Horn of Africa Natural Hazard Probability and Risk Analysis

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Executive Summary

The Horn of Africa (HOA), composed of Djibouti, Eritrea, Ethiopia, Kenya, and Somalia, suffers frequent natural disasters that commonly result in losses of life, destruction of infrastructure, and reduction of agricultural production. Formulating effective contingencies to respond to such emergencies is constrained by a limited understanding of the likelihood of a natural hazard occurring within a particular region and risks associated with that hazard. Robust early warning systems exist for national response and "hot spot" maps of risk have been produced at a global level; this level of resolution, however, is often not sufficient for sub-national resource distribution. This study presents the probabilities of natural hazards and the risk to populations or agricultural systems within the HOA, calculated on 1° by 1° grid cells. Such an analysis can provide a regional understanding of the probability of natural hazards as well as a more specific local characterization of the associated risks.

This study considers four types of natural hazards: droughts, floods, earthquakes and locust infestations. We recognize that these four natural hazards are not all of the natural hazards in the region, but they offer a good representation of several types of risk; including rapid onset versus slower onset hazards as well as those that primarily affect infrastructure versus those that primarily affect income and health. The analyses determine the annual probabilities from each hazard source individually and from drought, flooding, and locusts collectively (Seismic probabilities are not included in this combined probability analysis because damaging earthquakes occur an order of magnitude less frequently than the other hazard types). The resulting probability estimates for each hazard type are combined with measures of societal exposure to derive and map the risk associated with these four natural hazards. A full description of the probability and risk calculations are provided in an attached appendix.

Key questions:

1) What is the probability, or percent chance of occurrence, that a given natural disaster will develop in a given area of the HOA in within a given year?
2) How exposed, or vulnerable, are different regions within the HOA to different types of hazard?
3) How do these hazards combine to describe the combined probability of natural hazard in any particular area of the HOA?

Key findings:

Drought: Eastern and western Ethiopia and western Kenya are the areas most frequently affected by severe drought, with a greater than 40% annual probability of moderate to severe drought during the rainy seasons.

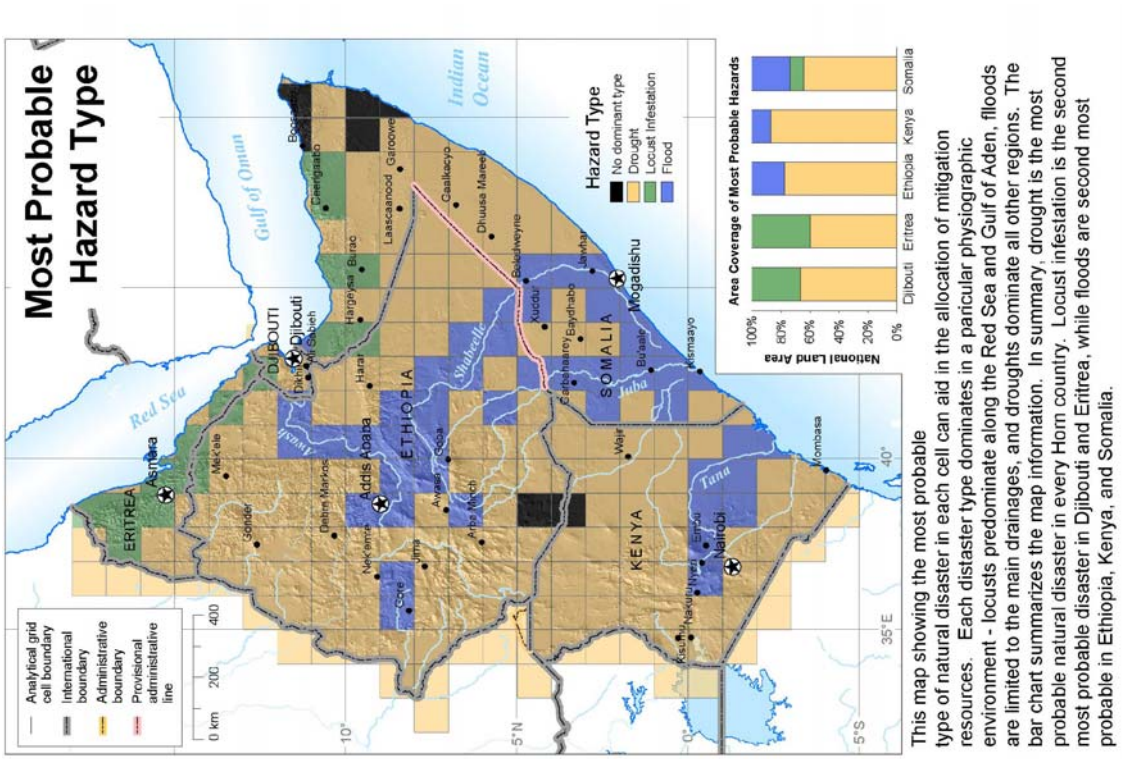
Flooding: On the long-term average, the Shabeelle River floods once a year and the Juba, Awash, and Tana Rivers flood once every two years. The densely populated areas along these rivers in Ethiopia, Kenya and Somalia face the highest risk associated with flooding within the HOA.

