



**YEAR 6 ANNUAL REPORT OF THE  
NATIONAL SOCIO-ENVIRONMENTAL SYNTHESIS CENTER**

Reporting on Activities from September 2016 to August 2017



[www.SESYNC.org](http://www.SESYNC.org)



## INTRODUCTION

SESYNC funds the world's leading social and natural scientists to travel to its Annapolis facility and work intensively in transdisciplinary groups to advance fundamental research on socio-environmental (S-E) problems. SESYNC's mission is to foster synthetic, actionable scholarship related to the structure, functioning, and sustainability of S-E systems. SESYNC was founded on the premise that progress toward a sustainable future requires new knowledge that arises from close collaborations across many disciplines including, for example, the natural, social, and computational sciences and involving academia, federal and state agencies, and non-governmental organizations. Since its inception SESYNC has developed a rich portfolio of synthesis activities and support services that have helped researchers, policy-makers, and representatives of many different groups to work together to discover solutions to socio-environmental problems. In this way, we have fostered the production of actionable science.

SESYNC's diverse offerings of programs, processes, and training are designed to accelerate knowledge generation, build new communities, educate and engage young scholars and teachers, lower the barriers to adopting unfamiliar synthesis methods, and to grow the synthesis process. We place a premium on flexibility and openness to new ideas from the community – not only topically but methods of engagement and synthesis team building. We practice “gentle interventions” with teams to help them overcome hurdles.

SESYNC leadership and staff are actively engaged with research teams. Over the course of this grant year, we worked to fulfil our commitment to core activities through Pursuits, Workshops, and Fellowships – efforts that enable the Center to serve the needs of a diverse and growing community of users in a manner consistent with our mission.

## CAPACITY-BUILDING FOR S-E SYNTHESIS

**Postdoctoral Training.** SESYNC offers a variety of training and professional development opportunities and programming for undergraduates, graduates, postdocs, and scholars. SESYNC awards approximately four to six new two-year fellowships each year. In this grant year, we have supported 14 Postdoctoral Fellows. Fellows conducted original synthesis research and participated in SESYNC's Socio-Environmental Immersion Program.

The Immersion Program is an education and training program intended to help the postdoctoral fellows learn how to enhance interdisciplinarity and understanding of socio-environmental synthesis; to identify and support new communities of socio-environmental researchers; and to increase their capacity for working in teams and conduct actionable science. The Immersion Program consisted of four, two-day workshops that focused on a specific discipline in terms of theory background; methods and data used; typical questions asked and problems addressed; and careers. The disciplines for this year were environmental history, ecology and society, behavioral economics, and ecological networks. In addition, Dr. Jim Boyd conducted a Policy Workshop that explored the interface of science and policy.

SESYNC Postdoctoral Fellows each had one or two collaborating mentors to support technical or novel aspects of their synthesis research. These mentors came from many disciplines and home institutions and none had collaborated with the fellows previously. These relationships help Fellows expand their expertise and their professional/research networks. SESYNC facilitated these interactions by providing travel funds for the fellow or the mentor and providing mentors remote access to the Fellow's presentations at SESYNC. Mentors' input was also used in annual evaluations of the postdocs.

Drs. Margaret Palmer and Morgan Grove were the on-site postdoctoral mentors and they both helped each fellow with develop their own professional development "program." This ranges from gaining teaching experience through contributions to short courses or some teaching on the main University campus to guidance on preparing applications for positions or grant proposals, developing effective research presentations, building research networks. These efforts are designed to help build the full suite of professional skills needed to become successful scholars.

**Graduate Student Training.** During this grant year, SESYNC continued to implement its program designed specifically for advanced doctoral students. The program prepares students to write proposals for Pursuits that are competed through a separate graduate student-only RFP. Graduate students supported through this program conduct interdisciplinary, team-based syntheses, network across multiple scholarly disciplines and gain skills in conceptualizing and analyzing S-E systems. Graduate teams receive the full suite of support services offered to all teams at SESYNC. At the conclusion of their work all participants are designated SESYNC Graduate Research Fellows. The first cohort of graduate projects completed their final onsite meetings in April 2016 and 3 of the 6 teams have published peer-reviewed journal articles. Two other RFPs have been issued resulting in 2 more cohorts that were working during this grant year; each has 3 teams. Final onsite meetings for the second cohort were held in May 2017 in order to expand networking and learning opportunities beyond the bounds of individual teams.

