COMPREHENSIVE PORTFOLIO

Austin M. Sandler

Department of Geographical Sciences
University of Maryland

Contents

1. Curriculum Vitae

Austin M. Sandler

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January, 2018

EDUCATION

University of Maryland
Doctor of Philosophy, Geographical Sciences

University of Minnesota August 2016
Master of Science, Applied Economics

Thesis: *Misclassification Error in Satellite Imagery Data: Implications for Empirical Land-Use Models*

University of Wyoming August 2014
Master of Science, Agricultural and Applied Economics

Thesis: *On Land-Use Change Modeling: A Treatise of Satellite Imagery Data and Misclassification Error*

University of Iowa May 2012

Bachelor of Science with Honors, Economics, (Policy emphasis)
Bachelor of Science with Honors, Geography, (Social Change emphasis)

Thesis: *A Spatial and Economic Study of Millennium Development Goals Across The World and U.S.: A Spatial Distribution, Trend Analysis and Panel Regression Approach*

HONORS AND AWARDS

Behavioral and Social Sciences Dean's Fellowship: University of Maryland

Comprehensive Funding Award: University of Wyoming

Certificate of Academic Excellence in Economics: University of Iowa

Economics Faculty Recognition Scholarship: University of Iowa

Rhodes Dunlap Scholarship: University of Iowa

Dean's List: University of Iowa

Honors Student: University of Iowa

PROFESSIONAL APPOINTMENTS

Graduate Teaching Assistant, University of Maryland
Department of Geographical Sciences: Supervisor, Dr. Ronald Luna

Graduate Research Assistant, University of Maryland
Department of Geographical Sciences: Supervisor, Dr. Laixiang Sun

Economic Development Specialist, Ohio University
Voinovich School of Leadership and Public Affairs: Supervisor, Dr. Jason Jolley

Adjunct Instructor, Ohio University
Department of Economics: Chair, Dr. William Shambora

Graduate Research Assistant, University of Minnesota
Minnesota Population Center, NHGIS: Supervisor, Dave Van Riper

Graduate Research Assistant, University of Wyoming
Department of Agricultural and Applied Economics: Supervisor, Dr. Ben Rashford

Undergraduate Research Assistant, University of Iowa
Department of Geography: Supervisor, Dr. Kathleen Stewart

Community Development Research Intern The Federal Reserve Bank of Richmond
Department of Community Development: Supervisor, Dr. Kimberly Zeuli

PUBLICATIONS

Refereed Journal Articles

Sandler, A.M., and B.S. Rashford. Misclassification Error in Satellite Imagery Data: Implications for Empirical Land-Use Models. *Land Use Policy* (Revise and Resubmit).

Jolley, G.J., K. O'Donovan, and **A.M. Sandler**. Do Rural Areas Experience the Same Benefit as Urban Areas from Disasters? Fiscal Evidence from Appalachian Ohio. *The Journal of Regional Analysis and Policy* (Forthcoming).

Federal Reserve Publications

Zeuli, K., S. McKay, and **A.M. Sandler**. 2011. Measuring and Mapping Local Innovation. *5th District Footprint*, Federal Reserve Bank of Richmond.

Zeuli, K., S. McKay, and **A.M. Sandler**. 2011. Where Are the Brick-and-Mortar Banks? *5th District Footprint*, Federal Reserve Bank of Richmond.

Monographs and Technical Reports

Jolley, G.J., G. Michaud, **A.M. Sandler**. 2017. *Appalachian Ohio Skillshed Analysis: Semi-annual Progress Report.* Voinovich School of Leadership and Public Affairs, Ohio University. Prepared as part of the U.S. Economic Development Administration University Center.

Jolley, G.J., G. Michaud, **A.M. Sandler**, D. Driver, B. Lumumba, K. Riley, and C. Smith. 2017. *City of Belpre Economic Development Strategic Plan.* Voinovich School of Leadership and Public Affairs, Ohio University. Prepared for Belpre Area Chamber of Commerce and the City of Belpre, Ohio.

Howe, S., **A.M. Sandler**. 2017. *Workforce Analysis for Proposed Integrated Energy System (IES) Complex at PORTS.* Voinovich School of Leadership and Public Affairs, Ohio University. Prepared for the PORTSfuture Project.

Howe, S., **A.M. Sandler**. 2017. *Economic Impact Analysis for Proposed Integrated Energy System (IES) Complex at PORTS.* Voinovich School of Leadership and Public Affairs, Ohio University. Prepared for the PORTSfuture Project.

Work in Progress

Sandler, A.M., and L. Sun. Unmasking latent and leading indicators of malnutrition in children: A case study of Kenya and Nigeria.

Sandler, A.M., and G.J. Jolley. How to skillshed: Reemployment analysis and techniques for practitioners.

PRESENTATIONS

Reemployment Options in Appalachian Ohio's Coal Economy: A Skillshed Analysis. Mid-Continent Regional Science Association 48th Annual Conference. Oregon, Ohio, June 7-9, 2017.

State of the Region. The Sixth Annual Appalachian Ohio State of the Region Conference: A New Era in Economic Resiliency. Athens, Ohio, May 23, 2017.

Change Strategies for the Future of Grassland Birds in the Midwest: A Conservation Deliberation Society for Conservation Biology, North American Congress for Conservation Biology Conference. Madison, Wisconsin, July 17-20, 2016.

TEACHING

Assistant: *GEOG 130 - Developing Countries*, University of Maryland, Fall 2017.

Instructor: *ECON 1040 - Principles of Macroeconomics*, Ohio University, Spring 2017.

PROFESSIONAL AFFILIATIONS

American Economics Association

Agricultural and Applied Economics Association

Midwest Economics Association

Western Agricultural Economics Association

Mid-Continent Regional Science Association

Association of American Geographers

SERVICE

Graduate Representative, Department of Geographical Sciences Graduate Committee

Member, Department of Geographical Sciences Department Committee

Executive Member, Geographical Sciences Graduate Student Organization

Organizer, Appalachian Ohio State of the Region Conference

Benevolent Social Planner, Applied Economics Graduate Club

SOFTWARE

ArcGIS, LaTeX, IMPLAN, R, Python, Office, Stata, SPSS, MATLAB, GAUSS, GAMS

LANGUAGES

English - Native

Italian - Limited Working Proficiency

2. Goal Statement

2.1. **Application Goal Statement**

Application Statement of Purpose

I am highly interested in earning my Ph.D. from the Department of Geographical Sciences at the University of Marylands College of Behavioral and Social Sciences because of your vision for academic, educational, and research directions of human and natural systems, land-use change, and geospatial information science. Likewise, I am motivated to integrate geographic science to answer fundamental questions of global importance in collaboration with your dedicated faculty who share my particular interest in empirical and theoretical land-use issues. Broadly, my focus is in optimal policy analysis related to the spatial modeling of land-use change and its impact on economic, environmental and agricultural systems. I am especially interested in complementary linkages between economics and geography. I see many exciting synergies between my interest in land use, geographic information science, ecosystem services, and spatial econometrics, and the research interests of the expert faculty mentors in your department.

