

YEAR 1 ANNUAL REPORT OF THE NATIONAL SOCIO-ENVIRONMENTAL SYNTHESIS CENTER

Reporting on Activities from September 2011 to August 2012





www.SESYNC.org



National Socio-Environmental Synthesis Center

SESYNC (să-sink) is a national research center supported by a grant from the National Science Foundation to the University of Maryland. The center funds the world's leading social and natural scientists to travel to the Annapolis facility and work intensively in transdisciplinary groups to advance fundamental research on socio-environmental problems.

Mission: To foster synthetic, actionable scholarship related to the structure, functioning and sustainability of socio-environmental

Synthesis is a research approach that accelerates knowledge production by distilling or integrating data, ideas, theories or methods. It may be used to draw more reliable or generalizable conclusions or to open doors to novel areas of study or new methods. It may involve critical analysis to evaluate arguments or interpret evidence. It typically addresses questions or develops applications that draw on data or ideas aggregated from many sources, many researchers or multiple fields of inquiry.

Socio-environmental synthesis is about bringing together diverse forms of knowledge from the social and natural sciences in ways that generate insights into the behavior and management of interlinked systems of people and nature.

Actionable socio-environmental science is scholarship with the potential to inform government, business, household, or individual decisions that affect the environment

Founding Partners University of Maryland Resources for the Future University of Maryland Center for Environmental Science

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DIRECTOR'S STATEMENT

Efforts to build the National Socio-Environmental Synthesis Center (SESYNC - sặ-sink) began on September 1, 2011 when \$27.5M in funding from the National Foundation was awarded to the University of Maryland for the first five years of the center's life. We are fortunate because the University of Maryland (UM) made major contributions by providing funds for scholars and staff, the lease of our beautiful space with its furnishings, and a great deal of the cyberinfrastructure. We also benefit greatly from close collaborations with our partners at the Washington, D.C. based nonprofit, Resources for the Future and those from the distributed laboratories of the University of Maryland Center for Environmental Science.

From September through December, we were busy overseeing the renovation of our space, establishing our administrative accounts, and hiring staff. Most of this was handled brilliantly by our Director of Administration, Amanda Grimes. This process was not a trivial exercise because of the stand-alone nature of the center in Annapolis – located some 25 miles from the UM campus. I was also fortunate to have an amazing cyberinfrastructure team that designed and installed our excellent networking and computational systems. During this time period, the Leadership team worked feverishly to complete the planning and prepare to launch the programs we had proposed to NSF.

While the official dedication of SESYNC was on January 30, 2012, the center opened its doors for business on January 1. By mid-January, we had already hosted a working group on synthesis education, as well as a Theme Identification workshop with 25 participants from around the country. The External Advisory Board met at SESYNC for the first time in February and provided new ideas and excellent input on our existing plans.

During this first year, we completed our Strategic Plan, launched three Themes each with multiple funded projects, supported a number of workshops, selected 9 undergraduate summer interns, mentored a team of 10 graduate students from all over the country that are using social networking to identify research Theme ideas, and established our Postdoctoral program by successfully recruiting four outstanding scholars to begin work at SESYNC by the fall.

We have identified many challenges for the coming year, the most important of which is to provide the level of service – technical, cyberinfrastructure, and facilitation – we believe will be needed by the Pursuit teams that begin working here in the fall. We also are undertaking a major effort to develop formal assessment metrics to evaluate the effectiveness of our services in promoting creativity, progress in bridging epistemological divides, and synthesis accomplishments.

Margaret

Margaret A. Palmer Professor and Director July 18, 2012

I. INTRODUCTION TO SESYNC

SESYNC (sặ-sink) is a national research center supported by a grant from the National Science Foundation to the University of Maryland. The center funds the world's leading social and natural scientists to travel to the Annapolis facility and work intensively in transdisciplinary groups to advance fundamental research on socio-environmental problems. The formal mission of the center is to foster synthetic, actionable scholarship related to the structure, functioning, and sustainability of socio-environmental systems.

The concept of a synthesis center is new to many people. Those familiar with other synthesis centers may find the concept of synthesis at SESYNC much broader than what they are accustomed to from past experience. SESYNC serves scholars from a very diverse array of disciplines including, for example, environmental science, economics, sociology, psychology, political science, policy, planning and design. The methods used by scholars in these disciplines are highly heterogeneous, and their scholarly cultures differ tremendously. Given that SESYNC was formed to help bridge these differences, it is essential that we embrace epistemological diversity. This is reflected in the following definitions and the philosophy of service:

Socio-environmental synthesis is defined as a research approach that accelerates the production of knowledge about the complex interactions between human and natural systems. The approach involves distilling or integrating data, ideas, theories or methods from the natural and social sciences. This may result in new data products particularly ones that address questions in new spatial or temporal contexts or scales, but it also may involve evaluating textual or oral arguments, interpreting evidence, developing new applications or models, or identifying novel areas of study.

Actionable socio-environmental science is scholarship with the potential to inform government, business, household, or individual decisions that affect the environment and its ability to meet the needs of humans now and in the future.

Bridging disciplines is not easy, and many scholars have worked for decades on ways to promote inter- or transdisciplinary work. Fostering actionable science is an extremely difficult task. Adding to that the goal of accelerating discovery related to socio-environmental systems make the challenges SESYNC leadership face even more difficult. For these reasons, the SESYNC leadership uses an organizational model in which we are quite engaged with the synthesis scholars whose projects we fund. We use a structured process for the following objectives: 1) facilitating the co-production of Themes and associated questions that are of mutual interest to social and natural scientists and have the potential to be actionable; 2) identifying specific services (cyber, group facilitation, geospatial analysis, etc.) to accelerate each project team's progress; and 3) fostering synthesis and discovery across funded projects. This "process" is experimental in the sense that we will adapt and change it in response to assessment metrics and input from the external community. In this way, we hope to foster continuing evolution of the center to maximize progress by the scholarly community.

II. PROGRAMMATIC STRUCTURE

SESYNC has a variety of integrated programs to support socio-environmental synthesis. The structure of these programs allows us to make advances in areas of national and international priority while accommodating the need for innovation and knowledge generation around emerging problems or opportunities. Our core programs involve individuals or teams of researchers working both separately and in coordinated efforts to help meet socio-environmental challenges. Links to policy and outreach are encouraged. Integrated fellowships and educational programs are key parts of the programmatic structure.



Thematically organized synthesis <u>**Pursuits:</u></u> Themes are co-developed by a diverse community of scholars and potential users of research through a facilitated process emphasizing the relevance of topics to knowledge creation in the social and natural sciences. Themes have multiple Pursuits to assemble an integrated portfolio that leverages ideas, expertise, and tools.</u>**

<u>Ventures</u> and <u>Workshops</u> to address emerging issues and opportunities: As high risk/high reward or time-sensitive synthesis projects, Ventures and Workshops can be proposed on any topic relevant to socio-environmental science provided they address a pressing need or the opportunity to develop innovative concepts and/or tools.

<u>Theme ID Workshops</u>, policy <u>Roundtables</u>, <u>Briefings</u>, and <u>Outreach Materials</u> for actionable outcomes: Working with our partners at **Resources for the Future** and others, we actively engage a range of stakeholders in the policy, management and public sector to identify research needs and extend scientific insights.

Supporting scholarship through <u>Fellowships</u> and integrated <u>Education Activities</u>: Fellowship opportunities are available for resident scholars at many levels (undergraduate to sabbatical). Education activities are implemented as Workshops, Ventures, or Pursuits.

Service and Cyberinfrastructure: A commitment to providing exceptional support for researchers is central to SESYNC's structure and philosophy.

THEMATIC PURSUITS

The range of important socio-environmental questions SESYNC scholars could address is immense. Thus, SESYNC organizes its major research programs – **Thematic Pursuits** - around a series of rotating themes. Themes are co-developed by a diverse community of scholars and potential users of the information through a facilitated process that emphasizes the relevance of topics to fundamental knowledge creation in multiple disciplines.

At any one time, several Themes may be ongoing, each with a number of funded synthesis projects (Pursuits). The Pursuits within a Theme form a portfolio, which collectively lead to actionable science and foster co-learning, sharing of databases, and development of computational and visualization tools. The thematic portfolio enhances the success of individual Pursuits while leveraging activities to achieve greater overall outcomes on a Theme. Synthesis across Pursuits is fostered through facilitated meetings. In the initial meetings, co-leads of the Pursuit teams within a Theme together identify critical questions and needs that can be best addressed by synthesis across projects. This process provides opportunities to bring together diverse researchers to focus on shared interests and goals.

Synthesis across Themes will also support and provide a unique laboratory to study the synthesis process itself. To accomplish the co-development of Themes, as well as the cross-Pursuit and cross-Theme interactions, a high level of support is provided by SESYNC staff. In addition to organizational and facilitation services, SESYNC provides a high level of cyberinfrastructure support. As soon as an individual Pursuit is funded, SESYNC organizes a web conference with the co-leads to identify the type and level of staff and cyber support needed for the project.



Theme Identification Process A theme represents a pressing issue or problem of major importance to multiple stakeholders who need credible scientific input to help inform decision-making. Ideally, a theme will have the following characteristics:

- Importance at international scale;
- Non-trivial social and environmental components;
- Tractable scientifically and using a synthesis approach;
- Potential for policy/decision impacts; and
- Provides opportunities for fundamental scholarly breakthroughs in both the social and natural sciences

SESYNC collects input on potential themes from many sources and communities. Intensive focus groups comprised of social and natural scientists, policymakers, and representatives from governmental agencies and non-governmental organizations are convened for theme identification workshops. SESYNC hosts sessions at national and international conferences where input on potential themes is solicited. SESYNC is also currently experimenting with the use of social networking techniques to engage young scholars from diverse fields in identifying themes.

SESYNC held four Theme Identification (ID) Workshops during its first year to gather information from a wide variety of experts and stakeholders. SESYNC's intent is to use this process to open a sustained dialogue with multiple communities that will help frame and refine research themes across the lifetime of the center.

Theme ID Workshops last two days with approximately 15-20 participants in attendance and are led by Jon Kramer and Jim Boyd. Prior to a workshop, participants fill out a short survey in which they vote on whether 11 "example themes" are consistent with the SESYNC mission. The survey is used to stimulate discussion during the workshop and specifically to achieve the following: (1) determine if the center's mission and goals are clear; (2) give concrete examples of themes – whether or not they are appropriate for the Center; and (3) assess whether the group exhibits consensus or divergence on the boundaries of our mission.

The first workshop day is dedicated to presenting an overview of SESYNC to participants and to reviewing the results of the short survey. The participants are then asked to write down and brainstorm themes for consideration. These suggestions are compiled for review on the second day of the meeting, and participants are asked to vote for their top choices for discussion. The "top" themes from the participants' suggestions and subsequent survey are discussed.

After the workshops, nominations for themes that SESYNC will adopt are circulated to the EAB for their input and approval.

VENTURES

Ventures are projects that stand out because they are particularly novel, creative, or urgent. They need not be tied to a current center Theme, and may focus on research or education. Ventures may be high risk, yet potentially high-reward, or they may be time-sensitive. They should be focused on quickly generating knowledge in response to a need or unexpected opportunity, or on developing tools or approaches that could markedly advance the synthesis process or the teaching of environmental synthesis.

Potential applicants are encouraged to contact a SESYNC Director prior to submission. As with Pursuit proposals, SESYNC leadership will provide advice and input prior to formal submission. This input is particularly important for Ventures as the community is often uncertain about what "qualifies" as a Venture.

WORKSHOPS

Workshops are single meetings focused on a broad topic or a set of related topics during which up to 40 participants engage in one or more of the following activities: summarizing/synthesizing the state of the art; identifying future directions; exploring novel opportunities for synthesis;, or developing educational or cyberinfrastructure products. Applicants are expected to describe how the proposed workshop could lead to the production of actionable science focused on the sustainability of socio-environmental systems or build capacity through education or cyberinfrastructure to tackle problems unique to those systems. Organizers (1 or 2 leads) identify up to half of the participants with the remaining participant slots filled through open application. The applicants selected to attend are notified by SESYNC within two weeks of the application deadline. Individuals with a strong interest in the topic, including post-docs and graduate students, are encouraged to apply.

SHORT COURSES

Short Courses may be proposed on topics relevant to socio-environmental systems, the synthesis process, data management and analysis, or cyberinfrastructure tools. Short-courses are typically three to ten days in duration and are held at SESYNC headquarters in Annapolis. SESYNC provides travel, accommodations, and an honorarium for instructors; accommodations, lunch, and local transportation are provided for participants. SESYNC handles the application and course administration logistics. Unless otherwise specified, students are responsible for the cost of their travel to the center and registration. Courses must meet a minimum enrollment. Successful courses can be rerun depending on demand. Applications can be submitted at any time, but will be reviewed quarterly.

FELLOWSHIPS

Postdoctoral Fellowships support early career researchers for two years to pursue independent social, environmental, or cyberinfrastructure synthesis projects that are consistent with the mission of SESYNC. Postdoctoral fellows will also participate in collaborative center activities. SESYNC leadership will work with successful applicants to co-develop collaborative activities, which could include efforts such as: working with an existing Pursuit team, organizing a workshop, working on a cross-Pursuit or cross-Theme synthesis project, developing an education or outreach activity, or exploring visualization or other cyber tools. Fellows will have two mentors: a professional mentor on-site at SESYNC and a domain mentor, preferably but not necessarily, at a SESYNC partner institution.

Postdoctoral fellows are selected through a highly competitive process. Selection of fellows involves reviews of the applicants' proposals, letters of reference, and interviews with the top candidates. Announcements of postdoctoral opportunities are generally made twice per year and are open to researchers in any relevant area. During SESYNC's first year, one open announcement was made with a second announcement focused only on recruitment of social science scholars. Such adjustments may be periodically made to ensure a disciplinarily diverse pool of postdoctoral scholars in residence at the center.

SESYNC provides an annual stipend for postdoctoral fellows, full University of Maryland employee benefits, and a small annual travel allowance to attend meetings or collaborate.

