National Center for Ecological Analysis and Synthesis

2008
Report to the National Science Foundation

NCEAS Annual report 2007-2008

1. Participants

William Murdoch, Interim Director PI

Stephanie Hampton, Deputy Director Co-PI

Mark Schildhauer, Director of Computing

Partner Organizations

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

The Gordon and Betty Moore Foundation has supported a diversity of NCEAS projects. An ongoing project identifying, mapping and comparing the importance of human impacts on the California Current marine ecosystem partners the University of California with non-governmental organizations and federal laboratories. In addition, a working group assembled by the Moore Foundation to examine the effects of climate change on wild Pacific salmon last year resulted in a larger project braiding together several Working Groups funded by the Moore Foundation, and supporting two postdoctoral associates at NCEAS. The Moore Foundation is funding a distributed graduate seminar that complements the NSF-funded working group 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 that will purchase a proprietary software package and move it into the public domain.

The Andrew W. Mellon Foundation has provided funding to support postdoctoral researchers and the implementation of ecoinformatics tools. During the past year, the Mellon Foundation provided support for a scientific programmer, a postdoctoral associate, and a metadata coordinator. With Mellon support, scientists from NCEAS and Kruger National Park in South Africa are participating in a collaborative effort to develop a unified framework for management and the dissemination of heterogeneous data and metadata from the Park.

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. The most recent stage of the project additionally involves a survey of conservation practitioners to examine modes of engagement that facilitate their involvement in EBM efforts.

The Nature Conservancy has provided funding for a postdoctoral researcher, graduate student and working groups assembled to examine the economic impacts of non-native forest pests and pathogens in North America.

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 recently funded a project designed to synthesize information related to the decline of endangered fishes in the San Francisco Bay Estuary.

NOAA Fisheries is supporting a working group to address the need for generalizable approaches to detecting species-level responses to large-scale environment management actions.

The California Coastal Conservancy has funded NCEAS and the California Ocean Protection Council to convene working groups to evaluate and synthesize methods for deriving the economic value of ecosystem services in coastal marine systems.

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 and gave students experience in Working Group collaborations.

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).

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

2. Activities and Findings

NCEAS Director Transition

Jim Reichman, who became Director of NCEAS in 1996, retired in December 2007. Reichman established NCEAS' prominence internationally as a center for seminal, interdisciplinary research. Among his many awards, Jim received the Distinguished Service Citation from the Ecological Society of America for "long and distinguished service to ESA, to the scientific community, and to the larger purpose of ecology in the public welfare." Reichman also received the C. Hart Merriam Award, the premier

research award of the American Society of Mammalogists. The citation that accompanied the award stated, “Just for his role at NCEAS, Jim would have to merit recognition as one of the most influential living ecologists."

NCEAS was fortunate to have William Murdoch, founding Director or NCEAS, step in as Interim Director. Murdoch is the Charles A Storke II Professor of Ecology in the Department of Ecology, Evolution, and Marine Biology at UC Santa Barbara. Murdoch has many honors and special distinctions including a Guggenheim Fellowship; the President's Award, given by the American Society of Naturalists; the MacArthur Award, given by the Ecological Society of America; and the Huffaker Medal in Population Ecology, given by UC Berkeley. He was elected to the American Academy of Arts and Sciences in 2002 and during this reporting period at NCEAS in 2008, he was elected to the National Academy of Sciences.

Science Advisory Board

The number of proposals submitted to NCEAS for review by the Science Advisory Board continues to grow (Figures 1, 2).

For our January 2008 deadline, we received a record number of proposals: 77 total proposals. The postdoctoral fellowship proposals were responsible for the greatest proportion of this increase; we received proposals for 39 postdoctoral fellowships, 9 sabbatical fellowships, 28 working groups, and 1 distributed graduate seminar. The Science Advisory Board met March 5-6, 2008 to review these proposals; based on their recommendations, decisions were made to support 3 postdoctoral fellowships, 2 sabbatical fellowships, 5 working groups, and no graduate seminars.

For our July 2008 deadline, we received 55 proposals: 21 postdoctoral fellowships, 6 sabbatical fellowships, 27 working groups, and 1 distributed graduate seminar. The Science Advisory Board will meet September 3-4, 2008 to review and recommend proposals.

A list of Science Advisory Board members is available on the NCEAS web site: http://www.nceas.ucsb.edu/sab/current.

Major Research Activities

Since the beginning of the reporting period, 1 October 2007, NCEAS has supported 13 sabbatical visitors and 22 total postdoctoral researchers. A list of sabbatical and postdoctoral researchers, including descriptions of their projects is provided below. During the past year, NCEAS postdoctoral scientists have accepted faculty or other career positions at The Nature Conservancy; University of North Carolina, Chapel Hill; Scripps Institute of Oceanography; University of California, San Diego; University of

Connecticut; and University of California, Davis. Two postdoctoral associates took new postdoctoral positions at the University of Georgia and Oregon State University.

Since the beginning of the reporting period, 781 different scientists participated in activities at NCEAS. Of these participants, 96 were either residents of NCEAS or scientists at UCSB, and 17.3% were visiting from foreign institutions. A total of 43 Working Groups and 4 Distributed Graduate Seminars have been active in the reporting period, and NCEAS has hosted meetings for 6 different collaborative groups. Eight Center Associates and at least 7 Scientific Visitors have been hosted at NCEAS in this reporting period. These activities are listed below.

Sabbatical Fellows

Atkinson, David
1 Oct 07 - 30 Jun 08
Towards a new metabolic theory of ecology

The hugely influential Metabolic Theory of Ecology (MTE) has been called “ecology’s big hot idea”. It is based on how body size and temperature set the pace of life, hence determine the speed and duration of many biological and ecological processes. However, substantial and systematic deviations from the predictions of the MTE have prompted me to develop an alternative theory, and construct databases with data from diverse organisms ranging from microbes to mammals, to test my predictions and those of the MTE. Over a period of 9 months working and interacting with colleagues at NCEAS, I would use these databases to test assumptions and predictions of metabolic theories of ecology, including: (i) how body or key organ surface areas affect the size-scaling of oxygen consumption; (ii) how adaptation affects the response of the rate of increase of populations to temperature; and (iii) how ecosystem photosynthesis/respiration balance is affected by temperature.

Brown, James
1 Jul 07 - 31 Dec 07
The Scale of Life

Most of my research concerns the related topics of biological scaling and metabolic theory. For 12 years I have been collaborating with physicist Geoff West and many others to understand how the metabolic rate of organisms scales with body size and temperature, and how these fundamental controls on metabolism affect the utilization and allocation of energy and materials at all levels of biological organization – from molecules and cells to ecosystems and the biosphere. The goal of my sabbatical at NCEAS is to write a book, co-authored with West, that summarizes and synthesizes this work.

Condit, Richard
9 Dec 05 - 14 Mar 08
Geographic distribution of neotropical tree species: Pattern and process

I propose a sabbatical at NCEAS to study geographic distributions of tree species in Central and South America. My goal is to gain understanding of the factors that limit tree ranges in neotropical forests, both at local scales (hundreds of meters across topographic or moisture gradients) and regional scales (hundreds of kilometers across climatic gradients). I have assembled extensive and precise datasets from tree plots at both scales in Panama and Ecuador, and I will develop novel population models that describe key biological processes: dispersal, reproduction, and survival of individual trees across habitats. The simulations offer predictions on spatial patterns of individuals relative to topography and habitat, and these will be compared with observed spatial patterns to

determine which population processes best account for the data. Neotropical forests hold a substantial share of the world's plant diversity, but our knowledge about species' ranges there is crude. Understanding the processes limiting ranges at local and regional scales is necessary to accurately predict future impact of deforestation and climate change.

Fagan, William
18 Aug 08 - 26 Sep 08
Dendritic landscapes: Exploring connectivity and biodiversity in an alternative geometry

As an NCEAS Sabbatical Fellow, I propose to explore the implications of dendritic (branching) geometries, such as those found in river networks and elsewhere in nature, for ecological complexity through the development of theoretical models.

Kodric Brown, Astrid
1 Jul 07 - 31 Dec 07
The role of acoustic communication in premating isolation in pupfish

Ecological behavior: The evolution of mate recognition systems and their role in speciation, with an emphasis on freshwater fish; scaling of secondary sexual traits with body size and age of reproduction; community structure and conservation of fish in deserts.

Leavitt, Peter
1 Feb 07 - 31 Dec 07
Ecological variability of lakes in time: Integrated insights from paleolimnology and long term ecological research

The intrinsic temporal variability of an ecological system is often assumed to be constant during the period of study, yet increasingly long-term ecological research (LTER) and paleoecological analyses reveal that this variability is itself variable (e.g, paradox of enrichment). While in principle the sources, transmission and consequences of temporal variability can be quantified using fossil, LTER or simulation approaches, to date few studies have explicitly integrated insights from these complementary strategies. Consequently, this project seeks funding to address three goals: a) calibrate high-resolution paleoecological records with monitoring time series to quantify the degree to which fossil records accurately record observed ecological variability; b) test the hypothesis that the disturbance of ecosystems by increasing mass or energy transfer causes increased temporal variability of lake ecosystems, and; c) develop a novel model that links modern ecological processes in lakes with the formation of sedimentary records. Taken together, these three projects are intended to facilitate the formal integration of paleoecology and long-term ecological research.

Lockwood, Rowan
1 Oct 07 - 31May 2008
Is rarity linked to extinction in the fossil record? Synthesizing data from background and mass extinctions in U.S. Coastal Plain mollusks

Ecological studies suggest that rare taxa are more likely to go extinct than abundant ones, but the relationship between rarity and extinction in the fossil record has received surprisingly little attention. The purpose of this research is to examine the link between rarity (defined here to include mean abundance, spatial and temporal variability in abundance, geographic range, and habitat specificity) and extinction during both background and mass extinction intervals in the Cenozoic record of U.S. Coastal Plain mollusks. The questions I will address include: (1) Are rare taxa more likely to go extinct? (2) Does the relationship between rarity and extinction differ in mass versus background extinction intervals? and (3) Does selectivity differ according to metric of rarity? To accomplish this, I will synthesize previously processed, but unpublished, abundance, habitat, and spatial occurrence data collected by myself and colleagues, along with substantial data from the paleontological literature. This research represents one of the first attempts to explore the relationship between fossil abundance and extinction and will contribute substantially to our understanding of abundance and diversity in the Cenozoic of the U.S. Coastal Plain.

Martinez, Neo
4 Dec 06 - 3 Dec 07
Synthesizing and analyzing complex ecological networks with ecoinformatics

As research on food webs and other complex ecological networks advance, the difficulty of accessing increasingly abundant information about these networks forms a greater impediment to understanding their structure and dynamics. Beyond access, there is also a greater need to increase the ease and sophistication of analyzing these networks once the information is obtained. Fortunately, the advances in general network science, especially those in biological networks, and associated informatics provide many rich opportunities to increase our ability to synthesize and analyze information describing ecological networks. During an NCEAS sabbatical, I will focus on using these opportunities, especially ecoinformatic activities based at NCEAS, to increase data availability and analytical tools available for the study of ecological networks. While increasing scientists' ability to conduct such research, I will also use these enhanced abilities to study ecological networks with an emphasis on their structural evolution over deep time and the ecosystem consequences of species loss and invasions. These activities are designed to answer my central research questions, "How do ecological networks govern the function of complex ecosystems?"

Schulz, Kimberly

1 Aug 07 - 31 Jul 08
Food quality effects on ecological efficiency at multiple scales in aquatic systems

I am interested in how the biochemical composition of food ('food quality') affects the performance and fitness of consumers, and how these nutritional effects on individuals translate to higher ecological levels such as population dynamics, community composition, and trophic transfer efficiency. Often, work on different aspects of food quality (e.g., nutrient content -- 'stoichiometry', essential fatty acid composition, protein content) has been done in disparate disciplines (e.g., limnology and aquaculture). I propose a sabbatical leave at NCEAS to (1) compile and synthesize data on the effects of several food quality parameters on different consumers in aquatic systems, and then to (2) compare predictions from these individual- level analyses to patterns of the consumers' abundance and distribution, to determine how important nutritional constraints may be in nature.

Swaddle, John
1 Oct 07 - 31 May 08
Testing the importance of ecological theory in predicting human disease: Does avian diversity and community structure predict the incidence of human West Nile virus infection?

West Nile virus affects bird and mammal populations worldwide and is recognized as an emerging disease of substantial public health, veterinary, and conservation concern. The virus primarily infects and replicates in birds but also affects “unintended” hosts, such as humans, when local bird communities have high levels of infection. Some bird species are much more likely to harbor the virus than others, and ecological theory predicts that the structure of local bird communities affects the amount of virus in the area and the chances of humans contracting the disease. In particular, as the diversity of local bird populations increases, the disease should be diluted among less-competent hosts and human disease incidence is predicted to decrease. Therefore, in areas with greater avian diversity, human incidence of West Nile should be lower. I will test this ecological prediction by comparing incidence of human West Nile infection with measures of avian community structure and diversity across the Eastern and Central US states from 2002-05. My own pilot data support these predictions and suggest that the completed project can be used to better predict the risk of West Nile to humans and can inform the design of more effective public health initiatives.

Tilman, David
1 Jan 08 - 30 Apr 08
The causes of biodiversity and the threats to its persistence

My NCEAS research focuses on two markedly different aspects of biodiversity. The first are the underlying causes of earth’s amazing biodiversity. The tree of life, which now contains on the order of 10 million species, was founded about 3 billion years ago by a

single ancestral species. The patterning of life's subsequent diversification has the potential to provide profound insights into the forces that shaped the life histories, morphologies, physiologies, behaviors and ecologies of both extant and extinct species. I will focus on the implications of one aspect of this patterning – the near-universal occurrence of competitive coexistence among competing species for at least the past 60 million years. When viewed in the light of current competition theory, this observation suggests that all of life has been bound to a universal competitive tradeoff surface. I will dedicate much of time at NCEAS reviewing and synthesizing the relevant paleontological and current ecological literature and related competition theory.

The second biodiversity issue focuses on the threats to biodiversity posed by land conversion and climate change. The 50% increase in global human population and the 140% increase in per capita global consumption projected for the coming 50 years have the potential to double global food and energy use. If cereal crop yields are unable to double in this period, as seems likely, the unmet demand for food is likely to be met by converting native forest and grassland to agriculture. Similarly, demand for biomass for production of biofuels could also greatly increase the rate of deforestation, and, if done poorly, might not provide any greenhouse gas emission benefit but rather lead to accelerated emissions. My goal at NCEAS is to compile and analyze the global data sets needed to better forecast the potential magnitudes of such food and biofuel effects on habitat destruction, greenhouse gas release and loss of biodiversity, and to propose solutions to this problem.

Vieglais, David
06 Aug 2007 - 5 Aug 08
Evaluating the role of current semantic web technologies for improving discovery, accessibility and interoperability of ecological and environmental data

The Semantic Web offers the potential for previously unrealized level of data integration for scientists working on complex, interrelated data sets such as are commonly found in biodiversity and ecological studies. The primary goal of this internship is to evaluate the practicality of using semantic web software tools to augment existing metadata catalog applications such as Metacat, and data access environments such as EarthGrid (formerly the EcoGrid of the SEEK project) being used by ecologists and environmental scientists. The practicality of providing a desktop or workgroup level semantic web node for indexing and sharing of researcher data using standard protocols such as SPARQL, the Open Archives protocol for metadata harvesting, and LSIDs (Life Sciences Identifiers) will also be examined.

Weiner, Jacob
1 Sep 07 - 31 Aug 08
The allometry of reproduction in plant populations

Growth and reproduction are two of the most fundamental processes for plants. After a plant produces biomass, it allocates this biomass to different structures and functions, among them reproduction. Most allocation patterns can be better understood in terms of size than in terms of time, so an allometric approach to allocation is needed. While there has been much recent research on broad allometric scaling relationships among species, the allometry of reproduction within populations is a very different question, which has not been given sufficient attention. The objective of the proposed research is to gather and analyze as much relevant data as possible on the allometry of reproductive allocation within plant populations to address the following questions: (1) Is there a general pattern of size-dependent reproductive output within plant species? (2) Is there a tradeoff between the minimum size for reproduction and allocation to reproduction above that minimum size? (3) When are size-fecundity relationships plastic, and when is reproductive output solely a function of size and fixed allometric allocation patterns? These questions are fundamental to plant population ecology and evolution, and for optimizing the use of resources in plant production systems.

Postdoctoral Fellows

Allen, Andrew
1-Mar-05 - 28-Feb-08
The role of temperature in the origin and maintenance of biodiversity

This proposal will support the efforts of an interdisciplinary group of ecologists, physicists and mathematicians to unify three areas of theoretical ecology that have advanced rapidly over the past decade: metabolic scaling theory, neutral biodiversity theory, and spatial macroecology theory. These theories have all yielded quantitative predictions that show striking agreement with patterns observed in nature. Furthermore, all three theories derive predictions based on the same postulate that biodiversity is largely controlled by universal principles and processes that operate at the level of the individual organism, and that therefore transcend species identity. Given this fundamental point of contact among theories, and that each theory focuses on a different axis of ecological complexity (energy, stochasticity, space), considerable progress could be achieved by their integration. This working group will work towards unifying metabolic scaling theory, neutral biodiversity theory, and spatial macroecology. Our goal will not be to summarize research to date, but rather to cross disciplinary boundaries and specializations to develop a prediction-rich synthetic framework for the evolutionary and ecological assembly of biodiversity across multiple spatial and temporal scales. We anticipate a vigorous and systematic attack on the problem by researchers committed to improving their theories by confronting them with data.

