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Anticipating the Implications of Post-COVID-19 Food Shortages for US National Security

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Food Security and Unrest in the Past Three Decades

Increased food insecurity is a national security concern. The US Global Food Security Strategy (FY17–21) emphasizes food insecurity's double-sided relationship to conflict—one that can both contribute to instability as well as result from it.[2]

- **2019 -** The removal of bread and oil price subsidies helped ignite the protest that subsequently ended Omar Al-Bashir's thirty-year reign in Sudan[3]
- **2015 -** The Intelligence Community dedicated its 2015 Assessment to global food security, and warned that "declining food security will almost certainly contribute to social disruptions or large-scale political instability or conflict, amplifying global concerns about the availability of food"[4]
- **2010–2011 -** The rise in food prices was a major driver of the Arab Spring[5]
- **2007–2008 -** Sharp rises in food prices lead to riots in over 40 countries, including toppling of governments in Haiti and Madagascar[6]
- **1990s -** Food insecurity linked with armed conflict in Ethiopia, Rwanda and Sudan[7]

Current Circumstances

Countries around the world are working to prevent food crises brought on by the coronavirus pandemic—which in many cases threaten to transform fragile environments into conflict hotspots. The World Food Program estimates COVID-19 and its consequences could almost *double the number* of people suffering acute hunger by the end of the year, with the potential to prompt mass migration and political unrest in many regions already struggling with conflict. In addition to an unprecedented humanitarian crisis, food insecurity may also fuel extremist activity, protests, and political violence - a possibility proven dangerously real during the 2007-2008 global food crisis, which ignited unrest in over 40 countries.[1] In many of these countries, hunger served as the tipping point for citizens to turn to protests and conflict.

In a similar manner, COVID-19 is accelerating insecurity among populations that are already vulnerable. Border closures, lockdowns, and curfews have dramatically *altered supply chains and livelihoods* in countries that rely heavily on labor-intensive activities like agriculture, manual labor, or subsistence farming. *Worldwide demand for oil and cash-crops has steeply declined* since the start of the pandemic, industries that account for substantial portions of government revenue and household income in many developing

1. Scott Aughenbaugh, Kristen Hadjuk, Melissa Hersh, and Kimberly Flowers, "What is Global Food Security," in The Sky is the Limit: Geospatial Data, Global Food Security, and Political Stabilities, Washington, DC: Center for Strategic and International Studies (2017), pp. 1-3.

2. U.S. Government Global Food Security Strategy (Sept. 2016), p. 3.

3. Judd Devermont, "Bashir's Removal Is Just the Beginning of the Sudanese Transition", Washington, DC: Center for Strategic and International Studies, 12 April 2019, *link*.

4. Office of the Director of National Intelligence, Intelligence Community Assessment: Global Food Security (2015), p. I.

5. Andrew Holland, "The Arab Spring and World Food Prices," American Security Project (2012), pp. 1-4.

6. Cullen S. Hendrix, "When Hunger Strikes: How Food Security Abroad Matters for National Security at Home," Chicago Council on Global Affairs (2016), pp. 1-14

7. Marc J. Cohen and Per Pinstrup-Andersen, "Food Security and Conflict," Social Research, 66.1 (1999), pp. 375-416.

countries. This volatile combination of collapsing economies, shortages of imported goods, and restricted livelihoods holds the potential to transition fragile regions into hotspots for conflict and instability. While food security is often seen as a rural challenge, this crisis will have major effects in urban areas as well, as regimes with pre-existing social, economic, and political fissures struggle to manage both old and new challenges.

