December 2018

Continental-Limnology Project[1] Policy:
Project personnel activities, responsibilities, and expectations[2,3]

This document is intended to help foster interdisciplinary collaborations and to more effectively set expectations across disciplines and across career stages. However, it has also well-served our team to facilitate important conversations about philosophical differences regarding the roles of scientists at all career levels within disciplines both within and across institutions. Please see Cheruvelil et al. 2014 for more information and further justification for the advantages of creating a policy such as this for other team and group efforts. Another important impetus for this document is to ensure that there is equity in project work across graduate students and post-docs on the CSI-Limnology project across institutions and disciplines.

This is an ambitious project that requires a wide range of disciplinary and technical expertise and very efficient collaboration among team members. Our current team includes approximately > 20 researchers with aquatic ecology, biogeochemistry, landscape ecology, computer science, statistics, ecoinformatics, and macrosystems ecology expertise, as well as technical expertise in GIS, spatial modeling, and database management. Due to the size and nature of the project, it has critical needs in the area of project management, student and post-doc mentoring, and facilitation of effective collaborative research interactions. We use and expand on project management strategies that we have employed in past projects as a guide for this project, with a focus on transparent and fair interactions across team members, frequent communication, clear goals and objectives for each participant, and active engagement of all personnel.

We have a very inclusive policy for project participants. We define project participants as any individual (PI, senior personnel, staff or student) who was part of the 2016-2021 grant, in addition to those individuals who have joined the project part-way through the grant timeline and are funded by the grant. We expect all project participants to be full collaborators and contributors on the project. In addition, we feel that early-career scientists should be involved in all aspects of the research project that co-PIs and senior personnel are involved in, including collaborations and interactions with project participants outside of their home institution as much as possible; in addition, we hope to provide leadership opportunities for early-career scientists for various aspects of the project. We also recognize the challenges of conducting interdisciplinary research. Therefore, we try to make clear our expectations for all individuals on our project while retaining flexibility to accommodate different levels of involvement both within and across disciplines. Below we describe general expectations for all project participants.

General expectations of all project participants

<u>Project communication and file sharing</u>

- Communicate in a respectful and inclusive fashion
- Participate in monthly video-conference calls
- Attend the annual week-long all-hands project workshop
- Participate in video-conference calls for sub-team project efforts or manuscripts

---

[1] CURRENT PROJECT: MSB: A macrosystems ecology framework for continental-scale prediction and understanding of lakes, 2016-2021. PI's: P.A. Soranno, K.S. Cheruvelil, C. Gries, E.M. Hanks, N.R. Lottig, E.M. Schliep, E.H. Stanley, P.-N. Tan, T. Wagner, J. Zhou. EF-1638679; EF-1638554; EF-1638539; EF-1638550
PRIOR PROJECT: The effect of cross-scale interactions on freshwater ecosystem state across space and time. PI's: *P.A. Soranno, K.S. Cheruvelil, E.H. Stanley, J.A. Downing, N.R. Lottig, P-N. Tan. NSF, Emerging Frontiers Division, Macrosystems Biology Program. 2011-2016.* Awards: 1065786, 1065818, 1065649

[2] For the purposes of this policy document, "early-career scientists" refers to post-doctoral researchers and graduate students.

[3] This policy document was first drafted by participants of the CSI-Limnology Project (www.csilimnology.org) during 2012 and has been subsequently revised to reflect the needs and perspectives of the team. This policy should be viewed as a living document that changes over time to reflect changing team membership, project goals, and effective strategies for collaboration.

- Join Dropbox and Google-drive for project file sharing, add/remove files as needed, and name files clearly
- Present 'product or analysis' plans to the team early in the planning phase via monthly vide-conference calls to ensure complete communication
- Solicit 'product or analysis' collaborators/co-authors by distributing the Continental-limnology co-authorship memo to the group early in the planning phase
- Post any presentation related to the Continental-Limnology project (and the associated abstract) on Dropbox in the 'manuscripts-presentation' sub-folder for the year of the presentation.
- Place the citation for all activities related to CSI-Limnology that should be recorded for the annual report to NSF in the annual report log on Google-drive.

