Exposure to Hurricanes Eta and Iota in Farming Communities in Northern and Central Nicaragua

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INTRODUCTION

Within just two weeks, Central America endured two late-season Category 4 hurricanes. On November 3rd, 2020, Hurricane Eta made landfall along Nicaragua's northern Caribbean coast. On the 17th of the same month, Hurricane Iota brought further devastation, landing a mere 15 miles further south than Eta. Persistent rainfall and heavy winds resulted in flash floods, river floods, landslides, and extensive agricultural, institutional, and residential infrastructure damage. Overall, the storms affected about 7.5 million people across Central America and the Caribbean region. The rapid succession of the two storms made separating damages difficult, but it is estimated that Eta was directly responsible for at least 165 deaths and $6.8 billion worth of damage. Iota directly contributed to an additional 67 deaths and $1.4 billion worth of damage, nearly half of which comprised damage in Nicaragua alone. Many fatal events occurred in the Jinotega Department of Nicaragua, where one mudslide buried at least 30 people. Loss of power, water, food, shelter, and telephone service was widespread throughout the region. This poster presents a spatial analysis of the intensity and movement of both hurricanes across Nicaragua. We will share a preliminary analysis of vulnerability and impacts focusing on crop devastation and landslides in northern and central Nicaragua. Finally, we will share an initial assessment of institutional and community response in smallholder farming communities, together with plans for follow-up field research. Future evaluation of survey data collected from smallholder farms will better our understanding of long-term impacts and the success of different hazard responses.

RESEARCH QUESTIONS

1. To what degree were farming communities in Northern Nicaragua's central highlands exposed to Hurricanes Eta and Iota in 2020?
2. What are our preliminary research findings and proposed strategies to assess:
   a. The institutional and community-level response to these hurricanes
   b. The relationships of agroecology-based diversification to disaster risk reduction
3. How could this preliminary research fit into the broader goals of our long-term research project to reduce vulnerability to hazards and build food sovereignty?

METHODS

Spatial Analysis: Utilizing ArcGis Pro, we mapped the hurricane tracks and wind swath impact over the region. A more specific analysis of the farming communities included use of precipitation, soil moisture, and crop failure data from November 2020 through January 2021.
Media and literature review: A synthesis of government, media, and humanitarian reports immediately following the hurricanes to assess impact and response.
Survey communities: Survey communities **(Fig 3)** were produced by drawing polygons around the community names from the 2014 survey of 311 farmers (Bacon et al. 2017), and then cross-checked with a local expert before they were changed from a .kmz file into GIS files and archived).

BACKGROUND

- **Nicaragua** is a vibrant and diverse country, with lower population density and more land area than Central American neighbors.
- We focus on Nicaragua's north central highlands, an area with a high concentration of smallholder farmers and part of Central American dry corridor, a global hotspot environmental hazards.