Allesina, Stefano
1-Sep-07 - 31-Aug-09

Reverse engineering of ecological networks: From the disassembly to the construction of robust networks

Molecular biologists study how a gene works in an organism by switching it off, engineers try to replicate the functioning of a device by taking it apart and studying how its components are wired together, archaeologists reconstruct ancient machinery by examining fragments buried for centuries: these are all examples of reverse engineering. This approach is usually precluded to ecologists given the potentially dramatic consequences of disturbing ecosystems, except in mathematical models and 'in silico' simulations of scenarios. I intend to study the patterns of secondary extinctions in ecological networks using mathematical and simulation models. In particular, I will try to identify which building blocks or network motifs confer robustness to ecological systems. The research on networks robustness has been so far dominated by the study of 'hubs' or most connected species, and has typically included only static analyses. I will focus not only on predator-prey interactions, but also on other major constituents of ecological networks, such as parasitism,
pollination and mutualism in a dynamic context, with the ultimate goal of understanding how to assemble robust networks. The 'hubs' based approach will be substituted by a functional approach in which the relative importance of the components of a network is explicitly evaluated.

Baskett, Marissa
13-Sep-06 - 30-Jun-08
Can coral reefs survive climate change?

Climate change threatens the persistence of coral reef ecosystems in the near future through the increase in mass coral bleaching events associated with the increased frequency and magnitude of temperature extremes. However, corals and their symbiotic algae may have the potential to respond to climate change through community shifts, physiological acclimation, and genetic adaptation. I will use analytical models and computer simulations to explore (1) the potential for coral communities to respond to a rapidly changing climate, (2) the potential indicators of coral communities most likely to survive future climate change, and (3) the interaction between additional anthropogenic impacts and coral responses to climate change. These models will further the understanding of the interaction between evolutionary and ecological processes, inform conservation management decisions, and create a theoretical framework for synthesizing coral bleaching data.

Broitman, Bernardo – *supported by* The David and Lucile Packard Foundation
15-Jan-06 - 16-Nov-08
Bottom-up ecosystem-based management of coastal systems: Social drivers of ecological and economic factors in EBM)

Ecosystem-based management call for the adoption of management practices that explicitly account for the cross-linkages between ecological, economic and social components. I propose an approach to determine the goals of EBM in coastal temperate oceans through a literature review of initiatives where a social process has advanced research priorities for scientists and economists. By examining and compiling these research priorities I will to compile large datasets of the environmental, ecological and economic variables singled out by the social process. Going one step further, I will generate uncertainty estimates through simulations that I will incorporate into simple bioeconomic models. This formal approach will allow for a clearer definition and examination of EBM in coastal systems.

Buckley, Lauren
7-Nov-07 - 6-Nov-08
Distribution dynamics in changing environments: Geographic trait variation and the potential for future adaptation

Mechanistic models that link individual energetics and population dynamics offer improved predictions of species' distribution dynamics in changing environments. Including population dynamics enables addressing the distribution implications of physiological adaptation (both plastic and evolutionary), species interactions, and dispersal limitations. I propose to first generalize an energetic optimization model across foraging strategies for ectothermic vertebrates. I will then examine current geographic trait variation for North American lizards to understand the potential for adaptation to moderate climate induced range shifts. This analysis will enable using performance optimization models and genetic models of thermal evolution to predict potential thermal adaptation following climate change. The potential for species to respond to changing climates through adaptation will be an important and little understood determinant of the biodiversity implications of environmental change.

Budden, Amber
1-May-07 - 30-Apr-09
Occurrence of publication bias in ecology

Metrics associated with publications such as citation rates and impact factors are widely used in the evaluation of academics, departments and institutions. However, factors other than the intrinsic quality of a manuscript can affect its publication and dissemination. Publication bias can be perceived as the extent to which the relative perceived merit of work predicts the relative actual merit of the work and such biases can affect both the publications available to the community, funding allocation, and potentially the career trajectories of researchers. General biases previously detected include the file drawer problem, over-interpretation of data, dissemination bias, institutional or individual status bias, and gender bias. However, the degree or prevalence of these factors has not been extensively explored within the discipline of ecology. Using survey data from multiple sources, online databases and bibliometric methods I aim to evaluate the utility of current

metrics, explore the incidence of biases associated with publication and dissemination of material and determine the potential impact of publication bias with respect to the composition of the working and publishing ecological community. I also intend to develop and advocate for best practices to be used by journals, editors, reviewers and authors. For example, preliminary research has demonstrated that the process of double-blind review may serve to reduce non-conscious bias against female authors. This review method is not widely practiced in ecology and I am currently examining community response to double-blind review and evaluating both the benefits and challenges associated with implementing double-blind review practices.

Cadotte, Marc
15 Jun 2007 - 14-Jun-09
Using phylogenetic information to predict the relative importance of equalizing versus stabilizing mechanisms on species coexistence

Understanding species coexistence is crucial to understanding the processes that structure communities. Niche mechanisms that promote coexistence result from trait differences that reduce niche overlap and thus reduce competitive interactions allowing stable coexistence. The relative importance of niche differentiation versus neutral mechanisms for driving community patterns is hotly debated in ecology. It is likely that in natural communities, coexistence mechanisms include both processes, which are determined by how similar or different two species are to one another. The degree of differentiation, or perhaps evolutionary distance, may be a surrogate to understand which species can coexist and under what mechanism. In this research project I will be analyzing published competition experiments to see if phylogenetic relatedness can predict which species are able to coexist and the mechanism of coexistence.

Cleland, Elsa
1 Aug 05 – 30 Jun 08
The response of ecological communities to nutrient enrichment: Utilizing meta-analysis and structural equation modeling to disentangle the influences of functional traits and environmental context

Ecologists have been fascinated by the relationship between plant species diversity and ecosystem productivity for many years. It is becoming increasingly important to understand this relationship as anthropogenic environmental changes such as nitrogen deposition fundamentally alter natural systems. At local scales, experimental research shows that species diversity tends to decline as resource availability increases. To date, diversity responses to nutrient enrichment have been quantified almost entirely by changes in taxonomic richness. Thus, we know little about the characteristics ¿ or functional traits ¿ of those species which decline. This research will seek to determine whether plant functional traits can predict shifts in species composition, species richness, and productivity in response to nutrient enrichment. This focus on functional traits will

facilitate comparison across ecosystem types, and generalization regarding species losses and their consequences in response to environmental change.

Davies, T. Jonathan
1-Feb-07 - 31-Jan-09
Coexistence, competition, and character evolution in carnivores and primates

Explaining species coexistence is one of the principal goals of ecology. Competition is thought to inhibit coexistence among species occupying the same ecological niche. Hence species sharing similar ecological traits are predicted to overlap less in their geographical range. However, the lack of robust null models and the scarcity of appropriate data have meant that the importance of competition in structuring ecological communities has proven hard to evaluate and remains controversial. In addition, other factors may dominate patterns of species overlap and trait similarity; for example, sympatric species might be similar due to convergent evolution as a consequence of sharing a similar environment or they may have only recently diverged, and therefore be similar by descent. Phylogenetic approaches enable the confounding influence of evolutionary history to be controlled for, and provide a simple null model for evaluating the relationship between coexistence and character divergence. This project uses new species-level phylogenetic trees along with extensive databases on species traits and distributions within mammals, to perform global analyses of species overlap and divergence across multiple carnivore and primate communities. Specifically, this project aims to evaluate whether divergence in ecological traits facilitates coexistence in these clades.

Drury, Kevin – *supported by The Andrew W. Mellon Foundation*
1-Aug-07 - 30-Sep-09
Data management and analysis tools supporting adaptive management in South African parks

Kruger National Park is faced with a challenge common to many research stations where dozens of loosely coordinated monitoring and experimental projects are underway at any time. The main challenge is how to effectively collect, present, and preserve this highly variable collection of scientific data for collaborative and integrative analyses. The Andrew W. Mellon Foundation has supported a partnership between Kruger National Park and the National Center for Ecological Analysis and Synthesis (NCEAS) over the past two years to address this informatics challenge by implementing and refining an approach for archiving KNP's scientific field data using methods developed and tested by NCEAS, the Long Term Ecological Research program, and other partners. The successful deployment of a metadata archive (Metacat) at KNP, along with two successful training workshops in its use, have validated the power and viability of this approach.

Kruger National Park is now part of a global "Knowledge Network for Biocomplexity" (KNB), which is based on the use of metadata standards in ecology, particularly

Ecological Metadata Language, or "EML" documents that are stored in Metacat database servers. The EML metadata specification is also being used by NCEAS, LTER, the Organization of Biological Field Stations, and the Ecological Society of America, all of which are examples of other major ecological research institutions that are committed to using a common metadata standard for documenting their data. At Kruger, staff and scientists have been trained to use the Morpho metadata and data management application to document their data holdings and upload these to the Kruger data repository (Metacat).
This project will:
A) expand-this data system to the broader-collection of parks and research stations in South Africa, and
B) create the additional analysis infrastructure needed to effectively use these data in adaptive management approaches in the parks.

Hurlbert, Allen
1-Sep-05 – 31-Aug-08
Exploring the Swiss Cheese Effect: The causes and consequences of patchily occupied species ranges

Although the geographic range is a fundamental unit of analysis for many macroecological and biogeographical studies, as a representation of the spatial distribution of individuals it is clearly a scale-dependent abstraction. As any amateur naturalist realizes, a species is not guaranteed to be present at every point within the range delimited by a field guide. The degree to which a species is predictably encountered within its range varies tremendously across species. Using paired datasets on species ranges and survey data for birds, butterflies, and small mammals, I plan to quantify the variation in range occupancy across species, and identify the primary species level traits (e.g. body size, population density, habitat specialization) that explain this variation. The porous nature of species¿ ranges also has consequences for community level analyses. The overlaying of range maps leads to an overestimate of species richness for local communities, as well as to the perceived coexistence of species that may not actually coexist at a biologically meaningful spatial scale. I also propose to examine the degree to which local community composition as identified by surveys represents a non-random subset of the regional pool (as defined by range maps) using simulation analyses.

Kappel, Carrie – *supported by The Packard Foundation*
25-Jan-06 – 07-Feb-09
A synthetic approach to the science of ecosystem-based management of coastal marine ecosystems (EBM)

We will develop a modeling and data integration framework for EBM and apply that framework to a case study from coastal California. By bringing experts in the modeling of natural and human systems together with policy specialists, the working group will develop a policy relevant modeling approach that includes the dynamics of social,

biophysical and economic components of the ecosystem and critical feedbacks among them, and an explicit risk assessment component. Then, in collaboration with scientists and managers knowledgeable about the coastal California system, we will develop a detailed case study using this modeling approach as a basis. Key questions about how to cope with uncertainty, how to define ecosystem boundaries, and what constitute appropriate and effective indicators of ecosystem health and performance, will be addressed through the case study. The result will be a tool that scientists and policy makers use to develop an ecosystem-based approach to management of this system, and by extension others.

Madrinan, Luis Francisco – *supported by The Moore Foundation*
2-Jun-08 - 1-Jun-10
Investigating responses of riverine habitats and Pacific salmon to climate change

Pacific salmon play an important ecological role by interacting with other species in the rivers where they are born, in the ocean where they spend most of their life, and later again in the river where they return to breed. As a result of their very complex life history, salmonid species have been affected by human activities such as harvest, hydropower, hatcheries and habitat destruction.
Climate controls fish metabolic rates, influences habitat use, and regulates behavioral responses to a variety of environmental stimuli. For this reason climate change shapes not only fish distribution patterns but fish community composition, because it influences the differential survival and reproduction of species across watersheds.
The objective of my work will be to identify salmon populations that are especially resilient or sensitive to climate change across their range from California to Alaska. A state-of-the-art climate model developed at the University of Washington combined with fine and coarse-scale hydrological drainage maps, abundance time-series and other datasets will be used to consider several possible scenarios.
In collaboration with other postdoctoral fellows at NCEAS and the University of Washington, we aim to develop a novel approach by increasing our understanding of likely selective or plastic responses due to climate change. We hope to estimate the likelihood of populations reaching a quasi- extinction threshold resulting in range shifts of the different species, as well as to identify management strategies helping to enhance the resilience of populations to likely habitat changes.

McRae, Brad
1-Nov-05 - 7-Jul-08
Linking landscape ecology and population genetics using algorithms from circuit theory

The proposed research addresses a lack of quantitative models that can link data on landscape pattern and gene flow in natural populations. Because current landscape connectivity models focus on dispersal but not emergent patterns of gene flow, they are unable to take advantage of a growing number of population genetic datasets for validation, and cannot predict genetic effects of landscape change. Similarly, population

genetic models either ignore spatial heterogeneity or suffer from prohibitive data and/or computational requirements. I propose to develop models which borrow computationally efficient algorithms from circuit theory to bridge geographic and genetic data and predict effects of landscape pattern on genetic structuring in natural populations.

Melian, Carlos
22-Feb-05 - 21-Feb-08
The evolution of behavior and the structure of ecological networks

Most studies on community ecology have focused on single interaction types (i.e., antagonistic, mutualistic, or competitive). On the other hand, the bulk of behavioral studies have considered interactions among individuals within the same species (i.e., group behavior or group size). To improve our understanding of community structure, I propose to investigate the interdependence between group behavior and the structure of ecological networks integrating multiple interaction types. First, I will introduce behavioral strategies among species within the framework of gametheoretic models. Second, I will complement existing database on food webs by introducing species group size and di_erent interaction types. Third, I will use this enlarged database to test alternative behavioral models of network built up to determine mechanisms generating the structure of ecological networks. This research should provide a first step toward understanding the role of group behavior in the structure of ecological networks with multiple interaction types. The relevance of this work relies on the integration of behavioral and community ecology.

Menge, Duncan
15Jul 2008 - 14-Jul-09
Synthesizing ecosystem development data in a theoretical framework to understand transitions from nitrogen limitation to colimitation to phosphorus limitation

The ability of ecosystems to sequester carbon (C) and help mitigate climate change depends on which factors limit C uptake into vegetation. It is increasingly clear that nitrogen (N) and phosphorus (P) play critical roles in regulating C uptake, and forests tend to transition from N limitation to colimitation to P limitation as they develop from bare ground. However, at present there is no theoretical framework that determines the conditions under which each resource limits production, or when transitions between the different states should occur. At NCEAS I will build such a theoretical framework, synthesize existing data from forest chronosequences worldwide, and combine theory with data to analyze transitions between the alternate ecosystem states of limitation by N, P, or both.

Parker, John
1-Aug-08 - 31-Jul-09

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.

Petersen, Christine - *supported by The Moore Foundation*
15-Apr-08 - 14-Apr-09
Assessing sensitivity of salmon species to river modifications and climate change

The salmonids are particularly predisposed to local adaptation to habitat and climate conditions due to their trait of returning to the natal stream for adult-stage reproduction. With ranges from California to Alaska, salmon species in the NE Pacific encompass a fairly diverse set of strategies for meeting the variety of challenges to survival posed during the stream and ocean phases of life history. Both climate and anthropogenic changes to riverine and ocean habitat are likely to influence this risk landscape. Optimal growth rates, timing of emergence, smoltification, return from the ocean and spawning, and other behaviors could be altered by warming stream temperatures, changes in ocean upwelling patterns, installation of river obstructions, or transformation of rivers into lake environments by dams. In addition, simple changes in environmental variables may drive complex population effects due to interspecies competition, predation, and disease dynamics.

We intend to use wide array of available hydrological drainage maps, abundance time-series and other datasets to consider several alternative future scenarios. A state-of-the-art climate model developed at the University of Washington will be used to inform both fine and coarse-scale hydrological landscape models constructed at several drainages between Alaska and California by a postdoctoral collaborator, also at NCEAS. The objective of my work will be to explore population dynamics of 2-4 different salmon species in response to the projected habitat change scenarios. With the larger working group, we hope to develop an innovative approach to incorporating understanding of likely selective or plastic responses to climate change. We hope to estimate the likelihood

of populations reaching a quasi- extinction threshold resulting in range shifts of the different species, as well as to identify management strategies helping to enhance the resilience of populations to likely habitat changes.

Ranganathan, Jai - *supported by The Nature Conservancy*
4-Sep-07 -3-Sep-09
Developing a return on investment approach for conservation planning in Argentina

Temperate grassland is among the most globally endangered of ecosystem types, as it is highly threatened by the expansion of agriculture, the intensification of grazing pressure, and other human activities. I will be focusing on grassland conservation strategies for Argentina, where much of the best remaining temperate grassland can be found. Using a return on investment approach, I will explore how the inclusion of economic information can improve the quality of environmental planning for Argentinean grassland and for conservation in general.

Smith, Jennifer
1-Oct-05 - 30-Jun-08
Coral reef degradation: Determining the relative role of top-down and bottom-up factors in the global decline of coral reefs

Coral reef ecosystems are among the most diverse and highly productive ecosystems on the planet yet are currently threatened by a number of natural and anthropogenic factors (Connell 1978, Hughes et al. 2003, Bellwood et al. 2004). Regardless of the cause, reef degradation generally results in an irreversible phase-shift from dominance by reef-building coral to dominance by fleshy macroalgae (Petraitis and Dudgeon 2004). These shifts are believed to be irreversible and lead to communities that are less diverse and much less complex. While a number of natural disturbances can cause localized coral mortality, reduced top-down control (caused by overfishing) and increased bottom-up control (caused by nutrient pollution) are the most frequently implicated causes of anthropogenic reef degradation (McCook 1999). Past research has focused on either one or the other of these factors independently, has involved large-scale field-based correlations and more recently involved factorial field and laboratory manipulations. However, despite much effort there is not consensus in the scientific community as to how these factors independently and interactively influence phase-shift formation (Smith 2003). Further, not all phase-shifts are alike; some result in blooms of a single species of algae while others result in a more diverse mixed species assemblage and still others involve invasive non-indigenous species. Through analysis and synthesis of data from the literature I propose to develop conceptual models to determine the relative strength of top-down versus bottom-up control on coral reefs. I also propose to conduct a meta-analysis of these data to test several hypotheses regarding the importance of top-down and bottom-up control across several gradients in the tropics including latitude, diversity and disturbance. Lastly, using a pre-existing database I will assess the role of top-down and bottom-up factors on the success of exotic macroalgae on tropical reefs and conduct a

risk assessment to identify species that are likely to be more invasive than others. The information generated by this project will be highly useful in implementing sound science-based management decisions for conservation of coral reef ecosystems across the globe.

