

**PAST
PRESENT
FUTURE**



PALEONTOLOGICAL
RESEARCH INSTITUTION

ANNUAL REPORT FY19

Founded • in • 1932, • the
Paleontological • Research
Institution • pursues • and
integrates • education • and
research, • and • interprets
the • history • and • systems



of • the • Earth • and • its • life.
Our • aim • is • to • increase
knowledge, • educate • society,
and • encourage • wise
stewardship • of • the • Earth.



**PALEONTOLOGICAL
RESEARCH INSTITUTION**

Annual Report

FISCAL YEAR 2019

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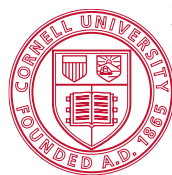
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Cornell University Affiliations

Since signing a formal affiliation agreement in 2004 the Paleontological Research Institution (PRI) and Cornell University have continuously strengthened their working relationship.

Teaching and Research

PRI is a significant teaching resource for several Cornell programs and departments at both the undergraduate and graduate levels. In addition, a number of Cornell courses require students to participate in exercises and training at the Museum of the Earth. Our collections and facilities are regularly used by Cornell faculty, staff, and, especially, undergraduate and graduate students for both research and teaching.



PRI's Director, Warren D. Allmon, is the Hunter R. Rawlings III Professor of Paleontology in the Department of Earth and Atmospheric Sciences, a position he has held since 2008. Three other staff hold adjunct faculty appointments in the department.

Outreach

PRI continues to contribute to Cornell's historic land-grant mission by facilitating public outreach in collaboration with various faculty and departments of the University, including the Department of Earth and Atmospheric Sciences (EAS). We collaborate on the online New York Climate Change Science Clearinghouse, and are a subcontractor for projects providing for NSF Broader Impacts outreach.

Director's and President's Message

The 2018-19 year at PRI was noteworthy for several reasons.

First, we completed and approved our first-ever formal strategic plan. For the first time in our long history, PRI has a detailed roadmap for our activity over the next five years. The plan was developed through a process that gathered survey responses from nearly 700 people across our several audiences, from scientists and educators around the nation, to teachers and students in Central New York, to visitors to the Museum of the Earth and Cayuga Nature Center in Ithaca, as well as detailed input from Board, staff, volunteers, and donors.

The resulting plan builds on PRI's historic strengths: a collection of more than 7 million specimens (one of the 10 largest in the U.S.), research and teaching by our scientific staff, our well-respected publications program, and our educational outreach, which ranges from exhibits and programs at our two public venues to teacher professional development across the country. We identified four main goals: 1) invest in our future, securing the financial resources and infrastructure that will ensure PRI's operational sustainability; 2) build national leadership, including greatly expanding our online educational presence, expanding research in the new field of conservation paleobiology (see page 9), accelerating physical curation and digitization of our specimen collection, and reorganizing and making more available our enormous research library; 3) build our capacity, by addressing deferred maintenance on our buildings, improving the effectiveness of our 30+ full-time staff, and strengthening Board governance; and 4) serve our local community of Ithaca, Tompkins County, and Central New York, by improving education programs and exhibits at the Museum of the Earth and the Cayuga Nature Center. The complete plan is available at www.priweb.org/pristrategicplan.

This year we also continued to make significant progress on a number of projects and programs that we already knew were strategic priorities. We opened two major and very popular temporary exhibits at the Museum, and opened a new permanent aquarium exhibit on "Cayuga Lake Past and Present" at the Nature Center. Our scientific staff and affiliated students at Cornell University published new cutting-edge research on conservation paleobiology, macroevolution, and Earth science education. Our specimen collection continued to grow, and we digitized almost 100,000 more specimens to make them available on-line. Our climate change education materials reached 49,593 teachers in 4,173 schools working with over two million students.

For 87 years, PRI has studied the past to inform the future. Institutionally and scientifically, we look back in order to look forward.

Director Warren Allmon (left) with incoming Board President Beth Mielbrecht and outgoing Board President Brian Bauer in the new John Wells Rare Books Room in the PRI Library.



7 million specimens.

PRI's collections rank among the **10** largest invertebrate paleontological collections in the United States, including nearly **13,000** stratigraphic "bulk" samples which provide a unique resource for scientific research, teaching, and exhibitions around the world.

Approximately **172,000** new specimens were accessioned into the research collection in FY 2019.

2.5 million people reached.

Teacher-Friendly Guides reached **30,000** teachers with a combination of books and CDs mailed to their schools, and another **4,000** downloaded copies.

Combined, these teachers touch the lives of over **2,000,000** students.

35,000 hours of education.

Over **13,500** education participants through in-person programming including about **9,250** in education programs and **4,300** at offsite events, totalling around **10,000** education program contact hours.

Our Summer Camp had **657** camper-weeks with over **20,000** Summer Camp contact hours.

Over **200** college students instructed, totalling over **5,000** contact hours through the academic courses taught by PRI Staff.

Reaching around **1,500** participants at national conferences and teacher workshops indirectly reaching approximately **90,000** students through the teachers that attend.

Over **400,000** website visits, about half of which are visitors to our *Teacher-Friendly Guides* and substantial numbers of people visiting the Digital Atlas of Ancient Life.

3,700 pre-K to college student groups in **180** programs through the Museum of the Earth, including **808** first graders through the Kids Discover the Trail programs.

Today, natural history collections like PRI's play a vital role in our understanding of biodiversity, evolution, and the environmental impacts of climate change—information that profoundly affects all of our lives.

Collections Growth

PRI's collections rank among the 10 largest invertebrate paleontological collections in the United States and are the intellectual core of the Institution. Over 7 million specimens and nearly 13,000 stratigraphic “bulk” samples provide a unique resource for scientific research, teaching, and exhibitions across the country and around the world. PRI's collection continued to grow throughout fiscal year 2019. Thirty-four donations, containing approximately 172,000 specimens, were accessioned into the research collection. These specimens ranged in geologic age from the Silurian (about 443 to 419 million years ago) to today, and locations from Central New York to Europe and Southeast Asia.

Collections Usage

This past year, 30 scientific loans of specimens in PRI's collection were made to researchers from around the U.S. and the world. Visitors came from five states and one foreign country to visit PRI's collections during FY 2019. PRI's collections were also cited in at least eight professional and student publications in the past year. PRI specimens are also often used in creating exhibitions and for public outreach purposes.

Specimen Digitization

Digitization—the process of creating or converting collections information into a digital form—is essential to make PRI's collections more available and therefore more relevant and valuable to today's scientific and educational communities. The 2019 fiscal year saw significant progress in specimen digitization, especially an ongoing NSF-funded project dubbed the “Eastern Pacific Invertebrate Communities of the Cenozoic” (EPICC). This project has ten partner institutions, led by University of California Berkeley. Each institution is cataloging, georeferencing, and photographing the Cenozoic invertebrate fossils from the west coast of the Americas, from Alaska to Chile. The goal of the EPICC project is to make 1.6 million specimen records available to the public through data aggregators such as iDigBio (www.idigbio.org). In FY 2019, for the EPICC project, we cataloged nearly 65,000 specimens, took over 3,760 specimen photographs, and georeferenced 500 localities.

Collections volunteers and interns as well as undergraduate and graduate students have played a vital role in the success of the EPICC project. They have helped us check taxonomy, research and georeference localities, and take photographs of specimens. Briana DiMarco, a Drexel University student interning in collections, spent many hours learning to photograph specimens for the EPICC grant project.



