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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:	1360760
Project Title:	Development of a Critical Zone Observatory National Office
PD/PI Name:	Louis A Derry, Principal Investigator Timothy S White, Co-Principal Investigator
Recipient Organization:	Cornell University
Project/Grant Period:	05/01/2014 - 04/30/2018
Reporting Period:	05/01/2014 - 04/30/2015
Submitting Official (if other than PD\PI):	Louis A Derry Principal Investigator
Submission Date:	07/28/2015
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	Louis A Derry

Accomplishments

* What are the major goals of the project?

The major goals of the Critical Zone Observatory National Office (CZO-NO) are

1. *Maintain and enhance communication among the CZOs and between the CZOs and the larger science community.*
We seek to establish and maintain effective mechanisms for communication and decision-making within the CZO network. We also seek to communicate the rationale for, nature of, and results from CZO research to the broader science community.
1. *Develop mechanisms to promote network level science activities, including questions, tools, techniques and concepts.*
This includes science questions that can or must be addressed at the level of part or all of the broader CZO network. It also includes the development of a common set of approaches to experimental design and data collection across the CZO network.

1. 3. *Developing education and outreach activities that will explain the importance of Critical Zone research to a broad audience, influence Earth Science education about the Critical Zone, and facilitate training of the next generation of Critical Zone scientists.* The Critical Zone Observatory network offers a range of opportunities for discussion about how science works and why it is relevant to the public interest. The “local” nature of critical zones makes the CZ concept well suited for interaction with the public, and an ideal platform for place-based, hands-on education.
1. 4. *Promoting collaboration between the U.S. CZO community, other U.S. environmental observing networks, and international CZ programs.* The Critical Zone concept has rapidly gained the attention of science communities around the world, and there is a growing international network of CZ scientists and study sites. There are other ongoing U.S. initiatives that are closely related to the CZO program, including the LTER, CUAHSI and NEON programs. The CZO-NO will seek to be a point of contact between the CZO community and other national and international programs.

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

Major Activities:

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- *Communication*

Under the general heading of communication, The CZO-NO initiated the establishment of the Network Executive Committee (NEC). We moved to establish the NEC when it became apparent that the expanded size of the PI group made it inefficient in dealing with a range of routine issues during the monthly PI telecons. We drafted a charter, circulated it, made modifications based on feedback from the PIs, and implemented the NEC. NEC membership consists of five individuals: the CZO-NO Director (Derry) and Program Coordinator (White), the PI Committee Chair (Richter) and Chair-elect (Lohse), and the Steering Committee Chair (Grant). The first NEC meeting was April 22, 2015. The NEC now meets monthly via teleconference.

CZO Newsletter: We established a quarterly CZO Newsletter beginning Q1 2015 that is distributed via CZEN.org and criticalzon.org.

- *Network level science:*

An important result has been the identification and funding of cross-site science working groups within CZO framework. At the CZO All Hands meeting in Tenaya (September 21-24, 2014) a number of informal thematic working groups emerged based on cross-site science questions emerged. At that time the NO decided to invite proposals to fund cross-site working group interactions. We received seven proposals by October 31, and supported five of these using funds from the SAVI award. Two other groups did not submit a proposal to the NO but instead set up interactions through alternative funding sources, making a total of seven active cross-site science groups. Each of these groups has had numerous virtual interactions, with face-to-face meetings planned for summer or fall 2015. The groups each reported out to the Annual Meetings at AGU (December 2014) and at IML (May 2015).

- *Education and outreach activities:*

As outline in the proposal, the CZO-NO led the establishment of a CZO cyberseminar series. The first event was held prior to AGU on December 8, 2014.

The CZO-NO organized multiple activities around the Fall 2014 AGU meeting to:

- facilitate within-CZO interaction and business. The CZO PIs, NO and NSF met on December 17 (summary below).
- facilitate international cooperation. The CZO-NO arranged a pre-AGU meeting between NSF staff, CZO PIs, and international scientists to discuss international cooperation in CZ science, December 13-14.

- raise the profile of the CZO program with the broader science community. The CZO-NO held an AGU Town Hall meeting at lunch on December 16. Approximately 175-200 people attended the meeting.
- held a social event for organic geochemistry/microbiology of the CZ at AGU, following the oral session "Thresholds in Soil Response to Global Change".
- Maintained CZO booth at AGU
- Supported the Graduate Research Group by sponsoring an evening social hour for all early career CZ scientists, mostly CZO postdocs (current or recent) and graduate students.

