

Historically robust natural ecosystems could collapse due to climate change and human activity

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Global change will strike the oldest and most complex ecosystems of the world hardest, regardless of their past stability. This alarming finding is reported in a JRC-led article published in *Nature Communications* today.

The authors hypothesised that [invasive species](#), the warming climate and environmental degradation have altered natural habitats so deeply that species adaptation to historical conditions may not be helpful under these new circumstances. Interestingly, the authors found independent support for this hypothesis from both computer simulations and real-world data.

Starting from a single ancestor digital organism, the authors let artificial life communities evolve for hundreds of thousands of generations under different, stable environmental settings. These simulated communities included both free-living and 'parasite' digital organisms that helped researchers investigate how biodiversity and ecological networks develop over time, under different environmental conditions. Over several generations, both hosts and parasites diversified, and their interactions became more complex.

The authors then investigated how these communities would respond to different scenarios of biodiversity loss. They found that when species become extinct in a sequence consistent with their degree of adaptation to the 'natural' environmental conditions within which they had evolved,

their extinction has only a limited effect on the overall diversity of the community. Any deviation from this pattern however, may trigger extinction cascades, eventually leading to the collapse of the entire network.

The tendency of consuming species to rely and specialise (develop in a way most suited to the environment) on dependable resources has enabled the evolution of complex systems. This basic mechanism may have doomed many species to extinction - the authors demonstrate it by comparing the results of their [artificial life](#) simulations with several empirical host-parasite networks of different animal groups. Resources that had been largely available in the past are now becoming increasingly scarce, putting at risk the species that rely on them.

As recently reported by the United Nations, a prime example are pollinators; nearly half of existing pollinator species are now at risk of extinction due to, amongst others, the reduction in availability of wildflowers. But there are countless, less spectacular cases. Large wild mammals represented for sure dependable resources for parasites in the past, but are now threatened by habitat loss and human activity. The white and black rhinos are now critically endangered mostly due to poaching. This situation is driving to extinction the largest fly species known in Africa, *Gyrostigma rhinocerotis*, whose larvae can develop only inside rhinos' stomach.

Ironically, species belonging to systems that have been in stable conditions for a long time, such as rainforests and coral reefs, could be those least prepared to face the new challenges posed by [global change](#).

EU policy on biodiversity and ecosystems

The EU is committed to protect its natural capital; over the last 25 years it has built the largest network of protected areas in the world which

covers 18% of EU's land. Nature and biodiversity are protected by EU law and a dedicated strategy sets concrete targets for halting the loss of biodiversity by 2020. This would permit to keep European ecosystems healthy and allow species to thrive across their entire natural habitat. Healthy ecosystems can in turn also help mitigate the impact of climate change.

More information: Giovanni Strona et al. Environmental change makes robust ecological networks fragile, *Nature Communications* (2016). [DOI: 10.1038/NCOMMS12462](https://doi.org/10.1038/NCOMMS12462)

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