Research and Sabbatical Fellowships are available for scholars who are at least 3 years post-PhD to work in residence at SESYNC. Fellows are awarded based on their proposed synthesis project and credentials. They are expected to undertake a synthesis activity relevant to the SESYNC mission. This activity may take diverse forms, including working with existing Pursuit or Venture teams, developing education materials, writing a book, engaging in science translation activities, etc. Fellows are encouraged to consider interacting with scholars at Resources for the Future and may even request to be in residence at the RFF offices. SESYNC is particularly interested in individuals and/or groups, including scholars from the international community, who can contribute to defining research frontiers at the interface of social and natural sciences and help lay the foundation for future interdisciplinary work.

While in residence at SESYNC, fellows are expected to participate in collaborative center activities including giving a scholarly seminar and interacting with postdocs and/or other center residents.

Salary is available for fellows that are in residence in the Annapolis facility for 2 to 12 months. Applicants can negotiate with the center about how they will spread their time in residence. SESYNC provides a stipend based on time in residence (not to exceed 50% of the fellow's annual home institution salary) and a small housing allowance (up to \$1000/month for those in full-time residence). Sabbatical Fellows are considered Visiting Scientists at the University of Maryland and are not eligible for benefits under the USM system; benefits would continue through the Fellow's home institution. Applications are accepted at any time. **Short-term Visitors** (2 weeks – 2 months) are scholars in residence at SESYNC who work on synthesis projects. SESYNC provides funds to travel to and work on-site, as well as technical support that will contribute to their scholarly efforts at SESYNC. Applicants submit a letter to the Executive Director (at any time) outlining the purpose of their visit, the length, and the expected outcome.

Policy and Practice Fellows propose short-term visits (< 2 months) in which they interact with the SESYNC community in Annapolis, MD, or at Resources for the Future (RFF) in Washington, DC. This program targets individuals from government, NGOs, corporations, and the media. Ideally, the interactions will benefit both the scholars in residence at SESYNC and Policy and Practice Fellows. Examples of activities include the following: organizing small-group discussions or workshops; working with SESYNC scholars to understand the needs of the policy/user community; assisting the SESYNC community in identifying opportunities to improve communication of the center's science; and leveraging practical applications of actionable science. SESYNC will provide funds for fellows to travel and work on-site at the center or at RFF. Applications are accepted at any time but will be reviewed quarterly. Applicants submit a letter to the Executive Director outlining the purpose of their visit, the length, and the expected outcome.

Maryland Fellows are from USM universities or other institutions within commuting distance who apply to work at SESYNC during periods of leave, or sabbatical from their home institutions. The program provides the fellows with an intellectually stimulating, supportive, and active community while in residence at SESYNC. Proposals can include any type of socio-environmental synthesis project, and may be from two months to one year. Participants are expected to spend the majority of their time at SESYNC and contribute to the in-house scientific community in some form. The University of Maryland (College Park) has provided SESYNC with a limited pool of funds for their tenure-track faculty to take advantage of this program. A limited stipend may be available for scholars from other institutions. Scholars interested in applying can contact a SESYNC Director for more information.

SPECIAL PROGRAMS

This category includes activities and opportunities that are not meant to be part of the permanent SESYNC programmatic offerings. Instead, these have a finite life-time (several years at most) since they are developed in response to a specific need, to stimulate input from a new area, or to "test" experimental programs.

Education Programs SESYNC is committed to integrating education programs throughout its core programs (Pursuits, Ventures, etc.); however, there will be some activities that fall outside the scope of the core. Examples include undergraduate internships, K-12 education or outreach activities, and potential public outreach. For the latter, there may be a fine distinction between communications, outreach, and education. Because of the diverse range of possibilities, we will not name permanent programs but instead will create, manage, and revise education related activities over time. However, we will always make substantial investments in education as we have done in Year 1 for the Founding Education Venture, the education workshop, the children's summer learning camp, and the Venture on STEM and sustainability education.

The Foundations of Socio-Environmental Synthesis Series was formed for two reasons. First, the SESYNC leadership wished to encourage the participation of scholars from disciplines that have been under-represented in collaborative research programs focused on socio-environmental (or socio-ecological) systems. Second, the leadership wished to stimulate the identification of critical or highly novel research topics relevant to the structure, function, and sustainability of socio-environmental systems. This program is "by-invitation" only , and the leadership relies on an extensive community for suggestions and/or nominations of scholars to lead a Foundations Series.

Scholars invited to lead a Foundations project are asked to identify a diverse but small group of scholars that will work with them to develop a disciplinary (as appropriate) article and an interdisciplinary, translational article that describes the following: (1) current and most critical emerging issues, methods, and data associated with their specific disciplines/domains or topic; and (2) relevance of existing methods and new frontiers to analysis of socio-environmental systems

Examples might include: 1) a foundations project organized around a specific social science discipline (such as anthropology, sociology, psychology, geography, planning, decision science, political science, or economics); 2) a cross-disciplinary domain (such as governance, landscape planning, climate-land use interactions); <u>or</u> 3) around a critical and emerging topic, such as the socio-cultural contexts influencing the use of environmental technologies, international development and the politics of sustainability, deforestation and infectious disease risk, food security and biodiversity conservation.

We emphasize that SESYNC's ultimate goal for this series is to foster research collaborations *across* various social science disciplines and across the social and natural sciences. However, two important foundational activities are to: 1) assess specific disciplines' and domains' own sense of what is innovative, challenging, and important; and 2) charge scholars who are exploring emerging or rapidly evolving socio-environmental issues to illuminate the new intellectual and policy-relevant challenges.

SESYNC Scholars is an experimental program designed to introduce SESYNC to a broad community of distinguished scholars. Individuals who are nominated for scholar status would receive an annual honorarium (provided by University of Maryland funding) and funds to cover up to two trips to SESYNC per year. They would be expected to visit at least once per year to give a seminar at SESYNC and contribute to a structured postdoctoral activity.

WHAT SESYNC DOES NOT FUND

- SESYNC does not fund projects if the activity should be funded by another entity or the activity is not linked to the SESYNC mission.
- SESYNC does not fund collection of new empirical data that requires field work, surveys, or assessments at sites other than SESYNC.
- SESYNC does not fund projects requesting overhead or funds to be spent by the investigator at the investigator's home institution.
- SESYNC does not provide salary support for participants in Pursuits, Ventures or Workshops unless they are resident Fellows.

III. SCIENTIFIC REVIEW PROCESS

SCIENTIFIC REVIEW COMMITTEE

SESYNC is committed to supporting synthesis projects of the highest scientific quality and with the greatest potential to contribute to accelerating actionable knowledge on the structure, functioning, and sustainability of coupled human-natural systems. As part of this commitment SESYNC has identified a diverse set of scholars to form a Scientific Review Committee (SRC). The SRC is charged with assessing applications submitted to the center for various types of synthesis projects. SRC members are asked to make a two-year commitment, and SESYNC covers all travel costs to our center in Annapolis. Remote conference capabilities are provided for SRC members who cannot travel to Annapolis, allowing them to join proposal discussions virtually.

SRC Members [PLEASE DO NOT DISTRIBUTE]:

PROPOSAL EVALUATION AND REVIEW

Calls for proposals for thematically organized Pursuits are issued twice per year. After each deadline SESYNC staff distributes the applications to the SRC for review. The SRC reads all of the applications, and individual SRC members will provide a written review on approximately six to eight applications. The review is based on a standardized form with a consistent rating scale for a number of factors. In addition, SRC members provide a brief narrative response detailing specific comments on the strength of the application and suggestions for improving the synthesis activity. Each application is given an overall rating from 1 (excellent) to 5 (poor) [See Appendix].

Once the reviews are submitted to SESYNC, an evaluation and assessment assistant compiles them. The SRC then convenes in Annapolis for a day-long panel discussion. These discussions prioritize projects and designate those recommended for support as part of the portfolio of research efforts addressing the given Theme. The results of these deliberations are conveyed to SESYNC's External Advisory Board, which has access to all full proposals, for their input prior to concluding the evaluation process.

SRC members also write short evaluations of applications received for synthesis projects submitted for the Ventures and Workshop Programs.

IV. CENTER ASSESSMENT PROCESS

During Year 1, SESYNC developed an operational and assessment framework that accounts both programmatically and temporally to the goals detailed in our strategic plan. The framework, or logic model, recognizes a series of short to long-term outcomes with associated metrics. These metrics are designed to accumulate over time, providing a longitudinal picture of the Center's progress as well as data upon which to base adaptive management. For clarity, we map our desired outcomes into a set of six general outcome areas. Specific center activities and their associated metrics are linked to these outcomes chronologically. Central to the model are the transformation of individuals and groups catalyzed by interactions and process at SESYNC, and the production of new discoveries leading to actionable science. Our assessment approach (**Figure 2**) is consistent

with those used by others — particularly those in the biomedical arena that have focused on catalyzing transdisciplinary research.





The chronology of the model is an accurate representation of how we will prioritize our activities. However, it is important to note that many/most activities will continue in some fashion throughout the first five years of the Center. For instance, our emphasis on community engagement in Year 1 is essential to the initiation of center programs and has already led to short term outcomes (see below). However, we fully intend to continue a robust series of activities designed to engage and expand the community of SESYNC users and advisors over the mid- to long-term. Similarly, scholarship initiated early will be a central activity throughout the center's lifespan.

Assessments and metrics are assigned to each of the outcome areas. These vary according to the specific types of activities that SESYNC supports, or the specific process steps that we are monitoring. In general terms, assessment and associated metrics fall into the following categories:

- Participant demographics through surveys
- Baseline tracking of support and types of activities
- Psychosocial measures (surveys, interviews and observations)
- Bibliometric analyses of publications and authorship
- Qualitative process tracking (journaling, narratives from facilitators, and staff)
- Outcomes and impacts analyses (longitudinal case studies, policy linkages and behavior change impacts)

Table 1. SESYNC Assessment Tools and/or Metrics

Outcome Areas	Assessment Tools and/or Metrics					
Community	- Number of meetings and other interactions					
Engagement	- Participant demographics (researchers, students & others)					
	- RFA Analysis (applicant demographics, team composition, scoring)					
	- Analysis of meeting journals, notes & staff debriefing					
	- Post-event encounters and level of interest (journaling)					
	- Post-event participant tracking (i.e., continued interaction)					
Scholarship	- Assessment of quality of applications (SRC Review and scoring)					
_	- Number of reports, manuscripts, publications and presentations					
	- Bibliometric analyses (including author/discipline analyses)					
	- Number of tools developed					
	- Number of models developed					
	- Databases developed/disseminated and rate of use					
	- Sabbatical and short term fellows at SESYNC					
Collaboration and	- Participant surveys (pre- and post- activity)					
Team Science	- Interviews and narratives					
	- Facilitator notes and journal analyses					
	- Process tracking and observations					
	- Analysis and tracking of SESYNC staff interactions with teams					
	- Participant network analysis (longitudinal studies)					
	- Bibliometric analyses (e.g., co-author demographics)					
	- Analysis of team demographics in given RFAs					
Incentives for	- Administrative/financial analysis by project					
Participation	- Participant surveys					
_	- Assess degree of leveraging					
	- Interactions w/other centers and co-funding					
Communications and	- Communications/outreach plans for projects					
Outreach	- Analysis of target non-peer audiences by project and center					
	- Number and type of communications produced					
	- Media hits and interest over time (interviews, etc.)					
	- Feedback from target audiences (surveys)					
	- Web tracking and requests for information					
Impacts on Science	- Number and types of interactions (SESYNC and Project participants)					
and Policy for	- Reference to SESYNC products in policy arena					
Sustainability	- Number provided and number of requests for briefings (by type)					
	- Interactions with outside actors (policy makers, NGOs, etc.)					
	- Case studies (longitudinal)					
	- Network analysis of researchers who participated at SESYNC					
	- Researcher surveys/focus groups and narratives					
	- Post education activity tracking and follow up					
Education	- Number of opportunities for student and postdoctoral training					
	- Number of publications, manuscripts, and presentations					
	- Interactions and collaborations with organizations outside of SESYNC					
	- Number of pursuits and ventures with an education component					
	- Number of workshops and short courses					
	- Case study analyses, focus groups, and surveys of program participants					

V. SESYNC ADMINISTRATION & PROGRAMMATIC OVERSIGHT

SESYNC serves the socio-environmental research community, providing opportunities for creative synthesis scholarship to a diversity of scholarly perspectives. In pursuit of these objectives, SESYNC must be fiscally accountable and support a fair and transparent external review process for proposals. This document describes the allocation of responsibility for governance functions. These are configured to meet the requirements for strong and accountable operations. However, based on the SESYNC process as described in the funded proposal to NSF, these functions and allocations may evolve and change as the needs of the scholarly community change and as the center evolves.

The governance structure is designed to ensure bottom-up guidance on program priorities combined with top-down operational and programmatic accountability. The community of producers and consumers of our synthesis research provides recommendations for which research Themes SESYNC should support and which submitted proposals merit consideration for funding, but the External Advisory Board (EAB) and, ultimately, the Executive Director must approve all decisions.

GOVERNANCE

Executive Director (ED) is responsible for program creation and administration, merit review of salaried SESYNC employees, budget, and day-to-day operations. Decisions regarding SESYNC staffing needs, space allocation, and Director appointments are made by the ED after seeking input from the Directors. The ED is reviewed annually by the University of Maryland Dean of Computer, Mathematical, and Natural Sciences. While SESYNC is evaluated annually by NSF, major reviews of the center, including the ED, will occur in Years 2 and 4. Input from the SESYNC EAB may be requested by the Dean's office or NSF as part of their reviews.

Directors consist of the five Directors that oversee day-to-day operations, play a critical advisory role to the Executive Director (ED), and include the following: Director of **Administration**, Director of **Synthesis and Interdisciplinary Science**, Director of **Cyberinfrastructure**, Director of **Education and Outreach**, and Director of **Social Science and Policy**. Individual directors oversee specific center activities or personnel per agreements made on a yearly basis with the ED. Members serve variable terms as set forth in written agreements with the ED at the onset of their appointment. Directors spend two to five days per week on site and are obligated to engage in the following activities:

- 1. Be an active participant in the center and provide advice on the formulation, implementation and evaluation of programs and center operations
- 2. Read proposals and attend proposal panel meetings
- 3. Contribute to and attend all board meetings
- 4. Participate in fiscal oversight meetings
- 5. Participate in staff hiring interviews and decisions

- 6. Provide input for staff evaluations
- 7. Provide input on strategic plan

Associate Directors for Research Innovation are recognized leaders in the external research community who are invited to identify creative or timely synthesis activities for SESYNC. Along with a co-lead that is not associated with the Synthesis Council, they may organize synthesis activities themselves; however, their primary role is to encourage and foster the development of proposals by members of the scholarly community.

