Empirical Forecasting of Slow-Onset Disasters for Improved Emergency Response

An Application to Kenya's Arid Lands

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Objective

- Develop an empirical forecasting model to predict the human impact of slow-onset disasters for early warning.

Motivation

- Increasing frequency of humanitarian crises call for efficient and practical methods of emergency needs assessment.

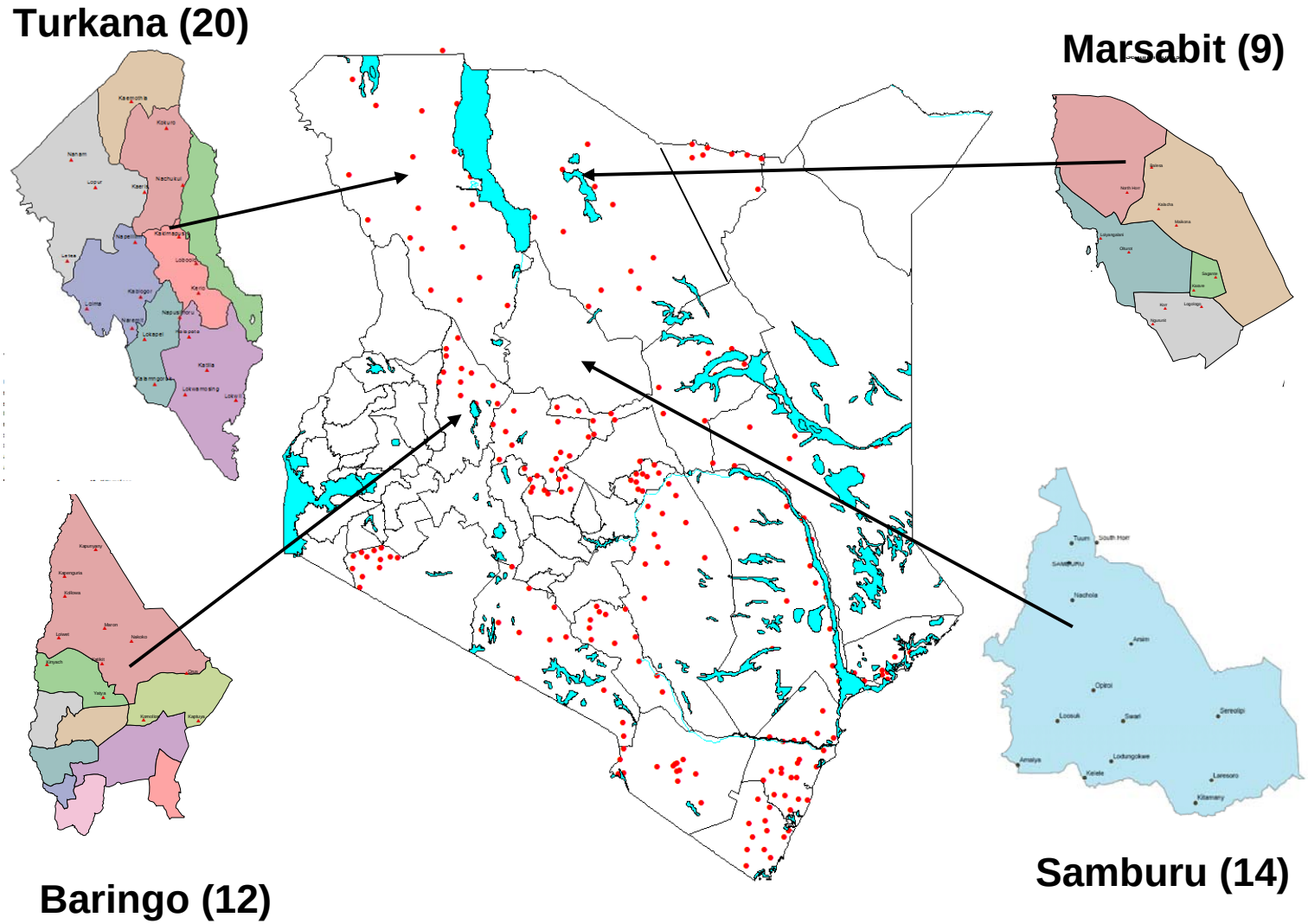
Geographic Focus: Kenya's Arid North

- Highly vulnerable to recurring shocks such as droughts and floods
- Largely populated by nomadic pastoralists

Data

- **Arid Lands Resource Management Project**
  - Livestock Variables
  - Child Nutritional Data
- **Global Livestock CRSP (LEWS/LINKS)**
  - Climate Variables

