2017 EESI Center Proposal

Center for Landscape Dynamics (CLD)

Director: Erica Smithwick

Curriculum Vitae

Department of Geography
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APPOINTMENTS

Current position	Associate Professor of Geography, Department of Geography The Pennsylvania State University
2015- present	Founding Director, Center for Landscape Dynamics, Earth and Environmental Systems Institute, The Pennsylvania State University
Jan-Jul 2016	Visiting Scientist/J. William Fulbright Scholar, Rhodes University, South Africa
2007- 2013	Assistant Professor of Geography, Department of Geography The Pennsylvania State University
2007- present	Graduate Faculty, Intercollege Graduate Degree Program in Ecology, and Dual-Title Graduate Degree Program in Biogeochemistry, The Pennsylvania State University
2007-present	Faculty Associate, Earth and Environmental Systems Institute, College of Earth and Mineral Sciences, The Pennsylvania State University
2002 -2007	Postdoctoral Research Associate, University of Wisconsin-Madison Landscape and Ecosystem Ecology Laboratory of Dr. Monica G. Turner
1997-2001	Graduate Research Assistant, Oregon State University
1997	USRA Graduate Student Summer Intern, NASA Goddard Laboratory for Terrestrial Physics, Biospheric Sciences Branch, Greenbelt, MD
1995-1997	Graduate Research Assistant, University of Montana

EDUCATION

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

CURRENT RESEARCH PROJECTS (OVERALL TOTAL (N=20); >$3,5 mill as PI; >$8.7 mill)

The National Socio-Environmental Synthesis Center (SESYNC), **Landscape Diversity and Dietary Diversity**, 03/01/2017 – 08/31/2017, co-PI ($21,541)

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

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

SELECTED PUBLICATIONS (TOTAL = 47)

Baldwin, D*, Manfreda S, Keller K, **Smithwick EAH**. 2017. Predicting root zone soil moisture with soil properties and satellite near-surface moisture data across the conterminous United States, Journal of Hydrology, http://dx.doi.org/10.1016/j.jhydrol.2017.01.020

Smithwick, EAH, Baldwin DC*, Naithani KJ*. 2016. Grassland productivity in response to nutrient additions and herbivory is scale-dependent, PeerJ 4:e2745; DOI 10.7717/peerj.2745

Taber ED*, Hutchinson, ML, **Smithwick EAH**, Blanford JI. 2016. A decade of colonization: the spread of the Asian Tiger Mosquito in Pennsylvania and Implications for disease risk. Journal of Vector Ecology 42(1): in press.

Smithwick, EAH. 2016. Build social costs into wildfire risks. Nature 535 (7611): 231.
Wu J*, **Smithwick EAH**. 2016. Landscape fragmentation as a risk factor for Buruli ulcer disease. American Journal of Tropical Medicine and Hygiene, 15-0647; Published online May 16, 2016, doi: 10.4269/ajtmh.15-0647
Tschakert P, Ricciardi V, **Smithwick EAH**, Machado M, Ferring D, Hausermann H, Bug L. 2016. Situated knowledge of pathogenic landscapes in Ghana: understanding the emergence of Buruli ulcer through qualitative analysis. Social Science and Medicine 150: 160-171. http://dx.doi.org/10.1016/j.socscimed.2015.12.005
Taber E* and **Smithwick EAH**. 2015. Influence of protected areas on malaria prevalence in sub-Saharan Africa. Applied Geography 64:35-45. DOI:10.1016/j.apgeog.2015.09.001
Smithwick, EAH, ML McCormack*, M Lucash, G Sivandran. 2014. Improving the representation of roots in terrestrial models, Ecological Modelling 291: 193-204. doi:10.1016/j.ecolmodel.2014.07.023
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
Smithwick EAH, Naithani KJ*, Balser TC, Romme WH, and Turner MG. 2012. Fine-Scale Spatial Distribution of Microbial Communities and Soil Nitrogen Cycling Following Wildfire. PLoS One, 7(11):e50597. doi:. 10.1371/journal.pone.0050597
Westerling AL, Turner MG, **Smithwick EAH,** Romme WH, Ryan MG. 2011. Continued warming could transform Greater Yellowstone fire regimes by mid-21st Century, Proceedings of the National Academy of Science 108: 13165-13170.