Specifically, my current interest is in spatially-explicit analysis of land use to understand the effects of various land-use change scenarios on agricultural production, global climate change, ecosystems services, and biodiversity. I would like to develop a consistent framework for modeling changes in land use with spatially explicit, long term, high resolution, and precise categorical data. By combining spatially explicit biological and economic models, this field shows promise to identify potential landscape alternatives of efficient agricultural output, transportation networks, and nutritional needs, while also balancing conservation needs.

Currently, I am the Economic Development Specialist for the Voinovich School of Leadership and Public Affairs and an Adjunct Instructor in the Economics Department at Ohio University. As the Economic Development Specialist I conduct applied research on community and economic development projects, primarily for the 32 Appalachian counties of Eastern Ohio. I manage multiple projects, write grant applications, and deliver presentations of analysis on economic, demographic, industry, and occupational data, focusing on the transition away from the coal economy. As an Adjunct Instructor I teach Principles of Macroeconomics to a class of 200 undergraduate students. My teaching objectives, through the use of team-based learning, include a non-traditional focus on historical and rhetorical perspectives of economic thought along side the rudimentary mission of a principles class.

My interests and experiences have all led to the goal of earning a Ph.D. In the spring of 2009, I spent a semester in the Rocky Mountains with the National Outdoor Leadership

School, totaling 87 days in the backcountry, with backcountry skiing in Wyoming, technical climbing in Nevada and Colorado, whitewater paddling down the San Juan and Green Rivers, and canyoneering in Utah. I went on to become a certified guide through the American Mountain Guide Association and a Wilderness First Responder. I learned about leadership, communication, and tolerance of adversity and uncertainty while gaining a deep respect and reverence for open spaces and wild places. I often bring this experience to bear, be it bringing a unique perspective to conservation or working with a dynamic group of people through a difficult task.

While earning dual B.S. degrees in Economics and Geography with Honors from the University of Iowa in 2012, I developed a special interest and expertise in using spatial tools to help inform economic decisions. I have dedicated myself to the intersectional study of economics and geography for the past eight years, starting with a strong foundation in the fundamentals of theory, conceptualization, method, hypotheses, and measurement. Indeed, for my honors thesis, I evaluated the Millennium Development Goals, examining the global progress of individual objectives by 2010 and further evaluated the impact on a subnational spatial scale to uncover hidden heterogeneity. During the penultimate summer of my undergraduate education at the University of Iowa, I embarked on an internship with the Federal Reserve Bank of Richmond. There, I researched community development issues of payday lending practices and affordable housing programs. This led to meaningful collaborations with other Fed economists to develop spatial and economic analyses to distinguish those communities that were most in need of traditional banking and housing assistance. Part of this work went into my publications in the October and November 2011 editions of the 5th District Footprint, an online publication by the Federal Reserve.

I earned my first M.S. degree in Agricultural and Applied Economics at the University of Wyoming in 2014, where my interests and expertise expanded to include environmental and natural resources. This led to my thesis, Land-Use Change Modeling: A Treatise of Satellite Imagery Data and Misclassification Error, which reconciles gaps between spatial statistics, remote sensing, and land-use economics. I examined how the largely ignored misclassification errors in satellite imagery data propagate through econometric land-use models. This work is now under consideration for publication in a peer reviewed journal. I would like to build on this research experience at the University of Maryland; broadening the application to include other theoretical issues in spatial econometrics that address empirical topics of land-use change modeling within an integrated geographic information science framework.

I earned my second M.S. degree in Applied Economics at the University of Minnesota in 2016, where I sought to deepen my understanding of rigorous theoretical and mathematical methods. The University of Minnesota is known for their particular brand of macroeconomics, wherein I gained exposure to the cutting-edge theoretical techniques in dynamic stochastic

general equilibrium analysis. Beyond that, I excelled most in econometrics. Along with the typical theoretical treatment of OLS, IV, discrete methods, GLS, and Bayesian techniques, I embarked on a special seminar series in randomized control trials and program evaluation. I draw on this experience to inform my research method and theoretical conceptualization.

As part of the University of Minnesota Ecosystem Services Working Group, I engaged with faculty and students to better understand advanced topics at the frontiers of economic research with a focus on rural ecosystem services. I also participated in interdisciplinary collaborations between the Institute on the Environment, Department of Applied Economics, and Department of Conservation Biology, resulting in a presentation on Change Strategies for the Future of Grassland Birds in the Midwest: A Conservation Deliberation, given at the 76th Midwest Fish and Wildlife Conference in 2016.

To fund my education at the University of Minnesota, I worked as a graduate research assistant in the Minnesota Population Center, honing my GIS programming skills while producing and maintaining spatially explicit demographic datasets. I used ArcGIS and Python to develop analytical procedures that rectify historical TIGER Shapefiles. Furthermore, I served on departmental committees as a student liaison and as the Benevolent Social Planner for the Applied Economics Graduate Club, working to imbue a greater sense of community within the department. Additionally, I sought out the many seminar series the department had to offer to meet guest scholars and expand my breadth of experience and depth of knowledge in other subjects.

I believe my background and educational training has prepared me to be successful in your program. My M.S. programs involved graduate coursework in development economics, producer and consumer theory, advanced natural resource economics, econometrics, and quantitative methods (e.g., mathematical programming and stochastic simulation). I also chose more advanced coursework; specifically, I undertook the core course sequence for Ph.D. students in three different departments, namely, the Economics and Applied Economics departments at the University of Minnesota and the Economics and Finance department at the University of Wyoming. These Ph.D. level courses prepared me for further advanced study and have confirmed my desire to pursue a Ph.D.

My long-term goal is to be a professor. I believe the University of Marylands Geographical Sciences Ph.D. program will enable me to best achieve this goal. I enjoy learning and working collaboratively on new frontiers of research, and educating the next generation of scholars. The combination of your programs focus on human and natural systems, land-use change, and geospatial information science, and the facultys interdisciplinary strength, will provide a strong theoretical and empirical foundation to help me succeed.

I have had the opportunity to communicate directly with Dr. Klaus Hubacek, Dr. Laixiang Sun, and Dr. Kathleen Stewart. Professor Hubaceks question oriented approach to land-use policy research relevant to international issues of ecosystem services is especially interesting to me. This is a methodology that I would like to foster in my own approach to research. Professor Suns rigorous theoretical and model building approach to land-use research related to spatial economic and econometric topics is a methodology especially pertinent to my future research aspirations. I would like to collaborate with members of CGIS, particularly Professor Stewart, because her expertise in spatiotemporal data modeling and geographic database design would enhance and balance these methodologies.

