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Feedbacks between agriculture and climate: an illustration of the potential unintended consequences of human land-use activities

C. Delire (1,2), N. Ramankutty (2) and P. Snyder (3)

(1) Institut des Sciences de l'Evolution, Universite Montpellier II, France, (2) Center for Sustainability and the Global Environment, University of Wisconsin-Madison, USA, (3) Department of Atmospheric Sciences, University of Illinois-Urbana, USA, (delire@isem.univ-montp2.fr / Fax: 33 4 67 04 20 32 / Phone: 33 4 67 14 38 08)

Agriculture has significantly transformed the face of the planet – in particular, croplands have replaced natural vegetation over large areas of the global land surface. To cultivate the land, humans take advantage of the resource provided by climate – optimum temperature and precipitation. However, land clearing for cultivation might have resulted in an inadvertent change in the climate. This feedback might, in turn, have altered the suitability of land for growing crops.

In this study, we made preliminary attempts at investigating the degree to which the replacement of natural vegetation by croplands might have altered the land suitability for cultivation using land cover data sets, a coupled climate-vegetation model and cropland suitability analysis. Our study showed that the major changes in suitability occurred in Canada, Eastern Europe, the Former Soviet Union, Mexico and Central America. Our study also showed that local land cover changes may very likely cause changes in climate elsewhere through changing the general circulation of the atmosphere. Therefore, similar to climate problems related to fossil-fuel emissions, local land use changes have the potential to become a global climate problem. Although the magnitude, sign, and spatial patterns of change indicated by this study may be an artifact of our particular model and experimental design, our study is illustrative of the potential inadvertent consequences of human activities on the land.