Assistant Directors are professional staff members who design and implement specific programs under the guidance of one or more Directors. They are onsite at SESYNC full-time and are hired through a competitive and open national search process.

ROLES AND RESPONSIBILITIES OF ADVISORY BODIES

Synthesis Council is chaired by the Director of Synthesis & Interdisciplinary Science and consists of the other Directors, the Associate Directors for Research Innovation, key cyberinfrastructure staff, and Assistant Directors or outside scholars on an as need basis. The Council or a subset of its members performs the following functions:

- **1.** Develop a roster of funding recommendations for the EAB using proposal reviews provided by the Scientific Review Committee (SRC) and other relevant information
- **2.** Identify what type of center support may be required for projects that are recommended for funding by the EAB and then meet with the lead PI(s) to discuss these needs and offer assistance
- **3.** Review the roles of Pursuits within the context of the Theme portfolio and facilitate cross-Pursuit interactions
- 4. Participate in the recruitment of SESYNC scholars and Research Innovators
- **5.** Is the formal entity through which any grievances concerning decisions by the Executive Director may be brought; grievances are first taken to the chair of the Synthesis Council who shares these with other members of the Synthesis Council

External Advisory Board (EAB) is an eminent group of individuals that meets twice a year to provide advice on overall policies and directions of SESYNC. Throughout the year they are asked to review and approve funding recommendations based on input from the SRC and Directors. They serve two-year terms with the potential for renewal. Nominations for new members will be solicited from the external community with the EAB making final decisions.

Scientific Review Committee (SRC) is a body of 15 – 20 scholars external to the SESYNC leadership who review proposals and provide recommendations regarding funding. They meet two or three times per year as a panel to discuss proposals. Terms are two years, and members may be invited to serve one additional term. Nominations for new members will be solicited from the external community and EAB. The Synthesis Council will make appointment decisions under the guidance of the Council's Chair.

SESYNC DECISION MAKING PROCESSES

Per the roles and responsibilities of SESYNC leadership and Advisory Bodies, decisions concerning staffing and center administration are made by the Executive Director after seeking input from the Directors. Decisions regarding the programmatic directions of SESYNC are based on input from the external research community, Center leadership, and the External Advisory Board. Funding decisions for synthesis projects are based on recommendations from ad hoc reviews and the scientific review committee (SRC) and must be approved by the EAB.

Day-to-day operations of SESYNC are overseen by full time Directors and staff under the leadership of the Executive Director. Should the ED be unavailable for a short period of time, the Director of Synthesis and Interdisciplinary Science assumes the ED science responsibilities, and the Director of Administration assumes the ED administrative responsibilities. In the event the Executive Director needs to be replaced, the University of Maryland Dean of Computer, Mathematical, and Natural Sciences, with input from the SESYNC External Advisory Board and the requisite NSF program officer, will initiate a search for a tenured full Professor in the ecological sciences. Should the current ED, Margaret A. Palmer, unexpectedly step down or otherwise be unable to carry out the duties of the position, Dr. William Fagan (Professor of Biology, University of Maryland) will act in the capacity of the ED during the transition process.



SESYNC ORGANIZATION CHART

LEADERSHIP



Margaret Palmer (PhD in Coastal Oceanography, University of South Carolina), the **Executive Director** of SESYNC, is a Professor of Entomology at the University of Maryland with a joint appointment at the University of Maryland Center for Environmental Science. She has more than 150 publications on the restoration and

ecosystem dynamics of streams and rivers and works closely with managers and policy makers to translate research to practice. She led efforts to develop the first comprehensive database on river restoration in the U.S. and she now manages a large research group. She is past chair of the international freshwater Diversitas committee, serves on multiple editorial and science advisory boards, has been honored as a AAAS Fellow, an Aldo Leopold Leadership Fellow, a Lilly Fellow, a Distinguished Scholar Teacher, and a University of Maryland Board of Regents Distinguished Faculty Award recipient. **Contact**: mpalmer@sesync.org.



Jonathan Kramer (PhD in Environmental Science, University of Maryland) is the **Director of Interdisciplinary Science** at SESYNC. Previously, Dr. Kramer served as the Director of the Maryland Sea Grant since 2000. He has worked to apply new approaches to link science to policy development and decision-making in the

environmental arena. Of particular interest is the use of facilitation, synthesis, and consensus building to help address critical environmental issues as well as the development of effective science outreach mechanisms. Recent efforts include developing the scientific infrastructure to support ecosystem-based fisheries management in Chesapeake Bay, and a synthesis of historical data relevant to the suitability of dredged materials from Baltimore Harbor for innovative reuse options. Jon is engaged in efforts that foster organizational development, strategic planning, and management to strengthen science-based organizations. He is currently a member of the Board of Directors of the Hudson River Foundation. **Contact**: jkramer@sesync.org.



Joseph JaJa (PhD in Applied Mathematics, Harvard University), the **Director of Cyberinfrastructure** at SESYNC, is a Professor of Electrical and Computer Engineering, and a Research Professor in the Institute for Advanced Computer Studies at the University of Maryland, College Park. He has published over 175 papers in a

number of areas including parallel and distributed computing, theoretical computer science, Very-Large-Scale-Integrated systems, and data-intensive computing. His current research interests are in high performance computing, long term archiving, management, and preservation of digital information, and scientific visualization. He served on several editorial boards, and is currently serving as a subject area editor for the Journal of Parallel and Distributed Computing and as an editor for the International Journal of Foundations of Computer Science. **Contact:** <u>joseph@sesync.org</u>.



James Boyd (PhD in Applied Microeconomics, University of Pennsylvania – Wharton School), the **Director of Social Science and Policy** at SESYNC, is a Senior Fellow at Resources for the Future, Washington DC and Director of RFF's Center for the Management of Ecological Wealth. An economist by training, his work focuses on the

measurement and management of ecological wealth, goods, and services. Previously, he was Director of RFF's Energy and Natural Resources Division (2002-2007). Boyd has been a Visiting Professor at Stanford University (2007) and Washington University in St Louis (1996) and has served on National Academy of Science, U.S. EPA Science Advisory Board, and numerous other government and private advisory panels. As a consultant he has advised the World Bank, European Commission, numerous federal agencies, and NGOs concerned with conservation and environmental protection. **Contact**: boyd@rff.org



David Hawthorne (PhD in Insect Genetics, Cornell University), the **Director of Education and Outreach** for SESYNC, is an Associate Professor in Entomology at the University of Maryland. Dave has contributed to research and regulatory efforts for the sustainable use of transgenic corn, and he studies insect speciation, particularly

that driven by adaptation to different host plants. He teaches courses targeting both the most advanced graduate students and non-majors undergraduates. Dr. Hawthorne is a 2008 Lilly fellow, contributing to a study of the transfer student population on the UMD campus, and a member of the Marquee Courses in Science and Technology learning community—designing and delivering top science and technology courses to non-science majors. A 2009 National Academy of Sciences teaching fellow, David loves conveying the day-to-day relevance of science to non-majors and sharing the application of basic research to applied problems to graduate students. **Contact**: <u>dhawthorne@sesync.org</u>.



Amanda Grimes (MBA, University of Maryland, UC) is the **Director of Administration and External Affairs** for SESYNC. Before joining the University of Maryland, she served in a similar role for the University of Maryland Center for Environmental Science – Chesapeake Biological Laboratory. She brings experience in

finance, business operations, grant accounting, and information technology. During her time at UMCES, she also tailored diverse programs and marketing materials for public outreach, development, and government affairs. Previously, she worked in the financial and information systems technology fields as a Vice President for Bank of America, Director for First Data Investor Services Group, and Assistant Vice President for Fifth Third Bank. She has served as a University Representative on the USM Women's Forum. **Contact**: agrimes@sesync.org.



Bill Fagan (PhD in Zoology, University of Washington), the **Associate Director for Natural Science Research Innovation** at SESYNC, is a Professor of Biology at the University of Maryland. He is well known for his research at the interface of ecological theory and data, much of which has major implications for conservation

and planning. He has authored more than 125 peer-reviewed papers and book chapters on diverse topics in ecology and conservation biology. His primary research blends theory, experiments, remote sensing, and database research to study critical questions in spatial and theoretical ecology. Current projects focus on ecoinformatics (including studies of animal movements, species distributions, and population abundance), successional dynamics, and the prediction of species' intrinsic rates of increase. He is also a co-founder of the innovative MathBench program, which NSF and HHMI have funded to infuse quantitative thinking and mathematical proficiency in undergraduate biology curricula nationwide. **Contact**: <u>bfagan@umd.edu</u>.



Joan Nassauer (MLA, Iowa State University), the Associate Director for Social Science Research Innovations, is a Professor in the School of Natural Resources & Environment at the University of Michigan. She investigates public acceptance and cultural sustainability of ecological planning and design of human-dominated landscapes. She teaches courses on metropolitan design dynamics, the use of ecological and social sciences in ecological design, and interdisciplinary approaches to brownfield redevelopment. Her lab develops alternative scenarios for landscapes and integrative assessments of alternative futures. She has more than 70 refereed papers and book chapters, as well as her books: *Placing Nature* and *From the Corn Belt to the Gulf*. Currently, she is collaborating with colleagues in social and natural sciences to investigate post-industrial cities and exurban sprawl. **Contact**: inassauer@sesync.org.



George Hurtt (PhD in Ecology & Evolution, Princeton University), the **Associate Director for Research Innovations** at SESYNC, is the Associate Director of the Joint Global Change Research Institute. From 1998-2010, Dr. Hurtt worked at the University of New Hampshire in the Institute for the Study of Earth Oceans and Space

and Department of Natural Resources, finally becoming Chair of the Natural Resources and Earth System Science Ph.D. Program and Director of the Complex Systems Research Center. In 2010, Dr. Hurtt joined the University of Maryland Department of Geography as Professor & Research Director and is now involved in multiple collaborative research projects with NASA, DOE, and others. He leads an international effort on global land-use harmonization in preparation for the IPCC 5th assessment and a NASA interdisciplinary science investigation focused on the role of natural disturbances on the Earth's coupled carbon-climate-human system. **Contact**: gchurtt@sesync.org.



Cynthia Wei (PhD in Ecology, Evolution, & Behavior, Michigan State University) is the **Assistant Director for Education and Outreach**. Her research as a postdoctoral researcher at the University of Nebraska, Lincoln combined psychological and biological approaches to study animal cognition. Dr. Wei has worked on several national STEM education programs and initiatives during her

time as a Christine Mirzayan Science & Technology Policy Fellowship at the National Academy of Sciences (NAS), and an American Association for the Advancement of Science (AAAS) Science and Technology Policy Fellow at the National Science Foundation (NSF)-Division of Undergraduate Education. Dr. Wei has worked on wide range of issues in STEM education, focusing primarily on biology education and climate change education. She has published articles on her scientific research, as well as articles on education issues and science pieces for general audiences. **Contact**: <u>cwei@sesync.org</u>

CENTER STAFF



Elizabeth Wise Financial Operations Coordinator ewise@sesync.org



Travis Burrell Systems Administrator tburrell@sesync.org



Donna Carpenter (begins Sept. 24) Travel and Events Coordinator <u>dcarpenter@sesync.org</u>



Jessica Marx Environmental Science Research Assistant jmarx@sesync.org



Mike Smorul Computing Manager <u>msmorul@sesync.org</u>



Rachel Berndtson Graduate Research Assistant rberndtson@sesync.org



Mary Shelley Digital Information Research Specialist <u>mshelley@sesync.org</u>



Maira Bezerra Graduate Research Assistant mbezerra@sesync.org



Bill Schenk Systems Administrator wschenk@sesync.org



Sabrina Purdy Administrative Assistant <u>spurdy@sesync.org</u>

EXTERNAL ADVISORY BOARD

The External Advisory Board (EAB) is comprised of scholars and experienced leaders representing the broad range of disciplines needed to provide guidance and oversight for SESYNC. Appointed in consultation with NSF, board members meet semi-annually and serve an initial term of two years. As the primary high-level advisory body, the EAB focuses on enhancing SESYNC's credibility and success by providing critical insights pertaining to strategic directions and through evaluation of the impacts of programs.

EAB duties include participation in the Center's strategic planning process, and in the selection of the overarching themes to structure research efforts. Board members provide insights on emerging trends and advancements in social and environmental research, modeling, and information technology, and, as appropriate, help SESYNC forge connections at the national and international levels. The EAB provides oversight of the proposal review and funding process, and conducts a biennial review of the SESYNC Executive Director. In a broader context, EAB members serve as ambassadors for SESYNC, by communicating with the research and policy community about the philosophy, expertise, and opportunities offered by the Center. They help SESYNC identify and reach out to scholars, policymakers, and others who have the potential to advance the Center's mission. Specific expectations of EAB members include the following:

- Agree to serve an initial term of two years and meet semi-annually at SESYNC in Annapolis. In the fall of each year, the board develops a list of new nominees in consultation with the SESYNC leadership. Upon approval by NSF, nominees are invited to join the board the following September 1st. The goal is to replace one third of the current board members each year.
- Elect a Chair and Vice-chair who are responsible for overseeing board activities including developing the agenda for and leading board meetings in collaboration with the Director of SESYNC. Using input from the entire board, the Chair and Vice-Chair are also responsible for producing written input for the Director's annual evaluation including recommendations relevant to those who report to the Director.
- EAB members are encouraged to participate in, and/or observe, meetings of the Scientific Review Committee, which is charged with evaluating applications for Pursuits, Ventures and Workshops. The EAB as a whole will review the proposed portfolios of projects under each Theme and will be asked to vote to approve each project prior to SESYNC initiating synthesis activities.