Application Goals and Research Interests

My long-term goal is to be a professor. I enjoy learning and working on new frontiers of research, and educating the next generation of scholars. Broadly, my focus is in optimal policy analysis related to the spatial modeling of land-use change and its impact on economic, environmental and agricultural systems. I am especially interested in complementary linkages between economics and geography. I see many exciting potential synergies between my interest in land use, geographic information science, ecosystem services, and spatial econometric theory and the research interests of the expert faculty mentors in your department. Specifically, my current interest is in spatially-explicit analysis of land use to understand the effects of various land-use change scenarios on agricultural production, global climate change, ecosystems services, and biodiversity. I want to develop a consistent framework for modeling changes in land use with spatially explicit, long term, high resolution, and precise categorical data. I would like to build on my previous research experience to explore empirical consequences of econometric modeling issues, broadening the application to include other theoretical issues in spatial econometrics that address empirical topics of land-use change modeling within an integrated geographic information science framework.

Application Experiences

My nascent interest in geography can be traced back to my childhood. I had an affinity for maps and mapmaking, and would spend my free time recreating political and thematic maps from National Geographic magazine inserts. This grew into a tacit spatial perspective that I rely on when approaching new research challenges.

In the summers of 2006 and 2008, I went to Tororo and Iganga Uganda to participate in the Life to Life Global Builders development initiative where I built housing and school rooms for AIDS orphans and underprivileged girls. I helped to raise over $100,000 to support these building projects. Through this experience I learned about empathy and humanity and gained a global perspective of a more nuanced and acute nature. This global perspective

and appreciation extends to Italy as well. I studied Italian language and culture as part of my liberal education in college. With a proficiency in speaking Italian, I had the opportunity to travel to Italy, traversing the country with a host family going from Rome to Bari to Palermo.

In the spring of 2009, I spent a semester in the Rocky Mountains with the National Outdoor Leadership School, totaling 87 days in the backcountry. Motivated to become an expert at whatever I do, I became a certified guide through the American Mountain Guide Association and a Wilderness First Responder. I learned about leadership, communication, and tolerance of adversity and uncertainty. This experience informs my perspective on our collective natural resources.

Determined to pursue my goal of being a professor, I accepted an adjunct professor appointment to teach Principles of Macroeconomics to a class of 200 undergraduate students. I try to imbue my students with a historical perspective of events and ideas. I teach from a liberal economic perspective while expounding the power of trade tested betterment.

2.2. **Current Goal Statements**

Written description detailing academic, research, and professional goals

I am still steadfast in my pursuit to be an academic. A serious and systematic scientist. For me nothing sounds better then to teach and do research at an institution of higher education. Living, learning, and collaborating an a diverse community – asking the big questions and finding answers. I want to push back the barriers of ignorance and share my expertise with others. In my research I want to be able to say something true and surprising.

I have had the opportunity to develop and teach my own curriculum, it was a terrifying and trying experience like stepping out into the void. I could not wait to be finished and I cant wait to do it again. There is no intellectual hiding place while teaching, I quickly discovered exactly what I did and did not know. It is an experience like to other. And it is great place to grow as a researcher too. I would also use the opportunity to test if my ideas held muster and to see if my exposition was clear. I want to grow as a teacher. I see so many aspects of where I could improve. Enabling students to develop a capacity to think critically is one of my overreaching goals. This can involve reasoning using simplified models and then a scrutiny of the models themselves. Much of this reasoning relies on identifying tradeoffs, constraints, relationships, and consequences. To further hone my clear communication and introspective credence I want to develop my teaching abilities.I have always been inspired and motivated my excellent teachers and they have in no small way contributed to my goal of joining their ranks. Since enrolling at Maryland I have attended most of the workshops provided by the Teaching and Learning Transformation Center and enrolled myself in their

University Teaching and Learning Program. And I had the opportunity to as a teaching assistant to apply many of the techniques and tools of team based learning in discussion oriented small classrooms.

I want to be a better geographer, too. I want to be better equipped with the tools and methods of remote sensing and GIS. In particular, I want to be confident in my convictions as a geographical scientist. My interests are broad and interdisciplinary, which lends itself well to the field of geography, but does not lend itself to a straightforward doctorate. My goal is to master the particular techniques and methods of geographers to conduct original scientific research. I have the advantage and perspicacity of previous experience in mastering the particular techniques and methods of applied economics. However, with this hindsight I understand how far I have yet to go in geography at the professional academics level. To this end I intend to strengthen my technical deficiencies in GIS database management and GIS modeling, spatial statistics, and remote sensing image analysis and computing. While also deepening my understanding of the history of thought and progression of the literature. This will give context and perspective to my research.

My academic goals in their scope are fairly standard and straightforward – I wish to earn a Ph.D .– that much is obvious. I have been pertinacious is this pursuit. And it has been my goal for well over a decade. I also want to grow generally as a scholar. I want to develop my writing abilities: writing and rewriting, early and often. I believe that much of successful science is aptly using rhetoric, or the available means of unforced persuasion – forensic, epideictic, and deliberative. Writing is not only a communication tool but also a reflective process where I can develop my methods of inquiry and scrutinize my ideas. Beyond the written word I want to develop my speaking and presentation skills. I plan to attend conferences and build relationships with other scholars. I hope this will lead to collaborations with other scientists on interdisciplinary projects. I is my academic and professional goal to continue publishing academic articles. And I will engage with non-scholars to give breath and context to my work. Particularly because I envisage an applied research agenda, it is essential that I actually communicate with the relevant stakeholders.

