



National Center for Ecological Analysis and Synthesis

1998

National Science Foundation Site Visit

Introduction

This packet will serve as reference material for the NSF Site Visit Team to the National Center for Ecological Analysis and Synthesis. The packet refers specifically to the Review Criteria developed between NCEAS and NSF (page 5). Each section of the packet refers to the six primary criteria areas and contains text and graphical information about the point under consideration. The presentations during the actual site visit will cut across the topics, and convey the nature and scope of NCEAS activities.

The idea for a synthesis center is based on the premise that there is a significant amount of knowledge about the ecological world, but that it is scattered in disparate places and formats, making true synthesis difficult. Recognizing this, the ecological community began to rally around the idea of a specific place for ecological discourse utilizing existing data. An initial workshop conducted by the Association of Ecosystem Research Centers spawned two subsequent workshops funded by the National Science Foundation and sponsored by AERC and the Ecological Society of America.

Acting on the reports from these workshops, NSF initiated a special competition for a Center for Ecological Analysis and Synthesis in 1994. Seventeen preproposals were received and after an initial screening, eight full proposals were requested and seven were submitted. The award was made to the University of California, Santa Barbara, which had submitted an excellent proposal under the initial PIs, Bill Murdoch and Mike Goodchild. The National Center for Ecological Analysis and Synthesis began operation May 1, 1995. The Center receives \$2M/year from NSF, \$500K/year from the State of California, and between \$200K-\$300K/year from UCSB. In addition, NCEAS has received a number of supplements for specific activities, ranging from REU (Research Experience for Undergraduates) projects to a Regional Workshop on Global Change.

The Mission for the Center (see page 6) is quite broad and, as the name implies, the primary objectives of the Center focus on analysis and synthesis. Analysis includes the analysis of large data sets, analytical work on ecological patterns and processes, computer models and simulations, and the development of theory. Synthesis includes the amalgamation of data and the integration of ideas. The structure of the Center's operations, which promotes planned and serendipitous interactions, significantly increases the opportunities for novel approaches to important questions.

An important embedded element in analysis and synthesis is the acquisition and management of data. Accordingly, NCEAS is deeply involved in eco-informatics, as a service to Center visitors, and to the ecological community in general. NCEAS has additional responsibilities in education and outreach. These efforts involve grade school children to graduate students and postdoctoral associates, as well as novel dissemination of information such as the EcoEssay on the NCEAS web site.

The vision (page 6) to accomplish the above objectives encompasses several types of activities. Initially, we separated group activities into workshops, training workshops, and working groups, the latter being longer than workshops, and usually involving more analysis

than discourse. We have moved toward a single designation of group activities, and encouraging longer visits, as these have been more productive and more closely match the mission of the Center. The Center also supports six FTE sabbatical Fellows and 10-12 FTE Postdoctoral Associate positions/year.

Travel, lodging, and per diem are covered for group activities. Sabbatical Fellows receive up to one half of their salary, a housing allowance, and RT travel from their home institution to NCEAS. Postdoctoral Associates receive a salary and \$2,500/year for incidental expenses such as travel, reprints, etc. Center Fellows are encouraged to develop group activities around their stay at NCEAS. Postdoctoral Associates may come to the Center as part of a Working Group or as independent investigators (although most in the latter circumstance eventually join one or more Working Groups pertaining to their research interests).

The Center is designed to optimize the time scientists spend here, and thus offers important resources for visitors. Assistance is provided for lodging, and foreign visitors are assisted with their complicated visa requirements. Meeting rooms, supplied with appropriate computing and audio visual equipment, are available (Appendix I). In addition, each group has a breakout room where additional facilities are made available as needed. Visitors are assisted with dining arrangements, and local field trips can be arranged. Long term visitors (Center Fellows and Postdoctoral Associates) are provided with fully equipped office space including the computing platform of their choice. A wide array of computing software is available, and two rooms at NCEAS are set up with all the devices needed to complete research projects, from computers to scanners, slide makers, and color printers. These visualization labs are open to all visitors to NCEAS. Keys are provided to visitors, and all facilities are available 24 hours a day.

Overview of Science Activities

A total of 841 individuals have participated in scholarly activities at NCEAS (many more have participated in activities from the local community or UCSB), including 723 from the U.S. (representing 48 states), and 118 from 20 different countries. Including multiple visits by individuals, NCEAS hosted 1,353 visitors through March, 1998.

The scientific activities at NCEAS have coalesced around several main approaches or questions (examples and details about specific projects will be presented during the site visit; Appendix II in this report and the NCEAS web site list the individual activities at the Center). These have emerged from the nature and scope of the proposals submitted, and from proactive efforts by the Center. One major group of activities revolve around the analysis of large scale patterns of ecological processes. These include patterns of biodiversity, trace gas fluxes, net primary production, relationships between productivity and diversity, responses of global communities to temperature changes, and the feedback between global climate change and natural ecosystems. Most of these groups shared one or more members, which promoted even broader syntheses.

A second area of emphasis has been in-depth analysis of population dynamics. These projects tend to be deeply analytical, and often employ the computing capabilities of the Center. An early activity at NCEAS was the Complex Population Dynamics Working Group, and they

continue to make significant gains using thousands of time series data sets. Other groups have used population analyses as they pertain to management issues, including the management of fish populations, and the study of gene flow in fragmented and managed populations. In addition to these research projects, NCEAS hosted a training workshop for Nature Conservancy scientists on population viability analysis.

Another group of NCEAS' projects involve patterns of interactions within communities. Several of these pertain to aspects of biodiversity, while others have investigated the interactions at species' borders, intrinsic and extrinsic variability in communities, the invasion of communities by alien species, top-down and bottom-up forces in community structure, patterns of disturbance and vegetation structure, and relationships between parasites and predators to their hosts or prey.

The Center has hosted a number of projects that involve specific management oriented science questions (outlined in Section 4 below). In several cases the issues under consideration were fairly specific, such as alternative farm retirement strategies for the San Joaquin Valley in relation to water and endangered species considerations. In other cases, the efforts were broadly applicable to management situations, such as reserve design or the application of ecosystem science in the private sector. One project to review the extent to which good science was used in the Habitat Conservation Plan process generated interesting and pertinent results, and served as a distinctive pedagogical tool for over 100 graduate students (see below).

Several projects have involved areas directly adjacent to core ecological issues, such as patterns of coevolution and the organization of biodiversity. One of the most interesting projects at NCEAS involved an analysis of the value of the world's ecosystem services and natural capital. In other projects, new analytical or statistical methods were investigated, including the application of meta-analysis to ecological problems, the theory and application of sampling curves in ecology, the quantification of uncertainty in spatial data for ecological applications, and the application of geostatistics in ecology. In addition to these statistical approaches, NCEAS has also hosted several informatics working groups.

An emerging cluster of activities involve the analysis of broad biogeographical patterns, such as latitudinal gradients, or the relationship between the number of endemic species on an island and their susceptibility to extinction. We also plan to develop "groups of groups", planned interactions between several members of several groups that share common interests. This will culminate in a large symposium next spring.

It is reasonable to ask which of these activities are the results of a Center like NCEAS. In the most basic sense, NCEAS was created to fund such efforts, but to make an important contribution to ecology, NCEAS must provide more than financial support. The Center does facilitate analysis and synthesis by providing facilities and logistical support, and a number of visitors have mentioned this as an important service that allows them to conduct a working group while they are busy with many other responsibilities. In the final analysis, the most important element of NCEAS is the opportunity to interact in distinctive ways. We work with NCEAS visitors to customize their approach to the issue at hand, guiding them towards novel approaches. We suggest that they seek collaborations with colleagues that might not come intuitively to

mind. Furthermore, once groups arrive they interact with each other and with other visitors in ways that could not have been imagined in the initial phases of their proposed work. As important as the direct results from any particular activity at NCEAS are, we are convinced that it is the unanticipated interactions fostered by the Center atmosphere that will eventually be the most important legacy of NCEAS.

We encourage you to peruse the NCEAS web site (<http://www.nceas.ucsb.edu>) for additional information about facilities, staff, research projects, results, and visiting scientists.

Specific Criteria for NCEAS Evaluation – NSF Site Visit, May, 1998

1. Quality of the science and change in culture
 - A. Culture of synthesis - evidence of change in community (e.g., % of synthetic papers in major journals)
 - B. Paradigm accelerators/initiators, novelty of ideas generated
 - C. Discoveries through analysis opportunities
 - D. Where scientific papers are published and citation index and impact factors; how many papers (direct and indirect), books
 - E. Research stimulated at the Center - new grant proposals or follow-up research
 - F. Serendipitous contacts/synthesis across projects (“metasynthesis”)
 - G. Contributions to data management, informatics in community at large
2. Center management
 - A. How decisions are made about science
 - B. How the broad discipline is contacted, and how well this has succeeded
 - C. How are advisory groups used and how well has this worked
 - D. Center expenses; information and data management; staff relevance/excellence
 - E. Involvement of under-represented groups
 - F. Techniques of assessment
3. Is ecological community taking advantage of NCEAS
 - A. Number of participants
 - B. Scope of state/organization type/institutional coverage
 - C. Number of proposals
 - D. Balance between groups represented at NCEAS
4. Impact on, communication with, managers and policy makers
 - A. Number and type of projects
 - B. Evidence of effects on managers/policy makers
 - C. Serendipitous contacts, synthesis across projects
 - D. Contributions to data management
5. Integration of research and education
 - A. Quality of postdocs, training, where they have gone
 - B. Training efforts; graduate and undergraduate research
 - C. Outreach efforts – grade schools, others
6. Interactions with University and Local Public
 - A. Alignment with UCSB outreach to community
 - B. Interaction with other UCSB Centers
 - C. Involvement of faculty and students at UCSB
 - D. Location of Center