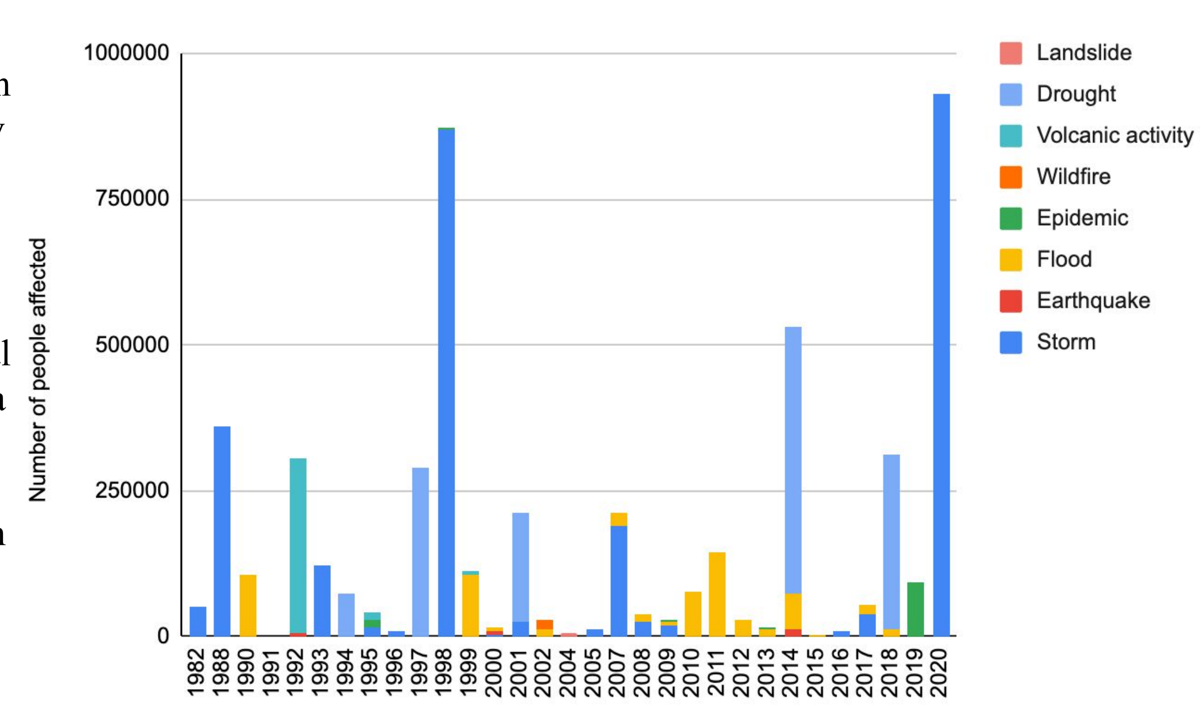

Figure 1. Summary of Environmental Hazards and People affected in Nicaragua, 1982-2020
Source: World Bank

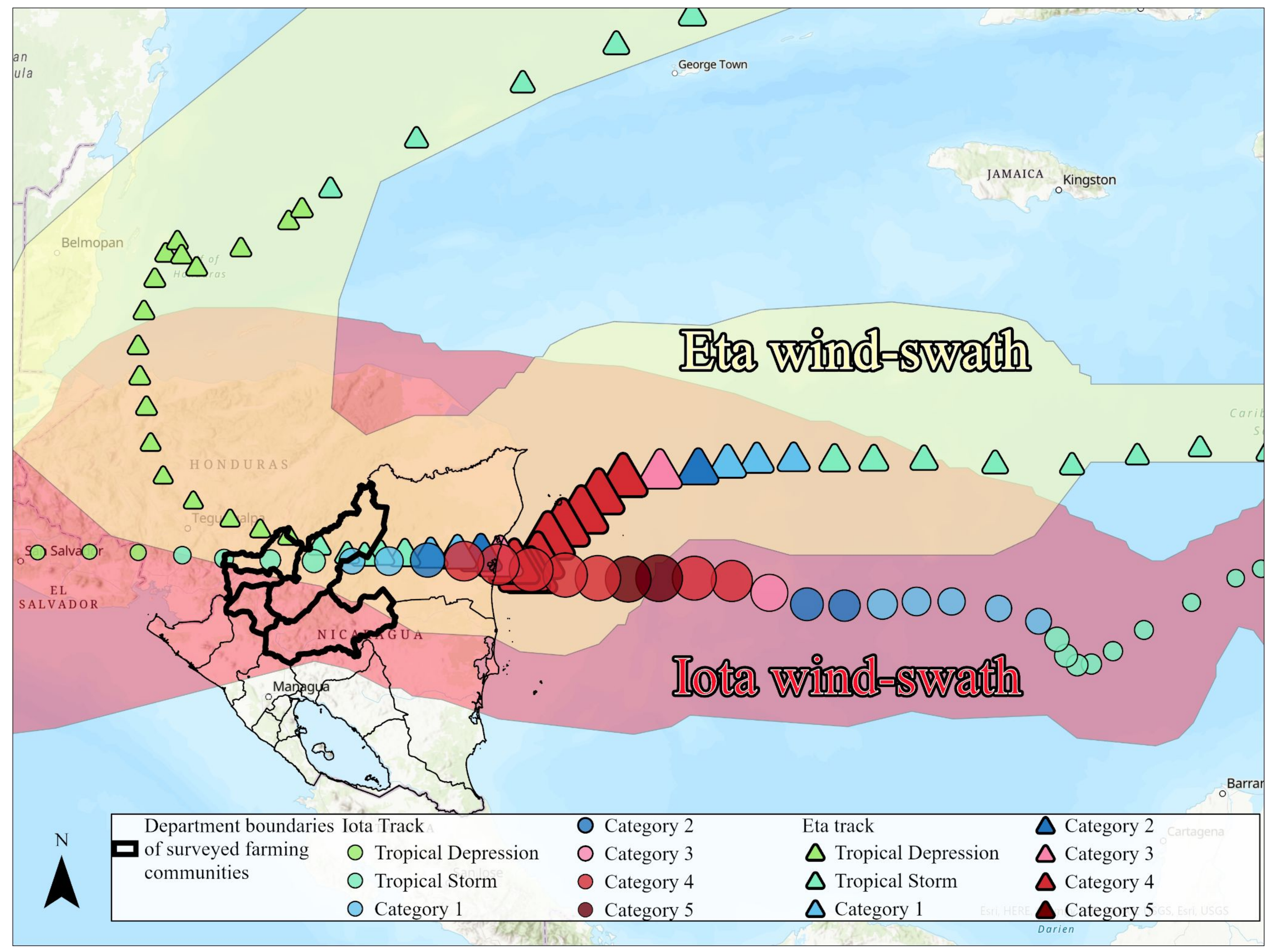

Figure 2. Map of Eta and Iota hurricane paths through Nicaragua
Sources: Data sourced from ArcGIS Online; DivaGIS

