent conflict, serious organized crime, weak state institutions, chronic poverty, food insecurity, and rapid urbanization, often in combination with high

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unemployment and burgeoning youth populations. The loss of a vital cash commodity crop for some of the poorest and most vulnerable citizens in these countries, and the detrimental effect on foreign exchange and GDP for their national economies, threatens to exacerbate such underlying fragilities and – in some cases – impact the drivers of insecurity in ways that could scale up to broader regional security concerns.

Despite some economic traits unique to coffee, a similar analysis could be done for any globally traded food crop or any crop that contributes to regional food and economic security. But, unlike with staple foods such as cereals, (which for many communities are necessary for survival), coffee, and the climate-exacerbated shocks to the communities that depend on it for their livelihoods, are not typically factored into analysis of state fragility or regional insecurity. In this context, it is possible that the potential security repercussions of a climate-related crash in coffee production could be overlooked, raising the risk that coffee crop failures become black swan events that would be easy to miss while focusing on arguably more immediate threats to staple crops.

### COFFEE PRODUCTION IN A CHANGING CLIMATE: SUPPORTING 25 MILLION FARMERS

Coffee is one of the world's most important agricultural commodities and the primary source of income for 125 million people globally.<sup>3</sup> Coffee beans are a labor-intensive, high-value crop that can maximize earnings from small landholdings, although coffee growers and laborers regularly endure hardships associated with this volatile commodity market. Ninety percent of the coffee that is traded is produced by smallholders, and it is on these small producers that damage to the coffee industry from climate change will fall most heavily, particularly as a large majority of the 25 million farmers who produce coffee may have few agricultural alternatives to provide their livelihoods.<sup>4</sup>

While coffee production has matured with time and technology, growing coffee berries has always been a delicate process. The coffee plant is highly sensitive to temperature and rainfall variations and has a narrow range of optimal conditions, outside of which bean quality and yield decline. Coffee flowers bloom only for about 48 hours, and the plant is vulnerable to disease and pests. Both *Coffea arabica* L. (Arabica) and *Coffea canephora*, syn. *Coffea robusta* (Robusta) require stable, predictable climatic conditions to flourish. Arabica is the higher-value variety that accounts for around 60% of export volume<sup>5</sup> and is the preferred choice for smallholders who produce coffee for export.

The stable, predictable, climate conditions that enable coffee production are projected to become less stable and predictable. Regional warming and increasingly erratic rainfall have already increased the frequency of poor coffee harvests in many countries, affecting regional and global prices. Further climate change will alter the geographic distribution of areas suitable for growing both main varieties of coffee. By 2050, the

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warming climate could shift the optimal altitude for coffee production from 1,400 m (in 2020) to 1,600 m.<sup>6</sup> As the climate zones suitable for coffee production gradually “climb up the mountain,” new geographies for coffee production will emerge as production becomes viable for higher-altitude smallholdings, while farmers at lower altitudes may no longer be able to produce their cash commodity crop.<sup>7</sup>

But any new opportunities to grow coffee may be short-lived as the climate continues to change and geographical suitability continues to shift. Investment in coffee trees and trade systems take 8-15 years to come to fruition,<sup>8</sup> reducing the window of opportunity for smallholdings that find themselves passing through a climate optimal zone, making planning for such shifts difficult. While the few, large trading and roasting companies will continue to purchase from wherever coffee beans are available, smallholders are less flexible. Without adaptation or crop diversification small producers will lose income, but even successful adaptation to the impacts of climate change on coffee production will increase costs, whether it is from purchasing pesticides and fungicides, diversifying crops, installing irrigation systems or planting shade trees. Smaller producers already tend to have more limited resources,<sup>9</sup> and declining crop yields and quality will put further strain on their finances. In turn, this may impair their ability to respond to disease outbreaks or undertake other climate adaptation measures, creating a vicious cycle that may be difficult to reverse.

The potential loss of income for small coffee growers and laborers from climate-driven shifts in agriculture threatens not only the economic security of households across coffee-producing regions, but could also have a significant impact on national economies in a number of developing countries. In a climate-disturbed world, this temperamental bean that supports the livelihoods of millions could become an increasingly unreliable bet.

#### CLIMATE-RELATED PATHOGEN – COFFEE LEAF RUST

Coffee leaf rust (*Hemileia vastatrix*), illustrates the potential of climate-driven damage to coffee production as an epicenter of risk. This climate-related fungal disease infects and destroys the leaves of Arabica coffee trees, impeding photosynthesis and gradually killing the trees. The fungus cannot survive below 50°F/10°C, which previously limited its spread above elevations of 1,600 m. Warm, humid conditions, rainy weather and warming night-time temperatures have expanded this ceiling to 2,000 m, bringing more coffee plantations within its reach. Historically, leaf rust has been a manageable risk because it is limited to certain elevations and climatic conditions. However, as with other climate-exacerbated stresses, the coping and risk management methods that have been developed for historic climates are unlikely to remain reliable.

