Environmental Migration and Land Inundation: An Agent-Based Modeling Approach

Kelsea Best[1], Jonathan Gilligan[1]

[1]Department of Earth & Environmental Science, Vanderbilt University, Nashville, TN

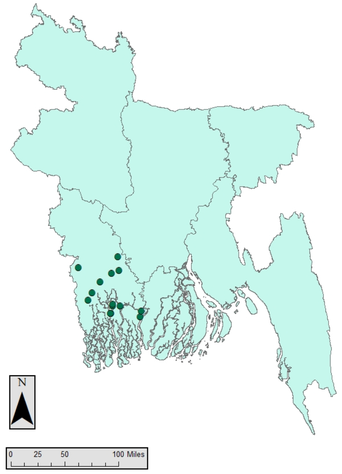
I. INTRODUCTION

- The decision to migrate is highly complex, and is influenced by economic, social, and environmental drivers.
- As climate change increases pressure on vulnerable communities, migration is one adaptation strategy.
- Bangladesh is one of the most climate vulnerable countries in the world.
- Migration has long been a way of life in Bangladesh, and people adapt to a dynamic natural environment.

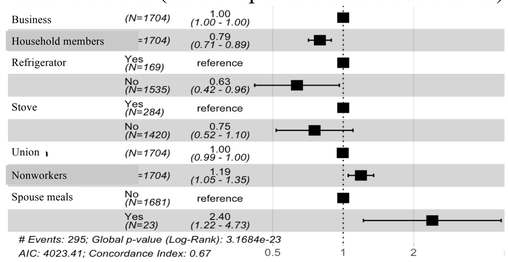
Research Goal:
Develop an agent-based model of environmental migration as a result of land inundation in Bangladesh.

II. DATA AND ANALYSIS TO INFORM MODEL

- Data collected through Bangladesh Environment and Migration Survey (BEMS).
- Contains migration, employment, and livelihood histories from randomly sampled households at sites.
- 1,695 observations of 1,997 unique variables.
- Previous work used random forest models to identify salient variables associated with migration in this dataset.
- Conducted survival analysis on salient variables for additional insight.



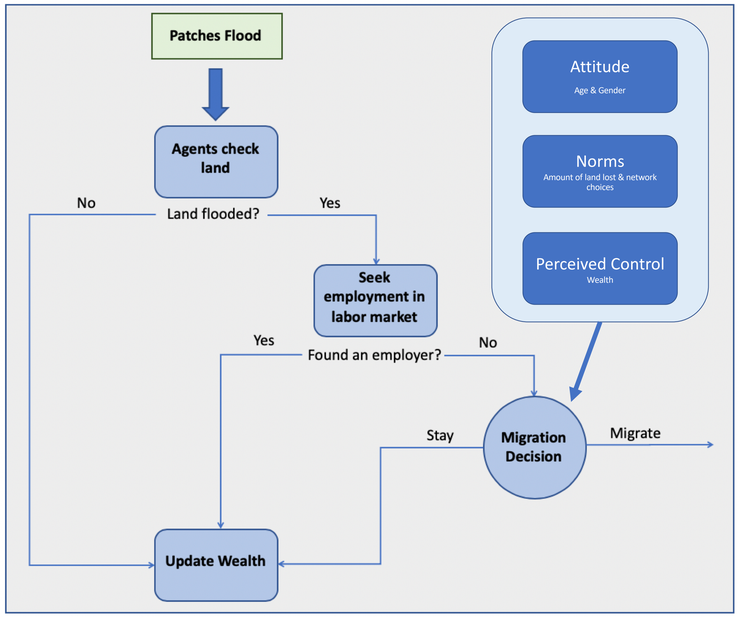
Hazard Ratios (Cox Proportional Hazards Model)



Hazards Ratio (HR):
HR = 1, no effect on baseline hazard
HR < 1, decreases baseline hazard
HR > 1, increases baseline hazard

