



National Center for Ecological Analysis and Synthesis

2013

Report to the National Science Foundation

NCEAS Annual Report 2012-2013

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NCEAS Annual Report 2012-2013

1. Participants

Frank Davis, Director PI

Stephanie Hampton, Deputy Director Co-PI

Mark Schildhauer, Director of Computing

Partner Organizations

Matching funds have been provided by the State of California and by the University of California, Santa Barbara.

The Gordon and Betty Moore Foundation is funding the “Ocean tipping points” project (formally “Ecosystem thresholds and indicators for marine spatial planning”) which supports a postdoc and working groups. This project seeks to understand and characterize ecological thresholds, or “tipping points,” in coastal and ocean systems, in which small changes in human use or environmental conditions result in large, and sometimes abrupt, impacts to marine ecosystems. The project’s goal is to help agencies and decision-makers anticipate and manage for these tipping points.

The David and Lucille Packard Foundation funded a three-week intensive training workshop in ecological analysis and synthesis for early-career researchers during the summer of 2013. Twenty-two participants were selected out of nearly 400 applicants to participate in the NCEAS Summer Institute. More information about the Summer Institute is provided below in the “Training and Workshop Sessions” section.

An award from Conservation International convenes experts to develop rigorous and transparent indices of “ocean health” to guide and influence science and policy at national and international levels. Professional, postdoctoral, and graduate student researchers have been supported on this award. This “Ocean Health Index” project was listed as one of the ten best ocean stories of 2012 by Smithsonian Magazine.

The Ocean Conservancy supports a postdoc and working group that aims to construct the theory of marine debris incorporating the needs of nonscientific constituencies. The project is examining the impacts of marine debris on ocean ecosystems and is evaluating a suite of potential solutions.

A new NCEAS initiative, “Science for Nature and People (SNAP)”, is a NCEAS collaboration with The Nature Conservancy and the Wildlife Conservation Society. The Gordon and Betty Moore Foundation is the primary funder of this initiative. Other supporters include Shirley and Harry Hagey, Steve and Roberta Denning, Seth Neiman, Ward W. and Priscilla B. Woods, and the David and Lucille Packard Foundation. This initiative is addressing the question “How can protecting nature help secure food, energy and water – and enhance the quality of life – for 10 billion people?” The first SNAP

working group project, “Conserving western Amazonia’s freshwater ecosystems & services”, met in September 2013.

Other Collaborators

To facilitate informatics research and to support the informatics needs of the ecological community, NCEAS continued strong research partnerships with a growing group of organizations: San Diego Super Computer Center, University of Kansas and University of New Mexico (LTER Network Office), UC-Davis, Oak Ridge National Laboratories, the National Evolutionary Synthesis Center (NESCent), and the Ecological Society of America (ESA). This year we have additional collaborations with the University of Wisconsin, the Caltech Jet Propulsion Lab, Earth Science Information Partners, Rensselaer Polytechnic Institute, the California Digital Library, the Renaissance Computing Institute (RENCI), Arizona Geologic Survey, and the Alaska Ocean Observing System. These partners work together on various NSF and private Foundation awards.

As of July 2013, NCEAS is an official member of the Earth Science Information Patners (ESIP) federation.

Other collaborators are highlighted on the NCEAS web site: <http://www.nceas.ucsb.edu/collaborators>

2. Activities and Findings

Computing & Informatics Support

NCEAS continues to provide informatics education and tools to the scientific community, in addition to maintaining a high level of computing support that facilitates scientific efforts at the Center. To date NCEAS has created over 250 collaboration websites using open source, free content management software, serving working groups, distributed graduate seminars, various meetings and special projects. Funding from this award supports such informatics education activities as: training workshops targeted to NCEAS resident scientists, one-on-one training for Working Group participants, and the development of undergraduate teaching modules in an undergraduate Distributed Seminar.

Many of the training activities highlighted elsewhere in this report are focused on informatics topics, in many cases leveraging external support. Other NSF awards to our Ecoinformatics team support training and outreach in Informatics to the broader ecological community.

Science Advisory Board

Proposals submitted and supported since NCEAS inception, by proposal period and by proposal type, are shown in Figures 1 and 2. There were no NSF calls for proposals during this reporting cycle, however the Science Advisory board met Oct. 3-4, 2012 to review proposals submitted in August 2012. We received 52 proposals for that call and 11 were accepted. Science Advisory Board members

during 2012 are listed in Table 1. A complete history of board members is available on the NCEAS web site: <http://www.nceas.ucsb.edu/sab/cumulative>.

In September 2013, a call for proposals was issued for the Science for Nature and People (SNAP) initiative (described above). Thirty proposals were submitted. As of this submission, final reviews are still pending.

Major Research Activities *(Based on data available as of August 31, 2012)*

Since the beginning of this reporting period, October 1, 2012, NCEAS has supported 10 postdoctoral researchers. A list of postdoctoral researchers, including descriptions of their projects is provided below. NCEAS did not support any sabbatical fellows during this reporting cycle.

Since the last report submission, NCEAS postdoctoral scientists have accepted faculty or other career positions at Florida State University, University of Virginia's College at Wise, and California University of Pennsylvania.

Former postdoc Duncan Menge was lead author on "Nitrogen and Phosphorus Limitation over Long-term Ecosystem Development in Terrestrial Ecosystems" by Duncan Menge, Lars Hedin, and Stephen Pacala, published in PLoS One (2012) vol. 7(8) which won Ecological Society of America's (ESA) theory section's 2013 best paper award. In addition Duncan Menge and former postdoc Marissa Baskett were both named ESA's 2013 Early Career Fellows.

Former postdoc John Parker received a \$250,000 grant to lead a study at NCEAS and other centers to develop an understanding of how different patterns of organization and interaction influence group performance and creativity, and facilitate deep synthesis of highly diverse scientific theories, concepts and methods. Participants of three NCEAS working groups wore "computer necklaces" which track how scientists interact with each other quantitatively and in real-time.

Since the beginning of the reporting period, 595 individuals participated in activities at NCEAS. Of these participants, 10% were either residents of NCEAS or scientists at UCSB, and 20% were visiting from foreign institutions. A total of ten Postdoctoral Fellows, 23 Working Groups, and one Distributed Undergraduate Seminar have been active or scheduled in the reporting period.

NCEAS also has hosted meetings for nine different collaborative groups. Seven Center Associates and at least 18 Scientific Visitors have been hosted at NCEAS in this reporting period. Activities are listed below.

Postdoctoral Fellows

Occurred or were scheduled between October 1, 2012 and September 30, 2013

Based on data available as of September 30, 2013

Ben Adams

15FEB2013 - 14FEB2014

INTEROP: A Community-driven scientific observations network to achieve interoperability of environmental and ecological data (Supported by NSF INTEROP (DBI-0743144))

Advances in environmental science increasingly depend on information from multiple disciplines to tackle broader and more complex questions about the natural world. Such advances, however, are hindered by data heterogeneity, which impedes the ability of researchers to discover, interpret, and integrate relevant data that have been collected by others. A number of earth science disciplines, however, are recognizing the interoperability benefits of describing data at the level of observation and measurement, rather than at the level of the data set. The investigators propose the Scientific Observations Network (SONet) to initiate a multi-disciplinary, community-driven effort to define and develop the necessary specifications and technologies to facilitate semantic interpretation and integration of observational data across earth science domains.

The technological approaches will derive from recent advances in knowledge representation that have demonstrated great utility in enhancing scientific communication and data interoperability within the genomics community. This effort will constitute a community of experts consisting of environmental science researchers, computer scientists, and information managers, to develop open-source, standards-based approaches to the semantic modeling of observational data. Working groups of experts will also engage in extending this core data model to include a broad range of specific measurements collected by the representative set of disciplines, and a series of demonstration projects will illustrate the capabilities of the approaches to confederate data for reuse in broader and unanticipated contexts.

Mark Browne

13FEB2012 - 31DEC2013

Marine debris: Scale and impact of trash in ocean ecosystems (Supported by the Ocean Conservancy)

To construct the theory of marine debris incorporating the needs of nonscientific constituencies, this working group will accomplish the following goals: 1) compile and synthesize existing information to determine how much harmful debris is in our ocean; 2) compile and synthesize existing information to determine impacts of marine debris on ocean populations and ecology; 3) compile and synthesize existing information to determine impacts of marine debris on human populations; 4) identify the three most prominent sources/items of plastic debris for which behavior-oriented solutions can be implemented; and 5) analyze research regarding efficacy of policy solutions such as plastic bag bans as they relate to ocean trash items.

Mariah Carbone

01MAR2011 - 28FEB2013

A synthesis of soil respiration in semi-arid and arid ecosystems across multiple spatial and temporal scales

Soil respiration (SR) represents a huge uncertainty in global climate models. This is because we lack a mechanistic understanding of the plant and microbial processes that drive SR rates across different landscapes and in time. Predicting SR in semi-arid/arid ecosystems is particularly challenging because of high interannual variability in precipitation, rapid wetting and drying cycles, large

temperature variations, and short phenological cycles. By conducting a multiple phase synthesis of existing continuous SR datasets that span a range of semi-arid/arid ecosystem types, this work will improve our basic understanding of the mechanistic controls on SR in these ecosystems. Semi-arid/arid ecosystems cover large areas of Earth, and compared to tropical, temperate and boreal ecosystems, information about them is currently lacking in global synthesis studies. Specifically, this research will identify key biotic and abiotic drivers of SR in these ecosystems, and quantify their relative importance in a clear spatial and temporal framework. This will be accomplished through a combination of basic statistical and time series data analyses, novel isotopic techniques, as well as innovative model-data integration approaches. Results will be used to: (1) improve parameterization and mechanistic representation of SR in models; (2) develop protocols and strategies for quantifying SR in and across semi-arid/arid ecosystems; (3) create a uniform and publically accessible SR database with original and derived data products, including characterization of data uncertainties; and (4) contribute more broadly to a global SR synthesis effort.

Derek Gray

17JAN2012 - 17JUL2013

Lake Baikal responses to global change (Supported by NSF Dimensions of Biodiversity)

Understanding how ecological communities will re-organize under global change is one of the main challenges facing ecologists today. Responses of communities will depend on the underlying genetic and functional diversity within and across species, as well as on the taxonomic diversity within communities. Here we will characterize these different aspects of diversity in the plankton of Lake Baikal, the oldest, largest (by volume) and most diverse lake in the world. Lake Baikal's planktonic food web is dominated by endemic species that are sensitive to changing climate and other anthropogenic stressors. These organisms fuel the rest of Baikal's incredibly diverse biota making responses of the plankton crucial to understanding how Lake Baikal biota will respond to global change. The UCSB team will analyze a Russian 60-yr time series from Lake Baikal to understand the complexity of community change over time, complementing field and laboratory studies carried out by other partners, in order to achieve a more holistic understanding of plankton biodiversity dynamics.

Mary Hunsicker

25FEB2013 - 24FEB2014

Ocean tipping points (Supported by the Gordon and Betty Moore Foundation)

Abstract:

An increasing number of examples of tipping points in ecosystems around the world have begun to raise concern among scientists and policymakers. In the oceans, diverse ecosystems ranging from reefs to estuaries to pelagic systems have undergone sudden, dramatic shifts. Changes in ocean climate, the abundance of key species, nutrients, and other factors drive these shifts, with resulting effects on ocean food webs, habitats, and ecosystem functions that have direct impacts on people's livelihoods and well-being. Ocean tipping points may be cause for particular concern because they are often unexpected and can be very difficult, if not impossible, to reverse. Though there have been many critical advances in the science of ecosystem tipping points in recent years, there is still a dearth of practical tools and information available to managers to anticipate and respond to ecosystem shifts. Through this four-year study, the team will synthesize data on when, where, and how marine ecosystem shifts occur, and develop early warning indicators and management tools to

begin to help managers anticipate, avoid or respond to tipping points. As ecologists, lawyers, and social scientists working in close partnership with managers, the team is tackling these problems from both the science side and from the policy and implementation side. Working with local managers, the team will implement ideas and test results in two case study locations: Haida Gwaii (in British Columbia) and Hawaii.

Catherine Longo

06JUL2010 - 30JUN2014

Ocean Health Index (Hosted by NCEAS, Supported by Conservation International)

Abstract:

The focus of the Ocean Health Index project is on narrowing the current suite of potential indicators to a tractable, meaningful, representative subset that can serve as critical tools for monitoring, planning, and policy with applicability across a range of systems and geographic scales. Specifically, this effort will bring together leading scholars and practitioners from ecology, fisheries, oceanography, economics, and the applied social sciences to develop ecosystem health metrics for the Arctic, coral reefs, estuaries, continental shelves and coastal upwelling regions. The resulting set of vital signs will serve as concrete concepts to help catalyze political will, pave the way for policy-making at all levels of government, provide critical tools to communicate the state of marine systems to the public, and facilitate much-needed integration across the social and natural sciences.

Benoit Parmentier

29AUG2012 - 28OCT2013

Choosing (and making available) the right environmental layers for modeling how the environment controls the distribution and abundance of organisms (B.Parmentier supported by iPlant)

We seek to understand how the environment controls species distributions. Despite the fact that a great deal of work in physiology has been done on this problem and that literally thousands of niche models (regressions of distribution on environment) have been run, we know surprisingly little about basic questions. Which aspects of environment are most central in controlling the distribution and abundance of organisms? How does this change with organism? with scale? what are the mechanisms linking environment to species distributions? We propose to assemble a state-of-the-art set of environmental layers that incorporate well-known but rarely used measures that have direct links to physiological processes like frost, water stress, growing season, soil properties, drainage properties, etc. We will assemble these variables into a unified, global, gridded, high resolution data set that will be made available to the public. This will be of enormous benefit to the community. We will use this data to explore the above-mentioned basic questions about the nature of the links between the environment and the distribution of organisms.

Stephanie Pau

11JAN2010 - 31DEC2012

Improving our understanding of the ecological controls on the distribution and phenology of C3 and C4 grasses in response to climate variations

This proposed project seeks to analyze and synthesize herbarium, climate, and satellite data over several decades to address the spatial and temporal response of C3 and C4 grasses to climate variability in the Hawaiian Islands. Complicating our understanding of C3 and C4 response to climate change and increased CO₂ are large uncertainties regarding their differential response to climate variability. Numerous studies have demonstrated ecological sorting of C3 and C4 grasses along static spatial climate gradients, though few studies have focused on phenological differences between C3 and C4 grasses. In Hawaii, C4 grasses initiate a grass-fire feedback cycle that directly affects ecosystem structure and function. El Niño-driven droughts, the greatest source of interannual climate variability in Hawaii, may contribute to this feedback by providing a “tipping point” for C4 grass invasion into new regions. Results from this project will provide new information on the functional significance of C4 photosynthesis and the invasion dynamics of C4 grasses. This work will also provide insight on the response of these grasses to climate variability, and lay the groundwork for merging herbarium datasets with satellite data to create an ecological informatics database for grasses.

Stacy Rebich Hespanha

17OCT2011 - 16OCT2013

DataONE: Observation Network for Earth (Supported by DataONE – NSF OCI-0830944)

DataONE (Observation Network for Earth) is building cyberinfrastructure for open, persistent, robust, and secure access to well-described and easily discovered Earth observational data. Supported by the U.S. National Science Foundation, DataONE will ensure preservation and access to multi-scale, multi-discipline, and multi-national science data. DataONE will transcend domain boundaries and make biological data available from the genome to the ecosystem; make environmental data available from atmospheric, ecological, hydrological, and oceanographic sources; provide secure and long-term preservation and access; and engage scientists, land-managers, policy makers, students, educators, and the public. DataONE is a collaboration between NCEAS/UCSB, the University of New Mexico, the Oak Ridge National Laboratory, the California Digital Library, NESCent, and a number of other organizations.

Josephine Rodriguez

11JAN2010 - 31JUL2013

Understanding a diverse insect-parasitoid community: insights from synthesizing biodiversity inventory data from the tropics

This proposal aims to synthesize the caterpillar (and their host plants and parasitoids) database inventory of the Area de Conservación Guanacaste (ACG) in Costa Rica (conducted by D. Janzen and W. Hallwachs) with an extensive genetic dataset from BOLD (Barcode of Life Data Systems) with focus on the Microgasterinae (Braconidae) an important group of caterpillar parasitoid wasps. Understanding the extent and cause of tropical insect diversity is one of the major challenges in modern ecology (Godfray et al., 1999) and generally requires two approaches: 1) rigorous biodiversity inventories of the insects at particular sites; and 2) reconstructing food webs demonstrating the trophic interactions between species (Godfray et al., 1999). Those two approaches are the major goals of this project and include testing specific hypotheses on microgasterine ecology and evolution. Specifically, I will integrate the genetic data (CO1 DNA barcodes) with inventory records to assess the number of species of microgasterine wasps and levels of host specificity. This

will be followed by construction and analyses of microgastrine parasitoid food webs which will provide insights into community structure, crucial in interpreting patterns of parasitoid diversity and provide the basis for hypotheses about structuring processes (Memmott and Godfray, 1993; van Veen et al., 2006).

