Climate Security in Somalia: *Vulnerability to River Flooding*

Background

Somalia is ranked by the Notre Dame Global Adaptation Index (ND-GAIN) as the country most vulnerable to climate change. Situated in the Horn of Africa and at the edge of the Sahara Desert, Somalia has two rainy seasons, the Gu (March-June) and the Deyr (October-December). The Gu season has historically produced higher precipitation but the Deyr rains are now more intense, causing severe flooding in many parts of the country. Deyr season flooding is an important trend to study because it occurs right before the lean season and could hurt food security if enough people and cropland are affected.

The generally accepted definition by the Intergovernmental Panel on Climate Change (IPCC) states that vulnerability is a function of exposure to harm, sensitivity to harm, and level of adaptive capacity. Unfortunately, some of the countries most exposed to the effects of climate change are also especially sensitive and least capable of coping. Somalia, which has endured decades of conflict, is one of these countries. Additionally, conflict-related factors are rarely accounted for in vulnerability assessments.

By identifying which areas are most vulnerable, this analysis could inform planning efforts for future adaptation projects and indicate areas potentially at risk of famine during the 2019-2020 lean season and in the future.

Research Questions

1. What areas of Somalia are most vulnerable to Deyr season flooding?
2. How much cropland is located in highly vulnerable areas?

