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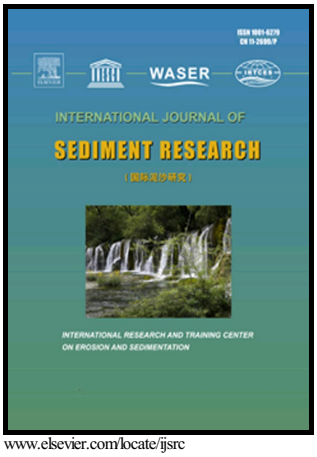


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# Influence of agricultural development and climate changes on the drainage valley density of the southern half of the Russian Plain

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**Abstract**

The southern half of the Russian Plain is characterized by a relatively short history of intensively ploughed lands. The duration varies from approximately three centuries in the southern part of the forest zone to less than one century in some parts of the steppe zone. It was found that after cultivation, on more than 40% of lands in river basins the drainage valley density ($D_{dv}$) decreased by 15% to 58% in all landscape zones. In the first stage, the $D_{dv}$ decrease was mostly associated with increasing surface runoff coefficient after cultivation of virgin lands with proportional decreases in groundwater runoff. In the second stage, usually after reaching areas of arable lands in river basins > 60%, the volume of eroded sediments entering small river channels exceeded the transport capacities of the permanent watercourses. As a result, the river channels completely silted. In later stages, the sediment redistribution cascade within the small river basins of the Russian Plain stabilized because of the increasing proportion of sediment eroded from the basin areas and re-deposited before entering the river channels because of the increasing area of sediment sinks due to the increase in dry valley lengths and total areas. The morphological parameters of small valleys and groundwater discharges are the key parameters that affect the intensity of small river aggradation on the regional scale.

**Keywords:** Soil erosion, Sediment redistribution, Climate change, Land use change, European Russia

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## 1. Introduction

The historical intensification of anthropogenic influences on river basins in plains and lowland areas has usually been associated with an increase in the area of cultivated lands. The most evident examples are the consequences of the intensive ploughing of the Great American and Russian Plains during the last two to three centuries. Tremendous volumes of soil material were removed from the cultivated slopes because of accelerated sheet, rill and gully erosion. Erosion occurred in conjunction with intensive sediment deposition at the base of cultivated

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