Distributed Undergraduate Seminar

Occurred or were scheduled between October 1, 2012 and September 30, 2013

Based on data available as of September 30, 2013

Toads, roads, and nodes: Collaborative course-based research on the landscape ecology of amphibian populations (Supported by non-core NSF funding)

Leader(s): Marsh, David; Hampton, Stephanie

We propose to link networks of undergraduate ecology and conservation biology courses to study the factors that promote the persistence of amphibian populations at landscape and regional scales. Using existing data from the North American Amphibian Monitoring Program (NAAMP) and satellite imagery from Google Earth, students in 10 classes will relate the presence/absence of amphibian species in their own state or region to landscape features such as forest cover, road density, and urbanization. Representatives from each class will then bring their data to a meeting at the National Center for Ecological Analysis and Synthesis (NCEAS) to compile and analyze them at the national scale. In the first year of the project, classes will examine the effects of current landscape features on amphibian distributions. In the second year, classes will use older satellite imagery to discern the residual effects of past land use on amphibians and determine the lag time over which forest loss and road construction affect amphibians. In each project year, students will engage with a complete piece of scientific research from hypothesis to conclusion, and each year's project should result in a research publication. With respect to assessment, the multi-year, multi-class structure of our project will allow for strong inference about the impact of the project on student attitudes and abilities.

Working Groups

Occurred or were scheduled between October 1, 2012 and September 30, 2013

Based on data available as of September 30, 2013

Title: Synthesizing frontiers in modeling drought- and insect-induced tree mortality with climate change

Leader(s): Anderegg, William; Hicke, Jeffrey; Fisher, Rosie

Participants: Craig Allen, William Anderegg, Juliann Aukema, Matthew Ayres, Barbara Bentz, Rosie Fisher, Jeffrey Hicke, Jeremy Lichstein, Alison Macalady, Nathan McDowell, Paul Moorcroft, Yude Pan, Ken Raffa, Anna Sala, John Shaw, Nate Stephenson, Christina Tague, Melanie Zeppel

Abstract:

Forest ecosystems store large amounts of carbon and absorb nearly a quarter of human emissions of carbon dioxide annually. Yet recent drought and insect-induced, widespread forest die-offs highlight that climate change could threaten these carbon sinks from boreal regions to the tropics.

Consequently, drought/insect-induced forest mortality constitutes a major uncertainty terrestrial ecosystem carbon cycling and climate change impacts. Despite its importance, current climate-vegetation models do not accurately capture forest die-off due to limitations in understanding of how trees die during drought, modeling infestation dynamics, and appropriate datasets for model validation. The proposed working group will 1) synthesize available modeling strategies for simulating tree mortality at different scales from the individual tree to global ecosystems, 2) characterize drought-induced tree mortality and insect outbreak dynamics in each modeling framework, 3) summarize interactions between insect dynamics and abiotic stress on trees, 4) compile datasets that can be used as benchmarking tests for model validation and intercomparison, and 5) present multiple strategies for simulating forest die-off and carbon cycle impacts at different spatial and temporal scales.

Title: Establishing an open-source animal-tracking analysis platform for archival geolocators

Leader(s): Bridge, Eli; Winkler, David; Rakhimberdiev, Eldar; Seavy, Nathaniel

Participants: Eli Bridge, Sarah Davidson, Philip Dow, Jonah Duckles, Steffen Hahn, Jeffrey Hostetler, Simeon Lisovski, Eldar Rakhimberdiev, Jim Regetz, Heiko Schmaljohann, Nathaniel Seavy, Michael Sumner, Caroline Taylor, David Winkler, Simon Wotherspoon, Michael Wunder

Abstract:

Light-level geolocation data loggers (henceforth geologgers), are simple animal-tracking devices that record light-levels over short time intervals and allow for the inference of location based on the timing of sunrise and sunset. Although these devices have long been used to track marine vertebrates, they have only recently achieved a level of miniaturization sufficient for use on small (<50g) land birds. For centuries, we have lacked the capability to determine how small birds move between breeding and wintering sites, and the few recent studies that have used geologgers to reveal songbird migration paths mark a revolution in the fields of ornithology and terrestrial ecology. However, a missing link in fulfilling the promise of this tracking method is a data analysis package that can make the most of the limited information stored on a geologger. Although a number of solutions exist, they all fall short as being either very simplistic (i.e. there is no accounting for potential location error) or so sophisticated that very few potential users can execute an analysis. Because of these shortcomings, there is a general lack of transparency and standardization with regard to the analysis and presentation of location data from geologger studies. Here we propose a working group that will bring together both simple and complicated analyses techniques into an extensive package for the R computing platform. In addition we will generate a user-friendly graphical user interface (GUI) available via Movebank.org that can execute analyses for users with little or no familiarity with R. This analysis platform would allow users to load raw data, run filters to identify possible analysis problems, choose among analysis methods, quickly run "canned" analyses, and pursue more specialized analyses to test hypotheses regarding the timing, direction, and speed of migratory movements. In pursuit of this goal, we propose to hold two meetings. The first will convene five biologists and statisticians working in the fields of marine biology and ornithology, who have pioneered new methods for obtaining animal tracking data using geologgers. This core group will work to refine and synthesize the analysis techniques that they and others have created. The second meeting will bring together a group of 15 scientists, including the core programming group as well as field biologists with geologger data sets that can be used to test the analysis platform. This second meeting will generate numerous examples of how to use the platform and will catalyze the implementation of the GUI.

Title: Global impacts of climate change on kelp forest ecosystems*Leader(s):* Byrnes, Jarrett; Connell, Sean; Novak, Mark*Participants:* John Bolton, Jarrett Byrnes, Kyle Cavanaugh, Sean Connell, Craig Johnson, Kwang Kim, Brenda Konar, Kira Krumhansl, Scott Ling, Fiorenza Micheli, Kjell Norderhaug, Mark Novak, Daniel Okamoto, Alejandro Perez-Matus, Andrew Rassweiler, Anne Salomon, Nick Shears, Isabel Sousa Pinto, Thomas Wernberg*Abstract:*

We propose a working group to examine the global impact of climate change on kelp forest ecosystems. Kelp forests are temperate and boreal rocky reefs dominated by macroalgae from the order Laminariales. Kelps currently dominate temperate near shore ecosystems, covering 25% of the world's coastline (Steneck et al 2002, Cavanaugh Unpublished Data). They are critically important species, forming the foundation of many temperate and boreal coastal ecosystems (Dayton 1985). Anticipated change to kelps and their associated communities could have a large impact on the goods and services they provide. While individual impacts of extreme climate events have been explored at the regional or subregional level by many groups around the world (Scheibling & Lauzon-Guay 2010), we currently lack a unified global understanding of how the slower, longer-term environmental shifts from climate change will alter kelp forest communities globally. Furthermore, our current knowledge is often limited to kelps alone, or kelps and a few key grazers. Our working group will fill these gaps to provide a synthetic picture of how climate change will alter the future of kelp forests. Our efforts will thereby jump start a growing global network of kelp forest researchers (50+ and growing) to better coordinate efforts to forecast climate change effects on kelp forests. Towards that end, we propose three activities: 1) We will identify relevant abiotic impacts of climate change in each major kelp dominated biogeographic region. We will then perform a meta-analysis of experimental and observational studies to examine the impact of predicted abiotic changes on kelps, other dominant space-holders, herbivores, and predators. 2) We will create a unified global database of all extant kelp community monitoring data sets. We will use these to model the direct and indirect impacts of changes in climate on community structure and function and highlight local deviations from global trends. 3) We will create a global database of species interaction networks for all kelp dominated regions. We will use results from our meta-analysis and detection of global trends to examine how extinctions, invasions, and more subtle changes in the abundance of different species or guilds of species will alter future network structures.

Title: Revisiting nutrient limitation in tropical forests*Leader(s):* Cleveland, Cory; Townsend, Alan*Participants:* Dana Chadwick, Cory Cleveland, Kyla Dahlin, Stephen Del Grosso, Chris Doughty, Rosie Fisher, William Smith, Benjamin Sullivan, Philip Taylor, Alan Townsend, Will Wieder*Abstract:*

Tropical forests have enormous ecological and societal significance. They are home to exceptional biological diversity (including humans), they profoundly affect a suite of global scale processes, and unfortunately, they are experiencing myriad effects of global environmental change. Yet, our understanding of basic ecosystem processes such as nutrient limitation in the tropics lags far behind many temperate and high latitude ecosystems, and those data that do exist have not been thoroughly synthesized. In many respects, this deficit results from a scarcity of data, but more from the fact that the tropical rain forest biome is extraordinarily complex. Tropical forests present many unique challenges to resolving questions about nutrient limitation, including the potential for limitation by

multiple elements across both small and large spatial scales. Despite these challenges, all confirmed participants of our proposed NCEAS workshop believe that we are now at the point where a productive synthesis of data describing tropical nutrient cycling and limitation can and should be undertaken, and that this endeavor has the potential to generate a suite of valuable products that will be of broad utility to ecologists, biogeochemists and to society as a whole. We therefore propose an NCEAS workshop that assembles ecologists, geologists and ecosystem modelers that collectively represent five continents and all major tropical regions to pursue three goals: 1) assemble a database and synthesize data collected using a variety of techniques to assess nutrient limitation in tropical rain forest ecosystems; 2) perform a metaanalysis of both above- and below-ground tropical nutrient limitation; and 3) further the development of conceptual and analytical ecosystem models that can better predict the fate of tropical forests in a rapidly changing environment. Our ultimate goal is to take full advantage of the NCEAS model – ranging from the opportunity to pursue the basic processes of data and conceptual synthesis, to the use of ecoinformatics resources that are unique to NCEAS – to advance our understanding of the nature of nutrient limitation in tropical forests. The time is right for a thorough synthesis, and given the importance of tropical forests to global biogeochemistry and to society as a whole, the potential value of such an effort is high.

Title: Forecasting phenology: Integrating ecology, climatology, and phylogeny to understand plant responses to climate change

Leader(s): Cook, Benjamin; Wolkovich, Elizabeth

Participants: Jenica Allen, Kjell Bolmgren, Elsa Cleland, Benjamin Cook, T. Jonathan Davies, Heather Kharouba, Nathan Kraft, Stephanie Pau, Jim Regetz, Nicolas Salamin, Steve Travers, Elizabeth Wolkovich

Abstract:

The magnitude and direction of plant species responses to climate change has widespread consequences for trophic interactions, ecosystem services, and our ability to predict the shape of future communities. To date, however, research has focused primarily on documenting species responses without developing a detailed understanding of why some species and communities vary with climate and others do not. Combining expertise from ecologists, phylogeneticists, and climatologists, we will use extensive plant phenology data from experimental and observational studies across North America and Europe to conduct a metaanalysis and develop robust predictors of plant phenology responses and sensitivities to climate change. Our resulting database of phenological studies, their related climate variables, and phylogenetic trees will be, we believe, the most comprehensive data available to study the relationship between climate change and plant species phenological responses. Our comparison of experiments to observational studies will test whether short-term, small-scale manipulations of climate can predict the long-term trends seen on global scales, and should improve the design of future climate manipulation experiments. Additionally, our work will develop new approaches for the use of climate metrics in ecology and inform the designs of government data inventories and citizen science projects.

Title: Venture: Understanding how land-use change impacts the dynamics of vector-borne and water borne infectious disease of humans and domestic livestock

Leader(s): Dobson, Andrew; Bharti, Nita; Bonds, Matthew

Participants: Marcella Alsan, Andres Baeza, Nita Bharti, Laura Bloomfield, Matthew Bonds, Giulio De Leo, Andrew Dobson, Christina Faust, Thomas Gillespie, Nicole Gottdenker, Petra Klepac, Eric

Lambin, Michael Levy, Hamish McCallum, Calistus Ngonghala, Mercedes Pascual, Raina Plowright, Andy Tatem

Abstract:

Land-use change is rapidly converting forests and savannas into anthro-habitat: land whose primary focus is the production of agriculture, or other goods and services of direct benefit to the human economy. This conversion significantly alters the interactions between the environment, disease vector species, and populations of humans and domestic livestock. The resulting changes in the infection dynamics of many vector- and water-borne disease systems lead to new opportunities for pathogen infections and only occasionally steer the dynamics towards pathogen reduction or eradication. In this venture we undertake a series of synthetic examinations that bring together GIS data on land-use change with data on disease and vector distributions and host abundance in order to develop mathematical and heuristic models. The goal is to understand the impact of land use change on disease ecology to minimize disease risk and maximize direct and indirect economic benefits. Our initial focus is on malaria, schistosomiasis, cholera, Chagas disease and African trypanosomiasis. Our approaches will build upon the large sets of data available for these pathogens to develop synthetic model frameworks that can primarily produce locally specific, anthropologically appropriate, actionable recommendations for minimizing disease risk. This framework will ultimately be adaptable to examine the interactions between land use change and a broad variety of pathogens.

Title: Developing an integrated botanical information network to investigate the ecological impacts of global climate change on plant biodiversity

Leader(s): Enquist, Brian; Condit, Richard; Dolins, Steven; Peet, Robert; Boyle, Brad

Participants: Benjamin Blonder, Brad Boyle, Richard Condit, Barbara Dobrin, Steven Dolins, John Donoghue, Kristine Engemann Jensen, Brian Enquist, Eric Fegraus, Peter Jorgensen, Nathan Kraft, Aaron Marcuse-Kubitza, Naim Matasci, Brian McGill, Naia Morueta-Holme, Martha Narro, Jeff Ott, Robert Peet, William Piel, Jim Regetz, Brody Sandel, Mark Schildhauer, Irena Simova, Nick Spencer, Jens-Christian Svenning, Barbara Thiers, Cyrille Violle, Susan Wisser

Abstract:

Many of the major questions in ecology span enormous geographic and temporal scales, yet much ecological knowledge is still based on observations of individual investigators conducted at single locales, often covering scales of only a few hundred square meters. Understanding ecological patterns and predicting future changes, including those caused by human impact, necessitates a holistic approach covering large spatial scales, and this will only be achieved by identifying, retrieving, and synthesizing diverse data from distributed sources: heterogeneous data from a global confederation of collaborating scientists including a broad range of disciplines. To address this pressing need, we propose to network eight of the largest databases on plant inventories in the Americas to assemble an accessible and readily analyzable database warehouse on distributions and abundances. With it, we will answer major questions of direct relevance to conservation of new world biota. In particular, how does climate and latitude influence the relative distribution and abundance of narrow and widespread plant species? While this and associated questions have been mainstays for ecology our inability to integrate data has significantly limited our ability to answer them. The proposed working group will significantly improve our ability to finally answer these questions. We will also make distribution and abundance data widely available so that further analyses, for example covering other plant taxa or particular regions, will be possible. It is also part of our plan to continue expanding our meta-database with additional inventories, collections, and plots not yet digitized, plus future field work.

This data network will provide a baseline of critical data will allow ecologists to address fundamental issues in plant ecology and global change biology.

Title: Developing comprehensive management models for marine mammals

Leader(s): Gerber, Leah

Participants: Leah Gerber, Manuela Gonzalez-Suarez, Felipe Hurtado-Ferro, Eric Johnson, Carrie Kappel, Sarah Mesnick, Jeffrey Moore, Lindsey Peavey, Robert Wildermuth, Rob Williams

Abstract:

Marine mammals are increasingly threatened by interactions with fishing gear, ocean noise, pollution, direct harvest, ship traffic, competition for food with fisheries, and coastal development. Managers must set limits to these sources of human-caused mortality and disturbance to marine mammals without compromising human welfare. Currently, the U.S. Marine Mammal Protection Act (MMPA) limits the allowable number of deaths caused by fisheries with a simple algorithm called Potential Biological Removal (PBR). NOAA has also recently committed to developing tools to depict underwater noise and the distribution and density of cetaceans. Although a vast improvement to the status quo, there are still two major limitations associated with these approaches: 1) they do not consider the cumulative impacts of all threats, and 2) assume largely unrealistic population dynamics. We propose to develop a new framework to incorporate cumulative impacts, which also allows for more realistic population dynamics, especially with respect to social complexity in marine mammals. Our analyses will provide managers with clear guidelines for managing the threats that marine mammals encounter in space and time. NCEAS is ideal for carrying out this work because there is no better boundary organization for bringing together academic and government scientists to discuss how to put science into policy. Moreover, we anticipate significant data synthesis, computation, and dissemination, which only NCEAS can accommodate.

Title: Conserving western Amazonia's freshwater ecosystems & services (SNAP) (Supported by Shirley and Harry Hagey, Steve and Roberta Denning, Seth Neiman, the Gordon and Betty Moore Foundation, and the David and Lucile Packard Foundation)

Leader(s): Goulding, Michael; Groves, Craig; Varese, Mariana

Participants: Avecita Chicchon, Steve Cornelius, Carlos Durigan, Bruce Forsberg, LeeAnne French, Michael Goulding, Craig Groves, Stephanie Hampton, Jane Carter Ingram, Julie Kunen, Charo Lanao, John Melack, Mariana Montoya, Victor Montreuil, Paulo Petry, Natalia Piland, Emma Torres, Mariana Varese

Abstract:

The Amazon Basin is the largest river system in the world, and the Western Amazon (including the Andes-Amazon slopes and western Brazil) contains the largest areas of flooded forests, floodplain lakes, and other wetlands in the Basin. These rivers and floodplains are critical to livelihoods, providing, among other things, important sources of high-protein food (fish, caimans and turtles), employment in a major fisheries industry, a vast inland transportation network, and drinking water for rural populations and growing cities. Large-scale infrastructure development, including hydroelectric dams, roads, and pipelines, is already impacting the Western Amazon, and more installations are planned. Aquatic ecosystems and the fisheries associated with them will increasingly be impacted by changes in the hydrological cycle caused by dam projects, by upland and floodplain deforestation associated with land conversion to farming and ranching, and by climate change.

