

# BIOLOGICAL and CULTURAL DIVERSITY of the TROPICS:

extraordinary opportunities and challenges  
in the midst of the Anthropocene

Strategic Plan 2019-2024



**Smithsonian**  
*Tropical Research Institute*

**The Smithsonian Tropical Research Institute (STRI)**, in the Republic of Panama, has its roots in the Smithsonian 1910-1912 Panama Biological Survey. STRI scientists now build on an unparalleled 100+ year record of terrestrial, marine, archaeological and environmental research. Our studies of marine and terrestrial paleontology and modern fauna and flora represent our great strengths, with each scientific area providing insights that inform the others for the benefit of humanity.

STRI benefits from a collaborative diplomatic agreement with the Republic of Panama and is privileged to serve as custodian of the Barro Colorado Nature Monument on behalf of the Republic of Panama, the international community and future generations. We will celebrate the 100th anniversary of the research station there in 2023. In 2018, we began our role as legal owner and custodian of Coibita Island in the Gulf of Chiriqui, significantly expanding our geographic reach and research capabilities.

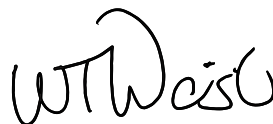
We provide modern facilities and research instrumentation for our scientists, bringing the latest technological breakthroughs to tropical forests and reefs. We sustain research over time to reveal long-term ecological patterns and understanding.

We partner with other Smithsonian units, diverse US government agencies, research institutions and universities in Panama and around the world to advance our mission while setting our sights on the scientific and environmental challenges anticipated in the 21st century.

This strategic plan describes those challenges and how we intend to address them as we expand our capabilities and ensure long term sustainability for our planet.



M.C. Larsen,  
Director



W.T. Wcislo,  
Science Advisor to the Director

Smithsonian Tropical Research Institute  
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# WHO WE ARE

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Earth remains a little-known planet. For numerous species—especially microbes and tiny invertebrates—we are still in the discovery phase. Millions of species are unnamed and many more have never been studied. Tropical forests host roughly half of Earth’s animal and plant species. A quarter of all marine organisms live on coral reefs. Yet these habitats cover only a small fraction of our planet’s surface. Tropical habitats provide food, medicines and fuel for more than a billion people. These ecosystems are key drivers in vital global-scale climate and hydrological cycles. Tropical environments have sustained rich indigenous cultures for thousands of years, generating socio-cultural diversity that rivals other facets of biodiversity. The long-term sustainability of tropical diversity is under significant threat.

The founders of what became the Smithsonian Tropical Research Institute (STRI) envisioned the tropics as an exquisite living laboratory for understanding the evolution of life on Earth. The Isthmus of Panama bridged two continents three and a half million years ago—opening the door to invading species from north and south—and it divided an ocean in two—a geological wedge that led to environmental changes that drive the origin and evolution of species. Nowhere else were two ideal natural experiments in ecology and evolution set in motion in recent geological time.

Today these natural laboratories are home to STRI facilities with advanced scientific instrumentation and sophisticated research infrastructure, enabling us to probe ever deeper to further refine our scientific knowledge. We aim to understand the rules of life -- the organizing principles that govern how organisms, species, communities and ecosystems are put together and change through time.

Our focus is expansive in scope and time, as many biological patterns reveal themselves only after many years, including geological time, or over large spatial scales. Long-term and experimental studies provide critical information for understanding how marine and terrestrial communities are assembled and function, at all levels of biological organization, from charismatic mega-fauna and flora to insects and other invertebrates, on land and sea, down to the microbes—the fungi, bacteria and viruses—and how they shape, and are shaped by, ecological processes.

## Our MISSION

*The Smithsonian Tropical Research Institute (STRI), is dedicated to the increase and diffusion of knowledge about the past, present and future of tropical biodiversity and its relevance to human welfare.*

## Our PEOPLE

We provide a core group of resident staff scientists with outstanding opportunities to pursue research in an open, collegial yet rigorous intellectual environment. Their work is supported by hundreds of collaborators, including fellows and interns who come from a quarter of all nations on Earth, and a dedicated support staff.

Complementing our resident scientists, STRI hosts visiting scientists from around the world, from undergraduate assistants to senior researchers. Invited Research Associates pursue independent long-term research at STRI and help us train tomorrow's leaders in tropical science.

## We ARE PART

Of the bigger Smithsonian museum and research complex and are actively incorporating the Institution's strategic goals into our own.