The Mission of NCEAS is to:

*Advance the state of ecological knowledge through the search
for general patterns and principles*

*Organize and synthesize ecological information in a manner useful to
researchers, resource managers, and policy makers
addressing important environmental issues*

Vision for NCEAS

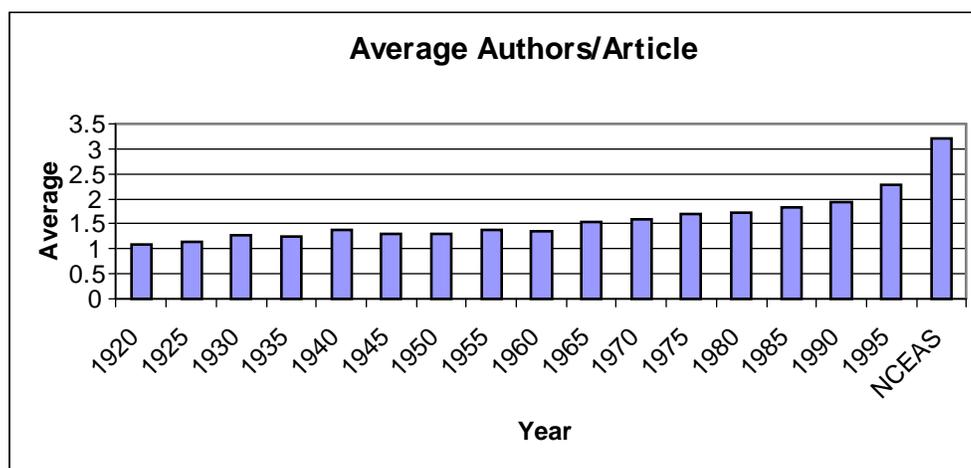
- ◆ Develop opportunities that accelerate and initiate paradigms
- ◆ Make NCEAS the facility where scientists look to support analysis and synthesis of existing ecological information with creative approaches
- ◆ Maintain a Center with a national character and broad interests
- ◆ Provide information to scientists, managers, and policy makers
- ◆ Maintain a Center that provides flexible and convenient support for visiting scientists

1. Quality of Science and Change in Culture

The list of projects supported by NCEAS is in Appendix II and on our web site. NCEAS is just three years old, so it is premature to use citation indices as a major criterion for evaluating the impact of the Center's efforts. However, papers generated by Center activities are published in the top journals, as well as outlets that represent new approaches to ecology (Trends in Ecology and Evolution, Integrative Biology; see the NCEAS web site for a publication list). Subjective comments from many visitors indicate that they often leave with unanticipated projects resulting from serendipitous interactions while at the Center. A number of these have generated spin-off projects or grant proposals. We anticipate that this will increase geometrically as more people become involved in the Center.

Working groups at NCEAS often bring together scientists who otherwise might not have an opportunity to collaborate. In some cases, these might be empiricists and modelers working on the same system (e.g., Ives and Frost, Intrinsic and Extrinsic Variation Community Dynamics; details of these projects and all others at NCEAS are available on our web site under Research Projects), or investigators from different disciplines (e.g., ecological economics, Costanza Working Group on the Total Value of the World's Ecosystem Services and Natural Capital). In other groups, scientists and resource managers interact in effective ways (e.g., the Gilpin and Stein group investigating Alternative Land Use and Habitat Conservation Strategies).

One indication of the level of collaboration is the average number of authors per paper published from NCEAS activities. As you can see below, there is a trend toward increased authorship in general in *Ecology*, and NCEAS products involve even more authors.



We expect that one of the major impacts NCEAS will have on changing the culture of the ecological community is through its effort in ecological informatics. Most NCEAS projects bring together pre-existing data, so it is in the best interest of the Center to promote activities which make data sharing and access more effective. Therefore, the Center has hosted several

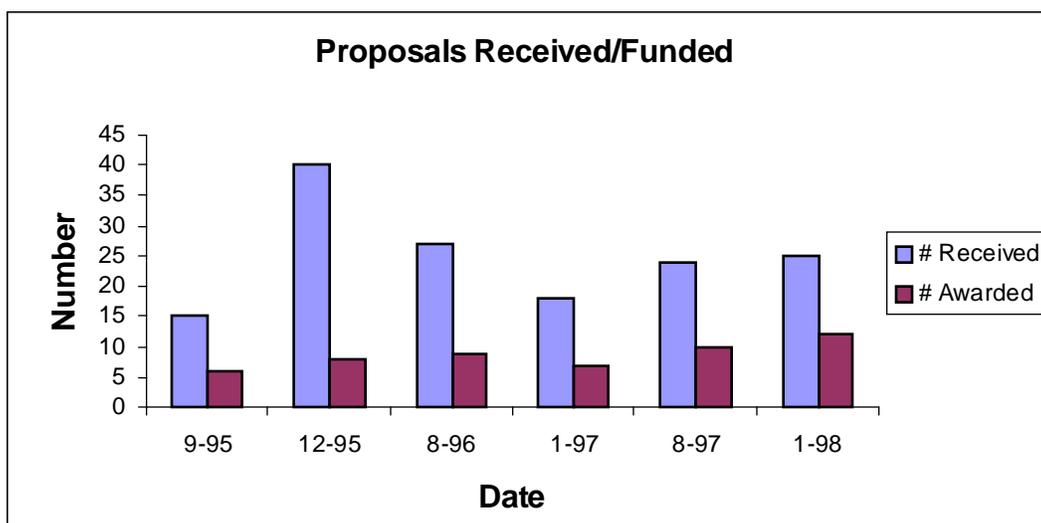
working groups and committees whose responsibilities include informatics. For example, ESA's Committee on Data Archiving and Storage met twice at NCEAS, and NCEAS has hosted its own Informatics Working Group. In addition, we help many of the groups that come to the Center get their data in formats that promote sharing and analysis, which imbues the group members with a sense of what can be done with regard to informatics. For example, for those groups that are interested, we establish a private user area on our web site through which the members can exchange information, data, manuscripts, and figures when they are away from the Center.

Responses to a recent questionnaire effectively summarize the ways in which visitors used the Center and what opportunities were important to the success of the groups. Activities involving synthesis and productive interactions were viewed as the most effective outcomes of NCEAS group activities, with analytical efforts being slightly less important (Appendix III, question #1). Similarly, services provided by NCEAS that enhanced interactions were viewed as being especially effective, while facilities for analytical research were used somewhat less by visitors (Appendix III, question #2).

2. Center Management

A. How decisions are made about projects – The Center has two proposal deadlines per year. Proposals are solicited primarily via our web page, and received electronically (we also announce opportunities in hard copy publications). Proposals are then distributed to our Science Advisory Board for review, and discussions and recommendations are made at the semi-annual SAB meetings. We also accept proposals between deadlines and can expedite a review as needed. The Director, Deputy Director, and Science Advisory Board members also solicit proposals for ideas or from individuals and groups who have ideas that fit the mission of the Center

Approximately 60% of the activities at NCEAS were initiated by individuals or groups. NCEAS has received 149 proposals in this manner, 52 (35%) of which were supported. It is pertinent to



note that the average number of participants per proposal is 12.5, so these proposals represent approximately 1,862 applicants and 650 recipients.

An additional 36 projects (a pproximately 450 participants) have been funded after being solicited by the staff or SAB. When the Center first began, the SAB solicited a number of “fast track” projects to get the Center up and running. The SAB continues to solicit proposals, and the senior staff of NCEAS frequently seek out individuals or ideas in an effort to be proactive in bringing projects to the Center. While we have rejected some proposals that are solicited, the success rate on these is higher than for unsolicited proposals. We view this proportion of unsolicited and solicited projects as an a ppropriate mix for the Center.

The evaluation criteria for reviewing proposals revolve around whether the project encompasses the objectives of the Center, whether it is an activity that will benefit from what the Center has to offer, and whether the questions being addressed are important. The Center is actively attempting to fund a mix of projects that meet these objectives in different ways, including analysis and meta-analysis of large data sets, evaluation of emerging ecological patterns, comparisons of different a pproaches to major questions, and synthetic theories that cut across disciplines. Some of these activities are fairly straight forward, while others are very innovative and carry the risk associated with i nnovation.

B. How are broad disciplines contacted – The Center relies heavily on the internet. Virtually all of our information is presented via our web site, and we receive and review proposals via the web. While this could be disadvantageous in the short run, we believe this is the direction the field is headed.

The Center has reached out to its core constituency – those that consider themselves ecologists. This appears to have been successful, as we receive a number of contacts from ecologists, and are involved in multiple activities with the Ecological Society of America.

We expect that many of the most innovative results from NCEAS will involve those who are more at the periphery of ecology – perhaps behavioral, physiological ecologists – or individuals from completely different disciplines such as statistics, mathematics, and ec onomics. We also expect that interactions with res ource managers and policy makers will be productive. In an attempt to i nform those outside the core of ecology, we have contacted the following scientific societies and asked them to published invitations in the j ournals, bulletins, and newsletters and most have done so.

- American Fisheries Society
- American Society of Limnology and Oceanography
- American Society of Microbiology
- American Society of Naturalists
- Animal Behavior Society
- Association of Environmental and Resource Economists
- Bioscience
- British Ecological Society
- Conservation Biology.

- Entomological Society of America
- International Association of Landscape
- International Association for Ecological Modeling
- North American Benthological Society
- Restoration Biology
- Society for the Study of Evolution
- Soil Ecology Society
- The Wildlife Society

It is not clear that these contacts have yielded responses from the organization's members. We have, however, had contacts with many scientists outside of ecology, and with resource managers. In almost all cases, they have read something about the Center in a publication, found our web site, or talked with a colleague who has been involved at NCEAS. Therefore, we believe the most effective means of getting other disciplines involved is to attract good ecologists with broad interests who then invite appropriate colleagues from other disciplines, and we encourage our visitors to do so.

