
2020 EESI Center Proposal

Center for Landscape Dynamics (CLD)

Director: Erica Smithwick, Curriculum Vitae

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EDUCATION

Oregon State University	PhD	2002	Forest Science/Ecology
University of Montana	MS	1997	Forestry/Resource Conservation
Tufts University, <i>Cum laude</i>	BS	1995	Geology and Environmental Studies

APPOINTMENTS

2019-present	Associate Director, Institutes of Energy and Environment, The Pennsylvania State University
2018-present	E. Willard and Ruby S. Miller Professor of Geography, Department of Geography, The Pennsylvania State University
2017-present	Director, The Ecology Institute, The Pennsylvania State University
2015- present	Founding Director, Center for Landscape Dynamics, Earth and Environmental Systems Institute, The Pennsylvania State University
2007- present	Graduate Faculty, Intercollege Graduate Degree Program in Ecology; Dual-Title Graduate Degree Program in Biogeochemistry; and, Human Dimensions of Natural Resources and the Environment, The Pennsylvania State University
2007-present	Faculty Associate, Earth and Environmental Systems Institute, College of Earth and Mineral Sciences, The Pennsylvania State University
2013-2018	Associate Professor of Geography, Department of Geography, The Pennsylvania State University
Jan-Jul 2016	Visiting Scientist/Fulbright Scholar, Rhodes University, South Africa
2007- 2013	Assistant Professor of Geography, Department of Geography, The Pennsylvania State University
2002 -2007	Postdoctoral Research Associate, University of Wisconsin-Madison

CURRENT RESEARCH PROJECTS

National Science Foundation. NNA-Navigating the New Arctic Track 1: Pursuing Opportunities for Long-term Arctic Resilience for Infrastructure and Society (POLARIS). Senior Personnel. (Principal Investigator: Guangqing Chi), 1/1/2020-12/31/2025 (\$3,000,000)

National Science Foundation. NRT-INFEWS: Landscape-U, Impactful partnerships among graduate students and managers for regenerative landscape design. Principal Investigator, 2018-2023, (\$3,000,000).

National Science Foundation. CNH-L: Visualizing forest futures under climate uncertainty: integrating indigenous knowledge into decision support tools for collaborative decision making. Principal Investigator, 06/01/2016 - 05/31/2021 (\$1,700,000)

USDI Joint Fire Sciences Program. Firescapes in the mid-Atlantic: mismatches between social perceptions and prescribed fire use. Principal Investigator, 08/01/2016- 07/31/2019, (\$327,726)

SELECTED PUBLICATIONS

- Smithwick EAH. 2019. Carbon stocks and biodiversity of coastal lowland forests in South Africa: implications for aligning sustainable development and carbon mitigation initiatives. *Carbon Management* 10 (4): 349-360. <https://doi.org/10.1080/17583004.2019.1620035>
- Baldwin D*, Manfreda S, Lin H, Smithwick EAH. 2019. Estimating spatial and temporal variation of root zone soil moisture across a temperate forested catchment with remote sensing data and simple hydrologic models. *Remote Sensing of Environment* 11(17), 2013, <https://doi.org/10.3390/rs11172013>
- Lucash M, Ruckert KL, Nicholas RE, Scheller RM, Smithwick EAH. 2019. Complex interactions among successional trajectories and climate govern spatial resilience after severe windstorms in central Wisconsin, U.S.A., *Landscape Ecology*, online 07 Nov 2019, <https://doi.org/10.1007/s10980-019-00929-1>.
- Buma B, Harvey B, Gavin D, Kelly R, Loboda T, McNeil B, Marlon J, Meddens A, Raffa K, Shuman B, Smithwick EAH, & McLauchlan K. 2019. The value of linking short and long-term perspectives to understand spatially-explicit ecosystem resilience. *Landscape Ecology* (34): 17-33.
- Young, C, Fritz H, Smithwick EAH, Venter JA. 2019. The landscape-scale drivers of herbivore assemblage distribution on the central basalt plains of Kruger National Park. *Journal of Tropical Ecology*. 36, 13-28. <https://doi.org/10.1017/S0266467419000312>
- Smithwick EAH, Baldwin D*, Naithani KJ. 2016. Grassland productivity in response to nutrient additions and herbivory is scale-dependent. *PeerJ*, 4, e2745. DOI: 10.7717/peerj.2745
- Smithwick EAH, McCormack ML*, Sivandran G, Lucash MS. 2014. Improving the representation of roots in terrestrial models. *Ecological Modelling* 291: 193-204. DOI:10.1016/j.ecolmodel.2014.07.023
- Horn KJ, Thomas RQ, Pardo LH, Lawrence GB, Clark CM, Fenn ME, Lawrence GB, Perakis SS, Smithwick EAH, Baldwin DC*, Braun S, Nordin A, Perry CH, Phelan JN, Schaberg PG, St.Clair SB, Warby R, Watmough S. 2018. Growth and survival relationships of 71 tree species with nitrogen and sulfur deposition across the conterminous U.S. *PLoS ONE* 13(10): e0205296. <https://doi.org/10.1371/journal.pone.0205296>
- Keane RE, McKenzie D, Falk DA, Smithwick EAH, Miller C, Kellogg L-K B. Representing climate, disturbance, and vegetation interactions in landscape models. 2015. *Ecological Modeling* 309-310: 33-47. DOI:10.1016/j.ecolmodel.2015.04.009
- Smithwick, EAH, Eissenstat DM, Lovett G, Bowden R., Rustad L, and Driscoll C. 2013. Root Stress and Nitrogen Deposition: Consequences and Research Priorities. *New Phytologist* 197 (3): 712-719. DOI: 10.1111/nph.12081

