Analysis of the President's Fiscal Year 2021 Budget Request for Biological Sciences Research and Education

A Report from the American Institute of Biological Sciences
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Summary

On February 10, 2020, President Trump released his proposed budget for fiscal year (FY) 2021. The plan would provide $1.3 trillion for discretionary spending, of which $590 billion (-5 percent) would be allocated to nondefense discretionary spending and $741 billion (+0.3 percent) to defense spending. Non-defense discretionary spending includes funding for the National Science Foundation, National Institutes of Health, and other non-defense agencies. Most federal science agencies would receive budget cuts in FY 2021 if the President's budget is enacted. The administration proposes $142 billion for federal research and development, 9 percent below the FY 2020 level. The proposed budget is subject to congressional appropriations.

On August 2, 2019, Congress enacted the Bipartisan Budget Act of 2019, a two-year budget agreement to increase discretionary spending caps by $320 billion over FY 2020 and FY 2021. Under the agreement, defense spending will increase to $741 billion and nondefense spending will increase to $635 billion in FY 2021. While the President's request for defense spending aligns with the new budget caps, the request for nondefense spending falls $45 billion below this cap.

Congress completed FY 2020 appropriations on December 20, 2019, nearly three months into FY 2020. Details of program level funding for some agencies for FY 2020 were not available during the preparation of this report. This analysis compares budget allocations in the FY 2021 budget request with FY 2020 enacted spending levels for most programs and FY 2019 enacted spending levels for which FY 2020 enacted data were unavailable.

A Primer on the Federal Budget

Federal spending is broadly categorized as discretionary or mandatory.

Congress determines discretionary spending on an annual basis through the appropriations process. Collectively, twelve pieces of legislation (appropriations bills) fund the federal government—everything from the military to national parks to research. Discretionary spending limits for various programmatic areas are established by a joint budget resolution adopted by Congress. These levels are informed by the recommendations of authorizing committees and political priorities. Each appropriations subcommittee is provided with a budget threshold within which they must fund the programs under their jurisdiction.

Funding for mandatory programs is controlled by laws outside of the appropriations process. Examples include Social Security, Medicare, and certain agriculture programs.

Mandatory spending has been a growing proportion of the federal budget for decades. Approximately 60 percent of the federal budget is allocated to mandatory spending programs.

Budget Sequestration

Spending caps have constrained federal spending since 2013, which limit the total amount of federal funding for defense and non-defense programs each year. This is a result of the Budget Control Act of 2011, which set limits on how much discretionary spending could grow over the course of a decade. In November 2015, lawmakers negotiated a deal to increase the spending caps by $80 billion for two years, which resulted in slight increases in federal spending for FY 2016 and 2017. In February 2018, Congress approved another two-year budget agreement to raise the cap on discretionary spending by $300 billion over FY 2018 and FY 2019.

The most recent agreement, the Bipartisan Budget Act of 2019, raised discretionary spending caps by $320 billion over FY 2020 and FY 2021 and suspended the nation's debt ceiling until July 2021.

PLEASE NOTE:

This report is based on the President's budget request, which was released prior to the global spread of COVID-19. That development is likely to have significant impacts on FY 2021 funding as the government works to respond to this global issue and also to address the significant economic impacts arising from COVID-19.

Only discretionary funding is reported in this document.

Calculations in this report are relative to the FY 2020 enacted level, unless otherwise noted.

Agency Budget Summaries

United States Department of Agriculture (USDA)

- *Department of Agriculture request: $23.4 billion (-$3.8 billion)*
- *Research, Education, and Economics request: $3.2 billion (-$151 million)*

The proposed budget for research, education, and economics is 4.4 percent below the FY 2020 level.

The National Institute of Food and Agriculture (NIFA) partners with academic institutions to conduct research, education, and extension activities. NIFA would receive $1.6 billion (+4 percent) in FY 2021. Within NIFA, the Agriculture and Food Research Initiative (AFRI) would receive funding at $600 million (+41 percent) for competitive extramural research grants. Lower priority research programs such as Animal Health and Disease Research (-$4 million), Aquaculture Research (-$2 million), and Sun Grants (-$3 million) would be eliminated. Sustainable Agriculture Research and Education, and Extension is slated to receive flat funding of $37 million in FY 2021. The Expanded Food and Nutrition Education program would be reduced by $1 million to $69 million and other higher education programs would also be slashed by 21 percent. The Budget provides $9.5 million to relocate NIFA outside the National Capital Region.

