2019 Ignite Graduate Research Fellowship Cover Sheet

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Project Focus area(s): Put an **X** before all that apply; Put #1 for primary if more than one area is selected.

X	Data and Complex Systems Analytics	#1	Healthy World Solutions
	Advanced Materials Development		EMERGING: Next Generation Health Technologies

Key Words: Provide three descriptive terms for your project topic area and methodologies to be used.

Topic Area	Priority Development	Sustainability Assessment	Civic Engagement
Methodologies	analytical hierarchy process, data envelopment analysis (DEA)	participatory GIS mapping	budgetary choice experiments and survey implementation, institutional analysis and development framework (IAD), social-ecological system framework (SES)

This project involves (underline applicable response)**: Human subjects** **Yes** No
Animal subjects Yes **No** **Hazardous materials** Yes **No** **Existing (protected) IP** Yes **No**
Potentially non-routine data management (HIPAA etc.) Yes **No**

Assurances, Certifications and Approvals of PIs and the Sponsored Research Services (SRS):

- We attest that the information contained is complete, accurate and truthful to the best of our knowledge and do not infringe on the intellectual property rights of others.
- We agree to submit an application for external funding within 9 months of project completion based upon the research results.
- We will adhere to all institutional, state and federal regulations applicable to the project work.
- We will submit required progress reports annually in accordance to instructions to be provided.

Title/Role	Printed Name	Date
PI	Erik C. Backus	12/2/18
Co-PI	Stephen Bird	12/1/18
Investigator	Marin Heintzelman	12/2/18
Investigator	Santosh Mahapatra	12/2/18
Investigator	Anne Mosher	12/1/18

Executive Summary

Project Title: **HWS: Best Practices for Implementation of Sustainable Holistic Planning Systems (SHPS) in the NY Olympic Region (NYOR)[1]**

A. ***Summary***: Our research focus is to rigorously assess: (i) how well SHPS work, both at the micro level and comparatively, (ii) to better understand best practices for SHPS, and (iii) to better understand how communities reconcile the disparate and potentially conflicting priorities of broadly-defined stakeholder groups (year-round community; seasonal residents; tourist visitors; and the global community). We will do this by implementing an initial investigation with our already established partners at the US Green Building Council (USGBC) and the NYOR who are implementing a pilot LEED for Communities (LFC) Program in their jurisdiction.

B. ***Intro/Background***: Evaluating community-scale sustainable development is too complex for a single investigator or discipline, requiring coordinated interdisciplinary teams that study the broad, consistent planning frameworks, which integrate the management of many data-intensive and interconnected projects. Previous research shows that SHPS (aka "smart cities"), as a set of frameworks, are flexible and adaptive for disparate kinds of communities and contexts, providing the potential of significant benefits to improve community scale planning and development. LFC is a unique and comprehensive SHPS introduced in 2016 by USGBC that develops essential goals in across the spectrum of communities. However, the effectiveness of various SHPS, and/or LFC in particular, in supporting its goals has not been determined. This project, using NYOR as a testbed, will conduct a rigorous, systematic, science-based evaluation of LFC to determine its effectiveness.

C. ***Impact***:
   a. Our proposed approach tests the impacts of a SHPS, via the USGBC LFC program, and will develop best practices for communities in customizing SHPS approaches to their particular circumstances, in a more rigorous and detailed manner. Results will inform the system's implementation to the execution and evaluation through a thorough and methodical analytical lens. It will improve our societal response to large-scale community scale development challenges and so contribute to sustainable development for communities in a manner that mitigates environmental harms, climate change, and sustains healthy communities in all ways.
   b. ***Targeted External Funding***: NSF (SCC, DRMS, SoO, STS, CRISP, GSS), NIST, NYSERDA, RWJ Foundation, Environmental Defense Fund, National Endowment for the Humanities.
   c. Pilot Grant support is essential to conduct the preliminary work needed to establish the feasibility and likelihood of success of future grant applications. Specifically, pilot funding will enable this research group to develop the necessary tools to execute the research methodologies described herein within the NYOR case study, which would be then used in the follow-on work to study other areas outside of the NYOR region using external grant support.

D. ***Research Plan***: The short-term objectives (years 1 and 2) are to aid communities in understanding SHPS frameworks and their utility for bringing communities together as well as to identify metrics (established or of their own creation) in order to track improvements over time. This would be done with the goal of reconciling the disparate and potentially conflicting priorities of broadly-defined stakeholder groups indicated above. We will use mixed methods for mapping these priorities including: analytical hierarchy process, institutional analysis and development frameworks, social-ecological system frameworks, participatory GIS mapping, surveys, focus groups, data envelopment analysis, and budgetary choice experiments. The extension and generalization of our work in NYOR to other communities would encompass the larger funded project (years 3–5). This process will inform our efforts to develop best practices and roadmaps for other communities to follow in implementing LFC to meet the specific needs of their own various stakeholder groups. The conception of sustainable communities is, by its nature, a multidisciplinary concept encompassing social, economic, and environmental factors. All of these disciplines (including scientists, engineers, economists, public policy experts, geographers, data analyzers, and other social scientists) are represented in this project from Clarkson and our partner institutions.

