

Science for Environment Policy

Biodiversity loss threatens key ecosystem functions

A synthesis of 192 studies has provided a quantitative estimate of the impact of the loss of plant biodiversity on ecosystem primary production, showing that this impact could be as great as that of other major environmental changes, such as climate warming, rising ozone levels and ocean acidification. They examined the effects of biodiversity loss on primary plant production of biomass and decomposition of plant litter, both of which underpin the carbon cycle and provision of key ecosystem services.

Previous studies have shown that loss of plant biodiversity will lead to falling plant productivity¹ However, the results of this latest study suggest that policymakers and land managers need to consider the threat of biodiversity loss on ecosystem health alongside other high profile environmental changes, such as higher ozone and UV, nutrient pollution or drought. The research provides a quantitative base which will allow policy-makers to incorporate species loss relevant for primary production and decomposition into ecosystem assessments, such as that planned by the Intergovernmental Science Policy Platform for Biodiversity and Ecosystem Services.

To compare the impact of species loss with other drivers of ecosystem changes, the researchers first looked at other studies that used experiments to estimate the average effect of environmental changes on primary production and decomposition across different environments over the course of this century. These were then compared to data from 192 publications that considered the impact of species loss on the same ecosystem processes. Finally, they looked at a set of 16 experiments which considered both species loss and another environmental change together.

Overall, productivity was more heavily affected than decomposition, suggesting that plant species loss could have implications for predictions of carbon storage in biomass. There was little impact on biomass production if species loss was at the lower end of current predictions (i.e. 0-20% of species lost). Average predicted levels of species loss (21-40%) had an effect on primary production comparable to that of both climate warming and the effects of ultraviolet radiation.

If 41-60% of species were lost, the impact on biomass production was much greater, for example, it fell by around 13% across terrestrial, freshwater and marine ecosystems if 50% of species are lost. This is comparable to the effects of acidification, ozone, or rising CO₂ in ecosystems. 50% species loss by the end of this century is at the high end of global biodiversity loss predictions, but it is predicted locally, particularly in regions where large patches of habitat have been lost. Species loss is unlikely to have as large an effect on biomass production as some drivers of ecosystem change, such as heavy nutrient pollution or drought. To do so, species loss must reach 75%.

The 16 experiments that considered both species loss and another driver of environmental change showed similar results. In these experiments, loss of 21- 40% of species resulted in loss of primary production similar to that caused by increased CO₂ or drought.

Decomposition was less-severely affected by species loss and other drivers of ecosystem change than primary production. Loss of litter consumer species reduced decomposition rates by around 8%, compared to reductions of around 2% for increased CO₂ and nitrogen pollution, although loss of litter diversity did not affect average decomposition rates.



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1.For example, see Cardinale *et al* (2011). The functional role of producer diversity in ecosystems. *American Journal of Botany* 98(3), p 572-592. doi: 10.3732/ajb.1000364