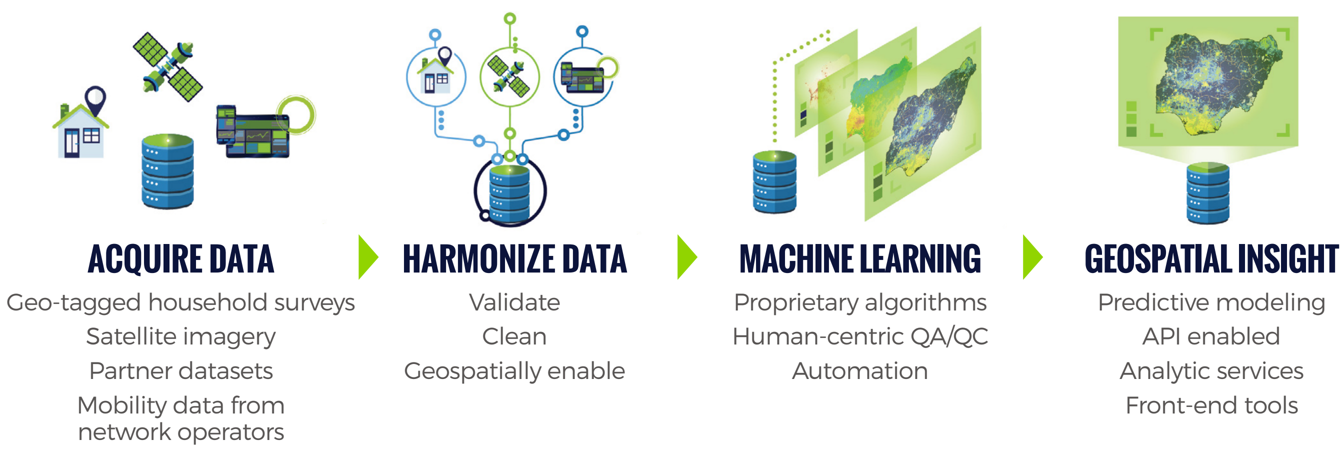
For illustration, conflict-prone regions of Africa, southeast Asia, and Latin America are already beginning to experience devastating effects from the pandemic. In Pakistan, rural food producing areas *like Sindh province* already suffered a series of climate-related hazards and high rates of child stunting and wasting before the pandemic, and cities like Lahore are seeing *food price increases of at least 25% coupled with average income reductions of 60%*. Lockdowns in the Nigerian city of Abuja and Lagos and Ogun states, and closed borders with neighboring Benin contributed to *food price increases up to 50%* as local farmers faced roadblocks getting their food to markets. In fragile contexts like these, the pandemic's potential effects on food production, incomes, and trade may push events over the edge, fueling grievances and unrest. **As the U.S. government and other actors assess and plan for COVID-19's impact, mapping these driving factors and vulnerabilities will be integral to anticipating—and mitigating—food insecurity and its secondary risks.**

Potential Solution

Mapping pre-existing vulnerabilities to food insecurity and instability will indicate which areas may experience the most severe destabilizing effects of the COVID-19 pandemic. However, the localized population and livelihood data required to produce such anticipatory analysis has traditionally been difficult or impossible to obtain for many geographies of interest to the U.S. government. In what follows, we illustrate how a **combination of OSINT data and advanced machine learning (ML) techniques can now yield unprecedented insight into the population-centric drivers of food insecurity and resulting instability in the post-pandemic world**.

Methodology

Foundationally, Fraym uses advanced ML to combine survey data and satellite imagery—specifically using harmonized survey data to 'train' a series of models which use remote sensing data as inputs to calculate population characteristics with 1km² resolution. The end product is a consistent, geospatial 'surface' of local population characteristics that covers an entire country. Fraym's approach can be applied to produce dozens of socioeconomic, demographic, and behavioral indicators for countries across Africa, Asia, Eastern



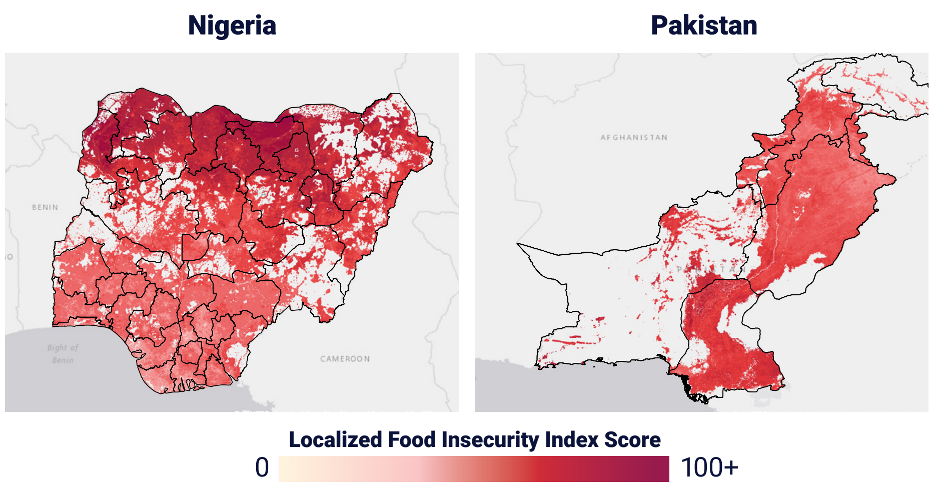
Europe, Latin America, and the Middle East.