E. ***Overlap***: There is presently no funding overlap.

[1] NYOR is the Village of Lake Placid, Town of North Elba, Olympic Regional Development Authority, and Lake Placid Central School District

Detailed Description

The concept of a Smart City has existed for over 20 years (Cocchia, 2014).Organizations include the Smart Cities Council (https://smartcitiescouncil.com/) and research partnerships like MetroLab (https://metrolabnetwork.org/about/) that support initiatives and continue to advance solutions. These solutions include the use of and are often identified as Sustainable Holistic Planning System(s) such as those from the National Institute of Standards and Technology (NIST), the Networking and Information Technology Research and Development Program, and the United States Green Building Council's (USGBC) LEED for Cities/Communities (LFC) program (Backus, et al, 2018. Numerous other systems are listed in the bibliography, citations 16-39). Introduced in December 2016 by the USGBC, LFC is a unique SHPS that develops essential goals in infrastructure, economic competitiveness, quality of life, environment, and public health within participating communities (USGBC, 2016). LFC interconnects city/community planning, development, operations and management with interactive feedback loops, with a primary emphasis on improving sustainability and quality of life of citizens around the world. LFC provides cities/communities its SHPS framework, through the Arc performance platform, which measures numerous metrics in order to track progress of the communities engaged in the program (USGBC, 2017).

Clarkson's partnership with NYOR began through existing connections with the stakeholders, the USGBC, and Prof. Backus. The stakeholders have interest in improving their development planning process to address a variety of issues not always consistently addressed under more conventional approaches to sustainability. In particular, they seek to address human experience challenges that fundamentally interact with sustainability goals and are well-suited to the USGBC's broad approach to sustainability in LFC. In early 2018 a series of planning meetings established the initial planning process, and serious planning began in August 2018 to develop initial certification through the fall of 2018. Students from Clarkson's Adirondack Semester were engaged in developing the initial data for the core metrics, and also successfully developed the additional fifty plus community metrics that will form the initial certification plan. During this same period, a core multi-disciplinary research team was brought together to begin planning for the research work that would accompany the actual implementation of the certification process, and the planning to develop that would continue from there.

Impact and Importance

The core research approach will be to apply various research methodologies to:

- Assess LFC as a Sustainable Holistic Planning System
- Improve our understanding of how LFC functions and SHPS generally
- Study how communities integrate priorities that are derived from SHPS, specifically in NYOR LFC, to improve community outcomes

This research objective is important as the ability for communities to integrate sustainable practices is the paramount need in order to create a healthy world.

Methodology

The NY Olympic Region (NYOR) is unique multi-jurisdictional partnership consisting of the Village of Lake Placid, Town of North Elba, the Olympic Regional Development Authority, and the Lake Placid Central School District. It is unique yet optimal laboratory for a rigorous systematic science-based investigation of the effectiveness of various facets of LFC. Because of its constituent parts, NYOR provides a group of stakeholders that mirrors other similar communities characterized by: high volumes of visitors/tourism, vacation home and seasonal residents, rural components, and outdoor and winter sports communities. Thus this study aims to support future research across a spectrum of localities and regions. The research team will utilize three main methods, as indicated below, to best enable these objectives as a set of best practices that can be used in other communities.

First Stage - The Olympic Region as Proving Ground

In the first two years of the project, we will focus our efforts specifically with the Olympic Region stakeholders to refine the LFC metrics to meet their specific needs. Recently, the STAR Community Rating System (http://www.starcommunities.org/about/framework/) was integrated into the LEED for Cities/Communities system as of November 2018 (USGBC, 2018). Over five hundred outcome oriented actions and guidelines of STAR as well as the existing two hundred plus LFC standard metric offerings are now integrated. This provides NYOR stakeholder groups examples of metrics used by other US communities.

In identifying stakeholder priorities and resolving conflicts across stakeholder groups, we propose to take a number of analytical approaches with the dual goals of achieving desired outcomes for the Olympic Region while also learning about the analytical approaches themselves. In a sense we will be working within a 3x4 matrix where we will be using the three methodologies within and across the four stakeholder groups. In this process we hope to learn how the methodologies affect the prioritization done by the different stakeholder groups, and how the different methodologies might lead to different resolutions to priority conflicts. The effort would also explore how the set of priorities and practices of various stakeholders should be weighted/emphasized to accomplish cost-effective social, environmental and economic outcomes for all categories of stakeholders.

Table 1, Methods and Subject Groups

Methodologies\Stakeholders	Full-Time Residents	Seasonal Residents	Short Term Visitors	Global Community
Analytical Hierarchy Process and Data Envelopment Analysis	X	X	X	X
Budgeting Choice Experiment	X	X	X	
Participatory GIS	X			

The effort to identify stakeholder priorities and linking those to LEED metrics will necessitate understanding of the interests, capabilities and constraints of different stakeholders for various LEED initiatives. Stakeholder preferences are guided by their unique missions and goals. Community stakeholder groups have high stakes and act based on subjective perceptions and judgments that have long-term implications. Therefore, exploring the relevance and relative significance of various LEED efforts for different stakeholders in the community is critical to identify the possible alternatives and their weightages for effective planning and execution in SHPS.