SYNERGISTIC ACTIVITIES

- Associate Editor, Ecosystems, 1/1/2015 – present
- Associate Editor, Regional Environmental Change, 1/1/2014 - present
- Invited External Peer Reviewer, Research Councils UK (RCUK)
- Invited External Peer Reviewer, NSF-Ecosystems, NSF-Geography and Spatial Sciences
- Invited Panelist, NSF-Ecosystems
- Invited Panelist, NASA ROSES Terrestrial Ecology
- Chair, Users Working Group, NASA/Oak Ridge National Laboratory Distributed Active Archive Center for Biogeochemical Dynamics (ORNL DAAC), 2014-2016
- Member, Users Working Group, NASA/Oak Ridge National Laboratory Distributed Active Archive Center for Biogeochemical Dynamics (ORNL DAAC), 2011-2016
- Editorial Advisory Board member, Global Change Biology 2008-2010
- Peer-reviewer for ~30 unique journals

- **Organized Conference Sessions & Workshops (last 3 years)**
  - Visualizing indigenous forest futures. Resilience 2017, Stockholm, Sweden August 21-23 2017
  - Visualizing Forest Futures (VIF) Community Workshop. 1-2 December 2016, College of Menominee Nation, Keshena Wisconsin
  - National Council for Science and the Environment: The Food-Energy-Water Nexus, 16th National Conference and Global Forum on Science, Policy and the Environment, January 19-21 2016, Washington D.C.
- **Invited Workshop Participation (last 3 years)**
  - National Academy of Sciences: A Century of Wildland Fire Research: Contributions to Long-term Approaches for Wildland Fire Management, 27 March 2017
  - Sante Fe Institute Workshop: "Reinventing the Grid: Designing Resilient, Adaptive and Creative Power Systems, 13-17 April 2015, Santa Fe Institute, Santa Fe, New Mexico
  - KNAW Academy Colloquium. Climate models revisited: the biogeochemical consequences of mycorrhizal dynamics, 8-10 April 2015, Amsterdam, The Netherlands
  - Shifting Seasons: Building Tribal Capacity for Climate Change Adaptation Summit, October 14-17, 2014, Kenosha WI
  - NOVUS Workshop: Fort Collins Colorado USA September 8-10, 2014
  - Global Sustainable Bioenergy and LACAf, Kruger National Park, South Africa, 2014

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**
Tim Murtha	Associate Professor of Landscape Architecture	**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**
Dave Mortensen	Professor of Weed and Applied Plant Ecology, Department of Plant Science	**Steering Committee/Affiliate**
Jeffrey Brownson	John and Willie Leone Family Department of Energy and Mineral Engineering, Associate Professor of Energy and Mineral Engineering and Materials Science and Engineering Solar Option Lead: iMPS in Renewable Energy & Sustainability Systems	**Affiliate**
Guido Cervone	Professor of Geography, Department of Geography	**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	Assistant professor of quantitative forest ecology	**Affiliate**
Sarah McClure	Assistant Professor of Anthropology	**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, Doug Kennett, Hong Wu, 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, 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 emerges from both internal and external forcings. Internally to our academic community, there is increased capacity and interest in exploring interdisciplinary research spaces. Externally, there is an increased need - determined by both social and environmental trends - to put our science to work in the context of applied decision-making or policy. The potential to do so depends on the 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 our initiative.

The work of CLD is additionally relevant to EESI's strategic plan. In particular, EESI's mission includes the development of "innovative, interdisciplinary research and education programs that benefit all stakeholders, including the Penn State community, the Commonwealth, scientific communities, government entities, and the public." CLD has demonstrated success in connecting science to relevant management objectives (e.g., fire management) through procurement of external funding, the development of interdisciplinary faculty communities, and integration of scientists and managers on common issues. CLD's science is relevant to deeper understanding of earth systems through deeper understanding of how critical ecological processes are connected to human land use and management decisions; this is additionally central to EESI's mission. Finally, CLD aims to disseminate the work we do through websites, outreach at meetings and conferences, and through deepening of collaborations with relevant agencies and scientific communities.

Goals for the next 3 years include:

Expanding the Science. Increasingly, opportunities to address environmental and social challenges are being addressed at landscape scales. The focus on "landscape" reflects a growing appreciation that emergent socio-ecological challenges can only be understood by unraveling complex flows across heterogeneous patches and scales. As such, increased funding in the areas of 'spatial resilience' and 'coupled natural-human systems' can be expected. Moreover, connecting science to applied management decisions is likely to be critical to funding success, and is a key focus of CLD. Our center aims to unite faculty across these themes, targeting funding in the areas of earth systems ecology, landscape science, and hazards.

