The Foundation supports five aspects of science and is a user of science and research.

The Foundation has historically supported basic research, applied science, science capacity building and science education. Today we heavily focus on user engagement to ensure that the results of science inform decisions through effective science communications and through use-inspired research, in which decision-makers and other users participate in identifying questions to be studied.

The Foundation also values incorporating science and research in its own decision-making processes:
- Use of analysis in developing strategies and determining return on investment
- Use of evaluations and monitoring for most grantmaking
- Staff includes scientists with relevant expertise
The majority of science grantmaking within the Conservation & Science Program (C&S) is for basic research

- C&S awarded $5.6 million in support of applied science and $1.9 million in support of user engagement (e.g., science communications, science assessments) in 2011.§
- 63 percent of the C&S grants for applied science and user engagement in 2011 were made by the Science subprogram

Building Science Capacity

$2.5M Center for Ocean Solutions (COS)*

Applied Science

$1M Partnership for Interdisciplinary Study of Coastal Oceans (PISCO)

$4.6M Other applied science within C&S

User Engagement

$1M Communications Partnership for Science & the Sea (COMPASS)

$1.9M Other user engagement within C&S

Data from institutional grantees (MBARI, Fellows, COMPASS, PISCO) from 2012 grants budget. Data from programs estimated from 2011 grants.

*COS 10-year grant prorated.
§ Additional funding, for science education and science literacy, is provided through the Foundation’s Local Grantmaking Program.
The Science Subprogram invests in developing knowledge that could significantly accelerate progress toward C&S Program goals. It supports scientific research, scientific assessments, and use-inspired research that includes communication of science to decision-makers and the engagement of decision-makers with scientists.

The Science Subprogram does not have its own five-year strategy. Instead, it supports C&S goals. The Science Subprogram includes long-term grantees PISCO (long-term monitoring, California Current) and COMPASS (marine science communications).

The goal of the Science Subprogram is to invest in research, assessments and science communications that support C&S Program goals.

**WHAT IS THE SCIENCE SUBPROGRAM?**

- The Science Subprogram invests in developing knowledge that could significantly accelerate progress toward C&S Program goals.
- It supports scientific research, scientific assessments, and use-inspired research that includes communication of science to decision-makers and the engagement of decision-makers with scientists.
- The Subprogram does not have its own five-year strategy. Instead, it supports C&S goals.
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**C&S SCIENCE SUBPROGRAM HISTORY**

- The subprogram was established after the merger of the Science Program and the Conservation Program in 2002.
- In addition to its role in administering institutional commitments (MBARI, Packard Fellows), between 2002 and 2009 the Science Subprogram also:
  - supported the launch of new institutions to link science with decision-makers (Aldo Leopold Leadership Program, COMPASS).
  - carried out a 5-year (2004-2009) strategy to promote the adoption of Ecosystem Based Management (EBM) within marine conservation.
- Since 2009, funding has focused on user engagement, both science communications and use-inspired research and synthesis.

**Applied Science and User Engagement Awards within C&S Program (excludes MBARI, Fellows, and COS)**

**Focus Of Science Subprogram Support 2010-12**

42 Grants, $10.7m
The Packard Foundation invests in alternative approaches to better use of science in conservation

**THE USUAL APPROACH: KNOWLEDGE WILL COMPEL CHANGE**

- Scientists have played a central role in conservation by discovering new species and interpreting wonders of nature (e.g., Jacques Cousteau).
- As a result, contributions of scientific knowledge to conservation have been dominated by an academic, science-led model—knowledge will compel action.
- As controversies have risen, in areas including land use, fisheries management and climate, the science-led model no longer assures action, and knowledge is often marginalized in decision-making.

**ALTERNATIVE APPROACH: USER ENGAGEMENT**

We considered three alternatives to the science-led approach that make sense given the Foundation’s resources.