The Agricultural Research Service (ARS) conducts intramural research in the areas of natural and biological science. It would receive $1.4 billion in FY 2021, $189 million below FY 2020. Funding for seven out of eight research areas within ARS would decrease, resulting in an overall budget of $1.2 billion (-$46 million). Research on livestock protection would increase by 3.4 percent. Research in support of environmental stewardship would receive $229 million (-$3 million). The request includes an increase of $35 million for new precision agriculture initiatives related to automation and data management; artificial intelligence innovations for agricultural production; long-term agroecosystems research; and management of excess water and erosion. The budget would provide a $15 million increase to an overall funding of $81 million for the National Bio and Agro-Defense Facility (NBAF), which replaces the Plum Island Animal Disease Center. This includes $23 million for operations and maintenance of the NBAF, which is a biocontainment facility for the study of foreign, emerging, and zoonotic animal diseases that pose a threat to United States animal agriculture and public health.

USDA Forest Service

- *Forest Service request: $5.3 billion (-$155 million)*
- *Forest and Rangeland Research request: $250 million (-$56 million)*

Funding for Forest Service (USFS) research would decrease by 18 percent, and the agency's overall budget would decline by 2.8 percent. Research funding has generally

been limited since FY 2010, when program funding hit a high of $312 million. The trend has reversed in recent years with Congress allocating $300 million in FY 2019 and $305 million in FY 2020.

The FY 2021 request for USFS prioritizes investments in risk-based wildland fire management and in improving forest conditions. The plan prioritizes research that identifies practical strategies and tactics to improve forest and rangeland condition, supports community economic development, and helps save lives and protect property from wildfires.

The plan describes four priority research areas that align with and inform agency land management priorities: applied science to support shared stewardship and improve forest conditions; forest inventory and trend analysis; wood product and market innovations; and enhanced prediction, planning, decision support, impact assessment, and recovery guidance for the wildland fire system.

The request would shutter the Pacific Southwest Research Station (-$18.5 million) and the International Institute of Tropical Forestry (-$2.5 million) to streamline the agency's research portfolio and reduce administrative overhead. Remaining priority research from these stations would be transferred to the Pacific Northwest and Southern Research Stations. Lower priority research areas such as recreation research (-$8.5 million) and wildlife and fish research (-$22.5 million) would be eliminated. An overall $8 million reduction is proposed for other Forest Service R&D programs, including forest and grassland health, forest soils, air quality, hydrology, silviculture, forest ecology, and applied science to improve forest conditions, forest inventory and trend analysis, and wood product and market innovations.

The budget provides $78.4 million (+$1.4 million) for Forest Inventory and Analysis to maintain the continuous forest census covering all 50 States, which provides critical information for forest management planning.

The plan proposes $2.4 billion (+$58.8 million) for Wildland Fire Management; $2 billion (+$47.6 million) for the management of National Forest System lands; $453.2 million (-$1.9 million) for Capital Improvement and Maintenance; and $217.4 million (-$129.5 million) for State and Private Forestry. The Wildfire Suppression Cap Adjustment for FY 2021 would be $2.04 billion, an increase of $90 million from FY 2020.

Department of Commerce

National Oceanic and Atmospheric Administration (NOAA)

- *NOAA request: $4.6 billion (-$728 million)*

Under the President's budget, funding for NOAA would be cut by nearly 14 percent. The budget supports reducing the impacts of extreme weather and water events and

"maximizing the economic contributions" of ocean and coastal resources by expanding the American Blue Economy.

The Office of Oceanic and Atmospheric Research would receive $353 million, a 38 percent cut from the 2020 enacted level. Climate research activities would be slashed by 50.5 percent to $84 million. Competitive grants for climate-change research, which received $63 million in FY 2020, would be terminated, with $20 million from that account transferred to Laboratories and Cooperative Institutes within Climate Research and the U.S. Weather Research Program to "allow for better alignment of funding."

The plan calls for eliminating NOAA's Air Resources Laboratory in College Park, Maryland (-$5 million), which studies air chemistry and atmospheric transport of hazardous chemicals. The Unmanned Systems Operations Program that supervises the use of marine and aircraft systems for weather, polar, and marine observations would be reduced by $7.6 million to $5.2 million. This reduction will decrease research and the acquisition of data from unmanned maritime systems, while continuing to increase the application and use of unmanned aircraft and marine systems.

The National Marine Fisheries Service would receive a 17 percent reduction in discretionary funding to $842 million, with significant cuts to Protected Resources Science and Management (-4.2 percent), Fisheries Science and Management (-10 percent), and Habitat Conservation and Restoration (-32 percent).