Stephens, Patrick
4-Oct-05 - 3-Oct-07
The effects of lineage age on the species richness of regional assemblages

Like area, time is a factor that must constrain diversity at some level, yet very little is known about how time and species richness are related in most groups. It was widely accepted during the first half of the 20th century that time constrained diversity in many groups, though there was little direct evidence for this. Ironically, interest in the relationship waned just before the phylogenetic tools necessary to investigate it directly it were developed. I propose to investigate the relationship between the relative age and species richness of regional assemblages in a wide variety of organisms.

Urban, Mark
15-Sep-06 – 14-Sep-08
Interaction traits and metacommunity gene flow

The metacommunity framework is stimulating novel predictions about community dynamics by considering both local species interactions and regional migration. In a similar manner, local evolution and gene flow can shape the diversity of ecologically relevant traits which, in turn, can alter local species interactions. Hence joint consideration of evolutionary and ecological processes may offer additional insights about communities. However, few empirical generalizations have emerged about how landscape connectivity and community heterogeneity govern trait distributions of interacting species in metacommunities. Toward this end, I am synthesizing data on variation in interaction traits—those characters that shape the outcomes of interspecific encounters—to explore relationships between trait distributions, community structure and landscape connectivity. Using assimilated data on natural and common garden studies of interaction trait variation, I then plan to evaluate interaction trait variation attributed to gene flow and community composition as conditioned on species' dispersal abilities and generation lengths. Results will be used to inform rapidly advancing theories on evolution in metacommunities.

Distributed Graduate Seminars

Economic Impact of Non-native Forest Pests and Pathogens in North America
Aukema, Juliann
Supported by The Nature Conservancy

We are conducting a distributed graduate seminar to determine the extent to which ecological and economic impacts of non-native forest pests and pathogens can be quantified. The seminar involves groups of students at seven universities: Northern Arizona University, Colorado State University, University of Minnesota, University of Montana, State University of New York, North Carolina State University, and Oregon State University. Each university-based seminar has two leaders, an ecologist and an economist. Each university has selected one to several forest pests or pathogens of local to regional concern. They are gathering key data and evaluating ecological and economic impacts. We will bring together representatives from each university for a comparison and synthesis of results, modeling approaches, and data gaps.

Participating Universities
Colorado State University, Fort Collins, North Carolina State University, Northern Arizona University; Oregon State University, State University of New York, Syracuse, University of Minnesota, University of Montana

Ushering in a New Era of Functional Ecology: Dynamics in a Changing Environment
Cleland, Elsa E.; Collins, Scott L.; Suding, Katharine Nash

Human activities are increasingly altering the environment in ways that impact plant communities and ecosystems. Climate change, invasive species, and nutrient enrichment of natural ecosystems are all examples of such environmental changes. The seminar will focus on emerging areas of research that are advancing functional ecology. A major goal of the DGS is to develop approaches to help predict how plant species and communities will shift in response to environmental changes. In particular the team will seek to connect plant traits, which reflect both ecological function and evolutionary history, to species responses to altered environmental conditions. To accomplish this goal they will bring together datasets from numerous locations throughout North America, including experimental manipulations of nitrogen, water, temperature and species composition, as well as observational datasets along existing environmental gradients. The capstone NCEAS meeting will combine analyses and techniques from each institution to generate predictions regarding national-level responses of plant communities to environmental change such as invasive species and nitrogen enrichment.

Participating Institutions:

Columbia University, Florida International University, Miami, University of California, Berkeley, University of California, Irvine, University of California, Santa Barbara, University of Houston, Texas, University of New Mexico, Albuquerque

Finding Common Ground in Marine Conservation and Management
Hilborn, Ray; Worm, Boris ; Hampton, Stephanie
Supported by The Gordon and Betty Moore Foundation

There is increasing concern among scientists, resource managers, and the general public about the current state of marine fisheries and their supporting ecosystems. Recent scientific progress on this topic has been partly overshadowed by significant controversy on how to assess marine resources and how to address current problems in ocean management. Marine ecologists and fisheries scientists often tend to favor contrasting approaches, and we observe that these schools of thought have polarized over time. We now recognize this situation as counterproductive and propose to address this controversy where possible. To help address this concern, the National Center for Ecological analysis and Synthesis (NCEAS) is supporting a Working Group to define common ground among marine ecologists and fishery scientists by (1) developing a unifying terminology and a common analytical framework for assessing marine fisheries and ecosystem change, (2) applying this framework to a number of representative marine ecosystems around the globe, and (3) assessing management successes and failures in order to identify a set of tools that have been proven to reverse trends of degradation in marine fish stocks and ecosystems. This process should also identify areas of continued disagreement, important for focusing future research. The central question we are trying to answer is: how can we merge contrasting objectives, tools, and scientific criteria among marine ecology, fisheries science, and management into a unifying framework. We envision that this group will be acting as a catalyst for joining scientific forces in a quest to sustain and restore valuable marine resources. Clearly, one of the solutions to integrating the interests and efforts of fisheries biologists and ecologists is to expose young scientists to the goals and approaches of the various interested parties dealing with these issues. Accordingly, NCEAS will coordinate a Distributed Graduate Seminar (DGS) to involve graduate students and mentors from six universities.

Participating Institutions:
University of Washington, Dalhousie University, University of New Hampshire, Stanford University, University of Patagonia Puerto Madryn (Argentina), Simon Fraser University (Canada)

The Role of Marine Protected Areas in Ecosystem-Based Management: Examining the Science and Politics of an Ocean Conservation Strategy
Pavia, Robert Lindholm, James

Recent reports by the U.S. Commission on Ocean Policy and the Pew Oceans Commission recommend specific actions necessary to drive advances in ocean governance, including the use of marine protected areas (MPAs) as tools for ecosystem-based management. With coastal development, pollution, and resource extraction pressures on MPAs increasing, national and international efforts are focusing on developing MPAs in the context of the ecosystems, both terrestrial and marine, in which they occur. We will conduct a Distributed Graduate Seminar dedicated to clarifying the role of MPAs as tools for ecosystem-based management. The National Marine Sanctuary Program, one of the primary MPA management programs in U.S. Federal waters, will serve as a vehicle for this exploration. Graduate students from Hawaii to New Hampshire will examine how our growing scientific understanding of ecosystem processes within MPAs, and evolving ocean-observing capabilities, can allow us to manage MPAs as integral components of the ecosystems in which they reside.

Participating Institutions:
California State University, Monterey Bay, Hawaii Institute of Marine Biology/University of Hawaii, University of California at Santa Barbara, University of Michigan, University of New Hampshire, University of Rhode Island, University of South Florida, University of Washington

Working Groups

Towards a unified theory of biodiversity
Leaders: Allen, Andrew; Green, Jessica; Hubbell, Stephen; Marquet, Pablo

Participants:

Allen, Andrew	Gowaty, Patty	O'Dwyer, James
Banavar, Jayanth	Green, Jessica	Okie, Jordan
Brown, James	Harte, John	Ostling, Annette
Davies, T. Jonathan	Hubbell, Stephen	Ritchie, Mark
Dunne, Jennifer	Lake, Jeffrey	Savage, Van
Enquist, Brian	Maritan, Amos	Volkov, Igor
Gillooly, James	Marquet, Pablo	West, Geoffrey
	Melian, Carlos	Zillio, Tommaso

Abstract:
This proposal will support the efforts of an interdisciplinary group of ecologists, physicists and mathematicians to unify three areas of theoretical ecology that have advanced rapidly over the past decade: metabolic scaling theory, neutral biodiversity theory, and spatial macroecology theory. These theories have all yielded quantitative predictions that show striking agreement with patterns observed in nature. Furthermore, all three theories derive predictions based on the same postulate that biodiversity is largely controlled by universal principles and processes that operate at the level of the individual organism, and that therefore transcend species identity. Given this

fundamental point of contact among theories, and that each theory focuses on a different axis of ecological complexity (energy, stochasticity, space), considerable progress could be achieved by their integration. This working group will work towards unifying metabolic scaling theory, neutral biodiversity theory, and spatial macroecology. Our goal will not be to summarize research to date, but rather to cross disciplinary boundaries and specializations to develop a prediction-rich synthetic framework for the evolutionary and ecological assembly of biodiversity across multiple spatial and temporal scales. We anticipate a vigorous and systematic attack on the problem by researchers committed to improving their theories by confronting them with data.

Genetic monitoring: Development of tools for conservation and management
Leaders: Allendorf, Fred; Schwartz, Michael

Participants:

Allendorf, Fred
Baker, C. Scott
Hansen, Michael
Jackson, Jennifer
Kendall, Katherine
Laikre, Linda
McKelvey, Kevin
McRae, Brad
Neel, Maile
Olivieri, Isabelle
Ryman, Nils
Schwartz, Michael
Shortbull, Ruth
Stetz, Jeffrey
Tallmon, David
Taylor, Barbara
Vojta, Christina
Waller, Donald
Waples, Robin

Abstract:
Genetic monitoring has the potential to become a valuable tool for the management and conservation of populations. Recent rapid advances in molecular genetic techniques make it relatively easy and inexpensive to quantify temporal changes in the genetics of populations over tens or even hundreds of years. However, it is currently unknown under what circumstances genetic monitoring would provide valuable information or what genetic data are required for effective genetic monitoring. We propose a working group that will address these issues in order to provide guidance for resource managers and policy makers. We will also evaluate the potential for using genetic monitoring of candidate genes likely to be affected by climate change and other forms of stress in order to understand evolutionary responses to environmental changes. The results of this working group will be rigorous and practical guidelines for the design of genetic monitoring strategies and should lead to improved assessments of population trends and evolutionary processes.

Economic impacts of non-native forest pests and pathogens in North America *(The Nature Conservancy)*
Leaders: Aukema, Juliann; Fleishman, Erica; Reichman, O.

Participants:

Aukema,Juliann
Bell, Kathleen
Britton, Kerry
Haight, Robert
Holmes, Thomas
Kareiva, Peter
McCullough, Deborah
O'Halloran, Thomas
Sills, Erin

Englin, Jeff	Kovacs, Kent	Stohlgren, Thomas
Frankel, Susan	Leung, Brian	Von Holle, Betsy
Gilligan, Chris	Liebhold, Andrew	Wainger, Lisa
Gutierrez, Andrew	McCoy, Nicole	

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.

Effects of trade policy on management of non-native forest pests and pathogens
(The Nature Conservancy)
Leaders: Aukema, Juliann

Participants:

Aukema, Juliann	Haack, Robert	Shannon, Margaret
Bratman, Greg	Hampton, Stephanie	Sills, Erin
Britton, Kerry	Lowenstein, Frank	Speekmann, Christa
Brockerhoff, Eckehard	Marassas, Carissa	Springborn, Mike
Cavey, Joseph	O'Halloran, Thomas	Turner, James
Dickerson, Bill	Olson, Lars	Vieglais, Christina
Fleishman, Erica	Royer, Matthew	Vo, Trang
Garrett, Lynn		

Abstract:
This working group will explore whether federal records on interceptions of non-native forest pests and pathogens can be used to identify species that may colonize the United States during the next several decades. The group will attempt to estimate the economic and ecological costs of such colonizations given different volumes and origins of trade. In addition, the group will explore how different policies related to interdiction, detection, or eradication may affect costs

Resilience of Pacific salmon to climate change *(Gordon and Betty Moore Foundation)*
Leaders: Beechie, Timothy; Ruckelshaus, Mary

Participants:

Augerot, Xan	Madrinan, Luis Francisco	Ruckelshaus, Mary
Beechie,Timothy	Mantua, Nathan	Schindler, Daniel
Greene, Correigh	Petersen, Christine	Stanford, Jack
Lawler, Joshua	Reed, Tom	Waples, Robin

Wu, Huan

Abstract:
This working group aims to classify populations or metapopulations of Pacific salmon along a gradient of sensitivity or resilience to climate change. The group also will examine potential management and conservation strategies that may benefit salmon populations along that gradient under alternative future climates. Attributes of salmon related to resilience include diversity of species, life history types, and genetics; abundance; and spatial distribution within catchments. This group will compile data on potential response to climate change of continental and local patterns of air temperature and precipitation, sea level, and currents and ocean conditions in the north Pacific. Responses of these environmental variables or phenomena may affect stream temperature and flows, structure and dynamics of floodplains, condition of estuaries and nearshore systems, and the abundance of food resources or predators.

Pyrogeography and climate change *(co-sponsored with KITP)*
Leaders: Bowman, David; Balch, Jennifer

Participants:

Artaxo, Paulo	DeFries, Ruth	Moritz, Max
Balch, Jennifer	Einhorn, Martin	Prentice, I. Colin
Bond, William	Johnston, Fay	Roos, Christopher
Bowman, David	Keeley, Jon	Scott, Andrew
Carlson, Jean	Krawchuk, Meg	Shang, Zongbo
Cochrane, Mark	Kull, Christian	Swetnam, Thomas
	Marston, John	van der Werf, Guido

Abstract:
It is time to rethink the place of fire on Earth. Megafires are currently overwhelming human control, despite huge budgets and mature fire-fighting technologies. There is mounting evidence that, beyond immediate destruction of life and property, landscape fires have long-term effects on global carbon stocks, biodiversity, climate, world economies, and human health. Despite fire's pervasive influence in many disciplines, there is no uniting theory or paradigm concerning the role of biomass burning in Earth science. Moreover, fire has not been satisfactorily considered by global change policy and ecosystem management. We, therefore, propose a thought experiment addressing:

1. Whether fire would evolve where carbon-based life is present
2. How it would evolve, and
3. How humans, their cultures, and fire may have coevolved

We will combine knowledge about biomass burning across fields to develop an integrative paradigm of 'pyrogeography' that addresses these fundamental questions. In a period of intensifying fire activity, our synthesis will provide crucial information that aids human adaptation.

Mechanistic distribution models: Energetics, fitness, and population dynamics
Leaders: Buckley, Lauren; Angilletta, Michael; Holt, Robert; Tewksbury, Joshua

Participants:

Angert, Amy	Gilman, Sarah	Porter, Warren
Angilletta, Michael	Holt, Robert	Rissler, Leslie
Buckley, Lauren	Keitt, Timothy	Sardinha-Pinto, Naiara
Crozier, Lisa	Kingsolver, Joel	Sears, Michael
	Kolbe, Jason	Tewksbury, Joshua

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.

Landscape and population connectivity *(Wilburforce Foundation)*
Leaders: Carroll, Carlos; Fleishman, Erica

Patricipants:

Beier, Paul	Hannah, Lee	Pressey, Robert
Cabeza, Mar	Kujala, Heini	Schill, Steven
Carroll, Carlos	Leu, Matthias	Schmiegelow, Fiona
Damschen, Ellen	McRae, Brad	Schumaker, Nathan
Davis, Frank	Moilanen, Atte	Segan, Dan
Dunk, Jeff	Nogeire, Theresa	Tabor, Gary
Fay, John	Noon, Barry	Theobald, David
Fleishman, Erica	Phillips, Steven	Urban, Dean

Abstract:
Conservation area design (CAD) is being used by many landscape-scale conservation efforts in western North America to establish geographic priorities and to raise awareness within the scientific, practitioner, and lay communities of the importance of critical areas. However, CAD techniques currently cannot evaluate factors that allow species and their resources to persist over time. These factors include land-cover connectivity and the resilience of reserve networks to ecological processes such as fire. Several new methods for CAD are emerging that have the potential to improve greatly on past methods. These new methods are unfamiliar to most practitioners, and no comparative evaluation of their usefulness in different contexts exists. Participants will test and compare new tools by applying them to conservation-planning challenges in several geographic areas in North

America. Participants also will develop a manual that evaluates new software tools for connectivity analysis, with guidelines for use of those tools. Ultimately, the group will develop a software toolkit and guidelines for its use that would be applicable to landscape-scale conservation planning in any region.

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

Leaders: Cavender-Bares, Jeannine; Ackerly, David; Burleigh, J. Gordon; Mack, Michelle; Ree, Richard; Reich, Peter

Participants:

Ackerly, David	Deacon, Nicholas	Lehman, Clarence
Ane, Cecile	Declerck, Steven	Lichstein, Jeremy
Beaulieu, Jeremy	Donoghue, Michael	McMahon, Michelle
Burleigh, J. Gordon	Edwards, Erika	Oakley, Todd
Cadotte, Marc	Fine, Paul	Ree, Richard
Cavender-Bares, Jeannine	Helmus, Matthew	Stephens, Patrick
Davies, T. Jonathan	Holt, Robert	Weiblen, George
	Kembel, Steven	

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.

Governance feasibility of marine ecosystem-based management: A comparative analysis (EBM) *(The Packard Foundation)*

Leaders: Christie, Patrick; Pollnac, Richard

Participants:

Alberti, Marina	Cochrane, Kevern	Pietri, Diana
Almocera, Atanacio	Eisma-Osorio, Liza	Pollnac, Richard
Armada, Nygiel	Fluharty, Dave	Pomeroy, Robert
Beck, Michael	Hixon, Mark	Puruncajas , Karis
Black, Theresa	Lowry, Gordon	Sievanen, Leila
Capitini, Claudia	Mahon, Robin	Tissot, Brian
Christie, Patrick	McConney, Patrick	Walters, Steven
	Mulvaney, Kate	White, Alan

Abstract:
The EBM Feasibility NCEAS working group has three main goals: 1) assessing how to modify governance structures to facilitate effective ecosystem-based management (EBM) in developing and developed world contexts; 2) generating practical ecological and social indicators for EBM, and 3) producing analyses and planning materials useful for scientists, EBM practitioners, and policy makers around the world. It will draw together disparate, socio-ecological datasets from the Philippines, Southwestern Africa, the Caribbean, and Hawaii Island to assess EBM success as measured by common social and ecological goals of various programs. These results will result in synthetic peer reviewed journal articles and form the basis for an empirically-based how-to guidebook and training program to support coastal EBM.

