

PROGRAM: AMAZON RESEARCH INITIATIVE FOR EDUCATORS (ARIE)

PROGRAM DATES: JULY 11–20, 2024

LOCATION: IQUITOS, PERU

PROGRAM OVERVIEW

The Amazon Research Initiative for Educators (ARIE) is a 10-day professional development research experience for K12 teachers based in the Amazon rainforest of Peru. During this research experience, teachers will examine the broad theme of “Biodiversity in the Changing World through Time and Space” by participating in Morpho Institute’s ongoing research projects. Teachers will learn key scientific methodologies, such as plant phenology monitoring, animal behavior observations, citizen science protocols, basic statistical analysis, and science communication. Teachers will contribute to the long-term data sets of the Morpho Institute, which will be used to monitor the changes to biodiversity and be available to teachers to use in their classrooms. Teachers will work closely with Morpho Institute faculty to investigate research questions in the Amazon. Additionally, teachers will have the opportunity to connect inquiry, Morpho’s research projects, and their research interests to their classrooms in curriculum connection brainstorming sessions.

PROGRAM LOCATION

Based in one of the most biologically diverse forests in the world, the Amazon Conservatory for Tropical Studies (ACTS) supports tropical research, educational initiatives, classes, workshops, and sustainable development projects in the Peruvian Amazon. The ACTS Field Station and ACTS Canopy Walkway are located within the private 4,136-acre Napo-Sucusari Biological Reserve in the upper Amazon basin of northeastern Peru. An extensive trail system through thousands of acres of primary rainforest is available for research and exploration.

The Napo-Sucusari Biological Reserve has one of the longest canopy walkway systems in the world, extending horizontally 500 meters throughout the treetops and reaching a maximum height of nearly 35 meters (115 feet). This system of aerial platforms and pathways allows scientists, educators, and students to observe and study previously inaccessible parts of the rainforest. With access to all levels of the rainforest, the ACTS Field Station and ACTS Canopy Walkway provide the resources to advance tropical research and conservation.

PROGRAM CONTACT HOURS

8+ hours of pre-departure preparation via online readings, discussions, and webinars. 50 hours of active participation in daily field activities while in the Amazon.

PROGRAM GOALS

The Amazon Research Initiative for Educators (ARIE) is a professional development program offering participants the opportunity to engage in scientific research within a compelling context for developing a global perspective, understanding biodiversity and ecological systems, and learning about the key elements of inquiry-based learning, STEM learning, and national curriculum standards and curricula to better meet the needs of a changing society and an increasingly diverse student population.

Program goals include:

1. Engage teachers in active research projects to increase understanding of science as a process and inspire the use of inquiry-based lessons in their classrooms.
2. Enhance teachers’ science literacy through personal experience with scientific thinking, research design, and excitement of discovery.
3. Introduce teachers to key research methodologies for monitoring ecological systems in a changing planet in the Amazon and ecological communities in the US.

4. Develop ecological databases that can be used to monitor and protect the sustainable use of the Amazon, and connect K12 students in comparative research projects in their classes.
5. Develop learning communities of teachers and researchers to provide inspiration, connection, and resources for inquiry-based learning in the K12 classroom.
6. Examine ways of communicating science to students, teachers, researchers, and the general public.
7. Develop inquiry-based curriculums that connect K12 US students with the scientific process and understanding of local and global environmental issues and inspire a broad diversity of students to consider higher education and careers in STEM.

PROGRAM RATIONALE AND RESEARCH OVERVIEWS

The Morpho Institute uses inquiry and scientific research as a way to build inquiry practices in the K12 classroom and support the Amazon conservation efforts of the Maijuna and other communities through evidence-based decision-making and inquiry. By engaging and designing inquiry projects, teachers identify themselves and their students as scientists, practice inquiry methods, develop a biodiversity dataset of the Amazon for use in the K12 classroom, and feel empowered to guide inquiries to examine the biodiversity in their home communities with the students.

To support these goals, the Morpho Institute focuses its research priorities on examining the biodiversity of a *Changing World through Time and Space*. Currently, the Morpho Institute is examining two long-term and two short-term research projects centering on how biodiversity is affected through natural and human-induced environmental changes over time and across spatial gradients. As tropical forest systems are always in flux both due to human and natural cycles, the Amazon provides a great framework to examine change in ecological systems, broadly defined. Throughout The Morpho Institutes research projects, teachers will examine the themes of biodiversity, adaptations, scale, and species interactions.

