Appendix 3

National Science Foundation Research Funding

After World War II, Americans recognized that scientists and engineers had helped the Allies win. Penicillin, radar to forecast weather, and the atomic bomb were among the contributions made by the research community. The next challenge was to ensure that science and engineering would continue both to expand the frontiers of knowledge and to serve the American people. The answer was establishment of the National Science Foundation (NSF) in 1950. NSF's mission was to support fundamental research and education in all scientific and engineering disciplines so that the United States would retain its leadership status.

This appendix examines the pattern of NSF funding for forest science and wood science over the past 65 years.

Study methods

NSF maintains an online, searchable database of grants awarded to researchers (http://nsf.gov/awardsearch/). A search using two key words—“forest” and “wood”—identified 8,693 awards from 1952 to 2015 with one or both words in the title or abstract. These titles and abstracts were reviewed to determine which awards were germane to forest and wood science research in the United States. Projects were struck from the list if they did not involve the United States (including Puerto Rico and the western Pacific islands) or two major U.S.-funded institutes: Smithsonian Tropical Research Institute (Panama) and La Selva Biological Station (Costa Rica). Projects with “wood” or “forest” in a proper name (e.g., Woods Hole Research Center) were deleted unless the project’s work focused on forest science or wood science issues. Also omitted were projects whose title and/or abstract did not describe work directly related to contemporary forest or wood-related scientific issues (e.g., archaeological studies of wood buried during the Triassic Period or population studies of wood-boring marine worms) and projects that provided summer instruction for secondary school teachers. A final screening eliminated projects whose title and abstract seemed marginally related to forest or wood research. For example, grants to acquire new scientific equipment may have been justified by its potential use across a wide range of scientific fields at a university, with forestry being one of a half-dozen fields mentioned. On the other hand, if the equipment was only for use by a forestry laboratory, the project remained on the list.

After this screening was completed, 3,243 awards remained (37 percent of the original list). This set was deemed the core NSF support for basic research supporting forest science and wood science over 55 years. The total funding for these awards constituted 16.2 percent of NSF’s total funding awarded between 1951 and 2015.

Figure 1 displays funding for the 3,243 awards by year, color-coded for presidential administrations. This graph shows that certain administrations were more successful in boosting funding for basic research in forestry and wood science.

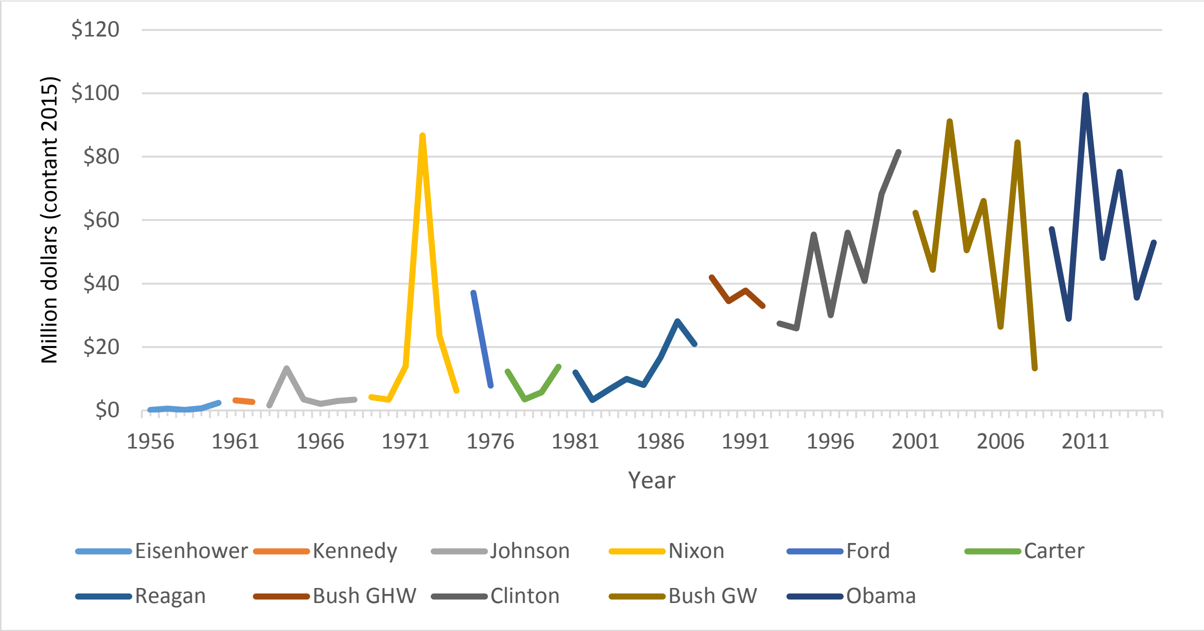

Figure 1. NSF funding for forestry and wood science, by presidential administration (n=3,243 awards)

