

Biophysical feedback on the regional climate system

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This paper reviews studies which have investigated the feedback of degradation in forest and other ecosystem in the Sahel, the central U.S., South America, and East Asia on regional climate. Numerical experiments with coupled the General Circulation Model/Biosphere model and the regional model/biosphere model show that land degradation led to a reduction in rainfall, evapotranspiration, soil moisture and runoff, and an increase in surface temperature and near surface wind field. In Sahel and East Asian studies a coupled model produced anomaly patterns consistent with the long-term droughts observed. In the Sahel the simulated climate anomaly is not limited to the specified degradation area and the summer rainy season, but extends to the south and into the autumn. In the East Asian simulation, the degradation of the Mongolian and Inner Mongolian grasslands produces a rainfall anomaly extending far to the south of the degraded area. In the central U.S. the regional climate is also very sensitive to the surface vegetation conditions but the simulated anomalies are mainly limited to within the area where the land conditions are changed. In South America, two deforestation scenarios are tested: clear cut and secondary forest. Experiments show the secondary forest case produces less precipitation and warmer temperature within two scenarios. In all these experiments changes in the hydrological cycle were the most important in producing the climate anomalies, in contrast to the conventional view that radiative effects dominate.