

DataONE



NCEAS

National Center for Ecological Analysis and Synthesis



Annual Report

2015-2016

University of California, Santa Barbara

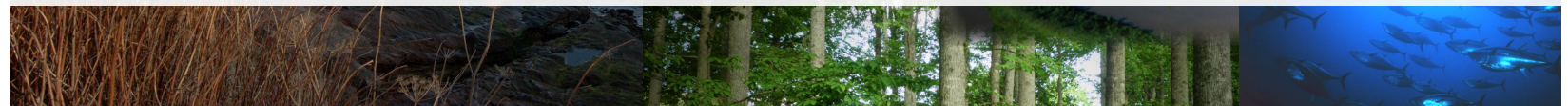


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Director's Statement



In 2015 the National Center for Ecological Analysis and Synthesis (NCEAS) celebrated its 20th year as a synthesis center. More than 6000 researchers from around the world have convened at NCEAS in interdisciplinary working groups to tackle big, important questions in ecology and the environment in order to rapidly advance scientific understanding and to benefit society. The first synthesis center of its kind, NCEAS remains a vibrant, innovative and influential enterprise both nationally and internationally.

NCEAS operates in downtown Santa Barbara, where visiting researchers have easy access to hotels and restaurants. At the same time, NCEAS maintains strong ties to campus. Most working groups include one or more UCSB faculty or researchers. Moreover, we employ and train a large cadre of graduate students in data management, scientific programming, and science communications.

Researchers at NCEAS do not collect new primary data; rather, they pool and integrate existing data and information to uncover general ecological patterns and relationships that are beyond the scope of individual research projects. Most NCEAS working groups are selected through open calls for proposals. In addition, the Center supports a small and growing community of resident researchers that concentrate on synthesis research or on development of informatics approaches and tools to support data-intensive synthetic science. NCEAS staff provides logistical and technical support, training, and outreach services to increase the productivity, creativity and impact of NCEAS researchers.

The NCEAS model continues to be extremely effective. During the past year, NCEAS working groups published high profile papers spanning a range of topics. For example, one group compared natural habitats (mangroves, seagrass) to manmade structures (seawalls, dykes) for their costs, benefits, and physical effectiveness at reducing wave impacts and protecting coastal communities ([Narayan et al., PLOS ONE, April 2016](#)). Another group's synthesis of 50 years of seabird studies revealed that plastics are becoming increasingly common in the guts of seabirds and predict that plastic ingestion will affect approximately 99% of all seabird species by the year 2050 ([Wilcox et al., PNAS, August 2015](#)).

During the past year NCEAS was awarded several large, multi-year grants that expand our work into exciting new areas:

- **NSF Long Term Ecological Research (LTER) [Network Communications Office \(NCO\)](#):** The NCO will support synthesis research, communication, outreach, and training across the 25 LTER field sites and more than 2,300 LTER scientists who are seeking to understand processes that control long term dynamics of ecosystems ranging from forests to grasslands, farmlands, cities, lakes, coastal wetlands, coral reefs and coastal oceans.
- **[State of Alaska Salmon and People Project \(SASAP\)](#):** The Gordon and Betty Moore Foundation funded NCEAS to lead an effort to produce an up-to-date interdisciplinary perspective on Alaska's salmon systems and the people who rely upon them.
- **NSF [Arctic Data Center](#):** NCEAS was chosen by NSF to develop and curate a new archive for Arctic scientific data and other related research documents. NCEAS will serve as the NSF Arctic research community's primary repository for data preservation and data discovery.



- **[TomKat UC Carbon Neutrality Project](#)**: In collaboration with UCSB's Institute for Energy Efficiency, the TomKat project is supporting innovative multi-disciplinary research teams that will substantially accelerate progress of the [University of California's Carbon Neutrality Initiative](#).

While bringing these new projects on board, NCEAS continued to collaborate on several existing and expanding projects.

- The **[Science for Nature and People Partnership](#)** (SNAPP) has continued to grow and evolve. A partnership with The Nature Conservancy and the Wildlife Conservation Society, SNAPP supports synthesis research to better understand the relationship between biodiversity conservation and human well-being and to deploy that understanding to improve conservation policy and management efforts. SNAPP now has 24 Working Groups.
- 2015 was the first full year for our two **Gulf of Alaska** working groups and postdoctoral associates engaged in synthesizing 25 years of data about the effects of the Exxon Valdez Oil Spill.
- NCEAS continued its role as a key partner in the NSF-sponsored **DataONE** network for managing and sharing earth observation data. The [DataONE federated network](#) now includes 32 Member Nodes comprising over 396,000 publicly accessible data objects (see [graph](#)).
- Under PI Ben Halpern's leadership, the past year witnessed rapid uptake and expanding policy influence of The **Ocean Health Index** (OHI). The OHI is a comprehensive framework used to measure ocean health from global to local scales. "OHI+" assessments tailored for local and regional application were recently completed for China and the Gulf of Guayaquil, Ecuador.
- These and more projects are described in more detail in the following pages of this report.

In July 2016, after five years as NCEAS Director, I am returning to teaching and advising students at the Bren School of Environmental Science & Management. I will also continue to direct the LTER Network Communications Office. Bren School Professor Ben Halpern is stepping in as NCEAS Director. Ben has been associated with NCEAS for 18 years and has a deep understanding of and appreciation for the role of NCEAS as a global force in environmental synthesis research. Ben is also a highly respected and influential scientist in ocean conservation policy and management. I have no doubt that NCEAS is in very capable hands and am excited about NCEAS' future under Ben's leadership.

In summary, this has been an extraordinarily productive year at NCEAS. I want to thank the Gordon and Betty Moore Foundation, the National Science Foundation, our partners at The Nature Conservancy and the Wildlife Conservation Society, and our many other sponsors for their generous support. I also want to acknowledge and thank the State of California and the leadership of University of California, Santa Barbara for their continued support and commitment to NCEAS.

Most Sincerely,

Frank Davis

NCEAS Mission Statement



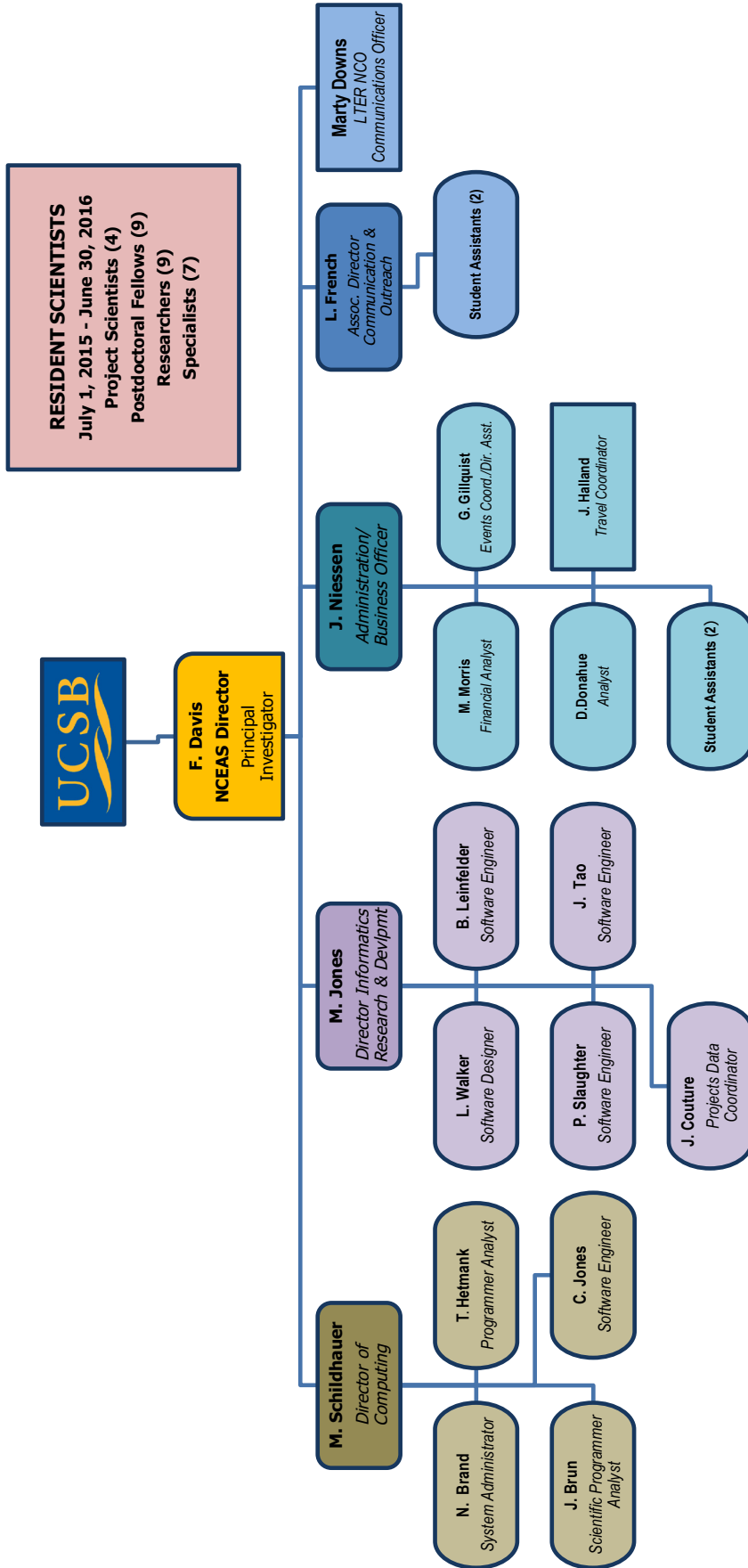
NCEAS rapidly advances ecological knowledge through analysis and synthesis of existing data to address critical environmental challenges for the benefit of nature and the well-being of people. NCEAS provides computing solutions to enable networked scientific collaboration by leveraging NCEAS' innovation and leadership in informatics. NCEAS promote the skills, knowledge and collaborative culture among scientists, policy-makers, and resource managers necessary for transformative research and to speed application.





