Collaboratory to Develop the Center for Integrated Multiscale Modeling
PI: Vivek Shandas*

Abstract

We propose a transdisciplinary collaboration between university researchers, educators, and community members to create a framework for conducting research at multiple scales organized around a central theme of Ecodistricts and supporting the goals of the recently developed Center for Integrated Multiscale Modeling (CIMM) at PSU. The collaboration will occur through three months in Summer 2011, and will consist of the following activities: (1) evaluate the current extent, type, and quality of *data available* for Portland Ecodistricts (meso-scale) and create an inventory of EcoDistrict research activities to *identify gaps* and needs to help shape a future research agenda; (2) conduct a literature review and develop a framework for deepening our understanding of *urban carbon dynamics*; (3) identify the *hardware and software* requirements for analyzing and modeling existing and emerging datasets to support the goals of CIMM; (4) identify *regional stakeholders* that might be directly involved in the integration of data and visualization platforms; (5) engage sustainability faculty members to explore the role of using Ecodistricts as an organizing concept in *curriculum and pedagogy*.

This collaboration will result in (1) a submission of a multi-million dollar grant proposal to NSF's Coupled Human and Natural Systems (due November 2011) organized around the theme of urban metabolism and scaling sustainability; (2) a synthesis paper on the relationship between carbon dynamics and scaling in urban systems; (3) a comprehensive EcoDistrict research inventory; (4) a suite of curricular and pedagogical resources for faculty to engage in place-based education; and (5) the creation of a website that hosts information about the CIMM. This project will complement other ongoing projects at PSU, including A Database for the EcoDistricts of Portland (ADEPT), capstones on place-based education, ULTRA-Ex, and IGERT. The integrative efforts proposed in this collabratory will help in establishing PSU as a sustainability-hub that links research with practice and curriculum.

PIs and Partners: *Dr. Vivek Shandas (PI, USP), Fletcher Beaudoin (co-PI, ISS), Johanna Brickman (partner, Oregon BEST), Craig Briscoe (partner, ZGF Architects), Naomi Cole (partner, PoSI), Geoffrey Duh (co-PI, GEOG), Shanna Eller (co-PI, CES), Sarah Eppley (co-PI, BIO), William Garrick (co-PI, ARC), Patricia Graf (co-PI, USP), Huafen Hu (co-PI, MME), Lucy Hutyra (partner, Boston University, Dept of Geography & Enviornment), Kevin Kesckes (co-PI, CAE); Steve Johnson (USP, co-PI), Barry Messer (co-PI, USP); Todd Rosenstiel (co-PI, BIO), Andrew Rice (co-PI, Physics), Amy Spring (co-PI, CAE); Alan Yeakley (co-PI, ESM).*

Problem Statement (1 page)

The year 2007 marked the first time in human history when more than half of the world's population lived in urban areas. As a result of this global urbanization, local actions in cities are playing an increasing role in changing global environmental conditions. Study of urban regions around the globe are beginning to identify cities as the catalyst for dramatically impacting the pace and magnitude of global change to be witnessed during the next century (IPCC, 2007). Take for example, the production of greenhouse gases (GHGs) created by local land use, transportation networks, land cover, and human behavior at regional scales and smaller. While urban regions are increasingly important to global change, such as the production of GHGs, few urban areas have systematically assessed the effectiveness of integrating data with robust stakeholder involvement. We currently do not know, for example, how changing regional climate will impact rates of carbon sequestration or how humans living in urban landscapes may influence this relationship. Nor do we understand the

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capacity for the metropolitan region to accommodate increases population, while providing ecological services to new and existing residents. Higher education may play a central role in advancing urban sustainability goals; however, we currently have limited integration of the research and educational resources for advancing sustainability goals at local and global scales.

The lack of integration between curriculum and research, and data and action, also limits our ability to engage community members and decision makers in developing an empirically based approach to mitigating and adapting to future global and local change scenarios. For example, despite the fact that the City of Portland and Multnomah County, together, have established themselves as a national leader in addressing broad goals of urban sustainability (Cogen et al., 2008; Sustainlane, 2009, Greenbiz, 2008, Popular Science, 2009), no empirical assessment of Portland's relationship between specific redevelopment strategies and sustainable values or behaviors exist. In fact, with an increasing interest in GHG inventories, we still do not know how changing neighborhood governance structures, or land use patterns at multiple spatial scales will impact GHG emissions. With the immediate and pressing challenges of linking local actions to global challenges, society will need to respond with strategies, plans and alternatives for meeting our current needs without compromising the ability of future generations to meet their needs.

The launch of Portland's EcoDistricts Initiative in 2009 offers an immediate and timely opportunity to examine the role of scale for addressing many of these pressing challenges facing urban sustainability. But different systems and strategies will inevitably optimize at different scales even within a neighborhood. As such, the concomitant creation of a Center for Integrated Multiscale Modeling (CIMM) at PSU offers mechanism for linking empirical assessments of global change and local actions. The aim of the CIMM is to facilitate the development of the next generation of data gathering, manipulation, visualization, and participatory, integrated modeling capabilities at multiple scales (from building, to district, to city, watershed, state, region, country and global) to understand how systems and strategies optimize across scales. In addition, it will provide a forum for the cooperative co-development of ideas among groups with expertise household (micro-scale), EcoDistricts (meso-scale), and regional and global (macro-scale) analysis. Because PSU currently lacks a comprehensive database architecture or a center that integrates the disparate research and education efforts, the CIMM links science and decision-making in new, participatory ways and helps produce a new cohort of researchers able to synthesize creative solutions across multiple disciplinary boundaries by involving them in real-world transdisciplinary problem solving. It can also improve curricular innovations by developing pedagogy that focuses on place-based education and engaging students in synthesis and problem solving, while meeting the learning goals of PSU. Efforts outlined in this summer collaboratory will use the developing theme of EcoDistricts for developing the infrastructure and collaborative capacity necessary to support a successful long-term CIMM at PSU.

Proposed Activities

This proposal for a collaboratory seeks to engage a group of transdisciplinary researchers, educators, and community members, from two universities and regional organizations to achieve five inter-related outcomes. Each activity is described below, and while we recognize that these activities are described as 'stand-alone,' we will aim to synthesize the findings of our summer efforts during the final week of our collaboratory.

Activity 1: Evaluate the current extent, type, and quality of data available for micro -, meso-, and macro- spatial and temporal scales, as an important contribution to the broader data goals of CIMM. The focus on these activities will begin with the EcoDistricts of Portland, as they have been the focus of several data integration activities to date. Over summer 2010, researchers, database designers, and sustainability practitioners, assembled a set of data that would serve as a starting point for more integrative efforts, which, in part, is the basis for this proposal. Although these efforts resulted in the creation of an assessment website, currently housed on the Portland Sustainability Institute (PoSI)

website (www.assess.pdxinstitute.org), they also provided several insights about data currently missing for developing a broader modeling framework. The first of the five collaboratory activities will focus on developing a framework for describing the type, quality, and breath and depth of data currently available, and the types of data needed for developing the CIMM. We will survey all the faculty on the CIMM list and those involved with the EcoDistrict initiative, eliciting information about data that can be helpful for addressing challenges currently faced by these individuals and organizations.

One area of data currently unexplored at PSU and elsewhere, but increasingly recognized as central to urban systems is urban carbon dynamics. Over the past two decades, an unprecedented scientific effort to understand the global carbon cycle is underway, but primarily occurring non-urban settings. Global measurement networks, intensive field campaigns, carbon emissions inventories, and models have led to a vastly improved quantification of the current carbon dioxide levels in the atmosphere, anthropogenic perturbations, and their trends in time. The contribution of urban environments to the global carbon cycle through intensified fossil fuel usage has been well established. Buildings are one of the biggest contributors to urban carbon footprints. Building carbon emissions are often taken into account through building energy use index (EUI) and therefore new building EUIs are often proposed in response to any urban carbon emission reduction plan. The EUI approach provides a representative measure of the current status of building carbon emission in a city or regional level. But meanwhile it fails to capture building carbon emission in a long-term time. Recognizing that a lack of carbon data prevents the development of a robust modeling apparatus for assessing the implications of urban development on the production of GHGs, we will begin by 'scanning' the current datasets available to our researchers, and identify gaps in research currently available in the literature. The results of the survey and literature review will help to inform the basis for integrating the existing datasets, and explicitly identify mechanisms for further expanding on available data.

