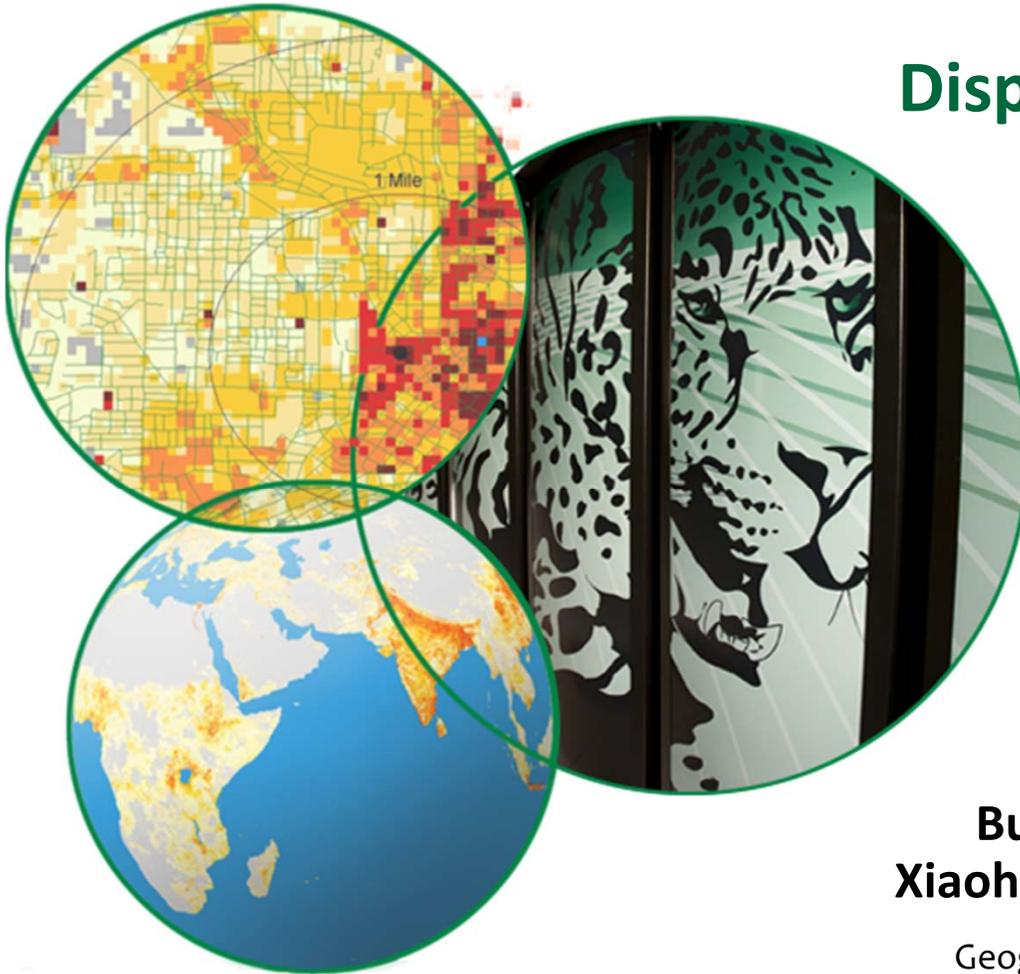


Climate Change, Social Vulnerability to Disasters, and Adaptation: Social Dissatisfaction, Displacement, and Migration



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Climate and Population Distribution



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- Human security is dependent upon availability and access to natural resources, which are in turn dependent upon climatic conditions
- Climate variability and change therefore poses a potential threat to natural resources (e.g., land, water) and human security:
 - Rapid-onset events: hurricanes, floods, heat waves
 - Slow-onset events: drought
- Migration is a behavioral response to resource insufficiency, displacement, and insecurity
- Understanding human exposure to climatic extremes and the local, regional and global distribution of resources provides insights into potential migration and resettlement patterns