Building Faculty Communities. CLD aims to foster opportunities for informal and formal events that unite faculty among common themes. These may include: (a) a "lab crawl" in which faculty visit other labs, (b) exchanges of personnel (tech support, grad students) between labs to share expertise and build community, (c) co-funding of talks and seminars amidst existing series, (d) exploring the opportunities for sharing research support personnel among centers (e.g., CLIMA, Human Ecology, CEDAR, etc.)

Promoting Learning Communities. In addition to building communities among faculty, a key objective is to support training of graduate students in landscape science and to foster outreach with managers and stakeholders. To do so, we propose (a) expanding outreach to media centers, including social media, and creation of a "video story" about the center, (b) building capacity for data storage, hosting, and analysis for management-relevant themes, (c) showcasing and disseminating methodology for training purposes, (d) continuing grad award funding, and (e) pursuing research training funds (e.g., NRT) that would serve to synchronize curriculum and promote training opportunities for graduate students in landscape management agencies (government, NGOs).

5. Funding Opportunities (1/2 page)

NSF National Research Traineeship (NRT) program. Recently added to the priority research areas of this program includes Nexus of Food, Energy, and Water Systems (or any other interdisciplinary research theme of national priority). Letters of intent typically due in December, with full proposals in February. Smithwick is on the steering committee of the HDNRE (Human Dimensions of Natural Resources and the Environment) graduate program and has been in discussions with Alan Graefe and Peter Newman about designing an NRT focused on landscape dynamics and resource stewardship. Innovations track = $500,000; Traineeship tracks = up to $3,000,000

Joint Fire Sciences Program (U.S. Department of the Interior and USFS). Annually funds research in the area of fire science and management, with strong science-agency partnerships required. (~$350,000). Though currently funded under this program, CLD plans to pursue related funding to better understand the impacts of climate variability on fire risk in the northeast.

National Science Foundation Coupled Natural Human Systems. Funds interdisciplinary research that examines human and natural systems process at multiple scales ($500,000 - $1.8 million). Smithwick and Chi (future affiliate) have 1 successful and 1 pending seed grant (IIE, SSRI) to study landscape change and migration and children well-being in response to climate change. This work is relevant to the CNH program and would promote CLD activity in the area of socio-ecological resilience and health-environment-climate interactions.

NASA Terrestrial Ecology or Carbon Cycle Science – Uses remote sensing and modeling to explore earth patterns and processes. Would allow us to track human impacts on the environment related to fire dynamics. ($600,000 – $1,000,000), dependent on continued funding.

Foundation support – An additional goal for the center in the next few years is to identify and pursue support from foundations in the area of landscape science and climate change adaptation.

6. Center Needs

CLD space is managed through the Department of Geography (Walker 222) so no additional space requests are needed.

We request continued EESI funding of $15,000. We have requested additional funding from:
IEE – Tom Richard (previous commitment=$3k; pending request=$6k)
ENRI – James Shortle (received commitment (see letter)=$2k)
Institute of Ecology – Matt Thomas (pending request: $4k; may be unable to fund existing centers)

Total requested budget: $26,000/yr

Budget justification

- Grad awards - $6,000

- Center resources (software, visualization tools, data storage) – $5,000
- Advertising/marketing/web page - $2,000
- Co-sponsored talks, research, and travel - $5,000
- Center events and activities- $2,000
- Summer grad wage support to assist with grant development, curriculum coordination and planning, and/or development of learning communities (faculty, grads, outreach) - $6,000

**Note – there is an approved carryover from the 2016/2017 budget of $4000 to fund two indigenous scholars to attend the international conference in Stockholm (Resilience Alliance 2017). The travel commitment was necessary during this fiscal year to ensure their abstract submission and eligibility for travel, but travel will not conclude until August 2017.

