Anthropocene ecological dynamics

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Human activities are now an increasingly dominant force in the Earth system. The global human population is growing and likely to reach a staggering 11 billion by year 2100 and human resource use is increasing both in total and per capita. This development is leading to massive environmental changes, hereunder in climate. It has also has strong impacts on biodiversity, with high and likely increasing rates of biodiversity loss a particular concern.

The massive human influence on the biosphere requires new foci for ecological research to provide scientific guidance for maintaining Earth's rich biodiversity and functional wild ecosystems in this Anthropocene epoch. I will discuss three key phenomena that demand attention and integration: ecological disequilibria, novel ecosystems, and trophic cascades, with attention to how these relate to the dynamics and preservation of the Masai Mara-Serengeti ecosystem in the Anthropocene.

The ongoing environmental changes are already driving changes in species ranges, community composition, and ecosystems, and such changes are expected to continue. What is less appreciated is that these dynamics are likely to involve strong ecological disequilibria, where biota and ecosystems on one hand and climate on the other becomes mismatched, notably through extinction debts and immigration lags. The consequences can be complex and unexpected ecological outcomes.

These dynamics together with other human-driven forcings, notably globalization, will cause increasing proportions of wild nature around the world to be novel ecosystems. Novel ecosystems are self-perpetuating ecosystems that have resulted from human activities and do not have natural historical precedents. While much debated in recent years, we do not yet have a good understanding how such ecosystems function, notably the role of exotic species in these ecosystems, their capacity to harbor biodiversity, and how they will respond to further Anthropocene changes, notably in climate.

Recent years has witnessed an increasing recognition of the role of trophic cascades in ecosystems, and jointly with this, their strong world-wide attrition due to defaunation. At the same time there is increasing interest in remedying this trophic downgrading, including via usage of non-native species as ecological replacements for extinct species. However, only limited empirical work has been done to evaluate how such trophic cascades interplay with other Anthropocene dynamics, limiting our ability to guide their usage for biodiversity conservation and ecological restoration.

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