

# Earth and Environmental Systems Institute

## Center for Environmental Informatics

Douglas A. Miller, Director

### Center Renewal Proposal

April 20, 2020

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#### **PARTICIPANTS (~2014 – Present)**

##### **Collaborating Penn State Faculty**

- Dr. Anthony Buda, USDA-ARS, Pasture Systems Research Lab
- Dr. Guido Cervone, Geography
- Dr. Andy Cole, Landscape Architecture
- Dr. Jonathan Dunn, Ecosystem Science and Management
- Dr. Shelby Fleischer, Entomology
- Dr. Larry Gorenflo, Landscape Architecture
- Dr. Christina Grozinger, Entomology
- Dr. Sarah Goslee, USDA-ARS, Pasture Systems Research Lab
- Dr. Kelli Hoover, Entomology
- Mr. Kyle Imhof, Meteorology and Atmospheric Sciences
- Dr. Margot Kaye, Ecosystem Science and Management
- Dr. Peter Kleinman, USDA-ARS, Pasture Systems Research Lab
- Dr. Jesse Kreye, Ecosystem Science and Management
- Dr. Laura Leites, Ecosystem Science and Management
- Dr. Marc McDill, Ecosystem Science and Management
- Dr. Allyson Muth, Center for Private Forests
- Dr. Cibir Raj, Agricultural and Biosystems Engineering
- Dr. Erica Smithwick, Geography
- Dr. John Tooker, Entomology
- Dr. Denice Wardrop, Geography

##### **External Collaborators**

- Dr. Erick DeWolf, Kansas State University
- Dr. Eric Grimm, Illinois Natural History Survey (retired, but remains active)
- Dr. David Wiedenfeld, American Bird Conservancy
- Dr. Jack Williams, University of Wisconsin, Madison

**Center Personnel**

- Doug Miller, Director
- Stephen Crawford, Assistant Professor of Research
- Dr. Martina Calovi, Post-Doctoral Associate

**CenterAffiliated Personnel** (funded through CEI projects, but not appointed at EESI)

- Brennan Holderman, Department of Ecosystem Science and Management

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**RATIONALE**

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The Center for Environmental Informatics (CEI) in the Earth and Environmental Systems Institute was originally formed in 2000 as the Outreach Center of the former Environment Institute within the College of Earth and Mineral Sciences. CEI focuses on the development of new and innovative approaches to the creation and dissemination of environmental information resources. In the 20 years of its existence as an interdisciplinary center within the Institute, the Center for Environmental Informatics has developed a unique niche that contributes to the tripartite mission of the University. We have achieved national and international recognition for our unique and inventive approaches to combining advanced web-based technology with domain-based scientific expertise to provide information resources for decision makers.

There may be no higher call to the science community than that made by society itself to address fundamental challenges related to the human predicament. As we move rapidly through the 21<sup>st</sup> Century this need will grow as we continue to stress our planetary system with a growing population demanding food, energy, and a clean environment. It is simply not enough for scientists to observe, measure, model, and assemble scientific knowledge as an academic exercise. We are increasingly called to show the relevance of our work—society’s investment—to the pressing problems of the time. This call lies at the very core of the mission and focus of CEI.

We believe that our contribution to the overall mission of the University is now needed more than ever. Increasingly decision makers are looking to the academic community for relevant contributions to society. In this spirit, CEI looks to continue to work with colleagues in a wide range of domain sciences to provide solutions to pressing earth system problems.

The Mission and Focus statements on our web site succinctly describe our Center:

**Mission**

Produce high quality environmental information resources, in usable forms and formats, that serve the needs of individuals, communities, and organizations at all levels of society.