Locust Infestation: Historical infestations are clustered in northern Eritrea and near the conjunction of Somalia, Ethiopia, and Djibouti, and the annual probability in these regions can exceed 30-40%. Over the past 15 years there have been 106 documented infestations, with 57% occurring in Eritrea, 26% in Ethiopia, and 17% in Somalia.

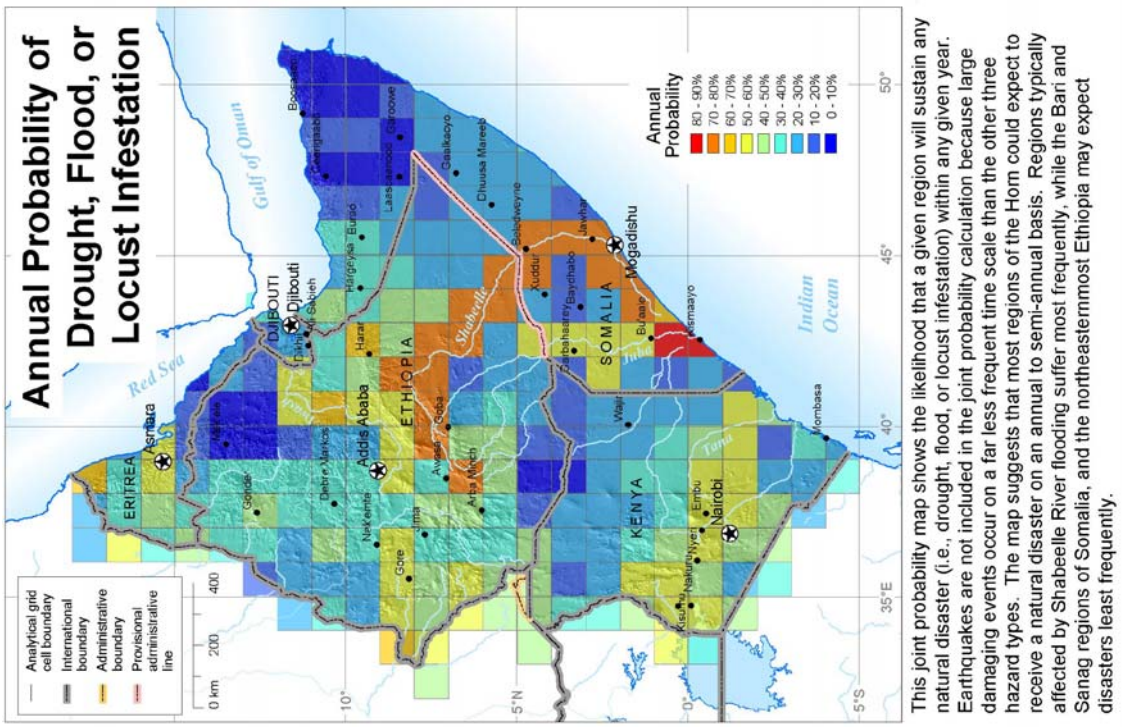
Seismic Activity: The largest earthquakes (greater than M 6.0) are most likely to occur along the Rift Valley regions of Djibouti, southern Eritrea and northeast Ethiopia; however, due to the relative

infrequency of large damaging earthquakes in the HOA, the risk from seismic hazard is not an annual concern like the other hazard types.

Combined Hazard: Calculations of joint probability of drought, flooding, and locust infestation suggest that most regions of the Horn could expect to receive a natural disaster on an annual to semi-annual basis with drought being the most probable over the most land area, followed by flooding.



This map showing the most probable type of natural disaster in each cell can aid in the allocation of mitigation resources. Each distaster type dominates in a paricular physiographic environment - locusts predominate along the Red Sea and Gulf of Aden, flloods are limited to the main drainages, and droughts dominate all other regions. The bar chart summarizes the map information. In summary, drought is the most probable natural disaster in every Horn country. Locust infestation is the second most probable disaster in Djibouti and Eritrea, while floods are second most probable in Ethiopia, Kenya, and Somalia.



This joint probability map shows the likelihood that a given region will sustain any natural disaster (i.e., drought, flood, or locust infestation) within any given year. Earthquakes are not included in the joint probability calculation because large damaging events occur on a far less frequent time scale than the other three hazard types. The map suggests that most regions of the Horn could expect to receive a natural disaster on an annual to semi-annual basis. Regions typically affected by Shabeelle River flooding suffer most frequently, while the Bari and Sanag regions of Somalia, and the northeasternmost Ethiopia may expect disasters least frequently.