

Building Resilient Tropical Working Landscapes

OVERVIEW

Designing resilient landscapes that will support humans and biodiversity in the face of unprecedented global change is one of the great challenges of this century. The Smithsonian Tropical Research Institute (STRI), the Smithsonian's National Zoo and Conservation Biology Institute (NZCBI), and the Smithsonian Environmental Research Center (SERC) seek to leverage flagship programs based in the tropical Americas — including [Smart Reforestation®/Agua Salud](#) and [Bird Friendly® Coffee](#) — to enhance the resilience of tropical working landscapes. Tropical working landscapes play a critical role in delivering ecosystem services, conserving biodiversity, and supporting livelihoods on our changing planet. Research themes could include optimization of biodiversity or ecosystem services under different scenarios of change; prioritization of reforestation within landscapes or watersheds; tradeoffs between social, economic, and ecological outputs of landscapes; and/or maintaining climate connectivity with biological corridors.

IMPORTANCE

The ecosystem services provided by tropical working landscapes support some of the most diverse human and biological communities on the planet. Within these landscapes, mosaics of different land covers are created by both human and natural processes, and their interactions profoundly affect human well-being, biodiversity, carbon, and water outcomes. Tropical working landscapes are also changing rapidly. Agricultural expansion is the primary driver of habitat conversion and biodiversity loss, but other processes, such as reforestation and regenerative agriculture, can increase the capacity of landscapes to provide ecosystem services and mitigate climate change impacts. Prioritization of short-term economic gain, however, often results in tradeoffs with ecosystem services and biodiversity. We urgently need to understand and build landscapes that will provide clean water, produce food, sequester carbon, and buffer the extreme weather events that are increasing in frequency and intensity.

The Smithsonian Tropical Research Institute (STRI), the Smithsonian's National Zoo and Conservation Biology Institute (NZCBI), and the Smithsonian Environmental Research Center (SERC) seek to leverage our research and conservation assets in the tropical Americas to enhance the resilience of tropical working landscapes on our changing planet. The Smithsonian Institution is uniquely positioned to advance the understanding and implementation of Resilient Tropical Working Landscapes. Two flagship programs—Smart Reforestation®/Agua Salud and Bird Friendly® Coffee—have developed unique datasets, conservation approaches, and local networks that can be synthesized along with other data sources to understand and design resilient tropical landscapes and watersheds.

POTENTIAL RESEARCH THEMES

STRI, NZCBI, and SERC seek to support a postdoctoral researcher interested in pursuing innovative science to advance the understanding and design of resilient working landscapes in the tropics by leveraging the data, networks, and infrastructure of flagship Smithsonian programs and partners. Potential research themes include, but are not limited to:

- **Optimization** of biodiversity, carbon sequestration, and water quality under current and future landscape and climate scenarios.
- **Prioritization** of areas and techniques for passive and active reforestation within landscapes or watersheds.
- **Co-benefits and tradeoffs** among social, economic, and ecological outputs of landscapes under different management and climate change scenarios.
- **Biological corridors** as a landscape management approach that integrates multiple themes above to maintain ecological connectivity and increase the climate resilience of tropical working landscapes.

Designing climate-resilient landscapes may require integrating multiple policies and interventions, including protected areas, restoration, and regenerative agriculture. A fellow could choose to focus on an individual intervention or the complementarity among interventions, leveraging datasets on restoration, sustainability certifications, and/or payments for ecosystem services programs in Colombia, Panama, Costa Rica, or multiple sites within the Mesoamerican Biological Corridor. Retrospective impact evaluation or spatial prioritization could be used to identify optimal areas for restoration or regenerative practices to achieve outcomes of carbon sequestration and biodiversity maintenance. A fellow could integrate field and remote sensing datasets to evaluate the contributions of restoration or regenerative agriculture to climate connectivity – the degree to which the landscape facilitates or impedes the movement of wildlife under climate change. Connected and resilient ecosystems are end-goals of efforts to restore degraded ecosystems and implement biodiversity-friendly agriculture in pursuit of targets under the UN’s Post-2020 Global Biodiversity Framework.

PROGRAMS AND ASSETS

Smart Reforestation® and Agua Salud are based in the Panama Canal Watershed. In the broadest terms, Smart Reforestation® provides a framework to maximize the efficient production and delivery of ecosystem services across landscapes through reforestation and land use planning. The Agua Salud project studies ecosystem services provided by tropical season forests and how they change with land use and climate change and includes significant research on passive and active reforestation. With over ten years of repeated measurements in its core research studies, Agua Salud possesses perhaps the most detailed and comprehensive data sets on land use effects on stream flows, secondary forest development, and native species forest restoration in the tropics. These datasets can inform scenario planning and expand upon projections of land-based carbon capture (and release) futures.

Smithsonian Bird Friendly® is a market-based certification and research program that defines and promotes farm management practices that conserve biodiversity in coffee and cocoa agricultural systems. The program offers established field sites and datasets in Panama and Colombia that 1) address how forest cover and farm management interact to impact biodiversity and 2) explore alignment between environmental conservation, farmer livelihoods, and agricultural production. The program supports regenerative agricultural practices, conservation planning at landscape scales, and development of decision support tools for farmers and industry. Scenario planning that incorporates Bird Friendly biodiversity models with models of carbon and/or water flow could help local communities and coffee companies prioritize the areas and actions that will have the greatest benefits to biodiversity and landscape or watershed resilience to climate change.

ADVISORS

The following Smithsonian staff scientists commit to advise climate fellows, facilitate access to datasets and project assets, and provide guidance to link research to management actions and policy decisions: Jeff Hall¹, Ruth Bennett², Justin Nowakowski³. Fellows are welcome to seek additional expertise from across the Smithsonian as appropriate.

¹(STRI-Agua Salud); ²(NZCBI-MBC); ³(SERC)