The People of NCEAS

Organizational Chart



Principal Investigators



Jennifer Caselle	Associate Research Biologist	UCSB Marine Science Institute
Steven Courtney	Center Associate	National Center for Ecological Analysis and Synthesis
Frank Davis	Director and Professor	National Center for Ecological Analysis and Synthesis
Jeff Dozier	Professor	Bren School of Environmental Science and Management
Benjamin Halpern	Professor	National Center for Ecological Analysis and Synthesis
Stephanie Hampton	Director	Washington State University, Center for Environmental Research, Education & Outreach
Krzysztof Janowicz	Associate Professor	UCSB Geography Department
Matthew Jones	Director of Informatics and Research and Development	National Center for Ecological Analysis and Synthesis
Carrie Kappel	Associate Research Biologist	National Center for Ecological Analysis and Synthesis
Christopher Lortie	Researcher	National Center for Ecological Analysis and Synthesis
Stacy Rebich-Hespanha	Research Associate	National Center for Ecological Analysis and Synthesis
Mark Schildhauer	Director of Computing	National Center for Ecological Analysis and Synthesis
Kimberly Selkoe	Associate Researcher	National Center for Ecological Analysis and Synthesis
Katja Seltmann	Director	UCSB Cheadle Center for Biodiversity and Ecological Restoration

NCEAS Scientists



Postdoctoral Fellows

Rachel Blake	Gulf of Alaska
Samantha Cheng	SNAPP: Evidence-based Conservation
Shelley Crausbay	SNAPP: Ecological Drought
Halley Froehlich	SNAPP: Sustainable Aquaculture
Siddharth Narayan	SNAPP: Coastal Defenses
Aaron Ramirez	SNAPP: Ecological Drought
Claire Runge	SNAPP: Better Land-use
Adrian Stier	Ocean Tipping Points
Colette Ward	Gulf of Alaska

Professional Researchers

David Auston (<i>visiting</i>)	TomKat, UC Carbon Neutrality Project
Carol Blanchette	ILTER NCO
Jennifer Caselle	ILTER NCO, SNAPP: Biocultural Indicators
Krzysztof Janowicz	Geolink
Carrie Kappel (<i>formerly Project Scientist</i>)	Ocean Tipping Points
Brandon Kuczenski	SNAPP: Data-limited Fisheries
Christopher Lortie (<i>visiting</i>)	Shrub Habitat Studies
Stacy Rebich-Hespanha	ILTER NCO
Kimberly Selkoe	Ocean Tipping Points, Impacts of Climate Change

Specialists

Jamie Afflerbach	Ocean Health Index
Jessica Couture	Gulf of Alaska
Ning Jiang	Ocean Health Index
Dawn Dougherty	SNAPP: Data-limited Fisheries
Margaret O'Brien	SONet, LTER NCO

Project Scientists

Catherine Longo	SNAPP: Data-limited Fisheries
Courtney Scarborough	Ocean Tipping Points
Julia Stewart Lowndes	Ocean Tipping Points



Staff Research Associates

Gulf of Alaska

SNAPP: Evidence-based Conservation

SNAPP: Ecological Drought

SNAPP: Sustainable Aquaculture

SNAPP: Coastal Defenses

SNAPP: Ecological Drought

SNAPP: Better Land-use

Ocean Tipping Points

Gulf of Alaska

Technical Staff

Julien Brun

Melanie Frazier

Benjamin Leinfelder

Bryce Mecum

Nicholas Outin

Peter Slaughter

Jing Tao

Lauren Walker

Daniel Yocum

Chris S. Jones

Matthew Jones

Mark Schildhaur

NCEAS Science Advisers



Jennifer Balch	University of Colorado
Carl Boettiger	University of California, Berkeley
Christopher Costello	University of California, Santa Barbara
John Drake	University of Georgia
Stephanie Hampton	Washington State University
Hillary Young	University of California, Santa Barbara

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SNAPP Science Advisory Council

Paul Armsworth	University of Tennessee
Elena Bennett	McGill University
Fabrice DeClerck	Bioersity International
Jane Carter Ingram	Ernst and Young
Carrie Kappel	University of California, Santa Barbara
Yuta Masuda	The Nature Conservancy
Jensen Montambault	The Nature Conservancy
Dilys Roe	International Institute for Environment and Development
Mark Schildhauer	University of California, Santa Barbara
Bhaskar Vira	University of Cambridge
James Watson	Wildlife Conservation Society

SNAPP Board



Frank Davis	University of California, Santa Barbara
Adriana Dinu	United Nations Development Programme
Harry Hagey	Retired Chair of the Board of Trustees, Dodge and Cox Funds
Peter Kareiva	University of California, Los Angeles
John Robinson	Wildlife Conservation Society
Cristian Samper	Wildlife Conservation Society
Mark Tercek	The Nature Conservancy
Michael Witherell	University of California, Santa Barbara
Ward Woods	Chair of the Board of Trustees, Wildlife Conservation Society

SNAPP Management Team

Cherie Carter	The Wildlife Conservation Society
Lynne Eder	The Nature Conservancy
LeeAnne French	University of California, Santa Barbara
Dayana Gonzalez	The Nature Conservancy
Craig Groves	The Nature Conservancy
Jane Carter Ingram	Wildlife Conservation Society
Robert Lalasz	The Nature Conservancy
Caleb McClennen	The Wildlife Conservation Society
Matthew Miller	The Nature Conservancy
Jensen Montambault	The Nature Conservancy
Julia Niessen	University of California, Santa Barbara
Mark Schildhauer	University of California, Santa Barbara
Todd Stevens	Wildlife Conservation Society

Students



Graduate Students	Project	Start Date	End Date
Terra Alpaugh	LTER Network Communications Office	02/04/16	09/30/16
Gabriel Antunes Daldegan	SNAPP: Science for Nature & People Partnership	06/25/15	-
Charlie Diamond	TomKat:The TomKat UC Carbon Neutrality Project	06/20/16	06/19/17
Jesse Goldstein	Collaborative Data Management & Holistic Synthesis of Impacts & Recovery Status Associated with the Exxon Valdez Oil Spill	04/04/16	09/30/16
Tova Handelman	NCEAS Outreach and Development	10/26/15	08/26/16
Hou Chung-Yi	DataONE: Observation Network for Earth	10/02/14	05/31/16
Sara Lafia	DataONE: Observation Network for Earth & INTEROP:A Community-driven Scientific Observations Network to Achieve Interoperability & Ecological Data	06/13/16	-
Melissa Maggass	NCEAS Outreach and Development	06/03/15	06/10/16
Jay McConagha	TomKat:The TomKat UC Carbon Neutrality Project	06/20/16	06/19/17
Ian McCullough	SNAPP: Science for Nature & People Partnership	06/30/15 06/14/16	03/31/16 09/30/16
Sarah McCutcheon	SNAPP: Science for Nature & People Partnership	06/23/15	-
Celine Nol	TomKat:The TomKat UC Carbon Neutrality Project	06/20/16	06/19/17
Sodavy Ou	Collaborative Data Management & Holistic Synthesis of Impacts & Recovery Status Associated with the Exxon Valdez Oil Spill	02/04/16	06/30/16
Nicole Poletto	LTER Network Communications Office	06/13/16	09/30/16
Evan Ritzinger	TomKat:The TomKat UC Carbon Neutrality Project	06/20/16	06/19/17
Devin Spencer	NCEAS Outreach and Development	06/15/15	07/30/16
Sandy Sum	Collaborative Data Management & Holistic Synthesis of Impacts & Recovery Status Associated with the Exxon Valdez Oil Spill	12/1/15	-
Sonja Alexandra Uribe	LTER Network Communications Office	02/18/16	-

Undergraduate Interns	Project	Start Date	End Date
John Clark	Collaborative Data Management & Holistic Synthesis of Impacts & Recovery Status Associated with the Exxon Valdez Oil Spill	12/01/15	-
Sarah Heller	Collaborative Data Management & Holistic Synthesis of Impacts & Recovery Status Associated with the Exxon Valdez Oil Spill	06/13/16	08/26/16
Monica Kunz	NCEAS Outreach and Development	09/01/14	12/01/15
Jaclyn Mandoske	Ocean Tipping Points	09/30/14	03/31/16
Jair Medina	Collaborative Data Management & Holistic Synthesis of Impacts & Recovery Status Associated with the Exxon Valdez Oil Spill	01/08/16	01/08/16
Shirley Ng	Collaborative Data Management & Holistic Synthesis of Impacts & Recovery Status Associated with the Exxon Valdez Oil Spill	12/01/15	08/26/16



NCEAS Programs & Working Groups

Long Term Ecological Research Network Communications Office



Project Title: [LTER Network Communications Office](#)

Lead Principal Investigator: Davis, Frank

Co-PIs: Schildhauer, Mark; Caselle, Jennifer; Rebich Hespanha, Stacy

In October 2015, the National Science Foundation chose NCEAS to operate the Network Communications Office (NCO) of the Long Term Ecological Research (LTER) Network, a confederation of research sites where long-term data collection, experimentation, and modeling contribute to the understanding of long-term, large scale processes that is essential for conserving and managing the nation's ecosystems.



The LTER program, launched by the National Science Foundation in 1980, transformed a previous pattern of short-term, unconnected ecological studies by establishing a network of sites that would collect long-term data and maintain ecosystem-scale experiments. The Long Term Ecological Research (LTER) sites quickly attracted top-notch researchers and became focal points for training students, testing models, and building collaborative teams.

Today, the LTER network encompasses 25 sites and over 2400 scientists working in diverse biomes, including marine and coastal systems, coral reefs, forests, grasslands, deserts, and Arctic and Antarctic ecosystems. The data collected at LTER sites (over 42,000 data packages and counting) is freely available to researchers around the globe through the Network's PASTA+ repository and other data repositories and discovery frameworks, such as DataONE.

Based at NCEAS, the Network Communications Office catalyzes and facilitates scientific synthesis, education, communications and outreach in support of the LTER Network. By spreading the word about LTER science and data, the Network Communications Office makes this immense data resource more accessible to potential users, including researchers, resource managers, students, and educators. By funding synthesis working groups, the NCO helps LTER and non-LTER researchers to wring new insights from this existing data.

The first round of synthesis working group funding, awarded in June 2016, includes projects to:

- Assess how and when the mix of ecological communities at a site may contribute to ecosystem stability
- Understand what factors control the export of energy and nitrogen in streams
- Synthesize the results of 101 long-term experiments simulating aspects of global change to look for consistent patterns and identify early indicators of major ecosystem shifts.

The mission of the NCO is a particularly good fit for NCEAS' historical and emerging strengths, as it draws on the Center's deep skill set in eco-informatics and collaborative research while also capitalizing on its growing success in applying and communicating research across sectors.



SNAPP: Science for Nature & People Partnership



SNAPP supports trans-disciplinary working groups to fill knowledge gaps and advance solutions for people and nature. NCEAS has partnered with The Nature Conservancy and Wildlife Conservation Society in a collaboration called Science for Nature and People Partnership (SNAPP). SNAPP brings together scientists, policymakers, and field practitioners to bridge the gap between analysis and action. SNAPP Working Groups collaborate and synthesize existing information to address key questions at the intersection of nature conservation, economic development, and human well-being in ways that will provide real world benefits for humankind.

Starting with the NCEAS model of soliciting open scientific Calls for Proposals for collaborative, interdisciplinary Working Groups, SNAPP goes one step further by involving practitioners and decision-makers from the start to create a clear and rapid pathway to implementation. NCEAS engages its community of more than 6,000 scientists to help provide scientific rigor in SNAPP Working Groups.

The SNAPP Working Groups are currently tackling some of the world's biggest challenges like food, clean water, and energy security by identifying ways in which conserving nature can create a net benefit to human well-being.

SNAPP is generously funded through founding grants by Shirley and Harry Hagey, Steve and Roberta Denning, Seth Neiman, Angela Nomellini and Ken Olivier, the Gordon and Betty Moore Foundation, Ward W. and Priscilla B. Woods, and the David and Lucile Packard Foundation.



SNAPP Fast Facts

- Over 600 experts have participated in SNAPP working groups
- SNAPP working groups bring experts from more than 250 institutions
- SNAPP working groups are diverse with participants from over 35 countries
- SNAPP currently supports 24 working groups
- SNAPP is a first-of-its-kind collaboration

Water Security and Nature

Nearly a third of the world's population faces water shortages on a regular basis SNAPP seeks innovative management approaches to balance the use of water for industry, agriculture, natural ecosystems, and human consumption.



Project Title: SNAPP: Prioritizing investments in green infrastructure to meet urban water security needs in Latin America

Lead Principal Investigator: Goldstein, Joshua

Co-PI: Tellman, Elizabeth

Water stress is an increasing global problem, with as much as 30% of the world's population facing water shortages on a regular basis. Water funds and other investments to protect upstream watersheds and water sources may be part of the solution, and may reduce the need for more costly built infrastructure like dams and reservoirs. This Working Group is developing a methodology to identify where and how investments in natural capital in select Latin American cities can help solve urban water quality, scarcity and management issues.