Long-term Research Projects

Trees and Trails: Primary producers (trees and plants) are the basis for the food webs and nutrient cycles in the tropics. Tropical forests are constantly changing, from the timing of leafing, flowering, and fruiting of trees, to the changes in the community dynamics and energy available on the forest floor after a tree fall and the regrowth of the forest after flooding. In this research stream, we will monitor forest succession (natural changes in the structure and diversity of forests through time) of a tree fall. Through these activities, teachers will examine the theoretical frameworks of community ecology and forest succession while learning to measure the biodiversity of plants and animals, monitor phenology (timing of life), and ask questions about ecological community change.

Bees and Biodiversity: With the high level of biodiversity in the Amazon, many species are still unknown, let alone monitored for changes in these diversity patterns over time and space. Scientists often use indicator species to learn about other species' diversity and monitor change. In this research project, we will be examining and monitoring orchid bee biodiversity and conservation. Orchid bees are diverse, relatively easy to identify, ecologically important, and relatively easy to inventory. In the process of building a long-term inventory of orchid bee species and genera of ACTS, we will test hypotheses about their distribution and species richness for the forest floor and the canopy. The long-term aspect of this project will enable us to look for environmental trends. In addition, orchid bee research already accomplished at other lowland tropical sites in Peru will allow us to make valuable comparisons with ACTS.

2024 Short-term Projects

Herps and Heights: Tropical forests are three-dimensional spaces, with each level of the canopy experiencing different challenges and opportunities for the animals that live within them. Found throughout canopy levels in the Amazon rainforest, reptiles and amphibians (collectively, herpetofauna or “herps”) are incredibly diverse groups of organisms that are often used as models for scientists to understand the processes of local adaptation.

In this research stream, teachers will investigate if and how herps experience varied predation over an elevational gradient via an experiment with clay lizard models. This investigation will consider how animals are exposed to varying selective pressures at different layers of the canopy. The research project is adaptable for classroom use, and the results can generate discussions about why species may differ in antipredator strategies or time budgeting over environmental gradients.

Heliconia and Herbivory: Plants and animals have dynamic relationships- some being mutualistic (pollination and seed dispersal) while others being detrimental (herbivory). These relationships are the foundation for explaining the physiological process but also the diversity of species in the tropics. In this research project, we will focus on the charismatic giant herb genus *Heliconia*. We will document the distributions of heliconia colonies around ACTS, learn to collect voucher specimens, study both flowering and leafing phenology, and study patterns of herbivory. Though relatively well studied in Central America, heliconia biology in Amazonia is very poorly known, creating significant opportunities for contributing to biodiversity and conservation science.

PROGRAM FORMAT

Pre-Departure:

The rainforest is an exciting and dynamic learning environment, and in order to take full advantage of the opportunities available through the ARIE program, participants will be provided with key background information, readings, and reflection activities prior to departure. These resources are carefully constructed to build requisite background knowledge and will be delivered in a variety of ways, including print and web-based resources. In addition, participants will engage in web-based community-building activities and discussions to make connections with fellow participants prior to arrival in the Amazon. All participants are expected to take full advantage of the resources provided, complete pre-departure readings, and contribute to online interactions.

In the Field,

The field component of the ARIE program takes full advantage of the learning resources only the Amazon can provide – amazing biodiversity, complex ecosystem structure, indigenous cultures, and a global learning environment.

Prior to departure, teachers will indicate their preferences for their research streams. They will be assigned one main and one secondary research stream. Throughout the week, they will work with researchers and teachers testing hypotheses, collecting data, analyzing results, and communicating their findings. In addition to the time working on research projects, teachers will learn about other research projects in the Amazon, discuss key topics in science education, and develop ways to connect their activities to their classrooms.

PROGRAM ASSIGNMENTS/RESPONSIBILITIES

The Amazon Research Initiative for Educators is an extraordinary professional development opportunity. In order to create a rich, rewarding, and maximized learning experience for *all*, it is imperative that each participant understands their *individual* role in the achievement of this goal. Participants are expected to:

- review and respond to all pre-departure readings and activities.
- share and apply what they learn pre-departure during the field experience.
- be positive, active, and engaged team members before, during, and after the Amazon field experience.