Sample Sites



Severe Child Malnutrition and Food Crisis

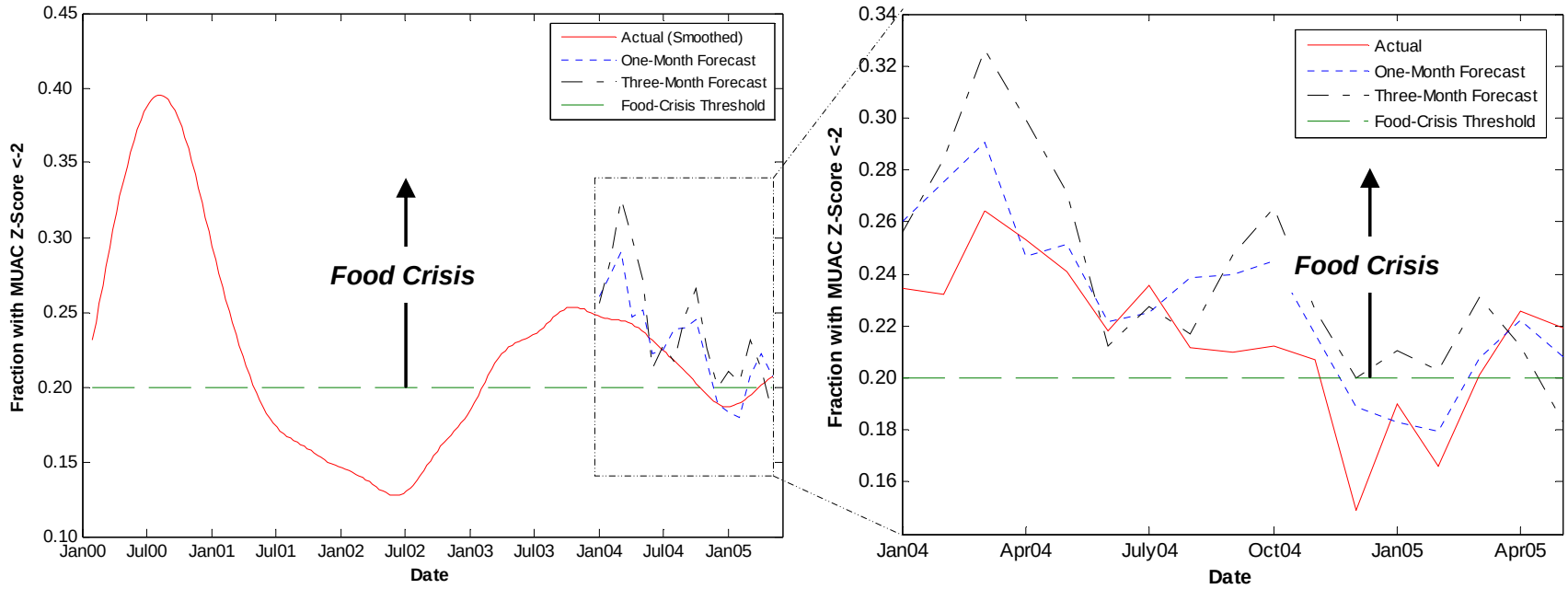
- Forecasting food crisis requires a suitable indicator variable
- Child anthropometric measures of acute malnutrition typically used
- **Mid-Upper Arm Circumference** (MUAC)
  - *Superior predictor of child mortality*
- A MUAC Z-Score of -2 often used as an indicator of “severe wasting”
- **Our Indicator of Food Crisis:** Whenever 20% or more of children are suffering severe wasting.

Early Warning: Forecasting Food Crisis

- **Effective response requires early warning**
- **Two-forecasting models:**
  - 1) One Month Forecast: Better accuracy, less response time
  - 2) Three-Month Forecast: Less accurate, more response time

Forecast Results

Fraction of Children Experiencing “Severe Wasting”



- **Frequent experience of food crisis**
- **Forecasts trace actual values quite well and improve with time**
- **Difference between one-month and three-month forecast accuracy not considerable**

Making Practical Use of the Forecasts

- **Example: Food Security Organization**
  - Predictions in the form of intensity of severe wasting
- **Decision making parameters**
  - Minimum likelihood of food crisis required before initiating emergency response
  - Defining a “correct decision”:
    - Initiating response when there is actually a food crisis
    - No response when there is no food crisis
- **Forecast Performance**
  - Fraction of correct decisions

Forecast Performance

Forecast Horizon	Confidence Threshold		
	75%	66%	50%
	Fraction of Correct Decisions		
One Month	0.777	0.786	0.785
Three Month	0.753	0.756	0.758
	Fraction of Errors that are Type 1		
One Month	0.328	0.275	0.214
Three Month	0.341	0.288	0.212

Type 1 Errors: Failing to respond when a famine actually occurs.

Conclusions/Policy Implications

- Developed an empirical forecasting model that can predict with reasonable accuracy the expected human impact of slow onset shocks such as drought.
- Model is based on a non-restrictive set of variables making it quite cost effective
- Model can be easily and regularly updated with new information that should continuously increase its forecast performance
- Invaluable for early warning and emergency response to food crisis

Acknowledgements

- Arid Lands Research Management Project
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- World Food Program