SYNERGISTIC ACTIVITIES

- Founding Director, Center for Landscape Dynamics at Penn State University Earth and Environmental Institute. The mission of the center is to promote scholarship and training in landscape science to inform decision-making and socio-ecological resilience.
- Development of an international field course in South Africa (2009-2012), which translated into three teaching grants at Penn State to develop interactive video for online course on global parks and sustainability (now enrolling >400 students annually)
- Subject-matter editor for *Ecosystems*
- Fulbright Core Research/Teaching Award to South Africa, January-July 2016
- Association of American Geographers Task Force on Climate and Inclusivity, 2018-present

3. Participants

Name	Affiliation	Role
Erica Smithwick	Associate Professor of Geography, EMS	Director
Margot Kaye	Associate Professor of Forest Ecology, School of Forest Resources, College of Agricultural Sciences	Steering Committee
Peter Newman	Department Head and Professor, Department of Recreation, Park and Tourism Management, College of Health and Human Development	Steering Committee
Alan Taylor	Professor of Geography, Department of Geography	Steering Committee
Katherine Zipp	Assistant Professor of Environmental and Resource Economics, Agricultural Economics, Sociology, and Education	Steering Committee
Jim Shortle	Distinguished Professor of Agricultural and Environmental Economics Director, Environment and Natural Resources Institute, College of Agricultural Sciences	Steering Committee
Hong Wu (new)	Assistant Professor, Stuckeman Career Development Assistant Professor in Design	Steering Committee
Nathan Piekielek (new)	Geospatial Services Librarian	Affiliate
Guido Cervone	Professor of Geography, Department of Geography	Affiliate
Sarah Ivory (new)	Assistant Professor, Department of Geosciences	Affiliate
Melissa Kreye (new)	Assistant Professor of Forest Resource Management, Department of Ecosystem Science and Management	Affiliate
Ken Davis	Professor of Meteorology and Co-Chair, North American Carbon Program Science	Affiliate
Larry Gorenflo	Professor of Landscape Architecture	Affiliate
Alan Graefe	Professor, Department of Recreation, Park, and Tourism Management	Affiliate
Armen Kemanian	Associate Professor of Production Systems and Modeling, Department of Plant Science	Affiliate
Laura Leites	Associate Research Professor of quantitative forest ecology	Affiliate
Doug Miller	Center for Environmental Informatics and Department of Geography	Affiliate
Katriona Shea	Alumni Professor of Biology	Affiliate
John Tooker	Associate Professor of Entomology, Extension Specialist, Department of Entomology	Affiliate
Tyler Wagner	Adjunct Professor of fisheries Ecology, Department of Ecosystem Science and Management, Assistant Unit Leader PA Cooperative Fish and Wildlife Research Unit	Affiliate
Klaus Keller	Professor of Geosciences, Department of Geosciences	Affiliate

Proposed new affiliates:

Doug Bird, Rebecca Bird, Guangqing Chi, Alex Klippel

4. Rationale

The mission of the Center for Landscape Dynamics (CLD) is to promote scholarship and training in landscape science to inform landscape decision-making and enhance socio-ecological resilience.