The Climate Induced Migration Project

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Challenges

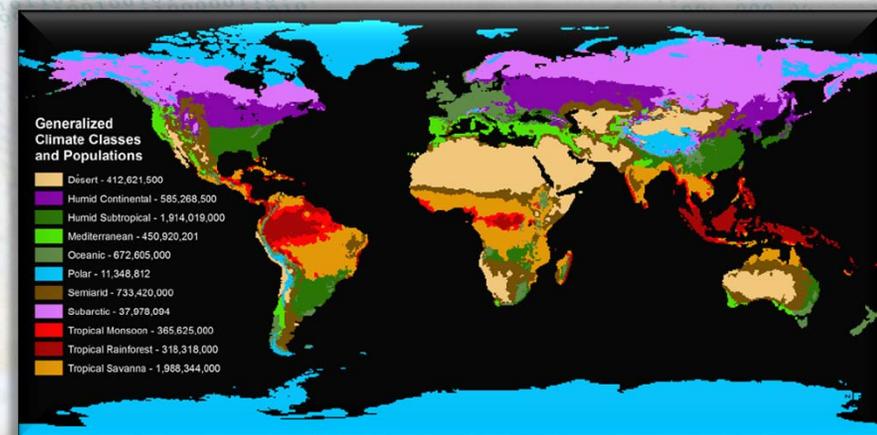
- Few precedents for this type of modeling endeavor
- Complex human/environment interactions are difficult to parameterize
- 'Deep uncertainty' about the future

Opportunities

- Potential for new breakthroughs and science leadership in modeling complex human/environment relationships and interactions.
- Potential to deploy methods in other applications
- Ability to provide 'on-demand' information to a range of stakeholders
- 'Uncertainty' about the future

Implications

- Food and Water Security
- Disaster Reduction
- Foreign Aid and Policy
- National Security



Research Questions

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- **How environmental factors affect the migratory patterns?**

- Who is likely to stay in their current location and accept risk? Why?
- Who is likely to move within country boundaries?
- Where internal migrants are likely to go?
- Who is likely to move outside of the country?
- Where emigrants are likely to go?



Environmental Hazards and Migration



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- Wolpert (1966): “Stress Threshold Model”- first to incorporate “noxious environmental influences”
- Speare (1974): “Residential Dissatisfaction Model”
- DeJong and Fawcett (1981): “Value-Expectancy Model”
 - Migration = f (value of certain goals + perception of how likely a chosen behavior will assist in reaching those goals)
- Zelinski (1971) “mobility transition hypothesis” – modernization increases freedom and reduces the difficulty of moving from residential origins
- Gardner’s (1981) “Migration decision-making” stages at which macro level factors should be taken into account
 - **“The study of migration decisions, while necessary proceeding on the micro level, must nevertheless take into account at all steps the influence of macro factors, the social the institutional, the economic, and the geographic context within which the individual exists.” (Gardner, 1981:88)**
- Walters (1994) – climate is a significant determinant of migration patterns within the context of the United States

Environmental Hazards and Migration

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- Slovic (1987) – people respond to hazards based on their perception. Relocation due to environmental hazards cannot be assumed.
- Reasons why residents might not migrate:
 - Not aware of hazard
 - Aware but disaster not expected
 - Disaster expected but losses not anticipated
 - Loss expected but not perceived as serious
 - Serious losses expected and loss reduction actions planned
 - Loss expected but accepted
 - No choice in location

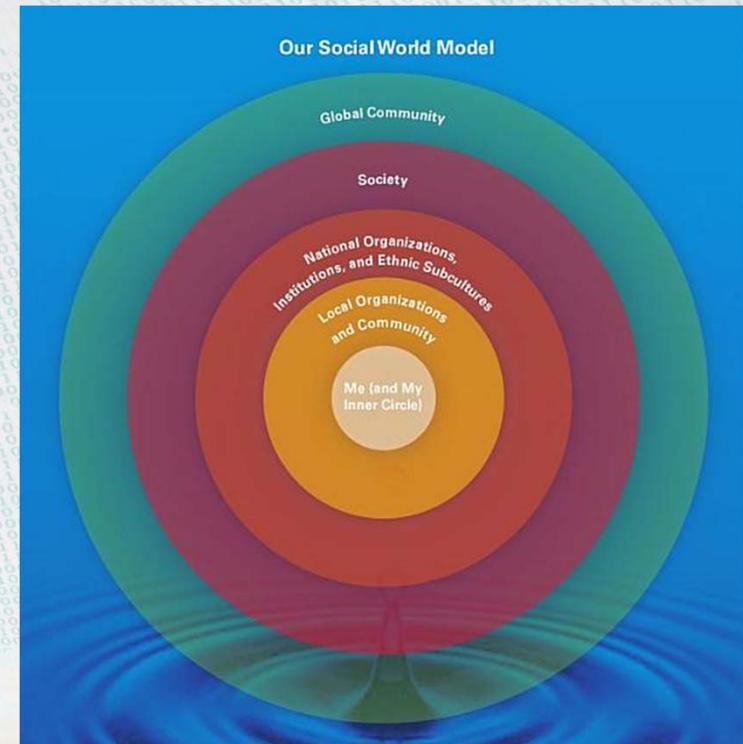
From Vulnerability Profiles to Applied Agent Based Systems