1. *Use-inspired research in which decision-makers and users participate in identifying questions to be studied.*
2. *Better communication of scientific knowledge to decision making arenas.*
3. *Campaign to revitalize national programs for science in conservation, e.g., as part of national ocean policy.*

The Science Subprogram is focusing on #1 and #2, believing that #3 is infeasible until the implementation of national policies for the oceans and terrestrial resources in our focal areas take a more proactive turn.
## Two alternative paths toward better use of science in conservation

In addition to basic research, the Science Subprogram pursues two uncommon grantmaking strategies (red, in bold). The Foundation is an innovator in supporting science communications. Since 2009 we have also developed the idea of use-inspired research.

<table>
<thead>
<tr>
<th>WHERE WE ARE NOW</th>
<th>POTENTIAL ACTIVITIES</th>
<th>OUTPUTS</th>
<th>SHORT-TERM OUTCOMES</th>
<th>INTERMEDIATE OUTCOMES</th>
<th>LONG-TERM OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academic science expertise</strong></td>
<td>Science-led research</td>
<td>Research published (high credibility)</td>
<td>Timing and relevance poor</td>
<td>Limited influence, delayed uptake</td>
<td>Foundation for ecosystem-based management created (medium probability)</td>
</tr>
<tr>
<td><strong>Some decision makers and NGOs want to strengthen scientific basis of decisions</strong></td>
<td>Use-inspired research</td>
<td>Targeted research Assessment and synthesis</td>
<td>Research and synthesis informs decisions identified at outset</td>
<td>Decisions contribute to C&amp;S strategies Use-inspired research gains legitimacy as a way to build useful knowledge</td>
<td>Science informs decision making routinely, leading to better outcomes (scale-up uncertain)</td>
</tr>
<tr>
<td><strong>Scientific understanding incomplete. Data often limited.</strong></td>
<td>Improve scientists as communicators</td>
<td>COMPASS Aldo Leopold</td>
<td>Leading scientists gain communications skills Scientists engage with media, policy</td>
<td>Network of leading scientists engaged in problem-solving Additional funders join</td>
<td>Science informs decision making more often, leading to better outcomes (scale-up uncertain)</td>
</tr>
<tr>
<td><strong>Some policy areas politically polarized.</strong></td>
<td>Campaign for new national environmental science policy</td>
<td>Recommendations from panel of experts Strategic communications campaign</td>
<td>Feasibility doubtful in current political environment</td>
<td>None likely</td>
<td>Scientific basis of environmental policy re-established (low probability)</td>
</tr>
</tbody>
</table>

### Assumptions:
Conservation funding continues to be constrained and may decline. Need for scientific knowledge for credible and effective decisions continues to rise (e.g., impact of certification; ecosystem-based management and ecosystem services; cost-effective monitoring)
**Linking Knowledge with Action: our user engagement grantmaking approach**

Scientific knowledge is essential, but the knowledge produced is often not useful to decision-making, and data needed for sound decisions are often lacking. Beginning in 2009, the Science Subprogram began to fund projects in use-inspired research projects. Our use-inspired approach – *Linking Knowledge with Action* – provides one or more grants targeted on a specific knowledge need and on an identified set of users with measurable outcomes within three years.

**LINKING KNOWLEDGE WITH ACTION OBJECTIVES**

- Work with both decision-makers and scientist from outset.
- Focus research on questions that are likely to be useful.
- Help decision-makers to better understand the limits of knowledge and scope of uncertainties.

**WHAT WE LOOK FOR IN DESIGNING PROJECTS**

- Does project align with C&S Program goals?
- Is the situation ripe? --can knowledge, by itself, make a difference?
- How will boundary between users and scientists be spanned?
- Are researchers and users capable?
- Are they organized to produce useful knowledge together?
- Will there be measurable change within three years?
- Will there be positive outcomes over the long term?

The way that knowledge becomes valuable differs in the worlds of action and science

*Science:* is the knowledge credible to other experts; is it reproducible and reliable?

*Action:* is the knowledge timely and relevant? Is it legitimate when the decision may be controversial? Do others recognize it as credible and produced in a transparent and inclusive way?