**Undergraduate Student Training.** SESYNC continued to work with Coppin State University, a HBCU in Baltimore, MD, to prototype a program for junior level undergraduates. The goal of the program is to introduce undergraduates and their campus mentors to S-E synthesis research. Structured workshops and seminars were provided by Dr. Nicolas Magliocca, Dr. Cynthia Wei, and Dr. Margaret Palmer. The program provided a highly interactive curriculum on S-E science, the use of synthesis methods, and training in associated competencies including data science and related quantitative skills. The program also worked to engage faculty mentors at Coppin with the goal of providing HBCU faculty with new teaching modules and the skills to use them in their classrooms.

## IMPACT

**Socio-Environmental Science.** Our support for exceptional scholarship has been evident in the many publications and other products teams have continued to develop over the past grant year. The body of published work originating at the Center continues to increase as more projects come to fruition. These publications are found in a very diverse cross section of journals including those with the highest impact factors. AltMetric scores for a number of publications are ranked among the highest percentiles of similarly tracked articles. Over time we believe that there will be a lasting impact of this scholarship on S-

E science. Similarly, cohorts of postdoctoral scholars are now leaving SESYNC to take a variety of academic (18) and non-academic positions (7) and graduate scholars are moving on to the next stage of their careers. Graduate Fellows from the first cohort of the program are employed as postdoctoral researchers, beginning to take tenure track positions, and are working in the private sector. Armed with a better understanding of new disciplines, new technical skills, and a strengthened disposition to work collaboratively on problem focused S-E synthesis research, these early career scholars will have a lasting impact.

Interdisciplinary teams are central to the success of synthesis research at SESYNC and we have developed a flexible process to support and accelerate teams throughout a project's lifetime. Given the unique challenges of actionable S-E scholarship, SESYNC's approach (our "process") has been informed by research in diverse areas including inter- and transdisciplinary studies, cognitive and learning studies, and the science of team science. We interact with teams across four general phases: engaging, priming, supporting, and outcomes. Feedback derived from formal and informal interactions, observations, and gentle interventions suggest that our approach is having an impact on teams while they work with the Center and more broadly as this growing community takes the approach forward to synthesis projects beyond those conducted here. During the past grant year we have added a new position (Associate Director for Research) who will work in support of our synthesis teams at SESYNC

**Collaborative Project Development.** Given our mission to build capacity in S-E research, SESYNC staff discuss proposed projects with team leads prior to submission and provide feedback on optimal revisions following expert review. We have continued and refined this highly interactive panel review process facilitated by SESYNC leadership over the past year and it has aided in our ability to identify the strongest proposals and determine how projects might be improved by sharpening questions or considering new methods, clarifying conceptual frameworks, expanding, or changing team composition (expertise, disciplinary diversity, and degree of prior collaboration), or considering additional data. Team leads are generally very appreciative of these interactions and the feedback we provide. Project development and review become more of a learning experience and there is substantive improvement in the applications as they go through the process. One added impact may well be to help refine review processes for highly interdisciplinary research proposals. The high level of iteration, targeted engagement of a long-lived interdisciplinary review committee, and facilitated process designed to improve worthy applications is emerging as a model that could be replicated in other instances where interdisciplinary approaches are required.

**Project Planning and Meetings Design.** All team leads participate in a "priming" webinar with a core set of SESYNC staff that focuses exclusively on their project. This discussion gives all a better understanding of the scholarly problem and further introduces the team leads to the resources at the center. A set of standard queries is posed examining issues regarding data (access, amounts, quantitative or qualitative nature), logistics, and potential epistemological hurdles associated with interdisciplinarity. We emphasize the central role of leaders in articulating an early vision and in building effective team process. For a number of teams, advice on effective meeting structure is very useful. Discussions with SESYNC staff often focus on pre-meeting activities and specific goal-oriented agendas that balance group work with time for individual reflection and opportunities for flexibility. We think this early, active engagement and emphasis on planning and design does more than prime each project. By emphasizing

preparation we are attempting to impact how the team leads approach teamwork itself. This is an often under-valued capacity that SESYNC is working to enhance.