Ushering in a new era of functional ecology: Dynamics in a changing environment
Leaders: Cleland, Elsa; Collins, Scott; Suding, Katharine

Participants:

Ackerly, David	Koch, Greg	Okie, Jordan
Aicher, Rebecca	Kraft, Nathan	Osmundson, Todd
Bunker, Daniel	Kreitler, Jason	Pennings, Steven
Carvajal, Alejandra	LeBauer, David	Sandel, Brody
Chamberlain, Scott	Marquardt, Emily	Shuldman, Michal
Cleland, Elsa	McIlroy, Susan	Spasojevic, Marko
Collins, Scott	Mirotchnick, Nicholas	Suding, Katharine
Goldstein, Leah	Munyon, Jay	Troxler, Tiffany

Abstract:
This distributed graduate seminar will engage graduate students in asking fundamental questions about the linkages among environmental change, niche-based functional traits and threshold/divergence dynamics in community structure. Plant functional traits are increasingly being utilized in an effort to generalize species and ecosystem responses to environmental changes, as well as to address fundamental questions in evolutionary ecology. They also present a tool to discern niche or deterministic, convergence, and divergence, and stochastic dynamics in communities. The seminar will focus on emerging areas of research that are advancing functional ecology. Each institution will use datasets that detail community and functional structure from several environmental change manipulative experiments and related observational datasets along environmental gradients. The capstone NCEAS meeting will combine analyses and

techniques from each institution to generate predictions regarding national-level responses of plant communities to environmental change such as invasive species and nitrogen enrichment.

Revisiting nutrient limitation in tropical forests
Leaders: Cleveland, Cory; Townsend, Alan

Participants:

Alvarez-Clare, Silvia	Houlton, Benjamin	Silver, Whendee
Bustamante, Mercedes	Martinelli, Luiz	Tanner, Edmund
Chuyong, George	Parton, William	Townsend, Alan
Cleveland, Cory	Porder, Stephen	Vitousek, Peter
Grierson, Pauline	Reed, Sasha	Wieder, Will
Harms, Kyle	Sierra, Carlos	

Abstract:
Tropical forests have enormous ecological and societal significance. They are home to exceptional biological diversity (including humans), they profoundly affect a suite of globalscale 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.

Conservation planning for ecosystem functioning: Testing predictions of ecological effectiveness for marine predators (EBM)

Leaders: Doak, Daniel; Estes, James; Wootton, J. Timothy; Williams, Terrie

Participants:

Carroll, Ian	Lindberg, David	Sanford, Eric
Doak, Daniel	Lovvorn, James	Sih, Andrew
Emmerson, Mark	Micheli, Fiorenza	Tinker, M. Timothy
Estes, James	Monson, Daniel	Williams, Terrie
Halpern, Ben	Novak, Mark	Wootton, J. Timothy
Jacob, Ute	Osenberg, Craig	

Abstract:

At a major symposium on marine ecosystem-based management at the 2005 AAAS meetings, one of the three principal themes deemed critical for future progress was interaction web dynamics¿the way in which species interact with one another and their physical environment. In particular, the scientific basis for marine ecosystem-based management must better incorporate understanding of the influences of multiple predator species on interaction web dynamics. These interactions are increasingly recognized as critical to the maintenance and restoration of marine communities and hence to the planning of marine reserves and other conservation strategies. Our working group will directly tackle this important issue, asking what approaches are most successful in estimating the interaction strength, also termed ecological effectiveness, of predator species on nearshore communities and how to use limited information on these effects to best conduct conservation planning in these ecosystems. We will focus our initial efforts on three extremely well-studied predator guilds of West Coast, near shore communities: sea otters in kelp forests; predatory whelks in mid-intertidal benthic communities, and wading shore birds in high to mid intertidal communities. For each of these very different systems, extensive data exist on the effects of predator abundance, physiology, and individual behavior. We will assemble these diverse data sets and use them to develop detailed interaction models as well as more broad-brush models that may be applicable to less-well-studied communities. Our overall goal is to use these models to ask what aspects of predator physiology and behavior, and what aspects of prey community structure, most determine the ecological effectiveness of predators and thus must be understood in order to plan viable marine conservation strategies.

Machine learning for the environment

Leaders: Drake, John; Langford, Bill

Participants:

Buston, Peter	Dzeroski, Saso	Langford, Bill
Caruana, Rich	Elith, Jane	Margineantu, Dragos
Chase, Jonathan	Furlanello, Cesare	Olden, Julian
Davies, T. Jonathan	Guestrin, Carlos	Schapire, Robert
Dietterich, Thomas	Hastie, Trevor	Ward, Gill

Dobson, Andrew
Drake, John
Keller, Reuben
Krause, Andreas
White, Matt
Zadrozny, Bianca

Abstract:
We believe that environmental science, ecology, and conservation biology would be greatly enriched by expanding the ecologist¿s analytical toolbox to include machine learning (ML) approaches to data analysis. We use the term ML loosely to distinguish between parametric statistics and a variety of new, computational methods for recognizing and analyzing patterns in data. Generally, parametric methods assume highly restrictive theoretical properties of data, such as additivity, linearity, independence, and distribution (e.g., normality). Ecological data, by contrast, represent highly complex systems and commonly violate these assumptions [1-3]. Unfortunately, failure to appreciate these subtleties of ecological data often results in misguided analysis and incomplete or incorrect conclusions. In recent years, ML researchers have developed techniques for analyzing data not suited to parametric statistics. Older machine learning algorithms include neural networks and decision trees. Now, newer techniques like boosting and kernel methods (e.g., support vector machines), provide new opportunities for extracting subtle patterns from complex data, while hybrid methods integrate parametric models and ML to exploit computation and hard-won biological understanding simultaneously. Despite successes elsewhere (e.g., bioinformatics, astrophysics) ML has not been widely adopted by ecologists. Complex situations that might be addressed with ML include identifying optimal policies for managing ecological systems under uncertainty, forecasting, nonlinear modeling, and scientific inference with non-independent data. Accommodating these scientific and statistical difficulties within parametric statistics ranges from cumbersome to impossible. Therefore, we propose a working group to identify obstacles, scope out promising research, produce case studies, and develop a book length tutorial for ecologists on the practical application of ML.

Analysis and Conservation Prioritization of Landscape Connectivity in Nevada
(Wilburforce)
Leaders: Fleishman, Erica

Participants:
Abele, Susan
Alverts, Bob
Beecher, Nancy
Bradley, Bethany
Carroll, Carlos
Chambers, Jeanne
Clement, Joel
Clemmer, Glenn
Davis, Frank
Devoe, Nora
Dickson, Brett
Dobkin, David
Fay, John
Fleishman, Erica
Hanser, Steve
Hopper, Robert
Jenkins, Chris
Joines, Denise
Knick, Steve
Leu, Matthias
Libecap, Gary
Lowry, John
Major, Don
McRae, Brad
Murphy, Dennis
Noss, Reed
Polly, Michael
Ramsey, Doug
Schumaker, Nathan
Tague, Joe
Visser, Ken

Abstract:
We will develop a rigorous scientific assessment of landscape connectivity from the perspective of multiple system components that can be used to inform management and

policy in Nevada. The Southern Nevada Public Land Management Act and the Lincoln County Conservation, Recreation, and Development Act are examples of specific, current opportunities to use science to prioritize land acquisition and allocation of multiple land uses. We will examine natural and, especially, anthropogenic drivers that may affect connectivity for riparian systems, sagebrush steppe, sage grouse, and pronghorn. This process, and its application to management and policy, will be enhanced by participation of a multidisciplinary group of approximately 20 scientists and practitioners who are dedicating their time and expertise to the effort. We anticipate that products of geospatial analyses will be used to explore alternative scenarios of land use, climate change, and management options in Nevada. We anticipate that the products will be used by scientists, land managers, policy makers, and other stakeholders.

Ecosystem analysis of pelagic organism declines in the Upper San Francisco Estuary (USDA Fish and Wildlife)
Leaders: Fleishman, Erica

Participants:

Bennett, William	Healey, Michael	Newman, Ken
Brooks, Marjorie	Kimmerer, Wim	O'Halloran, Thomas
Brown, Larry	Mac Nally, Ralph	Sih, Andrew
Castillo, Gonzalo	Maunder, Mark	Stoms, David
Culberson, Steven	Melack, John	Thomson, Jim
Feyrer, Fred	Meyer, Sue	Townsend, Howard
Fleishman, Erica	Murphy, Dennis	

Abstract:
In late 2004, scientists noted that abundance indices of several pelagic fishes in the upper San Francisco Estuary (delta smelt, age-0 striped bass, longfin smelt, and threadfin shad) had remained unusually low since 2001. Delta smelt is an endemic species listed as threatened under both the California and U.S. Endangered Species Acts. Protection of delta smelt often determines water management actions in the estuary, which supplies drinking water to more than 22 million people and supports a multi-billion dollar agricultural industry. The abundance of longfin smelt, another native species, has a strong positive relationship to freshwater outflow. Striped bass and threadfin shad are both introduced species that contribute substantially to the total biomass of pelagic fishes in the ecosystem and support valuable recreational fisheries. NCEAS and the Interagency Ecological Program are collaborating to convene several working groups on issues related to decline of pelagic organisms. We hope not only to gain a better understanding of the specific causes and mechanisms behind the organism declines in the San Francisco Estuary, but to place these declines in the broader context of estuarine degradation, organism declines, and approaches to solving these problems in other geographic regions. Among other goals, we seek to examine simultaneously the effects of multiple potential drivers on one or more fishes. Further, we aim to investigate whether fishes differ in their response to given drivers. We also wish to explore the ability of Bayesian analysis, path analysis, or other modeling approaches to draw inference regarding ecological

relationships among pelagic fishes, human actions, and inherent variability in the estuarine system.

Valuation of marine ecosystem services *(California Coastal Conservancy)*
Leaders: Fleishman, Erica

Participants:

Blackburn, Christine
Bohan, Drew
Boumans, Roelof
Boyle, Kevin
Colt, Steve
Fleishman, Erica
Knapp, Gunnar
Lopez, Ricardo
O'Higgins, Tim
Radtke, Hans
Raheem, Nejem
Rudd, Murray
Stoms, David
Swedeen, Paula
Talberth, John
Willer, Chuck

Abstract:
NCEAS and the California Ocean Protection Council are collaborating to examine existing methods of market and non-market valuation of marine ecosystem services. Participants in this workshop will compile a lexicon related to market and non-market valuation of ecosystem services. In addition, the group will outline available strategies for deriving the value of ecosystem services and associated uncertainties in measurement or interpretation. Participants will develop a preliminary list of services in coastal marine California that are expedient and tractable to value. They also will help to scope the potential for valuation of one or more services by future working groups of economists and ecologists.

Potential role of contaminants in declines of pelagic organisms in the Upper San Francisco Estuary, California *(USDA Fish and Wildlife)*
Leaders: Fleishman, Erica

Participants:

Brooks, Marjorie
Brown, Larry
Chai, Fei
Connor, Mike
Drever, James
Dugdale, Dick
Fleishman, Erica
Johnson, Mike
Kimmerer, Wim
Krolick, David
Lehman, Peggy
Luoma, Sam
Mitchelmore, Carys
Monismith, Steven
Mueller-Solger, Anke
O'Halloran, Thomas
Schlenk, Daniel
Scholz, Nathaniel
Stoms, David
Teh, Swee
Werner, Inge
van Veld, Peter

Abstract:
In late 2004, scientists noted that abundance indices of several pelagic fishes in the upper San Francisco Estuary (delta smelt, age-0 striped bass, longfin smelt, and threadfin shad) had remained unusually low since 2001. Delta smelt is an endemic species listed as threatened under both the California and U.S. Endangered Species Acts. Protection of delta smelt often determines water management actions in the estuary, which supplies drinking water to more than 22 million people and supports a multi-billion dollar agricultural industry. The abundance of longfin smelt, another native species, has a strong

positive relationship to freshwater outflow. Striped bass and threadfin shad are both introduced species that contribute substantially to the total biomass of pelagic fishes in the ecosystem and support valuable recreational fisheries. NCEAS and the Interagency Ecological Program are collaborating to convene several working groups on issues related to decline of pelagic organisms. We hope not only to gain a better understanding of the specific causes of the organism declines in the San Francisco Estuary, but to place these declines in the broader context of estuarine assessment and management in other geographic regions. This working group seeks to investigate the potential influence on observed declines of contaminants such as pyrethroid use, changes in wastewater discharge as California's human population increases, and changes in use of pesticides. Contaminants may be having chronic effects or effects on the food web rather than acute effects detectable by traditional bioassays. Wastewater includes steroids and other pharmaceuticals that can affect the endocrine and immune systems. There also may be maternal effects on eggs and larvae.

Development of a report card for assessing the status and trend of Bay-Delta ecosystems *(USDA Fish and Wildlife)*
Leaders: Fleishman, Erica

Participants:

Brown, Larry	Hoenicke, Rainer	Melack, John
Connor, Mike	Johns, Jerry	Murphy, Dennis
Dennison, William	Kimmerer, Wim	Nobriga, Matthew
Dugdale, Dick	Lorenzato, Stefan	Spies, Bob
Fleishman, Erica	Luoma, Sam	Wilkerson, Frances

Abstract:
This project aims to develop a report card to provide a transparent, timely, and geographically detailed annual assessment of the status and trend of the Sacramento-San Joaquin Bay Delta ecosystem. The project is a collaborative effort between NCEAS and the Integration and Application Network at the University of Maryland's Center for Environmental Science. Numerous federal and state agencies and programs, scientists, and stakeholders will be partners in the activities.

Synthetic macroecological models of species diversity
Leaders: Gotelli, Nicholas; Colwell, Robert; Rahbek, Carsten

Participants:

Anderson, Marti	Gotelli, Nicholas	Magurran, Anne
Arita, Hector	Graves, Gary	McCain, Christy
Chao, Anne	Green, Jessica	Rahbek, Carsten
Colwell, Robert	Grytnes, John	Rangel, Thiago Fernando
Connolly, Sean	Jetz, Walter	Romdal, Tom
Currie, David	Jiang, Yi-Huei	Soberon Mainero, Jorge

Dunn, Robert	Lyons, Kathleen	Webb, Campbell Willig, Michael

Abstract:
A major unsolved problem in macroecology and biogeography is the origin and maintenance of species richness gradients. Biogeographers are currently divided into three major camps: those who favor historical or phylogenetic mechanisms, those who favor explanations based principally on geographic patterns of contemporary environmental variables, and those who advocate the incorporation of null model approaches. In the existing catalog of simple null models, species¿ geographic ranges are randomized within a bounded domain, producing a middomain effect (MDE)¿a peak of species richness towards the center of the geographical domain. This working group will seek to develop a novel synthesis of historical, contemporary environmental, and MDE hypotheses, by modeling species¿ geographic ranges in an environmentally heterogeneous geographical domain, with spatially explicit colonization, range expansion, speciation, and extinction.

Measuring ecological, economic and social values of coastal habitats to inform ecosystem-based management of land-sea (EBM) *(The Packard Foundation)*
Leaders: Granek, Elise; Koch, Evamaria; Barbier, Edward; Stoms, David; Aswani-Canela, Shankar

Participants:

Aswani-Canela, Shankar	Granek, Elise	Perillo, Gerardo
Bael, David	Hacker, Sally	Polasky, Stephen
Barbier, Edward	Halpern, Ben	Primavera, Jurgenne
Cramer, Lori	Kappel, Carrie	Reed, Denise
Erdmann, Mark	Kennedy, Christopher	Silliman, Brian
Freed, Sarah	Koch, Evamaria	Stoms, David
	Muthiga, Nyawira	Wolanski, Eric

Abstract:
The recent Australia cyclone and the 2005 Caribbean hurricane season, coupled with the 2004 tsunami in the Indian Ocean, have stimulated interest in protective services provided by near-shore estuarine, wetland and mangrove habitats. The popular press now links the loss of human life and property to the degradation of interface ecosystems. These events provide a unique opportunity to quantify the value of protective services provided by near-shore vegetated habitats and compare them with economic gains from habitat conversion (e.g. forestry, shrimp farms, or development). We propose using these habitats in a case study for developing and testing assessment and planning tools for ecosystem-based management (EBM) that incorporates terrestrial and marine environments. We will bring together economists, ecologists, geographers, social scientists, and coastal managers to (1) collect and distill existing but scattered data on coastal zone services and value, (2) assess local community attitudes and institutions, and

disseminate information about short-term vs. long-term values to help managers determine conservation zones, and (3) use data and modeling to plan EBM strategies that incorporate the interface nature of these systems.

Ranking and mapping human threats and impacts to marine ecosystems in the California current *(Gordon and Betty Moore Foundation)*

Leaders: Halpern, Ben

Participants:

Arvai, Joe	Fischhoff, Baruch	Micheli, Fiorenza
Brooks, Marjorie	Halpern, Ben	Murray, Grant
Cooke, Roger	Kappel, Carrie	Selkoe, Kimberly
Crain, Caitlin	Kontgis, Caitlin	Shearer, Christine
Dowaltabadi, Hadi	Kroeker, Kristy	Teck, Sarah
Ebert, Colin	Martone, Rebecca	

Abstract:

Building on a similar global effort (Mapping current threats and impacts of human activities on global marine ecosystems this project will map current threats and impacts of human activities on the California Current marine ecosystem. The project will first survey experts in six subregions of the California Current to explore geographic variation in the effects of threats. A workshop will then be held to use decision theory to evaluate the tradeoffs of using expert opinion to assess threats and associated impacts. Data on ecosystems and threats will be gathered at resolutions of approximately one square kilometer. By synthesizing information and inferences regarding anticipated impacts of threats, project participants will develop a spatially-explicit understanding of the distribution and magnitude of human threats in the California Current. Project collaborators are based at University of California, Santa Cruz; The Nature Conservancy; University of California, Santa Barbara; and the Monterey Bay National Marine Sanctuary.