Sometimes need a “boundary organization”, an entity producing knowledge valuable for both action and science

*Examples:* The Millennium Ecosystem Assessment (2005) synthesized the first comprehensive analysis of ecosystem services of the planet to estimate their importance to humans. The draft reports were reviewed by more than 500 experts to assure scientific credibility; the drafts were also reviewed by 44 governments to validate their significance and legitimacy. The Millennium Ecosystem Assessment bridged the boundary between knowledge and action, providing science useful in decision-making.

The Packard Foundation has helped to launch several pioneering boundary organizations, including the California Marine Protected Area Monitoring Enterprise, the Micronesia Conservation Trust, and the Center for Ocean Solutions.
The Science Subprogram has a disciplined focus and expertise with our Linking Knowledge with Action grantmaking approach, by investing where we are confident that decision-makers are engaged and the science will inform decisions.

The Science Subprogram also supports institutions and projects that provide long-term benefits to C&S Program goals but that would be of lower priority for the individual subprograms given their more focused strategies.

For example:
- PISCO provided valuable scientific input that benefited the implementation of the Marine Life Protection Act, a goal of our coastal conservation grantmaking.
- COMPASS has brought high-profile media attention to science in key emerging topic areas, such as wetland restoration, by preparing scientists to be articulate, credible spokespersons.

As the subprogram builds experience with work linking science to decision-making, it can inform the work of other institutions.

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**WE ACHIEVE MORE IMPACT WITH A DEFINED SCIENCE SUBPROGRAM**

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**PROGRAMS WITH FEATURES SIMILAR TO THE SCIENCE SUBPROGRAM**

**WILBURFORCE FOUNDATION SCIENCE PROGRAM**

Funds in support of terrestrial wildlife conservation science in North America.

**Focus:** Addresses critical knowledge gaps; synthesizes existing knowledge; shares data; integrates science into decision making

**LENFEST OCEAN PROGRAM, PEW ENVIRONMENT GROUP**

Grantmaking in support of research and communications to improve fisheries management.

**Focus:** Expands and enhances use of science in decision-making; puts new issues onto public agenda; seeks adoption of research results in decision processes
What has been the impact of Science Subprogram investments?

<table>
<thead>
<tr>
<th>Tehachapi Windpower Assessment</th>
<th>Eco-labeling &amp; Standards</th>
</tr>
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<tbody>
<tr>
<td>The Conservation Biology Institute was funded to carry out a spatial analysis of the cumulative impact of wind power on bird and bat species in the Tehachapi Mountains, California, to inform a permitting process for wind projects. The Tehachapis ecosystem connects wildlife in the Sierra Nevada mountains with the coast range and Los Angeles basin, as well as the high desert.</td>
<td>An Achilles heel of current environmental certification arrangements is that there is inadequate measurement of the environmental outcomes of certification. Because of our major investments in market transformation in the Marine Stewardship Council and Roundtable on Sustainable Biofuels, we funded Resolve to convene an expert assessment of certification. We also funded the ISEAL Alliance to define standards for impact monitoring and verification, and to stimulate capacity building.</td>
</tr>
</tbody>
</table>

**Outcome?** Grantee completed an analysis but too little data on bird and bat migrations were available to be useful to the permitting agencies. Local governments also declined to use the model.

**Lessons:** Science and collaborating program officers were too optimistic about state of knowledge. Pressure to develop renewable energy rapidly limited ability of agencies to use the analysis provided.

**Outcome?** It is too early to tell what the impact will be. The assessment was completed in mid-2012 and is being disseminated to corporate and other stakeholder groups. ISEAL developed and adopted the standards, but members have had difficulty building capacity to implement the monitoring standards because of costs.

**Estimated Impact Science Subprogram Grants**

<table>
<thead>
<tr>
<th>Positive</th>
<th>None/Negative</th>
<th>Too Early</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>7</td>
<td>14</td>
</tr>
</tbody>
</table>

37 grants made since 2010
What has been the impact of Science Subprogram investments?