One of the methods we will apply is Analytic Hierarchy Process techniques (AHP) (Saaty and Kirti, 2008) to identify community priorities. AHP is especially useful when the decision elements are difficult to quantify or compare because the members have different perspectives. It is a method to derive ratio scaled measures from paired comparisons of subjective opinions. AHP is robust against some small inconsistency in judgment because human judgement is not always consistent. The technique has been extensively applied in complex decision-making situations involving priority setting and selection among a wide variety of alternatives (Bhusan and Rai, 2004). Once the stakeholder priorities and preferences for various LEED initiatives are identified, it might be necessary to understand how different stakeholder groups will emphasize different initiatives as they try to derive cost-effective combinations for their members. We will utilize Data Envelopment Analysis (DEA) technique to address this issue. DEA technique would also enable us to understand how different stakeholders groups compare in accomplishing the overall performance goals in SHPS. This could facilitate recommendations to different stakeholder groups for possible modifications in adoption of different LEED initiatives. DEA is particularly useful when the outputs/outcomes might not be independent of one another (Korhonen and Luptacik, M. 2004), and different

operational groups have unique preferences about various inputs/efforts (Charnes et al., 1994). LFC projects are likely to exhibit both characteristics.

In attempting to establish priorities amongst different groups for community development, another approach is to place stakeholder respondents in a position to tradeoff the costs of different priorities in a hypothetical framework. As a second method of investigation, the team will utilize an economic *choice experiment* approach which will give respondents multiple decisions, each posing two community development policies, plus a default choice consisting of the status quo. The policies posed will consist of combinations of priorities (air quality, affordable housing, infrastructure spending, etc.) at a few different levels, and various hypothetical costs to the respondents' households. This allows researchers to observe how respondents in the stakeholder groups rank different aspects of community development when faced with a cost to themselves. Specifically, it will allow us to estimate average willingness-to-pay for the different priorities. With a large sample of respondents in each of the stakeholder groups, we will be able to compare and contrast group rankings, identifying areas of agreement and disagreement. This can contribute to the identification of a roadmap for community development that maximizes value to stakeholder groups and, hopefully can generate broad-based support.

Our third method will use Participatory GIS (PGIS) which blends geographic information systems (GIS) and participatory learning and action (PLA) methods as techniques for including and integrating diverse stakeholder groups in the collection and curation of spatial knowledge. With training, it provides stakeholders with opportunities to collaborate with 'experts' (decision elites) on data analysis and decision-making, particularly on site specific interventions. In the NYOR/LFC context we will work to answer a series of questions: for which metrics can PGIS be a useful data gathering, analysis, and decision-making tool? How might stakeholder characteristics influence engagement and participation processes associated with PGIS? Given the decreasing barriers to entry provided by open source online GIS platforms, how might GIS training and geospatial analysis skills and competencies be developed within stakeholder groups so LFC monitoring can socially sustainable and transparent?

From each of these methods, the research team will consolidate and evaluate the degree to which the methods aided in our understanding of the key research objective of assessing, improving, and community integration of SHPS. From this consolidation, a set of tools and practices can be developed that will be transferrable outside the NYOR and be a part of a larger, externally funded research project.

Second Stage - Application of Lessons Learned to the Universe of Communities

Upon completion of the first stage the research team will begin to study other communities using the methodologies and tools developed for the study in NYOR. Particularly important will be the development of LFC-appropriate case study benchmarking rubrics, consistent with policy, governance, and infrastructure performance assessment methods incorporated in the interdisciplinary Institutional Analysis and Development Framework (IAD) and Social-Ecological System (SES) Framework approaches (Ostrom, 2011; Jansen et. al, 2013; Ostrom and Cox, 2010).

Management and Advisement of the Fellow

The Ignite Fellow supported by this grant would be advised by the Co-PI Dr. Stephen Bird as the primary advisor with significant participation by the other faculty in this project contributing along the lines of the area of expertise. The research team in total will function as the core of the fellow's committee. The fellow would be utilized to manage implementation of research development tools, to serve as a primary project manager, and to aid in the direction of undergraduate students that will participate in this study.

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ebackus@clarkson.edu; 315-268-6522 — Potsdam NY 13699-5710

Education

Univ. of Missouri-Rolla	Rolla, MO	Masters (MSCE), Civil Engineering, 2004.
Clarkson University	Potsdam, NY	Bachelor (BSCE), Civil Engineering, 1997.

Appointments – Scholarly and Professional

2016-Pres	Co-Chair, Market Lead. Advisory Board, New York Upstate Chapter, USGBC
2015-Pres	Team Leader, APPA Fac. Informatics Maturity Matrix Work. Group, Alexandria, VA
2014-Pres	Director, Const. Engineering Management, Clarkson University, Potsdam NY.
2011-2014	Engineering Planner, George Mason University, Fairfax, VA.
2010-2011	Chief, Engineering Division, Joint Base Myer-Henderson Hall, Fort Myer, VA.
2008-2010	Project Manager, George Mason University, Fairfax, VA.
2007-2008	Lead Design Engineer/Project Manager, 20th Engineer Brigade, Balad, Iraq.
2006-2008	Project Manager, George Mason University, Fairfax, VA.
2005-2006	Project Manager, Centennial Contractors, Fairfax, VA.
1997-2005	Commissioned Officer, US Army Corps of Engineers, Fort Leonard Wood, MO.