Our goals are to conduct research to understand the social and ecological factors that govern landscape resilience, to provide training opportunities in geospatial tools and analysis, and to synchronize management needs and science to inform decision-making in the northeastern US.

The need for this center persists due to its strong focus on interdisciplinary – and transdisciplinary – research opportunities, and its focus on applied decision-making or policy in environmental management at landscape scales. Exhibited success of CLD is founded on its development of “learning communities” that are built on sound science and trust. Building this transdisciplinary academic culture, promoting excellence in scientific research, and providing educational opportunities are foundational to the work of the center.

The work of CLD is additionally relevant to EESI’s strategic plan in the area of Stewarding our Planet’s Resources (SoPR). Landscape Ecology is the study of pattern-process interactions that influence ecosystem change. Here, we use landscape ecology principles and practice to understand, predict, and help manage these patterns and processes. Specifically, our focus on fire management has helped guide policy and land management decisions in local forests, while our focus on food-energy-water (FEW) systems in the Chesapeake aims to unite learning communities to expand the science-management interface.

Building on these successes, our goals for the next 3 years are:

- 1. To strengthen CLD’s position as the “go-to” center for mid-Atlantic fire science and management research.** There is no other institution in the mid-Atlantic that has the fire management expertise greater than that at Penn State (A.Taylor, M. Kaye, J. Kreye, M. Kreye, E.Smithwick, H.Wu, K. Zipp, P. Newman). Through our JFSP project and CLD work, we have now fostered strong partnerships with the PA Game Commission, the PA Bureau of Forestry, the PA Prescribed Fire Council, the NJ Forest Fire Service, and the Mid-Atlantic Fire Science Exchange network. Our work also uniquely bridges social and ecological science – providing much needed guidance for decision-making. Over the next funding cycle, we would like to further strengthen and expand these partnerships, supporting monitoring, modeling, and experimentation, and helping to guide policy where appropriate. For example, our work has indicated that there may be tradeoffs between land management for carbon and land management for restoration of pitch pine ecosystems – such tradeoffs present an opportunity to help guide decision-making using the best science available.
- 2. Create transdisciplinary learning communities on FEW landscapes in the Chesapeake.** Our LandscapeU faculty team supports a faculty community representing 10 different departments or programs. As a grad training grant, the work is creating new opportunities for graduate professional development and curriculum innovation; however, it is also a forum for expanding partnerships with stakeholders interested in

FEW nexus topics in the Chesapeake and beyond. CLD aims to help foster these relationships by helping to host events that bring students, faculty, and stakeholders together (virtually as needed!) to focus on landscape-level solutions. Currently, students are working on semester-long projects informed by stakeholder engagement to propose new strategies for Penn state engagement in FEW Nexus issues.

3. **Building Faculty Communities.** In respect of faculty and student time, CLD has not hosted a separate seminar series or brown-bag event. Rather, we have helped to co-host or co-organize speakers in other series. Moving forward, however, we would like to strengthen our faculty community through the establishment of **LandscapeCafes** (virtually as needed) to showcase our science and strengthen external relationships with regional agencies.
4. **Promoting Learning Communities in Landscape Science.** Building on the LandscapeU NRT, we aim to support a merged dual-title in HDNRE (proposal under development – see below). In addition, one of the large successes of CLD is the modest support for graduate student research and stakeholder engagement. Not only does this support our graduate students, it also supports our faculty community. We plan to continue this support, but aim to increase its impact through greater dissemination of the supported projects through our website and social media and greater integration of the students and advisors in center activities.

5. Funding Opportunities

The center currently oversees research through the **NSF National Research Traineeship (NRT) program focused on regenerative landscape science in food-water-energy systems**. We will continue to leverage/explore supplemental funding for this effort. For example, NSF offers funding through their **INTERN** program, which supports non-academic research internships for graduate students. Currently, LandscapeU has modest support for internships, but we will pursue these augmented funding strategies as our cohort grows.