The CZO-NO began the development of virtual instructional materials, known as Virtual Field Experiences (VFEs). A demonstration project used materials gathered during the field trip to the Southern Sierra CZO in September. This was presented to the PIs at the AGU breakfast meeting. Additional development is under way at other CZOs (SSCZO, Calhoun), and through the Shale Hills CZO and Stroud Water Research Center REU/RET program.. For an example see https://prezi.com/eq3oinqxzuw3/southern-sierra-czo-vfe/?utm_campaign=share&utm_medium=copy (takes a minute to load).

- *Promoting collaboration with other U.S. and international science programs:* The CZO-NO Director met with leaders of three major European critical zone programs at the GES-10 Meeting (Geochemistry of the Earth's Surface) at IPGP, Paris, August 2014. These were SoilTrEC, eLTER, and RBV. We specifically discussed ways to establish student exchanges. Support from the CZO-NO helped the eLTER (European Long Term Ecosystem Research Infrastructure) receive a substantial award from the EC Horizon 2020 program effective June 2015 - May 2019.

- The CZO-NO Director and Coordinator met with the Directors of CUAHSI (Rick Hooper) and LTER NO (Bob Waide) at AGU and by telephone at other times to discuss data system implementation issues. The CZO-NO Director was invited to join the CUAHSI Board of Directors meeting and strategic planning session to be held July 19-20 at Tufts University.

Specific Objectives:

1. Communications
 - 1.1 Maintain and expand teleconferencing activities among PIs, Steering Committee and NSF.
 - 1.2 Work with NSF and Steering Committee to develop new charge and expectations.
 - 1.3 Develop and implement plan for Network Executive Committee.
 - 1.4 Maintain and improve criticalzone.org website. Establish clear relationship between
criticalzone.org and czen.org.
 - 1.5 Establish prominent CZO presence at AGU.
 - 1.6 Represent CZO program at other science meetings.
 - 1.7 Establish CZO newsletter
 - 1.8 Establish CZO researcher profiles

2. Network level/cross-site science activities
 - 2.1 Establish working groups at All Hands Meeting
 - 2.2 Put out call for proposals to fund cross site science workshops.
 - 2.3 Promote efforts to raise funds outside CZO program for cross site science.
3. Education and Outreach
 - 3.1 Disseminate CZ-based learning materials to secondary school teachers.
 - 3.2 Implement REU/RET program
 - 3.3 Prototype Virtual Field Experiences (VFEs) at CZOs
 - 3.4 Organize effort for CZ textbook development
 - 3.5 Plan GSA short course on CZ science for teachers
4. International Collaboration
 - 4.1 Organize CZO - NSF China interaction at AGU
 - 4.2 Attend Southern Hemisphere CZO meeting
 - 4.3 Represent CZO program at GES-10
 - 4.4 Support international scholar program

Significant Results: See uploaded attachment

Key outcomes or Other achievements:

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

Support for the Graduate Research Group allowed them to continue their informal but important networking interactions at national meeting such as AGU and GSA. This group represents the “next generation” of CZ scientists, and has remained engaged and active as some members have gone on to professional positions while new members have become involved. For example, one of the two Powell Center proposals submitted to the USGS on April 30, 2015 was led by two members of this group who recently began assistant professorships. We regard the GRG as a very important aspect of the CZO program, and plan to continue to support them. We do not direct the GRG’s activities, but we do discuss with members regularly.

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

This year we distributed 16000 handouts for high school teachers via AGI. We also held a Town Hall meeting at AGU, and supported a booth at AGU. The Town Hall was well attended. The booth was also heavily visited, and we plan to rent a larger and more visible space for the Fall 2015 AGU meeting. We believe the AGU presence is an important activity, because it is a visible way to advertise opportunities for interaction with the CZO program to a broad set of scientists at all levels.

Both the criticalzon.org and czen.org websites have been updated, and more effectively "cross-talk" to each other. We sent out the first CZO quarterly newsletter via these web sites in Q1 15, and another in Q2 14. We have developed a series of profiles for CZO scientists at all levels and begun posting those to criticalzone.org.

CZO-NO staff have participated in multiple interactions with scientists from outside the CZO core network. Informal interactions range from phone calls and emails with scientists with questions about how to engage with the CZO program, to postdoctoral and graduate student inquiries. We believe the informal interactions are important. We have also participated in international meetings and represented the US CZO program there, including the Southern Hemisphere CZ meeting in Perth, 2014, and the Geochemistry of the Earth's Surface meeting (GES-10) in Paris, August 2014. The GES-10 meeting was

entirely dedicated to Critical Zone science. At that meeting the NO Director (Derry) was involved with leaders of several European CZ groups in planning for future activities and meetings, and was asked to provide letters of support to two EU CZ-related proposals. He also met with Chinese CZ scientists who will be hosting the next GES meeting in 2017. In September 2014 Derry attended a planning symposium at the Konza Prairie LTER site with participants from several universities and government agencies to explore the possibility of adding a Konza CZO site to the network.