Project Title: SNAPP: Water transactions to enhance streamflow, water supply reliability, and rural economic viability in the western United States

Lead Principal Investigator: Kendy, Eloise

Co-PIs: Richter, Brian; Purkey, Andrew

Over-allocation of water for agricultural, municipal, and industrial use severely depletes stream flows across the American West, degrading ecosystems, and posing economic risk to all who depend on reliable water supplies. This Working Group is developing a novel approach to water sharing – using legal water transaction agreements that change water use or transfer or sell water rights – to eliminate zero-sum competition between users, and instead advance a multiple-benefit approach that restores stream flows, reduces economic risk associated with water shortages, and maintains agricultural economies.

Project Title: SNAPP: Impacts of hydraulic fracturing on water quantity and quality for nature and people: Are we prepared for the future?

Lead Principal Investigator: Baruch-Mordo, Sharon

Co-PIs: Kiesecker, Joseph; Trainor, Anne; Ryan, Joseph; Fargione, Joseph

New technologies of horizontal drilling with hydraulic fracturing are making shale energy development possible and are helping meet increasing global energy demand. Hydraulic fracturing also uses large quantities of water and produces toxic chemical waste. This Working Group is examining the impacts of energy extraction on water supplies and wastewater contamination. By documenting best practices, SNAPP will help predict and avoid conflicts between shale energy development and the need for clean, safe water for people and natural systems.

Project Title: SNAPP: Amazon Waters - Balancing infrastructure development and conservation of waters, wetlands, and fisheries

Lead Principal Investigator: Goulding, Michael

Co-PIs: Kiesecker, Joseph; Trainor, Anne; Ryan, Joseph; Fargione, Joseph

The Amazon Basin is the largest tropical wilderness area and the most biologically diverse place on Earth. Amazonia is home to hundreds of indigenous peoples and other traditional cultures which rely on this vast freshwater system. How can connectivity of this vast, interlinked, and dynamic freshwater system be maintained, so as to support human well-being, wildlife, and the environments on which they depend? This will require the conservation of critical wetlands, strengthening fisheries management, and minimizing the environmental impacts of infrastructure and extractive industries on the Amazon's diverse aquatic ecosystems. This Working Group has developed a strong scientific foundation to support this vision, and is now in a position to suggest management and policy pathways for large-scale aquatic conservation.



Food Security and Nature

As the human population grows, pressure is increasing on global food production. SNAPP searches for science-based strategies to balance fisheries harvest and agricultural intensification with conservation to ensure long-term food security.

Project Title: SNAPP: Managing Data Limited Fisheries for Economic and Biological Objectives

Lead Principal Investigator: Wilson, Jono

Co-PIs: Revenga, Carmen; Rude, Jeremy

Overfishing threatens the health of many of the world's fish stocks and the millions who rely on fish for their livelihood and animal protein. We know that reliably assessed fisheries tend to be better managed and thus less overfished; however, we lack regular assessment data for more than 90% of Earth's fisheries. This Working Group is developing innovative, inexpensive approaches to assess such data-limited fisheries and will create new tools and local training to improve sustainability of small-scale fisheries and local economies.

Project Title: SNAPP: Measuring the status of fisheries and factors leading to success

Lead Principal Investigator: Hilborn, Ray

Co-PI: Parma, Ana; McClennen, Caleb

Fisheries are an important source of global food security, income and employment, and are closely tied to changes in the health of marine environments. Effective management of the world's fisheries suffers from many challenges, but the lack of data and analysis magnifies the challenges tenfold. To improve the science of fisheries management and the health of the world's fisheries, scientists from around the world will come together with new data to improve our understanding of the current status of key fish stocks, and provide a systematic analysis of all the factors that lead to good outcomes in fisheries management.



Project Title: SNAPP: Planning for the impacts of land-uses on coral reef fisheries and livelihoods under different climate scenarios

Lead Principal Investigator: Klein, Carissa

Co-PIs: Brown, Christopher; Possingham, Hugh

While most marine data tries to make sense of what is happening above and below the ocean surface, marine environments are also impacted by land-based activities such as logging, mining and construction. Increasing populations and economic development along coasts around the globe are leading to growing pressures on fisheries and other marine resources. This Working Group is creating a model to help predict the impacts of land-use changes on fisheries. By closing the gap between terrestrial development and marine resources, SNAPP will help decision makers assess how their choices could impact economic development, fisheries and livelihoods.

Project Title: SNAPP: Analyzing best practices and standards as a pathway to sustainable and conservation-friendly offshore aquaculture

Lead Principal Investigator: Grimm, Dietmar

Co-PI: Halpern, Benjamin

Aquaculture currently represents 50 percent of all fisheries products for direct human consumption. It's not a question of if or when aquaculture will take off, but more about how and where it will expand, and what people can do to help steer it towards more sustainable practices. This Working Group of industry representatives, scientists, and others will examine current best practices, analyze opportunities for sustainable expansion, as well as the economic and ecological impacts of potential aquaculture development scenarios, with a special focus on the emerging sector of open-ocean aquaculture, which currently has no best-practice guidance of any kind.

Project Title: SNAPP: Finding smart planning solutions in the Southern Agricultural Growth Corridor of Tanzania: What does sustainable intensification look like?

Lead Principal Investigator: Kamau, Felix

Co-PIs: Cleary, David, Magembe, Lucy

The expansion of agriculture into wild lands poses an enormous risk to conservation efforts. An alternative may be to intensify agriculture in specific places, growing more food on less land while sparing key natural areas. Large "infrastructure corridors" are being proposed in developing countries around the world as a way to expand intensive, commercial agriculture to feed the growing population. This Working Group is focusing on the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) to identify and map the trade-offs between agricultural intensification and the high risk to agricultural livelihoods, ecosystem services, and biodiversity to guide smart planning and sustainable agricultural development.

Community Resilience & Climate Change



Climate change poses many threats to ecosystems and humans; from long-term drought to sea level rise. SNAPP is developing new evidence-based responses to these challenges that balance conservation and human well-being outcomes.

Project Title: SNAPP: Integrating natural defenses into coastal disaster risk reduction

Lead Principal Investigator: Beck, Michael

Co-PI: Ingram, Jane Carter

Natural habitats such as mangroves, coral reefs, and wetlands, as well as manmade barriers including levees and seawalls, help coastal communities withstand the impacts of extreme environmental events. This Working Group is measuring how, where, and how much coastal habitats can protect communities from the impacts of storm surges, sea level rise, and other natural hazards. They are developing practical guidance and tools for decision-makers and practitioners to implement natural solutions that lead to reduced risks for coastal communities and livelihoods.

Project Title: SNAPP: Identifying common ground among fire researchers studying mixed conifer forests

Lead Principal Investigator: Moritz, Max

Co-PIs: Topik, Chris; Odion, Dennis; Morgan, Penny; Allen, Craig; Hessburg, Paul; Veblen, Tom

There is growing concern over how to best manage fire-prone landscapes in the face of an uncertain future climate, as well as an increasingly contentious scientific debate over how much high-severity fire should be considered “natural” in dry conifer forests across the Western U.S. Unfortunately, the debate has become a roadblock to practical action on fire management. To identify common ground among fire researchers, this Working Group will bring together representatives from both sides to address the core issues of the debate, review and synthesize available data, identify where consensus exists, focus on policy and management decisions based on that consensus, and develop a strategy for resolving issues that remain unsettled.



Project Title: SNAPP: Developing guidelines for and assessing relationships among biocultural indicators to improve long-term resilience of Pacific social and ecological communities

Lead Principal Investigator: Ticktin, Tamara

Co-PIs: Mejia, Manuel; Sterling, Eleanor; Jupiter, Stacy

Biodiversity and food- and water-security throughout the Pacific will be negatively impacted by climate change. Climate change, in combination with local stressors, will lead to the exploitation of resources, habitat transformation, and the spread of invasive species in the Pacific. Enduring these pressures will require practices and policies that best foster resilient and adaptive communities to be adopted. In order to improve long-term community resilience to these changes, this Working Group will develop a biocultural approach to community planning and monitoring that incorporates the intimate connections of Pacific peoples with the land and sea.

Project Title: SNAPP: Landscape sensitivity to ecological drought: The knowns, needs, and solutions for the real world

Lead Principal Investigator: Carter, Shawn

Co-PIs: Hall, Kimberly; Cross, Molly

The intensity and frequency of droughts in North America are expected to increase in scope and duration – with concurrent challenges to people and nature. To meet these challenges, this Working Group will synthesize the current understanding of ecological (multi-year, climate-induced) drought, and identify research priorities, including methods for evaluating future drought risks that don't rely only on historic data. They will also work with existing pilot efforts on drought resiliency, and field test a suite of community preparedness and conservation actions that increase resilience to drought without harming the natural systems that both depend on.

Project Title: SNAPP: Faith and conservation

Lead Principal Investigator: Mcleod, Elizabeth

Co-PI: Palmer, Martin

A partnership between conservation and religious groups can be influential because the success of conservation efforts often depends on the ability to change human values and behaviors. Faith-based organizations are common sources of values and behaviors. Historically, collaborations between conservation and religious groups wane over time, but by providing the proper tools and guidance, long-term partnerships and greater conservation outcomes can be achieved.

Project Title: SNAPP: Aligning coastal restoration with ecological and societal needs

Lead Principal Investigator: Grabowski, Jonathan

Co-PI: DeAngelis, Bryan; Arkema, Katie

Coastal ecosystems are being degraded and the extent of these ecosystems has been reduced worldwide. These changes are exposing coastal communities and assets to more risks of disasters and climate change. In response, new policies have been created to include coastal habitat restoration in risk management plans. Yet agencies are facing hard decisions about where to invest in coastal restoration, and how to set targets to meet the needs of both nature and people. This Working Group will inform future restoration decisions by examining agency needs for decision-making, assess past restoration projects, and develop achievable metrics and approaches for guiding future restoration efforts.

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Ecosystem Services & Biodiversity Benefits

Modern conservation challenges require innovative economic approaches. SNAPP is identifying practical solutions to help decision-makers weigh economic development opportunities alongside social and ecological concerns.

Project Title: SNAPP: Making ecosystems count in the Sustainable Development Goals

Lead Principal Investigator: DeClerck, Fabrice

Co-PI: Cleary, David

Providing for a growing and increasingly wealthy global population while protecting the environment calls for a dramatic paradigm shift in how we approach development. Working closely with government ministries of the Volta and Nile Basins, this Working Group is developing agriculture, ecosystem and natural resource-based indicators for planning and monitoring country-scale progress on the UN Sustainable Development Goals. The indicators will be grounded in ecosystem sciences, include novel evaluation measures for natural capital and ecosystem services, and have practical policy relevance.

Project Title: SNAPP: Integrating natural capital into system of national accounts: A case study of forestry and wetland landscapes in Rwanda

Lead Principal Investigator: Alavalapati, Janaki

Co-PIs: Lange, Glenn-Marie; Masozera, Michel

Gross Domestic Product, the most common indicator of economic performance, does not include many non-marketed services. As a result, the contributions that ecosystem services (natural capital provided by healthy forests, rivers, and other habitats) contribute to a country's economy are not accounted for. Today, many groups, including NGOs, research institutions, the World Bank and governments are emphasizing the importance of a system for natural capital accounting that will more accurately assess a country's true wealth.

This Working Group will focus on helping Rwanda, one of the World Bank's core implementing countries for natural capital accounting, determine the value of non-market services in two priority landscapes. The results of this work will directly support Rwanda's development planning process, as well as underpin the central role of natural capital in economic output. Beyond Rwanda, the results will give impetus to efforts by global initiatives, such as the UN's Green Economy, and provide a pathway for other governments committed to including natural capital accounting in their goals for, and measures of, economic growth.