Current EAB Members (2011 – present)



Lennart Olsson (PhD in Physical Geography, Lund University), **Chair** of the External Advisory Board, is Professor of Geography at Lund University and the founding Director of LUCSUS - Lund University Centre for Sustainability Studies. His research fields include human-nature interactions in the context of land degradation, climate

change, and food security in Africa and globally. Contact: <u>lennart.olsson@lucsus.lu.se</u>



Kathleen C. Weathers (PhD in Ecology, Rutgers University), **Vice-Chair** of the External Advisory Board, is a Senior Scientist at the Cary Institute of Ecosystem Studies. Her research interests include how biology affects geochemistry across heterogeneous landscapes, within and among multiple systems (air-land-water). She

also works at the interface of science and policy, education, and outreach. **Contact**: weathersk@caryinstitute.org



Dana R. Fisher (PhD in Sociology, University of Wisconsin-Madison) is Associate Professor of Sociology and the Director of the Program for Society and the Environment at the University of Maryland. Her work focuses on understanding the ways that social actors (individual or groups of individuals) engage in decision-

making processes and the successes and failures of such efforts. Contact: drfisher@umd.edu



Karin Frank (PhD in Mathematics, University of Leipzig) is Professor and Head of the Department of Ecological Modeling at the Helmholtz Centre for Environmental Research (UFZ) in Leipzig, Germany. She specializes in stochastic, spatially explicit ecological and ecological-economic modeling, particularly the development of new

methods for modeling and model analysis. Contact: Karin.frank@ufz.de



Barry D. Gold (DSc in Technology and Human Affairs, Washington University) is Program Director for Marine Conservation at the Gordon and Betty Moore Foundation, President of the Consultative Group on Biological Diversity, and Vice-Chair of the California Ocean Science Trust. His areas of interest include ecosystem services, natural security, and sustainability. **Contact**: <u>barry.gold@moore.org</u>



Ray Hilborn (PhD in Zoology, University of British Columbia) is a Professor in the School of Aquatic and Fishery Sciences, University of Washington specializing in natural resource management and conservation. He teaches graduate and undergraduate courses in environmental science, conservation, and quantitative

population dynamics. **Contact**: <u>rayh@u.washington.edu</u>



Peter Kareiva (PhD in Ecology and Evolution, Cornell University) moved to The Nature Conservancy (TNC) after 20 years as a university professor and three years working on salmon conservation for the National Oceanic & Atmospheric Administration Fisheries. He works on a range of projects that ask how humans can

meet their basic energy and food needs without damaging the planet. **Contact**: <u>pkareiva@tnc.org</u>



W. Michael Kemp (PhD in Systems Ecology, Center for Environmental Science) is Professor of Coastal Ecosystem Processes at University of Maryland. His research fields include sea grass ecology and restoration, ecosystem metabolism, coastal biogeochemistry, scale-dependence of ecological processes, and methods of synthesis

in coastal ecosystem science. Contact: kemp@umces.edu



Eric Lambin (PhD in Geographic Sciences, University of Louvain, Belgium) divides his time between the University of Louvain, Belgium, as Professor of Geography, and Stanford University, where he is the Ishiyama Provostial Professor at the School of Earth Sciences and Woods Institute for the Environment. He works on land change

and human-environment interactions. Contact: elambin@stanford.edu



Simon A. Levin (PhD in Mathematics, University of Maryland) is the George M. Moffett Professor of Biology and Director of the Center for BioComplexity at Princeton University. His research focuses on the maintenance of macroscopic patterns and processes at the level of ecosystems and the biosphere, on ecological and evolutionary

mechanisms, and infectious diseases. Contact: slevin@princeton.edu



Laura López-Hoffman (PhD in Biological Sciences, Stanford University) is an Assistant Professor in both the Udall Center for Studies in Public Policy and the School of Natural Resources and Environment at the University of Arizona. Her research fields include the nature-human dimensions of conservation biology and policy and

climate change impacts on ecosystems. Contact: laurah@email.arizona.edu



Molly K. Macauley (PhD in Economics, Johns Hopkins University) is Vice President for Research and Senior Fellow at Resources for the Future (RFF). Her research focuses on the application of technology to natural resources, including the value of earth science information and the application of earth science to understanding

ecological systems and human relationships. Contact: macauley@rff.org



Bonnie McCay (PhD in Environmental Anthropology, Columbia University) is a Board of Governors Distinguished Professor at Rutgers University in the Department of Human Ecology. Her research focuses on challenges and policies for managing common pool resources and on the intersections of ecology, community, and social

institutions of science, law and property. Contact: mccay@aesop.rutgers.edu



Richard B. Norgaard (PhD in Economics: Trade and Agriculture, University of Chicago) is a Professor of Energy and Resources at the University of California - Berkeley. His research focuses on how the resolution of socio-environmental problems challenges modern beliefs about science and policy, and explores

development as a process of coevolution between social and environmental systems. **Contact**: <u>Norgaard@berkeley.edu</u>



Dan Stanzione (PhD in Computer Engineering, Clemson University) is Deputy Director of the Texas Advanced Computing Center at the University of Texas in Austin. He is an expert in high-performance computing and is Co-lead of NSF's "iPlant Collaborative", an endeavor to build a community of scientists to develop

cyberinfrastructure and apply computational approaches to advance plant science. **Contact**: <u>dan@tacc.utexas.edu</u>



Thomas Sterner (PhD in Economics, University of Gothenburg) is Professor of Environmental Economics at University of Gothenburg. His main research interests lie in the design of policy instruments, and cover institutions in different kinds of economies, market, planned and developing. His work focuses on energy and

climate, natural resource management of fisheries, and industrial and transport pollution. **Contact**: <u>thomas.sterner@economics.gu.se</u>



Daniel Stokols (PhD in Social Psychology, University of North Carolina) is the Chancellor's Professor in the School of Social Ecology at the University of California, Irvine. His research examines contextual factors that influence the success of transdisciplinary research and training programs, as well as the health and behavioral

impacts of environmental stressors such as traffic congestion, overcrowding, and information overload. **Contact:** <u>dstokols@uci.edu</u>



Sara Vickerman (MS, Southern Oregon University) is the Senior Director for Biodiversity Partnerships for Defenders of Wildlife, and Director of the Northwest office. Working with the Oregon Sustainability Board, American Forest Foundation, the Doris Duke Foundation and others, she develops recommendations for policy

changes and metrics of success for conservation. **Contact:** <u>sara.vickerman@defenders.org</u>



James L. Wescoat, Jr. (PhD in Geography, University of Chicago) is the Aga Khan Professor in the School of Architecture and Planning at the Massachusetts Institute of Technology. His research concentrates on water systems in South Asia and the U.S. from the site scale to the river basin scale with a focus on water law, policy and the

historical geography of water development. Contact: wescoat@mit.edu

Past EAB Members:

Elinor Ostrom (deceased). 2011 - 2012

PARTNERSHIPS

Founding Partners In addition to support from NSF, additional funding for the Center comes from the three founding partners in this program:

- University of Maryland
- University of Maryland Center for Environmental Science
- Resources for the Future

Collaborators Central to the visioning and development of the center proposal include social scientists, educational scholars and computer and sustainability scientists from:

- University of Michigan [Joan Nassauer]
- University of Maryland Institute for Advanced Computer Studies (UMIACS)
- Cary Institute of Ecosystem Studies [Alan Berkowitz]
- Coppin State University [Mintesinot Jiru]
- Gallaudet University [Caroline Solomon]
- Michigan State University [Diane Ebert-May]
- Washington State University-Vancouver [John Bishop, Gretchen Rollwagen- Bollens, Paul Thiers]
- Helmholtz Centre for Environmental Research-UFZ, Leipzig, Germany [Karin Frank]
- Environment for Development Initiative (EfD) at the University of Gothenburg, Sweden [Thomas Sterner and Gunnar Kohlin]

Internal Policy on engaging in collaborations with other groups

SESYNC approaches partnerships with flexibility because they may take many forms. Some partnerships may be general alliances among organizations with similar goals, and others may be driven to complete specific projects with discrete goals. Core principles which inform decisions about forming specific partnerships include the following:

- Given that SESYNC's mission is to foster scientific advances, SESYNC will not engage in partnerships that may result in real or perceived endorsement of particular policy actions related to social and environmental issues. The distinction between promoting *actionable science* and promoting *actions* must remain clear.
- SESYNC is a national center whose mission is to serve the socio-environmental scholarly community and thus will not engage in partnerships to compete for grant funding against members of its scholarly community. Exceptions could occur if the community or its members are not positioned to respond to a grant opportunity or the community as represented through the EAB believes its best interests would be served by a response from SESYNC.
- SESYNC will not engage in "symbolic" partnerships, i.e., all partnerships must involve active participation in the principle functions of the partnership.

A rubric for discussion of new partnerships will include the following:

1) What is the purpose of the partnership? The purpose of the partnership must be clearly described and transparent. It must overlap with, or extend through synergy, the mission of SESYNC, without internal redundancy (doing through partnership things that are already done by SESYNC) or external redundancy (competing with other effective groups).

2) What does SESYNC bring to the partnership? The partnership must involve use of skills and activities of SESYNC. Partnerships that benefit only from SESYNC's administrative functions or from its scientific reputation and status will be discouraged (except as gifts).

3) What does the partner bring to the partnership? It should be clear how the SESYNC community benefits from the partnership and why this partner is the best to accomplish that goal.

4) What does the partner want from SESYNC—What does the partner have to provide SESYNC? In addition to resources directly targeting joint project(s), are there additional resources or assets of SESYNC / partner that will boost each organization?

5) How is success in the partnership defined and how/when will the partnership be dissolved? How will accomplishments be evaluated and tracked, and are there any limitations to our reporting them to our principle funding source (NSF)?

6) Which member of the leadership team and the external partner will serve as primary sources of information and accountability for the partnership? The SESYNC designee will be responsible for providing an annual summary of accomplishments related to the partnership and a recommendation for continuing the partnership.

VI. FACILITIES AND SERVICES

CYBERINFRASTRUCTURE

The cyberinfrastructure (CI) program at SESYNC exists to support the hardware, software, and data needs of the center and its supported research; to enhance onsite and remote collaboration; and to facilitate the provision of technical resources needed to produce actionable science. The CI team has instituted and will continue to refine a process for ongoing engagement with supported project teams which begins soon after award notification and aims to have cyber resources in place and ready for use well ahead of each team's first visit to SESYNC.

Cyber Support Process SESYNC is developing a systematic process that begins before a project is awarded in order to fully capture anticipated cyber support needs, actual consumed cyber resources, and overall success of SESYNC's cyber support. This information will be used to continually refine our support offerings, ensuring we always offer the latest relevant technology to researchers.

This process begins with an "Initial Cyber Review" during which the Computing Manager, Digital Information Research Specialist, and Director of Synthesis conduct a webinar with each project's PIs to discuss their goals from a CI perspective, including data and needs, appropriate tools and software, analytical staffing, and related issues. Five Initial Cyber Reviews were completed in the early summer of 2012, one for each of the four supported pursuits under the first theme and one for the first supported venture. Initial assessments of these reviews indicate a high demand for GIS and visualization applications, statistical and database software, and the need for shared data storage and analysis.

As part of our center-wide evaluation efforts, we are considering ways to determine whether this process and the CI services we provide are effective in helping to achieve the goals of supported research projects. Currently, the Computing Manager and Digital Information Research Specialist take extensive notes during an initial cyber meeting on specified aspects of a project to document initially stated goals and needs; these will be used in tracking how project needs evolve over the lifespan. We will continue to seek metrics of assessment for evaluating and improving the cyber support we provide.

Collaborative Research Environment While the specific research needs of the projects will vary; all projects share a common need to easily deposit data for sharing among group members, remotely access SESYNC computing resources, and track working group notes. To support these needs, SESYNC provides a unique login to everyone who interacts with the center. This login will be used to access both privileged resources such as remote desktop, the internal center network, and file sharing, as well as more publically available resources like proposal submission and workgroup documentation. Each SESYNC sponsored group is given access to shared data storage accessible over the internet and locally from SESYNC computing resources.

Groups have access to a Drupal Commons community website which provides an online meeting place for group discussion and links to other group resources. Depending on a group's needs, remote desktop support for GIS, other analysis software, and web conferencing facilities may be assigned to a project. All computing and storage resources provided to research groups are fully accessible both onsite and remotely by all group members.

This collaborative infrastructure is supported by a small computing cluster running virtualization services which can be allocated to groups on an as-needed basis. This cluster currently provides 36 CPU cores, 384Gb of memory, and 24Tb of storage to support our community. The cluster is configured to be easily scaled out as larger projects arrive. In addition, SESYNC is acquiring a 10Gbit dedicated connection to the University of Maryland Institute for Advanced Computer Studies (UMIACS), so that SESYNC researchers may access high performance computing clusters at the University of Maryland.

Cyberinfrastructure Services The following resources comprise the core of SESYNC's research CI:

- community.sesync.org SESYNC's social networking platform which allows groups to create and organize documents, view available SESYNC resources, and communicate between group members.
- Virtual Computing Resources SESYNC provides remote access to virtual computing resources running an array of preconfigured software such as various GIS toolkits, computational packages, and database services. Services are allocated on demand to groups and can be scaled out as necessary.
- Storage Services All groups at SESYNC have access to a dedicated storage pool where they can deposit working data sets. Access to this storage is available remotely through the web and smart devices (tablets, phones) and is locally available on a groups virtual computing resources.
- Advanced Conferencing and Multimedia Support All conference rooms at SESYNC can be configured to support live video streaming and event recording. The center is able to provide web and telephone conferencing to all groups and can support large groups with a mix of local and remote participants.
- Software Development Environment SESYNC offers an array of utilities to assist in project management. This includes, but is not limited to software code repositories, project and bug tracking services, automated testing services and development platforms for debugging software.

SESYNC Cyberinfrastructure Staffing The following individuals comprise the SESYNC CI team:

• <u>Computing Manager</u> (Mike Smorul) oversees all day-to-day IT operations at SESYNC and works with the Director of CI to plan and develop CI goals, policies, and resources.

- <u>Digital Information Research Specialist</u> (Mary Shelley) coordinates CI resources for supported projects and provides GIS, programming, and analytical support.
- <u>System Administrator</u> (Bill Schenk) administers network, communication, and virtual resources; maintains hardware resources; and, provides user support.
- <u>System Administrator & Web Developer</u> (Travis Burrell) maintains web applications and content; develops and manages SESYNC Community site; produces streaming and recorded media; and, provides web conference support.
- <u>Database Developer (vacant)</u> develops database schema and applications and provides support for administrative database programming, e.g., proposal submission, travel requests, etc.
- <u>GIS Developer (vacant)</u> provides advanced GIS support and develops custom GIS services in support of project and CI goals to create complex, outward facing GIS gateways.
- <u>Database/GIS Analyst (vacant)</u> performs data ingest, light programming, and assists in developing data set interfaces.