Relevant Products

Backus, Erik C., "Technology, Trends, and How to Not be Swept Away", CONEXPO/CONAGG News, September 26, 2017, http://www.conexpoconagg.com/news/september-2017/technology-trends-and-how-to-not-be-swept-away/

Backus, Erik. C. and Weidner, Ted, "Getting the Most out of APPA's FPI Survey and Report Tool—And a Preview of What's to Come", Facilities Manager, APPA (Sep/Oct 2017), pp 49-51

Hogue, Markus; **Backus, Erik C.**; Smeds, Christopher; and Webb, Mark, Code Talkers: Informatics Moving Forward, Facilities Manager, APPA (Nov/Dec 2016), pp. 32-33

Backus, Erik C.; Schay, Alan; Theimier, Ana, "APPA Facilities Informatics Maturity Matrix Technical Report", July 2016, APPA https://online.appa.org/appassa/ecssashop.show_product_detail?p_session_serno=&p_mode=detail&p_product_serno=345&p_cust_id=

Backus, Erik, "George Mason University Design Process Standards", http://facilities.gmu.edu/ProjMgmtConst/DesignStandardsManual/upload/2-DESIGN-PROCEDURES.pdf, June 28, 2013

Backus, Erik and Lo Margaret, "George Mason University Environmental Design Standards", http://facilities.gmu.edu/ProjMgmtConst/DesignStandardsManual/upload/3-4-ENVIRONMENTAL-STANDARDS.pdf, June 28, 2013

Ngan, Chun-Kit, Brodsky, Alexander, Egge, Nathan, and **Backus, Erik**, "A Decision-Guided Energy Framework for Optimal Power, Heating, and Cooling Capacity Investment", ICEIS 1, page 357-369. SciTePress, (2013); Best Paper Award

Backus, Erik, "True Sustainability: A Rubric for Evaluating Infrastructure Rating Systems and Resiliency", The Infrastructure Security Partnership, http://adweb.clarkson.edu/~ebackus/TISP.pdf, November 20, 2011

Showalter, William Eric and **Backus, Erik Carl**. "Recruiting Construction Leaders and Managers for the Future." The 10th International Conference "Modern Building Materials, Structures and Techniques", Vilnius Gediminas Technical University Publishing House "Technika" May 19, 2010, Lithuania, pp. 524–531

Backus, Erik C., Major. "Field Force and Facility Engineer Training." Engineer Bulletin April-June 2008; Volume 38 PB 5-08-2, pp. 40-42.

Synergistic Activities

1. Energy Planning, Modeling, and Standards. Mr. Backus was the key project leader in numerous energy initiatives at George Mason Univ., the largest such institution in the Commonwealth of Virginia. He led a team to evaluate the feasibility of a combined heat and power (CHP) plant for the Fairfax Campus serving some 16,000 students. He managed planning for the entire infrastructure of the University across 4 campuses in 6 jurisdictions, coordinating with more than 12 utility service providers. Synergizing these efforts, Backus was appointed as the Chair of the facilities standards committee, and through that effort, developed trend setting energy standards (among the most aggressive among colleges and universities in Virginia). This has now been carried forward to develop a set of metrics that can compare energy measures against academic and research outcomes, nationally.

2. Facilities Informatics. Mr. Backus is a national leader in the development of an ANSI standard for Facilities Informatics. This includes leadership in the Assoc. of Physical Plant Admin. (APPA) Working Group (http://www.appa.org/standards.cfm) which is developing a nomenclature and framework to manage information generated by and for facilities across numerous domains including, energy, grounds, custodial support, and many others. He delivered a technical report in 2016 that describes a matrix which categorizes data across these various domains and along a maturity transect.

3. Infrastructure and Facilities Asset Management. Erik is the project manager for the Ogdensburg Bridge and Port Authority (OBPA) Ogdensburg-Prescott Bridge Modeling project. This grant funded effort is enabling the Authority to manage one of the primary international transportation and economic links in the North Country of New York and North Eastern Ontario. Leveraging his knowledge of informatics and asset management developed at George Mason University and at Clarkson University, Backus has lead a team that is providing visualization tools and is developing database tools that will enable the OBPA to make wiser investments in the future as it maintains its critical infrastructure and builds regional resiliency.

4. Cross-Disciplinary Learning. As the Director of the Construction Engineering Program at Clarkson University, Mr. Backus has been able to introduce curricular changes that emphasize entrepreneurial and multi-disciplinary approaches to in-class projects and efforts. Erik has engaged his students in "real world" projects as the course driver in each course. This has been especially true in Fundamentals of Building Systems, his co-leadership of Civil Engineering senior design, and his participation in Mechanical Engineering's senior design.

5. Community and Campus Planning. Erik has served as a consultant and subject matter expert in numerous community planning efforts including, but not limited to: Fairfax County Bike Maser Plan, City of Fairfax Mason to Metro Task Force, Town of Potsdam Comprehensive Plan, and Village of Potsdam Alternate Transportation Improvement Projects. Further Backus was responsible for the development of the George Mason Master Plan in the area of Infrastructure and Energy Performance.