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• Agent based models in the social sciences

- Computer simulation technology can assist in describing and explaining social phenomena
- The profile-based approach to vulnerability does not take into account the temporal dynamics of human-environment interactions
- Agent based models allow researchers to analyze vulnerability to climate change as a process
- Opportunity for understanding human vulnerability to global environmental changes (Acosta-Michlik and Espaldon, 2008).

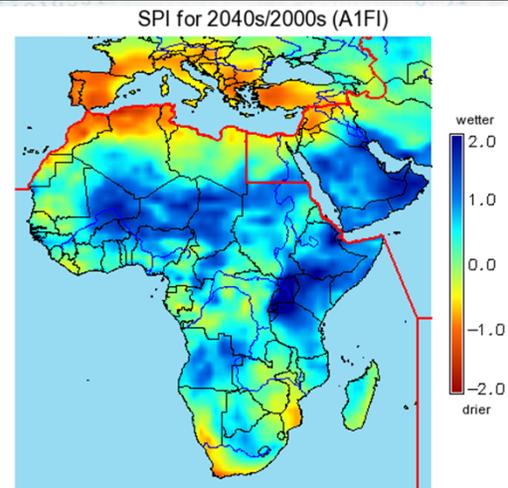
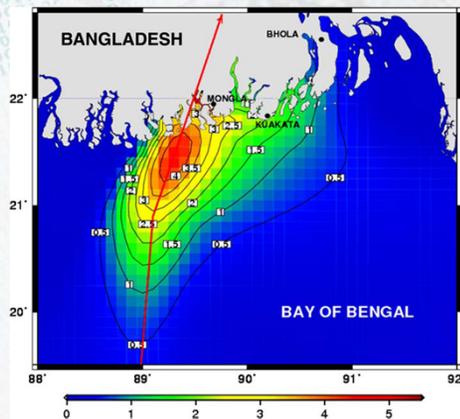
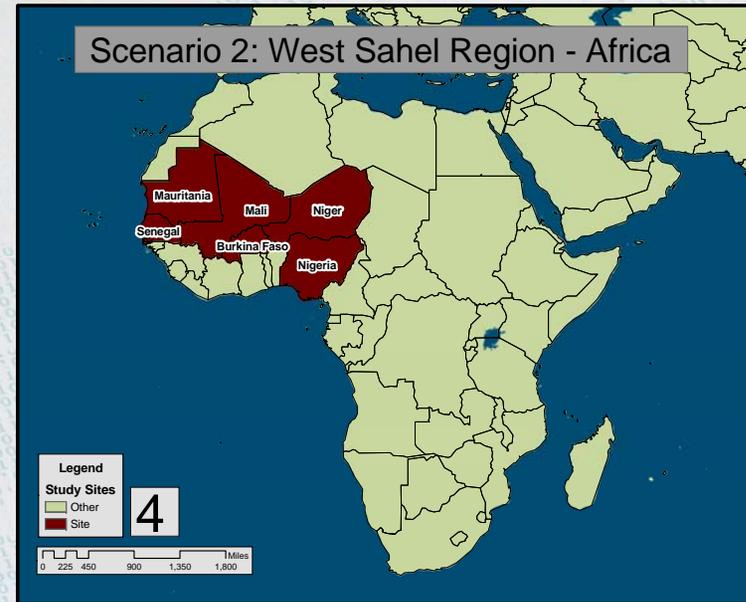
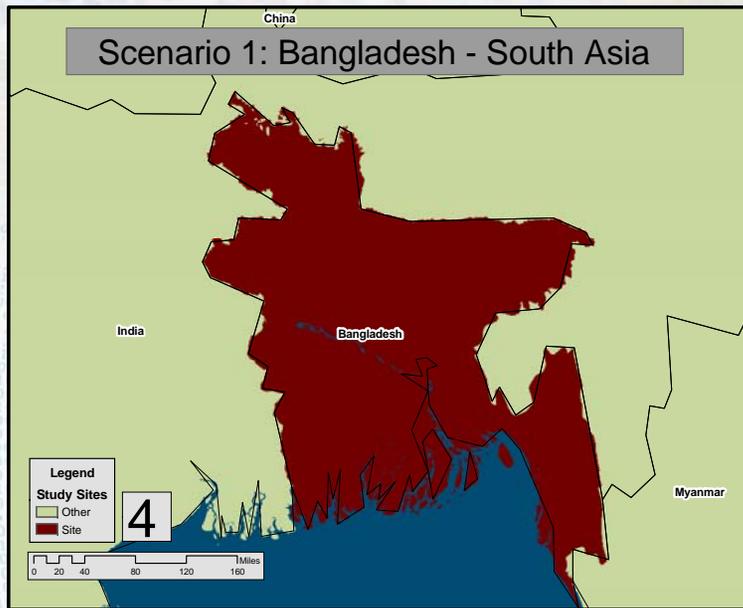


