



National Center for Ecological Analysis and Synthesis

2011

Report to the National Science Foundation

NCEAS Annual Report 2010-2011

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NCEAS Annual Report 2010-2011

1. Participants

Ed McCauley, Director (*January 1, 2010 – June 30, 2011*) PI

Frank Davis, Director (*beginning July 1, 2011*) 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 has supported a diversity of NCEAS projects. A Moore-funded project has supported two postdoctoral researchers and multiple Working Groups convened to examine the effects of climate change on wild Pacific salmon. The Moore Foundation funded a distributed graduate seminar in complement to a NSF-funded working group that was assembled to reconcile the viewpoints of Fisheries science and Ecology in issues of fisheries management. Finally, the Moore Foundation is supporting a project at NCEAS in which we purchased a proprietary software package (AD Model Builder) common in Fisheries management, moved it into the public domain and have provided free training sessions to extend its usefulness to other fields.

The David and Lucille Packard Foundation continue to fund working groups and postdoctoral fellows focused on a critical review of ecosystem-based management (EBM) efforts relevant to coastal-marine ecosystems and to design a longer-term program of activities to develop the scientific foundations for EBM in coastal marine systems. Packard EBM awards include a project which emphasizes making scientific results more available and useful for policymakers.

The Nature Conservancy supports Working Groups assembled to examine the economic impacts of non-native forest pests and pathogens in North America; previous phases of the project included support for postdoctoral researchers, distributed graduate seminar, and a graduate student.

The Paul G. Allen Family Foundation has supported a project that focuses on the design of sustainable fisheries that meet socioeconomic needs and conservation goals for society. This project also involves Environmental Defense, a non-governmental organization that is active in marine conservation.

The U.S. Fish and Wildlife Service has funded a project designed to synthesize information related to the decline of endangered fishes in the San Francisco Bay Estuary.

An ongoing NOAA Fisheries project has supported two working groups to address the need for generalizable approaches to detecting species-level responses to large-scale environment management

actions. NOAA is also a co-supporter of a CAMEO (NSF-NOAA) collaboration to examine natural and human influences on coral reef community structure, diversity, and resilience, a project involving technicians who collaborate with a postdoctoral researcher.

The Henry Luce Foundation founded graduate fellowships at UCSB as part of a program called Environmental Science to Solutions, in which graduate students received training in leadership, communication and ecoinformatics. NCEAS provided ecoinformatics training, gave students experience in existing Working Group collaborations, and continues to host Working Groups that the students themselves have convened. Student projects include "The effects of global change on malaria transmission: a meta-analysis", "Can eco-labeling drive conservation & sustainable harvesting of marine fisheries" and "The science, media reporting, and politics of CA air quality: Content, context, and voting patterns of Prop 23."

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, graduate student and high school researchers have been supported on this award.

One postdoctoral researcher is supported by the Schmidt Foundation to study shark interactions on coral reefs.

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). These partners work together on multiple NSF awards.

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

2. Activities and Findings

NCEAS Director Transition

Dr. Edward McCauley, formerly Professor and Canada Research Chair in Population Ecology in the Department of Biological Sciences at the University of Calgary, served as NCEAS Director from January, 1 2010 through June 30, 2011. Frank Davis, Professor of landscape ecology and conservation planning at the University of California, Santa Barbara and formerly Deputy Director of NCEAS (1995 – 1999), accepted the position of NCEAS Director beginning July 1, 2011.

Computing & Informatics Support

Responding to feedback from reviewers and the ecological community, NCEAS has increased our capabilities for providing 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. NCEAS currently has 54 working group and 10 distributed graduate seminar Plone collaboration websites (open source, free content management software), along with additional Plone sites serving 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, e.g. a training session the Brazilian LTER (formally PELD at INPA) supported a week-long training session in data management using approaches developed and maintained in the Knowledge Network for Biocomplexity, culminating in a new KNB node at the site. Other NSF awards to our Ecoinformatics team support training and outreach in informatics to the broader ecological community.

Center Ambience

In an effort to create a more inclusive experience, NCEAS provides a “family friendly” environment. Some family friendly accommodations include a private room for nursing mothers and a policy to allow new parents to work from home for 2 months after parental leave benefits have been exhausted, designed to allow a parental transition period back into the work place.

Science Advisory Board

Proposals submitted and supported by proposal period and by proposal type are shown in Figures 1 and 2.

There was only one call for proposals (July 2010) during this reporting period, requesting only working group proposals. We received 34 proposals.

The Science Advisory Board met September 1-2, 2010 to review these proposals; based on their recommendations, decisions were made to support 4 of those proposals.

One working group proposal was submitted “off-cycle,” in response to the Deepwater Horizon blow-out in 2010; the SAB reviewed this proposal rapidly via email communications, and we followed their recommendation to support it.

The SAB agreed that no spring 2011 meeting was necessary, given that proposal review is the primary reason to convene a face-to-face meeting. They have continued to respond quickly and efficiently to NCEAS requests for *ad hoc* advice and service.

Science Advisory Board members during 2010-2011 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>.

Major Research Activities *(Based on data available as of May 17, 2011)*

Since the beginning of this reporting period, October 1, 2010 NCEAS has supported eight sabbatical visitors and 19 total postdoctoral researchers. A list of sabbatical and postdoctoral researchers, including descriptions of their projects is provided below.

Since the last report submission, NCEAS postdoctoral scientists have accepted faculty or other career positions at New Mexico State University, University of British Columbia, University of Vermont, Arizona State University, Pennsylvania State University, Ohio State University, SUNY, and the University of Victoria.

Since the beginning of the reporting period, roughly 600 different scientists participated in activities at NCEAS. Of these participants, 80 were either residents of NCEAS or scientists at UCSB, and 20% were visiting from foreign institutions. A total of 36 Working Groups and two Distributed Graduate Seminars have been active or scheduled in the reporting period.

NCEAS also has hosted meetings for 5 different collaborative groups. Eight Center Associates and at least 14 Scientific Visitors have been hosted at NCEAS in this reporting period. An additional 2 hosted meetings and 2 Scientific Visitors were here during the last report period, but were not included in the 2009-2010 report due to the July 2010 submission date. Activities are listed below.

A new analysis of the factors associated with productivity of NCEAS working groups, and the collaborative tendencies of working group participants and NCEAS postdocs, will be published in *BioScience* in November 2011 (Hampton and Parker in press).

Sabbatical Fellows

Occurred or were scheduled between October 1, 2010 and September 30, 2011

Based on data available as of May 17, 2011

Gates, Ruth

1-Apr-10 – 31-Dec-10

Synthesizing molecular and ecological datasets to evaluate how diversity in coral endosymbiont communities (symbiodinium) maps onto environmental sensitivity in corals

Climate change related increases in seawater temperature pose a serious threat to the world's coral reefs. A key conservation issue, and research priority is understanding how corals and coral reef ecosystems will respond to these environmental shifts. Changes in the composition of coral endosymbiont (*Symbiodinium* spp.) communities have been proposed as a mechanism by which corals might adapt to elevated seawater conditions, in a time frame concordant with the rates of environmental change. As a sabbatical fellow at NCEAS, I propose to develop the capacity to examine the biological support for this proposed adaptive trait by synthesizing ecological data on coral responses

to thermal stress with molecular diversity data for coral endosymbiont communities. A major product of this effort will be a spatially contextualized Global Symbiodinium Database and Mapping Website that will provide an interface for any Internet user to perform text based or spatial queries of the database. I will use this powerful tool to examine how thermal history has influenced the present day global composition of coral endosymbiont associations and to evaluate whether corals that are ranked by ecological environmental sensitivity exhibit differences in the nature and composition of their endosymbiont communities that are predictable within rank. The results of these analyses will be the subject of a review article styled for Biological Reviews or Coral Reefs and this work will contribute to the science necessary to complete the activities in a companion NCEAS working group proposal that will be submitted in January 2010 in collaboration with Peter Edmunds and titled “Coral reefs of tomorrow: when the winners take over, what will it be like?”

Gross, Katherine

1-Nov-10 – 31-Mar-11

Predicting grassland community responses to fertilization: Exploring the role of clonality and other species traits

Nutrient enrichment is predicted to be one of the top three drivers of biodiversity loss this century (Sala et al. 2000). It is therefore critical to understand how biodiversity will respond to elevated nutrient levels in different ecosystems, including what species or functional groups will come to dominate in high fertility environments and why. In grasslands, high fertility sites are often dominated by clonal species. The observation that declining or hump-shaped diversity-productivity relationships occur more frequently when clonal species are present suggests that clonal species may play an important role in community responses to nutrient enhancement. However, the mechanisms underlying this effect, or if there are specific traits of clonal species that determine their ability to dominate high fertility environments is unknown. As a Sabbatical Fellow at NCEAS, I propose to address this question by analyzing data from fertilization experiments combined with data bases of species traits to determine if there are correlated traits that determine when clonal species will dominate in response to nutrient enhancement and if there is an environmental context (site history, productivity, soil fertility, species and functional group composition) to this response. I have proposed three projects, two which I expect to complete while a Fellow; the third, I will initiate at NCEAS. The first two projects will build on my ongoing long-term research in SW Michigan grasslands and involvement in the Productivity-Diversity Traits Network (PDTNet). Using my own data, the PDTNetwork, and other published data, I will conduct a multi-variate analysis of species and environmental traits to determine what conditions promote (or preclude) dominance by clonal species in response to nutrient enrichment. The third project will be a literature survey to develop a global data base of published field experiments on grassland community responses to fertilization. This will form the basis of a trait-based meta-analysis and global synthesis of clonal species responses to and impacts on diversity in grasslands. I would expect this project to become the focus of a NSF-RCN or future working group proposal to the National Center for Environmental Synthesis.

Marsh, David

28-Aug-10 – 31-Aug-11

Special advisor for synthesis education

I'm working on several initiatives aimed at bringing ecological analysis and synthesis to the undergraduate level. I'll be working with NEON and DataOne to systematically assess the needs of undergraduate ecology instructors with respect to quantitative ecology andecoinformatics. We want to learn more about the barriers to including these topics in undergraduate ecology courses and what NCEAS and partner organizations can do to help. We'll also be piloting an adaptation of the Distributed Graduate Seminar model at the undergraduate level. The goal is to take a defined question, break it up into manageable pieces for undergraduate labs or seminars, and then reassemble the complete product. We're interested in finding out whether useful science can be produced this way, and we'll be assessing how undergraduate students benefit from their involvement in the project. Additionally, we'll test out a "teach the teachers" program, in which we work to advance ecological analysis and synthesis by working directly with instructors at undergraduate institutions who may have had limited exposure these approaches.

Mittelbach, Gary

1-Nov-10 – 31-Mar-11

Community ecology in transition

I propose to spend five months of my upcoming sabbatical leave at NCEAS working on two projects. My primary goal during this sabbatical is to complete a graduate-level text in Community Ecology (currently, about 60% written). I believe NCEAS is an ideal setting for this work. The stimulating intellectual environment of NCEAS, with its excellent cadre of resident postdoctoral fellows, sabbatical fellows, and visiting scientists, will provide unparalleled exposure to the latest ideas in ecology, as well as the opportunity to get broad feedback on the contents and organization of the book. Not only will this benefit me by improving the quality of the final text and making it more useful to the ecological community, but this project will also benefit the NCEAS community. I will use Ecolunch and other informal opportunities to share my ideas for how the subject of community ecology may be organized and taught (I have taught a graduate-level class in community ecology at Michigan State University for >20 years). I am anxious to share this knowledge with others and to gather their input as well. In particular, I believe the NCEAS postdoctoral fellows, many of whom will end up with faculty positions teaching ecology, will profit from this interaction. Thus, I envision a productive synergy between this sabbatical project and the intellectual community at NCEAS. In addition, while at NCEAS, I will be working with Howard Cornell, Kaustuv Roy, and Doug Schemske on research examining the role of biotic interactions in driving latitudinal variation in rates of diversification.

Moritz, Max

1-Aug-10 – 31-Jul-11

Fire as a Global Ecological Disturbance

Fire affects a variety of biophysical patterns and processes, but we generally lack an understanding of fire's ecological influence at broad scales. Two key issues highlight this knowledge gap: 1) Fire is certain to alter species distributions as global climate change progresses, yet most models of how species ranges may shift overlook this important ecological disturbance; and 2) Analyses of existing biodiversity patterns, especially from continental to global scales, typically ignore the possible influence of fire. To address these issues, my sabbatical research will aim to synthesize current results on global patterns of fire, climate, and species distributions. This work should improve our

understanding of fire's direct and indirect influences on biodiversity, where different species will be able to persist as climate changes, and how to better incorporate fire into long-term conservation planning.

Sabo, John

1-Jun-09- 31-May-10

Dams, River Networks and the Distribution of Native and Non-Native Freshwater Fauna in the United States

Dams are ubiquitous in riverscapes and implicated in 'biotic homogenization' of river ecosystems. Biotic homogenization (BH) is defined as a reduction in biogeographic variation in species composition and caused by extinction of native fauna and invasion of non-indigenous species. The goal of my proposed Sabbatical Fellow research is to define a quantitative approach to conservation biogeography of rivers rooted in drainage network theory. I will use seven georeferenced databases to quantify the effects of river network structure, the quantity and size of dams and nature of dam placement within the context of river networks on flow-related changes in river biota across the US. In contrast to previous work on this topic I will tackle this question using a structural equation modeling approach that accounts for spatially autocorrelated errors in these datasets while simultaneously modeling complex cause-effect relationships. This will allow me to quantify the cumulative (serial) effects of multiple dams in drainage networks and the interactive effects of dam and network properties on BH. This work should provide general rules of thumb about where in watersheds dam removal and experimental release strategies would work best.

Schuur, Ted

16-Aug-09- 15-May-10

Permafrost and the Global Carbon Cycle: A Research and Education Synthesis Towards Understanding Terrestrial Feedbacks to Climate Change

At present, increasing greenhouse gases responsible for climate change are largely a result of human activities. However, climate change may alter the natural cycling of carbon (C) in ecosystems far from direct human influence. Because of the size and nature of the permafrost C pool, decomposition of previously frozen, old organic C is one of the most likely positive feedbacks from terrestrial ecosystems to climate change. Sustained transfers of C to the atmosphere that could cause a significant positive feedback from permafrost to climate change must come from 'old' C, which forms the bulk of the permafrost C pool. Radiocarbon measurements of ecosystem respiration losses provide the definitive proof of old C mobilization in natural ecosystems undergoing change. Two synthesis activities relating to this topic will be carried out as a sabbatical fellow at the National Center for Ecological Analysis and Synthesis. The first activity consists of compiling and analyzing soil incubation data from the published literature to understand the relative climate forcing effect of methane and carbon dioxide released from decomposing permafrost C. The second activity is the organization and writing of an isotope textbook focused on the use radiocarbon in ecology and earth system science. This activity will synthesize 5 years of materials developed for a short course taught at the Keck Carbon Cycle Accelerator Mass Spectrometer facility at UC Irvine. Together these research and education synthesis activities will advance understanding of terrestrial ecosystem feedbacks to climate change.

Tewksbury, Joshua

1-Sep-10 – 31-Jun-11

Natural history from decline to rebirth

Declines in natural history are reported in research, in education, and in childhood and adult experience. At the same time, the need for natural history information is in greater demand than ever before. Declines in natural history may have far reaching consequences, potentially reducing progress across the natural sciences, changing how we view and understand the world, and limiting the tools we have to plan for the future, and yet there is a paucity of data-driven evaluations exploring changes in natural history in research, education, and in society. This raises an important question: is Natural History truly declining or simply changing? Have we lost natural history from undergraduate education, or has it moved from taxon to topic-focused courses? In this sabbatical, I propose to synthesize contemporary trends in natural history and explore their consequences. During my sabbatical, I will manage 4 workshops (funded externally) that will assist in re-imagining the role of natural history in society, research, and education, and I will draw together a large array of data on the practice of natural history – from graduate and undergraduate “field time” in US institutions to field guide book sales and trends in nature center enrolment and curricula. All of this data will become part of the NCEAS database. In addition, I will integrate this work with ongoing ecoinformatics initiatives ongoing at NCEAS (DataONE). This effort, and this proposal, is the product of a session I organized at the Ecological Society of America annual meeting this year, focused on the past and future of natural history. This was the most heavily attended session of the meeting, with over 400 ecologists present, and multiple opportunities to synthesize this information (two book requests, two journal requests, and a workshop proposal to NSF) came directly from that session at ESA. The workshop proposal has now been funded, and I plan to integrate that work with ongoing initiatives at NCEAS.

Postdoctoral Fellows*Occurred or were scheduled between October 1, 2010 and September 30, 2011**Based on data available as of May 17, 2011***Adair, Carol**

6-Apr-09 - 5-Apr-11

Do microbes matter? Using global data to test implicit versus explicit representation of microbial activity in litter decomposition models

Despite the major contribution of decomposition to global carbon and nitrogen cycles, it remains poorly understood. This uncertainty is reflected in the diversity of approaches used to depict decomposition in ecosystem models and in debate regarding if, or how, microbes should be explicitly represented. I propose to compile a large-scale, long-term database of litter decomposition data, which I will use to compare two sets of decomposition models: the first varies only in how microbial activity is modeled; the second compares the best model(s) from the first set to a range of published models. Conducting a sophisticated model comparison using spatially and temporally extensive data will allow me to evaluate the relevance of explicitly incorporating microbial activity into large-scale

decomposition models and compare the ability of published models to accurately describe global decomposition.

Balch, Jennifer

1-Jan-09 - 31-Dec-10

Relative influence of fuels, climate, and ignition on fire frequency across earth's ecosystems

Fire is a critical catalyst of climate and vegetation change across the globe. Future shifts in fire regimes—associated with anthropogenic change—may alter ecosystems and biogeochemical cycles on a global scale. Yet, modeling efforts largely ignore fire in global vegetation and climate projections. Therefore, I propose to synthesize published data on fuel production, climate, and ignition sources with reconstructed fire histories in order to investigate the determinants of fire frequency across scales and ecosystems. Rather than gauge how fire influences the biosphere, I plan to assess the factors that control the global fire cycle. This fire-centric approach will illuminate the biotic and abiotic factors that increase fire frequency. Moreover, the results will provide mechanistic insights into historical fire patterns and bolster predictions of future fire regimes in an era of accelerating global land-cover and climate change.

