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Population and the Environment: Analytical Demography and Applied Population Ethics

October 15-16, 2018

Post-meeting Reflection by Presenters

Paul Hooper (SFI) - "Modeling complex populations - statistical inference from demographic data"

It's clear that an extended version of this course should include treatment of inequality (and more generally the distribution of the benefits and costs of environmental impacts within societies) and conflict between and within states. The #1 highlight is of course the group of people assembled here.

Caroline Bledsoe (Northwestern Univ.) - "Co-evolution of population and environment - perceiving climate change and its impacts on reproduction and migration."

With climate change, we appear to be entering into an era of partial and flawed awareness, on the parts of scholars as well as the public, of changes in natural forces bigger than we knew existed. Sociologist Ulrich Beck (2015) captures the dilemma this represents: "The idea that we are masters of the universe has totally collapsed and has turned into its opposite." How can we grasp the scale and character of these changes both in the environment and in the social world in categories we do not yet have, and at scales that are beyond our imagination?

Through what cultural frames – whether expressed through local, international, legal or scientific idioms – can we best grasp how people are responding to what we might see as dangerous climate change and the best solutions to it? While easy answers to these questions are illusive, findings from analogous studies – child fosterage, Western contraceptive use, and migration from West Africa to Europe and the US – may be brought to bear to address some of the principles on which they seem to rest.

Among the biggest puzzles in debates about climate change is why so many people support policies and politicians that appear to undermine their own best interests. These have been identified across the world, including in the US, where advocates for science in climate studies and action find themselves locked in battle with climate-change deniers. While these things can be addressed under classic rubrics of rationality, questions of meaning, nature, and what we tend to take for granted are equally important.

Christopher Cowie (Durham Univ.) - "Foundation of population ethics - population axiology & moral theory."

Highlights: People genuinely seeming to care about philosophy.

Open questions that came up: questions about the nature of duties to merely potential people and the application of my approach to personal choices as well as public policy choices. How your perspective changed: I wouldn't say my perspective changed. But I now think I was wrong to assimilate personal choices as well as public policy choices in my approach. Impact on your own work: A bit more clarity on the above, as well as on the sense of should used to frame my questions (= should of morality not of rationality).

Aisha Dasgupta (United Nations) - "Household decisions and their consequences - fertility & family planning."

Loved learning how demographers, philosophers, anthropologists, economists, ecologists, scientists... approach the subject, and the breadth of work taking place from these different fields. I was struck by the need to be able to produce decent estimates of the return on investment of family planning.

Lori Hunter (UC Boulder) - "Household decisions and their consequences - rural livelihoods, migration & climate."

The meeting has really emphasized the vast potential (and need) for interdisciplinary collaboration in the arena of population and environment. I have long been engaged with the social demographic research community focused on environmental demography, but we have not sufficiently bridged to those with expertise in anthropological or analytical demography nor with those in population ethics.

An important open question for me is "How do we make our research more policy relevant?" With the recent imperative from the IPCC, the research community must come together to generate impactful, meaningful insight that can help in identifying and prioritizing policy and programmatic response -- now.

On the prospective of shifting my own perspective, I don't know that my perspective has changed, but I certainly have greater appreciation for, and understanding of, the myriad ways in which scholars are thinking about population issues, including as related to philosophical questions around population ethics.

I can imagine that this workshop pushes me to more centrally engage anthropological demographers within my own work. Dr. Scott Ortman is an affiliate of the University of Colorado Population Center, for which I'm Director, and I can now better see the potential to consider commonalities and distinctions in population-environment linkages across long periods of time. Key, though, is I would aim to engage this work in ways that would yield impactful findings as related to our contemporary demographic and climate challenges.

Chris Kempes (SFI) - "Co-evolution of population and environment - ecological & metabolic dynamics"

Some of the highlights of the meeting for me were:

- Chris Cowie's detailed presentation of the consequences of various axiomatic assumptions about how to make decisions affecting entire populations in terms of the two dimensions of welfare and population size. This type of thinking is nice in that it forces people to explicitly express their preference regarding different types of outcomes and understand the tradeoffs therein.
- The discussion that followed between Simon Levin, Chris Cowie, and Partha Dasgupta regarding the ultimate moral responsibility to unborn children was fascinating, and touched on some of the deepest moral philosophy questions. Namely tradeoffs between responsibility to self, society, existing children, and potential children where the decision to have an unborn child is

connected to which of these categories of welfare one is weighting most strongly, and what one expects the future condition for the child, self, and society to be.