Together, these threats could jeopardize the diversity and productivity of aquatic systems and the livelihoods of the rural and urban people who depend on them. The vast size of the Amazon Basin and the interlocking relationships among the ecological systems and processes involved, such as between terra firme and flooded forests, hydrological cycles and fish migrations, dams and water quality and quantity, and between climate drivers and regional weather patterns strongly suggest that, to be effective, conservation actions must be informed by scientific analysis and synthesis of information at large enough scales as to be capable of capturing these ecological complexities. The rapid expansion of energy infrastructure and urbanization in the Amazon, coupled with greater frequency of extreme hydrological events, means that integrated river basin management has become critical to inform a balanced conservation and development strategy. A large scale management framework has begun to gain traction in the political arena, such as in the large department of Loreto, Peru where conservation planning and fisheries management measures related to infrastructure projects in the Andes and Amazonian lowlands are being put in place by local governments. By engaging with policy makers from the region from the inception of this working group, and by including scientific experts who are engaged in these incipient management efforts in the region, this SNAP effort will build upon and help strengthen these emerging frameworks. Also, some donors have reoriented their conservation strategies to include infrastructure impacts and freshwater management issues (e.g., Gordon and Betty Moore Foundation, John D. and Catherine T. MacArthur Foundation). WCS partners with both Foundations on related projects for fisheries management, protected area management, and other conservation goals in the western Amazon and has had a series of conversations with Foundation representatives to ensure complementarity among those efforts and the SNAP working group. This complementarity will be facilitated by the participation of representatives from both Foundations in the western Amazon working group. The proposed SNAP working group will launch its first Amazonian project with two critical goals: first, the working group will analyze and synthesize available data to generate a series of plausible future scenarios that reflect different land-use patterns, development and investment options, resource management regimes, and climate forecasts, at an unprecedented spatial scale that captures the complexity and interconnectivity of Amazon aquatic and terrestrial ecology and biodiversity; and second, by bringing government and donor stakeholders to the table to examine the tradeoffs associated with each scenario, the group will distill from the synthesized and analyzed data key recommendations for conservation actions at levels of decision-making appropriate to the scale and complexity of the Western Amazon. The final result will be a road map for integrated river basin management and planning that could achieve an acceptable balance among ecosystem health and connectivity, food security, and infrastructure needs in the western Amazon, informed by science and “translated” into a language and format usable by decision-makers.

The working group will address the following critical questions:

1. Where are the highest conservation value areas (HCVA) for migratory fish? Fish are the most important source of food security for the Amazon’s millions of human residents and as such the most important natural resource about which people are most likely to care. Both medium-distance (up to several hundred km annually) and long-distance (basin-wide) migratory fish play key roles in Amazonian aquatic ecosystem function and constitute 80% or more of the fish harvest. This expert working group, led by Michael Goulding, will convene a small group of fisheries and limnological experts to evaluate available data on fish production and reproduction and produce a spatial analysis of priority areas for conservation of migratory fish. The expert group will evaluate a) the distribution of each species; b) the distribution of major habitats such as flooded forests, lakes and floating meadows that are critical for fish growth; c) known spawning habitats for groups of migratory species; d) the distribution of nurseries habitats; e) the relative importance of existing protected areas and other managed areas to fisheries; and f) estimates of current levels of exploitation within

commercial and subsistence fisheries. The identification of high conservation value areas for fish derived from these analyses can then lead to recommendations (see #5) for an action plan to manage migratory fish harvest, and the flooded forests, floating meadows, lakes and river stretches necessary to maintain growth, reproduction and recruitment.

Title: Ocean Health Index (Hosted by NCEAS) (Supported by Conservation International)

Leader(s): Halpern, Benjamin

Participants: Benjamin Best, Benjamin Halpern, Huamei Huang, Tina Lee, Bin Liang, Jean Lineros, Zhiguo Liu, Catherine Longo, Ruby Ortiz Martinez, Jason Philibotte, Aviad Scheinin, Julia Stewart, Weiwei Yu, Bei Zhao

Abstract: From the many millions of people who count on ocean fisheries for their food and livelihoods, to the cultural and spiritual connections people have with marine species, to the uncounted lives saved by intact coral reefs during the 2004 Asian tsunami, people all over the world depend upon healthy oceans. But how healthy are our oceans? A newly developed measurement tool, the Ocean Health Index, answers that question for every coastal country in the world. The Index provides a uniform way with which to measure the health of ocean ecosystems around the world. The Index provides an important tool for advancing comprehensive ocean policy.

The Ocean Health Index evaluates the condition of marine ecosystems according to 10 human goals, which represent the key ecological, social, and economic benefits that a healthy ocean provides. The framework for the Ocean Health Index was first published in the journal *Nature* in August 2012. Researchers found that global oceans have an overall score of 60 out of 100 with a large variation between regions. Current activities involve annual recalculation of the global scores, regional applications at national and sub-national scales, support of other governments and NGOs developing regional applications of the Index, and a software toolbox to allow easy calculation and exploration of the Index and its results.

Title: Marine debris: Scale and impact of trash in ocean ecosystems (Supported by the Ocean Conservancy)

Leader(s): Hampton, Stephanie

Participants: Linda Amaral Zettler, Anthony Andrady, Morton Barlaz, James Browne, Mark Browne, Gee Chapman, Steven Gaines, Francois Galgani, Roland Geyer, Benjamin Halpern, B Hardesty, Jenna Jambeck, Kara Lavender Law, George Leonard, Nicholas Mallos, Nikolai Maximenko, Ramani Narayan, Chelsea Rochman, David Siegel, Ted Siegler, Hideshige Takada, Richard Thompson, Tony Underwood, Chris Wilcox, Rob Williams, Jan van Franeker,

Abstract:

To construct the theory of marine debris incorporating the needs of nonscientific constituencies, this working group will accomplish the following goals: 1) compile and synthesize existing information to determine how much harmful debris is in our ocean; 2) compile and synthesize existing information to determine impacts of marine debris on ocean populations and ecology; 3) compile and synthesize existing information to determine impacts of marine debris on human populations; 4) identify the three most prominent sources/items of plastic debris for which behavior-oriented solutions can be implemented; and 5) analyze research regarding efficacy of policy solutions such as plastic bag bans as they relate to ocean trash items.

Title: Dance with neighbors: What have we learned about species coexistence in tree communities from the global stem-mapped forest plots

Leader(s): He, Fangliang; Hubbell, Stephen; Condit, Richard; Wiegand, Thorsten

Participants: Tania Brenes, Lei Chen, Chenjing Chu, Liza Comita, Richard Condit, Matteo Detto, Fangliang He, Stephen Hubbell, Andreas Huth, Monica Moreno, Stephen Murphy, Guochun Shen, Anna Sugiyama, Xinghua Sui, I-Fang Sun, Junfeng Tang, Maria Uriarte, Igor Volkov, Thorsten Wiegand, Jian Zhang

Abstract:

Over the past 30 years, the Center for Tropical Forest Sciences has established a global stem-mapping forest plots network consisting of 5 million trees representing nearly 9000 species. This network has fundamentally changed the way forest biodiversity is studied. The fully mapped plots contain complete spatial locations of every single tree in a plot of, typically, 50 ha in size. Such spatial data are essential for inferring mechanisms of species coexistence. We seek to achieve two objectives. The first is to synthesize our understanding of the role that neighborhood spatial structure plays in mediating species coexistence in tree communities from the 1000+ papers published for the large-scale stem-mapping forest plots. The second is to develop new methods for quantifying the spatial interaction of multispecies and the spatio-temporal dynamics of tree point patterns. The proposed working group will contribute to a synthetic understanding of the maintenance mechanisms for tree communities from the spatial perspective and will further foster international collaborations in forest biodiversity study.

Title: When is a mutualist a cheater? A synthesis of conceptual and data-based perspectives on the causes and consequences of variation in mutualist quality

Leader(s): Jones, Emily; Friesen, Maren

Participants: Michelle Afkhami, Erol Akcay, Judith Bronstein, Redouan Bshary, Kevin Foster, Megan Frederickson, Maren Friesen, Katy Heath, Jason Hoeksema, Emily Jones, Josh Ness, Sabrina Pankey, Stephanie Porter, Joel Sachs, Klara Scharnagl, John Stachowicz, Dylan Weese, Jimmy Woodward

Abstract:

Cheating is a fundamental - yet fuzzy - concept in the study of mutualism. If it is defined at all, cheating is variously defined as obtaining rewards from a partner while reciprocating nothing, reciprocating less than other mutualists, or reciprocating less than is “fair” • . In all cases, cheating is considered a threat to the ecological and evolutionary stability of mutualisms; however, the ambiguity of what is actually meant by “cheating” stands in the way of understanding how common and how severe cheating is across mutualisms. The goal of our working group is to bring together a diverse group of scientists with expertise in different mutualisms to achieve a consensus on how to define and measure cheating, and mutualist quality in general. Specifically, we aim (i) to develop a standard, quantitative metric of cheating, (ii) to compile data on partner quality from across systems than span the range of mutualisms, and (iii) to use these products to generate insight into several outstanding questions in the evolutionary ecology of mutualism. By forging consensus between early and later career scientists working in multiple systems, our working group has the potential to transform the study of mutualism from a collection of examples into a unified field.

Title: DataONE: Observation Network for Earth (*Supported by the National Science Foundation – OCI-0830944*)

Leader(s): Jones, Matthew; Hampton, Stephanie

Participants: Paul Allen, Chris Brumgard, Amber Budden, Scott Chamberlain, Victor Cuevas, Roger Dahl, Ranjeet Devarakonda, Clifford Duke, Wendy Gram, Stephanie Hampton, Jeff Horsburgh, Matthew Jones, Christopher Jones, John Kunze, Hilmar Lapp, Ben Leinfelder, Deborah McGuinness, Sarah Menz, Robert Nahf, Giri Palanisamy, Line Pouchard, Stacy Rebich Hespanha, Skye Roseboom, Robert Sandusky, Ryan Scherle, Mark Schildhauer, A. Patrice Seyed, Carly Strasser, David Vieglais, Robert Waltz, Bruce Wilson, Stephanie Wright

Abstract:

DataONE (Observation Network for Earth) is building cyberinfrastructure for open, persistent, robust, and secure access to well-described and easily discovered Earth observational data. Supported by the U.S. National Science Foundation, DataONE will ensure preservation and access to multi-scale, multi-discipline, and multi-national science data. DataONE will transcend domain boundaries and make biological data available from the genome to the ecosystem; make environmental data available from atmospheric, ecological, hydrological, and oceanographic sources; provide secure and long-term preservation and access; and engage scientists, land-managers, policy makers, students, educators, and the public. DataONE is a collaboration between NCEAS/UCSB, the University of New Mexico, the Oak Ridge National Laboratory, the California Digital Library, NESCent, and a number of other organizations.

Title: Ocean tipping points (formally Ecosystem thresholds and indicators for marine spatial planning) (*Supported by The Gordon and Betty Moore Foundation*)

Leader(s): Kappel, Carrie; Halpern, Benjamin; Selkoe, Kimberly

Participants: Adina Abeles, Willow Battista, Margaret Caldwell, Larry Crowder, Ashley Erickson, Melissa Foley, Rod Fujita, Benjamin Halpern, Mary Hunsicker, Carrie Kappel, John Kittinger, Elodie LeCornu, Phillip Levin, Lindley Mease, Jameal Samhour, Courtney Scarborough, Kimberly Selkoe, Crow White

Abstract:

An increasing number of examples of tipping points in ecosystems around the world have begun to raise concern among scientists and policymakers. In the oceans, diverse ecosystems ranging from reefs to estuaries to pelagic systems have undergone sudden, dramatic shifts. Changes in ocean climate, the abundance of key species, nutrients, and other factors drive these shifts, with resulting effects on ocean food webs, habitats, and ecosystem functions that have direct impacts on people's livelihoods and well-being. Ocean tipping points may be cause for particular concern because they are often unexpected and can be very difficult, if not impossible, to reverse. Though there have been many critical advances in the science of ecosystem tipping points in recent years, there is still a dearth of practical tools and information available to managers to anticipate and respond to ecosystem shifts. Through this four-year study, the team will synthesize data on when, where, and how marine ecosystem shifts occur, and develop early warning indicators and management tools to begin to help managers anticipate, avoid or respond to tipping points. As ecologists, lawyers, and social scientists working in close partnership with managers, the team is tackling these problems from both the science side and from the policy and implementation side. Working with local managers, the team will implement ideas and test results in two case study locations: Haida Gwaii (in British Columbia) and Hawaii.

Title: The future of publishing in ecology, evolutionary biology, and environmental science*Leader(s):* Lortie, Christopher; Byrnes, Jarrett*Participants:* Edward Baskerville, Amber Budden, Jarrett Byrnes, Bruce Caron, Joseph Genden, Christopher Lortie, Cameron Neylon, Mark Schildhauer, Carol Tenopir*Abstract:*

The primary goal of this project is to explore the adoption of alternative publication models to promote more open science and to create a new system of disseminating completed research publications. What we hope to produce need not serve as a wholesale replacement for current journals but as an alternative to promote faster reviews, more transparency, collaboration, and more open access to the science we produce in every form. We are using the physics model of arXiv, the open access policy common in evidence-based medicine, and the data sharing policies of most genetics research as a point of departure for our working group and our vision of the future of science publishing. We will bring together participants from every aspect of the publication process in ecology and evolution from scientists to publishers, such as members of PLoS and arXiv, to the gatekeepers of academic databases, such as Google and ISI. To achieve our overarching goal, we will address the following three objectives. (1) To discuss how to more effectively promote ‘open science’ in ecology and evolution in general. The primary targets will be how to facilitate the linking of articles to their associated analytical and data attributes. Another target will be how to incorporate more of the discussion and review process associated with the end product including the decisions made in handling data and in analyzing and interpreting it in light of feedback from reviews. The deliverable will be a broad future directions paper on open science (including open access implications). (2) To discuss the viability of providing an arXiv pre-publication open forum for ecology and evolution and how to incorporate peer review into such a system (which arXiv currently does not). We will discuss whether the current journal and publication models in ecology and evolution are outdated or able to adapt. The primary deliverable from this objective will be a synthesis paper of the limitations and strengths of the current publication models (from publisher handling of journals to treatment of reviews) and a discussion of future directions. (3) The final objective will be to launch a version of the platform proposed. The critical elements will be discussed at the final meeting by a reduced roster of the participants. The targets of this objective will be to define key elements needed for ecology and evolution - specifically in an online model, identify keystone elements needed for a beta version, and develop a pipeline for launch and effective buy in by the community. Queen’s University has the capacity and staff to assist with providing the beta-version for two years including Creative Commons Attribution 3.0 Licensing, part-time staff, DOIs, and will include the ‘journal’ as part of the Open Journals System. In summary, this working group will provide an open-science synthesis publication, a balanced report on the state-of-the-art for publishing in ecology and evolution, and a beta-version of an alternative model as an open journal.

Title: Synthesizing theory and databases to advance a general framework for how warming affects trophic interactions*Leader(s):* O'Connor, Mary; Greig, Hamish*Participants:* Priyanga Amarasekare, Brandon Barton, Julia Blanchard, Christopher Clements, John DeLong, Anthony Dell, Benjamin Gilbert, Hamish Greig, Chris Harley, Heather Kharouba, Pavel Kratina, Kevin McCann, Mary O'Connor, Van Savage, Jonathan Shurin, Tyler Tunney, David Vasseur,

Abstract:

Environmental changes affect species by changing their physiology and thus activity rates and population growth rates. These rate changes affect trophic interactions among members of the community. Such higher-order, indirect effects are notoriously difficult to predict, leading to great uncertainty about how species abundance, food web structure and ecosystem function will respond to a changing climate. We will combine ecological theory, such as the Metabolic Theory of Ecology (MTE) and its descendants, with available databases to test predictions about how temperature affects species and their trophic interactions. First, we will test whether optimal performance temperatures correspond to mean environmental temperatures or instead to a time average of the physiological response that incorporates variance in temperature, and second, whether thermal sensitivity varies with body size. We will develop theoretical models to predict how these two possibilities alter species' interactions, and test these predictions using published data as well as empirical data from working group participants and results of warming experiments and observational studies. Our framework will help predict the response of food webs to warming across a range of habitats, which is critical for national and global efforts to understand how atmospheric changes affect biodiversity and ecosystem function. We will develop this framework by achieving three goals: 1) We will use key principles of physiological responses to temperature change to derive theoretical predictions for the sensitivity of individuals to warming based on body size and thermal tolerance traits, and then test these against data. 2) We will develop general theory to relate the effects of warming on individual performance to the strength and outcome of trophic interactions. 3) We will synthesize recent experiments that have warmed multi-trophic communities to test theory and revise our central principles and questions. This project builds on work begun in June 2012 in a Canadian Institute for Ecology and Evolution (CIEE) funded working group. However, our CIEE funding is limited, and we cannot continue without additional support. This is not a resubmission.