In the early 1970s, NSF began recording the particular directorate and subsidiary program area responsible for the award (Figure 2). Three directorates have funded the majority of the research in the forest science and wood science areas:

- Biological Sciences (BIO), particularly the Division of Environmental Biology (DEB). Other BIO divisions include Biological Infrastructure, Integrative Organismal Systems, Molecular and Cellular Biosciences, and the Office of Emerging Frontiers.
- Engineering (ENG), particularly the Divisions of Chemical, Bioengineering, Environmental, and Transport Systems; Civil, Mechanical, and Manufacturing Innovation; and Industrial Innovation and Partnerships.
- Geosciences (GEO), particularly Earth Sciences and Atmospheric and Geospace Sciences.

Some wood science research was funded by the Division of Chemistry in the Directorate of Mathematical and Physical Sciences. A small amount of forest policy and forest economics research was also funded by the Directorate for Social, Behavioral, and Economic Sciences.

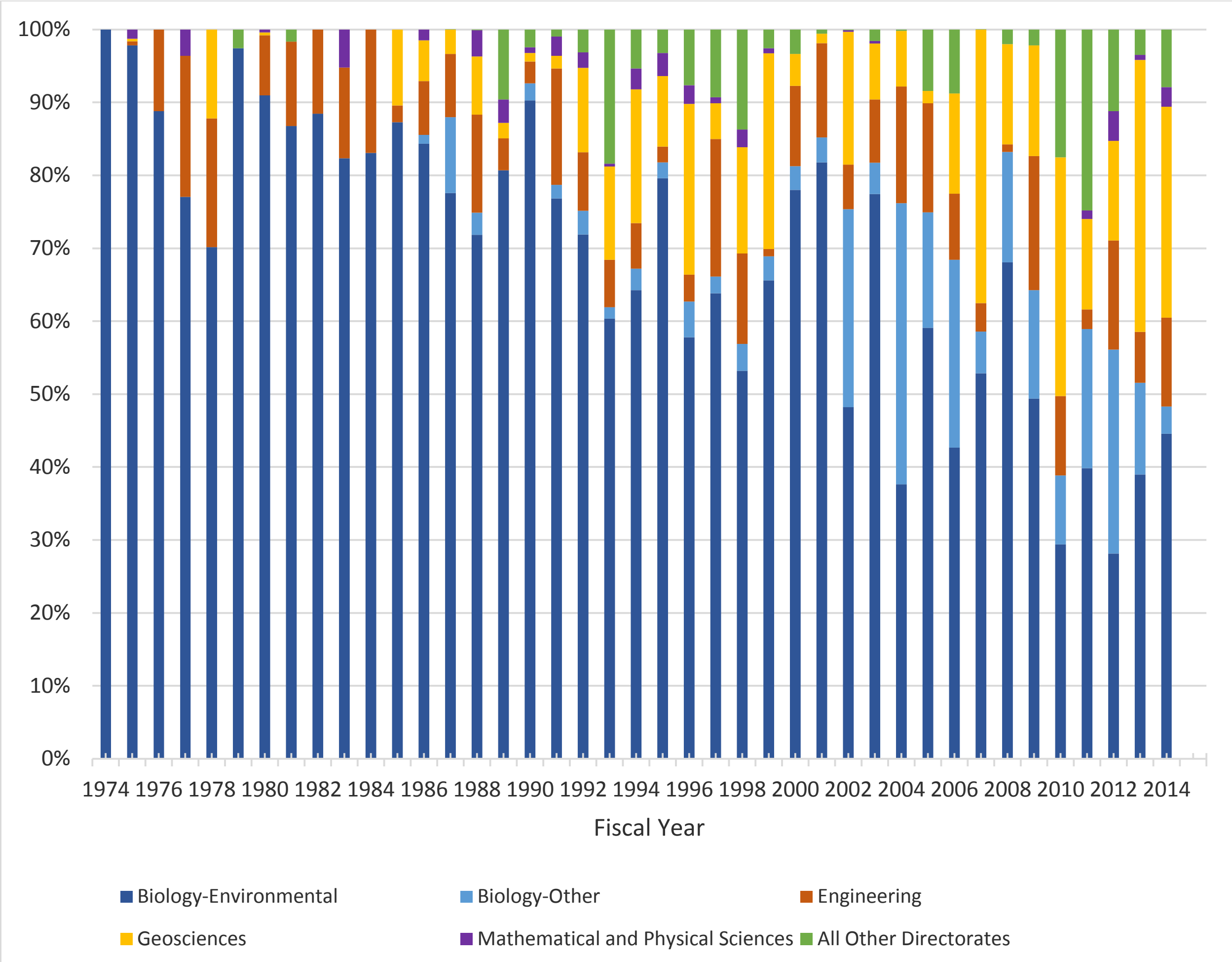

Figure 2. Percentage of total funding for forestry and wood science, by directorate, 1974–2014

Trends in research topics

1970s

The bump-up in funding during the 1970s (see Figure 1, above) was focused on Oak Ridge National Laboratory, in Tennessee, and the University of Washington, in Seattle. Of the $31.7 million awarded between 1971 and 1975, Oak Ridge received $22.9 million (72 percent) and the University of Washington, $8.1 million (26 percent). Together, these two institutions accounted for 98 percent of the NSF funding for forestry and wood science awarded in those five years—virtually all for forest ecology science research.