Computing and Storage SESYNC provides shared scientific and public workstations for use by resident scientists, as well as meeting and working group participants. These machines support common office software and provide support for high end statistical and GIS software, including Matlab, ArcGIS, SAS, and Mathematica.

For on-demand computing, SESYNC provides access to a cloud-computing platform based on OpenStack. Images can be deployed to this platform which supports a variety of research software. In addition, through collaboration with UMIACS, access to high performance computing can be made available to research that contains a novel computer science aspect. Interested researchers should contact the SESYNC Director of CI discuss these needs.

SESYNC can provide short term loaner laptops, projectors and other presentation tools to use during on-site research meetings as needed. A full list of available equipment is available on the SESYNC website under Visitor information (<u>www.sesync.org/equipment-reservation</u>). Reservations of this equipment may be made by contacting the SESYNC IT Staff (<u>itstaff@sesync.org</u>).

Office Hardware SESYNC provides a suite of commonly used office devices including copies, printers, scanners, and fax machines, which are available to guests and researchers. Center IT staff and administrative personnel are available to assist in using these technologies as needed.

Network SESYNC provides wireless coverage throughout the entire center and gigabit wired connectivity in any office or conference room. Wireless instructions are posted around the center prior to any event and wired connections can be supplied with advanced notice of five business days. Use of the SESYNC network is subject to the University of Maryland Policy on the Acceptable Use of Information Technology Resources (<u>www.nethics.umd.edu/aup/</u>).

Audio/Video and Conference Support SESYNC has four meeting rooms and a collaborative open space which can be configured in a variety of ways to support different

conferencing needs. Three of SESYNC's meeting rooms are equipped with high definition projectors which can be accessed through wired or wireless connections. The center is able to support remote participants for audio, web, or video conferencing. SESYNC can also provide support to record and stream the audio and video of Center events.

In order to ensure that conference resources are available and prepared for any meeting, we require that all A/V requirements including projector, wired network, and remote connectivity needs are registered with the SESYNC Travel and Event Coordinator at least five business days prior to the start of any event. Requests for video streaming and recording support must contact the SESYNC Travel and Event Coordinator at least five business days prior to the start of the event.

Application Hosting SESYNC provides an application hosting environment based on RedHat Linux for the development of tools and community-facing services. This environment supports the following services:

- Apache-based web server.
- PHP 5, MySQL 5.x and PostgreSQL 8.x
- Java 7, Glassfish 3.x or Tomcat 6.x or 7.x

SESYNC's hosting environment is designed to give projects a prototyping platform for currently active researchers and supported projects. SESYNC staff will work with project developers to configure hosting environments and provide troubleshooting support and training as necessary. In order to ensure the long term sustainability of hosted project, the leader of any hosted project must work with center staff to develop a disposition plan identifying support needs and steps for project archiving and/or off-site migration after a project has ended.

Data and Project Web space SESYNC provides a set of project templates to use to develop web sites for projects or data sets. Project members may edit these pages, create new pages, and upload small data sets and publications for distribution. In addition to locally hosting data sets, SESYNC IT Staff are available to assist in identifying and publishing data sets to national or international repositories, such as Dataverse or Dryad.

On-demand Computing SESYNC provides the OpenStack cloud-computing platform to provide on-demand virtual machines for research and development use. SESYNC staff will assist researchers in installing publically available images, as well as supplying a number of images preconfigured with common scientific software suites such as R.

Data Storage and Access SESYNC is able to provide large scale data storage accessible through several mechanisms including windows file share (cifs), object-based storage, and web-accessible storage. Projects requiring onsite storage are encouraged to contact the SESYNC Computing Manager to discuss their needs prior to submitting a proposal. As with Application Hosting, we will require a data disposition plan be developed for any hosted or developed collections so that long term access is ensured to all critical data.

Collaboration Tools To facilitate collaboration within supported projects, SESYNC supports a number of tools for groups to communicate. These tools allow members of sponsored research groups to remotely collaborate by sharing, accessing, and analyzing data from their individual locales at any time. Each supported project within SESYNC will be given access to the SESYNC community site. This site provides small document sharing, blogging ability, mailing lists, wiki-type workspaces, and group contact information. All researchers and projects supported by the center may also request community space. This space may be public or private depending on the needs and desires of the various groups. Sharepoint and windows file shares are also available upon request.

SESYNC provides each group with web and video conferencing services as required. Groups may request Adobe Connect access for full audio/video conferencing, or a phone bridge for toll-free teleconferencing.

In order to facilitate software development, SESYNC provides support for the following development tools:

- Subversion source code repository (<u>subversion.apache.org</u>)
- Jenkins Continual Integration Service.(<u>Jenkins-ci.org</u>)
- Redmine project management software (<u>www.redmine.org</u>)
- Drupal Commons to support discussion lists, wiki-style editing and small document sharing (<u>community.sesync.org</u>)

Scientific Software PIs should be prepared to communicate anticipated needs for analysis software during the Initial Cyber Review. In the event that additional software is necessary during the course of a project, those needs should be communicated to <u>itstaff@sesync.org</u> as soon as possible to allow time for licensing and setup. This communication is especially important for software and virtual machine configuration on SESYNC's OpenStack setup. SESYNC IT is responsible for acquiring, installing, and providing basic support for all approved software installed on SESYNC computing resources.

Database and Application Development In order to support the wide range of projects within SESYNC, our programming staff has been designed to assist projects in developing prototype applications rather than creating production-quality systems.

SESYNC IT staff can provide support in data modeling, database schema design and instantiation, and in programming web and standalone applications. The staff can also provide support in developing scripts and analysis workflows.

The following platforms are supported:

- Programming Languages: Python, Java
- Database platforms: PostgreSQL, MySQL
- Statistics platforms: R, Matlab, SAS
- Web Application & APIs: Python/Django, J2EE, PHP, RESTful services

- Middleware: Hibernate/Tomcat, Drupal
- GIS Support: PostGIS, ArcGIS

SESYNC is able to provide consulting and limited development time in support of sponsored projects. Visitors and projects who anticipate requiring application, database, or workflow support should contact the SESYNC Digital Information Research Specialist to discuss the projects data and processing requirements prior to accepting their award.

Disposition of Data and Software In order to ensure continued access to all data and software generated through SESYNC funding, all projects and researchers must work with SESYNC IT staff to develop a long term support plan for all project and/or source code which is compatible with SESYNC's published Data and Software Policy. While SESYNC is poised to offer development and prototyping support, we not positioned to offer a long term hosting and maintenance of project-specific software. SESYNC's CI group will work with all groups and researcher to help locate and migrate data to organizations better equipped to manage long term support requirements. In order to allow us to effectively plan, SESYNC IT staff will work with project leaders to develop a data plan which encompasses the following:

- **Product description** All data sets and software produced at SESYNC must be fully documented. In line with the NSF data management plan requirements, we ask that all projects provide a description of the format of data they will be using or producing, and any copyright or access restrictions which may be present.
- **Data export strategy** Modern data portals are often comprised of numerous technologies and interconnected systems. As these systems grow more complex there is large risk that the technology required to operate the portal may no longer exist, may no longer be affordable, or otherwise evolve in way which renders it incompatible with the original code. In order to ensure these technological changes do not affect the ability to retrieve data in the future, SESYNC IT staff will work with researchers to develop a plan to export data from these systems into a format which accurately preserves the critical elements of the data set.
- **Community impact** In support of SESYNC's mission of encouraging collaboration across the social and natural sciences, all products will be evaluated for reuse across the SESYNC community.
- **Cost analysis of maintaining any developed or hosting of data** Upon request, SESYNC IT staff will develop a cost analysis describing any post project support requirements. This will include estimates for maintenance, hardware and ongoing licenses.

CONFERENCE FACILITIES



SESYNC conference rooms can be configured to support any type of meeting from a small breakout session to a large workshop. In addition, a large, comfortable communal area equipped with couches and open terminals provides a comfortable space to work and relax between meeting sessions. All conference rooms and the communal area have access to wireless internet and plenty of whiteboard space. To support remote participants SESYNC can support phone and web conferences with an unlimited number of participants. These online conferences may be managed from any conference room except our small auxiliary meeting room.



Grey Room:

Our smallest equipped conference room designed primarily for small group and video conferencing.

- Capacity: 10
- 60" HD Display
- Polycom speakerphone (410-919-4821)
- Sony PTZ Camera
- In-room Teleconference facilities for Adobe Connect, Microsoft Lync, and Skype



Green Room:

Our mid-sized conference room.

- Capacity: 16
 - One ceiling-mounted HD projector
 - Polycom speakerphone (410-919-4822)



Blue Room:

Our large seminar room can be configured to support roundtable style discussion as shown below, or setup in a classroom format to seat up to 50 people. The projectors offer a variety of configurations to support any style of meeting.

- Capacity: between 30 (w/ tables) and 50 (w/o tables), depending on configuration
- Two ceiling-mounted HD Projectors
- Polycom speakerphone (410-919-4823)
- Support for remote meeting participants through Adobe Connect available upon advanced notice



Auxiliary Room:

- Capacity: 8
- Portable projector available upon request
- This overflow room is located out of the way and is good for small meetings or discussion where high end projection and teleconference facilities are not required.



Communal Space:

The large open area can support gatherings of up to 75 people. For smaller groups, it provides a comfortable space for either hacking on a coding project or relaxing on any of the couches. SESYNC kitchen facilities can support basic catering service for any on-site conference.





YEAR 1 ACTIVITIES AND ACCOMPLISHMENTS

I. LAUNCHING SESYNC

SESYNC was funded beginning September 2011 and thus at the time of writing this report (07/2012), we have only been in operation for nine months. During the first six-week period, our entire leadership team visited NCEAS, NIMBioS, and NESCent. Our goals for these trips were to learn more about their centers and begin to build a foundation for future collaborations. Over the next four months, we leased space, renovated and furnished it, equipped it with a state-of-the-art cyberinfrastructure backbone, and made critical initial staff hires. We also recruited an outstanding group of scholars to our External Advisory Board and later established our Scientific Review Committee that consists of 15 accomplished social and natural scientists. By the winter of 2011/2012 we had: 1) completed the formal language and guidelines for our funding programs; 2) solicited applications for our Postdoctoral Fellowship program; 3) announced opportunities for synthesis project funding under our founding Theme; 4) hosted the synthesis team for our founding Venture in education; 5) held our first External Advisory Board (EAB) meeting; and 6) completed a draft Strategic Plan. We describe specifics of progress to date for each of these programs over the remaining pages.

Overview of Year 1 SESYNC Activities and Participants From the beginning of the reporting period through the end of June 2012, 279 different people participated in 15 events sponsored, or co-sponsored, by SESYNC funding. We collected demographic data on 13 of the events.

For these 13 events, we collected demographic information for 265 different people, and of those 42% were female and 58% were male. Participants came from 103 cities and 14 countries, including 34 different states within the U.S. Researchers from 80 institutions, including 25 scientists from the University of Maryland, participated in SESYNC events. 234 participants chose to provide information on their race. 189 of these participants identified as White, 15 as Asian, 21 as Black or African American, 2 as Native Hawaiian or Other Pacific Islander, and 7 as more than one race.

Responses were provided by 197 participants on how they characterize their profession broadly (i.e, natural scientist, social scientist, or other). 111 participants self-characterized as themselves as natural scientists, 31 as social scientists, 38 as other, and 17 as more than one of these selections. Of the 199 participants that provided information about their professional status, 116 were at academic institutions, including 10 undergraduates, 10 postdoctoral students, 12 graduate students, and 84 college faculty/staff/admin. Additionally, there were 35 participants from the non-profit sector and 48 government staff participants. Trends in the types of participants in Theme Identification meetings and those scholars who participated in projects or funded workshops, indicated we had a high level of appropriate diversity with respect to disciplines.

During the months of July and August 2012, SESYNC is scheduled to host six more events with a total of approximately 123 different participants. Altogether, by the end of its first year, the center will have hosted 393 participants at a total of 17 SESYNC-sponsored working events (14 workshops, two Venture meetings, and one Pursuit meeting).

YEAR 1 ASSESSMENT STRATEGY AND SELECTED ANALYSES

By design, the focus of our initial activities in Year 1 has been on proactive engagement with a diverse community of scholars and potential users of the products of socio-environmental synthesis. Included were extensive efforts directed to gathering input used to develop research themes. In addition we focused on a developing mechanisms to broadly distribute solicitations for applications for synthesis activities and more targeted interactions with selected audiences through talks and participation in meetings, workshops etc. Many of these basic metrics are detailed elsewhere in this report as part of the normal NSF reporting requirements.

Our primary metrics to assess progress in achieving broad based engagement were demographic surveys and analysis of the results of our requests for applications. These track closely with standard metrics used by NSF tailored to SESYNC's specific needs. Several of these are summarized below. Because SESYNC is new and our operational model is different from other centers, much of what we will learn from Year 1 will serve as benchmarks for future efforts. This is true for quantitative metrics tracking the level and diversity of engagement as well as key aspects of the process used to solicit and review applications for synthesis projects. Similarly, more qualitative assessments examining our internal processes and team approaches will help us adapt our procedures as needed.

While a number of metrics for Year 1 are detailed elsewhere in this report, we summarize several key assessment metrics here. More specifically, we focus on those for the engagement and scholarship outcome areas that were most important in this first year.

Engagement A key outcome for SESYNC's first year was the identification of research themes essential for structuring our Pursuit program. We utilized three intensive focus groups (two in Annapolis, one in Ann Arbor, MI) to gather information from a diverse cross section of scholars, as well as policy makers, managers and others. Demographic metrics were collected at each event. The three theme identification meetings included a total of 57 participants. Of that number, 46 filled out a demographic survey (17 females [37%] and 29 males [63%]). Participants in Theme ID meetings came from 19 different states and 31 cities within the US. We provide more detail on the participants in a few pages.

The theme identification exercises used by SESYNC staff are designed to elicit a broad range of potential themes that are ultimately distilled to a subset that the focus groups feel should be priorities for the Center. In each case, the groups provided dozens of ideas (57, 41 and 49 for meetings 1-3 respectively). Facilitated sessions then narrowed these lists to a subset (5, 3 and 2 for meetings 1-3 respectively) that were then more fully developed. These meetings were the basis for the second and third solicitation for Pursuit applications. A fourth, Food Security/Insecurity, is under consideration for refinement for our fourth theme.