Baum, Julia

1-Jan-10 – 31-Dec-10

Predicting baseline, current, and future distributions and abundances of apex predators on coral reefs (Supported by Schmidt Research Vessel Foundation)

Predators can exert important controls on ecosystem structure and function, but are being rapidly depleted from the world's oceans. Remote Pacific islands harbor many of the world's remaining coral reef apex predator populations, yet little is known about these species and they are increasingly threatened by fishing pressure. My research aims to advance understanding of the ecological, physical, and anthropogenic factors that determine the abundance of these species on reefs across the Pacific, by integrating existing regional-scale spatially-explicit data into predictive species distribution models (SDMs). Robust, cross-validated models will then be used to predict geographically comprehensive predator distributions and abundances across the Pacific, to hindcast quantitative baselines for these species, and to forecast potential changes in their populations over the coming decades based on alternative management scenarios. Employing SDMs at the regional-scale in the ocean represents a novel application of these models. This research is timely, given the recent designation of many of remote Pacific reefs as U.S. national monuments. Research findings will be communicated to NOAA scientists and conservation practitioners with the aim of informing policy decisions for shark conservation.

Byrnes, Jarrett

1-Nov-10 – 31-Oct-11

Linking network theory and biodiversity-ecosystem function research: topology modifies the consequences of species loss for the flow of energy and nutrients within food webs

Over the past decade, the field of biodiversity-ecosystem function research has sought to understand the consequences of declines in species diversity due to human activities. The field has yielded many robust conclusions regarding the consequences of plant species loss for primary production and nutrient cycling. It has not, however, arrived at many generalities regarding the consequences of species loss at higher trophic levels for the flow of energy and nutrients through food webs, even in the most simplified of experimental systems. Nor do we have a strong idea of the consequences of extinction in food webs of real-world complexity. This lack of understanding is due to extinction altering not just the number of species in a food web, but also degrading the network structure of feeding connections between species. I propose uniting biodiversity-ecosystem function research with food web network theory to better understand the consequences of species loss for the efficiency of trophic transfer within food webs. I propose developing a unified theoretical framework that examines the consequences of species loss in the context of food web network structure. I will then examine how real-world complexity alters the dynamics of trophic transfer by applying this framework to multiple long-term community data sets. Lastly, I will perform a meta-analysis of published food web manipulations to examine how the topology of even simplified experiments can influence the dynamics of resource use. The results of this research will therefore fill a critical gap for managers in predicting the consequences of consumer species extinction in nature.

Carbone, Mariah

1-Mar-11 – 30-Sep-11

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.

Comita, Liza

16-Feb-10 – 30-Sep-11

Determinants of relative species abundance: A cross-continental comparison of tropical tree communities

Determining the causes of commonness and rarity in ecological communities is essential for understanding how communities are structured and has important implications for biodiversity conservation. Identifying the determinants of species abundance has been particularly challenging in tropical forests, which are characterized by both high species richness and high rarity. The objectives of the proposed study are to examine the determinants of, and limits to, species abundances in tropical tree communities, and to investigate whether the processes shaping species relative abundance patterns differ among forests. Specifically, I will address the following questions: (1) Do resource requirements and habitat preferences shape species' relative abundances in tropical tree communities? (2) Is there a phylogenetic signal in species relative abundance patterns? and (3) Does local-scale negative density dependence limit the abundance of tropical tree species? For the proposed project, I will take advantage of existing, standardized datasets from a global network of large forest dynamics plots coordinated by the Center for Tropical Forest Science (CTFS). CTFS possesses the world's largest database on tropical tree dynamics, with information on over 3.5 million individuals of ~7500 species, estimated to represent 10% of all tropical tree species on earth. Using these data, I will test hypotheses concerning patterns of commonness and rarity both within and among tropical tree communities. Specifically, spatially-explicit analyses of survival and growth will be used to identify drivers of species abundance patterns within diverse plant communities. Comparisons among sites will allow for an assessment of the consistency of these drivers among tropical forests that vary in biogeographic history, species composition, climate, and disturbance regime. The proposed study will be among the most comprehensive cross-site analyses of species abundance and will provide fundamental information about how diverse ecological communities are structured. An understanding of the similarities and differences among tropical forests sites will aid efforts to conserve and restore the incredible diversity of the tropics. In addition, the project will yield multiple high-profile publications, and will result in publically available derived data products and a statistical package in R, which will facilitate future research efforts by scientists around the globe.

Johnson, Darren

1-Oct-09 – 30-Sep-11

Converting evolutionary costs into ecological currency: linking trait variation, natural selection, and population dynamics

Numerous studies in the ecological and evolutionary literature have estimated the magnitude of natural selection. Although natural selection is widespread and often strong, much less is known about the immediate effects of selection on population dynamics. I propose a method that can be used to quantify the direct effects of trait variation and natural selection on population dynamics. This method will be applied to meta-analyses examining the overall influence of selection on demographic components of fitness in a broad variety of organisms. Information from meta-analyses will be combined with models of population dynamics to evaluate how trait variation and selection can affect key population attributes such as size, growth rate, and probability of extinction. This work will be further applied to develop conceptual models of how different modes of selection (i.e., directional, stabilizing and disruptive) influence concurrent population dynamics. This project has clear ramifications for incorporating evolutionary considerations in the management and conservation of living natural resources.

Lancaster, Lesley

1-Mar-09- 28-Feb-11

What Community Characteristics Promote Recent and Current Bio-Diversification? An Investigation of Community-Level, Ecological Correlates of Rapid Diversification in Replicate, Temperate Angiosperm Genera

Processes behind patterns of angiosperm biodiversity in temperate regions are little understood. Further, we do not know whether particular communities that currently support relatively high temperate biodiversity are the same communities that promote the evolutionary process of diversification (i.e. speciation). I propose to compare diversification rates within selected angiosperm genera that inhabit a range of temperate communities using published phylogenies and sequence data, focusing on clades in which nodes can be or have been dated. I will then map habitat and community characteristics that have been hypothesized to be general factors promoting rapid diversification. I will apply method-of-moments estimators of diversification rates (using a stochastic birth-and-death model of diversification) both within and between selected genera to look for correlations between recent rapid divergence within clades and characteristics of habitat or community type occupied by those clades. Previous studies of diversification processes have targeted particularly diverse clades or communities and then attempted to draw conclusions about which factors led to their respective high species numbers. However, my proposed method will allow for more rigorous hypothesis testing and generalization of conditions promoting diversification by starting with a phylogenetically diverse array of genera and ecological conditions within which to compare habitat characteristics and diversification rates. Furthermore, recent advances in estimating diversification rates will allow me to disentangle the relative effects of speciation vs. extinction on diversification rates. These methods have seldom been applied to diversification rates within less inclusive crown clades, which may be the most relevant for understanding the processes of speciation and conservation of habitat features or communities that are most likely to be sites of current speciation and/or extinction.

Lango, Katie

6-Jun-10 – 5-Jul-11

Ocean Health Index (Supported by Conservation International)

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.

O'Connor, Mary

7-Jan-09- 6-Jan-11

Linking Physiological Rates and Community Ecology: Effects of Temperature on Food Web Dynamics and Population Connectivity

Fisheries productivity and population connectivity are two complex ecological processes that are relevant to effective management of ocean resources but are very difficult to

study directly. Developing a quantitative understanding of how these processes vary with environmental conditions will provide insight into the mechanisms governing each process, as well as how the processes change geographically or with climate change. I will use a general theory of metabolic responses to temperature to determine the role of temperature in driving variation in food web productivity and larval dispersal and survival in marine systems. This research will produce marine food web and larval dispersal databases, along with models, simulations and maps of how these processes are affected by ocean temperature under specific climate change scenarios.

O'Leary, Jennifer

15-Jun-10 – 14-Jun-11

Ocean Health Index (Supported by Conservation International)

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.

Parker, John

11-Aug-08- 10-Aug-10

Disciplinary synthesis and collaboration in ecology: Organizations, research groups, and work lives

This is a proposal to extend and develop an ongoing investigation of current attempts to synthesize research in ecology and the social sciences. Ecology is undergoing a rapid transformation, a major component of which is the increasingly interdisciplinary scope of ecological research. Among the most salient attempts to bridge disciplines are occurring between ecology and the social sciences. Driven by the complexity of social-ecological interactions and pressing environmental concerns, attempts to merge these disciplines have become institutionalized in research centers, funding initiatives, scholarly journals and conferences. Because change has been rapid, little is known about the character of these efforts and their impact on science. These issues will be explored through a comparative, multi-method investigation of the practice and outcomes of synthetic social-ecological research. Expected outcomes include: 1) enhancing understanding of the most effective means by which to catalyze disciplinary synthesis, 2) advancing knowledge about the social and technical processes characteristic of synthetic collaborations, 3) increasing insight regarding the effect of synthetic participation on researchers' careers, and 4) providing information on disciplinary synthesis as an agent of scientific change.

Pau, Stephanie

11-Jan-10 – 30-Sep-11

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.

Queensborough, Simon

20-Jan-10 – 19-Jan-11

Addressing a long-standing paradox: How do dioecious plant species persist?

Breeding system impacts on the ecology and evolution of coexisting plant species. Perhaps the best example of such impacts is exemplified by dioecious plant species (those with separate male and female individuals), populations of which suffer a fitness cost because of the lower number of seed-bearing stems relative to ecologically similar hermaphroditic species. To maintain per capita growth rates that are equal to their hermaphroditic counterparts, female individuals in dioecious populations must exhibit one or more fitness advantages, which might include: higher fecundity, higher rates of offspring recruitment, earlier ages of reproduction, more frequent reproduction, or higher quality offspring. The fitness advantages predicted to have evolved in dioecious species have remained elusive because of inadequate data and a failure to fully integrate phylogeny and dynamic demographic and distribution data with other species functional traits. This study will use a newly developed functional-trait database of plant reproductive traits and recently-available rigorously collected spatially-explicit plant demographic data on >6,000 species and >3,000,000 individuals to examine the associations among breeding systems, demography and functional traits in a phylogenetically informed way in order to seek evidence for fitness advantages in dioecious taxa.

Rodriguez, Josephine

11-Jan-10 – 10-Jan-11

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 Microgastriinae (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 microgastrine ecology and evolution. Specifically, I will integrate the genetic data (COI DNA barcodes) with inventory records to assess the number of species of microgastrine 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).

Ryan, Sadie

1-Mar-09- 28-Feb-11

Quantifying long-term landscape vegetation dynamics in and around Kibale National Park, Uganda, to establish appropriate landscapes for zoonotic disease models

Models of zoonotic diseases, particularly those at the spillover interface, require a certain degree of spatial information that theoretical, spatially implicit models cannot always encompass. This is often the situation for parasitic or locally contaminant infectious diseases, or location-specific reservoirs that re-infect populations. For these types of diseases, particularly those that may be the subject of vaccination programs, agent-based models incorporating explicit landscapes may provide a more appropriate framework for analyzing disease spread. However, introducing the complexity of geographically explicit landscape interactions, particularly with temporal dynamics, is irrelevant if the mechanisms and agency of disease spread within that landscape is not reducible to patterns at a scale meaningful to the model's mechanistic drivers. In this project I propose to examine a specific landscape, Kibale National Park, Uganda, in which primate parasitic disease, anthropogenic fragmentation and climate change are posited to be interacting. I am currently working on agent-based models of zoonotic diseases, particularly addressing the human-primate interface, and would like to complement this work with quantified, data-driven dynamic landscapes. This will lay the groundwork for similar approaches in other sites and scenarios, such as Ebola vaccination in gorillas (with P. Walsh, NCEAS working group) and control of SIV or respiratory disease transmission in Gombe chimpanzees (with M. Wilson and A. Pusey, Jane Goodall Institute, MN).

Scheef, Lindsay

4-Jan-10 – 3-Jan-11

CAMEO: Building the foundation: New statistical tools for analyzing community dynamics with applications to marine zooplankton (Supported by NOAA/NSF CAMEO)

We will develop an extended multivariate autoregressive (MAR) modeling framework to analyze community dynamics from time-series data, and then demonstrate the framework through investigations of long-term marine plankton data sets. MAR modeling has been used extensively for freshwater plankton communities to infer the inter-species interactions, the dominant environmental drivers, and the system stability and resilience. MAR modeling is well-grounded on theory concerning population and community dynamics and comparative properties of communities, such as resistance to disturbance, resilience, and return time after disturbance. The proposed research will

address four technical barriers that hinder widespread application of the MAR framework to marine data sets – observation error, lower temporal autocorrelation due to open systems and infrequent sampling, multiple spatially-distributed sampling locations, and uncertainty introduced by unmeasured species or environmental drivers. The extended MAR framework will be used to do a comparative study of marine plankton community dynamics from different geographic regions using existing long-term data sets. The primary goals are 1) to identify the major drivers of plankton productivity and any directional changes in dynamics due to long-term changes in ocean conditions and 2) to compare the community dynamics – specifically interaction strengths and community stability – to four well-studied freshwater systems.

Strasser, Carly

1-Sep-10 – 31-Aug-11

DataONE: Observation Network for Earth (*Funded by the National Science Foundation - 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.

Williams, Jennifer

2-Dec-08- 1-Dec-10

Evaluating Life History Theory and the Consequences of Reproductive Strategy For Population Fluctuations

Organisms have evolved a variety of mechanisms to maximize individual fitness in the face of environmental stochasticity that may also serve to buffer population fluctuations. Life history strategies for reproduction, including whether to produce all offspring at once (semelparity) or to spread out the reproductive effort across several bouts (iteroparity), can lead to important consequences for population persistence. While much theory predicts which strategy should be optimal for individuals, few empirical tests exist. The proposed research will use stochastic population models compiled from published and unpublished data of species that exhibit facultative semelparity to address two unresolved issues in evolutionary biology and population ecology: when can iteroparity buffer population fluctuations and do life history predictions match the observed strategy with realized levels of stochasticity? This project will help to refine current life history theory on semelparity and iteroparity, and will clarify the connection between selection pressures on individuals and the consequences for population persistence. Understanding a mechanism that can buffer population fluctuations will also contribute to predictions of which species may be more vulnerable to increased climate variability. Support from NCEAS will be crucial for gathering the

volume of data necessary to conduct this research, and collaborations with resident and visiting ecologists will enhance not only this project but initiate new research.

Distributed Graduate Seminars

Occurred or were scheduled between October 1, 2010 and September 30, 2011

Based on data available as of May 17, 2011

A graduate seminar network to facilitate synthetic research on context-dependency in the mycorrhizal symbiosis

Leaders: Hoeksema, Jason; Bever, James

Although mycorrhizal symbioses, in which plants exchange carbohydrates for nutrients with root associated fungal symbionts, are classically considered a mutualism, they can display a high degree of variability in ecological outcomes ranging from mutualism to parasitism. Given the ubiquity and importance of this interaction, understanding the controls on its variability is paramount for basic and applied ecology. One centerpiece activity of a previous NCEAS working group (“Bridging the gap between theory and practice in mycorrhizal management,” 2005-2007) was to initiate an effort to understand this ecological variability through an empirical synthesis of mycorrhizal inoculation experiments. As part of that effort, we created a database of nearly 2000 such experiments, and developed innovative new methods for multi-factor meta-analysis to assess the relative importance of numerous biotic and abiotic factors hypothesized to explain variation among experiments in plant responses to mycorrhizal inoculation. Although important insights were gained from that analysis, it revealed limitations of the approach (detailed below) which prevented the full exploitation of that effort. Through the NCEAS distributed graduate network project proposed here, we plan to address these limitations to answer fundamental questions about context-dependency in the mycorrhizal symbiosis (detailed below). In this process, graduate students will be trained in mycorrhizal ecology, data management/ecoinformatics, and statistical meta-analysis, and will have the opportunity to take the lead in meaningful synthetic ecological science. NCEAS will provide necessary logistical support, staff support, and funding for planning and face-to-face collaboration, without which this project would not be possible.

Engaging undergraduate students in ecological investigations using large, public datasets

Leaders: Mourad, Teresa; Gram, Wendy; Grant, Bruce

The Ecological Society of America (ESA), in close partnership with NEON Inc., will facilitate a distributed seminar to focus on examining effective student activities and assessment strategies for using large public datasets in the classroom. The rapidly increasing availability and quantity of publicly accessible large scale datasets present an outstanding opportunity for minority-serving and small undergraduate institutions to introduce their students to a new digital age of ecology and environmental science. The teaching activities to be developed, implemented and assessed through this seminar aim to enable undergraduate students to both better understand ecological concepts and equip them with fundamentally critical quantitative ecoinformatics skills as the demand for a data-savvy workforce grows steadily in the 21st century. The seminar itself will be evaluated for its

potential as a model for future faculty development. The teaching activities will be made available in a variety of sources and the pedagogical implications of these educational activities will be synthesized for publication in *Frontiers*, ESA's well-respected multi-disciplinary journal.

An Undergraduate Network for Analyzing Plant Invasion in U.S. National Wildlife Refuges

Leader: David Marsh

The scientific goal for this undergraduate seminar project is to determine the factors associated with non-native plant invasion in U.S. National Wildlife Refuges. Factors we can examine include refuge area, habitat heterogeneity, native plant richness, and the regional prevalence of non-native plants. We also ask whether these factors are consistent across Fish and Wildlife Service regions and between mainland and island refuges.