The general focus of BIO funding was to better understand the structure and function of ecosystems, split between western coniferous forests (University of Washington) and eastern forests (Oak Ridge). A secondary emphasis was on nutrient cycling by mycorrhizae and fungi, water cycles, and water use by plants in forests, grasslands, and deserts, and tree seed predation by insects.

The emphasis in ENG in the late 1970s was on conversion of lignocellulose to other chemicals, flow of liquids in wood, wood drying, wood strength behavior, and wood preservation.

1980s

In the late 1970s, NSF convened discussions on the importance of long-term ecological data. This led to creation of the Long-Term Ecological Research (LTER) program. Its first six sites were established in 1980, followed by five more in 1981, five in 1987, and three in 1988. By the end of the 1980s, seven LTER sites in forest ecosystems had been established—Coweeta in North Carolina, H.J. Andrews in Oregon, Niwot Ridge in Colorado, Hubbard Brook in New Hampshire, Bonanza Creek in Alaska, Luquillo in Puerto Rico, and Harvard Forest in Massachusetts. Only Niwot Ridge and Harvard Forest were not on Forest Service land and did not actively involve Forest Service research and development staff.

Beyond creating LTER program, BIO research funded in the 1980s continued to emphasize nutrient cycling and other below-ground processes. Forest succession was also a focus. Research on birds and other wildlife was initiated.

In the wood science area, the ENG focus was on the behavior of low-rise wood-frame buildings during earthquakes and hurricane-force winds, including the reliability of wood members under stress and the effectiveness of metal plates in strengthening wood trusses. Some wood chemistry research was funded, aimed at the potential of organic solvents to break down lignin and celluloses. Finally, there was an initial grant to study new lamination concepts for lumber.

1990s

During the Clinton administration (1993–2000), NSF support for forest and wood research grew dramatically. The average award for forest and wood research during 1987–1989 was $208,000; a decade later, 1997–1999, the average was $444,000.[1] The number of grants also rose 30 percent, from 199 in 1987–1989 to 259 in 1997–1999.

GEO research grew during this decade but was largely retrospective work, such as analysis of dendrochronology related to climate. Some atmospheric chemistry work was funded, looking at sulfur chemistry. For the first time, troposphere chemistry and climate variability were funded. A few grants funded instrumentation development, design, and acquisition.

ENG research continued on structural aspects of wood, including more work on metal plate performance with trusses, composite beams, and designs for wood joist floor systems. Some work was funded on polymer chemistry, but less on lignin and cellulose breakdown. For the first time, awards were made on wood-plastic composites, using wood fibers to strengthen and improve the performance of molded thermoplastic parts.

BIO research grew and broadened significantly, with major increases in funding for LTERs. Deeper, narrower, more focused research was also funded on a wide variety of topics, including nutrient cycling, soil chemistry, and soil microbes. Additional research on forest dynamics was funded, signaling the beginning of a long-term focus on the relationships between forest ecosystem components, such as the interaction of nutrient cycles with carbon cycles and the interaction of below-ground and above-ground biota and processes.

Although GEO and ENG research grew on a percentage basis, the large absolute increases in funding meant that BIO research funding rose significantly, particularly within the Division of Environmental Biology. The average annual DEB funding in 1997–1999 was $32.7 million (constant 2015 dollars), compared with $20.9 million in 1987–1989[2]. BIO funding in the other divisions was $1.61 million (constant 2015 dollars) for 1997–1999, versus $1.04 million

[1] In terms of constant 2015 dollars, the averages were $405,000 for 1987–1989 and $611,400 for 1997–1999.

[2] In nominal dollar terms, average BIO-DEB funding for 1997–1999 was $23.6 million, compared with $9.9 million in 1987–1989. BIO funding in the other divisions averaged $1.161 million annually for 1997–1999, versus $0.605 million for 1987–1989.

for 1987–1989. Although that was a 54 percent constant-dollar gain in Other BIO funding in a decade, it remained only 5 percent of the DEB funding.

