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UCSB's National Center for Ecological Analysis and Synthesis: A Model for Enhancing Scientific Understanding

Scientists from all over the world gather several times a year on the third floor of a building overlooking State Street in downtown Santa Barbara. They're lured not by the breathtaking scenery, or by the high-end shopping center outside their front door. What brings them to the Central Coast of California is UC Santa Barbara's National Center for Ecological Analysis and Synthesis.

NCEAS (pronounced EN-SEAS), as it's called by the scientists who come together there, was created in 1995 by the National Science Foundation in response to pleas by ecological researchers who saw a need for meaningful synthesis of scientific data.

"There was a sense in the early '90s that ecology of all disciplines was really in need of synthesis to pull together all of the different specialized research," said Frank Davis, director of NCEAS. "At the same time, people were asking ecologists to solve problems. How do you make fisheries sustainable? How do we deal with climate change? Those are questions you can't answer from a single ecological perspective. You really need lots of ecological as well as other disciplinary perspectives on those subjects to advance social solutions."

According to the NCEAS web site, the center supports cross-disciplinary research that uses existing data to address major fundamental issues in ecology and allied fields, and encourages the application of science to management and policy.

NCEAS is a unique institution with an explicit mission to foster synthesis and analysis, turn information into understanding and, through effective collaboration, alter how science is conducted.

In a new study published in the journal Bioscience, Stephanie Hampton, deputy director of NCEAS, and her colleague, ecologist John N. Parker, examine the history of scientific synthesis and provide some insight into the importance of the research undertaken at NCEAS. They also explain the factors that have led to the many successful working groups at NCEAS, including face-to-face, collaborative interaction between scientists from multiple institutions.

In their study, "Collaboration and Productivity in Scientific Synthesis," Hampton and Parker explain how the NSF idea spawned a successful incubator of scientific research. "By 2005," Hampton and Parker wrote, "the center had risen into the top 1 percent of the 38,000 institutions worldwide publishing in ecology and environmental sciences in terms of scientific impact. The average impact factor for NCEAS publications is substantially higher than the average for top ecology journals, and two of the three most influential publications on the ecological response to climate change in 2010 were NCEAS products."

In 1995, most scientific research was conducted in a typical fashion –– going into the field, collecting samples and data, and then analyzing what was collected to produce a study that was published in a peer-reviewed scientific journal. That changed with the creation of NCEAS. No new data would be collected for the center's studies; instead, the researchers would use only existing data. In addition, the NSF guidelines for NCEAS stated that it would not focus on a specific area of research, and that the primary function of the center would be to provide the time, resources, and creative environment in which visiting researchers would be able to immerse themselves in collaborative synthesis.

"NCEAS is unusual in at least two aspects that are different from other research centers," Hampton said in an interview. "First, we don't have a resident faculty. We operate mainly through the work of visiting scientists, whether they're short-term

scientists who come to us through working groups, or they're longer-term residents who are based here. But when I say longer-term, it's still only two or three years –– people who come in as postdocs (postdoctoral researchers), or come in on sabbaticals.

"The second is that we use only existing data," she added. "We don't send people out into the field to collect new data. The idea is that we have been counting fish, and measuring trees, and counting and measuring things for hundreds of years. We should be able to get a lot by standing back and looking at what we can already know, given the data at hand."

Working group proposals are solicited twice a year by NCEAS. A science advisory board, including experts in ecology and affiliated fields, helps choose the projects, and NCEAS directors then step back and let the scientists do their work, providing autonomy and flexibility to organize group activities. The groups consist of 8-15 scientists, who meet face-to-face at NCEAS to engage in deep analysis and synthesis of theory, methods, and data. The members meet for about a week, 10-12 hours per day, several times a year, over two or three years. The researchers then continue their work at their home institutions until the next group meeting.

"I think what NCEAS is good for is putting ideas, issues, and concepts out there on the global scale," said Robert Condon, a scientist with the Dauphin Island Sea Lab of Alabama, and co-lead investigator of an NCEAS working group studying jellyfish. "From an increasing jellyfish globally type of issue, that's what's required. Until recently it's just been regional studies done on this issue. The way to do it is to look at a global issue from a global database. It's not a one- or two-person job. You need a true working group. NCEAS lays the platform so you can all come together, and collaborate together."

The working groups have also provided insight into the sociology and psychology of group interactions. "The long hours of intensely focused face-to-face collaboration, in a location free from outside distractions, facilitate effective and rapid communication and problem-solving, and significantly increase the velocity at which ideas are generated," Hampton and Parker wrote. "These conditions also yield high degrees of instrumental trust, limit conflict, and facilitate creativity, which allow the collaborators to share ideas and data freely."

Based on a study of more than 200 synthesis working groups, statistics show that the process has been very effective. Since 2006, the NSF has awarded more than $43 million to synthesis-center initiatives, and recently announced an additional $27.5 million commitment to its fourth synthesis center. International synthesis centers are growing as well, with Sweden, the Netherlands, and Australia developing new synthesis programs in the past couple of years.

As for NCEAS, the UCSB center is facing a new challenge. NSF funding, which is renewed every five years, is shifting to a new synthesis center in the next cycle, after backing NCEAS for the past 15 years. As a result, NCEAS is seeking independent funding to support its programs.

"The mission is still strong and still relevant," said Davis. "When you ask our user groups, they say: ‘More than ever, NCEAS is a place we look to, to get synthetic research done. It's something we really value.'

"Environmental issues have only gotten more pressing," he added. "We have to get to relevant science answers faster here at NCEAS. I think we can do that. The other thing is that when NCEAS first started, we didn't have a lot of the networking tools that we have now. The World Wide Web was just a fledgling operation, and Google didn't exist. Now we can do a lot of the work remotely. We can speed up synthesis that way."

Davis added: "It will be a challenge to replace NSF core funding, but if we can do that, we have a very bright future, I would say."

[RETURN TO TOP]

† Top image: Frank Davis and Stephanie Hampton, in front of a wall covered with photos of postdoctoral researchers at NCEAS.

Credit: George Foulsham, Office of Public Affairs

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