7. Management Structure

The center will be directed by Erica Smithwick, Associate 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. Past Budgets and Work

Detailed outcomes of CLD activity are detailed below, but are summarized as exemplar narratives here:

Narrative 1. Faculty Networking (or…. "I know a guy")

A challenge of working at a large, interdisciplinary research institution like Penn State is that often particular expertise is 'hidden' from view. This narrative is a story about how CLD was able to connect faculty expertise towards a common goal. The challenge was that a number of us on the steering committee had successfully received a grant to study "firescapes" in the mid-Atlantic but we needed expertise in survey design. Based on his individual research program, Peter Newman "knew a guy" who soon become infamous to us. This "guy" was Jimmy Chr, in the Department of Agricultural Economics, Sociology, and Education. Jimmy was a senior graduate student who was then able to work with Katherine Zipp, a junior faculty member, on survey design. The connection was crucial because it allowed us to find expertise quickly, and then to build a team of expertise in this research area that is now currently led by Zipp.

Narrative 2. Interdisciplinary Faculty Communities (or…. "Holy ****, I wrote a paper with an anthropologist")

The steering committee and affiliate structure is purposely interdisciplinary. Currently represented on the steering committee includes faculty from 5 departments (Geography; Ecosystem Science and Management; Agricultural Economics, Sociology and Education; Landscape Architecture; and Recreation, Parks, and Tourism Management) and 4 colleges (EMS, Ag, Arts&Architecture, Liberal Arts). To foster research synergies, the center has held faculty mixers and has had regular steering committee meetings. The outcome has been two team-led interdisciplinary grants and associated papers (see below). In addition, our successful grad award program has funded 14 students over the past 3 years with research funding ($500-$1500). Recipients have come from Geography, Ecology IGDP, Landscape Architecture, and Ecosystem Science and Management. Importantly, the center provided the opportunity to build informal relationships that developed over time and which continue to lead in interesting directions.

Narrative 3. Thematic initiatives ("Firescapes")

The center has identified and pursued common thematic initiatives that have connected interdisciplinary teams. These have, to date, included: "Fire-scapes", "Socio-ecological systems" and "Nutrient-scapes". Although these themes have been championed by individual members of the center, the center provided an opportunity to collectively expand the research frontier to the landscape-level and to connect the team with management needs. For example, the center hosted a fire management conference for ~20 local fire managers, allowing us to build trust with that community and showcase Penn State's research capacity and interest. The connection allowed us to collaborate on fire-monitoring activities and to engage in regional prescribed fire meetings and discussions. Our research-management partnership was critical to the receipt of our JFSP funding. Linkages across data sets, capacity, and tools was critical to the empowerment of this thematic focus.

Detailed Outcomes

Our existing budget has been: EESI: $15,000, ENRI: $2000, IEE: $3000

Note: only team-led projects are emphasized here; individual faculty successes (e.g., overall faculty publications by affiliates) are not included

General

- Created Website (cld.psu.edu)
- Created Listserve (L-CLD@lists.psu.edu)
- Regular Steering Committee Meetings
- Hosted and Organized the Fall 2015 EarthTalks: The Next Century of Conservation. "*The series foreshadows the 2016 centennial of the National Parks Service and will inspire the audience to imagine what energy and environment conservation will look like in the next 100 years."*
- Hosted and Organized E-SCAPE Day**,** a one-day event focused on fostering a graduate community around the themes of landscape methodology and practice. The center hosted a "speed-dating" lunch on research methods for grad students. A faculty mixer was also held to introduce faculty and graduate students to the center and its initiatives.

Supporting Research (themes = firescapes, socio-ecological resilience, nutrient-scapes)

2015/2016 Penn State Institute of Energy and Environment Seed Grant**. Landscapes of fire and people: how climate, human values, and shifting ecologies will influence mid-Atlantic forest management.** 3/15/16 – 6/30/15. Smithwick EAH (PI), Kaye M, Mortensen D, Newman P, Orland B, Shortle J, Taylor A. ($24,737)

USDI Joint Fire Sciences Program, Firescapes in the mid-Atlantic: **Mismatches between social perceptions and prescribed fire use**, 08/01/2016- 07/31/2019, Erica Smithwick (PI), with Margot Kaye, Alan Taylor, Katherine Zipp, Peter Newman (co-PIs) ($327,726)

National Science Foundation, CNH-L: **Visualizing forest futures under climate uncertainty: integrating indigenous knowledge into decision support tools for collaborative decision making**, 06/01/2016 – 05/31/2021, Erica Smithwick (PI) with Robert Scheller, Melissa Lucash, Rebecca Bird, Nancy Tuana, Klaus Keller, Robert Nicholas ($1,700,000)

NSF- INFEWS (not funded)

USDA NIFA Sustainable Bioenergy and Bioproducts Coordinated Agricultural Projects: Chesapeake Biomass Consortiuum (not funded)

