Background

- Hurricane María devastated the island of Puerto Rico in 2017 drawing worldwide attention to a major humanitarian crisis for food security. What many may not realize, however, is that the situation on the island was desperate even before the disaster struck.
- In 2016, Puerto Rico imported 85% of the food for consumption and over a third of the population relied on federal food assistance as the dependent variable. The model included several predictor variables and the number of households receiving federal food assistance at the municipality level from the USDA agricultural census 2012.
- Federal food assistance data, also at the municipality level, were retrieved from the American Community Survey of 2016 (5-year estimates from 2012-2016). Households receiving food stamps/SNAP equivalent were used here as a proxy for food insecurity.
- In ArcGIS Pro, the food insecurity and coffee production data were retrieved from the American Community Survey of 2016 (5-year estimates from 2012-2016). Households receiving food stamps/SNAP equivalent were used here as a proxy for food insecurity.
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Results and Discussion

- The individual raster maps illustrated interesting trends in the spatial distribution of population, federal food assistance, and coffee production. In general, both coffee production and higher rates of food insecurity reached their peak in rural areas along the island’s interior, but they did not entirely overlap.
- Municipios with a larger number of farms tended to have an intermediate distribution of sun monocultures versus shaded-grown farms, whereas areas with a small number of farms had more extreme values (80% diversified shade-grown or 80% sun-grown monoculture).
- Adjuntas, Lares, and Maricao were the three municipios that received the highest value of the “Coffee Farm Diversification for Food Security Index.” These areas therefore had a high potential for coffee farm diversification to address local food insecurity. Interestingly, besides being among several municipios in the lowest class of total households, the three differed in all other composite maps suggesting that no single variable dominated the calculated index.

Methods

- Data on coffee farm abundance and farm management type (shaded diversified versus full-sun/monoculture) were obtained at the municipio level from the USDA agricultural census 2012.
- Federal food assistance data, also at the municipality level, were retrieved from the American Community Survey of 2016 (5-year estimates from 2012-2016). Households receiving food stamps/SNAP equivalent were used here as a proxy for food insecurity.
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Spatial Analysis

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Statistical Analysis

The statistical analysis revealed a significant positive effect of the total number of coffee farms on rates of food insecurity (F=2348, df=1, p<0.0001). There was also a slight, but significant, negative relationship between the percentage of monoculture farms and rates of food insecurity (F=2348, df=1, p<0.0001). This trend was likely driven by a couple municipios with relatively low rates of food aid and exclusively sun-grown monocultures. The plotted results supported a greater effect of the total number of coffee farms, rather than farm management type, since the darker circles are clustered in the upper half of the graph. Although the data here show no evidence of coffee farm diversification enhancing food security, they highlight target areas where coffee farms could be diversified to incorporate additional nutritional resources and alternative farmer income.

Limitations and Future Directions

- The present analysis was limited in a couple important ways. First, the approach focused on a handful of variables and assumed census data on federal food aid was an appropriate proxy for food insecurity. Second, the agricultural census does not differentiate farms with a single species of shade tree from those with a more biodiverse canopy, nor does it indicate whether farmers use the shade trees to supplement their income and/or nutrition.
- Field data collection with a higher spatial resolution and a more comprehensive ecological assessment would add rigor to the analysis.
- Hurricane María presented an opportunity to rebuild local agriculture on the island through sustainable and diversified food systems. The analysis will be expanded as agricultural and community census data on post-Maria Puerto Rico become available.

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Data sources:

- Flag: Wikimedia commons.