**Computational Support.** A comprehensive overview of computational, analytical, and communication support tools are made available to all teams. A dedicated 9-member team of IT and computational experts is available to help in advance of or during team meetings. These experts work to understand the unique needs of each project and sometimes assist as participants, combining and analyzing diverse types of data. Ongoing engagement between these staff and team members is a key component of SESYNC's support structure. This active engagement around computational needs is essential for many individual projects at the Center. However, the impact goes beyond research conducted here. When combined with our very successful and often over-subscribed computational short courses, SESYNC's investment in computational support is helping researchers (from emerging to senior scholars) and disciplines (from social to biophysical sciences) gain new and durable capacities that they will carry forward to work beyond that completed at the Center.

**A Focus on Interdisciplinary Process.** Facilitation services have become an important tool for a number of teams working at SESYNC. Interactions with SESYNC staff during the early design phase and especially during the first (often critical) team meeting has helped teams in the development of a shared conceptual framework and to ensure the involvement of all team members and their diverse perspectives on research problems. Overall this has had a positive impact on the interdisciplinary synthesis being done. More broadly, it has given SESYNC an opportunity to introduce teams and team leads to a more process-based approach to teamwork. As our community has expanded so too has the demand for these services, a sign that our approach has gained acceptance among participants. Because the demand for these services has increased over the past year, the new Associate Director for Research will contribute additional capacity here.

**Actionable Science.** We make a concerted effort to discuss the relevance of our projects to decision-making, resource management, and informing policy contexts with team leads and team members. We also actively encourage integration of decision-makers and knowledge users in appropriate ways in projects especially during the initial development of questions and conceptual models. This form of co-development is an important part of interdisciplinary solution finding. This is also a capacity building effort on our part. Over time this will have a positive impact on our community of users and ultimately on how scientific outputs from the work conducted at SESYNC can have broader societal impacts.

**Human Resources.** During this reporting period, SESYNC supported over 600 individual participants. We received 83 applications for postdoctoral fellowships and 22 proposals for team synthesis projects from the Graduate Student Pursuit RFP and biannual Pursuit and Workshop RFP in October 2016.

The SESYNC community is growing and is diverse by all measures - geographic, disciplinarily, by sector, gender, and race/ethnicity. Of those reporting, SESYNC has supported 1227 men and 1028 women (54.4% and 45.6%, respectively) since its inception. SESYNC's response rate for the demographic survey is roughly 50%. For those participants who filled out the survey through summer 2017, the following percentages illustrate SESYNC's cumulative impact on the development of human resources

(from 2012 through this award period). Approximately 84% of participants are from the United States, representing all 50 states, and 16% of participants come from 50 countries around the world.

Participants are also categorized as "scholars" (academics) or "knowledge users" based upon their selection for "institutional status" within the demographic survey. Scholars are those within academic institutions as graduate/postdoc students and teaching or research faculty and knowledge users are those within the policy, business/industry, government, or NGO/nonprofit sectors. Of those reporting their institutional status from our Pursuit, Venture, Workshop, and Foundation core programs, there are 829 academics, 270 knowledge users, and 10 participants who classify as both. Of the overall knowledge users, 50% come from the NGO/non-profit sector, 42% from the government sector, and 9% from the business/industry sector.

The disciplinary diversity of participants responding to the demographic survey is illustrated in the percentages of overall "scholars" within each domain below.

- Life Sciences: 32%
- Social Sciences: 34%
- Geosciences: 12%
- Computer Science and Engineering: 8%
- Policy: 5%
- Humanities: 2%
- Other (e.g., business, education, public health): 5%
- N/A: 2%

SESYNC's race and ethnic diversity of all participants who filled out a demographic survey is illustrated in the percentages below versus All Biological Science Degrees, US Citizen and Permanent Resident (2012) from the National Science Board Science and Engineering Indicators in parentheses:

- White: 72.9% (67.6%)
- Asian or Pacific Islander: 10% (11.7%)
- Black: 3.2% (4.7%)
- Hispanic: 6.3% (5.8%)
- American Indian or Alaska Native: 0.2% (0.6%)
- Multi: 3.2% (Indicator's category of "Other or Unknown Race or Ethnicity": 9.6%)