C. Advisory groups – The Center has two main advisory groups, the Science Advisory Board, and the External Advisory Committee. The SAB is composed of active, senior and mid-level scientists. There are 19 members, including ecologists from many disciplines, as well as an economist and a representative from a resources agency. One position is dedicated to a UC-Santa Barbara representative, and another to an individual not at a US-based university. The SAB meets twice a year and provides advice to the Director in several areas, including strategic directions, specific proposals, and other issues pertinent to the year to year functioning of the Center. The 1997-1998 SAB included:

Charles H. Peterson (Chair) - Institute of Marine Sciences, University of North Carolina
 James Brown - Department of Biology, University of New Mexico
 Stephen Carpenter - Center for Limnology, University of Wisconsin
 Terry Chapin - Department of Integrative Biology, UC Berkeley
 James S. Clark - Department of Botany, Duke University
 Philip H. Crowley - Center for Evolutionary Ecology, University of Kentucky
 Diana H. Wall (formerly Freckman) - Natural Resource Ecology Lab, Colorado State University
 Nancy Grimm - Department of Biology, Arizona State University
 Ilkka Hanski - Department of Ecology and Systematics, University of Helsinki
 Robert Holt - Museum of Natural History, University of Kansas
 Jeremy Jackson - Smithsonian Tropical Research Institute
 Peter Kareiva - Department of Zoology, University of Washington
 William Murdoch - Department of Ecology, Evolution and Marine Biology, UC Santa Barbara
 Roz Naylor - Stanford University
 Alison Power - Department of Ecology and Systematics, Cornell University
 Mary E. Power - Dept. of Integrative Biology, UC Berkeley
 Steven W. Running - School of Forestry, University of Montana
 Dave Schimel - National Center for Atmospheric Research
 Donald R. Strong - Bodega Marine Lab, University of California

In the spring of 1998, departing members Carpenter, Chapin, Clark, Crowley, Kareiva, and Wall were replaced with Marc Mangel, Mike Pace, John Pastor, Dan Simberloff and two others who have yet to decide whether to accept the position.

The SAB has been an extremely effective group for the Center. They provide good advice about specific projects, and about the Center in general. They participate in spirited discussions about the direction of the Center, and serve as effective advocates for the Center and its programs.

The External Advisory Board has had an ambiguous role from the inception of the Center. It is composed of senior scientists who have moved on to other responsibilities, corporate leaders, foundation program directors, and agency representatives. It has never been clear whether this group was to offer advise on scientific issues and strategic directions for the Center, or serve as an entrée into Center sponsorship and fund raising opportunities. The EAC has met twice at NCEAS, and offered good advice on a number of issues. However, it has become clear that the EAC does not function well in its hybrid mode between scientific advice and fund raising. Currently, the EAC remains constituted as an active Committee, but the Director seeks advice from the visiting reviewers as to the need for such a group and its role.

Initial EAC members:

Mr. Jack Dangermond - Environmental Systems Research Institute

Mr. Steven L. Jarvis - California Trade and Commerce Agency

Mr. Paul Johnson - U.S. Department of Agriculture

Dr. Ron Pulliam – University of Georgia *

Dr. Paul Risser - President's Office, Oregon State University *

Mr. William Robertson IV - The Andrew W. Mellon Foundation *

Mr. James Strock - Secretary for Environmental Protection

The Honorable Douglas Wheeler - The California Resources Agency *

* Current Members

D. Center operations - The Center currently has a permanent staff of 10, as follows (additional staff are employed for specific projects):

Director – Jim Reichman

Deputy Director – Frank Davis (50%)

Director of Computing – Mark Schildhauer

Database Specialist – Matt Jones

Programmer – Deby Deweese

Office Manager – Marilyn Snowball

Director's Assistant – Shari Staufenberg

Housing Coordinator – John Gaffney

Administrative Assistant – Kristan Lenehan

Programmer – Bruce Satow

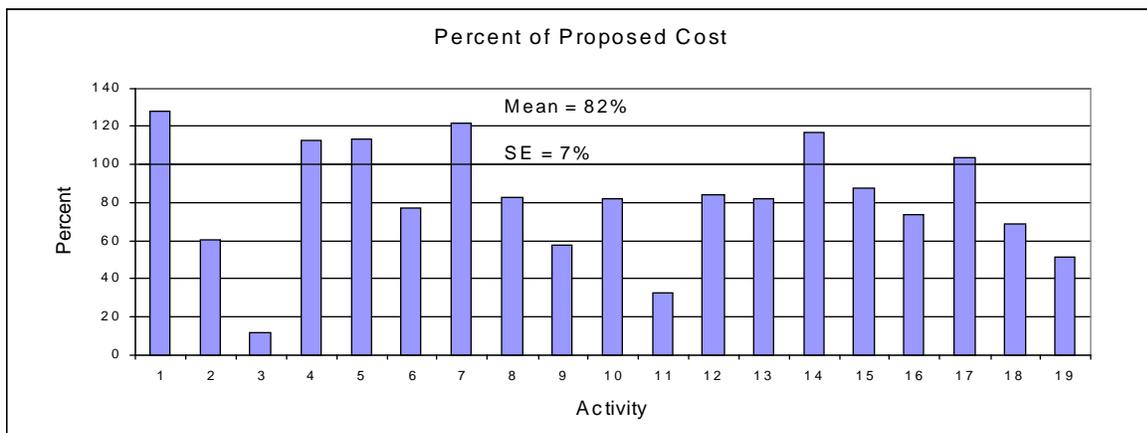
The single most common comment about the Center is the high quality of the service provided by the staff. In one sense, the most important resource the Center provides is time for productive, but busy, scientists to address important questions. The broad array of services provided by the staff, from meeting coordination, to housing, to computation, allows visitors to begin work immediately, and remain productive while they are in residence.

For a variety of reasons, it is important for NCEAS to track information about the activities at the Center and the participants involved. Therefore, we have developed an Administrative Database that tracks information and allows us to manage the meetings and visitors to the Center. We are currently completing a second generation of the database that will allow us to dispense with much of the paperwork associated with coordinating the meetings. The newest version of the database will also allow convenient tracking of costs associated with NCEAS events.

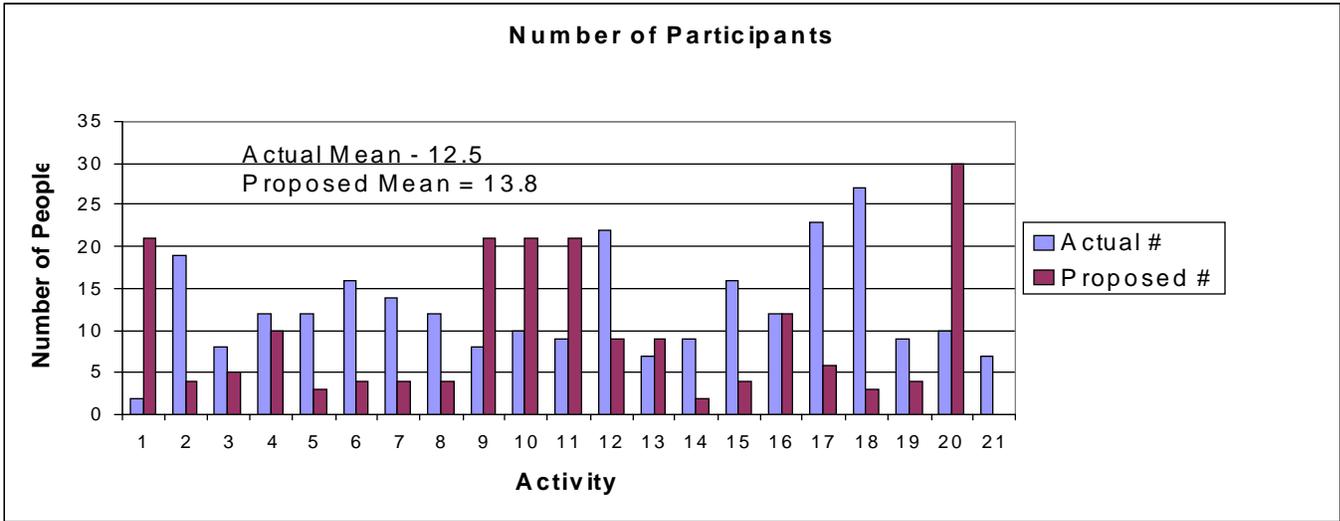
The activities at the Center represent a fairly distinctive enterprise but we have now conducted enough activities to get a sense of the absolute costs, and the cost in relation to what was budgeted for the project. A summary of the average expenses for Working Groups are as follows:

Per diem	\$ 38 (this has recently risen to \$46)
Hotel/night	\$ 71
Airline ticket	\$ 513
Cost/participant/day (including travel)	\$ 189
Number of nights/visitor	5
Number of participants/event	14
Cost/participant/event	\$ 1,110 (includes costs spread over all participants, such as local transportation)
Cost/event (event = 1 meeting of a project)	\$ 13,064
Cost/project (all meetings of a project)	\$ 41,912

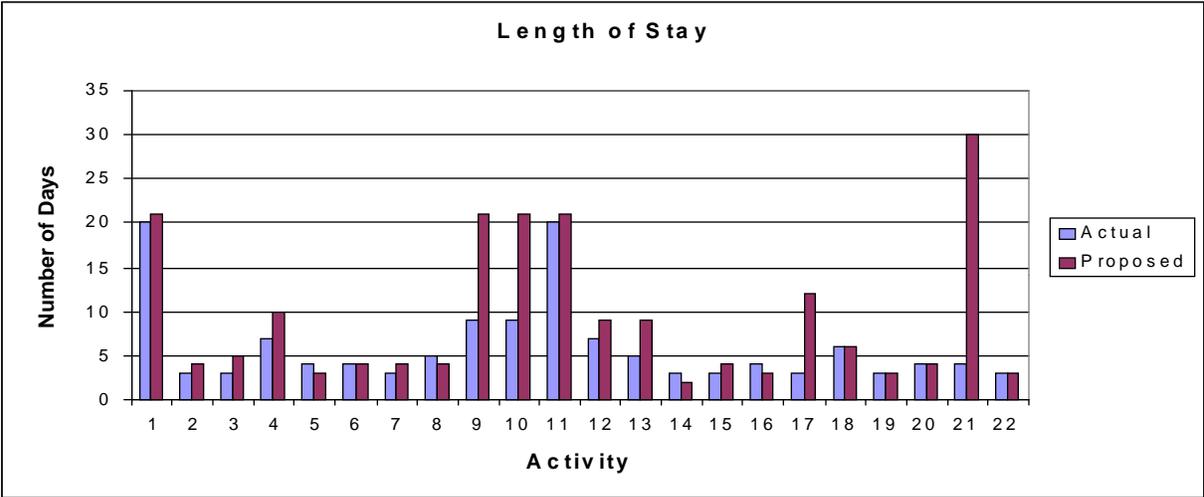
In general, the actual cost of an activity (below) is less than proposed.