### Smithsonian Institution-wide goals:

1. Be One Smithsonian
2. Catalize new conversations and address complex challenges
3. Reach 1 billion people a year with a "digital first" strategy
4. Understand and impact 21st century audiences
5. Drive large, visionary, interdisciplinary research and scholarly projects
6. Preserve our natural and cultural heritage while optimizing our assets
7. Provide a nimble, cost effective, and responsive administrative infrastructure

## Our VALUES

The 21st century is the age of biology. We aim for a comprehensive understanding of the patterns and processes that form life in the tropics, including the roles played by humans in shaping, restoring, and maintaining these processes. We produce new knowledge that can be used to devise ever-smarter solutions to our most pressing environmental challenges, and to better enable decision-makers to make wise choices. We inspire citizens young and old to better understand and appreciate our natural world, thereby laying the foundation to conserve and sustain it.

- **Excellence** in science is the universal way of increasing knowledge about our world. STRI aspires to hire the best scientists from around the world, and to give them the freedom, resources and scientific support to pursue long-term innovative research programs.
- **Enlightened risk-taking** is essential as the results of scientific research are not predictable. Our willingness to take big bets and risk failure often leads to spectacular scientific breakthroughs.
- **Engagement** with a rapidly changing world enables STRI to provide policy-makers with scientific data and meaningful interpretation to make effective decisions on use and conservation of natural resources and the environment.
- **Transparency, accountability, and integrity** are central to a public trust organization. This responsibility commits us to the highest standards of transparency and accountability, using measurable outcomes to support science in the most efficient ways possible.
- **Diversity** lies at the heart of biology. Just as biodiversity helps sustain robust and healthy ecosystems, cultural diversity sustains a healthy and robust organization and community.

# OUR MAJOR CHALLENGES

Ours is a remarkable time for science! New technologies and new opportunities offer almost infinite possibilities to pose new questions, yet the global scientific community faces two major challenges:

## 1 **A mismatch between the geographic distribution of biodiversity and research capacity.**

Most of the world's biodiversity is tropical while most centers of research excellence are in temperate-zone universities and institutions. This contrast hinders discovery, interpretation and understanding in science. STRI research and our location on the isthmus of Panama enables ever deeper understanding of the flora and fauna of the tropics.

## 2 **Tropical ecosystems are under severe stress.**

Intensification of land use leads to species and habitat loss, while changing climates are altering fundamental biological processes. Invasive species and emergent infectious diseases compound these stressors. STRI is uniquely positioned to provide decision makers with solid, scientific data as they shape the future.

# THE WAY FORWARD: OUR STRATEGIC PRIORITIES

This strategic plan commits us to expand our scientific activities and intensify our efforts in the face of extraordinary opportunities and challenges.

Our scientific goals leverage our strengths and align with two major objectives of the United States' National Science Agenda. In 2016 the National Science Foundation identified understanding the rules of life as one of the significant grand challenges for biology. What processes generate biological and anthropological form and function in changing environments, and what are the consequences? These broad questions define the collective agenda of the STRI community.

Also in 2016, the White House Office of Science & Technology Policy announced an initiative to advance our understanding of the roles played by microbes in maintaining human health and ecosystem functions. This announcement included work at STRI to understand the functional roles played by microbes in tropical environments. With new genomic tools in hand, we are beginning to better understand the microbial world.

In the next five years, we will generate an improved understanding of tropical biodiversity, and share our discoveries with our multiple audiences, to strengthen the role of science in service to the natural environment.

- 1** PRIORITY 1  
**Increase our efforts to discover and understand biological, cultural and functional diversity in the tropics**
- 2** PRIORITY 2  
**Strengthen the role of science in service to the environment**
- 3** PRIORITY 3  
**Support and mentor the next generation of scientists**
- 4** PRIORITY 4  
**Communicate the beauty of nature and thrill of scientific discovery to the public**
- 5** PRIORITY 5  
**Enhance operations and facilities in support of our mission**
- 6** PRIORITY 6  
**Advance administrative process through technology and simplification**

# 1 PRIORITY 1

## Increase our efforts to discover and understand biological, cultural and functional diversity in the tropics

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### Goal 1:

Seek answers to challenging, fundamental and intertwined questions relating to the genomic, developmental, physiological, behavioral, ecological patterns and processes that drive the evolution of biological diversity, and associated environmental conditions.

We aim to understand how local studies scale to the global tropics by addressing key research questions:

- What are the governing relationships between organisms including humans, and their environments, from the ancient past to the present?
  - What processes generate and maintain biodiversity from genes to organisms?
  - How is evolution affected by interactions with other species, including humans?
  - How can we better use our deep knowledge of biology and human ecology to develop smart solutions to environmental and ecological challenges?
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### Goal 2:

Establish a living laboratory in the Tropical Eastern Pacific.

In 2018 STRI took possession of Coibita Island, giving us access to a new living laboratory and basic research facilities. As part of a migratory corridor for marine and avian species from North and South America, Coibita is a strategic vantage point for studies of the Eastern Tropical Pacific.