This unique geospatial product provides the information necessary to identify and target at-risk areas, address their vulnerability to food insecurity and ultimately, illustrate the underlying drivers of conflict at the hyper-local level. To this end, Fraym constructed a Localized Food Insecurity Index adapted from components in the International Food Policy Research Institute's (IFPRI) Global Hunger Index (GHI). Policymakers have relied upon the GHI since 2006 for identifying food security threats and vulnerabilities at the national level. **Fraym's goal was to make the same insight available for decision-makers at the hyper-local level.** GHI scores are generated annually using four indicators: undernourishment, child wasting, child stunting, and child mortality (See Table 1). Each component is standardized according to the examined countries' highest observed levels of each indicator between 1988 and 2013 and aggregated to produce a score from zero to 100, where a score above 35 is considered to be alarming.[8] Please see Appendix 1 for more details on the formulas and inputs used.

The resulting **Localized Food Insecurity Index** is a highly detailed targeting tool that maps populations vulnerable to food insecurity. With this information, efforts to address food security and its downstream effects can be designed and implemented at the level of individual communities, instead of a country-or regional-level. Potential applications include:

- Illustrating areas at greatest risk for food shortages to inform **humanitarian assistance planning and resource allocation**
- Providing critical context and situational awareness for **intelligence analysis and operational preparation** in these environments
- Modeling the likelihood of unrest or extremist activity as a result of food insecurity to provide critical **indications and warnings** for priority areas of interest
- Anticipating likely economic consequences of food insecurity, particularly in the context of **geopolitical competition**

Below, we outline potential use cases for Fraym's Localized Food Insecurity Index in more detail:



Gray areas in each country are 1x1 square kilometer grids with less than 30 people.

Figure 1: Examples of Localized Food Insecurity Index Maps for Nigeria and Pakistan. These maps can be created for over 100 geographies.

8. Scores can be categorized into five levels of severity: low (less than 10), moderate (between 10 and 20), serious (between 20 and 35), alarming (35 to 49), and extremely alarming (50 or higher).

Application One: Situational Awareness

The U.S. consulate in Karachi, Pakistan's largest city with *16 million people*, is a known potential target since it was hit by bombings between 2002 and 2006. In the pandemic era, the installation sits in potential "dry tinder" due to nearby economic inequality and likely food insecurity. How can Fraym's Localized Food Insecurity Index provide useful input for a risk analysis of this point of interest?

As shown in Figure 2, Fraym's Index illustrates a disparity in the level of food security between the consulate's location and the surrounding three-kilometer radius. The neighborhood in and around the consulate scores between 25 and 30, notably lower than the city's average of 45. Meanwhile neighborhoods just three kilometers away, such as Kalakot and Usmanbad, score above 60, which is considered 'extremely alarming' and on par with the severe food crises in countries like Yemen. These scores lay bare the inequality that exists in the city, and demonstrates where the food security situation is likely to worsen as the global economic downturn continues.

Using additional Fraym layers for context, we can dive deeper into the driving factors behind the risks that the Localized Food Insecurity Index has exposed. Using Fraym's socioeconomic classification methodology, we see that the neighborhood around the consulate, with 120,000 people, is 60 percent middle class, compared to only 43 percent in the Kalkot and Usmanabad area (107,000 people). Similarly, financial inclusion—a helpful proxy of a household's resilience—is 19 percentage points higher in the consulate neighborhood area versus Kalkot and Usmanabad area (65 percent versus 46 percent).

What do these factors tell us? While the consulate is surrounded by a relatively richer, more food secure, and economically resilient population, highly vulnerable populations are just a few kilometers away. Deteriorating livelihoods due to the economic fallout of the COVID-19 pandemic will exacerbate food insecurity in the coming months—and coupled with the other economic vulnerabilities present in these areas—the likelihood of unrest or instability in this area will rise.

An analyst could use the same approach to guide risk analyses in other geographies of interest—assessing specific points, communities, or regions of interest to illustrate the underlying social and economic factors that may drive future instability in these areas.