<table>
<thead>
<tr>
<th>Nitrogen in the Climate Assessment</th>
<th>Monitoring of Marine Protected Areas</th>
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<tbody>
<tr>
<td>The U.S. National Climate Assessment (NCA) is designed to inform federal and state management decisions and the allocation of federal research funding. The previous assessment gave little attention to the impact of climate change on nitrogen cycles or the potential for reducing GHG emissions by improving nitrogen management. We funded Woods Hole Research Center to carry out an assessment process linked to the NCA to assess the state of knowledge on reactive nitrogen compounds in the environment and the link with climate change.</td>
<td>The Foundation has made major investments in marine protected areas (MPAs) and locally managed marine areas (LMMAs) but the foundation, the conservation community, and managers, don’t have the information they need on the impact of these conservation tools to inform management and priority setting. We have made a series of linked grants to the University of California, the California Monitoring Enterprise, WWF, WCS, TNC, and the Micronesia Conservation Trust to align monitoring with decision making so that cost-effective and sustainable collection of monitoring data can be achieved.</td>
</tr>
<tr>
<td><strong>Outcome?</strong> The project succeeded. The summary was submitted to the NCA for inclusion in the 2013 assessment report. A series of papers has been submitted to a refereed journal.</td>
<td><strong>Outcome?</strong> Too early to tell. Initial scientific papers are being published. A collaboration between the Monitoring Enterprise and the Great Barrier Reef Marine Park Authority has been built. Other major efforts still being launched.</td>
</tr>
<tr>
<td><strong>Lessons:</strong> This successfully built on the Foundation's support of the International Nitrogen Initiative. Program staff played a key role in linking the researchers to the NCA.</td>
<td><strong>Lessons:</strong> This project involves engagement of all of the Foundation’s coastal subprograms and involves multiple grants to several institutions. It is an experiment with a slightly different model from the original approach of a single grant linked with a single subprogram.</td>
</tr>
</tbody>
</table>
What has been the impact of Science Subprogram investments?

<table>
<thead>
<tr>
<th>Emerging Contaminants</th>
<th>Managing the Sea of Cortez</th>
</tr>
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<tbody>
<tr>
<td>For more than 30 years there has been concern about pollutants released to marine and terrestrial environments at such low levels that obvious impacts are not apparent. There are more than 200,000 such chemicals, including endocrine disruptors, pharmaceuticals, and pesticides. We funded the Southern California Coastal Water Research Project to convene a panel of scientists to recommend a strategy to the State Water Board to monitor key emerging contaminants.</td>
<td>A university-NGO consortium called PANGAS was founded in 2005 to demonstrate the value of ecosystem-based management. Since 2009 we have provided funding to link the science produced by PANGAS to agency decision-making in the Mexican government.</td>
</tr>
</tbody>
</table>

**Outcome?** So far so good. The recommendation, to use a risk-based approach to select pollutants to monitor, is being studied by the State Water Board, and a new rule will be considered in the coming two years. The State Water Board thought this project was important enough that they provided additional funds to expand the scope of work to include freshwater systems, in addition to the marine ecosystems analysis we had funded.

**Lesson:** User engagement came at the outset and prompted the State Water Board to increase funding on its own initiative.

**Outcome?** PANGAS data and knowledge are being used to formulate management plans in Mexican fisheries and conservation agencies. But the process of adopting and implementing those plans has gone slowly. A durable relationship among NGOs and agencies has been built, but the institutional sustainability of PANGAS is not clear, now that Foundation funding has ended.

**Lesson:** The close cooperation between NGOs and government built by the Gulf of California subprogram has opened an opportunity to ground decision-making in science. Realizing that promise takes institutional persistence, which is mostly beyond the capability of the Science Subprogram.
What lessons have we learned?