As mentioned in other sections of this report, SESYNC's collaboration with Coppin State University was developed to increase the participation of underrepresented and minority students and faculty in socio-environmental science. SESYNC staff have provided five guest lectures on a range of S-E topics and research practices, including a lecture on scientific writing to an upperclassmen research course and a three-hour group problem-solving exercise based on an S-E case study in an ecology course, both led by Dr. Cindy Wei. In addition to these activities, Dr. Nicholas Magliocca provided a lecture on approaches to S-E synthesis as part of the Gilbert Ogonji Science Symposium, and a lecture on the global ecology of

agriculture and food production. In addition, Dr. Magliocca served as a guest instructor for three weeks of Dr. Minte Jiru's Physical Sciences course, which involved lectures two times a week, and the design and evaluation of homework assignments and tests. To date, 76 minority students from Coppin State have participated in activities resulting from this collaboration.

SESYNC also supported two undergraduate students from Coppin State University through SESYNC internships. These interns developed their own socio-environmental science research projects focused on wetlands. With supervision and support from Dr. Margaret Palmer and Maira Bezerra, a GRA at SESYNC, the students completed literature reviews in addition to their own field work in which they analyzed data and reported on outcomes.

**Societal Impact.** Fostering actionable scholarship is critical if the research community is to contribute to the solution of social problems. “Actionable” has a very specific meaning in the context of SESYNCS goals. It is meant to describe a characteristic of SESYNC's portfolio of funded projects. Many, but not all, synthesis teams directly engage non-academics who we refer to as potential "knowledge users." Other teams undertake projects that potential knowledge-users have identified as important to our mission. Interaction with knowledge users occurs across our programs and throughout our engagement with teams.

They are also represented on our advisory boards (both the External Advisory Board and the Scientific Review Committee). The participation of knowledge users helps frame research questions that emphasize solutions to socio-environmental problems, stimulates creativity, provides guidance on policies and institutions affecting environmental decision-making, and helps communicate with broader audiences. SESYNC embraces a spectrum of actionable scholarship, from fundamental research needed before more applied research can move forward, to research on broad, global socio-environmental issues, to research that informs more specific policy questions.

Policy-relevant research is one form of actionable scholarship and includes, for example, a SESYNC project to develop practical ecosystem services analysis methods for government decision makers. This project brought together six academics and fifteen knowledge users from Federal agencies and NGOs including the U.S. Forest Service, the Office of Management and Budget, the U.S. Environmental Protection Agency, The Nature Conservancy, and the Council on Environmental Quality (CEQ). The work was input for subsequent guidance from the CEQ on ecosystem services and federal decision making.

Another project with policy-relevant research brought together legal scholars, water scientists, and government managers to develop flexible, adaptive trans-boundary water agreements. Finally, in the last grant year scholars working with representatives of the U.S. Fish and Wildlife Service developed a new tool to aid in decision making relevant to implementation of the Endangered Species Act. Some projects also include private sector participants, such as one exploring non-native pest invasions arising from the plant trade which included representatives from the Society of American Florists and the American Nursery and Landscape Association.

Because actionable scholarship is often under-rewarded within academia, academic researchers often lack the training and experience needed to productively interact with knowledge users and to address public policy questions, as opposed to purely academic questions. We see our mission as primarily geared toward the academic community's development of new actionable skills, research, and partnerships.

SESYNC therefore takes a deliberate approach to fostering actionable scholarship. We do this in both systemic and targeted ways. We actively encourage inclusion of knowledge-users in the SESYNC community and on research teams. We support potential team leads on knowledge user participation and policy relevance throughout the research process, including consultation prior to proposal submission.

Of those reporting demographic information from our core programs, 25% of SESYNC participants come from outside academia and 67% of the 130 research teams reporting include knowledge users. In 2016 we initiated a "policy immersion" short course for post-doctoral researchers to better acquaint them with opportunities to apply scientific research to private sector, government, and NGO decision-making. SESYNC also works to integrate knowledge application (decision-relevance) strategies in team facilitation. For those synthesis teams that use our facilitation services, we deliberately include a component on research relevance to policy, institutions, and resource management. An emphasis on geospatial data and informatics is part of this due to spatial information's increasing importance to decision-making and science communication. We require that all proposals include a section on actionability and our review committee takes that review element seriously. We also use a pro-active approach to recruitment of policy-relevant projects. SESYNC will also continue to support projects specifically targeted at actionable scholarship. For example, we have funded "Foundations" projects focused on topics like "Large-Scale Natural Resource Conservation and Restoration," and "Environmental Governance." Also, our requests for proposals often feature targeted calls for research pertinent to social outcomes and decision-making (the recent call for proposals on "Environmental Dynamics and Food Systems" is an example).