Briana DiMarco

Drexel University allows their students to choose a six-month program to work and gain experience in their preferred field. Because DiMarco chose to come to PRI she was able to encounter a wide range of job opportunities. These came in the form of photographing specimens for the collections team, reconstructing a fossil snail database for the PRI director, and volunteering to educate and interact with the public at the horseshoe crab touch tank in the museum. All three of these jobs amplified her previously-learned skills as well as exposed her to new ones.

She had this to say about her experience “Photographing specimens was a relatively novel ability that I had only dabbled in briefly...but it required a great amount of precision and an eye for detail. Working in the collections workroom also showed me how much labor occurs behind the scenes.”

“This focus-on-detail mentality also bled into the database research because the job required me to read through hundreds of papers mentioning *Turritella* snails. If I missed any brief mention of a species...the database would not be as extensive as required for other researchers to utilize it as a taxonomic resource.” She added, “This co-op/internship at PRI gave me more responsibility within the workplace. I will be able to take not only the technical skills, but also the life lessons I learned, and apply them to any work environment I may encounter in the future.”



Warren Allmon gives a tour of the Collections Department to Cornell students.



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Achatinella land snails collected by Wesley Newcomb in the 19th century, along with a paper published about his specimens, and a period map of Hawaii.

4. *Achatinella* splend
minata, solida

Cornell University Malacology Collection finds new home at PRI

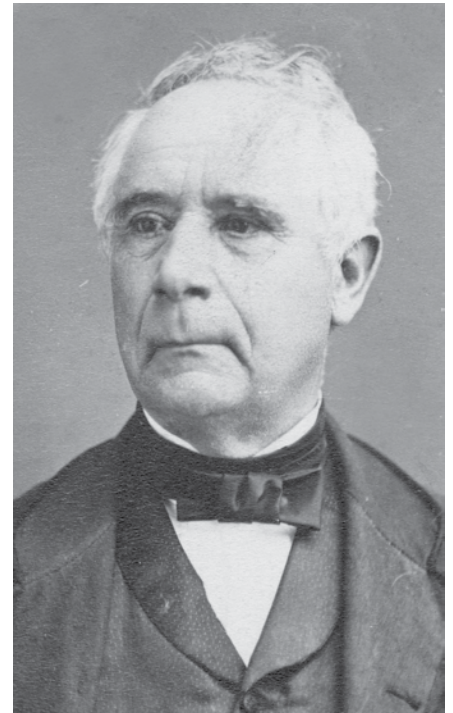
The Cornell University (CU) Malacology Collection consists of approximately 69,000 specimens of modern land, freshwater, and marine mollusks from around the world. The core of the collection are specimens collected in the 19th century by Wesley Newcomb (1818-1892). Newcomb trained as a physician but collected mollusks throughout his adult life. He described 126 mollusk species, including many Hawaiian tree snail species in the genus *Achatinella* that were collected in the 1850s. These species are now extinct or endangered because of changes to their habitats and the impacts of invasive predators. The Newcomb collection was purchased by Ezra Cornell in 1868 and was thought to be one of the most complete shell collections in North America at that time.

In the 1930s, the CU Malacology Collection was moved from Cornell's Paleontological Museum (which was disbanded) and stored until 1953, when Arthur Soper and Arthur C. Clarke re-curated the collection. It was soon stored away and forgotten again until the early 1980s when it came to the attention of personnel in Cornell's Section of Ecology and Systematics and was unpacked. The last acquisition to the CU Malacology Collection was a donation in 1995 by Julian Smith, a Cornell professor of chemical engineering and amateur malacologist, who focused his collecting on land and freshwater snails from Tompkins County in Central New York. His collection, which was made between 1952 and 1992, includes more than 2,000 specimens representing around 200 species.

In 1995, the entire CU Malacology Collection was moved to PRI, which provided storage space while Cornell personnel inventoried and organized the shells separately from the PRI modern mollusk collection. In 2008, a Memorandum of Understanding was signed by Cornell and PRI, which detailed the conditions of a permanent loan of the collection to PRI. Under the arrangement, Cornell retained ownership of the collection, while PRI formally took over the day-to-day management and care of the collection. The collection, however, still could not be digitized and made available online. Recognizing that the collection would be most useful if it was digitized, Cornell formally transferred ownership of the CU Malacology Collection to PRI in 2018.

PRI collections staff have worked over the past year to come up with a plan to integrate the former CU collection with its own modern mollusk collection. The expected benefit of this planned project is increasing the discoverability and accessibility of the CU Malacology Collection at PRI.

With the completion of this project, the 69,000 specimens and their associated records in the collection will be upgraded to the highest curatorial standards, enhanced with new information (e.g., georeferenced localities, updated taxonomy and images of historic original labels), physically integrated with PRI's existing modern mollusk collection, and made accessible online via a searchable database to researchers, students, and educators worldwide.



Dr. Wesley Newcomb

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Since its founding in 1932, research has been a fundamental part of PRI's institutional activity and identity. Today, PRI staff and affiliated students from Cornell pursue primary research in a variety of areas related to the history of life, including how to use paleontological information to address contemporary environmental challenges.

Evolution and Paleobiology

PRI is home to one of the largest collections of fossil mollusks (clams, snails cephalopods, and their kin) in the U.S., and research on the evolution of these groups has always been one of PRI's core scientific strengths. Today, PRI staff and students are engaged in cutting-edge studies of these abundant fossils, from discovering the history of biodiversity of marine life in the ancient Caribbean, to using both genes and fossils to reconstruct the evolutionary history of marine snails, to exploring what the shape of their fossil shells tells us about how the evolutionary process works. This research increases our knowledge of the history of the diversity of life and the evolutionary processes that have produced that diversity.

PRI Research Assistant Jaleigh Pier working with oyster samples.



Conservation Paleobiology

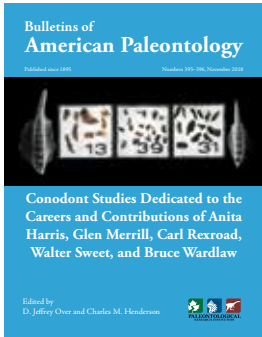
Conservation Paleobiology is a rapidly developing subfield of paleontology that uses information from the fossil record to inform future conservation decisions. Gregory Dietl, PRI's Director of Collections and Curator of Cenozoic Invertebrates, is among the leaders in this field.

Research highlights in Fiscal 2019 included work on the HOBS (historical oyster body size) project. Long-term data on patterns of oyster reef health over time are critical for effective restoration. Unfortunately, data on past reef health are not available for many of Florida's estuaries. PRI scientists have teamed up with the Florida Department of Environmental Protection to establish otherwise unavailable baselines for oyster reef health using records from the past. Decision makers will use these data to help select focal areas where restoration efforts are most needed.

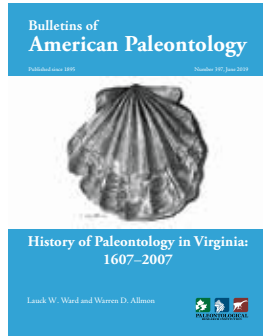


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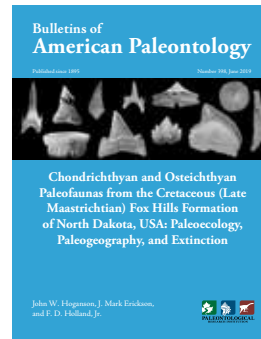
The Paleontological Research Institution has been a publisher since its founding. Its in-house technical journal, *Bulletins of American Paleontology* (BAP), has been printed continuously since 1895. BAP provides an important outlet for monographic-length research in paleontology. Three issues of BAP were published during the past year.