SESYNC staff record extensive meeting minutes during the course of these focus groups. These provide a rich source of qualitative data regarding how participants gain an understanding of the center, the nature and boundaries of SESYNC themes, and the framing of socio-environmental

issues/problems. In addition, they reveal interesting and important epistemological differences between natural and social science disciplines. For instance, in one focus group, a natural scientist's (an environmental epidemiologist) linkage of poverty, human disease, and degraded environmental quality met great resistance from a social scientist (an anthropologist) who objected that the statement, as framed, implied that "the poor were at fault for disease and environmental degradation". The dialog that followed led to a refinement of how the problem was stated, producing one that was more accurate and acceptable across both disciplines. Similar epistemological discussions have been observed in all the focus groups.

Figure 1. Composition of SESYNC participants in 2012

A) Disciplinary composition of scholars participating in SESYNC funded projects and workshops, B) Participants in Theme ID meetings included those who could potential "use" knowledge generated by the center, C) Composition of "knowledge users" included policy-makers in government agencies, representatives from non-profits and the business sector, as well as urban and land planners (practitioners).



A. SESYNC Scholars: Disciplines

II. THEMES

Three Themes were launched by SESYNC this year. After each of these themes was identified and approved, a request for proposals was posted for synthesis Pursuits with formal deadlines. The first theme (Founding Theme) was developed by the leadership team as part of our proposal and pre-award work together. The second and third Themes were developed based on Theme Identification Workshops that we held this past year and with input directly from our External Advisory Board. Theme selections and their published descriptions are subject to an EAB approval process prior to finalization. The number of proposals received from each call for proposals varied, as did the number funded or recommended for funding:

- Theme 1: 11 proposals received; 4 funded, 1 pending resubmission
- **Theme 2**: 9 proposals received; 4 recommended for funding by SRC*, 1 funded/1 pending resubmission as a Workshop
- **Theme 3**: 8 proposals received; 5 recommended for funding by SRC*, 4 funded/1 pending resubmission

*pending EAB approval

THEME DESCRIPTIONS

The following pages contain the three themes approved by the EAB which were posted as calls for proposals.

THEME 1: Founding Theme

Ecological Wealth and Changing Human Populations

Human population changes have occurred throughout history, shifting the spatial distribution of environmental pressures and creating legacies of environmental impacts, but also presenting opportunities for both conservation and restoration of ecological wealth. Population fluxes may occur as people move during periods of urban economic development and decline or during famine or conflict. Migration may be associated with use pressures on the most productive and/or pristine areas, increased human conflict over access to resources, or a host of other socio-environmental problems. While many studies have focused on economic wealth as a driver of human population changes or as it is impacted by such changes, less is known about how human population change influences ecological wealth and how ecological wealth influences populations. The latter refers not only to natural systems and the goods and services they provide, but also the access to that wealth, which varies substantially between and within populations. The interactions between shifting populations and the placement and replacement of ecological wealth raise important science and policy questions. As human populations change over short and long time periods, they influence where ecological wealth is 'placed' (e.g., protected or used sustainably), 'lost' (e.g., diminished), or 'replaced' (e.g., with human-designed or highly managed resources). We

seek proposals from social and environmental scientists whose work, individually or collectively, can contribute to actionable synthetic socio-environmental research on this Theme.

Multi-disciplinary groups whose work synthesizes social and environmental science are invited to apply, as are single-discipline groups or individuals whose work could contribute to future socioenvironmental synthesis. All proposals should have implications for placing and replacing ecological wealth as related to changing human populations across landscapes. We are particularly interested in Pursuits that focus on regions and people at potentially critical junctures of socioenvironmental change such as developing countries experiencing major population migrations or industrialized countries experiencing urban distress. Example research questions might broadly include, but are in not limited to:

- How has the rise of megacities influenced biogeochemical fluxes and how has (or will) this influence ecological wealth?
- How do different forms of governance affect socio-environmental sustainability in regions undergoing major population fluxes?
- How will the geographic ranges of species be influenced by the interplay between climate change and human population movements? What conservation or management approaches may contribute to sustaining biodiversity and meeting human needs?
- To what extent does ecological wealth (or access to ecological wealth) act as a driver for population change, and what does that imply for public policy?
- Do differences in the cultures and experiences of different stakeholder groups affected by human population fluxes influence ecological wealth?

THEME 2

Globalization and Environmental Change

SESYNC seeks proposals for activities that will illuminate linkages between globalization and natural resources and environmental change at any scale. Globalization here refers to increased economic and social interaction among peoples via trade, migration and employment, or via new forms of communication. Activities could focus on the natural resource implications of social, cultural, or economic phenomena related to globalization, they could focus on natural resources as a driver of globalization patterns and social change, or they could focus on the nature of linkages between social and environmental phenomena. We encourage research proposals related to the wide variety of globalization-environment linkages. These linkages include, but are not limited to:

- Natural resource scarcity driven by globalization
- Policy intended to protect natural resources that act as a barrier to globalization
- Globalization triggered by environmental degradation
- Globalization triggered by social change, with implications for the ways communities manage their indigenous natural resources

- Diffusion of more environmentally friendly technologies and practices triggered by globalization
- Natural resource implications of political alliances and social movements driven by globalization
- Environmental risks created by changing and accelerating the movements of people and materials as part of globalization

These examples are meant to convey a breadth of questions related to globalization's impact on socio-environmental systems.

THEME 3

Informing Sustainability and Adaptation Decisions through Assessment and Modeling of Ecosystem Services

SESYNC seeks proposals for activities related to data, modeling and methods that will improve our capacity to observe ecosystem services. This includes measures of social processes and outcomes related to the ecosystem services' benefits to households, communities, and businesses – and biophysical outcomes related to the presence or production of beneficial ecological features and processes. In general, there is a need for observational tools that foster spatial measurement and for analysis that facilitates integration of social and biophysical data across local, regional and global scales. There is also a need for time-series observations to detect changes in socio-ecological systems and the production and benefit of ecosystem services.

Ideally, proposals should provide insights and improve methods needed to understand and respond to current conditions, as well as anticipation of and adaptation to future scenarios. We also encourage proposals that place emphasis on information relevant not just to research, but also to natural resource decision-making.

We encourage research proposals related to the wide variety of issues pertaining to observational and modeling approaches. These include, but are not limited to:

- Limitations in the structure and coordination of current observing systems that limit their relevance to decision-making
- Strategic analyses and visualization approaches that will transform measurement of ecosystem services into more policy-relevant information
- Methods and standards for integrating diverse types of data to ensure their relevance to multiple research fields and lines of decision-making
- Approaches for standardizing plot- and landscape-level ecosystem service metrics so that diverse sources of data can be used to advance regional and global synthesis
- Dynamically coupled physical and social models of the human, natural system to advance assessment of policy options
- Use of different forms of data for alternative approaches to integrate modeling and thus improve understanding of the dynamics of ecosystem services
- We emphasize that proposals while focused on data, modeling, and other methods should also address topic-specific questions relevant to socio-environmental systems

• We encourage explorations across a wide variety of topics including, but not limited to, improved options for climate mitigation and adaptation, protection of biodiversity, resource management to alleviate poverty, and the effect of future demands for food, fiber, energy, and water on ecological and social conditions

These examples are meant to convey the breadth of questions related to advancing the *concept* of ecosystem services to a *quantitative science* capable of assessing and projecting the relationship between human well-being, and the resources and processes supplied by natural ecosystems.

FUNDED PURSUITS

THEME 1: Ecological Wealth and Changing Human Populations

The following Pursuits will hold their meetings throughout Year 2 and beyond, thus full descriptions of their activities and products will come in later years.

1. Pursuit 2012T1-003: "Evaluating relationships among human health and welfare, ecological condition and natural resource governance"

Principal Investigators: Brendan Fisher, Conservation Science Program, World Wildlife Fund; Taylor Ricketts, Gund Institute for Ecological Economics, University of Vermont

2. Pursuit 2012T1-005: "Creating a global database of how different populations within cities are dependent on freshwater ecosystem services"

Principal Investigators: Robert I. McDonald, The Nature Conservancy; Deborah Balk, City University of New York Institute for Demographic Research and Baruch College

3. Pursuit 2012T1-006: "Rural forest communities at a tipping point? Trends and actionable research opportunities"

Principal Investigators: Brian McGill, School of Biology and Ecology, University of Maine; Kathleen Bell, School of Economics, University of Maine

4. Pursuit 2012T1-009: "Synthesis to link understanding, planning, and management of urban ecosystems in China"

Principal Investigators: Wei-Ning Xiang, Shanghai Key Lab for Urban Ecology and Sustainability (SHUES); Joan Iverson Nassauer, School of Natural Resources and Environment, University of Michigan

5. Pursuit 2012T1-011*: Urban ecological sustainability: Multi-level governance of water, energy and carbon in the Northeast mega region of the United States" *Principal investigators:* Steward T.A. Pickett, Cary Institute of Ecosystem Studies; James Connolly, Northeastern University

*Funding contingent upon revision and resubmission of proposal by late-September.

THEME 2: Globalization and Environmental Change

The following Pursuits will hold their meetings throughout Year 2 and beyond, thus full descriptions of their activities and products will come in later years.

1. Pursuit 2012T2-003: "Globalization of the live plant trade: Informing efficient strategies for reducing non-native pest invasion risk"

Principal Investigators: Rebecca Epanchin-Niell, Fellow, Resources for the Future; Andrew Liebhold, USDA Forest Service Northern Research Station

2. Pursuit 2012T2-009:* "Globalizing our understanding of rural land use change" *Principal Investigators:* Jasper van Vliet, Amsterdam Global Change institute, VU University Amsterdam; Erle C. Ellis, Geography & Environmental Systems, University of Maryland, Baltimore County

*Funding contingent upon revision and resubmission of proposal as a Workshop proposal by mid-September.

THEME 3: Informing Sustainability and Adaptation Decisions through Assessment and Modeling of Ecosystem Services

The following Pursuits will hold their meetings throughout Year 2 and beyond, thus full descriptions of their activities and products will come in later years.

1. Pursuit 2012T3-003:* "How will businesses speak biodiversity? Novel and adaptive uses for ecosystem services data" *Principal Investigator:* Sally Duncan, Oregon State University, Policy Research Program Director,

Institute for Natural Resources

2. Pursuit 2012T3-004: "Monitoring the direct links between ecosystems and people" *Principal Investigators:* Heather Tallis, Lead Scientist, Natural Capital Project; Belinda Reyers, Natural Resources and the Environment, Council for Scientific and Industrial Research; Sandy Andelman, Executive Director, Vital Signs Africa

3. Pursuit 2012T3-005: "Incorporating values and assessing social and environmental trade-offs in managing for ecosystem services"

Principal Investigators: Lydia Olander, Nicholas Institute for Environmental Policy Solutions, Duke University; Dean Urban, Nicholas School of the Environment, Duke University

4. Pursuit 2012T3-007: "Solving the mystery of marine protected area (MPA) performance: Linking governance, conservation, ecosystem services, and human well-being" *Principal Investigator:* Helen Fox, Conservation Science Program, World Wildlife Fund; Robert Pomeroy, Department of Agricultural and Resource Economics/Connecticut Sea Grant Program, University of Connecticut Avery Point Campus

5. Pursuit 2012T3-008: "Integrating biodiversity and ecosystem services into sustainable global climate mitigation scenarios"

Principal Investigator: George Hurtt, Joint Global Change Research Institute, Pacific Northwest National Laboratory; James Edmonds, Joint Global Change Research Institute, Pacific Northwest National Laboratory

*Funding contingent upon revision and resubmission of proposal by mid-September.

Assessment Results from Year 1 Pursuit Activities

One of the important outcomes for Year I was the implementation of SESYNC's Thematic research program, with a strong emphasis on bringing together both natural and social scientists to work collaboratively on synthesis projects. Central to our efforts in this regard was a broad distribution of requests for applications (RFA's) and a robust application review process. RFA's were distributed electronically through selected society and web-based venues. Nine were selected for the initial efforts. In addition for Themes 2 and 3 we developed a direct email distribution system that reached 500 individuals.

Based on what we learned from our Founding Theme, we implemented the SESYNC Scientific Review Committee to evaluate applications. Their review employs a numerical rating across 8 common factors as well as the assignment of an overall score (standard NSF rating scale). The SRC also provides narrative comments regarding strengths and weaknesses and suggestions for areas that can be improved. In total the process gives SESYNC leadership and the EAB — who make the final decision on what to support —a comprehensive set of criteria and metrics for comparison. Quantitative evaluation criteria (1 = Excellent, 2 =Very Good, 3= Good, 4 = fair, 5 = Poor) include:

- Appropriateness for the Theme
- Novelty
- Feasibility
- Data Availability
- Suitability of Approach
- Potential for Actionable Outcomes
- Qualifications of Team
- Diversity of Team
- Overall Rating

For the recently completed RFAs (announcement of support anticipated in August 2012), and looking just at the overall rating for applications received, those recommended for support had an average score of 2.42 and 2.27 for Theme 2 and 3 respectively. Those not recommended for support had an average score of 2.73 and 3.13. We are cognizant of the limitations of metrics such as these, particularly given our focus on building and enhancing the capacity for SE-synthesis. The SRC and SESYNC leadership use these metrics in conjunction with the narratives provided as the basis for detailed discussions with Team Leaders who in many cases have the opportunity to revise their projects. In this manner, those that have innovative ideas can be guided to better meet the focus of a Theme, or to enhance their approach by clarification of questions, additions of new expertise, etc.

An important outcome of these early stage solicitations is the development of synthesis teams that reflect a diversity of natural (and/or biophysical) scientists and social scientists (see Table 2). An early baseline can be established for team diversity based on an analysis of CV's of lead applicants

as well as the applicant's descriptions of the expertise of proposed team members for all Pursuit applications submitted.

(Data from CV's and Expertise Reported by Applicants)								
RFA	Team Leads			Composition of Proposed Team				
	% Natural	% Social	%	%	% Natural	% Social	%	%
	Scientists	Scientists	Male	Female	Scientists	Scientists	Male	Female
Theme 1	63	37	78	22	55	45	61	39
Theme 2	44	56	56	44	48	52	78	22
Theme 3	62	38	93	7	49	51	61	39

Assessing collaboration SESYNC has begun to engage Pursuit and Venture teams.