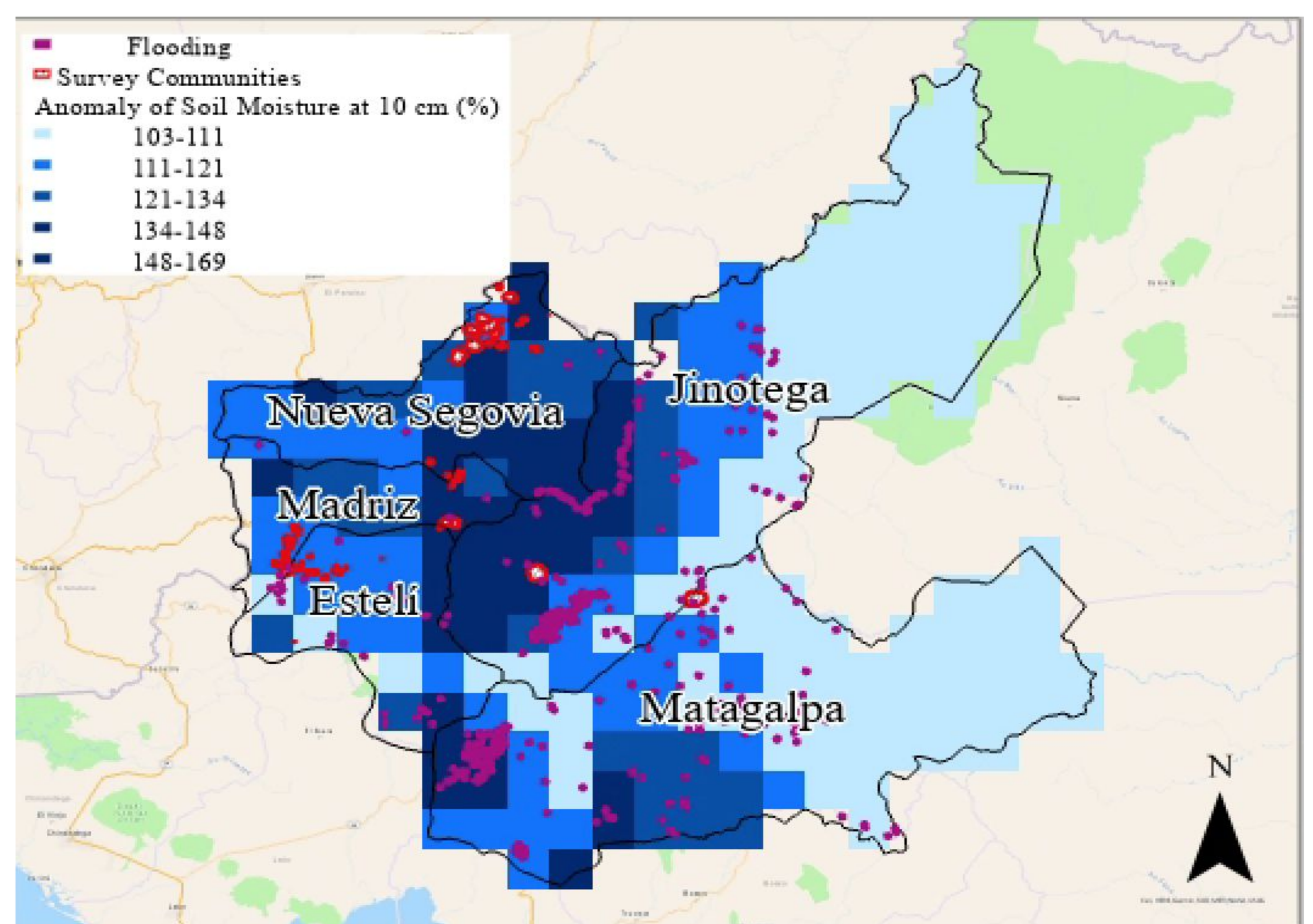

Figure 3. Map of departments in which the survey communities are located with flooding summaries and soil moisture anomalies, which represent the difference of November 2020 soil moisture content levels from a 30-year (November 1982-2011) mea**n. Sources:** ArcGIS Online; USGS