Research activities – *database development and maintenance*

Due to the complex nature of building the large integrated geospatial database for this project, it is expected that most participants contribute to some aspect of the creation, QAQC, or documentation of the database by contributing to some of the activities listed below. In general, we expect aquatic ecologists and non-aquatic ecologists to be involved in activities that are related to their area(s) of expertise. Examples of work that all project participants are expected to contribute to, according to their area(s) of expertise:

- Database design
- Gather datasets and methods from individual researchers, agencies, etc.
- Create/author metadata for each dataset entered into the database
- Gather GIS datasets and research methods related to these data
- Help in the development of methods for GIS analysis such as watershed delineation
- Database activities such as database management, backup, access, querying, user interfaces, etc.
- Help view/analyze early database versions to identify errors in database
- Conduct analyses/make recommendations for database issues such as detection limits, comparability of lab methods, lake size thresholds, etc.
- Quality Control/Quality Assurance of the limnology database
- Quality Control/Quality Assurance of the GIS database
- Create/author documentation of the limnology database
- Create/author documentation of the GIS database
- Conduct agency/outreach activities
- Develop and maintain webpage
- Database maintenance

Research activities – *analytical methods, code, and models*

Because this is a data-intensive research project, most manuscripts (except for commentaries) will involve the use of existing or novel analytical methods. We have a wide range of expertise on this project regarding methods and coding. In general, it is expected that project participants share R code (or other methods) with each other for processing data and analysis. However, we also expect that an important part of our collaboration is to learn from each other to build all of our skills in coding and analytical methods. In addition to basic coding, there is the development of novel analytical methods. We describe general guidelines below (note, that these are written specifically for R because that is what many of use use, but it applies to any software):

- **R coding for data importing, graphing, manipulation, mapping, etc** – Overall, sharing of such code among all project participants will result in a more efficient research environment if we can build off of each other's code for such tasks. We encourage researchers to post their R code on their or the Continental-limnology Github repository. This sharing also has the added benefit that we will be processing the data in some standard ways, which also has benefits.
- **R code or other methods for standard models/analyses** – Such code is for methods that have been well published and often are in the public domain anyways but have been written for the Continental-limnology-related questions. The project will benefit from the sharing of such code

from an efficiency standpoint, as well as to somewhat standardize the methods used across working-groups.

- **R code or other methods for novel models/analyses** – Such code is for methods that have not been commonly used, and for which few if any code exists in the public domain. If a Continental-limnology member has created such code, model design, or analytical approach, then it is assumed that that this member would be contacted early on to actively participate in the use of such a method or code in a manuscript, particularly since this person would likely need to be heavily consulted for interpretation given the novel nature of the method.
- **Sharing code on Github –** We strongly recommend that all team-members use Github to store code. In addition, it is recommended that for all code, the developers annotate the code to the degree possible for not only their future use, but others as well.

Research activities – *manuscripts, and conference presentations*

All project participants are expected to serve as lead or coauthors on one or more project manuscripts as well as serve as lead or coauthors on conference presentations. We also suggest that each project participant serve as a lead author on a minimum of one manuscript (as well as a conference presentation if possible) or critical analysis that facilitates the database development or use (described above). For all Continental-Limnology manuscripts, the lead-author will write an authorship contribution paragraph and submit it with the manuscript.

Additional expectations of lead PI

- Provide overall project management and database stewardship
- Coordinate activities above across all project participants
- Facilitate the participation of co-PIs in collaborative decision-making on the project
- Facilitate communication such as monthly video-conferences and annual project meetings
- Serve as liaison with database manager
- Serve as supervisor of GIS analyst
- Serve as supervisor to some of the graduate students or post-docs
- Serve as lead author on one or more manuscripts during the duration of the project, and co-author on several manuscripts

Additional expectations of co-PIs

- Serve as supervisor to some of the grad students, post-docs, or staff
- Help coordinate and lead specific sub-teams of the research project
- Participate and help to make decisions regarding overall direction of project
- Serve as lead author on one or more manuscript during the duration of the project

Additional expectations of Senior Personnel

- Serve as a lead or on either a manuscript or a critical analysis that facilitates the database development or use (see above)
- Serve as co-author on project manuscripts

Additional expectations regarding early-career scientist research topics

It is assumed that each early-career scientist will choose his or her research topics primarily with their major advisor/supervisor. However, all scientists are expected to communicate their proposed research to the entire Continental-Limnology team to solicit feedback and be sure that there is not undue overlap with any student dissertations or ongoing research efforts.

For graduate students who are funded on the project and are limnologists: we expect that at least some of the 'chapters' of their dissertation will relate directly to the Continental-Limnology project. We recognize that some of these students may have a dissertation chapter that is only loosely related to the project given their research interests (e.g., students who may wish to have a field-component as part of their dissertation). For graduate students who are funded on the project, and are not limnologists (i.e., computer

scientists or statisticians), there are two possible models for inclusion in the Continental-Limnology project, both of which are valid and are to be decided based on communication among the graduate student, advisor/supervisor and lead PI: (1) the student can be hired to work on the project to conduct analyses needed to answer research questions, but not take the lead in writing the manuscript. Rather, they would collaborate with other researchers who would take the lead on the manuscript, or (2) the student can conduct his/her dissertation on a topic related to the field of computer science, but also demonstrate in at least one chapter (or manuscript), the application of the proposed solution to a problem related to the Continental-Limnology project. With this latter model, there likely will be other opportunities for the student to contribute to additional research projects for which their proposed computational solution may be applicable, but he/she would not take the lead on these additional resulting manuscript(s). Once all graduate students who are funded on the project have decided on research questions and written a proposal, it is expected that the student present his/her proposed research to the entire Continental-Limnology team to ensure complete communication of research plans among all project personnel. It is also expected that the student posts either the proposal or a shortened version of the proposal in Dropbox for future reference by project participants.

