Protecting forests alone would not halt land-use change emissions

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Credit: Wikipedia.

Global forest conservation measures meant to mitigate climate change are likely to drive massive cropland expansion into shrublands or savannahs to satisfy the ever-growing hunger for arable land. The consequent changes in land use could cause substantial greenhouse gas emissions, a new study in the journal *Nature Climate Change* shows.

In contrast to previous assumptions, conservation schemes that focus only on forests may thus fail to significantly reduce CO2 emissions from land-use change. If ecosystem protection policies aim at climate protection, they need to cover the whole range of land types, according to comprehensive computer simulations. To compensate for such restrictions on land use, intensification of agriculture to generate higher yields is important.

"While protecting forests to abate climate change is definitely worthwhile, our results illustrate for the first time that forest protection policies alone will not be enough to mitigate greenhouse gas emissions from land-use change", lead author Alexander Popp of the Potsdam Institute for Climate Impact Research (PIK) says. Roughly one tenth of overall man-made greenhouse gas emissions originate in changes of land use - mainly due to the conversion of tropical forests to agricultural land, as the forests store much more carbon in their lush plant cover and pristine soil. Mechanisms that aim to reduce emissions from deforestation are therefore widely discussed.

A crucial challenge is to avoid merely displacing emissions instead of reducing them. While forest protection according to the scientists could save 77 billion tons of CO2 emissions up to 2100, it would also trigger cropland expansion into non-forested areas, releasing 96 billion tons of CO2. "Our study shows that, without further management, a global implementation of forest conservation schemes could lead to new type of carbon leakage," Popp explains. While carbon leakage usually means that emissions are shifted from one country to another to evade emission restrictions, forest protection schemes might inadvertently shift emissions to other vegetation types.

Scrutinizing one of the key elements of the world climate summit in Lima

The team of scientists from the Potsdam Institute analyzed the effects of the currently discussed REDD scheme (Reduced Emissions from Deforestation and Degradation) - a major strand of the current UN negotiations for a global climate treaty. REDD focuses on forest conservation only. The study compared a REDD scenario to a scenario without forest conservation and to simulations with internationally applied conservation schemes that also include other land types.

"The results show that the largest benefits for climate change mitigation could be achieved by a full participation of all countries in a forest conservation scheme and the inclusion of other land types with high carbon content, like wet savannahs," Popp says. Comprehensive conservation policies could also account for additional environmental assets like biodiversity: Reducing land-use change provides a huge opportunity to protect biodiversity as a co-benefit of maintaining carbon stocks.

Food prices have to be weighed up against land conservation

However, given the slow progress in recent international climate negotiations, the implementation of such a comprehensive scheme may be regarded as optimistic, co-author Hermann Lotze-Campen says: "A more achievable approach to minimize the risk of displacing instead of reducing CO2 emission sources could be to focus on the conservation of non-forest ecosystems with especially high value for their carbon stock and biodiversity. That would also mean including financing structures to ensure that conservation investment is spread over the range of ecosystems not covered by the REDD mechanism."

The study also indicates that higher agricultural productivity would be needed to compensate for the reduced availability of land for agricultural

use caused by forest conservation measures. Land use competition and effects on agricultural production costs and food prices would have to be balanced against the positive effects on CO2 reductions through forest and land-use conservation schemes, Lotze-Campen says: "Preserving ecosystems while increasing agricultural production remains a central challenge for sustainable development".

More information: Popp, A., Humpenöder, F., Weindl, I., Bodirsky, B.L., Bonsch, M., Lotze-Campen, H., Müller, C., Biewald, A., Rolinski, S., Stevanovic, M., Dietrich, J.P. (2014): Land-use protection for climate change mitigation. *Nature Climate Change* (Advance Online Publication) DOI: 10.1038/NCLIMATE2444

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