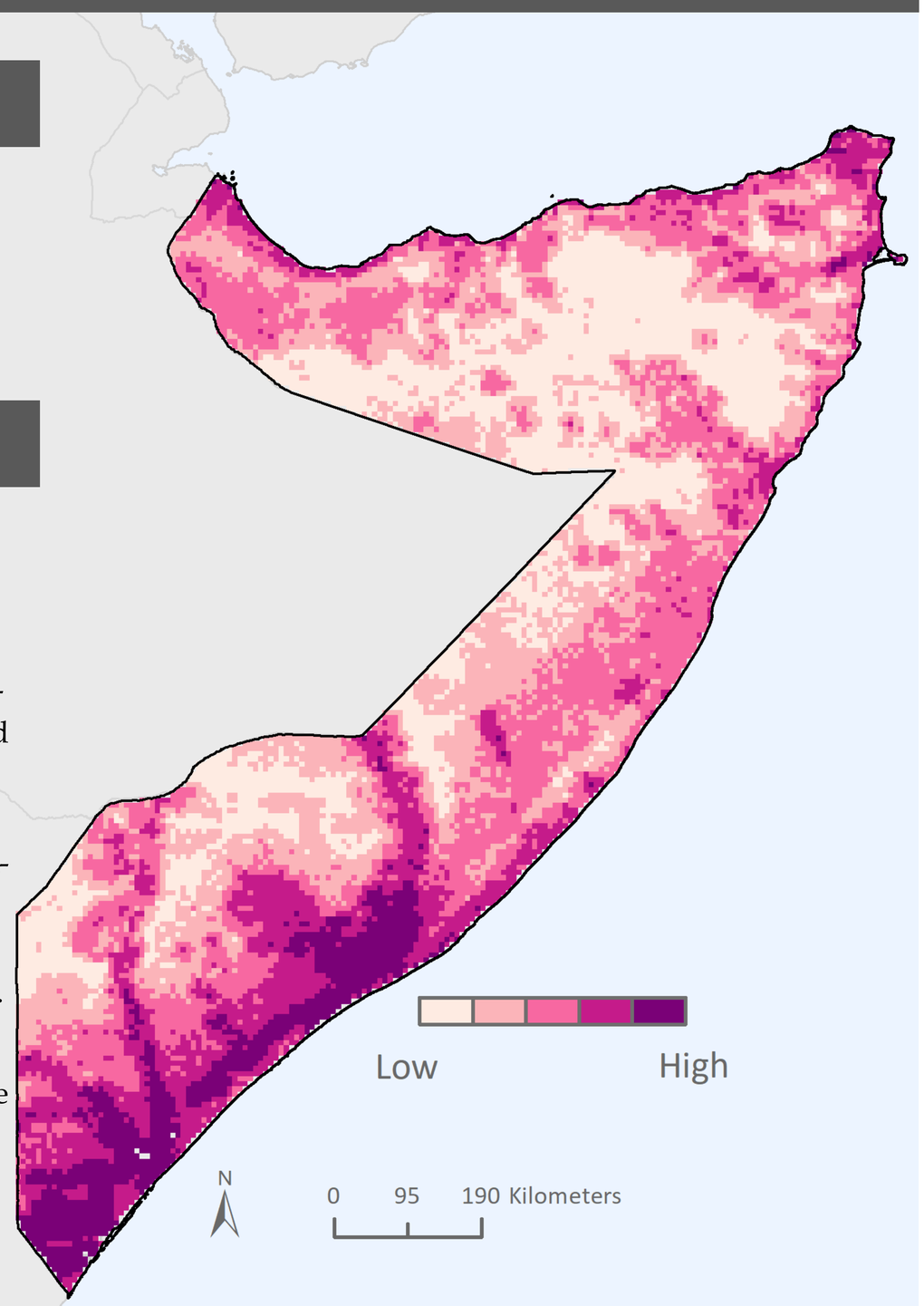
Methods

In order to answer these questions, I divided vulnerability into three fundamental factors: risk, sensitivity, and adaptive capacity. Factors for risk included distance from rivers and elevation. The appropriate thresholds were calculated using Euclidean distance and zonal statistics on satellite images of flood extent from November 2019. This information was then used to reclassify elevation and distance to rivers into five risk categories. Then, these scores were averaged with raster calculator to create a final risk raster.

Next, sensitivity to flooding was calculated using population and cropland density. I ran the Euclidean distance tool on both layers and reclassified each into five sensitivity categories. Then, these two layers were averaged to calculate an overall sensitivity raster.

Adaptive capacity was determined using data on proximity to conflict, economic development (using nighttime lights as a proxy variable), distance from roads, and distance from weather monitoring stations. Conflict density was determined by plotting tabular data of conflict events and using kernel smoothing to create a hot spot raster. This was averaged with the other capacity raster data to determine an overall adaptive capacity score.

Lastly, these three raster layers were added to create a final vulnerability ranking and then reclassified into five categories. I then used the tabulate area tool to calculate area of cropland in each vulnerability zone.



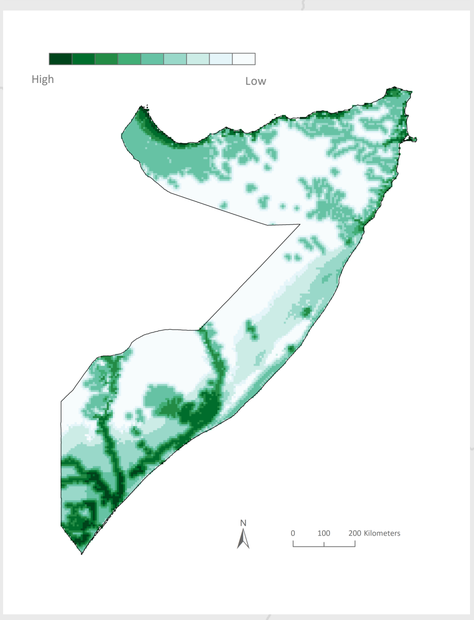
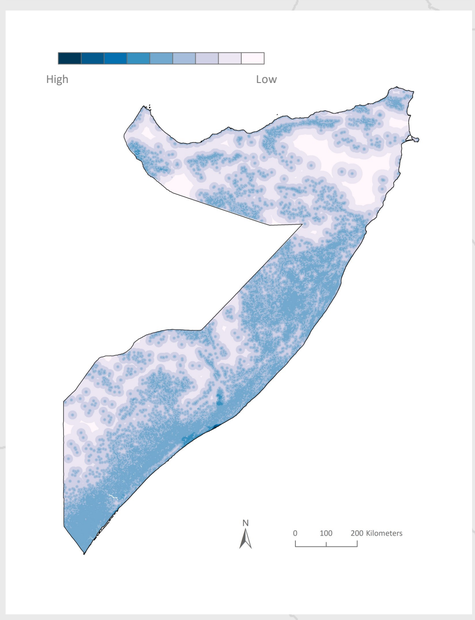
Limitations & Results

Vulnerability Ranking	Hectares of Cropland	Percentage of Total Cropland
Low	0	0%
Moderate Low	381,834.20	12.7%
Moderate	759,228,.46	25.26%
Moderate High	683,794.61	22.75%
High	1,181,022.05	39.29%

Protracted conflict in Somalia has limited the availability of important socio-economic data. As such this project relies on population estimates and proxy variables which may not be up to date or exact.

However, the final results show that a significant proportion of Somalia's cropland is moderately to highly vulnerable. Additionally, there is no cropland in areas of low vulnerability. This indicates high potential for food insecurity or even famine as Deyr season flooding continues to increase due to climate change.

The majority of the high risk area is concentrated in southern Somalia, which is also where al-Shabaab activity limits government crisis response and prevents climate adaptation projects from being implemented. This analysis highlights the importance of linking climate and conflict resolution efforts in Somalia for improved food security and long-term resilience.

Risk	Sensitivity	Capacity
		

Cartographer: Dana Thomas
Course: DHP P207 GIS for International Applications
Date: December 17, 2019
Projection: WGS 1984 UTM Zone 38N

Photo: Sylvie Doutriaux

Sources: UCDP (2019), GADM (2018), UNOSAT (2019), MODIS (2012), FAO (2014), WFP (2017), NOAA (2013) , STRM (2008), WorldPop (2019)

THE FLETCHER SCHOOL
TUFTS UNIVERSITY