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RESEARCH HIGHLIGHTS

Smithsonian
Institution

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SCHOLARLY STUDIES AWARDS IN FY2018 SUPPORT 32 DIVERSE RESEARCH PROJECTS

In late December 2017, **the Office of the Provost** announced the recipients of the FY2018 Scholarly Studies Awards. The internal grants program (approximately $2M) is available to Smithsonian staff in all disciplines with a maximum $75,000 one-year award drawn from trust and endowment funding.

A group of confidential Smithsonian peer scholars reviewed, rated, and ranked all 92 proposals received. Given the limited funding available, a total of 32 awards were made to Smithsonian investigators or investigator teams.

The Smithsonian's collections are the foundation for long-term research. They represent our nation's rich heritage, art from across the globe, and the immense diversity of the natural and cultural world.

The internal program will support a variety of research endeavors. For example: *The evolution of domestication in cassava*, a project proposed by Logan Kistler of the **National Museum of Natural History** working with a Brazilian co-Investigator; *Investigating the Validity of the Planet-9 Hypothesis,* research proposed by Matthew Payne and Matthew Holman of the **Smithsonian Astrophysical Observatory**; and an exhibition and book project, *American Cosmos*, proposed by Eleanor Harvey of the **Smithsonian American Art Museum**, to examine the impact of 19th-century naturalist Alexander von Humboldt.

SMITHSONIAN SCHOLARS GUEST EDIT AND CONTRIBUTE TO SPECIAL EDITION JOURNAL

CURATOR
THE
MUSEUM
JOURNAL

A group of Smithsonian scholars and museum peers have come together to produce an issue of Curator: The Museum Journal exclusively focused on ivory. The journal, published quarterly since 1958, reaches 2,800 subscribers and invites museum professionals, researchers, and students to explore and debate the urgent issues shaping the museum field.

Guest editors Scott Miller, **Deputy Under Secretary for Collections and Interdisciplinary Support**, Cheryl Braunstein of the **National Zoo**, and Marjorie Trusted, Senior Curator at the Victoria and Albert Museum in

London, contributed to the issue and secured the cooperation of 24 contributors. Additional Smithsonian contributors include Richard Kurin, **Ambassador at Large**; Madelyn Shaw, **National Museum of American History**; and Barbara Stauffer, **National Museum of Natural History**.

The ivory issue discusses threatened African and Asian elephants but also highlights the role of historic ivory works of art and how museums might engage visitors on the topic of ivory. The special focus issue was triggered, in part, by stricter regulations in May 2016 that made it illegal to import any ivory into the U.S. Contributors grapple with the need for more effective measures to preserve elephants while also protecting and treasuring ivory in historical contexts. Director Emerita Johnnetta Betsch Cole, for example, examines the issue through the lens of the **National Museum of African Art** which has strategically used historic ivory within exhibitions to inspire dialogue about current policy and conservation challenges.

The special issue journal will be published in January 2018 as a double-issue with open access planned for all articles.

In The Wild, Diversity Determines Ecosystem Production as Much as Climate and Nutrients

Biodiversity is proving to be one of humanity's best defenses against extreme weather and rising temperatures. In past experiments, diversity has fostered healthier, more productive ecosystems, such as shoreline vegetation that guards against hurricanes. However, many experts doubted whether these experiments would hold up in the real world. A Smithsonian and University of Michigan study published in a September issue of Nature offers a decisive answer: biodiversity's power in the wild does not match that predicted by experiments—it surpasses it, in some cases topping even the effects of climate.

A school of grunts explores a shallow reef at Carrie Bow Cay, Belize, one of Smithsonian MarineGEO's long-term research sites. Biodiversity not only can make sites beautiful but can also help boost their biomass and make them more productive. Credit: Ross Whippo/SERC

"Biodiversity is not just a pretty face," said Emmett Duffy, lead author and marine ecologist. Duffy directs the Smithsonian's **Marine Global Earth Observatory** (MarineGEO), an international network of sites that track biodiversity in coastal ecosystems around the world. "Protecting it is important for keeping the ecosystems working for us, providing food, absorbing waste, and protecting shorelines."

In the past, ecologists primarily tested biodiversity's impact through carefully controlled experiments: planting one or several species in plots while ensuring everything else remained the same, and observing which plots grew best. However, those experiments in many ways do not mimic reality. In this study, biologists synthesized data from 67 observational studies of nature in the field, covering grasslands, forests, freshwater environments, and marine environments. The studies spanned all seven continents and contained data from over 600,000 sampling locations around the world.

In every type of ecosystem the team analyzed, biodiversity went hand-in-hand with more flourishing ecosystems. More diverse systems had higher biomass, and the effect was stronger in natural studies than has been predicted from controlled experiments. This connection held true even after the team controlled for other environmental factors, such as temperature and nutrients. More strikingly, in nature biodiversity topped climate as the most powerful predictor of biomass production in roughly half the studies, and it topped nutrients in two-thirds of them.