Working Groups

Occurred or were scheduled between October 1, 2010 and September 30, 2011

Based on data available as of May 17, 2011

Title: Monarch butterflies as a model for understanding the spatiotemporal dynamics of migratory species and their response to environmental change

Leader(s): Altizer, Sonia; Oberhauser, Karen; Ries, Leslie

Participants: Sonia Altizer, Becky Bartel, Rebecca Batalden, James Battin, Lincoln Brower, Andrew Davis, Erica Fleishman, Dennis Frey, Elizabeth Howard, Nathan Nibbelink, Karen Oberhauser, A. Townsend Peterson, Eduardo Rendon, Leslie Ries, Monte Sanford, Orley Taylor, Elise Zipkin

Abstract:

Each year, North American monarch butterflies undergo a spectacular two-way migration from breeding locations in Canada and the US to overwintering sites in Mexico. Throughout their annual cycle, monarchs utilize habitats in three different countries and require strikingly different resources and habitats at each life stage. Like other migratory animals, this shifting spatial distribution poses challenges for identifying key determinants of monarch population dynamics and assessing their conservation status. Monarchs are an incredibly popular insect that has been exceptionally well studied; multiple long-term monitoring programs exist within North America that span timescales of 3 to over 30 years. This virtually unprecedented wealth of data on a single animal species represents a rare scientific resource for understanding how natural and anthropogenic factors affect the population dynamics and movement patterns of migratory species. At the same time, a great need exists to integrate existing data sets for analysis and interpretation of both within-season and longer term population trends. Our proposed working group includes a team of experts in monarch ecology, migration biology, statistical model building, climate modeling and geography to answer the most fundamental questions of monarch biology throughout their range in North America. We will explore data from throughout the monarchs' annual life cycle to identify major ecological mechanisms that shape large-scale patterns of abundance and movement, and to predict the consequences of human activities, including shifting agricultural practices, deforestation and climate change, for long-term dynamics. We will also work directly with NCEAS informatics staff to develop a web-based portal that allows public access to and use of monarch butterfly observational data, much of which has been

collected by volunteer observers. Although our efforts focus primarily on a single species, our questions, approaches and findings will have great relevance to understanding the dynamics of other pollinator species and neotropical migrants across North America.

Title: Ecotoxicology of the gulf oil spill: a holistic framework for assessing impacts

Leader(s): Anderson, Sean; Peterson, Charles; Cherr, Gary

Participants: Richard Ambrose, Sean Anderson, Shelly Anghera, Nancy Baron, Steve Bay, Michael Blum, Gary Cherr, Thomas Dean, Michael Guzy, Stephanie Hampton, Samantha Joye, John Lambrinos, Bruce Mate, Doug Meffert, Charles Peterson, Sean Powers, Christopher Reddy, Robert Spies, Caz Taylor, Ronald Tjeerdema, Joseph Torres, Kimberly Trust

Abstract:

The largest oil spill in U.S. history, infused with dispersants released into the waters of the northern Gulf of Mexico in response to this still-unfolding disaster, has created an unprecedented threat to the ecology of coastal and marine communities. To date, most efforts have been directed towards halting the spill or documenting its current state. With apparently limited ecotoxicological information, governmental and private entities are preparing to create and fund large-scale and long-term monitoring efforts across the Gulf. We propose to assemble ecologists, chemists, and ecotoxicologists with experience in coastal oil spills, in coastal and pelagic ecology, and who are collecting in situ data in the wake of the Gulf Coast spill. Our group will create a framework outlining potential ecotoxicological impacts upon Gulf populations and communities with a primary goal of providing this information to decision making and funding entities in an expedited manner.

Title: Comparative ecology of cities: What makes an urban biota "urban"

Leader(s): Aronson, Myla; Katti, Madhusudan; Warren, Paige; Nilon, Charles

Participants: Myla Aronson, Mary Cadenasso, Sarel Cilliers, Bruce Clarkson, Cinnamon Dobbs-Brown, Mark Goddard, Marcus Hedblom, Madhusudan Katti, Ingolf Kuhn, Frank La Sorte, Christopher Lepczyk, Jip Louwe Kooijmans, John Marzluff, Rachel McCaffrey, Mark McDonnell, Ian McGregor- Fors, Ulla Mortberg, Charles Nilon, Dave Oleyar, Stefan Siebert, Paige Warren, Peter Werner, Nicholas Williams

Abstract:

The rapid urbanization of the world has profound effects on global biodiversity and urbanization has been counted among the processes contributing to the homogenization of the world's biota. However, there are few generalities of the patterns and drivers of urban biota and even fewer global comparative studies. A comparative approach of urban biota is needed to produce comparable methodologies to understand, preserve, and monitor biodiversity in cities. We propose an NCEAS working group involving researchers from cities worldwide to develop synthesis of urban ecology. We ask the overarching question: "What makes an urban biota 'urban'?" and with that, "Are the patterns of urban biota and the processes that shape them the same across the world's cities?" We have identified several factors that may serve as filters determining species distributions. We propose a hierarchical series of filters: 1) regional scale biogeographic context, 2) metropolitan scale urban intensification, and 3) local scale socio-economic/cultural factors. We will use plants and birds as independent datasets for addressing these broad questions. There is a newly matured wealth of existing urban bird and plant datasets for cities of different sizes, ages, and cultural and development patterns such as Baltimore, Berlin, Jalisco, New York City, Phoenix, Potchefstroom, and Stockholm,

among others. We propose to bring datasets together, using commonly available data (e.g. land cover layers, national censuses, life history databases) to synthesize the urban biota. Outcomes from these proposed extensive comparative analyses will not only help to push forward the frontiers of transdisciplinarity in ecology, but will also provide useful information for planners and managers.

Title: Economic impacts of non-native forest pests and pathogens in North America (*Supported by The Nature Conservancy*)

Leader(s): Aukema, Juliann; Reichman, O.; Hampton, Stephanie

Participants: Juliann Aukema, Eckehard Brockerhoff, Joseph Cavey, Thomas Holmes, Kent Kovacs, Brian Leung, Andrew Liebhold, Frank Lowenstein, Michael Springborn, James Turner

Abstract:

The ecological effects of many non-native forest pests and pathogens in North America have been well documented. The economic costs of these effects, however, have not been estimated credibly. NCEAS will synthesize ecological data on forest invaders and conduct complementary economic analyses. This will allow us to inform decisions regarding alternative strategies for controlling forest invaders. The project will examine the extent to which current knowledge allows credible prediction of the effects of emerging pests and pathogens. We also will investigate the economic impacts of non-native forest insects and diseases on ecosystem services provided by forests. Integration of ecological and economic data will lead to development of least cost / greatest benefit approaches that can be implemented by practitioners.

Title: Ecology of environmental justice in metropolitan areas

Leader(s): Boone, Christopher; Cadenasso, Mary; Grove, J. Morgan; Pickett, Steward

Participants: Christopher Boone, Geoff Buckley, Mary Cadenasso, Daniel Childers, Michail Fragkias, Nancy Grimm, J. Morgan Grove, Melissa McHale, Jarlath O'Neil-Dunne, Laura Ogden, Diane Pataki, Steward Pickett, Stephanie Pincetl, Kirsten Schwarz, Ali Whitmer, Weiqi Zhou

Abstract:

This working group brings together experts in ecology and environmental justice to examine the socio-ecological dynamics of environmental justice in five metropolitan areas – Baltimore, Los Angeles, Miami, Sacramento, and Phoenix – that occupy humid temperate, Mediterranean, arid desert, and subtropical biomes.

Title: Mechanistic distribution models: Energetics, fitness, and population dynamics

Leader(s): Buckley, Lauren; Angilletta, Michael; Holt, Robert; Tewksbury, Joshua

Participants: Amy Angert, Michael Angilletta, Lauren Buckley, Lisa Crozier, George Gilchrist, Sarah Gilman, Robert Holt, Leslie Rissler, Michael Sears, Joshua Tewksbury

Abstract:

Biologists must understand the dynamics of species distributions to address questions about community structure and to predict distributional shifts over space and time (1). Despite recent theoretical progress (2), predictions of species' ranges still rely largely on correlational methods (3, 4). Our working group will achieve a more dynamic and mechanistic understanding of species' distributions by incorporating individual energetics, fitness curves, population dynamics, and

evolutionary change. Several distinct, but complementary, mechanistic models of species' distributions were recently published and share strong mechanistic and physiological bases (5-7). The working group will evaluate these mechanistic models, synthesize salient features of each, and generalize the synthetic model to include physiological adaptation (both plastic and evolutionary), species interactions, and dispersal limitations. Model development and empirical validation will focus on predicting climate-induced shifts in native ranges and the spread of invasive species using both modern and paleontological data.

Title: Biodiversity and the functioning of ecosystems: Translating results from model experiments into functional reality

Leader(s): Cardinale, Bradley; Duffy, Emmett; Hooper, Dave

Participants: Carol Adair, Patricia Balvanera, Jarrett Byrnes, Bradley Cardinale, Laura Dee, Emmett Duffy, Lars Gamfeldt, Andrew Gonzalez, Michael Goulden, John Griffin, Andrew Hector, Dave Hooper, Bruce Hungate, Jonathan Lefcheck, Kristin Matulich, Mary O'Connor

Abstract:

We propose a working group that will advance recent efforts to synthesize one of the fastest growing fields of ecology? Biodiversity and Ecosystem Functioning. Over the past two decades, more than 200 experiments have examined how the diversity of bacteria, fungi, plants and animals influence important ecosystem processes in habitats throughout the world. Though diversity effects have by no means been universal, recent summaries have revealed considerable generality in how the number of genes, species, and functional groups of organisms impacts the efficiency by which communities process the energy and matter that define how ecosystems 'function'. These results suggest that modern biodiversity loss may have substantial impacts on the services that ecosystems provide to humanity. But the research remains controversial, in part, because results of often highly simplistic experiments have yet to be translated into meaningful predictions about how biodiversity loss will impact ecological processes in realistic systems at appropriate scales. We will overcome such limitations by accomplishing three goals at this frontier between academic and applied ecology:

(1) We will develop quantitative scaling relationships that allow conversion of the results of small-scale, short-term experiments into predictions about the fraction of species required to optimize biological processes in more natural ecosystems.

(2) We will characterize how biodiversity simultaneously impacts the suite of ecosystem processes that have been measured in past experiments to identify trade-offs and potential synergisms, and to provide guidance on optimizing the 'multi-functionality' of diverse systems.

(3) We will evaluate how the impacts of biodiversity on key ecological processes (e.g., biomass production) can be translated into ecosystem 'services' (e.g., CO₂ uptake and storage) that can be used to aid decisions in conservation and management.

Title: Linking phylogenetic history, plant traits, and ecological processes at multiple scales

Leader(s): Cavender-Bares, Jeannine; Ackerly, David; Burleigh, J. Gordon; Mack, Michelle; Ree, Richard; Reich, Peter

Participants: David Ackerly, Jeremy Beaulieu, Brendan Bohannon, Jean Burns, Marc Cadotte, Jeannine Cavender-Bares, T. Jonathan Davies, Russell Dinnage, Erika Edwards, Nancy Emery, Paul Fine, Elisabeth Forrestel, Catherine Graham, Matthew Helmus, Ginger Jui, Steven Kembel, Kenneth Kozak, Juan Luis Parra, Pedro Peres-Neto, Richard Ree, Jessica Savage, Stephen Smith, Sharon Strauss, Nathan Swenson, John Vincent, George Weiblen, Timothy Whitfeld

Abstract:

We propose a series of multi-disciplinary working group meetings, sponsored jointly by NCEAS, and NESCent to investigate the links between evolutionary history, plant traits, community structure and ecosystem processes. We will use data from the Long-Term Ecological Research (LTER) network and beyond to examine the influence of phylogenetic relationships on community structure and traits relevant to ecosystem processes, at nested spatial and taxonomic scales across North America. In doing so, we will break new theoretical ground and develop new experimental and statistical protocols. Despite growing interest in understanding the influences of phylogeny on ecological processes, a synthesis across local and continental scales has yet to be attempted. Progress toward a unified understanding of the problem has been hampered by a lack of synthesis of existing phylogenetic and ecological data. A signature outcome will be a database of phylogenetic information for North American land plants and corresponding databases of plant traits and species abundances across local and large-scale environmental gradients. A second outcome will be a set of user-friendly software tools for statistical analysis of these data. These products will be used to clarify the significance of phylogenetic history and trait evolution for community organization and ecosystem processes across critical local and continental environmental gradients in North America. A North American synthesis will provide a framework for subsequent global analyses. We propose two NCEAS and two NESCent meetings between 2007 – 09, bringing together physiological, community and ecosystem ecologists with plant systematists and computational biologists to develop new theory and statistical methods widely applicable to the study of the evolution and assembly of communities.

Title: A synthesis of patterns, analyses, and mechanisms of beta-diversity along ecological gradients

Leader(s): Chase, Jonathan; Sanders, Nathan; Freestone, Amy

Participants: Marti Anderson, Jonathan Chase, Liza Comita, Howard Cornell, Thomas Crist, Kendi Davies, Amy Freestone, Susan Harrison, Brian Inouye, Nathan Kraft, Jonathan Myers, Nathan Sanders, James Stegen, Nathan Swenson, Mark Vellend

Abstract:

The factors that regulate biodiversity in any given locality are well studied, and include environmental, biotic, and regional factors. An important but poorly understood aspect of biodiversity is the variation in the composition of species that occur in different localities. This compositional variation, known as Beta-diversity, is driven by a variety of factors. Understanding the patterns of Beta-diversity and underlying processes that shape it is fundamental to studies of biodiversity, but is hampered by a lack of appropriate metrics, statistical analyses, and datasets. This working group will bring together ecologists with varied expertise in biodiversity and its statistical analysis across a variety of ecosystems. We will develop Beta-diversity metrics and analyses. We will then use these to synthesize the patterns of Beta-diversity among a variety of taxa along key ecological gradients to understand how and why Beta-diversity varies spatially, and how it influences the scaling of biodiversity from small to large scales. This research will not only provide a much clearer understanding of biodiversity gradients across ecological scales, but will inform biodiversity conservation and restoration actions, which typically only focus on local spatial scales.

Title: Revisiting nutrient limitation in tropical forests

Leader(s): Cleveland, Cory; Townsend, Alan

Participants: Silvia Alvarez-Clare, Mercedes Bustamante, Cory Cleveland, Eric Davidson, Kyle Harms, Benjamin Houlton, Adrienne Keller, Alison Marklein, Duncan Menge, Helene Muller-Landau, Stephen Porder, Sasha Reed, Whendee Silver, Edmund Tanner, Philip Taylor, Peter Thornton, 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:* Global expansion of jellyfish blooms: Magnitude, causes and consequences**

Leader(s): Condon, Robert; Graham, William; Duarte, Carlos

Participants: Richard Brodeur, Craig Carlson, Robert Condon, Carlos Duarte, Stefan Gelcich, William Graham, Steven Haddock, Cathy Lucas, Larry Madin, Kylie Pitt, Kelly Rakow Sutherland, Kelly Robinson, Shin-ichi Uye, Lily Whiteman, Paul del Giorgio

Abstract:

Jellyfish are an important and often conspicuous component of oceanic food webs. During the past several decades, dramatic spatial increases and temporal shifts in jellyfish distributions have been reported around the world. Undoubtedly there are associated ecological ramifications such as food web and biogeochemical pathway alterations. Moreover, socio-economic impacts include damage to fisheries, industry and tourism. However, reports have remained local in scope, and scientists agree that a composite understanding of the extent of the problem is still lacking. The bottle-neck is the lack of synthetic analyses across marine ecosystems, due to the present fragmentation of data sources. This proposal will provide a global synthesis of reports of jellyfish abundance to achieve four main

objectives: (1) to examine the hypothesis of a global expansion of jellyfish blooms, and to explore the possible drivers for this expansion; (2) to examine the effects of jellyfish blooms on the ecosystem, addressing in particular, carbon cycling, and food webs; (3) to identify current and future consequences of jellyfish blooms for tourism, industry and fisheries, including ecosystem-based management on regional and global scales; and (4) to notify the public at large of the project results. The centerpiece of this project will be a scientifically coordinated global jellyfish and environmental database based on already identified datasets from coastal, estuarine and open-ocean regions. This is a two year project and meetings will be a combination of plenary and specific group level sessions involving data acquisition and statistical analyses, global synthesis of trajectory maps of regional jellyfish blooms, generation of conceptual diagrams of the role of jellyfish in biogeochemical cycles and food webs, and discussions relating to the socio-economic ramifications of jellyfish blooms. Discussions surrounding the framework of the database and identifying deficiencies and additional data requirements will take place in the first meeting. The deliverable products addressed in the proposal include: (1) at least six group publications submitted to major scientific journals in addition to several articles in the popular literature, (2) several new process-oriented proposals to be submitted to US and international funding bodies based on hypotheses generated from the database, (3) multi-lingual website and blog housed on the NCEAS network including the interactive jellyfish database, and educational information on jellyfish blooms, (4) two public seminars and discussion forums, hosted in Spain and another one facilitated by NCEAS coinciding with one of the meetings, (5) white papers designed for funding agencies and environmental managers identifying research priorities and protocols for monitoring jellyfish blooms, and (6) a book detailing the biogeochemical, ecological and societal aspects of jellyfish blooms.

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

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

Participants: Jenica Allen, Toby Ault, Julio Betancourt, Kjell Bolmgren, Elsa Cleland, Benjamin Cook, Theresa Crimmins, T. Jonathan Davies, Nathan Kraft, Lesley Lancaster, Susan Mazer, Gregory McCabe, Brian McGill, Abe Miller-Rushing, Camille Parmesan, Stephanie Pau, Jim Regetz, Nicolas Salamin, Mark Schwartz, Steve Travers, Elizabeth Wolkovich, S. Joseph Wright

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: When are matrix models useful for management? An empirical test across plant populations

Leader(s): Crone, Elizabeth; Menges, Eric; Ellis, Martha

Participants: Timothy Bell, Paulette Bierzychudek, Elizabeth Crone, Johan Ehrlen, Martha Ellis, Tom Kaye, Tiffany Knight, Peter Lesica, Eric Menges, William Morris, Gerard Oostermeijer, Pedro Quintana-Ascencio, Amanda Stanley, Tamara Ticktin, Teresa Valverde, Jennifer Williams

Abstract:

In the past three decades, the role of matrix-based demographic models in plant conservation has steadily increased. However, the reliability of these methods remains hotly debated. Most tests of model performance have relied on strict conditions for either the datasets being tested or the criteria used to judge accuracy of the results. This leads to a potential disconnect between the variety of ways in which models are used in practice and the limited set of conditions where their performance has been evaluated. Our working group brings together a group of ecologists who have worked with these models in applied settings. We will review how models have actually been used in the recent past and discuss what predictions we expect these models to usefully provide. We will then use our demographic data from long-term studies to evaluate how well demographic models actually predict the dynamics of perennial plant populations. We will also address whether increasing methodological complexity (e.g. density dependence, integral projection modeling) improves reliability. The convergence of our group occurs at a moment when sufficient time and data have accumulated to test the predictions of demographic models at relevant time scales for management, and takes advantage of NCEAS capacities to bring together diverse groups and archive key data. Thus, this working group provides a timely opportunity to reevaluate what has become an exceptionally important tool in conservation and management.