Source: Ballantine and Roberts, 2009

“The study of migration decisions, while necessary proceeding on the micro level, must nevertheless take into account at all steps the influence of macro factors, the social the institutional, the economic, and the geographic context within which the individual exists.” (Gardner, 1981:88)

Case Studies: Bangladesh and West Sahel

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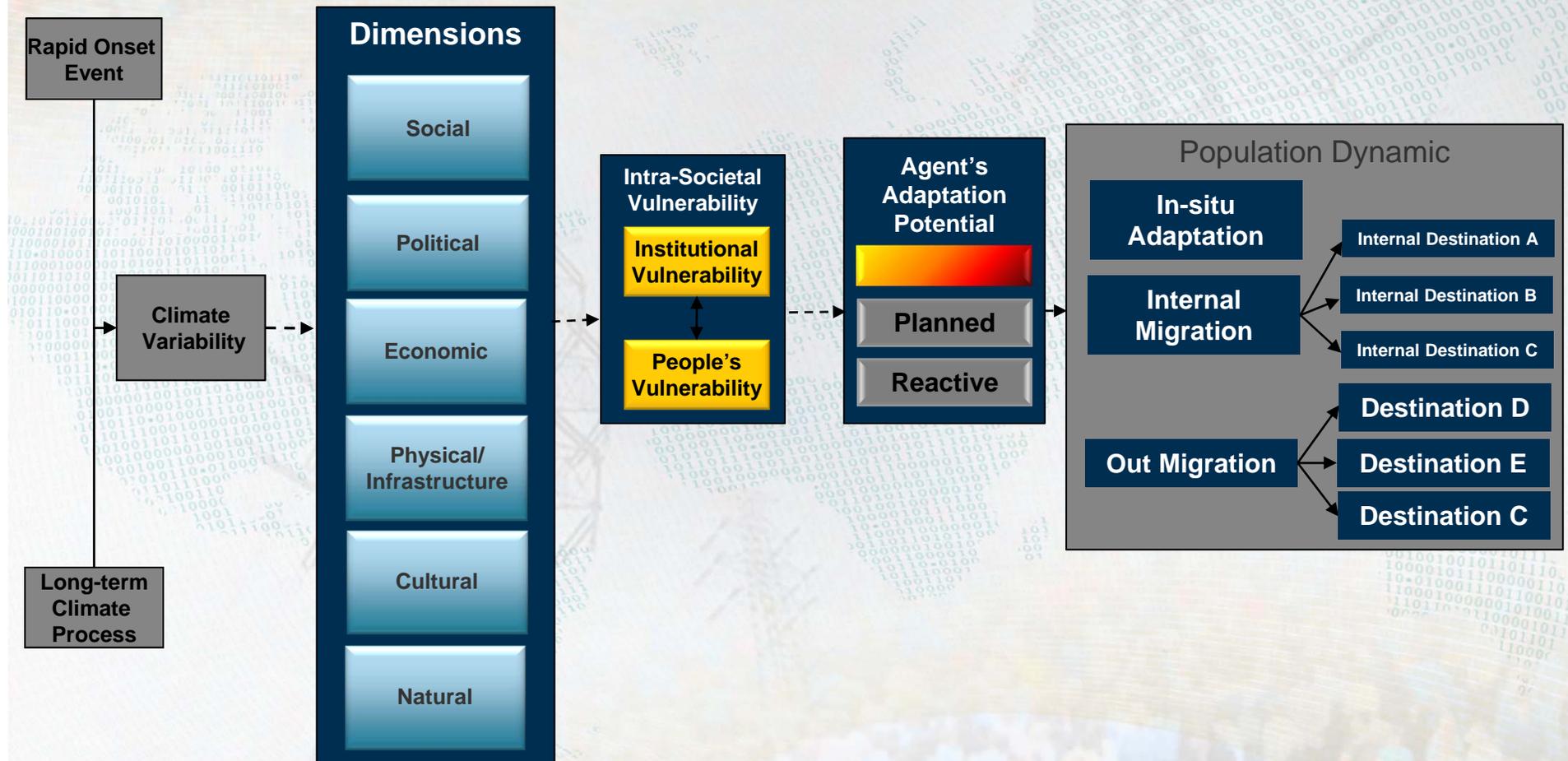
Ganguly et al (2009)