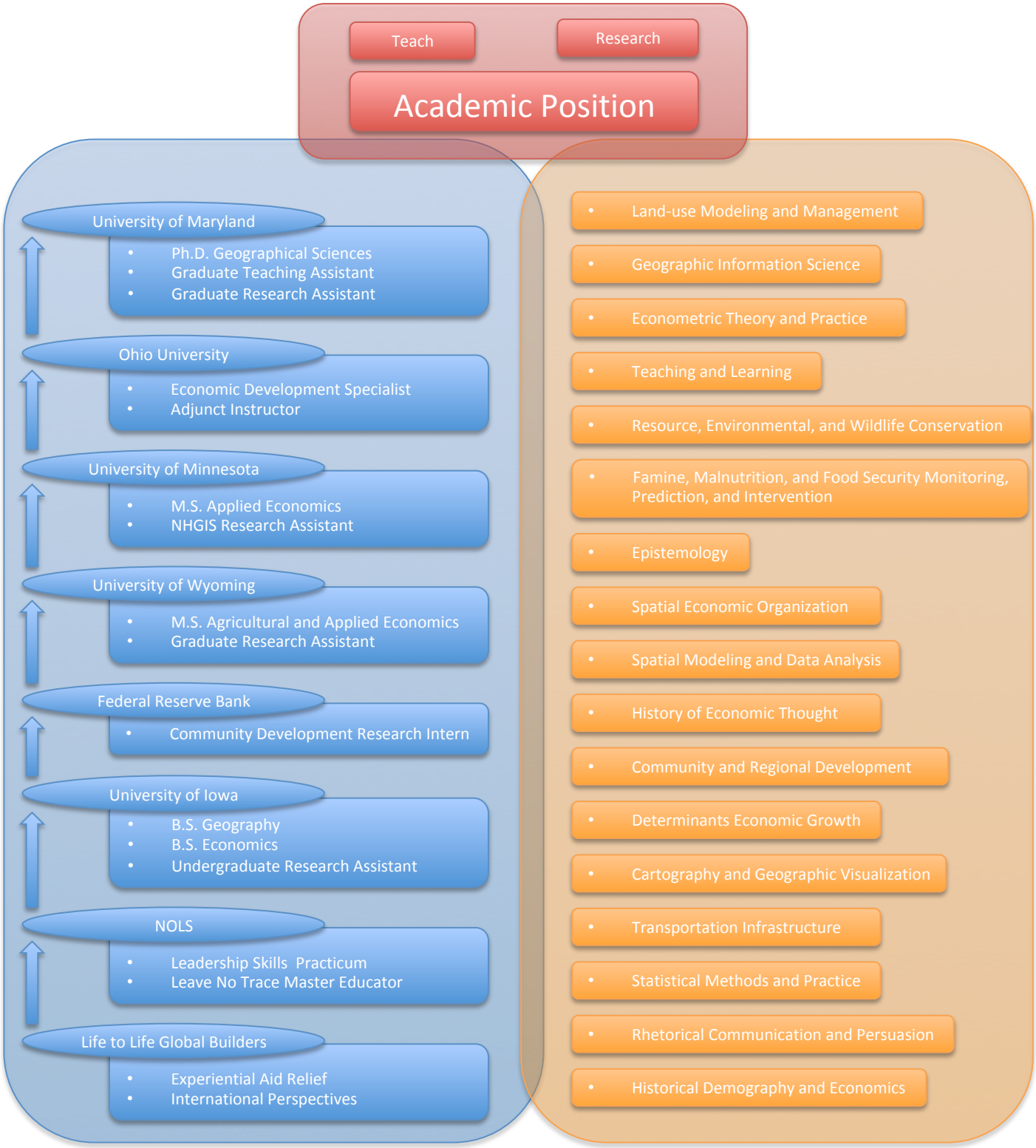
I want to be an expert, but not in the way of Harry Truman, instead as an serious student of science. For my immediate research agenda I want to learn about the causes of malnutrition and the field of food security and famine early warning systems more generally. From the perspective of aid organizations their goals, history, motivation, methods, successes and failures. From the historical perspective to give context and measurability. The academic perspective of scope, scale, and focus. It is my goal to generate and test predictive models of malnutrition. I am in the early stages of developing multilevel spatio-temporal econometric models within the confines inapt data sources. I want to know what causes famines and why do famines persist in Africa? To answer this I need to develop a stronger background

in the history of famines, malnutrition, food aid and security. I need to know scope, scale, severity, duration, horizon, and uncertainty in previous studies and interventions. Along this line of inquiry I will investigate the issue of aid. What evidence is there of successful interventions? Where has it gone? How much and what kind? What is the impact of this aid? How do we measure and quantify success of failure? I will develop and test spatially and temporally explicit econometric models to explain the causes of malnutrition by finding leading indicators using inputs from household survey data, remote sensing data, conflict data, disaster data, and environmental data in a multilevel analytical framework. I plan to have a completed abstract and outline of results by the end of January.

It is my professional goal to be an academic, to both teach and do research at a university. Through a holistic approach to education, research, teaching, and practical experience I am advancing towards my goals. I am broadly interested in the complementary linkages between economics and geography. During to course of my education and experiences I have developed many interests. This include: land-use modeling and management; geographic information science; econometric theory and practice; teaching and learning; resource, environmental, and wildlife conservation; famine, malnutrition, and food security monitoring, prediction, and intervention; epistemology; spatial economic organization; spatial modeling and data analysis; history of economic thought; community and regional development; determinants of economic growth; cartography and geographic visualization; transportation infrastructure; statistical methods and practice; rhetorical communication and persuasion; historical demography and economics. I want to find an important question, ask the question, and then answer it. I want to study the serious business of understanding the world. It is my goal to be systematic inquirer producing meaningful and interesting results.

My extracurricular goals involve a number of ongoing projects. I want to better understand land-use dynamics and the development of theoretical models. I would like to further expand and develop the misclassification methodologies to include a more general approach that encompasses land-use change dynamics and multinomial specification. It is still my goal to expand my approach to land-use policy research relevant to international issues of ecosystem services, too. And I am in the final stages of revision for the original paper for publication in *Land Use Policy* that I plan to complete by this February. I also have ongoing projects of skillshed and reemployment analysis that I hope to flesh-out and generalize. I am also still developing tools and techniques for a skillshed analysis that I greatly expanded and improved this fall during *Topics in Data Visualization with Processing and Applications in R*. I envisage both academic publications along with community outreach and interactive extension products. In the meantime I continue to read outside the discipline to glean different perspectives and approaches to science. It is my goal to continue to publishing to satisfy my holistic academic, research, and professional goals.

Schematic Framework of Interests, Experience, and Plans



3. Coursework Experiences and Plans

3.1. **Program of study**

University of Maryland Ph.D. Program

Course Name	Credits	Semester	Institution
Pre-Candidacy Research	3	Fall 2017	University of Maryland
The Nature and Practice of Science	3	Fall 2017	University of Maryland
Topics in Data Visualization with Processing and Applications in R	3	Fall 2017	University of Maryland
Comprehensive Portfolio Assessment Summary	1	Fall 2017	University of Maryland
University Teaching and Learning Program	NA	Fall 2017	University of Maryland
Applied Spatial Econometrics	NA	Fall 2017	University of Maryland
Pre-Candidacy Research	8	Spring 2018	University of Maryland
Seminar Series	2	TBD	University of Maryland
Doctoral Dissertation Research	≥ 12	TBD	University of Maryland

Environmental and Biological Aspects of Earth Systems Science

Course Name	Credits	Semester	Institution
Introduction to Geography	4	Fall 2008	Evergreen State College
Introduction to Environmental Economics	2	Fall 2008	Evergreen State College
Topics in Biology	4	Spring 2009	NOLS
Environmental Ethics	2	Spring 2009	NOLS
Introduction to Botany	4	Fall 2009	University of Iowa
Introduction to Earth Systems Science	4	Spring 2010	University of Iowa
The Contemporary Global System	4	Spring 2011	University of Iowa
Advanced Natural Resource Economics	3	Spring 2013	University of Wyoming
Natural Resource Economics	3	Spring 2015	University of Minnesota
Research in Wildlife: Grassland Landscapes Deliberation	1	Fall 2015	University of Minnesota