Project Title: SNAPP: Land-use change and conservation policy in Brazil and the U.S. for biodiversity, ecosystem services, and economic returns

Lead Principal Investigator: Polasky, Stephen

Co-PIs: Durigan, Carolos; Fargione, Joseph; Pennington, Derric; Plantinga, Andrew

Many critical land-use decisions are made without a full understanding of the tradeoffs between economic returns, impacts on biodiversity, and benefits derived from nature that land use alternatives might provide or maintain. This Working Group will use a data-driven, economic analysis-based approach to incorporate the impacts of both markets and policies on land-use decisions. This framework will enable decision-makers to see with unprecedented breadth and depth the full range of potential tradeoffs different land-use choices might yield among social, economic and environmental values.



Project Title: SNAPP: Forest sharing or sparing for conservation and communities in tropical timber landscapes

Lead Principal Investigator: Griscom, Bronson

Co-PI: Ashton, Mark; Putz, Francis

Native tropical forests under selective logging for timber production already cover more than twice the area of those under strict conservation protection. Meanwhile, a smaller but growing proportion of tropical forests is being converted to high-intensity timber plantations. This Working Group aims to develop an empirical, science-based framework to answer the question: How do people and countries achieve the greatest conservation and human well-being outcomes in landscapes with target levels of timber production?

Project Title: SNAPP: Finding solutions to the ivory crisis: What would an economically rational Chinese ivory trade policy look like?

Lead Principal Investigator: Kang, Aili

Co-PI: Zhang, Li (Aster)

Reducing demand for ivory is seen as vital to eliminating pressure on increasingly threatened elephant populations. How to reduce such demand in China – whether by regulating the legal trade (which entails effectively combating the parallel illegal ivory trade) or instituting a permanent ban on all ivory trade – is the subject of debate because so little is known about the economic intricacies of the Chinese ivory trade. To help policymakers make informed decisions between regulation or a ban, this Working Group will assess the economics of the Chinese ivory trade, its impacts on human livelihoods in China and Africa, and provide policy recommendations to the Chinese government in time to inform China's 2016 National Congress Conference, which is a particularly important opportunity because it will guide Chinese policies at the next Conference of the Parties to CITES (CoPI7) in October 2016.

Project Title: SNAPP: Advancing human well-being through evidence-based conservation

Lead Principal Investigator: McKinnon (Bottrill), Madeleine

Co-PIs: Wilkie, David

As global conservation and policy organizations wrestle with challenges like water scarcity and overfishing, they are placing growing emphasis on showing the value of a healthy environment to the health, development and well-being of people. However, we still lack substantiation linking the effects of conservation efforts to social outcomes – both good and bad. This Working Group will appraise existing evidence documenting such links and illustrate how the science could guide conservation project managers, policy makers and social impact investors.

Project Title: SNAPP: Documenting, measuring and valuing the ecosystem service and human well-being benefits delivered by Key Biodiversity Areas

Lead Principal Investigator: Langhammer, Penny

Co-PIs: Gerber, Leah; Woodley, Stephen

In an effort to support management decisions of biologically important areas, the International Union for the Conservation of Nature (IUCN) has led the development of a new standard for the identification of sites, known as Key Biodiversity Areas (KBAs). KBAs are areas that contribute to the global persistence of biodiversity and the current standard for identifying these sites, is based solely on characteristics of the biodiversity they contain. While the standard also requests that each identified site include information on the ecosystem services provided as well as the human well-being benefits that are gained through its protection, this information is not used in determining KBA sites. A new SNAPP working group is bringing together the exiting efforts on ecosystem service assessment and the emerging KBA standards, with the goal of including ecosystem services and the benefits to human well-being in the KBA identification process.

State of Alaska's Salmon and People Project



Project Title: [State of Alaska's Salmon and People](#) (SASAP)

Lead Principal Investigator: Davis, Frank

Co-PI: Dutton, Ian

State of Alaska's Salmon and People (SASAP) is a knowledge synthesis that is designed to inform the future of management of Alaska's wild salmon. The SASAP project specifically seeks to:

- Connect knowledge across disciplines and agencies, between cultures and users, and across regions such that we gain a fuller picture of this complex and dynamic system, can set shared research priorities, develop and monitor indicators of system health and drive better management of the system
- Create new institutional capacity for interdisciplinary salmon knowledge generation and to establish a shared and credible baseline for integrated knowledge that can be built on over time

The knowledge generated from the SASAP project is expected to play a seminal role informing future salmon management and research in Alaska and more broadly in the North Pacific region. Outputs from the SASAP synthesis will be used by government, education, research, community and commercial interests to strengthen their understanding of salmon systems and prioritize future research, monitoring and management efforts.

NCEAS will collaborate with subawardee and project coordinator, Nautilus Impact Investing (NII), to establish a number of Working Groups (approximately 10) which will focus on the wide range of issues associated with Alaska's salmon, including but not limited to, social, legal, cultural, economic and environmental concerns.

In addition, all working groups will have an opportunity to collaborate and exchange knowledge during two three-day meetings per year. It is expected that many of these groups will be linked with the University of Alaska system and NCEAS will play a key mentoring role for those participants, helping develop their capacity for interdisciplinary research and collaboration.



Ocean Health Index



Project Title: [Ocean Health Index](#)

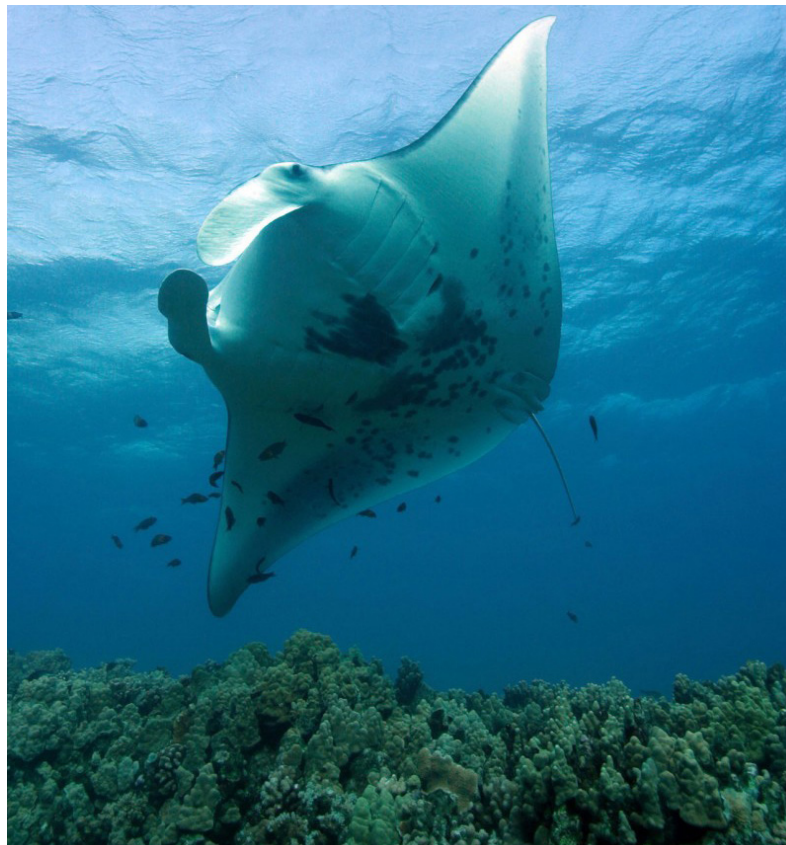
Lead Principal Investigator: Halpern, Benjamin

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

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

The Index is a collaborative effort, made possible through contributions from more than 65 scientists/ocean experts and partnerships between organizations including the National Center for Ecological Analysis and Synthesis, Sea Around Us, Conservation International, National Geographic, and the New England Aquarium.

The Index is possible by the generous support from the Pacific Life Foundation to Conservation International and the Gordon and Betty Moore Foundation to NCEAS.



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Ocean Tipping Points



Project Title: [Ocean Tipping Points](#)

Lead Principal Investigator: Kappel, Carrie

Co-PIs: Halpern, Benjamin; Selkoe, Kimberly



An increasing number of examples of tipping points in ecosystems around the world have begun to raise concern among scientists and policymakers. In the oceans, diverse ecosystems ranging from reefs to estuaries to pelagic systems have undergone sudden, dramatic shifts. Changes in ocean climate, the abundance of key species, nutrients, and other factors drive these shifts, with resulting effects on ocean food webs, habitats, and ecosystem functions that have direct impacts on people's livelihoods and well-being.

Ocean tipping points may be of particular concern because they are often unexpected and can be very difficult, if not impossible, to reverse. Though there have been many critical advances in the science of ecosystem tipping points in recent years, there is still a dearth of practical tools and information available to managers to anticipate and respond to ecosystem shifts.

Through this four-year study, the team will synthesize data on when, where, and how marine ecosystem shifts occur, and develop early warning indicators and management tools to begin to help managers anticipate, avoid or respond to tipping points. As ecologists, lawyers, and social scientists working in close partnership with managers, the team is tackling these problems from both the science side and from the policy and implementation side. Working with local managers, the team will implement ideas and test results in two case study locations: Haida Gwaii (in British Columbia) and Hawaii.

This work is supported by the Gordon and Betty Moore Foundation, Fisheries and Oceans Canada (DFO), the National Center for Ecological Analysis and Synthesis, the University of California, Santa Barbara, and the State of California. Ocean Tipping Points partners include Stanford's Center for Ocean Solutions, the Environmental Defense Fund, the National Oceanographic and Atmospheric Administration (NOAA), the California Polytechnic State University, San Luis Obispo, Parks Canada, Fisheries and Oceans Canada, Council of the Haida Nation, and the State of Hawaii.

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Gulf of Alaska Working Groups



Project Title: Applying portfolio effects to the Gulf of Alaska ecosystem: Did multi-scale diversity buffer against the Exxon Valdez oil spill?

Lead Principal Investigator: Marshall, Kristin

Co-PIs: Shelton, Andrew; Ward, Eric; Hunsicker, Mary; Brenner, Richard; Beaudreau, Anne

Understanding how ecosystems respond to environmental variability and large perturbations is a central problem in ecology. The Exxon Valdez oil spill was an extremely large perturbation to the Gulf of Alaska (GOA) ecosystem. However, because species and populations differ in the timing and magnitude of response to perturbations, the effects of the oil spill may be difficult to detect. We propose an NCEAS working group centered on the application of portfolio theory in the GOA using novel spatiotemporal modeling approaches. We will synthesize time-series from the GOA ecosystem and fisheries.

Our goals are to:

1. Synthesize the temporal and spatial scales of biomass, growth, and recruitment variability for herring, salmon, groundfish, and crabs, and compile existing studies on climate forcing on these taxa in the GOA
2. Examine the role of diversity in stabilizing a) temporal dynamics of plankton and focal fish species, and b) catch portfolios in the GOA pre- and post-oil spill
3. Investigate evidence for changing species interactions and community resilience using multispecies models applied to plankton, fish, and Steller sea lions in Prince William Sound and the GOA

We will use recently developed multivariate spatiotemporal models to build on previous syntheses of GOA data and investigate the role of climate drivers and ecological interactions. We will evaluate the effects of the oil spill after accounting for these other drivers. Our synthesis will improve understanding of the role of multiple sources of variability in structuring GOA communities and advance new methods in spatiotemporal modeling. The methodology we develop will be broadly applicable to exploited marine ecosystems around the world.

Project Title: Understanding changes in the Coastal Gulf of Alaska Ecosystem: Analysis of Past Dynamics to Improve Prediction of Future Response to Natural and Anthropogenic Change

Lead Principal Investigator: Okey, Thomas

Co-PIs: Ruzicka, James; Klinger, Teresa

How will the structure, the productivity, and the dynamics of the coastal Gulf of Alaska ecosystem respond to anticipated changes in environmental conditions and human disturbances within coastal waters? Our proposed working group will take an integrated two-pronged approach to examining the past 25-years of data from the Gulf of Alaska for insights into the present state and future changes in the region, both anthropogenic and natural.

