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Preview of Award 1331906 - Annual Project Report

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Cover	
Federal Agency and Organization Element to Which Report is Submitted:	4900
Federal Grant or Other Identifying Number Assigned by Agency:	1331906
Project Title:	Critical Zone Observatory for Intensively Managed Landscapes (IML-CZO)
PD/PI Name:	Praveen Kumar, Principal Investigator Alison M Anders, Co-Principal Investigator Elmer Bettis III, Co-Principal Investigator Timothy Filley, Co-Principal Investigator Thanos Papanicolaou, Co-Principal Investigator
Recipient Organization:	University of Illinois at Urbana-Champaign
Project/Grant Period:	12/01/2013 - 11/30/2018
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Submitting Official (if other than PD/PI):	N/A
Submission Date:	N/A
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	N/A

Accomplishments

* What are the major goals of the project?

The central hypothesis of Critical Zone Observatory for Intensively Managed Landscapes (IML-CZO) is that, through human modification, the critical zone of IMLs has passed a tipping point (or threshold) and has gradually shifted from being a *transformer* of material flux with high nutrient, water, and sediment storage to being a *transporter* of material flux with low nutrient, water and sediment storage. We expect that the *understanding of IMLs as systems in disequilibrium whose components are co-evolving under strong human, geological, and climatic drivers and which act as non-linear filters for material transformation and transport* will provide new insights to guide practices and policies for sustaining CZ services in the Anthropocene. The IML-CZO effort, distributed across two primary sites (Upper Sangamon River Basin [USRB] (~3700 sq. km.) in Illinois and Clear Creek Watershed [CCW] (~270 sq. km.) in Iowa and a partner site Minnesota River Basin [MRB] (~44,000 sq. km) (funded independently through a NSF WSC Grant) is divided into multiple themes to cover a broad range of issues. The present report is organized per these themes and primarily reports on the effort and outcomes from the primary sites (results for the Minnesota River Basin effort is available through the project report associated with the WSC project [NSF Grant # CBET 1209402]);

Theme A: Geologic Timescale Processes-Glacial Legacy to Future Climate Change

Theme A's major goal is to better understand how the glacial and prehistoric legacy recorded in the landscape and deposits of IMLs influence present processes and the trajectory of CZ evolution. Toward this end, four primary research foci are encompassed by this theme: 1) formulation of criteria for and mapping of fundamental landscape units; 2) assessment of the record of anthropogenic landscape disturbance recorded in post settlement alluvial deposits (PSA); and 3) documenting the physical, chemical, and hydrologic characteristics of the weathering profile.

Theme B: Short- and Long-Term Dynamics of Soil Organic Matter

Theme B's major goal is to examine how intensive cultivation has altered soil organic matter fluxes, residence time, and storage using key state variables under the forcings of regional climate and local anthropogenic activity. The key questions in this theme are: What is the dynamic relation between active and stabilized forms of SOM in IMLs and how does that relationship vary in activity centers and activity intervals? What are their effects on biotic and abiotic activities as they relate to SOM storage?

Theme C: Coupled Surface Water – Groundwater Hydrology and Biogeochemistry

The major goal of Theme C is to quantify how intensive management of landscapes affects residence times & aggregate fluxes of water, carbon, nutrient, and sediment at scales ranging from flowpaths to catchments? Four key research questions have been articulated to achieve this goal: (1) How does the coupled interaction of surface water and groundwater control fluxes of water and solutes within the critical zone and their residence times in different elements of the landscape (e.g., vadose zone, stream, aquifer)? (2) How do the signatures of key materials that are exported (e.g., SOM and DOC) relate to those stored in the landscape? (3) How anthropogenic impacts have altered these fluxes, stores, residence times? and (4) How do different materials move through the system, and what are the timescales relevant for their transformation processes?

Theme D: Water, Soil, Sediment and Landscape Connectivity: Short- and Long-Term Budgets

Theme D's major goal is to determine fluxes of water and sediment at different spatial (hillslope, stream, watershed) and temporal (annual, seasonal, event-based) scales within intensively managed landscapes, to establish sediment budgets at the watershed scale, and to determine the role of human and natural factors in water and sediment fluxes. Key question: How are the sources, fluxes, and sinks of sediment in IMLs distributed in space and time? How do geomorphic, biogeochemical, hydrologic, and human processes interact with sediment production, transfer, and storage rates?

Theme E: Integrated Modeling and Critical Zone Services

The major goal of this theme is to lead the development of an integrated modeling system that (1) exploits high resolution data such as those obtained from LiDAR and hyperspectral technologies; (2) represents micro-topographic variability in landscapes, roughness, vegetation and biogeochemical attributes; and (3) characterizes critical zone services in IMLs.

Theme F: Cyberinfrastructure and Services: Creation of an interactive web-portal for storage, retrieval, visualization and analysis of data produced by IML-CZO (measurements and simulations).

Details in the attached Activities Report document.

Theme G: Education/Outreach & Dissemination Plan: building a stakeholder network for dissemination of IML-CZO research through targeted education and outreach activities.

Details Below

Theme H: External Research Partnerships: actively engage IML-CZO in similar large-scale national projects and broadening its international dimensions.

Details below.

* What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?

Major Activities:	<ul style="list-style-type: none">Performed subsurface geological investigations (coring geophysical surveys) in CCW and USRB.Performed shallow groundwater level monitoring in CCW.Conducted infiltrometer studies of selected soils in CCW A-2: completed Pb and Cs analyses of legacy sediment cores in CCWCompleted geochemical analyses and interpretations of upper two weathering profiles in CCWCompleted geochemical analysis of upper weathering profile in till similar to that at MRBAcquired core to study USRB weathering profileDefine and map fundamental landscape units in the IML-CZOAnalyzed thermal properties of sediments from 100-m-deep core from USRBCompleted models relating landscape evolution to different flow routing schemes Revised geological framework for Quaternary deposits in USRBCollected surface soil samples in CCW and USRB and conducted analysis of surface soil samples from representative hillslopes in the USRB in terms of soil type, gradient, and management continued in year 4.Performed ER experiments in CCW and USRB. Analyze static and dynamic samples for geochemical soil properties. Dynamic ER experiments were conducted in USRB to determine the selective entrainment of soil carbon during rainfall-runoff-erosion events.
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- Measured total SOM using VNIR in CCW and USRB surface soil samples. The soil samples collected as part of the baseline campaign and ER experiments in USRB were analyzed for total SOM using VNIR.
- Performed modeling short- and long-term SOM storage for CCW and USRB.
- Modeled linkages between climate, simulated soil moisture, and measured geochemistry in surface soils for the Upper Sangamon.
- Performed detailed geochemical measurements of the microbial reactivity of mobilized and buried soil organic carbon to connect below ground SOM reactivity to surface biogeochemical driver. Select cores from CCW were studies for their biochemical reactivity for: nitrate reduction, basal respiration, and thermal stability.
- Assessment of SOM geochemical properties on microbial interaction with emerging pollutants through laboratory incubation study of two Midwestern agricultural soils of contrasting edaphic properties found in the USRB and carbon nanomaterials (CNM) that are now becoming common place in electronic, cosmetics, and plastics.
- Assessment of implications of SOM geochemical properties and land use practice on microbial processing of litter inputs, and comparison with international partners in China.
- Sampling of precipitation, surface runoff, tile drain effluent, groundwater, vadose zone water, and stream water during storm events in both CCW and USRB. In-stream sampling during storms was also conducted at several in-stream sites in CCW and USRB. Stream water samples have been collected pre-, during- and post- storm event to evaluate how biogeochemical signatures vary in the Clear Creek and Upper Sangamon watersheds. Organic and inorganic C, sediment mineralogy and concentration, and dissolved metals (Sr, Ca) and Sr isotopes (87/86) have been monitored. Samples were collected in the field. Chemical analyses was done in the laboratory. Additionally, we have engaged in a modeling exercise using the Agro-IBIS and THMB models. These models simulate coupled water, energy, carbon, and nutrient dynamics at the landscape-scale.
- Installed a fiber optic cable along the river bed to undertake a Distributed Temperature Sensing (DTS) study in the Upper Sangamon River.
- Collected monthly temperature data in two boreholes in USRB using a Fiber-Optic Distributed Temperature Sensing (FO-DTS) system.
- Quantified erosion rates, travel times, and lag coefficients for CCW and USRB through rainfall simulator experiments.
- Characterize net sediment fluxes and sediment rating curves within stream channels of CCW and USRB using storm-based evaluations.
- Developed short-term (i.e., single event) sediment budgets for CCW and USRB using stable and radio-isotopes to partition sediment sources.
- A number of modeling efforts have taken place:
 - We have continued to advance the theory of mean nitrogen age for 3-D studies including understanding the role of micro-topographic variability and tile drain in structuring the spatial patterns of concentration-age distribution [DOI: 10.1002/2017WR021053].
 - We have advanced the 3-D modeling of critical zone processes as an integrated system called *Dhara* [DOI: 10.1002/2017WR020377].
 - We have established how critical zone services can be used as environmental assessment criteria to guide sustainable management [doi:10.1002/2016EF000517].
 - We have formalized how information theory based approaches can be used to understand dynamic connectivity between from processes from multivariate time series analyses [doi:10.1002/2016WR020216, doi:10.1002/2016WR020218].
 - We have shown how hydrologic variability at decadal and longer time scales shapes the structure and pattern of floodplains and valleys.
 - We have contributed to a number of cross-CZO initiatives including papers on "Designing a network of Critical Zone Observatories", and "Integration of terrestrial observational networks for advancing modeling".
 - We are developing a model that couple landscape evolution with carbon transport in the 3-D framework to understand how carbon mobilizes and get buried under soil and how the vertical carbon profile evolves.

Specific Objectives: Based on published and submitted articles, we have compiled a list of scientific findings from the past four years of research at IML. These are described through short articles in a consistent form. We attempt to make this accessible to a broader audience by minimizing jargon. These brief narratives are aimed at providing a good insight into the

Significant Results: diverse range of research outcomes from IML. These are uploaded a pdf portfolio in four parts due to file size limitations associated with uploads.

Key outcomes or Other achievements:

International Collaboration Activities

- In collaboration with the Institute of Earth Environment, Chinese Academy of Science (IEE/CAS) in Xi'an, the IMLCZO team consisting of 10 members (5 investigators and 5 graduate students) visited the CLP in Oct. 9-16, 2016 and have gained valuable first-hand experience with the Chinese Loess Plateau (CLP). This trip kicked off a strong partnership between IML-CZO and the CLP-CZO. A team of 5 senior scientists from the IEE/CAS visited IML CZO on May 4-6, 2017 as a follow up to explore specific points of collaboration. The visit gave the scientists from IEE/CAS the first-hand knowledge of what is being done in the IML CZO and has stimulated further development of the IML-CLP partnership. An IMLCZO team consisting of 10 members (5 investigators and 5 graduate students) will visit the CLP again in Oct. 1-8, 2017 to carry out specific collaborative efforts, and an MOU was signed for a long-term and productive partnership.
- Prof. Yunqiang Wang and Prof. Zhao Jin from the IEE/CAS have each spent a year in Henry Lin's lab at Penn State to conduct collaborative research on the CLP CZO. A joint Ph.D. student Jinzhao Liu has also spent 1.5 years at Lin's lab at Penn State to conduct research related to the CZOs in China. e.
- From 2016-2017, Filley has hosted four visiting scholars from the Dongbei region of China: Ms. Xinxin Jin (18 months), Prof. Xueli Ding (12 months), Ms. Ming Li (24 months), and Ms. Wang Xin (12 months) (each from Shenyang Agricultural University), and two from the CLP including Ms. Xiaoyu Peng (24 months) and Ms. Tingyu Hou (24 months) (each at Northwest Agricultural and Forestry University). The students are working on IML-CZO and cross-site projects while being co-advised by Filley and their advisor at the home institution.
- Filley is participating in a workshop in Shenyang in December 2017 (the Global Black Soil Critical Zones Geo-ecological Survey (BASGES)) designed to establish global comparison of mollisols and establish a CZO in China Dongbei. Filley will represent the IML-CZO.