Human Dimensions of Global Change

Course Name	Credits	Semester	Institution
Introduction to Geography	4	Fall 2008	Evergreen State College
Introduction to Political Science	4	Fall 2008	Evergreen State College
Introduction to Land Use Planning	4	Fall 2008	Evergreen State College
Western Civilization III: The Modern World	4	Fall 2009	University of Iowa
Principles of Microeconomics	4	Fall 2009	University of Iowa
Principles of Macroeconomics	4	Spring 2010	University of Iowa
Introduction to Law	3	Spring 2010	University of Iowa
Microeconomic Theory	3	Fall 2010	University of Iowa
Macroeconomics	3	Fall 2011	University of Iowa
Transportation Economics	3	Spring 2011	University of Iowa
Economic Growth and Development	3	Spring 2011	University of Iowa
Topics in Policy Economics: History of Economic Thought	3	Fall 2011	University of Iowa
The Global Economy	3	Fall 2011	University of Iowa
Geography of Health	3	Spring 2012	University of Iowa
Theory of Producer Behavior	3	Fall 2012	University of Wyoming
Community and Economic Development	3	Fall 2012	University of Wyoming
Consumer Behavior	3	Spring 2013	University of Wyoming
Advanced Microeconomic Analysis	3	Fall 2013	University of Wyoming
Applied Microeconomic Analysis of Consumer Choice and Consumer Demand	2	Fall 2014	University of Minnesota
Applied Microeconomic Analysis of Production and Choice Under Uncertainty	2	Fall 2014	University of Minnesota
Applied Microeconomic Analysis of Game Theory and Information	2	Spring 2015	University of Minnesota
Applied Microeconomic Analysis of Social Change and Welfare	2	Spring 2015	University of Minnesota
Macroeconomic Theory Part I	2	Fall 2015	University of Minnesota
Macroeconomic Theory Part II	2	Fall 2015	University of Minnesota
Microeconomic Analysis of Economic Development	3	Fall 2015	University of Minnesota

Geospatial Information Sciences (GIS)

Course Name	Credits	Semester	Institution
Foundations of GIS	3	Fall 2010	University of Iowa
Introduction to Geographic Visualization	3	Spring 2011	University of Iowa
Special Topics: Introduction to Geoinformatics	3	Fall 2011	University of Iowa

Quantitative Methods

Course Name	Credits	Semester	Institution
Introduction to Statistics	4	Fall 2008	Evergreen State College
Calculus I	4	Spring 2010	University of Iowa
Calculus II	4	Fall 2010	University of Iowa
Intro to Mathematical Statistics I	3	Fall 2011	University of Iowa
Intro to Mathematical Statistics II	3	Spring 2012	University of Iowa
Introduction to Econometrics	3	Spring 2012	University of Iowa
Elementary Linear Algebra	3	Fall 2012	University of Wyoming
Quantitative Methods	3	Fall 2012	University of Wyoming
Intermediate Econometric Theory	3	Spring 2013	University of Wyoming
Advanced Mathematical Economics	3	Fall 2013	University of Wyoming
Advanced Econometric Theory I	3	Fall 2013	University of Wyoming
Econometric Analysis I	4	Fall 2014	University of Minnesota
Econometric Analysis II	4	Spring 2015	University of Minnesota

Research Methods

Course Name	Credits	Semester	Institution
Expository Writing	4	Fall 2008	Evergreen State College
Introduction to Research Design	2	Fall 2008	Evergreen State College
Accelerated Rhetoric	4	Fall 2009	University of Iowa
The Interpretation of Literature	3	Spring 2010	University of Iowa
Honors Thesis in Geography	3	Spring 2012	University of Iowa
Honors Thesis in Economics	3	Spring 2012	University of Iowa
Readings and Independent Study in Economics	3	Spring 2012	University of Iowa
Research Methods	1	Spring 2013	University of Wyoming
Thesis Research	12	Spring 2014	University of Wyoming
First Year Graduate Seminar	1	Fall 2014	University of Minnesota
Graduate Research Development Seminar	1	Spring 2015	University of Minnesota
PhD Qualifying Paper Seminar I	1	Fall 2015	University of Minnesota
Doctoral Thesis Research	5	Fall 2015	University of Minnesota

3.2. **Self-reflective description of previous and current coursework**

Through my previous coursework, I built a broad and deep foundation in environmental, economic, and geospatial studies substantiated by quantitative and research methodologies. I have tried to cultivate an encompassing multidisciplinary approach throughout my education. Starting with my bachelors at University of Iowa I pursued dual degrees in Economics and Geography, where I developed my skills for using spatial tools to help inform economic decisions. At this intersection I began to build a foundation in the fundamentals of theory, conceptualization, method, hypotheses, and measurement. During my masters at University of Wyoming my interests and expertise expanded to include land-use modeling, research methods, and environmental and natural resources. I engaged with new methods that bridge the geographic and economic spheres with heuristic practice doing original research. During my masters at University of Minnesota I added depth to my understanding of theoretical and mathematical methods. I gained exposure to techniques in numerous general equilibrium concepts, mathematical programming, stochastic simulation, and advanced econometrics, with a continuation of topics in the natural resources field and a return to topics in economic development. Thus far at University of Maryland I have pursued further developments in my teaching abilities to support my goal to be a professor. Along with beginning to grapple with the topics and techniques that will become my dissertation, I have tried to develop new technical abilities in R programming and visualization. I believe my background and educational training has prepared me to be successful and resilient. My program of study includes a well rounded and deep exposure to theory, concepts, and methods that will bolster my holistic academic, research, and professional ambitions.

4. Research Experience and Plans

4.1. **Previous and current research activities**

My research interests and experiences are wide ranging. They include geographic visualization, economic growth and development, environmental and natural resources, land use modeling, history of economic thought, sustainability, innovation, ecosystem services, econometric modeling, epistemology, regional policy, Geographic Information Science, rhetoric, community development, historical demography, heterodox economics, and statistical rectification. Each of these disparate components are weaved throughout my program of research where laid-out below I catalog some of the more significant and substantive research highlights.

Millennium Development Goals: Panel Regressions, Spatial Statistics, and Multi-Scale Analysis. For my undergraduate honors thesis, I evaluated the Millennium Development Goals, examining the global progress of individual objectives by 2010 and further evaluated the impact on a subnational spatial scale to uncover hidden heterogeneity. I examined the global spatial distribution of the progress of countries towards attaining Millennium Development Goals 1, 2, 3, 4, and 7, based on the specific indicators agreed to at the United Nations Millennium Summit in 2000. I examined corresponding indicators for the United States on a county and state level to show the sub-national heterogeneity in spatial distribution of the indicator levels. I used methods from spatial trends analysis to extract spatial variability lost in aggregate data analysis. And I used an econometric approach based on nonlinear panel regression analysis to assess the roll Gross Domestic Product has on achieving the targets of the Millennium Development Goals.