- Caroline Bledsoe's discussion of the variety of husband perspectives on contraception across multiple wives was fascinating, highlighting the stronger connection to individual relationships rather than blanket opinions. For example, if a husband viewed contraception as a means for an individual wife to recover from child birth and delay the next birth lead generally to a receptive perspective of contraceptive use. This work connected strongly to Aisha Dasgupta's plot of a negative correlation between fertility and contraceptive prevalence across countries, where outliers in fertility at the same contraceptive use may indicate detailed cultural processes.
- Mary Shenk's overview of the demographic transition and contrasting of humans with other primates was also very useful for understanding the broad-scale history of human populations.

Charlotte Lee (Duke Univ.) - "Co-evolution of population and environment - environment, food supply & demography"

Highlights: Very many of the issues with which I've wrestled in my own thinking--from big-picture and philosophical questions to methodological ones at various levels of detail--are being studied and advanced by others at this meeting. There have been a few ways of measuring things, or of thinking about them at all, which were completely new and cool to me. And of course, several questions and topics about which I personally haven't thought much, but are clearly important to population and environment

Impact on my own research: I've come to a renewed awareness of the value and difficulty of interdisciplinary integration. For example, there are many places in my research where social organization plays some role in the dynamics of food supply and population change, and sharing this here has reminded me of how much can be important and how much there is to find out.

Simon Levin (Princeton) - "Modeling complex populations - dynamics of age-structured populations"

The interrelated topics of population growth and resource depletion are central to sustainability, and ideal topics for SFI. Potential for greater integration of conceptual foundations and applications is high; these are prototypical complex adaptive systems, and problems of the Commons are at the core as regards resource use, disease management, etc.. I would like to see even more-post-meeting integration of these topics. I may work more on migration.

Andy Rominger (SFI) - "Co-evolution of population and environment - anthropogenic change & biodiversity"

This has been a great meeting with many good ideas and excellent people. I was left with several thoughts: populations in wealthier countries have lower fertility: why? This was from Mary's talk and is really fascinating. In particular I wonder how economic pressures versus cultural pressures drive this. In my very naive view I can mostly think of cultural reasons--cultural pressures that empower women and change symbols of status away from family size for example; and the economic pressures would seem to work in the opposite direction: it should be economically easier to have more children in wealthy countries, connecting to observations Partha presented earlier.

And yet, Mary's work points to economic drivers being more statistically supported--I'll be excited to engage with her findings more. Also, again born of my ignorance on the subject, I wondered when we speak of morality around populations, how do we avoid arguments that facilitate (while not

explicitly being) eugenic views on who should reproduce and who should not? If evolution drives populations to higher fitness can fitness maximization be a moral construct?

Mary Shenk (Pennsylvania State Univ.) - "Household decisions and their consequences - fundamentals of the demographic transition"

This has been a very productive meeting for me. At first, I thought "I don't do environmental work, so what do I have to contribute to this course?" But I was interested in the topic so I decided to participate, and it turns out that there are many interesting intersections between my work and that of other participants who are more directly focused on the environment. I have also found an environmental perspective embedded in my own work that I have been able to make more explicit as part of my presentation for this workshop. In terms of professional outcomes, I have already developed one new potential collaboration relevant to human population and demographic transitions in the past and an idea for a future workshop.

Post-meeting Reflection by Non-presenting Attendees

Aman Borkar (Tata Inst. of Social Sciences):

I have learnt the linkages between various themes presented from extinction to population demographics to family planning and conservation. Although most of the data presented has limited and very specific variables but the presentation of such variables and correlation between the variable is non-conventional. However, much of the focus of explanation of such linkages is quantitative rather than qualitative. Thus, there is huge scope of finding more meaning to the data and substantiating the quantitative findings with the qualitative ones.