Licensure/Certifications/Accreditations/

Professional Engineer (P.E.) #2005000948, State of Missouri – 2005
Leadership in Energy and Environmental Design Accredited Professional (LEED AP), Building Design and Construction (BD+C) – 2006
Facility Management Professional (FMP) – 2011
Envision Sustainability Professional (ENV SP) - 2017

Stephen Bird

Associate Professor, Political Science — Clarkson University
sbird@clarkson.edu; 315-268-3990 — Potsdam NY 13699-5750

Education

Boston University	Boston	Doctor of Philosophy, Political Science, 2009.
Harvard University	Cambridge	Masters (ALM), Government (class marshal), 2003.
Berklee College of Music	Boston	Bachelor of Arts, Music (magna cum laude), 1988.

Appointments – Scholarly and Professional

2009-current	Associate Professor, Political Science (Humanities and Social Sciences & Inst. of Sustainable Environment), Clarkson University, Potsdam NY. (2015 tenure)
2016-current	Senior Fellow, Centre on Governance, and Faculty Research Fellow, *Positive Energy* Group, University of Ottawa, Canada.
2016-current	Case Studies in the Environment, editorial board.
2016 Fall	Fulbright Research Fellow, Visiting Research Chair in Public Administration and Governance at the University of Ottawa, Canada.
2005-2010	Rapporteur, Harvard Electricity Policy Group (HEPG), Harvard University.
2003-2009	President, Board of Directors (2004-2009), Massachusetts Energy Consumers Alliance.
2005	Environmental Policy Consultant, Massachusetts Environmental Affairs (OTA).
2004	Harvard University Rappaport Fellow.

Selected Publications (Products) – Peer-reviewed: 21, last 5 years: 16

Journal Articles

1. Bird, Stephen, and Lisa Legault. 2018. "Feedback and Behavioral Intervention in Residential Energy and Resource Efficiency: A Review." Edited by Yu Wang. *Current Sustainable/Renewable Energy*.
2. Legault, Lisa, Stephen Bird, Susan E. Powers, Amanda K. Sherman, Alan Schay, Daqing Hou, and Kerop Janoyan. "Impact of a Motivational Intervention and Interactive Feedback on Electricity and Water Consumption: A Smart Housing Field Experiment." *Environment and Behavior*, 2018.
3. Bird, Stephen, and Chelsea Hotaling. 2017. "Multi-Stakeholder Microgrids for Resilience and Sustainability." *Environmental Hazards*, Special issue on Sustainability and Environmental Hazards, http://dx.doi.org/10.1080/17477891.2016.1263181.
4. Nikdel, Leila, Stephen Bird, Kerop Janoyan, Susan Powers. Multiple Perspectives of the Value of Occupancy-based HVAC Control Systems. *Buildings and Environment.* Accepted November 2017.
5. Cleland, Michael, Stephen Bird, Stewart Fast, Shafak Sajid, and Louis Simard. "A Matter of Trust: The Role of Communities in Energy Decision-Making." *Energy Regulation Quarterly* 4, no. 4 (November 23, 2016). http://www.energyregulationquarterly.ca/articles/a-matter-of-trust-the-role-of-communities-in-energy-decision-making.

6. Walsh, Patrick J., Stephen Bird, and Martin D. Heintzelman. 2015. "Understanding Local Regulation of Fracking: A Spatial Econometric Approach." *Agricultural and Resource Economics Review* 44 (2): 138–63. Also NAREA (Northeast Agricultural and Resource Economics Association) Conference Paper winner.
7. "Distributed (Green) Data Centers: A New Concept for Energy, Computing, and Telecommunications." Bird, S., Achuthan, A., Ait Maatallah, O., Hu, W., Janoyan, K., Kwasinski, A., Matthews, J., Mayhew, D., Owen, J., Marzocca, P. (2014). *Energy for Sustainable Development* 19, 83-91.
8. "Policy Options for the Split Incentive: Increasing Energy Efficiency for Low-Income Renters." Stephen Bird and Diana Hernández. *Energy Policy* 48, September, 506-514 (2012).

Book Chapters (peer-reviewed)

9. Stephen Bird, Amir Enayati, Chelsea Hotaling, and Tom Ortmeyer. 2017. "Resilient Community Microgrids: Governance and Operational Challenges." In *Energy Internet: An Open Energy Platform to Transform Legacy Power Systems into Open Innovation and Global Economic Engine*, edited by Alex Q. Huang and Wencong Su. Elsevier.
10. Bird, Stephen, and Martin D. Heintzelman. 2017. "Canada/U.S. Transboundary Energy Governance." In *Transboundary Environmental Governance Across the World's Longest Border*, edited by Stephen Brooks and Andrea Olive. East Lansing, MI: Michigan State University Press.