Climate Change and Population Dynamics



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Identify variables that influence climate migration



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- Literature Review: 229 References including books, chapters, journal articles, reports, and conference proceedings

Journals

- Theory and Society
- Social Forces
- Sociological Inquiry
- Rural Sociology
- Sociological Forum
- Sociology
- Transactions of the Institute of British Geographers
- Swiss Political Science Review
- Review of Policy Research
- Singapore Journal of Tropical Geography
- Regional Environmental Change
- Population Studies
- Population Research and Policy Review
- Proceedings of the National Academy of Sciences
- International Migration Review
- International Migration
- International Journal of Refugee Law
- Global Environmental Change
- Geographical Review
- The Geographical Journal
- Gender and Development
- Food Policy
- Fish and Fisheries
- Asian Survey
- Arctic
- Annual Review of Sociology
- Annual Review of Anthropology
- Annals of the Association of American Geographers
- Societies Without Borders
- Climate Dynamics
- Oxford Journal of Development
- Psychonomic Bulletin and Review
- Population and Environment
- Population and Development Review
- Political Geography
- PNAS
- PLoS Biology
- Philosophical Transactions
- Natural Hazards
- Pacific Affairs
- Middle Eastern Studies
- Land Economics
- Journal of Urban Economics
- Journal of the Royal Anthropological Institute
- Journal of Risk and Uncertainty
- The Journal of Regional Analysis and Policy
- Journal of Population Economics
- Journal of Population
- The Journal of Political Economy
- Journal of Place Research
- Journal of Mathematical Psychology
- Journal of Development Studies
- Journal of Business Strategies
- International Sociology
- European Journal of Population
- Environment, Development, and Sustainability
- Environmental Politics
- Environmental Management
- International Journal of Climatology
- African Population Studies
- Annals of the American Academy of Political Science
- Environmental Impact
- Assessment Review
- Environmental Hazards
- Environment and Planning
- Economic and Political Weekly
- Econometrica
- Ecology and Society
- Earth and Environmental Science
- Dynamics of Atmospheres and Oceans
- Disasters
- DRC Preliminary Papers Series
- Development Policy Review
- Current Sociology
- Current Opinion in Environmental Sustainability
- Climatic Change
- Conservation Biology
- CSpA Working Paper Series
- Climate and Development
- Chinese Geographical Science
- Center for Migration and Development Working Paper Series
- Canadian Studies of Population
- Bangladesh Institute of Development Studies
- Atmospheric Research
- BioScience
- Canadian Journal of Forest Research
- Ecological Modeling
- Energy Policy
- Development and Change
- Bangladesh e-Journal of Sociology
- Cultural Sociology
- Cultures & Conflicts
- Development in Practice
- European Journal of Sociology
- Global Social Policy
- Immigrants and Minorities
- Indian Economic and Social History Review
- International Journal of Politics, Culture, and Society
- International Journal of Population Geography
- International Migration Law
- Demography
- Demographic Research
- Population Bulletin
- Population, Place, and Space
- Decision Analysis
- Journal of Behavioral Decision – Making
- Journal of Multi-Criteria Decision Analysis
- American Journal of Economics and Sociology
- Theory and Decision
- African Journal of Food Agriculture, Nutrition and Development

Adaptation Potential

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- **Behavioral Model for Nested Agent-Based Approach**



Age
Gender
Race
Income
Occupation
Dependence on Land
Political participation
Level of education
Role in the family
Country of citizenship
District
City
Transnational network
Possible courses of action

**Intra-Societal
Vulnerability**

**Institutional
Vulnerability**

**People's
Vulnerability**

Characterization of Social Structures



“The large systems and the super-individual organizations that customarily come to mind when we think of society, are nothing but immediate interactions that occur among men constantly every minute, but that have become crystallized as permanent fields, as autonomous phenomena (Simmel in Wolff 1950, p. 10).”