Joint Fire Sciences Program (U.S. Department of the Interior and USFS). We are currently closing a 3-year project focused on fire management in the mid-Atlantic. Success from this project has helped us identify the work of the center moving forward. Although research funding for JFSP is currently limited, we will continue to pursue opportunities as they arise, given the strong focus on science-management partnership, which aligns with the mission of CLD. JFSP continues to support graduate student research and Smithwick's graduate student and EESI scholar, Jamie Peeler, was awarded a **GRIN** (graduate innovation) from this program to fund her research in the Greater Yellowstone Ecosystem.

National Science Foundation CNH2: Dynamics of Integrated Socio-Environmental Systems (DISES). PENDING: Smithwick is part of a large interdisciplinary team (led by Guangqing Chi) who proposed to this program in Fall 2019; the work would focus on agropastoral management, migration, and climate change in highland ecosystems.

National Science Foundation Human-Environment and Geographical Sciences Program (HEGS). This program supports research into: the "nature, causes, and/or consequences of the spatial distribution of human activity and/or environmental processes across a range of scales." We plan a submission in the near future to support research in Kenya exploring adaptive capacity of agro-pastoral landscapes.

State-Agencies/The Nature Conservancy. We will seek funding to provide the science to support the work of the state agencies and NGOs focused on land management issues (e.g., prescribed fire).

6. Center Needs

CLD space is managed through the Department of Geography (Walker 222) so no additional space requests are needed. However, JEWEL/EESI space requested for hosting LandscapeU Café events.

We request EESI funding of \$15,000

We request continued funding from IEE (\$3,000)

Total requested budget: \$18,000/yr

Budget justification

- Grad awards - \$8,000
- Center resources (Misc: lab/office supplies, software) – \$2,000
- Supplemental support for research (travel, supplies,wage)- \$5,000

- Wage support – Etchison (1%) - \$1000
- Center events and activities (meals, speakers)- \$2000

7. Management Structure

The center will be directed by Erica Smithwick, Professor of Geography. A Steering Committee will provide regular guidance about strategic planning and budget decisions. The steering committee meets at least once/semester and, to date, has had regular communication alongside existing research projects (so, actual communication is more frequent). The center will continue to use Walker 222 for meeting space, or will meet in informal venues. Now that the center has gained strength in the past 3 years, we propose to host additional meetings and events to recruit greater participation by faculty affiliates, while continuing to disseminate information over center website and listserves. Computer space/data storage is available for faculty affiliates and associates in Walker 222 and using the center as a data clearing house for landscape-level data around center themes has been discussed. Purchase of software or other computer resources for the center is considered a shared resource that could be used by any faculty affiliate (e.g., VR headsets, iPads for fieldwork, ArcGIS software).

8. Prior expenditures and past work

Our existing budget has been: EESI: \$15,000, IEE: \$3000 (Total \$18000)

Year	Expense	Notes
2017/18		
	<i>Grad Award</i>	\$5915
	<i>Misc</i>	\$12354
	TOTAL:	\$18269
2018/19		
	<i>Wage</i>	\$1600
		(Ethan Davis)
	<i>Grad Award</i>	\$9640
	<i>Misc</i>	\$9483
		Travel, research support, group meals
	TOTAL:	\$20723
2019/20		
	<i>Salaries</i>	\$464
		(C. Etchison, LandscapeU coordinator)
	<i>Wage</i>	\$1700
		(Shaina Walk – OPP Hort Woods study)
	<i>Grad Award</i>	\$8250
	<i>Misc</i>	\$1824
		Research support, group meals, software
	TOTAL:	\$12238
		[to date; had travel plans for remaining funds]

Currently funded projects: (total = \$8,069,646)

Landscape Management/Resilience

Smithwick, E. A. H. (Principal Investigator), "NRT-INFIEWS: Landscape-U, Impactful partnerships among graduate students and managers for regenerative landscape design," Sponsored by National Science Foundation, Federal Agencies, \$3,000,000.00. (September 1, 2018 - August 31, 2023).