The FY 2021 budget proposes significantly decreased funding for the National Ocean Service (-37.2 percent). Large cuts are proposed for coastal science and assessment (-54.4 percent) as well as navigation, observations, and positioning activity (-10 percent).

The request would eliminate several "lower priority" programs, including the National Sea Grant College Program (-$87 million), the National Estuarine Research Reserve System (-$27.5 million), coastal zone management grants (-$77 million), and the Pacific Coastal Salmon Recovery Fund (-$65 million). The National Sea Grant College Program supports more than thirty American universities that conduct research, education, and training programs on ocean-related topics.

The budget proposes to all but eliminate the Office of Education (-97 percent), ending competitive education grants (-$3 million), an educational partnership program with minority serving institutions (-$17.2 million), and watershed education and training programs (-$7.8 million). The remaining $1.1 million would be targeted towards STEM education activities.

National Institutes of Standards and Technology (NIST)

- *NIST request: $738 million (-$296 million)*
- *Science and Technical Research Services request: $652 million (-$102 million)*

NIST would receive a 29 percent budget cut, with all of its accounts being significantly reduced.

The budget supports the Administration's "Industries of the Future" initiative by prioritizing research on artificial intelligence (AI), quantum information science, 5G and advanced communications, advanced manufacturing, and biotechnology.

The Scientific and Technical Research Services (STRS) account would shrink by 13.5 percent. Laboratory programs would receive $591 million (-10 percent). Within STRS, 391 staff positions would be cut in FY 2020. This represents a 15 percent reduction to the number of scientists and engineers at the agency. Most of the lab program areas would receive a reduced budget, including health and biological systems measurements, which would be reduced by nearly 6 percent. Cybersecurity and privacy and exploratory measurement science would be the two accounts to receive an increase in funding.

Supplementary Strategic and Emerging Research Initiatives funding to support the Joint Institute for Metrology in Biology (-$2.6 million) would be terminated.

The Industrial Technology Services account would receive $25.2 million, which is an 84.4 percent budget cut. The budget further proposes a 49 percent cut to construction of research facilities, which would receive only $60 million.

Department of Energy (DOE)

DOE Office of Science

- *DOE request: $35.4 billion (-3.1 billion)*
- *Office of Science request: $5.8 billion (-$1.2 billion)*
- *Biological and Environmental Research request: $517 million (-$233 million)*

DOE Office of Science is slated to receive a 17 percent cut in FY 2021. The Office of Science supports both scientific research and design, development, construction, and operation of scientific user facilities. Approximately 23,000 researchers located at over 300 institutions and the 17 DOE national laboratories are supported by grants from the Office of Science.

The budget for the Office of Science includes $475 million for exascale computing, $237 million for quantum information sciences (QIS), and $125 million for AI and machine learning, to support the Administration's "Industries of the Future" initiative.

Funding for Biological and Environmental Research (BER) would be slashed by 31 percent from the FY 2020 level to $517 million, with funds directed to support "fundamental research to understand complex biological, biogeochemical, and physical principles of natural systems at scales extending from the genome of microbes and plants to the environmental and ecological processes at the scale of the planet Earth."

The FY 2021 request for Biological Systems Science prioritizes core research areas of genomic sciences, including foundational genomics that supports secure biosystems design research to modify microorganisms and plants with specific beneficial traits for renewable bioenergy, bioproduct and biomaterials production; new computational bioscience tools; and the four Bioenergy Research Centers. Overall, Biological Systems Science would receive $339 million, a decrease of 16.2 percent. The budget for Genomic Science would shrink by 9.7 percent, with the Bioenergy Research Centers slated for a flat budget of $100 million. The Biomolecular Characterization and Imaging Science account would receive a 45 percent cut and Biological Systems Facilities and Infrastructure would receive a 22 percent cut.

The budget would shrink for all three BER scientific user facilities, namely the Joint Genome Institute (-22 percent), the Atmospheric Radiation Measurement Research Facility (-22 percent), and the Environmental Molecular Sciences Laboratory (-3.3 percent).

Earth and Environmental Systems Sciences would receive $177.6 million (-49 percent) in FY 2021, with funding reduced substantially for all accounts including atmospheric systems research (-66 percent), environmental system science (-75.5 percent), earth and environmental systems modeling (-61 percent), and facilities and infrastructure (-16.6 percent). Environmental system science supports the study of terrestrial ecosystems, including the Arctic.