Title: Human impacts of water infrastructure on watershed ecosystems and the sustainability of irrigated agriculture in the coterminous US

Leader(s): Sabo, John; Bowling, Laura; Schoups, Gerrit

Participants: Sankur Arumugam, Laura Bowling, Noah Diffenbaugh, Caitlin Dyckman, William Graf, Michael Hanemann, John Kominoski, Kenneth Kunkel, Robert Lang, Brian Richter, Jennifer Roath, John Sabo, Gerrit Schoups, Tushar Sinha, Stuart Sweeney, Laura Taylor, Wesley Wallender

Abstract:

The goal of the proposed working group is twofold: 1) to measure the ecological footprint of freshwater infrastructure in the US (e.g., dams, irrigated agriculture, growing urban centers), and 2) to identify sustainable solutions to potential water shortages given climate change and rapid growth of major US urban areas. The underlying approach includes synthesis of numerous publicly available datasets describing surface and groundwater hydrology, human population growth, agriculture, economics and ecology. The approach also includes a novel analysis in which we will apply macroscale hydrologic models and IPCC climate forecasts to provide sustainable solutions to water shortages that consider water for cities, farms and biodiversity. The group hopes to publish 2-3 high impact papers prior to the 25th anniversary of Cadillac Desert: The American West and its disappearing water (Reisner 1986, Penguin Press) in 2011. The activities will culminate in a final workshop in which noted popular press authors and policy makers are invited to write an op-ed piece to be submitted to the NY Times. This popular press article will comment on the state of US

freshwater infrastructure then (based on Cadillac Desert) and now (based on our scientific work), and propose a policy platform for freshwater sustainability in the US.

Title: **Global climate change and adaptation of conservation priorities** (*Supported by The Nature Conservancy*)

Leader(s): Shaw, M. Rebecca

Participants: Frank Davis, John Dingman, Alan Flint, Lorrie Flint, Janet Franklin, Alex Hall, Lee Hannah, Ian McCullough, Max Moritz, Kelly Redmond, Helen Regan, M. Rebecca Shaw, Peter Slaughter, Lynn Sweet, Alexandra Syphard

Abstract:

This working group will develop methods for the production of future climate projections at biologically-relevant scales (30m - 5km). Methods explored will include expert-driven and Bayesian probability frameworks. The group will include expertise in taking information from multiple GCMs and multiple climatologists to make informed estimates of local changes in temperature and precipitation. The methods developed will allow use of information from GCMs and RCMs where they are in agreement, but use expert opinion where the climate models clearly do not capture local conditions well (e.g., fire weather, fog, snowpack). This method will be relevant to local changes in individual species and viable for individual management areas, such as individual parks and conservation areas.

Title: **Synthesizing top-down and bottom-up approaches to ecological energetics**

Leader(s): Shevtsov, Jane

Participants: Kristina Anderson-Teixeira, Gwendolyn Bachman, Joanna Bernhardt, James Brown, Anthony Dell, S. K. Morgan Ernest, Brian Fath, James Gillooly, John Grady, Charles Hall, Sven Jorgensen, Mary O'Connor, Dorion Sagan, Van Savage, Eric Schneider, John Schramski, Jane Shevtsov, Richard Sibly

Abstract:

Our proposed workshop involves synthesizing and cross-pollinating metabolic ecology and the older lines of research in ecological energetics and thermodynamics. These research areas offer different approaches to closely related problems; yet little collaboration exists between them. The workshop will bring together scientists from energy-centered lines of research, help them come to understand each other's research areas (particularly their conceptual and theoretical aspects), and ask what emerges when we try to bring metabolic ecology and ecological thermodynamics together and what questions could be addressed from these bottom-up and top-down perspectives. The participants will identify points of agreements and disagreement, along with possible resolutions and testable predictions. These predictions will then guide data analysis and simulation work. The minimum outcome would be a synthesis paper, several more specific papers, an organized data set, and, we hope, a research program.

Title: **A standard assessment framework for ecosystem services**

Leader(s): Urban, Dean; Olander, Lydia; Comer, Patrick

Participants: Stewart Allen, Ken Bagstad, Frank Casey, Patrick Comer, Janet Cushing, Frank Davis, Robert Deal, Micah Effron, John Fay, Anne Guerry, Kenna Halsey, Kevin Halsey, Dylan Harrison-

Atlas, Sarah Howell, Christy Ihlo, Bruce Jones, Jimmy Kagan, Lynn Maguire, Edward Maillett, Rebecca Moore, Anne Neale, Lydia Olander, Paul Ringold, , Trista Patterson, Mark Plummer, David Saah, Paul Sandifer, Emily Schieffer, Samantha Sifleet, David Theobald, Howard Townsend, Dean Urban, Sara Vickerman, Lisa Wainger

Abstract:

Ecosystems services--the benefits that natural ecosystems provide to society--are increasingly the focus of public and private land management decisions. There is a growing demand for standardization of assessment tools (measures, metrics and standards) that can be applied in a consistent manner across ecoregions and by practitioners from agencies with differing programmatic mandates. This task will require agreement across ecologists, economists, social scientists, and practitioners from academia, state and federal agencies, nonprofits, and the private sector. We propose an NCEAS working group to focus on the ecological and biodiversity characteristics related to the production of ecosystem services, especially, the development of robust, consistent methods and metrics for measuring the quantity and relative ecological value of these services in a multi-criteria decision framework. This effort will be coordinated with parallel activities, focused on social valuation, conducted through the National Socio-Environmental Synthesis Center (SESYNC), and with a larger stakeholder audience represented by the National Ecosystems Services Partnership (NESP). NCEAS activities will include a series of workshops within interim tasks that will evolve as a national program on ecosystem services is refined and codified. Key words: decision analysis, ecological production function, geospatial analysis, economic valuation.

Title: Fungal pathogens and disease-induced extinction: Are fungal diseases different?

Leader(s): Voyles, Jamie; Briggs, Cheryl; Kilpatrick, Auston

Participants: David Blehert, Benjamin Bolker, Cheryl Briggs, Tina Cheng, James Collins, Matthew Fisher, Winifred Frick, Auston Kilpatrick, Aaron King, Kate Langwig, Daniel Lindner, Hamish McCallum, Jessica Metcalf, Kris Murray, Robert Puschendorf, Erica Bree Rosenblum, Mary Toothman, Jamie Voyles, Mark Wilber, Craig Willis

Abstract:

Fungi have not traditionally been regarded as a conservation threat. Yet emerging fungal diseases have caused mass-mortality events and multiple extinctions in vertebrate hosts. Some of the most notable examples include white-nose syndrome in bats and amphibian chytridiomycosis, which has been well studied for over a decade. Our working group will consider the theoretical mechanisms that could predispose host populations to extinction from fungal pathogens. We will use pre-existing datasets to address specific questions regarding transmission, rate of spread, the range of host species and pathogen persistence independent of the host, all of which are factors implicated in disease-induced extinction. We will ask if these mechanisms are sufficient to explain the large impacts that recently emerging fungal diseases are having on their host populations, or if other unique features of fungal diseases are contributing to their impacts. This work will provide specific recommendations for research and conservation for newly emerging fungal diseases that threaten their hosts with extinction.

Title: Red flags and species endangerment: Meta-analytical development of criteria for assessing extinction risk

Leader(s): Waples, Robin; Hutchings, Jeffrey

Participants: H. Resit Akcakaya, Priyanga Amarasekare, Stuart Butchart, Ben Collen, Nick Dulvy, Elizabeth Holmes, Jeffrey Hutchings, Douglas Keinath, David Keith, Marta Nammack, Michael Schwartz, Andrew Shelton, Robin Waples

Abstract:

The proposed project builds on previous work (some of it sponsored by NCEAS) to evaluate performance of criteria for identifying species at risk. Novel aspects of our approach include the following: 1) We begin with a conceptual definition of an endangered species (one that has entered a Red Zone where both extinction risk and uncertainty about biological processes increase non-linearly); 2) We will leverage large datasets that have become available over the last decade, including those for taxa (e.g., marine fishes) for which application of standard risk criteria has been very controversial; 3) We propose a rather broad interpretation of depensation and Allee effects that facilitates consideration of the importance of ecological and evolutionary processes; 4) We will explicitly consider how risks scale on the continuum populations/metapopulations/ESUs/species; 5) We will evaluate practical utility of candidate RedFlag criteria by applying them to case studies of species that have been formally considered for federal protection in the US and Canada.

Meetings Hosted by NCEAS

Occurred or were scheduled between October 1, 2012 and September 30, 2013

Based on data available as of September 30, 2013

11SEP2012 - 12SEP2012 and 06DEC2012 - 07DEC2012

Expert Judgement

Leader(s): Hampton, Stephanie

08OCT2012 - 12OCT2012

Lake Baikal responses to global change

Leader(s): Hampton, Stephanie

19OCT2012 - 19OCT2012

Ocean Health Index

Leader(s): Halpern, Benjamin

17DEC2012 - 19DEC2012

The Joint TNC-NCEAS Visioning

Leader(s): Davis, Frank

22JAN2013 - 24JAN2013

Data-Poor Fisheries Stock Assessments

Leader(s): Hampton, Stephanie

04FEB2013 - 06FEB2013

Natural Reserve System (NRS) Visioning Meeting

Leader(s): Davis, Frank

02APR2013 - 03APR2013

DataUp

Leader(s): Hampton, Stephanie

17APR2013 - 19APR2013

Ocean tipping points

Leader(s): Kappel, Carrie; Halpern, Benjamin; Selkoe, Kimberly;

15AUG2013 - 15AUG2013 and 12SEP2013 - 12SEP2013

Steering Committee meeting for "Conceptualizing an Institute for Sustainable Earth and Environmental Software"

Leader(s): Jones, Matthew; Schildhauer, Mark;

Scientific Visitors

Occurred or were scheduled between October 1, 2012 and September 30, 2013

Based on data available as of September 30, 2013

Easterday, Kelly

13MAY2013 - 09AUG2013

Development of UC Natural Reserve System's administrative boundary and management shapefiles

Host: Frank Davis

Gerber, Leah

24JUN2013 - 01AUG2013

Conservation and management of marine mammals

Host: Davis, Frank

Hackett, Edward

28MAY2013 - 07JUN2013

Scientific collaboration and interdisciplinary research

Host: Frank Davis

Izmestyeva, Lyubov

10DEC2012 - 15DEC2012

Lake Baikal responses to global change (NSF Dimensions of Biodiversity)

Host: Hampton, Stephanie

Kim, Tae-Eun

28MAY2013 - 07JUN2013

Studies of scientific collaboration

Host: Davis, Frank

Klein, Carissa

05AUG2013 - 16AUG2013

Ocean Health Index (Hosted by NCEAS)

Host: Halpern, Benjamin

Lukas, Dieter04SEP2012 - 31OCT2012, 02JAN2013 - 18JAN2013, 06MAR2013 - 25MAR2013, 08MAY2013
- 24MAY2013, and 02SEP2013 - 30SEP2013

The evolution of social monogamy in mammals

Host: Hampton, Stephanie

Molotch, Noah

18JUL2013 - 31AUG2013

Snow hydrology and ecohydrology

Host: Davis, Frank

Moritz, Max

14DEC2011 - 30SEP2013

Wildfire, land use and climate change

Host: Hampton, Stephanie

Parker, John

03MAY2013 - 15AUG2013

Studies of scientific collaboration

Host: Hampton, Stephanie

Pau, Stephanie

20MAY2013 - 05JUL2013

Relationship between C4 grasslands and fire

Host: Frank Davis

Rochman, Chelsea

29AUG2013 - 25SEP2013

Marine Debris

Host: Hampton, Stephanie

Rockwood, R. Cotton

15JUL2013 - 05AUG2013

Ocean Health Index (Hosted by NCEAS)

Host: Halpern, Benjamin

Sabo, John

24JUN2013 - 01AUG2013

Freshwater ecology and sustainability

Host: Davis, Frank

Seyed, A. Patrice

11APR2013 - 19APR2013

INTEROP: A Community-driven scientific observations network to achieve interoperability of environmental and ecological data

Host: Schildhauer, Mark

Teixido, Nuria

15JUL2013 - 19JUL2013

Host: Halpern, Benjamin

Thornton, Stephanie

27FEB2013 - 16JUN2013

Ocean tipping points

Host: Kappel, Carrie

Troup, Molly

22JUL2013 - 09SEP2013

Ocean tipping points

Host: Kappel, Carrie

Center Associates Hosted by NCEAS

Occurred or were scheduled between October 1, 2012 and September 30, 2013

Based on data available as of September 30, 2013

Baron, Nancy*

03MAY2004 - 30SEP2014

COMPASS

**Nancy Baron was awarded the 2013 Benchley award for Excellence in Media*

Budden, Amber

10OCT2010 - 30SEP2014

DataONE: Observation Network for Earth

Courtney, Steven

14SEP2009 - 17DEC2012

Roles of scientists and science managers

Halpern, Benjamin

01OCT2011 - 30JUN2014

Ocean Health Index

Kappel, Carrie

01OCT2012 - 30SEP2014

Ocean tipping points

Ranganathan, Jai

08JAN2010 - 30SEP2014

Developing a return on investment approach for conservation planning in Argentina

Selkoe, Kimberly

01OCT2012 - 30SEP2014

Ocean tipping points

Research Training Activities

Six graduate and one undergraduate students were involved with research activities at NCEAS during the reporting period. They are listed below, along with the titles of the projects on which they worked.

Graduate Student Interns

Occurred or were scheduled between October 1, 2012 and September 30, 2013

Based on data available as of September 30, 2013

Couture, Jessica

01NOV2012 - 30SEP2013

Collaborative data management and holistic synthesis of impacts and recovery status associated with the Exxon Valdez oil spill

Elmore, Aaron

01OCT2010 - 30JUN2013

Ecoinformatics graduate internships

Freeman, Emma

01NOV2012 - 30JUN2013

Collaborative data management and holistic synthesis of impacts and recovery status associated with the Exxon Valdez oil spill

Han, Xueying (Shirley)

01JAN2009 - 30JUN2013

Ecoinformatics graduate internships

McDonald, Gavin

01NOV2012 - 30JUN2013

Collaborative data management and holistic synthesis of impacts and recovery status associated with the Exxon Valdez oil spill

Song , Runsheng

05JUL2013 - 30SEP2013

Marine debris: Scale and impact of trash in ocean ecosystems

Undergraduate Student Interns

Occurred or were scheduled between October 1, 2012 and September 30, 2013

Based on data available as of September 30, 2013

Bragg, Jessica

08JAN2013 - 30JUN2013

DataONE: Observation Network for Earth

Postdoctoral Training Sessions

For training sessions, NCEAS Postdoctoral Associates are the primary audience, with attendance by other NCEAS scientists and UCSB scientists of all stages welcomed.

Career Development Series

Based on data available as of September 30, 2013

Sabbaticals and UCSB faculty are invited to provide faculty perspective in a discussion with Postdocs on career development topics that vary from year to year.

Teamwork and conflict management 101 (Hampton, 9/17/2012)

Discussion of storytelling and communication through environmental media: Discussion of Blue Horizons films (Richard Hutton, 12/12/2012)

Should ecologists get involved in environmental advocacy? (Derek Gray, 1/11/2013)

How to communicate a clear message (Baron, 1/23/2013)

What's all the h about? A summary of performance metrics for academics & journals (Lortie, 5/13/2013)

Sociology of scientific collaboration (Parker, 6/19/2013)

The broken job market (Parker, 6/26/2013)

Thinking preferences - discussion and activity (Hampton, 7/19/2013)

Communicating conservation science to non-scientists: Strategies and practices (Eric Cardenas & David Fortson, LoaTree & LoaCom, 9/30/2013)

Training and Workshop Sessions

Occurred or were scheduled between October 1, 2012 and September 30, 2013

Based on data available as of September 30, 2013

From June 19, 2013 – July 10, 2013, NCEAS conducted its first three-week intensive training workshop in ecological analysis and synthesis for early-career researchers. Twenty-two participants were selected from nearly 400 applicants for the NCEAS Summer Institute. Leaders included Benjamin Bolker, Stephanie Hampton, Matthew Jones, Jim Regetez, and Mark Schildhauer. Participants received hands-on guided experience using best practices in the technical aspects that underlie successful synthesis – from data discovery and integration to analysis and visualization, and special techniques for collaborative scientific research. The training emphasized integration of statistical analysis into well-documented workflows through the use of open-source, community-supported programming languages that are well suited for rapid yet robust implementation of scientific data analyses. During course work, participants explored new approaches to open, reproducible science that support environmental synthesis. Materials from the course were made available online. The NCEAS Summer Institute was funded by the Packard Foundation.

During summer of 2013, NCEAS residents did two remote Morpho metadata training sessions for a number of agency scientists affiliated with GulfWatch Alaska. Some of the agencies included were NOAA, USGS, USFWS, UAF and the Prince William Sound Science Center.

Other workshops included the following:

07FEB2013 - 08FEB2013

Coral Reef Preservation and Management

Leader(s): Gates, Ruth

28NOV2012 - 29NOV2012

Ocean Health Index (OHI) Decision Support Tool Workshop (Hosted by NCEAS)

Leader(s): Halpern, Benjamin

11MAR2013 - 13MAR2013, 13AUG2013 - 14AUG2013, 10SEP2013 - 11SEP2013 (offsite)

Conceptualizing an Institute for Sustainable Earth and Environmental Software (ISEES)

(Supported by non-core NSF funding)

Leader(s): Jones, Matthew; Schildhauer, Mark

Additional Seminars

The wide range of visiting and resident scientists at NCEAS has provided excellent opportunities for interactions through the NCEAS Roundtable Discussion series. The Roundtable format provides an informal setting that encourages discussions on current research pursuits with NCEAS, UCSB and visiting scientists. Roundtable includes a Word Press web site, <http://roundtable.nceas.ucsb.edu/>, where materials can be posted and discussions can continue online. A list of Roundtable discussions is included in Table 2.

