



Phase I – Research Concept Papers

To prepare for the next round of NSF EPSCoR RII Track-1 funding, Maine EPSCoR is executing a formal proposal development process.

For Phase I, researchers from Maine are invited to submit a concept paper that describes a current research problem/need for the state that might be applicable for the next Maine NSF EPSCoR RII Track-1 project.

Note that the Track-1 grant is required to address a comprehensive, integrated, trans-disciplinary, statewide focus that creates a substantial academic research infrastructure and involves participants from colleges and universities throughout the state. It is not designed for individual, single institution, or small group faculty research.

INSTRUCTIONS:

Please fill in the template below, using standard NSF font size requirements. The allowable maximum is two pages. If you require additional space, you may delete unused lines in the Senior Personnel section, or blank lines in the document - please do not delete any other lines or instructions.

Sections:

- 1) Indicate the general focus area of the research that you are proposing (i.e., aquaculture, alternative energy, etc.).
- 2) Indicate the contact person for this concept.
- 3) Indicate potential key personnel who could be part of the effort to address this research concept.
- 4) Intellectual Merit – please provide a brief description in each of the sections, relating it to the research focus that you have identified as a current problem/need for Maine.
- 5) Broader Impacts – please provide a brief description in each of the sections.

Due by:	February 15, 2017
Submit to:	shane.moeykens@maine.edu (as pdf or Word doc)

By submitting this concept paper, Maine researchers are giving permission to post this document on the Maine EPSCoR website in order to encourage statewide discussions and potential collaborative engagement prior to the next phase of the RII Track-1 project development process.

Personnel from each submitted concept paper are encouraged to look over the other submitted concept papers for potential synergy, and to contact others as applicable.

For more information see: <https://umaine.edu/epscor/track-1-rii-development-process/>
<https://www.nsf.gov/pubs/2016/nsf16557/nsf16557.htm>

1) Proposed Research Focus:					
2) Primary Contact Person:					
Name:	Institution:	Title:	Dept.	E-mail:	Phone:
David Emerson	Bigelow Laboratory for Ocean Sciences	Senior Research Scientist		demerson@bigelow.org	3152567x303
3) Suggested/Potential Key Senior Personnel:					
Name:	Institution:	Title:	Dept.	E-mail:	Phone:
Whitney King	Colby College	Professor	Chemistry		
Kevin Strange	MDIBL	Director			
Jeremy Rich	UMaine	Asst. Professor	Darling		
4) Intellectual Merit: (the research focus)					
<p>A. <i>Need:</i> a brief statement of the research problem/need to be addressed, and why it is urgent for Maine to address this problem/need now (how it is currently limiting the state’s capacity/research competitiveness).</p> <p>Big data, environomics, and aquatic health. Data gathering associated with almost every area of science and technology is growing exponentially, and it is essential that our ability to either develop, or make use of tools for organizing, making sense of, and putting this data to use match the capacity to capture the data itself. We see this as part of our daily work at Bigelow, whether it is genomic data coming from the many diverse organisms that play key roles both beneficial and harmful in many diverse ecosystems, or capturing information coming from satellites monitoring the global ocean, or sensing systems monitoring local waters including lakes. We believe an effort that we broadly categorize as environomics could produce a cutting edge research effort that integrates big data toward a common goal of making sense of environmental data towards solving problems relevant to the economy, the environment, and the social well-being of Maine and Mainers. We would propose to focus this effort within the area of aquatic health, both marine and freshwater, since aquatic ecosystems are essential to Maine on many levels. Furthermore, within the state there exists distributed efforts at both data collection and data analysis, and through coordinated efforts we would propose to focus on integration of these efforts with the aim of developing several case studies that take advantage of efforts already underway. With this effort we would also train the next generation of scientists in utilizing big data, as well as planning and developing data gathering strategies relevant to environmental and commercial interests within the state. Select implementations of the environomics approach, coupled with training opportunities, will enhance research competitiveness across the state, and allow an opportunity for specific aquatic health programs to carve out niches for performing state of the art research or business development opportunities within the region, as well as nationally and internationally.</p>					
<p>B. <i>Research Goal & Objectives:</i> describe the overall project goal to address this problem/need, and 1-3 key research objectives.</p> <p>Develop a distributed network of data scientists working together with field specialists, educators, and end-users.</p> <p>Focus area 1: Aquatic Health – monitoring of coastal waters and lakes for conditions that give rise to conditions and/or outbreaks of disease causing organisms, or unhealthy aquatic ecosystems.</p> <p>Focus area 2: Training and development – education of college and graduate students in the use of large databases and data analysis tools, artificial intelligence and machine learning development of bespoke data analysis systems relevant to aquatic health in Maine.</p>					

Focus area 3: Workshops, seminars, and training programs that reach out to end users, e.g., state organizations responsible for environmental or fisheries monitoring, consultants, or associations or professional organizations.

C. **Research Actions:** describe a few specific key research actions that could be implemented to meet the objectives. Feel free to withhold any information deemed sensitive, given this information will be shared with the community.

- Identification of three – four areas where this approach is applicable, and requisite expertise exist among different institutions within the state. Examples include prediction and mitigation of harmful algal blooms, disease outbreaks in aquaculture or fisheries, water quality monitoring for lakes and municipal water supplies.
- Implementation of bio-centric monitoring programs that integrate modern genomic monitoring techniques with database analysis, meta-data analysis, and ecosystems modeling. This will involve facile exploitation of existing databases, for example the short-read archive at NCBI, or the biological and chemical oceanography (BCO-DMO) database, as well as integration of AI approaches to finding specific subsets of relevant data meaningful for a specific project, or finding patterns of interest in large datasets.

D. **Priority:** indicate how this research would address NSF and state priorities in advancing the frontiers of knowledge and understanding (within a field and/or across different fields).

Comprehensive tools for integrating data for useful outcomes is a major focus of various NSF programs, for example NEON and Earthcube. A state-wide effort that also drew on regional aspects would provide a means of bringing these larger national and international level efforts into the hands of local stakeholders, and could provide valuable feedback to these larger efforts.

5) Broader Impacts: (related to the research focus)

E. **Impacts:** potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

- Improvements in our ability to monitor, predict, and mitigate aquatic environmental problems.

F. **Impacts:** potential economic development as a result of this research.

- Empowerment of professionals in modern data techniques and tool who are engaged in all aspects of aquatic health.
- Development of bespoke approaches that can be marketed and used broadly, nationally and internationally, for problems related to aquatic health.

G. **Impacts:** potential for statewide workforce development in this research area (faculty, postdocs, graduate and undergraduate students, and the professional workforce).

- Hiring of new faculty/scientists focused on large data questions and analysis.
- Education of students in integrated data analysis
- Education of professionals in a range of disciplines and activities related to aquatic health.

H. **Impacts:** potential to provide infrastructure that grows the state's academic research and education capacity.

- Selected improvement of computational infrastructure and improved monitoring capacities.