



Changes of soil erosion in cropland over the past 300 years in Northeastern China

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Accelerated soil erosion in cropland is a real menace to food production. However, as one of the most important food production area of China, northeastern China's soil erosion has not attracted enough attention because of more flat terrain and smaller sediment load than other regions in China. In order to get a clear understanding of cropland soil erosion in northeastern China, data of cropland area in the past 300 years and data of national water conservancy survey in 2012 were used to analysis the temporal and spatial changes of cropland soil erosion in the northeast of China from 1653 to 2012. From 1653 to 2012, totally $422.67 \times 10^8 \text{ t}$ of soil eroded from cropland in northeastern China, and 52.80% occurred after 1950. Annual soil loss was $0.10 \times 10^8 \text{ t/a}$, $0.35 \times 10^8 \text{ t/a}$, $0.94 \times 10^8 \text{ t/a}$, and $1.54 \times 10^8 \text{ t/a}$ for 1653-1739, 1740-1791, 1792-1910, and 1911-1949, respectively, while $3.68 \times 10^8 \text{ t/a}$ and $4.58 \times 10^8 \text{ t/a}$ for 1950-1999 and 2000-2012. The eroded cropland was only in the south of the Liaoning province before 1780, and started to expand to the north of Jilin and Heilongjiang provinces after 1908. Heilongjiang province has the largest eroded cropland after 1950. Cropland erosion rate was low during 1653-1949, while increased dramatically during 1950-1980, and slowed down again due to ecological policies implementation after 1999. The area percent of cropland with soil erosion rate higher than 0.1 mm/a (tolerance soil loss) to the county's total area were 49.94, 25.22, and 24.84% from the south to the north of Liaoning, Jilin, and Heilongjiang provinces in 1908. However, the ratios became 36.46, 22.40, and 41.14% in 1950. The total cropland area with soil erosion rate higher than 0.1 mm were $51.31 \times 10^4 \text{ km}^2$ for all of the northeast of China in 1980, and more than half of it was in Heilongjiang province, and expanded to the north slowly during 2000-2012.