Education and Outreach Activities

NCEAS publicizes new research to increase the public understanding of science through press releases and information on our website, provides outreach training and experiences to resident scientists, fosters the inclusion of synthesis in ecology education and contributes, educationally and culturally, to the local community participation in community events.

Communicating Science

Press/Publicity

NCEAS continues to emphasize the importance of media coverage and media training, expanding its coverage to maximize exposure for its research, education and outreach efforts. Working with NCEAS scientists, collaborators, and funding sources we have increased visibility of NCEAS activity and results via public media. We continue to prepare and coordinate press releases with an expanding number of scientists' home institutions, University of California, and NSF media professionals; and work with resident and visiting scientists to craft public-oriented summaries of their research. Between October 1, 2012 and September 30, 2013 publications resulting from NCEAS support were featured in at least 10 press releases developed by UC Santa Barbara on behalf of NCEAS.

Policy Influence

In January 2013, Senator Robert P. Casey, Jr. called on the Administration to focus on restoring Lake Erie in a letter to the President's Council on Environmental Quality. A NCEAS publication "Joint Analysis of Stressors and Ecosystem Services to Enhance Restoration Effectiveness" (Allen et al., Proceedings of the National Academy of Sciences, 2013, Vol 110 (1), pg. 372-377) was used as a source for that call.

Media Training

Media Training is a key component of the postdoctoral experience at NCEAS. This year we offered several interactive presentations on how scientists can communicate their work effectively. Included were sessions on storytelling and communication through film and how to communicate a clear message.

Social Media

NCEAS has continued its activity on Twitter in the past year and NCEAS now has over 2000 followers. SciFund, a crowdsourced fundraising platform, is the brainchild of Center Associate Jai Ranganathan and former NCEAS postdoc Jarrett Byrnes; the primary purpose is to help scientists communicate the importance of their science to the public while also raising modest funds to support various research.

Public Understanding of Science and Community Outreach

NCEAS maintains website material written for the general public under "Current Working Groups" and "Featured Research". We interact with journalists and other communications professionals, and collaborate with local and national organizations such as COMPASS, to promote public interest in and understanding of science.

In addition to hosting Center Associate Nancy Baron (COMPASS) who has participated in many NCEAS efforts to communicate science to the public, NCEAS also hosts Jai Ranganathan who has

initiated two well-attended public “Science for Everyone” events: “Lake Baikal, the Sacred Sea of Siberia” (speaker: Stephanie Hampton) and “How Healthy are our Oceans” (speaker: Ben Halpern) . Both Center Associates interact regularly with visitors and residents.

NCEAS strives to track popular media coverage of publications that result from NCEAS-sponsored research. As a result of this effort, we found that it has been an active year for many researchers and groups. A number of projects have inspired prominent media attention, both in the U.S. and around the world. Below are only a few examples.

Examples of Projects that Received Prominent Press Coverage

PI(s): Jennifer Balch

Project: ***Relative influence of fuels, climate, and ignition on fire frequency across earth’s ecosystems***

J. Balch, et al. Introduced annual grass increases regional fire activity across the arid western USA (1980-2009), *Global Change Biology* 19(1):173-183 (2013)

Covered by: *Conservation Magazine; Futurity; International Business Times; Nature World News; Science Daily*

PI(s): Mariah Carbone

Project: ***A synthesis of soil respiration in semi-arid and arid ecosystems across multiple spatial and temporal scales***

M. Carbone, et al. Cloud shading and fog drip influence the metabolism of a coastal pine ecosystem, *Global Change Biology* 19(2):484-497 (2012)

Covered by: *Los Angeles Times; Forest Carbon Asia; Futurity; e! Science News; PhysOrg; Science Daily; Red Orbit*

PI(s): Robert Condon, Carlos Duarte, and William Graham

Project: ***Global expansion of jellyfish blooms: Magnitude, causes and consequences***

R. H. Condon, et al. Recurrent jellyfish blooms are a consequence of global oscillations, *Proceedings of the National Academy of Sciences* 110(3):1000-1005 (2012)

Covered by: *CBS News; Discovery (US); Huffington Post; Green Pages (Australia); LiveScience; PhysOrg; National Science Foundation; Science Daily; Wild Singapore News (Singapore); Blue Marine Foundation (UK); Global Warming Policy Foundation (Denmark); Marine Research and Conservation (Spain); The Conversation (Australia); University World News (UK)*

PI(s): Kevin Lafferty, Andrew Dobson, and Mercedes Pascual

Project: ***Parasites and food webs – the ultimate missing links***

J.A. Dunne, et al. Parasites affect food web structure primarily through increased diversity and complexity, *PLoS Biology* 11:e1001579 (2013)

Covered by: *PhysOrg; Science Daily; Science Magazine; United Academics* (Amsterdam)

PI(s): **Lesley Lancaster**

Project: *What community characteristics promote recent and current bio-diversification? An investigation of community-level, ecological correlates of rapid diversification in replicate, temperate Angiosperm Genera*

L. T. Lancaster, et al. Origin and diversification of the California flora: Re-examining classic hypotheses with molecular phylogenies, *Evolution* 67(4):1041-1054 (2013)

Covered by: *Discovery; Futurity; Los Angeles Times; Santa Cruz Sentinel; Science Daily; Science Newslines; Terra Daily* (Australia); *UPI; Easy Branches* (Thailand)

PI(s): **Erin Mordecai**

Project: *The effects of global change on malaria transmission: A meta-analysis (Luce Fellows) and*

PI(s): **Sadie Ryan**

Project: *The effects of global change on malaria transmission: A meta-analysis (Luce Fellows)*

E.A. Mordecai, et al. Optimal temperature for malaria transmission is dramatically lower than previously predicted, *Ecology Letters* 16(1):22-30 (2013)

Covered by: *New Scientist; Science Daily; Health Medicine Network*

PI(s): **Anthony Richardson and Elvira Ploczanska**

Project: *Towards understanding marine biological impacts of climate change*

E.S. Poloczanska, et al. Global imprint of climate change on marine life, *Nature Climate Change* 3:919-925 (2013)

Covered by: *ABC Australia* (Australia); *Albany Tribune*; *ANI News* (Asia); *Asian Scientist* (Singapore); *Berliner Zeitung* (Germany); *Canada Broadcasting Company*; *Courier Mail* (Australia); *Counter Currents* (India); *Die Welt* (Germany); *Discovery*; *e! Science News*; *French Tribune* (France); *Futurity*; *Iber Campus* (Spain); *Inside Costa Rica* (Costa Rica); *Le Monde* (France); *Live Science*; *MSNC* (US); *Nature World News*; *Oregon Public Broadcasting*; *Pacific Standard*; *PhysOrg*; *Plymouth Herald* (UK); *Science Daily*; *Sydney Morning Herald* (Australia); *The Australian*; *The Conversation* (Australia); *The Global Herald* (UK); *The Guardian*; *Vietnam Breaking News*; *Voice of America*; *UPI*; *Wild Singapore*

Diversity Initiatives

NCEAS continues to expand efforts to reach students and scientists from groups currently under-represented in ecology. Our Distributed Seminar for undergrads is continuing, organized in partnership with ESA's Diversity and Education program and NEON, in which half of participating colleges/universities are Minority Serving Institutions. In addition, NCEAS works with NESCent and other partners to co-produce a suite of activities to promote careers in ecology and evolution.

K-12 and Community Outreach

NCEAS scientists additionally participated in the broader community by giving talks at UC Santa Barbara, coordinating the Roundtable series, and judging ecology projects for the Santa Barbara Country Science Fair.

Initiatives Focused on Undergraduate Education

During the last NSF reporting period, the Synthetic Undergraduate Networks for Analyzing Ecological Data (Project SUN), was designed and carried out by David Marsh from Washington and Lee University. Project SUN introduced undergraduate students in ecology to the benefits of collaboration and synthesis through actual research experience carried out in partnership with students from other universities. The initial research project focused on identifying factors that promote or inhibit plant invasions. Dr. Marsh and Dr. Hampton sought and received NSF support for an evolution of this model, to reach more undergraduates in synthesis research, funded by the NSF TUES program. That new project is called: Toads, Roads, and Nodes: Collaborative Course-Based Research on the Landscape Ecology of Amphibian Populations.

In addition, as an outcome of the Distributed Graduate Seminar "Engaging undergraduate students in ecological investigations using large, public datasets", Barbara Abraham and NCEAS postdoc Josephine Rodriguez published "Investigating the ecology of West Nile Virus in the United States" in *Teaching Issues and Experiments in Ecology*.

Diversity of Community Engagement

Since 1995, over 5,750 scientists and other professionals have participated in activities at NCEAS and Figure 3 shows the level of participation per year. The vast majority of NCEAS visitors come only once (Figure 4), allowing NCEAS to continue to engage new scientists. Of these NCEAS participants, roughly 200 come from Minority Serving Institutions as defined by the Department of Education (i.e., Minority Institutions, Historically Black Colleges and Universities, Alaska Native-Serving Institutions, High Hispanic Enrollment, Hispanic-Serving Institutions, Indian Tribally Controlled Colleges and Universities, and Native Hawaiian-Serving Institutions). Representation of women in Working Groups at NCEAS has grown from < 20% in 1996 to roughly 35% (Figure 5), and representation has increased on the Science Advisory Board since NCEAS establishment (Figure 6). Disciplinary breadth continues to increase; participants over the lifespan of NCEAS have belonged to over 600 different professional societies and have published their NCEAS work in 330 distinct journals. Since 1995, participants have come from over 1,500 different institutions. Finally, 30% of the participants during this reporting period to date were from non-academic institutions.

We continue to strive to reach new participants. The NCEAS leadership and our Science Advisory Board actively encourage Working Group leaders to recruit participants who have not had previous NCEAS experience. We advertise our Call for Proposals through professional listservs, such as Ecolog, and the relatively high number of “hits” on our online Call for Proposals that are directed to us from email servers following these listserv advertisements indicates success in gaining attention through this approach. In addition, we also announce the Call for Proposals via Twitter and our “news” email list.

Publications and Products

The total number of publications from NCEAS activities now exceeds 2,400 since the establishment of NCEAS (Figure 7). (This does not include publications from the NSF-supported SEEK project, which are reported to NSF independently.) Recently we matched our publications to the most recent Impact Factor scores available, and we present in Table 3 selected high-impact journals and the number of publications NCEAS has had in these journals over its lifespan. A number of NCEAS articles have ranked in the top 20 of highly-cited articles in some of those high-impact journals. Those rankings and articles are listed in Table 4.

Below we list 291 newly reported publications for the period since the last report submission date. Note that this list includes publications that have been reported to us by participants in NCEAS activities during this period, and actual publication dates may precede this period. It does not include publications reported for the SEEK project, which are reported to NSF separately.

In addition to publications reported, we have listed 12 data sets that were registered or uploaded to the NCEAS Data Repository since September 1, 2012. During this reporting cycle NCEAS scientists have reported 86 presentations of their NCEAS work, submitted 19 new proposals to other organizations (we are aware that at least 11 of these were funded), conducted 18 meetings or workshops, and completed one thesis as a result of activities at NCEAS.

Other notable outcomes of NCEAS work include three software tools, five student training events, and one follow-on project at SESYNC (titled “Globalization of the live plant trade: Informing efficient strategies for reducing non-native pest invasion risk”). Members of the “Linking phylogenetic history, plant traits, and ecological processes at multiple scales” project (PIs: Jeannine Cavender-Bares, David Ackerly, Richard Ree, J. Gordon Burleigh, Michelle Mack, and Peter Reich) reported that the Supplementary issue of Ecology title “Ecology branches into the tree of life” was an outcome of their work at NCEAS.

Publications Reported August 31, 2012 through November 2013

Includes journal articles, books, and book chapters

* *Indicates publication is being updated from previously reported as “in press”*

Aarssen, Lonnie W.; Lortie, Christopher J. 2012. Science Open Reviewed: An online community connecting authors with reviewers for journals. *Ideas in Ecology and Evolution*. Vol: 5(2). Pages 78-83.

Adair, Elizabeth C.; Reich, Peter B.; Trost, Jared J.; Hobbie, Sarah E. 2011. Elevated CO₂ stimulates grassland soil respiration by increasing carbon inputs rather than by enhancing soil moisture. *Global Change Biology*. Vol: 17. Pages 3546-3563.

Alberts, Susan; Altmann, Jeanne; Brockman, Diane; Cords, Marina; Fedigan, Linda M.; Pusey, Anne E.; Stoinski, Tara S.; Strier, Karen B.; Morris, William F.; Bronikowski, Anne. 2013. Reproductive aging patterns in primates reveal that humans are distinct. *Proceedings of the National Academy of Sciences*. Vol: 110. Pages 13440-13445.

Allan, J. David; McIntyre, Peter B.; Smith, Sigrid D. P.; Halpern, Benjamin S.; Boyer, Gregory L.; Buchsbaum, Andy; Burton, Jr., G. A.; Campbell, Linda M.; Chadderton, W. Lindsay; Ciborowski, Jan J. H.; Doran, Patrick J.; Eder, Tim; Infante, Dana M.; Johnson, Lucinda B.; Joseph, Christine A.; Marino, Adrienne L.; Prusevich, Alex; Read, Jennifer G.; Rose, Joan B.; Rutherford, Edward S.; Sowa, Scott P.; Steinman, Alan. 2013. Joint analysis of stressors and ecosystem services to enhance restoration effectiveness. *Proceedings of the National Academy of Sciences*. Vol: 110(1). Pages 372-377.

Allesina, Stefano. 2011. Predicting trophic relations in ecological networks: A test of the Allometric Diet Breadth Model. *Journal of Theoretical Biology*. Vol: 279. Pages 161-168.

Allesina, Stefano. 2012. Modeling peer review: An agent-based approach. *Ideas in Ecology and Evolution*. Vol: 5(2). Pages 27-35.

Alonso, Conchita; Vamosi, Jana C.; Knight, Tiffany M.; Steets, Janette A.; Ashman, Tia-Lynn. 2010. Is reproduction of endemic plant species particularly pollen limited in biodiversity hotspots?. *Oikos*. Vol: 119. Pages 1192-1200.

Altizer, Sonia; Bartel, Becky; Han, Barbara A. 2011. Animal migration and infectious disease risk. *Science*. Vol: 331(6015). Pages 296-302.

Anderson, Sean C.; Branch, Trevor A.; Ricard, Daniel; Lotze, Heike K. 2012. Assessing global marine fishery status with a revised dynamic catch-based method and stock-assessment reference points. *ICES Journal of Marine Science*. Vol: 69. Pages 1491-1500.

Anderson, Sean C.; Mills Flemming, Joanna; Watson, Reg; Lotze, Heike K. 2011. Rapid global expansion of invertebrate fisheries: Trends, drivers, and ecosystem effects. *PLoS ONE*. Vol: 6(3). Pages e14735-e14735.

Anderson, Sean S.; Peterson, Charles H.; Cherr, Gary; Hampton, Stephanie E.; Blum, Michael. 2012. Casual observations on DWH dispersant effects expose the lack of rigorous science: Response to Rorick and colleagues. *BioScience*. Vol: 62(12). Pages 1010-1011.

Aswani-Canela, Shankar; Christie, Patrick J.; Muthiga, Nyawira; Mahon, Robin; Primavera, Jurgenne H.; Cramer, Lori A.; Barbier, Edward B.; Granek, Elise F.; Kennedy, Christopher J.; Wolanski, Eric; Hacker, Sally. 2012. The way forward with ecosystem-based management in tropical contexts: Reconciling with existing management systems. *Marine Policy*. Vol: 36(1).

Ault, Toby R.; Macalady, Alison K.; Pederson, Gregory T.; Betancourt, Julio L.; Schwartz, Mark D. 2011. Northern Hemisphere modes of variability and the timing of spring in western North America. *Journal of Climate*. Vol: 24(15). Pages 4003-4014.

Badano, Ernesto I.; Marquet, Pablo A. 2009. Biogenic habitat creation affects biomass-diversity relationships in plant communities. *Perspectives in Plant Ecology Evolution and Systematics*. Vol: 11(3). Pages 191-201.

Bai, Xuejiao; Queenborough, Simon A.; Wang, Xugao; Zhang, Jian; Li, Buhang; Yuan, Zuoqiang; Xing, Dingliang; Lin, Fei; Hao, Zhanqing. 2012. Effects of local biotic neighbors and habitat heterogeneity on tree and shrub seedling survival in an old-growth temperate forest. *Oecologia*. Vol: 170. Pages 755-765.

Bakker, Victoria J.; Doak, Daniel F.; Roemer, Gary W.; Garcelon, David K.; Coonan, Timothy J.; Morrison, Scott A.; Lynch, Colleen; Ralls, Katherine; Shaw, M. Rebecca. 2009. Incorporating ecological drivers and uncertainty into a demographic population viability analysis for the Island Fox. *Ecological Monographs*. Vol: 79(1). Pages 77-108.