Activity 2: Identify the hardware and software requirements to analyze datasets and implement CIMM. As part of the ongoing efforts by the PSU's Advisory Committee on Academic Information Technologies, we will work with evaluate the current computing infrastructure on campus, and develop a detailed description about the hardware and software needs for establishing CIMM. Specifically, we will engage Academic Resource Computing in discussions about the current capacity for modeling infrastructure at PSU, and identify needs for expanding resources to support CIMM. As part of these activities, we will collaborate with several institutions from around the country to understand how they have developed modeling systems, learn from their mistakes, and develop a plan for the suite of hardware and software systems most appropriate for our purposes. For example, the University of Maryland Baltimore County has developed a modeling center that provides 'real time' output from sensors, integrated datasets, and visualization platforms that describe changes in environmental conditions over multiple spatial and temporal timescales. Other such systems include Arizona State University's Decision Theater, and the following: http://www.casa.ucl.ac.uk/news/newsStory.asp?ID=228; http://senseable.mit.edu; and http://www.tyndall.ac.uk/. We will conduct detailed interviews with the database managers and operators using these systems. Our focus will be on three dimensions: data integration standards and procedures, database design, and visualization platforms. We will also assess the resources necessary for building and maintaining these systems, and the organizational structures that best enable ongoing support.

Activity 3: Conduct curriculum integration for linking multiple scales to a place-based pedagogy. Using Ecodistricts (meso-scale) as an organizing concept in *curriculum and pedagogy*, this activity will support the above two activities by explicitly identifying the courses and faculty that might best contribute to a place-based effort. By blurring the lines between education and research, the members

assembled in this collaboratory will aim to identify dimensions undergraduate and graduate curriculum that can help to understand the relationship between geographic scales as they relate to urban sustainability. Ongoing projects by Students Engaging in EcoDistricts (SEED), Coalition Of Students Interested in EcoDistricts (COSIE), and other campus groups have already developed resources for engaging faculty examining the role of neighborhood in sustainability efforts. In 2008, a senior capstone was established that evaluates PSU's carbon footprint and conducts quantitative audits of proposed carbon mitigation measures; it has been offered in alternative years since that time (http://web.pdx.edu/~arice/carboncapstone/421.htm). These efforts contributed to the construction of a PSU Climate Action Plan, which was constructed by the Campus Sustainability Office in 2010, with the help of several courses, faculty and staff. A cornerstone of this work will also be the training and development of graduate students as they emerge from their disciplinary programs into the research environment requiring the integration multiple disciplines to address important scientific questions of our time. Graduate student involvement in this work will be in the areas of soil carbon dynamics, atmospheric modeling, biosphere-atmosphere interactions, GIS, environmental planning and others.

Our focus on curricular integration will consist of information gathering and assessment by a working group consisting of the SEED Program Coordinator, a faculty scholar from Center for Academic Excellence (CAE), a neighborhood representative, and a representative of the Campus Sustainability Office at PSU. This group will organize existing data (gathered at several events on campus and the neighborhood), review literature on issues relevant to the topic of place-based engaged curriculum for sustainable, inventory place-based education strategies at PSU, analyze case studies of best practices in place-based engaged curriculum, in formal education or within community organizations that involve research and stewardship activities around issues of urban sustainability. Although the collaboratory will allow the curriculum team to examining concepts of place-based pedagogy broadly, another equally important dimension of this work is to organize and coordinate curricular activities within the University EcoDistrict. Specifically, we will link the findings from the literature review and inventory of best practices with the University EcoDistrict and evaluate opportunities for expanding related efforts.

Proposed Outcomes

The outcomes of the Summer collaboratory include: (1) a submission of a multi-million dollar grant proposal to NSF's Coupled Human and Natural Systems (due November, 12 2011) organized around the theme of urban metabolism and scaling sustainability; (2) a synthesis paper on the relationship between carbon dynamics and scaling in urban systems; (3) a comprehensive EcoDistrict data (existing and aspirational) inventory; (4) a suite of curricular and pedagogical resources for faculty to engage in place-based education; and (5) the creation of a website that hosts information about the CIMM. In the narrative below we describe in more detail the significant outcomes of our proposed summer collaboratory.

A primary focus of this summer collaboratory is the development of a highly competitive NSF - Coupled Human Natural Systems Proposal for submission in Nov 2011 on the integration of ecological and social processes for influencing carbon dynamics in urban ecosystems. Drs. Rosenstiel (Biology), Rice (Physics) and Shandas (USP) have agreed to spearhead and coordinate this multi-investigator effort. This proposal will build on the research strengths and interests of our assembled research team and will examine the role of ecological scaling of sustainable practices in urban landscapes, using the Portland EcoDistricts as a novel experimental framework for engaged biophysical and socio-economic science research. Specifics of the proposal will be developed as part of the summer collaboratory and will rely heavily on the activities outlined above.

In addition, members of the summer collaboratory will be involved in the development of a significant synthesis paper examining the opportunities and challenges of coupling biophysical and socieeconomic knowledge towards developing a better understanding of scaling sustainability in urban environments. An important aspect of this effort will be an extensive survey of research

methodologies employed worldwide to understanding carbon dynamics in urban environments, including a critical evaluation o their strengths and weaknesses. With the emphasis of the November Coupled Human Natural Systems proposal on understanding carbon metabolism in urban environments, our group will identify effective new and established techniques employed currently employed across number disciplines. The synthesis manuscript from this activity will bring our research team up to speed with the state of the science and to refine our own approaches towards studying urban metabolism in the metropolitan Portland region in the context of generalized urban systems.

The outcomes of the place-based integration of curricular efforts will result in a synthesis paper focused on the nexus of education, research and civic engagement within the context of an existing neighborhood and for the purpose of meeting ambitious sustainability performance goals. This paper will provide background information outlining the opportunity for transformative collaborative processes within an educational strategy and will outline the resources and opportunities available to implement a strategy within the EcoDistrict encompassing the PSU. The information gathered in this synthesis paper will be important for current and new faculty aiming to build capacity for a research focused engaged curriculum throughout the University Studies, in the new school of business capstone program, and in other courses throughout various departments at PSU. It will provide a framework for faculty to develop courses that guide students and community members in critical inquiry into and engaged research of global to local environmental sustainability issues. This synthesis paper will directly inform the creation of an implementation guide for curriculum focused on urban sustainability issues during the 2011-12 school year. This guide will coordinate efforts of the SEED Program and integrate related efforts in place-based education for the purpose of understanding and creating the University EcoDistrict. As a result, the curricular assessment and will offer models for expanding place-based emphasis across disciplines (social, natural and humanities), while identifying mechanisms for linking curricular efforts.

Timetable of Activities

Activity	**Responsible Faculty**	**Time Period (June 16 – August 5, 2011)**					
		June 16 - 30	**July 1 - 8**	**July 11 –15**	**July 18-22**	**July 25 – 29**	**Aug 1- 5**
Assemble the core team of PIs for 'kick off' meeting	All	X					
Literature review of carbon dynamics in urban systems, including methods & data for analyzing urban metabolism	Rosensteil, Rice, Shandas, Hutyra		X				
Draft of synthesis manuscript of urban carbon dynamics	Rosensteil, Rice, Shandas, Hutyra			X	X	X	X
Engage database designers for website development and	Garrick				X	X	

database evaluation							
Conduct survey of CIMM and EcoDistrict stakeholders to evaluate pressing needs for data	All		X				
Literature review of place-based pedagogy	Graf, Messer, Eller, Spring, Kesckes, Beaudoin			X	X	X	
Organize existing data for place-based engagement and education	Graf, Messer, Eller, Spring, Kesckes, Beaudoin		X	X			
Develop synthesis paper on place-based pedagogy and resource guide for faculty	Graf, Messer, Eller, Spring, Kesckes				X	X	X

Participants (in alphabetical order)

(1) Fletcher Beaudoin (co-PI, ISS) is a sustainability program manager for the Institute for Sustainable Solutions and has expertise in engaging students in research activities. Over the past year Fletcher worked with members of this team to draft the PSU first Climate Action Plan, participated in research on EcoDistricts, and organized symposia to identify sustainability priorities at PSU.