Stratification Systems

Prestige and Status



Social Class

Race

Gender

Birth

Age

Institutionalization

Political

Economy

Education

Family

Religion

Military

Law

Mass Media

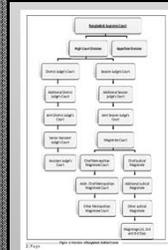
Bangladesh: Characterization of Social Structures



Characterization of Social Structures

Bangladesh	Class	Race	Gender	Birth	Age
Urban	44.3% (55.9M) in absolute poverty		Large proportion of men		
Rural	Sources of power: Agrarian	Hindo (elite) -Muslim (mass) historical conflict	Patriarchy	Street Children ~380,000 Boys 74.3% Girls 25.7%	Elder Social Security: No Strong support from family
	Division of Labor: Segregated by Sex	Lingering Hindu caste system	Decision Maker: Male Head		
	42.3% (42.6M) in absolute poverty	Marginalized groups: Dalits	Purdah (women isolation among Muslims) Significant migration to rural areas		

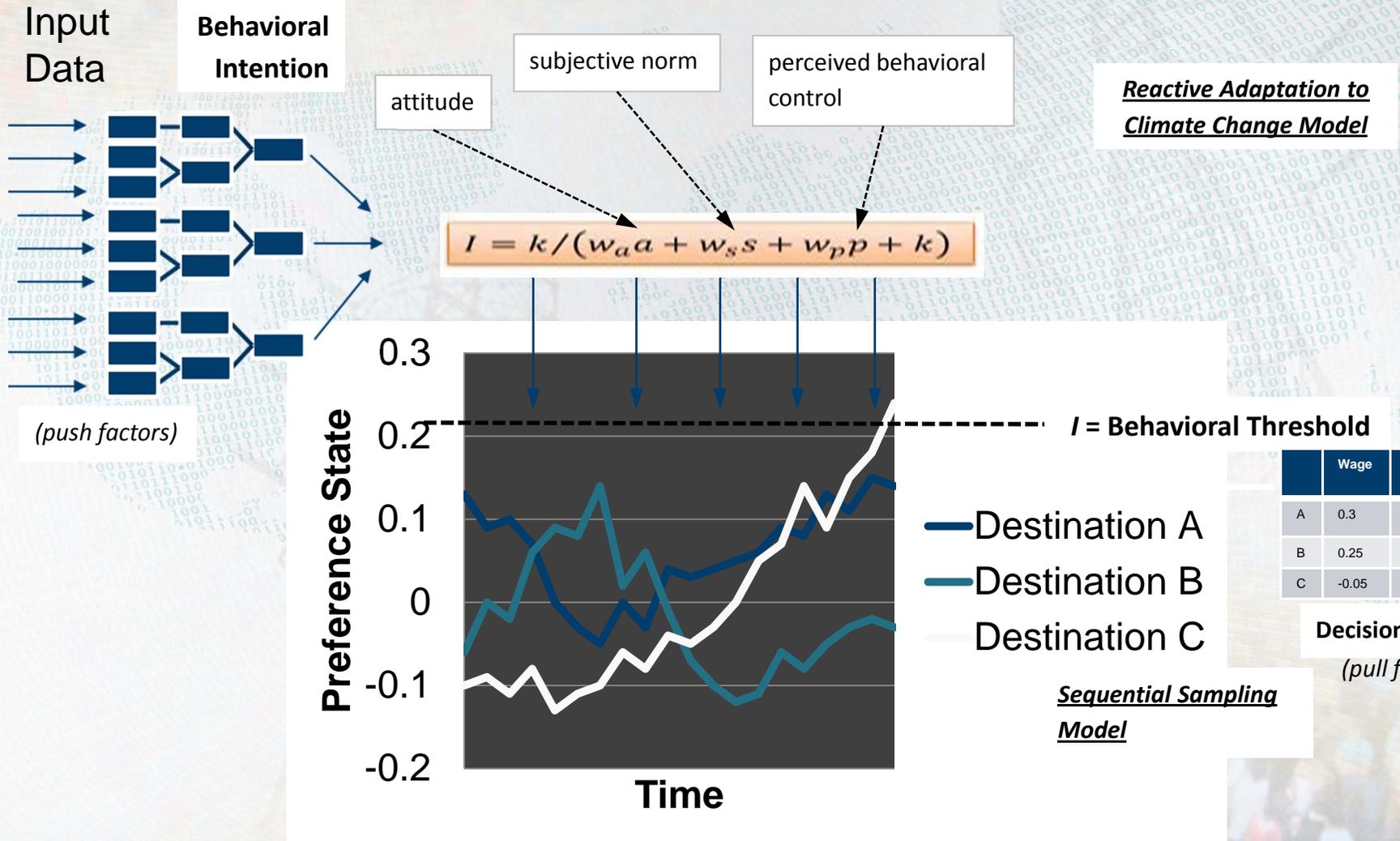
Bangladesh	Political	Economy	Education	Family	Religion	Military	Law	Mass Media	Health
Urban	Colonial Imprint Parliamentary Democracy – 30-40 political parties Two-tier administration system Ministry Division Wings Departments 81M eligible voters Political Participation (2008): 80%	60 M live with less than US \$1 a day Main Employer: Private sector 97% of Bangladeshi enterprises employ less than 10 workers Firms by sector: Services 13.09% Manufacturing 17.49% Trade 69.27% Agriculture 0.15%	2.4% GNP on education Enrollment: 94% Attendance: 60% Drop-out: 24% of those who enter primary school *Most non-enrolled belong to socio-economically disadvantaged and illiterate parents Student/Teacher Ratio 60:1	Nuclear family Avg Household Size: Rural 4.89 Urban 4.72 National 4.85	80% Muslims 13% Hinduism > 1M Christians Muslim: Three types of religious beliefs: - Modern – rational interpretation of the Koran that differentiates between tradition and principles. - Orthodox – total and literal acceptance of the Koran. - Popular- integrates Hindu deities <u>Religious practice</u> Rural 51.4% High religiosity 47.8% Medium religiosity 08 Low religiosity Urban 49.6% High religiosity 46.8% Medium religiosity 3.6% Low religiosity	~150,000 soldiers Bangladesh Army, Bangladesh Air Force, Bangladesh Navy	Based on English Common Law Islamic Family Law applied through the court system Organizations: Supreme Court, Appellation Division	1991 - Press freedom guaranteed by the constitution Newspaper Circulation: does not exceed 1 million Television per 1,000: 5.9 Computer per 1,000: 1.5 Internet Access per 1,000: 0.8	Maternal mortality: 35 per day IMR: 45/1,000 TFR: 2.4 85% of deliveries occur at home Mortality Rate: 7/1,000 Natural Increase: 1.5% Life expectancy Male: 65 Females: 67 Both: 66
	Rural	Salish – village councils 4,498 Union Councils comprised of 10-15 villages each	Production and Consumption: Family based Main crop: Paddy Per Capita Income > \$200/yr	Women Literacy: 20.2%	Kinship: Patrilocal marriage Households: Nuclear				