Title: Envisioning a sustainable global seafood market and restored marine ecosystems

Leader(s): Crowder, Larry; Smith, Martin;

Participants: James Anderson, Molly Anderson, Frank Asche, Carrie Brownstein, Kristin Carden, Larry Crowder, Kristen Dubay, Gary Gereffi, Atle Guttormsen, Benjamin Halpern, Ahmed Khan, Dane Klinger, Joonkoo Lee, Lisa Liguori, Ethan Lucas, Aaron McNevin, Roz Naylor, Mary O'Connor, Cathy Roheim, Raphael Sagarin, Kimberly Selkoe, Geoffrey Shester, Martin Smith, Dale Squires, Ussif Rashid Sumaila, Wilf Swartz, Mary Turnipseed, Peter Tyedmers,

Abstract:

Ecologists, conservationists, and economists agree that many of the world's wild-capture fisheries are overfished, overcapitalized, and continue to decline. At the same time, global demand for fish protein is growing rapidly. Aquaculture provides an increasing share of the world's edible fish protein, but there are potentially adverse environmental effects of large-scale aquaculture production. Wild-capture fisheries and aquaculture together comprise the global seafood market. Though the deleterious impacts of fisheries and aquaculture on marine ecosystems have been widely studied, few studies have focused on the mechanisms by which the global seafood trade contributes to declines in marine ecosystems and how this trade might be altered to support restoration of marine ecosystems. Also, scientists from different disciplines mainly study the constituent parts of seafood production in isolation without an overarching vision of what an ecologically and economically sustainable seafood

system would look like. This is the void in scholarship we seek to fill with a team of marine ecologists, conservation practitioners, natural resource economists, and an anthropologist. We seek to explore three overarching questions: 1) Can we envision a global seafood system that is sustainable and does not degrade marine ecosystems? 2) Are there features of the global seafood trade that, if enhanced, could facilitate bottom-up sustainability of individual fisheries and aquaculture operations? 3) Are there top-down policy instruments or international agreements that would nudge the global seafood trade towards more sustainable practices? This study is timely and of vital importance, and we believe we have assembled an ideal team to carry it out. By linking knowledge about how the global seafood trade works with knowledge about the ecological impacts of fisheries and aquaculture operations, we will identify the pressure points to shift the global seafood trade away from harming marine ecosystems and towards a sustainable seafood system.

Title: Tropical coral reefs of the future: Modeling ecological outcomes from the analyses of current and historical trends

Leader(s): Edmunds, Peter; Gates, Ruth

Participants: Mehdi Adjeroud, Marissa Baskett, Julia Baum, Iliana Baums, Ann Budd, Robert Carpenter, Peter Edmunds, Nicholas Fabina, Tung- Yung Fan, Erik Franklin, Ruth Gates, Kevin Gross, Xueying Han, Lianne Jacobson, Tim McClanahan, Jennifer O'Leary, Xavier Pochon, Hollie Putnam, Tyler Smith, Michael Stat, Madeleine van Oppen, Robert van Woesik

Abstract:

Climate change and local impacts are driving unprecedented global declines in the integrity of marine ecosystems. Although reefs generally exemplify this biome degradation, some reefs and individuals corals on reefs appear surprisingly resistant or resilient to environmental disturbances. This suggests that they are better adapted, or possess community and/or organismic attributes that make them less vulnerable or better equipped to recover. We propose to synthesize data from long-term coral monitoring projects and the primary literature to identify biological attributes and physical conditions that associate with environmental resistance and resilience in coral species and reef communities. Further, we propose to use this information to feed a population and community level model aimed at projecting coral reef community structure for a Caribbean and a Pacific reef 200 years into the future.

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; Peet, Robert; Boyle, Brad; Dolins, Steven;

Participants: Sandy Andelman, Brad Boyle, Jeannine Cavender-Bares, Richard Condit, Doug Daly, Barbara Dobrin, Steven Dolins, John Donoghue, Brian Enquist, Karla Gendler, Steve Goff, Naia Holme, Peter Jorgensen, Gabriela Lopez-Gonzalez, Zhenyuan Lu, Yadvinder Malhi, Brian McGill, Sheldon McKay, Martha Narro, Jeff Ott, Robert Peet, Oliver Phillips, William Piel, Mark Schildhauer, Irena Simova, Lindsey Sloat, Nick Spencer, Jens Svenning, Nathan Swenson, Barbara Thiers, Cyrille Violle, Corine Vriesendorp, Susan Wisser, Hans ter Steege,

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: Ecological thresholds in the San Francisco Estuary (*Supported by the U.S. Fish and Wildlife Service*)

Leader(s): Fleishman, Erica

Participants: Marissa Bauer, Denise Breitburg, Larry Brown, Erica Fleishman, Peter Groffman, Mevin Hooten, Michael Johnson, Wim Kimmerer, Peter Moyle, Hans Paerl, David Schoellhamer

Abstract:

Land use in the San Francisco Estuary since the mid to late 1800s likely has altered the system to the point that traditional objectives for restoration (e.g., reversion of structure, composition, and function to the original state of the system) cannot be achieved. This working group will address three major issues through analysis of existing data and associated discussions about conceptual frameworks. First, we will address the scope of changes in system state in the San Francisco Estuary, especially with respect to productivity in the pelagic zone. Second, given evidence of changes in system state, we will investigate the future states of the estuary that may be possible, and the inputs (primarily ecological, but also economic and social) that would be necessary to achieve those states. Third, we will compare changes in system state in the San Francisco Estuary with other estuarine systems in and beyond the United States.

Title: Cultural ecosystem services from marine and coastal systems: Counting the intangibles (*Supported by the Packard Foundation*)

Leader(s): Guerry, Anne; Chan, Kai;

Participants: Patricia Balvanera, Xavier Basurto, Ann Bostrom, Gregory Bratman, Kai Chan, Ratana Chuenpagdee, Gretchen Daily, Rachelle Gould, Anne Guerry, Benjamin Halpern, Neil Hannahs, Sarah Klain, Jordan Levine, Bryan Norton, Mary Ruckelshaus, Roly Russell, Terre Satterfield, Debra Satz, Jordan Tam, Ulalia Woodside,

Abstract:

The field of ecosystem service science has begun to align economic incentives with conservation outcomes by identifying and valuing a more complete set of the services provided to humans by ecosystems than is traditionally considered in decision-making processes. Ecosystem services are the

provision of things and experiences by ecosystems for people. The ecologists and economists working in this field have primarily focused on measuring, mapping, and valuing provisioning and regulating services; cultural services are always mentioned, but the integrated incorporation of such services into decision-making remains decades behind the more tangible services. We propose to change this by jump-starting the integration of cultural services into ecosystem-service decision-making tools. This working group will bring together an interdisciplinary group of ecologists, anthropologists, political scientists, philosophers, sociologists, and practitioners to tackle the thorny question “How do changes in ecosystems affect changes in cultural values in different scenarios for use of coastal and marine regions?” We will review the available data linking such ecosystem change to changes in cultural values, paying particular attention to interactions between services, and to non-linearities. Our project will provide a framework for employing quantitative and—where necessary—qualitative methods to explicitly consider such values in marine and coastal planning.

Title: DataONE: Observation Network for Earth

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

Participants: Paul Allen, Archer Batcheller, Amber Budden, Roger Dahl, Cliff Duke, Wendy Gram, Jeff Horsburgh, Corinna Gries, Stephanie Hampton, Heather Henkel, Vivian Hutchison, Matthew Jones, Chris Jones, John Kunze, Robert Nahf, Giri Palanisamy, John Porter, Robert Sandusky, Ryan Scherle, Mark Servilla, Carly Strasser, Joshua Tewksbury, Kristin Vanderbilt, Ravichand Vegiraju, David Vieglais, Robert Waltz, Linda Wayne, Bruce Wilson

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: Parasites and food webs - the ultimate missing links

Leader(s): Lafferty, Kevin; Dobson, Andrew; Pascual, Mercedes;

Participants: Cheryl Briggs, Giulio De Leo, Andrew Dobson, Thilo Gross, Kevin Lafferty, Mercedes Pascual,

Abstract:

Food webs are a conceptual underpinning for community ecology. Unfortunately, nearly all webs do not include parasites. Considering that parasitism is the most popular lifestyle on Earth, there is concern that food webs may not be complete without parasites. This working group brings together a range of experts on parasitism, food web theory, and empirical food webs to consider how parasites can be included into food-webs and to explore the consequences of their inclusion. The working group will focus on developing theoretical food webs capable of considering parasites, investigate, in detail, the few food webs that include parasites, and collate information that will allow us to assemble

food-webs for a number well-studied ecosystems for which parasite data are available. Ultimately we hope to convince ecologists to incorporate parasites into all future food web studies.

Title: Applying population ecology to strategies for eradicating invasive forest insects

(Supported by US Forest Service)

Leader(s): Liebhold, Andrew; McCullough, Deborah

Participants: Ludek Berez, Julie Blackwood, Rebecca Epanchin-Niell, Robert Haight, Alan Hastings, Dan Herms, John Kean, Danny Lee, Andrew Liebhold, Deborah McCullough, Steve Norman, Max Suckling, Patrick Tobin, Takehiko Yamanaka

Abstract:

Eradication refers to management activities that result in the extirpation of a species from a given area. Despite the vast amounts of money and effort expended on eradication programs and their importance to mitigation of undesirable effects of non-indigenous species, a scientific basis for eradication founded on basic principles of population ecology is lacking. We plan to assemble a team comprised of applied ecologists familiar with invasive forest insects and eradication efforts, theoretical ecologists with expertise in the dynamics of low-density populations, and economists with backgrounds in optimization and decision theory. This diverse group will assemble historical data and develop population models that capitalize on our knowledge of Allee effects, stochastic dynamics, and spatial ecology to formulate and optimize new strategies for eradicating alien species and for identifying conditions under which eradication is practical.

Title: Evaluating and improving open source software for nonlinear statistical modeling in ecology

Leader(s): Maunder, Mark; Gardner, Beth; Bolker, Ben

Participants: Ben Bolker, Mollie Brooks, Liza Comita, Elizabeth Crone, Sarah Cubaynes, Trevor Davies, Beth Gardner, Olivier Gimenez, Marc Kery, Eunjung Kim, Cleridy Lennert-Cody, Arni Magnusson, Steve Martell, Mark Maunder, Mihoko Minami, John Nash, Anders Nielsen, Jim Regetz, Jeffrey Royle, Hans Skaug, Casper Willestofte Berg, Elise Zipkin, Perry de Valpine

Abstract:

Increasingly, non-linear and complex models are applied as a tool for improving understanding of ecological systems. These statistical models are often used to test hypotheses and make inferences about ecological theories and management decisions based on available data. This explosion in the application of such models is due to rapid and current development of methodology to carryout statistical inference of complex nonlinear models and improvements in computer power (faster and multiple processors). While there are many tools available for statistical inference that differ in their effectiveness for specific applications, no formal comparisons have been conducted between various software packages. It is therefore important to identify which tools are most appropriate for given applications and to demonstrate how such tools can be used most effectively. We evaluate three open source software packages commonly used to carry out statistical inference of complex nonlinear models: OpenBUGS, AD Model Builder, and R. To test the strengths and weaknesses of each package, we will bring together experts in all three software packages and apply a common set of ecological models. Working directly with NCEAS informatics staff, we will produce a web-based guide regarding the utility of each package for particular applications that includes annotated model code for each package, the data sets used in the applications, and peer-reviewed articles. We will also

identify how the different packages can be modified to improve their applicability to an array of complex nonlinear models that are essential for advancing ecological research. As statistical models are becoming increasingly more complex and ecologists are faced with a myriad of software options, the results of this project will provide support for ecologists and analysts across a broad spectrum of specialties.

Title: Choosing (and making available) the right environmental layers for modeling how the environment controls the distribution and abundance of organisms

Leader(s): McGill, Brian; Jetz, Walter; Guralnick, Robert; McPherson, Jana

Participants: Jennifer Balch, Lauren Buckley, John Donoghue, Jane Elith, Simon Ferrier, Rodney Forster, John Gallant, Robert Guralnick, Robert Hijmans, Walter Jetz, Tien Ming Lee, Brian McGill, Jana McPherson, Ramakrishna Nemani, Stephanie Pau, Steven Phillips, Thiago Fernando Rangel, Florencia Sangermano

Abstract:

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.

Title: A framework to assess ecosystem health in support of ecosystem-based management of coastal-marine systems (Supported by the Packard Foundation)

Leader(s): McLeod, Karen; Crowder, Larry; Rosenberg, Andrew; Fogarty, Michael

Participants: Daniel Brumbaugh, F. Stuart Chapin, Larry Crowder, Kendra Daly, Braxton Davis, Scott Doney, Michael Fogarty, Steven Gaines, Benjamin Halpern, Leah Karrer, Steve Katona, Heather Leslie, Sarah Lester, Katherine Longo, Karen McLeod, Elizabeth Neeley, Jennifer O'Leary, Stephen Polasky, Andrew Rosenberg, Jameal Samhouri, Paul Sandifer, Elizabeth Selig, Kevin St. Martin, Heather Tallis

Abstract:

Maintaining healthy, productive marine ecosystems is a recurrent theme in policy recommendations, management deliberations, and public sentiment. While healthy oceans are a broadly shared goal, distinct vital signs to gauge the state of oceans have not been widely implemented, yet are essential for effective policy-making. This working group will reduce hundreds of candidate indicators to a manageable set that will serve as critical monitoring and planning tools for effective marine ecosystem-based management. Specifically, we will bring together leading scholars and practitioners from ecology, fisheries, oceanography, economics, and applied social sciences to develop ecosystem health metrics for the Arctic, continental shelves, coral reefs, estuaries, and coastal upwelling

regions. We will address three overarching questions: (1) What does ecosystem health mean and how can we measure it? (2) How can we measure the degree to which human well-being is sustained by marine systems? (3) How transferable are such metrics across different systems? The indicators developed through this initiative 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.

Title: Spatial statistical models for stream networks: Synthesis and new directions (*Supported by the National Oceanic and Atmospheric Administration*)

Leader(s): Peterson, Erin; Ver Hoef, Jay; Isaak, Daniel

Participants: Noel Cressie, Jason Dunham, Jeffrey Falke, Marie-Josée Fortin, Daniel Isaak, Chris Jordan, Kristina McNyset, Pascal Monestiez, Erin Peterson, Aaron Ruesch, Aritra Sengupta, Nicholas Som, Ashley Steel, David Theobald, Christian Torgersen, Jay Ver Hoef

Abstract:

Spatial autocorrelation quantitatively represents the degree of statistical dependency between random variables using spatial relationships (Cressie 1993). It is an intrinsic characteristic of freshwater stream environments, where watersheds are nested within one another and sites are connected by stream flow through directed networks. Analyzing spatially correlated data requires the use of spatial statistical methodologies because the assumption of independence is violated, making many conventional statistical methods inappropriate (Cressie 1993). Spatial statistical methods have only recently been developed that represent the unique spatial configuration, longitudinal connectivity, flow volume, and flow direction found in freshwater ecosystems (Cressie et al. 2006, Ver Hoef et al. 2006, Peterson and Ver Hoef 2010, Ver Hoef and Peterson 2010). These methods provide significant potential advancements for ecological research and aquatic monitoring because spatial statistical models can be used to quantify patterns of spatial autocorrelation across multiple scales, to make predictions at unobserved sites with estimates of prediction uncertainty, and yield unbiased regression parameter estimates relating ecological variables to the environment (Cressie 1993). Our proposed working group will extend the capabilities of spatial statistical models for stream networks to include additional functionality available in traditional spatial statistical methods, so that a wider range of ecological and management questions can be fully addressed. To accomplish this goal, we will: 1) identify the most pressing needs in terms of analytical capabilities (i.e., what would be most useful for informing science and management) and begin developing these models, with possible extensions to include space-time models, generalized linear mixed models, computing for massive datasets, and others as identified by the working group, 2) assess the current state of software and functionality and determine whether it is sufficient to meet those needs, and develop new ones in conjunction with the previous objective, and 3) intensely analyze a single, nationally important, large, multivariate, stream dataset collected across the Northwestern (NW) United States (US) to gain ecological insights, evaluate methods, and demonstrate the new spatial statistical modeling capabilities.

Title: Supporting decision making in the Coral Triangle Initiative: Prioritizing socially and economically viable projects and places for biodiversity conservation (*Supported by the Packard Foundation*)

Leader(s): Possingham, Hugh; Klein, Carissa

Participants: Vera Agostini, Maria Beger, Michael Bode, Joshua Cinner, Zach Ferdana, Helen Fox, Edward Game, Leah Gerber, Hedley Grantham, Abdul Halim, Benjamin Halpern, Rebecca Jumin, Stacy Jupiter, Carissa Klein, Azusa Makino, Hugh Possingham, Elizabeth Selig, Kimberly Selkoe, Mark Spalding, Annabelle Trinidad

Abstract:

The coral reefs of the Coral Triangle provide sanctuary for the highest concentration of marine biodiversity in the world and support the livelihoods and protein needs of millions of people. The health and productivity of these reefs are in serious decline from numerous threats, ranging from local threats such as over fishing and pollution, to the global threat of climate change. Local threats reduce the resilience of coral reefs to withstand global impacts from climate change, resulting in deterioration of reef structure and the ability of these ecosystems to sustain their ecological interactions. We will assemble data from disparate sources to develop a framework for prioritizing between places and among specific conservation actions that cost-effectively mitigate proximate land- and sea-based threats to coral reefs and apply it to regions within the Coral Triangle. With the overall goal of supporting decision making, we will work in close collaboration with local managers and policy makers to synthesize this data and develop a framework that is capable of considering complex ecological, social, and economic dynamics relevant to the region. We will demonstrate its utility at local and regional scales and under different social and economic management constraints within the Coral Triangle. Typically, management decisions on the land and sea are made independently, without fully considering how terrestrial land-uses impact marine biodiversity. Our work is novel as it is the first example of using economic theory to balance decisions between land and sea-based management actions. This information will help guide decision makers in determining where, when, and how money would be spent efficiently to protect coral reefs, sustain protein needs, and foster livelihoods of millions, in the face of a changing climate.