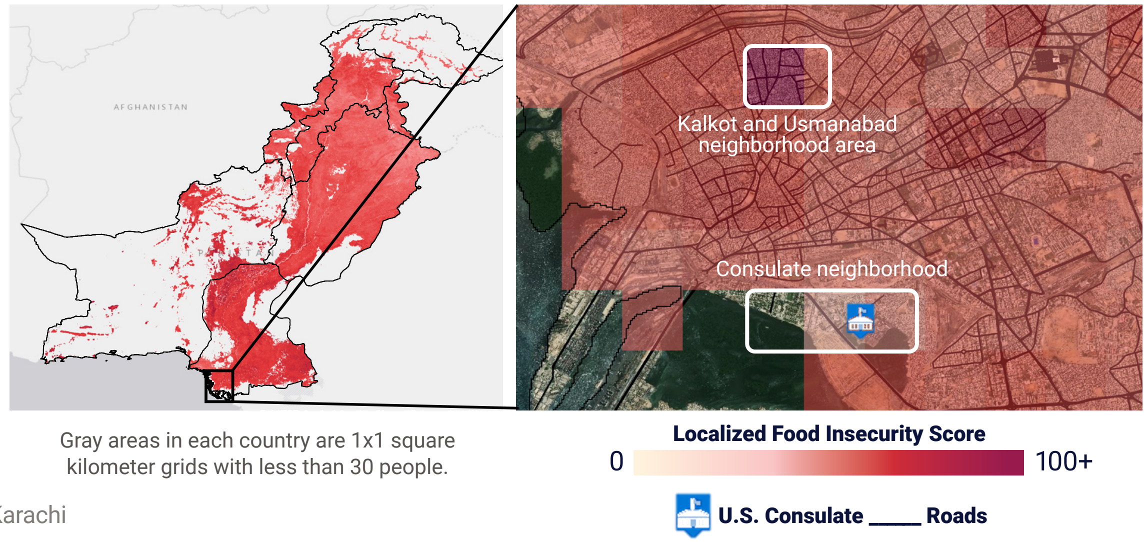


Figure 2: Karachi

Application Two: Mapping Humanitarian Needs

Many urban and rural markets around the world are absorbing dual food supply and demand shocks due to the COVID-19 pandemic. The implications of these shocks are particularly acute across much of the developing world—and will likely lead to widespread hunger. For example, food shocks in Nigeria threaten to exacerbate the food security circumstances across the country. In May 2020, President Buhari announced Nigeria had *'no more money'* to pay for rice imports, and with local production delayed or adversely affected by border closures, the country faces an impending rice shortage. In cases like this, how can the Fraym Localized Food Insecurity Index help decision-makers target humanitarian relief for maximum effect?

It is no surprise that the Famine Early Warning System Network (FEWS NET) projects that parts of Zamfara, Sokoto, and Katsina states will move from phase two to three (out of five), or to the 'crisis' stage, between June and September 2020 (see Figure 3). All three states rely heavily rice production for food and income. But effective interventions in these states will demand localized insight on at-risk communities and their unique characteristics and needs. To do this, we can leverage Fraym's Localized Food Insecurity Index and examine variation between communities.

For example, in Zamfara state, we see that communities lying between Talata Mafara and Bakura local government areas score between 80 and 85 on the Index, or 10 to 15 points higher than the state average of 69 (see Figure 4). Coupled with the fact that rice prices have risen more than 10 percent between March and April 2020 in Zamfara state, households in these communities will have their purchasing power greatly diminished and their food supply further stretched. On the supply side, import restrictions have *prevented farmers from obtaining inputs*, such as fertilizer and seeds, and beginning their planting seasons. Concurrently, border closures and lockdowns have prevented food from reaching local markets. According to Fraym data, in Bakura and Talata Mafara alone, 100,000 people are living in households that rely on agricultural enterprises as their primary source of income—households without adequate