(2) Johanna Brickman (partner, BEST) is the *Manager of Sustainable Built Environment Program in the Oregon Built Environment and Sustainable Technologies Center.* Johanna brings to this project the experience of working with business leaders through advocacy, education, leadership cultivation, civic interaction and community building.

(3) Craig Briscoe (partner, ZGF Architects) is is a LEED® AP with 10 years of architectural experience in large and mid-size institutional projects. Craig serves as a member of ZGF's Sustainable Design Team, consulting with project teams on technical issues in sustainable design.

(4) Naomi Cole (partner, PoSI) Program Manager for PoSI and works primarily on the EcoDistricts Initiative. She brings an interdisciplinary background in architecture, environmental science, and urban studies.

(5) Geoffrey Duh (co-PI, GEOG) is an Assistant Professor of Geography and specializes in remote sensing and geographic information systems. His expertise in understanding the types of data and their integration will help to address the activities in the proposal.

(6) Shanna Eller (co-PI, CES) is the Director of Community Environmental Services where her team provides community partners in Portland, the region, and beyond with research data and technical assistance on urban environmental issues and resource sustainability, while giving PSU students the opportunity to develop leadership capacity and practical job skills through education, service, and research.

(7) Sarah Eppley (co-PI, BIO) is an Assistant Professor of Biology, where she focuses on understanding the role of stress, particularly extreme environmental stress, in the ecology and evolution of plant species. Her knowledge of vegetation conditions in the face of environmental change is critical to our ability to protect rare and endangered plant species and to predict the

impacts of climate change on plant communities.

(8) William Garrick (co-PI, ARC) is the director of Academic Research Computing, which is in the office of information technologies. William has experience working with spatial and aspatial data, developing databases, and online systems integrating datasets.

(9) Patricia Graf (co-PI, USP) is a staff member in Urban Studies and Planning and has led several curricular and engagement efforts on place-based education. Her expertise in coordinating and organizing people on theme based efforts will help guide the curricular efforts outlined in this proposal.

(10) Lucy Hutyra (partner, Boston University) is an Assistant Professor of Geography and Environmental Sciences at Boston College. Lucy expertise is in global change and urbanization, focusing specifically on carbon cycles and ecosystem ecology.

(11) Kevin Kesckes (co-PI, CAE) is Associate Vice Provost for Engagement and the Director, Community-University Partnerships in the Center for Academic Excellence (CAE). His involvement with engagement efforts generally and EcoDistricts specifically will help this team assemble the resources for faculty focusing on place based pedagogy.

(12) Barry Messer (co-PI, USP) is an Associate Professor of Urban Studies and Planning and has conducted several capstones in place-based learning. His expertise in linking curricular efforts to community interests is long-standing and can offer several insights into the development of faculty resources.

(13) Huafen Hu (co-PI, MME) is an Assistant Professor of Mechanical and Materials Engineering, and has expertise in building performance simulation, model-based control, natural ventilation, and zero energy buildings.

(14) Todd Rosenstiel (co-PI, BIO) is an Assistant Professor of Biology and has expertise in plant physiology and carbon dynamics. His recent work is focusing on urban carbon metabolism.

(15) Andrew Rice (co-PI, PHY) is an Assistant Professor of Physics, where his research focuses on better understanding sources and sinks of important atmospheric trace gases using small variations in naturally occurring stable isotopes.

(16) Vivek Shandas (PI, USP) has expertise in environmental planning and assessment. He examines the relationship among environmental change, human and institutional response, and the effectiveness of management actions. He is trained broadly in natural and social sciences, which defines his approach to conducting collaborative transdisicplinary projects.

(17) Amy Spring (co-PI, CAE) is Asst. Director, Community-University Partnerships in the Center for Academic Excellence (CAE). Here involvement with engagement efforts, mobilizing faculty and students, and coordinating curricular efforts will provide guidance for the most effective approaches for advancing our interests in place-based pedagogy.

(18) Alan Yeakley (co-PI, ESM) is a Professor of Environmental Sciences and Management where he focuses on water dynamics in the urban landscape. As the founder of the Urban Ecology Research Consortium he can provide perspectives on the types of data and stakeholders who might best link with our database efforts.

Budget

We request a total of $89,733 for completing all the activities in this proposal. The proposal consists of a total of $66,936 in personnel resources, which provides the PI and co-PIs with approximately one week of summer salary, with the exception of Graf, Eller, and Johnson who will receive approximately $4,500 for their involvement. In addition, support from the two co-PIs from CAE requires an additional $3,240 total. Two graduate assistants are also requested to help support collection and organization of data resources, and for assisting in the communication and coordination of project PIs and partners. The gradate students will be funded at $12.50/hour for 180 hours over the duration of this proposal. Standard PSU fringe rates apply to all those funded by this project.

We request a total of $1,800 to engage one researcher from Boston University (Hutyra). Travel for Hutyra consists of $600 round trip airfare from Boston to Portland, and six nights at $200/night.

To prepare the November proposal to NSF we request $7,000 for hiring a grant writer. A writer who has successfully won several grants has been identified, and we anticipate preparing the majority of the proposal by summer's end, the Nov deadline may require that the total request be extended to Fall 2011.

For preparing the website and the database analysis we request a total of $14,000. These funds will support Academic Research Computing in preparing the website for housing relevant data, setting an online data interface, and for conducting interviews with organizations outside Portland.

Finally, we request a total of $6,365 to help in the coordination of these grant funds. Each of the PIs and partners being paid by this project will require specialized administrative assistance for meeting all procedural requirements. The project will be housed in the Center for Urban Studies (CUS) and grant assistance will be available through this Center.

CVs of PIs

Vivek Shandas, PI

a. Professional Preparation

- University of California, Santa Cruz (CA) BS, Biology (1994)
- Rensselaer Polytechnic Institute, Troy (NY), MS, Economics (1999)
- Rensselaer Polytechnic Institute, Troy (NY), MS, Environmental Management & Policy (1999)
- University of Washington, Seattle (WA), Ph.D., Urban Studies and Planning (2005)

b. Appointments, Current and Past

- Associate Professor, Urban Studies and Planning, Portland State University (OR), 2010 –
- Research Associate, Center for Urban Studies, Portland State University (OR), 2005 –
- Assistant Professor, Urban Studies and Planning, Portland State University (OR), 2005 - 10
- National Science Foundation, IGERT Fellow, University of Washington, Seattle (WA), 2001 – 04
- Environmental Policy Analyst, New York State Governor's Office, Albany (NY) 1998 – 2000
- Science Teacher, Washington County Educational Service District, Hillsboro (OR), 1994 – 1996

c. Relevant Peer-Reviewed Publications

- **Shandas, V** (under review). The implications of climate change on residential water use: A micro-scale analysis of Portland (OR), *Journal of Climate and Water.*
- Bassett, E, and **V Shandas** 2010. "Innovation in Municipal Climate Planning", *Journal of the American Planning Association 76(4): 435 – 450.*
- **Shandas, V.**, J Graybill, and C Ryan, 2008. "Are Planners Using Ecosystem Based Management when Developing Environmental Policy? Evidence from the Pacific Northwest (US)", *Journal of Environmental Planning and Management 51(5): 649-664*.
- A Mills, T Francis, **V Shandas**, K Whittaker, and J Graybill, 2008. "Using best available science to protect critical areas in Washington state: challenges and barriers to planners", *Ecology and Society 11(4).*
- **Shandas, V**., and M Alberti, 2008. "Exploring the Role of Vegetation Fragmentation on Aquatic Conditions: Linking upland with riparian areas in Puget Sound lowland streams", *Landscape and Urban Planning: 60: 66-75*
- Francis, T., K Whittaker, **V Shandas**, A Mills, and J Graybill, 2004. "Using science in the environmental policy process: A case study from Washington State", *Ecology and Society 10(1).*
- Duh JD, **V Shandas**, H Chang, and LA George, 2008. "Rates of Urbanization and the Resiliency of Air and Water Quality"*, Science of the Total Environment 400 (1-3): 238 – 256.*