2000–2005

Funding patterns during the George W. Bush administration fluctuated but were still within the higher funding zone established during the Clinton administration. The percentage of funding devoted to Other BIO rose, largely within the Division of Biological Infrastructure (DBI). Awards by DBI were aimed at maintaining or growing the capacity for research at laboratories and field stations; developing and acquiring next-generation analytical equipment (e.g., development of LIDAR, light detection and ranging); and building computing capacity to take advantage of "big data" becoming available on large data sets funded by other BIO work.

Taken together, the Other BIO average funding during this period was $6.6 million annually,[3] roughly 20 percent of the $33 million annually for BIO—a quadrupling from the 5percent of the 1990s.

Substantial investments in LTER sites and programs continued. And in 2000, the Center for Ecological Analysis and Synthesis at the University of California–Santa Barbara received $16 million for pulling together data streams from various ecological studies, including LTERs, and making regional and national sense of them.

Within the ENG directorate, research broadened in two areas: hydrology and wood products. Advances in modeling enabled researchers to better model stream chemistry and flow patterns. Research to develop biogeochemical watershed models was funded, as was work on sediment transport and postforest fire hydrology.

Wood products research included extensions of past work on structural members and also introduced research on nanobiomaterials and woody biomass conversion to transportation fuels. The structural work included strength-testing mechanisms for oriented-strand board (OSB), design standards for wood-frame structural members and fire-resistant wood floor systems, and initial designs for seismic-resistant midrise wood-frame construction. Several awards were made

[3] In constant 2015 dollar terms, average BIO-DEB funding for 2000–2005 was $7.89 million.

for “advanced technologies” for housing and the Great Lakes Wood Manufacturing Partnership. Also funded was work on sawmill operations and renewable biopolymers for reinforced thermoplastic composites and other composite wood products.

The nanobiomaterials work focused on lignocellulosic raw materials, as did the chemistry work on transportation fuels. Searching for “designer cellulases” to make biomass conversion more efficient was the aim of one project.

Within the GEO directorate, research continued on analyzing tree rings and correlating them with climate records. Although this work sounds similar to work funded 20 years earlier, the focus was now the internal chemistry of tree rings—the changes in the wood caused by climatic variations, not just their width to impute climate or precipitation patterns. Work increased on atmospheric composition and deposition work, with nitrogen fluxes receiving larger awards. Climate change research increased, and the first carbon sequestration work was mentioned. Initial funding for a MODIS satellite downlink station was provided, beginning a stronger focus on building remote-sensing research capacity.

2006–2010

The average award for this period was $462,000, not significantly different from the late 1990s. But what increased was the number of awards per year (53 and 59 in FY 2006 and FY 2008, respectively, versus 90 and 105 in FY 2007 and FY 2009) and the total nominal funding $22 million and $12 million in FY 2006 and FY 2008, respectively, versus $73 million and $51 million in FY 2007 and FY 2009).[4]

Within BIO, climate change and carbon research was heavily funded. Some BIO work also became more integrative, comparing the results from several research locations or examining interactions among climate change, land management policies, and forest succession. Other work integrated social science research and ecological research, such as the effects of suburban expansion into the wildland-urban interface, ecological processes, and disturbances (e.g., fires). Connections between water availability (droughts) and health, of both forests and

[4] In constant 2015 dollars, the value all awards, by fiscal year were 2006, $26 million; 2007, $83 million; 2008, $13 million; and 2009,$57 million. The same conclusion holds: the considerable variation in the number of awards means highly variable annual funding.

individual trees, were studied. Also funded was research on how species ranges might be affected by climate change, based on precipitation and temperature records from the recent past (20–40 years). The climate-related work was more focused and detailed. For example, several awards funded work on winter temperatures' effects on dormancy and specific parts of trees, such as buds. Funding for imputing paleoclimates from dendrochronology, popular a decade or two before, had vanished.

A second major emphasis area in BIO was genomics. Funding was provided both for studies to sequence the genes of particular tree species and for acquisition of the advanced instruments needed for genomics research.

ENG funding helped create the Center for Advanced Forestry Systems, an industry-university cooperative research center whose scientists seek to solve complex, industry-wide problems and transcend traditional disciplinary boundaries (https://research.cnr.ncsu.edu/cafs/). The center's mission is to optimize genetic and cultural systems to produce high-quality raw forest materials for new and existing products. Although it is based at North Carolina State University, its members come from all parts of the United States and its studies involve northern and western species in addition to southern pines.

Other ENG awards included research on performance of structural materials—emissions from structural insulated panels, the structural capacity of residential roofs, resistance to hurricane and wind damage, and design specifications for structural composite lumber. A broader assortment of research was funded in both nanotechnology and the biobased fuels. Biofuels funding included research on feedstock conversions, biofuel enzymes, gasification, and the biofuel production network and supply chain. A $3 million grant titled "Building a Technologically Advanced Pulp, Paper, and Allied Industries Workforce and Contributing to the Development of the Nation's Renewable Energy Capacity" was made to Alabama Southern Community College for leading a consortium of 15 community colleges in preparing graduates to work in next-generation mills, poised to take advantage of markets for new biobased products.