Title: Towards understanding marine biological impacts of climate change

Leader(s): Richardson, Anthony; Poloczanska, Elvira

Participants: Andrea Anton, Keith Brander, Chris Brown, John Bruno, Lauren Buckley, Mike Burrows, Carlos Duarte, Mark Gibbons, Benjamin Halpern, Johnna Holding, Carrie Kappel, Wolfgang Kiessling, Pippa Moore, Mary O'Connor, John Pandolfi, Camille Parmesan, Elvira Poloczanska, Anthony Richardson, David Schoeman, Franklin Schwing, William Sydeman

Abstract:

This Working Group will provide the globally coherent view of marine biological changes in response to climate change that is currently lacking but so desperately needed. We will bring together marine experts specializing in diverse ecosystems and robust statistical analysis to address key questions concerning the vulnerability of marine systems to climate change:

1. What are the similarities and differences between marine and terrestrial systems in terms of types and rates of responses?
2. Which marine species, taxonomic groups and systems (e.g., pelagic, benthic, rocky shore, sandy beach, coral reef) are most sensitive?
3. What are the similarities and differences in the types and rates of responses in tropical, temperate and polar seas?
4. Do multiple human stresses increase vulnerability of species and habitats to climate change?
5. Can we attribute change in marine ecosystems to climate change?

To answer these key questions, we will undertake three tasks:

Task 1: Database assembly – Build a marine climate impacts database employing an innovative tiered approach to classify impacts. The database will be publicly-accessible through the NCEAS data repository, enabling researchers to validate entries and upload new results.

Task 2: Impacts analysis – Address the first 4 key questions above by applying robust meta-analytic techniques (e.g., Parmesan & Yohe 2003) to the marine climate impacts database.

Task 3: Attribution – Employ the analytical techniques of the IPCC (2007) and Rosenzweig et al. (2008) to attribute changes in marine biological ecosystems to global warming with a high degree of certainty (key question 5).

Title: An interdisciplinary approach to advancing landscape genetics

Leader(s): Rosenberg, Michael; Epperson, Bryan; Storfer, Andrew

Participants: Corey Anderson, Michael Antolin, Aurelie Bonin, Mark Dale, Bryan Epperson, Marie-Josée Fortin, Patrick James, Pierre Legendre, Stephanie Manel, Brad McRae, Melanie Murphy, Michael Rosenberg, Kim Scribner, Stephen Spear, Andrew Storfer, Helene Wagner, Lisette Waits

Abstract:

Landscape genetics is the intersection of landscape ecology with population genetics. While spatial analytical methods have been applied to genetic data for three decades, advances in high-throughput collection of genetic data combined with increased availability of GIS-based landscape data have outpaced advances in statistical methods. Classical population genetic measures (e.g., F_{st} and Nei's D) are aspatial in nature and most often applied to allele frequencies from limited numbers of molecular markers. Today we are capable of generating hundreds of markers from distinct individuals (e.g., genome-wide SNP assays or AFLP loci). A distinct benefit of landscape genetics is that significantly more genetic variation can be explained by spatially-explicit analyses than traditional aspatial analyses. As such, landscape genetics holds great promise for ecological genetics research, such as explaining processes that affect the distribution of neutral or adaptive genetic variation, revealing cryptic barriers to dispersal, and developing conservation programs focused on landscape features that facilitate connectivity among populations. This working group will bring together landscape ecologists and spatial analysts with population geneticists to (1) examine the applicability of historic and currently used spatial tools for estimating spatial genetic structure with the various types of data generated in modern population genetics studies; (2) examine the statistical rigor of each combination of statistic and data type to test hypotheses about underlying spatial-temporal processes; (3) adapt existing and invent new methods for analyzing modern genomic data in a spatial context; and (4) develop forums for communicating with practicing ecological and evolutionary geneticists, landscape ecologists, spatial statisticians and conservation biologists.

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: Laura Bowling, John Kominoski, Jennifer Roath, John Sabo, Gerrit Schoups, Tushar Sinha,

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

Leader(s): Schildhauer, Mark

Participants: Luis Bermudez, Shawn Bowers, Cyndy Chandler, Simon Cox, Philip Dibner, Ruth Duerr, Peter Fox, Corinna Gries, Jeff Horsburgh, Matthew Jones, Chris Jones, Steve Kelling, Carl Lagoze, Hilmar Lapp, Ben Leinfelder, Joshua Madin, Andrew Maffei, Peter McCartney, Deborah McGuinness, Chris Mungall, Margaret O'Brien, Mark Parsons, Mark Schildhauer, David Tarboton, David Vieglaiss, Campbell Webb, Stephan Zednik

Abstract:

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.

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

Leader(s): Shaw, M. Rebecca

Participants: Frank Davis, Alan Flint, Lorrie Flint, Janet Franklin, Alex Hall, Lee Hannah, Maki Ikegami, Max Moritz, Malcolm North, Kelly Redmond, Helen Regan, Patrick Roehrdanz, M. Rebecca Shaw, Alexandra Syphard

*Title: **Public domain ADMB project*** (*Supported by the Gordon and Betty Moore Foundation*)

Leader(s): Sibert, John; Maunder, Mark

Participants: Teresa A'mar, Johnnoel Ancheta, Mollie Brooks, Dave Fournier, Chris Grandin, Stephanie Hampton, Brian Linton, Weihai Liu, Arni Magnusson, Steve Martell, Mark Maunder, Anders Nielsen, Jim Regetz, Mark Schildhauer, Derek Seiple, John Sibert, Tim Sippel, Hans Skaug, Casper Willestofte Berg

*Title: **Climate change and invasive species: Are non-natives poised for greater success in future climatic conditions?***

Leader(s): Sorte, Cascade; Dukes, Jeffrey; Lawler, Joshua

Participants: Dana Blumenthal, Bethany Bradley, Carla D'Antonio, Jeffrey Diez, Jeffrey Dukes, Regan Early, Edwin Grosholz, Ines Ibañez, Sierra Jones, Joshua Lawler, Luke Miller, Nicole Molinari, Julian Olden, Cascade Sorte, Wilfried Thuiller

Abstract:

Climate change and biological invasions are two of the primary causes of biodiversity loss, and it has been hypothesized that these factors may operate synergistically in the future. We propose a working group composed of experimentalists and modelers whose objective will be to quantitatively evaluate the interaction between climate change and species invasions. First, we will conduct the first cross-ecosystem meta-analysis of non-native and native species' physiological tolerances and impacts of changing climatic conditions on demographic rates. Our goal will be to address whether non-natives are poised for greater success in future climate conditions. Second, using information on current ranges and on physiological tolerances, we will construct a combination of bioclimatic envelope models and mechanistic distribution models to compare changes in range sizes for non-native and native species. Such integration between modeling techniques has rarely been attempted, despite it being one of the most promising methods for advancing our understanding of the ecological consequences of climate change. Finally, we will further integrate our meta-analysis and modeling results to address the relative change in invasion impacts for target species, with the goal of improving recommendations for conservation and management. The uncommon breadth and depth of our study will yield robust insights into how the spread and impact of invasive species will be altered by climate change. Specific results will inform estimates of the species- and location-specific risks of invasions, which will support invasive species management decisions. Our working group is uniquely poised to make progress toward forecasting the effects of climate change on species invasions because our participants have access to a large quantity of high-quality data and bring the theoretical and empirical expertise needed for the task.

*Title: **Evolutionary ecology of primate life histories*** (*Funded jointly with NESCent*)

Leader(s): Strier, Karen; Alberts, Susan

Participants: Susan Alberts, Jeanne Altmann, Diane Brockman, Anne Bronikowski, Marina Cords, Linda Fedigan, William Morris, Anne Pusey, Tara Stoinski, Karen Strier

Abstract:

Primates are highly charismatic and often serve as flagship species in conservation efforts. They are also the closest living relatives of humans, and therefore hold the keys to resolving many questions about human evolution and ecology. However, the slow life histories of primates, combined with their complex social systems, their behavioral plasticity, and the challenging field conditions in which primate researchers must work, have severely limited analyses of mortality and fertility in wild, unprovisioned primate populations. This in turn limits both conservation efforts and comparative analyses that can shed light on the population dynamics and the social and ecological adaptations that have shaped both human and nonhuman primate evolution. We propose a Primate Life Histories Working Group to compare mortality and fertility schedules across taxa and evaluate a set of hypotheses about the evolution of mortality, and the relative importance to fitness of variation in fertility and survival rates. Using unique, individual-based life history data that have been collected from wild populations by eight working group participants over a minimum of 15 years, we will develop age-specific mortality and fertility schedules and create population projection matrices for each species. Our immediate goals are to test current hypotheses about the evolution of mortality, lifespan and reproduction, in order to advance our understanding of primate evolution. Our longer-term goal is to move toward a collaborative, shared databank housing irreplaceable life history data on primates. Many primate species are endangered or are under increasing anthropogenic pressure, and compiling these data is important both for conservation efforts and for scientific archives.

Title: Evolutionary and plastic responses of Pacific salmon to climate change (*Supported by the Moore Foundation*)

Leader(s): Waples, Robin; Schindler, Daniel

Participants: Brian Beckman, Lisa Crozier, Erica Fleishman, Richard Gomulkiewicz, Jeff Hard, Peter Lawson, Tom Quinn, Tom Reed, William Satterthwaite, Mark Scheuerell, Daniel Schindler, James Seeb, Robin Waples

Abstract:

This working group will explore the relative importance of evolutionary and plastic responses of Pacific salmon to climate change. Phenotypic plasticity is the ability of the same genotype to produce different phenotypes under different environmental conditions. Although phenotypic plasticity is well-documented in Pacific salmon, the limits to phenotypic plasticity are not. Similarly, abundant empirical evidence demonstrates the importance of local adaptation in Pacific salmon, but we lack a general understanding of how rapidly, and under what conditions, evolutionary change can occur in salmon. A synthesis of existing information on these two broad topics should produce novel insights into the role each is likely to play in shaping the response of Pacific salmon to climate change. Proposed analyses are likely to highlight life history stages and populations with a high probability of experiencing climate-induced change, as well as life history stages and populations that are likely to be more robust and resilient.

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, Jean Cochrane, Ben Collen, Daniel Doak, Nick Dulvy, Elizabeth Holmes, Jeffrey Hutchings, Douglas Keinath, David

Keith, Robert Lacy, Georgina Mace, 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.

Following are working groups prior to October 1, 2010, but not reported in the NSF 2009-2010 report due to submission of the report prior to the end of the reporting period:

Title: Integrated history and future of people on Earth (IHOPE): Building a community data base and testing the resilience - sustainability hypothesis across scales

Leader(s): Costanza, Robert; Graumlich, Lisa; van der Leeuw, Sander

Participants: Stephan Barthel, Simon Brewer, Michael Burek, David Cleveland, Sarah Cornell, Robert Costanza, Carole Crumley, John Dearing, Lisa Graumlich, Joel Gunn, Scott Heckbert, Kathy Hibbard, Stephen Jackson, Ida Kubiszewski, Vernon Scarborough, Paul Sinclair, Sverker Sorlin, Will Steffen, Steve costanza, Sander van der Leeuw

Abstract:

Understanding the reasons for the emergence, sustainability, decline, or collapse of human societies is a key prerequisite for creating a sustainable and desirable future. A central hypothesis is that the probability of societal collapse, or failure increases with loss of resilience in social-ecological systems. The proposed working group will assemble integrated environmental and human historical data at the global scale for comparative analysis and for a few key case study areas for dynamic analysis in order to help build this understanding. We will develop criteria for integrating and analyzing disparate data across scales and disciplines. Key lessons from an ongoing project titled "Integrated Research Information System (IRIS)" using the ARCHAEOMEDES dataset from southern Europe (van der Leeuw, 1998, 2005) will be incorporated. A key component of this activity will be developing better ways to integrate and visualize data from the broad range of relevant sources (i.e. from historical narratives to ice cores) and with a broad range of spatial and temporal resolution and quality. In assembling the integrated data base the working group will also develop meta-variables and indices that can serve as proxies for environmental predictability and system resilience. We can then test the ability of various proxies of system resilience to explain sustainability or breakdown of social structures, relative to alternative hypotheses. A range of modeling approaches will be applied to the problem.

Title: Benchmarking ecosystem response models with experimental data from long-term CO2 enrichment experiments

Leader(s): Norby, Richard; Luo, Yiqi; Oren, Ram; Prentice, I. Colin; Hanson, Paul

Participants: Michael Dietze, Paul Hanson, Thomas Hickler, Atul Jain, Julian Jenkins, David Kicklighter, Yiqi Luo, Belinda Medlyn, Richard Norby, Ram Oren, William Parton, I. Colin Prentice, M. Lynn Tharp, Peter Thornton, Anthony Walker, Ying-Ping Wang, Shusen Wang, David Warlind, Yuanhe Yang, Sonke Zaehle

Abstract:

Ecosystem models have been increasingly incorporated into earth system models to predict climatic and atmospheric dynamics. However, ecosystem models themselves are far from perfect and need continued improvement. We will advance this necessary model improvement using some of the longest and most comprehensive data sets on CO2 impacts on ecosystems from field experiments. Twelve ecosystem process and land surface models, which are being used for predicting terrestrial response to atmospheric and climatic change, will be parameterized with site and weather data from the Duke University and Oak Ridge National Laboratory free-air CO2 enrichment (FACE) experiments. We will evaluate the ability of the models to reproduce the measured processes of the carbon, water, and nitrogen cycles of the experimental forest stands and their responses to elevated atmospheric CO2 concentration. Similarities and differences among the models and their components will provide guidance for improving all of the models. With the experimental data as a benchmark for model performance, the utility of the models for extrapolation to environmental change questions can be demonstrated with increased confidence. This working group will include participants who are most familiar with the experimental data, a data manager to assemble and format the data for model input, representatives from diverse modeling groups, and a neutral observer to synthesize model results. This data-model intercomparison project has the potential to provide better scientific outputs for policy making.

Meetings Hosted by NCEAS

Occurred or were scheduled between October 1, 2010 and September 30, 2011

Based on data available as of May 17, 2011

3-Nov-10 to 5-Nov-10

Leader: Gross, Katherine

Predicting grassland community responses to fertilization: Exploring the role of clonality and other species traits

16-Dec-10 to 17-Dec-10

Leader: Gross, Katherine

Predicting grassland community responses to fertilization: Exploring the role of clonality and other species traits

2-Feb-11 to 4-Feb-11

Leader: Mordecai ,Erin

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

19-Apr-11 to 21-Apr-11

Leader: Brachman ,Micah

The science, media reporting, and politics of California air quality: Content, context, and voting patterns of Proposition 23 (Luce Fellows)

14-Jun-11 to 17-Jun-11

Leader: Teck ,Sarah

Can eco-labeling drive conservation and sustainable harvesting of marine fisheries? (Luce Fellows)

Following are meetings that took place prior to October 1, 2009, but not reported in the NSF 2008-2009 report due to submission of the report prior to the end of the reporting period:

26-Sep-10 to 30-Sep-10

Leader: Fleishman ,Erica

Evaluation of declines of pelagic organisms in the upper San Francisco Estuary (Supported by US Fish and Wildlife Service)

28-Sep-10 to 29-Sep-10 ,

Leader: Hampton, Stephanie

Education, outreach and communication coordinators annual meeting

Scientific Visitors

Occurred or were scheduled between October 1, 2010 and September 30, 2011

Based on data available as of May 17, 2011

Lei Chen

20-Jan-11 to 3-Feb-11

Determinants of relative species abundance: A cross-continental comparison of tropical tree communities

Host: Liza Comita

Trevor Davies

1-Apr-10 through 31-Dec-11

Estimating population trends and recovery potential of poorly monitored marine fishes

Host: Hampton, Stephanie

Maria Gonzalez

7-Feb-11 to 11-Feb-11

Multivariate time series analysis of long-term experimental data on gizzard shad effects in shallow ponds

Host: Stephanie Hampton

Emily Grman

21-Feb-11 to 24-Feb-11

Predicting grassland community responses to fertilization: Exploring the role of clonality and other species traits

Host: Katherine Gross

Lila Rose Kaplan

6-Jan-11 to 30-Sep-11

Science and the humanities

Host: Stephanie Hampton

Kristin Kleisner

2-Apr-11 to 6-Apr-11

Ocean Health Index (Hosted by NCEAS)

Host: Benjamin Halpern

Eve McDonald

18-Apr-11 to 30-Jun-11

Coral reef ecosystems

Host: Stephanie Hampton

Scott Merrill

6-Apr-09 through 5-Apr-12

Understanding the link between precision agriculture and landscape ecology

Host: Stephanie Hampton

Xiangcheng Mi

20-Jan-11 to 3-Feb-11

Determinants of relative species abundance: A cross-continental comparison of tropical tree communities

Host: Liza Comita

Curtis Runyan

1-Jan-09 to 30-Sep-11

Nature Conservancy Magazine

Host: Stephanie Hampton

Courtney Scarborough

12-Apr-10 through 11-Apr-11

Ocean Health Index

Host: Halpern, Benjamin

Peter Thrall, James Bever & Michael Hochberg

7-Dec-10 to 16-Dec-10

Host: Stephanie Hampton

Following are visitors prior to October 1, 2010, but not reported in the NSF 2009-2010 report due to submission of the report prior to the end of the reporting period:

Åke Hagstrom

30-Aug-10 to 2-Sep-10

Synthesis for fisheries and marine ecosystems in Sweden

Host: Stephanie Hampton

Dan Pendleton

28-Jun-10 to 1-Jul-10

CAMEO: Building the foundation: New statistical tools for analyzing community dynamics with applications to marine zooplankton

Host: Stephanie Hampton

Center Associates Hosted by NCEAS

Occurred or were scheduled between October 1, 2010 and September 30, 2011

Based on data available as of May 17, 2011

Andelman, Sandy

Conservation International

1-Feb-10 through 30-Sep-11

Baron, Nancy

SeaWeb

3-May-04 through 2-May-12

Budden, Amber

Occurrence of publication bias in ecology

9-Aug-10 through 31-Dec-11

Courtney, Steven

Roles of scientists and science managers

14-Sep-09 through 30-Sep-11

Halpern, Benjamin

Mapping Human Impacts to Massachusetts Marine Ecosystems

1-Jun-09 through 31-Dec-11

and

Knowledge and capacity-building to support ecosystem-based management (EBM) for sustainable coastal-marine systems

1-Jan-07 through 31-Dec-11

Ranganathan, Jai

Developing a return on investment approach for conservation planning in Argentina

And

Increasing public understanding of ecological science through multimedia communication

8-Jan-10 through 31-Dec-11

Selkoe, Kimberly

Elucidating marine dispersal with population genetics: A simulation approach with case studies on the Northwest Hawaiian Islands and the Pacific coasts of Baja and Southern California

21-Sep-05 through 20-Sep-11

Wade, Alisa

Assessment of the sensitivity of wild Pacific salmon to climate change (*Supported by the Moore Foundation*)

1-Jun-09 through 07-Aug-11

Research Training Activities

Twelve graduate and three undergraduate students were involved with research activities at NCEAS during the reporting period. An additional three graduate students were here during the previous reporting period, but were not included in the 2009-2010 report due to the July 2010 submission date. 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, 2010 and September 30, 2011

Based on data available as of May 17, 2011

Bruno , Peter

Envisioning a sustainable global seafood market and restored marine ecosystems

1-Jul-10 through 31-Dec-10

Chang, Michelle

DataONE: Observation Network for Earth

7-Jun-11 through 12-Aug-11

Clark, Sarah

DataONE: Observation Network for Earth

20-Jun-11 through 12-Aug-11

Donoghue, John

Developing an integrated botanical information network to investigate the ecological impacts of global climate change on plant biodiversity
1-Sep-10 through 30-Nov-10

Elmore, Aaron

Ecoinformatics graduate internships
1-Oct-10 through 30-Jun-11

Han, Xueying (Shirley)

Ecoinformatics graduate internships
1-Jan-09 through 30-Jun-11

Lalonde, Seth

Ecoinformatics graduate internships
13-Sep-10 through 30-Jun-11

Lee, Tien Ming

Choosing (and making available) the right environmental layers for modeling how the environment controls the distribution and abundance of organisms
1-Jul-10 through 31-Jul-11

Lucas , Ethan

Development and application of scientific knowledge to ecosystem-based management of coastal marine systems
1-Jul-10 through 31-Dec-10

Nuding , Amelia (Meghan)

Effects of trade policy on management of non-native forest pests and pathogens
1-Jan-10 through 31-Oct-10

Phillips, Jessica

Metrics of successful collaborations
25-July-11 through Aug-2011

Wheeler, Matt

Ecoinformatics graduate internships
1-Apr-10 through 31-Dec-10

Following are graduate students prior to October 1, 2010, but not reported in the NSF 2009-2010 report due to submission of the report prior to the end of the reporting period:

Chaudhary, Bala

A graduate seminar network to facilitate synthetic research on context-dependency in the mycorrhizal symbiosis
1-Sep-10 through 30-Sep-10

Landguth , Erin

Developing best practices for testing landscape effects on gene flow: Distributed Graduate Seminar
1-Dec-09 through 30-Jun-10

Sloat , Lindsey

Developing an integrated botanical information network to investigate the ecological impacts of global climate change on plant biodiversity
1-Jun-10 through 31-Aug-10

Undergraduate Student Interns

Occurred or were scheduled between October 1, 2010 and September 30, 2011

Based on data available as of May 17, 2011

Aiyaswamy, Sruti

Disciplinary synthesis and collaboration in ecology: Organizations, research groups, and work lives
2-Dec-10 through 30-Jun-11

Amy Briggs

30-Aug-10 to 15-Aug-11

Predicting baseline, current, and future distributions and abundances of apex predators on coral reefs

Kilroy, Cailean

Quantifying long-term landscape vegetation dynamics in and around Kibale National Park, Uganda, to establish appropriate landscapes for zoonotic disease models

12-Oct-10 through 30-Jun-11

Highschool Student Interns

Aislinn Dunne

Ocean Health Index (*Hosted by NCEAS*)

5-July-11 to 31-Aug-11

Postdoctoral Training Sessions

For training sessions, NCEAS Postdoctoral Associates are the primary audience, with attendance by other NCEAS scientists (e.g., sabbaticals, graduate students) and UCSB scientists of all stages welcomed.

Career Development Series

(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.)

Academic Job Application Process (series)

Non-academic Careers (series)

Mentoring

Social Networking in Science
 Outreach with K-12 Students
 Working with the Media
 Preparing data management plans
 Science writing (series)
 Grant proposal preparation
 Scientific leadership
 Designing an ecology course

Training Sessions

*Occurred or were scheduled between October 1, 2010 and September 30, 2011
 Based on data available as of May 17, 2011*

6-Oct-10 to 7-Oct-10

Structured population modeling workshop

Instructor: Jennifer Williams

15-Nov-10 to 16-Nov-10

NCEAS servers, Subversion, Morpho, and KNB

Instructor: Jim Regetz

17-Feb-11 to 17-Feb-11

Luce graduate fellows informatics seminar

Instructor: Jim Regetz

16-Mar-11 to 18-Mar-11

COMPASS training workshop

Instructors: Nancy Baron and Ben Halpern

Additional Seminars

The wide range of visiting and resident scientists at NCEAS provides excellent opportunities for interactions through the NCEAS Ecolunch seminar series. A list of speakers is provided in Table 2. In addition, the Postdoctoral Associates organize an informal Friday afternoon discussion on diverse topics. In this reporting period, Friday afternoon discussions included topics such as foundations of ecology, more effective and efficient writing, job applications and negotiating academic job offers, setting up a new lab, potential negative effects of ecological research methods on subjects and research results, managing data, applications of text mining and analysis, holding an audience, the place and value of natural history, deep sea research, and writing about science for popular media.

Networking of Visiting and Resident Scientists

Residence at the Center provides many additional opportunities for meeting visiting scientists. "Tea Time with the Postdocs" augments opportunities for interactions by setting aside designated times for Working Groups to mingle with NCEAS residents.

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 through a K-12 program and 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. Through July 27, 2011 of the funding period, publications resulting from NCEAS support were featured in seven press releases developed by UC Santa Barbara on behalf of NCEAS.

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 to journalists. Included were sessions on science blogging, how the media reports on science, and how to conduct both radio interviews and interviews with writers.

The presenters included:

- Jai Ranganathan & Jarrett Byrners discussed science blogging and podcasting
- The Director of Ocean Science Outreach for COMPASS discussed working with journalists

Further, the Packard Foundation supported a media training workshop for scientists involved not only in EBM projects but also in relevant NSF-supported projects, such as NCEAS residents working on Conservation International's Ocean Health Index project, and other NCEAS postdocs. This training workshop emphasized communicating science effectively through both traditional and online media, as well as with policymakers. The workshop included presentations from COMPASS and journalists from *Science*, National Public Radio, *Miller-McCune* magazine, *Scientific American* and *Discover*.

In addition to observing the Packard-sponsored media training, the NCEAS Program Associate (who provides content for the NCEAS website and interfaces with UCSB's press office) attended a Science Writing Workshop organized by science writers & New York Times journalists. The five-day workshop provided a variety of presentations, instructors from the New York Times, Wired, and the Boston Globe, daily practice writing exercises, and tips for writing for short to long forms of popular media. Upon return, she ran an Open House with postdocs to share insights from the workshop.

Public Understanding of Science

NCEAS maintains a section of the website with material written for the general public - “Featured Research Underway”. We interact with journalists and other communications professionals, and collaborate with local and national organizations such as COPUS, the Coalition on the Public Understanding of Science and 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 now also hosts Jai Ranganathan who produces a podcast for Miller-McCune magazine. Both Center Associates interact regularly with visitors and residents, with Dr. Ranganathan drawing heavily from the stream of visitors to create his podcasts about science. <http://www.miller-mccune.com/category/curiouser/>

NCEAS recently initiated procedures for tracking and logging 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 some researchers and groups. For example, the Working Group “Finding common ground in marine conservation and management” had three major papers published during the funding period, each of which generated attention from multiple media outlets. Another project, “Dams, river networks and the distribution of native and non-native freshwater fauna in the United States” received media coverage of two papers published in late 2010. Other projects also inspired prominent media attention, in the U.S. and around the world.

Examples of Projects that Received Prominent Press Coverage

Finding common ground in marine conservation and management (PIs: Boris Worm & Ray Hilborn)

T. Branch et al., The trophic fingerprint of marine fisheries, *Nature* 468: 431-435 (2010)
Covered by: MSNBC, AFP, Reuters, *Scientific American*, Yahoo News (India), Live Science, NineMSN (Australia), *The Independent* (UK), *The Age* (Australia), *Philippine Daily Inquirer* (Philippines), *Kaleej Times* (UAE), *Science Magazine News of the Week*

T. Branch et al., Contrasting Global Trends in Marine Fishery Status Obtained from Catches and from Stock Assessments, *Conservation Biology* (2011)
Covered by: *New York Times*, *New Scientist*, UPI, *Dalje* (Croatia)

M. Pinsky et al., Unexpected patterns of fisheries collapse in the world's oceans, *Proceedings of the National Academies of Science* 108: 8317-8322 (2011)
Covered by: *CBC News*, *Scientific American*, *San Jose Mercury News*, Yahoo News (Canada), *Rhode Island Offshore*, *Nature News*

The PIs recently won ESA’s Sustainability Science award for this work:

<http://www.nceas.ucsb.edu/news/nceas-working-group-publication-wins-sustainability-science-award-esa>

Dams, river networks and the distribution of native and non-native freshwater fauna in the United States (PI: John L. Sabo)

J.L. Sabo et al., Reclaiming freshwater sustainability in the Cadillac Desert, *Proceedings of the National Academies of Science* 107: 21263-21269 (2010)

Covered by: *New York Times*, *Miller-McCune*, *Scientific American*

J.L. Sabo *et al.*, The Role of Discharge Variation in Scaling of Drainage Area and Food Chain Length in Rivers, *Science* 330: 965-967 (2010)

Covered by: *Conservation Magazine*, Postmedia News (Canada)

Evolutionary ecology of primate life histories (funded jointly with NESCent – PIs Karen B. Streir, Susan Alberts)

Bronikowski *et al.*, Aging in the Natural World: Comparative Data Reveal Similar Mortality Patterns Across Primates, *Science* (2011)

Covered by: Xinhua (China), ABC News (US), CBS News, MSNBC, NPR, *USA Today*, ABC (Australia), Postmedia News (Canada), *The Hindu* (India), *The Daily Mail* (UK), Yahoo News, *Sydney Morning Herald* (Australia), *Japan Times* (Japan), Discovery News, News 24 (Africa)

Integrating the aquatic with the terrestrial component of the global carbon budget (PIs Jonathan J. Cole, Carlos M. Duarte, Yves T. Prairie)

D. Bastviken *et al.*, Freshwater Methane Emissions Offset the Continental Carbon Sink, *Science* 331: 50 (2011)

Covered by: MSNBC, Reuters, MSN News (Brazil), *Daily Telegraph* (Australia), *Taipei Times* (Taiwan), Terra (Brazil), Discovery News, All Africa

The 60-year data set of plankton dynamics in Lake Baikal: Examining facets of the jewel of Siberia (PIs: Evgeny A. Zilov, Stephanie E. Hampton, Marianne V. Moore)

S.L. Katz *et al.*, Influence of Long-Distance Climate Teleconnection on Seasonality of Water Temperature in the World's Largest Lake - Lake Baikal, Siberia, *PLoS ONE* (2011)

Covered by: Discovery News, *Scientific Computing*, Miller-McCune

Ecosystem services on an urbanizing plant: What 2 billion new new urbanites means for air and water (PIs: Robert I. McDonald, Peter J. Marcotullio)

R. McDonald *et al.*, Urban growth, climate change, and freshwater availability, *Proceedings of the National Academies of Science* (2011).

Covered by: AFP, Xinhua (China), *El País* (Spain), MSN News (Latin America & Asia), Yahoo News (Asia), TeleSur (Latin America), *Sydney Morning Herald* (Australia), *The Age* (Australia), *The Jakarta Globe* (Indonesia), *The Independent* (UK), Terra (Argentina), News 24 (Africa), *Scientific American*

Diversity Initiatives

NCEAS continues to expand efforts to reach students and scientists from groups currently under-represented in ecology.

In our Distributed Graduate Seminars (DGS) we work with PI's to include Minority Serving Institutions in their proposals, with the intention of reaching our goal: to have 25% of participating

institutions be MSI's. 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 association with this Distributed Seminar, our NCEAS postdoc Jennifer Balch recently visited Diné College, on the Navajo Nation, to work through a fire-cheatgrass module with Diné students.

<http://www.nceas.ucsb.edu/news/nceas-postdoc-jennifer-balch-reaches-out-navajo-nation>

NCEAS works with NESCent and other partners to co-produce a suite of activities to promote careers in ecology and evolution. These include a scientific symposium, career panel, and film discussion at the annual conference of the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS). NCEAS postdocs Josephine Rodriguez and Sadie Ryan represented NCEAS at the 2010 SACNAS meeting.

Our K-12 program, Kids Do Ecology, reaches a local community in which participating elementary classrooms have high Hispanic enrollment, from 45-94% Hispanic students in 2010-2011.

K-12 and Community Outreach

NCEAS offers postdoctoral and sabbatical fellows training and hands-on opportunities for outreach through the K-12 Kids Do Ecology program and associated activities.

The Kids Do Ecology (KDE) classroom program, a successful initiative that has been our primary means of outreach to K-12 students since 1995, continues to flourish. Thirteen NCEAS postdocs provided instruction and mentoring to students in seven fifth-grade classrooms in Santa Barbara. An annual Poster Presentation Day was held at NCEAS in March 2011 for students, their families and teachers, and NCEAS staff.

In November 2010, NCEAS organized a special outreach event called Jellyfish ROCK: Reaching Out to Community and Kids. Jellyfish scientists from the NCEAS working group "Jellyfish Blooms of the Global Ocean: Magnitude, Causes and Consequences for Marine Food Webs, Carbon Cycling and Socioeconomics" gave presentations about jellies and jellyfish blooms, the good and the bad aspects of jellies, and their importance to both coastal communities such as Santa Barbara and to ocean ecosystems around the world. More than 170 attendees converged at the Santa Barbara Museum of Natural History for the interactive evening of videos, presentations from the international jellyfish experts, live jellyfish, and an exhibition of children's artwork from around the world.

In conjunction with Jellyfish ROCK, the Aquarium of the Pacific organized an international art contest for children up to twelve years old. The contest received more than 550 entries, including jellyfish drawings, paintings and three-dimensional artwork. Children from 14 countries and 4 U.S. states submitted their designs, with winning pieces coming from Japan, Spain, the U.K. and the U.S. The art contest judges included local artists, as well as two NCEAS postdocs.

Jellyfish ROCK was such a great success for NCEAS thanks to coordination with a number of partners who donated time, expertise and resources; partners included host Santa Barbara Museum of Natural History; art contest organizer Aquarium of the Pacific; COMPASS, which directed the program development and delivery; master of ceremonies Michael Todd of Miller-McCune

magazine; the Dauphin Island Sea Lab Foundation; Blue Ocean Productions; Monterey Bay Aquarium Research Institute (MBARI); and NOAA Channel Islands National Marine Sanctuary. <http://www.nceas.ucsb.edu/news/nceas-sponsored-outreach-event-brings-jellyfish-science-public>

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

Initiatives Focused on Higher Education

In association with a related NCEAS Distributed Graduate Seminar “Engaging Undergraduate Students in Ecological Investigations Using Large, Public Datasets,” several teaching modules have been submitted for review at TIEE, including a module by NCEAS postdoc Jennifer Balch who visited the Navajo Nation this summer to pilot it with the students (see p. 49).

In another program targeted at undergraduates, this funding period saw the launch of a new NCEAS initiative Synthetic Undergraduate Networks for Analyzing Ecological Data (Project SUN), designed and carried out by David Marsh who is visiting NCEAS as a special advisor on undergraduate education. Project SUN introduces 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. Participating institutions were Jacksonville University, Massachusetts College of Liberal Arts, Mount Holyoke College, San Francisco State University, Stanford University, University of Wisconsin-Stout, Utah State University, and Western Carolina University. Dr. Marsh and Dr. Hampton sought and received additional funding for the grand synthesis meeting from NSF.

For graduate-level students, NCEAS continued its collaboration with the Henry Luce Foundation. The Luce Environmental Science to Solutions Fellowship Program (Luce Fellows) allows selected Ph.D. scholars to carry out multi-disciplinary research on environmental issues under the guidance of experienced scientist mentors at NCEAS and UCSB. Student-driven working groups hosted at NCEAS are a component of the program. A list of Luce Fellows meetings held during the funding period is included in the Meetings section of this report.

Collaborations in Outreach and Assessment

NCEAS is working with other NSF-funded Centers to explore common needs in communication, education and outreach. A meeting of outreach and education staff from the Centers occurred in September 2010 at NCEAS. Participants included NCEAS, NIMBios, NESCent, NEON, EOL, and iPlant.

NCEAS postdocs also participated in a synthesis postdoctoral summit at NESCent in April 2011. Other participants included: NESCent, NIMBioS, EOL, and the Canadian Institute of Ecology and Evolution.

In 2011, as a follow up to the previous year’s assessment workshop at NIMBioS, we adopted NESCent’s administrative database structure to streamline assessment and reporting.