Other Significant Publications

- **Shandas, V.** (in press). Localizing Environmental Health Impacts of Climate Change: Targeting neighborhood scale interventions for reducing mortality from heat waves, *Health Affairs.*
- **Shandas V**, and L George, 2009. "Spatial Patterns of Air Toxins in the Region," *Metroscape*, 12 (3).
- Baker L, A Brazel, LB Byrne, A Felson, M Grove, K Hill, KC Nelson, **V Shandas**, J Walker, 2007 (authors in alphabetical order)."Effects of Human Choice on Characteristics of Urban Ecosystems", *Bulletin of the Ecological Society of America 88 (4): 404–409*
- O'Hara S, **V Shandas**, and E Wright, 2000. "The Cost of Technology Intensive Education: A preliminary analysis of studio physics"*, Journal of Computers in Mathematics and Science Teaching 19(4): 379 - 396*
- O'Hara, S., **V Shandas**, and J Vazquez, 2000. "Communicating Sustainable Development Options - Who Evaluates the Trade-Offs?" in: I. Ring, B. Klauer, F. Waetzold, B. Mansson (eds.) Regional Sustainability: Applied Ecological Economics Bridging the Gap between Natural and Social Sciences. Physica Verlag. Heidelberg, Germany.

d. Synergistic Activities

- Organized NSF-sponsored international workshop on rapid urbanization and infrastructure planning.
- Collaborating across disciplines on ecosystem service projects.
- Working with interdisciplinary teams to evaluate models of graduate level interdisciplinary education.
- Working with regional decision makers to improve techniques for natural resource management.
- Working with scholars from University of Washington, Colgate University, and the University of Texas, Austin to assess the application of scientific information to environmental policy.

e. Collaborations Outside Portland State University

- Marina Alberti, Associate Professor, Department of Urban Design and Planning, University of Washington, Seattle, USA.
- TV Ramachandra, Director, Center for Ecological Sciences, Bangaluru, India.
- Maresi Nerad, Director, Center for Innovation and Research in Graduate Education, and Associate Professor of Education, University of Washington, Seattle, USA.
- Kiran Chhokar, Program Coordinator, Center for Environmental Education, New Delhi, India
- Clare Ryan, Associate Professor, College of Forest Resources, University of Washington, Seattle, USA
- Jessica Graybill, Assistant Professor, Department of Geography, Colgate University, USA.

(f) Teaching

Lead Instructor

- Public Participation GIS (USP 493/593), Portland State University
- Geographic Information Systems for Planners (USP 531), Portland State University
- Urban Planning -- Environmental Issues (USP 313), Portland State University
- Environmental Planning Methods (USP 510), Portland State University
- Topics in Urban Studies (USP 510), Portland State University
- Geospatial Applications to Planning (USP 543), Portland State University
- PhD Colloquium, Dept. of Urban Design and Planning, University of Washington

- Applied Research Methods – Urban Parks Studio, University of Washington

Co-Instructor

- ***Ecosystem Services for Sustainability, Portland State University***
- ***Coupled Human, Natural, and Material Systems, University of Washington***
- ***Advanced Urban Ecology Reading Seminar, University of Washington***
- ***Urban Ecology: Interdisciplinary Perspectives, University of Washington***

Jiunn-Der Geoffrey Duh, co-PI

Professional Preparation
National Taiwan University, B.S. Geography (1986)
National Taiwan University, M.S. Geography (1991)
University of Michigan, PhD. Natural Resources & Environment (2004)

(b) Appointments

Assistant Professor & Director of GIS Programs, Department of Geography, Portland State University, 2006 - present.
Visiting Assistant Professor & Interim Director of GIS Programs, Department of Geography, Portland State University, 2004 - 2005.
Assistant Researcher, Agricultural Engineering Research Center, Taiwan, ROC, 1996.
General Manager, GAIA GIS Consultant Co. Ltd. Taipei, Taiwan, ROC, 1995.
Project Manager, GAIA GIS Consultant Co. Ltd. Taipei, Taiwan, 1992-1994.

(c) Publications

Publications most closely related to the proposed project:

Duh, J., Shandas, V., Chang, H., and George, L. (2008) Rates of urbanization and the resilience of air and water quality. Science of the Total Environment 400: (1-3): 238-256

Cifaldi, R., Allan, J.D., Duh, J.D. and Brown, D.G. (2004) Spatial patterns in land cover in exurbanizing watersheds in southeastern Michigan. Landscape and Urban Planning, 66: 107-123.

Brown, D.G. and Duh, J.D. (2004) Spatial simulation for translating from land use to land cover. International Journal of Geographic Information Science,18(1): 35-60.

Brown, D.G., Pijanowski, B.C., and Duh, J.D. (2000) Modeling the Relationships between Land-Use and Land-Cover on Private Lands in the Upper Midwest, USA. Journal of Environmental Management, 59: 247-263.

Brown, D.G., Duh, J.D., and Drzyzga, S.A. (2000) Estimating error in an analysis of forest fragmentation change using North American Landscape Characterization (NALC) data. Remote Sensing of Environment, Vol. 71(1):106-117.

Other significant publications:

Duh, J.D. and Brown, D.G. (2007) Knowledge-Informed Pareto Simulated Annealing for Multi-Objective Spatial Allocation. Computers, Environment and Urban Systems, 31(3): 253-281.

Duh, J.D. and Brown, D.G. (2005) Generating prescribed patterns in landscape models. In: D.J. Maguire, M.F. Goodchild and M. Batty (Eds) GIS, Spatial Analysis and Modeling. ESRI Press.

Duh, J.D. Knowledge-Informed Simulated Annealing for Generating Prescribed Spatial Patterns in Resource Allocation. (2004) PhD Dissertation. The University of Michigan, Ann Arbor.

Brown, D.G., Jacquez, G.M., Duh, J.D., and Maruca, S. (2000) Accuracy of Remotely Sensed Estimates of Landscape Change using Patch- and Boundary-based Pattern Statistics. In: Huevelink, G. et al., eds. Spatial Accuracy Assessment in Natural Resources and Environmental Sciences, Delft University Press, pp. 75-82.

Duh, J.D. and Brown, D.G. (1999) Local reduction of systematic error in 7-1/2 minute DEMs by detecting anisotropy in derivative surfaces. In K. Lowell and A. Jaton, Eds. Spatial Accuracy Assessment: Land Information Uncertainty in Natural Resources. Chelsea, MI: Ann Arbor Press, 281-292.

Sarah M. Eppley, co-PI

(a) Professional Preparation

University of California, Santa Cruz	Biology	B.A. (1991)
University of California, Davis	Population Biology	M.S. (1995)
University of California, Davis	Population Biology	Ph.D. (2000)
University of Oxford, UK (postdoc)	Plant Biology	2002-2004
Victoria University of Wellington, NZ (postdoc)	Population Biology	2004-2005

(b) Appointments

Assistant Professor, Portland State University (PSU), Department of Biology	2005 – present
Research Assistant, University of California, Davis, with Dr. M. Stanton	1995 – 1996
Teaching Assistant, University of California, Davis, various courses	1993 – 1997
Research Assistant, University of California, Davis, with Dr. T. Wilkins	1992 – 1993
Laboratory Assistant, UC, Berkeley, with Dr. P. LeMaux	1991 – 1992
Research Assistant, UC, Santa Cruz, with Dr. R. Curry	1991
Smithsonian Fellow, Smithsonian Environmental Research Center	1990

(c) Publications

i) 5 publications most closely related to the proposed project

Eppley, S. M. Rosenstiel, T. N., Graves, C. B., Garcia, E. 2011. Limits to sexual reproduction in geothermal bryophytes. *International Journal of Plant Sciences*. In press

Mercer, C. and Eppley, S. M. 2010. Intra- versus inter-sexual competition in the dioecious grass, *Distichlis spicata*. *Oecologia* 164: 657-664

Rosenstiel, T. N. and S. M. Eppley. 2009. Long-lived sperm in the geothermal bryophyte *Pohlia nutans*. *Biology Letters* 5: 856-860

Eppley, S. M. and Jesson, L. K. 2008. Moving to mate: the evolution of separate and combined sexes in multicellular organisms. *Journal of Evolutionary Biology* 21: 727-736

Eppley, S. M. and J. R. Pannell. 2007. Density-dependent self-fertilization and male versus hermaphrodite siring success in an androdioecious plant: testing the metapopulation model. *Evolution* 61: 2349-2359.