June - September 2020

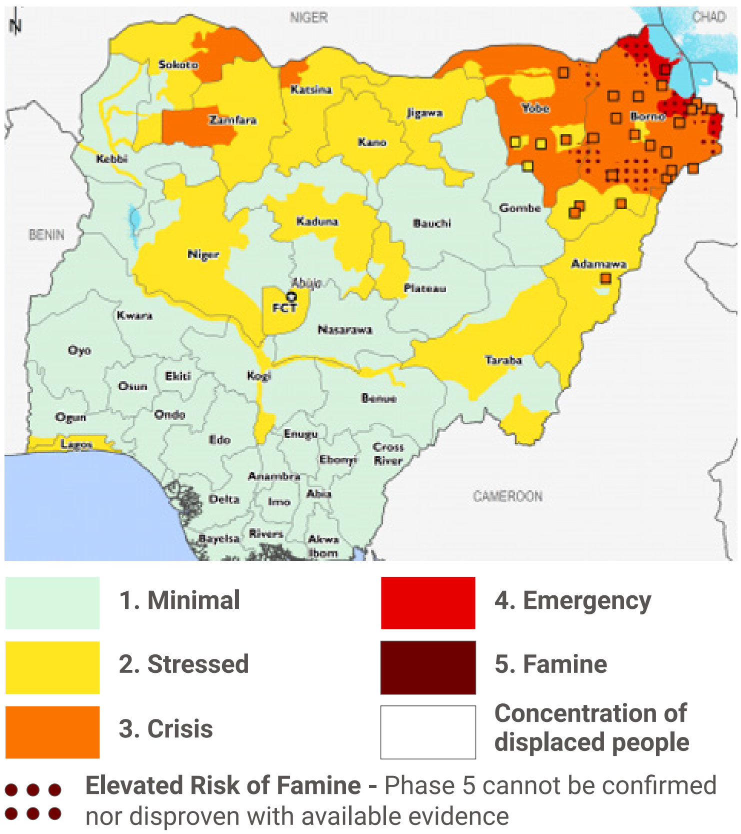


Figure 3: FEWS NET Projection – Nigeria

9. Phase 3 of FEWS is defined as 'Have food consumption gaps that are reflected by high or above-usual acute malnutrition' or 'are marginally able to meet minimum food needs but only by depleting essential livelihood assets or through crisis-coping strategies'. *https://fews.net/west-africa/nigeria*, *https://fews.net/IPC*

10. *https://fews.net/sites/default/files/documents/reports/NG_LZ_2018.pdf*

11. The rise in rice prices increased by more than 10 percent across sources (locally or imported), and distribution channels (retail and wholesale channels). Prices were obtained from the World Food Prices database.

farming input will likely experience food shortages in the coming months. Further, with tensions escalating due to *farmer-herder conflicts and increasing infiltration from Islamists extremists in North-West Nigeria,* this instability will only serve to disrupt planting and harvesting cycles. Securing market access and providing food aid relief to households in areas like Bakura and Talata Mafara will be critical to reducing the destructive impact that these households face from demand and supply shocks in North-East Nigeria. Similarly, decision-makers can use the Fraym Localized Food Insecurity Index to map and quantify needs and inform humanitarian resource allocation in at-risk countries across Africa and around the world.

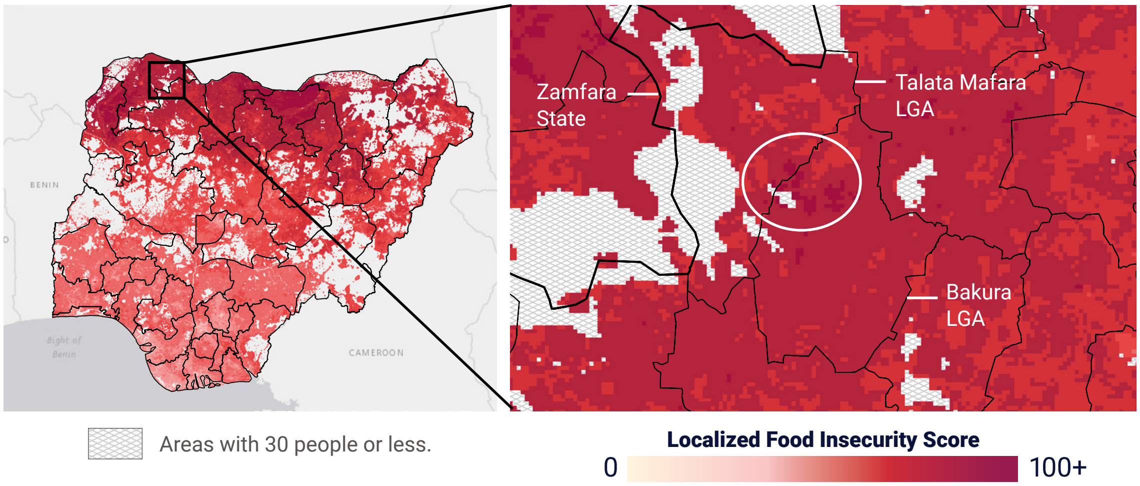


Figure 4: Example of Localized Food Insecurity Index in Zamfara state, Nigeria. Fraym's index provides much more detailed context on the local food security situation within a FEWS NET high-risk area