Department	Total Rainfall	November moisture difference from normal (0-10 cm)	Eta maximum wind speed exposure	Iota maximum wind speed exposure
Jinotega	Eta: 50-150 mm Iota: 75-100 mm	0.401 - 0.45 m^3/m^3 106-150%	80 mph Category 1	86 mph Category 1
Nueva Segovia	Eta: 75-100 Iota:25-100 mm	0.401 - 0.45 m^3/m^3 106-150%	34.5 mph Tropical depression	46 mph Tropical storm
Esteli	Eta: 75-150 mm Iota: 50-100 mm	0.401 - 0.45 m^3/m^3 106-135%	Not exposed to Eta winds	46 mph Tropical storm
Madriz	Eta: 50-100 mm Iota: 50-100 mm	0.401 - 0.45 m^3/m^3 106-150%	Not exposed to Eta winds	46 mph Tropical storm
Matagalpa	Eta:50-100 mm Iota: 50-200	0.401 - 0.45 m^3/m^3 96-150%)	Not exposed to Eta winds	86 mph Category 1

Notes: Total Rainfall NOAA Nov. 1-5 FOR ETA and Nov 16-17 for IOTA fro INITER. Source: NOAA (2) Data compares soil moisture for Nov. 2020 vs. 30 year mean for all Novembers from 1982-2011. Source: USGS

Preliminary Findings Continued

Table 2: Indicators of Institutional Emergency Response to Eta & Iota

Pre-impact Actions	Impacts During Hurricanes	Assistance During Hurricanes
SINAPRED planning meetings	# Rescue missions	Water bottles
# COMUPRED (Munnicial) coordination and planification Meetings	# Families/persons Affected	psychosocial support in shelters- volunteer based
Early Warning Comm.	# Death Reported	Food packages to shelters
# Persons Evacuated	# Ambulance trips and transfers	Medical attention in shelters
	# Persons Missing	Hand washing campaigns
	# Damaged Infrastructure	Humanitarian support for families (food, clothing & water)
		Prehospital medical attention
		Covid 19 5x30 kits (ppe) and other covid actions preventions
		Emergency Backpack
		Humanitarian assistance for volunteers
		# Mission national level (land, water and air)

Discussion

Table 3: Incidence of coping responses to common hazards (% of respondents naming each response – multiple responses allowed), 2017 survey

Coping response	Top 3 hazards	Coffee leaf rust	Crop loss due to drought	Increased food price	Decreased crop price	Crop loss due to flood
Harvest more wild food	72.8	0.7	4.6	100.0	0.0	100.0
Reduce spending	58.1	45.1	52.3	50.4	37.7	31.7
Spend from savings	55.1	41.5	54.2	47.3	34.0	18.3
Extra casual labor	40.1	24.0	36.6	33.3	24.5	6.7
Help from family or friends	38.9	19.3	30.1	20.9	21.7	11.7
Harvest more ag. products	30.2	2.5	2.0	4.7	3.8	100.0
Nothing in particular	26.3	12.4	17.0	14.7	19.8	21.7
Sell assets	23.7	5.8	9.8	7.8	5.7	1.7
Borrow	20.7	9.8	4.6	3.9	4.7	10.0
Aid from organizations	19.2	2.2	5.2	0.8	0.9	1.7
Sell future harvest at low price	15.3	1.8	10.5	3.1	0.9	3.3
Number of respondents naming this hazard in top three most severe	334	275	153	129	106	60

Note: Each respondent was asked to identify the top three most severe (greatest impact on their HH) hazards from a list of options. For each of those three hazards, they identified their various coping responses, with multiple responses permitted.

After Hurricane Mitch rocked Nicaragua in 1998 (See Fig 1), a seminal study found that agroecolgical farmers were more resilience than their conventional neighbors (Holt-Gimenez, 2002), our recent studies (Bacon and Sundstrom 2021), also show a degree evidence that farmers with more on-farm agrobiodiversity (a key element of agroecology-based diversification) has greater dietary diversity following a drought.

Next Steps

Initial Conclusions - Jinotega, Matagalpa, and Nueva Segovia were the most impacted of the 5 departments of our study area. However, each of the communities was exposed to severe wind exposure and rainfall. This redirects our future study to focus on how the communities responded to and recovered from the these hazards.

Next Steps - In addition organizations, we are especially interested in which institutions count when it comes to reducing vulnerability to hurricane exposure, and helping households maintain food insecurity, dietary diversity, and a greater sense of autonomy.

We will use a long-term relationships with organized smallholders and participatory action research to co-construct findings and training materials about which types of diversification are more likely to reduce vulnerability and build food sovereignty.

References

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