Statistical analysis of observed states and changes among physical and biological ecosystem components will highlight sensitivities to changes in the physical environment across trophic levels. Model analyses will characterize sensitivities to environmental variability and estimate the effects of future oceanographic changes and management and policies on both ecological and human dimensions. Experts in social-ecological systems will guide research and activities towards the examination of the consequences of ecosystem change to human needs and activities.

The [Gulf Watch Alaska](#) project is funded by Exxon Valdez Oil Spill Trustee Council (EVOSTC) and state and federal agencies.



TomKat UC Carbon Neutrality Project



Project Title: The TomKat UC Carbon Neutrality [Project](#)

Lead Principal Investigator: Auston, David

The TomKat UC Carbon Neutrality Project seeks to develop and deploy solutions to mitigate climate change by capitalizing on the vast resources and researchers within the University of California (UC) system. The goal of the Project is to support innovative multidisciplinary research projects that will substantially accelerate progress of the University of California Carbon Neutrality Initiative. The TomKat UC Carbon Neutrality Project was launched by UC Santa Barbara's Institute for Energy Efficiency (IEE) in partnership with the National Center for Ecological Analysis and Synthesis (NCEAS) to help advance the University of California's system-wide goal to achieve zero net scope 1 and 2 greenhouse gas emissions by 2025. Funding for this project was made possible by a gift from the TomKat Foundation together with supplemental funding from the University of California Office of the President.

The TomKat project solicited proposals for working groups to address topics such as technology assessments, energy efficiency, communications strategies, economic incentives, behavior modification, and other potentially high impact topics. Two working groups were chosen to work on this initiative. The first working group focuses on transitioning UC away from natural gas as an energy source by performing techno-economic analyses of natural gas alternatives. The second focuses on using strategic communication to build stakeholder support for the necessary actions and changes that are needed to meet the ambitious goals of the University of California Carbon Neutrality Initiative.

The TomKat UC Carbon Neutrality Project is unique, because it has a specific local goal -- creating a pathway for achieving carbon neutrality at the University of California -- which can then be replicated at other large institutions. The teams will identify solutions and strategies that the members of the University of California community can deploy to achieve its sustainability targets. Ultimately, this effort will serve as an example for transitioning larger energy systems away from fossil fuel dependence.

The project draws on the extensive intellectual resources of the ten campuses and the affiliated national laboratories of the University of California system. The complex and multifaceted nature of climate change mitigation requires a dynamic interdisciplinary approach that is both synergistic and interactive. Tackling big challenges like transitioning off natural gas, introducing renewable energy, electrifying transportation, and strategically communicating these initiatives will mandate an integrated approach where technologists, policy experts, economists, behavioral scientists, and communications specialists work together to forge solutions.



More Science Projects



Project Title: Workshop: Increasing capacity for data-intensive research in environmental biology

Lead Principal Investigator: Davis, Frank

Co-PIs: Jones, Matthew; Hampton, Stephanie

This workshop will convene leaders in environmental biology research and education to collectively design a way forward for the scientific community to broadly improve skills necessary for data-intensive science.

In August 2013, a steering committee of 6 individuals will caucus remotely to produce a list of 20 invitees, and draft an agenda and manuscript outline. In January 2014, approximately 20 individuals will meet for 2 days at the National Center for Ecological Analysis and Synthesis (NCEAS) to identify current inadequacies in training at all career stages, and both the short-term and long-term opportunities to address these deficiencies. The steering committee will remain for an additional 2 days to draft a manuscript targeted to BioScience and pursue other opportunities for dissemination and building partnerships.

We will produce a concrete set of recommendations that target

1. Universities, research centers and other employers of scientists
2. Prospective funders,
3. Relevant policymakers

Further, we anticipate that the workshop will mobilize a network of like-minded advocates for data-intensive research training to raise awareness, and collaboratively lead future activities that raise the level of computing literacy in the environmental biology workforce.

Project Title: Prospects and priorities for satellite monitoring of global terrestrial biodiversity

Lead Principal Investigator: Davis, Frank

Co-PIs: Schimel, David; Pavlick, Ryan; Schildhauer, Mark

Global geospatial data are essential for understanding and predicting the role of ecosystems in the Earth System. As the world enters the Anthropocene, a new geologic period defined by humanity's signature on the planet, the Earth's rapidly changing environment is putting critical ecosystem services such as carbon sequestration, climate regulation, and food production at risk. Current rates of climate change in the terrestrial biosphere exceed the highest rates observed in the recent paleo-record and may increase further. Predicting ecosystem changes in the next century will require far more detailed data on functional diversity than exists today in order to predict physiological, community and ecosystem processes.

This Working Group will investigate the use of remote sensing for global biodiversity research and how this new technological dimension can complement and integrate with the three other dimensions of biodiversity science: genetics, taxonomic/phylogenetic, and functional dimensions of biodiversity.

The team will identify grand challenges in biodiversity research and how remote sensing can address these challenges as a complementary fourth dimension of biodiversity science. They intend to complete a proof-of-concept case study for integrating the spectral, functional, and phylogenetic/taxonomic information resources.

The Working Group will collaborate on a manuscript that will describe and promote the synthesis of hyperspectral imagery with functional, genomic and phylogenetic information in biodiversity science. Lastly, the group will suggest requirements for a spaceborne hyperspectral mission to address the urgent need for truly global biodiversity data, and inform the NASA Decadal Survey process.



Project Title: A study of endangered blunt-nosed leopard lizard-shrub dynamics at the Carrizo Plain National Monument

Lead Principal Investigator: Lortie, Christopher

Carrizo National Monument is home to many endemic, rare, and federally listed plant and animal species. The blunt-nosed leopard lizard is one of these instances. We are using radio telemetry, detailed observation, and habitat surveys to identify potential ecological drivers critical to their persistence and survival within this region. Excellent progress has been made in tracking in particular with nearly 30 individuals monitored in 2016. There is also preliminary evidence that foundation plant species are needed for this and many other animal species within the region.

Project Title: Plants, lizards, and shrubs as key responders to global change in Santa Barbara County: micro-environmental change and biotic interaction buffers

Lead Principal Investigator: Lortie, Christopher

Drought and a changing climate will continue to significantly impact desert ecosystems globally. In California, the San Joaquin Desert is a set of integrated, regionally distributed desert and grassland systems. There is every indication that the long-term droughts in this system are important and unique and that key target taxa are responding to these novel changes in climate. Given this context, there is likely no better immediate course of scientific pursuit than to directly collect data at scales that matter to these and other taxa. In Cuyama Valley, we have deployed an extensive array of microenvironmental climate loggers to measure these changes. We are also monitoring plants and animals within this region to examine causal links between global change variation and resilience of this unique desert ecosystem.



Project Title: The Sociology of Science, Work, and Organizations

Lead Principal Investigator: Parker, John

Dr. John N. Parker has expertise in the the sociology of science, work, and organizations. His research focuses on social dimensions of scientific creativity, scientific collaborations, scientific elites, scientific careers, and the role of emotions in scientific work. He has also written about boundary organizations, scientific synthesis, and natural resource governance. He also holds a position as an Honors Fellow at Arizona State University.



Informatics

Projects and Working Groups



Project Title: [NSF Arctic Data Center](#)

Lead Principal Investigator: Jones, Matthew

Co-PIs: Dozier, Jeff; Schildhauer, Mark; Baker-Yeboah, Sheekela; Budden, Amber

Investigators at the UCSB, DataONE, and NOAA will build and operate a multi-institutional knowledge archive serving diverse Arctic disciplines, including ecology, earth science, atmospheric science, oceanography, anthropology, archaeology, and social and political science.

The Arctic Data Center archive will provide unprecedented capabilities to reproducibly preserve and discover all products of NSF-funded science in the Arctic, including data, metadata, software, documents, and provenance that link these in a coherent knowledge model, using infrastructure from the successful NSF-sponsored DataONE federation of data repositories. Storage will utilize the KNB Data Repository for its strong versioning and accessioning to enable an effective archive. Data will be replicated to administratively diverse institutions (NCEI and the Amazon cloud), as this is critical to long term preservation.

DataONE researcher-facing tools will be adapted to provide convenient pathways to document and archive diverse data formats as part of scientists' normal workflows (e.g., both through the web and via analytical tools such as Matlab, R, and IDL). This infrastructure will be supported with an outstanding set of community services, including data discovery tools, metadata assessment and editing, data cleansing and integration, data management consulting, and user help-desk services. A data recovery team will engage the community to prioritize and rescue critical Arctic data from past NSF research that is currently inaccessible.

In addition to the traditional functions of a data archive, modern cloud-based data facilities will support detailed provenance tracking of the science process, data usage and citation reporting, linkages among heterogeneous disciplines, and direct linkages between the literature, investigators, and funding programs through the use of DOI, ORCID, and FundRef identifiers.

Usability and outreach specialists will engage an interdisciplinary Arctic Science Advisory Board and the broader polar science communities to drive continuous improvement by evaluating tools and services, gathering requirements and use cases, and prioritizing improvements to infrastructure and service offerings of the archive. Usage data and usability studies will drive an iterative cycle of assessment and development to improve operations. A sustainability model will be vetted and phased in to provide long-term curation and preservation of research that ultimately has a broad impact on science and societally critical policy issues in the Arctic.

Project Title: Collaborative Research:ABI Development:A toolbox for analysis of long-term ecological dynamics using the Kepler Workflow System

Lead Principal Investigator: Jones, Matthew

Co-PIs: Gries, Corinna; Collins, Scott

As ecologists continue to gather long-term data at site, regional, continental and global scales, there will be an increasing need for tools to measure the pattern and rate of change in plant and animal communities in response to multiple environmental drivers.

The National Science Foundation (NSF) Advances in Biological Informatics (ABI) program has recently funded the NCEAS Informatics team and collaborators to gather together multiple metrics of ecological dynamics into one toolbox that will provide ecologists with a new set of tools for quantifying how communities change over time. Their approach builds upon many recent informatics developments (Kepler, DataONE, and Ecological Metadata Language) to advance ecological research.

The toolbox will make community analysis more accessible, expose a variety of indices to wider use, and, with existing workflows, will help reduce data preparation efforts and foster unprecedented potential for collaboration.



Project Title: DataONE: Observation network for Earth

Lead Principal Investigator: Jones, Matthew

Co-PI: Hampton, Stephanie

DataONE (Observation Network for Earth) is building cyberinfrastructure for open, persistent, robust, and secure access to well-described and easily discovered Earth observational data. Supported by the U.S. National Science Foundation, DataONE will ensure preservation and access to multi-scale, multi-discipline, and multi-national science data.

DataONE will transcend domain boundaries and make biological data available from the genome to the ecosystem; make environmental data available from atmospheric, ecological, hydrological, and oceanographic sources; provide secure and long-term preservation and access; and engage scientists, land-managers, policy makers, students, educators, and the public. DataONE is a collaboration between NCEAS/UCSB, the University of New Mexico, the Oak Ridge National Laboratory, the California Digital Library, NESCent, and a number of other organizations.



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

Lead Principal Investigator: Jones, Matthew

Co-PIs: N/A

Following the Exxon Valdez Oil Spill in 1989, the oil-impacted areas of the Gulf of Alaska have been extensively monitored to examine impacts of the spill on the ecosystem and to assess and promote recovery of impacted species. Gulf Watch Alaska is a long-term monitoring program in the Gulf of Alaska region that is expected to be 20 years in total length but planned and funded in five-year increments. The project includes 25 principal scientists who seek to provide data to identify and help understand the impacts of multiple ecosystem factors on the recovery of injured resources.