## DISSEMINATION OF RESULTS

SESYNC's communications program translates and disseminates research results, promotes the Center's programs, and builds the capacity of the Center's researcher community to engage with broad audiences outside of academia. Our strategy in this regard is based on producing high-impact digital communication products and actively developing networks to connect researchers to key knowledge users and decisions makers.

SESYNC is committed to broadening participation of under-represented minorities (URM) in the socio-environmental research community. Over this past grant year, SESYNC has continued to make efforts to reach out to Historically Black Colleges and Universities, as well as Hispanic and Native American communities, to share research and educational opportunities. We also developed visual displays at SESYNC; since we have hundreds of visitors per year, this is one more way to communicate results but also to highlight outstanding minority scholars, many of whom participate in Center activities.

The communications program continued to build capacity for the Center's researcher community by promoting their research through our website, social media pages, and with the external research community. SESYNC sends monthly newsletters with the Center's latest news, research highlights, and opportunities. The monthly newsletter grew to over 3,000 subscribers during this past year. SESYNC also developed news releases to highlight recently published research products as well as recent visits to the Center by various Workshop and Pursuit teams. Between September 2016 and March 2017, the SESYNC website received 53,500 total visitors, with 113,715 unique page views. Aside from the homepage, this



traffic was heavily concentrated around funding opportunities – i.e., dynamic site content that received extensive advertising and outreach support, including the Immersion Postdoctoral Fellowship program, SESYNC-LTER Postdoctoral Fellowship program, Synthesis Research for Graduate Students program, and Bayesian Modeling short course. These analytics reflect the effectiveness of our advertising, new media, and general outreach efforts around dynamic website and deadline-oriented content. SESYNC's social media channels, which include Facebook, Twitter, YouTube, and LinkedIn, have been extremely successful tools for reaching and engaging new audiences within the scholarly community with a primary goal of driving those audiences to dynamic content on our website. For example, our Twitter community continues to grow, increasing from 2,705 followers in February 2016 to 3,550 followers in March 2017. Twitter was our #1 referral of website traffic, representing 62 percent of total referral traffic between September 2016 and March 2017. Our Facebook community also continues to grow, increasing from 886 likes in February 2016 to 1,064 likes in March 2017. Facebook is our #3 referral of web traffic, representing 15 percent of total referral traffic between September 2016 and March 2017.

The SESYNC communications team includes Emily Cassidy, Science Communications Coordinator, and Lisa Palmer, Senior Fellow for Socio-Environmental (S-E) Understanding. Together they have actively communicated science developed at SESYNC to new audiences. A few of these interactions include Chicago Council on Global Affairs, The Wilson Center, and the Center for Security and International Studies, as well as meetings of various national and international scientific organizations. Both the Senior Fellow and Communications Coordinator conducted formal and informal discussions with SESYNC postdoctoral fellows and researchers through the exchange of ideas and resources for strategic communications. One outcome of this effort was a news article on energy savings from the shade of trees written by the Senior Fellow and published in *Nature Energy*. The article acknowledged and quoted postdoctoral fellow Dr. Joseph Maher and research fellow Dr. Morgan Grove for their analysis and modeling of tree shade. In addition, *National Geographic* published an interview featuring the work of SESYNC postdoctoral fellow Dr. Heather Randell.