Misclassification Error in Satellite Imagery Data: Implications for Empirical Land-Use Models. I examined the roll of disregarded misclassification error in causing inconsistency for discrete choice models of land-use. I adapted theoretical correction techniques, and demonstrated there effects with Monte Caro simulations and an empirical application for land-use in the Northern Great Plains. I further refined the empirical techniques and theoretical explications of misclassification error in land-use models. I focused particular attention to the cross disciplinary operational delineations between econometrics and remote sensing, and a better econometric identification and explanation of the models and results. In its published form I caution that researchers must exercise care when working with these satellite imagery datasets due to misclassification error, which causes inconsistent parameter estimates in models of land-use and land-use change. The empirical results from an typical analysis of land-use in the Northern Great Plains indicate that ignoring misclassification will lead to biased results. Even seemingly insignificant levels of misclassification error (e.g., 1%) result

in biased parameter estimates, which alter marginal effects enough to affect policy inference. And at the levels of misclassification typical in many satellite imagery datasets (e.g., 35%), ignoring misclassification can lead to systematically erroneous land-use policies.

Regional Analysis and Policy, Disaster Data, and difference in difference in differences. I contributed to the economic and regional science literature on the impacts of disasters, which focused on the area of fiscal impacts of disasters in rural areas. I used a difference in difference in differences approach to measure the differences in sales tax collections in Appalachian and non-Appalachian Ohio counties following a series of Derecho wind storms in the summer of 2012. The Appalachian counties experienced a decrease in sales tax collections of $254,845 per county post storm compared to their non-Appalachian counterparts in Ohio. In total, the Appalachian region lost nearly $5.1 million in sales tax collections. The tested hypothesis is wether or not and by how much the limited economic base of rural economies not only makes them less resilient to natural disasters, but also prevents them from experiencing the post-disaster relief and gross fiscal spending that often occur in urban areas.

4.2. **List of competencies for which additional preparation is needed**

My preparation largely revolves around literature reviews and archival research on intersectional topics related to my dissertation. These include:

- Malnutrition Dynamics
- Famines and Food Security
- Conflict Events and Measurements
- Agricultural Development
- Water and Sanitation
- International Food Prices and Shocks
- Famine Early Warning Systems
- Multilevel Spatio-Temporal Econometric Forecasting
- Aid Agencies and Aid Intervention Antecedents
- Satellite Remote Sensing of Vegetation Dynamics
- Monitoring and Assessment Datasets
- Climate Monitoring Products
- Natural Disasters
- Household Survey Techniques
- Error Hazards, Limitations Assessment, and Contingency Planning
- Agroecosystems
- Cultural Competency

4.3. **Planned future research activities**

I am currently involved in a number of research activities. I would like to further expand and develop the misclassification methodologies to include a more general approach that encompasses land-use change dynamics and multinomial specification. And I am in the final stages of revision for the original paper for publication in *Land Use Policy* that I plan to complete by this February. I am also still developing tools and techniques for a skillshed analysis that I greatly expanded and improved this fall during *Topics in Data Visualization with Processing and Applications in R*. I have already begun processing data and conducting preliminary analysis for work related to my dissertation. I plan to have a completed abstract and outline of results by the end of January. In the meantime I continue to read outside the discipline to glean different perspectives and approaches to science. Concurrent with my holistic academic, research, and professional ambitions, I plan to continue publishing.

4.4. **List of significant research outputs**

- **A.M. Sandler**. 2012. *A Spatial and Economic Study of Millennium Development Goals Across The World and U.S.: A Spatial Distribution, Trend Analysis and Panel Regression Approach*. Honors Thesis. The University of Iowa, Iowa City, IA.

- **A.M. Sandler**. 2014. *On Land-Use Change Modeling: A Treatise of Satellite Imagery Data and Misclassification Error*. Masters Thesis. The University of Wyoming, Laramie, WY.

- **A.M. Sandler**. 2016. *Misclassification Error in Satellite Imagery Data: Implications for Empirical Land-Use Models*. Masters Thesis. The University of Minnesota, Minneapolis, MN.

- Jolley, G.J., K. O'Donovan, and **A.M. Sandler**. Do Rural Areas Experience the Same Benefit as Urban Areas from Disasters? Fiscal Evidence from Appalachian Ohio. *The Journal of Regional Analysis and Policy* (Forthcoming).

- **Sandler, A.M.**, and B.S. Rashford. Misclassification Error in Satellite Imagery Data: Implications for Empirical Land-Use Models. *Land Use Policy* (Revise and Resubmit).

5. Professional experiences

5.1. List of significant professional products

- Zeuli, K., S. McKay, and **A.M. Sandler**. 2011. Where Are the Brick-and-Mortar Banks? *5th District Footprint*, Federal Reserve Bank of Richmond.

- Zeuli, K., S. McKay, and **A.M. Sandler**. 2011. Measuring and Mapping Local Innovation. *5th District Footprint*, Federal Reserve Bank of Richmond.

- Federal Reserve Bank of Richmond. 2011. *Community Data Resource Center*. Federal Reserve Bank of Richmond, Richmond, VA. (I curated a collection of measures from public data sources compiled for the Fifth District)

- Federal Reserve Bank of Richmond. 2011. *The Map Resource Center*. Federal Reserve Bank of Richmond, Richmond, VA. (I created a collection of maps using public data compiled for the Fifth District)

- Minnesota Population Center. 2011. *National Historical Geographic Information System: Version 2.0*. The University of Minnesota, Minneapolis, MN. (I developed analytical interpolation techniques and algorithms to realign historic shapefile boundaries to accord with updated 2010 TIGER/Line data. And I digitized historical demographic census data for the United States from 1790-1970.)

- *Change Strategies for the Future of Grassland Birds in the Midwest: A Conservation Deliberation* Society for Conservation Biology, North American Congress for Conservation Biology Conference. Madison, Wisconsin, July 17-20, 2016.

- *ECON 1040 - Principles of Macroeconomics*, Ohio University, Spring 2017. (I developed and taught a new course curriculum.)

- Howe, S., **A.M. Sandler**. 2017. *Workforce Analysis for Proposed Integrated Energy System (IES) Complex at PORTS.* Voinovich School of Leadership and Public Affairs, Ohio University. Prepared for the PORTSfuture Project.

- Howe, S., **A.M. Sandler**. 2017. *Economic Impact Analysis for Proposed Integrated Energy System (IES) Complex at PORTS.* Voinovich School of Leadership and Public Affairs, Ohio University. Prepared for the PORTSfuture Project.