The GEO directorate's awards had a strong focus on fire—fire emissions, fire weather, thermal imaging, fire models, smoke issues, and effects of burns on watershed hydrology. Research also continued on atmospheric chemistry, with emphasis on nitrogenous compounds. Hydrology research focused on relationships between global carbon cycles and hydrologic cycles. New in this period were several awards for research on snow weather and snowpacks. Development and use of LIDAR imagery continued. An $11.25 million award in FY 2007 went to the University of Alaska–Fairbanks for “Resilience and Vulnerability in a Rapidly Changing North: The Integration of Physical, Biological and Social Processes.”

2011–2015

The most recent five years of awards also had substantial fluctuations in funding (nominal dollars), from $84 million in FY 2011 to $35 million in FY 2014.[5] This period featured major emphases in three named areas: Interaction among Climate, Land Use, and Ecosystem Service ($20 million in FY 2011[6]); Dynamics of Coupled Natural-Human Systems ($12.8 million over the period[7]); and Sustainable Climate Risk Management Strategies ($11.9 million in FY 2012[8]). In addition, the LTER sites received a total of $39.4 million[9] over the period.

Over the five years the BIO directorate awarded $173 million (nominal dollars),[10] accounting for 60 percent of the total awarded. Two-thirds of that was granted by DEB, and the remainder by other BIO divisions (continuing the increase in these divisions’ proportion, begun a decade earlier). The National Ecological Observatory Network received a hefty allocation to broaden and accelerate continental-scale monitoring. Funding for the LTER network and the plant genome programs also was provided. Climate change received a substantial emphasis with several foci, including biodiversity, decomposing organisms, and the effects of below-ground ecology on above-ground nutrient cycling and plant productivity. Other research focused on multiscale drivers of change and developing more detailed and spatially explicit climate change models that provided consistent results across a range of spatial scales. Some focus on invasive species was also found.

The ENG directorate made awards for broad work in sustainable manufacturing and sustainable biofuels production. Wildfire research looked at links to regional climatic patterns

[5] In constant 2015 dollars, $100 million in FY 2011 compared to $36 million in FY 2014.
[6] $21.3 million, in constant 2015 dollars.
[7] $14.3 million, in constant 2015 dollars.
[8] $12.4 million, in constant 2015 dollars.
[9] $41.0 million, in constant 2015 dollars.
[10] $175.3 million in constant 2015 dollars.

and fires' effects on streams and water quality. Some work on pulping continued, particularly on enzymes to improve processes. The Center for Advanced Forestry Systems received an additional $2 million. Biomass gasification research also continued. Research picked up on development of mobile biomass conversion technologies and equipment.

The GEO directorate also addressed atmospheric chemistry and climate change research, particularly for modeling recent trends and improving decadal projections. Several studies on insect-caused tree mortality in the Rocky Mountains looked both backward (how climate patterns put forests at risk) and forward (the effects of widespread mortality on watershed hydrology and fire risk).

Summary of trends

The nature and focus of research funded by NSF have changed dramatically over the past 45 years and can be summarized as follows (see also Table 1 and Figure 4):

- *Since 2000, integrating research results across topics and across landscapes has received emphasis.* In the early years, understanding components of ecological processes was important. More recently, connecting those processes—particularly through the carbon cycle, nutrient cycles (largely nitrogen), and water cycles—has become important. Recently, research connecting social and economic issues with forest ecological issues has received some funding.
- *Climate change has been the single largest question that has driven integration* both within ecological research and also among the biological, engineering, and geosciences research communities. Connections have been made between climate's effects on forest flora and fauna, water issues (ENG), and atmospheric issues (GEO).
- *The Long-Term Ecological Research network remains well funded and is contributing valuable research* on a wide variety of topics. Synthesizing, and making sense of all the data flowing from the LTER sites remain a challenge.
- *Funding has helped research centers get started and grow.* Repeated grants to cooperative research programs and institutions—some virtual—can be seen in the awards database. The LTER network was the first. The Center for Advanced Forestry Systems, a

recent one, has made some good early progress. But others, such as the National Ecological Observatory Network network, have been much slower to get started. Why some were successful and some less so is not apparent from the NSF database.

- *The proportion of forest and wood science research funded by the BIO directorate through divisions other than DEB has grown.* In the early years, DEB was the only division funding forest research. By the late 1980s, BIO funding on forests by other divisions accounted for 5 to 6 percent of total BIO funding. By 2000–2005, 20 percent of the BIO funding was from other divisions, including Biological Infrastructure, Integrative Organismal Systems, and Emerging Frontiers. A decade later, in 2010–2015, these other divisions accounted for 33 percent of the funding. Basically, the percentage increase resulted from (1) a decline in DEB funding; (2) more emphasis on how the "pieces" interact while DEB continued to fund work on the individual pieces; (3) an increase in infrastructure funding, which supports longer-term research capacity; and (4) a deliberate attempt to shift focus from what's happening today to emerging risks and future uncertainties.