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- Balmer, Michelle B.; Downing, John A. 2011. Carbon dioxide concentrations in eutrophic lakes: Undersaturation implies atmospheric uptake. *Inland Waters*. Vol: 1. Pages 125-132.
- Balvanera, Patricia; Siddique, Ilyas; Dee, Laura; Paquette, Alain; Byrnes, Jarrett E.; O'Connor, Mary I.; Isbell, Forest; Griffin, John N.; Hungate, Bruce A.; Gonzalez, Andrew. In press. Linking biodiversity and ecosystem services: Assessing uncertainties and finding a way forward. *Frontiers in Ecology and the Environment*.
- Barseghian, Derik; Altintas, Ilkay; Jones, Matthew B.; Crawl, Daniel; Potter, Nathan; Gallagher, James; Cornillon, Peter; Schildhauer, Mark P.; Borer, Elizabeth T.; Seabloom, Eric; Hosseini, Parvizeh R. 2010. Workflows and extensions to the Kepler scientific workflow system to support environmental sensor data access and analysis. *Ecological Informatics*. Vol: 5. Pages 42-50.
- Bertram, Susan M.; Katti, Madhusudan. 2013. The social biology professor: Effective strategies for social media engagement. *Ideas in Ecology and Evolution*. Vol: 6. Pages 22-31.
- Blair, Christopher; Weigel, Dana; Balazik, Matthew; Keeley, Annika T. H.; Walker, Faith M.; Landguth, Erin L.; Cushman, Samuel A.; Murphy, Melanie A.; Waits, Lisette; Balkenhol, Niko. 2012. A simulation-based evaluation of methods for inferring linear barriers to gene flow. *Molecular Ecology Resources*. Vol: 12. Pages 822-833.
- Bolker, Benjamin; Gardner, Beth; Maunder, Mark N.; Berg, Casper W.; Brooks, Mollie; Comita, Liza S.; Crone, Elizabeth E.; Cubaynes, Sarah; Davies, Trevor D.; de Valpine, Perry; Ford, Jessica; Gimenez, Olivier; Kéry, Marc; Kim, Eunjung; Lennert-Cody, Cleridy; Magnusson, Arni; Martell, Steve J. D.; Nash, John C.; Nielsen, Anders; Regetz, Jim; Skaug, Hans J.; Zipkin, Elise. 2013. Strategies for fitting nonlinear ecological models in R, AD Model Builder, and BUGS. *Methods in Ecology and Evolution*. Vol: 4. Pages 501-512.
- Bolzoni, Luca; Dobson, Andrew P.; Gatto, Marino; De Leo, Giulio. 2008. Allometric scaling and seasonality in the epidemics of wildlife diseases. *American Naturalist*. Vol: 172(6). Pages 818-828.
- Bond, William J.; Scott, Andrew C. 2010. Fire and the spread of flowering plants in the Cretaceous. *New Phytologist*. Vol: 188. Pages 1137-1150.
- Boone, Christopher G. 2012. Urban sustainability and ecology of environmental justice. *Urbanization and Global Environmental Change Viewpoints*. Vol: 7. Pages 36-39.
- Boone, Christopher G. 2010. Environmental justice, sustainability and vulnerability. *International Journal of Urban Sustainable Development*. Vol: 2(1-2). Pages 135-140.
- Boone, Christopher G.; Fragkias, Michail. 2012. Connecting environmental justice, sustainability, and vulnerability. Edited by Boone, C.; Fragkias, M.. *Urbanization and Sustainability: Linking Ecology, Environmental Justice, and Global Environmental Change, Human Environment Interactions*. Springer Press. Vol: 3. Pages 49-60.
- Boone, Christopher G.; Fragkias, Michail. 2012. *Urbanization and Sustainability: Linking Ecology, Environmental Justice, and Global Environmental Change*. Edited by Boone, C.; Fragkias, M.. Human Environment Interactions. Springer Press. Vol: 3. Pages 1-216.
- Borer, Elizabeth T.; Bracken, Matthew E.; Seabloom, Eric; Smith, Jennifer E.; Cebrian, Just; Cleland, Elsa E.; Elser, James J.; Fagan, William F.; Gruner, Daniel S.; Harpole, W. Stanley; Hillebrand, Helmut; Kerkhoff, Andrew J.; Ngai, Jacqueline T. 2013. Global biogeography of autotroph chemistry: Is insolation a driving force?. *Oikos*. Vol: 122. Pages 1121-1130.
- Bothwell, Helen; Bisbing, Sarah; Therkildsen, Nina Overgaard; Crawford, Lindsay; Alvarez, Nadir; Holderegger, Rolf; Manel, Stephanie. 2012. Identifying genetic signatures of selection in a non-model species, alpine gentian (*Gentiana nivalis* L.), using a landscape genetic approach. *Conservation Genetics*.

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Broitman, Bernardo R.; Szathmary, P. L.; Mislan, A. S.; Blanchette, Carol A.; Helmuth, Brian. 2009. Predator-prey interactions under climate change: The importance of habitat vs body temperature. *Oikos*. Vol: 118. Pages 219-224.

Brooks, Marjorie L.; Fleishman, Erica; Brown, Larry R.; Lehman, Peggy W.; Werner, Inge; Scholz, Nathaniel L.; Mitchelmore, Carys L.; Lovvorn, James R.; Johnson, Michael L.; Schlenk, Daniel; van Drunick, Suzanne; Drever, James I.; Stoms, David M.; Parker, Alex E.; Dugdale, Richard. 2012. Life histories, salinity zones, and sublethal contributions of contaminants to pelagic fish declines illustrated with a case study of San Francisco Estuary, California, USA. *Estuaries and Coasts*. Vol: 35. Pages 603-621.

Buckley, Lauren B. 2010. The range implications of lizard traits in changing environments. *Global Ecology and Biogeography*. Vol: 19. Pages 452-464.

Buckley, Lauren B.; Jetz, Walter. 2010. Lizard community structure along environmental gradients. *Journal of Animal Ecology*. Vol: 79. Pages 358-365.

Buckley, Lauren B.; Kingsolver, Joel G. 2012. Functional and phylogenetic approaches to forecasting species' responses to climate change. *Annual Review of Ecology Evolution and Systematics*. Vol: 43(1). Pages 205-226.

Buckley, Lauren B.; Tewksbury, Joshua; Deutsch, Curtis. 2013. Can terrestrial ectotherms escape the heat of climate change by moving?. *Proceedings of the Royal Society of London Series B-Biological Sciences*. Vol: 280(1765). Pages 20131149-20131149.

Buston, Peter M.; Elith, Jane. 2011. Determinants of reproductive success in dominant pairs of clownfish: A boosted regression tree analysis. *Journal of Animal Ecology*. Vol: 80. Pages 528-538.

Cadotte, Marc W.; Davies, T. Jonathan. 2010. Rarest of the rare: Advances in combining evolutionary distinctiveness and scarcity to inform conservation at biogeographical scales. *Diversity and Distributions*. Vol: 16(3). Pages 376-385.

Cadotte, Marc W.; Mehrkens, Lea; Menge, Duncan N. 2012. Gauging the impact of meta-analysis on ecology. *Evolutionary Ecology*. Vol: 26(5). Pages 1153-1167.

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- Woods, Kerry D.; Hicks, David J.; Schultz, Jan. 2012. Losses in understory diversity over three decades in an old-growth cool-temperate forest in Michigan, USA. *Canadian Journal of Forest Research-Revue Canadienne de Recherche Forestier*. Vol: 42. Pages 532-549.

Worm, Boris; Branch, Trevor A. 2012. The future of fish. *Trends in Ecology and Evolution*. Vol: 27(11). Pages 594-599.

Xiong , Xiaozhen; Barnet, Christopher D.; Zhuang, Qianlai; Machida, Toshinobu; Sweeney, Colm; Patra, Prabir K. 2010. Mid-upper tropospheric methane in the high Northern Hemisphere: Spaceborne observations by AIRS, aircraft measurements, and model simulations. *Journal of Geophysical Research*. Vol: 115. Pages D19309-D19309.

NCEAS Related Data Sets Registered or Uploaded to NCEAS Data Repository

Based on data reported as of November 2013

Sumanta Bagchi. 2012. *Body size and species coexistence in consumer-resource interactions: a comparison of two alternative theoretical frameworks.*

Benjamin Cook. 2012. *Divergent responses to spring and winter warming drive community level flowering trends.*

Richard Condit. 2012. *Barro Colorado plot data.*

John N. Griffin. 2013. *Data set for Griffen et al. 2013 Effects of predator richness on prey Suppression: A meta-analysis.*

Darren Johnson. 2012. *Selection measurements.*

Christopher Konrad. 2013. *Flow Experiment Attributes.*

Christopher Konrad. 2013. *Flow Experiment Site Attributes.*

Lesley Lancaster. 2013. *Origin and diversification of the California flora: re-examining classic hypotheses with molecular phylogenies.*

Evan L. Preisser. 2012. *Data on nonconsumptive predator effects.*

Elvira Poloczanska. 2013. *Impacts of Climate Change on Marine Organisms.*

Daniel Ricard, Coilin Minto, Olaf P. Jensen, Julia K. Baum. 2013. *RAM Legacy Stock Assessment Database.*

Carly Strasser. 2013. *The fractured lab notebook: Undergraduate and ecological data management training in the United States.*

NCEAS Related Software Tools

Reported to NCEAS between October 1, 2012 and September 31, 2013

Peterson, Erin E. 2011. *Spatial Tools for the Analysis of River Systems (STARS) ArcGIS Toolset*.

Verburg, Piet; Antenucci, J. P. 2010. *Matlab script to estimate latent and sensible heat fluxes from lake water surfaces*.

Waples, Robin. 2009. *Evoplastic Salmon model*.

3. Tables and Figures

Table 1. Science Advisory Board Members 2012

A complete history of Science Advisory Board members can be found at <http://www.nceas.ucsb.edu/sab/cumulative>.

SAB Members During 2012	Institutions	Term
Briggs, Cherie	University of California, Santa Barbara	2009-2012
Essington, Tim	University of Washington	2009-2012
Holmes, Elizabeth	National Marine Fisheries Service, Seattle WA	2009-2012
Pendall, Elise	University of Wyoming	2009-2012
Smith, Felisa	University of New Mexico	2009-2012
Altizer, Sonia	University of Georgia	2010-2012
Bolker, Ben	McMaster University	2010-2012
Curran, Lisa	Stanford University	2010-2012
Fryxell, John	University of Guelph	2010-2012
Liebold, Andrew	USDA Forest Service	2010-2012
Litchman, Elena	Michigan State University	2010-2012
Sabo, John	Arizona State University	2010-2012

Table 2. Roundtable Discussions

September 1, 2012 – September 30, 2013

Fall 2013 – Spring 2013

Date (2012 - 2013)	Name	Topic
September 5	Derek Gray (NCEAS)	Understanding community responses to environmental change
September 17	Stephanie Hampton (NCEAS)	Teamwork and conflict management 101
September 28	Dieter Lukas (University of Cambridge)	Constraints on adaptations during the evolution of mammalian social systems
October 5	Steve Katz (NOAA)	Problems in model selection: Is there a place for common sense?
October 12	Sarah Clark (NCEAS)	An informal look at the difference between communicating ecology in scientific journals and the news via topic modeling
October 24	Frank Davis	What is in store for NCEAS?
November 2	Stephanie Pau	Clouds and temperature drive dynamic changes in tropical flower production
November 6	Louis Pitelka (NEON)	The National Ecological Observatory Network (NEON): From petals to petabytes
November 14	Mariah Carbone (NCEAS)	Tracking carbon within trees: Nonstructural carbohydrate dynamics in temperate forests
November 30	Ben Adams (NCEAS)	Operationalizing place: Discovering, reasoning about, and exploring place knowledge from descriptions (Ph.D. defense practice)
December 7	Josephine Rodriguez (NCEAS)	Untangling patterns of host-specificity and chance in a hyperdiverse tri-trophic food web
December 12	Richard Hutton and LeeAnne French (Carsey-Wolf Center, UCSB)	Discussion of storytelling and communication through environmental media: Discussion of Blue Horizons films
December 19	Dr. Eli Bridge (Oklahoma Biological	Songbird migration and the geolocator revolution

	Survey, University of Oklahoma)	
January 11	Derek Gray (NCEAS)	Should ecologists get involved in environmental advocacy?
January 18	Dieter Lukas (Department of Zoology, Cambridge)	Can we infer causality from observational data?
January 23	Nancy Baron (NCEAS)	How to communicate a clear message
January 30	Dr. Nick Dulvy (Department of Biological Sciences, Simon Fraser University)	What is the global status of fisheries? Let's ask the sharks.
February 8	Kara Woo (NCEAS) & Stacy Rebich Hespanha (NCEAS)	Creating a more inclusive academic culture
February 15	Stacy Rebich Hespanha and Jessica Bragg (NCEAS/DataONE)	Tell us your tales of data management and sharing
February 18	Ron Rice (UCSB Dept. of Communication)	A conceptual framework for ocean sustainability
February 27	Pat Comer (Chief Ecologist/ Conservation Planner, NatureServe)	NatureServe: A network connecting science with conservation – some history, current projects, and future directions
March 8	Dieter Lukas (University of Cambridge)	Why be monogamous? Perspectives from other mammals
March 13	Corina Logan (SAGE Junior Research Fellow, UCSB)	Conflict management in crows and beyond
March 20	Ben Best (NCEAS)	Statistical and spatial toolbox for the Ocean Health Index and cumulative impacts
April 9	Marco Millones (College of William and Mary)	Fire as a proxy for land cover change: A spatial analysis for the Mexican Yucatan
April 19	Mary Hunsicker (NCEAS)	Climate variability and demography impact an important predator-prey system in the North Pacific Ocean
April 26	Katie Longo (NCEAS)	Value sets and management priorities: Assigning weights to benefits and services that contribute to ocean health

May 3	Kristin Marshall (NOAA-NMFS Northwest Fishery Science Center)	Wolves, elk, and willows: Have trophic cascades restored riparian ecosystems on Yellowstone's northern range?
May 10	Stacy Rebich Hespanha (NCEAS)	Finding the lede for a 'big data' study of news reporting on climate change
May 13	Chris Lortie (York University)	What's all the h about? A summary of performance metrics for academics & journals.
May 31	Benoit Parmentier (NCEAS)	Variability in the Earth system: Identifying patterns and teleconnections in global sea surface temperature time series
June 3	NCEAS personnel	The future of the NCEAS Roundtable
June 14	Mary Hunsicker, & Julie Stewart (NCEAS)	The contribution of cephalopods to global marine fisheries & Humboldt squid in the California Current: Investigating the range expansion of a large marine predator
June 19	John Parker (NCEAS)	Sociology of scientific collaboration (with NCEAS Summer Institute)

Summer 2013 – Fall 2013

Date (2013)	Name	Subject
June 24	Dr. Robert Schick (University of St Andrews, Scotland)	Using hierarchical Bayes to estimate body condition in marine mammals
June 26	John Parker	The broken job market
July 8	David Marsh (Washington and Lee University)	Roads, toads, and nodes: Linking undergraduate ecology courses to study the impacts of land use on amphibian populations
July 19	Stephanie Hampton (NCEAS)	Thinking preferences - discussion and activity
July 22	LeeAnne French (NCEAS)	Brainstorm - NCEAS website
September 13	Dieter Lukas	How to find data

September 18	Mark Browne	Benign by Design: Fabrics with minimal impact
September 23	Bertrand Lemasson (US Army Corps)	Using models and data to evaluate how selective attention influences social coordination and individual risk in animal groups
September 30	Eric Cardenas & David Fortson (LoaTree & LoaCom)	Communicating conservation science to non-scientists: Strategies and practices

Table 3. Number of NCEAS Articles Published in a Selection of High-impact Journals

Includes number of NCEAS publications since the establishment of NCEAS in 1995, sorted by Impact Factor of the journal. Does not include SEEK publications, which are reported separately.