Advanced scientific computing research would receive $988 million, a small boost of 0.8 percent, with $439 million targeted to the development of exascale computing.

The budget for basic energy sciences would be slashed by 12.5 percent to $1.9 billion, with funding directed towards highest priority early-stage fundamental research, operation and maintenance of scientific user facilities, and facility upgrades. The request would continue to support the Energy Frontier Research Centers, two Energy Innovation Hubs, and five research centers for nanoscale science, among others. High priority research areas include QIS, next-generation microelectronics, artificial intelligence, exascale computing, critical materials, polymer upcycling, and next-generation biology. Under next-generation biology, the agency would support the development of bio-inspired, biohybrid, and biomimetic systems.

Science Laboratories Infrastructure is slated to receive $174 million, a decrease of 42 percent, with the funds directed towards three new construction projects: the Princeton Plasma Innovation Center at Princeton Plasma Physics Laboratory (PPPL), the Critical Infrastructure Recovery and Renewal project at PPPL, and the Ames Infrastructure Modernization project at Ames Laboratory, and fifteen ongoing construction projects.

Workforce development for teachers and scientists would be cut by $7.5 million to $20.5 million, with funds targeted towards programs that place qualified students in STEM learning opportunities at Department of Energy laboratories as well as the National Science Bowl competition.

Environmental Protection Agency (EPA)

- *EPA request: $6.6 billion (-$2.4 billion)*
- *Science and Technology request: $485 million (-$231 million)*

Budget for the EPA would be slashed by 26.5 percent. The Administration proposed drastic cuts to EPA's budget in FY 2018, FY 2019, and FY 2020 as well. These were rejected by Congress. Under the budget request, the number of full-time-equivalent staff positions would decrease from 14,172 to 12,610.

The budget prioritizes support for core programs and infrastructure for a "cleaner healthier environment," collaborations with state, tribal and federal partners, and creating "consistency and certainty for the regulated community" by removing redundant regulations, modernizing the permitting process.

Scientific research within EPA is slated for a 32 percent cut. EPA Science and Technology, which supports research used to identify and mitigate environmental problems, would receive $485 million. Funding for research and development programs would be slashed by 43 percent.

Within the Office of Research and Development, funding for research on sustainable and healthy communities would decline to $70.9 million (-53 percent). Support would be targeted to research on efforts to achieve the Administrator's priorities of revitalizing land and preventing contamination, providing clean and safe water, improving air quality, and ensuring the safety of chemicals in the marketplace. The plan provides additional funding in FY 2021 for research to advance implementation of the PFAS (Per- and Polyfluoroalkyl Substances) Action Plan, research associated with food waste reduction, and research related to lead issues. Funds would also support technical assistance for states, tribes, and local communities on ecological and human health risk assessment.

The Safe and Sustainable Water Resources account would receive $78.9 million (-29 percent) and prioritize research in areas PFAS, lead exposure, nutrients, harmful algal blooms, watersheds and water infrastructure. Research on chemical safety and sustainability would be cut by 30 percent, with funding directed towards developing tools that accelerate data-driven chemical evaluations, support sustainable innovation of chemicals, and enable EPA and states to make environmentally sound decisions. The air and energy research budget would be reduced by 65 percent.

The budget for the Atmospheric Protection Program would be slashed by 86 percent. The Greenhouse Gas Reporting program would be retained, but other climate-related programs would be eliminated.

Water Quality Research and Support Grants, a congressionally directed competitive grant program to support water quality research, would be eliminated. Congress provided $23.7 million in funding for this program in FY 2020, an increase of $3.7 million from FY 2019.

Other eliminated programs include; Global Change Research (-$19.3 million), which develops scientific information that allows policy makers, stakeholders, and society to respond to climate change; Science to Achieve Results (STAR) Research Grants (-$28.6 million), which fund research grants and graduate fellowships in environmental science and engineering; WaterSense (-$4.5 million), which aims to reduce water-use; the National Estuary program (-$29.8 million), which is focused on restoring estuaries and coastal ecosystems; and Environmental Education (-$8.6 million), which supports environmental education to promote public engagement.