Eppley, S. M. and J. R. Pannell. 2007. Sexual systems and measures of occupancy and abundance in an annual plant: testing the metapopulation model. *American Naturalist* 169: 20-28.

ii) 5 other significant publications, whether or not related to the proposed project

Eppley, S. M, Mercer, C. A., Haaning, C., Graves, C. B. 2009. A sex-specific mutualistic interaction in a dioecious grass. *American Journal of Botany* 96: 1967-1973

Taylor, P., Jesson, L. K., and S. M. Eppley. 2007. Sporophytic inbreeding depression in mosses occurs in a species with separate sexes but not in a species with combined sexes. *American Journal of Botany* 94: 1853-1859.

Eppley, S. M. 2006. Females make tough neighbors: sex-specific competitive effects in seedlings of a dioecious grass. *Oecologia* 146: 549-554.

Eppley, S. M. 2001. Gender-specific selection during early life-history stages in the dioecious grass *Distichlis spicata. Ecology* 82: 2022-2031.

Eppley, S. M., Stanton, M. L., and R. K. Grosberg. 1998. Intrapopulation sex ratio variation in the salt grass *Distichlis spicata*. *American Naturalist* 152: 659-670.

(d) Synergistic Activities

I am collaborating with the City of Portland's Parks and Recreation Department, Portland, Oregon to study the effects of invasive plant management strategies in urban parks. Undergraduate and graduate students from and Plant Ecology course at Portland State University are designing experiments to test management strategies for invasives in Portland parks.

Served as an ad hoc reviewer for the following journals: *American Journal of Botany, Annals of Botany, Canadian Journal of Botany, Ecography, Ecology*, *Ecology Letters, Evolution, Functional Ecology, Heredity, International Journal of Plant Sciences, Invertebrate Biology, Journal of Ecology, New Phytologist, New Zealand Journal of Botany, Oecologia, Oikos, Proceedings of the Royal Society of London, Biological Sciences, Theoretical Population Biology*

(e) Collaborators & Other Affiliations

Collaborators and Co-Editors:

Regina Berjano, Universidad de Sevilla, Spain
Marcel Dorken, Department of Plant Sciences, Oxford University, UK
Philip Garnock-Jones, School of Biological Sciences, Victoria University of Wellington, New Zealand
Linley Jesson, School of Biological Sciences, Victoria University of Wellington, New Zealand
Darren Obbard, School of Biological Sciences, University of Edinburgh, UK
John Pannell, Department of Plant Sciences, Oxford University, UK
Todd Rosenstiel, Portland State University
Phil Taylor, School of Biological Sciences, Victoria University of Wellington, New Zealand
Miguel Verdu, European Union Centro de Investigaciones sobre Desertificacion, Valencia, Spain

Graduate and Postdoctoral Advisors:

Graduate advisors: Rick Grosberg and Maureen Stanton, Center for Population Biology, University of California, Davis
Postdoctoral Sponsor: John Pannell, Department of Plant Sciences, Oxford University
Postdoctoral Sponsors: Philip Garnock-Jones and Linley Jesson, School of Biological Sciences, Victoria University of Wellington

Thesis Advisor and Postgraduate-Scholar Sponsor:
Estefanía Laneza Garcia – MS student (2007-), Portland State University
Camille Graves – MS student (2007-), Portland State University
Charlene Mercer– MS student (2008-), Portland State University
Sally Rogers– MS student (2009-), Portland State University

(d) Synergistic Activities

1. New computer algorithm (Knowledge-Informed Simulated Annealing - KISA) was designed and implemented in Duh's dissertation research. The computer program generates desirable landscape patterns based on landscape ecological principles prescribed by landscape architects. The problem was tested by staff from Winrock International in sustainable rural development projects.

2. A Monte Carlo simulation algorithm was developed by Duh for generating land-cover maps based on land-use information, an approach to bridging the semantic discrepancies between natural and social scientists and promoting interdisciplinary collaborations. A research paper based on this computer program was published in the International Journal of Geographic Information Science (Brown and Duh 2004).

3. Duh designed and developed the Basin Analysis GIS (BAGIS) used by water forecasters at USDA-NRCS National Water and Climate Center for the selection of SNOTEL sites and for the compilation of geospatial data used in hydrological modeling. On-site benchmark results show that the tool has reduced the time required to conduct hydrological modeling by a factor of 10. USGS hydrologists are reviewing BAGIS for future adoption and integration in national water forecast and hydrological modeling.

(e) Collaborators & Other Affiliations

Collaborators:

- Elisabeth Addink, University of Utrecht.
- David Allan, School of Natural Resources and Environment, University of Michigan.
- Heejun Chang, Geography, Portland State University
- Linda George, Environmental Sciences and Management Program, Portland State University
- Keith Hadley, Geography, Portland State University
- Audrey Hatch, Oregon Department of Fish and Wildlife
- Sandra Kosek-Sills, Ohio Department of Natural Resources
- Amy Lobben, Geography, University of Oregon.
- Joan Nassauer, School of Natural Resources and Environment, University of Michigan
- Vivek Shandas, School of Urban Studies and Planning, Portland State University
- Melinda Trask, Oregon Department of Transportation
- Vince Van Der Hyde, Oregon Department of Transportation
- Jim Marron, USDA-NRCS, National Water and Climate Center

Graduate Advisors:
- Dan Brown, School of Natural Resources and Environment, University of Michigan.
- Tzu-How Chu, Geography, National Taiwan University.

Master Thesis Advisor, Geography, Portland State University:
- Dan Craver, Beth Goralski, Jamie Ludwig, Craig Warden

Huafen Hu, co-PI
Department of Mechanical and Materials Engineering

(a) Professional Preparation
Georgia Institute of Technology, Atlanta, GA USA
Ph.D., College of Architecture, High Performance Buildings, December 2009
Thesis: Risk-conscious design of off-grid solar energy houses
Tsinghua University, Beijing, China
B.S., Department of Building Sciences, July 2002

(b) Appointments
Portland State University, *Portland, Oregon, USA*
Assistant Professor of Mechanical Engineering, January 2010 – present
Research foci include building performance modeling and simulation, approaches of how building simulation could be integrated into building design and operation, model-based control, and building energy management.
Georgia Institute of Technology, *Atlanta, GA, USA*
Research Assistant, August 2004 – December 2008
Researched the feasibility of hybrid ventilation in providing passive cooling for highrise apartments; and how uncertainties impact building performances.
American Council of Engineering Companies, *Washington DC, USA*
Statistics analyst, January 2008 – August 2009
Conducted statistical analysis of field survey data for their yearly publication: Design & Construction Industry Trends Survey.