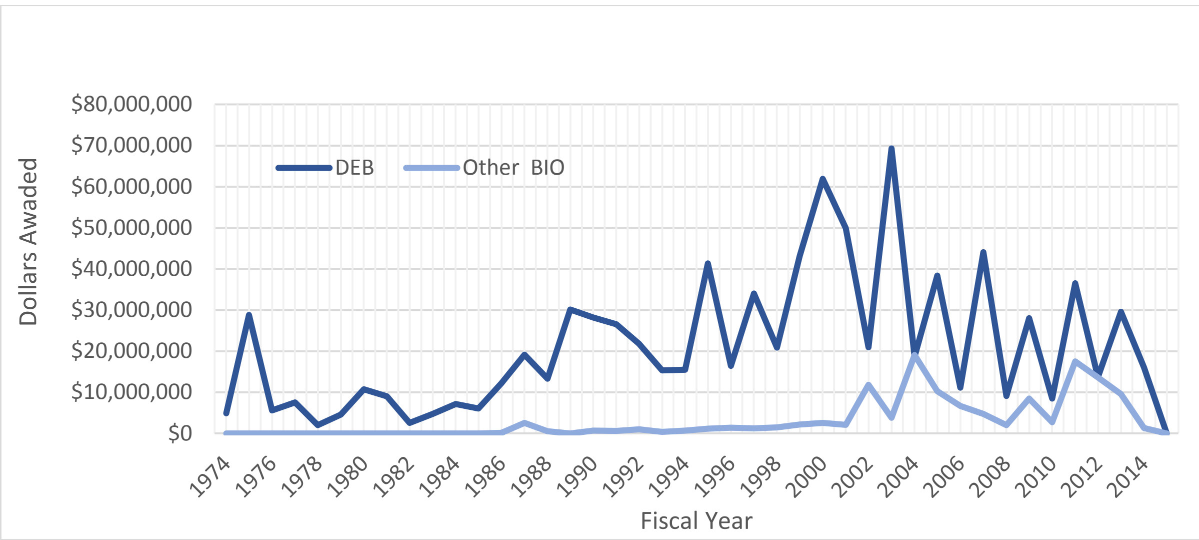

Figure 3. BIO funding for forest- and wood-related research, 1974–2014 (constant 2015 dollars)

- *The focus of Engineering research awards has shifted since the 1990s.* In the 1990s, research supporting improvements in structural uses of wood and engineered wood products to improve their service life and safety in seismic events and high winds helped the forest products industry. Some research also supported the early stages of laminated structural members and wood-plastic composites. It's less apparent how that research has influenced market development for the forest products industry. At the same time, some work on lignin and cellulose chemistry helped the pulping and specialty chemicals industry segment of the forest products industry. But in recent years, support for these types of research has waned. The cause is unclear but is probably related to fewer grant applications and lower priorities for this type of research, given today's concern with climate change.

- *Geosciences research has surpassed Engineering research in recent years.* This shift appears driven by the connections between atmospheric conditions and climate change, the rising importance of wildfire research, and the increased emphasis on airborne and satellite-borne sensors for monitoring. Further, the interest in connections between changing precipitation patterns (part of the changing climate) and effects on watershed conditions (resulting from pest infestations and fires) and forest health has emerged more strongly in the geosciences fields. Recent intense, short-term (three- to five-year) droughts and their consequences for forest health, instream water conditions, and snowpacks have also received increased funding.
- *Fostering the next generation of researchers is not emphasized.* Few grants were made for dissertation research in the forest and wood science areas. The McIntire-Stennis program of the National Institute of Food and Agriculture provides support to more students and thus seems more effective as a capacity growth program for forestry and wood science.

Conclusions

NSF was created to fund basic research, and most of its awards related to forests and wood have supported basic science in forest ecology and basic aspects of wood science. Some work might be classified as applied research, however—particularly the work on improving the structural performance of lumber, panel products, and engineered wood products (e.g., laminated timbers) and consequent design specifications and architectural standards. But NSF remains an institution focused on funding basic research. Thus, its contributions to the forest sector are more foundational than contributions that quickly turn into new product or new market opportunities.

The funding levels indicate that forest research capacity has generally risen over the years, but amounts in the past 15 years have fluctuated widely. Because long-term research, much of it in forest biology, has continued to be funded, the fluctuations largely affect shorter-term research—the basic science to support growth in the forest products sector.