Gulf Watch Alaska builds upon more than 20 years of restoration research and monitoring by the Exxon Valdez Oil Spill Trustee Council (EVOSTC) and federal and state agencies. This long term monitoring program includes sites in Prince William Sound, lower Cook Inlet and the outer Kenai Peninsula coast. Map of study region.

To facilitate a thorough understanding of the effects of the oil spill, the NCEAS Informatics team has collaborated with investigators from Gulf Watch Alaska and the Herring Research and Monitoring program to collate historical data from a quarter century of monitoring studies on physical and biological systems impacted by the spill. The 25 years of historical data NCEAS has collated and documented is available for use by a wide array of technical and non-technical users.

NCEAS selected two cross-cutting synthesis Working Groups and two Postdoctoral Associates to do a full-systems analysis of the effects of the 1989 oil spill on Prince William Sound and the state of recovery of the affected ecosystems.

The Gulf Watch Alaska project is funded by Exxon Valdez Oil Spill Trustee Council (EVOSTC) and state and federal agencies.



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

Lead Principal Investigator: Schildhauer, Mark

Co-PIs: McGuinness, Deborah; Gries, Corinna; Dibner, Philip; Bowers, Shawn

This project will build a “Scientific Observations Network”--as a multi-disciplinary, community-driven effort to define and develop a unified model for observational data, to enhance data sharing, merging and reuse in the earth and life sciences. This effort will coordinate work of a community of experts drawn from numerous disciplines, including ecology, hydrology, oceanography, geo-sciences, the geospatial community, and life sciences, working closely with computer scientists and information managers, to develop necessary specifications and technologies to facilitate intelligent interpretation and seamless integration of observational data.

Advances in environmental science and ecology increasingly depend on information from multiple disciplines to address broad, complex questions about the natural world. Researchers are extremely challenged, however, in effectively locating, interpreting, and integrating data that might be relevant for these investigations. This is due to extreme variability in the structure and contents of the data that scientists collect. This project will support the growing interest in the earth and life sciences in the possibilities of describing data at the level of observation and measurement, rather than the traditional focus at the level of the data set, in order to achieve stronger data discovery and interoperability.

The Scientific Observations Network will work to develop compatible, open-source, standards-based approaches to the semantic modeling of observational data. A key goal will be the development of a core conceptual data model for representing scientific observations. This core observations model will provide a common basis for developing, extending, and applying highly specialized scientific terminologies required for detailed descriptions of data relevant for environmental research. Subgroups of experts will engage in extending the core data model to include a broad range of specific measurements collected by the representative disciplines, and a series of demonstration projects will illustrate the capabilities of these approaches to confederate data for reuse in broader and unanticipated contexts. The scientific Observations Network will help to insure that scientific data, once collected, is put to the greatest possible use by the broadest group of users.



Project Title: EarthCube Building Blocks: GeoLink -- leveraging semantics and linked data for data sharing and discovery in the geosciences

Lead Principal Investigator: Schildhauer, Mark

Co-PI: Jones, Matthew

A key challenge for EarthCube is to enable data discovery, access, and integration in a sustainable way. Existing data repositories and networks must be linked, while retaining their independent missions and services to existing disciplinary communities.

In this project, we propose to develop an EarthCube Building Block, GeoLink, based on: 1) digital publication of geoscience data and knowledge as “Linked Open Data”; combined with 2) semantic integration using design patterns and vocabularies shared among federated repositories; and 3) an underlying cyberinfrastructure extendable in both depth and breadth, that can become a central building block for EarthCube data harmonization.



Meetings



Meeting

Arizona State University	13 Jul - 14 Jul 2015
SNAPP: Management Team	12 Aug - 13 Aug 2015
Stream Resiliency RCN: Food Web Modeling	19 Oct - 22 Oct 2015
Translational Ecology	17 Nov - 19 Nov 2015
Grazing Exclosure Consortium	03 Dec - 05 Dec 2015
NCEAS Science Advisers	14 Jan - 15 Jan 2016
NRC Gulf Resotration	20 Jan - 21 Jan 2016
SNAPP: Board Meeting	28 Jan - 29 Jan 2016
SNAPP: Management Team	03 Feb - 03 Feb 2016
M2M Team Meeting	08 Feb - 09 Feb 2016
Arctic Data	10 Feb - 11 Feb 2016
Grazing Exclosure Consortium	18 Feb - 20 Feb 2106
2016 LTER Science Council	17 May - 20 May 2016
SNAPP: Science Advisory Council	09 Jun - 10 Jun 2016
Envisioning the Channel Islands' Biodiversity Information System	13 Jun - 13 Jun 2016



Training and Outreach

Community Roundtables

Open to the public, Roundtable is an informal discussion on current research pursuits with NCEAS, UCSB, and visiting scientists, as well as, other science-related topics.



Date	Speaker	Affiliation	Topic
01 Jul 15	John Parker	Arizona State	Emotions in scientific work and scientific creativity
07 Jul 15	Rachel Blake, Jessica Couture, Colette Ward	NCEAS	Discussion on synthesis hurdles in the context of working groups
08 Jul 15	Brent Johnson	National Park Service	Connecting Traditional Knowledge & Contemporary Ecological Management
15 Jul 15	Ian McCullough	SNAPP	Assessing effects of climate change on ponderosa pine forests in California's Sierra Nevada
22 Jul 15	John Sabo	Arizona State	A spectral framework for forecasting near term inland fisheries in the Mekong River under climate change
29 Jul 15	Siddharth Narayan	NCEAS	Habitats, coastal protection, and the SNAPP Coastal Defenses Working Group
09 Sep 15	Delphine Renard	McGill Univ & Quebec Center for Biodiversity Science	Bundling multiple ecosystem services in agroecosystems: Insights from a historical perspective
16 Sep 15	Stacy Rebich Hespanha	NCEAS	Environmental and social sustainability in synthesis centers
23 Sep 15	Jamie Afflerbach	NCEAS	Spatial R Workshop
30 Sep 15	Halley Froelich	NCEAS	When does hypoxia affect management performance of fisheries? A MSE of Dungeness crab fisheries in Hood Canal, WA
07 Oct 15	Frank Davis	NCEAS	LTER National Communications Office
14 Oct 15	Vera Hausner	University of Tromsø/ Universitetet i Tromsø	What kind of science do we need to create sustainable pathways in the Arctic?
21 Oct 15	Per Fauchald	FRAM - High North Research Centre for Climate and the Environment	Transitions of social-ecological subsistence systems in the Arctic
28 Oct 15	Kim Selkoe	NCEAS	Protecting and predicting genetic diversity of whole communities- case study of Hawaiian reefs
03 Nov 15	Dawn Dougherty	SNAPP	Progress towards developing a fisheries management strategy for data-limited species in Peru
05 Nov 15	David Ackerly	UC Berkeley	TomKat UC Carbon Neutrality
10 Nov 15	Jaime Matera	California State University, Channel Islands	A Network Approach to Assessing Social-Ecological Systems in the Cook Islands
18 Nov 15	Julia Lowndes Stewart	NCEAS	Open Science with the Ocean Health Index



Date	Speaker	Affiliation	Topic
02 Dec 15	Julia Lowndes Stewart	NCEAS	Intro to GitHub Tutorial and Workshop
06 Jan 16	Rachel Blake, Jessica Couture, Colette Ward	NCEAS	Synthetic ecology across scales: Follow-up to the synthesis hurdles discussion
13 Jan 16	Jeanne Kearns	NCEAS	NCEAS development
20 Jan 16	Katja Seltmann	UCSB, Cheadle Center for Biodiversity and Ecological Restoration	Natural history collections and data sharing
27 Jan 16	Barbara Endemaño-Walker & Kyle Lewis	UCSB	Barriers to diversity in higher education and the promise of diverse scientific teams
03 Feb 16	Charlotte Chang	Princeton	Hunting in the tropics: Examining hunter rationality
10 Feb 16	Casey O'Hara	NCEAS/OHI	WorkshopL Vector Analyses in R
17 Feb 16	Claire Runge	NCEAS/SNAPP	Birds, birds, birds!
24 Feb 16	Jason Flower	Foundation for Environmental Conservation	Organizing a Conference on Islands - ideas and Inputs
02 Mar 16	NCEAS Early Career Researchers	NCEAS	Early-career researchers and their role in synthesis groups: a discussion
09 Mar 16	Doro Hodapp	University Oldenburg	Environmental and trait variability constrain community structure and the biodiversity-productivity relationship
16 Mar 16	Dr Toni Frohoff, Laura Bridgeman, Elizabeth Oriol, and Tema Milstein	TerraMar Research	How interspecies coastal communities inform conservation of shared ecosystems
23 Mar 16	Milo Adkinson and Anne Beaudreau	GOA Portfolio Effects WG / UAF	Bristol Bay, AK salmon fishery management; Salmon in Afognak lake food webs
30 Mar 16	Marty Downs	NCEAS/LTER	Highlights from the sackler colloquium on the science of science communication
06 Apr 16	Samantha Cheng	NCEAS/SNAPP	Mapping the evidence for conservation's impact on human well-being
13 Apr 16	Amber Budden	NCEAS	DataONE
14 Apr 16	Devin Spencer et al.	UCSB - BREN	An Economic Valuation of Southern California's Coastal Wetlands
20 Apr 16	Rémi Daigle	Simon Fraser University/OHI	Optimizing Marine Protected Area Networks: The effects of climate change on larval dispersal and connectivity
27 Apr 16	Heather Soyka	NCEAS/DataONE	Understanding community records co-creation using a continuum informatics approach
04 May 16	Jai Ranganathan	NCEAS	YouTube: not just for cat videos! Simple ways to create online videos that connect people to your science.



Date	Speaker	Affiliation	Topic
11 May 16	Brandon Kuczenski	NCEAS/UCSB	Industrial Ecology: Earth observation at the nature-industry boundary
18 May 16	Alex Filazzola	York University, Canada	Defining gradients within arid environments: Regional, local, and micro scales
25 May 16	Claire Runge	NCEAS/SNAPP	Introduction to Marxan, a hands on tutorial
01 Jun 16	Scott Butterfield	The Nature Conservancy	Enhancing conservation outcomes and improving rangeland monitoring efficiency with RDMapper, a web-based rangeland productivity monitoring tool
08 Jun 16	Casey O'Hara	NCEAS/OHI	Model-based assessment to inform ecology education & communication
16 Jun 16	Benjamin Halpern	NCEAS/UCSB	NCEAS vision for the next five years
22 Jun 16	Francie Diep & Nicholas Jackson	Pacific Standard Magazine	How scientists can speak to reporters
29 Jun 16	Shelley Crausbay & Aaron Ramirez	SNAPP	Ecological drought in the 21 st Century

Training

Training Title: SNAPP: Computational and collaboration training workshop (12733)

Instructors: Schildhauer, Mark

Date: 27 June - 30 June 2016

A SNAPP Workshop titled “Computational & Collaboration Skills for Integrative Conservation Science” was held at NCEAS from June 27 to June 30, 2016. This training, sponsored by the Science for Nature and People Partnership (SNAPP), brought together SNAPP postdoctoral associates and technical liaisons to foster the SNAPP community and collaboration, as well as promote scientific computing and open science best practices. Topics included data modeling, manipulation and visualization; collaborative and open science principles and techniques; geospatial analysis; and coding best practices.