Journal Title	2011 Impact Factor	# NCEAS pubs as of Aug. 2012	2013 Impact Factor	#NCEAS pubs as of Oct. 2013
Nature	36.28	46	38.6	48
Science	31.201	82	31.03	83
Ecology Letters	17.557	100	17.95	113
Trends in Ecology and Evolution	15.748	47	15.39	51
PLoS Biology	11.452	7	12.69	8
Systematic Biology	10.225	2	12.17	3
Annual Review of Ecology, Evolution, and Systematics	14.373	16	10.38	17
Proceedings of the National Academy of Sciences	9.681	63	9.74	70
Ecological Monographs	7.433	11	8.09	12
Frontiers in Ecology and the Environment	9.113	31	7.62	34
Global Ecology and Biogeography	5.145	14	7.22	18
Global Change Biology	6.862	34	6.91	37
Molecular Ecology	5.522	12	6.28	13
Proc. Royal Society of London Series B	5.415	37	5.68	43
Journal of Ecology	5.044	9	5.43	13
Ecology	4.849	150	5.18	164*
Evolution	5.146	11	4.86	12
BioScience	4.621	42	4.74	46
Journal of Applied Ecology	5.045	8	4.74	9
Global Biogeochemical Cycles	4.785	7	4.68	10
American Naturalist	3.24	76	4.55	84
Conservation Biology	4.692	47	4.36	52
Ecological Applications	5.102	60	3.82	81**

* Includes one article in a special issue "Ecology: Phylogenetic Approaches to Community Ecology"

** Includes 17 articles in a supplemental issue "Ecological Applications: The Science of Marine Reserves"

Table 4. NCEAS Publications Ranked in Top 20 of Top-cited Papers in a Selection of High Impact Journals

Top-cited Ranking	Journal: <i>Ecosystems</i>
4	McClain, Michael ; Boyer, Elizabeth ; Dent, C. ; Gergel, Sarah ; Grimm, Nancy ; Groffman, Peter ; Hart, Stephen ; Harvey, Jud ; Johnston, Carol ; Mayorga, Emilio ; McDowell, William ; Pinay, Gilles. 2003. Biogeochemical hot spots and hot moments at the interface of terrestrial and aquatic ecosystems. <i>Ecosystems</i> . Vol: 6.4. Pages 301-312.
7	Cole, Jonathan ; Prairie, Yves ; Caraco, Nina ; McDowell, William ; Tranvik, Lars ; Striegl, Robert ; Duarte, Carlos ; Kortelainen, Pirkko ; Downing, John ; Middelburg, Jack ; Melack, John. 2007. Plumbing the global carbon cycle: Integrating inland waters into the terrestrial carbon budget. <i>Ecosystems</i> . Vol: 10.1. Pages 172-185.
10	Paine, R. T., M. J. Tegner, and E. A. Johnson. Compounded Perturbations Yield Ecological Surprises. 1998. <i>Ecosystems</i> Vol: 1.6. Pages 535-545.
12	Turner, Monica; Baker, William; Peterson, Chris; Peet, Robert. 1998. Factors influencing succession: Lessons from large, infrequent natural Disturbances. <i>Ecosystems</i> . Vol: 1.6. Pages 511-523.
Top-cited Ranking	Journal: <i>Annual Review of Ecology, Evolution, and Systematics</i>
6	Willig, M. R., D. M. Kaufman, and R. D. Stevens. Latitudinal gradients of biodiversity: Pattern, process, scale, and synthesis. 2003. <i>Annual Review of Ecology, Evolution and Systematics</i> . Vol: 34. Pages 273-309.
19	Knight, Tiffany; Steets, Janette; Vamosi, Jana; Mazer, Susan; Burd, Martin; Campbell, Diane; Dudash, Michele; Johnston, Mark; Mitchell, Randall; Ashman, Tia-Lynn. 2005. Pollen limitation of plant reproduction: Pattern and process. <i>Annual Review of Ecology, Evolution and Systematics</i> . Vol: 36. Pages 467-497.
Top-cited Ranking	Journal: <i>Journal of Applied Ecology</i>
11	Palmer, Margaret ; Bernhardt, Emily ; Allan, J. David ; Lake, P. Sam ; Alexander, Gretchen ; Brooks, Shane ; Carr, Jamie ; Clayton, Steve ; Dahm, Clifford ; Follstad-Shah, Jennifer ; Galat, David ; Loss, S. ; Goodwin, Peter ; Hart, David ; Hassett, Brooke ; Jenkinson, Robin ; Kondolf, G. ; Lave, Rebecca ; Meyer, Judy ; O'Donnell, T. Kevin ; Pagano, Laura ; Sudduth, Elizabeth.

	2005. FORUM: Standards for ecologically successful river restoration. Journal of Applied Ecology. Vol: 42.2. Pages 208-217.
Top-cited Ranking	Journal: <i>BioScience</i>
12	Beck, Michael; Heck, Kenneth; Able, Kenneth; Childers, Daniel; Eggleston, David; Gillanders, Bronwyn; Halpern, Benjamin; Hays, Cynthia; Hoshino, Kaho; Minello, Thomas; Orth, Robert; Sheridan, Pete; Weinstein, Michael. 2001. The Identification, Conservation, and Management of Estuarine and Marine Nurseries for Fish and Invertebrates. Bioscience. Vol: 51.8. Pages 633-641.
Top-cited Ranking	Journal: <i>Ecology</i> 1998-2013
1	Post, David M. Using stable isotopes to estimate trophic position: Models, methods, and assumptions. 2002. Ecology. Vol: 83.3. Pages 703-718.
8	Hawkins, Bradford; Field, Richard; Cornell, Howard; Currie, David; Guegan, Jean-Francois; Kaufman, Dawn; Kerr, Jeremy; Mittelbach, Gary; Oberdorff, Thierry; O'Brien, Eileen; Porter, Eric; Turner, John. 2003. Energy, water, and broad-scale geographic patterns of species richness. Ecology. Vol: 84.12. Pages 3105-3117.
9	Mittelbach, Gary; Steiner, Christopher; Scheiner, Samuel; Gross, Katherine; Reynolds, Heather; Waide, Robert; Willig, Michael; Dodson, Stanley; Gough, Laura. 2001. What is the observed relationship between species richness and productivity? Ecology. Vol: 82.9. Pages 2381-2396.
11	Werner, Earl E., and Scott D. Peacor. 2003. A review of trait-mediated indirect interactions in ecological communities. Ecology. Vol: 84.5. Pages 1083-1100.
14	Hedges, Larry V., and Jessica Gurevitch. 1999. The meta-analysis of response ratios in experimental ecology. Ecology. Vol: 80.4. Pages 1150-1156.
20	Gurevitch, Jessica, and Larry V. Hedges. 1999. Statistical issues in ecological meta-analyses. Ecology. Vol: 80.4. Pages 1142-1149.
Top-cited Ranking	Journal: <i>Ecology Letters</i>
3	Leibold, Mathew; Holyoak, Marcel; Mouquet, Nicolas; Amarasekare, Priyanga;

	Chase, Jonathan; Hoopes, Martha; Holt, Robert; Shurin, Jonathan; Law, Richard; Tilman, David; Loreau, Michel; Gonzalez, Andrew. 2004. The metacommunity concept: A framework for multi-scale community ecology . Ecology Letters. Vol: 7.7. Pages 601-613.
8	Elser, James; Bracken, Matthew; Cleland, Elsa; Gruner, Daniel; Harpole, W. Stanley; Hillebrand, Helmut; Ngai, Jacqueline; Seabloom, Eric; Shurin, Jonathan; Smith, Jennifer. 2007. Global analysis of nitrogen and phosphorus limitation of primary producers in freshwater, marine and terrestrial ecosystems . Ecology Letters. Vol: 10.12. Pages 1135-1142.
15	Shurin, Jonathan; Borer, Elizabeth; Seabloom, Eric; Anderson, Kurt; Blanchette, Carol; Broitman, Bernardo; Cooper, Scott; Halpern, Benjamin. 2002. A cross-ecosystem comparison of the strength of trophic cascades . Ecology Letters. Vol: 5.6. Pages 785-791.
16	Currie, David; Mittelbach, Gary; Cornell, Howard; Field, Richard; Guegan, Jean-Francois; Hawkins, Bradford; Kaufman, Dawn; Kerr, Jeremy; Oberdorff, Thierry; O'Brien, Eileen; Turner, John. 2004. IDEAS AND PERSPECTIVES: Predictions and tests of climate-based hypotheses of broad-scale variation in taxonomic richness . Ecology Letters. Vol: 7.12. Pages 1121-1134.
Top-cited Ranking	Journal: <i>Frontiers in Ecology and the Environment</i>
7	Nelson, Erik; Mendoza, Guillermo; Regetz, Jim; Polasky, Stephen; Tallis, Heather; Cameron, D. Richard; Chan, Kai; Daily, Gretchen; Goldstein, Joshua; Kareiva, Peter; Lonsdorf, Eric; Naidoo, Robin; Ricketts, Taylor; Shaw, M. Rebecca. 2009. Modeling multiple ecosystem services, biodiversity conservation, commodity production, and tradeoffs at landscape scales . Frontiers in Ecology and the Environment. Vol: 7.1. Pages 4-11.
19	Hannah, Lee; Midgley, Guy; Andelman, Sandy; Araujo, Miguel; Hughes, Greg; Martínez-Meyer, Enrique; Pearson, Richard; Williams, Paul. 2007. Protected area needs in a changing climate . Frontiers in Ecology and the Environment. Vol: 5.3. Pages 131-138.
Top-cited Ranking	Journal: <i>Global Ecology and Biogeography</i>
10	Martinez-Meyer, Enrique, A. Townsend Peterson, and William W. Hargrove. 2004. Ecological niches as stable distributional constraints on mammal species, with implications for Pleistocene extinctions and climate change projections for biodiversity . Global Ecology and Biogeography. Vol: 13.4. Pages 305.

Figure 1. Number of Proposals Submitted and Supported in total for each NSF proposal period since the establishment of NCEAS in 1995. Note that 2010-Jul and 2012-Aug were only Working Group proposals (see Figure 2) and there was no call for proposals in 2011 and 2013.

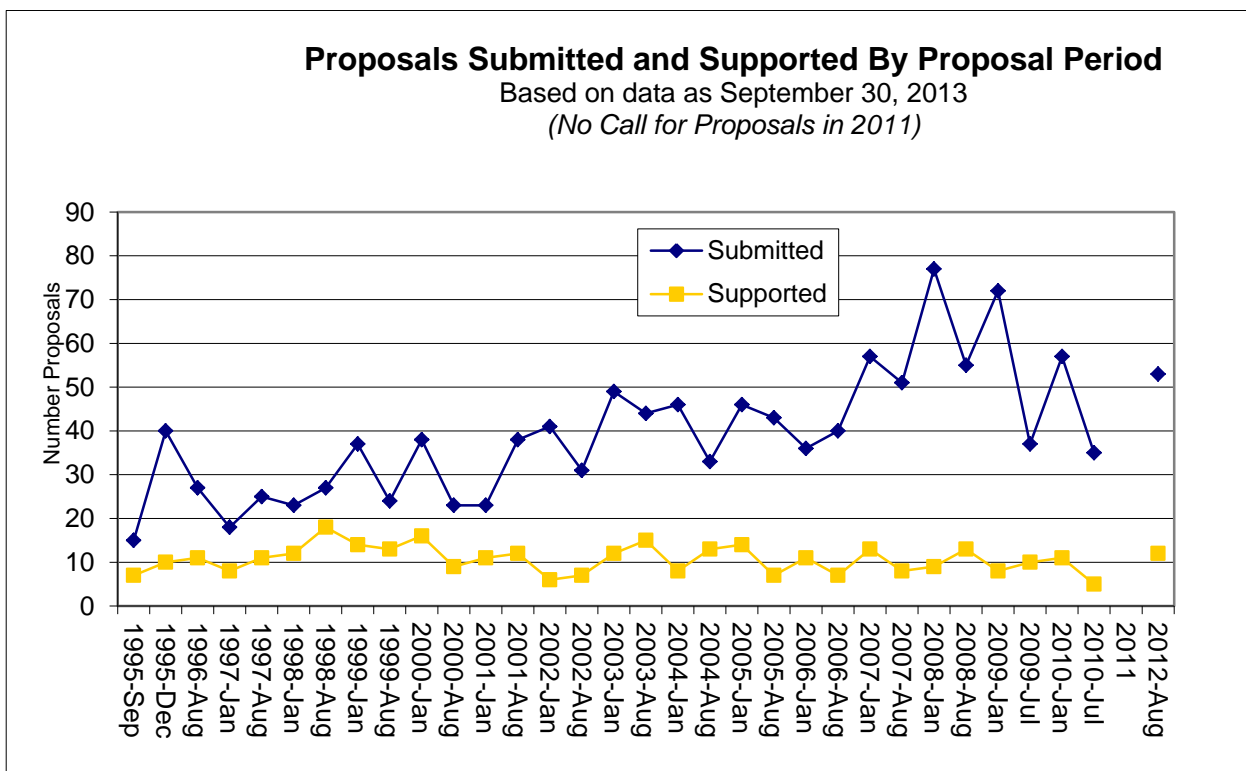
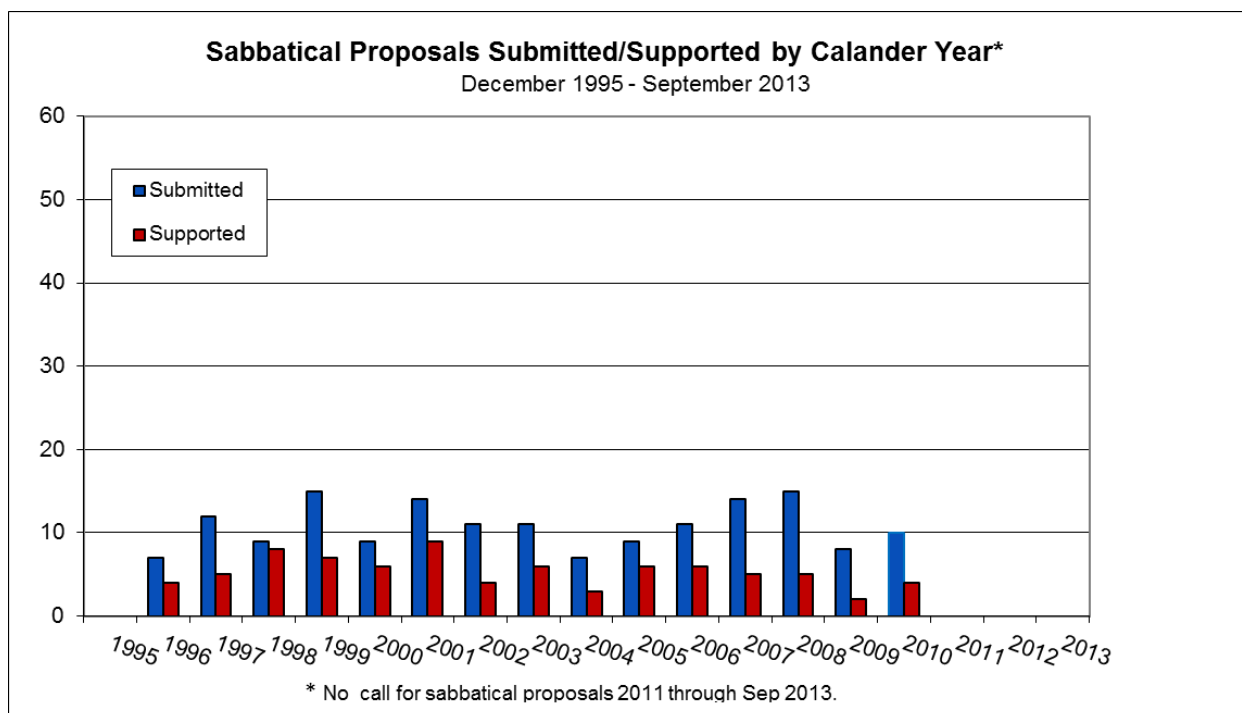
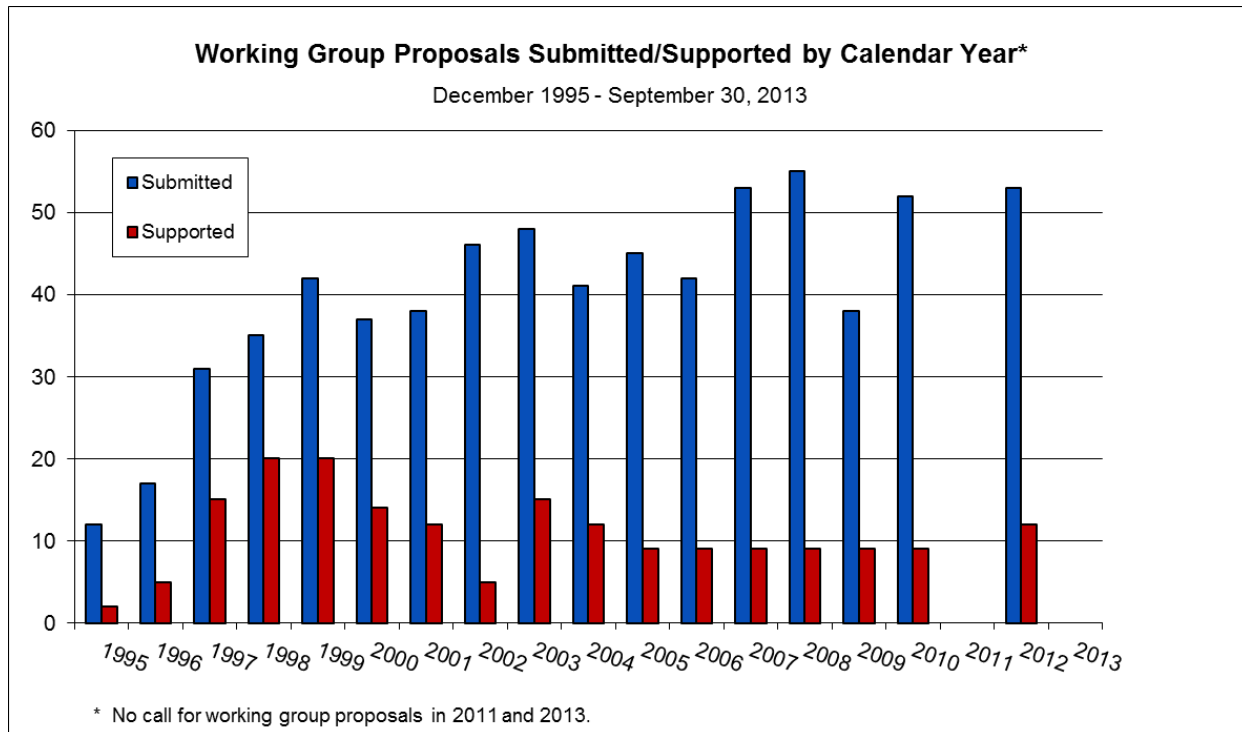


Figure 2. Proposals Submitted and Supported by Activity Type

Note that there was no call for proposals in 2011 and 2013. Years 2010 and 2012 include only one call for working group proposals, while all other years in the past decade have included two calls. August 2012 was a record high of 52 working group proposals in a single call compared to a previous high of 35 in July 2010.