III. MODEL OVERVIEW

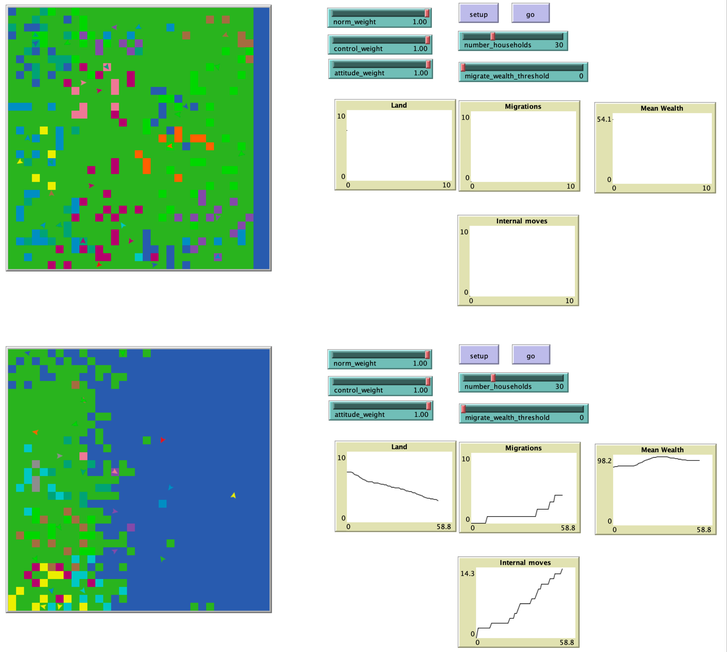
Model process at each step



Model variables (parameterizing from data)

Agent Variables		Patch Variables
Wealth	Patches owned	Distance to river
Age household head	Willing to pay	Erosion risk
Household Size	Willing to accept	Productivity
Nonworkers	Employees	Inundated?
Land owned	Employer	Land?
Employment	Salary	Owner
Network	Payments	
Moves internal	Someone migrated?	