With two layers of legal protection as part of Panama's Coiba National Park and a UNESCO World Heritage Site, Coibita is an ideal location to launch long-term research that will provide key insights in marine biology. In the next five years we will:

- Improve our existing field facility in Coibita. This development represents a major step in completing our goal of two-ocean field facilities, complementing our Caribbean research stations at Galeta and Bocas del Toro in the Caribbean, and our Naos Marine Laboratories in the Pacific.
  - Acquire a research vessel to access marine ecosystems in the two oceans surrounding the Isthmus of Panama.
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### Goal 3:

Decipher the roles of human diversity and cultural change in shaping tropical environments.

The tropics are hotspots for cultural diversity. Indigenous peoples, each with their own language, culture, belief systems and world-view, provide differing perspectives on how humans modify and use their environment. Pre-Columbian societies extensively modified the habitats and biota of the Americas over the past 14,000 years, as they developed novel cultural ideas and technologies, including large-scale and long-term infrastructure for ever more complex societies, which flourished, vanished or merged with other societies.

- Continue efforts to strengthen our program in human ecology through staff additions, to better understand how pre- and post-Columbian indigenous societies used their natural and cultural resources to manage their world.
- Seek to better understand:
  - To what extent has past human activity shaped present-day tropical environments?
  - What are the biological and cultural limits of landscape transformation?



## 2 PRIORITY 2 Strengthen the role of science in service to the environment

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### Goal 1:

Provide accurate, timely and relevant scientific data and understanding.

We aspire to provide the best empirical data possible for policy- and decision-makers to remediate environmental damage, restore ecosystems and better sustain the natural world for coming generations.

### Goal 2:

Develop more institutional scientific partnerships.

Advance our mission by expanding partnerships with fellow Smithsonian units, diverse agencies in Panama and the United States, and collaborating research institutions and universities from around the world. Our current national partners include the National Secretariat for Science, Technology and Innovation (SENACYT) and Institute of Scientific Investigation and Technological Services (INDICASAT). We will strengthen international ties with institutions such as the Beijing Genomics Institute among other potential partners, including the numerous strategic collaborators involved in ForestGEO.

## 3 PRIORITY 3 Support and mentor the next generation of scientists

STRI is dedicated to inspiring and training future generations of scientists. Our resident scientists, interns, and research fellows represent our scientific future, enrich our community, and expand our reach.

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### Goal 1:

Scientific staffing

We must maintain our core of resident scientists and expand our staff with new scientific positions.

- We will increase our resident, full-time, scientific staff with five new hires by 2019.
- We will add at least three new staff scientists by 2024 via philanthropic support for endowed chairs to expand our research portfolio to advance exciting new frontiers.

### Goal 2:

Post-doctoral fellowship support

Post-doctoral fellows enhance ongoing studies and advance our research in emerging directions.

- We will increase fellowship support at all levels, from undergraduate interns, to graduate students, to post-doctoral researchers.
- We will add five new postdoctoral fellowships by 2024.

# 4

## PRIORITY 4

### Communicate the beauty of nature and thrill of scientific discovery to the public

Our scientists share a child's sense of wonder. We aim to bring science to the people by sharing our joy in experiencing a tropical forest or reef, and the thrill of new scientific discoveries.

We strive to nurture a sense of curiosity about the natural world, to inspire some to become scientists, others to work to conserve the spectacular diversity of life in the tropics, and for all to be part of an informed citizenry.

#### Goal 1:

Reach multiple, international audiences through sophisticated digital platforms and public programs.

- Engage STRI's internal and external audiences – scientific community, science and nature enthusiasts, youth, government officials and potential donors – by continuously sharing our discoveries and research processes through social media and our new STRI web site.
- Facilitate outstanding science-based education and outreach programs at our public program facilities in Punta Culebra, Galeta Point, Barro Colorado Island and Bocas del Toro, including a major revitalization at Punta Culebra.

#### Goal 2:

Enhance local relevance and visibility in Panama through scientific themes of global importance.

STRI enjoys a long history of goodwill shown by the government and people of Panama, yet our extensive research documenting the natural and cultural history of Panama is not sufficiently known.

- Improve our communications strategy through proactive planning and exposure of scientific themes that highlight the wonder and impact of our science, and its relevance to Panama and the world.
- Design exhibits for public spaces, positioning STRI scientific findings before multiple audiences in cultural, governmental, and business venues across the country.

# 5 PRIORITY 5

## Enhance operations and facilities in support of our mission

In partnership with the Smithsonian Facilities office, we will enhance STRI facilities to support advanced science collaboration and activities. We aim to refurbish and expand the world's best tropical research platform and increase the sustainability of our operations.

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### **Gamboa Laboratory**

Our new laboratory in Gamboa is fully operational. Complementing this facility, over the next five years we will reconfigure two existing structures into an ambient-temperature laboratory for experimental research, and a residence for scientific visitors.