Filley is participating in the CZO national office effort to establish international CZO linkages. After the 2016 pre-AGU International CZO meeting Filley and other CZO colleagues began discussion to establish a common CZO soil C data platform and mechanism for data archival and sharing. Several e-meetings have taken place between IML-CZO scientist, data managers, and colleagues from the International Soil Carbon Network (ISCN) to partner on this effort. At the 2017 AGU meeting Filley will co-convene the session B063: Soil Carbon Dynamics at Broad Scales.

Webportal for the IMLCZO observatory:

We have continued to enhance the Webportal for IMLCZO, which consists of a front end GeoDashboard for publicly available data: <http://data.imlcz.org/geodashboard/#explore>, and a backend "Clowder" for the complete datasets (including raw data) that the GeoDashboard accesses: <http://data.imlcz.org/clowder/>. We have migrated services from running on one virtual machine on a legacy server at NCSA to more than 13 virtual machines running on the NCSA Nebula OpenStack cluster. The system has now access to a total of 12 CPUs, 170GB of memory, and 29TB of disk. By splitting the required services over multiple virtual machines, we have made it easier to upgrade, fix, and scale out individual components. For example, the MongoDB database that stores the metadata for each file and dataset in Clowder is now a cluster composed of 3 instances replicating the information so that if one node goes down the system can still function. As part of this process we have migrated all raw files from being stored in MongoDB to being stored on the file system. This makes backing up files and metadata much easier and performant. We have upgraded the underlying service multiple times this year as new versions of the software were released. Clowder was updated to versions 1.0, 1.1, 1.2, 1.3, 1.3.1, and 1.3.2; Geodashboard was upgraded to 1.4.1 and 1.4.2. All data was migrated as part of the updates. The change logs for each are publicly documented and include a full list of changes: <https://github.com/ncsa/clowder/blob/master/CHANGELOG.md> <https://opensource.ncsa.illinois.edu/bitbucket/projects/GEOD/repos/geodashboard/browse/CHANGELOG.md>

Working with the community, we have changed how data is organized in Clowder to make it easier for users to find relevant data. The new hierarchy maps the Clowder specific data model to the requirements of the community. At the top level, spaces are used to categorize the data by type (e.g.: "Surface Water"), while datasets represent geographical locations. Collections and Folders are also utilized to provide further organization. We have migrated existing datasets to the appropriate space and collections, and in some cases split up existing datasets into new datasets.

To support the CZO network level data effort, we have setup resources on the NCSA Nebula Cluster to provide a proof of concept data services for the CZO network using technologies currently used at each site. We have deployed standalone instances of Clowder and Geodashboard. We have also supported data managers from the network to contribute and install other services, including ODM2Admin being developed for the Luquillo CZO.

We developed a new Python library to simplify writing of new data parsers. Data parsers are used to parse the values from loggers and custom formats in Excel files and CVS files into the JSON based data format required by the Geodashboard.

We adopted standard name vocabularies, in particular CSDMS format, and created new standard names for Flux Tower and Allerton site variables. This provides a standard naming schema that can be utilized across various stations with similar data. With standard names, searches are faster and more complete for the user. When ingesting new data, the CSDMS inspired names are added to the Geostreaming API and the Geodashboard GUI. This is most apparent in the Downloaded data, in the Explore Page listed items, and in the modal dialog boxes. This is an improvement over using the various names that may be present in the raw data files. In addition, the use of standard names contributes to homogeneity across the Geodashboard and Clowder. The long-term goal is to make this change to all stations present on the Geodashboard.

* What opportunities for training and professional development has the project provided?

Under the guidance of Praveen Kumar, Allison Goodwell completed her PhD in May 2017 and is presently a postdoc with IMLCZO. She will be starting as a faculty at University of Colorado at Denver in Jan 2018. Dong Kook Woo completed his PhD in May 2017 and is presently a postdoc with IMLCZO. Further, Phong Le completed his Postdoc with IMLCZO and is now a faculty in his home country, Vietnam, with National Vietnam University.

Under the guidance of Thanos Papanicolaou, there were three Ph.D. students and two Masters students who were involved in the field collection, sample processing, data analysis, and modeling studies. These include Ben Abban, Violet Freudenberg, Christos Giannopoulos, Adam Merook and Shengnan Zhou at UTK. Under the guidance of co-tenure leader Tim Filley, One Purdue Ph.D. (Ms. Tingyu Hou) and one Purdue Masters student (Ms. Ulyssa Hester) was involved in the field collection and geochemical analysis in 2017. Additionally, three visiting scholars; Prof. Xueli Ding (Shenyang Agricultural University), PhD candidate Ming Li (Shenyang Agricultural University), and PhD candidate Xinxin Jin (Shenyang Agricultural University) were visiting scholars in Filley's lab working on the IML-CZO project either at the USRB, CCW, or collaborative sites in Shenyang, China. Ms. Jin and Ms. Li are coadvised by Filley and Jingquan Wang (Dean of the College of Agriculture, Shenyang Agricultural University). These students are mentored through frequent discussions (both organized and impromptu individual/group meetings) with Prof. Papanicolaou, Prof. Filley, and Prof. Kumar, and other IML-CZO investigators.

Further, Kathryn Goff completed MS in Geoscience under the guidance of Art Bettis and Jingtao Lai and Cecilia Cullen were trained by Alison Anders at UIUC. The project has also supported one post-doctoral researcher, two PhD students, and two masters students at Indiana University. Several visiting scientists and graduate/undergraduate students were involved in the deployment and data collection.

Six undergraduates have worked on this project this year at Northwestern. They learned about discharge-concentration relations, as well as chemical analyses such as FTIR, elemental and isotopic analyses.

Under the guidance of senior investigator Bruce Rhoads three PhD students Mingjing Yu, Quinn Lewis, and Muhammad Umar have participated in field data collection. Mingjing Yu has taken on primary responsibility for geochemical analysis of sediment samples, for statistical analysis of samples to determine sediment fingerprinting, for compiling and managing sediment concentration data, and for developing a model of watershed-scale sediment dynamics.

In summary, IMLCZO directly or indirectly enabled the participation of the following number of people:

Participant Category	Number	Gender		Disciplinary Background
		Male	Female	
Total participants	63	38	25	Civil and Environmental Engineering (26), Earth and Planetary Sciences (10), Other (13), Biology (3), Earth and Environmental Science (3), Geography (3), Geology (5)

Undergrad students	11	7	4	Civil and Environmental Engineering (2), Earth and Planetary Sciences (2), Biology (3), Other (3), Earth and Environmental Science (1)
Main Personnel	19	16	3	Civil and Environmental Engineering (7), Earth and Planetary Sciences (3), Other (4), Geology (3), Geography (1), Earth and Environmental Science (1)
External participants	3	2	1	Other (1), Earth and Planetary Sciences (1), Civil and Environmental Engineering (1)
Graduate students	23	9	14	Civil and Environmental Engineering (11), Earth and Planetary Sciences (3), Earth and Environmental Science (1), Geography (2), Other (4), Geology (2)
Postdoctoral	7	4	3	Civil and Environmental Engineering (5), Earth and Planetary Sciences (1), Other (1)

25 K-12 teachers also participated in exploring NGSS (Next Generation Science Standards) bundle.

* How have the results been disseminated to communities of interest?

A number of journal publications, conference presentations, presentations to local community, and across many universities have been made. Information has also been communicated through social media such as YouTube and Twitter where IML has a very active presence. Data have been shared with local and federal USGS agencies. In summary, the following list provides a summary of contributions.

Products	78
Journals	33
Book Chapters	1
Books	0
Thesis / Dissertation	5
Other Conference Presentations/Papers	33
Other Publications	3
Technologies and Techniques	0
Patents	0
Inventions	0
Licenses	0
Websites	1
Other Products	2

IMLCZO Education and Outreach activities

1. Informing watershed management plan with CZO science results from Clear Creek Watershed
2. Partnering with investigators focusing on economic/societal impacts and issues in intensively managed landscapes
3. Technical Advisory Board and Committee participation for the Clear Creek Watershed Management Authority.
4. Synergistic activity with NSF Coupled Natural-Human Systems project (People, Water and Climate: Adaptation and Resilience in Agricultural Watersheds - BCS 1114978)
5. Engaging K-12 teachers to development lesson plans aligned with NGSS (Next Generation Science Standards) bundle. A report is included in Part 4 of the pdf document uploaded.

A weather station has also been installed through CZO project in Fowler Farm (40.151018, -88.333556) in March 2017 that also serves as a Junior Observatory for Middle and High School students (Champaign Unit 4 school district). The goal was to create an opportunity for the students to use the station also as a lab and bring in a number of interesting approaches to their experience. It enables an understanding of variability, uncertainty, and statistical concepts.

6. IML-CZO with the help of UIUC Extension program has been working on developing a number of courses that are made available to Crop Advisors who take those courses to maintain their certification. As a result, two 50-min online courses in sediment source and transport will be offered by Prof. Bruce Rhoads (UIUC) and Prof. Thanos Papanicolaou (University of Tennessee Knoxville) through CZO. The courses will be up live in December 2017. The outline of the course is as follows:

- Healthy soils
- Organic matter
- The living soil
- Soil tests
- Soil sources and delivery
- Reducing runoff and erosion
- Future steps

7. Furthermore, CZO has planned to hold a webinar through UIUC Extension program on February 20th, 2018. This annual webinar is for Certified Crop Advisors (CCAs) to receive credits in Soil and Water Management. The name and the title of the talk of the presenters from CZO are as follows:

- Dr. Adam Ward (Indiana University) and Laura Keefer (UIUC): How extreme weather controls nutrient exports from the agricultural Midwest to the Gulf, and what we can do about it.
- Dr. Bruce L. Roads (UIUC) and Dr. Thanos Papanicolaou (University of Tennessee, Knoxville): Where does eroded soil come from and where does it go? Implications for soil and stream management

Presentations will be 50 min in length. CCA's in Illinois (about 1,200) will be notified about this event in early November through mail.

8. Establish connections between teachers, students and farmers who can benefit from CZO's ongoing projects and available data through three different projects.

* What do you plan to do during the next reporting period to accomplish the goals?

As is indicated through the attached documents of the scientific findings, we have attempted to develop cross-disciplinary communication within the team and also facilitate communication with people outside IMLCZO. We expect that this will enhance our ability to synthesize the knowledge generated to develop more holistic picture that can be translated into better understanding of IMLCZO as a system, and enhance our predictive capability, through mechanistic modeling and statistical characterizations. Further, novel approaches developed by our team, such as those based on information theory, RFID sensors, drone based measurements, etc. provide avenues to explore dynamical connectivities and non-linear dependencies, that have not been possible before. Our effort during the next year will be directed towards these goals, through targeted field studies using tracers (eg. using rare earth elements and conservative tracers), laboratory analyses of soil and water samples including isotopic studies, and modeling and synthesis. We still have some incomplete laboratory analyses work which will be completed. We are in the process of providing statistical and mechanistic explanations of some of the patterns that are observed in our studies and we expect these to be completed during the coming year. We believe that this will require some gap filling through further field data collection. We are attempting to close the gap between observation and modeling, and in some cases modeling generated hypotheses providing the impetus for targeted data collection. Some studies require a longer term data to ascertain confidence in the conclusions of the analyses and these publications are awaiting continued data collection through the coming year.