- Jolley, G.J., G. Michaud, **A.M. Sandler**, D. Driver, B. Lumumba, K. Riley, and C. Smith. 2017. *City of Belpre Economic Development Strategic Plan.* Voinovich School of Leadership and Public Affairs, Ohio University. Prepared for Belpre Area Chamber of Commerce and the City of Belpre, Ohio.

- Jolley, G.J., G. Michaud, **A.M. Sandler**. 2017. *Appalachian Ohio Skillshed Analysis: Semi-annual Progress Report.* Voinovich School of Leadership and Public Affairs, Ohio University. Prepared as part of the U.S. Economic Development Administration University Center.

- *State of the Region.* The Sixth Annual Appalachian Ohio State of the Region Conference: A New Era in Economic Resiliency. Athens, Ohio, May 23, 2017.

- *Reemployment Options in Appalachian Ohio's Coal Economy: A Skillshed Analysis.* Mid-Continent Regional Science Association 48th Annual Conference. Oregon, Ohio, June 7-9, 2017.

- Jolley, G.J., K. O'Donovan, and **A.M. Sandler**. Do Rural Areas Experience the Same Benefit as Urban Areas from Disasters? Fiscal Evidence from Appalachian Ohio. *The Journal of Regional Analysis and Policy* (Forthcoming).

- **Sandler, A.M.**, and B.S. Rashford. Misclassification Error in Satellite Imagery Data: Implications for Empirical Land-Use Models. *Land Use Policy* (Revise and Resubmit).

6. Evidence of analytical and integrative thinking

• Zeuli, K., S. McKay, and **A.M. Sandler**. 2011. Where Are the Brick-and-Mortar Banks? *5th District Footprint*, Federal Reserve Bank of Richmond.

We examined patterns in the location of bank branches across the Fifth District. We uncovered that factors other than population density determine location and access to alternative options like online banking are similarly heterogenous.

• Zeuli, K., S. McKay, and **A.M. Sandler**. 2011. Measuring and Mapping Local Innovation. *5th District Footprint*, Federal Reserve Bank of Richmond.

We examined patterns in the location of innovation performance across the Fifth District. We uncovered that metropolitan areas and research universities can be indicative but neither are deterministic, similarly innovation and unemployment are not obverse.

• Minnesota Population Center. 2011. *National Historical Geographic Information System: Version 2.0*. The University of Minnesota, Minneapolis, MN.

I developed analytical interpolation techniques and algorithms to realign historic shapefile boundaries to accord with updated 2010 TIGER/Line data. And I digitized historical demographic census data for the United States from 1790-1970.

• **A.M. Sandler**. 2012. *A Spatial and Economic Study of Millennium Development Goals Across The World and U.S.: A Spatial Distribution, Trend Analysis and Panel Regression Approach*. Honors Thesis. The University of Iowa, Iowa City, IA.

I examined the global spatial distribution of the progress of countries towards attaining Millennium Development Goals 1, 2, 3, 4, and 7, based on the specific indicators agreed to at the United Nations Millennium Summit in 2000. I examined corresponding indicators for the United States on a county and state level to show the sub-national heterogeneity in spatial distribution of the indicator levels. I used methods from spatial trends analysis to extract spatial variability lost in aggregate data analysis. And I used an econometric approach based on nonlinear panel regression analysis to assess the roll Gross Domestic Product has on achieving the targets of the Millennium Development Goals.

• **A.M. Sandler**. 2014. *On Land-Use Change Modeling: A Treatise of Satellite Imagery Data and Misclassification Error*. Masters Thesis. The University of Wyoming, Laramie, WY.

I examined the roll of disregarded misclassification error in causing inconsistency for discrete choice models of land-use. I adapted theoretical correction techniques, and demonstrated there effects with Monte Caro simulations and an empirical application for land-use in the Northern Great Plains.

- **A.M. Sandler**. 2016. *Misclassification Error in Satellite Imagery Data: Implications for Empirical Land-Use Models.* Masters Thesis. The University of Minnesota, Minneapolis, MN.

I further refined the empirical techniques and theoretical explications of misclassification error in land-use models. I focused particular attention to the cross disciplinary operational delineations between econometrics and remote sensing, and a better econometric identification and explanation of the models and results.

- *Change Strategies for the Future of Grassland Birds in the Midwest: A Conservation Deliberation* Society for Conservation Biology, North American Congress for Conservation Biology Conference. Madison, Wisconsin, July 17-20, 2016.

I participated in an interdisciplinary seminar of the U.S. Fish and Wildlife Service, the Midwest Grasslands Network, and the University of Minnesota. We exchanged ideas focusing on the problem ofhow can we replicate local grassland conservation successes at a scale sufficient to reverse the loss of native grassland and the precipitous declines of grassland birds in the Midwest? As a summary project, we developed a multi-path approach to sustaining grasslands, bird populations, and the aggregated resources and services that prairies and surrogate grasslands provide. And we presented the strategies and invited discussion of their merits, as well as opportunities for implementation.

- Howe, S., **A.M. Sandler**. 2017. *Workforce Analysis for Proposed Integrated Energy System (IES) Complex at PORTS.* Voinovich School of Leadership and Public Affairs, Ohio University. Prepared for the PORTSfuture Project.

I conducted a six part workforce analysis of a proposed closed-loop, advanced manufacturing complex for community outreach material. Using input-output analysis I showed a breakdown for labor demanded in the region for each of the proposed industrial installations: combined cycle gas turbine power plant, oil refinery, coal refinery, natural gas refinery, biomass refinery, and ammonia fertilizer plant.

- Howe, S., **A.M. Sandler**. 2017. *Economic Impact Analysis for Proposed Integrated Energy System (IES) Complex at PORTS.* Voinovich School of Leadership and Public

Affairs, Ohio University. Prepared for the PORTSfuture Project.

I conducted a six part economic impact analysis of a proposed closed-loop, advanced manufacturing complex for community outreach material. Using input-output analysis I showed expected employment, labor income, value added, and total output by direct, indirect, and induced avenues in the region for each of the proposed industrial installations.

- Jolley, G.J., K. O'Donovan, and **A.M. Sandler**. Do Rural Areas Experience the Same Benefit as Urban Areas from Disasters? Fiscal Evidence from Appalachian Ohio. *The Journal of Regional Analysis and Policy* (Forthcoming).

Contributing to the economic and regional science literature on the impacts of disasters, we focused on the understudied area of fiscal impacts of disasters in rural areas. We measured the differences in sales tax collections in Appalachian and non-Appalachian Ohio counties following a series of Derecho wind storms in the summer of 2012. We found Appalachian counties experienced a decrease in sales tax collections of $254,845 per county post storm compared to their non-Appalachian counterparts in the state. In total, the Appalachian region lost nearly $5.1 million in sales tax collections. The limited economic base of rural economies not only makes them less resilient to natural disasters, but also prevents them from experiencing the post-disaster relief and gross fiscal spending that often occur in urban areas.