(c) Publications
(i) Related Publications
1. Hu, H. "Risk-conscious design of off-grid solar energy houses," Doctoral dissertation, 2009, Georgia Institute of Technology, Atlanta, GA.
2. Hu, H., G. Augenbroe. "Right sizing an off-grid solar house," Building Simulation Conference, 2009, Glasgow, Scotland.
3. Hu, H., G. Augenbroe, and R. Choudhary. "Feasibility of controlled hybrid ventilation in mid rise apartments in the USA," Building Simulation Conference, 2007, Beijing, China.
4. Choudhary, R., G. Augenbroe, R. Gentry, and H. Hu. "Simulation-Enhanced Prototyping of an Experimental Solar House," Building Simulation: An International Journal. 2008. 1(4): p. 336-355.
5. Choudhary, R., G. Augenbroe, R. Gentry, and H. Hu. "Simulation enhanced prototying of an experimental solar house," Building Simulation Conference, 2007, Beijing, China.
(ii) Other Significant Publications
1. Hu, H. and Srebric, J. "Indoor VOC source and sink modeling in multi-zone simulations of real buildings," CIB World Building Congress, 2004, Toronto, Canada.

(d) Synergistic Activities
Teaching: Solar engineering (ME426/526, Mechanical engineering, Portland State University), Advanced architectural technology (ARCH460, Architecture, Portland State University), and Building energy modeling (ME422/522, Mechanical engineering, Portland State University).

Practice: continuous practice in low energy building design through integrated building performance simulation both in academia and design industry, including intelligent building control, natural ventilation design, net zero energy house design. Hu was the student leader in

building simulation group in Georgia Tech team during their entry to the Solar Decathlon 2007 competition, where she developed an in-house building simulation package GTSIM and consistently worked with design team to reach the net zero energy house design goal.

(e) Collaborators & Other Affiliations
• Collaborators: David Sailor (Portland State University), Graig Spolek ((Portland State University), Sergio Palleroni (Portland State University), Loren Lutzenhiser (Portland State University), Raul Cal (Portland State University), Russell Gentry (Georgia Institute of Technology), Ruchi Choudary (Cambridge University)
• Graduate Advisors: Yingxin Zhu (Tsinghua University, China); Godfried Augenbroe (Georgia Institute of Technology); Ellis Johnson (Georgia Institute of Technology)
• Graduate students: Nicolas Johnson (master student), Steve Gross (master student).

Lucy Hutyra, Partner

Department of Geography and Environmental Sciences
Boston University

Professional Preparation

Harvard University, Cambridge, MA, USA
Ph.D., Department of Earth & Planetary Sciences, April 2007
Thesis: Carbon and Water Exchange in Amazonian Rainforests
Harvard University, Cambridge, MA, USA
A.M, Department of Earth & Planetary Sciences, June 2006
Yale University, New Haven, CT, USA
Graduate coursework, School of Forestry, 1998 – 1999
University of Washington, Seattle, WA, USA
B.S., College of Forest Resources, Forest Ecology and Management, March 1998

Appointments

Boston University, *Boston, Massachusetts, USA*

Assistant Professor of Geography & Environment, December 2009 – present
Research foci include (but are not limited to) measurements of land-atmosphere carbon fluxes, studies of coupled water and carbon dynamics in terrestrial ecosystems, the impact of humans on regional to global carbon budgets, and the use of remote sensing for carbon cycle science.

University of Washington, *Seattle, Washington, USA*
Research Scientist & Laboratory Manager, May 2007 – October 2009
Research focused on characterizing and quantifying the environmental consequences of urbanization and land cover change. This is a unique position where I have the opportunity mentor graduate students, teach, prepare grants, and conduct my own scientific research.

Harvard University, *Cambridge, Massachusetts, USA*
Research Assistant, under Dr. Steven C. Wofsy, June 1999 – September 2002
Investigated carbon and water cycle dynamics in temperate, boreal, and tropical forested ecosystems through coupling of ground-based forest biometry measurements and tower based eddy covariance measurements.

SELECT RELEVANT PUBLICATIONS --- BOST CLOSELY RELATED

Hutyra, L.R., Yoon, B., Alberti, A. Terrestrial carbon stocks across a gradient of urbanization: A study of the Seattle, WA region. *Global Change Biology*, doi: 10.1111/j.1365-2486.2010.02238.x, 2011.

Malhi, Y., Aragão, L.E., Metcalfe, D.B., Patiño, S., Quesada, C.A., Almeida, S., Anderson, L., Brando, P., Chambers, J.Q., Costa, A.C.L., Martins, L., Hutyra, L.R., Oliveira, P., Pyle, E.H., Robertson, A.L.

Comprehensive assessment of carbon productivity, allocation and storage in three Amazonian forests. *Global Change Biology*. doi: 10.1111/j.1365-2486.2008.01780.x, 2009.

Barford, C.C., Wofsy, S.C., Goulden, M.L., Munger, J.W., Pyle, E.H., Urbanski, S.P., Hutyra, L., Saleska, S.R., Fitzjarrald, D., Moore, K., Factors controlling long- and short-term sequestration of atmospheric CO_2 in a mid-latitude forest, *Science*, *294*, 1688-1691, 2001.

Hutyra, L.R., Yoon, B., Hepinstall-Cymerman, J., Alberti, A. Land cover change in the Seattle metropolitan region: An examination of spatio-temporal patterns and carbon consequences. *Ecological Applications*, under review.

Hepinstall-Cymerman, J., L.R., Hutyra, S., Coe. Patterns of land cover change in the central Puget Sound, Washington, 1986-2007, *Urban Ecosystems*, accepted.

OTHER SIGNIFICANT PUBLICATIONS

Hutyra, L.R., Munger, J.W., Hammond-Pyle, E., Saleska, S.R., Restrepo-Coupe, N., de Camargo, P.B., Wofsy, S.C., Resolving systematic errors in estimates of net ecosystem exchange of CO_2 and ecosystem respiration in a tall-stature forest: application to a tropical forest biome, *Agricultural and Forest Meteorology*, 148: 1266-1279, 2008.

Pyle, E.H., Santoni, G.W., Nascimiento, H.E.M., Hutyra, L.R., Carmargo, P.B., Vieira, S., Saleska, S.R., Laurance, W.F., Wofsy, S.C., **Dynamics and disequilibria of carbon, biomass, and structure in two Amazonian forests**, *Journal of Geophysical Research – Biogeosciences,* 113, G00B08, doi:10.1029/2007JG000592, 2008*.*

Hutyra, L.R., Munger, J.W., Nobre, C.A., Saleska, S.R., Vieira, S.A., Wofsy, S.C., Climatic variability and vegetation vulnerability in Amazonia, *Geophysical Research Letters*, *32*, L24712, 2005.

Saleska, S.R., Miller, S.D.,Matross, D.M., Goulden, M.L., Wofsy, S.C., da Rocha,H., de Camargo, P.B., Crill, P., Daube, B.C., de Freitas, H.C., Hutyra, L., Keller, M., Kirchhoff, V., Menton, M., Munger, J.W., Pyle, E.H., Rice, A.H,Silva, H, Carbon fluxes in old-growth Amazonian rainforest: seasonality and disturbance-induced net carbon loss, *Science*, *302*, 1554-1557, 2003.

Hutyra, L.R., Munger, J.W., Gottlieb, E.W., Daube, B.C., Camargo, P.B., Wofsy, S.C., Seasonal controls on the exchange of carbon and water in an Amazonian rainforest, *Journal of Geophysical Research-Biogeosciences*, 112, G03008, 2007.

SYNERGISTIC ACTIVITIES

Peer-Reviewer: National Science Foundation (Ecosystems, Climate & Large Scale Dynamics); National Aeronautics and Space Administration (Terrestrial Ecology); Department of Defense (Strategic Environmental Research & Development); Agricultural & Forest Metereology, Climate Dynamics, Global Change Biology; Journal Climate, Journal of Geophysical Research – Biogeosciences, Proceedings of the National Academy of the United States of America (PNAS), Biogeosciences, Forest Ecology & Management, Journal Climate.

Teaching: The Atmosphere (Science A30, Harvard University—2001, 2004, & 2006); Environmental Planning (URBDP 498, University of Washington – 2009); Physical Geography (GE 104, Boston University – 2010).

Conference Session Chair: Workshop on Monsoon Asia Tropical Forest Carbon Dynamics and Sustainability, (Thailand, 1/2009), Forest Dynamics and Disturbance (NASA LBA Science Team

Meeting 9/2007), Carbon Fluxes in Upland Ecosystems (NASA LBA Science Team Meeting 10/2006).