This pattern could result from overestimating the actual costs, or from the activity having fewer participants than proposed, or visitors staying for shorter periods than proposed. In fact, both of the latter conditions exist – the number of participants is slightly less than proposed by the group leader (below).

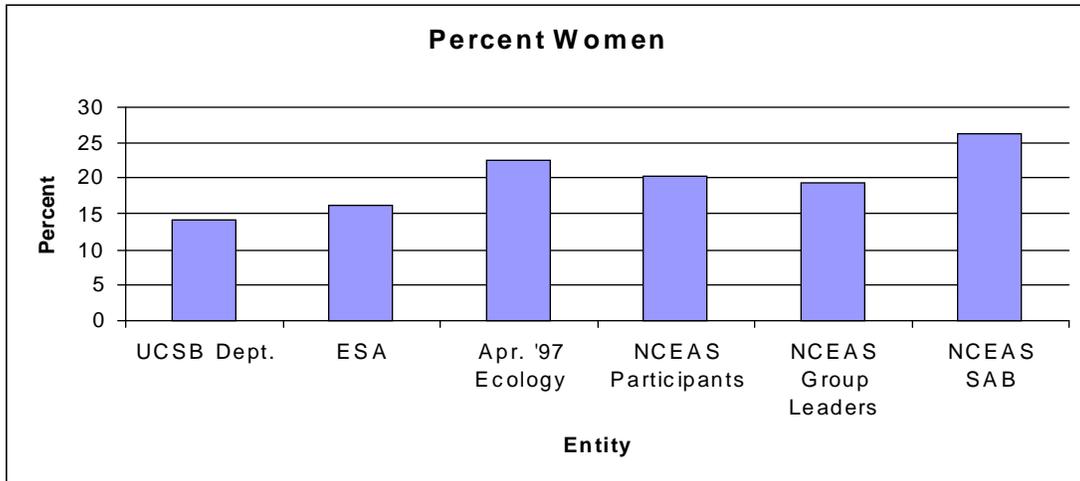


More significantly, the actual length of time participants stay is significantly less than proposed (below). We have found that longer stays by groups are usually more productive than shorter stays, so we view this reduction in the length of stay, compared to that proposed, as a pattern to reverse.



The cost for sabbatical visitors average slightly over \$50,000/year, including the housing allowance and travel. Postdoctoral Associates average \$47,000/year, including fringe benefits, and an additional \$2,500 annually for incidental expenses.

D. Involvement of underrepresented populations – The number of women involved in NCEAS activities is reasonably in line with other ecological entities (below)



It should be noted that the NCEAS Group Leaders data includes Postdoctoral Associates, who, as younger ecologists, have a larger percentage of women represented than older cohorts of ecologists.

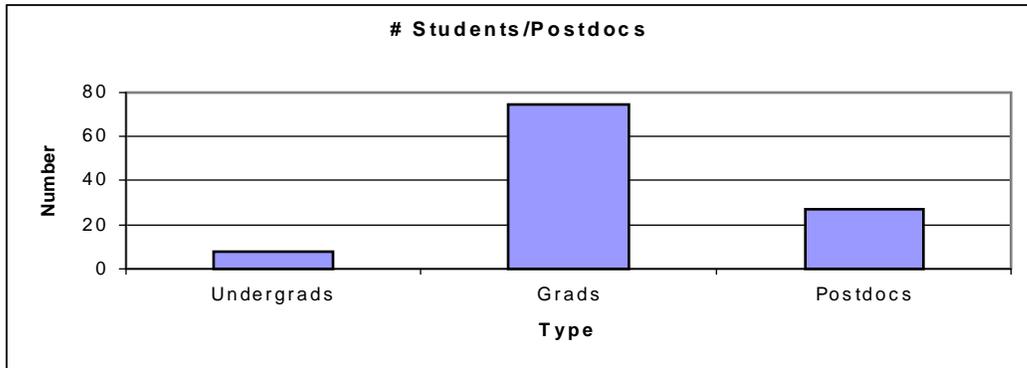
The Center faces the same problems attracting ethnic minorities as many academic units. It is especially difficult for the Center, as we do not involve as many undergraduates as university campuses, and hence have access to even fewer minorities. We do not track ethnic status in our database, but we have not had many participants from underrepresented populations. We are beginning a relationship with a campus organization that fosters interactions with Hispanic students interested in science. In addition, our involvement with the local school district through the Los Marineros program (see Section 6A below) brings us into contact with a large Hispanic population (about 40% of the children are Hispanic). We have requested an REU intern for the Center to work with the Los Marineros program, and will target an Hispanic graduate student to fill that position and serve as a role model for the children.

E. Evaluation – Because the Center is so young, we have relied on traditional means of evaluating our efforts. For example, we track the publications that emerge from Center activities, as well as other standard indicators of indicators scholarship. We are receiving numerous subjective comments about the influence of NCEAS on the way we undertake ecological research. However, we are beginning to work with a unit on campus that conducts evaluations of organizations to determine if there are procedures we can use to identify where NCEAS is having an impact on the ecological community.

3. Is the Ecological Community Taking Advantage of NCEAS?

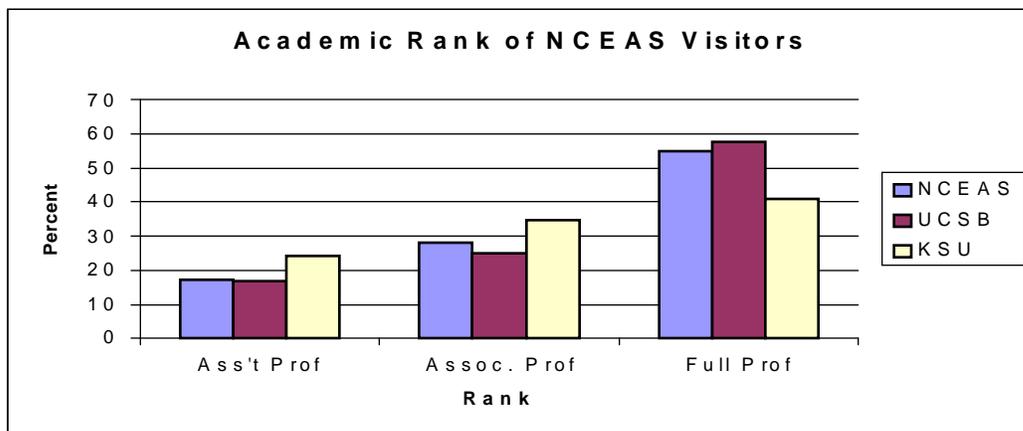
A. Number of individuals – As noted, a total of 841 individuals have participated in scholarly activities at NCEAS (many more have participated in activities for the local community or UCSB), including 723 from the U.S. (representing 48 states), and 118 from 20 different countries. Including multiple visits by individuals, NCEAS hosted 1,353 visitors through March, 1998.

B. Scope of coverage - While a majority of Center visitors are senior scientists, a large number are undergraduate and graduate students, and Postdoctoral Associates (below).



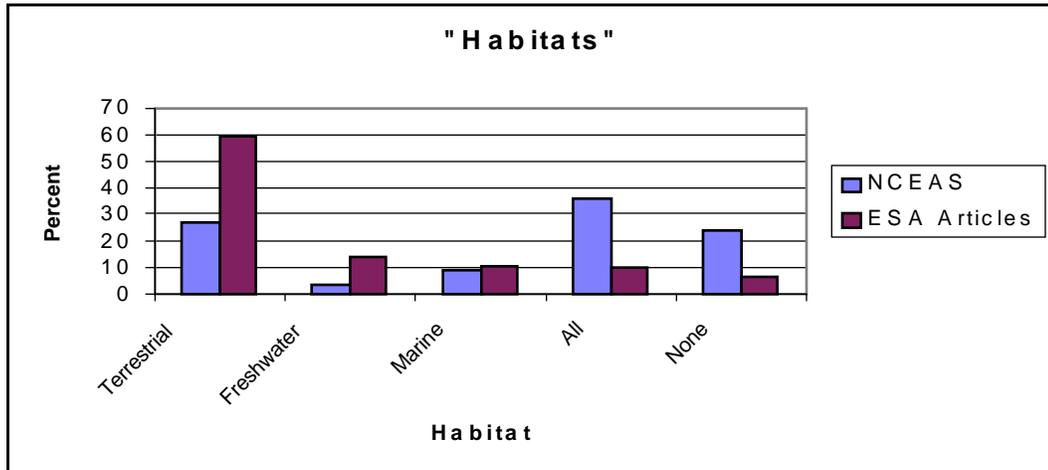
Note that an additional 70 graduate students were involved in a unique NCEAS activity in which 8 universities conducted graduate seminars to evaluate Habitat Conservation Plans. Approximately 35 graduates actually came to NCEAS to complete the project, but another 70 participated in the seminars but did not travel to NCEAS.