Supporting Communities of Learning (Outreach & Partnerships)

Organized Workshop: CLD Workshop Current and Future Firescapes of Pennsylvania: Linking Science, Management, and Public Perceptions. June 2015

Organized Workshop: Visualizing Forest Futures (VIFF) Community Workshop. 1-2 December 2016, College of Menominee Nation, Keshena Wisconsin

Organized Session: Visualizing indigenous forest futures. Resilience 2017, Stockholm, Sweden August 21-23 2017

Organized Session: National Council for Science and the Environment: The Food-Energy-Water Nexus, 16th National Conference and Global Forum on Science, Policy and the Environment, January 19-21 2016, Washington D.C.

Workshop Participation: Burning Issues: Sparking Effective Communication About Prescribed Fire, Pennsylvania Prescribed Fire Council, February 2017

Workshop Participation: National Academy of Sciences: A Century of Wildland Fire Research: Contributions to Long-term Approaches for Wildland Fire Management, 27 March 2017

Invited Presentation: Exploring visualization tools for communicating natural resource management information, April 19 2017, Portland State University, sponsored by USFS

Invited Presentation: Joint Fire Science Program Governing Board Field Trip; North Atlantic Fire Science Exchange; New Jersey Pine Barrens, October 2016

Supporting Graduate Training

- CLD Grad Awards – 3 times – 14 students (list available)
- Recipients have two provided "Lightning talks" about their research at the Department of Geography Coffee Hour
- Have begun to identify curriculum needs across the university for training in landscape science
- Smithwick became a member of the strategic steering committee for the HDNRE program and is discussing proposals and revisions to improve interdisciplinary training

9. Support Letters (attached)
Tim Murtha
Jim Shortle
Douglas Bird
Klaus Keller

PENNSTATE

Department of Landscape Architecture
H. Campbell and Eleanor R. Stuckeman
School of Architecture and Landscape Architecture

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4.14.17

RE: LETTER OF SUPPORT FOR THE CONTINUED FUNDING OF CLD

It is a pleasure to provide a letter of support for the continued funding of the Center for Landscape Dynamics (CLD). CLD is a model research center at Penn State, coordinating, integrating and disseminating faculty and graduate student research concerning advanced landscape decision making and management. Uniquely, CLD combines fundamental research with applied broader impacts, by engaging students and faculty with landscape managers and agencies. Increasingly, external funding in support of landscape scale research demands interdisciplinary faculty communities. CLD has successfully cultivated diverse communities and would be well positioned to continue those successes with continued support. Faculty from five colleges regularly participate in center activities and support for graduate student research mirrors this diversity.

Several additional factors clearly establish CLD as a lead center at Penn State.

1. The Center for Landscape Dynamics works directly with communities and mangers on important science-related issues, thereby offering potentially transformative broader impacts for center related research.
2. CLD not only cultivates interdisciplinary faculty research, but exposes Penn State graduate students to active interdisciplinary research and training.
3. The annual graduate student research awards are competitive and provide substantial support for students finishing their graduate thesis and dissertations in a number of departments on campus.
4. Graduate student awards emphasize the connection between their work and landscape scale management. By doing so, graduate students focus not only on core science activities, but the application of their research.
5. The CLD offers exceptional potential for linking datasets and creative science as evidenced by the recent CNH-L award for *visualizing forest futures under climate uncertainty*. Projects like that are transformative for developing and maintaining learning and research communities.

Erica Smithwick leads the center critically and thoughtfully. The center provides a place and the foundation for collaborative research to emerge. Continued support will not only allow new research to emerge, but also to sustain the work that has already begun.

If I can provide any additional information, please feel free to contact me.

Sincerely,

Timothy Michael Murtha Jr., PhD (murtha@psu.edu)
Associate Professor, Landscape Architecture
Director, Hamer Center for Community Design

PENNSTATE

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Douglas Bird

11 April 2017

I am writing to give my strongest support for the continued interdisciplinary work in Penn State's Center for Landscape Dynamics (CLD). The CLD is a growing and vital hub for facilitating research and integrating communities focused on understanding the socio-ecological resilience of landscapes. Most of the environmental challenges we face today involve human action, changing landscapes, and changing climates. The CLD is critical for Penn State's commitment to promote sustainability and the EESI's mission to support interdisciplinary science and training programs focused on environmental issues that engage Penn State communities, policy-makers, and the public.