## MAJOR ACTIVITIES

SESYNC has a variety of mechanisms to support synthesis. These "programs" collectively contribute to our research, education, and cyberinfrastructure goals and mission. Cumulatively, for this award we have offered support for the following:

- **Pursuits:** Collaborate team-based synthesis projects focused on a pressing socio environmental problem. Projects may focus on rotating Themes or an appropriate socio-environmental problem. **17 RFPs, 82 Pursuits.**
- **Workshops:** Single meetings focused on development of a new topic, under developed field or promising idea. **52 Workshops (32 formal applications, 20 internal).**
- **Foundations:** Recruited projects on critical, emerging or understudied topics, or efforts that bring new disciplinary perspectives to S-E scholarship. **8 Foundations.**
  - **Short Courses:** Teaching S-E synthesis; Bayesian Approaches; Database Management; Introduction to and Use of Cyber Tools. **16 Courses.**
  - **Fellowships:** Postdoctoral Fellows, Sabbatical and Research Fellows, Short-term Visitors, Policy and Practice Fellows, Journalism Fellows. **37 Postdocs, 21 Fellows.**

**Newly Funded Synthesis Projects.** Listed below are the projects that were awarded support based on solicitations opened prior to September 1, 2016:

### **PURSUIITS**

#### **RFP/Cohort 13: Collaborative & Interdisciplinary Team-based Research Projects**

- 2016C13-005: Socio-spatial ecology of the bed bug and its control (Daniel Schneider and Michael Levy)

#### **RFP/Cohort 14: Collaborative & Interdisciplinary Team-based Research Projects**

- 2016C14-002: Linking trade, biology and pet owner decisions to the risk of vertebrate invasions in the U.S. (Julie Lockwood and Christina Romagosa)
- 2016C14-003: Accounting for U.S. ecosystem services at national and subnational scales (Ken Bagstad, Jane Carter Ingram, and Carl Shapiro)
- 2016C14-019: People, land, water and fish: Integrating social and environmental models in the Chesapeake watershed (Gerrit Jan Knaap and Raleigh Hood)
- 2016C14-021: Towards understanding landscape diversity as a driver of dietary diversity (Sarah Gergel and Terry Sunderland)
- 2016C14-010: The economic value of climate stability from forests: The case of the Brazilian agricultural frontier (Sally Thompson and Timothy Griffin)

#### **RFP/Graduate Student Program Cohort III: Collaborative & Interdisciplinary Team-based Research Projects**

- 2017GS-004: A socio-ecological framework for assessing stormwater infrastructure equity: A case study of New York City (Paris Edwards and Julia Domenech-Eckberg)
- 2017GS-005: Feasibility of temporary conservation areas in agricultural landscapes to improve habitat for migratory bird species in the United States (Alexander Killion and Jessica Gilbert)
- 2017GS-002: Examining vacant lot to urban garden transitions to determine drivers of ecological wealth and dearth (Elsa Anderson and Monika Egerer)

#### **RFP/Cohort 15: Collaborative & Interdisciplinary Team-based Research Projects**

- 2016C15-005: There's still time to save Africa's vultures (William Bowerman and Andre Botha)
- 2016C15-006: Actionable science in transboundary river basins (Andrea Gerlak and Anita Milman)
- 2016C15-007: Expanding access to data-intensive remote sensing algorithms through collaboration with the SES research community (Michael Alonzo and Jamon Van Den Hoek)
- 2016C15-013: Risk perception in provision of aquatic ecosystem services (D.G. Webster and Semra Aytur)

### **WORKSHOPS**

- 2016W-060: Qualitative data sharing and use to accelerate synthesis for conservation and sustainability science (Kristal Jones and Steve Alexander)
- 2016W-061: Social and ecohydrological science connections for environmental flows (Rebecca Tharme and Sue Jackson)
- 2016W-062: The effects of sea-level rise and saltwater intrusion on wetland nutrient transport and vegetation dynamics in the North American Coastal Plain (Rebecca Tharme and Sue Jackson)

- 2016W-063: Toward establishment of a Future Earth Knowledge-Action Network on systems of sustainable consumption & production (Maurie Cohen and Steven McGreevy)
- 2016W-064: Developing a Sustainable Agriculture Matrix on a national scale (Xin Zhang and Eric Davidson)
- 2017W-065: Cross-disciplinary statistical applications in the Anthropocene (Christopher Trisos, Noelle Beckman, and Joe Maher)
- 2017W-066: Indigenous communities: Pathways to promote social and ecological sustainability in the face of global environmental change (Jeremy Pittman and Laura Coristine)
- 2017W-067: The recovery debt: Estimating the magnitude of anthropogenic disturbance of ecosystems during the degradation-recovery continuum (David Moreno Mateos and Edward Barbier)

### **SHORT COURSES**

- Short Course 16: Introduction to Spatial Agent-Based Modeling