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## RISK ZONE – CENTRAL AMERICA

Coffee is the most profitable export crop in coffee-growing regions of Central America. The industry directly employs more than 2 million people in Central America and the Caribbean, with hundreds of thousands more employed by suppliers and in service industries.

A severe outbreak of coffee leaf rust in 2012/2013 impacted half of the approximately 1 million acres of coffee cultivated in Central America. Occurring simultaneously with a global fall in coffee prices, it meant Guatemala, El Salvador and Honduras saw the total value of their export coffee crops decline from about US\$3.4 billion in 2011/12 to US\$1.6 billion in 2013/14. The region saw more than half a million job losses and all three countries declared national states of emergency.<sup>10</sup>

While the reasons for the severe 2012/3 leaf rust outbreak are complex, a 30% fall in coffee prices resulting from broader market issues contributed to poor institutional and farmer capacity to respond effectively to the early stages of the outbreak<sup>11</sup> and limited funds available for fungicide and fertilizer to strengthen trees. It is likely that increased climate variability was an important factor behind the scale of the outbreak.<sup>12</sup>

For smallholders and harvesters in this region, income from coffee is essential for purchasing food and supplies for the cultivation of staple grains.<sup>13</sup> The loss of income that accompanied the leaf rust outbreak caused significant food insecurity, with the Famine Early Warning Systems Network and World Food Program both warning of potential famine.<sup>14</sup> These dynamics acted as push factors for both internal (primarily urban) and cross-border migration, a routine coping strategy for Central Americans in the agricultural sector to improve food security but one that makes migrants vulnerable to human traffickers and which can exacerbate underlying security fragilities. The coffee rust epidemic, as part of the wider context of economic stagnation and poverty, was one potential factor contributing to the 2014 surge in unaccompanied minors seeking to enter the United States, almost all of whom came from Guatemala, El Salvador or Honduras.<sup>15</sup>

These trends are layered on top of pre-existing tensions and vulnerabilities. Mesoamerica, and these “Northern Triangle” countries in particular, struggle with narcotrafficking and serious organized crime resulting in some of the highest murder rates in the world.<sup>16</sup> Youth who find themselves unemployed in urban areas may have few economic options other than getting involved with gangs, and the level of gang activity and violence can, in turn, act as a push factor for migration as well as limit economic growth and compromise state capacities.

## POTENTIAL FRAGILITY REPERCUSSIONS OF CLIMATE IMPACTS ON COFFEE

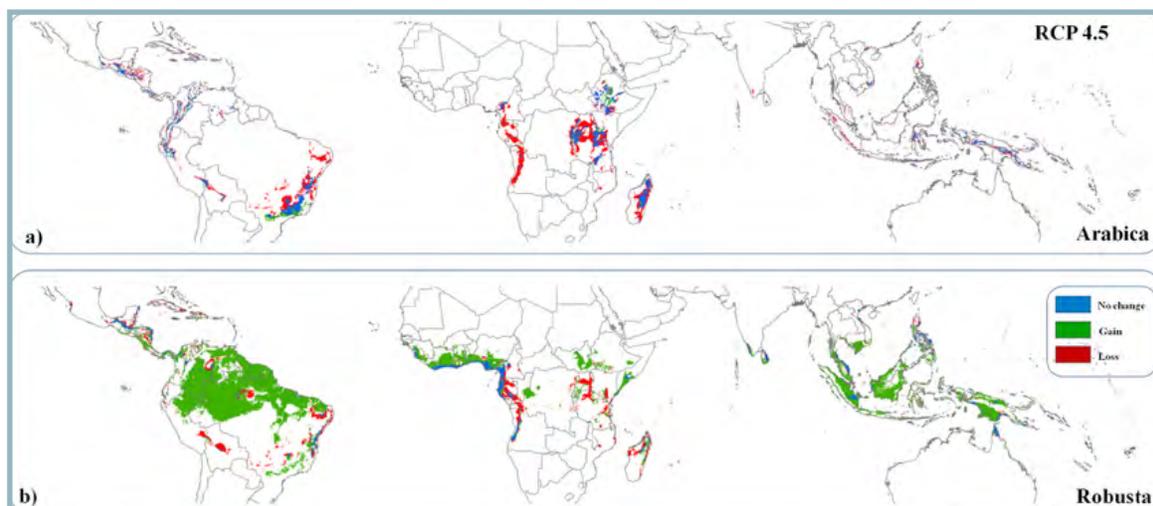
Not all regions where climate change will significantly affect coffee production have the underlying security dynamics of Central America. However, because so much coffee is grown by small producers, climate-driven disruption to coffee production is likely to impact livelihoods and economic security, and have socioeconomic repercussions wherever it occurs. That includes in other regions with underlying security fragilities, where the effect of unemployment, contracting livelihoods and poverty on local security will emerge in context-specific ways.