Faculty Institutes for Reforming Science Teaching (FIRST II)

Leaders: Jones, Matthew; Ebert-May, Diane; Schildhauer, Mark; Urban-Lurain, Mark

Participants:

Ebert-May, Diane	McFall, Ryan	Urban-Lurain, Mark
Jones, Matthew	Schildhauer, Mark	Weber, Everett

Abstract:

The Faculty Institutes for Reforming Science Teaching (FIRST II) project is developing new metadata standards for assessment in biological education. Participants will develop means to semantically describe assessment instruments, student responses, assessment settings, and concept categories. Faculty will use the ontologies to find assessments and student responses, manage and document assessment data, and facilitate the exchange of educational assessment data. In this project, FIRST researchers are collaborating with the

informatics team at NCEAS to build data systems for representing, collating, and analyzing educational assessment data.

SDCI NMI improvements: Development of Kepler CORE -- a comprehensive, open, robust, and extensive scientific workflow infrastructure *(UC Davis, flow through from NSF)*
Leaders: Jones, Matthew; Schildhauer, Mark

Participants:

Altintas, Ilkay	Leinfelder, Ben	Sudan, Madhu
Barseghian, Derik	McPhillips, Timothy	Tao, Jing
Berkley, Chad	Riddle, Sean	Tuot, Christopher
Crawl, Daniel	Schildhauer, Mark	Wang, Jianwu
Jones, Matthew	Schultz, Aaron	Welker, David
		Yildiz, Ustun

Unifying approaches to statistical inference in ecology
Leaders: King, Aaron; Rohani, Pej

Participants:

Breto, Carles	Ionides, Edward	Lavine, Michael
Ellner, Stephen	Isham, Valerie	Newman, Ken
Ferrari, Matthew	Kendall, Bruce	Reuman, Daniel
Gibson, Gavin	King, Aaron	Rohani, Pej
Hooker, Giles	Koelle, Katia	Wearing, Helen

Abstract:
In the face of ecological complexity, it has very often proved useful to formulate mathematical models, which allow us to examine the consequences of specific sets of assumptions. While this approach has generated interesting and important ideas, progress has been frustrated by a fundamental hurdle: direct confrontation of models and data in a statistically robust way. We propose a working group aimed at overcoming this hurdle by synthesizing numerous state-of-the-art techniques. The approaches we will consider explicitly take into account common causes of mismatch between models and data such as process noise (demographic and environmental stochasticity), measurement error, unobserved variables, and nonstationarity. The end result of this working group will be a thorough review of the strengths and weaknesses of the various approaches under different circumstances and a set of easy-to-use statistical tools for use by non-specialists.

Meta-analysis in ecology: Lessons, challenges and future
Leaders: Koricheva, Julia; Gurevitch, Jessica

Participants:

Cote, Isabelle
Curtis, Peter
Gurevitch, Jessica
Hedges, Larry
Jennions, Michael
Koricheva, Julia
Lajeunesse, Marc
Lau, Joseph
Lortie, Christopher
Mengersen, Kerrie
Myers, Ransom
Rosenberg, Michael
Rothstein, Hannah
Schmid, Christopher
Stewart, Gavin

Abstract:
Meta-analysis represents a set of statistical methods for quantitative research synthesis developed in medicine and social sciences in late 1970s and introduced to ecology in early 1990s. It provides a more objective and informative alternative to narrative reviews and "vote-counting" approaches traditionally used for research synthesis in ecology. Despite its great potential in addressing both basic and applied research questions, the progress in meta-analytic applications in ecology is still hindered by the limited availability of meta-analytic training for ecology students, limited palette of meta-analytic techniques and tools available in ecology compared to that available in medicine and social sciences, and the need to adjust these techniques to account for the structure of ecological data and the nature of ecological questions. The aims of our working group are to facilitate and to promote the thoughtful and critical use of meta-analysis for research synthesis in ecology, and to improve the power and rigour of ecological meta-analysis. These aims will be achieved by writing a handbook of meta-analysis for ecologists, by updating existing statistical software for ecological meta-analysis, by creating an online forum on ecological meta-analysis containing bibliography and teaching aids, by taking advantage of recent methodological developments in quantitative research synthesis in medicine and social sciences, and by adjusting standard meta-analytical procedures to address specific ecological issues and problems.

Parasites and food webs - the ultimate missing links
Leaders: Lafferty, Kevin; Dobson, Andrew; Pascual, Mercedes

Participants:

Allesina, Stefano
Arim, Matias
Briggs, Cherie
Dobson, Andrew
Dunne, Jennifer
Hampson, Katie
Hechinger, Ryan
Johnson, Pieter
Kuris, Armand
Lafferty, Kevin
Marcogliese, David
Marquet, Pablo
Martinez, Neo
McLaughlin, John
Memmott, Jane
Mordecai, Erin
Pascual, Mercedes
Poulin, Robert
Thieltges, David

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.

A quantitative exploration of the role of publication-related biases in ecology
Leaders: Lortie, Christopher; Aarssen, Lonnie; Koricheva, Julia; Tregenza, Tom

Participants:

Aarssen, Lonnie	Francis, Rich	Leimu, Roosa
Borsuk, Robyn	Grod, Olyana	Lortie, Christopher
Budden, Amber	Koricheva, Julia	Tregenza, Tom

Abstract:
Progress in a scientific discipline is normally achieved through publication and dissemination of knowledge. Number of publications and their citation frequency are also widely used for academic evaluation of individual researchers, departments, and universities. Therefore, any bias in publication and dissemination of scientific content may potentially affect the development of a field in terms of what kind of information is available for synthesis, who is successfully employed, and where funding is allocated . We will specifically focus on publication bias in ecology in this working group using meta-analysis techniques (and other standard statistics) on several sizeable collections of published papers and related online resources such as citation frequencies and impact factors. We have loosely identified three levels of attributes of the publication and dissemination process in ecology: characteristics of the study (number of hypotheses, effect size, support for main hypothesis), attributes of the publication itself (merit, length, number and gender of authors), and attributes of the journal (reputation, impact factor, circulation). General publication biases identified in medicine and ecology include the file drawer problem, overinterpretation bias, dissemination bias, status bias, visibility bias, and gender bias. Few synthetic studies however have quantitatively tested the importance of these proposed biases nor related these biases to specific attributes of the publication process. Furthermore, there has been no quantitative evaluation of the relative importance and potential interactions between these factors.

Tools and fresh approaches for species abundance distributions
Leaders: McGill, Brian; Etienne, Rampal; Gray, John; Green, Jessica

Participants:

Alonso, David	Green, Jessica	Morlon, Helene
Anderson, Marti	He, Fangliang	Olff, Han
Bahn, Volker	Hu, Xinsheng	Ostling, Annette
Benecha, Habtamu Kassa	Hurlbert, Allen	Pueyo, Salvador
Dornelas, Maria	Magurran, Anne	Soykan, Candan

Enquist, Brian
Etienne, Rampal
Gray, John
Marquet, Pablo
Maurer, Brian
McGill, Brian
Tokeshi, Mutsunori
Ugland, Karl
White, Ethan
Zillio, Tommaso

Abstract:
The species abundance distribution (SAD) is a central pattern in ecology and of great importance for basic and applied management questions. Yet, surprisingly little progress has been made in identifying the mechanisms responsible for this fundamental pattern. We identify seven obstacles that have slowed progress in this field of research. We propose a working group that will develop a standardized database of SADs and computer code for analyzing SADs. The working group will publish these for the scientific community at large and also use them to pursue a promising new direction in exploring SADs based on perturbations (how the SAD changes as various environmental factors covary).

A synthetic approach to the science of ecosystem-based management of coastal marine ecosystems (EBM) *(The David and Lucile Packard Foundation)*
Leaders: Micheli, Fiorenza; Rosenberg, Andrew

Participants:
Altman, Irit
Broad, Kenneth
Broitman, Bernardo
Brumbaugh, Dan
Chan, Kai
Costello, Christopher
Eastman, Ronald
Fogarty, Michael
Gaines, Steven
Halpern, Ben
Kappel, Carrie
Lluch Cota, Salvador
Mangel, Marc
Martone, Rebecca
Menzel, Susanne
Micheli, Fiorenza
Osio, Giacomo
Rosenberg, Andrew
Sanchirico, James
Shester, Geoffrey
Siegel, David
Spalding, Ana
Teck, Sarah
Watson, James

Abstract:
We will develop a modeling and data integration framework for EBM and apply that framework to a case study from coastal California. By bringing experts in the modeling of natural and human systems together with policy specialists, the working group will develop a policy relevant modeling approach that includes the dynamics of social, biophysical and economic components of the ecosystem and critical feedbacks among them, and an explicit risk assessment component. Then, in collaboration with scientists and managers knowledgeable about the coastal California system, we will develop a detailed case study using this modeling approach as a basis. Key questions about how to cope with uncertainty, how to define ecosystem boundaries, and what constitute appropriate and effective indicators of ecosystem health and performance, will be addressed through the case study. The result will be a tool that scientists and policy makers use to develop an ecosystem-based approach to management of this system, and by extension others.

Gradients in biodiversity and speciation
Leaders: Mittelbach, Gary; Cornell, Howard; Schemske, Douglas

Participants:

Allen, Andrew
Barraclough, Timothy
Brown, Jonathan
Bush, Mark
Cornell, Howard
Davies, T. Jonathan
Harrison, Susan
Hurlbert, Allen
Jablonski, David
Knowlton, Nancy
Lessios, Harilaos
McCain, Christy
McCune, Amy
McDade, Lucinda
McPeek, Mark
Mittelbach, Gary
Near, Thomas
Nee, Sean
Orr, H. Allen
Price, Trevor
Ricklefs, Robert
Roy, Kaustuv
Sax, Dov
Schemske, Douglas
Schluter, Dolph
Sobel, Jay
Stephens, Patrick
Turelli, Michael

Abstract:
The diversity of life varies predictably with climate and is greatest where it is warm and wet (the humid tropics). But, the question ¿why¿ has puzzled biologists for over a century. Recent attention has focused on evolutionary mechanisms, in particular whether speciation rates may vary predictably with climate/latitude, whether such variation in speciation rates can account for higher species richness in tropical environments, and what mechanisms might cause geographical variation in speciation rates. We propose to bring together an interdisciplinary team of ecologists, evolutionary biologists, and paleontologists to address the conceptual issues of how climate interacts with ecological and physiological processes to affect speciation rates. Our goal is to test whether speciation/diversification rates vary with climate/latitude using phylogenetic and paleontological data. However, formidable challenges stand in the way of these tests. Therefore, our group will work to identify ways to meet these challenges and to address methodological issues of how to use phylogenetic analysis, as well as paleontological data, to estimate rates of speciation and evolutionary diversification across geographical gradients.

Detritus and dynamics of populations, food webs and communities
Leaders: Moore, John; Dong, Quan

Participants:

Berlow, Eric
Bradford, Mark
Callaway, Duncan
Coleman, David
Covich, Alan
Diaz, Ricardo
Dong, Quan
Hagen, Beth
Hastings, Alan
Hunt, H. William
Johnson, Nancy
McCann, Kevin
Melville-Smith, Kimberly
Moore, John
Morin, Peter
Nadelhoffer, Knute
Post, David
Rooney, Neil
Rosemond, Amy
Sabo, John
Scow, Kate
Strong, Donald
Vanni, Michael
Wall, Diana
Wallenstein, Matthew
Webb, Colleen
Wolkovich, Elizabeth
de Ruiter, Peter

Abstract:

Food web theory was developed in large part on the pathway of primary production from plants to herbivores to predators even though most primary productivity is uneaten by herbivores and enters the food web as detritus. What happens to this dominant chunk of the world's productivity? Is the detrital food web a self-contained sink internally recycling energy and nutrients or a link that affects the population dynamics of classic herbivore webs? Do these dynamics differ with system productivity or among habitats, e.g., aquatic versus terrestrial? Whatever the case, we should understand much more about this fundamental component of communities. This working group will focus on the role of detritus in the dynamics and structure of communities; determine systematic differences in its production, quality, and use among habitats; and delineate a framework to integrate detrital and classic food webs.

Global trajectories of seagrasses: Establishing a quantitative basis for seagrass conservation and restoration

Leaders: Orth, Robert; Dennison, William

Participants:

Carruthers, Tim	Hughes, A. Randall	Orth, Robert
Dennison, William	Kendrick, Gary	Short, Frederick
Duarte, Carlos	Kenworthy, W. Judson	Waycott, Michelle
Fourqurean, James	Livingstone, Suzanne	Williams, Susan
Heck, Kenneth	Olyarnik, Suzanne	

Abstract:

Seagrasses are a group of flowering plants that have evolved a unique set of characteristics to live, grow, and reproduce in marine underwater habitats (Les et al., 1997), with key ecosystem services that they provide to coastal areas of the world (Costanza et al., 1997). During the past two decades there has been a significant increase in the number of studies on the distribution, abundance, biology and ecology of seagrasses, including the recent publication of a seagrass atlas (Green and Short, 2003); methods book (Short and Coles, 2001) and research synthesis (Larkum et al., in press). However, the need for a better understanding of seagrasses today has taken on a new meaning and increased urgency. The rate of ecosystem alteration in coastal regions where seagrasses reside is accelerating (Cohen et al., 1997), and these alterations are occurring globally (Short and Wyllie-Echeverria, 1996). The very survival of seagrasses, which have been present for the past 100 million years, depends on their ability to cope with these natural and anthropogenic alterations. The goal of the ¿Global Seagrass Trajectories¿ working group, and the designated sub-groups, will be to use quantitative approaches to critically evaluate the types of changes that seagrasses are experiencing and evaluate likely causes. A previous qualitative examination of the literature indicates that seagrasses are experiencing loss rates (Green and Short, 2003) which match or exceed those of other threatened coastal habitats, such as salt marshes, mangrove forests, and coral reefs (e.g., Pandolfi et al., 2003), for which there is ample scientific and social awareness. Yet, a global assessment with quantitative data for seagrasses is lacking and is the focus of this effort. Synthesizing available information and conveying them to the

broader scientific community and society in an effective way will be a key outcome of this project.

Monitoring responses of Pacific salmon to climate change *(Gordon and Betty Moore Foundation)*
Leaders: Peterman, Randall

Participants:

Adams, Pete	Jordan, Chris	Parken, Chuck
Drake, Doug	Larsen, David	Peterman, Randall
Fleishman, Erica	Leider, Steve	Rodgers, Jeffrey
Geiger, Harold	Lincoln, Rich	Webster, Michael
Holt, Kendra	Olsen, Anthony	

Abstract:
This working group will develop monitoring programs that can identify changes in populations of Pacific salmon and attribute those changes to different potential mechanisms, including climatic change. Analyses of data from such programs will (1) document changes in salmon populations,
(2) provide empirical data to compare with previous predictions, (3)inform evaluation of alternative hypotheses about mechanisms by which climate change affects salmon, and (4) inform suggested actions to maintain wild Pacific salmon populations over the long term. The group will develop guidelines for identifying an appropriate monitoring design given both budget constraints and location-specific concerns about the response of Pacific salmon to climate change. These guidelines will be applied to several illustrative situations. Further, the group will explore the consequences of deviating from the "best" design for a given situation, which will facilitate quantification of tradeoffs among monitoring programs.

Linking carbon storage in terrestrial ecosystems with other climate forcing agents: A synthesis allowing for effective carbon dioxide stabilization policies
Leaders: Randerson, James; Canadell, Josep; Jackson, Robert

Participants:

Anderson, Ray	Canadell, Josep	Hungate, Bruce
Avissar, Roni	DeFries, Ruth	Jackson, Robert
Baldocchi, Dennis	Dickinson, Robert	Kueppers, Lara
Bonan, Gordon	Diffenbaugh, Noah	Law, Beverly
Caldeira, Ken	Field, Christopher	Pataki, Diane
		Randerson, James

Abstract:
Reforestation, afforestation, and avoided deforestation mitigation options influence climate at local to global scales by mechanisms in addition to their effect on stabilizing

atmospheric carbon dioxide levels. In some cases, for example, climate forcing from concurrent changes in albedo, evapotranspiration, and aerosols may have a larger impact regionally and globally than the net effects of greenhouse gases, yet these mechanisms are not accounted for in current policy frameworks such as the Kyoto Protocol. We propose a series of three meetings, bringing together ecosystem ecologists, climate scientists, and policy experts to synthesize recent work on tradeoffs between biogeochemical and biophysical forcing agents associated with land cover change. In a second step, we plan to draft a policy perspective that reevaluates the role of terrestrial ecosystems in climate policy.

Making decisions on complex environmental problems
Leaders: Regan, Helen; Sarkar, Sahotra

Participants:

Burgman, Mark
Colyvan, Mark
Drechsler, Martin
Dyer, James
Fuller, Trevon
Justus, James
Lubell, Mark
Maguire, Lynn
Margules, Christopher
Martin, Tara
Moffett, Alexander
Regan, Helen
Rothley, Kristina
Ruckelshaus, Mary
Sarkar, Sahotra
Skyrms, Brian

Abstract:
Environmental scientists must often facilitate complex decision-making based on scientific data but subject to societal and other constraints on management options. Complexity arises from: (i) multiple, often incommensurable, criteria that must be incorporated into decisions; (ii) decisions that must reflect the often conflicting long- and short-term goals of multiple stakeholders; and (iii) decisions that must be made in the presence of risk and uncertainty. The purpose of this project is to characterize scenarios for environmental decision-making and develop a conceptual taxonomy of them; review existing methods for dealing with multiple criteria and objectives, multiple stakeholders, and risk and uncertainty; develop integrated protocols for the use of these methods for complex decision making scenarios in conservation, wildlife management and/or environmental science; develop software tools for some of the methods for which existing tools are inadequate; test protocols and tools against available data sets; and identify areas in which more research is needed.

