GLOBAL SYNTHESIS OF FORESTGEO DATA TO ACCELERATE UNDERSTANDING AND SUPPORT POLICY ON THE RESPONSE OF FORESTS TO CLIMATE CHANGE

OVERVIEW

The response of forests to climate change will have profound effects on future global patterns of temperature and rainfall. Predicting the future of forests under climate change will be advanced through the synthesis of decades of forest monitoring data produced by the Forest Global Earth Observatory (ForestGEO) network. Delivering these findings through an online dashboard for Forest Health will support policy and decision making by providing real-time, verifiable estimates of forest carbon stocks, trajectories of forest change, and projections of likely future changes in response to climate change.

IMPORTANCE

Forests are essential to life on earth. They store carbon, influence climatic and hydrological cycles, house 70% of all species, provide medicines and fuel, and their future will strongly influence Earth's future temperature and rainfall patterns. Forests are in the midst of the greatest transformation since the last great extinction through deforestation, degradation, pollution, invasive species, and climate change. An opportunity exists to transform knowledge and support policy and decision making on how these complex ecosystems will respond to climate change at a global scale. It will require the synthesis of existing knowledge and rapid delivery of this knowledge to forest conservation and climate practitioners, policy makers, scientists, and the public.

Forests worldwide are displaying variable responses to climate change and other global change drivers, with some sequestering more carbon (a negative feedback to climate change) while others are in decline (a positive feedback to climate change). The biotic and abiotic drivers of these complex responses remain incompletely understood. A robust knowledge of how forest dynamics depend on forest structure and composition, and on environmental drivers like climate, soil properties, disturbance, and interactions with other taxa (e.g., seed-dispersing animals) is a critical precursor to predicting the future of forests under global change. Important knowledge gaps at the global scale reduce our ability to make the broad inferences, driven by a mechanistic understanding of global forest systems, that are necessary to better quantify and predict the future dynamics of forests in the Earth System.

POTENTIAL RESEARCH THEMES

ForestGEO seeks postdoctoral fellows to leverage the extraordinary scientific resources of the Smithsonian Institution and ForestGEO to accelerate scientific and societal understanding of the response and feedbacks between forests and climate. ForestGEO seeks postdoctoral fellows working at the forefront of forest science. Proposals should outline a series of key questions on the response of forests to climate change that can be addressed with the ForestGEO data.

PROGRAM AND ASSETS

Forests are being monitored globally by the Smithsonian-led ForestGEO and numerous regional networks, yet critical synthetic analyses are not being conducted and communicated directly to relevant

stakeholders at a pace that matches the rate of change and need for up-to-date information. Restoring and protecting the world's forests – and with them, Earth's climate, biodiversity, and forest-reliant human communities – in this time of unprecedented change requires new science and communication tools.

New syntheses of the enormous ForestGEO datasets will address gaps in understanding of forest responses to climate change. Immediate goals of this synthesis include, but are not limited to: (i) resolving long-term, whole plot patterns in forest demography (growth, mortality, and recruitment) in relation to climate variation and change, (ii) analyzing annual and sub-annual data on forest dynamics in relation to climatic fluctuations, and (iii) identifying species undergoing rapid declines threatening local extinction. Opportunities also exist for multi-network collaboration to provide broader synthesis of forest data (e.g., the Alliance for Tropical Forest Science, ATFS) and engage a broader community of stakeholders.

If humans are to avert dangerous warming, immediate action needs to be taken on many fronts. Advances in knowledge and prediction of forest responses to climate change need to be shared with the scientific community, policy makers, and the public accurately and rapidly. The IPCC, local and regional management agencies, and other international stakeholders require verifiable estimates of current forest carbon stocks, trajectories of forest change, and ideally, projections of likely future changes in response to climate change. The science community needs to more proactively deliver clear messages on current knowledge of forest "health" (including carbon and biomass stocks, biodiversity status, etc.) based on frequent, repeatable syntheses of the science data.

An opportunity exists to build a framework for rapid translation between the syntheses of forest science data described above and the delivery of these data through an accessible, interpretable platform for public access. Clear annual metrics of forest "health", including trends in carbon stocks ("state of the forest carbon-stock"), trends in forest growth and mortality, changes in biodiversity, including clear statements of uncertainty, can be readily developed with existing data. These assessments would be presented through a "ForestGEO Forest Health" online dashboard that updates data, revises forecasts, and integrates data collection with the needs of key stakeholders. It will also connect ForestGEO with other data sources and offer a platform through which forest science can be taught. Identifying where clear uncertainties in particular estimates or differences between sites or regions exist will help identify key areas requiring more research.

ForestGEO has pioneered long-term observations of forests worldwide through the establishment of 74 large-scale permanent plots in 28 countries where over 7 million trees representing >12,000 tree species (>20% of Earth's total tree species diversity) are mapped, measured and monitored. A wide range of complementary data are collected at each plot, including tree species functional characteristics, growth histories, local climate, soils, and more. Forest scientists estimate the biomass of trees by extrapolating from their diameters, and half of that biomass is carbon. The millions of diameter measurements made every year across the 74 ForestGEO plots therefore offer unprecedented insights into where carbon is, where it is increasing or decreasing, and based on our understanding of how these forests are changing, what the future of carbon stocks and fluxes might be. These data are fundamental for calibrating remote-sensing observations, testing models, and informing forest carbon accounting under the UN Framework Convention on Climate Change.

ADVISORS

Fellows will work with the ForestGEO research team which includes Helene Muller-Landau, David Kenfack & Stuart Davies from the Smithsonian Tropical Research Institute (STRI), Sean McMahon from the Smithsonian Environmental Research Center (SERC), and Kristina Anderson-Teixeira from the National Zoo and Conservation Biology Institute (NZCBI). The fellow will join a diverse team of postdoctoral fellows and interns, and will interact closely with the international ForestGEO science community, participating in international workshops and training opportunities.

PRINCIPAL INVESTIGATORS: ForestGEO Team - Stuart Davies, Helene Muller-Landau & David Kenfack (STRI), Kristina Anderson-Teixeira (NZCBI) & Sean McMahon (SERC)