Geophysical Research Abstracts
Vol. 17, EGU2015-7213, 2015
EGU General Assembly 2015

Has anthropogenic land-cover change been a significant climate forcing in the past? – An assessment for the Baltic Sea catchment area based on a literature review

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We reviewed the recent published scientific literature on land cover-climate interactions at the global and regional spatial scales with the aim to assess whether it is convincingly demonstrated that anthropogenic land-cover change (ALCC) has been (over the last centuries and millennia) a significant climate forcing at the global scale, and more specifically at the scale of the Baltic Sea catchment area. The conclusions from this review are as follows: i) anthropogenic land-cover change (ALCC) is one of the few climate forcings for which the net direction of the climate response in the past is still not known. The uncertainty is due to the often counteracting temperature responses to the many biogeophysical effects, and to the biogeochemical vs biogeophysical effects; ii) there is no indication that deforestation in the Baltic Sea area since AD 1850 would have been a major cause of the recent climate warming in the region through a positive biogeochemical feedback; iii) several model studies suggest that boreal reforestation might not be an effective climate warming mitigation tool as it might lead to increased warming through biogeophysical processes; iv) palaeoecological studies indicate a major transformation of the landscape by anthropogenic activities in the southern zone of the study region occurring between 6000 and 3000/2500 calendar years before present (cal. BP) (1) ; v) the only modelling study so far of the biogeophysical effects of past ALCCs on regional climate in Europe suggests that a deforestation of the magnitude of that reconstructed for the past (between 6000 and 200 cal BP) can produce changes in winter and summer temperatures of +/- 1°, the sign of the change depending on the season and the region (2). Thus, if ALCC and their biogeophysical effects did matter in the past, they should matter today and in the future. A still prevailing idea is that planting trees will mitigate climate warming through biogeochemical effects. Therefore, there is still an urgent need to better understand the biogeophysical effects on regional and continental climate of afforestation in the hemiboreal and boreal regions, and their significance in relation to the biogeochemical effects.

(1) Trondman, A.-K. et al. (2014) Global Change Biology (2014), doi: 10.1111/gcb.12737

(2) Strandberg, G. et al. (2014) Climate of the Past 10, 661-680.