In this two-day seminar, I have identified around 18 new interdisciplinary topics to research on. In my coming teaching and field sessions at Tata Institute of Social Sciences (Mumbai-India), I will be working on these 18 topics with my Master's Students

Eva Nurwita (Univ. New Mexico):

I am very grateful that I got a chance to attend this very great meetings and met with great people from a very diverse background, and diverse field of knowledge. I am an economics graduate student, whom before came to this meeting has a very limited knowledge on how broad is the population-climate problem. As I am exposed to the knowledge I received from this very meeting, I now have a sense of more factors that made my mind opened quite larger than before. I now understand that as some more people out there debating on which one to do first from which part of the world and what scientific method to be used, the more effective way to do is to tackle population-climate problem in collaborative scientific methodology, the way this meeting has been set up since the very beginning.

Iza Romanowska (Barcelona Supercomputing Center):

Many thanks for the most wonderful opportunity to learn from and engage with an incredible group of researchers. It would be preposterous to limit the list of things I've learnt to one. C. Cowie's presentation on population axiology has opened up an area of inquiry that I was not even aware existed. M. Shenk's paper was probably the clearest introduction to demography I could wish for, similarly to L. Hunter's talk on migration. All the talks on mathematical underpinnings of some of the questions raised (and especially S. Levin's) were pitched at such a low level that even non-math folks like me could follow (THANK YOU!) which is much appreciated. I could go on but shifting to the 'how are you planning on using what you've learnt?' question. The socio-natural model presented by C. Lee has a good potential for being an absolute game changer for my research. It really opened up new avenue for linking environmental variables to demography that I was not aware of previously. Stay tuned!

Jake Organ (University of New Mexico):

I'm still (Thursday) trying to internalize and make sense of the intense intellectual experience that was my attendance at the Population and Environment conference. Firstly, the Institute itself was an amazing discovery, that such places exist beyond the realm of Sci-fi was eye-opening; and the atmosphere in the conference and the wider Institute really encouraged a level of deep thinking that often goes on in private but is rarely talked about in such an open and relaxed way. I loved the short, sharp shock lecture style; i.e. all these relatively brief but penetrating talks from experts in a wide variety of fields. I woke up around 3.30am on Tuesday grappling with two thoughts that wouldn't go away; Mary Shenk's concept of the Homo Sapien discovery of 'Co-operative breeding' and the implications of that especially as that process seems to be reversing in the Western World, and a couple of sentences by Simon Levin on the differences between optimization and game theory and which models the actual process more effectively. Thankfully, I got a chance to have a great talk with Mary in which she helped me think about the implications of globalization and development, especially as they relate to the areas of Sub-Saharan Africa that I study. Also, Simon gave me some of his time to discuss the prevalence of optimization, especially in the field of economics and pointed me to some excellent papers to help to develop my thoughts.

So much more I could say: both Mary and Caroline Bledsoe gave me a deeper insight into anthropological methods, Lori Hunter's talk touched directly on a lot of my research and though I'm not a biologist, there were many parts of Caroline Lee's, Chris Kempes's and Andy Rominger's talks that really spoke into my research. Hearing Sir Partha Dasgupta at the end was a great inspiration, and aided many of us economists because he pointed to ways that we could integrate the wider research into our own work. I could write more, but I'll end with thanks to Paul, Amy, Carla and David for the warmth of the welcome, the creation of such a unique atmosphere and the constant supply of food and coffee.

Kaarel Sikk (University of Luxembourg):

As I am working with conceptualizing the formation of human settlement patterns, I came searching for the state of art knowledge on socio-ecological processes influencing their formation. Santa Fe and the Institute greeted me with even lot more than expected starting from eclectic societies of art and science in the city to the bold focus on "the most important" backed by art and mathematics in the SFI.

The course on population and environment offered a wide range of bits and pieces related to demographic dynamics, population size, migration, economy and spatial processes all essentially connected to my own study. All those bits and pieces created a confident methodological background that significantly advances my work. Several ideas in the talks and personal exchange with other participants were directly related to my work. The themes of demographic transitions, migrations, ecosystem services gave me a lot of thought food. More philosophical questions asked in population axiology presented paradoxes in maximization in ranking which in addition to ethical inquiry also makes you think on the level of abstraction of models.

Another topic I was secretly pursuing was the projection of long-term processes to the future. As my own work is based on archaeological data from the past, envisioning it towards to the future creates a powerful motivator. And I did observe several interesting trends. Although in most parts we were presented analytical aggregate models the reasoning and understanding behind those macro-level processes involves choice. So a somewhat emotional takeaway from the course for me was - if we want to project from the past to the future, we need to conceptualize our models to the level of choice, and even further to the level of agency (and hopefully use agent-based models on the go).