Among the more senior ecologists, the distribution between junior and senior level faculty ranks does not differ significantly from those found in other academic institutions (for the data below, visitors in non-academic organizations were categorized in a “rank” based on the number of years post-PhD). The data compare the distribution of ranks of NCEAS participants with UCSB and Kansas State University. It does not appear that NCEAS is overly top-heavy among its visitors.

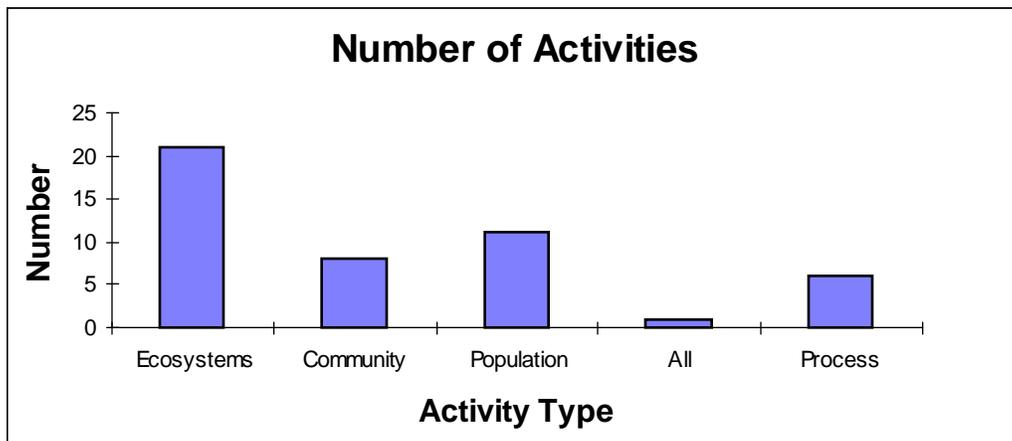


C. Number of proposals – As noted in section 2A above, approximately 60% of the activities at NCEAS were initiated by individuals or groups. NCEAS has received 149 proposal in this manner, 52 (35%) of which were supported.

D. *Balance between groups* - The figure below indicates the types of habitats that have been the focus of NCEAS activities vs. *Ecology* articles over the last year. Those indicated as “all” had participants representing terrestrial, freshwater, and marine habitats, while those with “none” were conceptual or analytical in nature. NCEAS activities appear to be somewhat more evenly distributed than articles in *Ecology* and focus more on general questions involving non-habitat specific questions or theoretical issues.



There are two natural constituents to NCEAS-type activities – ecosystems studies that cover large areas and often have large data sets, and population studies, which can be very analytical in nature. As the figure below indicates, these do, in fact, make up the largest portion of the activities at NCEAS.



One interesting measure of the degree to which the ecological community is using the Center is indicated by the willingness of other institutions and organizations to conduct their meetings at NCEAS or co-fund projects.

Outside Activities Hosted (funded outside NCEAS budget):

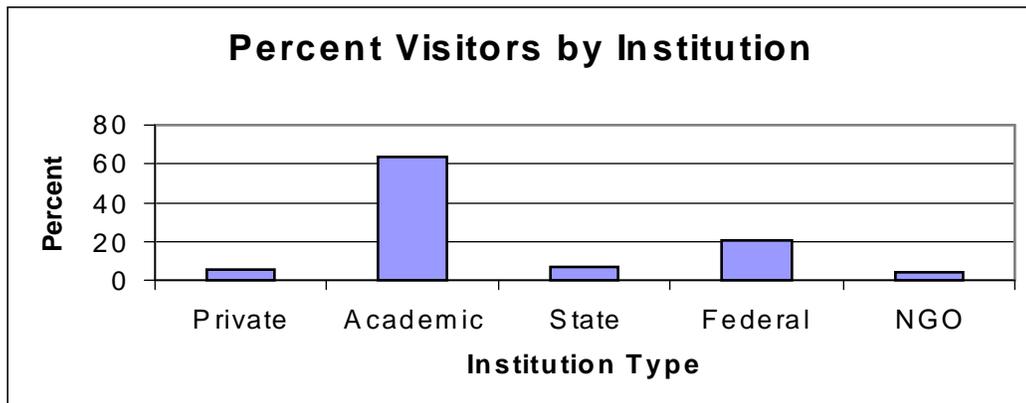
- Restoration Ecology Workshop – 4/96 - Edie Allen - *NSF*
- Association of Ecosystem Research Centers – 11/96 – Tim Seastedt
- ESA Data Committee – 2/97, 9/97 – Aaron Ellison - *ESA*
- Arctic Boreal Workshop – 4/97 – Terry Chapin – *NSF*
- Varenus/Natonal Center for Geographical Information and Analysis - 8/97 – Mike Goodchild
- LTER Coordinating Committee – 10/97 - Ray Smith - *NSF*
- Geography and Regional Science Pane- - 11/97 – Frank Davis – *NSF*
- JGOFS – 1/98 – Dave Siegel – *NSF*
- TNC Population Viability – 2/98 – Grove, Kareiva – *TNC*
- Sea Web – long term – Patty Debenham – *Sea Web*
- USGCRP Global Change Workshop – 3/98 - *NSF*
- OBSF Informatics Workshop – 5/98 – Stanford, McKee - *NSF*

Supplements, Co-Funding (funded or co-funded with another organization):

- HCP Review – 12/97 – James, Davis, Kareiva – *AIBS*
- Net Primary Production Working Group – 10/97, 2/98 – Prince, Olsen – *IGBP*
- Database Activities – Postdoc – *NSF*
- USGCRP Global Change Workshop – 3/98 - *NSF*
- OBSF Informatics Workshop – 5/98 – Stanford, McKee - *NSF*

4. Relationship to Resource Managers and Policy Makers

A. *Number and Types of Activities* – Almost 20% of the individuals participating in NCEAS activities come from non-academic entities, particularly state and federal agencies, and NGOs. These individuals represent over 36% of the institutions that have sent participants to NCEAS.



Approximately 30% of the projects undertaken by NCEAS have direct applied significance. That is, they pertain to a specific management issue at a specific place. For example, several groups have undertaken case studies in conservation planning and reserve design. The Working Group led by Katherine Ralls and Patrick Kelly is composed of ecologists, economists, and hydrologists who are developing a conceptual approach and spatially explicit, multi-objective decision model to analyze alternative farmland retirement strategies for restoring San Joaquin Valley ecosystems. Another group, led by Mike Gilpin has developed a conservation planning tool to support habitat conservation in Alameda and Contra Costa Counties in California. A third group led by Sandy Andelman is bringing together theory and models from conservation biology, population biology, and operations research to explore alternative regional reserve design in the Columbia Basin. These groups share some members in common, and are becoming increasingly synergistic. On a similar topic, an incipient Working Group, led by Jane Lubchenco, will investigate the design of marine reserves. In addition, Frederick Wagner is using a sabbatical year at the Center to develop a synthesis of the effects of elk on Yellowstone National Park, and how management decisions were influenced by the science being conducted at the Park. While these projects address specific management issues, their pioneering approaches involve development of new methodologies or conceptual frameworks for resource management which should have broad applicability.

The Center has conducted or is completing a series of projects that have direct relevance to resource agencies such as the recently completed California Climate Change Workshop. The workshop had over 125 participants from many sectors in California. We are planning a series of workshops on ecological monitoring that will use the Natural Communities Conservation Plan (NCCP) of southern California as a case study. Recently, in collaboration with the staff of the Resources Agency, we have initiated an assessment of managed areas in California's Coastal Marine environments.

Another 35% of NCEAS project have explicit management benefits but are not tied directly to a particular location. For example, sabbatical Fellow Stephen Hart is conducting a synthetic review of information on the historical range of variability of forest ecosystems in the western U.S. with implications for ecological restoration. Postdoctoral Associate Fiorenza Micheli is evaluating top-down and bottom-up forces on the structure and dynamics of estuarine and marine systems to consider interactions between nutrient input and fisheries harvest.

B. Evidence of impact - Perhaps the most intriguing activity at NCEAS that has management implications involved a review of the Habitat Conservation Plan (HCP) process. This project was jointly conceived by Frank Davis (NCEAS' Deputy Director) and Fran James, representing AIBS. Recognizing that a solid, non-partisan review of the process would be beneficial, they invited Peter Kareiva to generate a review process that was distinctive as both a research and pedagogical exercise. Professors from eight universities conducted graduate seminars involving 104 students. The professors and students developed an extensive questionnaire and review 44 HCPs (2 in common for all seminar, the remainder unique to each seminar). The goal was to determine whether the results of contemporary scientific research were included in the HCPs and if these were used properly.

The professors and 35 of the students visited NCEAS in early December, 1997, and conducted a preliminary analysis of the data. Two smaller groups returned subsequently, and are currently completing the review. The activity received extensive attention in the scientific and public media and the findings are of real interest to the public and private sectors. The final report is being reviewed by the US Fish and Wildlife Service, and is on a fast track for publication in *Ecological Applications*. In early May, Interior Secretary Babbitt will be briefed on the project findings.

C. Serendipitous Contacts, Outcomes - NCEAS creates many opportunities for serendipitous interactions that spawn new research directions and management applications. For example, last year Jim Gaither of the California Resources Agency attended a meeting of the Andelman working group on reserve siting and described a specific problem related to selecting old-growth redwood stands for conserving marbled murrelets in the Headwaters Forest of northwestern California. Postdoctoral Associate Ross Gerrard, associated with the Gilpin Working Group, was brought into the discussion and collectively the team formulated a site selection model to analyze alternative habitat conservation plans for marbled murrelets. By the end of the week Ross had implemented the model and worked with Gaither to produce a summary white paper for the Resources Agency (and a manuscript for *Conservation Ecology*).