**Focus**

- Develop web-based decision support tools and enabling information technology systems

- Integrate geospatial technologies with environmental observation networks
- Deploy mission-critical environmental information applications

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## **FUNDING OPPORTUNITIES**

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Funding opportunities to sustain CEI contributions exist at all levels of government and numerous private and NGO organizations. We see strong continued support for our work from Federal agencies such as the USDA, USGS, USFWS, NSF, NASA, and EPA. Over the past 20 years much of our work has been focused at the national and regional scales. While continuing to work at these scales with agencies that have traditionally funded us, we are now interested in moving “down-scale” where we see great promise for the application of our advanced web-based geospatial technology for decision makers working at the landscape scale. In this realm we have focused our recent efforts on the development of capacity at Penn State for the application of small unmanned aerial systems (UAS) for detailed characterization and mapping of land surfaces.

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## **CENTER NEEDS**

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The Center for Environmental Informatics is located on the 3<sup>rd</sup> floor of the Earth-Engineering Sciences Building (EESB). We greatly appreciate the office and laboratory space provided by the Institute since we moved to the building in 2001. Dr. Miller and Mr. Crawford have offices on the 3<sup>rd</sup> floor of EESB. The Mobile Geospatial Systems Group receives laboratory space in the Forest Resources Building for UAS maintenance and field equipment storage. Dr. Calovi maintains an office in the USDA Pasture Systems and Watershed Research Unit on campus.

With this renewal proposal, CEI requests a designated annual amount, not to exceed \$7,500.00, for project development, hardware and software procurement and staff training and enrichment activities—including travel to present our work at suitable national venues.

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## **MANAGEMENT STRUCTURE**

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CEI maintains a flat organizational structure designed to empower staff members to work effectively with our internal and external collaborators to meet specific project requirements. Overall administration of the Center resides with the Center Director who is responsible for the day-to-day operations where they identify potential collaborators, write proposals, administer funded projects, assign project tasks, and coordinate CEI staff to accomplish project objectives. CEI staff members are actively involved in project decision making with collaborators and are empowered to move projects forward under minimal direct supervision.

## PREVIOUS SUCCESSES

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CEI highlights from the past 3 years:

- The initiation of a new cross-campus group, the “Mobile Geospatial Systems Group”, devoted to environmental sensing with small, unmanned autonomous systems (sUAS). The collaborative efforts initiated in this area have focused on aerial imaging of vegetation and detailed mapping of land surfaces for geomorphic characterization of riparian areas, vegetation impacts from Spotted Lantern Fly, forest canopy mensuration, and grazing impacts to pastureland.
- USDA Wheat Fusarium HeadBlight. This fusarium is the major wheat plant pathogen on Earth. We provide the only daily forecast for this pathogen in North America and have been doing this continuously since 2002. 2020 marks 18 years of continuous funding for this project in conjunction with the State Climatologist’ office in Meteorology and Atmospheric Sciences
- Geoinformatics: Collaborative Research: Neotoma Paleoecology Database, Pliocene-Quaternary grant. 9/1/2010 - 8/31/2021. >\$1.6M. This long-term effort leverages CEI capabilities in data modeling and management, as well as interface design, to advance collaborative work in paleoecology. We have just received notice that this effort will be funded for an additional 3 years by NSF, through 2023.

The following list is a non-exhaustive tabulation of the funding successes that CEI has had since approximately 2014 in working with colleagues within Penn State as well as our external collaborators.

### *Partial List of Projects Funding CEI (2014 – Present)*

**Title:** "Geoinformatics: Collaborative Research: Neotoma Paleoecology Database, Pliocene-Quaternary (Revised Budget)"

**Sponsor:** National Science Foundation

**Period of Performance:** 6/1/2016-5/31/2021

**Total Budget Requested:** \$168,565

**Title:** "Continued Deployment of Prediction Models for Fusarium Head Blight"

**Sponsor:** USDA Agricultural Research Service

**Period of Performance:** 6/7/2016-6/6/2018

**Total Budget Requested:** \$62,833

**Title:** "Graduate training in applied integrative pollinator ecology: managing pollinators and landscapes for sustainable ecosystems services"