Department of Health and Human Services

National Institutes of Health (NIH)

- *NIH request: $38.7 billion (-$3 billion)*

The President's budget proposes a 7 percent budget cut for NIH. The leading biomedical research agency in the world would receive budget cuts across the board. All NIH centers are slated for budget reductions:

- National Cancer Institute: -8.7 percent
- National Heart, Lung, and Blood Institute: -9 percent
- National Institute of Neurological Disorders and Stroke: -8.2 percent
- National Institute of Allergy and Infectious Diseases: -7.3 percent
- National Institute of General Medical Sciences: -9 percent
- National Institute of Environmental Health Sciences: -9.1 percent
- National Institute of Mental Health: -9.7 percent
- National Human Genome Research Institute: -8.9 percent
- National Institute of Biomedical Imaging and Bioengineering: -8.9 percent
- National Library of Medicine: -9 percent

The proposal would also cut the Office of the Director's budget by 8.2 percent. The buildings and facilities account for NIH would see a boost of 50 percent to $300 million, with the increased targeted to renovations and repairs at NCI's Frederick, Maryland, facility.

The Administration once again proposes replacing the Agency for Healthcare Research and Quality (AHRQ), an independent agency in the Department of Health and Human Services, with the National Institute for Research on Safety and Quality (NIRSQ) under NIH. The AHRQ received $445 million from Congress in FY 2020, but the budget would provide only $355 million (-20 percent) for NIRSQ in FY 2021. Congress has repeatedly rejected the Administration's efforts to move AHRQ under NIH.

The NIH budget request includes a $50 million initiative to use artificial intelligence (AI) to develop a better understanding of the causes of chronic diseases and to identify early

treatments. This plan is in line with the Administration's "Industries of the Future" effort, which supports using and developing AI across sectors.

The budget would provide $50 million for the Childhood Cancer Data Initiative that plans "to build a connected data infrastructure to enable childhood cancer data sharing from multiple sources; to identify opportunities to employ that data better for patients, clinicians, and researchers; and to develop and enhance tools and methods to extract knowledge from the data to directly address challenges in caring for children with cancer." This 10-year, $500 million initiative proposed by the President doing his 2019 State of Union address is now in its second year.

Another priority for NIH in FY 2021 would be research on tickborne diseases. The proposal includes $44 million in additional funding to accelerate NIH's priorities outlined in its Strategic Plan for Tickborne Disease Research published in 2019. The budget for NIH also includes $404 million in funding made available through the 21st Century Cures Act. The budget includes $1.4 billion for opioids and pain research across NIH, including $533 million for the Helping to End Addiction Long-Term Initiative, which was launched in April 2018 to combat opioid addiction and perform research on pain and addiction. NIH will continue to support research to improve influenza vaccines. The plan would also provide $16 million for the NIH-sponsored Centers for AIDS Research.

Department of the Interior

United States Bureau of Land Management (BLM)

- *BLM request: $1.2 billion (-$145 million)*
- *Management of Lands and Resources request: $1.1 billion (-$117 million)*

The budget for BLM would be cut by 10.5 percent in FY 2021. Support for Management of Lands and Resources would also be reduced by 9.6 percent.

BLM's budget request addresses Administration priorities such as active management of timber and rangeland resources to reduce wildland fires, creating resilient landscapes, and protecting local communities.

The Wildlife and Aquatic Habitat Management activity would receive $115.2 million (-38 percent) in FY 2021, with $83.5 million for wildlife habitat management and $31.7 million for aquatic habitat management. Priorities for the aquatic habitat management include monitoring water quality; maintaining, restoring, and conserving riparian habitats and wetlands; and restoring fish habitat and productivity. Overall the aquatic habitat management would be slashed by $24 million to focus on high priority work. The wildlife habitat management sub-activity would be cut by $47 million to focus on high priority projects, including expanding hunting and wildlife viewing opportunities, sagebrush restoration, native plant conservation and restoration, and endangered species conservation.

The Land Resources activity would receive a small boost of 0.3 percent. Rangeland Management would shrink by 10.7 percent and Cultural Resource Management would be reduced by 17.7 percent. Public Domain Forest Management would receive a small increase of 1.4 percent and Wild Horse and Burro Management would receive a 15 percent boost to increase field operations.

National Monuments and National Conservation Areas would receive $37.6 million (-14.2 percent). The Resource Protection and Maintenance activity would receive a 23 percent cut, with its Abandoned Mine Lands and Hazardous Materials Management account receiving $27.8 million (-28 percent) in funding.

United States Fish and Wildlife Service (USFWS)

- *USFWS request: $1.4 billion (-$265 million)*

The proposed budget includes a 16 percent overall cut for the United States Fish and Wildlife Service. The USFWS is the federal agency responsible for the management of biological resources. It protects endangered species, migratory birds, marine mammals, and other fish and wildlife species.