### **Earl S. Tupper Center**

We will revitalize the Earl S. Tupper Center, including the central courtyard in the Tupper Plaza to better foster interactions within the STRI community and with the public, convening meetings, workshops, and celebratory events.

We will complete a safety and security upgrade.

Through a new kinetic/optical sculpture by world-renowned artist Carlos Cruz-Diez, we will bring artwork to a public space and recognize an important historic site adjacent to our campus.

### **Barro Colorado Island**

We will complete renovation project associated with the Panama Canal Expansion. STRI will also make plans to celebrate 100 year anniversary in 2023.

### **Canopy Crane**

STRI pioneered the use of construction cranes as a research tool to study life in forest canopies. We will replace our seasonally dry-forest crane in Parque Metropolitano.

### **Galeta Point Marine Laboratory**

We will continue improvements to our Galeta Point Marine Laboratory, to upgrade research, housing, and public-program facilities. We will integrate activities at the San Lorenzo Canopy Crane site with Galeta, so Galeta can serve as a base of operations for Caribbean research in central Panama.

### **Coibita Island**

We will upgrade our field station on Coibita Island and establish baseline environmental monitoring and scientific research.

### **Research Vessel**

STRI will determine specifications and obtain support for a research vessel to advance frontier research in the Tropical Eastern Pacific and beyond.

### **Punta Culebra Nature Center**

We will continue to significantly upgrade the Punta Culebra Nature Center in Panama City, including a Discovery Center for schoolchildren, improved aquaria and exhibits.

### **Naos Marine Laboratory**

We will revitalize the Naos laboratories to improve current facilities in support of STRI Marine programs, and to provide state-of-the-art infrastructure for the Molecular Biology program. Included in the revitalization are new office and laboratory spaces for our staff, and an improved seawater system.

### **Bocas Del Toro Research Station**

We continue to work in the upgrade of both laboratories and housing facilities to provide better infrastructure for marine and terrestrial research. We will renovate the old dorms and living quarters, as well as some of the laboratory spaces. We also seek to revitalize the dock space and boat house.

# 6 PRIORITY 6

## Streamline administrative process through technology and simplification

We constantly consider new ways for advancing our administrative processes, and aim to optimize workflow to further support our scientific research.

### Finance and Administration

- Provide the Office of Human Resources state of the art technology necessary to recruit, hire and support the best local talent for STRI. This will be accomplished by acquiring and implementing Evolution, a software that handles payroll, recruitment and performance appraisal.
- Develop a common framework for Scientific Databases (DKAN).
- Support science by providing the permits office with technology that enables processing and tracking permits automatically .
- Enh ance the scientific visitor experience at STRI by addressing their needs, to assure a pleasant and productive experience. Surveys will be implemented at all sites to obtain feedback from scientific visitors and respond to their recommendations. A tutorial will be designed and implemented to facilitate the registration process for visitors.
- Provide the necessary technology to the accounting department to move to a paperless process. This will support our mission of a transparent and effective accounting process that guarantees that the funds provided are used in the most efficient way.

# KEY DELIVERABLES

Recruit and retain a talented and diverse workforce from Panama and around the world.



**5 new**  
staff scientists  
by 2019



**3 new**  
trust-funded staff  
scientists by 2023



**5 new**  
Post Doctoral  
Fellows by 2023



Raise **\$4M** annually and increase financial stability by growing private funding streams.



Provide the most advanced research instrumentation at the edges of forests and reefs.

Liaise with the Smithsonian Institution to leverage digital communication resources.

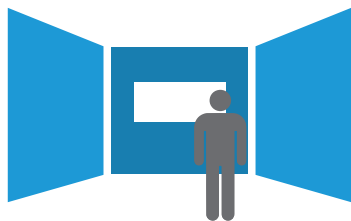


Receive a minimum of **1,200**  
scientific visitors per year.



Improve visitor experiences at STRI facilities through enhanced public programs.

400



Stage one digital or itinerant exhibit per year.



Mentor and train the next generation of scientists through robust academic programs.



Manage resources efficiently, transparently and strategically.

**stri.si.edu**

Actively update information on the new STRI web site with a new publication every two weeks.

Publish a minimum of **400** articles in peer reviewed scientific journals per year.

# CONCLUSION

We live in a remarkable time for science. Research capabilities are advancing ever more rapidly, while environmental problems from population growth, resource exploitation, and global change present us with increasing challenges. STRI is located at the epicenter of many of these problems —the tropics— where half the world's population lives and where environmental degradation, including loss of forest cover and over-exploitation of marine resources is largely unchecked. As we lose biodiversity around the world, and particularly in the tropics, we endanger the future of our own species.

STRI enables ever deeper understanding of the environments that we humans manage. If our species is to survive and flourish in the future, we must be better stewards. This can only happen with science-based decision making derived from knowledge. We encourage you to join us in our vital effort.

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