We will complete the course offerings and the webinar through the UIUC Extension program. During the coming year our E&O team at Univ. of Iowa will also focus on developing on-line resources for CZO-based STEM units for K-12 teachers. Further, the partnership with the School District in Champaign-Urbana will be extended to include teacher's training. They will draw upon our experience and material developed at Univ. of Iowa as much as possible.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
0-ScientificFindingsPortfolio-Part1.pdf	IMLCZO Findings in short reports are combined into a pdf portfolio and uploaded in four parts due to file size limitations. This is Part 1:	Praveen Kumar	10/29/2017
0-ScientificFindingsPortfolio-Part2.pdf	IMLCZO Findings in short reports are combined into a pdf portfolio and uploaded in four parts due to file size limitations. This is Part 2:	Praveen Kumar	10/29/2017
0-ScientificFindingsPortfolio-Part3.pdf	IMLCZO Findings in short reports are combined into a pdf portfolio and uploaded in four parts due to file size limitations. This is Part 3:	Praveen Kumar	10/29/2017
0-ScientificFindingsPortfolio-Part4.pdf	IMLCZO Findings in short reports are combined into a pdf portfolio and uploaded in four parts due to file size limitations. This is Part 4. It also contains an E&O report and the budget for Year 5.	Praveen Kumar	11/07/2017

Products

Books

Book Chapters

Papanicolaou, A.N., and B.K.B. Abban (2016). Chapter 65: Channel Erosion and Sediment Transport. In Chow, V.T. (ed.). *Handbook of Applied Hydrology 2nd*. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes ; Peer Reviewed = Yes

Inventions

Journals or Juried Conference Papers

110. Praveen Kumar, **Phong V. V. Le, A. N. Thanos Papanicolaou, Bruce L. Rhoads, Alison M. Anders, Andrew Stumpf, Christopher G. Wilson, E. Arthur Bettis III, Neal Blair, Adam S. Ward, Timothy Filley, Henry Lin, Laura Keefer, Donald A. Keefer, Yu-Feng Lin, Marian Muste, Todd V. Royer, Efi Fourfoula-Georgiou, and Patrick Belmont (2017). Critical Transition in Critical Zone of Intensively Managed Landscapes. *Anthropocene*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

112. Susan Brantley, William McDowell, William Dietrich, Timothy White, Praveen Kumar, Suzanne Anderson, Jon Chorover, Kathleen Ann Lohse, Roger Bales, Daniel Richter, Gordon Grant, and Jerome Gaillardet (2017). Designing a network of Critical Zone Observatories to explore the living skin of the terrestrial Earth. *Earth Surface Dynamics*. . Status = AWAITING_PUBLICATION; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Abban, B., A.N. Papanicolaou, M.K. Cowles, C.G. Wilson, O. Abaci, K. Wacha, and K.E. Schilling (2015). Sediment source dynamics in the headwater stream of an intensively cultivated agricultural watershed: A Bayesian fingerprinting study using stable isotopes. *Water Resources Research*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Abban, B.K.B., A.N. Papanicolaou, C.P. Giannopoulos, D.C. Dermisis, K.M. Wacha, C.G. Wilson, and M. Elhakeem (2017). Quantification of change in soil surface roughness at the raindrop detachment zone as a function of rainfall intensity under flatbed preconditions.. *Non-linear Interactions*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Abban, B.K.B., A.N. Papanicolaou, C.P. Giannopoulos, D.C. Dermisis, K.M. Wacha, C.G. Wilson, and M. Elhakeem (2017). Quantifying the changes of soil surface microroughness due to rainfall-induced erosion on a smooth surface. *Nonlinear Processes in Geophysics*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Abban, B.K.B., A.N. Papanicolaou, M.K. Cowles, C.G. Wilson, O. Abaci, K. Wacha, K.E. Schilling, and D. Schnoebelen (2017). An enhanced Bayesian fingerprinting framework for studying sediment source dynamics in intensively managed landscapes. *Water Resources Research*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1002/2015WR018030

Allison Goodwell and Praveen Kumar (2017). Temporal Information Partitioning Networks (TIPNets): A process network approach to infer ecohydrologic shifts. *Water Resources Research*. 53 . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1002/2016WR020218

Berry, T.D., Filley, T.R., Clavijo A., Bischoff Gray, M., Turco, R.F. (2017). Degradation and Microbial Uptake of Fullerols in Contrasting Agricultural Soils. *Environmental Science and Technology*. 51 . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Blair, N.E., E.L. Leithold, A.N. Papanicolaou, C.G. Wilson, L. Keefer, E. Kirton, D. Vinson, D. Schnoebelen, B. Rhoads, and M. Yu (2017). The C-biogeochemistry of a Midwestern USA agricultural impoundment in context: Lake Decatur in the Intensively Managed Landscape Critical Zone Observatory. *Biogeochemistry*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Bressan, F., A.N. Papanicolaou, and B.K. Abban (2014). A model for knickpoint migration in first- and second-order streams. *Geophysical Research Letters*. 41 . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1002/2014GL060823

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11/7/2017

RPPR - Preview Report

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115. Smruti Pady, Greg Jansen, Jay Alameda, Edgar Black, Liana Diesendruck, Mike Dietze, Praveen Kumar, Rob Kooper, Jong Lee, Rui Liu, Richard Marciano, Luigi Marini, Dave Mattson, Barbara Minsker, Chris Navarro, Marcus Slavenas, William Sullivan, Jason Votava, Inna Zhamitsky, and Kenton McHenry (2015). *Leveraging everything towards autocuration.* IEEE International Conference on Big Data (Big Data). Washington, DC. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Fine, A.K., C.G. Wilson, A.N. Papanicolaou, S.M. Schaeffer (2017). *Microbially-mediated carbon fluxes vary with landscape position in two erodible, intensively managed agricultural landscapes.* American Geophysical Union Fall Meeting. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Ward, AS, S Spak, T Balson, Y Li, K Dalymple (2017). *Nutrient export from intensively managed landscapes integrates human and natural forcing.* U.S. Critical Zone Observatories All-hands Meeting. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Neal Blair, Adam Ward, Art Bettis, Thanos Papanicolaou and Chris Wilson (2017). *Particulate organic carbon (POC) and particulate N behaviors in response to storm events in the Clear Creek, IA site of the Intensively Managed Landscape – Critical Zone Observatory (IML-CZO).* AGU. New Orleans. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Wacha, K.M., A.N. Papanicolaou, B.K. Abban, and C.G. Wilson (2014). *Potential carbon transport: linking soil aggregate stability and sediment enrichment for updating the soil active layer within intensively managed landscapes.* American Geophysical Union Fall Meeting. San Francisco, California. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Papanicolaou, A.N., M. Elhakeem, and C.G. Wilson (2015). *Predictions of saturated hydraulic conductivity (Ksat) dynamics in intensively managed watersheds.* 2015 Tennessee Water Resources Symposium. Burns, TN. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Ward, AS, DM Cwierny, EP Kolodziej (2014). *Product-to-parent reversion processes: Stream-hyporheic spiraling increases ecosystem exposure and environmental persistence.* American Geophysical Union Fall Meeting. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes
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- Wilson, C.G., A.N. Papanicolaou, K.D. Denn, and B. Abban (2014). *Quantifying sediment sources to the suspended load of an agricultural stream using radioisotopes.* EWRI-ASCE World Environmental and Water Resources Congress 2014: Water without Borders. Portland, OR. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Giannopoulos, C.P., B.K.B. Abban, A. N. Papanicolaou, D.C. Dermisis, K.M. Wacha, C.G. Wilson, and M. Elhakeem (2017). *Quantifying the evolution of soil surface roughness as a function of rainfall intensity.* 26th Tennessee Water Resources Symposium. Burns, TN. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Bettis, E.A., K. Parsons, C.G. Wilson, A.N. Papanicolaou, and D. Grimely. (2016). *Rate, magnitude and impact of legacy sediment accumulation on a headwaters watershed in eastern Iowa.*. Geological Society of America, North-Central Section - 50th Annual Meeting.. Urbana, IL.. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Ward, AS, JA Cullin, DM Cwierny, LB Barber, DW Kolpin, PM Bradley, SH Keefe, LE Hubbard (2013). *Reach-scale predictions of the fate and transport of contaminants of emerging concern at Fourmile Creek in Ankeny, Iowa.* Fourth International Conference on Occurrence, Fate, Effects, & Analysis of Emerging Contaminants in the Environment. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Woo, D. K. and P. Kumar (2016). *Role of micro-topographic variability on soil carbon and nitrogen dynamics in Intensively Managed Landscape.* AGU, Fall Meet. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Balson, T, Y Li, AS Ward, HEC Dennis, R Henschel, H Brunst, S Simms, S Slavin (2017). *Scaling parallel modeling of agroecosystems with Lustre.* Lustre User Group Conference. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Abban, B., A.N. Papanicolaou, C.G. Wilson, O. Abaci, K. Wacha, and D.E. Schnoeblen (2015). *Sediment Fingerprinting in Intensively Managed Landscapes: Application of an Enhanced Bayesian Un-mixing Framework that accounts for Spatiotemporal Heterogeneity to Study Intra-Seasonal Trends in Source Contributions.* Fall American Geophysical Union. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Blair, N.E., A.N. Papanicolaou, C.G. Wilson, E.L. Leithold, and L. Keefer (2017). *Sediment dynamics and C-sequestration in the Midwestern USA reservoir, Lake Decatur.* Goldschmidt 2017. Paris, France. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Abban, B., A.N. Papanicolaou, C.G. Wilson, O. Abaci, K. Wacha, D. Schnoeblen, B. Rhoads, and M. Yu. (2015). *Sediment fingerprinting in intensively managed landscapes: Application of an enhanced Bayesian un-mixing framework that accounts for spatiotemporal heterogeneity to study intra-seasonal trends in source contributions.* American Geophysical Union Fall Meeting. San Francisco, California. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Goodwell, A. E., and P. Kumar (2016). *Temporal Information Partition Networks (TIPNets): A Process Network Framework to Reveal Eco-Hydrologic Feedbacks, Responses and Shifts.* AGU, Fall Meet. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Ward, AS (2017). *The OTHER hockey stick wars: Nitrogen fertilizer, land use, and climate change interactions in the agricultural Midwest.*. Environmental Policy Seminar Series, School of Public and Environmental Affairs, Indiana University. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Ferin, KM, A VanLoocke, AS Ward (2017). *The impact of climate variability and land management practices on water quality in Iowa.* watershed scale Iowa Water Conference.. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Freudenberg, V.B., A.N. Papanicolaou, B.K.B. Abban, C.P. Giannopoulos, C.G. Wilson, MS. Ghanneezad (2017). *The role of cover crops to soil and water quality under a variable climate.* 26th Tennessee Water Resources Symposium. Burns, TN. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Stumpf, A.J., Lin, Y-F. (2017). *Thermophysical Characterization of the Heterogeneous Subsurface.* 2017 Geological Society of America Annual Meeting. Seattle, WA. Status = ACCEPTED; Acknowledgement of Federal Support = No
- Filley, T.R., Marini, L., Todd-Brown, K.E., Malhotra, A., Harden, J., Kumar, P (2017). *Toward a standardized soil carbon database platform in the US Critical Zone Observatory Network.*. American Geophysical Union Fall Meeting. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes
- Abban, B.K.B., A.N. Papanicolaou, M.K. Cowles, C.G. Wilson, O. Abaci, and K.M. Wacha. (2016). *Towards a holistic model for simulating sediment dynamics at watershed scales: partitioning of sediment sources and uncertainty quantification.*. European Geophysical Union General Assembly 2016.. Vienna, Austria.. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

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Yu, M., Rhoads, B.L. and Stumpf, A. (2016). *Tracing suspended sediment sources in the upper Sangamon River basin using fingerprinting techniques.*. AGU. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Yu, M., Rhoads, B.L., Stumpf, A. (2016). *Tracing suspended sediment sources in the upper Sangamon River basin using conservative and non-conservative tracers.*. AGU Fall Meeting.. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Abban, B.K.B., A.N. Papanicolaou, C.G. Wilson, C.P. Giannopoulos, M. Sivapalan (2017). *Understanding the role of the co-play between land use and climate on sediment flux laws in intensively managed landscapes.* American Geophysical Union Fall Meeting. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Freudenberg, V.B., A.N. Papanicolaou, and C.G. Wilson. (2016). *Using a life cycle assessment model to demonstrate the intricate relationship between the quality of soil and the quantities of food and water.*. 16th Annual Meeting of the American Ecological Engineering Society.. Knoxville, TN.. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Dalrymple, KE, J Krajewski, AS Ward, SN Spak (2015). *We are what we drink: Examining public perceptions of water quality in the agricultural Midwest.* Water Sustainability and Climate Annual Meeting, National Science Foundation. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Le. P. V. V., and P. Kumar (2016). *'Dhara': An Open Framework for Critical Zone Modeling.* AGU, Fall Meet. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Other Products

Other Publications

Kelleher, S (2016). *Conservation Farming Shown to Protect Carbon in Soil.*. EOS: Earth & Space Science News <https://eos.org/research-spotlights/conservation-farming-shown-to-protect-carbon-in-soil>. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