Community: Columbia University Women in Science Panelist (2010), Boston University Science and Engineering Day judge (2010), contributor to global change articles for the World Book Encyclopedia.

COLLABORATORS & OTHER AFFILIATIONS

Collaborators: Marina Alberti (University of Washington), Carol Barford (University of Wisconsin), Plinio de Carmargo (University of Sao Paulo), Allison Dunn (Worcester State College), David Foster (Harvard University), Mark Friedl (Boston University), Suchi Gopal (Boston University), Michael Goulden (University of California, Irvine), Robert Grant (University of Alberti), Jeff Heppinstall (UGA), David Hollinger (USFS), Alfredo Huete (University of Arizona), Robert Kauffman (Boston University), Kazuhito Ichii (NASA, Ames), William Laurance (Smithsonian Tropical Research Institute), Yadvinder Malhi (Oxford University), Scott Miller (SUNY- Albany), Paul Moorcroft (Harvard University), J. William Munger (Harvard University), Ranga Myneni (Boston University), Nathan Phillips (Boston University), Chris Potter (NASA, Ames), Natalia Restrepo-Coupe (University of Arizona), Scott Saleska (University of Arizona), Eva van Gorsel (CSIRO), Steven Walters (University of Washington), Steven Wofsy (Harvard University), Xiangming Xiao (University of Oklahoma)

Graduate Advisor: Steven Wofsy (Harvard Univ.); **Post-Doctoral Advisor**: Marina Alberti (Univ. of Washington)

Graduate Students: Jared Newell (MS 2010), Preeti Rao (PhD student), Andy Reinmann (PhD student), Brittian Briber (PhD student), Poliana Lemos (PhD student), Rose Abramoff (PhD student), Hollie Emery (PhD student)

Andrew Rice, co-PI
Department of Physics

Professional Preparation

UNIVERSITY OF WASHINGTON
Postdoctoral Fellow
Joint Institute for the Study of the Atmosphere and Oceans

UNIVERSITY OF CALIFORNIA, IRVINE
Ph.D., Chemistry, March 2002
M.S., Chemistry, 1999

NASA Earth System Science Fellow 1998-2001
Outstanding Student Paper Award, American Geophysical Union, December, 2000

UNIVERSITY OF CALIFORNIA AT BERKELEY
B.S., Chemistry 1995
Music Minor

Appointments

2005-present	*Assistant Professor,* Portland State University, Department of Physics
2002-2005	*Postdoctoral Fellow,* JISAO, University of Washington
1997-2002	Graduate Researcher, Departments of Chemistry and ESS, UC Irvine
2002	Teaching Assistant, COSMOS program, UC, Irvine

1996-2001	Teaching Assistant, Departments of Chemistry and ESS, UC Irvine
1994-1996	Research Assistant, Lawrence Berkeley Laboratories
1994	Summer Intern, Lawrence Berkeley Laboratories
1993	Research Assistant, Desalination Systems Incorporated

Recent Publications

Rice, A. L. and G. Bostrom, Measurements of carbon dioxide in the Portland, Oregon metropolitan region, *Atmos. Environ.,* 45, 1138-1144, 2011

Rice, A. L., Dayalu, P. Quay, and R. Gammon, Isotopic fractionation during soil uptake of atmospheric hydrogen, *Biogeochem. Disc.,* 7, 8001-8018, 2010

Khalil, A., C. Butenhoff, M. Shearer, R. Mitchell, A. Rice, G. Achterman, J. MacArthur, B. Drumheller, Oregon climate change assessment report, Chapter 2. The shape of the problem and the drivers of climate change, First report from the Oregon Climate Change Research Institute (OCCRI), 2010

Rice, A.L., C.L. Butenhoff, M.J. Shearer, D. Teama, T.N. Rosenstiel, M.A.K. Khalil, Emissions of anaerobically produced methane by trees, *Geophys. Res. Lett.,* 37, L03807, doi:10.1029/2009GL041565, 2010

Rice, A. L., P. D. Quay, J. Stutsman, R. Gammon, H. Price, L. Jaeglé, Meridional distribution of molecular hydrogen and its deuterium content in the atmosphere. *J. Geophys. Res*., 115, D12306, doi:10.1029/2009JD012529, 2010

Rice, A.L. and P.D. Quay, The isotopic composition of formaldehyde in urban air. *Environ. Sci. Technol.,* 43, 8752–8758, 2009

Price, H., L. Jaeglé, A. Rice, P. Quay, P. C. Novelli, R. Gammon. Global Budget of Molecular Hydrogen and its Deuterium Content: Constraints from Ground Station, Cruise, and Aircraft Observations, *J. Geophys. Res.,* 112, D22108, doi:10.1029/2006JD008152, 2007.

Tyler, S. C., A. L. Rice, H. O. Ajie, and E. J. Dlugokencky, Measurements of CH_4 mixing ratio and D/H and $^{13}C/^{12}C$ isotope ratios in atmospheric samples from continental United States. *J. Geophys. Res.*, 112, D03303, doi:10.1029/2006JD007231, 2007

Rice, A. L., and P. D. Quay, Isotopic analysis of atmospheric formaldehyde by gas chromatography isotope ratio mass spectrometry. *Anal. Chem.* 78 (18), 6320-6326, 2006.

Valentine, D. L., A. Chidthaisong, A. L. Rice, K. Hinrichs, W. S. Reeburgh, and S. C. Tyler. Carbon and hydrogen isotope fractionation by moderately-thermophilic methanogens *Geochem. Cosmochem. Acta*, 68(7):1571-1590, Apr. 2004

Rice, A. L., S. C. Tyler, M. C. McCarthy, K. A. Boering, and E. Atlas, The carbon and hydrogen isotopic compositions of stratospheric methane: Part 1. High-precision observations from the NASA ER-2 aircraft. *J. Geophys. Res.,* 108(D15), 4460, doi:10.1029/2002JD003042, 2003

McCarthy, M. C., K. A. Boering, A. L. Rice, S. C. Tyler, P. Connell, and E. Atlas, The carbon and hydrogen isotopic compositions of stratospheric methane, Part 2: 2-D model results and implications for kinetic isotope effects. *J. Geophys. Res.,* 108(D15), 4461, doi:10.1029/2002JD003183, 2003

Graduate Advisors Stanley Tyler and Ralph Cicerone (Department of Earth System Science, University of California, Irvine)

Postdoctoral Advisors Paul Quay and Richard Gammon (School of Oceanography, University of Washington)

Thesis Advisor Jeremy Parra, Portland State University, Physics Ph.D. candidate
Gregory Bostrom, Portland State University, Physics Ph.D. candidate
Doaa Teama, Portland State University, Physics Ph.D. candidate
Lucas Hill, Portland State University, Physics Ph.D. candidate

Synergistic Activities

Physics Undergraduate Advisor, PSU (2008-current)
Oregon Climate Change Research Institute (2007-current)
National Science Foundation Research Experience for Undergraduates Advisor (2006-current)
Focus the Nation steering committee, PSU (2006-2008)
Radio Science Guest – KOPB, KBOO, WK radio (2008-present)

Collaborators (other than coauthors)

Dean Atkinson, Department of Chemistry, Portland State University
Vivek Shandas, College of Urban and Public Affairs, Portland State University
Reinhold Rasmussen, Environmental and Biomolecular Systems, Oregon Graduate Institute
Linda George, Department of Environmental Science and Resources, Portland State University
Ronald Jones, Department of Biology, Portland State University
Norman Scully, Department of Biology, Portland State University
Radu Popa, Department of Biology, Portland State University
Jon Bullister, NOAA, Pacific Marine Environmental Laboratories
Bjoern Siepel, Department of Physics, Portland State University

Todd N. Rosenstiel, co-PI
Department of Biology

Professional Preparation:

Northland College	Biology/Chemistry	B.S., 1995
University of Colorado, Boulder	Ecology and Evolutionary Biology	Ph.D., 2004
University of Colorado, Boulder	CIRES (postdoctoral)	7/04 -8/06

Appointments:

9/06-present Assistant Professor, Department of Biology, Portland State University
7/04-8/06 Postdoctoral Research Associate, Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder
2002 - 2004: Research Assistant (EE Biology, University of Colorado)
1999 - 2002: Research Assistant - Biosphere-Atmosphere Training Grant (EE Bio)

Five publications most important to the current proposal:

Monson RK, Trahan N, **Rosenstiel TN**, Veres P, Moore D, Wilkinson M, Norby RJ, Volder A, Tjoelker MG, Briske DD, Karnosky DF and Fall R (2007) Isoprene emission from terrestrial ecosytems in response to global change: minding the gap between models and observations. *Philosophical Transactions of the Royal Society (A)* – 365 (1856): 1677-1695.