The Resource Management account would receive $1.3 billion (-6 percent), with ecological services being cut by 8.2 percent. Ecological Services Listing uses scientific information to identify plant and animal species that are in danger of extinction or likely to become extinct and therefore require protection under the Endangered Species Act. The Listing activity would receive $9.4 million, a reduction of 54 percent.

The USFWS budget for Science Support would be eliminated (-$17.3 million). Funding for habitat conservation would remain essentially flat at $70 million. The National Wildlife Refuge System would receive an increase of 4.6 percent. The account for Conservation and Enforcement would shrink by 2 percent. Fish and Aquatic Conservation would receive a 24 percent cut.

United States Geological Survey (USGS)

- *USGS request: $971.2 million (-$300 million)*
- *USGS Ecosystems Activity request: $127.3 million (-$124 million)*

The budget for the USGS would be cut by 24 percent. Funding decreases have been proposed for USGS programs across the board, with the exception of Energy and Mineral Resources.

The budget once again proposes to consolidate the agency's seven mission areas into five new mission areas to "better address stakeholder priorities." The five new mission areas would be: Ecosystems, Energy and Mineral Resources, Natural Hazards, Water Resources, and Core Science Systems. Programs formerly under the Environmental

Health area would be moved into the Ecosystems mission area and programs formerly under Land Resources would be transferred to Ecosystems and Core Science Systems.

Under the new structure, the Ecosystems mission area would receive $127 million in FY 2021, nearly 50 percent below FY 2020 enacted levels. The plan restructures the Ecosystems account to include programs formerly under Land Resources and Environmental Health mission areas, specifically the National and Regional Climate Adaptation Science Centers, significant portions of Land Change Science, Toxic Substance Hydrology, and Contaminant Biology.

Other mission areas are also slated for budget cuts. Water Resources would be slashed by nearly 23 percent, with the Water Resources Research Act program (-$10 million) terminated. Support for Natural Hazards would be reduced by 19 percent. This includes programs to monitor earthquakes (-29 percent) and volcanoes (-9 percent). Core Science Systems is facing a 14 percent reduction, but its Science Synthesis, Analysis, and Research Program would receive a 0.8 percent boost. The plan would provide $85.9 million (-$20.9 million) for the National Land Imaging Program, including continuing ground system development for launching Landsat 9 in partnership with the National Aeronautics and Space Administration in 2021.

Energy and Mineral Resources, however, is looking at a small increase of 1.3 percent, with its Mineral Resources program slated for a 1.3 percent increase and its Energy Resources program receiving a 1 percent boost. The Science Support accounts at USGS would receive a small cut of 2.7 percent and the Facilities account would be slashed by nearly 30 percent.

The plan proposes reductions for several research programs, including species-specific research (-$5.9 million), research on contaminants (-$1.3 million), harmful algal blooms (-$1.3 million), White-nose syndrome (-$0.9 million), Coral disease (-$0.4 million), Asian Carp (-$5 million), Chronic Wasting disease (-$1 million), habitat research (-$1.3 million), and water use and quality research. Environmental Health Research (-$23.3 million) as well as research on the Everglades (-$5.8 million), California Bay Delta (-$1.7 million), Chesapeake Bay (-$5.7 million), and Changing Arctic Ecosystems (-$3.6 million) would be zeroed out.

Drastic cuts have again been proposed to climate research. The National and Regional Climate Adaptation Science Centers are responsible for developing the science and tools to address the effects of climate change on land, water, wildlife, fish, ecosystems, and communities. Under the proposed restructuring, these centers would be consolidated into a single Climate Adaptation Science Center, which would also include a portion of the Land Change Science program. Overall the Climate Adaptation Science Center program is slated for a 64 percent budget cut under the new structure, with climate research and development reduced by $6.1 million. Congress provided a $13 million increase to the program last year.

The request once again proposed the elimination of the Cooperative Research Units (CRUs), which are located on 40 university campuses in 38 states. The CRUs allow USGS to leverage research and technical expertise affiliated with these universities to

conduct research, provide technical assistance, and develop scientific workforces through graduate education and mentoring programs. Congress has rejected the Administrations repeated attempts the shutter this program in the past and provided CRUs with a more than $5 million increase in FY 2020.

Funding for Museum collections, which supports the Biological Survey Unit (BSU), a group of USGS scientists stationed at the Smithsonian Institution's National Museum of Natural History, would also be zeroed out under the proposal. Established in 1885, the BSU maintains an extensive collection of bird, reptile, and mammal specimens.