Reactive Migration as Adaptation Model



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Established contacts for data acquisition



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- We have established a number of contacts and identified potential data sources including
 - **LandScan** – in-house data
 - **U.S. Census Bureau** – International Population Division: District level data for Bangladesh was obtained
 - **Population Reference Bureau** – National level data for all countries was obtained
 - **United Nations** – access to the UN migration database was obtained
 - **Kaufmann, Kray and Zoido-Lobaton governance data set** - requested
 - **National Center for Atmospheric Research** – data on climate scenarios was obtained and researchers working on regional models have been identified
 - **EM-DAT** – data on disaster events in countries of interest was obtained
 - **Relief Web** – reports on disaster events in countries of interest are being collected and a database on disaster impacts in Bangladesh is being developed
 - **International Institute for Democracy and Electoral Assistance** – available online
 - **Cingranelli-Richards (CIRI) Human Rights Scales** – available online
 - **UN International Communications Union** – available online
 - **Freedom House** – available online
 - **Worldbank** – data available online and contact personnel identified
 - **The Embassy of Mali** – contact identified
 - **Senegal Directorate of Forecasting and Statistics** – contact in process
 - **Mauritania National Statistics Office** – contact in process
 - **Niger Institut National de la Statistique** – contact in process
 - **Nigeria National Bureau of Statistics** – district level data obtained
 - **Burkina Faso Institut de la statistique et de la démographie** – national level data obtained and district level data requested

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Questions

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