Assessments are premature as participants have yet to come to the center. However, we are already examining our internal process and tracking how we are initiating interactions with teams. For instance, staff are keeping journals that summarize preliminary (web-based) meetings with Theme 1 Pursuit leads and Venture leads with an emphasis on tracking key needs (i.e., cyber support and logistical considerations) and exploring the "readiness" of the teams to initiate synthesis activities. A common finding has been that many teams need/want to convene a subset of the entire group for a pre-meeting to develop more detailed tactical plans for their projects. In at least one case, a team has asked for additional facilitation by SESYNC to help them in this regard a role consistent with our support structure. In addition, our Thematic model requires that the leads of all Pursuits meet to jointly discuss their projects, identify common interests, opportunities to share data, and possibly collaborate more extensively. They will also discuss gaps in the portfolio of projects that could be filled to enhance the overall outcome of the Theme. Our initial meeting for Theme 1 will take place July 27, 2012. Journals from preliminary conversations with team leads reveal that there was uniform enthusiasm for the meeting and at least one leader noted that they thought they would learn a great deal from the group that would help them "articulate better questions that will meet the broad goals of the theme".

III. VENTURES

There was a great deal of interest in the Ventures program during our first year. Most of the proposals received so far do no yet fall into the category that we would call high-risk/high reward and urgent, but they represent important projects to be funded. Further, it is important that the community be engaged in SESYNC and aware of the center's resources; funding these important projects provided one mechanism to achieve this engagement. During this year, we received five Venture proposals; three were funded. Information about these Ventures and their activities so far is provided below.

FUNDED VENTURES

1. Founding Venture: "Experiment in teaching the socio-environmental synthesis process" PI: Alan Berkowitz, Cary Institute of Ecosystem Studies; Co-PI: David Hawthorne, Director of Education & Outreach, SESYNC; Synthesis Meeting Dates: 1) June 6-7, 2012, 2) August 30 – Sept 4, 2012

Participants (#): 18

In the initial proposal to NSF, we proposed a founding Venture on socio-environmental educationtheory and practice. This Venture focuses on teaching undergraduate researchers the skills for effective socio-environmental synthesis (SES). The goal is to focus on identifying the critical skills needed for SES, describing patterns of student thinking and learning that promote effective SES, developing modules that could be used in undergraduate classes to facilitate SES learning, and developing tools to assess the development of these skills. The learning modules developed as part of this venture will be tested across a diverse range of institutions of higher education.

The SESYNC Director of Education & Outreach, Dr. David Hawthorne, in collaboration with SESYNC investigator, Dr. Alan Berkowitz of the Cary Institute of Ecosystem Studies, launched this Venture during Year 1 of funding. They recruited a synthesis team that includes ecologists, an economist, an anthropologist, a political scientist, and several environmental science teaching faculty. They also recruited and worked with experts in curriculum development, faculty development and student assessment. The campuses involved in the testing of the modules include a large land grant university, a private university servicing hearing-impaired students, an HBCU, and a campus that primarily services returning students.

The SES Teaching study is progressing well towards development of the learning modules for introducing SES to undergraduate classrooms. Considerable work towards defining learning goals, integration of SES scenarios into teachable units, and expanding one's point of view beyond their normal disciplinary boundaries has both challenged and inspired the participants. The modules will have a common architecture, but not necessarily a common set of content—depending on the course topic and the target student audience. The first iteration of the modules will be delivered to classrooms during the fall semester of 2012.

The Venture's goals for the upcoming year include completion of development of the first round of modules and delivery of those modules in 1-2 courses at each institution. The team will also begin development of assessment tools for the students to evaluate attainment of learning goals and student's affective measure of the modules utility and effectiveness. Assessment tools to measure faculty learning will also be developed in 2012-2013.

2. Venture 2012V-002: "State policies to transform undergraduate STEM education in support of global sustainability"

PI: Catherine Middlecamp, Nelson Institute for Environmental Studies, University of Wisconsin-Madison; *Co-PI*: Melvin George, University of Missouri; *Co-PI*: Judith Ramaley, Portland State University; Synthesis Meeting Dates: 1) July 17-20, 2012, 2) December 3-4, 2012 *Participants* (#): 28

The overall goal of this Venture is to address two urgent issues: 1) designing and delivering undergraduate STEM courses that better engage students and increase their learning; 2) preparing citizens to address global challenges (e.g., energy, environment, health, food) that are coupled with strong economic development. This synthesis effort is to identify how to use real-world problems in sustainability to address these issues.

The first synthesis meeting connected teams from five states that have begun to change content and pedagogy in undergraduate STEM courses in ways that support their long-term objectives. Teams included representatives from higher education, government, and business/industry who seek to align STEM education with their states' priorities for global sustainability. These teams began efforts to collect data to fully examine approaches being taken in each state.

In future team meetings, the group will synthesize what is known about various effective statelevel practices. The results of these meetings will be used to prepare proposals, in cooperation with the five initial states, to recruit and engage additional states and the National Academy of Sciences in this work in years 2 and 3.

3. Venture 2012V-003: "International Forestry Resources and Institutions (IFRI) research on forest social ecological systems for actionable science" *PI*: Arun Agrawal, University of Michigan; *Co-PI*: Peter Newton, Postdoc, University of Michigan *Date*: January 2013, TBD

This Venture seeks to bring together IFRI and other researchers working on forest socialecological systems to advance the understanding of 1) how local communities use and govern their forests; 2) the factors that explain broad patterns of community forest use and governance; and 3) how institutional and ecological factors combine across multiple contexts to yield different patterns of outcomes. The Venture will substantially improve the IFRI database and the capacity of SES researchers worldwide to contribute to actionable science for community-used and governed forests in human-dominated landscapes.

The proposed work will be punctuated by three meetings of researchers at SESYNC. The interdisciplinary team of researchers and the proposed meetings will: 1) clean, fill gaps in, and consolidate the global IFRI database, significantly increasing the number of cases with complete information and augmenting the analytical utility of the dataset; 2) advance the analysis for eight

research papers that examine and explain effective governance of community forests; 3) begin discussions to integrate new household-level data into the IFRI database; and 4) refine IFRI's datacollection tools and define the network's future aims and directions. The final product from the Venture will be a set of 8-10 research papers based on cross-national data that will illuminate critical areas of needed research on forest social ecological systems.

4. Venture 2012V-004: "Using spatial data and analysis to understand the human impacts of ocean acidification"

Pl: Linwood Pendleton, Nicholas Institute; *Co-Pl*: Sarah Cooley, Woods Hole Oceanographic Institution; *Date*: October 29-30, 2012

The overall goal of this venture is to conduct an integrated, spatial assessment of the potential chemical, biological, and human dimensions of ocean acidification (OA) facilitated by three meetings and a parallel data synthesis guided by two overarching goals: 1) assess the potential impact of OA on coastal communities in order to identify hot spots where OA impacts will be most acute, and 2) assess whether current natural and social science research can address policy and environmental management needs for OA. Globally, the venture will identify regions where impacts are likely to be acute. In the U.S., where data are more spatially refined, specific communities and fisheries at most risk will be identified.

To date, OA science has not been driven by tractable policy questions such as: Where can local action curb the effects of OA? How can we design better monitoring systems to collect data on OA to inform coastal managers? This work will compile interdisciplinary knowledge in a new type of framework designed to be useful for policymakers.

This synthesis will help policymakers tailor existing and planned activities to reduce the human consequences of OA. Understanding where local and regional impacts will occur is the first step in preparing for a more acidic ocean. The impacts of ocean acidification could be exacerbated by the impacts of other environmental problems (e.g. nutrient enrichment). Policy makers who understand where the effects of OA are likely to be acute can take steps to reduce the negative effects of these other "actionable" environmental factors.

5. Venture 2012V-006: "Linking biodiversity and ecosystem services: From expert opinion to prediction and application"

PI: Bradley Cardinale, School of Natural Resources & Environment, University of Michigan; *Co-PI*: Edward B. Barbier, Department of Economics and Finance, University of Wyoming; *Date:* TBD

The variety of genes, species, and biological traits in ecosystems is being rapidly depleted due to human domination of the planet. Over the last 20 years, unequivocal evidence has emerged to show that loss of this biodiversity causes natural and managed ecosystems to be less efficient at capturing biologically essential resources, leading to declines in their productivity and stability. Because of reduced productivity and stability, it is often claimed that extinction will compromise the goods and services ecosystems provide to humanity. But direct evidence for this claim is scarce, partly because researchers have yet to develop explicit, quantitative relationships linking biodiversity to services of direct value to society.

We propose a working group to develop predictive models describing how changes in biodiversity influence five ecosystem services with quantifiable economic value. Our group will bring together ecologists and economists with complementary expertise in select ecosystem services for which it is possible to (1) quantify ecological production functions linking biodiversity to the delivery of each service, and (2) develop economic demand functions valuing the marginal willingness to pay (WTP) for the impact of biodiversity change.

IV. WORKSHOPS

During the first year (September 1, 2011 – August 31, 2012), SESYNC received 13 proposals for Workshops. Eight of these were funded; two were declined; and three are still under review at the time of this report.

FUNDED WORKSHOPS

1. Workshop 2012W-002: "Citizens science, butterfly monitoring, & cyberinfrastructure" P.I. Leslie Ries, SESYNC Research Associate, University of Maryland; *Date:* May 9-11, 2012 *Participants:* 36

Citizen-scientists throughout North America perform thousands of surveys each year but unlike their European counterparts, the data from these monitoring programs are little known and less used. This workshop brought together all major butterfly data producers with representatives from the scientific and technology communities with the goal to develop systems to promote and support expanding public participation in and use of butterfly data and knowledge. By involving the public more closely in knowledge generation, analysis, and education, we can gather data at spatiotemporal scales to meet our current global challenges for supporting socio-environmental systems and also increase the investment that the general public has in both the data sources and results.

The workshop resulted in the formation of a network of data providers and includes butterfly monitoring groups that currently collect several types of data: 1) transect data based on the European "Pollard" protocols (represented by several states, including Illinois, Ohio, Florida, Iowa, and Michigan, and some organizations hoping to start new programs); 2) checklist data where all species are recorded from organized field trips and include a range of protocols (organized largely by NABA- the North American Butterfly Association and local chapters such as Massachusetts Butterfly Club); 3) opportunistic data (through programs like NABA and Butterflies and Moths of America); and 4) a network of organizations focused specifically on one species of butterfly (MonarchNet).

2. Workshop 2012W-003: "Socio-environmental synthesis education: Goals, resources, & tools" David Hawthorne, SESYNC Director of Education and Outreach; *Date:* June 4-6, 2012 *Participants:* 40

The participants were scholars involved in STEM education at all levels –graduate students to Associate Deans from universities as well as representatives from the extension service, Maryland Public Television, The National Academies of Science, National Ecological Observatory Network (NEON), Ecological Society of America (ESA), and the National Council for Science and the Environment (NCSE). The objectives of this workshop were to: 1) Identify the essential skills, practices, knowledge, discourses and attitudes of effective socio-environmental synthesis (SES) to define goals for learning; 2) describe strategies for fostering SES proficiency and using SES as a pedagogical tool; 3) discuss strategies and tools for assessing the essential skills of SES; 4) explore institutional challenges and opportunities for SES learning; and 5) catalyze formation of a community of synthesis education scholars and practitioners.

At the workshop a list of SES learning outcomes and linked teaching strategies for SES teaching were developed and topics for future research in SES education were identified, including the need for strategies for faculty development for SES education. Perhaps the most significant product of this workshop was the development of a new community of researchers and practitioners of "synthesis education". One indicator of workshop success is the catalysis of new avenues of inquiry by new teams of scholars. Immediately following the workshop, at least two groups began development of ideas which could become new education Ventures or Workshops. Subsequently, those two groups have merged and we have learned that a Venture proposal is nearing submission.

Future efforts stemming from this workshop will include publishing a "white paper" on the lessons learned, encouragement of continued interaction among participants and development of Venture and Workshop proposals.

3. Workshop 2012W-004: "Visualization technologies to support research on humanenvironment interactions" Joseph JaJa, SESYNC Director of Cyberinfrastructure; *Date:* July 23-24, 2012 *Participants:* 60

This workshop was designed to focus on the visualization and use of spatial datasets from the social and environmental sciences. The workshop brought together a very diverse set of speakers and interested participants to discuss and identify some of the current visualization challenges and emerging opportunities in using spatial datasets to study human-environment interactions. As such, the meeting took on a 'problem-solving' format in which domain scientists from the social and environmental sciences learned about visualization tools and resources available for their work and computational scientists learned about the as-yet unmet visualization needs in the domain sciences.

The workshop included three keynote addresses: "Visualization for knowledge discovery in socioenvironmental synthesis", "Visualizing socio-economic pathways with climate change", and "Visual computing for designing sustainable urban ecosystems". Additionally, there were five contributed paper sessions and a series of facilitated discussions. These discussions focused on the visualization challenges associated with using spatio-temporal datasets, possible collaborative IT efforts that could be supported under the SESYNC's programs or through other funding mechanisms, and the establishment of a network of researchers to interact on a regular basis, share information, and exchange ideas about the priorities identified during the workshop. 4. Workshop 2012W-005: "Learning exchanges for conservation: An examination of lessons learned (LExCELL)"
PI: Lekelia (Kiki) Jenkins, University of Washington, School of Marine and Environmental Affairs Co-PI: S. Hoyt Peckham, Director de Ciencias y Pesquerias Date: TBD
Participants: 17 (approximately)

This workshop will assess and synthesize key attributes of learning exchanges for marine conservation. No comparative analysis of the effectiveness of fisher learning exchanges has been made to date, despite the large investments in them by NGOs and federal agencies, including NOAA Fisheries, The Nature Conservancy, and Environmental Defense Fund. Given the urgency of fishery management challenges plus ever scarcer conservation and fisheries management resources, the PIs proposed this interdisciplinary workshop to begin to objectively assess the effectiveness of fisher exchanges and to identify key attributes that can enhance the success of fisher learning exchanges, using methods, including focus groups, interviews, and reflexive discourses. They will synthesize these attributes into an actionable research plan to guide a subsequent two phase field research program on fisher learning exchanges.