National Science Foundation (NSF)

- *NSF request: $7.7 billion (-$537 million)*
- *Research and Related Activities request: $6.2 billion (-$524 million)*
- *Major Research Equipment and Facilities Construction request: $230 million (-$13 million)*
- *Education and Human Resources request: $931 million (-$9 million)*
- *Biological Sciences Directorate request: $705 million (-$79 million*)*

*(*compared to FY 2019 enacted levels)*

The President's budget request proposes a 6.5 percent cut to NSF compared to FY 2020.

NSF will continue to invest in its Big Ideas and Convergence Accelerator, providing support for "bold inquiries into the frontiers of science and engineering" in order "to break down the silos of conventional scientific research funded by NSF to embrace the cross-disciplinary and dynamic nature of the science of the future."

Among the research-focused Big Ideas, Understanding the Rules of Life (URoL), Navigating the New Arctic (NNA), and Windows on the Universe would each receive flat funding of $30 million relative to FY 2019. The agency would allocate $45 million each to Harnessing the Data Revolution (HDR) (+50 percent) and the Future of Work at the Human Technology Frontier (+50 percent). Quantum Leap (QL): Leading the Next Quantum Revolution, would receive $50 million, which is a 67 percent increase relative to FY 2019. NSF INCLUDES, which supports education and career pathways to help broaden participation in science and engineering and build a diverse and skilled American workforce, would receive $18.9 million (-6 percent). Growing Convergence Research at NSF would receive a 3.8 percent cut, while Mid-scale Research Infrastructure would receive a boost of 63 percent compared to FY 2019. For the Convergence Accelerator, the agency would provide a 60 percent boost compared to FY 2019 for a total of $70 million.

Research would be cut by 7.8 percent. The Research and Related Activities account would receive $6.2 billion, $524 million below FY 2020. Most research directorates across the agency would lose funding relative to FY 2019:

- Biological Sciences Directorate (BIO): $705 million (-10.1 percent)
- Geological Sciences Directorate (GEO): $836.6 million (-13.7 percent)
- Computer and Information Science and Engineering Directorate (CISE): $1.06 billion (+7.8 percent)
- Engineering Directorate (ENG): $909.8 million (-8.2 percent)
- Mathematical and Physical Sciences Directorate (MPS): $1.4 billion (-2.8 percent)
- Social, Behavioral and Economic Sciences Directorate (SBE): $246.8 million (-9 percent)
- Office of International Science and Engineering: $44 million (-10.2 percent)
- Office of Polar Programs: $420 million (-14.1 percent)
- Integrative Activities: $539 million (-1.6 percent)
- U.S. Arctic Research Commission: $1.6 million (+8.1 percent)

The Education and Human Resources Directorate (EHR) would operate at $931million, one percent below FY 2020. Within EHR, the Division of Undergraduate Education would see their budget cut by nearly 11 percent, while the Division of Graduate Education would receive an 11 percent boost compared to FY 2019. NSF's investments in the STEM professional workforce would fall by 8.4 percent relative to FY 2019 to $430 million. EHR would allocate $9 million for bioeconomy through research and workforce development programs.

Support for Major Research Equipment and Facilities Construction (MREFC) would decrease by 5.5 percent to $230 million compared to FY 2020. Agency Operations and Award Management would receive a 2.6 percent boost, while the National Science Board would lose 6.4 percent compared to FY 2020.

The NSF Innovation Corps, which improves researchers' access to resources that help transfer knowledge to downstream technological applications, would receive $31.4 million, a decrease of 4 percent from FY 2019.

Cross-cutting programs would receive funding cuts all across the board. The Long-Term Ecological Research (LTER) network would receive $28 million, nearly 16 percent below FY 2019. The Research Experiences for Undergraduates program would be slashed by 19.2 percent compared to FY 2019. Support for Faculty early career development programs or CAREER grants would be slashed by 30.2 percent compared to FY 2019.

NSF Graduate Research Fellowships would be cut by 3.3 percent compared to FY 2019 to $275 million in FY 2021, while support for NSF's Research Traineeship program would increase to $62 million (+14.4 percent).

NSF's Biological Sciences Directorate

Overall, the BIO directorate is slated for a 10.1 percent cut compared to FY 2019.

The number of BIO research grants awarded would decrease slightly and the median award size would increase slightly from FY 2019. The funding rate for BIO research grants is expected to decrease from 33 percent in FY 2019 to 28 percent in FY 2021, a figure that does not include the pre-proposal review process, where some NSF program solicitations require submission of a preliminary proposal in advance of submission of a full proposal.