The funding received over multiple years by several research centers and collaborations suggests that researchers who organize themselves into a team or a virtual center with a focus on complex, difficult-to-solve problems may succeed in winning competitive grants. Some investment from other sources, such as foundations or partnerships, is needed to create the collaborative teams or centers of excellence and the governance structures necessary for their operation. But this organizational work needs to be completed before grant applications can be prepared for NSF funding. NSF does not provide the seed money to start research consortia; rather, it wants to see the organizational work done before committing funding to research by the team or partners.

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Table 1. NSF grants for forest and wood science research (2015 dollars) (n=3,243), 1974–2015

Fiscal year	*Total funding*	*National Science Foundation directorate*					*BIO funding split*	
		BIO	*ENG*	*GEO*	*MPS*	*Other*	*DEB*	*Other BIO*
1974	$4,918,779	$4,918,779	$0	$0	$0	$0	$4,918,779	$0
1975	$29,493,341	$28,846,822	$175,019	$100,811	$370,689	$0	$28,846,822	$0
1976	$6,273,657	$5,570,371	$703,286	$0	$0	$0	$5,570,371	$0
1977	$9,810,378	$7,556,872	$1,897,639	$0	$355,867	$0	$7,556,872	$0
1978	$2,827,855	$1,983,936	$499,227	$344,692	$0	$0	$1,983,936	$0
1979	$4,749,183	$4,627,990	$0	$0	$0	$121,193	$4,627,990	$0
1980	$11,833,245	$10,763,047	$977,155	$47,495	$45,548	$0	$10,763,047	$0
1981	$10,368,484	$8,996,316	$1,199,672	$0	$0	$172,495	$8,996,316	$0
1982	$2,899,776	$2,564,540	$335,236	$0	$0	$0	$2,564,540	$0
1983	$5,806,840	$4,781,550	$722,130	$0	$303,161	$0	$4,781,550	$0
1984	$8,638,481	$7,176,740	$1,461,741	$0	$0	$0	$7,176,740	$0
1985	$6,987,662	$6,097,892	$161,005	$728,764	$0	$0	$6,097,892	$0
1986	$14,531,359	$12,433,415	$1,071,808	$808,344	$217,792	$0	$12,254,827	$178,588
1987	$24,713,031	$21,745,283	$2,138,271	$822,145	$0	$7,332	$19,169,962	$2,575,320
1988	$18,501,709	$13,851,888	$2,490,301	$1,478,540	$659,727	$21,253	$13,291,057	$560,830
1989	$37,370,240	$30,148,122	$1,645,639	$790,796	$1,191,335	$3,594,349	$30,148,122	$0

1990	$31,249,252	$28,934,747	$941,476	$369,736	$245,061	$758,233	$28,207,214	$727,532
1991	$34,555,075	$27,186,502	$5,516,192	$610,903	$909,321	$332,156	$26,545,877	$640,625
1992	$30,346,816	$22,805,140	$2,437,857	$3,509,683	$647,117	$947,019	$21,818,909	$986,231
1993	$25,392,506	$15,719,661	$1,653,454	$3,253,686	$91,165	$4,674,540	$15,321,573	$398,088
1994	$24,075,970	$16,175,817	$1,506,930	$4,418,051	$687,677	$1,287,497	$15,475,801	$700,015
1995	$51,945,099	$42,485,737	$1,107,482	$5,025,660	$1,648,953	$1,677,267	$41,347,798	$1,137,939
1996	$28,482,281	$17,852,177	$1,057,787	$6,660,476	$739,779	$2,172,063	$16,464,080	$1,388,097
1997	$53,377,305	$35,298,814	$10,073,756	$2,600,644	$434,601	$4,969,490	$34,071,771	$1,227,044
1998	$39,152,182	$22,280,170	$4,843,597	$5,700,917	$949,713	$5,377,785	$20,836,143	$1,444,027
1999	$65,822,272	$45,339,866	$679,690	$17,656,777	$438,742	$1,707,197	$43,181,885	$2,157,981
2000	$79,436,333	$64,544,845	$8,732,496	$3,488,057	$0	$2,670,936	$61,945,899	$2,598,946
2001	$61,037,167	$52,010,585	$7,886,795	$791,693	$0	$348,094	$49,902,060	$2,108,525
2002	$43,466,150	$32,757,734	$2,653,853	$7,913,745	$100,356	$40,463	$20,954,079	$11,803,654
2003	$89,543,207	$73,165,838	$7,774,049	$6,893,996	$296,126	$1,413,198	$69,352,621	$3,813,218
2004	$49,576,151	$37,774,308	$7,935,950	$3,781,321	$0	$84,572	$18,667,478	$19,106,829
2005	$64,991,336	$48,696,159	$9,725,205	$1,100,391	$0	$5,469,581	$38,407,472	$10,288,687
2006	$26,037,609	$17,820,253	$2,355,780	$3,575,980	$0	$2,285,596	$11,103,546	$6,716,707
2007	$83,369,756	$48,822,539	$3,252,548	$31,274,772	$0	$19,897	$44,063,015	$4,759,524
2008	$13,335,616	$11,094,851	$139,367	$1,831,263	$0	$270,135	$9,080,162	$2,014,690
2009	$56,843,099	$36,515,212	$10,451,029	$8,633,518	$0	$1,243,339	$28,061,291	$8,453,921