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Explanation</th>
<th>Implications and Actions Underway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linking scientists with users is no simple matter</td>
<td>As a condition for Science Subprogram funding, we have required users of research to be engaged and asking for the product. This has been difficult for scientists to understand and on occasions has led to pro-forma indications of user engagement.</td>
<td>As we build more successful examples, our grantees will have more experiences to use as models.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We plan to relax this criterion in certain cases (see below).</td>
</tr>
<tr>
<td>Not all opportunities require user engagement</td>
<td>Some research can be ‘agenda setting’ even without the engagement of decision-makers.</td>
<td>Support for this type of research is higher risk than support for research where the users are engaged in the design of the process.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We expect to continue to focus primarily on research where users are engaged, but will relax this criterion on occasion where we see significant opportunities for an agenda-setting study.</td>
</tr>
<tr>
<td>Mini-strategies may be more effective than individual grants</td>
<td>Although we have had success with individual grants, for many of the issues we are addressing, several grants to different researchers or organizations may result in more progress than an individual grant.</td>
<td>We have now made multiple grants to different organizations for several projects: monitoring for decision support, and assessment and strengthening of certification, and expect to continue or expand this approach going forward.</td>
</tr>
<tr>
<td>Ad-hoc project identification may be sub-optimal</td>
<td>To date we have relied on the program officers’ own networks to identify possible Science Subprogram grants. This increases the likelihood that a grant will align with a C&amp;S subprogram but we are concerned that we may be missing opportunities for more influential investments.</td>
<td>We are considering experimenting with an advisory committee. The pool of funding is small, however, and projects underway may leave insufficient room to justify an elaborate advisory process.</td>
</tr>
</tbody>
</table>
The Foundation’s support for science compared to other donors

The Foundation is one of a small number of philanthropies making major investments in scientific research initiatives across a range of disciplines.

- **DRIVE TOWARD A COMPLETE UNDERSTANDING OF HOW THE BRAIN WORKS**
  - How does the brain store, encode, and process information?
  - What are the cellular building blocks that underlie all brain function, and are often targets of disease?
  - How do those cells develop, and then create the circuits that drive behavior, thought and brain dysfunction?
  
  *Paul Allen – $200 million founding gift; $300 million pledge to fund first four years of ten-year initiative*

- **THIRTY METER TELESCOPE**
  - To build the world’s largest ground-based optical/infrared telescope.
  - $50 million, 2003-2007 for design study; $200 million pledge begun in 2007 for completion of design and early construction

- **MOORE MICROBIOLOGY INITIATIVE**
  - To uncover the principles that govern the interactions among microbes and that influence the microbially mediated nutrient flow in the marine environment.
  - $158 million in grants from 2001-2012

- **DECADE OF VACCINES**
  - To help research, develop, and deliver vaccines for the world’s poorest countries.
  - $10 billion pledge from 2010-2020

- **CENSUS OF MARINE LIFE**
  - To advance a major international observational program to assess and explain the diversity, distribution, and abundance of marine life.
  - $78 million, 2000-2010
Philanthropy’s potential for investment in science is small in comparison to government ($ millions in figure below)

The Foundation’s support for science compared to government

But, philanthropic support for science can play a unique role:

- Create knowledge institutions with political independence and staying power (e.g., MBARI, Center for Ocean Solutions)
- Research aimed at elevating topics onto policy agenda (e.g., Lenfest Ocean Program at Pew)
- Producing knowledge that supports strategic grantmaking (e.g., studies of economic benefits of preschool)
- Science communications in contested arenas (e.g., COMPASS, Aldo Leopold)
- “Venture” and “Mezzanine” investor--taking a promising (nonprofit) idea to/beyond proof of concept (e.g., creation of academic field of public health)

Note: All dollar amounts in millions
Federal budget numbers are from the President's budget request for FY 2013, as reported by AAAS
Packard budget numbers for 2012
Basic Research: MBARI comparisons

“David Packard …challenged us to develop and apply new methods, instruments, and analytical systems to address fundamental problems in ocean science and to identify new directions where innovative technologies will accelerate progress. Achieving this requires a peer relationship among scientists and engineers…”

Monterey Bay Aquarium Research Institute

An institution dedicated to research and education to advance understanding of the ocean and its interaction with the Earth system, and to communicating this understanding for the benefit of society.