Conodont studies dedicated to the careers and contributions of Anita Harris, Glen Merrill, Carl Rexroad, Walter Sweet, and Bruce Wardlaw. Edited by D. Jeffrey Over and Charles M. Henderson (BAP 395-396).



History of paleontology in Virginia: 1607-2007. By Lauck W. Ward and Warren D. Allmon (BAP 397).



Chondrichthyan and osteichthyan paleofaunas from the Cretaceous (Late Maastrichtian) Fox Hills Formation of North Dakota, USA: Paleoecology, Paleogeography, and Extinctions. By John W. Hoganson, J. Mark Erickson, and F. D. Holland, Jr. (BAP 398).

Earth@Home to bring together resources



In order to continue to grow our existing prominence as a national leader in Earth science education, as well as to expand our online reach, PRI is working on creating a novel web platform called Earth@Home.

Our goal is for this platform to become a quality go-to source for information about earth science and climate change. Visitors will have the opportunity to learn about the geological history and fossil record of the place where they live, as well as the reasons for its modern climate, topography, soils, mineral and energy resources, and natural hazards.

Earth@Home will integrate decades of PRI outreach content—ranging from our *Teacher-Friendly Guide™* series to our books on evolution and climate change—and combine it with a comprehensive Earth science textbook, which will build upon the success of our current Digital Encyclopedia of Ancient Life. All of these products will be open access. A project of this size and scope is possible at PRI because we already have much of the resources in-house. The Earth@Home project will update existing content, develop new material, and push to introduce the Earth sciences to new audiences.

Andy and Yu Kai's dreams come true

We came to PRI from Wesleyan University in Middletown, Connecticut, where we are student curators at the Joe Webb Peoples Museum of Natural History. We are avid collectors with a special fondness for seashells and other marine invertebrates.

We spent a significant part of our internship at PRI during the summer of 2019 curating a collection of recent shells donated by Dr. William Zinsmeister, who was a paleontology professor at Purdue University. The collection is made up of over 10,000 modern mollusk specimens amassed from varied sources—everything from purchased specimens to those that were collected by Zinsmeister himself during his travels. Zinsmeister used these specimens for the paleontology courses that he taught. Through verifying information on the labels associated with each specimen lot, we soon realized that there was much to be learned about esoteric and often eccentric collection practices of collectors. Each collector would have an individualistic set of fieldnote-taking and specimen-annotating styles, making the documentations associated with the specimens an intriguing collection in themselves.

The most mesmerizing aspect of being in the collections is that no matter how many wondrous hours you have spent wandering through the hallways, some surprising treasure always lurks in a drawer you peek into—a treasure that ought to be looked at by more pairs of eyes.

We turned that thought into a project assembling a temporary exhibition in the Museum of the Earth on the importance of amassing vast collections of what may seem to many as holiday souvenirs that are a dime a dozen—seashells. Our assembly of the Zinsmeister recent mollusk taxonomic exhibit was to break the fourth



Andy Tan and Yu Kai Tan in front of the Museum of the Earth

wall—by explaining the human aspect of creating such exhibits, as well as showing the faces and labor of the folks who toiled to execute it. To us, the most illuminating part was collaborating with different museum professionals to create content that balanced factual accuracy with easy accessibility for a wide range of viewers.

We had a wonderful summer at the PRI, not just with the awesome collections but also with the amazing people we met—from getting insects we found around Ithaca identified by Brian Gollands, PRI's entomologist and IT Manager, to fun discussions during the weekly Friday reading groups, to learning fossil prep while getting our own specimen scanned using 3D-photogrammetry. Nor can we forget the endless conversations with volunteer Bill Klose while working with the coral collection...just a few examples of the many marvelous experiences we had.

Having grown up in a country (Malaysia) where Creationism is prevalent, and resources in the sciences are meagre, natural history collections have always been inaccessible to us. We could only dream

about learning about or handling the seemingly far-away and untouchable animal, vegetable and mineral world. Coming to the States and interning at PRI has been more than a dream come true and is definitely an invaluable experience in making informed decisions in the direction we intend to take in academia. Thank you, PRI!



Their Zinsmeister recent mollusk taxonomy exhibit.

PRI provides local, regional, and national educational outreach by offering programming, publications, and resources to school teachers, science educators, and the general public, both as a primary source and as part of partnerships with other institutions.

Teacher Professional Development

By reaching teachers we reach their students, increasing our impact many fold. Teacher professional development has been a focus of PRI's educational programming for over two decades. We help teachers teach societally significant topics such as climate change and energy use and place-based approaches to Earth systems generally. Workshops seek to engage participants as collaborators and to foster active discussions about topics such as what good teaching looks like, how to use technology in teaching, how to integrate the Next Generation Science Standards, and how to organize teaching through the lens of a small number of cross-cutting big ideas.

Among our many workshops in FY 2019, some of the highlights included the following:

- PRI worked in collaboration with New York Sea Grant to offer a 3-day climate change workshop at Stuyvesant High School in New York City and the Cornell Tech campus on Roosevelt Island.
- We provided a two-day professional development program for teachers in Maryland's Prince George's County School District focused on the *Teacher-Friendly Guide™ to Climate Change*. The district has 22 high schools and 142,000 students.
- At the American Museum of Natural History (AMNH), we led workshops for Earth science teacher candidates in AMNH's Masters of Arts in Teaching program. These programs focused on virtual fieldwork experience development and use with special attention to critical zone science. AMNH's teacher education program is one of the largest producers of certified Earth science teachers in the country.



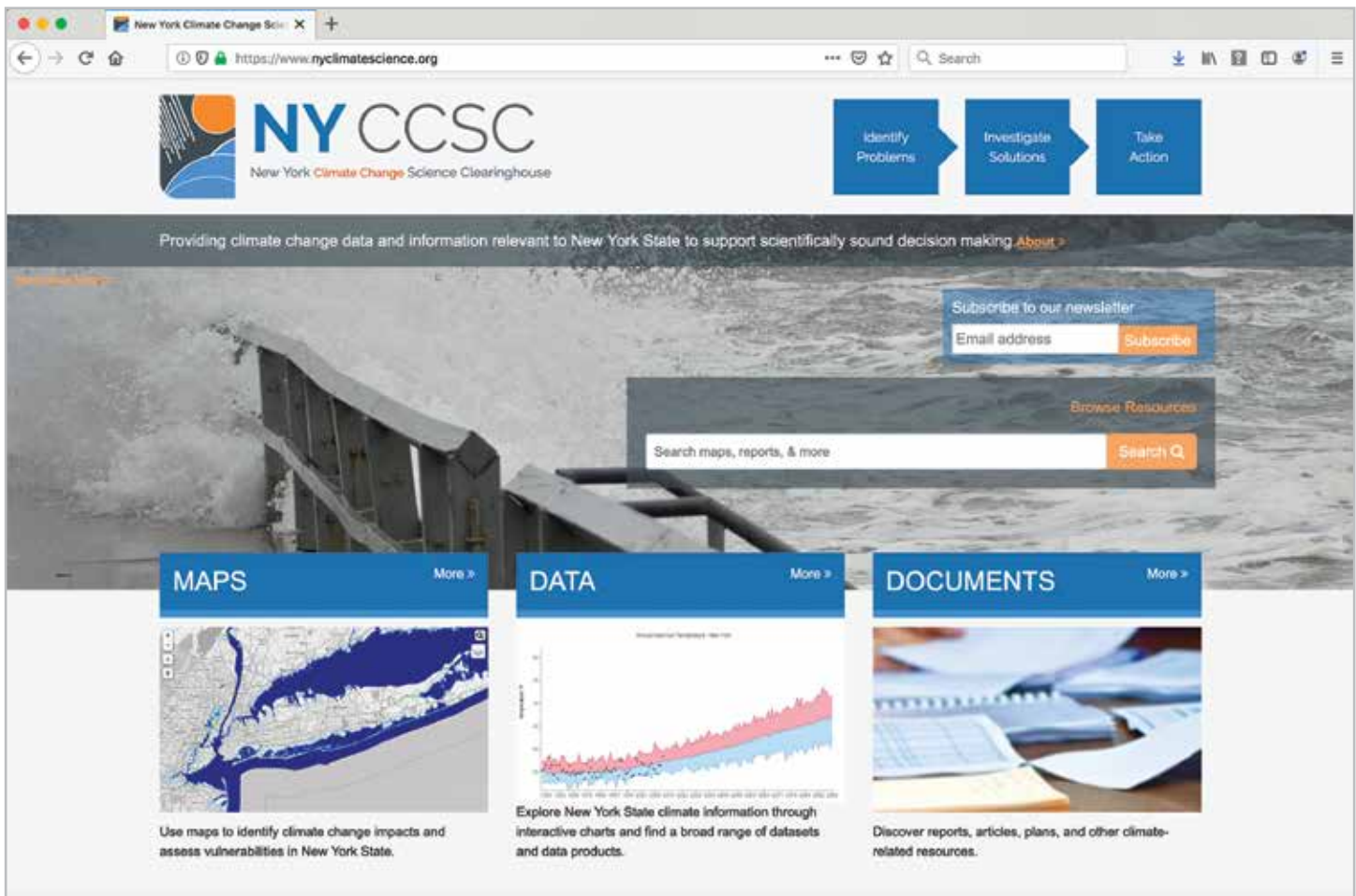
High school student participants in the Western New York Youth Climate Summit in Buffalo, New York in June, 2019.