**Sponsor:** USDA National Institute of Food and Agriculture

**Period of Performance:** 6/1/2017-5/31/2022

**Total Budget Requested:** \$262,500

**Title:** "Extension Resources for Kansas Wheat Producers"  
**Sponsor:** Kansas State University  
**Period of Performance:** 7/1/2019-6/30/2020  
**Total Budget Requested:** \$10,000

**Title:** "USDA APEX Modeling of Temperate Pastures"  
**Sponsor:** USDA  
**Period of Performance:** 7/15/2018-7/14/2020  
**Total Budget Requested:** \$84,160

**Title:** "USDA Parameterizing the APEX Model"  
**Sponsor:** USDA  
**Period of Performance:** 7/15/2018-7/14/2020  
**Total Budget Requested:** \$34,160

**Title:** "Context Is Key: Tools for Adapting Beekeeping Practices to Diverse Landscapes"  
**Sponsor:** USDA National Institute of Food and Agriculture  
**Period of Performance:** 4/1/2018-3/31/2021  
**Total Budget Requested:** \$901,176

**Title:** "Assessing wetland characteristics of 0-order contributing areas above montane headwater wetland- stream complexes in the Appalachian Mountains – A Pennsylvania Assessment"  
**Sponsor:** PSU IEE  
**Period of Performance:** 4/1/2018-3/31/2019  
**Total Budget Requested:** \$25,000

**Title:** "Location, Location, Location: Developing Tools for Selection and Management of Landscapes to Promote Healthy Bee Populations"  
**Sponsor:** Foundation for Food and Agriculture Research  
**Period of Performance:** 1/1/2018-12/30/2020  
**Total Budget Requested:** \$818,000

**Title:** "Continued Deployment of Prediction Models for Fusarium Head Blight"  
**Sponsor:** US Wheat and Barley Scab Initiative  
**Period of Performance:** 6/1/2018-5/31/2020  
**Total Budget Requested:** \$59,930

**Title:** "PA-DEP CAFO Web Reporting Application"  
**Sponsor:** COP: Department of Environmental Protection  
**Period of Performance:** 1/1/2019-12/31/2019  
**Total Budget Requested:** \$115,116

**Title:** "PA Forest Landowners Collaborative Tool "  
**Sponsor:** PSU/United States Forest Service  
**Period of Performance:** 7/1/2019-06/30/2021  
**Total Budget Requested:** \$119,680

**Project:** "Enhancements to Web-Based MS4 Periodic Reporting Application"

**Sponsor:** COP: Department of Environmental Protection

**Period of Performance:** 11/1/2016-6/30/2017

**Total Budget Requested:** \$98,500

**Project:** "Kansas Wheat Dashboard: Information about Emerging Stripe Rust Epidemics and Other Threats to Wheat Production"

**Sponsor:** Kansas State University

**Period of Performance:** 7/1/2016-6/30/2017

**Total Budget Requested:** \$10,000

**Project:** "Web-based Tool for Estimating Climate Change Impacts on CONUS Cropping Patterns Using the National Commodity Crop Productivity Index (NCCPI)"

**Sponsor:** USDA Natural Resources Conservation Service

**Period of Performance:** 9/16/2015-9/30/2017

**Total Budget Requested:** \$74,986

**Project:** "Comprehensive Data Management and Modeling for the USDA-ARS Pasture Systems and Watershed Management Research Unit"

**Sponsor:** USDA Agricultural Research Service

**Period of Performance:** 8/28/2014-5/31/2017

**Total Budget Requested:** \$41,500

**Project:** "Center for Multi-Scale Nutrient Pollution Solutions"

**Sponsor:** Environmental Protection Agency

**Period of Performance:** 9/1/2013-8/31/2017

**Total Budget Requested:** \$2,220,649

**Project:** "Developing a Web-based Forecasting Tool for Nutrient Management"

**Sponsor:** USDA National Institute of Food and Agriculture

**Period of Performance:** 3/1/2012-2/28/2018

**Total Budget Requested:** \$484,000

**Project:** "Center for Multi-Scale Nutrient Pollution Solutions"

**Sponsor:** Environmental Protection Agency

**Period of Performance:** 9/1/2013 - 8/31/2016

**Total Budget Requested:** \$2,220,649

**Project:** "Geoinformatics: Collaborative Research: Neotoma Paleoecology Database, Pliocene-Quaternary (Revised Budget)"

