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Holocene land cover - atmosphere coupling

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Land-cover changes during the last several thousand years, i.e., since the very end of the last glaciation, have occurred naturally and have been imposed by land use. According to a number of palaeobotanic archives, the boreal tree line has shifted by several hundred kilometres in some regions, while some 6000 years ago, the Sahara was much greener than today. Currently, some 1/3 to 1/2 of the continental surface is directly affected by land use. In the mid-Holocene, the main driver of climate and vegetation change presumably were insolation variations due to subtle changes in the Earth orbit. The latter were most likely amplified by biogeophysical feedbacks and their synergy with other feedbacks associated with ocean and sea-ice dynamics. For example, it is shown that the synergy between the so-called taiga-tundra feedback and the sea-ice albedo feedback is able to amplify the precession of equinoxes such that annual mean temperatures are affected even at global scale. It is hypothesized that biogeophysical feedbacks including their synergies overcompensate biogeochemical feedbacks to amplify climate change through the glacial – interglacial cycle. Although humans have perturbed natural vegetation most likely since the mid-Holocene, it is suggested that – contrary to a recent hypothesis – anthropogenic land cover change has markedly influenced global climate only for some 200 years. It is argued that humans could have prolonged the so-called Little Ice. In future, however, either biogeochemical or biogeophysical effects could, depending on the scenario under consideration, exacerbate greenhouse-gas induced climate change.