Diversity of Community Engagement

Since 1995, over 5,000 scientists 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, 152 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 continues to grow (Figure 5), and 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 580 different professional societies and have published their NCEAS work in over 300 distinct journals. Since 1995, participants have come from over 1,580 different institutions. Finally, 23% 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. Figure 7 shows a trend consistent with the Board's increasing scrutiny of participant lists, encouraging recruitment of new faces; seemingly more participants report that their first knowledge of NCEAS has come via invitation from a Working Group leader. 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.

Publications and Products

The total number of publications from NCEAS activities now exceeds 1,900 since the establishment of NCEAS (Figure 8). (This does not include 193 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.

Below we list 156 newly reported publications for the period since July 2010 (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 also includes some publications for which we now have complete citations, and were reported as "in press" in the past. It does not include publications reported for the SEEK project, which are reported to NSF separately.

In addition to publications reported, we have listed 32 data sets that were registered or uploaded to the NCEAS Data Repository since 1 July 2010. NCEAS scientists have reported that they made 88 presentations of their NCEAS work, and submitted 6 new proposals to other organizations as a result of activities at NCEAS.

Publications Reported from June 13, 2010 – July 17, 2011

Includes journal articles, books, and book chapters

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

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3. Tables and Figures

Table 1. Science Advisory Board Members 2010-2011

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

SAB Members 2008-2009	Institutions	Term
Bever, Jim	Indiana University	2007-2010
Denno, Robert	University of Maryland	2007-2010
Harms, Kyle E.	Louisiana State University	2007-2010
Martiny, Jennifer Hughes	University of California, Irvine	2007-2010
Pfister, Cathy	University of Chicago	2007-2010
Tank, Jennifer	University of Notre Dame	2007-2010
Thrall, Peter H.	CSIRO Agricultural Sustainability Initiative	2007-2010
Ashley, Mary	University of Illinois at Chicago	2008-2011
Belnap, Jayne	US Geological Society	2008-2011
Bjornstad, Ottar	Pennsylvania State University	2008-2011
Cottingham, Kathryn	Dartmouth College	2008-2011
Miriti, Maria	Ohio State University	2008-2011
Osenberg, Craig	University of Florida	2008-2011
Ricketts, Taylor	World Wildlife Fund	2008-2011
Briggs, Cherie	University of California, Santa Barbara	2009-2011
Ceballos-Gonzales, Gerardo	Instituto de Ecología, UNAMK	2009-2011
Essington, Tim	University of Washington	2009-2011
Holmes, Elizabeth	National Marine Fisheries Service, Seattle WA	2009-2011
Pendall, Elise	University of Wyoming	2009-2011
Smith, Felisa	University of New Mexico	2009-2011
Altizer, Sonia	University of Georgia	2010-2011
Bolker, Ben	McMaster University	2010-2011
Curran, Lisa	Stanford University	2010-2011
Fryxell, John	University of Guelph	2010-2011
Liebold, Andrew	USDA Forest Service	2010-2011

Litchman, Elena	Michigan State University	2010-2011
Pendall, Elise	University of Wyoming	2009-2011
Sabo, John	Arizona State University	2010-2011

Table 2. Ecolunch seminars at NCEAS

September 1, 2010 – May 31, 2011

FALL 2010

- September 9 **Sadie Ryan, NCEAS**
Satellites to parasites: assessing health in African park landscapes
- September 9 **Jennifer O'Leary, NCEAS**
Using science for management: development of an Adaptive Management Program in Kenya's marine protected areas
- September 16 **Jim Morris, University of South Carolina & Steve Crooks, Philip Williams & Assoc. Ltd.**
Bringing coastal wetlands to the carbon market
- September 23 **Todd Oakley, UCSB**
Biodiversity equals complexity...How do they originate?
- September 30 **Robin Waples, NOAA Fisheries Service**
Human-mediated evolution in an endangered species
- October 7 **Jennifer O'Leary, NCEAS**
Indirect effects of fishing on reef building taxa
- October 14 **Anthony Richardson & Elvira Poloczanska, CSIRO Marine and Atmospheric Research**
Marine climate change ecology
- October 21 **Karen Oberhauser, University of Minnesota**
Using citizen science data to understand monarch butterfly migration and population dynamics
- October 28 **Van Savage & Samraat Pawar, UCLA**
The effects of body size and temperature on consumer-resource interactions and population dynamics
- November 4 **Susan Harrison, University of California, Davis**
Partitioning diversity into alpha, beta and gamma: new insights from the original dataset (Whittaker 1960)

- November 11 **Veteran's Day. No EcoLunch**
- November 18 **Ruth Gates, NCEAS Sabbatical Fellow**
Environmental thresholds in reef building corals: implications of diversity and flexibility in coral/dinoflagellate endosymbioses
- November 25 **Thanksgiving. No EcoLunch**
- November 25 **Katie Longo, NCEAS**
Size-structured effects of fishing on marine fish diversity
- December 2 **Jim Bever, Indiana University**
Microbial mediation of plant community structure
- December 9
- Winter / Spring 2011**
- January 13 **Ben Bolker, McMaster University**
Estimating demographic parameters from samples of unmarked individuals
- January 20 **No Eco-Lunch**
David Tilman @ UCSB Campus
- January 27 **Ines Ibañez, University of Michigan**
Beyond their ranges, outside their niches: assessing the adaptation and migratory potential of temperate forests to global warming
- February 3 **Gary Mittelbach, NCEAS Sabatical Fellow & Kellogg Biological Station**
Teaching ecology
- February 10 **Patricia Balvanera, UNAM, Mexico**
Interdisciplinary studies on ecosystem services: building a conceptual framework
- February 17 **Kay Gross, NCEAS Sabbatical Fellow & Michigan State University**
What's so great about biological stations.. and KBS in particular?
- February 24 **Tim McClanahan, Wildlife Conservation Society**
Preparing for Climate Change: establishing priorities by integrating environmental, ecological and social variables
- March 3 **Josh Tewksbury, NCEAS Sabbatical Fellow & University of Washington**
Why are chilies hot? The evolution of a major spice
- March 10 **Jonathan Levine, UCSB**
The importance of niches for the maintenance of species diversity
- March 17 **Kirsten Rowell, University of Washington**

Turning off the Colorado tap – Establishing natural history baselines through geochemical logs of the Sea of Cortez

- March 24 **Andrew Gonzalez, McGill University**
Rescue, robots and ranges: experimental explorations of the eco-evolutionary response to environmental change
- March 31 **Christopher Boone, Arizona State University**
An expanded view of environmental justice
- April 7 **Mike McGinnis, Victoria University of Wellington, New Zealand**
Future ocean governance in [Aotearoa] New Zealand; linking science to policymaking
- April 13 **Egbert Leigh, Smithsonian Tropical Research Institute, Panama** *Wednesday!*
Economies and Ecosystems: useful analogies and crucial differences
- April 21 **Tom Miller, Rice University**
Sex, dispersal, and the spread of invasive species
- April 28 **Max Moritz, NCEAS Sabbatical Fellow & UC Berkeley**
By treating fire like an organism, what can we learn about global fire patterns, their controls, and their effects on biodiversity?
- May 5 **David Marsh, NCEAS Sabbatical Fellow & Washington & Lee University**
Patterns of plant invasion in National Wildlife Refuges: results and reflections from a 200-student undergraduate research project
- May 12 **Susan Mazer, UCSB**
*The joint evolution of mating system, phenology, physiology, and life history in farewell-to-spring (*Clarkia*: *Onagraceae*): will selfers fare well in a rapidly changing climate?*
- May 19 **Cherie Briggs, UCSB**
Investigating the dynamics of an emerging infectious disease of amphibians
- May 26 **Stacy Rebich Hespanha, UCSB**
Climate change in U.S. news media 1969-2009: Visualising themes and trends

Table 3. Number of NCEAS articles published in a selection of high-impact journals since the establishment of NCEAS in 1995, sorted by Impact Factor of the journal.

Journal Title	2008 Impact Factor	2009 Impact Factor	2010 Impact Factor	# NCEAS pubs as of June 17, 2010	# NCEAS pubs as of July 2011
Nature	31.434	34.48	36.101	37	42
Science	28.103	29.747	31.364	72	81
Ecology Letters	9.392	10.318	15.253	92	97
Trends in Ecology and Evolution	11.904	11.564	14.448	40	46
PLoS Biology	12.683	12.916	12.469	7	7
Annual Review of Ecology, Evolution, and Systematics	10.161	8.19	10.698	16	17
Proceedings of the National Academy of Sciences	9.38	9.432	9.771	53	60
Systematic Biology	7.833	8.48	9.532	2	2
Frontiers in Ecology and the Environment	5.605	6.922	8.82	24	26
Molecular Ecology	5.325	5.96	6.457	4	6
Global Change Biology	5.876	5.561	6.346	28	28
Ecological Monographs	5.238	4.862	5.938	9	10
Evolution	4.737	5.429	5.659	9	10
BioScience	4.058	4.064	5.51	36	38
Global Ecology and Biogeography	5.304	5.913	5.273	13	14
Global Biogeochemical Cycles	4.09	4.294	5.263	7	7
Journal of Ecology	4.262	4.69	5.26	7	7
Ecology	4.874	4.411	5.073	131	131
Proc. Royal Society of London Series B	4.248	5.117	5.064	30	37
Journal of Applied Ecology	4.56	4.197	4.97	8	8
Conservation Biology	4.705	4.666	4.894	40	44
American Naturalist	4.67	4.796	4.736	74	75

* over NCEAS lifetime; Does not include SEEK publications

Figure 1. Number of Proposals Submitted and Supported in total for each NSF proposal period since the establishment of NCEAS in 1995.

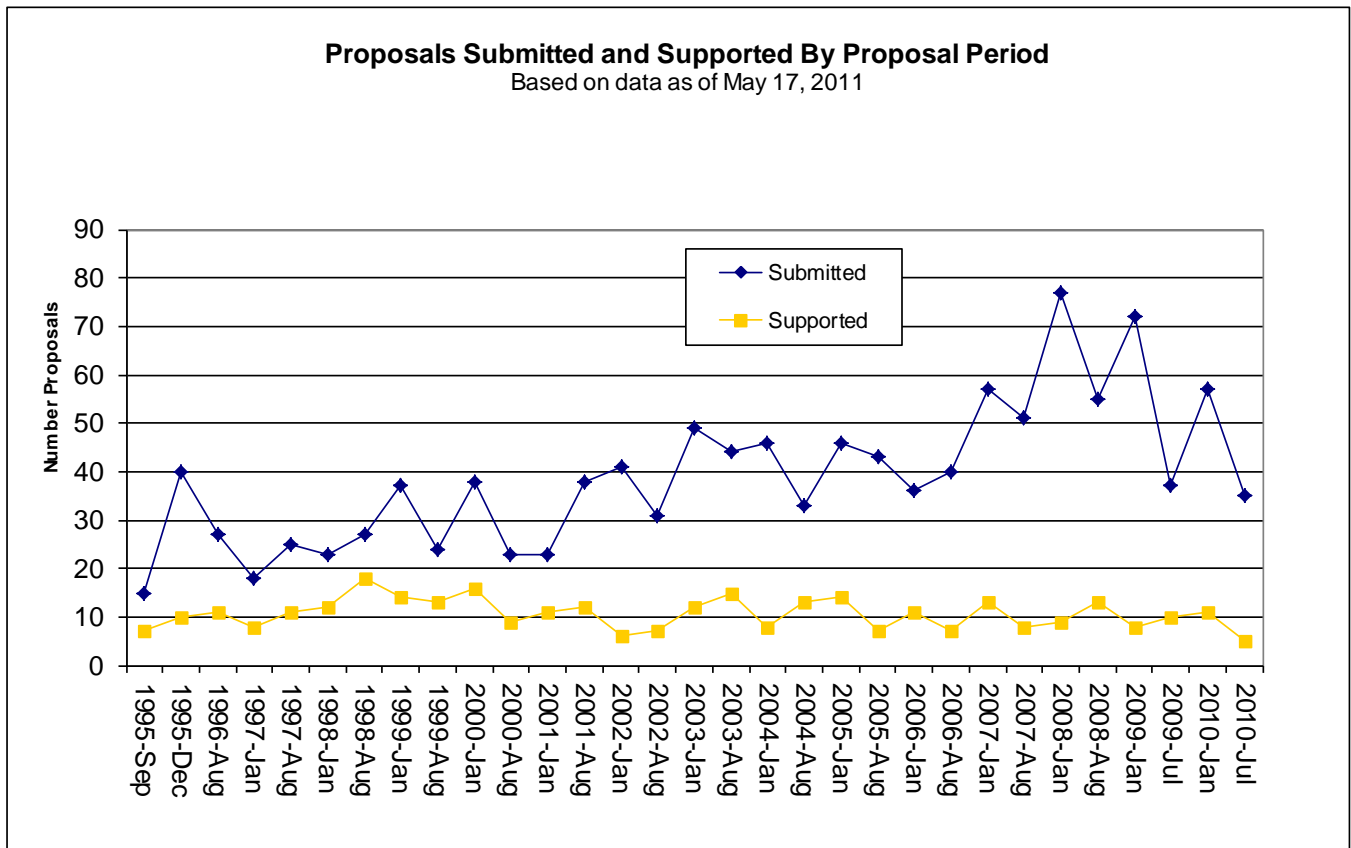


Figure 2. Proposals Submitted and Supported by Activity Type Since NCEAS Establishment

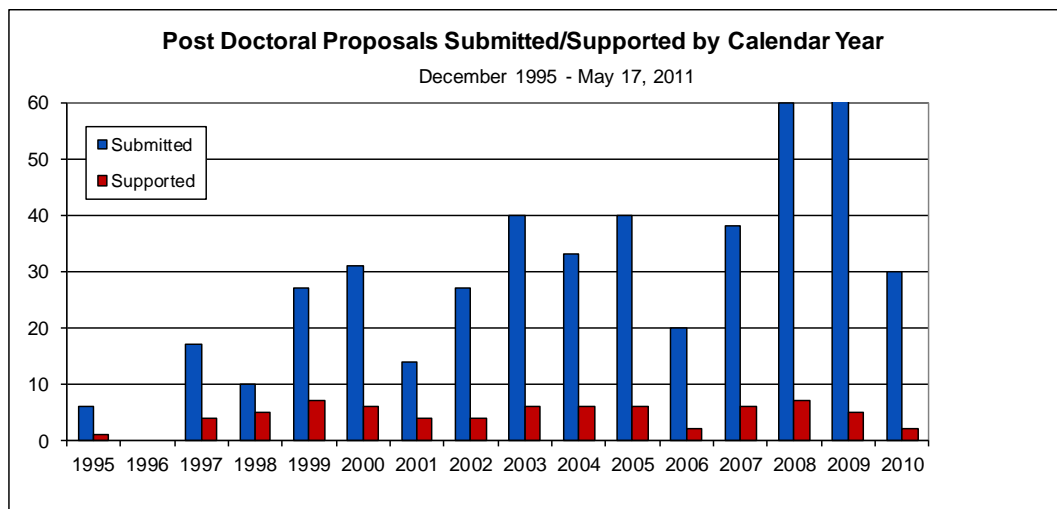
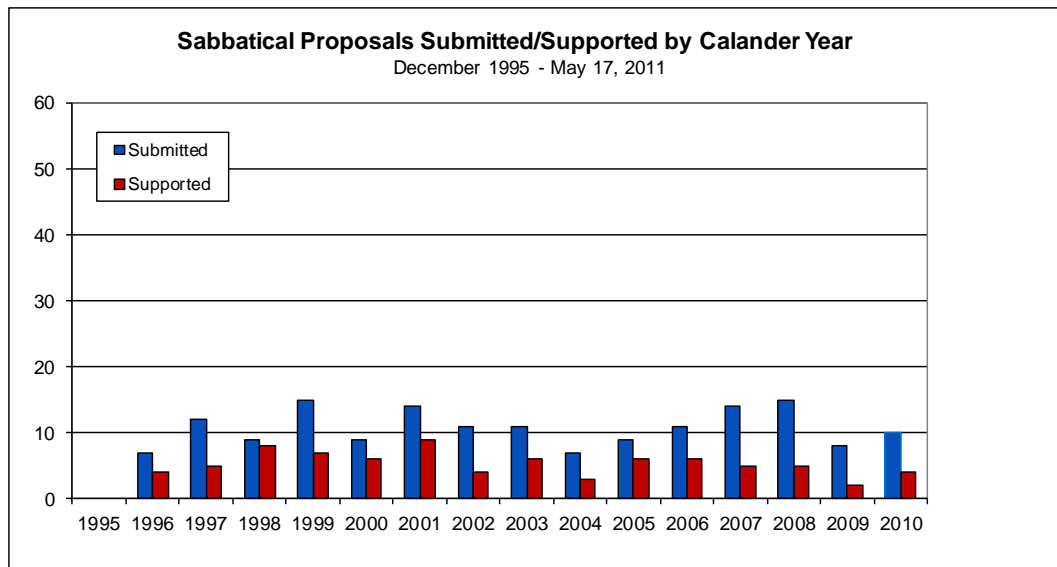
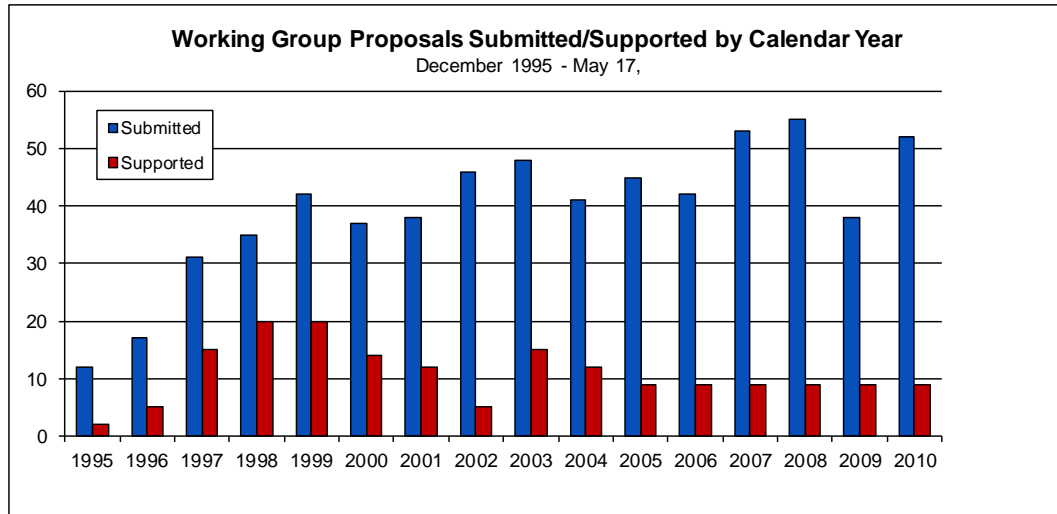
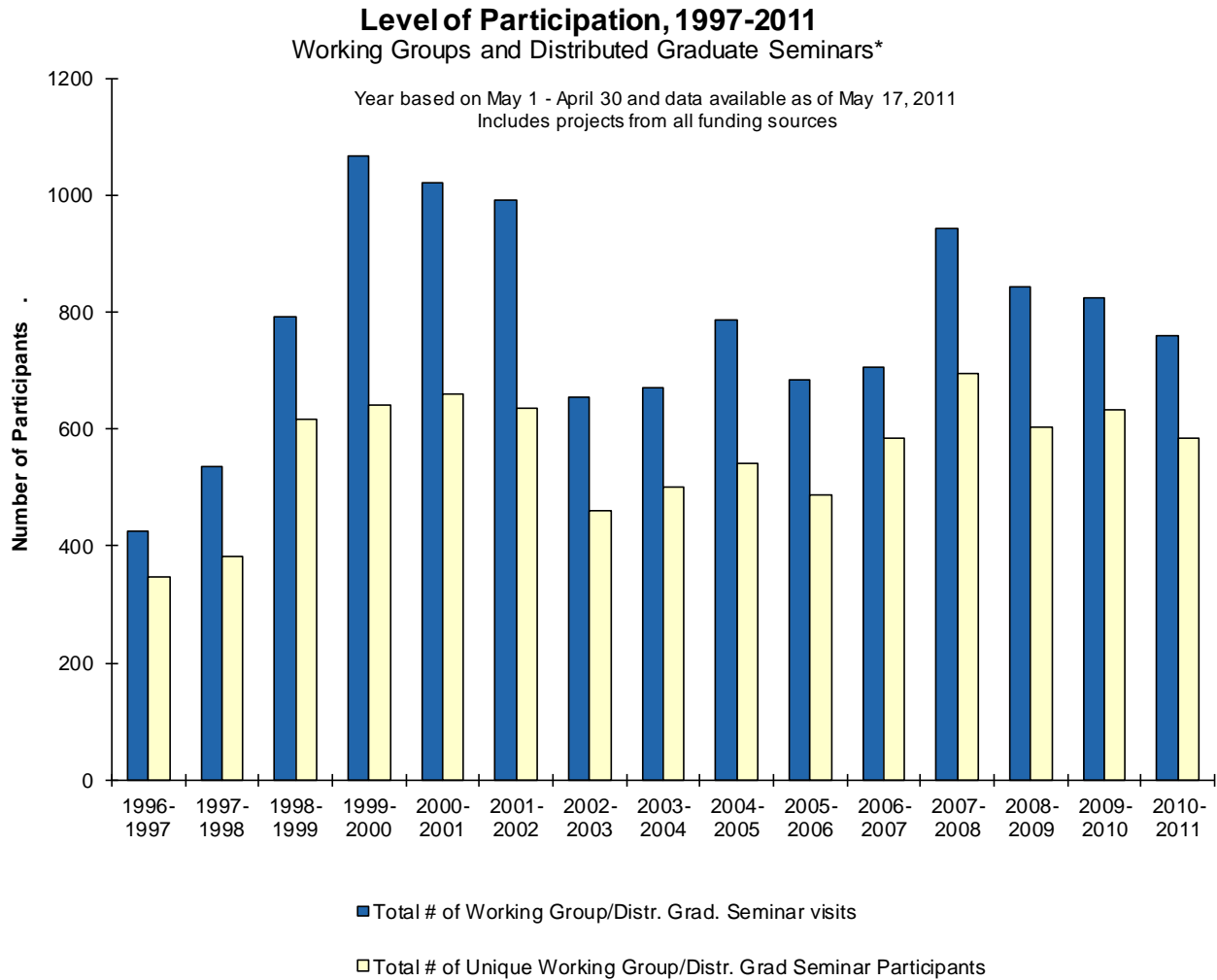


