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Reconstruction of cropland cover changes in the European part of Tsarist Russia from 1500 to 1914 based on historical documents

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To evaluate the climatic and ecological impacts of anthropogenic activities in global change research, it is essential to reconstruct historical land use and land cover change on regional and global scales. In this study, we reconstructed cropland areas for 54 provinces within the European part of Tsarist Russia (ETR) over the periods of 1500-1914 using historical data, including cropland area, population, grain consumption, and grain yield per unit area. The main results are as follows. (1) Total cropland areas and fractional cropland areas of ETR for 11 time sections (1500 AD, 1540 AD, 1585 AD, 1696 AD, 1719 AD, 1725 AD, 1763 AD, 1796 AD, 1856 AD, 1887 AD and 1914 AD) during 1500-1914 were reconstructed, respectively. The total cropland area of ETR increased from 4.26×10^4 km² in 1500 AD to 147.40×10^4 km² in 1914 AD. The fractional cropland area increased from 2.40% to 29.20%, and the per capita cropland area decreased from 2.58 ha to 1.13 ha during 1500-1914. (2) Cropland expanded from the central and southwest of ETR to the black soil region, surrounding area of the Volga River, Ukraine region, the new Russia region, and the vicinity of Ural for the increase and migration of population. While in the northern region of ETR, cropland area remained stable due to unfavorable climatic conditions throughout the study period. (3) In 1914 AD, the cropland area and fractional cropland area of each province varied from 0.16×10^4 km² and 0.76% to 5.65×10^4 km² and 76.68%, respectively. (4) The comparisons show that the cropland areas on the ETR in this study for 1500-1914 are higher than those of the HYDE 3.2 dataset. The main reason might come from the underestimation of per capita cropland areas in HYDE 3.2 dataset, which values remained about 1 ha from 1500 to 1920 in that dataset.