Smithwick, E. A. H. (Principal Investigator), Tuana, N. A., Klippel, A. K., Keller, K., Nicholas, R., Bliege Bird, R., Smithwick, E. A. H. (Principal Investigator), "CNH-L: Visualizing forest futures under climate uncertainty: integrating indigenous knowledge into decision support tools for collaborative decision making," Sponsored by National Science Foundation, Federal Agencies, \$1,700,000.00. (August 1, 2016 - July 31, 2021).

Chi, G., Holen D, Tickameyer A, Maio C, Halvorsen K., Smithwick, E. A. H. (Senior Personnel), "NNA Track 1: Pursuing Opportunities for Long-term Arctic Resilience for Infrastructure and Society (POLARIS)," Sponsored by National Science Foundation, Federal Agencies, \$3,000,000.00. (January 1, 2020 - December 31, 2023).

Fire Science

Smithwick, E. A. H. (Principal Investigator), Kaye, M. W., Newman, P. B., Taylor, A. H., K. Z., Smithwick, E. A. H. (Principal Investigator), "Firescapes in the mid-Atlantic: Mismatches between social perceptions and prescribed fire use," Sponsored by Joint Fire Sciences Program, Federal Agencies, \$326,646.00. (August 25, 2016 - June 30, 2020).

Smithwick, E. A. H. (Principal Investigator), "Scale-dependent effects of landscape context on post-fire forest regeneration in the Northern Rockies," Sponsored by Joint Fire Sciences Program, Federal Agencies, \$25,000. 07/01/19-06/30/21

Smithwick, E. A. H. (Principal Investigator), "Doctoral Dissertation Research: Spatial Resilience in Forests Recovering from Fires," Sponsored by National Science Foundation, Federal Agencies, \$18,000.00. (June 15, 2019 - May 31, 2021).

Supporting Communities of Learning (Outreach & Partnerships)

- Our work in mid-Atlantic fire management and FEW systems has been broadly disseminated at local (e.g., Schlow library Research Unplugged), regional (e.g., NJ Forest Fire Service Staff Meeting, Fire in Eastern Oak Forests Conference, Central Appalachian Fire Learning Network), national (e.g., AGU), and international (e.g., International Association of Landscape Ecology (Milan, Italy)) meetings.
- WPSU-produced videos about our fire management work. One has been integrated into a video quiz in a large (200-person), GenEd course (GEOG 1N: Global Parks and Sustainability); the other has been disseminated broadly with the Fire Science Exchange network nationally via social media
<https://vimeo.com/user12944121/review/384593048/84d22595c2>
<https://vimeo.com/386811665/7fe48534d8>

Supporting Graduate Training

- CLD Grad Awards – Annually
 - Of the 26 students supported, they represented *Geography, Plant Science, Forestry/Ecosystem Science and Management, Anthropology, Women Gender and Sexuality Studies, Biology, Geosciences*.
 - All non-EMS students received a match from their home unit.
 - Recipients provided two “Lightning talks” about their research
 - One student was highlighted in Penn State news:
<https://news.psu.edu/story/540853/2018/10/09/research/geography-student-models-future-fires-restore-past-forests>
- Proposal development underway for new Dual-Title in Resilient Landscape Solutions [Title TBD] that would merge the curricular goals of LandscapeU with the existing HDNRE Dual-Title. The focus of this Dual-Title would be new graduate training on regenerative, transdisciplinary approaches to landscape management.

For discussion: *Staff support for management of this dual-title currently through RPTM; CLD or IEE should consider supporting admin time (in RPTM or GEOG) to oversee the program?

General

- Website (cld.psu.edu) – leveraged from support from EESI & Geography staff; needs help!
- Listserve (L-CLD@lists.psu.edu)