2010	$28,820,209	$11,201,044	$3,130,788	$9,429,559	$0	$5,058,818	$8,474,477	$2,726,567
2011	$100,240,772	$54,068,212	$2,454,269	$11,369,442	$1,098,697	$22,749,592	$36,551,033	$17,517,179
2012	$48,638,468	$27,295,390	$7,259,027	$6,647,609	$1,982,365	$5,454,077	$13,681,339	$13,614,051
2013	$75,924,107	$39,145,391	$5,280,181	$28,330,890	$515,363	$2,652,282	$29,585,437	$9,559,954
2014	$35,929,929	$17,357,666	$4,370,967	$10,394,643	$967,930	$2,838,723	$16,010,291	$1,347,376
2015	$52,923,049	$41,432,984	$1,857,315	$7,232,266	$497,089	$1,903,485	$24,924,280	$16,508,614

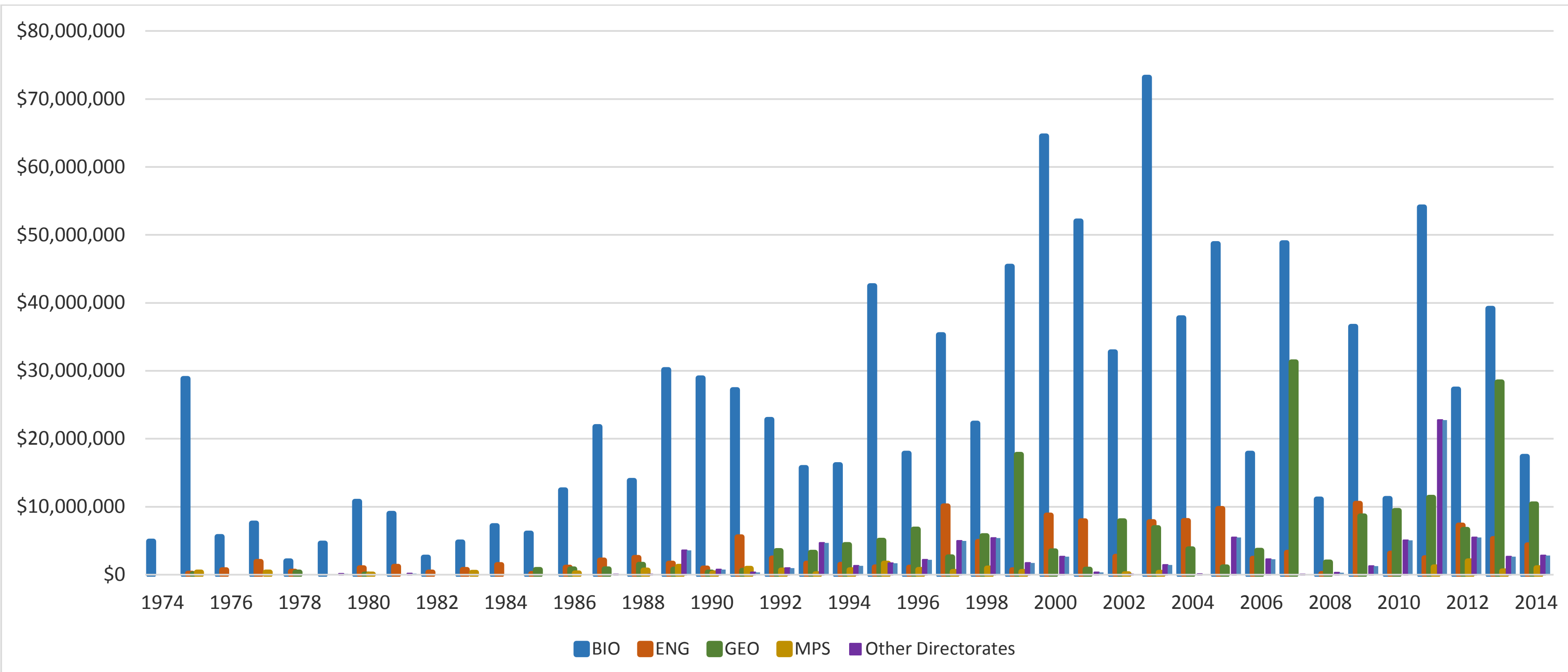

Figure 4. NSF awards for forest and wood science research (2015 dollars), 1974–2015 (n=4,243)