Awards and Funding

Award Sponsors



Biodiversity International

Conservation International

Gordon and Betty Moore Foundation

Johannson Family Foundation

NASA Washington, D.C. Headquarters

National Science Foundation

Ocean Conservancy

Parks Canada

Prince William Sound Science Center

Texas A&M University

The HDF Group

The Nature Conservancy

University of California, Berkeley - UCB

University of Illinois, Urbana Champaign

University of New Mexico

USDI Bureau of Land Management

USDI Geological Survey (Incl National Biological Service)

Wildlife Conservation Society

Awards Administered



Biodiversity International

F. Davis	10/01/14 - 12/31/16	\$131,806
Science for Nature and People Partnership (SNAPP): Making ecosystems count in the sustainable development goals (14/111)		
	Subtotal	\$131,806

Conservation International

B. Halpern	03/01/14 - 11/30/15	\$25,235
Analytical support for data limited fisheries working group (60000250)		
B. Halpern	01/01/15 - 12/31/15	\$330,001
Global Ocean Health Index Assessment (6000024)		
	Subtotal	\$355,236

Gordon and Betty Moore Foundation

F. Davis	12/20/12 - 12/31/16	\$2,440,941
SNAPP: Science for Nature and People: NCEAS core support and capacity building (Nature Lab) (3530)		
F. Davis	11/21/15 - 01/31/18	\$2,415,000
State of Alaskan Salmon and People (SASAP) (5124)		
F. Davis	12/08/14 - 12/15/16	\$292,190
Science for Nature and People Partnership (SNAPP): Land-use Change and Conservation Policy in Brazil and the US for Biodiversity, Ecosystem Services and Economic Returns (4641)		
B. Halpern	10/24/14 - 01/30/18	\$1,534,725
Regional application of the Ocean Health Index in Moore MCI priority areas (3538.01)		
C. Kappel	08/17/12 - 10/31/17	\$3,073,140
Ocean Tipping Points (2897.01)		
	Subtotal	\$9,755,996

Johansson Family Foundation

B. Halpern	03/01/15 - 08/31/16	\$233,000
Baltic Sea Ocean Health Index (SB150110)		
	Subtotal	\$233,000

NASA Washington, D.C. Headquarters

F. Davis	07/10/14 - 09/30/16	\$77,992
Prospects and priorities for satellite monitoring of global terrestrial biodiversity: A proposal for an interdisciplinary synthesis working group (5136)		
	Subtotal	\$77,992



National Science Foundation

F. Davis; S. Hampton	09/15/11 - 08/31/15	\$347,437
Dimensions in Collaborative Research: Lake Baikal Responses to Global Change: The Role of Genetic, Functional and Taxonomic Diversity in the Plankton (I136637)		
F. Davis; S. Hampton	09/01/14 - 08/31/15	\$49,990
Planning Workshop: Increasing capacity for data-intensive research in environmental biology (EF-1358900)		
F. Davis; M. Schildhauer; J. Caselle; S. Rebich Hespanha	10/01/15 - 09/30/19	\$3,514,189
Long Term Ecological Research (LTER) National Communications Office (LNCO) (I545288)		
M. Jones; M. Schildhauer	04/01/13 - 03/31/17	\$472,188
Collaborative Research: ABI Development: A toolbox for analysis of long-term ecological dynamics using the Kepler Workflow System		
M. Jones; J. Dozier; M. Schildhauer	10/24/14 - 01/30/18	\$1,184,952
NSF Arctic Data Center: A Knowledge Archive for Discovery and Reproducible Science in the Arctic (DBI-1262463)		
M. Schildhauer	04/01/16 - 03/31/18	\$72,501
Workshop: MacroMycoFunc - Forming an integrated understanding of function across fungi (DEB 1623040)		
M. Schildhauer	08/01/13 - 07/31/15	\$65,760
EarthCube Domain End-User Workshop (I344385)		
M. Schildhauer; K. Janowicz; M. Jones	09/01/14 - 08/31/16	\$481,214
EarthCube Building Blocks: Collaborative Proposal: GeoLink-Leveraging Semantics and Linked Data for Data Sharing and Discovery in Geosciences (DEB 1623040)		
M. Schildhauer	08/01/08 - 07/31/16	\$750,000
INTEROP: A Community-Driven Scientific Observations Network to Achieve Interoperability of Environmental and Ecological Data (DBI-0753144)		
	Subtotal	\$6,938,231

Ocean Conservancy

F. Davis; S. Hampton	07/01/13 - 12/31/16	\$355,488
Marine Debris: Scale and Impact of Trash in Ocean Ecosystems (SBI20078)		
	Subtotal	\$355,488

Parks Canada

C. Kappel	11/12/14 - 04/30/17	\$54,527
Ocean Tipping Points (VCA9 / GC-703)		
	Subtotal	\$54,527



Prince William Sound Science Center

M. Jones; M. Schildhauer	02/01/12 - 01/31/17	\$1,590,748
Collaborative Data Management and Holistic Synthesis of Impacts and Recovery Status Associated with the Exxon Valdez Oil Spill (12-81-01)		
	Subtotal	\$1,590,748

Texas A&M University

K. Selkoe	07/01/14 - 09/30/15	\$6,231
Impacts of Changing Climate on the Marianas Trench, Rose Atoll and Pacific Islands Marine National Monuments (15-04)		
	Subtotal	\$6,231

The HDF Group

M. Jones	05/20/15 - 04/30/18	\$544,539
Beyond Data Discovery: Shared Services for Community Metadata Improvement		
	Subtotal	\$544,539

The Nature Conservancy

F. Davis	01/01/16 - 06/30/17	\$400,000
SNAPP Administrative Support (SNAP_NCEAS2016)		
F. Davis	11/01/13 - 06/30/16	\$1,050,000
Science and Nature for People Partnership- TNC (SNAP 2013-2014)		
F. Davis	03/01/16 - 07/31/17	\$288,675
SNAPP: Landscape sensitivity to ecological drought: The knowns, needs, and solutions for the real world (SNP014) (OCS-NCEAS-02012016)		
F. Davis; C. Lortie	01/04/16 - 06/01/18	\$30,000
A study of endangered blunt-nosed leopard lizard-shrub dynamics at the Carrizo Plain National Monument (NC-08262015-3179)		
C. Lortie; F. Davis	01/04/16 - 06/01/17	\$62,907
Plants, lizards, and shrubs as key responders to global change in Santa Barbara County: micro- environmental change and biotic interaction buffers (TNC-120120150-3414)		
	Subtotal	\$1,831,582

University of California, Berkeley - UCB

M. Jones	10/01/15 - 09/30/16	\$108,679
Codemeta: A Rosetta Stone for Metadata in Scientific Software (8966)		
	Subtotal	\$108,679



University Illinois, Urbana Champaign

M. Jones	03/01/16 - 02/28/21	\$500,000
CC*DNI DIBBS: Merging Science and Cyberinfrastructure Pathways: The Whole Tale (2015-05845-04)		
	Subtotal	\$500,000

University of New Mexico

M. Jones; M. Schildhauer	10/01/14 - 09/30/19	\$2,706,715
DataNetONE: Observation Network for Earth - Renewal (063045-873R)		
	Subtotal	\$2,706,715

USDI Bureau of Land Management

C. Lortie; F. Davis	08/25/15 - 09/30/19	\$140,000
BLM CA CESU Panoche Plateau Leopard Lizard Shrub Habitat Study, Äi Cencal District, Hollister (L15AC00219)		
	Subtotal	\$140,000

USDI Geological Survey (Incl Natl Biological Service)

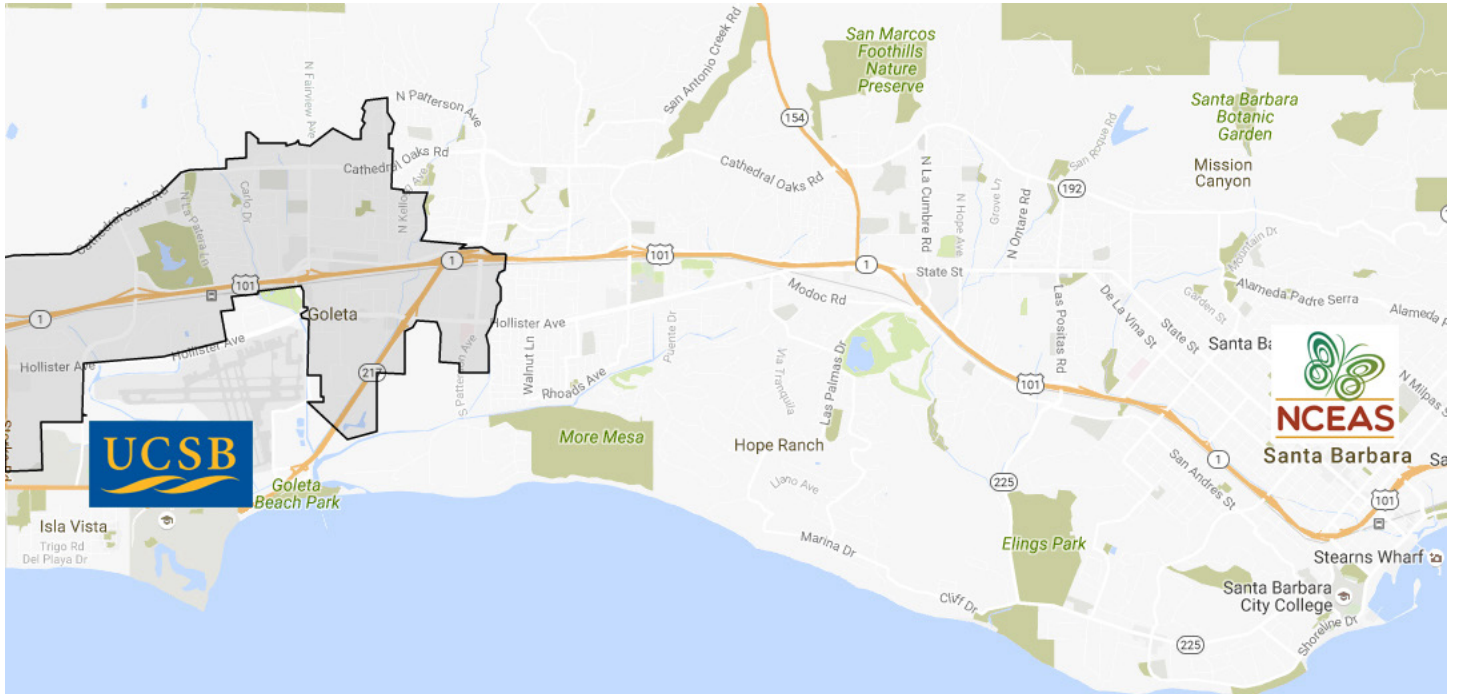
F. Davis	10/01/15 - 09/30/16	\$140,000
The theory and practice of translational ecology (L15AC00219)		
	Subtotal	\$140,000

Wildlife Conservation Society (New York Zoological Society)