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

1. Network Strategic Planning

One of our most pressing goals for this coming year is to work with the CZO PIs to develop a CZO Network Strategic Plan to carry us through 2018. It has become clear that different parts of the CZO community do not have exactly the same vision of what the larger CZO network can and should accomplish, and how the various tasks should be prioritized.

The CZO community needs to identify the most important goals for the next three years and design a strategy to meet them. Once we have identified those goals we can address the questions of the necessary time frame and the order in which they can be accomplished. We can further identify who will be responsible for a given task, as well as develop some project milestones and timelines. This process should provide a road map for the CZO Network and will define the goals for the National Office in a way that is built on community input.

The National Office will lead a strategic planning process for the CZO Network. We have already begun this discussion with the PI community, and they are very supportive. We have started a Google doc to collect ideas and input, and are developing a schedule of virtual meetings to move the planning process forward. We plan to hold a two day face-to-face planning workshop in Fall 2015, and are actively considering hiring an outside facilitator for this process.

2. Working groups

In our view the working groups are proving to be highly effective. We will continue to monitor and participate (where appropriate) in the CZO cross science working groups. In 2016 we may have additional funds available through the SAVI program to fund additional or new interactions of this type. The pending Powell Center proposal may provide additional funds to one or two of the working groups.

3. Research instrumentation

As planned, we are working on a proposal to NSF EAR Instrumentation and facilities to obtain a LiCOR CO₂ soil gas exchange monitoring system. Such a system could be deployed campaign style at CZOs, and used to obtain soil gas exchange data from a variety of sites. These data would be complementary to eddy flux tower data, as the planned system measures soil CO₂ efflux directly. This proposal would be in collaboration with Calhoun PI Dan Richter. A decision on when to submit has not yet been made.

4. We did not hire postdoc this year as originally planned. We expect to in the coming weeks. This individual will work on cross site science questions (the exact nature of which will depend on the postdoc's interest and expertise), and on developing social media tools for the CZO program.

5. We expect to build social media interaction into the CZO communication system this year. In particular we plan to focus on developing a Twitter feed to bring attention to new CZO results as they become available. We will work with science journalism students in the Dept. of Communication at Cornell to better understand how we can effectively bring CZO science results to the attention of science journalists.

6. Connected to the effort to reach out to journalists and the broader public, we will encourage development of non-technical science result articles from the CZO community. The CZO-NO currently employs a part time write who has experience in producing non-technical articles of varying lengths on environmental science issues. What we will need is the input and cooperation of CZO scientists and students, but this should be to everyone's advantage. Once we have these pieces, we will use the social media tools to increase their distribution. These may range from one page summary of recent results at a CZO, to longer articles intended for popular science journals such as Scientific American, Geotimes, Science News, Discover and others.

7. We expect to move more routine decision making to the NEC, and plan on monthly teleconferences following the long-standing PI teleconferences

8. There are several levels of website upgrades that we are considering, depending on funding availability:

Content - Ongoing work to fill gaps, improve quality, etc.

Maintenance - technical updates, bug fixes, answering questions, general communication.

Search - add search box on every page, National pages to include cross-CZO search.

Nacigation - Some readjustments to navigation and menus (required to make space for Search box).

Educ/Outreach - finish the existing "hands on" portions of educ/outreach.

Home Page - redesigned home page to shorten listings, tell more of "story", add flexibility.

Performance - faster site speed for easier content entry and better viewing experience.

Newsletter Signups - create signup to an email list of folks interested in receiving CZO communications

Twitter feed – create Twitter account that will send notification of new CZO content with links to website.

Additional “stretch goals” for year 2 and future years (some require additional support):

DEV WORKFLOW - set up development server, Git version control (faster, safer coding).

INTERFACE IMPROVEMENTS - Many ways to improve functionality (build on Bales' comments)

CZO REPORTING - an idea proposed by Luquillo (M. Leon) to improve the website so it can be used to organize and track information for NSF reports.

PROTOCOLS - consider how the CZO website can help K Lohse's effort on supporting the discussion and creation of protocol content that can be widely distributed

GROUP COLLABORATION - implement some tools to help working groups, maybe third-party tools?