Comparing trophic structure across ecosystems (Extended)
Leaders: Shurin, Jonathan; Hillebrand, Helmut; Gruner, Daniel

Participants:

Bolker, Ben
Borer, Elizabeth
Bracken, Matthew
Brown, James
Cardinale, Bradley
Cottingham, Kathryn
Elser, James
Gruner, Daniel
Harpole, W. Stanley
Hillebrand, Helmut
Seabloom, Eric
Shurin, Jonathan
Smith, Jennifer
Smith, Melinda
Wolkovich, Elizabeth

Cebrian, Just
Cleland, Elsa
Ngai, Jacqueline
Sandin, Stuart
de Mazancourt, Claire

Abstract:
Trophic structure, the partitioning of biomass among organisms at different positions in a food web, varies both within and among ecosystems. However, the causes of this variation are poorly understood. Elton's "pyramid of numbers", where primary producers dominate and consumer densities decrease as trophic levels become more remote from the base of production, applies well to most terrestrial systems. However, many aquatic ecosystems apparently violate Elton¿s rule with inverted biomass pyramids, or ratios of heterotroph-to-autotroph biomass (H:A) greater than one. In this proposal, we describe synthetic work aimed at understanding differences in trophic structure and the relative strength of bottom-up and top-down inputs between diverse freshwater, marine and terrestrial ecosystems. We will test candidate hypotheses for this variation based on factors known to distinguish food webs in the two habitats, such as nutrient limitation and turnover rates, productivity (quantity) and nutrient stoichiometry (quality). Meta-analysis of local-scale herbivore manipulation experiments will be integrated with theoretical development of food web models, and with larger-scale temporal and spatial patterns from resource gradients. This work will move us closer to a comprehensive trophic-dynamic theory, unified across taxa and ecosystem types. It will also increase our mechanistic understanding of how human impacts, such as eutrophication or predator extirpation, propagate or attenuate in ecosystems through trophic interactions.

Evolutionary and ecological sorting in space
Leaders: Urban, Mark; Leibold, Mathew

Participants:
Amarasekare, Priyanga
Cavender-Bares, Jeannine
DeMeester, Luc
Declerck, Steven
Gomulkiewicz, Richard
Helmus, Matthew
Hochberg, Michael
Klausmeier, Christopher
Leibold, Mathew
Lively, Curtis
Loeuille, Nicolas
Norberg, Jon
Nuismer, Scott
Ovaskainen, Otso
Pantel, Jelena
Parent, Christine
Peres-Neto, Pedro
Strauss, Sharon
Urban, Mark
Vellend, Mark
Wade, Michael
de Mazancourt, Claire

Abstract:
The last fifteen years have witnessed an increasing realization that ecological dynamics operating at coarse spatial scales have important ecological consequences. One of the more exciting ideas that has ensued is the "metacommunity" (Figure 1), a concept that has contributed significant insights about population, community and ecosystems ecology (see Leibold et al. 2004 for a recent review, Holyoak et al. 2005 for the scope of this idea).

To date, however, the metacommunity concept has been evaluated in a purely ecological context. Nevertheless, close parallels and obvious interrelations exist between ecological and evolutionary dynamics at multiple spatial scales (McPeek and Gomulkiewicz 2005). Mounting evidence suggests that evolutionary dynamics can occur on time scales similar to those involving ecological dynamics (Cousyn et al. 2001, Kinnison and Hendry 2001, Grant and Grant 2002, Yoshida et al. 2003). If so, metacommunity and evolutionary dynamics may interact strongly. Yet, we are only now beginning to understand this interaction. While metacommunity ecology will continue to contribute interesting insights about a diverse array of ecological phenomena, we foresee that these insights will soon be constrained by our limited knowledge about how ecological and evolutionary processes interact in metacommunities.

We seek to bring together scientists from diverse backgrounds to synthesize current knowledge and generate new understanding about evolutionary and metacommunity dynamics. We intend to 1) develop and refine an evolving metacommunity framework, 2) explore the potential for emergent dynamics by incorporating evolution into existing metacommunity models; 3) evaluate how multi-species interactions impact community evolution and dynamics; and 4) develop tools to test and apply the theory. The proposed synthesis of evolutionary and metacommunity theory promises to improve our understanding of species coexistence and provide strategies for preserving biodiversity and controlling rapidly evolving pests and pathogens.

Efficient wildlife disease control: From social network self-organization to optimal vaccination

Leaders: Walsh, Peter

Participants:

Bansal, Shweta
Benavides, Julio
Boesch, Christopher
Boyer, Denis
Caillaud, Damien
Crofoot, Margaret
Getz, Wayne
Hampson, Katie
Meyers, Lauren
Ryan, Sadie
Salvador, Liliana
Scarpino, Samuel
Walsh, Peter
Wylie, Dennis

Abstract:

As large vertebrates are restricted to ever smaller populations, the threat posed by infectious disease grows. This multidisciplinary working group will investigate how information on social network connectivity can be used to make wildlife disease control programs more efficient. Using primates as a model system, we will build from studies on the way in which memory-based cognitive skills drive social network self-organization to the modeling of optimal disease control. Our modeling will be strongly data-based, using large datasets on ranging and disease prevalence\mortality from gorillas, chimpanzees and four monkey species to parameterize and validate agent-based simulation models. The datasets are from primate species that both suffer disease spillover from humans (e.g. measles, yaws, gut parasites) and act as reservoir or intermediate hosts for viruses that are of high public health (HIV, yellow fever) or

bioterror (anthrax, Ebola) importance. The group's research will be focused on three overlapping topics. First, we will investigate how cognitive skills influence social network self-organization and interact with landscape processes such as habit degradation and hunting to determine patterns of disease emergence. Second, we will evaluate both generic strategies for controlling disease in protected areas and detailed case studies of optimal disease control in specific systems, including a special focus on controlling the impact of Ebola, which has killed about one third of the world's protected area gorilla population over the last 15 years. Third, the group will perform cost-benefit analyses to evaluate the cost-effectiveness and feasibility of vaccination relative to other conservation strategies, as well as make recommendations on which steps need to be taken to streamline the movement of vaccines and treatments from laboratory development to field implementation. Working group products will include both basic research on the mechanisms of disease network self-organization and more applied work on optimal disease control in real systems. A large body of primary and derived data products will be deposited in publicly accessible databases. The group has excellent diversity and balance in terms of the scientific discipline, career stage, gender, and geographic origin of its participants.

Evolutionary and plastic responses of Pacific salmon to climate change *(Gordon and Betty Moore Foundation)*
Leaders: Waples, Robin; Schindler, Daniel

Participants:

Augerot, Xan	Hutchings, Jeffrey	Rand, Pete
Aziz, Omar	Kimball, John	Reed, Tom
Beechie, Timothy	Kinnison, Michael	Rogers, Lauren
Bernatchez, Louis	Lawson, Peter	Ruckelshaus, Mary
Bottom, Dan	Mangel, Marc	Scheuerell, Mark
Crozier, Lisa	Mantua, Nathan	Schindler, Daniel
Fleishman, Erica	Meir, Eli	Seeb, James
Gomulkiewicz, Richard	Myers, Kate	Waples, Robin
Gregory, Stan	Petersen, Christine	Webster, Michael
Hard, Jeff	Quinn, To	Wu, Huan

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.

Exploring compensatory mitigation and markets as mechanisms for resolving fisheries bycatch: Biodiversity conservation conflicts
Leaders: Wilcox, Chris; Donlan, C. Josh

Participants:

Buckelew, Stacey	Graham, Alistair	Rice, Richard
Crowder, Larry	Hemphill, Arlo	Sagarin, Rafe
Cudney-Bueno, Richard	Lavers, Jennifer	Sequeiros, Manuel
Dalzell, Paul	Mandel, James	Squires, Dale
Dalzell , Paul	Melvin, Edward	Sullivan, Joe
Donlan, C. Josh	Pascoe, Sean	Turnipseed, Mary
Fletcher, Kristen	Peckham, Hoyt	Wilcox, Chris
Gjertsen, Heidi	Pergams, Oliver	Wingfield, Dana

Abstract:
The social and economic importance of fisheries and the biological realities of its impacts results in cardinal tensions over ocean resources. Fisheries provide approximately 16% of all protein consumed by humans and are valued at US$82 billion annually. However, eight percent of the global fishery catch is bycatch which is discarded; resulting in major impacts on marine systems. Increasingly, institutions are pressuring for sustainable management of species impacted by fisheries. Where bycatch cannot be avoided, fishery closures are being implemented, often driven by lawsuits, with costly outcomes for society. An offset approach to this conflict could facilitate high value uses of biological resources while making conservation gains for threatened species. Taking seabirds as an example, fishers could be levied for bycatch and capital transferred to fund conservation actions on breeding colonies (e.g., the removal of invasive mammals¿the primary threat to seabirds worldwide). A preliminary analysis has shown eradication of invasive predators can be 12 times more effective from an economic cost-conservation benefit perspective in comparison with fisheries closures. In addition, transferable bycatch fees, which could increase with endangerment, also provide individual incentives for avoiding bycatch, the most effective mechanism for sustainable management of fisheries. We are developing a general framework for this approach, using seabirds and sea turtles as case studies. Given limited conservation dollars, compensatory mitigation provides an opportunity to address a global concern, maximize the return on investment of conservation interventions, and forge an alliance between conservation and fisheries organizations, circumventing costly and socio-politically damaging battles over bycatch conflicts.

Finding common ground in marine conservation and management
Leaders: Worm, Boris; Hilborn, Ray

Participants:

Baum, Julia	Hilborn, Ray	Minto, Coilin
Coleman, Felicia	Jennings, Simon	Murawski, Steve

Collie, Jeremy
Costello, Christopher
Essington, Timothy
Fogarty, Michael
Fulton, Beth
Jensen, Olaf
Lotze, Heike
Mace, Pamela
McClanahan, Tim
Micheli, Fiorenza
Palumbi, Stephen
Parma, Ana
Rosenberg, Andrew
Watson, Reg
Worm, Boris

Abstract:
There is increasing concern among scientists and the general public about the current state of marine fisheries and their supporting ecosystems (Ludwig et al. 1993, Hilborn et al. 2003, Myers & Worm 2003, Pauly et al. 2003, Worm et al. 2006). Recent scientific progress on this topic has been partly overshadowed by significant controversy on how to assess marine resources and how to address current problems in ocean management (Jackson 2001, Myers & Worm 2005, Polachek 2005, Hilborn 2006). Marine ecologists and fisheries scientists often tend to favor contrasting approaches, and we observe that these schools of thought have polarized over time. We now recognize this situation as counterproductive and propose to address this controversy where possible. In the proposed Working Group we are trying to define common ground among marine ecologists and fishery scientists by (1) developing a unifying terminology and a common analytical framework for assessing marine fisheries and ecosystem change, (2) applying this framework to a number of representative marine ecosystems around the globe, and (3) assessing management successes and failures in order to identify a set of tools that have been proven to reverse trends of degradation in marine fish stocks and ecosystems. This process should also identify areas of continued disagreement, important for focusing future research. In a final step (to be funded by a third party) we would present our conclusions to managers, NGO and government agencies, helping them to understand the progress that has been made. The central question we are trying to answer is: how can we merge contrasting objectives, tools, and scientific criteria among marine ecology, fisheries science, and management into a unifying framework. We envision that this group will be acting as a catalyst for joining scientific forces in a quest to sustain and restore valuable marine resources.

Toward an adequate quantification of CH4 emissions from land ecosystems: Integrating field and in-situ observations, satellite data, and modeling
Leaders: Zhuang, Qianlai; Melillo, Jerry; Prinn, Ronald; McGuire, A. David

Participants:
Butenhoff, Christopher
Crill, Patrick
Dlugokencky, Ed
Fischer, Marc
Frolking, Steve
Gauci, Vincent
Gedney, Nicola
Houweling, Sander
Keller, Michael
Khalil, Aslam
Matthews, Elaine
McDonald, Kyle
McGuire, A. David
Meirink , Jan Fokke
Melack, John
Melillo, Jerry
Potter, Chris
Prinn, Ronald
Reeburgh, William
Roulet, Nigel
Tan, Qian
Tang, Jinyun
Turetsky, Merritt
Wallage, Zoë
Walter, Katey
White, Jeffrey
Wickland, Kimberly
Xiao, Jingfeng
Xiong , Xiaozhen
Zhuang, Qianlai
Zimov, Sergei

Abstract:
Emissions of CH4 from natural and managed land ecosystems account for a significant source of greenhouse gases to the atmosphere. In recent decades, extensive field observations of CH4 emissions and atmospheric CH4 concentrations have been made during a time in which process-based and inversion modeling approaches have matured as powerful tools in estimating regional and global CH4 emissions. However, there are still substantial uncertainties in estimating CH4 exchange with the atmosphere. Much of this uncertainty arises from uncertainties in the extent of wetland distributions and incomplete understanding of the controls and mechanisms of methanogenesis, methanotrophy, and CH4 transport pathways to the atmosphere. Furthermore, there is variability in which factors control CH4 production and consumption in different natural and managed ecosystems. For example, in northern high latitudes, permafrost dynamics significantly influences emissions, while the seasonality of wetland extent is critical in determining emissions from tropical regions. For managed ecosystems (e.g., rice paddies), irrigation and fertilization significantly impact both methanogenesis and methanotrophy. Here we propose a Working Group to make progress in synthesis of CH4 dynamics through three activities: 1) to identify key issues in quantifying CH4 emissions from land ecosystems through conducting comparisons of model and field observations for different geographical locations and ecosystems; 2) to parameterize and extrapolate process-based models at regional and global scales and explore the uncertainty of CH4 emissions; and 3) to couple process-based estimates with inversion modeling approaches to constrain the uncertainty with air-borne, satellite, and in-situ observed datasets and to identify the factors, mechanisms, and controls to the uncertainty of emissions at large-scales.

Meetings Hosted by NCEAS

Araime, Satie
2-Oct-07 - 4-Oct-07
Marine Protected Areas Monitoring Group (Hosted by NCEAS)

Beard, Douglas
15-Jan-08 - 17-Jan-08
NBII/GAP Meeting (Hosted by NCEAS)

Cadotte, Marc
26-Mar-08 - 26-Mar-08
Diversity metrics that weight community phylogeny (Hosted by NCEAS)

Connors, Margaret
19-Apr-08 - 19-Apr-08
Santa Barbara educators' roundtable: Proposal planning/educational website

Sabo, John
28-May-08 - 30-May-08
Cadillac Desert (Hosted by NCEAS)

Kareiva, Peter; Ricketts, Taylor; Daily, Gretchen; Polasky, Stephen
3-Feb-08 – 06-Feb-08 and 7-Apr-08 – 11-Apr-08
Conservation priorities: Can we have our biodiversity and ecosystem services too? (Hosted by NCEAS)

Scientific Visitors

Diéguez, María, Centro Regional Universitario Bariloche, Argentina
1 Apr 08 – 8 Apr 08
Fulbright Fellowship: Plankton and insect interactions (Host: Stephanie Hampton)

Graham, Mark, University of Alberta (graduate student)
30 Apr 08 – 5 May 08
Paleolimnology and climate change (Host: Stephanie Hampton)

Lortie, Christopher, York University
1-May-07 - 31-Aug-08
Publication bias in ecology (Host: Amber Budden)

Moore, Marianne, Wellesley College
14 Nov 07 – 19 Nov 07
Lake Baikal Plankton (Host: Stephanie Hampton)

Pressey, Robert, New South Wales National Parks and Wildlife Service
5 Mar 08 – 9 Mar 08
(Host: Erica Fleishman)

Savolainen, Vincent, Imperial College, Silwood Park
9-Jun-08 - 11-Jun-08
Coexistence, competition, and character evolution in carnivores and primates (Host: Jonathan Davies)

Vinebrooke, Rolf, University of Alberta
30 Apr 08 – 5 May 08
Long-term plankton dynamics in response to fish and climate change
(Host: Stephanie Hampton)

Center Associates Hosted by NCEAS

Alroy, John
Paleobiology Database (Hosted by NCEAS)

Aukema, Juliann - *supported by The Nature Conservancy*
Economic and ecological implications of non-native forest pests and pathogens

Baron, Nancy
SeaWeb (Hosted by NCEAS)

Kontgis, Caitlin
Predicting community-level responses to disturbance: Implications for reserve design (Hosted by NCEAS)

Halpern, Benjamin - *supported by Packard Foundation*
Project Coordinator, Ecosystem-based Management Program

Melian, Carlos – *supported by Microsoft Research Limited*
22-Apr-08 - 21-Apr-09
Unifying niche-neutral theories of molecular, community and network evolution (Gift) evolutionary scales

O'Halloran, Thomas – *supported by The Nature Conservancy & U.S. Fish & Wildlife Service*
Quantitative analysis of ecosystem processes in forests and estuaries

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 (Hosted by NCEAS)

Research Training Activities

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

Graduate Student Interns

Bursuk, Robyn
5 May 08 – 27 Jun 08
A quantitative exploration of the role of publication-related biases in ecology
Project Lead: Christopher Lortie

Conrad-Saydah, Ashley *(supported by The Nature Conservancy)*
1Jan-07 – 30-Jun-08
Biodiversity, conservation and ecosystem services in managed landscapes (The Nature Conservancy)
Project Lead: Fabrice De Clerk

Freed, Sarah *(supported by The Packard Foundation)*
1 Jul 08 – 30 Sep 08
Measuring ecological, economic and social values of coastal habitats to inform ecosystem-based management of land-sea (EBM)
Project Lead: Elise Granek

Grod, Olyana
5 May 08 – 27 Jun 08
A quantitative exploration of the role of publication-related biases in ecology
Project Lead: Christopher Lortie

Kreitler, Jason
1 Jan 08 – 30 Jun 08
Ushering in a new era of functional ecology: Dynamics in a changing environment (Distributed Graduate Seminar)
Project Lead: Elsa Cleland

Trebilco, Rowan
25 May 08 – 30 May 08; 15 Jun 08 – 15 Jul 08
Putting ocean wilderness on the map: Building a global GIS atlas of pristine marine environments
Project Lead: Ben Halpern

Undergraduate Intern

Kashtuyeva, Yelena
29 May 08 – 30 Aug 08

The 60-year data set of plankton dynamics in Lake Baikal: Examining facets of the jewel of Siberia
Project Lead: Stephanie Hampton and Marianne Moore

High School Student

Yamazaki, Stacy
26 Jun 08 – 01 Aug 08
Using phylogenetic information to predict the relative importance of equalizing versus stabilizing mechanisms on species coexistence
Project Lead: Marc Cadotte

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 – *4 sessions*
- Advice for New Faculty
- Mentoring
- Finding and Landing a Job in the NGO Sector
- Dual Career Couples in Ecology/Science
- How to Write Clearly and Efficiently for Scientific Publications
- Negotiating Your Academic Contract
- Ecological Salaries

Media Training

- Communicating Science
  Nancy Baron, NCEAS & SeaWeb/COMPASS

- Bridging the Worlds of Science and Journalism
  Anna Davison, Freelance Journalist & Michael Todd, Online Editor, *Miller-McCune.com*

Technical Training

- Introduction to Ecoinformatics
  Jim Regetz (NCEAS) and the NCEAS Ecoinformatics Development Team

  An overview of the ecoinformatics research program and its products, on-the-ground applications, ongoing collaborative projects, and emerging technologies. In addition, a free-form, hands-on software session provided opportunities to:
  - Manage data/metadata in Morpho,
  - Test drive some scientific workflows in Kepler
  - Register a dataset

- Ecological Network Structure and Dynamics
  Neo Martinez, PEACElab

  A two-day course introduced a powerful theoretical framework for exploring central ecological problems from diversity-stability relationships to the effects of biodiversity loss and species invasions.