I really thank SFI, all the organizers and participants for the great opportunity.

Kailey Martinez (NM State Univ.):

I am so grateful to have been given the opportunity to attend this short course and grateful for the instructors that took the time to attend and teach us. Obtaining my undergraduate degrees in both Wildlife Ecology & Management and Anthropology provided me the chance to learn about two subjects that have always been deeply interesting to me. Five seasons of archaeological field experience, starting right after my freshman year, provided me practical skills to partner with what I was learning in the classroom. Through undergraduate courses and now my graduate program though, I have found that the kind of interdisciplinary thinking I naturally lean towards is not always fostered in a traditional academic setting, which is why I was so excited to see that it was the main focus throughout the course.

The topics concerning fertility and human population were very interesting, as I had little knowledge in the form of relating these concerns to deeper global issues, besides the basics of an increased population, and the solutions that could be found through more critical understanding and application. The topics presented by Chris Kempes, Caroline Bledsoe, Lori Hunter, and Andy Rominger were most directly related to my interests and helped me to better understand how I could apply my variable knowledge, as well as what I learn in the future, to globally relevant issues that I feel compelled to work with, such as climate change and conservation/sustainability. Being able to talk with the other students was also extremely interesting. As one of the few students at the Masters level, hearing about research being conducted by all of the doctoral students and professionals, was inspiring. The two thought provoking days we were able to be a part of have impacted me greatly and will provide me with greater ideas to include in my thesis as well as hopefully help me explore and decide upon a path for me to pursue in my future doctoral studies.

Kaitlyn Davis (UC Boulder):

For me, the most useful about this course was seeing more examples of and talking through the process of moving from 1) establishing research questions to 2) identifying the key variables to 3) developing the equations to relate the variables to each other to 4) developing models of how the systems work. For me, steps 3 and 4 have always been the most difficult and are currently the steps I am thinking through for my dissertation. Getting to talk with other researchers about this process and seeing how they developed equations and models to capture and depict their topics of interest has helped me make some inroads to get started on this process in my own research.

Some additional useful things learned in the course: The importance of always being aware of and periodically re-assessing/re-identifying the interplay between 1) models/abstractions of data patterns and 2) on the ground interviews and data collection that reveal the key variables/driving factors and logics/frameworks of the subjects that contribute to the observed data patterns (such as in Caroline Bledsoe's . Without this ground-truthing and finding out what variables actually matter for the study organisms and how they conceptualize them, our models will be flawed due to either missing key variables or not being able to actually explain the implications of the patterns they show.

The importance of considering time lengths/durations in a process. For example, as we saw in Mary Shenk's lecture on demographic transitions, the same pattern (e.g. declining fertility rate), but over different time scales (e.g. a longer time in one area than another), can have significantly different impacts (e.g. amount of population in each of the two different areas). Another example from this workshop was thinking about what is the temporal resolution of our data and how this aligns with the temporal resolution of the variable of interest (such as Lori Hunter discussed in terms of census data and temporary migrations).

As I'm building models and thinking of variables to consider for my dissertation, which deals with agricultural adaptations in light of socioeconomic changes in the indigenous American Southwest, this workshop will be extremely helpful (particularly Chris Kempes's work on the land/resources needed to sustain a given population and Charlotte Lee's model integrating environment, population, and society).

Mohammad Ali (Univ. New Mexico):

This unique program allows researchers to learn by making conceptual connections between ideas and facts that are spread across different disciplines. I wanted to attend this program to see how researchers simultaneously apply the knowledge gained in one discipline to another in order to enhance their learning experience. The two days of learning during the course gave me an opportunity to look at the problems that I am interested in from a different lens than what Economics offers. The experience gained from this course made me realize that studying topics by themes is an excellent way to integrate ideas, create engaging learning experiences and producing more holistic research.

However, one of the biggest challenges of achieving an interdisciplinary environment is facilitating collaboration between departments and educators. That is where the Santa Fe Institute has and is doing a wonderful job of bringing together researchers from different areas of research and providing them opportunities to explore research questions without limiting their boundaries of curiosity. Personally, I feel that this course will help me incorporate the relationship of environment,

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demographics and social networks to my current research on human capital formation and early childhood development.

