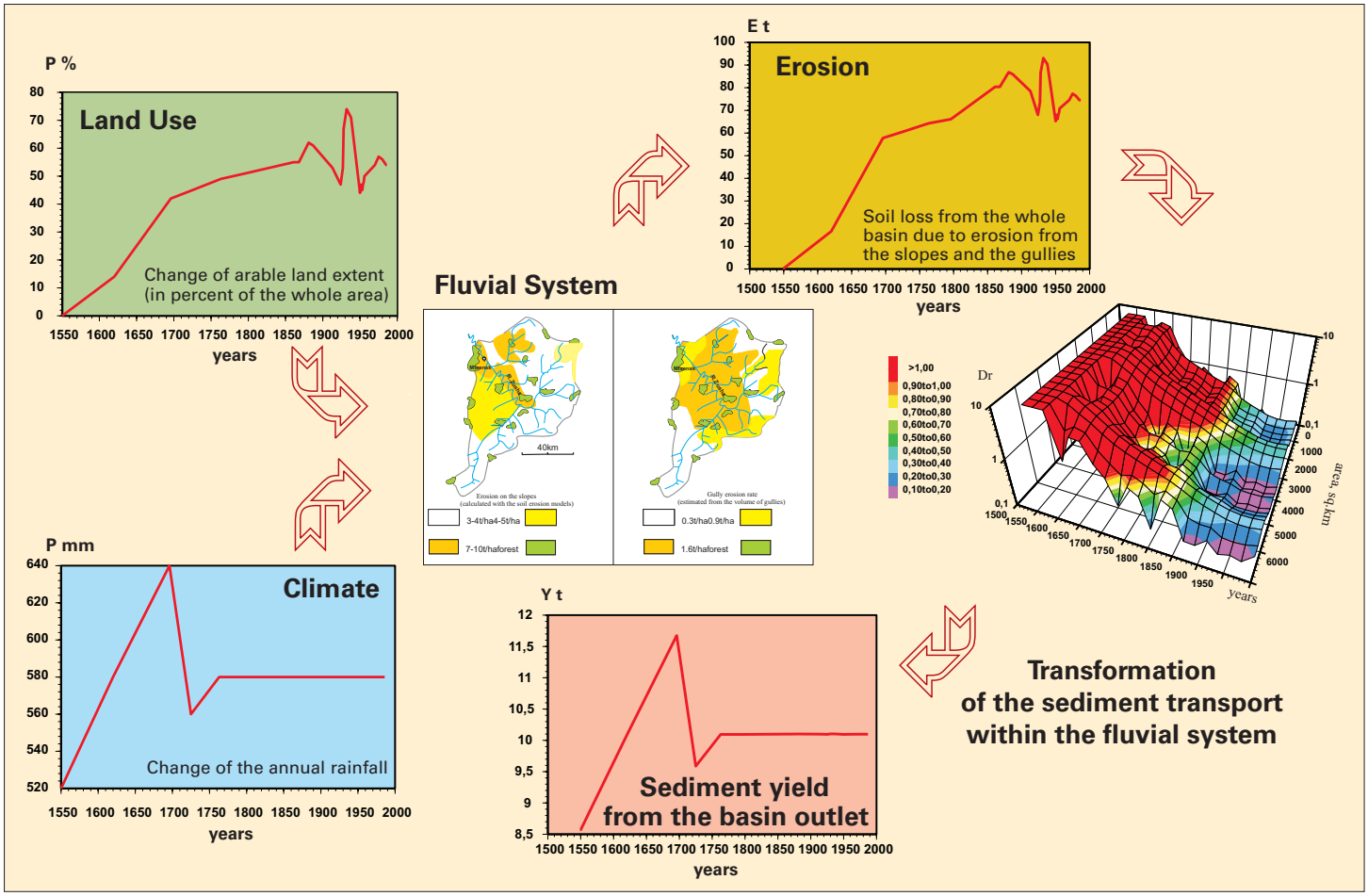

Figure 1: Land use and climate change cause erosion of the Zusha River channel net, altering sediment yield. Sediment delivery to rivers of the Zusha Basin is controlled by erosion of cultivated land. Sediment movement in the river is controlled by rainfall and runoff.

Past Erosion and Sedimentation within Drainage Basins on the Russian Plain

An aggregate sediment budget for the entire Russian plain has been estimated for the period of agriculture. A sediment budget equation for the river net has been derived (Sidorchuk, 1996) using coefficients which have been calibrated with contemporary and/or past erosion/sedimentation rate data. The equation is then used to reconstruct the sediment budget for climatic and land use conditions in the past, and for forecasting erosion and sedimentation for future scenarios of climate and land use.

In the Zusha River catchment, a tributary of the upper Oka River not far from Moscow, land use and climate have been estimated for the period since 1550 AD from statistical records (Krokhalev, 1960; Tsvetkov, 1957; Zlatokrilin *et al.*, 1986). Rates of sheet and rill erosion have been estimated by Belotserkovskiy *et al.* (1991) using two models tested under Russian conditions taking account of the time series of land use and climate. The volume of gully erosion was calculated by Kosov *et al.* (1989) and Sidorchuk (1995).

By applying the calibrated model, sediment yield from the Zusha basin and the sediment delivery ratio (ratio of basin yield to total basin erosion) have been calculated. The model results show that under natural conditions of dense forest-steppe vegetation during the 16th century, slope and gully erosion was very low and the delivery ratio (Dr) was greater than unity; that is, channel erosion dominated, sediment yield was equal to the transport capacity of the channel, and yield was greater than the input from hillslopes and gullies. Dr fell below unity once cultivation began in the 14th century because the transport capacity of the river was less than the input of sediments from slopes and gullies, despite river flow being at its highest for the last 500 years as a result of a peak in precipitation. Cultivation reached its maximum extent in the basin in the 1930's, and Dr was less than 0.2. During this time, erosion of slopes and gullies overwhelmed the transport capacity of the river and sediment storage was high.

The main factor controlling the slope and gully erosion rate during the last 500 years has been the area of arable land. Erosion variation has been large, from 0.2 kg/s under natural conditions to 70–90kg/s at the beginning of the 20th century, and 50–70kg/s at the end of the century. Precipitation varied by ± 10%, as did flow transport capacity and sediment yield, compared with a variation of ± 20% in the area of protective vegetation.

This case study suggests that the low relief, cold continental climate, grey forest soil landscape of the Russian Plain is very sensitive to the level of land use.

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For full references please consult *www.pages-igbp.org/products/newsletters/ref2003.html*