- We provided workshops for the New York State Master Teacher Program, which provides professional development for New York's top teachers. We gave workshops on evolution and diversity using the Museum of the Earth's special exhibits, and provided day-long workshops, with Mike Hubenthal from IRIS, for Binghamton-area Master Teachers. We also worked with the Western New York Master Teachers as they prepared for the Third Annual Western New York Youth Climate Action Summit in June 2019.
- We gave workshops at science teacher conferences such as the National Science Teachers Association national meeting and Science Teacher of New York State annual meeting.

Climate Clearinghouses

Municipal offices and many others need high quality climate data and model predictions for their own area for planning purposes. PRI's staff provide this service through curating two clearinghouses for climate change science information: the New York Climate Change Science Clearinghouse (<https://www.nyclimatescience.org>) and ResilientMA, Climate Change Clearinghouse for the Commonwealth of Massachusetts (<http://resilientma.org>). Both sites focus mainly on adaptation and resilience to climate change, and they are portals to data, maps, documents, decision support tools, plans, case studies, videos, and more.

Several of PRI's outreach staff are active members of the Climate Literacy and Energy Awareness Network (CLEAN), the group responsible for the national Climate Literacy Principles that have been cited in several federal educational initiatives and requests for proposals in an array of grant programs.



New York Climate Change Science Clearinghouse website

Climate Change Education

Teach Climate Science is PRI's initiative to support teachers nationwide in teaching about climate change.

The Teacher-Friendly Guide™ to Climate Change



A Master Teacher with her copy of The Teacher-Friendly Guide™ to Climate Change.

In 2017, we published *The Teacher-Friendly Guide™ to Climate Change* (TFG-CC), a book written by PRI staff with input from IPCC lead authors and leading climate scientists. *The Teacher-Friendly Guide™ to Climate Change* is written for middle and high school teachers—and anyone—who could benefit from a “teacher-friendly” resource that includes both the basics of climate change science and perspectives on teaching a subject that has become socially and politically polarized.

With our book just a few months away from publication in the Spring of 2017, we learned that the Heartland Institute—a think tank actively engaged in science denial— was sending a book promoting misleading and false information about climate science to teachers around the country. This motivated us to begin our own campaign to send *The Teacher-Friendly Guide™ to Climate Change* to every public high school science teacher in the United States. We have been crowdfunding and approaching private foundations to support this effort, and are now in the second year of this initiative. Our book and crowdfunding campaign have received national attention from news outlets and organizations such as NPR, Yale Climate Connections, Frontline, the National Science Teachers Association, the National Earth Science Teachers Association, and Sierra Magazine.

To date we have sent the TFG-CC to every public high school science teacher in the states of Idaho, Maine, Vermont, New Hampshire, Connecticut, Rhode Island, North Carolina, South Carolina, Florida, Nevada, and Iowa, along with most teachers in New York and New Jersey. In addition to these mailings, we have distributed books to teachers in another 27 states through meetings, individual contacts, etc., reaching a total of 40,000 teachers.

In September 2018 we created a new publication, our 12-page *Quick Start Guide to the TFG-CC*. Each page of the Quickstart Guide features one essential concept drawn from each of the 12 chapters of the full TFG-CC. The Quickstart Guide is now included with all of our mailings and outreach. The project web site (<https://teachclimatescience.wordpress.com>) contains information about the book and the

campaign to ship books and CDs to high schools across the country; it also contains downloadable PDFs of the book and individual chapters and descriptions of selected classroom activities.

PRI Climate Change Education in NYC

Through a private donation, PRI offered climate change education in New York City, in collaboration with New York Sea Grant (NYSG), which is administered by Cornell University (similar to Cooperative Extension). NYSG and PRI staff used the existing NYC Emergency Management preparedness vehicle, “Go Bags,” to be ready with supplies if the event of extreme weather.

The workshop was part of the New York City Department of Education STEM Institute. The three-day workshop was held at NYC Stuyvesant High School and at Cornell Tech campus on Roosevelt Island. The workshop covered the basics of climate change science, impacts on New York City, mitigation of carbon emissions, resilience to extreme weather hazards associated with climate change, and communicating climate change.



Alexandra Moore helping with sea level rise measurements during a New York City workshop.

PRI Climate Change Education in Our Own Community

At the Cayuga Nature Center, funding from the Park Foundation allowed us to continue to develop and run a variety of climate change education programs. At the 2018 Summer Camp, Ingrid Zabel, our Climate Change Education Manager, ran programs on using green infrastructure to protect buildings from heavy rain, building lemon batteries to help learn about energy storage, planting native plants to help wildlife adapt to change, measuring temperature, and building the campers' understanding of why we have seasons.

We ran activities with middle school-age students together with The Learning Web, a local organization that helps youth explore different careers and volunteer experiences. With New Roots Charter School students we provided outreach for the general public at both of our public venues, such as a “Ask a Scientist about Climate Change and Hurricanes” table during hurricane season at the Museum of the Earth.

PRI is an active member of Western New York Environmental Alliance (WNYEA), an alliance of more than 100 groups and institutions who work to resolve environmental issues in western New York, and PRI staff serve on several of their working committees.

PRI is also a member of the Tompkins County Climate Protection Initiative (TCCPI)—a climate action and clean energy coalition in the Ithaca, New York area made up of community leaders from the education, business, government, nonprofit, and youth sectors.



Teachers making measurements of trees as part of a Teaching Climate Science workshop at the Museum of the Earth.

National and Regional Outreach



Don Haas speaking about the Next Generation Science Standards at a teacher professional development workshop held at Allegheny College.

PRI provides local, regional, and national educational outreach by offering programming, publications, and resources to schools, teachers, and science educators, and by working in partnerships with other institutions. PRI's Education and Outreach staff have been involved in the national development discussion and implementation of the new Next Generation Science Standards.