Synergistic Activities and Grants

1. Co-PI, LEED for Communities in the New York Olympic Region. Director of Adirondack Semester and Professor for LFC NYOR semester long research project.
2. 2016-2017. New York Department of Public Service / National Grid / New York State Energy Research Development Agency (NYSERDA). *Potsdam REV Demonstration Project.* 2016-2017. New York Prize (Microgrid) Stage 2. Co- PI, (lead: Tom Ortmeyer) $220,000 with GE Energy Consulting.
3. 2015-2018. National Science Foundation (NSF). Developing Advanced Resilient Microgrid Technology to Improve Disaster Response Capability. Co- PI, (lead: Tom Ortmeyer) $1 million.
4. 2013-2015. New York State Energy Research Development Agency (NYSERDA). *Clean Energy and Smart Student Housing: Motivational Interventions for Improved Energy Efficiency in University Housing.* $120,000. PON 2631. PI: Stephen Bird; Lisa Legault & Sue Powers – co-PIs.
5. *Leveraging Existing Campus-Wide Wireless Network and Ubiquitous Mobile Devices to Predict Room Occupancy and Save Energy in HVAC.* $100,000. PON 2606. PI: Daqing Hou. Co-PI: Stephen Bird
6. 2011-2014. New York State Energy Research Development Agency (NYSERDA). *Green Data Center Computing: A Demonstration Project.* $350,000. Co-PI; PI: Pier Marzocca. 2013: $50,000 Supplemental for Policy, Economic, and Market Analysis, PI: Stephen Bird.

Graduate Students:	Current: 2,	Past 7.
Undergraduate Research Students:	Current: 4,	Past 13.

MARTIN D. HEINTZELMAN

PROFESSIONAL PREPARATION

University of Michigan	Ann Arbor, MI	Economics	Ph.D., 2006
University of Michigan	Ann Arbor, MI	Natural Resource Policy and Behavior	MS, 2010
University of Michigan	Ann Arbor, MI	Economics	MA, 2003
Duke University	Durham, NC	Economics (Canadian Studies)	BS, 1998

APPOINTMENTS

2012-Present	Associate Professor, Clarkson University, Potsdam, NY
2015-2016	Fulbright Visiting Research Chair, University of Ottawa, Ottawa, ON, Canada
2006-2012	Assistant Professor, Clarkson University, Potsdam, NY
1998-2000	Research Assistant, Resources for the Future, Washington, DC

TOTAL NUMBER OF PEER-REVIEWED PUBLICATIONS: 18 **AND IN LAST FIVE YEARS**: 11

MOST CLOSELY RELATED PUBLICATIONS/PRODUCTS

Tang, Chuan, Martin D. Heintzelman, and Thomas Holsen, "Mercury Pollution, Information, and Property Values," *Journal of Environmental Economics and Management* (forthcoming, 2019).
https://doi.org/10.1016/j.jeem.2018.10.009

Heintzelman, Martin D., Richard Vyn and Sarah Guth, "Understanding the Amenity Impacts of Wind Development on an International Border" *Ecological Economics* Volume 137, July 2017, Pages 195-206.
https://doi.org/10.1016/j.ecolecon.2017.03.008

Walsh, Patrick J., Stephen D. Bird and Martin D. Heintzelman, "Understanding Local Regulation of Hydro-Fracking: A Spatial Econometric Approach", *Agricultural and Resource Economics Review* Vol 44 No. 2, August 2015.
https://doi.org/10.1017/S1068280500010261

Tuttle, Carrie M. and Martin D. Heintzelman, "A Loon on Every Lake: A Hedonic Analysis of Lake Quality in the Adirondacks," *Resource and Energy Economics* Vol 39 (pgs. 1-15), February 2015.
https://doi.org/10.1016/j.reseneeco.2014.11.001

Heintzelman, Martin D., Patrick J. Walsh, and Dustin J. Grzeskowiak "Explaining the Appearance and Success of Open Space Referenda," *Ecological Economics*, Vol 95(pgs. 108-117), November 2013.
https://doi.org/10.1016/j.ecolecon.2013.08.001

OTHER RELEVANT PUBLICATIONS/PRODUCTS

Echazu, Luciana and Martin D. Heintzelman, "Environmental Regulation and Love for Variety," *Review of International Economics* (forthcoming, 2019).

Heintzelman, Martin D. and Jason J. Altieri, "Historic Preservation: Preserving Value?," *Journal of Real Estate Finance and Economics* 46(3), April 2013.
https://link.springer.com/article/10.1007/s11146-011-9338-8

Heintzelman, Martin D. and Carrie M. Tuttle, "Values in the Wind: A Hedonic Analysis of Wind Power Facilities," *Land Economics*, Vol. 88(3), August 2012.
https://doi.org/10.3368/le.88.3.571

Heintzelman, Martin D., "The Value of Land Use Patterns and Preservation Policies," *The B.E. Journal of Economic Analysis & Policy*: Vol. 10 : Iss. 1 (Topics), Article 39, May 2010.
https://doi.org/10.2202/1935-1682.2484

Heintzelman, Martin D., "Measuring the Property Value Effects of Land-Use and Preservation Referenda," *Land Economics*, Vol. 86, No. 1, February, 2010.
https://doi.org/10.3368/le.86.1.22

SYNERGISTIC ACTIVITIES

Graduate student training

- Number of graduate students currently in the laboratory: 1 Post-Doc
- Number of graduate students (MS, PhD) completed in the last five years: 4 MS, 1 PhD

Undergraduate training

- Number of undergraduate students currently in the laboratory: 1
- Number of undergraduates in the lab who are women, disadvantaged, or underrepresented: 1

External funding

Current Awards:

Great Lakes Research Consortium (GLRC) Small Grants Program. "Economic Value of Controlling Aquatic Invasive Species in New York State" $22,500. July 2017-June 2018 (PI – Martin Heintzelman; Co-PI – Chuan Tang)

New York Department of Public Service / National Grid / New York Energy Research and Development Authority (NYSERDA). Potsdam REV Demonstration Project. 2016-2017. New York Prize (Microgrid) Stage 2. Co- PI, (lead: Tom Ortmeyer) $220,836, contracted with GE Energy Consulting.

