

## **Advisory Committee for Environmental Research and Education (AC ERE)**

November 4-5, 2019

### **Summary Minutes**

**Committee Members Present:** Andres Clarens (Chair), Lora Billings, Ann Bostrom, Maria Carmen Lemos, Rich Loft, Patricia Matrai, Diane Pataki, Julia Parrish, Ben Preston, Anu Ramaswami, Jeanne VanBriesen, Lisa White (remote)

**Guest Speakers (Day 1):** Martin Storksdieck (Oregon State University), Tina Grotzer (Harvard University), Megan Bang (Northwestern University)

**Guest Speakers (Day 2):** Christine Kirchhoff (University of Connecticut), Julian Marshall (University of Washington – remote), Jonathan Overpeck (University of Michigan), Rita Teutonico (Florida International University)

**NSF Staff:** Leah Nichols (OIA, Executive Secretary for AC ERE), Suzi Iacono (OH OIA), Karen Marrongelle (AD EHR), Dawn Tilbury (AD ENG – Day 2), Bill Easterling (AD GEO – Day 2), Steve Meacham (Section Head OIA) J.Paul White (IT Specialist OIA), Turquoise Brown (Program Analyst OIA), Bruce Hamilton (Program Director CBET), Irina Dolinskaya (Associate Program Director CMMI – Day 1), Kendra McLaughlin (Program Director DEB-Day 1) Doug Maughan (Head, Convergence Accelerator Office -Day 1), Betsy Von Holle (BIO - Day 1), Roland Roberts (BIO – Day 2)

**Notetakers:** Ashely Pierce (AAAS S&T Fellow CBET), Tammy Wilbert (AAAS S&T Fellow EFMA)

### **Monday – November 4, 2019**

**NSF Senior Hosts: Suzi Iacono (Head OIA), Karen Marrongelle (Assistant Director, EHR)**

#### **9:00 – 9:15a Welcoming Remarks**

Dr. Iacono welcomed Andres Clarens as the new chair and welcomed the new Advisory Committee member, Jeanne VanBriesen. Dr. Iacono gave an overview of the NSF FY 2019 budget and an update on the NSF FY 2020 budget, noting the Continuing Resolution (CR) through November 21, 2019 and describing the House and Senate mark up of an FY 2020 appropriation bill. Dr. Iacono then gave a brief overview of NSF's 10 Big Ideas, citing 232 funded projects in FY 2019, some of which enabled game-changing ideas that fill gaps in research. She gave more details on three of the Big Ideas: NSF 2026, NSF INCLUDES, which is now funding alliances, and Mid-scale Research Infrastructure, together with the new Convergence Accelerator. Dr. Clarens welcomed the Committee and highlighted the value of the AC ERE's work; for example, its production of decadal and shorter scale reports that identify key research challenges in ERE.

#### **9:15a – 9:45a Sustainable Urban Systems, Bruce Hamilton (ENG)**

Bruce Hamilton gave a presentation on the state of NSF activity surround Sustainable Urban Systems (SUS). Driven by excitement over the Sustainable Urban Systems report released by the AC ERE in January 2018, NSF program officers formed a working group in 2018 to develop calls for proposals on SUS-themed research. This working group contains at least one program officer from each of the seven directorates, as well as individuals from OIA and OISE. NSF posted the webpage "Urban Systems and Communities in the 21st Century" to give a big picture of the Foundation's engagement in urban

systems science and engineering. This page describes “Smart and Connected Communities”, “Sustainable Urban Systems”, “Coastlines and People”, and “Long Term Ecological Research – Urban Ecology”. Following the launch of that site, NSF posted a Dear Colleague letter for SUS workshops. NSF awarded 27 SUS workshops in summer 2019 to gather information on what SUS-related themes would be important to include. The workshop award abstracts and posted workshop reports can be found at <https://www.nsf.gov/ere/ereweb/urbansystems/awards.jsp>. These workshops were held across the country, with wide-ranging themes, including education, the urban corridor, and the urban-rural connection. Many workshop reports recommended that co-production with stakeholder participation be encouraged in any potential SUS solicitation, without being required for all SUS-related research. The Committee was excited to see how the SUS workshops had impacted the research community. Committee members suggested that community engagement in a research project should have some type of formal plan. SUS-themed research also presents an opportunity for researchers to expand into convergence even more through co-production.