Nadia Farooq (Pakistan Inst. Development Economics):

It was a nicely designed course. It has developed a new sense of getting solutions with the help of complex modelling. I am thinking to evolve a new model with the mixture of burning issue of climate change and increasing population growth into the macroeconomic model for Pakistan. I am sure that it'll be unique with the addition of complexity.

Dr. Shenka's presentation was very interesting, either as a citizen of South Asia, the outcomes were not unfamiliar to me but her way of presentation was amazing and easily understandable.

Peter Roolf (Portland State Univ.):

The most useful part of this short course for me was learning the high level perspectives of experts outside of my field. As a systems science PhD student, I am interested in studying social-ecological systems and how we as a society are going to adapt to a changing climate, resource depletion, population growth, energy transitions, etc. My personal interest is in implementing circular economies at the community level (neighborhoods, towns, etc) and so I found Chris Kempes' "Ecological & Metabolic Population Constraints" and Charlotte Lee's "Environment, Food Supply, & Demography" presentations particularly relevant to my work, and I am interested in utilizing some of their findings into the development of agent based models of local economies. Additionally, I have not had significant exposure to demographics, fertility, and migration in recent memory, and so I now have plenty of additional information to consider when designing models or community interventions. And lastly, the "Anthropogenic Change & Biodiversity" talk by Andy Rominger and the closing thoughts by Partha Dasgupta reinforced my understanding of the larger problems at hand and provide the larger context for the smaller investigations and projects that I am involved in.

Insofar as how I plan to use this knowledge, over the past several years I have formed the equivalent of what physicians would call a "general impression" of the great changes that are taking place. The content of this course has largely validated my differential diagnosis and has enriched my understanding by providing details backed up by rigorous research. As I move forward with my academic and professional work, I will undoubtedly refer to my lecture notes and dig deeper into the research papers cited. And, although I will not go into detail in regards to a number of interesting conversations during the course, suffice it to say I am delighted to now be a part of this intellectual network and I plan to connect with several students and faculty for further conversation and collaborations.

Rajan Bishwakarma (University of New Mexico):

I think talks/lectures selection reflected the overall objective of the course. From an economists' viewpoints, most lectures were thought provoking and I thoroughly enjoyed. Personally, not only that the lectures helped me to improve my dissertation, I am grateful to some of the organizer for their help.

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Usama Bilal (Drexel Univ.)

Most useful thing I've learned: The idea of outlining several causal models and the predictions that they can make about a certain phenomenon of interest, to then test which one fits the data better. This type of deductive reasoning is, I'd say, underused in my field. I'd like to think again about the causal models for fertility and to review potential causal models for epidemiologic transitions. However, at the same time, the conclusion from the lecture (and the paper) on these causal models for fertility ended up being about the importance of considering all models simultaneously, or, even better, considering how they have a differential effect over time. That is, some of the models may have an importance in the beginning of the fertility decline while some others may be more important in the later stages. I think we need to leverage the idea of feedback loops and endogeneity in complex systems to better accommodate the presence of multiple causal models.

Planning to use knowledge: I plan to use the framework on migration determinants, especially at the macro level, and to leverage some of the data sources that were mentioned in the migration lecture. In particular, I'd like to see the connections between internal migration (rural to urban) in the determination of urban health outcomes. I'd also like to incorporate some of the lessons about causal models, but applying them to epidemiologic transitions.

Interesting conversation:

- On the necessity to consider endogeneity in the causes of population dynamics. X affects Y than in turn affects X again.
- On the necessity to consider inequalities and distributional effects

Zachary Cooper (UC Boulder):

First and foremost, I would like to thank the Santa Fe Institute for this incredible opportunity! This experience was intense and intellectually stimulating in many different ways. As an archaeologist, I found Dr. Lee's presentation on agroecological and environmental-dependent demographic models to be fascinating, and I certainly can see the relevancy of such models in generating better prehistoric population estimates. In addition, I found Dr. Hooper's presentation on statistical model selection to be very useful. Last, but certainly not least, I truly enjoyed the opportunity to interact with my fellow attendees. There is an incredible amount of value in simply chatting with so many interesting and intelligent people in one place. In my opinion, the synergies that derive from the aggregation of so many great minds in one location is one of the many benefits of a place like SFI. I hope to have the opportunity to return to SFI in the near future.