Pending Awards:

USDA NIFA Conference Grant (sub- to University of Vermont). 2019 NAREA Workshop on Environmental Regulation and Innovation in Rural Communities. Co-PI (lead: Donna Ramirez-Harrington, UVM) $40,577.

USDA NIFA AFRI Research Grant (sub- to University of Connecticut). Wind Energy Driving Rural Change: Economic Diversification, Land Value, Agriculture, and Natural Resource-based Tourism. Co-PI (lead: Stephen Swallow, UCONN) Clarkson Share: $60,882.

Santosh K. Mahapatra

Associate Professor
Operations and Information Systems
The David D. Reh School of Business
Clarkson University
Potsdam NY 13699-5790

Ph: 315-268-3980
Fax: 315-268-3810
Email: smahapat@clarkson.edu

a) Education

Michigan State University East Lansing, MI, USA	Operations Management	Ph.D. 2006
Xavier Institute of Management Bhubaneswar, India	Finance	MBA 1995
Indian Institute of Technology Mumbai, India	Energy Systems Engineering	MS 1990
Sambalpur University Burla, India	Civil Engineering	BS 1987

b) Appointments

The David D. Reh School of Business, Clarkson University, Potsdam, NY, USA
Associate Professor (2012-present), Assistant Professor (2006-2012)

Amrita University, Kollam, India, Adjunct Associate Professor and Honorary Director at Amrita Center of Humanitarian Operations Management, (June 2014 – present)

Xavier Institute of Management, Bhubaneswar, India, Visiting Associate Professor (Sabbatical, August 2013-December 2013)

University of Bologna, Italy, Visiting Associate Professor at Department of Management,
(Sabbatical, July 2013 – August 2013)

S. P. Jain Institute of Management and Research, Mumbai, India, Assistant Professor of Operations Management and Information Systems (June 1999- June 2001)

c.1) Publications related to environmental and social sustainability in supply chains

1. **Mahapatra, S.**, William, W. S., Padhy, R. K. Alignment in the Base of the Pyramid (BoP) Producer Supply Chains: The Case of the Handloom Sector in Odisha, India. *Journal of Business Logistics* (Forthcoming)
2. Cole, D., **Mahapatra, S.** and Webster, S. (2017). A Comparison of Buyback and Trade-In Policies to Acquire Used Products for Remanufacturing. *Journal of Business Logistics*, 38(3), pp 217-232.
3. **Mahapatra, S**., Pal, R., Hult, T., and Talluri, S. (2015). "Assessment of Proactive Environmental Initiatives: Evaluation of Efficiency Based on Interval Scale Data." *IEEE Transactions in Engineering Management*, 62(2), pp 280-293.
4. **Mahapatra, S.,** Pal, R., Narasimhan, R. (2012). Hybrid (re)manufacturing: manufacturing and operational implications. *International Journal of Production Research* 50(14), pp 3786–3808.
5. **Mahapatra, S.,** Melnyk, S. A., & Calantone, R. J. (2007) "Understanding Environment Management Systems Performance: An Expanded Empirical Study." *International Journal of Productivity and Quality Management*, 2(2), pp 263-286.

c.2) Other selected publications related to supply chain management

1. **Mahapatra, S.**, Narasimhan, R., and Barbieri, P. A Contingent Assessment of Structural and Governance Characteristics in Multi-tier Supply Chains: Insights from Interconnected Dyads. *International Journal of Operations and Production Management*. (Forthcoming)
2. **Mahapatra, S.,** Levental, S., and Narasimhan, R. (2017). "Market Price Uncertainty, Risk Aversion and Procurement: Combining Contracts and Open Market Sourcing Alternatives." *International Journal of Production Economics*, 185, pp 34-51.
3. **Mahapatra, S.,** Bisi, A., Narasimhan, R., and Levental, S. (2016) "Integrated Contract and Market Procurement By A Risk Averse Buying Firm." *IEEE Transactions in Engineering Management*, 63(2), pp 151-164.
4. Milne, R. J., **Mahapatra, S.** and Wang, C. (2015). "Optimizing Planned Lead Times for Enhancing Performance of MRP systems." *International Journal of Production Economics*, 167, pp 120-131.
5. **Mahapatra, S.,** Das, A., and Narasimhan, R. (2012). A Contingent Theory of Supplier Management Initiatives: Effects of Competitive Intensity and Product Life Cycle. *Journal of Operations Management, 30*(5), pp 406-422.
6. **Mahapatra, S.,** Yu, D., and Mahmoodi, F. (2012). Impact of the Pull and Push-Pull Policies on the Performance of a Multi-Stage Supply Chain. *International Journal of Production Research*, 50(16), pp 4699–4717.
7. **Mahapatra, S.,** Narasimhan, and R., Barbieri, P. (2010) "Strategic Interdependence, Governance Effectiveness and Supplier Performance: A Case Study Investigation and Theory Development". *Journal of Operations Management*, 28(6), pp 537-552.