MARINE COSTAL SPECIES HITCH A RIDE ACROSS THE PACIFIC FOLLOWING TSUNAMI

The 2011 Japanese tsunami set the stage for something unprecedented. For the first time in recorded history, scientists have detected entire communities of coastal species crossing the ocean by floating on makeshift rafts. Nearly 300 species have appeared on the shores of Hawaii and the U.S. West Coast attached to tsunami debris, as reported by marine biologists from the **Smithsonian Environmental Research Center**, Williams College, and other institutions. Their work was featured in the journal *Science* in September.

Examples of species rafted to the U.S. on tsunami debris. Left: Mediterranean mussels, barnacles and sea anemones in found Long Beach, Washington, in February 2017. Credit: Nancy Treneman. Right: Marine sea slugs washed ashore in Oregon in April 2015. Credit: John Chapman.

The tsunami occurred on March 11, 2011, triggered by an earthquake of 9.0 moment magnitude that struck Japan the same day. At its highest point, the tsunami towered 125 feet over Japan's Tōhoku coast and swept millions of objects out to sea, from small pieces of plastic to fishing boats and docks. These types of objects, scientists said, helped the species attached to them complete the transoceanic journey.

"I didn't think that most of these coastal organisms could survive at sea for long periods of time," said Greg Ruiz, a co-author and marine biologist at the **Smithsonian Environmental Research Center**. "But in many ways, they just haven't had much opportunity in the past. Now, plastic can combine with tsunami and storm events to create that opportunity on a large scale."

Scientists began finding tsunami debris washing up in Hawaii and western North America in 2012, with living organisms still attached. From 2012 to 2017, they continued to find debris, including buoys, crates, vessels, and docks. In total, they detected 289 living species on tsunami debris originating from Japan, and they suspect there are far more that escaped their notice. While the arrivals have slowed down, they have not stopped. The team was still finding new species when the study period ended in 2017.

The increase in marine plastics and other more durable debris also made survival easier, according to the researchers. Much of the debris the scientists found rafted ashore was made of fiberglass or other plastic materials that do not decompose and could easily survive six or more years at sea.

"There's an increasing load of plastic and microplastics at sea that are thought to have significant consequences for biology and ecology," Ruiz said. "This is one other dimension and consequence of plastics and manmade material that deserves attention."

SCIENCE AND ART COME TOGETHER AT THE SACKLER GALLERY

The only existing sixth- and seventh-century Chinese lacquer Buddha sculptures have come together for the first time in an exhibition at the **Arthur M. Sackler Gallery**. *Secrets of the Lacquer Buddha* will be on view through June 10, 2018.

Modern technology and scientific analysis have revealed how these extremely rare life-sized Chinese Buddha sculptures were created and what they are made of. These new insights offer a deeper historical understanding of the three Buddha sculptures: one from the Freer Gallery of Art, one from the Walters Art Museum in Baltimore and one from the Metropolitan Museum of Art in New York City. The exhibition explores the methods and ancient process of making sculptures in lacquer, a resin from native trees of northeast Asia.

The above sculptures are both called Buddha; China, Tang dynasty (618–907), early 7th century. Both are hollow-core lacquer with pigment and gilding. The sculpture on the left is part of the collection of the Freer Endowment. The sculpture on the right is part of the collection at The Metropolitan Museum of Art.

Highlighting the impact science has on understanding art, *Secrets of the Lacquer Buddha* identifies the materials used in the creation of these centuries-old sculptures. The complex and time-consuming process began with a core made of wood or clay covered with cloth strips wet with lacquer and thickened with materials such as oils, blood, and burnt bone.

The layers of strips and lacquer created a three-dimensional surface. Each layer of lacquer was dried through a complex process, requiring it to set before the next coating was applied. The sculpture was painted bright colors to give a lifelike appearance, and gold leaf was added to resemble glowing skin. These details and other hidden features were revealed through sophisticated conservation techniques.

“We thought that such sculptures were expensive and fragile; through scientific analysis, we have confirmed this,” said Donna Strahan, the **Freer|Sackler’s** head of conservation and scientific research. “We found the methods used to make them were much more complicated than those used to create utilitarian lacquer objects.”

The **Freer|Sackler's** Department of Conservation and Scientific Research used specialized equipment and new methods to analyze the sculptures, exposing microscopic details. X-radiography and computerized tomography scans explored details hidden to the human eye. X-ray fluorescence analysis analyzed the eyes, and a scanning electron microscope was used to study bone particles mixed into the lacquer. Newly developed methods were used to study unusual organic materials in the lacquer layers. With each method, insights were gained that open up a new understanding of the lacquer process used in sixth- and seventh-century China. This technology allows visitors to peer into the science behind the art of ancient lacquer.