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Impact of tropical cyclones on global ecosystems

Chahan M. Kropf^{1,2}, Loïc Pellissier^{1,3}, Lisa Vaterlaus¹, Christopher Fairless¹, and David N. Bresch^{1,2}

¹ETH Zürich, Institute for Environmental Decisions, Department of Environmental Systems Science, Basel, Switzerland

²Federal Office of Meteorology and Climatology MeteoSwiss, Operation Center 1, P.O. Box 257, 8058 Zurich-Airport, Switzerland

³Swiss Federal Research Institute WSL, Zürcherstrasse 111, 8903 Birmensdorf, Switzerland

Human societies rely on the existence of functioning global ecosystems, which are threatened by a combination of gradual changes and extreme events. Among the latter, natural hazards such as wildfires or floods can play a **functional** role for ecosystems, with plant and animal species requiring regular disturbance in their life-cycle in order to thrive, but beyond a threshold, the extreme events might cause ecosystem degradation.

Here we map and project the risk of tropical cyclones on coastal ecosystems worldwide, using the probabilistic risk model CLIMADA to describe the vulnerability of global terrestrial ecosystems to tropical cyclones. First, a baseline for the current climate conditions is used to determine whether ecosystems are resilient, dependent, or vulnerable to tropical cyclones. We show that most ecosystems in the tropics are at least resilient to lower-intensity storms, but only a few ecosystems are not vulnerable to high-intensity storms. Second, the changes in tropical cyclone frequency under the high-emission scenario RCP8.5 in 2050 are used to determine which ecosystems are at risk. We show that while the global increase in the frequency of strong storms is the most threatening effect, several ecosystems with a dependency relationship are also at risk of locally decreasing frequency of low to middle-intensity storms.

Our study paves the way for a better understanding of the functional and vital relationship between extreme weather events and ecosystems at a global scale, and how regime shifts under climate change might threaten them. This can prove useful to improve ecosystem management and design appropriate nature-based protection measures in a rapidly changing climate.