**Sponsor:** National Science Foundation

**Period of Performance:** 9/1/2010-8/31/2017

**Total Budget Requested:** \$1,486,857

**Project:** "Developing a Web-based Forecasting Tool for Nutrient Management"

**Sponsor:** USDA National Institute of Food and Agriculture

**Period of Performance:** 3/1/2012 - 2/28/2017

**Budget:** \$484,000

## CENTER DIRECTOR VITA

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### Douglas A. Miller

Research Professor of Geography  
The Pennsylvania State University  
317G EES Building  
University Park, PA 16802

Phone: 814-863-7207  
Cell: 814-883-1127  
dam8@psu.edu  
<http://cei.psu.edu>

### Professional Preparation

The Pennsylvania State University	Earth Science	B.S., 1981
The Pennsylvania State University	Agronomy	M.S., 1987
The Pennsylvania State University	Soil Science	Ph.D., 1999

### Appointments

- 2015: Research Professor, Department of Geography and Department of Ecosystem Science and Management; Director, Center for Environmental Informatics and Mobile Geospatial Systems Group, Earth & Environmental Systems Institute;
- 2005: Associate Professor and Director, Center for Environmental Informatics, Earth & Environmental Systems Institute, Penn State University
- 2000: Assistant Professor and Director, Center for Environmental Informatics, Earth & Environmental Systems Institute, Penn State University
- 1999: Research Associate, EMS Environment Institute, Penn State University
- 1993: Research Assistant, Earth System Science Center, Penn State University
- 1988: Research Assistant, Office for Remote Sensing of Earth Resources, Environmental Resources Research Institute, Penn State University

### Closely Related Products (since 2013)

- Blanford, J., P. Kennelly, B. King, **D. Miller**, and T. Bracken. 2019. Merits of capston & projects in an online graduate program for working professionals. *J. Geog. High. Ed.* DOI: 10.1080/03098265.2019.1694874
- Calovi, M., C.M. Grozinger, D.A. Miller, and S.C. Goslee. 2019. Predicting overwintering survival in the European honey bee (*Apis mellifera*). In review. *Ecology and Evolution*.
- Wang, X., **D.A. Miller**, and S. Goslee. 2016. Topographic variables improve climate models of forage species abundance in the northeastern United States. *Applied Veg. Sci.* 20 (1) :84-93.

- Niu, X., J. Z. Williams, **D.A. Miller**, K. Lehnert, B. Bills, S. L. Brantley. 2014. An Ontology Driven Relational Geochemical Database for the Earth's Critical Zone: CZchemDB. *J. Environmental Informatics* 23:10-23.
- Brubaker, K.M. W.L. Myers, P. J. Drohan, **D.A. Miller**, and E. W. Boyer. 2013. The Use of LiDAR Terrain Data in Characterizing Surface Roughness and Microtopography. *Appl. and Environ. Soil Science*. Article ID 891534. 13 pages. <http://dx.doi.org/10.1155/2013/891534>
- Buda, A., P.J.A. Kleinman, G.W. Feyereisen, **D.A. Miller**, P.G. Knight, P.J. Drohan, and R.B. Bryant. 2013. Forecasting Runoff from Pennsylvania Landscapes. *J. Soil and Water Cons.* 68:185-198.
- Dickinson, Y.L., E.K. Zenner, and **D.A. Miller**. 2013. Examining the effect of diverse management strategies on landscape scale patterns of forest structure in Pennsylvania using novel remote sensing techniques. *Canadian Journal of Forest Research* 44: 301-312