**9:45 – 10:15a Navigating the New Arctic, Greg Anderson (GEO), Irina Dolinskaya (ENG), Kendra McLaughlin (BIO)**

Greg Anderson (GEO), Kendra McLaughlin (BIO), and Irina Dolinskaya (ENG) gave an overview and a status update of the “Navigating the New Arctic” Big Idea (NNA). As sea ice degrades in the Arctic, coastal erosion increases. Populations on the coastlines must adapt to this erosion and other environmental changes brought on by increased temperatures and ice melt. The increasing sea level will affect coasts around the world, and as more sea ice melts, new shipping lanes will open across the Arctic, changing trade economies and travel patterns. The main goal of NNA is to improve the understanding of Arctic change and the local and global effects of this change. Research outcomes will inform US national security and economic development needs and enable resilient sustainable Arctic communities. Convergence and co-production are both important to NNA research. However, co-production is not required. In FY 2018 and 2018, NSF funded NNA-related workshops and Research Coordination Networks (RCNs). FY 2019 was the first year NSF posted a NNA solicitation (See [NSF 19-511](#)). In FY 2019, NSF funded 47 NNA awards (21 unique projects) for a total of \$37.6 million. The committee was curious as to how new researchers could be brought into NNA research and if what is learned about the Arctic (which has a faster rate of environmental change) could be applied to other areas. The speakers described the NNA program’s office hours, which are virtual, that allowed new researchers to speak with NNA program directors. As for applying NNA results to other geographic areas, the speakers elaborated on the valuable research on the teleconnections of trade, economics, and the rest of the world, and that some projects have specifically looked at other effects around the world related to Arctic change such as increased wildfires.

**10:30– 11:15a Coastlines and People**

**Program Update - Betsy Von Holle (BIO)**

**Workshop Synthesis - Rita Teutonico (Florida International University)**

Dr. Von Holle discussed the Coastlines and People program with the committee. The program will explore natural processes and hazards with human dynamics and the built environment. In FY18, NSF funded four scoping workshops on this topic to determine community interests. In 2019, NSF posted the Dear Colleague Letter: Research Opportunities Related to Coastlines and People (See [NSF 19-059](#)) that called for conference proposals designed to bring together a diverse group of scientists and practitioners to explore new synergistic research topics, EAGER projects to build capacity and support the development of pilot projects, and Research Coordination Networks (RCNs) to establish new collaborations among coastal research communities. Ten workshops and 17 EAGER projects were

awarded, and RCN projects were being evaluated at the time of the AC meeting. There is also a scoping and synthesis process.

Guest speaker Dr. Teutonico attended the synthesis workshop convened by UCAR and reported on what was discussed at the workshop. Workshop participants summarized the state of the community and identified themes and elements for dealing with sustainability in coasts and the next steps. The discussion that followed centered on co-production, funding mechanisms, coordination, and data.

#### **11:15a – 12:00p Discussion with Doug Maughan (Head, Convergence Accelerator Office)**

Dr. Maughan discussed the progress of the Convergence Accelerator program and some of the current projects. The goal of the Convergence Accelerator is to identify areas of research where investment in convergent approaches – those bringing together people from across disciplines, united to solve problems – have the potential to translate to high-benefit results and advance ideas from concept to deliverables. A Dear Colleague Letter called for projects that focused on two different Big Ideas: “Harnessing the Data Revolution” (Track A) and “The Future of Work at the Human-Technology Frontier” (Track B). Forty-three planning grant proposals were funded. Teams will be selected from this group for phase 2 cooperative agreements that span two years.

#### **12:00 – 1:00p Working Lunch: AC Liaison Reports**

**Ann Bostrom – AC SBE**

**Diane Pataki – AC BIO**

Dr. Bostrom gave an overview of the fall meeting for the AC SBE which focused on the repositioning of some of SBE’s programs.

Dr. Pataki gave an overview of the AC BIO meeting which focused on reintegrating biology across the fragmented biology subdisciplines. This fragmentation potentially prevents major advances in biology. Dr. Pataki also reported on the joint AC BIO and AC Cyberinfrastructure session which focused on computational reproducibility and replicability in science. The National Ecological Observatory Network (NEON) was also discussed at the AC BIO meeting, with a focus on making sure that scientists are aware of NEON and use it accordingly.

#### **1:00p – 4:00p ENVIRONMENTAL EDUCATION SYMPOSIUM:**

##### **How People Come to Understand Complexity in Socio-Environmental Systems**

#### **1:00p Introduction by Symposium Moderator, Julia Parrish**

Dr. Parrish described the purpose of the symposium as looking for intersections between STEM and primary sciences to remove the line between EHR and the other Directorates. Environmental education can play a key role in removing this barrier. Environmental education also could help determine how people understand complex systems and think about scale.