5. Workshop 2012W-007: "Social networking and priority scholarship" Rachel Berndtson, SESYNC Graduate Research Assistant; *Date:* June 20-21, 2012 *Participants:* 10

The participants represented the natural and social science discipline, including: public policy, sociology, geography, environmental science, biology, natural resources and urban planning. They were from diverse geographic regions including Washington, DC, New York City, Southern California, British Columbia, and the American Southwest. The goals of this workshop were to: (1) develop SESYNC themes by learning about and engaging in SESYNC's theme identification process; and (2) prepare for the social networking component of the Graduate Scholars Program.

During the workshop, Graduate Scholars learned about SESYNC's thematic structure, the characteristics of SESYNC themes, and the community-driven process of theme identification. Students then engaged in SESYNC's facilitated theme identification process. Throughout the meeting, they suggested themes and commented on and questioned the theme suggestions of others, resulting in the creation of three fully-developed working themes. The students then discussed logistics and potential strategies for the social networking component of their project. This discussion continued following the conclusion of the workshop through an active online forum.

For the next six months, the student scholars will engage in the social networking component and each will recruit for, maintain, and moderate his/her own online social network of other graduate students for further theme development. Half of the Graduate Scholars will provide their social networks with the three themes developed at the workshop as a starting point from which to engage in theme identification. The other half of the Graduate Scholars will provide their social networks with only the description of SESYNC themes and the theme identification process as a starting point. The students will monitor the products and processes within their own online social networks during this six-month period. A final workshop will be held at SESYNC following this six-month period to discuss the processes and products of the social networks. They seek to

discover the nature of the processes (network diversity, centrality, density, etc.) and products (theme development and feedback) resulting from graduate student online social networking as a means of developing research priorities.

6. Workshop 2012W-008: "Macro-evolution of ecosystem services" Co-PIs: Nathan Kraft, University of Maryland, Department of Biology; Bill Fagan, Associate Director of Research Innovations, SESYNC Date: July 25-26, 2012 Participants: 10

This workshop was proposed as a novel synthesis idea that should be considered high-risk/high reward. It has the potential to open doors to new areas of investigation and may lead to the development of new methods. The goal was to assemble a small group for a one-time scoping meeting in which participants would explore existing work, learn about existing data resources, methodologies, and perspectives, and identify possible directions and specific research questions within the broader subject of the macroevolution of ecosystem services. Preliminary discussions outside of SESYNC identified multiple directions this group could go that would be innovative from the perspectives of diverse disciplines. These include: 1) a comparative examination of the biogeography of tree traits across landscapes where the economic value and ecosystem services of alternative land uses could be quantified economically using different species occurrence scenarios; and 2) using economic valuation perspectives to explore the evolutionary tradeoffs among several tree traits related to ecosystem services that occur in different combinations across phylogenetic trees. This latter idea, which would quantify the consequences of 'landscape-scale artificial selection' from an ecosystem service perspective, might afford a path toward quantifying 'evolutionary opportunity costs'.

7. 2012W-011: "Linking socio-environmental science to socio-environmental change" *Principal Investigator:* Thaddeus Miller, Nohad A. Toulan School of Urban Studies and Planning Faculty Fellow, Institute for Sustainable Solutions, Portland State University Date: October 10-11, 2012 Participants: 22

This workshop proposes to examine how socio-environmental science and, more specifically, efforts supported by SESYNC, can inform and foster social action for sustainability. Largely missing from the literature on linking knowledge to action is an empirically and conceptually rich understanding of how social and environmental change occurs. Furthermore, there are considerable epistemic, ontological, and institutional barriers to conducting such integrative and solutions-oriented research. The proposed workshop will address the following issues in order to spur SESYNC initiatives and research in the socio-environmental sciences, more broadly, that is oriented toward generating more sustainable outcomes: 1) development of a rigorous interdisciplinary research agenda for exploring how socio-environmental science can contribute to actions that lead to more sustainable outcomes; 2) examine the epistemic, ontological, and institutional barriers to constructing such an agenda; and, 3) explore how research and education efforts—in our respective fields, through new collaborations and at SESYNC—that might overcome these barriers can be encouraged.

V. FELLOWSHIPS

SABBATICAL FELLOWSHIPS

During the first year, SESYNC received 3 requests for sabbatical support and declined all three. Each application was reviewed with an emphasis on determining how closely the goals of the proposed work would align with SESYNC's interest in integrating natural and social sciences around issues of sustainability. In each case, the goals of the applicant's research plan were significantly distant from our mission; and therefore SESYNC would not have provided the correct venue for a fully successful sabbatical.

POSTDOCTORAL FELLOWSHIPS

During the first year, SESYNC had two solicitations for postdoctoral applications. The first was posted in the early fall (September 2011) with a due date of January 31, 2012. We ran ads in a number of journals, including *Science, Nature, Frontiers in Ecology & the Environment*, as well as on society websites that spanned the range of computer science, sociology, psychology, anthropology, and others. The second posting was in February with an April 20, 2012 deadline. The latter was specifically targeting social science postdoctoral fellowships since the vast majority of the applications we received in the first solicitation were from natural scientists (http://www.sesync.org/postdocs/social-science-postdoctoral-fellows). A total of 33 postdoctoral applications were received during year one. Four offers were made, and all four candidates accepted.

As of this writing, our 4 postdoctoral fellows will be in residence at SESYNC by September 30, 2012. We have begun the process of identifying domain mentors for each fellow. As the fellows begin their residence at SESYNC, we will initiate the mentorship program in synthesis science and in professional development. We have joined the effort to bring CIRTL (Center for the Integration of Research, Teaching and Learning—www.cirtl.net) membership to the University of Maryland and will encourage SESYNC Fellows to take part in the STEM education opportunities offered through the CIRTL consortium.

Our first cohort of SESYNC postdoctoral fellows includes the following scientists:

- 1) **William Burnside** earned his Ph.D. in Ecology with major interests in human macroecology and sustainability. He will develop a synthesis of the ecological, societal and economic correlates of sustainability.
- 2) **Judy Che-Castaldo** earned her Ph. D. in Ecology studying ecological monitoring and phytoremediation of heavy metal contamination in soils. She will conduct a synthesis of anthropogenic threat and demographic data to predict species extinction risk.
- 3) **Drew Gerkey** earned his Ph. D. in Evolutionary Anthropology analyzing cooperation and collective action among salmon fishers and reindeer herders in Kamchatka, Russia. His

fellowship work will use a behavioral ecology framework for synthesis of the sustainability of social networks in socio-ecological systems.

4) **Julio Postigo** earned his Ph.D. in Geography analyzing how climate change, political and economic trends, and land reform have affected pastoralist society in Peru. He will analyze pastoral societies' responses to global environmental change.

VI. OTHER ACTIVITIES

CYBERINFRASTRUCTURE

SESYNC has participated in two proposals (one as lead and one as sub) submitted to the NSF Office of Cyber Infrastructure for supplemental funding to develop cross-center cyberinfrastructure collaborations. Under the leaded funded proposal, SESYNC will lead monthly video conferences during which IT staff from multiple bio centers will identify CI problems and learn how to approach them, based on other centers' experience. As part of this collaboration, yearly workshops to implement solutions to key challenges will be held. The second funded proposal, led by BEACON, aims to improve the computational knowledge of the biology community at large and empower scientists to make better use of available CI resources in their research. SESYNC will host two cross-center working group meetings to identify critical gaps in bio-computational knowledge and assist in the management and development of assessment tools for the materials developed.

UNDERGRADUATE INTERNS

In 2012, we initiated the SESYNC Intern Program for outstanding undergraduates to obtain valuable educational experiences in policy and natural science elements of socio-environmental issues. Our coordinated program has academic and government arms providing a diversity of internship opportunities. The government interns include 3 interns working with city and county planning offices on green infrastructure and land-use planning. There are 7 academic interns working with faculty at the University of Maryland and Coppin State University on various research projects spanning disciplines including policy, resource economics, geography, environmental science, and entomology. The entire cohort met at SESYNC regularly for a series of lectures, problem solving, and socio-environmental synthesis training. The lectures were provided by senior leadership of SESYNC, graduate students associated with SESYNC, and one of the supervisory mentors in the Prince Georges County Planning Department.

A graduate student in the UMD MEES program, Maira Bezerra, was hired to coordinate this program. While Maira's work was essential for the implementation of this program, we also see her involvement as an opportunity to provide a professional development opportunity to a graduate student. This project involved a great deal of "hands-on" experience in all aspects of building this new program, offering Ms. Bezerra numerous challenges. She was mentored closely by two of the directors to support her development of a confident demeanor towards the interns and their discipline mentors, and to build her administrative and leadership skills.

In the coming years we plan to enrich the internships with linked classroom and/or distance learning experiences and to further broaden the diversity of internship opportunities through new government, industry and non-profit organizations involvement. Interns in 2012 hailed from three universities (University of Maryland, Coppin State University, Dartmouth University), and we anticipate that engagement with institutional partners will increase the number of institutions represented in future cohorts.

Socio-environmental Gemstone Program for College Freshmen

The Gemstone Program at the University of Maryland is a unique **multidisciplinary four-year research program** for selected undergraduate honors students of all majors. Each year, groups of freshmen select a project to work on for four years among a selection presented to them by mentor-faculty. Many of the proposed projects are not selected; however, Dr. William Fagan, a SESYNC Associate Director of Research Innovation pitched a socio-environmental synthesis project that was selected by a group of students and which will proceed in coordination with SESYNC events and activities. We anticipate active engagement of these students in SESYNC activities as their research project becomes fully developed.

SUMMER SOCIO-ENVIRONMENTAL CAMP FOR YOUTH

Instructor: Dr. Earlene Armstrong, University of Maryland Participants: 40 Date: Summer, 2012

The two sessions of this one week "Insects & Ecosystem Services" camp emphasized the positive role of insects in the environment and in the quality of life for humans. Campers between the ages of 7 and 11 years had the opportunity to participate in a variety of written as well as hands-on/interactive activities. Field trips were an integral part of the camp and these activities were age appropriate for participants. Camp objectives included promoting a positive attitude of students towards science by using insects as models to learn basic science concepts, exposing students to different types of data collection, analysis, and synthesis about insects using a variety of media and illustrating the important link between humans and the environment using insects as indicators.

Two sessions were run with a demographically diverse group of young students which included 16 African Americans, 3 Hispanics, 1 African-Cuban, and 1 Persian-American. Approximately 66% were male and 33% were female.

VII. YEAR 2 GOALS

SESYNC's goals for Year 2 build directly from those detailed in our strategic plan (Appendices). The following goals are of particular importance:

PROGRAMS

Thematically Organized Synthesis SESYNC will initiate two new themes in the second grant year. In addition, we will examine progress made in the current themes, and consider if any should be re-advertised based on the need to fill critical research gaps. SESYNC staff will continue to engage with a broad community both in the U.S. and with our partner programs overseas to identify important priority areas for synthesis research.

Opportunities for Innovation The early success of our Ventures and Workshop programs points to a tangible need in the community for opportunities for exploratory and innovative research, tool development, and engagement. In Year 2, SESYNC will actively promote these programs with a specific focus on providing support for high risk/high reward and time sensitive projects.

Process and Assessment SESYNC's process to help teams develop socio-environmental synthesis projects that are scientifically robust and actionable will evolve in Year 2. We will fully document the program's mechanisms to facilitate team science and provide support systems that enhance the success of research efforts at SESYNC. In addition, we will work internally and with outside experts to complete the operational and observational framework for SESYNC to empirically measure, assess, and innovate SE synthesis activities.

Support for Scholars SESYNC will actively recruit early, mid-career, and senior scholars for various fellowship opportunities at the Center. Supporting sabbatical fellows from diverse disciplines who pursue socio-environmental synthesis research is a priority.

Reaching Out to Social Scientists We will fully implement the SESYNC Social Science Foundation series in Year 2. A minimum of four workshop series will be conducted by noted social scientists during this period. In addition, we will broaden the Foundation effort by targeting natural scientists to examine frontiers for transdisciplinary contributions

Education Programs We will complete the development of undergraduate learning modules and graduate student social networking studies. We will expand our summer intern program and seek additional opportunities with our partnering academic institutions to extend SESYNC programs to students at various levels.

Initiate Policy Interactions In Year 2, we will initiate greater interactions with agency, NGO, and corporate stakeholders through additional theme identification meetings, direct briefings, and, as appropriate, involvement in Pursuits, Ventures, and Workshops.

Postdoctoral Program In 2013, we will offer 2 rounds of recruitment, with a goal of awarding 5 additional fellowships. We will also begin development of an assessment rubric for evaluation of

the fellows and for their evaluation of the program as the first cohort reaches the end of their 2year appointments.

Cyberinfrastructure programs In Year 2, we will devise and implement a comprehensive evaluation program of the CI services provided by SESYNC that will determine what data and tools are needed by center researchers, what resources may be available but underutilized, and more generally how we can improve all the CI services. The CI team will scope and develop an administrative database with a web-based user interface that will eventually allow multiple functions to be accessed and coordinated in one place by all members of the SESYNC community and will greatly facilitate center evaluation. The team will also make web-based map services available to all working groups so they can interact via the internet with GIS products they are developing. In addition, we will begin development of a data portal through which researchers can easily search and access data relevant to socio-environmental synthesis from a wide range of organizations and agencies. Finally, the team will develop and deliver informal training programs to on-site scientists, tailored to their needs, covering the specific CI resources available at SESYNC, such as GIS, web programming, and database and statistical software.

Assessment Goals for Year 2

The number and variety of activities at SESYNC will expand considerably in Year 2. By year's end we will have a full complement of Pursuits running under four Themes as well as a diverse mix of Ventures and Workshops. Our assessment of these activities will build on what we have learned in Year 1. Several key elements of the upcoming assessments are highlighted below:

- Continuation of baseline demographic surveys for participants. We are also exploring opportunities to standardize and develop common cyber platforms across NSF funded synthesis centers.
- Implementing participant surveys designed to assess collaborative processes and success in transdisciplinary interactions. We are examining potential models for these surveys and will modify them as needed to reflect the unique aspects of SESYNC's projects.
- Financial and workload assessment of projects to determine overall center spending and capacity issues.
- More standardized journal formats for meetings specifically directed to monitoring interand trans-disciplinary interactions, team progress and the role of SESYNC staff in facilitating/accelerating synthesis.
- Tracking the use of cyber resources to determine what technologies (analytical, communications, etc.) are being utilized and are most effective for teams.
- Tracking of policy interactions and briefings, as well as specific communications and outreach efforts.
- Use of follow-up surveys to assess participant satisfaction with SESYNC support.