PROGRAM OVERSIGHT

Program Faculty

Robert Naczi, PhD - *Arthur J Cronquist Curator of North American Botany, New York Botanical Garden*

Rob is a plant systematist whose research focuses on the flora of North America, plant conservation, the Sedge Family (Cyperaceae), and Western Hemisphere Pitcher Plants (Sarracenaceae). He and collaborators are writing a comprehensive account of northeastern North America's wild plants, *New Manual of Vascular Plants of*

Northeastern United States and Adjacent Canada. Prior to working at NYBG, Rob was an Associate Professor of Botany at Northern Kentucky University and Herbarium Curator and graduate professor at Delaware State U. At Delaware State, he developed and co-taught “Tropical Agriculture, Ecosystems, and Conservation in Belize” for undergrad and grad students, and continues to work in Belize. He also has conducted fieldwork in Costa Rica, Mexico, Peru, and Venezuela. Rob earned a B.S. in Biology from St. Joseph’s U., and a Ph.D. in Botany from U. of Michigan.

Lindsey Swierk, PhD - *Assistant Research Professor, State University of New York, Binghamton & Director of Scientific Research, The Morpho Institute*

Lindsey is a tropical ecologist studying the behavior and evolution of herpetofauna (reptiles and amphibians). Lindsey heads an Organismal Ecology research laboratory at the State University of New York, Binghamton, where she and her lab investigate topics related to animal communication, social and reproductive behaviors, and adaptation to a changing world. Lindsey has conducted research throughout Central and South America and the Caribbean. Lindsey serves as the Associate Director of Research for the Amazon Conservatory for Tropical Studies (ACTS) in Peru, with a research focus on lizards living in the tree canopy. Lindsey received a BA in Biology and Environmental Studies and a Masters in Environmental Biology from the University of Pennsylvania, and a Ph.D. in Ecology from Penn State. She was a Donnelley Environmental Fellow at Yale University’s School of the Environment. Lindsey is actively engaged in several initiatives to make science more accessible to the public and particularly to historically underrepresented groups in science.

Rosana Ruiz, EdD - *Lecturer, Fresno State & Director of Educational Engagement, The Morpho Institute*

Creating personal and meaningful experiences is what drives Ro, whether it concerns participants in the Morpho Institute’s PD programs, the many interns she mentors, the volunteers she works alongside, or the students she has taught over the years. Ro began an engineering career in the Space Shuttle program with Rockwell International, but an undying passion for the environment and conservation led her to a second career in Outdoor Recreation and Administration. As a natural teacher and non-stop learner, Ro recently completed her Doctorate in Educational Leadership at California State University, Fresno. Her dissertation, “Awe as a Professional Development Approach in Environmental Education,” included research on the impact of Morpho’s Educator Academy in the Amazon as a transformative PD experience for K12 educators.

Christa Dillabaugh - *Director, The Morpho Institute*

Christa Dillabaugh is the Program Director for The Morpho Institute and coordinator of our flagship program, The Educator Academy in the Amazon. Prior to founding the Morpho Institute, she launched Amazon Rainforest Workshops, LLC, and has coordinated numerous student and university field programs in the Amazon. Christa began her love of the Amazon and Neotropical rainforests while leading expeditions for her own students from Bexley, Ohio. She has also worked as a freelance science consultant to Pearson Education and Discovery Communications, contributing to curriculum and activity guides as well as educator in-service workshops and training materials focusing on STEM and Understanding by Design in the science classroom. Her current area of focus is community-based conservation and conservation education.

Nancy Trautmann, PhD - *Director of Education, Cornell Lab of Ornithology*

Under Nancy’s leadership, the Education Program at the Cornell Lab of Ornithology creates resources and opportunities that aim to inspire people of all ages to care about birds and the critical issues facing our environment today. The BirdSleuth Habitat Connections curriculum is one of the resources produced by this team. Nancy’s interests center on curriculum development, teacher professional development, and interactive online learning opportunities that help people build closer connections with nature, learn about birds and the natural world, and participate in citizen science and conservation action. Curricula she has published include *Birds Without Borders* (Carte Diem Press); *Citizen Science, Decay & Renewal*, *Assessing Toxic Risk*, *Invasion Ecology*, and *Watershed Dynamics* (National Science Teachers Association), *Biodiversity: The Keystone to Life on Earth* (California Education and the Environment Initiative); and *Composting in the Classroom* (Kendall Hunt).

REQUIRED READINGS/MATERIALS/EQUIPMENT

The majority of course readings and assignments will be available online. Participants will have access to these materials a month before the departure date. Online discussions related to the background readings, Morpho's research projects, and pedagogy/instructional practices will begin approximately six weeks prior to departure.

A comprehensive optional/suggested reading list will also be provided to participants upon registration. A recommended list of field equipment/supplies will also be supplied prior to departure.

PROGRAM CONTACT INFORMATION

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PROGRAM & REGISTRATION DETAILS

<https://morphoinstitute.org/arie/>