



Land use/land cover changes and climate: modeling analysis and observational evidence

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This article summarizes the changes in landscape structure because of human land management over the last several centuries, and using observed and modeled data, documents how these changes have altered biogeophysical and biogeochemical surface fluxes on the local, mesoscale, and regional scales. Remaining research issues are presented including whether these landscape changes alter large-scale atmospheric circulation patterns far from where the land use and land cover changes occur. We conclude that existing climate assessments have not yet adequately factored in this climate forcing. For those regions that have undergone intensive human landscape change, or would undergo intensive change in the future, we conclude that the failure to factor in this forcing risks a misalignment of investment in climate mitigation and adaptation. © 2011 John Wiley & Sons, Ltd.

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INTRODUCTION

A great deal of attention is devoted to changes in atmospheric composition and the associated regional responses. Less attention is given to the direct influence by human activity on regional climate caused by modification of the atmosphere's lower boundary—the Earth's surface. Land use/land cover change (LULCC), as discussed in this article, concerns human-caused changes that affect the biophysics, biogeochemistry, and biogeography of the terrestrial surface and its affect on the atmosphere.^{1–3} Vast areas of the Earth's terrestrial surface have undergone LULCC.^{4,5} LULCC effects on climate include direct alterations in surface solar and longwave radiation and in atmospheric turbulence which result in changes

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