O'Brien, M. (2016). *Critical Zone Observatories help U.S. plan for the future.* NSF Science Nation. http://www.nsf.gov/news/special_reports/science_nation/criticalzones.jsp. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Unknown (2015). *Did Dust Bowl's ravages end in the 1940s? New study says no.*. NSF Science 360 News <http://news.science360.gov/obj/story/763a5273-5f7a-4732-b655-92b29e7f0c2d/dust-bowls-ravages-end-1940s-new-study>. Publication Year: 2015. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Patents

Technologies or Techniques

Thesis/Dissertations

Debsunder Dutta. *Data Driven Estimation Of Soil And Vegetation Attributes Using Airborne Remote Sensing.* (2016). University of Illinois. Acknowledgement of Federal Support = Yes

Dong Kook Woo. *Dynamics of Inorganic Soil-Nitrogen Age In Intensively Managed Landscape.* (2017). UIUC. Acknowledgement of Federal Support = Yes

K.M. Wacha. *From Soils to Landscapes: A Landscape Oriented Approach to Stimulate Soil Organic Carbon Dynamics in Intensely Managed Landscapes.*. (2015). University of Iowa,. Acknowledgement of Federal Support = Yes

Phong V. V. Le. *Predicting Malaria Dynamics Under Climate Change.* (2016). University of Illinois. Acknowledgement of Federal Support = Yes

Haowen Xu. *Prototyping Hydroinformatics-based Systems for Supporting Decision Making.* (2015). The University of Iowa. Acknowledgement of Federal Support = No

Allison Goodwell. *Temporal Information Partitioning Networks To Infer Ecohydrologic Behaviors.* (2017). UIUC. Acknowledgement of Federal Support = Yes

Websites

Participants/Organizations

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Kumar, Praveen	PD/PI	1
Anders, Alison	Co PD/PI	2
Bettis III, Elmer	Co PD/PI	2
Filley, Timothy	Co PD/PI	1
Papanicolaou, Thanos	Co PD/PI	1
Belmont, Patrick	Co-Investigator	0
Burkholder, Barbara	Co-Investigator	0
Foufoula-Georgiou, Efi	Co-Investigator	0
Garcia, Marcelo	Co-Investigator	0
Jacobson, Andrew	Co-Investigator	0
Keefer, Laura	Co-Investigator	1
Krajewski, Witold	Co-Investigator	0
Lin, Henry	Co-Investigator	1
Lin, Yu-feng	Co-Investigator	3
Packman, Aaron	Co-Investigator	0
Parker, Gary	Co-Investigator	0
Peschel, Joshua	Co-Investigator	0
Phillips, Andrew	Co-Investigator	0
Schnoebelen, Douglas	Co-Investigator	0
Weber, Larry	Co-Investigator	0
Blair, Neal	Faculty	3
Chaubey, Inderjeet	Faculty	1
Dere, Ashley	Faculty	1
Ding, Xueli	Faculty	12
Flynn, Leslie	Faculty	1
Kumar, Charu	Faculty	0
Leithold, Elana	Faculty	0
Michalski, Greg	Faculty	0
Neal, Ted	Faculty	1
Rhoads, Bruce	Faculty	1

Name	Most Senior Project Role	Nearest Person Month Worked
Stumpf, Andrew	Faculty	3
Ward, Adam	Faculty	4
Wilson, Christopher	Faculty	2
Berry, Timothy	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Elag, Mostafa	Postdoctoral (scholar, fellow or other postdoctoral position)	0
Goodwell, Allison	Postdoctoral (scholar, fellow or other postdoctoral position)	6
Hernandez, Oscar	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Le, Phong	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Li, Yuwei	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Lu, Nanxi	Postdoctoral (scholar, fellow or other postdoctoral position)	0
Quijano, Juan	Postdoctoral (scholar, fellow or other postdoctoral position)	0
Schmadel, Noah	Postdoctoral (scholar, fellow or other postdoctoral position)	2
Singh, Sarmistha	Postdoctoral (scholar, fellow or other postdoctoral position)	3
Tsakiris, Achilles	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Woo, Dongkook	Postdoctoral (scholar, fellow or other postdoctoral position)	5
Hochstedler, Mary	Other Professional	1
Keefer, Donald	Other Professional	1
Larson, Timothy	Other Professional	1
Marini, Luigi	Other Professional	1
Pitcel, Michelle	Other Professional	4
Vogelgesang, Jason	Other Professional	1
Angelo, Brock	Technician	0
Bauer, Erin	Technician	1
Boyd IV, William	Technician	5
Hodson, Tim	Technician	5
Sargent, Steven	Technician	3
Seek, Lara	Technician	1
Stoeffler, Thomas	Technician	4
Storsved, Brynne	Technician	0
Grimley, David	Staff Scientist (doctoral level)	0
Muste, Marian	Staff Scientist (doctoral level)	1
Wang, Hong	Staff Scientist (doctoral level)	1
Abban, Benjamin	Graduate Student (research assistant)	12
Amir, Abbas	Graduate Student (research assistant)	0
Arnott, Ryan	Graduate Student (research assistant)	6
Balson, Tyler	Graduate Student (research assistant)	3
Boys, John	Graduate Student (research assistant)	12
Burns, Adam	Graduate Student (research assistant)	0
Cain, Molly	Graduate Student (research assistant)	9
Childress, Laurel	Graduate Student (research assistant)	0
Cullin, Cecilia	Graduate Student (research assistant)	2
Culotti, Alessandro	Graduate Student (research assistant)	0
Dutta, Debsunder	Graduate Student (research assistant)	0
Ettema, Will	Graduate Student (research assistant)	2
Farber, Brianna	Graduate Student (research assistant)	0
Fillyaw, Roy	Graduate Student (research assistant)	0
Freudenberg, Violet	Graduate Student (research assistant)	1
Giannopoulos, Christos	Graduate Student (research assistant)	12
Goff, Kathleen	Graduate Student (research assistant)	12
Hameed, Haider	Graduate Student (research assistant)	0

Name	Most Senior Project Role	Nearest Person Month Worked
Handa, Saki	Graduate Student (research assistant)	0
Hernandez, Leila	Graduate Student (research assistant)	11
Hester, Ulyssa	Graduate Student (research assistant)	12
Hou, Tingyu	Graduate Student (research assistant)	12
Jiang, Peishi	Graduate Student (research assistant)	12
Jin, Xinxin	Graduate Student (research assistant)	12
Lai, Jingtao	Graduate Student (research assistant)	6
Lee, Esther	Graduate Student (research assistant)	12
Leonard, Michael	Graduate Student (research assistant)	0
Lewis, Quinn	Graduate Student (research assistant)	1
Li, Zheng	Graduate Student (research assistant)	0
Li, Ming	Graduate Student (research assistant)	12
Luo, Yaqi	Graduate Student (research assistant)	2
Maciel, Fernanda	Graduate Student (research assistant)	0
Merook, Adam	Graduate Student (research assistant)	2
Muhammad, Umar	Graduate Student (research assistant)	1
Parsons, Kelli	Graduate Student (research assistant)	12
Prior, Kara	Graduate Student (research assistant)	1
Richardson, Meredith	Graduate Student (research assistant)	12
Roots, Paul	Graduate Student (research assistant)	0
Roque-Malo, Susana	Graduate Student (research assistant)	11
Schmalle, Kayla	Graduate Student (research assistant)	0
Stevenson, Leigh	Graduate Student (research assistant)	1
Tokuhsa, Rai	Graduate Student (research assistant)	0
Wacha, Kenneth	Graduate Student (research assistant)	6
Wagner, Derek	Graduate Student (research assistant)	0
Wang, Kunxuan	Graduate Student (research assistant)	12
Xu, Haowen	Graduate Student (research assistant)	1
Yan, Qina	Graduate Student (research assistant)	12
Yu, Mingjing	Graduate Student (research assistant)	6
Zhou, Shengnan	Graduate Student (research assistant)	12
Abuyazid, Nabil	Undergraduate Student	2
Ainsley, Benjamin	Undergraduate Student	0
Baldwin, Drew	Undergraduate Student	6
Barth, George	Undergraduate Student	6
Brown, Scott	Undergraduate Student	2
Clay, Samora	Undergraduate Student	2
Coker-Gunnick, Sophia	Undergraduate Student	1
Cooperberg, Danna	Undergraduate Student	2
Daugherty, Michael	Undergraduate Student	3
DeBartolo, Gia	Undergraduate Student	4
DeFries, Emily	Undergraduate Student	3
Dunn, Jesse	Undergraduate Student	5
Gamblin, David	Undergraduate Student	6
Hayes, John	Undergraduate Student	2
Hughes, Madison	Undergraduate Student	2
Kazmierczak, Breanna	Undergraduate Student	0
Kirton, Erin	Undergraduate Student	1
Lopez, Jazmin	Undergraduate Student	2
Magnuson, Angela	Undergraduate Student	3

Name	Most Senior Project Role	Nearest Person Month Worked
Mettenberg, Daniel	Undergraduate Student	4
Moravek, Jessie	Undergraduate Student	5
Parcher, Sarah	Undergraduate Student	6
Patterson, Kaity	Undergraduate Student	1
Quan, Wei	Undergraduate Student	7
Santana, Lorraine	Undergraduate Student	2
Sevilla, Tiffany	Undergraduate Student	8
Shen, Bomo	Undergraduate Student	0
Skillman, Clark	Undergraduate Student	1
So, Rachel	Undergraduate Student	2
Wang, Jia Jia	Undergraduate Student	4
Williams, Joshua	Undergraduate Student	0
Winters, Jake	Undergraduate Student	1
Yu, Zhihan	Undergraduate Student	2
Zhou, Nina	Undergraduate Student	3
Zona, Dominic	Undergraduate Student	1
Gasparini, Nicole	Consultant	1
Fetty, Nicholas	Other	0
Zeng, Yue	Other	0

Full details of individuals who have worked on the project:

Praveen Kumar

Email: kumar1@uiuc.edu

Most Senior Project Role: PD/PI

Nearest Person Month Worked: 1

Contribution to the Project: Director and Lead PI

Funding Support: NSF

International Collaboration: Yes, China

International Travel: Yes, China - 0 years, 0 months, 7 days

Alison M Anders

Email: amanders@uiuc.edu

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 2

Contribution to the Project: Manuscript preparation

Funding Support: This grant

International Collaboration: No

International Travel: No

Elmer Bettis III

Email: art-bettis@uiowa.edu

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 2

Contribution to the Project: lead weathering studies, manage field activities and supervise technicians at Clear Creek watershed site.

Funding Support: NSF

International Collaboration: No

International Travel: No

Timothy Filley

Email: filley@purdue.edu

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 1

Contribution to the Project: Co-PI in Theme B IML-CZO activities, focusing on biogeochemistry

Funding Support: IML-CZO

International Collaboration: No

International Travel: No

Thanos Papanicolaou

Email: tpapanic@utk.edu

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 1

Contribution to the Project: Co-Director of IML-CZO. Leader of Themes B and D, focused in the areas associated with Aggregate Stability, SOM Dynamics, Erosion & Deposition, Saturated Hydraulic Conductivity, Landscape Processes, Upland-Floodplain-Channel Connectivity.

Funding Support: IML-CZO

International Collaboration: No

International Travel: No

Patrick Belmont

Email: patrick.belmont@usu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 0

Contribution to the Project: geomorphology, sediment transport, fluvial systems

Funding Support: Utah State University

International Collaboration: No
International Travel: No

Barbara Burkholder

Email: bkb0811@umn.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: None; Barbara has disengaged from the project. Her E&O responsibilities have been transferred.