Nearly all life lives in the Earth's "critical zone"—the outer skin of the Earth, extending from the top of the tree canopy to the base of the groundwater lens. There are nine CZOs that monitor biological, chemical, and geological parameters across a range of ecosystem types. PRI leads the education and outreach effort of the Critical Zone Observatories National Office, established at Cornell University in 2014.

The CZO education and outreach mission is to increase awareness and understanding of Critical Zone science in learners nationwide. PRI staff coordinated the network of outreach providers, worked on virtual fieldwork experiences for several of the CZO sites, disseminated literature about using critical zone science in education, and organized existing education resources on the CZO National Office web site. The Critical Zone Observatories Educational Resources Collection has both nearly doubled in size and seen improvements to the user-interface over the last several months. The collection now boasts 38 resources appropriate to educators in a wide variety of settings.

PRI's Director of Teacher Programs, Don Haas, was President of the National Association of Geoscience Teachers (NAGT) until October 2018, then assumed the role of Past President, while also serving on NAGT's Advocacy and Nominations Committees and acting as a liaison between NAGT and the National Earth Science Teachers Association.

In December 2018, Don began a three-year term on the International Ocean Discovery Program's (formerly, the International Ocean Drilling Program) United States Advisory Committee. He serves in a newly-created *ex officio* position for education and outreach.

National Association of Science Teachers Position Statement

While the National Association of Science Teachers (NSTA) has long had dozens of position papers on many aspects of science education, it did not have a position paper on climate change until September of 2018. PRI's Director of Teacher Programs Don Haas served on the committee that authored the statement and supporting documents released in Fall 2018. *The Teacher-Friendly Guide™ to Climate Change* is noted on the NSTA website as a recommended resource for teachers. The position statement can be found at <https://www.nsta.org/about/positions/climatescience.aspx>.



Teachers learning about horseshoe crabs evolution at a New York State Master Teachers workshop on living fossils at the Museum of the Earth.



PRI Receives Friend of the Planet Award

In June 2019 PRI received the National Center for Science Education's **Friend of the Planet Award**, given to an individual or organization that has made a substantial contribution to climate change education. In making the award NCSE notes PRI's "Invaluable contributions to climate change education, both locally in the Ithaca, New York area, and globally, through your publications," calling *The Teacher-Friendly Guide™ to Climate Change*, "The single best resource on climate change for teachers to be published in the last few years."

Virtual Fieldwork Experiences

PRI is partnering with educators at the University of California Museum of Paleontology to produce Virtual Fieldwork Experiences that allow students to visit classic paleontological field sites along the Pacific coast and explore images and data from specimens that have been collected there—from computers anywhere in the world. You can see the first two VFEs at <https://epiccvfe.berkeley.edu>.

The Kettleman Hills home page from the EPICCC Virtual Field Experiences website focuses on a site in the California coastal mountain range.

Local Educational Outreach



Dr. Carl Brett (University of Cincinnati) (center) and Dr. Gordon Baird (SUNY Fredonia) leading a field trip to local outcrops during PRI's annual Summer Symposium.



Dr. James Lamsdell (West Virginia University) giving the keynote on horseshoe crabs as living fossils during PRI's annual Darwin Days in February, 2019.

PRI runs numerous education and outreach events each year for people in Central New York. Our annual Teacher Resource Day provides thousands of fossils, rocks, and shells for free for teachers to use for educational purposes, along with publications and other materials.

Upstate New York is renowned for the quality and quantity of its invertebrate fossils, and one Saturday of each month June-August, we lead a public fossil collecting field trip to a locality. Fossil collecting can be enjoyed by participants of every age and level of experience, and provides a great opportunity to feel the excitement of discovery.

The famous gorges of the Finger Lakes are ideal outdoor classrooms to learn about the origin of our spectacular landscape. The James Potorti Gorge Walks take place every Friday morning in the month of August. PRI has been offering summer gorge walks for 20 years. They were officially renamed in 2005 to the James Potorti Interpretive Gorge Walks in memory of Ithaca native James E. Potorti, who died in the September 11, 2001 attacks.

Since 2006, Ithaca Darwin Days has been our annual week-long salute to the father of evolutionary biology. Cosponsored with Cornell University, each year we offer public lectures, panel discussions, a science trivia night, films, and a Darwin-themed Family Day. Events are held at the Museum of the Earth, Cornell University, and in downtown Ithaca. Speakers this year included Dr. William Bemis, Cornell University; Dr. Maria A. Gandolfo, Cornell University; Dr. William Crepet, Cornell University; Dr. Elizabeth Hermsen, Paleontological Research Institution; and the keynote speaker Dr. James Lamsdell, from West Virginia University.



Alexandra Moore, PRI Senior Education Associate, on the right, showing teachers a simple experiment they can run in their classrooms to show the effects of carbon dioxide in the atmosphere.

Digital Atlas of Ancient Life



PRI's Digital Atlas of Ancient Life project provides free online resources to help people learn about fossils from particular regions and time periods, and better understand Earth's ancient life. The project is supported by the National Science Foundation and led by Director of Science Communication Jonathan Hendricks. It has three major components:

- 1 Field guides to fossils from particular regions. These are designed to help avocational and professional paleontologists, as well as teachers and their students, identify and learn about their fossil discoveries. Digital Atlases have already been produced for the Ordovician fossils from the Cincinnati region, the Pennsylvanian of the midcontinent United States, and the Neogene of the southeastern United States. A fourth Atlas, which focuses on Cretaceous fossils from the Western Interior Seaway—which divided North American in two during the age of the dinosaurs and covered places like modern Kansas below a shallow ocean—is currently being developed.
- 2 An open access, online “textbook” about ancient life called the Digital Encyclopedia of Ancient Life (DEAL). Most of the content—including the text itself and most of the images—of this new resource has Creative Commons licensing, meaning that educators can use it as they wish with few restrictions. Chapters online now range from overviews of the fossil record and geological time, to pages about ancient snails, cephalopods, corals, and plants.
- 3 An online Virtual Collection of nearly 500 interactive, digital 3D models of fossil specimens that are on exhibit in the Museum of the Earth and stored “behind the scenes” in PRI’s research collections. The Virtual Collection is arranged taxonomically by fossil group, and we expect it will be of interest to teachers (especially who educate online), their students, and others who are interested in prehistoric life. All of the models are also posted on our project Sketchfab page and may be freely downloaded and 3D printed.

You can visit all of them at:
www.digitalatlasofancientlife.org



Hundreds of fossil 3-D images created

Digitization Assistant Emily Hauf, who recently graduated with a bachelor's degree in geology from SUNY Geneseo, has spent the past two summers at PRI developing digital interactive 3D models of fossil specimens from PRI's "behind the scenes" research collections and on display at the Museum of the Earth using a technique called photogrammetry. Photogrammetry involves taking numerous photographs of a single specimen from multiple angles, then using an advanced computer program to convert those photographs into a 3D model. These models may all be freely downloaded, and you can create your own replicas of the original fossils using a 3D printer.

Emily created nearly 470 of these 3D models and they are now being integrated into Virtual Collections as part of the Digital Atlas of Ancient Life project (<https://www.digitalatlasofancientlife.org/vc/>). Representatives of nearly all major taxonomic groups have been scanned and are now online, providing broad coverage across the tree of life. We expect that these models will be of interest to educators because they provide a novel means to share exceptional fossil specimens with their students in an interactive and engaging way. The models will also be of use to students as a means to study the details of fossils (which can be labeled using digital annotations) outside of classroom settings.



PAST
PRESENT
FUTURE

Museum of the Earth

PRI's award-winning Museum of the Earth provides meaningful learning experiences about the rich history of the Earth and its life. The Museum appeals to a wide range of audiences, from local students and their families to visitors from around the world.