Within BIO, which provides about 67 percent of federal funding for fundamental non-medical biological research at academic institutions, funding cuts would be allocated to its five divisions accordingly (relative to FY 2019):

- Molecular and Cellular Biosciences: $130.9 million (-9.5 percent)
- Integrative Organismal Systems: $175.8 million (-9.5 percent)
- Environmental Biology: $150.3 million (-2.2 percent)
- Biological Infrastructure (DBI): $158 million (-12.6 percent)
- Emerging Frontiers: $89.9 million (-18.5 percent)

The "bioeconomy" has been recognized as a research priority by the White House Office of Science and Technology. The BIO directorate would increase investments to support the bioeconomy to $96 million (+6.7 percent compared to FY 2019) through research funding programs in synthetic biology, genomics, bioinformatics, and biotechnology, and training fellowships to build the U.S. workforce. Other research directorates within NSF will work together with BIO to make investments in the bioeconomy, including CISE ($4.75 million), ENG ($96 million), and MPS ($25 million).

Other major BIO investments include stewardship for URoL, Advanced Manufacturing, Artificial Intelligence, Quantum Information Sciences (QIS), and Understanding the Brain (UtB), which includes the BRAIN initiative. URoL would support multi-disciplinary, team science approaches towards a predictive understanding of how complex traits of an organism emerge from the interaction of its genetic makeup with the environment. In collaboration with the Engineering Directorate, BIO would support Advanced Manufacturing through investments in synthetic biology. Investments in Artificial Intelligence through the Division of Biological Infrastructure would focus on applying machine learning and genetic algorithms in biological research to solve problems such as genome sequence alignment, predicting species range distributions, and predicting protein structure. The directorate would also increase funding for QIS through investments in fundamental research in biophysics to understand quantum phenomena within living systems.

The National Ecological Observatory Network (NEON) would receive a total of $65 million in FY 2021 through DBI, a decrease of 12 percent from FY 2019.

Smithsonian Institution

- *Smithsonian Institution request: $1.1 billion (+$62.9 million)*

Federal support for the Smithsonian Institution would grow by 6 percent. This increase includes the congressionally mandated pay raise and funds to continue the major renovation project at the National Air and Space Museum and begin major renovations at the Smithsonian Institution Building. Smithsonian is also funded by private donations and a trust fund.

Facilities Capital account would receive $290 million (+14 percent), including $55 million for the National Air and Space Museum; $25 million for the National Zoo's ongoing revitalization work; $5.9 million for the Smithsonian Environmental Research Center; $4.5 million for the Smithsonian Tropical Research Institute; $16.3 million for the Hirshhorn Museum and Sculpture Garden; and $52.5 million to begin major renovations at the Smithsonian Institution Building or Castle.

The National Museum for Natural History (NMNH) would receive $13.4 million under the Facilities Capital account to continue major revitalization work. Under the Salaries and Expenses account NMNH would receive $52.1 million (+4.6 percent).

Small funding increases are proposed for most ongoing activities, including the interdisciplinary research programs (+$3.4 million), public programs for dissemination of information (+$0.7 million), exhibitions (+$3.3 million), and educational programs (+$1.4 million).

Funding for preservation of collections would increase by 6.3 percent to $75.1 million. Digitization of collections to make them accessible online would remain a priority and would receive an increase of $0.6 million in funding. An additional $1.1 million are requested to rebuild curatorial and collections management staffing to provide optimal collections care.

The Smithsonian Tropical Research Institute (STRI), which works towards understanding the biological and cultural diversity in the tropics would also receive a slight boost of 5.7 percent to $15.5 million. The Smithsonian Environmental Research Center (SERC) conducts research on land and water ecosystems in the coastal zone and would receive $4.7 million (+7 percent). In 2021, SERC research on coastal marine ecology will focus on the structure and dynamics of marine food webs; the integrity and biodiversity of crucial marine ecosystems; linkages of ecosystems at the land-sea interface; and the ecological regulation of marine biodiversity. SERC will continue to link its research with national and international research networks through the Marine Global Earth Observatories (MarineGEOs) initiative, which assess the health of coastal areas and the oceans to determine how to manage these resources, and enhance the Marine Science Network and the Tennenbaum Marine Observatory Network.

What's Next?

The President's budget request is only a proposal; it does not have binding authority. Congress uses the President's budget request as a starting point for their budget negotiations. Congress has already begun their consideration of the FY 2021 budget, although it will be several months before any final decisions are made.

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