#### **1:10p Environmental Education and Research at NSF, Karen Marrongelle (AD EHR)**

Dr. Marrongelle gave an overview of the structure of EHR and described programs such as the National Science Foundation Research Traineeship ([NRT](#)) Program and Preparing Responsive Educators using Place-Based Authentic Research in Earth Systems ([PREPARES](#)). She highlighted different funded projects that are in the scope of environmental education and posed some high-level questions to the AC ERE for where to go next. The discussion that followed addressed who a “learner” is (anyone who is learning, i.e. students, faculty, professionals, general public, etc.) and what support exists for learners outside of the

academic “learner” category. Committee members were concerned that there were not many programs that supported lifelong learning. As an example of how NSF does support lifelong learning, Dr. Marrongelle stated that, while programs like NRT are primarily focused on graduate students, the awards also provide learning opportunities for professors.

### **1:30p Guest Speakers**

#### **Martin Storksdieck (Oregon State University)**

Dr. Storksdieck talked about the center he runs that studies learning at any part of life and where and when people learn.

#### **Tina Grotzer (Harvard University)**

Dr. Grotzer introduced the committee to her research focused on how cognitive science can inform environmental awareness, understanding, and inclination and how technology can aid in this. Dr. Grotzer introduced EcoXPT as an example of how to work on these issues.

#### **Megan Bang (Northwestern University)**

Dr. Bang discussed her work on designing heterogeneous nature-culture relations and studies of relational construal. Main points included changing the design of science education around socio-ecological phenomena, participation, and place-based learning.

### **2:45p Panel / Committee Discussion**

Discussion centered on better integration of education in research and the need to change how broader impacts are peer reviewed. Co-production and better ways to train all people were also discussed.

### **3:45p Concluding Discussion**

The Committee discussed the need to identify a faster way to get feedback from AC meetings to NSF, and how and where NSF is addressing environmental science. It noted that environmental science has a place in all sciences.

## **Tuesday – November 5, 2019**

**NSF Senior Hosts: Suzi Iacono (Head, OIA), Bill Easterling (Assistant Director, GEO), Dawn Tilbury (Assistant Director, ENG)**

### **9:00 – 9:10a Welcome and Committee Business, Andres Clarens (chair)**

Dr. Clarens reminded the committee that the next meeting was set for March 25-26, 2020. The minutes from the previous meeting were accepted.

### **9:10 – 9:30a Environmental Science and Human Security Subcommittee, Ann Bostrom**

Dr. Bostrom gave an update on the subcommittee activities, including the preparation of an initial draft of a white paper to describe major research challenges in understanding the relationships between rapid environmental change and various aspects of security. It also describes how these challenges potentially fit within NSF’s mandate for fundamental research, and it will include recommendation strategies for working with other entities that work in this topic area. The discussion focused on the ties between environmental research, human security and other broader impacts. The subcommittee held teleconference interview calls with current or former members of the national security community to gain insight. This subcommittee will conduct more interviews, complete the draft white paper, circulate it for feedback, and discuss final edits at the spring 2020 meeting.

### **9:30 – 10:00a National Ecological Observatory Network (NEON), Roland Roberts (BIO)**

Dr. Roberts introduced the National Ecological Observatory Network (NEON), a network of identical sensors across the nation, designed to enable continental-scale ecological research and environmental forecasting. The same environmental parameters are measured in most domains. Once the data is collected across the nation, they are deposited in an open access data collection site in Boulder, CO, and then made publicly accessible. The discussion centered on how NEON is connected to other data projects, how many community members are accessing the data once they are deposited in the open access data site, and NEON management in the future.

### **10:00a – 1:00p CO-PRODUCTION SYMPOSIUM: Opportunities and Challenges**

#### **10:00a Introduction by Symposium Moderators: Maria Carmen Lemos and Anu Ramaswami**

Dr. Lemos introduced the focus of the Co-production symposium - to define co-production. She posed the questions:

- How do you co-produce?
- Where should you co-produce?
- How do you scale up co-production?

Dr. Ramaswami described how Sustainable Urban Systems Science is already partially driven by co-production.