Figure 3. Number of Participants Since 1997, reported by the total number participants unique per year (i.e., excludes multiple visits within a year).



* Includes only those Distributed Graduate Seminar participants who visited NCEAS during the seminar.

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

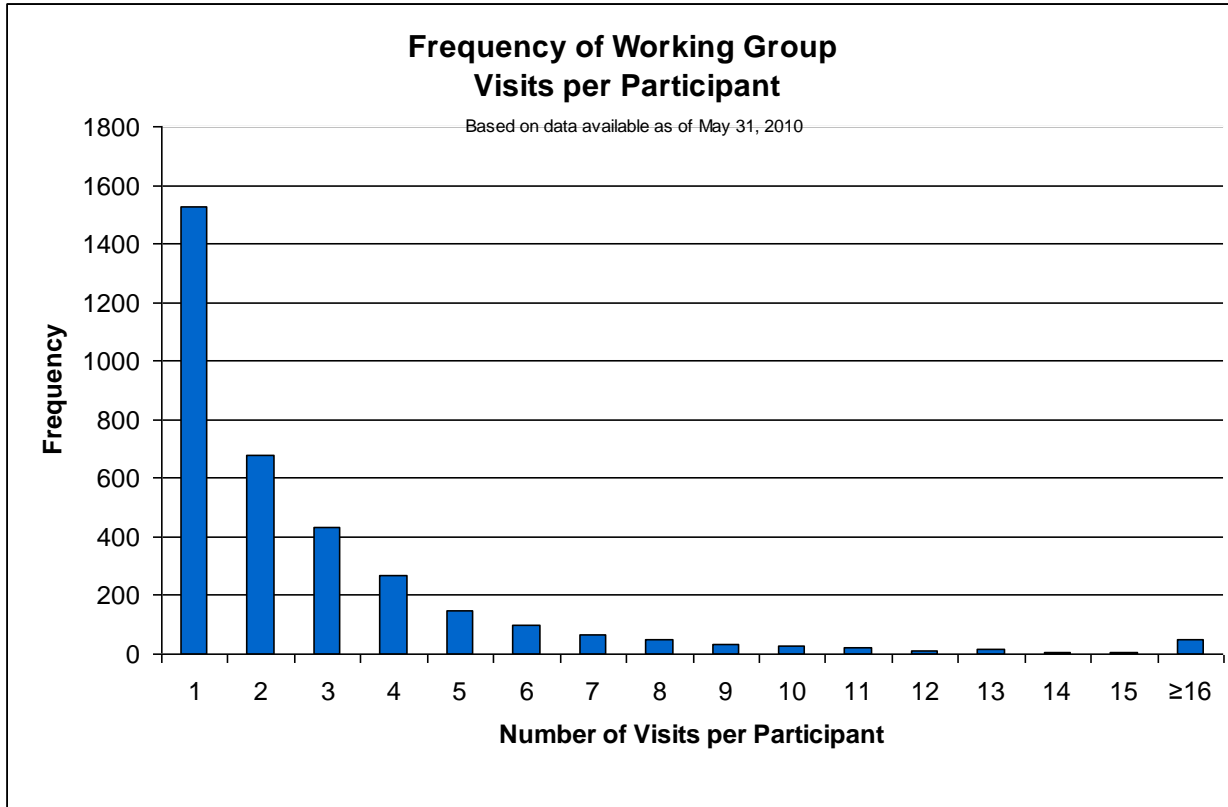


Figure 5. Percent Women Participating in Working Groups since establishment of NCEAS in 1995. For comparison, among ESA members who answered diversity survey questions for a 2006 report, the average female representation on faculty was 36% (30% women among senior professors, 44% women among junior professors).

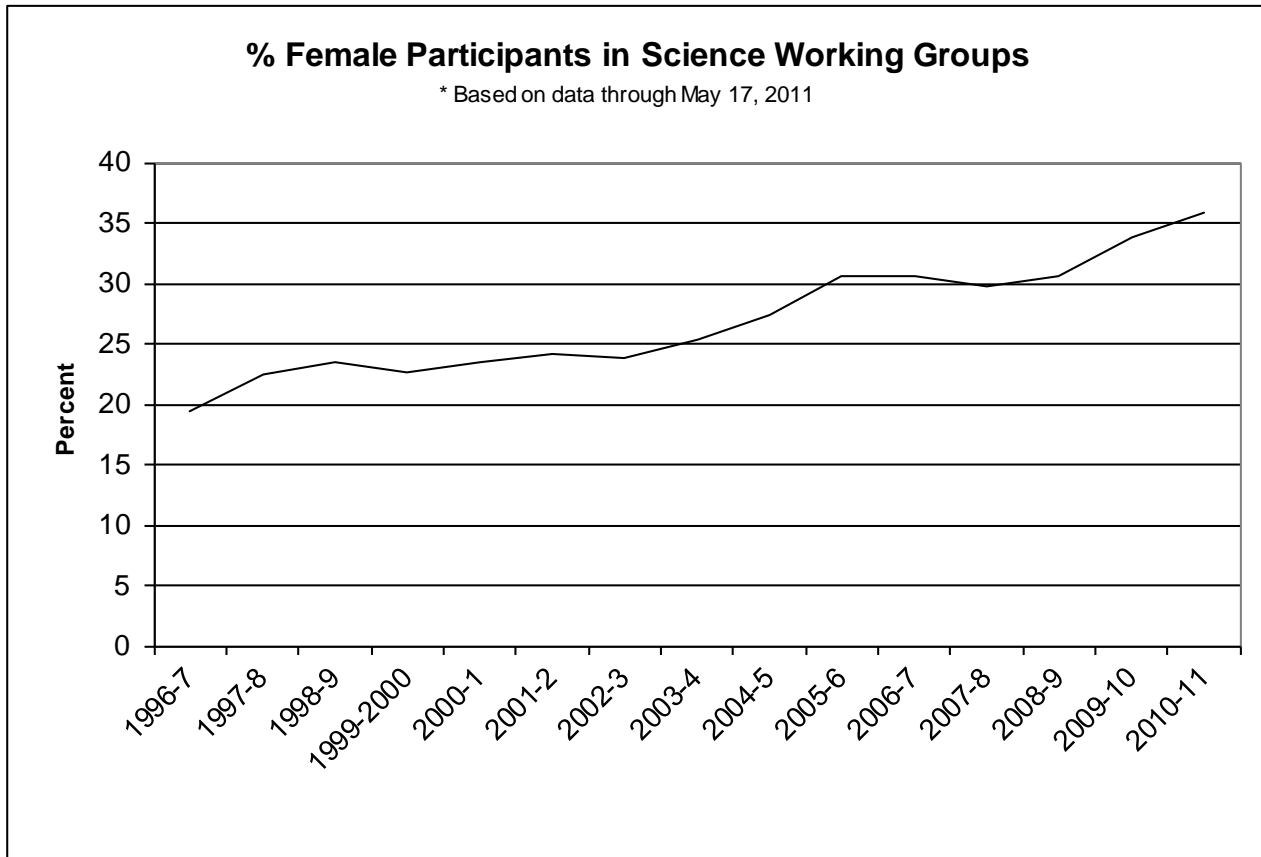


Figure 6. Percent women on the NCEAS Science Advisory Board

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).

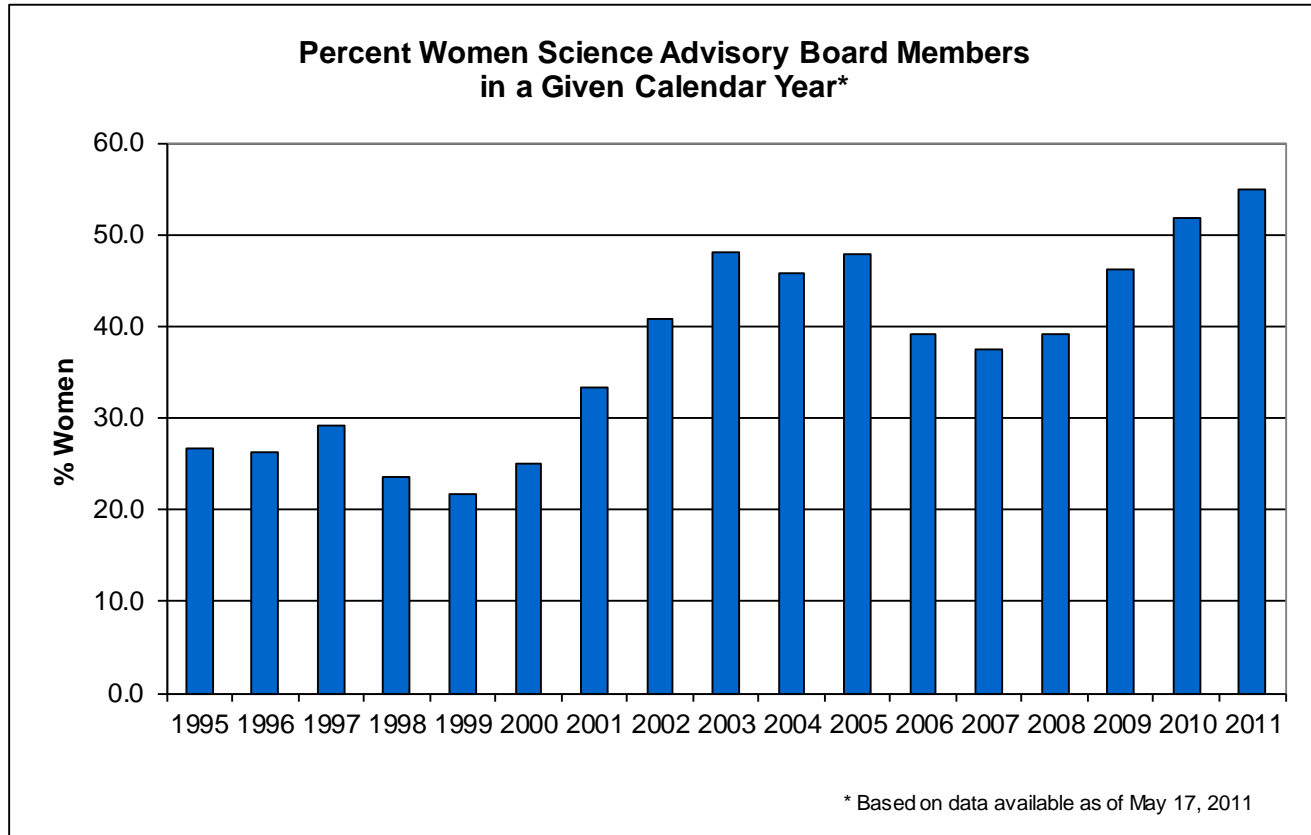


Figure 7. How did you hear about NCEAS?

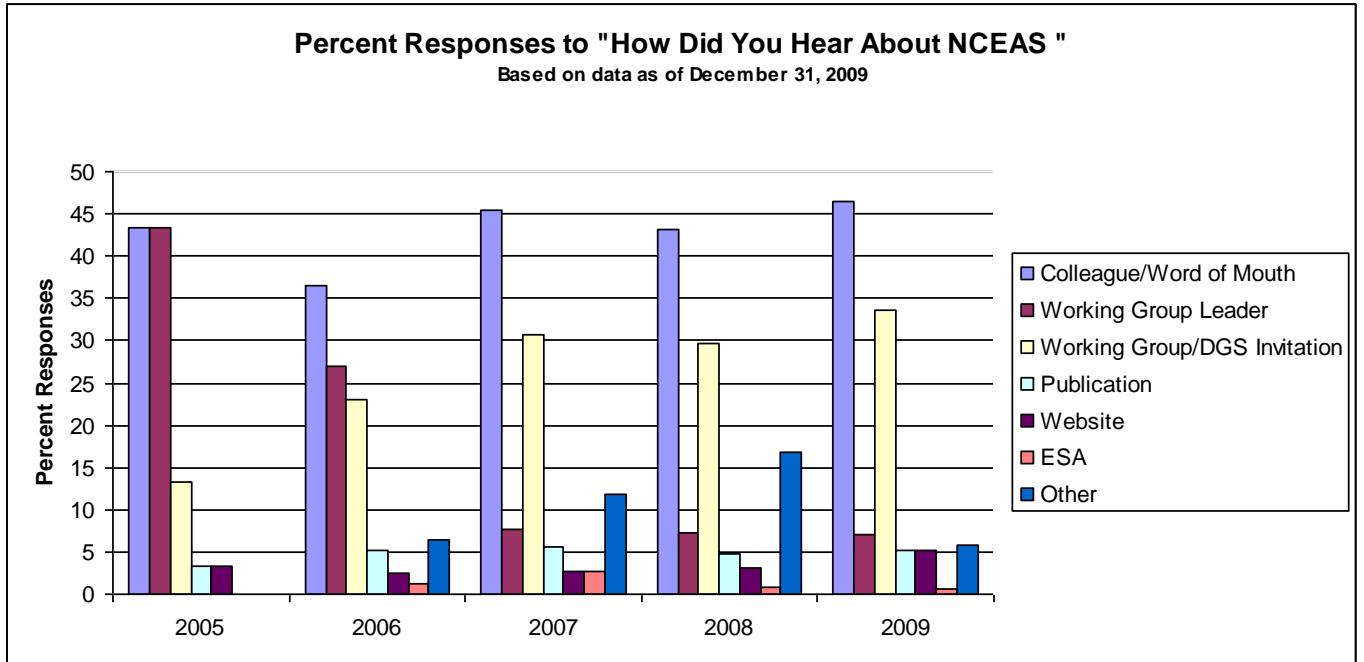


Figure 8. Number of publications reported from NCEAS activities since establishment in 1995, by publication date.

