

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) and the Smithsonian's National Zoo and Conservation Biology Institute (NZCBI) seek to leverage three flagship programs based in the tropical Americas—[Smart Reforestation®/Agua Salud](#), Cañete River Watershed “De la Sierra al Mar”, and [Bird Friendly® Coffee](#)—to enhance the resilience of tropical working landscapes to deliver critical ecosystem services, conserve biodiversity, and support livelihoods on our changing planet. Potential research themes 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 co-development of sustainable land use practices with local stakeholders.

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 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 landscape to provide ecosystem services and mitigate the negative impacts of global climate change. 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.

Tropical working landscapes play a critical role in meeting the needs of humans while conserving biodiversity and ecosystem functions. 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) and the Smithsonian's National Zoo and Conservation Biology Institute (NZCBI) seek to leverage our research and conservation assets in the tropical Americas to enhance the resilience of tropical working landscapes to deliver critical ecosystem services, conserve biodiversity, and support livelihoods on our changing planet. The Smithsonian Institution is uniquely positioned to advance the understanding and implementation of Resilient Tropical Working Landscapes. Three flagship programs—Smart Reforestation®/Agua Salud, Cañete River Watershed “De la Sierra al Mar”, and Bird Friendly® Coffee—have developed unique datasets, conservation approaches, and local networks that can be synthesized and advanced to build more resilient tropical landscapes and watersheds.

POTENTIAL RESEARCH THEMES

STRI and NZCBI 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. Potential research themes include, but are not limited to:

- **Optimization** of biodiversity, carbon sequestration, and water quality and flow under different landscape and climate change scenarios.
- **Prioritization** of areas and techniques for passive and active reforestation within landscapes or watersheds.
- **Tradeoffs** between social, economic, and ecological outputs of landscapes under different management and climate change scenarios.
- **Co-development** of sustainable land use practices (e.g., agriculture, forestry, livestock, fishing) with local communities and industries.

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.

The Cañete River Watershed (CRW) in Peru comprises a patchwork of people and ecosystems, all nearing the brink of water insecurity due to the combined threats of climate change and unsustainable land use practices. The Smithsonian program, “**De la Sierra al Mar**”, seeks to address water security in the CRW and provide data that can be used to inform an integrated watershed-level management strategy. The program offers unique opportunities to promote co-benefits for biodiversity and human well-being through 1) co-design of land use planning and practices with local agencies, 2) study and scaling up of conservation interventions (e.g., restoration, fencing, improved irrigation canals, etc.), and 3) advancing understanding of the interconnectedness of livelihood activities from ridge to reef in the basin and their impacts on ecosystem services. Datasets that can be leveraged by a climate fellow include land use models, macroinvertebrate data collected across the watershed, and evaluations of stakeholder perceptions and livelihoods.

Bird Friendly® Coffee is a market-based certification that defines and promotes farm management practices that conserve biodiversity in coffee agricultural systems. The program works in five coffee-farming landscapes from Panama to Peru to 1) understand how forest cover and coffee plantation management interact to impact bird diversity and 2) identify conservation opportunities that align with coffee landowner and industry priorities. Near-term program outputs will include a Bird Friendly landscape certification option and shade tree catalogs that promote species with strong co-benefits to local food webs and to farmers. 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. Datasets replicated across the five landscapes that can be leveraged by a climate fellow include land cover models, bird occurrence data, tree species phenologies, and socioeconomic surveys of coffee producers.

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, Jessica Deichmann³, Scott Sillett², Tom Akre⁴. Fellows are welcome to seek additional expertise from across the Smithsonian as appropriate.

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