Each early-career scientist and his/her advisor/supervisor should discuss the degree to which other project participants should serve as co-authors or direct collaborators on particular products, and then solicit feedback from the group. The general policy of co-authorship (and thus direct collaborations) for the Continental-Limnology project (see the co-authorship policy document) applies to student dissertations/manuscripts and post-doctoral manuscripts of Continental-Limnology participants. However, it is assumed that the early-career scientist will be the lead author and likely the primary data analyst on these collaborative manuscripts. If an early-career scientist leaves his/her institution prior to publishing these manuscripts, he/she will have ~1 year to submit their work before a co-author (likely the advisor/supervisor) has the option to take over writing and submitting the manuscript. Exceptions can be made after discussion among all parties involved. This target deadline is simply to recognize the reality that after a year, the likelihood of manuscripts being written declines substantially, and it is in the best interest of the student to complete them in a timely manner.

<u>Expectations regarding early-career scientist contributions and work on Continental-Limnology-related tasks</u>

(i.e. Non-dissertation activities)

It is expected that all project participants will help with the day-to-day work that needs to be conducted to collect, develop, build, maintain, and access the large database that forms the basis of this project. Philosophically, we feel that this is important not only because we need the work done, but because it will also help early-career scientists get a better feel for the database, project activities, and to learn the challenges of conducting research at this scale. For early-career scientists funded on the project, it is assumed that a portion of his/her time will be devoted to help with the database development and documentation, even if it does not directly pertain to his/her dissertation. In many projects such as this, it is not always easy to anticipate and stipulate the exact number of hours needed for such work. However, to be equitable across students (within and across institutions), we have some suggested guidelines for hours that we expect students to provide to the project. Typically, we will assign tasks to students from which they may derive some value and that do not take an undue amount of time in any one semester.

Graduate students: To ensure that any one graduate student does not shoulder more of the burden than others, we recommend that each graduate student does ~15 hrs/week of such work for at least 2 of the semesters for which they are funded on the project. During some of the summers in which students are funded, they may also be asked to work ~15 hrs/week on such work, depending on project needs and timelines. The details of the work will be decided through open communication among each graduate student, the adviser/supervisor and the lead PI.

Post-docs: We expect post-docs who are funded on the project to contribute to project research tasks in support of the overall project in proportion to the amount of funding they receive from the Continental-Limnology project. Thus, if they are paid half-time on the project, their obligations to the project are 50% lower than a post-doc that is paid full time. The actual work/tasks to be done will depend on the expertise of the post-doc, the project needs and the timing of activities the post-doc is involved in.

The details will be decided through open communication among the post-doc, the supervisor and the lead PI.

Exceptions: We expect the above statements to be general guidelines for work and project development. For example, we recognize that it is acceptable for many graduate students in computer science to do at least one summer internship to gain valuable work experience. During such summers, the students are not funded on the Continental-Limnology project and would not have the expectation to make progress on their research or contribute to the project work. However, the student must inform his/her advisor about such intention as early as possible so that the information can be shared with other project participants. In addition, we recognize that some early-career scientists may be involved in the Continental-Limnology project who are not funded by the project grant. Because we expect these students to be in the minority, we expect the student's advisor/supervisor will communicate with the lead PI to discuss the involvement of the student on the project and to clearly lay out expectations and responsibilities, which will then be shared and discussed with the project co-PIs. However, depending on the level of involvement of the student on the project and the degree to which they use the Continental-Limnology data, it is expected that they will contribute hours to the project as needed, but to a lesser degree than students fully funded on the project. Similarly, for students who are partially-funded on Continental-Limnology, their obligations regarding hours can be scaled accordingly.

Requirements for Responsible Conduct of Research

Graduate students, post-docs and staff who are funded and supervised on NSF projects are required to show that they have participated in activities that provide training in the responsible conduct of research. Examples include discussions about scientific ethics, standard practices related to conducting science, publishing, presenting, attribution, and other such important aspects of conducting science. Each institution is required to fulfill this requirement for the individuals on the Continental-Limnology project under their supervision. However, many of the discussions that occur at the annual Continental-Limnology workshop fulfill some of these requirements.

References

Cheruvelil, K.S., P.A. Soranno, K.C. Weathers, P.C. Hanson, S. Goring, C.T. Filstrup, and E.K. Read. 2014. Creating and maintaining high-performing collaborative research teams: the importance of diversity and interpersonal skills. Frontiers in Ecology and the Environment. 12(1):31-38.