The gross value of production of green coffee is over US\$16 billion annually.<sup>17</sup> The table below indicates the countries in which coffee exports (both green and roasted beans) contributed the highest percentage of GDP from 2003-2013.<sup>18</sup>

	Country	Percentage of GDP from green and roasted coffee exports, averaged over 2003-2013
1	Honduras	4.53
2	Nicaragua	3.24
3	Burundi	2.83
4	Ethiopia	2.33
5	Vietnam	1.88
6	Guatemala	1.67
7	Uganda	1.60
8	Papua New Guinea	1.41
9	El Salvador	1.12
10	Rwanda	1.08
11	Costa Rica	0.95
12	Colombia	0.75
13	Côte d'Ivoire	0.56
14	Peru	0.52
15	Kenya	0.49
16	United Republic of Tanzania	0.39
17	Guinea	0.35
18	Cameroon	0.32
19	Brazil	0.25
20	Jamaica	0.21
21	Togo	0.20
22	Belgium	0.17
23	Switzerland	0.16
24	Indonesia	0.14
25	Madagascar	0.12

Many of the countries that get the most economic benefit from coffee also face underlying fragilities such as a history of recent conflict, weak governance and institutions, rapidly growing youth populations in the context of low economic development and high unemployment, serious organized crime and other security issues.

This map<sup>19</sup> of regions projected to be suitable for Arabica and Robusta cultivation in 2050 helps identify the countries that face the biggest risks to their coffee industries from climate-driven changes in coffee production.



SOURCE: Ainhoa Magrath and Jaboury Ghazoul, “Climate and Pest-Driven Geographic Shifts in Global Coffee Production: Implications for Forest Cover, Biodiversity and Carbon Storage,” *PLoS One* (2015)

Countries at particular risk include:

### HONDURAS

Honduras has both the highest percentage of GDP derived from coffee exports and large areas of the country where Arabica is currently cultivated that are projected to become unsuitable by mid-century. A modest increase in areas suitable for Robusta is unlikely to compensate for this loss, which could present a significant challenge to economic growth and development, heavily impacting the livelihoods of smallholder producers. The repercussions of this change could interact with the drivers of instability in Honduras by spurring urban migration and limiting alternative livelihoods, which could increase the likelihood of involvement in illicit economic activity. Honduras’s underlying security fragilities include narcotrafficking and serious organized crime, political instability and weak state institutions.

### UGANDA

20–30% of Uganda’s foreign exchange earnings are provided by coffee exports, and 90% of Uganda’s export coffee crop is produced by smallholders on farms ranging from 0.5 to 2.5 hectares.<sup>20</sup> A significant segment of the country’s population derive their livelihoods directly from coffee production – as such, coffee is also important for income and food security.

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The impacts of climate change are already being felt on livelihoods, food security and migration patterns in Uganda.<sup>21</sup> Uganda grows rain-fed Arabica and Robusta coffee varieties, with climate change expected to bring a significant reduction in the area suitable for cultivating both. Uganda's coffee industry does not have a history of responding well to shocks,<sup>22</sup> and disrupted coffee production has the potential to compound underlying fragilities in the country. These include recurring food insecurity, a large and growing youth population, legacy of conflict, emergence of armed rebel groups, the effects of an autocratic government and fractiousness in political parties and election violence.<sup>23</sup>

In countries that face the loss of coffee as a viable export commodity, managing the threat to livelihoods and corresponding security risks might require finding alternative cash crops that can manage in a changing climate. Crops such as cacao might offer a viable alternative in some places, but even successful transitions to other crops will involve an inevitable degree of economic turbulence, and require investment and planning over significant periods of time. In some cases, weak institutional capacity in countries affected by instability and conflict could present a barrier to effective adaptation of the sector.

#### STEPS TO MINIMIZE ADVERSE OUTCOMES

Managing the risks to livelihoods, economic development and stability posed by the effects of climate change on coffee production will require first and foremost a better understanding of how climate stress to coffee production can increase fragility. If this risk is not being monitored, it could easily be missed by those whose responsibility it is to prepare for and manage shocks and stresses, including increased fragility risk and damage to livelihoods.

There are other measures that are also important to preparing for these changes. These include adapting coffee production through more robust crop varieties, new pest and disease management techniques and strengthening early warning systems. It will also be necessary to support livelihood diversification for producers and to promote local-level adaptation and resilience, particularly where state-level capacities are weak. The coffee industry has begun to incorporate food security concerns into its sustainability agenda and supply chain risk analysis; continuing to do so will help to improve resilience in the face of climate-related risks.

Recent climate impacts on the market have shown that we should prepare for the unexpected in the near-term, and expect major geographic shifts to coffee production in the medium-term. As one of the world's most valuable agricultural commodities, and a highly climate-sensitive crop produced by smallholders in countries facing an array of political and socioeconomic challenges, climate risks to the unassuming coffee bean could have an outsized impact on stability if ignored.

## NOTES

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