d) Synergistic activities

- Advising doctoral dissertation at Amrita University, India. (Spring 2015-continuing).
- Developed and taught courses on Supply Chain Environmental management, Supply Chain and Operations Management, and Quality Management and Lean Organizations to business students at Clarkson University over past 11 years.
- Taught in seminars for company executives on topics such as Environmental Sustainability in Supply Chains, Supply Chain Flexibility, and Strategic Configuration of Supply Chains.
- Delivered invited lectures on sustainable operations at University Bologna, Italy, Indian Institute of Management, Kolkata and Indian Institute of Management, Bengaluru.
- Co-guided and served on the doctoral dissertation committee at Whitman School of Business, Syracuse University. (Fall 2009-Summer 2011).
- Was awarded P&G curriculum development grant in 2007 to educate Clarkson business students on "Environmental Life Cycle Impact of Packaging in Personal Care and Detergent Product Supply Chain".
- Was awarded a grant to participate in "Lean Supply Chain Simulation Workshop", Sponsored by WPI/NSF, $10000.

Anne E. Mosher

PROFESSIONAL PREPARATION

Institution	Location	Field/major	Degree, Year
Penn State University	University Park, PA	Urban and Historical Geographies/Geography	PhD 1989
Penn State University	University Park, PA	Urban and Historical Geographies/Geography	MS 1983
Macalester College	St. Paul, MN	Double majors: Geography, International Studies	BA 1981

APPOINTMENTS

2016-. Syracuse University. Maxwell School of Citizenship and Public Affairs. Maxwell Program in Citizenship and Civic Engagement. Faculty Chair.

2004-. Syracuse University. Daniel Patrick Moynihan Institute of Global Affairs. Maxwell School of Citizenship and Public Affairs. Senior Research Fellow.

1998-. Syracuse University. Department of Geography. Associate Professor.

TOTAL NUMBER OF PEER-REVIEWED PUBLICATIONS AND IN LAST FIVE YEARS:

2010. Mosher, Anne E., and Laurie A. Wilkie. "Historical Archaeo-Geographies of Scaled Statehood: American Federalism and Material Practices of National Prohibition in California, 1917–1933," *Archaeologies: Journal of the World Archaeological Congress* 6 (1):82-114.

2009. "Earle's Theory and Conception of the Geographical History of the United States," in Heppen, John and Samuel M. Otterstrom, eds. Geography, History and the American Political Economy, Lanham, MD: Lexington Books, pp. 7-18.

2009. "Earle's Dialectical Policy Regimes and the Erie Canal," in Heppen and Otterstrom, op. cit., pp. 99-124.

2004. Mosher, Anne E. *Capital's Utopia: Vandergrift, Pennsylvania, 1855-1916.* Baltimore: Johns Hopkins University Press.

OTHER RELEVANT PUBLICATIONS/PRODUCTS

2018. Aliyeva, Albina, et al. "Understanding Partnership and Collaboration within the CNY Nonprofit Ecosystem: A First-Cut Analysis," Final Report Prepared for CNY Community Partner Organizations by the Maxwell Program in Citizenship and Civic Engagement Course MAX 302: Research Seminar in Civic Engagement. Anne E. Mosher, Editor.

2007. "Maps as Stories: An Exhibition on Community Mapping in Rome, New York," September-November 2007, Rome Historical Society, Rome, NY. NOTE: *Anne Munly (Syracuse University School of Architecture) was solely responsible for the construction and installation of this exhibition. My contribution occurred between 2001 and 2006 through the collaborative research project on which Munly's exhibition was based.*

SYNERGISTIC ACTIVITIES

Graduate Student Training

- Number of graduate students currently in the laboratory**: 0**
- Number of graduate students (MS, PhD) completed in last five years: **1**

Undergraduate training

- Number of undergraduate students currently in the laboratory: **1**
- Number of undergraduates in the lab who are women, disadvantaged, or underrepresented: : **1**

External funding.

Current Awards: Sponsor name, award number, project title, your role

No current externally funded projects.
2 current internally funded projects.

Subject: IRB/HS
From: Anne E Mosher <amosher@maxwell.syr.edu>
Date: 12/3/2018, 9:06 AM
To: Erik Backus <ebackus@clarkson.edu>

Dear Erik,

As requested, I affirm my adherence to all applicable human subjects and other provisions for our proposed research project on LEED for Communities in the New York Olympic Region.

Sincerely,

Anne E. Mosher, PhD
Chair, Maxwell Program in Citizenship and Civic Engagement
Associate Professor, Geography | Senior Research Fellow, Moynihan Institute of Global Affairs
Maxwell School of Citizenship and Public Affairs | College of Arts and Sciences
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