EDUC/OUTREACH - support efforts by CZO-NO collaborators, ie virtual field experiences.

SOCIAL MEDIA - encourage and support more experiments by more CZOs (ie Twitter, Facebook)

PHOTO & VIDEO GALLERY - new pages that bring galleries together.

9. We will use SAVI funds to support graduate students and postdocs to participate in international collaborations, as available and discussed above.

10. We will support a CZ workshop/field school during the summer 2016. The exact nature of that workshop will depend on the outcome of a number of ongoing discussions with three PIs and the rest of the CZO community. For example, we used SAVI funds this year to support the working groups, and that represents a change from the original plan for the use of those funds. We wish to be able to respond dynamically to the needs of the CAZO program.

11. Webinars – the CZO webinar series appears to be well attended, and there were proposal at the IML meeting to develop a monthly CZO-wide presentation. We will continue to support and solicit webinar presentations for the CZO, and make these available via criticalzone.org and czen.org.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
criticalzone-org traffic 2014 - april 2015.pdf	Traffic analysis map fro criticalzone.org website visits, 2014-15.	Louis Derry	05/13/2015

Filename	Description	Uploaded By	Uploaded On
CZO structure diagrams ver 2a.pdf	Schematic of CZO governance structure proposed spring 2015. The NEC (indicated as CZO Executive Committee) was established April 2015.	Louis Derry	05/13/2015
PRI CZO 2014-2015.pdf	Description of PRI staff activities for E&O activities for CZO-NO	Louis Derry	05/14/2015
Significant Results CZONO 2014-15.pdf	Replaces Significant Results section of previous report	Louis Derry	07/28/2015

Products

Books

Book Chapters

Inventions

Journals or Juried Conference Papers

Licenses

Other Conference Presentations / Papers

Duggan-Haas D, Ross R, Derry L, White T, (2014). *Virtual Fieldwork and Critical Zone Observatories as Vehicles for Teaching "Three Dimensional" (NGSS) Science*. ED53E-08.. AGU Fall meeting. San Francisco. Status = PUBLISHED; Acknowledgement of Federal Support = No

Other Products

Other Publications

Patents

Technologies or Techniques

Thesis/Dissertations

Websites

Critical Zone Exploration Network website

<http://www.czen.org/>

website for outreach to broader CZO community

Critical Zone National website

<http://criticalzone.org>

main web site for US CZO network

Southern Sierra VFE

http://virtualfieldwork.org/A_VFE_Database.htm

Multimedia demonstration of the VFE concept based on September CZO field trip. When accessing site, click the placemark in Central California.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
Participants Int. CZO AGU 2014.pdf	Participants at International CZO Meeting AGU	Louis Derry	07/28/2015
Revised Agenda Konza CZO workshop v3.pdf	Konza workshop agenda	Louis Derry	07/28/2015
Brantley et al., 2015 EOS.pdf	EOS article reporting on International meeting	Louis Derry	07/28/2015
CZNews_Q1_Q2_2015.pdf	Both Q1 and Q2 2015 editions of CZ Newsletter	Louis Derry	07/28/2015

Participants/Organizations**What individuals have worked on the project?**

Name	Most Senior Project Role	Nearest Person Month Worked
Derry, Louis	PD/PI	2
White, Timothy	Co PD/PI	3
Duggan-Haas, Don	Other Professional	1
Lubinski, David	Other Professional	1
Ross, Robert	Other Professional	1
Copman, Linda	Other	1

Full details of individuals who have worked on the project:**Louis A Derry**

Email: lad9@cornell.edu

Most Senior Project Role: PD/PI**Nearest Person Month Worked:** 2**Contribution to the Project:** Project Director**Funding Support:** NSF**International Collaboration:** Yes, Greece**International Travel:** Yes, France - 0 years, 0 months, 7 days**Timothy S White**

Email: tswwhite@essc.psu.edu

Most Senior Project Role: Co PD/PI**Nearest Person Month Worked:** 3**Contribution to the Project:** Project Coordinator

Funding Support: NSF

International Collaboration: Yes, United Kingdom

International Travel: No

Don Duggan-Haas

Email: dugganhaas@gmail.com

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 1

Contribution to the Project: co-responsibility for outreach and education programming, develop VFE modules

Funding Support: NSF

International Collaboration: No

International Travel: No

David Lubinski

Email: david.lubinski@colorado.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 1

Contribution to the Project: responsible for web site maintenance and development

Funding Support: NSF

International Collaboration: No

International Travel: No

Robert Ross

Email: rmr16@cornell.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 1

Contribution to the Project: co-responsibility for outreach and education programming

Funding Support: NSF

International Collaboration: No

International Travel: No

Linda Copman

Email: lsc49@cornell.edu

Most Senior Project Role: Other

Nearest Person Month Worked: 1

Contribution to the Project: Administrative assistance. Write who developed scientist profiles for CZO web site

Funding Support: NSF

International Collaboration: No

International Travel: No

What other organizations have been involved as partners?