Application Three: Tipping and Cueing

Fraym's Localized Food Insecurity Index can be used to identify city neighborhoods that have the greatest potential for unrest in the aftermath of COVID-19. For example, data from the Armed Conflict Location and Event Data Project (ACLED) reveals a strong relationship between COVID-19 protests and food insecurity in Lagos, Nigeria. On April 3, three people were injured when police intervened to stop a gathering in the Mushin neighborhood. *On April 20, hundreds of youth* demonstrated in Oke Odo neighborhood over coronavirus restrictions and lack of state support. Less than 15 miles away, hundreds of workers at the Chinese-managed *Ogun Guangdong Free Trade Zone (OGFTZ)* demonstrated over coronavirus restrictions, destroying the gate, sentry box, and nearby vehicles.

The neighborhoods of Surulere, Lekki, Oke-Odo, Oto, Igbesa, and Alimosho—all locations of riots and protests since March 2020—score over 50 on Fraym's Localized Food Insecurity Index, a figure that is considered "alarming" and well above the city's average of 35. Sitting close to a nerve center of the Nigerian economy—and a major center of Chinese investment—disturbances in these food-insecure neighborhoods have the potential to compromise critical port and terminal infrastructure that carried $137 billion and more than 75 percent of Nigeria's imports in 2017. A worsening economic downturn and underlying social tensions may lead to more similar protests and demonstrations.

In the city of Abuja, riots and protests related to the provision of COVID-19 supplies have also occurred near food insecure areas. On 27 April, residents engaged in a street-fight with police officers in the Kubwa neighborhood during the distribution of coronavirus palliatives following rumors that officials were planning to hijack the relief items, leaving several police officers injured. On 16 April, youth in the Lugbe neighborhood fought over the delivery of food supplies, damaging a delivery truck in the process. The Localized Food Insecurity Index of these areas is over 40 on a 100-point scale, compared to the city average of 35. Notably, these scores are not significantly higher than the city average, which suggests that the city as a whole could experience unrest if the economic shocks continue.

Fraym's Localized Food Insecurity Index gives an analyst the ability to assess a large geographic area, identify potential 'hotspots,' add in other contextual data, and determine quickly where additional investigation or investment is warranted. This kind of application can be scaled to any city, region, or country of interest.