- GeoSpatial Software Tools Workshop
  NCEAS Scientific Computing Staff

  The workshop addressed the following questions:
  - How can ecologists benefit from using geospatial techniques and software in their research?
  - Within the past several years the Open Source software community has produced several software packages with geospatial analysis features. What are the capabilities of these packages, especially with respect to ecological research?
  - How are NCEAS associates using these tools in their day-to-day work?

- Meta-analyses in Ecology
  Julia Koricheva

  A brief introduction to meta-analysis and research synthesis in ecology. Day one was designed to start with the basics and was suitable for people with little or no experience with meta-analysis. Day two was a continuation of day one and addressed more advanced issues.

- An introduction to the analysis of community time series using Multivariate Autoregressive (MAR) models
  Stephanie Hampton (NCEAS), Elizabeth (Eli) Holmes & Mark Scheuerell (NOAA Fisheries, Seattle)

  Multispecies (or Multivariate) Autoregressive (MAR) modeling is a versatile time series modeling approach that allows users to address many

common questions in ecology, such as: 1) Which abiotic and biotic factors best predict the abundance of various taxa?, 2) What are the relative strengths of abiotic and biotic interactions between community members?, 3) How stable is the community structure? In this workshop, participants were given a basic introduction to autoregressive time series modeling in general and to multivariate autoregressive modeling in particular. Specific case studies where MARs have been used to analyze species interactions, environmental drivers and community stability in aquatic ecosystems were presented to give concrete examples of how MARs can be used to address ecological questions.

Additional seminars

The wide range of visiting and resident scientists at NCEAS provides excellent opportunities for interactions through the NCEAS seminar series. A list of speakers is provided in Table 1. 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 “characteristics of effective collaboration” and “ethics of funding in science.”

Education and Outreach Activities

NCEAS provides outreach and training, effectively publicizes new research to increase the public understanding of science, fosters interest in ecology and technology professions, particularly among underrepresented groups, and contributes to the local community.

Communicating Science

NCEAS provides maximum visibility for its research. By coordinating with researchers’ home institutions, University of California, Santa Barbara’s Office of Public Affairs, and the National Science Foundation, Media and Public Information Section, we have expanded publicity efforts resulting in increased coverage in the popular media. Our Outreach Coordinator also meets with environmental writers to propose story ideas related to NCEAS research. In addition, NCEAS offers media training workshops for resident and visiting scientists to enhance their skills in effectively communicating their research. NCEAS scientists meet with local, state and federal agencies, policy makers, and non-governmental organizations to provide scientific information about ecological issues.

NCEAS collaborates with other organizations such as the California Ocean Communicators Alliance and The Coalition on the Public Understanding of Science to promote public interest in and understanding of science. Editorial assistance is provided

to resident and visiting scientists to craft public-oriented summaries of their research, and these summaries appear on a "Featured Research" section of the NCEAS website.

Several scientific studies have attracted major media attention in this reporting period, such as:

Halpern et al. 2008. A Global Map of Human Impact on Marine Ecosystems. Science 319: 948-952.
National Public Radio: http://www.npr.org/templates/story/story.php?storyId=19059595
NBC Nightly News: http://www.msnbc.msn.com/id/3032619/vp/23170513#23170513
New York Times (interactive graphics): http://www.nytimes.com/interactive/2008/02/25/science/earth/20080225_COAST_GRAPHIC.html

Hampton et al. 2008. Sixty Years of Environmental Change in the World's Largest Freshwater Lake--Lake Baikal, Siberia. Global Change Biology 14: 1947-1958.
New York Times: http://www.nytimes.com/2008/05/06/science/earth/06lake.html
Discovery Channel News: http://dsc.discovery.com/news/2008/06/05/lake-baikal-warming.html

Diversity Initiatives

NCEAS is acutely aware of the need to increase diversity in its own programs, and more generally, to support development of STEM careers. NCEAS promotes its calls for proposals among diverse professional and student groups (such as the ASLO Minorities Program, the National Postdoctoral Association/Diversity Section, and Faculty for the Future) and provides opportunities for our postdoctoral fellows to present their research at Minority Serving Institutions.

NCEAS has completed multiple recruitments for Distributed Graduate Seminars (DGS). These integrated, multi-campus graduate seminars are designed to engage students in ecological analysis and synthesis, with the cohort including minority serving institutions. Our goal of 25% MSI participation has not yet been met but we are working proactively with PI's in the preproposal stage to identify MSI participants. We are attempting to increase the pool of applicants by emphasizing in our publicity that undergraduate, as well as graduate programs, are encouraged to submit proposals.

With the intention of increasing participation in DGS among undergraduates, especially those at Minority Serving Institutions, we have initiated planning for a cooperative venture with the Ecological Society of America's SEEDS program. The project will facilitate collaborative undergraduate research among student chapters of the SEEDS network, providing a foundation for future DGS proposals from institutions with SEEDS chapters. The project will also provide an opportunity for students to learn teleconferencing skills needed for collaborative work.

NCEAS has established collaborations with other organizations fostering diversity in STEM fields, including the American Institute of Biological Sciences, the Ecological Society of America, the Society for the Advancement of Chicanos and Native Americans in Science and the National Evolutionary Synthesis Center.

With these partners we coordinated an Ecology and Evolution program at the 2007 conference of the Society for the Advancement of Chicanos and Native Americans in Science. The activities included a panel discussion on "Exploring Careers in Evolution and Ecology" and a field trip to the University of Kansas Natural History Museum & Biodiversity Research Center including a behind the scenes presentation by Director Jorge Soberon. A proposal for a similar program at the 2008 conference, including a scientific symposium on ecology and evolution and a mentoring session, has been accepted.

We are working with NOAA's Multicultural Education for Resource Issues Threatening Oceans (MERITO) Program staff to integrate an ecology training section, taught by NCEAS scientists, into a project proposal for a multicultural STEM initiative in science and new media.

Community Outreach/Collaboration

NCEAS *Kids do Ecology* classroom program, designed to provide an inquiry- based approach for fifth graders to learn about ecology and the scientific method, continues to be successful in the community. Five classrooms participated this year (approximately 150 students), at schools serving primarily Hispanic students. Nine NCEAS scientists and 2 graduate students provided team teaching and coached students in presenting their work at NCEAS for scientists, teachers and parents.

NCEAS sponsors an Ecology Award at the annual Santa Barbara County Science Fair and partners with local organizations in the Santa Barbara Educators' Roundtable to publish a monthly educational page for children in the local Sunday newspaper, and to plan proposals for other shared education and outreach projects. NCEAS also sponsors community events such as a weekly Ecolunch series (Table 1) and an annual Kids do Ecology Poster Day.

Outreach partner organizations:

- ESA/SEEDS
- AIBS
- SeaWeb/COMPASS
- NESCent
- Santa Barbara Educators Round Table
- Santa Barbara Elementary Schools
- Carpinteria Unified School District

- Coalition for the Public Understanding of Science
- National Marine Sanctuaries MERITO
- California Ocean Communicators Alliance
- Santa Barbara County Science Fair
- Society for the Advancement of Chicanos and Native Americans in Science

Diversity of Community Engagement

Since 1995, over 4,100 scientists have participated in activities at NCEAS (Figure 3), and the vast majority of NCEAS visitors come only once (Figure 4), allowing NCEAS to continue to engage new scientists. Of these NCEAS participants, 109 come from Minority Serving Institutions as presently 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 500 different professional societies and have published their NCEAS work in 220 distinct journals. Since 1995, participants have come from over 1,500 different institutions. Finally, 23% of the participants during this reporting period to date were from non-academic institutions.

Publications and Products

The total number of publications from NCEAS activities now exceeds 1,300 since the establishment of NCEAS (Figure 7). Recently we matched our publications to the most recent Impact Factor scores available and present in Table 2 below selected high-impact journals and the number of publications NCEAS has had in these journals over its lifespan.

Below we list 168 publications for the reporting period 1 October 2007 – 30 June 2008. 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.

In early 2008, we made a major effort to solicit product reporting from participants, such that more products than usual are reported here for which publication date precedes this reporting period, but these publications have not been previously reported to NSF. In addition to publications reported, we have listed 41 data sets that were registered or uploaded to the NCEAS Data Repository since 1 October 2007. NCEAS scientists have reported that they made 61 presentations of their NCEAS work, and submitted 7 new proposals to other organizations as a result of activities at NCEAS.

Publications Reported from October 1, 2007 to June 30, 2008

(Includes journal articles, books, and book chapters)

* *Indicates publication is being updated from in press*

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3. Tables and Figures

Table 1. Ecolunch seminars at NCEAS during the reporting period 2007-2008.

NCEAS EcoLunch Seminar Series
August 30, 2007 – June 12, 2008

Fall 2007

August 30	**Peter Mumby, University of Exeter** *Understanding and managing the resilience of coral reef*s
September 6	**Jim Bever, Indiana University** *Ecological dynamics and evolutionary maintenance of the mycorrhizal mutualism*
September 13	**Andrew Campbell, Triple Helix Consulting** *Developments Downunder - current trends in science and policy for managing Australian landscapes*
September 20	**Brian Silliman, University of Florida** *Climate change, food webs and new paradigms in marine ecology*
September 27	**Jim Brown, University of New Mexico** *Productivity and kinetics: the metabolic basis of species diversity*
October 5 **Friday Ecolunch**	**Rob Dunn, North Carolina State University** *Climate and global patterns of ant diversity and invasion*
October 11	**Marc Cadotte, NCEAS** *Species diversity and spatially-dependent mechanisms of coexistence*
October 18	**David Alonso, University of Michigan** *Randomness, natural selection and physical constraints for a changing world*
October 25	**Bill Dennison, University of Maryland** *Global trajectories of seagrasses, the biological sentinels of coastal ecosystems*
November 1	**Nick Shears, University of California - Santa Barbara** *Context dependent effects of fishing on kelp forest ecosystems*
November 8	**Louie Yang, University of California - Santa Barbara** *Resource pulses, periodical cicadas and the ecology of extreme events*
November 15	**Andrew Allen, NCEAS** *Setting the absolute tempo of biodiversity dynamics*
November 22	**No EcoLunch - Thanksgiving holiday**
November 27 **Tuesday seminar**	**Astrid Kodric-Brown, University of New Mexico & NCEAS** *Disturbance is essential for the preservation of desert fish communities*
November 29	**Lawrence McCook, Manager, Great Barrier Reef Marine Park Authority & Pew Fellow in Marine Conservation**

	Science & management of resilience of Great Barrier Reef in context of climate change
December 6	***Aaron King*, University of Michigan** *New insights into cholera dynamics: asymptomatic infections, rapid loss of immunity, and mode of transmission*
December 13	**Jacob Weiner, University of Copenhagen & NCEAS** *Applying plant population ecology - increasing the suppression of weeds by cereal crops*

Winter/Spring 2008

January 17	**Jeanine Cavender-Bares, University of Minnesota** *Linking phylogenetic history, plant traits and environmental gradients*
January 23 **Wednesday**	**Sam Luoma, USGS** *Potential role of contaminants in declines of pelagic organisms in the Upper San Francisco Estuary, California*
January 31	**Carlos Melian, NCEAS** *Unifying neutral theories of molecular, community and network evolution*
February 7	**Stephen Polasky, University of Minnesota** *Valuing ecosystem services: the good, the bad and the ugly*
February 14	**Christopher Lortie, York University** *A net interction based approach to understanding plant community dynamics.*
February 21	**David Atkinson, University of Liverpool & NCEAS** *Temperature- and size-dependency of biological rates, and their ecological consequences*
February 28	**John Swaddle, The College of William and Mary & NCEAS** *Urbanization, mate preference, and public health: the effects of development on avian and human societies*
March 6	**Chris Wilcox, CSIRO Marine and Atmospheric Research** *An integrated approach to managing fisheries bycatch*
March 13	**Raphael Sagarin, Nicholas Institute for Environmental Policy Solutions, Duke University** *Darwinian Security: findings from an NCEAS working group on evolution and security*
March 20	**Richard Condit, Smithsonian Tropical Research Institute & NCEAS** *TBA*
March 27	**Beth Witherell, Editor-in-Chief of The Writings of Henry D. Thoreau** *An introduction to Henry David Thoreau's phenological data, collected in Concord, Massachusetts, between 1851 and 1861*
April 3	**Jai Ranganathan, NCEAS** *Tiger, tiger, burning bright: hope for tiger conservation in the wilA*
April 10	**Andy Sih, University of California, Davis** *Behavioral syndromes: evolutionary and ecological issues and implications*
April 17	**Nancy Baron, NCEAS & SeaWeb/COMPASS** *Communicating Science: Bridging the Worlds between Scientists and Journalists*

April 24	**Rowan Lockwood, The College of William and Mary & NCEAS** *Is rarity linked to extinction in the fossil record? A case study using Cenozoic mollusks from the U.S. Coastal Plain*
May 1	**Stefano Allesina, NCEAS** *The spider and the web: inference in ecological networks*
May 8	**Mark Bradford, University of Georgia** *Are soil microbial communities functionally equivalent?*
May 15	**Kim Schultz, SUNY & NCEAS** *When "all you can eat" may not be enough: why ecologists should be as concerned with quality as quantity in the aquatic food web buffet*
May 22	**Annette Ostling, University of Michigan** *Do tradeoffs lead to neutral communities?*
May 29	**Lonnie Aarssen, Queen's University** *Death without sex - or how the meek plants have inherited the earth because of evolution*
June 3	**David Bowman, University of Tasmania** *Pyrogeography: integrating across the temporal, spatial and cultural dimensions of fire*
June 5	**Tristan Long, UCSB** *Evolutionary consequences of sexual conflict*
June 12	**Lynn Maguire, Duke University** *Endangered? threatened? not warranted?: criteria for ESA listing decisions*

Table 2. 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.

	Impact Factor	Number NCEAS pubs as of June 30, 2008
Nature	28.751	29
Science	26.372	50
Trends in Ecology and Evolution	14.797	36
PLoS Biology	14.1	3
Annual Review of Ecology, Evolution, and Systematics	10.34	13
Proceedings of the National Academy of Sciences	9.64	34
Ecology Letters	8.204	61
Ecological Monographs	8.117	5
Ecology	4.822	103
Global Change Biology	4.786	19
American Naturalist	4.543	63
Evolution	4.502	7
Frontiers in Ecology and the Environment	4.269	11
Proc. Royal Society of London Series B	4.11	18

Figure 1. Number of proposals submitted and supported in total for each proposal period since the establishment of NCEAS in 1995.