The Museum hosts a variety of special events each year to provide engaging educational experiences. These include Darwin Family Day, Fossil ID Days, Museum in the Dark, the History of Life lecture series, and the annual Summer Symposium. The Museum hosts public educational hands-on programs during local Winter, Spring, and Summer school recesses, and PRI's Fossil Mania in observation of National Fossil Day in October.

Programs are geared to groups of many different backgrounds—from young children to older adults and educators. The Museum of the Earth is a participant in the local annual teacher appreciation week Ithaca Loves Teachers, providing special programming and discounts for dozens of area teachers. PRI continues to expand its Community Accessibility Program, which was created to ensure that Earth science and environmental education are available to everyone regardless of resources or special needs. Opportunities include the Young Naturalists Accessibility Program (YNAP), Museums for All, Winter Free Days, Community Day, and human service agencies group memberships.

From the very beginning of life on Earth, to the flora and fauna of your backyard, the Museum, along with its sister venues Cayuga Nature Center and Smith Woods, tells the story of life on Earth and the value in preserving and protecting it.



The Museum hosted two special exhibits in FY19: “Secrets of the Skull: From Titanoboa to Tuatara” and “Survivors: Up Close with Living Fossils”.

The Survivors exhibit included live animals from the Cayuga Nature Center that gave museum visitors a chance to get up close to real examples of living fossils. In addition, a new touch tank contained live horseshoe crabs and sea stars. Visitors could also touch species of plants that had existed for hundreds of millions of years relatively unchanged. All of these were paired with fossils of early examples of the species, along with information about evolution, species adaptability, and conservation.

Left: Volunteers staffing the Survivors: Up Close with Living Fossils exhibit's touch tank allowed visitors to get up close and personal with live horseshoe crabs and sea stars at the Survivors exhibit.

Below: Andrielle Swaby, PRI Evolution Education Manager, leads a tour of the Survivors exhibit.





*Above: The 44-foot long Right Whale #2030 skeleton that hangs above the Borg Warner Gallery.
Below: Visitors enjoying the Survivors: Up Close with Living Fossils exhibit.*



“Kids Discover the Trail!” at the Museum

As a member of Ithaca’s Discovery Trail, the Museum takes part in their **Kids Discover the Trail!** program. Each year the Museum provides fun, hands-on educational programming for every 1st grade class in the Ithaca, Trumansburg, Groton, Newfield, Lansing, and Dryden, New York School Districts. Through this program, nearly 800 1st grade students participated in custom-designed programs at the Museum during FY 2019. The programs use hands-on activities to help the children explore Earth science concepts and discover how scientists work, in addition to helping their teachers meet curricular goals and learning standards.

In addition to Kids Discover the Trail the Museum welcomed many other K-12 classrooms, and our educators conducted programs that build upon the Museum’s exhibits and core concepts such as local Devonian fossils, dinosaurs, coral reefs, and glaciers. In all, over 4,300 students participated in over 200 programs during FY 2019.





Education staff members and volunteer docents work with the teachers in Tompkins County, New York, to bring the history of the Earth to life for first grade students through activities that teach about how rocks form, how fossils are created, and how paleontologists work.



Cayuga Nature Center

PRI's Cayuga Nature Center cultivates awareness, appreciation, and responsibility for the natural world through outdoor and environmental education. The live animal ambassadors, interpretive exhibits, and miles of trails through 120 acres of woods, open fields and gorges build knowledge, spark curiosity, and stimulate awareness of the importance of conservation.

The Nature Center is critical to PRI's goal to create premier educational resources for teaching and learning about evolution and the impact of climate change on the fauna and flora of Central New York. Each year thousands of people are reached through public programs, school programs, and camps. The Nature Center hosts 800 Tompkins County 5th graders each year who participate in the Center's outdoor and animal educational program as part of the Kids Discover the Trail! Program.



The new roadside sign for the Cayuga Nature Center. A row of solar panels along the top powers the nighttime illumination. Local blacksmith, Durand Van Doren, created the plant and animal silhouettes in iron that encircle the center panel.



Staff member Natalee Wrege pointing out the fish native to Cayuga Lake to visitors to our "Cayuga Lake: Past and Present" aquariums.

The Cayuga Nature Center also provides an opportunity to monitor our own local environment and provide public outreach. Examples include digital weather data, growth and budding of selected trees; and lists of species on the property. We are in the process of planning for monitoring the chemistry of the air, stream, and vegetation at the site.

Tree species including northern white cedar, red oak, winterberry, silky dogwood, and sand cherry were planted during this past year to help with erosion near the stream banks on the property.

Several of the Nature Center's live Animal Ambassadors were critical components of the "Survivors: Up Close With Living Fossils" exhibit at Museum of the Earth. Snakes, tortoises, cockroaches, and scorpions were incorporated into the exhibit to help visitors' understanding the adaptations and characteristics that make some organisms "living fossils." During the Survivor's exhibit Nature Center staff also cared for aquariums with spotted gar

and a young sturgeon, as well as maintaining a touch tank with live horseshoe crabs and sea stars.

In March the Nature Center hosted another outstanding Maple Fest. Visitors enjoyed maple syrup making demonstrations, tours of the Center's Maple Trail, vendors, live music, and programs.



One of our volunteer animal caretakers with Ichabod the Turkey Vulture.



Runners competing during our annual Fox Trot 5K Trail Run.



Visitors during our annual Maple Fest learn about the process of making maple syrup in our Sugar Shack, and learn about maple trees and the effect of climate change on forests with Cornell professor emeritus Dr. Brian Chabot.

Cayuga Nature Center's Summer Camp



The Cayuga Nature Center Summer Camp provides environmental and outdoor education experiences for over 400 campers each season ranging in age from 3 to 16 years old, many of whom return to the camp year after year, in part because of the high quality of the experience and our veteran staff.

Nature Center camp staff and educators excel at bringing to life the camp curriculum, which offers a wide variety of enriching educational experiences. Where the educators truly shine is in utilizing the outdoors as a platform to engage campers in meaningful experiences suited to a multitude of different learning styles. For many of the campers, finding success in learning not only builds their knowledge of the natural world, but also helps them build confidence during their time at camp.

Our programming combines hands-on activities, guided outdoor exploration, and educational game-play. The curriculum benefits greatly from the skilled and knowledgeable educators who work with us each year, including PRI staff who come in as guest

speakers. Specialized educators talked with campers about topics ranging from Native American artifacts to insects to the formation of the gorge on the Nature Center property.



The Young Naturalist Access Program (YNAP) provides youth in need (aged 5 - 17) free access to either a week of summer camp at Cayuga Nature Center and a one-year YNAP Youth Membership to the PRI and both of our public educational venues. YNAP provides young people and their families/caregivers all of the benefits of a regular PRI membership plus free access to all of our ticketed events, such as Maple Fest and local Fossil Field Trips. This year, YNAP scholarships covered the cost of an Explorer week for 99 campers.



Smith Woods

Henry A. Smith Woods is a 32-acre old-growth forest located just outside of Trumansburg, New York. It is one of the largest remaining flat tracts of old-growth forest in Central New York. This small but spectacular place, with its enormous trees, dense forest canopy, and never-plowed ground, is a glimpse into the past. A walk through this small forested area may be the closest one can get in the region to experiencing a landscape that European settlers first witnessed. Old-growth forests are important both ecologically and culturally, providing a unique habitat and embodying local history. Sadly, these forests have declined every year since European settlement of the continent. According to the Old Growth Forest Network, only 1% of original forests in the Northeast US remain. Most Americans will never get to see an old-growth forest.