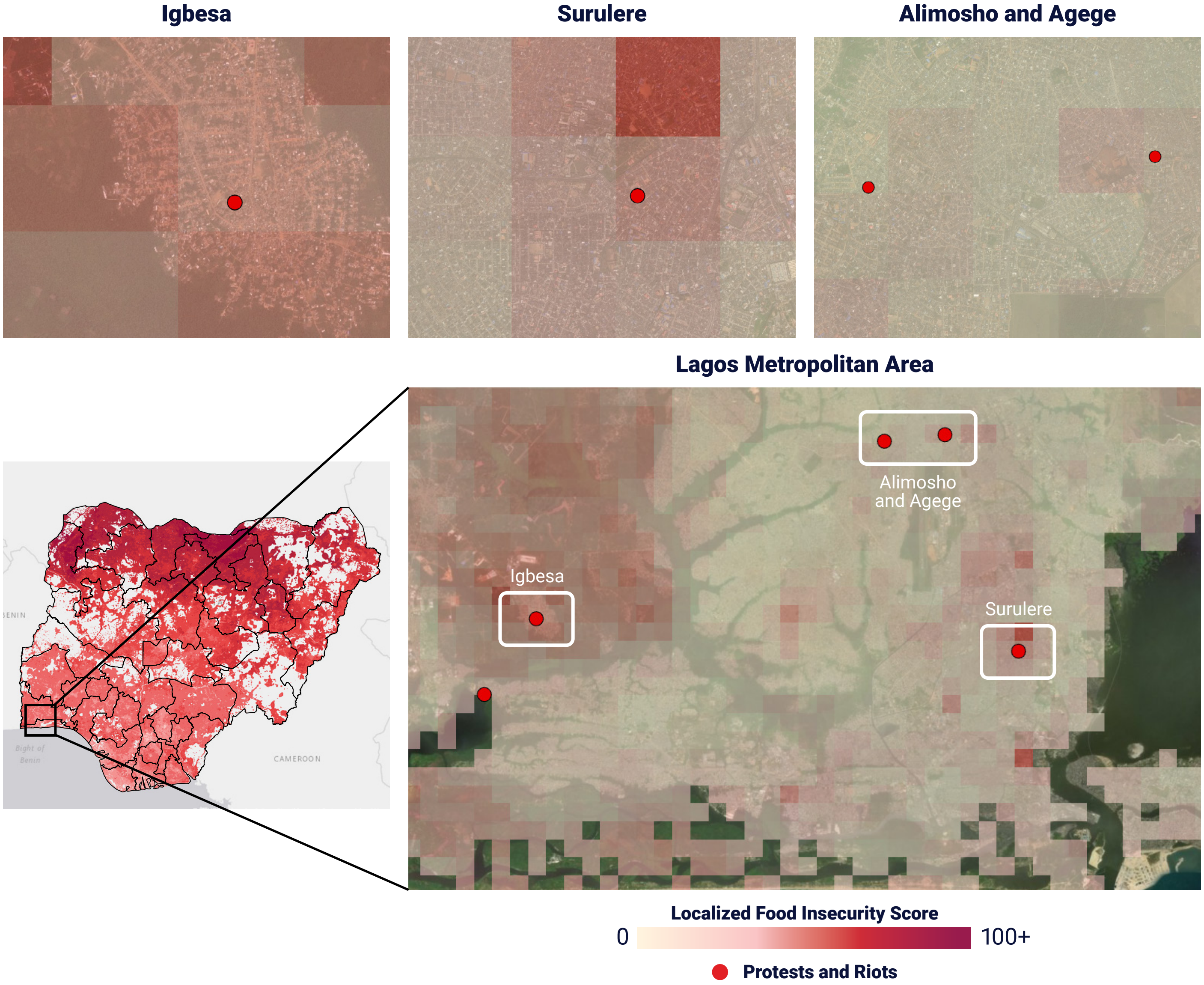


Figure 5: Food Insecurity in Unrest-Prone Areas of Greater Lagos, Nigeria

Appendix 1: Index Methodology

Fraym produced data layers covering each of the four components at the 1km² level with only modest definitional adjustments listed in Table 1. Next, following the longstanding GHI approach, each data layer component was divided by the highest observed levels of each indicator (from 1988 to 2013) and multiplied by one hundred to obtain a standardized score for each component (see Figure 6). These scores were weighted according and then aggregated to produce a final score (see Figure 7).

Components	Definition	2018 Highest Observed Level
Child Mortality (CM)	Mortality rate of children under the age of five.	35%
Child Stunting (CST)	Share of children under the age of five who are stunted: defined as two standard deviations from median height for age of reference population, reflecting chronic undernutrition);	70%
Child Wasting (CWA)	Share of children under the age of five who are wasted: defined as two standard deviations from median weight for height of reference population, reflecting acute undernutrition)	30%
Undernourishment (PUN)	Share of the population that is undernourished: defined as caloric intake that is insufficient to meet the minimum energy requirements necessary for a given individual). Please see Fraym's technical methodology note for further details on this calculation.	80%

Table 1: IFPRI, Global Hunger Index.

$$\text{Component Standardization} = \frac{\text{Component}}{\text{Highest Observed Level of Component x 100}}$$

Figure 6: Standardization formula

$$\text{Localized Food Security Index Score} = \tfrac{1}{3}\text{ Standardized CM} + \tfrac{1}{3}\text{ Standardized PUN} + \tfrac{1}{6}\text{ Standardized CWA} + \tfrac{1}{6}\text{ Standardized CST}$$

Figure 7: Localized Food Insecurity Index score

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Dustin Homer
202.494.5193
d.homer@fraym.io

Address: 3101 Wilson Blvd., Suite 300, Arlington, VA 22201
Cage Code: 7QVL1
DUNS: 080416518
US Small Business