#### Five Other Significant Products

- **CONUS-Soil** – Conterminous US 1-km Soil Information Database Climate and Hydrology Modeling; [www.soilinfo.psu.edu](http://www.soilinfo.psu.edu)
- **PAMAP** – Commonwealth of Pennsylvania Statewide Digital Orthoimagery and Lidar mapping program; 2005 – 2011.
- **PennPilot** – Comprehensive aerial imagery database for the Commonwealth of Pennsylvania; [www.pennpilot.psu.edu](http://www.pennpilot.psu.edu)
- **Fusarium Head Blight Prediction Center** – The Fusarium Head Blight Prediction Center helps growers evaluate the risk of Fusarium head blight in their area. The system uses weather conditions reported for an area to estimate the risk of a severe outbreak of disease. [www.wheatcab.psu.edu](http://www.wheatcab.psu.edu)
- **Pestwatch** – A northeastern regional view over space and time of dynamic information useful for managing insects or diseases. [www.pestwatch.psu.edu](http://www.pestwatch.psu.edu)

#### Synergistic Activities

- Founder and Director of the *Center for Environmental Informatics* (Center founded in 2000; PI or Co-PI on >\$34M in externally sponsored grants including NASA, NOAA, NSF, EPA, USDA and others).
- Founder of the Mobile Geospatial Systems Group focused on building capacity at Penn State for small, unmanned aerial systems (sUAS) for environmental applications; Approximately 5 undergraduates have worked in this group since 2016.
- Former Advising Coordinator for the Masters of GIS program offered through the Dutton e-Education Institute; Responsible for coordinating advising for ~300 MGIS graduates since 2007; Adviser to 43 MGIS graduate students.



**SUPPORT LETTERS**

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April 17, 2020

Dr. Susan Brantley  
Director, Earth-Environmental Systems Institute  
Distinguished Professor  
2217 EES Building  
University Park, PA 16802

Re: Collaboration with Center for Environmental Informatics

Dear Dr. Brantley,

I have collaborated with the Center for Environmental Informatics for over a decade, primarily under the auspices of the USDA's Grazinglands Conservation Effects Assessment Project (CEAP). The objective of this project is to develop tools to monitor and predict the outcomes of agricultural management practices, and to use those tools to better steward the nation's resources. Collaborations with the Center have included development of remote sensing techniques for assessing primary production in temperate grazing lands, of machine learning models for forage species distribution, and to deploy models of forage production across large geographic regions.

A great strength of the Center is in development of decision support tools, a vital method of sharing the knowledge gained through scientific research with the stakeholders who employ that knowledge to make informed management decisions. Ongoing collaborations with the Center have resulted in a variety of spatially-based tools for managing agricultural systems. Current work will culminate in a regional forage selection tool that incorporates multiple ecosystem services alongside forage production.

The Center for Environmental Informatics is deeply involved in many avenues of research and decision support tool development. I have also worked with them on a variety of projects including development of a database to effectively manage decades of land use practices within an experimental watershed, and on the analysis of honey bee overwintering survival and subsequent design and implementation of an assessment tool for beekeeper use. All of these projects have greatly benefitted from Center involvement, and in turn benefit both researchers and practitioners.

Sincerely,



Sarah Goslee



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April 17, 2020

Dear Sir or Madam:

I am writing in support of the Center for Environmental Informatics as it comes up for renewal. I strongly support the CEI and Doug Miller's efforts to provide powerful and useful tools and access to information in a useable way, and to make development of those tools a painless process.

American Bird Conservancy has been working with Doug for about 10 years on various projects scattered across the US. We worked with Doug and CEI in the development of an important online mapping and data tool to help address the issue of bycatch on seabirds in marine harvest fisheries worldwide. The project involved assembling hundreds of maps and underlying data, developing tools to query those data spatially, and presenting those data dynamic in a useful report format. The project was released in 2015, and since then CEI has hosted and maintained the web site. With CEI, we are now in a major update to the data and the its associated tools, with the expectation of completing later in 2020.

