Innovative Finance Mechanisms for Biodiversity Conservation: Quantitative Synergies for Knowledge Sharing

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Abstract

Biodiversity is an all-encompassing concept referring to the diversity of the biosphere measured at various levels in individuals, populations, species, communities, and ecosystems. The term usually covers genetic, species, and habitat diversity. It is regarded as the base for various ecosystem services such as nutrient cycling, climate regulation, food production, and water cycle regulation, linking it closely with human well-being (Habibullah et al., 2021). But the current human usage of natural resources has led to biodiversity loss and significant alterations in biodiversity distribution, composition, and abundance.

The main drivers of biodiversity change include climate change, land use change, direct exploitation of wild species, pollution, invasive alien species, illegal wildlife trade, and demographic damage (IPBES, 2019). Climate change affects demographic rates and causes habitat loss due to rising sea levels, increased fire frequency, changing weather patterns, glacial recession, and habitat warming (Bellard et al., 2014). Preliminary calculations estimate that the rate of biodiversity loss is one thousand times higher than the background and historical extinction rate. None of the 20 Aichi biodiversity targets has been fully achieved globally till now (CBD, 2020), and according to the Living Planet Index 2020, the population sizes of amphibians, birds, fish, mammals, and reptiles have decreased an average of 68% between 1970 and 2016 (WWF, 2020).

Climate change enjoys greater attention in media, and among the population due to associated policy responses involving major economic sectors and also because the concept of biodiversity is difficult to understand and quantify; thus business risks related to biodiversity loss are still undervalued. The World Economic Forum 2020 has called upon the attention of many sectors to avoid ecosystem destruction, which may increase climate risks (Verrisimo et al., 2014).

Africa and Central America are vulnerable regions as far as climate change is concerned. Africa has warmed over 0.7 degrees Celsius over the past century (IPCC, 2007), and the temperature is expected to continue to rise at the rate of 0.2 degrees Celsius per decade (low scenario) to 0.5 degrees Celsius per decade (high scenario). Central America is characterized by a large number of microclimates which makes it a unique climate region, and processes originating in the Pacific Ocean and Caribbean Sea, such as El Nino-Southern Oscillation, trade winds, Inter-Tropical Continental Zone, etc., which makes it a region of high climate variability (Hidalgo, 2021).

Africa is a land of biological variations (Zeller et al., 2017), with some of the most endemic-rich and species-rich ecosystems bundled together. It hosts a variety of ecosystems, from mangroves to deserts, Mediterranean to tropical forests, temperate to sub-tropical and montane grasslands, and savannahs (Wangai et al., 2016). Its living organisms comprise around a quarter of the global biodiversity, and the continent houses the world's largest intact assemblages of large mammals. It contains eight of the 34 recognized biodiversity hotspots.

Central America contains about 7% of the world's terrestrial species. It also features a wide variety of ecosystems, such as tropical forests, Savannah grasslands, deserts, and high-altitude habitats (UNEP, 2016). The Mesoamerican hotspot covers parts of Central America. Latin America and the Caribbean house about a third of the world's forests and about half of its tropical forests (Restropo, 2022). Costa Rica has the highest biodiversity in Central America and the highest percentage of protected land in the world, with approximately 25% of its land area dedicated to parks and reserves (Parlona, 2017).

Climate change will affect African biodiversity by reducing the amount and availability of suitable habitats (Sintayehu, 2018). A loss of species from an ecosystem affects the interactions with other species and impacts the general ecological functions of these interactions. Significant causes of degradation are subsistence and commercial agriculture, timber extraction, urbanization, and the rise of biofuel plantations. Africans are converting over three million hectares of natural habitat annually. The continent is also witnessing unprecedented population growth rates and is expected to host more than half of the global population growth by 2050. The rapid temperature rise could result in significant loss of certain species due to range retraction. Similarly, in Central America, habitats are rapidly degrading due to agriculture and pasture for livestock. This region is also rife with extreme climate events such as droughts, hurricanes, and floods (CEPAL, 2018). By the 2080s, vast areas of central America will be subjected to climatic conditions outside natural variations, which may lead to altitudinal migration or extirpation, with broadleaf forests, savannahs, and mangroves being the most susceptible (Sempris et al., 2008).

Currently, approximately 15% of terrestrial and freshwater ecosystems and 8% of the marine ecosystems are covered by the more than 270,000 designated Protected Areas worldwide. Protected Areas need to be integrated and more coordinated investment is required. $140 billion annually is required to protect 30% of the world's land and oceans (JRC Technical Report, 2023).

Previously, Austin et al. (2015) have undertaken a combined quantitative and qualitative analysis to assess the effectiveness of habitat conservation programmes in Scotland using a Discounted Present Value model. Toetzke et al. (2022) have tried to estimate the gap between the proposed and the current international climate funds using machine learning. Using quantitative models, OECD (2020) estimated the current global biodiversity finance investments and biodiversity finance needs.

The main motive of our study is to explore the synergies between climate change, the economic and political environment, and financial investments by innovative financial mechanisms for biodiversity conservation, and ultimately bring out the prospect of knowledge sharing and collaboration between two different mechanisms with similar goals and actions but operating in different regions (Uganda and Costa Rica). Our study was driven by two researchers: 1) Pringle (2017) studied two distinct conservation mechanisms operating in two different socio-economic contexts (one in Costa Rica while the other in Mozambique) to generalize underlying philosophies and approaches which can be applied worldwide, though the specific activities are place based, context dependent and continuously evolving. 2) Worlen et al. (2020) who qualitatively studied the drivers of synergy and extent of collaboration between multilateral climate finance mechanisms for four nations (Kazakhstan, Cambodia, Namibia, and Mongolia).

This study is of immediate relevance to policymakers since the application of synergy degree modelling may assist them in designing innovative finance mechanisms to be more aligned with climate change. The presence of synergies with other seemingly unrelated mechanisms would also provide the possibility of association and learning from mistakes already made, thus improving the efforts toward conserving biodiversity.

The rest of the paper is structured as follows: Section II sets up the background by providing some definitions pertinent to our paper and details two finance mechanisms we have chosen for this study. Section III presents the literature review of the interrelations between biodiversity and climate change and biodiversity conservation financing. Then in Section IV, we quantitatively analyse the mechanism of Mgahinga and Bwindi Impenetrable Forest Conservation Trust to bring out the synergies of its conservation impacts with climate change. We also examine potential information transfer and synergistic collaboration between innovative finance mechanisms by investigating possible linkages between Bwindi Mgahinga Conservation Trust and the Guanacaste Dry Forest Conservation Fund. This fund has been instrumental in conserving tropical forests in the Guanacaste province of Northwestern Costa Rica. Section V presents the results, and section VI concludes the paper while suggesting future research directions and shortcomings.