#### **10:10a Co-Production at NSF Dawn Tilbury / Bill Easterling**

Dr. Tilbury described how the Engineering Directorate has supported co-production with industry since 1994, when the GOALI (Grant Opportunities for Academic Liaison with Industry) program was launched. This co-production research has also continued with the [INTERN](#) supplemental opportunity, but reaches beyond industry to government, non-profit, and other non-academic organizations by enabling student internships beyond academia for up to six months. She also highlighted the Engineering Research Centers program, which started in 1984 and is designed to bring together academia and industry, and the IUCRC Industry-University Cooperative Research Center (IUCRC) program. A recent center focused on environmental topics include the “Reinventing the Nations Water Infrastructure (ReNUWIt)” Engineering Research Center.

Dr. Easterling discussed the start of co-production as “stakeholder involvement” in the early ‘90s and described NOAA projects that funded graduate students to work with small farmer cooperatives to help describe climate change in a useful context for decision making. If done well, stakeholders are immersed in every aspect of a research project. Dr. Easterling described how co-production can fundamentally change the questions you ask and the outcomes you are looking for.

#### **10:30a Guest Speakers**

**Christine Kirchoff (University of Connecticut)**

**Julian Marshall (University of Washington) - remote**

**Jonathan Overpeck (University of Michigan)**

Dr. Kirchoff introduced co-production as the interaction between scientist and users to influence how scientists pursue science and how users understand the possibilities and limits of science. She discussed the value added by co-producing knowledge and described some of the challenges and the ethical

considerations of co-production as well as possible scientific frontiers. The committee discussion focused on how to decide when it is or is not appropriate to co-produce.

Dr. Marshall described the Grand Challenges Impact Lab (GCIL), a 10-week study-abroad program in India where interdisciplinary teams work with local organizations to identify a problem and customer, and then propose and test a solution. The program is based on design thinking – the team starts the project with the community and goes through an iterative process of problem/customer identification and then proposing and testing a new solution. Committee discussion focused on how the program was assessed for success.

Dr. Overpeck described how he became involved in NOAA's Regional Integrated Sciences and Assessments (RISA) climate assessment for the Southwest, a project that required social science and co-production for success. Dr. Overpeck shared lessons learned from this experience:

- Transdisciplinary knowledge is necessary for appropriate climate assessment;
- Broader impacts activities are not enough - engagement and relationships take time and need to be sustained;
- Institutions and funding agencies need to value real-world impact as much as scholarly impact in research.

Committee discussion with Dr. Overpeck focused on how to support early career faculty and students who want to realize greater impacts from their research, potentially through co-production of knowledge.

#### **11:45a Panel / Committee Discussion**

The Committee discussion touched on stakeholder fatigue that can occur for various projects, varying timescales of co-production-driven research, scaling-up solutions driven by co-production, how to identify blind spots in co-production research, how to change institutional structure to incentivize co-production when it is appropriate, and changes to degree requirements such as dissertations that would be impacted by this new way of approach research.

#### **12:45p Concluding Discussion**

Dr. Kirchoff remarked that it is important to hear different perspectives and experiences in identifying blind spots in community-driven research.

Dr. Marshall remarked that If done well, co-production can fundamentally change the questions researchers choose to ask and answer. This type of change is important for NSF, and co-production training for the next wave of scientists is vital.

Dr. Overpeck remarked that NSF will need to focus on making the co-production enterprise larger, faster, and more productive, which may include funding facilities like the NOAA RISAs.

#### **1:00 – 2:00p Wrap up discussion**

Dr. VanBriesen gave a brief introduction to her research as the newest member of the committee.

The wrap up discussion focused on breaking down barriers between research and education and on the potential assessment strategies of co-production. Working groups were formed in order to determine what kind of output would be appropriate to address these two topics. The committee decided a white paper on environmental education could be a quick output, with a possible report-out by the next AC ERE meeting in March. For co-production, the committee discussed a synthesis document exploring the

many modes of co-production by discipline, including: What disciplines and groups participate, and what are good and bad examples or situations for co-production? How and where does co-production intersect with discovery? What are the assumptions and myths about co-production, what infrastructure is available and how do you use what is already there? How could AC ERE or NSF demonstrate the need for co-production, and how does one evaluate co-production in research? How can NSF and researchers avoid unintended negative impacts?

Committee members interested in participating in a co-production working group: Andres Clarens, Maria Carmen Lemos, Anu Ramaswami, and Ben Preston.

Committee members interested in participating in an education working group: Andres Clarens, Julia Parrish, Jeanne VanBriesen.