D. Contributions to Data Management - State organizations such as the California Resource Agency and Federal agencies such as USGS and Oak Ridge National Laboratory have been involved in data management projects at NCEAS. The Center prepared an Expertise Database for state agencies, and staff members serve on the Federal Index Site committee and the Marine Minerals Service Data Panel

5. Integration of Research and Education

A. postdoctoral Associates – We have supported 15 Postdoctoral Associates at the Center. They have come from a variety of institutions, and 5 are not US citizens. Approximately two thirds of the Associates came to the Center as a part of a Working Group, while the other third came to develop their own projects. They have been highly interactive, and have developed many distinctive and productive activities at the Center (journal clubs, open houses for UCSB students and faculty). The first cohort of Postdoctoral Associates have had some success in getting interviews and jobs (bold indicates accepted position):

Anna Arft – Southern Oregon University

Kathy Cottingham - **Dartmouth College**; University of Illinois at Urbana-Champaign; Notre Dame University; University of Minnesota; University of Washington

Michelli - University of Washington; University of Georgia

Russell – Columbia (came in second); CUNY Staten Island; York (UK).

Gerrard - University of North Texas; Department of Planning and Zoning, Jefferson County, Colorado; Redevelopment Programmer/Analyst, Redevelopment Agency, City of Missoula, Montana; Lead GIS Analyst/Program Manager, Natural Resources Department, Confederated Salish and Kootenai Tribes of the Flathead Nation, Pablo, Montana; Program manager, Isera Group Inc., Goleta, California

Kendall – U. Calgary, SUNY - Staten Island
Parmesan – Rice University

There are two concerns most often expressed for the Associates. The first is that they are not associated with a particular scientist at the Center – NCEAS has no permanent faculty, and the Group Leader of a Working Group is rarely a local scientist. Thus, the Postdocs might appear to be mentor-less. Discussions with the Postdocs indicate that this is not a major problem, and to some extent is replaced by the huge number of ecologists coming through the Center. Nevertheless, we are considering providing a small fund for the Postdocs to invite a mentor of their choice to visit the Center once or twice a year (or, in some cases, the Postdoc will visit the mentor).

There is also concern that Postdocs may not be able to take full advantage of the Center in two years, given that the Postdocs are doing a new type of research. Recognizing this, we are developing a plan to allow those interested in a third year of support to give a presentation of their work to the SAB after they have been in residence for approximately 18 months, and a decision will be made as to whether their effort warrants an additional year of support.

We are also aware that the Center will be appropriate for only certain types of students – those that have a strong independence, have projects that require synthesis and analysis, and that are not doing extensive field work. The postdocs that have come to the Center seem to take full advantage of the opportunities here by joining in Working Groups, attending seminars on campus, and even generating their own group projects.

B. Undergraduate and Graduate Involvement – The nature of the research at NCEAS requires a certain level of maturity (to synthesize broad ideas) or analytical skills, which on the surface might seem to exclude undergraduates. However, 7 undergraduates have been involved at the Center. Several of these have worked as students assistants, and three have actually been involved in projects.

Two of these were REU (Research Experience for Undergraduates) students. One of the students worked closely with NCEAS on the Los Marineros Program. Brice Semmens, the graduate intern Coordinator of the Program, and an REU student developed a custom Web site for this group, called 'Kids Do Ecology'. The site augments the written curriculum for the Los Marineros Program, and has a unique chapter intended to enrich children's understanding of 'data': what data are, and how they can be displayed and interpreted. The REU student assisted Brice in this venture--learning HTML programming, and creating simple scientific visualizations for the Web that will engage and instruct fifth graders about 'data' and the scientific method. He also developed a handbook to assist teachers in using these Web resources.

The other REU student worked with NCEAS' scientific computing staff to increase her experience with data analysis, and analytical software. She learned the rudiments of the SAS programming environment, and used these skills to analyze data collected by students in the Los Marineros Program. She learned several additional aspects of scientific computing with this exercise, including basic understanding of working in networked environments, familiarity with the Unix operating system and HTML coding, and how to structure data for analysis and sharing.

NCEAS has developed a Graduate Intern policy, which is available on the website under Opportunities. Over 70 graduate students have been involved in NCEAS projects. Some have participated with their faculty mentors in specific projects. For example, the Population Management project (Shea, Mangel, and Possingham on the web site) involved 6 faculty, each of whom brought a graduate student to participate for 3 weeks.

Several of the graduate students have served as data analysts for specific groups. This appears to have been an especially effective and rewarding experience for the students, as they have learned new skills, and participated in the intellectual exercises of the group. In the past we have sought graduate students to serve as analysts for individual projects, but we are currently developing a plan to hire several graduate students for longer terms to serve as analysts for a variety of projects. This will broaden their opportunities, and reduce the overhead of training a new student for every project.

One graduate student has coordinated the Los Marineros project (see below), and several others have coordinated specific projects such as the HCP review project. As noted, 104 graduate students participated in the HCP review, 35 of whom visited NCEAS.

B. Outreach Efforts - Our primary contact with the scientific community is through the traditional mean of publications (dozens) and presentations (scores, including symposia at the ESA meetings). Another major outlet is through our web site. We are almost completely web-based, and have had good response to this approach. The number of hits on our web site has risen dramatically, evidence that scientists are increasingly using this mode of communication. We have developed a distinctive EcoEssay for our web site in which an individual prepares an essay on a particular topic. We then commission three official responses, and all four are made available on the web. The site is then opened up to a threaded electronic discussion which tracks the directions that various discussions go. The first two essays have discussed the perceived lack of progress in ecology in the last decade, and the importance of data and information sharing in ecology.

We have been approached a number of times by publishers about organizing a Center-based synthesis publication series. Initially this appears to be an good idea, but none of our participants have had any trouble securing publishers for the results of NCEAS activities. Thus it seems that such a formal relationship is not necessary. We are keeping in mind, however, that we might want to enter some venture that would use the influence of the Center to promote the publication of ecological synthesis in general, including projects not conducted at NCEAS.

It is important that the Center reach out to the lay as well as the professional community. The Center itself has received notice in the popular press, both locally and nationally, and several of the projects conducted by NCEAS' visitors have been broadly popularized (e.g., Camille Parmesan's butterfly range expansions in relation to climate change, and Costanza's ecosystem services work). Center personnel often gives talks to the public, and we are considering a program with the Santa Barbara Botanical Garden to develop a speakers program involving Center visitors.

The Center's most interesting outreach to the local community is through the local Los Marineros program. This program is conducted by the Santa Barbara Museum of Natural History and serves as the basis of the physical and natural sciences curriculum for the 5th grade. The students identify, count, weigh, and measure various parameters associated with the ocean and shoreline. NCEAS has become the database manager for this effort, allowing the student to enter and access data through our web site ("Kids Do Ecology"). Currently, over 300 students are involved, about 40% of whom are Hispanic. In addition to the data management, 10 NCEAS scientists have given 4 talks each to the 5th-graders this year, exposing the students to what scientists do, as well as interesting scientific questions.

A final note about training and education. When NCEAS began we imagined a series of traditional training workshops where students are brought in and taught new techniques for analysis and synthesis. However, as our program has evolved we see much more effective means of training that are less traditional. The HCP review effort is an excellent example. Students all over the country were involved in the analysis of real-world issues. They worked extremely hard (one professor estimated that the students spent 11 times as much time working on the HCP project as in a typical graduate seminar), and had a chance to delve deeply into a relevant topic. We view approaches like this as more effective than traditional training workshops (we're looking at several other opportunities to employ this approach), and believe that they fit well into the innovation that NCEAS is seeking.

5. Interaction with University and Local Community

A. Outreach between UCSB and Community - The Center is located off campus, in downtown Santa Barbara. We spend a large fraction of our budget in local establishments, and pay rent for the building we inhabit. These economic benefits are recognized and appreciated by the local community, and the UCSB administration views NCEAS as a good ambassador of the university to the community. Local newspaper editorials, and comments from community leaders indicate that the recognition of this is spreading.

B. Interaction with other UCSB Centers - The campus is broadly interdisciplinary, particularly in the environmental sciences. We interact regularly with individuals involved in the National Center for Geographic Information and Analysis, another NSF Center. UCSB sponsors an NSF Digital Library initiative (Alexandria Digital Library), which focuses on digital spatial data, and NCEAS interacts with its faculty at several levels. NCEAS is currently involved in a research project with the San Diego Supercomputing Center, and additional collaborations are planned. The Director of NCEAS serves on the advisory board for the Institute for Computational Earth Systems Science, and we have been involved with the Institute for Social, Behavioral, and Economic Research, the Evolution Psychology Center, and the Interdisciplinary Humanities Center.

C. Involvement with UCSB faculty and students - Initially there was concern about the Center making contact with the campus. To preclude this, 17 faculty members were designated Host Participants who would carry the word about NCEAS to the campus. Because of the ability to communicate with many people directly, isolation has not been a problem and the role of Host

Participants has not been necessary. We send an electronic monthly announcement about upcoming NCEAS activities to over 300 individuals on campus (and 350 people elsewhere), who are invited to participate by contacting the Working Group Leaders.