Scott-Denton LE, **Rosenstiel TN**, and RK Monson (2006) Differential controls by climate and substrate over the heterotrophic and rhizospheric components of soil respiration. *Global Change Biology* 11:1-12.

Monson RK, Sparks JP, **Rosenstiel TN**, Scott-Denton LE, Huxman TE, Harley PC, Turnipseed AA, Burns SB, Backlund B, and Hu J. (2005) Climatic influences on net ecosystem CO2 exchange during the transition from wintertime carbon source to springtime carbon sink in a high-elevation, subalpine forest. *Oecologia* 146:130-147.

Rosenstiel TN, Ebbets AL, Kahtri W, Fall R, and RK Monson (2004) Induction of poplar leaf nitrate reductase: a test of extrachloroplastic control of isoprene emission rate. *Plant Biology* 6: 12-21.

Rosenstiel TN, Potosnak MJ, Griffin KL, Fall R, and RK Monson (2003) Increased CO_2 uncouples growth from isoprene emission in an agriforest ecosystem. *Nature* 421: 256-259

[Available online at Nature advance online publication: doi 10.1038/nature01312]

Five additional publications:

Rosenstiel TN & Eppley SE (2009) Long-lived sperm in the geothermal bryophyte Pohlia nutans. Biology Letters 5: 857-860.

Monson RK, **Rosenstiel TN**, Forbis TA, Lipson DA, and Jaeger CH (2006) Nitrogen and carbon storage in alpine plants. *Journal of Integrative and Comparative Biology* 46: 35-48.

Adams WW III, Demmig-Adams B, **Rosenstiel TN**, Brightwell AK, and V Ebbert (2002) Photosynthesis and photoprotection in overwintering plants. *Plant Biology* 4: 545-557.

Rosenstiel TN, Fisher AJ, Monson RK, and R Fall (2002) Differential accumulation of dimethylallyl diphosphate in leaves and needles of isoprene-emitting, methylbutenol-emitting, and non-emitting species. *Plant Physiology* 129:1276-1284.

Karl T, Curtis AJ, **Rosenstiel TN**, Monson RK, and R Fall (2002) Transient releases of acetaldehyde from tree leaves – products of a pyruvate bypass mechanism? *Plant, Cell, and Environment* 25:1121-1131.

Synergistic Activities
Science advisor for Portland Parks, Air Quality Assesment of Forest Park
Manuscript Referee for: *Global Change Biology, New Phytologist, Planta, Plant Biology, Plant Cell and Environment, Plant Physiology*, *Plant Sciences, Tree Physiology, Trends in Ecology and Evolution, and Trends in Plant Sciences*

Collaborators & Other Affiliations:
Collaborators during past 48 months. Sarah Eppley (PSU), Jim Pankow (PSU), Kelley Barsanti (PSU), David Hanson (U. New Mexico), Jogi Schnitzler (Helmholtz Munich), Nate McDowell (Los Alamos Labs), Russ Monson (U. of Colorado), Heinz Rennenberg (U. Freiburg). There are no co-editors to report.
Graduate Advisor: Russell K. Monson

Post-doctoral Advisor: Ray Fall

J. Alan Yeakley, co-PI
Professor
Environmental Science & Management, Portland State University, Portland, OR 97201
Phone: 503-725-8040 Fax: 503-725-9040 Email: yeakley@pdx.edu
www: http://web.pdx.edu/~yeakleya/alan.htm

(a) Professional preparation

Texas A&M at Commerce	Mathematics	B.S.	1986
University of Texas at Dallas	Environmental Science	M.S.	1988
University of Virginia	Environmental Science	Ph.D.	1993
University of Georgia	Institute of Ecology	Post-doc	1992-1994

(b) Appointments

Professor	Environmental Science	Portland State University	2009-present
Associate Professor	Environmental Science	Portland State University	2001-2009
Assistant Professor	Environmental Science	Portland State University	1994-2001
Postdoctoral Associate	Institute of Ecology	University of Georgia	1992-1994
Teaching Assistant	Environmental Science	University of Virginia	1991-1992
University Fellow	Environmental Science	University of Virginia	1988-1991
Teaching Assistant	Environmental Science	University of Texas-Dallas	1986-1988
Chief Lab Technician	Wastewater Analysis Lab	City of Paris, Paris, Texas	1983-1984

(c) Publications

(i) 5 recent publications

Caplan, J.S., and **Yeakley, J.A**. *2010.* Water relations advantages for invasive Rubus armeniacus over two native ruderal congeners. *Plant Ecology 210:169-179*

Jenkins, N.J., **Yeakley, J.A.**, and Stewart, E.M. 2008. Responses of *Phalaris Arundinacea* L. to managed flooding of wetlands in the Columbia Slough in Portland, Oregon, USA. *Wetlands* 4:1018-1027.

Ozawa, C.P. and **Yeakley, J.A.** 2007. Performance of management strategies in the protection of riparian vegetation in three Oregon cities. *Journal of Environmental Planning and Management* 50: 803-822.

Sonoda, K., and **Yeakley, J.A.** 2007. Relative effects of landuse and near-stream chemistry on phosphorus in an urban stream. *Journal of Environmental Quality* 36: 144-154.

Hook, A.M. and **Yeakley, J.A.** 2005. Stormflow dynamics of dissolved organic carbon and total dissolved nitrogen in a small urban watershed. *Biogeochemistry* 75:409-431.

(ii) 5 other significant publications

Yeakley, J.A., Coleman, D.C., Haines, B.L., Kloeppel, B.D., Meyer, J.L., Swank, W.T., Argo, B.W., Deal, J.M., and Taylor, S.F. 2003. Hillslope nutrient dynamics following upland riparian vegetation disturbance. *Ecosystems* 6: 154-167.

Yeakley, J.A. and Weishampel, J.F. 2000. Multiple source pools and dispersal barriers for Galápagos plant species distribution. *Ecology* 81: 893-898.

Yeakley, J.A., Swank, W.T., Swift, L.W., Hornberger, G.M., and Shugart, H.H. 1998. Soil moisture gradients and controls on a southern Appalachian hillslope from drought through recharge. *Hydrology and Earth System Sciences* 2: 41-49.

Yeakley, J.A., Moen, R.A., Breshears, D.D. and M.K. Nungesser. 1994. Response of North American ecosystem models to multi-annual periodicities in temperature and precipitation. *Landscape Ecology* 9: 249-260.

Yeakley, J.A. and Cale, W. G. 1991. Organizational levels analysis: a key to understanding processes in natural systems. *Journal of Theoretical Biology* 149:203-216.

(d) Synergistic activities

Team member, Independent Multidisciplinary Science Team; State of Oregon, gubernatorial appointee (http://www.fsl.orst.edu/imst), 2009-present.

Associate editor, *Écoscience*; member of editorial board (http://www.ecoscience.ulaval.ca), January 2006-present.

Founding member, Urban Ecosystem Research Consortium of Portland/Vancouver (UERC); the UERC holds annual symposia and publishes proceedings of abstracts on urban ecosystem science management in the Portland/Vancouver region (http://www.esr.pdx.edu/uerc), 2001-present.

Visiting faculty member, Universidad Nacional de Rosario, Rosario, Argentina; taught 2 study abroad courses in environmental sustainability, Spring term 2007.

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