Named for the its last owner, Henry Atterbury Smith (1822-1891) this undeveloped forest fragment was left to the Village of Trumansburg in 1909 to be preserved as a public park forever. The purpose of the park is “the preservation of the park in its natural state and for educational and recreational purposes”.

In 2007, ownership of this forest was transferred to Cayuga Nature Center, and PRI has committed itself to preserving the integrity of the forest in keeping with the original intent of the trust. The educational mission of the park is continued by PRI through school visits and public hikes. Smith Woods is also open to the public year round.

In 2017, PRI installed fencing around the entire perimeter of the forest. Smith Woods, like many forested areas, had seen a stripping away of its undergrowth because of the rapid rise in local deer populations. Within the first year the undergrowth sprang back with a new life, helping to preserve the unique character of this old-growth forest for future generations. During this past year we added an additional two feet to the top of the existing fence, bringing the total height to eight feet, to further discourage deer encroachment.



Trustees & Staff

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Jennifer Biloski
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Ann Budd
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Kaitlyn Bagnall-Newman, Environmental Education Manager
Maureen Bickley, Museum Education Manager
Helaina Blume, Director of Exhibitions
Patrick Branigan, Visitor Services & Volunteer Coordinator
Kelsey Brewster, Assistant Camp Director
Maija Cantori, Director of Visitor Services
Gregory Dietl, Director of Collections & Curator of Cenozoic
Invertebrates
David Fass, Membership & Website Manager
Dana Friend, Postdoctoral Fellow
Rebecca Gray, Visitor Services Associate
Heather Delaney, Visitor Services Associate
Tiffany Garwol, Facility Rentals & Visitor Services Coordinator
Brian Gollands, IT Manager/Web Developer
Michael Griswold, Facilities Manager
John Gurche, Artist-in-Residence
Ryan Hamilton, Temporary Animal Staff
Don Haas, Director of Teacher Programming
Jim Harper, Manager of Marketing & Communications
Jonathan Hendricks, Director of Publications
Elizabeth Hermsen, Research Scientist
Helena Hauck de Oliveira, Temporary Animal Staff
Dayna Jorgenson, Director of Nature Center Programs
Viola Jones, Visitor Services Associate
Cheyenne Lee, Temporary Animal Staff
Georgia Lesh, Associate Director for Philanthropy
Beth Anne McGrogan, Visitor Services Associate
Pam Millar, Membership & Finance Associate
Alexandra Moore, Senior Education Associate
Jaleigh Pier, Research Assistant
Amanda Piha, Campaign & Giving Manager
Lily Rhoades, Visitor Services Associate
Robert Ross, Associate Director for Outreach
Matt Sacco, Outdoor Education Manager
Madeline Sempler, Director of Live Animal Collection
Leslie Skibinski, Collections Manager
Jaimi Shoemaker, Associate Director for Operations
Jansen Smith, Research Scientist
Kelley Snedeker, Visitor Services Associate
Chelsea Steffes, Assistant to the Director
Andrielle Swaby, Evolution Education Manager
Patricia Troy, Visitor Services Associate
Vicky Wang, Collections Assistant
Savannah Wilson, Animal Education Manager
Emily Weaver, Education & Operations Coordinator
Natalee Wrege, Manager of Aquatic Animals
Ingrid Zabel, Climate Change Education Manager
Michael Zelko, Temporary Collections Assistant

Summer Camp Staff

Katie Bagnall-Newman, Camp Director
Katelin Nelson, Education Associate
Kelsey Brewster, Assistant Camp Director
Ellen Mary Woods, Camp Health Director

Meghan Dushko, Environmental Educator
Christina Wildridge, Environmental Educator
Max Kroll, Environmental Educator
Carl Zabel, Environmental Educator
Callie Kaplan-Wright, Environmental Educator
Camille Wrege, Environmental Educator
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Aidan Kaplan-Wright, Environmental Educator
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Rose Zabel, Program Assistant
Hope Keifer, Program Assistant
Kasieum Pia-Miller, Program Assistant
Mason Zoner, Program Assistant

Internships/Assistants/Work-Study

College student interns are an important part of PRI every year. Internships and assistantship opportunities are an extension of the students' education where they share their knowledge with the staff and expand their understanding of their project's subject.

During a specified time frame the students work side-by-side with a staff member acting as a mentor through a specific project. These experiential positions encourage learning and growing. Internships are unpaid, assistantships are paid positions. Most work-study positions are offered through a college community service program and are in conjunction with federal work study awards.

During FY 2019, students logged 1,197 intern hours and 2,211 work-study and assistant hours, for a total of 3,408 hours.

Interns

Elizabeth Altier
Elle Bent
Noah Fuller
Siddharth Gavirneni
Tahlia Lehmann
Sarah Lieberman
Sarah Ousley
Samantha Socha
Andy Tan
Yu Kai Tan
Tim Clark
Martin Welych-Flanagan

Assistants

Taylor Buckley
Briana DiMarco
Emily Hauf
Kate Rowell
Michael Zelco

Work-Study

Preston Ancello
Isabella Eclipse
Cheyenne Eisenhut
Grace Hageman
Jessica Lecorchick
Alberto Matute
David Jose Ospina
Emily Prest
Zachery Siper
Emily Werdal
Turner Wilson

Colleges and Universities

Colgate University
Cornell University
Drexel University
Ithaca College
New College of Florida
Oberlin College
SUNY Cortland
SUNY Geneseo
SUNY Oneonta
TC3
Texas Tech University
Wesleyan University

Volunteers

Nearly 200 individuals contributed their time and talent to PRI this fiscal year, totaling 7,500 hours of accomplishments in nearly every facet of our mission. While some assist for a day to give back to their community, others become as crucial as staff members and return each week. Thank you to the following individuals for strengthening our capabilities and expertise:

George Adams
 Alex Allmon
 Anastasia Alvarado
 Christina Alvarado
 Julia Amos
 Arya Basu
 Kyra Bean
 Soren Beck
 Otto Beer
 Matthew Bell
 Noel Bentley
 Deb Bilinski
 Elisabeth Bodnaruk
 Quint Brahler
 Rebekah Brahler
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 Janice Brown
 Ed Bugliosi
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 Laurie Van Vleet
 Emily Werdal
 Cathy Whalen
 Annelise Wiesel
 Dave Williams
 Don Wilson
 Camille Wrege
 Rose Zabel

Our thanks also go out to the following volunteer organizations and initiatives:

Claritas
 Cornell Alpha Phi Omega
 Cornell Flora Rose House
 Cornell Pre-Orientation Service Trips
 Ithaca College Biology Club
 Ithaca College Service Saturday
 Learning Web of Tompkins County



Teachers selecting rocks and fossils that they can use in their classrooms during PRI's annual Teacher Resource Day.