F. Davis	03/06/14 - 10/31/15	\$125,000
SNAPP Western Amazonia (SBI50014)		
	Subtotal	\$125,000



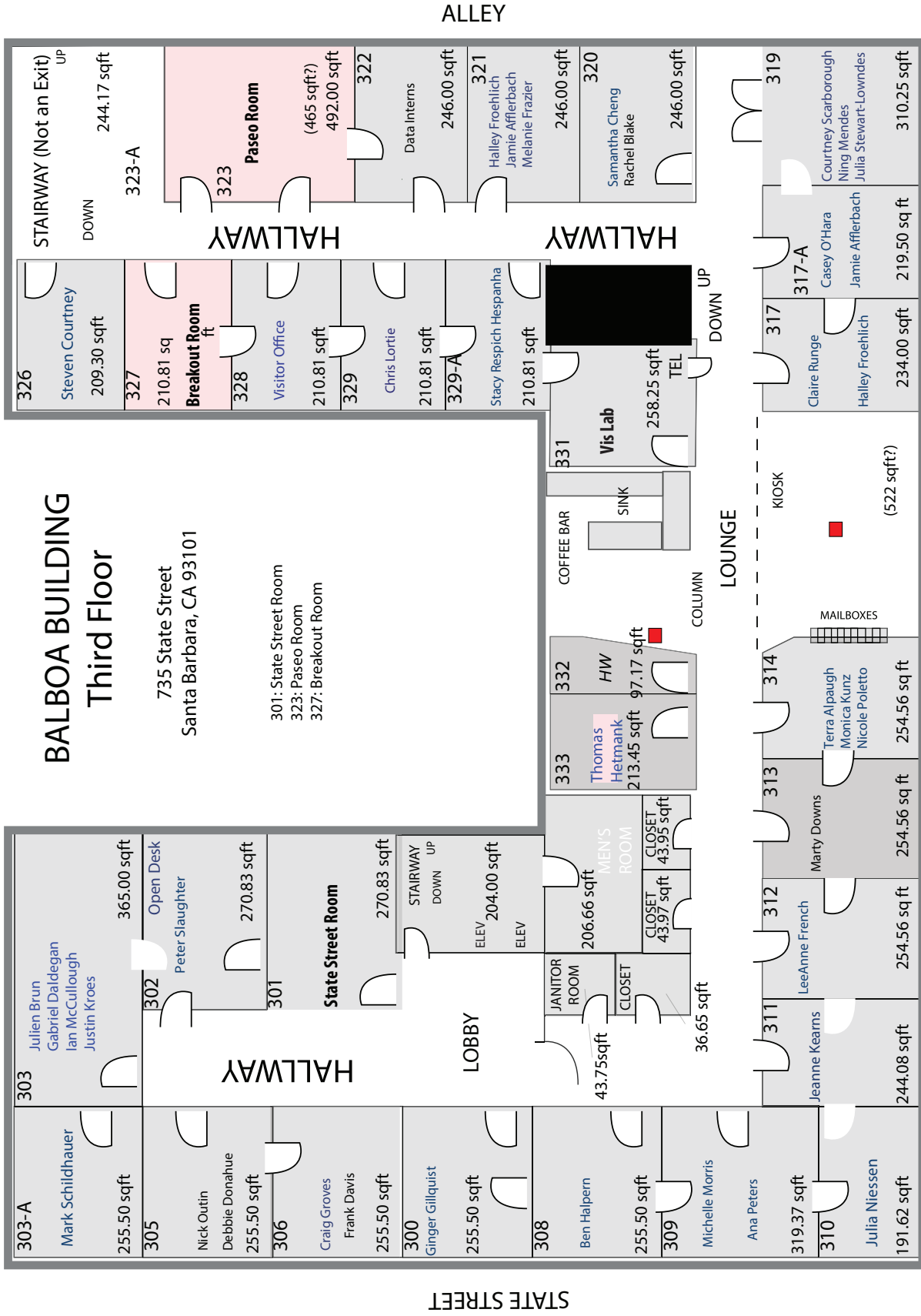
Space



National Center for Ecological Analysis and Synthesis

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Statistical Summary

Statistical Summary



1. Academic personnel engaged in research	
a. Faculty	3
b. Professional Researchers (including visiting)	10
c. Project Scientists	4
d. Specialists	7
e. Postdoctoral Scholars	0
f. Postgraduate Researchers	9
Total	33
2. Graduate Students	
a. Employed on contracts and grants	18
b. Employed on other sources of funds	0
c. Participating through assistantships	0
d. Participating through traineeships	0
Total	18
3. Undergraduate Students	
a. Employed on contracts and grants	6
b. Employed on other funds	4
c. Volunteers and unpaid interns	0
Total	10
4. Participation from Outside UCSB	
a. Academics (without Salary Academic Visitors)	21
b. Other (Center Associate from COMPASS)	1
Total	22
5. Staff (University and Non-University Funds)	
a. Technical	20
b. Administrative/Clerical	6
Total	26
6. Seminars, symposia, workshops sponsored	47
7. Proposals submitted	15
8. Number of different awarding agencies	14
9. Number of extramural awards administered	25
10. Dollar value of extramural awards	\$25,241,621
11. Number of Principal Investigators	14



12. Dollar value of other project awards	\$30,000
13. Number of other project administered	1
14. Total base budget for the year (as of 30 June 2016)	\$399,272
15. Dollar value of intramural support	0
16. Total assigned square footage in ORU	11,325 ft²
17. Dollar value of awards for year	\$8,996,534



Products and Publications

The following lists include publications that have been reported to NCEAS during fiscal year 2015-2016, though actual publication dates may precede this period.



Books

Kim, Yoon Hyung; Young, Oran R.; Kim, Jong Deog. (2014). *The Arctic in world affairs: A North Pacific dialogue on international cooperation in a changing Arctic: 2014 North Pacific Arctic Conference proceedings*. Seoul, Korea: Korea Maritime Institute.

Norton, Bryan. (2015). *Sustainable values, sustainable change: A guide to environmental decision making*. Chicago, IL: University of Chicago Press.



Book Chapters

Howard, Elizabeth; Davis, Andrew. (2015). Tracking the fall migration of eastern monarchs with Journey North roost sightings: New findings about the pace of fall migration. (K. R. Nail & S. Altizer, Eds.). In K. S. Oberhauser (Ed.), *Monarchs in a Changing World: Biology and Conservation of an Iconic Butterfly* (pp. 207-214). Ithaca, NY: Comstock Publishing Associates.

Oberhauser, Karen S.; Ries, Leslie; Altizer, Sonia; Batalden, Rebecca V.; Kudell-Ekstrum, Janet; Garland, Mark; Howard, Elizabeth; Jepsen, Sarina; Lovett, Jim; Monroe, Mia; Morris, Gail; Rendon-Salinas, Eduardo; RuBino, Richard G.; Ryan, Ann; Taylor, Orley R.; Treviño, Rocío; Villablanca, Francis X.; Walton, Dick. (2015). Contributions to Monarch Biology and Conservation through Citizen Science: 70 Years and Counting. (K. R. Nail & S. Altizer, Eds.). In K. S. Oberhauser (Ed.), *Monarchs in a changing world: Biology and Conservation of an Iconic butterfly* (pp. 13-30). Ithaca, NY: Comstock Publishing Associates.

Ries, Leslie; Taron, Douglas J.; Rendon-Salinas, Eduardo; Oberhauser, Karen S. (2015). Connecting Eastern Monarch Population Dynamics Across their Migratory Cycle (K. R. Nail & S. Altizer, Eds.). In K. S. Oberhauser (Ed.), *Monarchs in a Changing World: Biology and Conservation of an Iconic Butterfly* (pp. 268-282). Ithaca, NY: Comstock Publishing Associates.

Young, Oran R. (2014). Navigating the Arctic/non-Arctic Interface: Avenues of Engagement (J. D. Kim & Y. H. Kim, Eds.). In O. R. Young (Ed.), *The Arctic in World Affairs: A North Pacific Dialogue on International Cooperation in a Changing Arctic* (pp. 267-334). Seoul, Korea: Korea Maritime Institute.

Young, Oran R. (2015). Adaptive Governance for a Changing Arctic (J. Yang & I. Stensdal, Eds.). In L. Lunde (Ed.), *Asian Countries and the Arctic Future* (pp. 15 -34). Toh Tuck Link, Singapore: World Scientific Publishing Co. Pte. Ltd.

Journal Articles



Anderson, James; Anderson, Chris; Chu, Jingjie; Meredith, Jennifer; Asche, Frank; Sylvia, Gil; Smith, Martin D.; Anggraeni, Dessy; Arthur, Robert; McCluney, Jessica K.; Ward, Tim; Akpalu, Wisdom; Eggert, Håkan; Flores, Jimely; Freeman, Matthew; Holland, Daniel; Knapp, Gunnar; Kobayashi, Mimako; Larkin, Sherry; MacLauchlin, Kari; Schnier, Kurt; Soboil, Mark; Tveteras, Sigbjorn; Uchida, Hirotsuga; Valderrama, Elvis. (2015). The Fishery Performance Indicators: A Management Tool for Triple Bottom Line Outcomes. *PLOS ONE PLoS ONE*, 10(5). doi:10.1371/journal.pone.0122809

Atkinson, Scott; Jupiter, Stacy D.; Adams, Vanessa M.; Ingram, Jane Carter; Narayan, Siddharth; Klein, Carissa J.; Possingham, Hugh P. (2016). Prioritising Mangrove Ecosystem Services Results in Spatially Variable Management Priorities. *PLOS ONE PLoS ONE*, 11(3). doi:10.1371/journal.pone.0151992

Balch, Jennifer K.; Nagy, R. Chelsea; Archibald, Sally; Bowman, David; Moritz, Max A.; Roos, Christopher; Scott, Andrew C.; Williamson, Grant. (2016). Global combustion: The connection between fossil fuel and biomass burning emissions (1997–2010). *Philosophical Transactions of the Royal Society: Biological Sciences*, 371(1696), 20150177. doi:10.1098/rstb.2015.0177

Batllori, Enric; Ackerly, David D.; Moritz, Max A. (2015). A minimal model of fire-vegetation feedbacks and disturbance stochasticity generates alternative stable states in grassland–shrubland–woodland systems. *Environmental Research Letters*, 10(3), 034018. doi:10.1088/1748-9326/10/3/034018

Beger, Maria; McGowan, Jennifer; Treml, Eric; Green, Alison; White, Alan T.; Wolff, Nicholas H.; Klein, Carissa J.; Mumby, Peter J.; Possingham, Hugh P. (2015). Integrating regional conservation priorities for multiple objectives into national policy. *Nature Communications*, 6, 8208. doi:10.1038/ncomms9208

Berkman, Paul (2015). Institutional Dimensions of Sustaining Arctic Observing Networks (SAON). *Arctic*, 68(5), 89. doi:10.14430/arctic4499

Berkman, Paul. (2014). 'Unstructured Data' Practices in Polar Institutions and Networks: A Case Study with the Arctic Options Project. *Data Science Journal*, 13(0). doi:10.2481/dsj.ifpda-11

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Brett, Michael T. (1997). Meta-analysis in ecology. *Bulletin of the Ecological Society of America*, 78(1), 92-94.

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Brigham, Lawson W. (2015). Future perspective: The maritime Arctic in 2050. *Fletcher Forum of World Affairs*, 39(1), 109-120.



Bronikowski, Anne; Cords, Marina; Alberts, Susan; Altmann, Jeanne; Brockman, Diane; Fedigan, Linda M.; Pusey, Anne E.; Stoinski, Tara S.; Strier, Karen B.; Morris, William F. (2016). Female and male life tables for seven wild primate species. *Scientific Data*, 3, 160006. doi:10.1038/sdata.2016.6

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Chaudhary, Bala; Rúa, Megan; Antoninka, Anita; Bever, James D.; Cannon, Jeffery; Craig, Ashley J.; Duchicela, Jessica; Frame, Alicia; Gardes, Monique; Gehring, Catherine; Ha, Michelle; Hart, Miranda; Hopkins, Jacob; Ji, Boaming; Collins Johnson, Nancy; Kaonongbua, Wittaya; Karst, Justine; Koide, Roger; Lamit, Louis J.; Meadow, James F.; Milligan, Brook; Moore, John C.; Pendergast, Thomas H.; Piculell, Bridget; Ramsby, Blake; Simard, Suzanne; Shrestha, Shubba; Umbanhowar, James A.; Viechtbauer, Wolfgang; Walters, Lawrence; Wilson, Gail W.; Zee, Peter; Hoeksema, Jason D. (2016). MycoDB, a global database of plant response to mycorrhizal fungi. *Scientific Data*, 3, 160028. doi:10.1038/sdata.2016.28

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