Funding Support: None

International Collaboration: No
International Travel: No

Efi Foufoula-Georgiou

Email: efi@uci.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: geomorphic transport, scaling in river basins; supports collaboration with WSC funded project in the Minnesota River Basin

Funding Support: University of Minnesota

International Collaboration: No
International Travel: No

Marcelo H Garcia

Email: mhgarcia@illinois.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: river mechanics and environmental hydraulics

Funding Support: University of Illinois

International Collaboration: No
International Travel: No

Andrew D Jacobson

Email: adj@earth.northwestern.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: aqueous and isotopic geochemistry

Funding Support: Northwestern University

International Collaboration: No
International Travel: No

Laura Keefer

Email: lkeefer@illinois.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 1

Contribution to the Project: Upper Sangamon River Basin Site & Facilities Co-coordinator, Fluvial Geomorphology, Hydraulics/Hydrology

Funding Support: NSF (IMLCZO) & University of Illinois, Illinois State Water Survey

International Collaboration: No
International Travel: No

Witold Krajewski

Email: witold-krajewski@uiowa.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: hydrometeorology, radar rainfall estimation

Funding Support: University of Iowa

International Collaboration: No
International Travel: No

Henry Lin

Email: henrylin@psu.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 1

Contribution to the Project: Co-Lead Theme E, Cross-site studies, hydrogeology, sub-surface flow

Funding Support: Pennsylvania State University

International Collaboration: Yes, China
International Travel: No

Yu-feng Lin

Email: yflin@illinois.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 3

Contribution to the Project: Directed study of surface-groundwater interactions in USRB

Funding Support: Prairie Research Institute (General Revenue Funds)

International Collaboration: No
International Travel: No

Aaron Packman

Email: a-packman@northwestern.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: environmental transport processes, stream ecology, microbiology

Funding Support: Northwestern University

International Collaboration: No
International Travel: No

Gary Parker
Email: parkerg@illinois.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: morphodynamics and fluvial processes

Funding Support: University of Illinois

International Collaboration: No
International Travel: No

Joshua Peschel
Email: peschel@illinois.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: USRB Site & Facilities Co-coordinator, unmanned aerial system, robotics; As of yr 4 of the project, Josh Peschel is not engaged with the IMLCZO project as he has moved.

Funding Support: University of Illinois/CEE

International Collaboration: No
International Travel: No

Andrew Phillips
Email: phillips@isgs.illinois.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: quaternary landscape evolution

Funding Support: Illinois State Geological Survey

International Collaboration: No
International Travel: No

Douglas Schnoebelen
Email: douglas-schnoebelen@uiowa.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: E&O Co-Coordinator, nutrient and sediment transport, CZO Network Web manager group As of yr 4, Doug is no longer engaged with the IMLCZO project as he has moved to another position.

Funding Support: NSF (IMLCZO) & University of Iowa

International Collaboration: No
International Travel: No

Larry Weber
Email: larry-weber@uiowa.edu
Most Senior Project Role: Co-Investigator
Nearest Person Month Worked: 0

Contribution to the Project: environmetal hydraulics, tile drainage.

Funding Support: University of Iowa

International Collaboration: No
International Travel: No

Neal Blair
Email: n-blair@northwestern.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 3

Contribution to the Project: Oversaw processing of ISCO collected samples for chemical analyses. Oversaw organic C analyses of samples. Synthesized data and prepared manuscript.

Funding Support: IML-CZO project, Northwestern University

International Collaboration: No
International Travel: No

Inderjeet Chaubey
Email: ichaubey@purdue.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 1

Contribution to the Project: Helped with Theme B ecohydrology and solute transport research activities.

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Ashley Dere
Email: adeere@unoomaha.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 1

Contribution to the Project: collaborating on weathering zone study across climatic gradient from Nebraska to Iowa

Funding Support: Univeresity of Nebraska

International Collaboration: No
International Travel: No

Xueli Ding
Email: ding171@purdue.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 12

Contribution to the Project: Related to Theme B IML-CZO activities

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Leslie Flynn

Email: leslie-flynn@uiowa.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 1

Contribution to the Project: taught methods class focusing on CZO science in U of Iowa Department of Education Organized teacher workshop

Funding Support: NSF IML-CZO

International Collaboration: No
International Travel: No

Charu Kumar

Email: cgkumar@illinois.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 0

Contribution to the Project: metagenomics

Funding Support: University of Illinois

International Collaboration: No
International Travel: No

Eilana Leithold

Email: leithold@ncsu.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 0

Contribution to the Project: Prof. Leithold oversaw the Lake Decatur core analyses at LacCore and performed grain size measurements on the same

Funding Support: None for salary. This project provided support for the analyses.

International Collaboration: No
International Travel: No

Greg Michalski

Email: gmichalski@purdue.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 0

Contribution to the Project: geochemistry

Funding Support: Purdue University; IMLCZO provides support for analysis but none for salary

International Collaboration: No
International Travel: No

Ted Neal

Email: ted-neal@uiowa.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 1

Contribution to the Project: Directed K-12 teacher workshops and engagement

Funding Support: This project Center For Regional and Global Environmental Research (u. of Iowa)

International Collaboration: No
International Travel: No

Bruce Rhoads

Email: brhoads@illinois.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 1

Contribution to the Project: Helped to supervise work on measurement and analysis of suspended sediment concentration data from the Upper Sangamon River basin as well as sediment tracing data on sediment sourcing

Funding Support: NSF - CZO project

International Collaboration: No
International Travel: No

Andrew Stumpf

Email: astumpf@illinois.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 3

Contribution to the Project: Provided expertise on Quaternary geology in USRB

Funding Support: Prairie Research Institute, General Revenue Funds

International Collaboration: No
International Travel: No

Adam Ward

Email: adamward@indiana.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 4

Contribution to the Project: senior personnel for Theme C

Funding Support: NSF

International Collaboration: No
International Travel: No

Christopher Wilson

Email: cwilso97@utk.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 2

Contribution to the Project: Co-Investigator involved in activities related to Themes A, B, and D with research areas associated in erosion & deposition, the use of radionuclides and other tracers, saturated hydraulic conductivity, and water-sediment-carbon transport within watersheds. Data manager for Clear Creek.

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Timothy Berry

Email: berry10@purdue.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)
Nearest Person Month Worked: 1

Contribution to the Project: 13C content of lignin phenols in IML

Funding Support: EPA/NSF (IML-CZO)

International Collaboration: No
International Travel: No

Mostafa Elag

Email: mostafaelag@gmail.com

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)
Nearest Person Month Worked: 0

Contribution to the Project: Development of semantic technologies and integration of IMLCZO data. As of yr 4, he is no longer with the project as he has accepted employment in a private company.

Funding Support: NSF (SEAD project)

International Collaboration: No
International Travel: No

Allison Eva Goodwell

Email: goodwel2@illinois.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)
Nearest Person Month Worked: 6

Contribution to the Project: Development of information theory approach to understanding process network dynamics.

Funding Support: IML-CZO

International Collaboration: Yes, China
International Travel: No

Oscar Hernandez

Email: oscar-hernandezmurcia@uiowa.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)
Nearest Person Month Worked: 1

Contribution to the Project: E&O, modeling

Funding Support: INRC and LACMRERS funds/NSF (IML-CZO)

International Collaboration: No
International Travel: No

Phong Vu Viet Le

Email: phongle1@illinois.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)
Nearest Person Month Worked: 12

Contribution to the Project: Development of "Dhara" model for Critical Zone processes.

Funding Support: NSF (WSC REACH project)

International Collaboration: No
International Travel: No

Yuwei Li

Email: yuwei.lee03@gmail.com

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)
Nearest Person Month Worked: 1

Contribution to the Project: Agro-IBIS modeling

Funding Support: IU

International Collaboration: No
International Travel: No

Nanxi Lu

Email: nanxi.lu@northwestern.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)
Nearest Person Month Worked: 0

Contribution to the Project: Biogeography of environmental microbiome at the IML-CZO

Funding Support: Other

International Collaboration: No
International Travel: No

Juan C Quijano

Email: juan.quijano@gmail.com

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)
Nearest Person Month Worked: 0

Contribution to the Project: ecohydrologic & nutrient dynamics modeling; As of yr 4 he is no longer with the project as he has moved back to South America (Ecuador).

Funding Support: University of Illinois

International Collaboration: No
International Travel: No

Noah Schmadel

Email: noahschm@indiana.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)
Nearest Person Month Worked: 2

Contribution to the Project: spatial data analyses

Funding Support: Indiana University, NSF

International Collaboration: No
International Travel: No

Sarmistha Singh

Email: singh202@purdue.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)
Nearest Person Month Worked: 3

Contribution to the Project: Related to Theme B IML-CZO activities

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Achilles Tsakiris

Email: atsakiri@utk.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 1

Contribution to the Project: Related to software/hardware and technical issues regarding Theme B IML-CZO activities.

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Dongkook Woo

Email: dwoo5@illinois.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 5

Contribution to the Project: Development of a model to identify the age of nutrients in agricultural land.

Funding Support: IML-CZO

International Collaboration: Yes, China
International Travel: No

Mary E Hochstedler

Email: beth-hochstedler@uiowa.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 1

Contribution to the Project: organized and coordinated State Hygienic laboratory with teacher workshop

Funding Support: State of Iowa

International Collaboration: No
International Travel: No

Donald Keefer

Email: dkeefe@illinois.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 1

Contribution to the Project: glacial deposit mapping, shallow groundwater flow

Funding Support: ILLINOIS STATE GEOLOGICAL SURVEY

International Collaboration: No
International Travel: No

Timothy Larson

Email: thlarson@illinois.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 1

Contribution to the Project: geophysics

Funding Support: Illinois State Geological Survey & IMLCZO

International Collaboration: No
International Travel: No

Luigi Marini

Email: lmarini@illinois.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 1

Contribution to the Project: Data management

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Michelle Pitcel

Email: mpitcel2@illinois.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 4

Contribution to the Project: Data management

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Jason Vogelgesang

Email: jason-vogelgesang@uiowa.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 1

Contribution to the Project: Resistivity surveys and interpretation of data Clear Creek Watershed

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Brock Angelo

Email: jba@illinois.edu

Most Senior Project Role: Technician

Nearest Person Month Worked: 0

Contribution to the Project: large-scale data management system, cyber collaborator; As of yr 4 he is no longer with the project. He has accepted another employment.

Funding Support: NSF (IMLCZO) & University of Illinois/NCSA

International Collaboration: No
International Travel: No

Erin Bauer

Email: ebauer@illinois.edu
Most Senior Project Role: Technician
Nearest Person Month Worked: 1

Contribution to the Project: Other

Funding Support: Illinois Department of Natural Resources

International Collaboration: No
International Travel: No

William Boyd IV

Email: will-boyd@uiowa.edu
Most Senior Project Role: Technician
Nearest Person Month Worked: 5

Contribution to the Project: Installed and maintained CCW stream sensors, sampled pore water, data uploading

Funding Support: NSF IMLCZO

International Collaboration: No
International Travel: No

Tim Hodson

Email: tohodson@gmail.com
Most Senior Project Role: Technician
Nearest Person Month Worked: 5

Contribution to the Project: Other

Funding Support: NSF (IML-CZO)

International Collaboration: No
International Travel: No

Steven Sargent

Email: slsargen@illinois.edu
Most Senior Project Role: Technician
Nearest Person Month Worked: 3

Contribution to the Project: Maintains Sensors at Flux Tower; supervises data collection at Rantoul geothermal well; developed plan for DTS installation in Sangamon River

Funding Support: NSF IMLCZO

International Collaboration: No
International Travel: No

Lara Seek

Email: laraseek@illinois.edu
Most Senior Project Role: Technician
Nearest Person Month Worked: 1

Contribution to the Project: Other

Funding Support: Illinois Department of Natural Resources

International Collaboration: No
International Travel: No

Thomas Stoeffler

Email: thomas-stoeffler@uiowa.edu
Most Senior Project Role: Technician
Nearest Person Month Worked: 4

Contribution to the Project: sensor installation

Funding Support: NSF-IML-CZO

International Collaboration: No
International Travel: No

Brynne Storsved

Email: storsve2@illinois.edu
Most Senior Project Role: Technician
Nearest Person Month Worked: 0

Contribution to the Project: Other

Funding Support: NSF (IML-CZO)

International Collaboration: No
International Travel: No

David Grimley

Email: dgrimley@illinois.edu
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 0

Contribution to the Project: Supervised collection of cores. Trained students in measurement of fly ash. Analysis and interpretation of PSA data. First author of manuscript.

Funding Support: ISGS

International Collaboration: No
International Travel: No

Marian Muste

Email: marian-muste@uiowa.edu
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 1

Contribution to the Project: Design of the Annual Report Tool and overseeing workflow developments for the IML-CZO geo-portal

Funding Support: CZO

International Collaboration: No
International Travel: No

Hong Wang

Email: hongwang@illinois.edu

Most Senior Project Role: Staff Scientist (doctoral level)

Nearest Person Month Worked: 1

Contribution to the Project: Completed study soil organic carbon (SOC) cycling in the Upper Sangamon River Basin

Funding Support: Prairie Research Institute, General Revenue Funds

International Collaboration: No

International Travel: No

Benjamin Abban

Email: babban@vols.utk.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 12

Contribution to the Project: Graduate student contributing to Themes B and D focused in upland-floodplain-channel connectivity, aspects of microroughness, and spatiotemporal scaling laws.