9. Support Letters

Sarah Ivory, Margot Kaye, Alan Taylor



20 April 2020

To the selection committee, To Dr. Brantley and EESI Center Review Committee

RE: Letter of support for Center for Landscape Dynamics renewal proposal

I am writing to express my enthusiastic support for the renewal of the Center for Landscape Dynamics (CLD) proposal. With Erica Smithwick's direction CLD has effectively lead Penn State in a field of research that is essential for the conservation and management of natural resources and has brought together faculty in the physical, biological, and social sciences to tackle complex human-natural systems problems. I have been involved with CLD since its inception as a member of the steering committee and have found the center to be a positive force in interdisciplinary research at Penn State. In previous cycles of funding CLD has supported dozens of graduate student research awards, created an interdisciplinary research team focused on prescribed fire in the mid-Atlantic, and hosted several speakers and events on the topics of landscapes. Throughout these efforts Erica has been an outstanding leader. She recently convened the CLD steering committee and we had an enthusiastic discussion about the many topics CLD could tackle, ranging from the FEW nexus to the Chesapeake Bay to human perceptions of public lands and ecosystem services. These topics are of both societal importance and ideally suited for the interdisciplinary teams that are built through CLD.

The most unique contribution of CLD is bringing together research teams from EMS, College of Agricultural Sciences, College of Arts and Architecture, and College of Health and Human Development in a collegial and productive way. These collaborations may not have happened otherwise because the field of "landscape dynamics" does not have a clear home in any single college or department. Continued support of CLD from EESI will allow the center to continue building this area of strength in landscape dynamics and build new collaborations in human-natural systems.

Margot W. Kaye, Associate Professor of Forest Ecology





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April 19, 2020

To Dr. Susan Brantley and EESI Center Review Committee

RE: Letter of support for Center for Landscape Dynamics renewal proposal

I am writing to express my enthusiastic support for the renewal of the CLD center proposal. I have a strong interest in promoting interdisciplinary research that strengthens connections between EMS and the life sciences at Penn State. CLD has been very effective at building these connections and also evolving by taking advantage of the relationships it has built with other faculty and research groups across campus. A clear example of this was the successful NRT proposal to NSF which emerged, in part, from nascent discussions with CLD faculty affiliates and the Steering Committee. Based on submissions to the Graduate Research Award program proposals CLD is also recognized across campus as a center that supports innovative graduate student research on landscape ecology. Proposals were submitted by graduate students in three colleges and five departments. These examples demonstrate the value added by CLD, which is significant, and I would expect this to continue with a renewal.

CLD is well positioned to help lead the two proposed research foci in the center proposal during the next three years: 1) Fire Science and Management in the Mid-Atlantic; and 2) Expanding Learning Communities on FFW Landscapes in the Chesapeake. A core group of fire scientists collaborating with social scientists within CLD have made significant contributions to basic research that can guide land management and CLD has developed good relationships with a range of resource agencies across the region. Consequently, CLD research is likely to be used, and based on CLD relationships, lead to new translational research in ecology on fire in mid-Atlantic ecosystems. There are good funding opportunities from agencies that fund both basic and mission-oriented research for this kind of work. Similarly, using CLD funds to amplify student outcomes and build stronger collaborative communities within the NRT program is likely to have a significant impact. Both these proposed activities will increase the impact and relevance of the center in developing resilient landscapes in Pennsylvania and beyond.

Best Wishes

Alan H. Taylor

Professor of Geography and Ecology



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April 16, 2020

To Dr. Brantley and EESI Center Review Committee

RE: Letter of support for Center for Landscape Dynamics renewal proposal

I am writing to express my enthusiastic support for the renewal of the CLD center proposal, led by Erica Smithwick.

As an early-career faculty member, one of the great attractions of Penn State and the Department of EMS was its breadth and excellence in research focused on landscape dynamics. Further, in my experience as a scientist working in this field, highly interdisciplinary research of this kind is strongly supported by a genuine interest in creating mechanisms and places for diverse perspectives surrounding landscapes to meet, interact, and build up a common vocabulary. In my last year in as a CLD affiliate, I have been very appreciative of the opportunities provided by the center for making important connections between researchers, practitioners, and stakeholders. The center also does a really good job of supporting and engaging graduate students, who benefit from involvement in a community that challenges communication across fields and broadens their perception their work in context with their peers.

Finally, it strikes me that landscape dynamics is a theme which cross-cuts EESI, the college, and the university at large. The university has outlined that “food, water, and energy” issues are key to our research mission, and CLD fits well within this scope. The importance of this theme in a changing global environment underscores why we need mechanisms like the CLD to promote and support critical but challenging interdisciplinary fields that are working toward solutions.

Sincerely,

Sarah Ivory