CEI and Dr. Miller have made the process of development of the project efficient and effective, and providing an outstanding product. I look forward to continuing our relationship with Doug and the CEI and I strongly endorse the renewal of the program.

Sincerely,

David A. Wiedenfeld, Ph.D.  
Senior Conservation Scientist  
540-260-5596



18 April 2020

Susan Brantley, Director  
Earth-Environmental Systems Institute  
The Pennsylvania State University  
University Park, PA 16802

**Re: Letter of support for Center for Environmental Informatics**

Dear Dr. Brantley,

I am writing in support of continued funding for the Center for Environmental Informatics (CEI). I have known of the Center since I came to Penn State in 2007 to interview for a position (I think it had the same name then). CEI provides critical expertise for a remarkably broad range of projects at Penn State; I think its continuation is extremely important for the university, and I recommend its continued support without reservation.

I have called upon Dr. Doug Miller and the CEI staff for years, primarily in support of my own geographic information system (GIS)-related work in East Africa and at global scales. I have found, repeatedly, that CEI has a remarkable control of emerging technology, ranging from unmanned aerial systems (UASs) to GIS technology. I have attended Doug's presentations and field demonstrations on UASs, which have been extremely helpful, as have been several private conversations with him on the topic. Based on those experiences, I am hoping to bring Doug to Tanzania this coming summer or fall to follow up on possible UAS work related to participatory land use planning that integrates virtual reality in rural villages near a national park where I work. Doug's team has helped me fill in high-resolution satellite imagery for community mapping in the same area through converting on-line imagery to formats that are amenable to GIS manipulation. I have called upon him for assistance in setting up global species datasets as a means of tracing the interface of cultural and biological diversity. And he has been instrumental in focusing my attention, as well that of one of my PhD students, on Google Earth Engine as a means of tracing land use change over several decades in several geographic areas of interest.

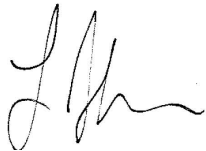
Beyond the personal benefits I mention above, Doug and CEI have been involved in projects that have had broad impacts beyond the bounds of Penn State. One that comes to mind is Penn Pilot, where CEI provided online access to historic aerial photographs of Pennsylvania. As you probably know, prior to that project people had to travel to a single photo archive to access these materials. Penn Pilot provided online access to those aerial photos, something that has been important for various projects that can potentially generate environmental impacts as well as in teaching; I have used the site for years to instruct undergraduate Landscape Architecture students as they learn to use GIS to examine real problems in Pennsylvania through better understanding prior landscape configurations. Having worked in other states as well, I can attest to the unique value of Penn Pilot compared to other parts of our nation. I would also note CEI efforts to post-

process LiDAR data, providing much improved datasets for Pennsylvania that have been useful for a range of students at Penn State as well as beyond the boundary of the university.

For me, I think one of the greatest achievements of CEI is its ability to have big impacts with what often involve fairly small investments. One of the best examples of this is some of the UAS work, which I believe has been embraced by many parts of the university and has helped train some very strong graduate students. I think CEI's ability to obtain funding and assemble a strong staff are testimonies to its sustainability, and to be honest I have a hard time imagining Penn State without such an organization ... something I occasionally tell Doug when I threaten to undermine whatever retirement plans he eventually develops. Simply put, CEI houses people that can do things, and many of those things are of great use to a broad portion of our university. I think the range of skills embodied within CEI are essential to much of what Penn State does on the research front, and that, coupled with the Center's impact relative to funds available, argue strongly for its continued funding.

Please contact me for any clarification or further information.

Best regards,

A handwritten signature in black ink, appearing to read 'L.J. Gorenflo', written in a cursive style.

L.J. Gorenflo, PhD

Eleanor R. Stuckeman Chair in Design, School of Architecture and Landscape Architecture  
Professor, Landscape Architecture (courtesy appointments in Geography and African Studies)  
Faculty-in-Charge, Environmental Inquiry Minor