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WHERE DOES COMPUTATIONAL MODELING OF CLIMATE-INDUCED MIGRATION STAND AND WHAT CHALLENGES STILL NEED TO BE OVERCOME

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ABSTRACT

Climate change has the potential to displace large populations in many parts of the developed and developing world. Understanding why, how, and when migrants decide to move is critical to successful planning within national and international organizations. Computational modeling techniques are one way to explore planning options and investigate consequences in simulated digital environments. While modeling is a powerful tool, it presents both opportunities and challenges both for model consumers, and the teams who create them. This poster seeks to lay a foundation for both groups. It does so by providing an overview of pertinent climate-induced migration research, describing different types of models, how to select the most relevant one(s) for your problem, highlighting three different perspectives on how to obtain data to use in said model(s). Finally two attempted projects will illustrate the challenges of this work and how they can be overcome.

1 LITERATURE OVERVIEW

Projected climate change scenarios could become catalysts for conflict that in turn could worsen security risks both nationally and internationally (Board, 2014). Such conflicts will impact many areas including infrastructure, access to resources, quality of life, and will range in scale and severity. The types of information required to explore these challenges do not currently exist consistently on large enough scales. Undaunted, a growing number of researchers are starting to contribute work, and a number are implementing computational approaches. There is no right answer when it comes to computational modeling of complex systems, only groupings of possibilities to be explored. Contributions by social scientists bring critically needed perspectives about different climate-change-related issues (Agrawal et al., 2012). Over the past 20 years the number of publications addressing climate-related human migration is increasing. This is encouraging: the questions being asked are becoming more involved, the methods implemented to address them are broadening, and there is now demand for new tools to be developed to continue gains. Publications range from small-scale efforts right the way through to massive international undertakings. Researchers, interest groups, and stakeholders are coming together and realizing we really do not know how climate change-migration systems work, and it is well past time we did.

2 WHICH MODEL SHOULD BE IMPLEMENTED?

The adoption of computational modeling and simulation by the social sciences is a relatively new phenomenon, only now gaining some acceptance 20 years after its first implementations. A recent publication by Kelly et al (2013) summarizes five commonly used computational approaches: 1) Systems Dynamics, 2) Bayesian networks, 3) Coupled Component Models, 4) Agent-Based Models and 5) Knowledge-Based Models (also known as Expert Systems). Before any approach is chosen researchers should ask three questions: What is the purpose of the model? What types of data are available to develop and specify the model? And, who are the model users? Depending on the answer to these questions, and more, some approaches may be better suited than others. Computational work in the area of climate change-migration has predominantly been conducted in isolation in spite of calls for larger and more rigorous investigations. One of the limiting factors contributing to this is data availability which is discussed next.

3 DATA COLLECTION METHODS: NOT ALL DATA ARE CREATED EQUALLY

Here, three ways a research group can obtain data are introduced personified as 'The Engineer, The Anthropologist, and The Experimenter'. Briefly, the engineering approach seeks to collect existing data, compile it and look for patterns. While greatly informative this approach can be hindered by collection biases outside of the control of secondary researchers. The anthropological approach seeks to generate its own data by interacting directly with people who are experiencing the situation being researched. This approach creates high resolution data for a specific location and issue, but findings may not be applicable outside of those parameters. Lastly in the experimenter method the researcher constructs a specific experiment relating to a hypothesis and then collects data from participants that interact with the experiment environment and each other. Experimental design is critical for this method to ensure that data addresses the hypothesis's and not questions outside of the research scope. The data needed for research is very tightly linked to the questions being addressed. Perspective is also vital to keep in mind when it comes to data gathering as nuances between emic (insider) and etic (outsider) standpoints can not only impact the data itself, but also the research outcomes if potential biases are not identified and managed correctly.

4 IF AT FIRST YOU DON'T SUCCEED

Recently two different, yet related ORNL research efforts sought to delve into the climate-change migration nexus using computational approaches. The first; Island World, was to be a tool for researchers to customize to generate migration decision data through a crowd sourcing approach. The data generated would then be used to inform more complex migration decision models. This tool would have been greatly beneficial to future research efforts as this type of decision data is not available on the intended scales. The second effort aimed to model migration outcomes stemming from environmental stressors for the entire country of Bangladesh. Both efforts were forward thinking and addressed current needs in the research community. However both were unable to be completed. The lessons that have been drawn from these attempts are pivotal if we are to move forward in this research area. Expressing these lessons is difficult in an environment where academic publishing emphasizes success, when "it may be the dead-ends that were encountered on route that provide the most important information" (O'Sullivan, 2004). We do not want to see future efforts suffer from the same or related setbacks that were encountered during the above mentioned projects. Both efforts experienced shortcomings in the quality and breath of background research conducted, which had detrimental effects on the direction the projects took. Failure to ask questions when uncertainties arose, a deficit of open communication between team members, staff turnover, and a lack of sufficient record keeping with respect to how decisions were made also contributed to significant research direction deviation over time. These and other lessons need to be more openly admitted, discussed, and learned from if research is to move forward as an accountable and respected whole.

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