Name	Type of Partner Organization	Location
Paelontological Research Institution	Other Nonprofits	Ithaca, NY
University of Colorado	Academic Institution	Boulder, CO

Full details of organizations that have been involved as partners:

Paelontological Research Institution

Organization Type: Other Nonprofits

Organization Location: Ithaca, NY

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution:

University of Colorado

Organization Type: Academic Institution

Organization Location: Boulder, CO

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution:

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 goals of the project include making it facilitating means for scientists from different CZOs to work together on questions that are broader than can be answered at any one study site. We are specifically supporting mechanisms that we believe will make that goal easier to achieve.

What is the impact on other disciplines?

The project is by its very nature interdisciplinary. By developing the cross site working groups, the project is supporting the integration of hydrology, geochemistry, ecosystem biology and pedology.

What is the impact on the development of human resources?

Support of both the Graduate Research Group and the cross site working groups is putting graduate students and postdocs into communication and collaboration with senior scientists, other postdocs and other graduate from around the CZO network. These groups provide outstanding opportunities to broaden the experience of young scientists and to make connections with others that may impact their careers over time.

What is the impact on physical resources that form infrastructure?

Nothing to report.

What is the impact on institutional resources that form infrastructure?

Nothing to report.

What is the impact on information resources that form infrastructure?

The CZO-NO is working to enhance the function of the core web sites that serve the Critical Zone community. We are developing tools to make it easier to share information and collaborate virtually.

What is the impact on technology transfer?

Nothing to report.

What is the impact on society beyond science and technology?

Nothing to report.

Changes/Problems

Changes in approach and reason for change

1. We established the Network Executive Committee after it became apparent the monthly PI meetings involved too many people to efficiently deal with some issues.
2. We spent a lot of time on the question of how to advance the CZO data initiative. It became quite clear over the course of fall 2014 that many PIs, we at the NO, and NSF staff had concerns over the state of the CZO data system project. What was less clear was whether those concerns reflected a communications breakdown or something else. We spent considerable time discussing the issue with various stakeholders as well as with outside groups like CUAHSI and LTER who have experience dealing with data issues. Eventually we organized presentations for the PIs at AGU and IML, as well as working with Anthony Aufdenkampe to present a CZO webinar on the data system project in January. The CZO data system is clearly vitally important for the success of the overall project, and yet there was no functioning mechanism that was getting the PIs and the data system developers to communicate effectively. Despite some difficult moments we think progress has been made on that front.

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

3. We did not hire a postdoc this past fall (2014) as the initial candidates did not seem to be a good fit. Once we moved into 2015 there were other more pressing issues that took our attention. We expect to proceed with a hire this summer (2015). We can see a number of ways in which a person in this position can be a real asset to the NO, and to the cross site science issues.

Changes that have a significant impact on expenditures

3. As noted above, we expect to hire a post doc very soon. The original budget had the postdoc position at 100% in year 1, and 75% in year 2. We are rolling over uncommitted funds to year 2 to cover the postdoc salary 100%
4. We did hire a part time writer who developed the new CZO scientist profiles now appearing on criticalzone.org. Now that she is more familiar with the CZO she will be able to help in other ways, including potential work on proposals to foundations and other outside sources of funding for E&O activities. She also will work on non-technical summaries of CZO research and articles from the popular science press. We had a discussion of how the PIs might take advantage of this capability at the most recent PI meeting in Illinois.
5. We increased our budget allocation for web site development as the initial budget for year 1 was low. That permitted additional work on criticalzone.org and czen.org, and has helped improve connectivity between the two, as well as add some more features to criticalzone.org.
6. We used SAVI funds initially intended for one large summer workshop to instead fund five different cross site science working groups.
7. We have already rented a larger booth space at AGU for the Fall 2015 meeting (it saves money to do it well in advance), and so increased our AGU budget for this year and next. The amount we had budgeted was insufficient to cover all the costs this past year.
8. We need to identify funds to pay for the participation of the Steering Committee in the CZO meetings. That was not part of the solicitation, proposal, our initial charge or budget, but we recognized the need to facilitate SC participation and decided to take it on. We will work with NSF to identify funds for this purpose.

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.