STAFF ~900
GRAD STUDENTS ~130

GRANTS RECEIVED 2011 $182M
TOP PRIVATE FUNDERS (2003-2011)*
$6.4M Gordon and Betty Moore Foundation
$6.1 Comer Science and Education Foundation (no longer active)
$3.2M Stanley W. Watson Foundation
$2.7M G. Unger Vetlesen Foundation
$2M The W.M Keck Foundation

Federal 72% 28% Private

STAFF 1,300
GRAD STUDENTS 240

GRANTS RECEIVED 2011 $153M
TOP PRIVATE FUNDERS (2003-2011)*
$2.7M G. Unger Vetlesen Foundation
$4.7M Moore Foundation**
~$1M Ellen C. Revelle Trust
$700K Comer Science and Education Foundation
$650K The San Diego Foundation

Federal 95% 5% Private

*Available data from Foundation Center – not a complete list but provides major donors.
**Data from Moore Foundation grantee list
Basic Research: Packard Fellowships Comparisons

Packard Fellowships for Science & Engineering
Awarded to early-career professors nominated by the president of their university to pursue science and engineering research in new and innovative ways.

Founded 1988
Grant Limitations: No restrictions as long as used for research
Fellows: 16-20/yr
Award Amount: $850k/5yr
Total Awarded to Date: $300M

MacArthur Fellows
Awarded to talented individuals who have shown extraordinary originality and dedication in their creative pursuits and a marked capacity for self-direction.

Founded 1981
Grant Limitations: Completely unrestricted – recipient can use funds as desired
Fellows: 20-30/yr
Award Amount: $500k/5yr
Total Awarded to Date: $~425M

Moore Foundation MMI 2012 Investigator Competition
Awarded to current and emerging leaders in the fields of microbial ecology, biogeochemistry, modeling, evolutionary biology, bioinformatics, and others.

Founded 2012 (one time competition)
Grant Limitations: No restrictions as long as used for research
Fellows: 10-15
Award Amount: $200k-$500k per yr/5yr
Total to be Awarded 2012-17: $25M

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Strategic Science: Center for Ocean Solutions Comparisons

**MISSION**
To solve the major problems facing the ocean, and prepare both current and future leaders to take on these challenges.

**FULL TIME STAFF** 22  
**ASSOCIATED RESEARCHERS** 27

**OPERATING BUDGET** $2.6M FY 2011  
$1.9M (Packard Foundation)  
$700K (outside gifts)

**FUNDING**  
$25M/10yr founding grant from Packard

**RECENT EXAMPLES OF POLICY IMPACT OF CENTER FOR OCEAN SOLUTIONS**
- Fisheries Leadership and Sustainability Forum: Transfer of ideas and innovations between U.S. Regional Fishery Management Council members and experts in fisheries law, policy, economics, and the sciences.

**MISSION**
To help decision makers create timely, effective, and economically practical solutions to the world’s critical environmental challenges.

**FULL TIME STAFF** 38  
**AFFILIATED FACULTY** ~61

**OPERATING BUDGET** $6.2M FY 2011

**FUNDING**  
Operational support from Duke.  
Private funders: Packard, Energy Foundation, Linden Trust for Conservation, EDF

**RECENT EXAMPLES OF POLICY IMPACT OF NICHOLAS INSTITUTE**
- Fisheries forum with EDF, Stanford, and COS for semi-annual forum to educate Fisheries Management Council members.
- Advises CARB on design aspects of cap-and-trade policy.
- State Water Allocation Policy: Co-led study on water allocation policy options for North Carolina General Assembly which has been the foundation for subsequent laws.

**MISSION**
To provide leadership in advancing policy-relevant knowledge about the most important challenges of international security and other critical issues where science, technology, environmental policy, and international affairs intersect.

**FULL TIME STAFF** 43  
**ASSOCIATED RESEARCHERS** 62

**OPERATING BUDGET** Not disclosed

**FUNDING**  
1978 founding grant from Ford Foundation. Re-endowed in 1997 ($7.5 million) by Belfer family

**RECENT EXAMPLES OF POLICY IMPACT OF BELFER CENTER RESEARCH**
- Action Agenda to Prevent Nuclear Terrorism: Senators Nunn and Lugar credit the Belfer Center as the incubator of Nunn-Lugar legislation