- **Sandler, A.M.**, and B.S. Rashford. Misclassification Error in Satellite Imagery Data: Implications for Empirical Land-Use Models. *Land Use Policy* (Revise and Resubmit).

Researchers must exercise care when working with these satellite imagery datasets due to misclassification error, which causes inconsistent parameter estimates in typical land-use models. Our results from satellite imagery data of the Northern Great Plains indicate that ignoring misclassification will lead to biased results. Even seemingly insignificant levels of misclassification error (e.g., 1%) result in biased parameter estimates, which alter marginal effects enough to affect policy inference. At the levels of misclassification typical in current satellite imagery datasets (e.g., 35%), ignoring misclassification can lead to systematically erroneous land-use policies.

7. Initial Dissertation Planning

7.1. **Real world problem to be addressed**

Malnutrition is responsible for nearly half of all deaths of children under five years of age (Grace et al., 2017). Childhood stunting, a measure of malnutrition and chronic food insecurity, is characteristic of many children in the developing world (Grace et al., 2016). Stunted children are more likely to face severe negative health and economic impacts. This can even affect the next generation of children (Grace et al., 2016). Undernourished female preschoolers are likely to grow into undernourished young women who are more likely to give birth to babies who are undernourished even before they are born, thus perpetuating the intergenerational transmission of deprivation (Smith and Haddad, 2001).

The causes of child malnutrition are complicated, multidimensional, and interrelated. They range from broadly impacting factors such as political unrest and economic growth to those as specific as respiratory infection and diarrheal disease (Smith and Haddad, 2001). Indeed, the implied solutions vary from widespread measures to improve the stability and economic performance of countries to efforts to enhance access to sanitation and health services in individual communities. Debates continue to flourish over what the most important causes of malnutrition are and what types of interventions will be most successful in reducing the number of malnourished children (Smith and Haddad, 2001).

It is the goal and purpose of many government and non-government agencies to prevent child malnutrition. Malnutrition early warning systems are implemented by organizations that use social, economic, and environmental data about food access, combined with spatially extensive biophysical data to determine malnutrition events (Brown, 2008). The success of early warning is determined by its capability of applying the data to complex decision making, often conducted in times of crisis. To conclude that a malnutrition event at a variety of scales is occurring, there is usually a qualitative judgment, which depends on confirmation through multiple indicators that all must move in the same direction, or a convergence of evidence (Brown et al., 2008).

Furthermore, the antithesis of malnutrition, proper nutrition, is an essential component of food security: a universal human right. According to the FAO (2009) food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of food security are availability, access, utilization and stability with the nutritional dimension as an integral component for food security (FAO, 2009).

I will investigate the height-for-age z-score (HAZ) (i.e., linear growth) and weight-for-height z-score (WHZ) (i.e., wasting) among children younger than six years old. Identifying causal

pathways is empirically challenging because determinants may be endogenous and latent. I confront this challenge with a litany of datacontrolling for spatial and temporal variability, as well as demographic, social, economic, institutional, biologic, agronomic, and climactic factors.

7.2. **Theoretical background**

Colloquially, famine is a symptom of extreme food scarcity as in famished and comes from the French *faim* and Latin *fames* meaning hunger. But formally it is much more stringent. The Integrated Phase Classification Version 2.0 used by the United Nations requires three specific criteria to be met; 1) At least one in five households faces an extreme lack of food, 2) More than 30 percent of the population is suffering from acute malnutrition (wasting), and 3) At least two people out of every 10,000 are dying each day. The literature has trended away from famine studies towards malnutrition. This is likely because famines are becoming less frequent and severe. Also much like pollution, the pernicious damages to health from previously unknown sources continue to be discovered.

Many antecedents have been proffered to the inquiry into the nature and causes of malnutrition. According to de Waal (1997) the issue is neo-liberal doctrines of structural adjustment programs. For Sen (1999) democracy is the solution. Whereas Devereux (2009) blames failing markets that do not deliver access to food at affordable prices. And Mellor (1986) sees lack of over supply as the root cause. I will attempt to measure the impact of each of these explanations and test their explanatory power, across time and space. I am interested in determining the confidence with which practitioners can rely on these explanations, too.

7.3. **Research questions**

- Why do famines persist in Africa?
- What causes famines, hunger, malnutrition, and food insecurity?
- What is the historical trend and evidence for malnutrition?
- What is the level of accuracy in records, analysis, prediction?
- What is the level of confidence in identifying errors of omission and commission?
- How have spatial trends changed over time?
- What historical precedence of successful early warning systems?
- What is the scope, scale, severity, duration, horizon, and confidence of these systems?
- How does conflict affect malnutrition?
- How does education affect malnutrition?
- How do colonial legacies affect malnutrition?
- How do political institutions affect malnutrition?
- How does land-use affect malnutrition?

- How do international markets affect malnutrition?
- What role does price variability and level play in causing malnutrition?
- How does climate affect malnutrition?
- How does seasonality affect malnutrition?
- What are the risks and opportunity costs of malnutrition prediction?
- How robust are forecasts to spatial and temporal scale changes in data?
- What is the current state of publicly available data on malnutrition indicators?
- what role does privacy, liberty, and dignity play in malnutrition analysis and prediction?

7.4. **Proposed methods**

To address the historical and theoretical questions surrounding this issue I will deploy cliometric, and epidictic methodologies. This mainly involves investigating the historical record in terms of the empirical objective and of the theoretical explanations. To address the immediate issue of prediction, I plan to develop and test spatially and temporally explicit econometric models to explain the causes of malnutrition by finding leading indicators using inputs from household survey data, remote sensing data, conflict data, disaster data, and environmental data in a multilevel analytical framework. My research will provide a framework for the feasibility and extent of predicting malnutrition events. These best practices and constraints will illuminate the feasibility of future projects that attempt early warning prediction and intervention.

Econometric methods can identify empirical relationships with specifications that account for place, scale, time, reciprocal causality, and shocks. Available geo-referenced data of malnutrition and expected causal factors, allows for a model that predicts malnutrition outcomes at the village level using leading and shock variables. The exact structure and estimation method of the spatial econometric model will depend upon the structure and completeness of the final dataset. Barring developments in the data discovery process, the current specification consists of a censored tobit regression of cross-sectional household level variables. This method allows for specifications that restrict the outcome variable (e.g., nutrition score) so that variability explained by the model can be applied to the range of interest (e.g., wasting).

7.5. **References**

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Mellor, J. W. 1986. Prediction and prevention of famine. Federation of American Societies for Experimental Biology 45:10.

Sen, A. 1999. Development as freedom. Oxford University Press.

Smith, L.C., and L. Haddad. 2001. How important is improving food availability for reducing child malnutrition in developing countries? Agricultural Economics 26 191-204.

8. Documentation