The obvious connection between campus and the Center is through the Department of Ecology, Evolution, and Marine Biology. While interactions with this Department are common, NCEAS has had participants from an array of units on campus, including Computer Science, Economics, Bren School of Environmental Science and Management, Geography, and Statistics and Applied Probability. In addition to these departments, the Center has interactions with Alexandria Digital Library (ADL), the Environmental Sciences Program, the Institute for Computational Earth Systems Science (ICESS), Marine Science Institute, and the National Center for Geographic Information and Analysis (NCGIA)

A total of 61 UCSB-based individuals have participated in a total of 201 activities (i.e., some of them multiple times). During Grant Year 3 – 26 of 31 activities had one or more of the original Host Participants in them and since the beginning of NCEAS, 13 of 16 Host Participants have participated in Center activities. The Center hosts informal Open Houses, and in addition to faculty members, 20 graduate students, 6 postdocs, 2 visiting graduate students, and 2 visiting postdocs have participated.

The Center has developed a Thursday ecolunch, about half of which are presented by UCSB students and faculty. We often invite a faculty member and their lab to come to the Center and talk informally about their research at these seminars. Conversely, NCEAS visitors have provided over one third of the EEMB Departmental seminar speakers over the last 18 months.

D. Location of NCEAS – The Center was initially located off campus because of the lack of space on campus, and to establish its position as a national, rather than University of California, Center. Most of those involved at the time imagined that the Center would move to campus as soon as possible (NSF wanted it moved within three years). However, it became obvious that its current location is ideal for the way the Center operates.

The campus is quite isolated – the nearest decent hotel is 3 miles away, and there is very little available for dining other than the typical campus facilities. Another Center on campus, the Institute for Theoretical Physics, finds housing and transportation for their visitors to be a major problem. NCEAS, on the other hand, is located near many hotels and restaurants, significantly easing the logistical problems of hosting over 600 visitors a year. Visitors regularly work late or on weekends because they can come and go at their own pace. This would be very difficult on campus.

Many visitors mention another, unanticipated, factor about being downtown. They note that being off campus gives a special feel to the enterprise, and keeps them from falling into their “campus mode”. Repeatedly, visitors have mentioned that the current facility and its location, promote a level of activity that would not be present if the Center was on campus. As noted, the Center’s presence downtown is perceived as an opportunity for the campus to be involved with the local community. It also enhances the sense that NCEAS is a national center.

There are potential drawbacks. The one most commonly mentioned is use of the library. With electronic means of access to information, this is becoming less of a problem. We run a shuttle service for needed materials, and can assist with parking for visitors who want to use the campus library. So far, this has not generated a problem.

Another possible concern is that the distance will inhibit interactions. This might be the case if UCSB faculty and students could just drop in to NCEAS activities. However, the Working Groups are not a series of seminars – rather, they involve in-depth analyses and are difficult to slip in and out of. Therefore, campus participants actually appreciate the opportunity to leave campus physically and immerse themselves in an NCEAS activity. Conversely, several have mentioned that having hundreds of ecologists – including friends and colleagues – milling around their offices over the course of a year could be disruptive. We have not found any difficulty getting students involved with NCEAS activities – there is an express bus that runs from campus to near NCEAS, and parking is available for visitors.

Finally, there is concern that NCEAS might be out of sight/out of mind. We certainly have not had that sense – we are often called upon to represent the university in interactions with visitors, and have received unqualified support from the UCSB administration for virtually all of our projects, ideas, and recommendations. We try to keep visible to those on campus, and it seems to be working.

We strongly believe that we should remain off campus, and located near downtown. There is a move in the city to build a public aquarium near the beach. We have been asked to become a tenant there, as part of a university enclave at the facility. This would be a spectacular location for the Center, and we would fit well into the university arm located there.

Appendix I

Facilities and Services

Meeting Facilities: Meeting rooms accommodating small (8-10 participants) or mid-sized (11-25) groups are available; we also have access to a 100-seat theater. A comfortable lounge, which contains serving facilities, is available for breaks and informal gatherings. Large offices serving 2-3 visitors each come fully equipped with supplies and computers.

Computing: NCEAS provides networked computing resources to support visiting researchers on-site as well as via the Internet. High performance computing is available for demanding modeling, statistical, visualization, and data management projects. We maintain two high performance computational servers: a four-processor, SMP Silicon Graphics Origin 2000 server, and a four-processor, SMP Silicon Graphics Challenge-L. For extremely demanding computation, we provide access to a 32 CPU SMP Origin 2000 that is a part of UCSB's supercomputing infrastructure, as well as links with regional Supercomputing Centers. Visitors have access to advanced PC, Macintosh, and Unix workstations running a broad range of software for accomplishing all phases of ecological analysis. NCEAS' computing systems are maintained by our resident scientific computing staff, who are also available to provide analytical and general technical support and advice.

Services: A major responsibility of the NCEAS administrative staff is to provide services that enhance the activities at the Center. This includes assistance with travel arrangements and accommodations prior to arrival. Upon arrival visitors can receive assistance with transport, and are provided with packets of information including guides to restaurants and local points of interest.

Services provided during the Center activity include copying, overhead and transparency production, special audio-visual needs, UCSB Library service, and mail service. The Center staff can be available on weekends if necessary (with 4 weeks notice), and a note-taker can be available for meetings (3 weeks notice, please). Assistance is also provided for travel reimbursements and for securing J-1 visas.

APPENDIX II
NCEAS WORKSHOPS/WORKING GROUPS/CONFERENCES/MEETINGS

DATE	CO- ORDINATORS	# PARTICIPANT S	ACTIVITY *
June 1-3, 1995	William Murdoch	15	Science Advisory Board (M)
October 22-24, 1995	William Murdoch Stephen Carpenter	17	Science Advisory Board (M)
January 4-19, 1996 August 29-September 9, 1996	Roger Nisbet William Murdoch Peter Turchin	12	Complex Population Dynamics (WG)
January 21-24, 1996	David Tilman Peter Kareiva	17	Role of Space in Population Dynamics and Interspecific Interactions (WG)
February 13-14, 1996	William Murdoch Stephen Carpenter	11	External Advisory Committee/NSF (M)
February 14-16, 1996	William Murdoch Stephen Carpenter	13	Science Advisory Board (M)
February 28-March 2, 1996	William Murdoch	105	Spatio-Temporal Dynamics in Ecological Systems (C)
March 30-April 3, 1996	Michael Rex Donald Strong	9	Deep-Sea Biodiversity (WS)
April 19-21, 1996	Edith Allen	38	Restoration Ecology (WS)
May 20-22, 1996	Virginia Dale Monica Turner	20	Comparing Large, Infrequent Disturbances: What Have We Learned? (WS)
May 29-June 1, 1996	Jonathan Roughgarden David Starrett	18	Theory of Ecological Economics (WS)
June 1-9, 1996 September 14-28, 1996	Bradford Hawkins Howard Cornell	2	Predators, Pathogens, and Parasitoids as Mortality Agents in Phytophagous Insect Populations (WG)

June 2-5, 1996	Terry Chapin Osvaldo Sala	20	Scenarios of Future Biodiversity: Causes, Patterns and Consequences (WS)
June 6-9, 1996	Peter Stine Bryan Baker	8	Investigating Alternative Land Use/Habitat Conservation Strategies Using GIS and Optimization Modeling (WG)
June 17-21, 1996	Robert Costanza	11	Total Value of the World's Ecosystem Services and Natural Capital (WS)
July 1-3, 1996	James Clark	11	The Role of Dispersal in the Holocene Expansion of Trees (WS)
July 24-28, 1996	Craig Osenberg	12	Meta-Analysis, Interaction Strength and Effect Size: Application of Biological Models to the Synthesis of Experimental Data (WG)
September 10-20, 1996	Robert Waide Michael Willig	22	An Analysis of the Relationship Between Productivity and Diversity Using Experimental Results from the Long-Term Ecological Research Network (WG)
September 14-28, 1996	Bradford Hawkins Howard Cornell	2	Predators, Pathogens, and Parasitoids (WG)
September 19-22, 1996	Michael Pace Peter Groffman	9	Establishing a Structure for the Synthesis and Integration of Progress in Ecosystem Science (WS)
September 25-27, 1996	Stephen Carpenter	13	Science Advisory Board (M)
October 2-6, 1996	Robert Jackson	17	Toward an Explicit Representation of Root Distribution in Global Models (WG)

October 7-9, 1996	Anthony Ives Thomas Frost	11	Intrinsic and Extrinsic Variability in Community Dynamics (WG)
October 14-15, 1996	Lindsay Boring	12	New Directions and Applications for Ecosystem Science in the Private Sector (WS)
November 7-8, 1996	Tim Seastedt	30	AERC (M)
November 12-15, 1996	Brian Walker Will Steffan	26	Global Change and Terrestrial Ecosystems: A Synthesis (WS)
November 17-20, 1996	Stephen Carpenter	152	Synthesis Symposium (C)
December 4-9, 1996	Marilyn Walker	30	Circumpolar Comparison of Tundra Response to Temperature Manipulation (WS)
January 1-10, 1997	Peter Turchin William Murdoch	10	Complex Population Dynamics III (WG)
January 6-17, 1997	Anthony Ives Thomas Frost	14	Intrinsic and Extrinsic Variability in Community Dynamics II (WG)
January 9-12, 1997	Craig Osenberg	14	Meta-Analysis Interaction Strength and Effect Size: Application of Biological Models and Experimental Data II (WG)
January 30- February 1, 1997	James Kitchell	9	Apex Predators (WG)
February 21-23, 1997	Aaron Ellison	10	ESA Committee on Data Archiving and Sharing (M)
February 24-28, 1997	Carolyn Hunsaker	8	Quantification of Uncertainty in Spatial Data for Ecological Applications (WG)
March 5-6, 1997	Stephen Carpenter	16	Science Advisory Board (M)
March 10-12, 1997	James Brown	10	Universal Phenomena in Ecology (M). Held at Santa Fe Institute