IV. MODEL INTERFACE

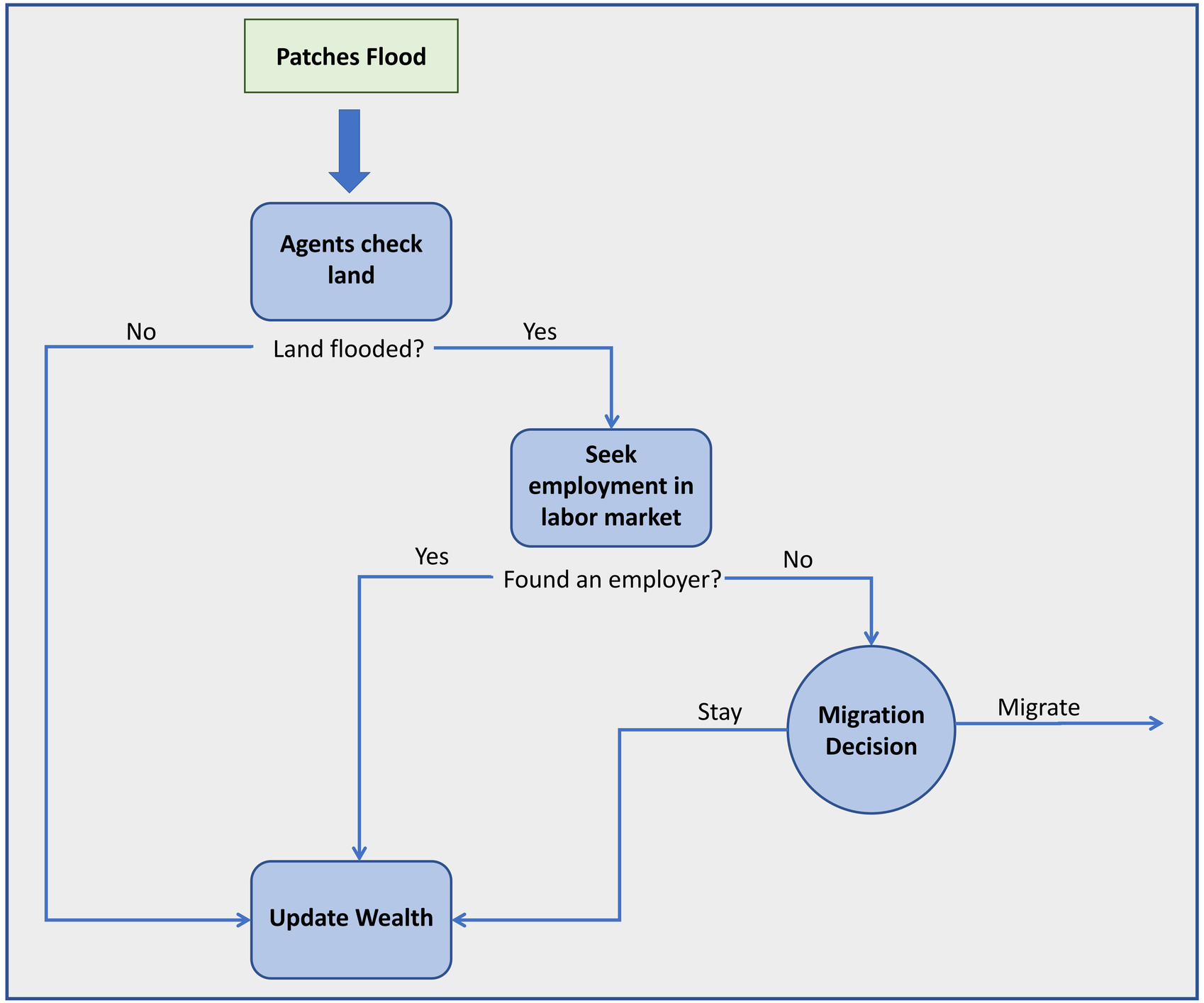


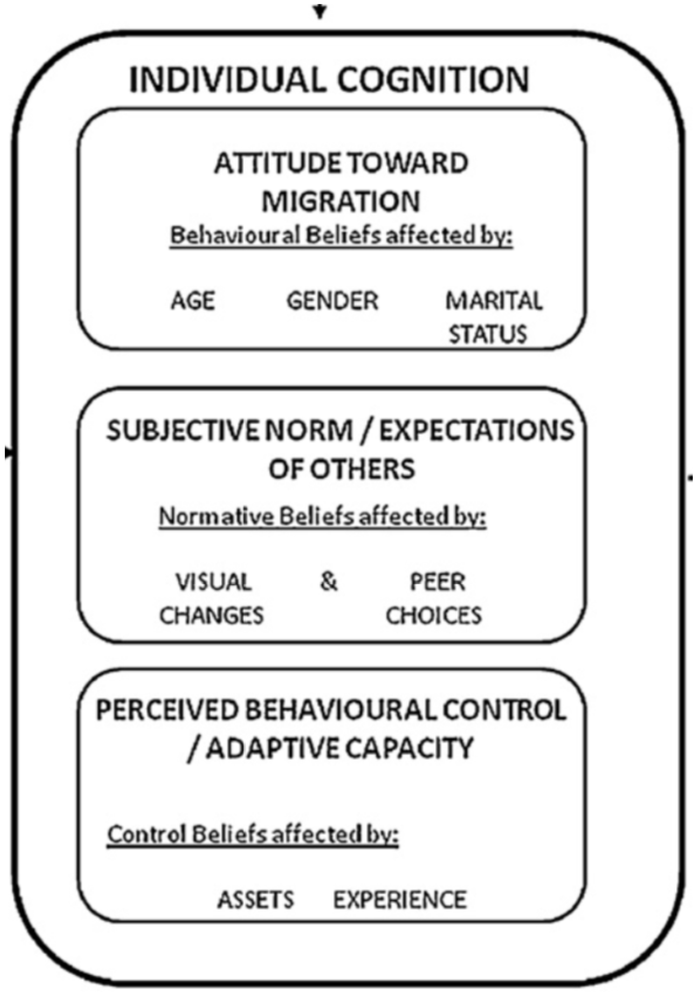
V. NEXT STEPS

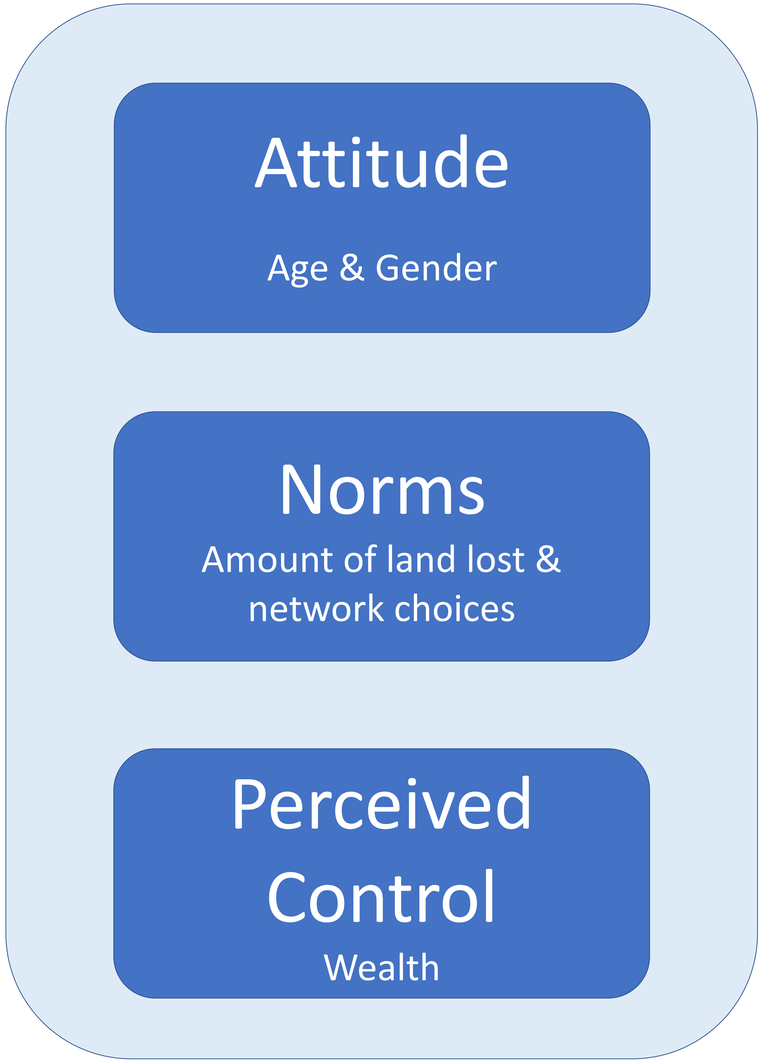
- Further develop model, incorporate different types of environmental change, decision strategies, and responses.
- Develop migration destinations to include “push” and “pull
- Use model to address questions:
  - How will future environmental stress impact migration?
  - What household characteristics will be important for future migration?
  - How do social networks impact migration?
- Participatory game to study decision making

VI. ACKNOWLEDGEMENTS

- Thank you to Jonathan Gilligan, Hiba Baroud, Amanda Carrico, Katharine Donato, Brooke Ackerly, Bishawjit Mallick, Vanderbilt EES, CSDMS.
- This work was supported by the National Science Foundation Coupled Human-Natural Systems Grant No. 1716909


Patches Flood
Agents check land
Land flooded?
No
Yes
Seek employment in labor market
Found an employer?
Yes
No
Migration Decision
Stay
Migrate
Update Wealth


INDIVIDUAL COGNITION
ATTITUDE TOWARD MIGRATION
Behavioural Beliefs affected by:
AGE
GENDER
MARITAL STATUS
SUBJECTIVE NORM / EXPECTATIONS OF OTHERS
Normative Beliefs affected by:
VISUAL CHANGES
&
PEER CHOICES
PERCEIVED BEHAVIOURAL CONTROL / ADAPTIVE CAPACITY
Control Beliefs affected by:
ASSETS
EXPERIENCE


Attitude
Age & Gender
Norms
Amount of land lost & network choices
Perceived Control
Wealth