2022_91_ZSL_Pettorelli: Ecosystem degradation, climate change and tropical ecosystem stability – Tanzania as a case study

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Tropical ecosystems in Africa face unprecedented anthropogenic impacts over the next few decades resulting from the predicted doubling of the sub-Saharan human population. This steep increase in human population size poses serious challenges to the resilience of ecosystems, due to the impacts of land use change to grow crops and overexploitation of natural resources to support a rapidly growing human population. Unpredictable and extreme weather conditions that result from anthropogenic climate change place additional pressures on these highly diverse ecological systems, with detrimental local, national and international impacts for biodiversity and human wellbeing. Global environmental change will thus have catastrophic consequences for humans and wildlife in Africa in the coming years if no solutions are found to feed a growing human population whilst maintaining ecosystem services and reducing biodiversity loss. To address this developing situation, and design environmental solutions that will protect both nature and people, it is essential to first understand the mechanistic pathways that lead to reductions in ecosystem functionality and service delivery; to a loss of resilience; and ultimately to ecosystem collapse.

This project aims to assess the impacts of ecosystem degradation and climate change on ecosystem functioning stability within and across ecosystems where impacts are predicted to have some of the most severe effects: Tanzania. The country is a renowned biodiversity hotspot undergoing rapid changes in climate and land use; it is expected to have one of Africa’s fastest growing populations over the next decades. The project will (1) assess ecosystems’ ability to maintain functioning in the face of increased degradation, and (2) examine how ecosystem degradation alters ecosystem resistance and resilience to environmental perturbations. For the purpose of this research, the project will focus on 27 sites where camera-trap information on species distribution was collected over the period 2004-2017. These sites are exposed to variable levels of anthropogenic pressures: they represent a selection of reserves with variable levels of protection and are distributed across a selection of ecosystem types. Using satellite remote sensing and ground-based information from these 27 sites, the student will (i) explore how fragmentation relates to functional and phylogenetic diversity as well as ecosystem functioning; (ii) assess how fragmentation alters ecosystem resistance and resilience to natural disturbances, focusing on droughts and/or floods. A central output of this research is an enhanced knowledge of how changes in ecosystem functions relate to changes in ecosystem composition and structure. This understanding will be of immediate applied value and improve our ability to safeguard biodiversity. This research will also identify ecosystems likely to be most sensitive to future ecological change, helping prioritise interventions.

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