Annual Giving

Darwin Society \$10,000+

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Brian and Lori Bauer
Elisabeth Boas
James Morin and Myra Shulman

Devonian Society \$5,000-\$9,999

Susan Fleming
Armour Winslow

Cayuga Society \$2,500-\$4,999

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William Kirchgasser
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Jan and Susan Suwinski
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Gorges Society \$1,000-\$2,499

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 John Handley and Kym Pocius

Roald and Eva B. Hoffmann
 Michael and Debbie Kamarck
 Beth Mielbrecht
 James Morin and Myra Shulman
 D. Jeffrey Over
 Ken Rother and Michelle Kortenaar
 Judith Terry Smith
 David and Marisue Taube
 Roger D. K. Thomas
 Emily Vokes
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 Don and Dolly Wilson

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 Lisa Ginete
In honor of James Beech
 Riley Family Foundation
In honor of Percy Browning

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In memory of James Brower
 Alan Leviton
In memory of J. Thomas Dutro, Jr.
 Teresa M. O'Neill
In memory of Brian J. O'Neill
 Anne and Paul Bakeman
In memory of Victor E. Schmidt
 David and Marisue Taube &
 Licia and Pete Cleaveland
In memory of Keren Johns Wells

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Robyn Schmitt
Rosamond Gifford Zoo
Sciencenter
South Hill Cider
The Frame Shop
The Watershed
Viva Taqueria

Wegmans Food Markets
Wende Young
Wine and Design

Collections Specimens Donors

Warren Allmon
Muawia Barazangi
Carlton Brett
Nikki Chase and Clifton Chase
Cornell University
Jesse Czekanski-Moir
Greg Dietl
Steve Durham
Florida Department of Environmental Protection
Larry Jensen
Paul Krohn
David Mayer
Marjorie McKinney
William Miller III
James Scatterday
Leslie Skibinski
James Smaling
John Spina
Martin Welych-Flanagan
William Zinsmeister



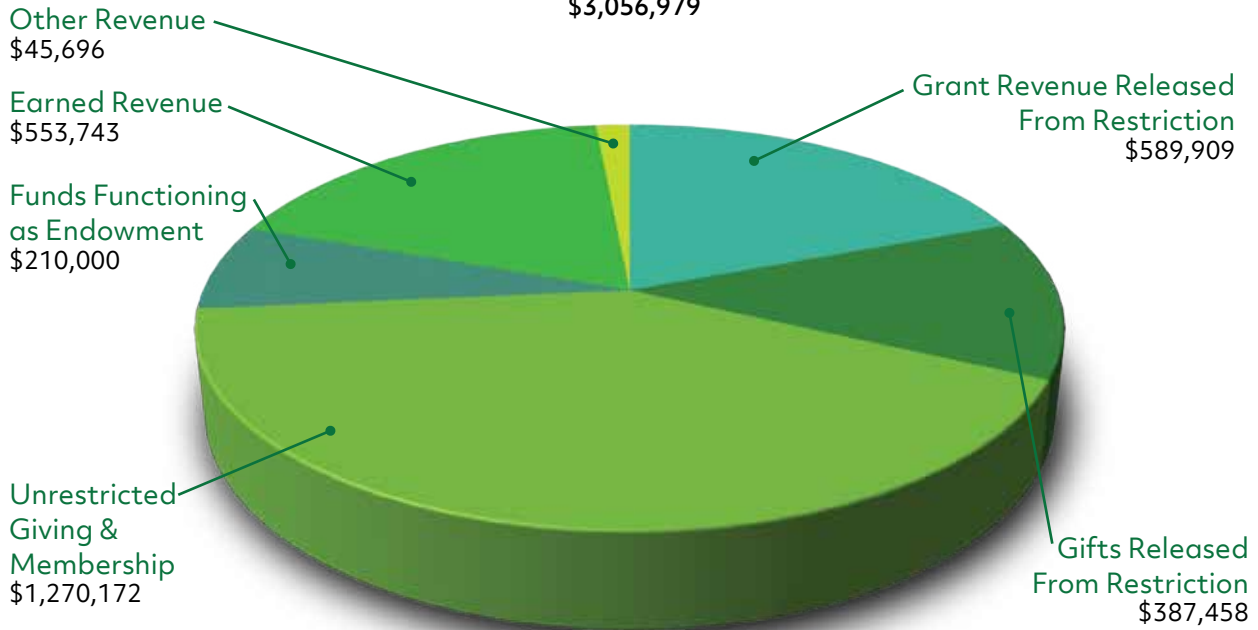
The live sturgeon that was part of the "Survivors: Up Close with Living Fossils" special exhibit at the Museum of the Earth

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- Kelley, P.H., G.P. Dietl, and C.C. Visaggi, 2019. Model for improved undergraduate training in translational conservation science. *Conservation Science and Practice*, 1:e5, <https://doi.org/10.1111/csp2.5>
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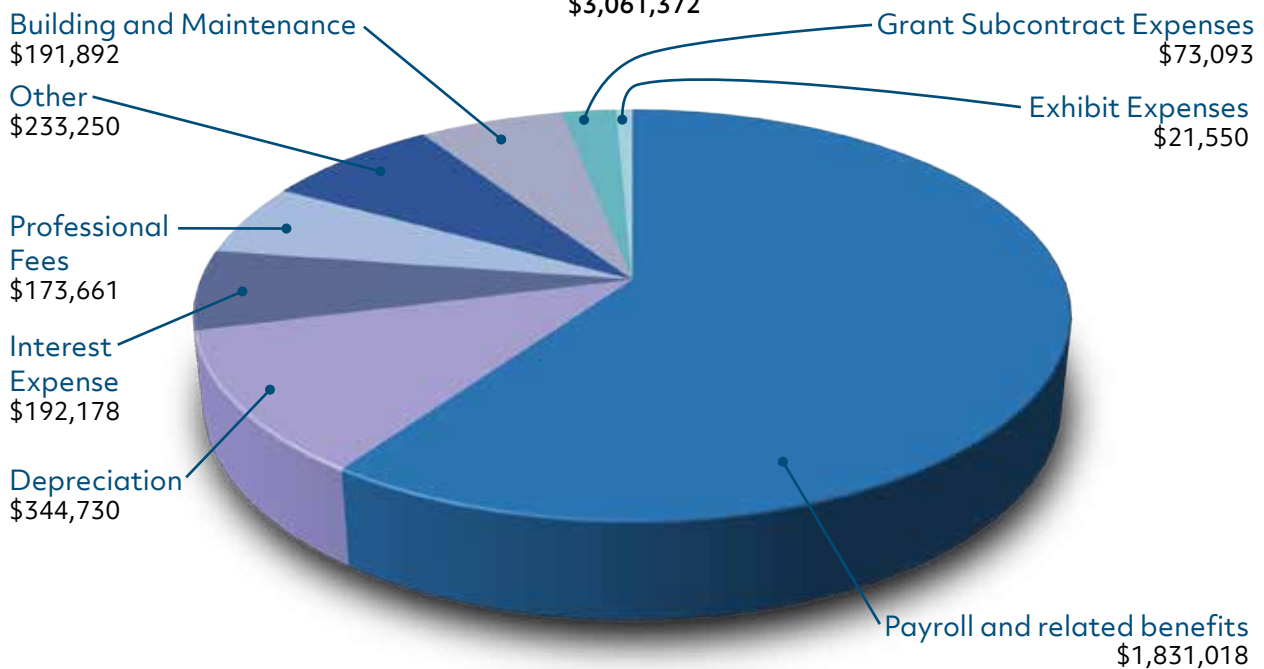
Revenue

\$3,056,979



Expenses

\$3,061,372



Palmer Hall

Named in honor of Katherine Palmer (Director, 1952-1978), Palmer Hall is the Institution's main building, housing PRI's collections, laboratories, library, and offices.



Cayuga Nature Center

The Cayuga Nature Center's education programs and exhibitions focus on the natural history of the Cayuga Lake basin, and are conducted in the Lodge and on the 120 acres of woodlands and fields. Our live Animal Ambassadors enhance the learning experience.



Museum of the Earth

Opened in 2003, the Museum of the Earth is home to temporary and permanent exhibitions that teach thousands of visitors each year about the history of life on Earth.



Smith Woods

Located in Trumansburg, NY, Henry A. Smith Woods is the largest plot of old-growth forest in Central New York. More than 32 acres in size, Smith Woods serves as a education resource for elementary through graduate students and a unique laboratory for researchers.





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