Funding Support: IML-CZO

International Collaboration: No

International Travel: No

Abbas Ali Amir

Email: abbasali-amir@uiowa.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Was involved in an exploration task for figuring out a web-based project management tool

Funding Support: NSF (IMLCZO) & University of Iowa/Other

International Collaboration: No

International Travel: No

Ryan Arnott

Email: arnott2@illinois.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 6

Contribution to the Project: Spatial and Temporal Variability in Floodplain Sedimentation during Individual Hydrologic Events on a Lowland, Meandering River: Allerton Park, Monticello, Illinois; He is no longer with the project as he has accepted a position with ISGS.

Funding Support: University of Illinois at Urbana-Champaign/NSF(IML-CZO)

International Collaboration: No

International Travel: No

Tyler Balson

Email: tbalson@umail.iu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 3

Contribution to the Project: Agro-IBIS and THMB simulations of the Mississippi River Basin and Iowa River Basin

Funding Support: Indiana University, IML-CZO

International Collaboration: No

International Travel: No

John Boys

Email: jboys@utk.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 12

Contribution to the Project: How does management affect the various pools of SOM? What are the key mechanisms affecting changes in SOM storage potential in IMLs? What are the effects of tillage, pH, and N-fertilizer applications on aggregates, SOM decay and respiration rates?

Funding Support: University of Tennessee, Knoxville/NSF(IML-CZO)

International Collaboration: No

International Travel: No

Adam Burns

Email: burns7@illinois.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: A Mobile High-Resolution Phenotyping Robot

Funding Support: Gates Foundation; Peschel

International Collaboration: No

International Travel: No

Molly Cain

Email: calnmr@umail.iu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 9

Contribution to the Project: Field experiments at Clear Creek site, laboratory analysis of samples

Funding Support: IML-CZO

International Collaboration: No

International Travel: No

Laurel Childress

Email: lbchildr@u.northwestern.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Provided assistance with isotope analyses and supervision of undergraduates

Funding Support: This project and NSF GeoPrisms project 1144483

International Collaboration: No

International Travel: No

Cecilia Cullin

Email: ccullin3@illinois.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 2

Contribution to the Project: adding groundwater component to model

Funding Support: This grant

International Collaboration: No

International Travel: No

Alessandro Culotti

Email: aculotti@u.northwestern.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: How does IML land use and water drainage influence the diversity and composition of microbial communities

Funding Support: Water Research Foundation

International Collaboration: No

International Travel: No

Debsunder Dutta

Email: debsunderdutta@gmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Development of a novel approach for use of hyperspectral, lidar and other remote sensing data for Critical Zone studies; He is no longer with the project as he is now a postdoc at JPL.

Funding Support: NASA Fellowship

International Collaboration: No

International Travel: No

Will Ettema

Email: william-ettema@uiowa.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 2

Contribution to the Project: What role does intensive management of the landscape by humans plays in connectivity of water and sediment fluxes and corresponding budgets? Which controlling variables govern watershed response in terms of runoff and sediment fluxes? What are the feedback mechanisms between hydrological processes and the landscape, and how do these affect runoff and sediment distribution and fluxes on the landscape?

Funding Support: University of Iowa/NSF(IML-CZO)

International Collaboration: No

International Travel: No

Brianna Farber

Email: bdfarber13@gmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: E &O, Science/Farming

Funding Support: University of S. Carolina/NSF (IML-CZO)

International Collaboration: No

International Travel: No

Roy L. Fillyaw

Email: lfillyaw@indiana.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: storm data analysis

Funding Support: IU

International Collaboration: No

International Travel: No

Violet Freudenberg

Email: vfreuden@vols.utk.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Graduate student contributing to Theme B activities focused on soil erosion and carbon transport using modeling and GIS analysis, as well as the role of different management practices on a carbon balance.

Funding Support: IML-CZO

International Collaboration: No

International Travel: No

Christos Giannopoulos

Email: cgiannop@vols.utk.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 12

Contribution to the Project: Graduate student contributing to Themes B and D focused in transport/ travel times of water, sediment, and carbon, as well as aspects of microroughness, and spatiotemporal scaling laws

Funding Support: IML-CZO

International Collaboration: No

International Travel: No

Kathleen Goff

Email: kathleen-goff@uiowa.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 12

Contribution to the Project: assisted with well installation data collection data analysis data collection data analysis literature research

Funding Support: NSF-IML-CZO NSF- EPSCoR

International Collaboration: No

International Travel: No

Haider Hameed

Email: haider-hameed@uiowa.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Designer and developer of the Annual Report Tool for IML-CZO

Funding Support: IML_CZO

International Collaboration: No
International Travel: No

Saki Handa
Email: shanda3@illinois.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 0

Contribution to the Project: Human-Machine Interaction for Unmanned Surface Systems

Funding Support: Gates Foundation; Peschel

International Collaboration: No
International Travel: No

Leila Hernandez
Email: lch2@illinois.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 11

Contribution to the Project: Characterization of landscape scale boundary layer fluxes in IML

Funding Support: NSF IMLCZO

International Collaboration: No
International Travel: No

Ulyssa Hester
Email: uhester@purdue.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 12

Contribution to the Project: Related to Theme B IML-CZO activities

Funding Support: Purdue Diversity Scholarship/NSF (IML-CZO)

International Collaboration: No
International Travel: No

Tingyu Hou
Email: hou56@purdue.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 12

Contribution to the Project: Focusing on statistics and biogeochemical sample analysis in Theme B IML-CZO

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Peishi Jiang
Email: pjiang6@illinois.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 12

Contribution to the Project: Use of IMLCZO data for semantic technology based model-data integration.

Funding Support: NSF (Geosemantics project)

International Collaboration: No
International Travel: No

Xinxin Jin
Email: jinxinxin0218@163.com
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 12

Contribution to the Project: Related to Theme B IML-CZO activities

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Jingtao Lai
Email: jlai11@illinois.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 6

Contribution to the Project: model development, testing, manuscript writing

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Esther Lee
Email: elee98@illinois.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 12

Contribution to the Project: Development of MLCan model for application in a semi-arid region; supported collaboration with Catalina-Jamez CZO.

Funding Support: NSF grant

International Collaboration: No
International Travel: No

Michael Leonard
Email: mleonar@umail.iu.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 0

Contribution to the Project: Groundwater-surface water interaction

Funding Support: Other

International Collaboration: No
International Travel: No

Quinn Lewis**Email:** qlewis2@illinois.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Related to IML-CZO Theme D activities.**Funding Support:** IML-CZO**International Collaboration:** No**International Travel:** No

Zheng Li**Email:** zhengl6@illinois.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** Nonisothermal Vapor Diffusivity in Soils**Funding Support:** ORD; Peschel**International Collaboration:** No**International Travel:** No

Ming Li**Email:** li-ming89@hotmail.com**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 12**Contribution to the Project:** Related to Theme B IML-CZO activities**Funding Support:** IML-CZO**International Collaboration:** No**International Travel:** No

Yaqi Luo**Email:** Yaqi.Luo@hotmail.com**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 2**Contribution to the Project:** Provided field support and assisted development of model for heat transport**Funding Support:** Prairie Research Institute**International Collaboration:** Yes, Chile**International Travel:** No

Fernanda Maciel**Email:** maciely2@illinois.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** Spatially Distributed Bioaccumulation Risk Analysis: A GIS-Based Tool and a Case Study of Polychlorinated Biphenyls in the Great Lakes**Funding Support:** Fulbright; Peschel; NGRREC/NSF(ML-CZO)**International Collaboration:** No**International Travel:** No

Adam Merook**Email:** amerook@vols.utk.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 2**Contribution to the Project:** Related to IML-CZO Theme D activities**Funding Support:** Supported from other projects**International Collaboration:** No**International Travel:** No

Umar Muhammad**Email:** umar83@illinois.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Related to IML-CZO Theme D activities**Funding Support:** IML-CZO**International Collaboration:** No**International Travel:** No

Kelli Parsons**Email:** kelli-parsons@uiowa.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 12**Contribution to the Project:** how has agricultural land management affected sediment dynamics in a headwater basin**Funding Support:** University of Iowa/NSF(ML-CZO)**International Collaboration:** No**International Travel:** No

Kara Prior**Email:** kprior@umail.iu.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** field data collection and analysis**Funding Support:** CZO, IU startup**International Collaboration:** No**International Travel:** No

Meredith Richardson**Email:** mricha2@illinois.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 12

Contribution to the Project: Development of Critical Zone Services for Intensively managed Landscapes

Funding Support: NSF (IMLCZO)

International Collaboration: Yes, China

International Travel: No

Paul Roots

Email: pkroots@gmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: stream sediment analysis

Funding Support: NSF (IML-CZO)

International Collaboration: No

International Travel: No

Susana Roque-Malo

Email: sroque2@illinois.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 11

Contribution to the Project: Coupled Modeling of Rhizosphere and Reactive Transport Processes

Funding Support: Fellowship

International Collaboration: No

International Travel: No

Kayla Schmale

Email: kayla-schmale@uiowa.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: How does the late glacial history of large valleys in glaciated regions affect their response to glacial/interglacial climate transitions

Funding Support: NSF (EPSCoR), NSF (IML-CZO)

International Collaboration: No

International Travel: No

Leigh Stevenson

Email: leestev@indiana.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: analysis of in-stream nutrient data

Funding Support: IU

International Collaboration: No

International Travel: No

Rai Tokuhisa

Email: rai-tokuhisa@uiowa.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Urban Stream/biocells

Funding Support: University of Iowa/NSF (IML-CZO)

International Collaboration: No

International Travel: No

Kenneth Wacha

Email: Ken.Wacha@ARS.USDA.GOV

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 6

Contribution to the Project: Worked on IML-CZO Theme D research on enrichment ratio, aggregate stability, as well as the field work and laboratory analysis component.

Funding Support: IML-CZO

International Collaboration: No

International Travel: No

Derek Wagner

Email: dcwagner5@hotmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Development of model for flow through tiles; Installation and management of field facilities.

Funding Support: NSF (IMLCZO)

International Collaboration: No

International Travel: No

Kunxuan S. Wang

Email: kswang3@illinois.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 12

Contribution to the Project: Study of vegetation characteristics using waveform lidar data.

Funding Support: NSF (BrownDog project)

International Collaboration: No

International Travel: No

Haowen Xu

Email: haowen-xu@uiowa.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Workflows and tools for the IML-CZO Clear Creek

Funding Support: USACE's Institute for Water Resources

International Collaboration: No
International Travel: No

Qina Yan
Email: qinayan2@illinois.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 12

Contribution to the Project: Characterization of alluvial valleys in IMLCZO and modeling of landscape evolution to understand carbon transport due to human impact.

Funding Support: NSF (IMLCZO and Browndog)

International Collaboration: Yes, China
International Travel: No

Mingjing Yu
Email: myu18@illinois.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 6

Contribution to the Project: Aided with Geographic Information Science and research on long-term sediment dynamics related to Theme D.

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Shengnan Zhou
Email: zshengna@vols.utk.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 12

Contribution to the Project: Graduate student working on Theme B activities focused on soil organic carbon distributions in IMLs as functions of slope and management using Visible Near infrared Spectroscopy and modeling.

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Nabiel Abuyazid
Email: abuyazi2@illinois.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 2

Contribution to the Project: Developed algorithms for the use of Lidar data in modeling.