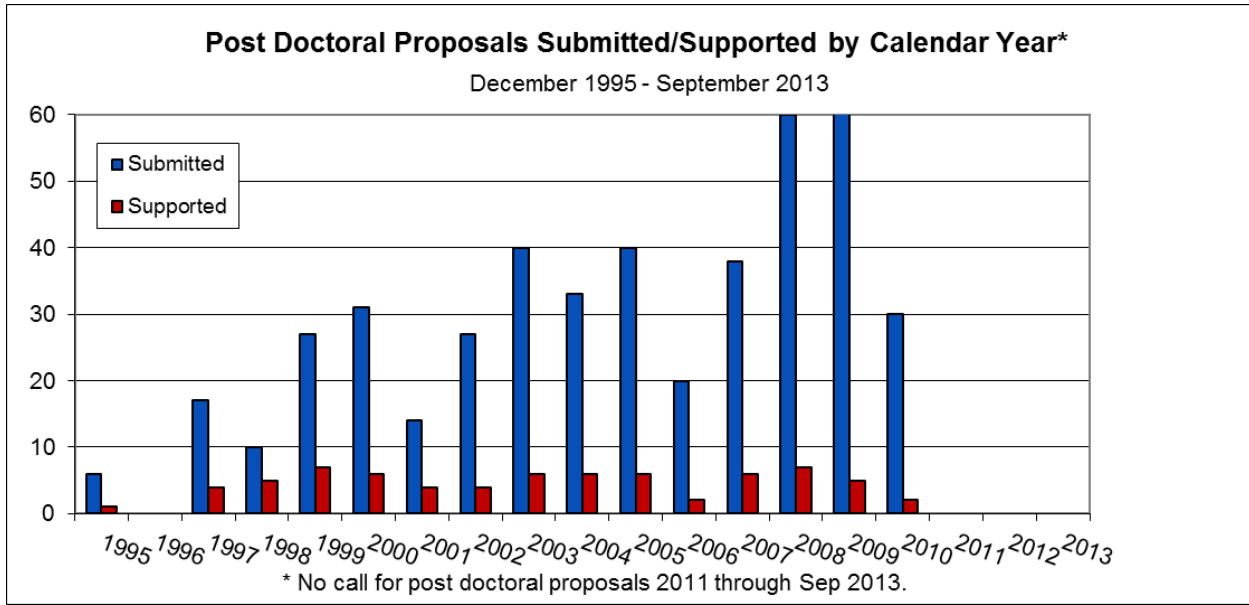


Figure 3. Number of Participants Since 1996

“Unique participants” excludes multiple visits within a given year

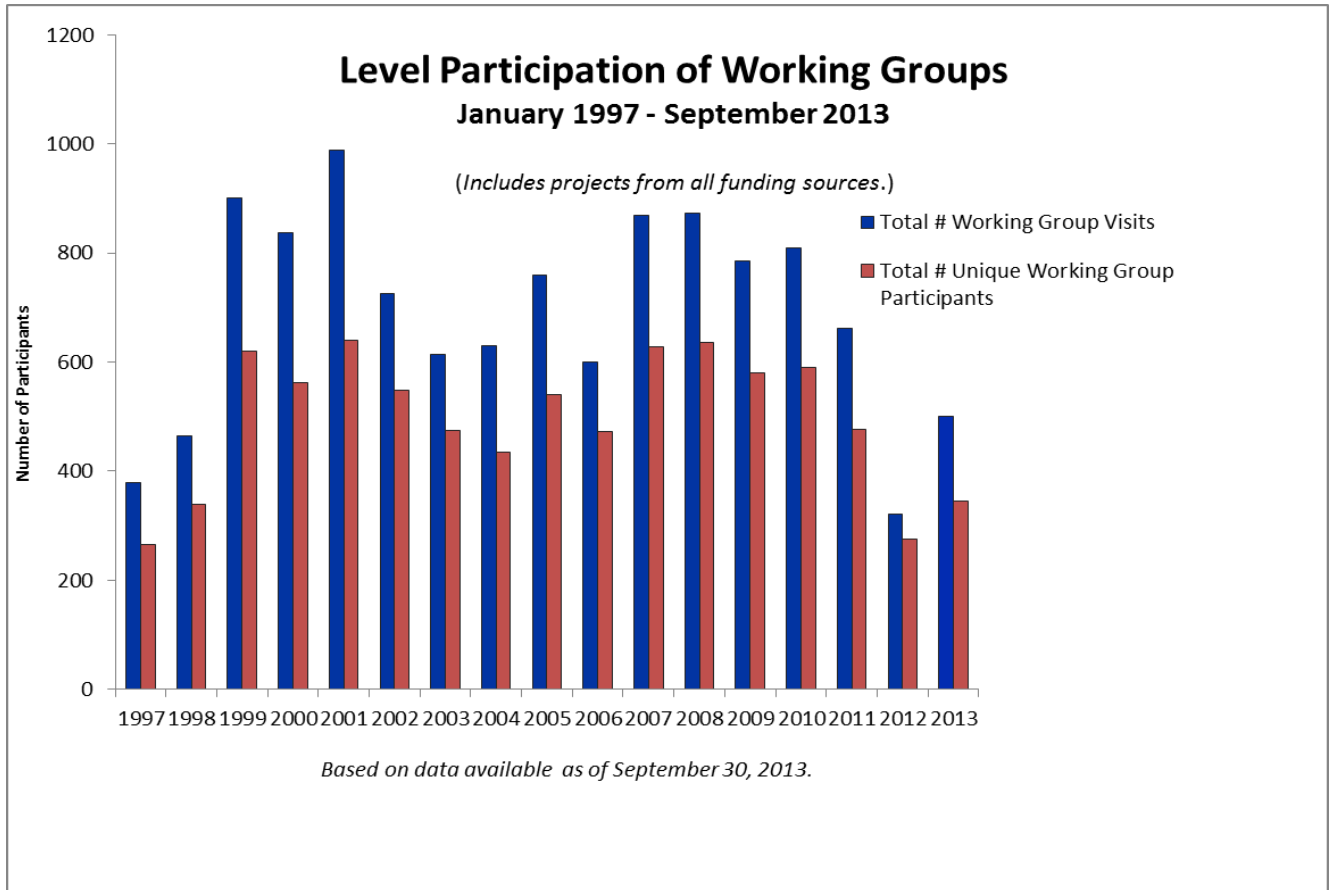


Figure 4. Frequency of Visits by each unique Working Group participant since establishment of NCEAS in 1995.

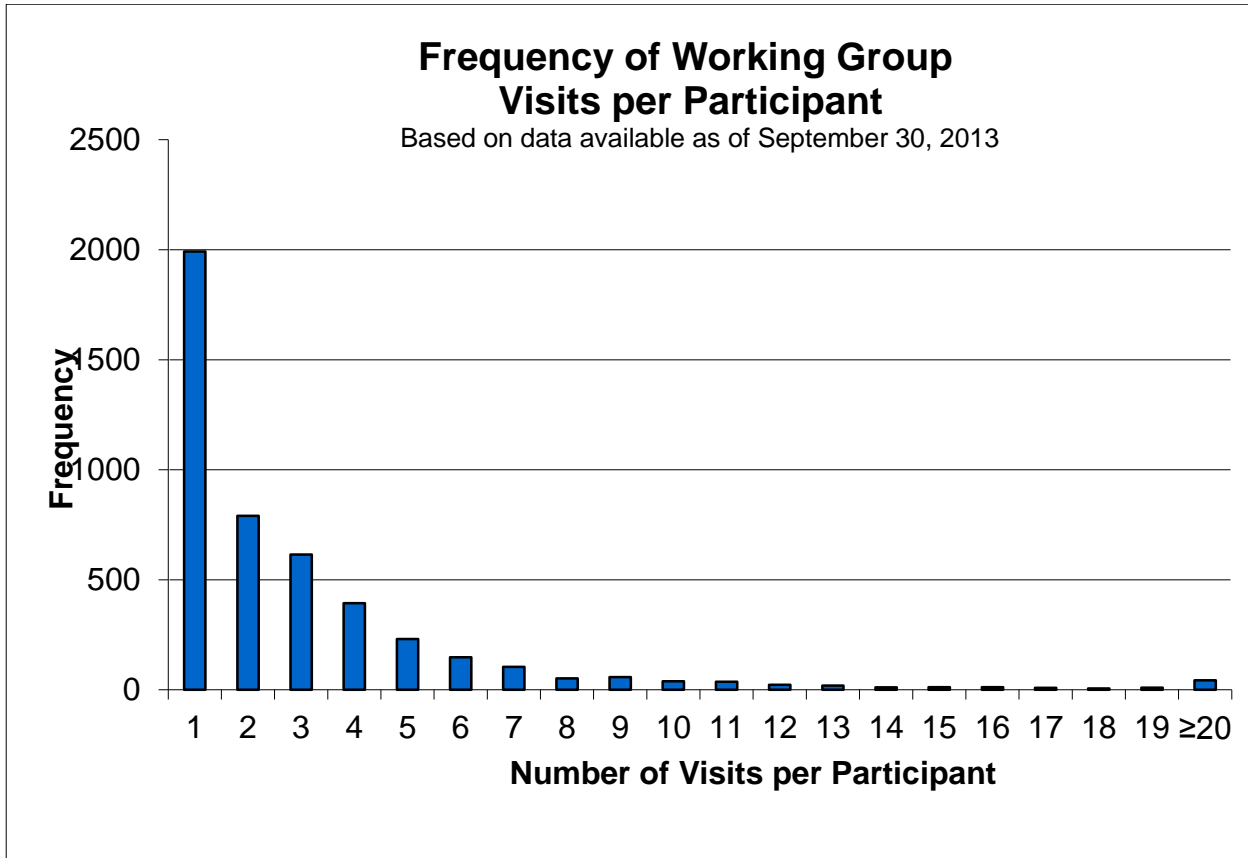


Figure 5. Percent Women Participating in Working Groups since establishment of NCEAS in 1995. For comparison, among ESA members who answered diversity survey questions for a 2006 report, the average female representation on faculty was 36% (30% women among senior professors, 44% women among junior professors).

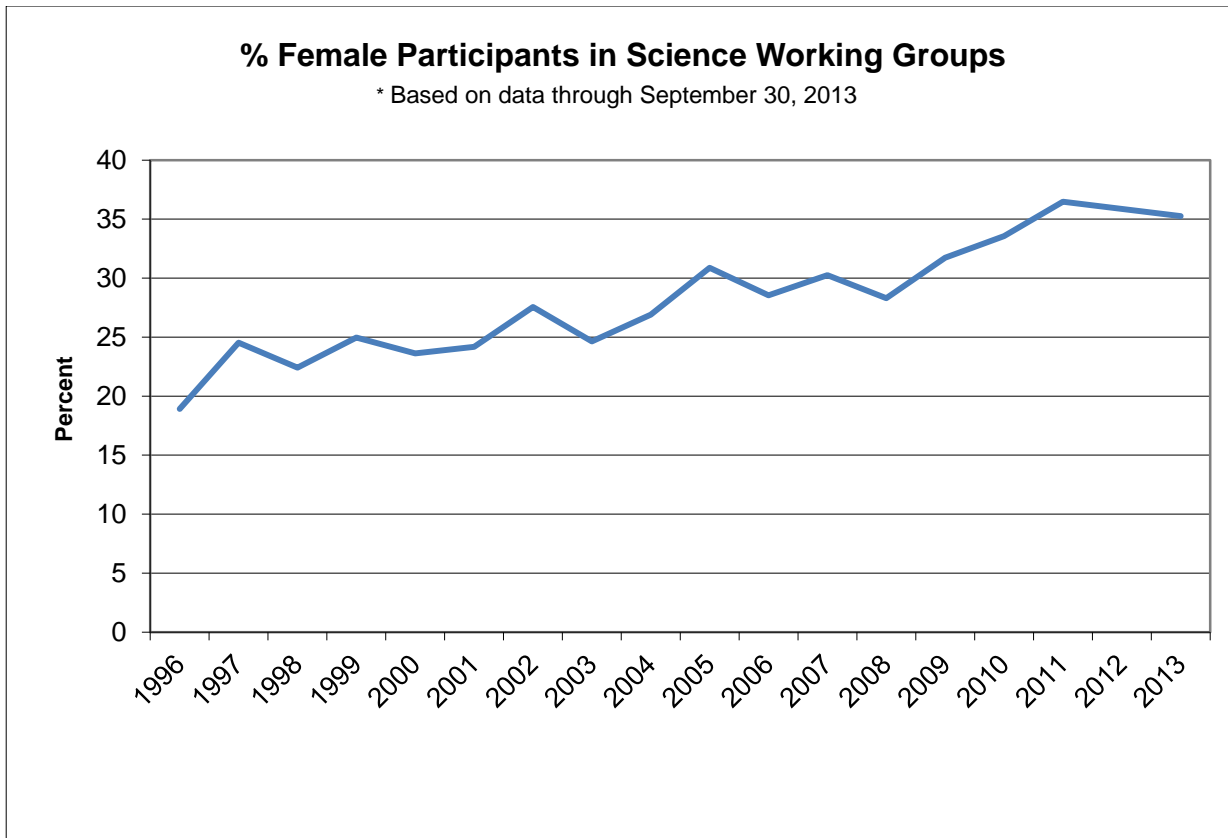


Figure 6. Percent Women on the NCEAS Science Advisory Board

for each year since NCEAS establishment. For comparison, among ESA members who answered diversity survey questions for a 2006 report, the average female representation on faculty was 36% (30% women among senior professors, 44% women among junior professors).

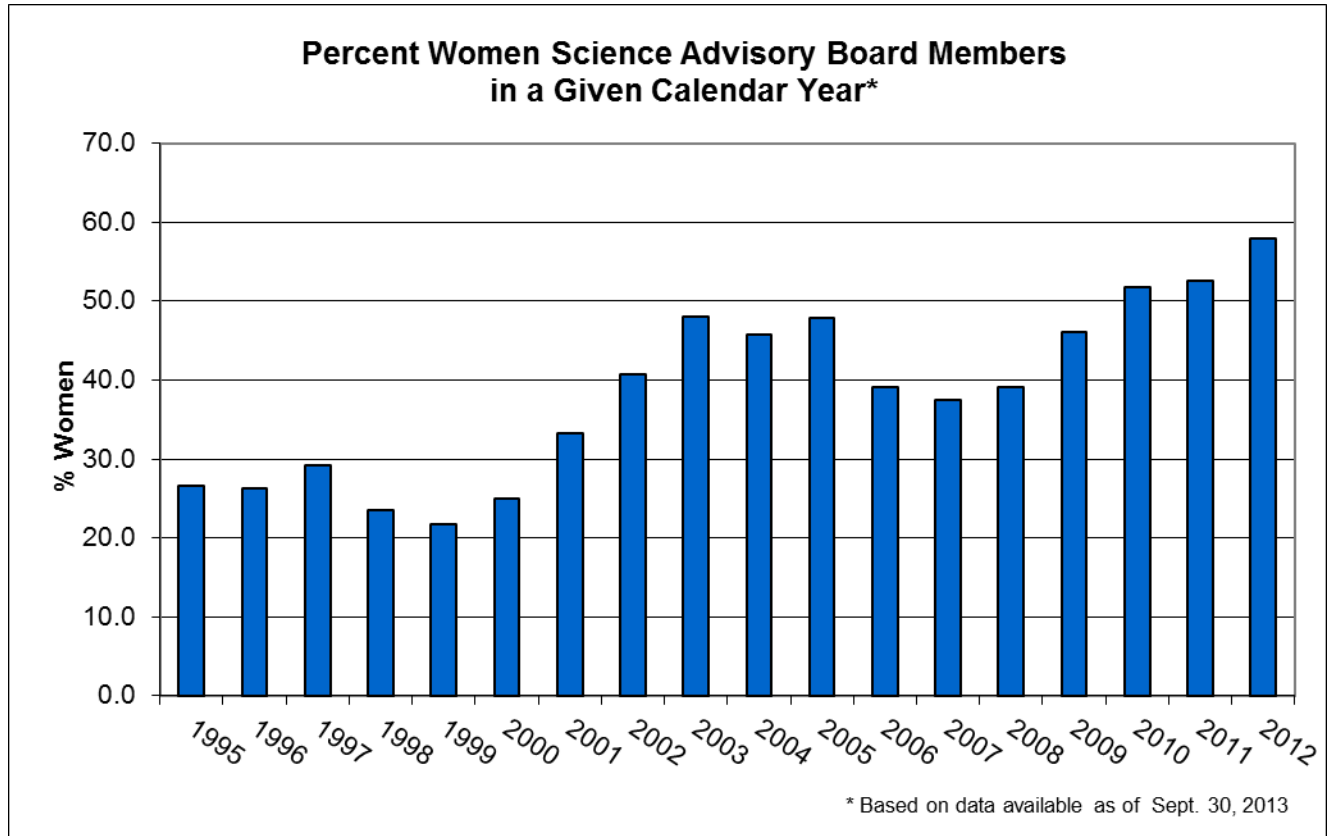


Figure 7. Number of Publications reported from NCEAS activities since establishment in 1995, by publication date.