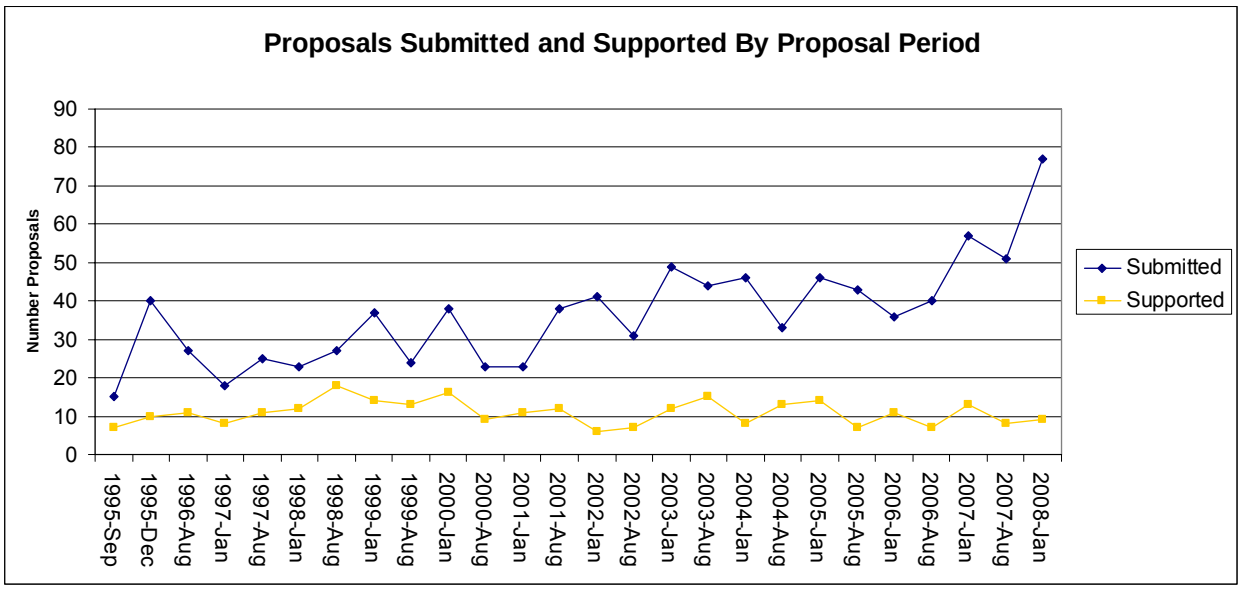
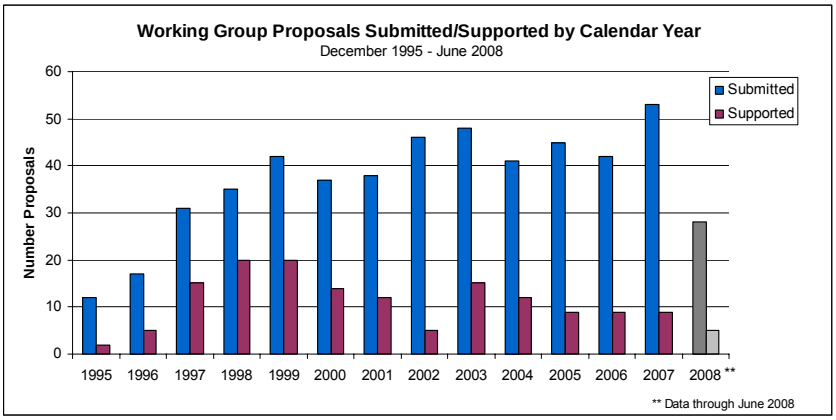
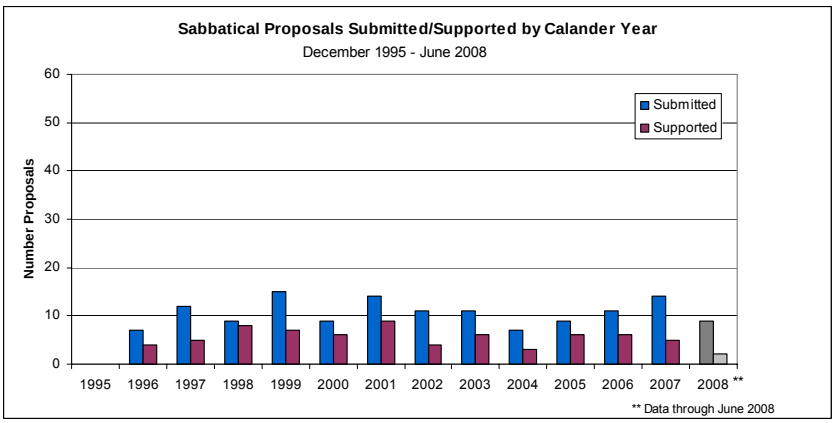


Figure 2. Proposals submitted and supported by activity type since NCEAS establishment.





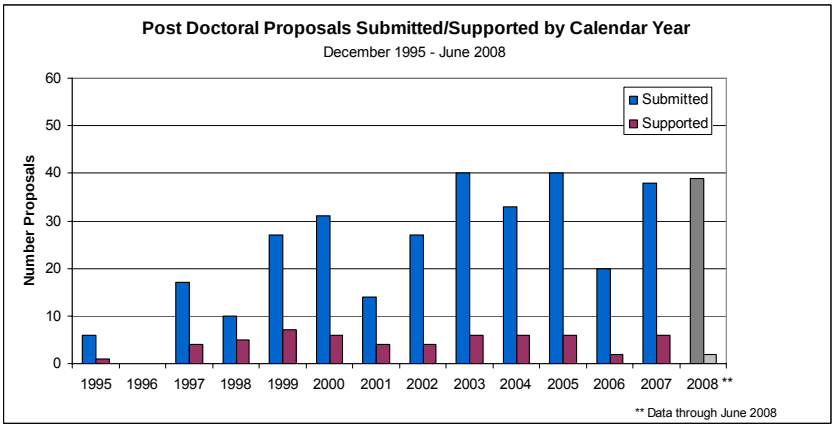


Figure 3. Number of participants since 1997, reported by the total number, and those that were unique (i.e., excludes multiple visits within a year).

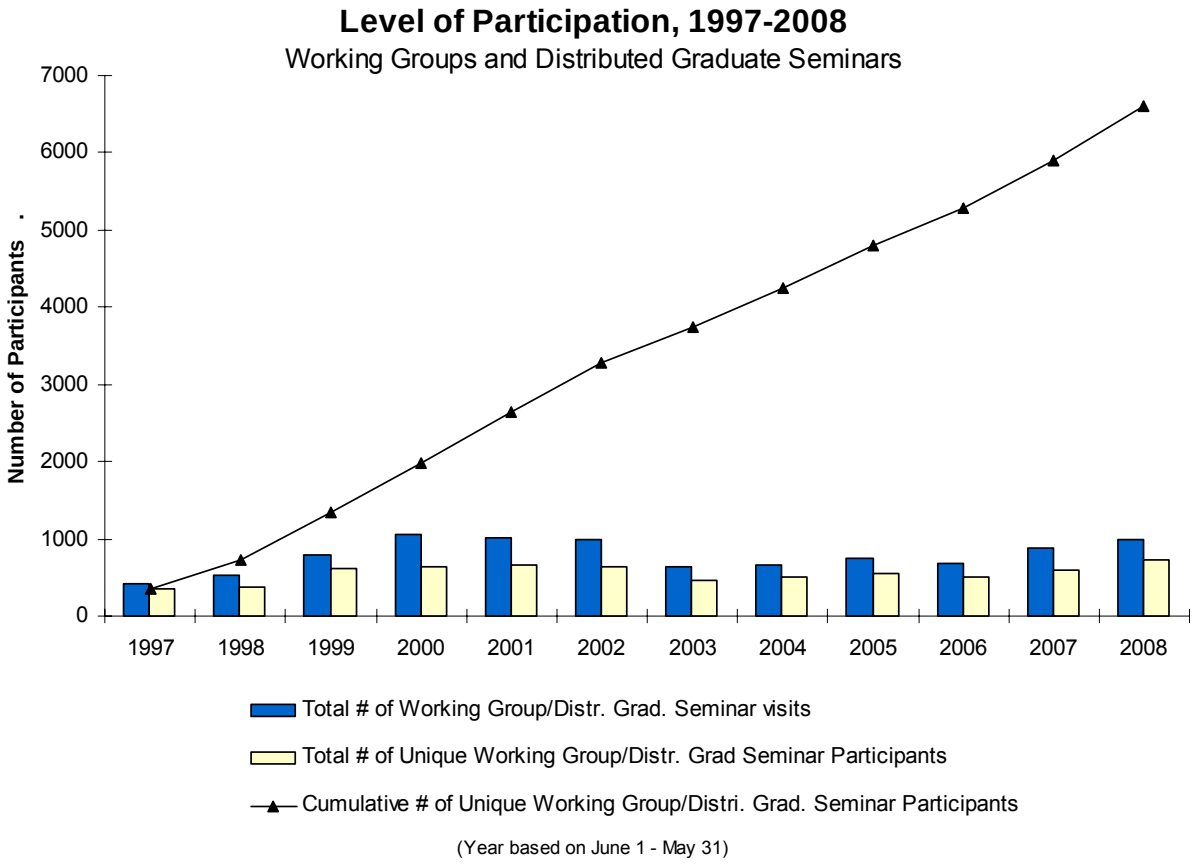


Figure 4. Frequency of visits by each unique Working Group participant since establishment of NCEAS in 1995.

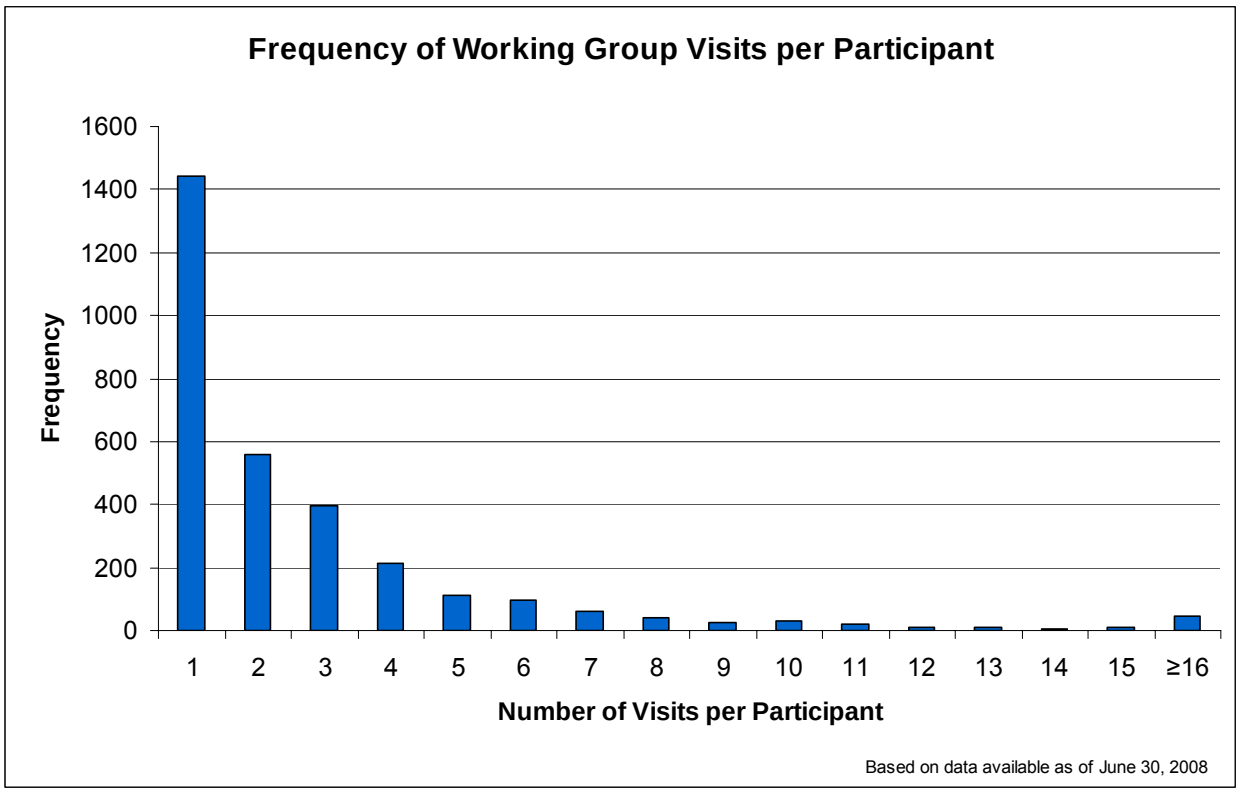


Figure 5. Percent women participating in Working Groups since establishment of NCEAS in 1995. For comparison, among ESA members who answered diversity survey questions for a 2006 report, the average female representation on faculty was 36% (30% women among senior professors, 44% women among junior professors).

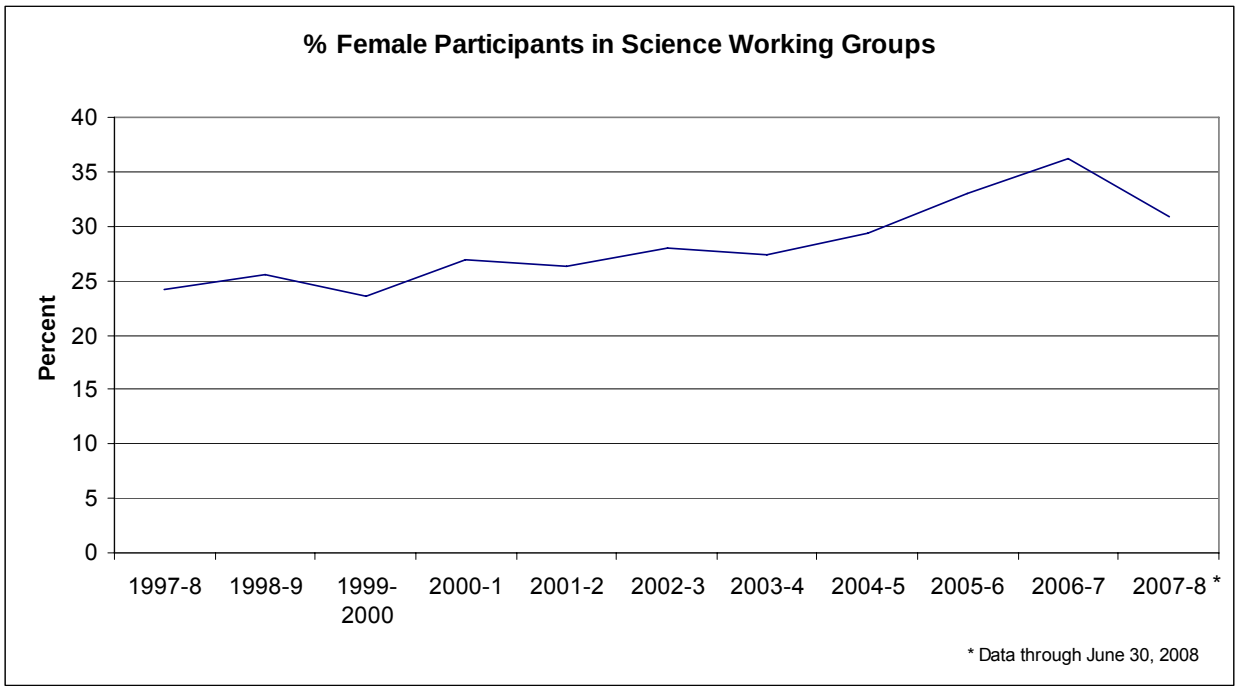


Figure 6. Percent women on the NCEAS Science Advisory Board for each year since NCEAS establishment. For comparison, among ESA members who answered diversity survey questions for a 2006 report, the average female representation on faculty was 36% (30% women among senior professors, 44% women among junior professors).

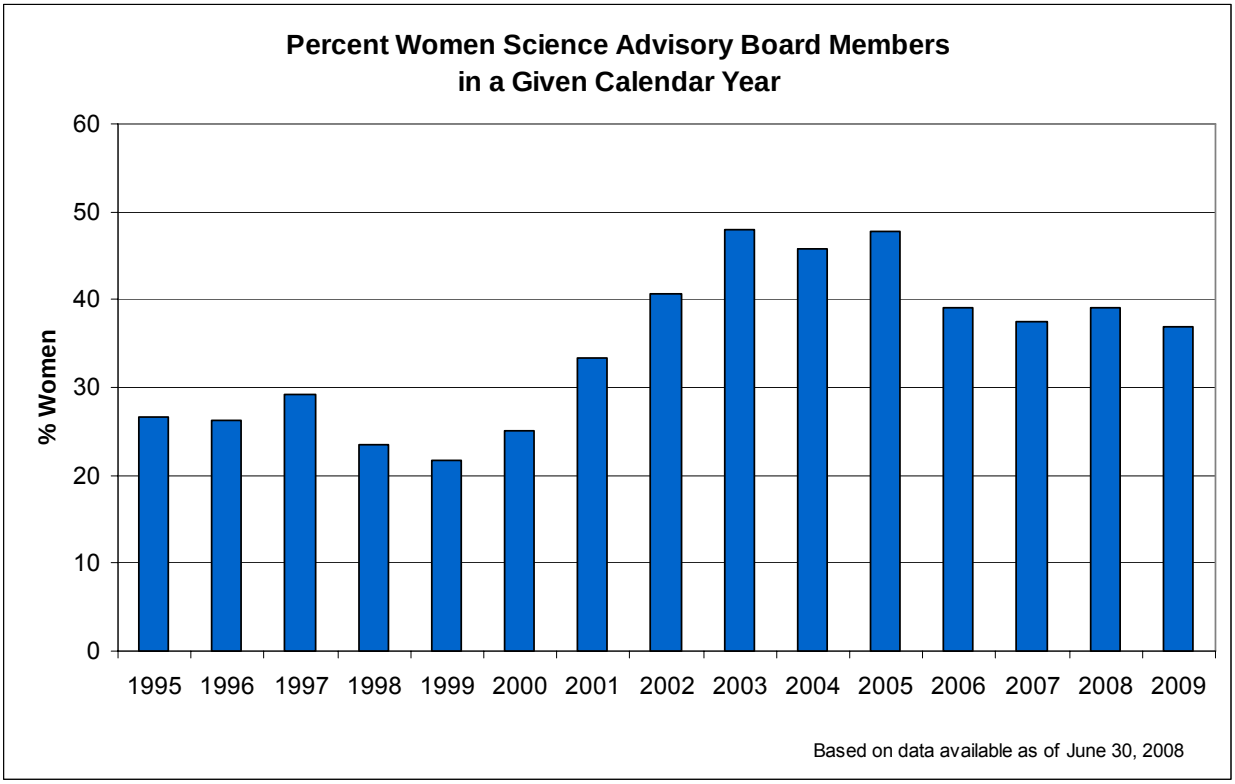


Figure 7. Number of publications reported from NCEAS activities since establishment in 1995, by publication date.