Funding Support: Self funded

International Collaboration: No
International Travel: No

Benjamin Ainsley
Email: BenjaminAinsworth2019@u.northwestern.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 0

Contribution to the Project: stream sediment analysis

Funding Support: Northwestern

International Collaboration: No
International Travel: No

Drew Baldwin
Email: baldwi39@purdue.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 6

Contribution to the Project: Help with dye tracing and sampling

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

George Barth
Email: unknown2@purdue.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 6

Contribution to the Project: Related to Theme B IML-CZO activities

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Scott M Brown
Email: ScottBrown2017@u.northwestern.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 2

Contribution to the Project: Video documentation of project

Funding Support: none

International Collaboration: No
International Travel: No

Samora Clay
Email: samora-clay@uiowa.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 2

Contribution to the Project: Conduct field works associated with the experimental setup

Funding Support: CNH

International Collaboration: No
International Travel: No

Sophia Coker-Gunnick**Email:** sophia-cokergunnick@uiowa.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 1**Contribution to the Project:** undergrad research green storm water infrastructure**Funding Support:** Other**International Collaboration:** No**International Travel:** No

Danna Cooperberg**Email:** DannaCooperberg2016@u.northwestern.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 2**Contribution to the Project:** stream sediment analysis**Funding Support:** Other**International Collaboration:** No**International Travel:** No

Michael Cronin Daugherty**Email:** MichaelDaugherty2018@u.northwestern.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 3**Contribution to the Project:** Biomarker analysis of Lake Decatur sediments**Funding Support:** None for salary. This project provided support for the analyses.**International Collaboration:** No**International Travel:** No

Gia DeBartolo**Email:** giamarie-debartolo@uiowa.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 4**Contribution to the Project:** undergrad research green storm water infrastructure**Funding Support:** Other**International Collaboration:** No**International Travel:** No

Emily DeFries**Email:** edefries@purdue.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 3**Contribution to the Project:** Related to Theme B IML-CZO activities**Funding Support:** IML-CZO**International Collaboration:** No**International Travel:** No

Jesse Dunn**Email:** jesse-dunn@uiowa.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 5**Contribution to the Project:** undergrad research shallow groundwater**Funding Support:** other**International Collaboration:** No**International Travel:** No

David Gamblin**Email:** gamblind@purdue.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 6**Contribution to the Project:** Other**Funding Support:** Other**International Collaboration:** No**International Travel:** No

John M. Hayes**Email:** JohnHayes2018@u.northwestern.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 2**Contribution to the Project:** Biomarker analyses of sediments**Funding Support:** University**International Collaboration:** No**International Travel:** No

Madison Hughes**Email:** hughes80@purdue.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 2**Contribution to the Project:** Undergrad research: Isoscapes in CCW baseline**Funding Support:** Other**International Collaboration:** No**International Travel:** No

Breanna Marie Kazmierczak**Email:** BreannaKazmierczak2016@u.northwestern.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 0

Contribution to the Project: Sample processing, data management, training

Funding Support: This project

International Collaboration: No

International Travel: No

Erin Kirton

Email: Erinkirton2015@u.northwestern.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 1

Contribution to the Project: stream sediment analysis

Funding Support: Northwestern URG

International Collaboration: No

International Travel: No

Jazmin Lopez

Email: jazmin-lopez@uiowa.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 2

Contribution to the Project: assisted with well installation data collection data analysis

Funding Support: NSF-EPSCoR

International Collaboration: No

International Travel: No

Angela Magnuson

Email: amagnus2@illinois.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 3

Contribution to the Project: Expanded the work of Qina Yan on hydrogeomorphologic characterization of river valleys to include other CZOs.

Funding Support: NSF (IMLCZO)

International Collaboration: No

International Travel: No

Daniel Mettenberg

Email: daniel-mettenberg@uiowa.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 4

Contribution to the Project: undergrad research soil sediment dynamics

Funding Support: U of Iowa

International Collaboration: No

International Travel: No

Jessie Moravek

Email: jessiemoravek@gmail.com

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 5

Contribution to the Project: stream sediment analysis

Funding Support: Other

International Collaboration: No

International Travel: No

Sarah Parcher

Email: sparcher015@gmail.com

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 6

Contribution to the Project: assist well installation data collection data analysis

Funding Support: NSF-EPSCoR

International Collaboration: No

International Travel: No

Kaity Patterson

Email: kpatte21@vols.utk.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 1

Contribution to the Project: Theme B ER and Baseline sample analysis

Funding Support: IML-CZO

International Collaboration: No

International Travel: No

Wei Quan

Email: quanweisdu@gmail.com

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 7

Contribution to the Project: Developed a GIS based approach for developing vegetation indices from Landsat data.

Funding Support: CEE REU Support

International Collaboration: No

International Travel: No

Lorraine Santana

Email: unknown@purdue.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 2

Contribution to the Project: Related to Theme B IML-CZO activities

Funding Support: IML-CZO

International Collaboration: No
International Travel: No

Tiffany Sevilla
Email: tiffanysevilla2015@u.northwestern.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 8

Contribution to the Project: How does IML land use and water drainage influence the diversity and composition of microbial communities

Funding Support: Northwestern Murphy Fellowship

International Collaboration: No
International Travel: No

Bomo Shen
Email: shen-bomo@uiowa.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 0

Contribution to the Project: Cyberinfrastructure

Funding Support: NSF/(IML-CZO)

International Collaboration: No
International Travel: No

Clark Skillman
Email: ClarkSkillman2018@u.northwestern.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 1

Contribution to the Project: Sample preparation

Funding Support: None

International Collaboration: No
International Travel: No

Rachel Tung So
Email: RachelSo2020@u.northwestern.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 2

Contribution to the Project: Sample preparation and FTIR analyses

Funding Support: University

International Collaboration: No
International Travel: No

Jia Jia Wang
Email: jjawang2@illinois.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 4

Contribution to the Project: Collection of cores. Fly ash measurements. Data interpretation. Assistance with NC-GSA field trip.

Funding Support: ISGS

International Collaboration: No
International Travel: No

Joshua John Williams
Email: JoshuaWilliams2016@u.northwestern.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 0

Contribution to the Project: Developed an age model for the Lake Decatur sediment cores

Funding Support: none

International Collaboration: No
International Travel: No

Jake Winters
Email: winters9@purdue.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 1

Contribution to the Project: Undergrad research: soil DOC

Funding Support: Other

International Collaboration: No
International Travel: No

Zhihan Yu
Email: ZhihanYu2014@u.northwestern.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 2

Contribution to the Project: Biomarker analyses of stream organic C

Funding Support: None for salary. This project provided support for the analyses.

International Collaboration: No
International Travel: No

Nina Zhou
Email: YingnanZhou2019@u.northwestern.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 3

Contribution to the Project: Sample preparation, FTIR and EA-IRMS analyses

Funding Support: University

International Collaboration: No
International Travel: No

Dominic John Zona
Email: DominicZona2018@u.northwestern.edu
Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 1

Contribution to the Project: Sample preparation and FTIR analyses

Funding Support: none

International Collaboration: No
International Travel: No

Nicole Gasparini
Email: ngaspari@tulane.edu
Most Senior Project Role: Consultant
Nearest Person Month Worked: 1

Contribution to the Project: Dr. Gasparini has generously shared her expertise in helping us develop new LandLab components and providing guidance in testing/debugging LandLab models

Funding Support: none

International Collaboration: No
International Travel: No

Nicholas Fetty
Email: nick-fetty@uiowa.edu
Most Senior Project Role: Other
Nearest Person Month Worked: 0

Contribution to the Project: conducted interviews, produced video, wrote summaries of research and outreach efforts

Funding Support: NSF IML-CZO

International Collaboration: No
International Travel: No

Yue Zeng
Email: yuezeng2017@u.northwestern.edu
Most Senior Project Role: Other
Nearest Person Month Worked: 0

Contribution to the Project: Analysis of high frequency events observed in Lake Decatur cores.

Funding Support: None for salary. This project provided support for the analyses

International Collaboration: No
International Travel: No

What other organizations have been involved as partners?

Name	Type of Partner Organization	Location
City of Coralville,	State or Local Government	Iowa
Illinois State Water Survey, Prairie Research Institute	State or Local Government	Urbana, Illinois
Purdue University	Academic Institution	West Lafayette, Indiana
United States Geological Survey	State or Local Government	Urbana, Illinois
University of Iowa	Academic Institution	Iowa City, Iowa
University of Minnesota	Academic Institution	Minneapolis, MN
University of Tennessee Knoxville	Academic Institution	Knoxville, Tennessee
University of nebraska-Omaha	Academic Institution	Omaha Nebraska
Utah State University	Academic Institution	Logan, Utah
Illinois State geological Survey-Prairie research Institute	Academic Institution	Champaign, Illinois
Indiana University	Academic Institution	Bloomington, Indiana
Iowa-Cedat Watershed Interagency Coordination Team	State or Local Government	Iowa
LacCore	Academic Institution	University of Minnesota
North Carolina State University	Academic Institution	Raleigh, NC
Northwestern University	Academic Institution	Evanston, Illinois
Pennsylvania State University	Academic Institution	State College, Pennsylvania
Prairie Research Institute	State or Local Government	Urbana, Illinois

Full details of organizations that have been involved as partners:

City of Coralville,

Organization Type: State or Local Government
Organization Location: Iowa

Partner's Contribution to the Project:
Facilities

More Detail on Partner and Contribution: assisted with Watershed Improvement Research Board Tour in Clear Creek Watershed Financial support for buses

Illinois State Water Survey, Prairie Research Institute

Organization Type: State or Local Government
Organization Location: Urbana, Illinois

Partner's Contribution to the Project:
Facilities
Collaborative Research
Personnel Exchanges

More Detail on Partner and Contribution:

Illinois State geological Survey-Prairie research Institute

Organization Type: Academic Institution
Organization Location: Champaign, Illinois

Partner's Contribution to the Project:

Facilities
Collaborative Research
Personnel Exchanges

More Detail on Partner and Contribution:

Indiana University

Organization Type: Academic Institution
Organization Location: Bloomington, Indiana

Partner's Contribution to the Project:

Facilities
Collaborative Research
Personnel Exchanges

More Detail on Partner and Contribution:

Iowa-Cedat Watershed Interagency Coordination Team

Organization Type: State or Local Government
Organization Location: Iowa

Partner's Contribution to the Project:

In-Kind Support
Facilities

More Detail on Partner and Contribution: Workflows for specific tasks in the Clear Creek IML-CZO were developed through a funded project for the Interagency Team by the Institute for Water Resources of USACE.

LacCore

Organization Type: Academic Institution
Organization Location: University of Minnesota

Partner's Contribution to the Project:

Facilities

More Detail on Partner and Contribution: The LacCore facility was used to analyze Lake Decatur cores for magnetic susceptibility, porosity and color.

North Carolina State University

Organization Type: Academic Institution
Organization Location: Raleigh, NC

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: Prof. Leithold's group at NCSU assisted with the Lake Decatur sedimentology.

Northwestern University

Organization Type: Academic Institution
Organization Location: Evanston, Illinois

Partner's Contribution to the Project:

Facilities
Collaborative Research
Personnel Exchanges

More Detail on Partner and Contribution:

Pennsylvania State University

Organization Type: Academic Institution
Organization Location: State College, Pennsylvania

Partner's Contribution to the Project:

Facilities
Collaborative Research
Personnel Exchanges

More Detail on Partner and Contribution:

Prairie Research Institute

Organization Type: State or Local Government
Organization Location: Urbana, Illinois

Partner's Contribution to the Project:

In-Kind Support
Facilities
Collaborative Research
Personnel Exchanges

More Detail on Partner and Contribution: Illinois State Geological Survey and Illinois State Water Survey, which are part of PRI, are strong partners in the IMLCZO effort. Several personnel from PRI are directly or indirectly engaged in IMLCZO effort in field activities and scientific investigations.

Purdue University

Organization Type: Academic Institution
Organization Location: West Lafayette, Indiana

Partner's Contribution to the Project:

Facilities
Personnel Exchanges

More Detail on Partner and Contribution:

United States Geological Survey

Organization Type: State or Local Government
Organization Location: Urbana, Illinois

Partner's Contribution to the Project:

Facilities

Collaborative Research
Personnel Exchanges

More Detail on Partner and Contribution:

University of Iowa Organization Type: Academic Institution Organization Location: Iowa City, Iowa Partner's Contribution to the Project: Facilities Collaborative Research Personnel Exchanges More Detail on Partner and Contribution:

University of Minnesota Organization Type: Academic Institution Organization Location: Minneapolis, MN Partner's Contribution to the Project: Facilities Collaborative Research Personnel Exchanges More Detail on Partner and Contribution:
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University of Tennessee, Knoxville Organization Type: Academic Institution Organization Location: Knoxville, Tennessee Partner's Contribution to the Project: Facilities Collaborative Research Personnel Exchanges More Detail on Partner and Contribution:
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University of nebraska-Omaha Organization Type: Academic Institution Organization Location: Omaha Nebraska Partner's Contribution to the Project: Financial support More Detail on Partner and Contribution:
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Utah State University Organization Type: Academic Institution Organization Location: Logan, Utah Partner's Contribution to the Project: Facilities Collaborative Research Personnel Exchanges More Detail on Partner and Contribution:
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What other collaborators or contacts have been involved?
Nothing to report

Impacts

What is the impact on the development of the principal discipline(s) of the project?