April 6-13, 1997	F. Stuart Chapin	39	Arctic Boreal Processes that Feed Back to Climate: Extrapolation and Synthesis (WS)
April 18-22, 1997	Robert Waide Michael Willig	8	Analysis of Relationship Between Productivity and Diversity Using Experimental Results from the Long Term Ecological Research Network II (WG)
May 15-19, 1997	Craig Osenberg	12	Meta-Analysis Interaction Strength and Effect Size: Application of Biological Models and Experimental Data III (WG)
May 15-June 5, 1997	Peter Turchin	9	Complex Population Dynamics IV (WG)
May 23-26, 1997	James Kitchell	10	Apex Predators II (WG)
May 28-29, 1997	Katherine Ralls	13	A Multidisciplinary Analysis of Alternative Farmland Retirement Strategies for Restoring San Joaquin Valley Ecosystems (WG)
June 23-July 3, 1997	Sandy Andelman	2	Designing and Assessing the Viability of Nature Reserve Systems at Regional Scales: Integration of Optimization, Heuristic and Dynamic Models (M)
July 15-16, 1997	O.J. Reichman	16	Data Management for the Ecological Sciences (WG)
July 16-17, 1997	Ray Hilborn	11	Predicting Extinction: The Dynamics of Populations at Low Densities (WG)
July 24-August 3, 1997	Sandy Andelman	8	Designing and Assessing the Viability of Nature Reserve Systems at Regional Scales: Integration of Optimization, Heuristic and Dynamic Models (WG)

July 28-August 24, 1997	Marc Mangel	12	Population Management (WG)
September 20-22, 1997	Aaron Ellison	11	ESA Committee on Data Archiving and Sharing (WG)
September 22-23, 1997	Peter Kareiva	21	Habitat Conservation Planning (WG)
September 24-25, 1997	Charles Peterson	18	Science Advisory Board (M)
September 29-October 1, 1997	Carolyn Hunsaker	21	Quantification of Uncertainty in Spatial Data for Ecological Applications (WG)
October 1-2, 1997	Michael Gilpin Peter Stine	10	Investigating Alternative Land Use/ Habitat Conservation Strategies Using GIS and Optimization Modeling II (WG)
October 12-16, 1997	Sandy Andelman	4	Designing and Assessing the Viability of Nature Reserve Systems at Regional Scales: Integration of Optimization, Heuristic and Dynamic Models (WG)
October 16-21, 1997	Robert Holt	18	The Ecological and Evolutionary Dynamics of Species' Borders (WG)
October 22-24, 1997	John Thompson	17	Rapid Evolution of Interspecific Interactions and the Organization of Biodiversity (WG)
October 24, 1997	Ray Smith	50	LTER CC (M)
October 25-28, 1997	Robert Waide Michael Willig	9	Analysis of Relationship Between Productivity and Diversity Using Experimental Results from the Long-Term Ecological Research Network III (WG)
October 28-29,	O.J. Reichman	5	External Advisory Committee

1997			(M)
November 6-18, 1997	Anthony Ives Thomas Frost	16	Intrinsic and Extrinsic Variability in Community Dynamics III (WG)
November 17-18, 1997	Tom Leinbach	9	Fall Panel Meeting: NSF Geography and Regional Science (M)
November 24, 1997	Robert Wilkinson	17	California Regional Climate Change Planning (M)
December 2-6, 1997	Dennis Ojima Arvin Mosier	29	Analysis and Synthesis of Trace Gas Fluxes (WG)
December 5-21, 1997	Sandy Andelman	7	Designing and Assessing the Viability of Nature Reserve Systems at Regional Scales: Integration of Optimization, Heuristic and Dynamic Models III (WG)
December 6-10, 1997	Peter Kareiva	77	Habitat Conservation Planning for Endangered Species II (WG)
December 7-9, 1997	Stith Gower Ross McMurtrie	11	An Analysis of the Age-Related Decline in Aboveground Net Primary Production: Potential Causes and Stand-to Global Scale Implications (WG)
December 10-15, 1997	Stephen Prince Richard Olson	21	Development of a Consistent Worldwide Net Primary Production (NPP) Database (WG)
December 10-23, 1997	Peter Turchin	11	Complex Population Dynamics V (WG)
January 5-9, 1998	Victoria Sork	14	Theoretical and Empirical Approaches to the Study of Gene Flow in Fragmented and Managed Populations (WS)
January 10, 1998	James Beach Leonard	17	Systematics Community (M)

	Krishtalka		
January 21-23, 1998	Mary Zawoysky	35	US JGOFS Science Steering Committee (M)
January 26-29, 1998	Sandy Andelman	4	Designing and Assessing the Viability of Nature Reserve Systems at Regional Scales: Integration of Optimization, Heuristic and Dynamic Models IV (WG)
February 16, 1998	Michael Gilpin Peter Stine	4	Investigating Alternative Land Use/ Habitat Conservation Strategies Using GIS and Optimization Modeling III (WG)
February 18-22, 1998	Stephen Prince Richard Olson	11	Development of a Consistent Worldwide Net Primary Production (NPP) Database II (WG)
February 23-25, 1998	Craig Groves	35	The Nature Conservancy (WS)
February 23-March 2, 1998	Ingrid Parker	10	Invasion Biology: Toward A Theory of Impacts (WG)
March 1-6, 1998	Gareth Russel Michael McKinney	10	Sampling Curves in Ecology: Theory and Application (WG)
March 4-5, 1998	Charles Peterson	18	Science Advisory Board (M)
March 6-9, 1998	John Thompson	4	Coevolution and the Organization of Biodiversity II (WG)
March 7-13, 1998	Victoria Sork	4	Theoretical and Empirical Approaches to the Study of Gene Flow in Fragmented and Managed Populations II (WG)
March 16-25, 1998	Sandy Andelman	4	Designing and Assessing the Viability of Nature Reserve Systems at Regional Scales: Integration of Optimization,

Heuristic and Dynamic Models V
(WG)

March 20-22, 1998	Donald Strong Michael Rex	9	Deep-Sea Biodiversity: Spatiotemporal Dynamics and Conservation Strategies (WG)
March 23-28, 1998	Anthony Ives Thomas Frost	6	Intrinsic and Extrinsic Variability in Community Dynamics IV (WG)
March 30-April 5, 1998	Bradford Hawkins Howard Cornell	2	Predators, Pathogens, and Parasitoids III (WG)
March 30-April 6, 1998	Sandy Andelman	5	Designing and Assessing the Variability of Nature Reserve Systems at Regional Scales: Integration of Optimization, Heuristic and Dynamic Models VI (WG)

*

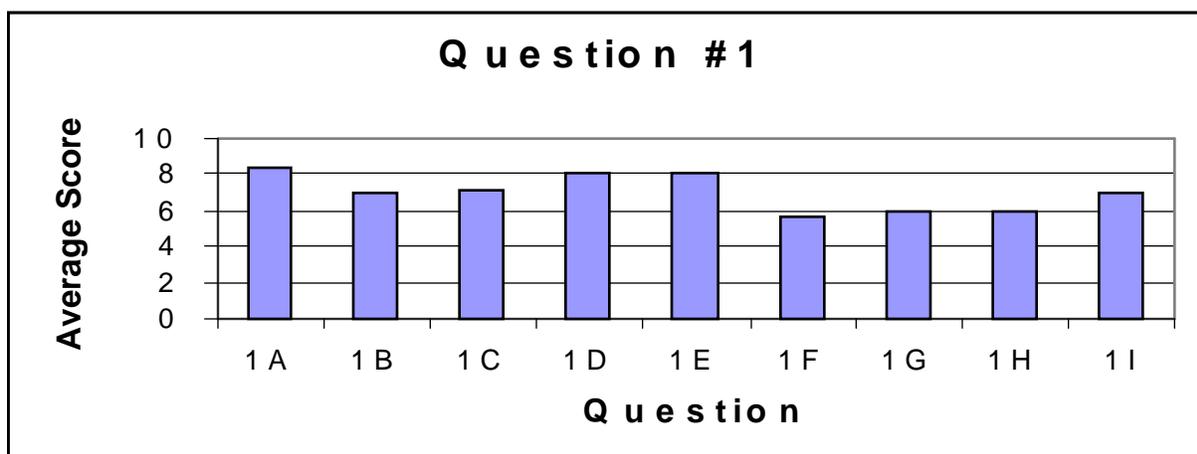
- WG = Working Group
- WS = Workshop
- C=Conference
- M=Meeting

APPENDIX III

Group leaders were asked to answer the following two questions by rating their involvement with NCEAS on a scale of 1-10, with 1 = not important and 10 = very important. They could also answer Not Applicable, in which case the answer was excluded from the average.

1. What was the most important finding or result from your activity at NCEAS?

- A. informal interactions among participants spawned new ideas and research directions
- B existing work was summarized and written up for publication
- C. synthetic analysis of data was used to test the generality of existing ecological theory
- D. synthetic analysis of data led to the formulation of new and/or more general ecological theory
- E. synthetic analysis of data suggested new directions for ecological research
- F. analytical modeling (e.g., mathematical, numerical, simulation) was used to test the generality of existing ecological theory
- G. analytical modeling led to the formulation of new and/or more general ecological theory
- H. analytical modeling suggested new directions for ecological research
- I. synthetic and/or analytical research was successfully applied to better understand or to address an environmental management or policy issue



2. *Did a facility like NCEAS make your activity possible, or facilitate it in an important way?*

- A. without NCEAS funding this activity would not have occurred
- B. NCEAS staff simplified the logistical aspects of the activity
- C. the location in downtown Santa Barbara was convenient and conducive to the activity
- D. NCEAS technical staff facilitated data compilation, statistical analysis, and/or computer modeling
- E. the NCEAS Web facility facilitated collaborative research
- F. NCEAS computing facilities made it possible to conduct new data analyses and modeling activities
- G. UCSB scientists and graduate students provided a local pool of expertise and intellectual capital

