

Science for Environment Policy

Review confirms climate change is threatening many ecosystem services

Climate change is having mixed — but mostly negative — impacts on ecosystem services, suggest data analysed by a new study. The research, which brings together the findings of over 100 other studies, found that 59% of reported impacts of climate change on ecosystem services are negative, while just 13% are positive. However, the method of research was shown to strongly influence whether impacts are reported as positive or negative, with expert opinion studies far more negative than other types of study.

Climate change is having a major impact on ecosystem services. It is, therefore, essential that [climate change](#) is integrated into assessments of ecosystem services to help avoid poor outcomes of environmental management. Coastal planning that ignores the effects of sea-level rise could lead to a long-term decline in ecosystem services provided by coastal wetlands, such as flood protection, for example.

There are many studies which have explored climate change's impacts on ecosystem services, but this new study is the first to quantitatively bring together a wide range of findings to provide an overview of the situation. The researchers gathered and reviewed 117 research papers from around the world that explored links between climate change and ecosystem services. The papers were published between 2003 and 2014, although most (78%) were published after 2011, which reflects growing research interest in this area.

The majority of the analyses (59%) reported negative impacts on ecosystem services. Around a quarter (24%) reported mixed impacts, 13% were positive and 4% were neutral. The impact varied, to some extent, depending on what kind of ecosystem service was being assessed; for instance, cultural ecosystem services were more likely to be negatively affected than 'provisioning' ecosystem services (e.g. food and water production).

Of the specific types of ecosystem service, carbon sequestration was reported to have the most varied response to climate change: 41% of analyses suggested impacts would be mixed, 35% negative, 20.5% positive and 3.5% neutral. Impacts of carbon dioxide (CO₂) fertilisation (increased plant growth from elevated atmospheric CO₂) were most likely to be positive; 36% of analyses suggested positive impacts; 36% negative; 14% mixed; and 14% neutral. This underscores the researchers' further findings that the context of each study appeared to affect the direction of climate change impacts, whether this was due to geography or ecosystem type — in one study in the UK, researchers showed that temperature increases would have a negative effect on carbon sequestration; in another study, in the Swiss Alps, researchers showed that it would have a positive impact. Other studies revealed that carbon sequestration response to temperature increase varied by ecosystem type.

More generally, the expected impacts of climate change varied according to the geographical context of each study. Crop production was shown to be affected variably between temperate and Mediterranean climate types in France and also across different crop types globally, between temperate and tropical regions. This variability extended into the marine environment, with maximum fisheries catch potential differing between offshore and coastal zones. This, the researchers say, highlights the importance of conducting local and regional ecosystem-service assessments, rather than relying on averages or aggregates from other contexts.

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Importantly, the method of study was shown to influence the outcome. Nearly all (94%) of studies which drew conclusions by gathering opinions from experts were negative, and none reported positive impacts. However, just under half (47%) of studies which used either empirical methods (i.e. observing actual climate change impacts), or computer modelling methods, were negative, with 29% reporting mixed impacts, 9% neutral and 15% positive impacts.

The authors of this study recommend that, in future, researchers should use a variety of methods and not rely on expert opinion alone, as this may be affected by personal motivations or 'accessibility bias' — a psychological term which describes how opinions are, unintentionally, most influenced by information that is the easiest to retrieve from memory.

The authors also stress how important it is for environmental management to account for multiple, simultaneous impacts of climate change and other drivers of change (e.g. land-use change) on ecosystems services, and within a socioeconomic context. For example, although high levels of CO₂ may help boost crop growth through fertilisation, this benefit could be offset by declines in rainfall and shorter growing seasons, while increased demand for crops from a growing population will affect the scale and intensity of agriculture. However, an integrated approach was often overlooked in the analyses, with only 17% considering how ecosystem services may interact, in trade-offs or synergies. Other gaps in the research included a lack of studies in regions other than Europe and the USA and on [marine ecosystem](#) services.