The baseline sampling and ER (enrichment ratio) experiments is helping us tease out how IMLs respond under different management practices and hydrologic forcings. The monitoring of dynamic enrichment ratios is key to quantifying the lateral transport of carbon, which is a neglected term in many carbon budgets. IMLs have the potential of storing high amounts carbon, but first the lateral fluxes must be determined accurately. Moreover, the enrichment ratio can help us capture the connectivity issue between the landscape and the stream as well as address the key question related to SOM transport dynamics. Due to the unique correspondence of the enrichment ratio with soil texture, bulk density, the enrichment ratio has been used as a method to determine sources of organic matter and for performing event-based dynamics of carbon budgets across sites. Quantifying dynamic indices like ER or Ksat are extremely useful as they reflect better the impacts of agricultural management. Dynamic indices are better suited to assess functionality and sustainability of an agroecosystem than the static, or slow-changing, soil characterization parameters that more accurately reflect long-term interactions between landscape features, climate, and biology. Dynamic indices reflect the response of the agroecosystem on similar time scales as the dominant drivers of climate and management to provide a more complete accounting of sustainability.

Our findings allow scientists and modelers to conceptualize and implement models for estimating water, sediment, and nutrient fluxes at different spatial and temporal scales. The influence of roughness evolution at the grain scale, as well as fluxes at the plot scale under different management practices and hillslope location/characteristics can be better represented and linked based on the plot experiment results. Travel times from plot to watershed scales, as well as the origin of flux material, can also be taken into account in when determining changes in flux propagation along a flow path from a point to the watershed outlet. These are also based on the outcomes of the plot, dye, radionuclide/ REE sourcing, and tile flux monitoring experiments. The findings so far provide an aggregated measure of the connectivity between the different parts of the landscape, as well as between the landscape and the channel. These can be incorporated into the estimation of the sediment delivery ratio as a function of not only drainage area (space) but also a function of time. The sediment delivery ratio can be seen as a reflection of the connectivity on the landscape. The changes in travel times and sediment delivery ratio over the course of a growing season, as we have found, both reflect the amount of places along the landscape where water, sediment, and nutrients can be retained. Other scaling laws and rating curves can benefit from the findings by incorporating the influences of travel times and sediment delivery.

New methodology is being developed to study labile and inert SOC which is supporting the development of a new conceptual framework for evaluating the rates of SOC accumulation, erosion and weathering, and identifying their dynamic connections from the weathering zone into the deep critical zones or between different landscapes. A new distributed numerical model that combines landscape evolution with carbon transformation through the vertical column and surficial transport is being developed that better predicts the downslope vertical profiles of carbon.

Further, models that predict the age and concentration of N through the landscape and its efflux from tile drains has been developed. The theory of age-concentration of inorganic nitrogen and the supporting spatially distributed predictive model is likely to have a significant impact in informing precision management practices.

What is the impact on other disciplines?

The CZO program is interdisciplinary by nature. Two central components are the following: (1) to develop a unifying theoretical framework that integrates new understanding of coupled hydrological, geochemical, geomorphological, sedimentological and biological processes; and (2) to develop, couple and validate system-level models to predict how the critical zone responds to external forces such as anthropogenic, climatic, and/or tectonic processes. The processes driving the water-sediment-nutrient budgets are co-evolving but have really only been examined in isolation. We have started synthesizing the knowledge that IMLCZO brings together to develop a unified understanding of human impact on landscape in glaciated landscapes.

What is the impact on the development of human resources?

Due to the interdisciplinary nature of the CZO program, students are working on research topics with co-mentoring across departments and institutions. A good example is the regular meetings between the Papanicolaou's and Filley's groups at UTK and Purdue, respectively. These meetings are allowing the students to see the co-evolution of short-term (event-based) mechanisms like erosion and management affect the long-term (decades) stabilization mechanism of soil carbon. Another example is Papanicolaou's effort to get his students co-advised jointly with Bruce Rhoads at UIUC. This exposure to other schools of thought will open new avenues to explaining how systems of interrelated processes with multiple feedbacks function.

Filley's group and Kumar's groups have also met several times in person and through web conferencing. The students in the two groups communicate on a regular basis and visit with each other. Some of Kumar's students have Filley and Papanicolaou on their PhD committees that fosters further inter-disciplinary growth of the students.

During the past four years over 140 different individuals including senior personnel, graduate and undergraduate students have participated in IMLCZO activities. Further, IMLCZO has contributed substantially to the K-12 E&O programs, both formal and informal. In addition, effort is underway to reach a broader community in partnership with UIUC Extension Program.

What is the impact on physical resources that form infrastructure?

A 25-m tall flux tower is operational in USRB (Illinois) that is allowing an estimation of ecosystem scale fluxes in agricultural landscapes. Other existing towers generally at low heights (10m) allowing field scale estimates. A number of field sensors have been deployed and are in continuous operation both in USRB (Illinois) and CCW (Iowa).

What is the impact on institutional resources that form infrastructure?

We now have an operational total organic carbon-isotope ratio monitoring (TOC-IRMS) capability in the Filley lab. There are only a handful of such devices in the US. This instrument purchase and subsequent development was funded in part by a supplement to the IML-CZO award.

What is the impact on information resources that form infrastructure?

The IMLCZO data portal provides a sophisticated CyberInfrastructure for data management, that draws upon our our from IML as well as several other technology projects. This portal is being explored as possibility for hosting data for other observatories in discussion with data managers from other observatories. This is being evaluated along with the option of HydroShare by CUAHSI among others.

What is the impact on technology transfer?

With our developed network of collaborations in China we have been working to cross-fertilize the IML-CZO program with technology being used in the CZO sites in China. This includes analytical methods for microbial necromass abundance measures. Our colleagues in China are seeking to learn how to utilize the recently developed TOC-IRMS capability as well as standard tools like lignin extraction and analysis. In partnership with IEE/CAS (Institute of Earth Env./ Chinese academy of Science) we have established a sister sites in CLP (Chinese Loess Plateau) where we are directly influencing the design and measurement to enable comparative study. Since CLP exists in steep (albiet loess) topography, it offers a contrasting environment to enable broader generalization of the science learned at IMLCZO.

What is the impact on society beyond science and technology?

Conservation programs have helped slow, and in some cases reverse, the trend of IMLs becoming transporters. The IML-CZO can provide a more comprehensive scientific underpinning of the management strategies geared toward preserving or rebuilding healthy soil environment. Rebuilding SOM, especially the more recalcitrant carbon, is central to reducing erosion, improving water holding capacity, and increasing soil quality, thus making IMLs more resilient. This study can lead to the development of watershed management plans that promote sustainable agriculture and ecosystem services through teaching, training, and learning towards environmental literacy and land stewardship.

Changes/Problems

Changes in approach and reason for change

The items below are not significant changes but more enhancement of what we had targeted.

- We have added a significant component to two E&O effort. First we have engaged with UIUC's Extension Program to develop two online courses that reaches out to Crop Advisor's for thrier certification. Second, we have engaged with the school districts of Champaign and Urbana to enhance their curricular efforts. We have strategically installed a weather station in a farm, that students use for their studies. The data from the weather station is directly accesible to the students in middle and high school classrooms and the teachers are building a curriculum around these data.

- Our international effort with China has gained significant momentum. We are partnering with them to apply the models developed in IMLCZO to Chinese Loess Plateau, and informing them about data collection efforts. Henry Lin from our team has a partial appointment in IEE/CAS and is spearheading this effort. Praveen Kumar has recently been appointed as Guest Professor to further facilitate this collaboration. Praveen Kumar and Henry Lin successfully obtained an EAGER grant to develop this momentum further.

Actual or Anticipated problems or delays and actions or plans to resolve them

- One aspect of the project, which is to conduct detailed field studies of connectivity pathways in the USRB that can be linked to results of sediment tracing studies have been frustratig because of withdrawal of landowner permissions to access some important field sites. This withdrawal reflects changes in decision-making authority within landowner families, namely, the death of heads of households. We are seeking alternative field sites that can appropriately represent the site to which we no longer have access.

Changes that have a significant impact on expenditures

We have approximately \$689K underspent funds accumulated over the past four years. We expect that we will request a no-cost extension at the end of year 5. An explanation for the underspending and plans to manage that is presented below.

- Univ. of Tennessee has had about 32% underspending of its cumulative total during the past 4 years. The primary reason for the unspent funds relate to the move of Thanos Papanicolaou from the University of Iowa to the University of Tennessee. The move delayed for nearly 2 years the recruitment of a second dedicated student to complete the work related to Themes B and D in the original proposal. Those individuals who picked up the slack of the missing student were unable to be charged to the project as they were receiving funding from other sources (e.g. IGERT scholarships, teaching assistantship) or in a different pay schedule. Ben Abban, one of the student with Thanos is graduating with PhD and will continue as a postdoc on the project. The underspending has created an opportunity to hire Ben. This addition of a postdoc will allow us to bridge crucial gaps in our understanding of sediment transport processes and microtopographic variability. He will work jointly between Univ. of Tennessee and Univ. of Illinois. Two graduate students will also be supported during this period who will focus on connectivity studies (using rare earth elements) and aggregate dynamics.

- Northwestern Univ. has had about 32% underspending of its cumulative total during the past 4 years. At NU personnel is significantly underspent because a PhD student had not joined the project. Work has been performed through undergraduate students, and analyses have almost kept pace with what was projected despite not having a graduate student dedicated to the project for yrs 1-4 and the fact that it took a year to get the ISCO sampler network up and functioning at CCW. We now have a PhD student in Env Eng (Jieun Kim) who arrived this fall and is supported on a fellowship and who will start on the project in 2018. She will specifically be doing the organic geochemistry of the stream samples so that we can compare stream sample POC (particulate organic carbon) to the analyses that Tim Filley (Purdue) has done on the soils. We expect this student to help integrate across Northwestern Univ., Purdue and Indiana Univ. A small amount of funds (\$28K) are being transferred to UIUC to cover for field work and technician support during year 5 and possible no-cost extension period.

- Univ. of Iowa has had about 12% underspending of its cumulative total during the past 4 years. Art Bettis, lead personnel at Univ. of Iowa and a Co-PI is retiring at the of June 2018. He will continue to support the IMLCZO effort until end of Yr 5 (Nov 2018). Funds are allocated for this support and some funds are being re-purposed to continue the E&O activities. During the coming year our team will focus on developing on-line resources for CZO-based STEM units for K-12 teachers.

- Indiana Univ. has a 20% underspending of its cumulative total during the past 4 years. This is due to the mid-project move by Adam Ward to Indiana University. The expense trajectory is on track to support student/postdoc for accomplishing the projected targets of the project.

- Univ. of Illinois has a 5.6% underspending of its cumulative total during the past 4 years. These funds along with the small amount of transfers from Northwestern Univ. and Univ. of Iowa will be used to provide support to field technicians, data management effort, and student and postdoc support to support the project and complete modeling and synthesis efforts that are essential to develop an integrated perspective about IMLCZO.

- At UIUC we had initially budgeted \$34,500 towards participant support cost in Yr 5. Based on our projected needs, we are requesting that this be reduced to \$14,500. The remaining \$20K will be reallocated towards E&O, technical support or support for student/postdoc as needed.

- At Purdue Univ. and PennState Univ. we had budgeted \$20K and \$8K, respectively, towards participant support cost in yr 5. We were expecting to use these funds for international engagement. We believe that we have significant momentum towards these goals. We are requesting that we be allowed to convert this to regular budget items to support students/postdocs and laboratory analyses.

An indication of expenses so far and request for Year 5 budget is included in the attached pdf portfolio document (in Part 4). Since only four separate pdf files are allowed to be uploaded, the budget had to be combined with the other documents.

Significant changes in use or care of human subjects

Nothing to report.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use or care of biohazards

Nothing to report.