Operationalizing this commitment requires investment into research that transcends traditional academic disciplines and engages directly with local communities concerned with landscape management. The CLD is catalyzing this commitment with basic transdisciplinary research into how local values and processes of decision-making shape socio-ecological interaction at landscape scales. Beyond their intent to develop an NSF National Research Traineeship Program (under the new emphasis on "Nexus of Food, Energy, and Water Systems"), the CLD is already coordinating two large-scale research programs that will run through 2019-21 respectively. One funded by USDI Joint Fire Sciences Program and another by NSF's Coupled Natural Human Systems program, and both of which focus on how human values and practices shape decision-making about natural systems at landscape scales. These are broad collaboratives involving researchers across colleges at Penn State, integrated with local communities and land managers.

Such interdisciplinary and community-based work in the CLD not only provides vital understanding of the ecological role of anthropogenic landscape-level disturbance, but supports opportunities for graduate training, new ways to link environmental data sets, and new ideas for creative solutions to large-scale environmental dilemmas. The CLD has supported 15 Graduate Awards, providing fundamental skills in geo-spatial analysis and data collection in the field. This will facilitate a generation of young scientists with tools to work well beyond traditional academic boundaries, contributing directly toward community-based solutions to dilemmas we face in managing sustainable landscapes.

I very much look forward to developing links with the CLD through the new Center for Human Ecology (CHE) at Penn State. CHE has just been approved by the Huck Institutes and PSIEE, and we will launch the Center this fall with a reception and mini-symposium. CHE's mission is to facilitate transdisciplinary scholarship and training into the ecological consequences of human

resource use through our evolutionary history. The next year will provide important opportunities to formally integrate some of the parallel objectives of the CLD and CHE, especially in supporting work on the full diversity of human-environment interactions, and implications of understanding such diversity for ecological dilemmas we now face. Such cross-center collaboration will be important for expanding science and building communities within and beyond Penn State, deepening collaborative research into human-environmental interaction.

Sincerely,

Douglas Bird
Associate Professor of Anthropology
Director of the Center for Human Ecology
https://douglas-bird.squarespace.com

PENNSTATE

Klaus Keller
Professor of Geosciences
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Sunday, April 16, 2017

Erica Smithwick,
Director Center for Landscape Dynamics (CLD)
Via email

Re: Letter of Support for the CLR renewal proposal

Dear Erica, Dear Review Committee,

Please accept this letter as evidence for my enthusiastic support of the CLD renewal proposal.

CLD provides mission-critical building blocks to many activities that are central to the strategic objectives of the University, EESI, and EMS (to name just a few). For example, CLD helps to provide crucial concepts, data, and tools to inform assessments of how land management strategies map into prospects and risks. These building blocks as well as your leadership have been extremely important in securing external research funds to support mission-oriented basic science.

CLD has also provided tremendous synergies for the work within the center for climate risk management. I am very much looking forward to continue this collaboration (e.g., though coordinated activities such as the building and support for tools and data sets).

Continuing and expanding the support for CLD is a necessary, wise, and overall profitable investment in a time of sparse and increasingly uncertain research support.

Please do not hesitate to contact me if I can be of any assistance.

Many cheers,

Klaus Keller, Professor of Geosciences, Penn State

PennState
College of Agricultural Sciences

Environment and Natural Resources Institute

The Pennsylvania State University
111 Ferguson Building
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April 13, 2017

Dear Erica: This note is to express my strong continuing support for the Center for Landscape Dynamics, and to enthusiastically endorse your request for renewal of the center.

The CLD fills an essential need at Penn State for leadership to build training programs, relationships, and research capacities in landscape science across the University. I am really impressed and pleased by how well the CLD has done in connecting people from across campus and multiple disciplinary perspectives, generating significant new collaborations, and supporting student research. I am especially pleased to see the success the center has had in developing a landscape science community at Penn State. This has been long needed and will pay big dividends with your continued leadership through the CLD.

I applaud your efforts and continue to see the center as an excellent investment for EMS. There is also significant benefit to faculty and students in the College of Agricultural Sciences. Accordingly, in addition to endorsing the renewal of the center, I am eager to continue to provide supplemental support from ENRI for the next 3 years at the rate of $2000/year.

Sincerely,
Jim

James S. Shortle
Distinguished Professor of Agricultural and Environmental Economics
Director, Environment and Natural Resources Institute