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Human impacts on Water and Sediment Quality of Selenga River system

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Selenga River is the main tributary of Lake Baikal which is the largest freshwater reservoir in the world. Jointly with Angara and Enisey rivers it forms the longest river network in Eurasia. Selenga River contributes about 50% of the total water inflow into Baikal. It originates in the mountainous part of Mongolia and then drains into Russia. There are numerous industries and agricultural activities within the Selenga drainage basin that affect the water quality of the river system. Historically the principal land use is grazing. Other land uses include mining, forestry, and row crop agriculture. In the Mongolian part of the Selenga basin waters of the Orkhon River, downstream Tuul River, and the Eroo River are reported to get impacted [Integrated Water, 2010]. Orkhon, Tuul, Kharaa and Khans are experiencing increased pollution by urbanization and industrial activities within the basin [MNE, 2007; Batimaa et al. 2011]. At the same time rivers drain broad alluvial valleys and thus are distinguished by high rates of bank erosion. Matter fluxes of the rivers are effected by both natural (bank erosion) and anthropogenic (mining and slope wash from the deforested lands and pastures) drivers.
Suspended and dissolved matter fluxes have been reported to increase in recent times [Boyle et al., 1998; Khazheeva et al., 2006]. However any permanent observations of sediment and dissolved matter mass flows in the upper Selenga basin (within Mongolia) have never been performed [Ecosystems. . . , 2003]. Therefore field surveys are considered to be the main source of information for suspended and dissolved matter fluxes analyses. In our 2011 (July-August) field campaign water samples for total suspended sediment concentration assessment were collected in rivers of Mongolian part of the basin. The hydrological field measurements included discharge, turbidity (T), suspended sediment concentration (SSC), major dissolved ions concentration (Ca^{2+}, Mg^{2+}, K^{+}, Na^{+}, Cl−, ${SO_4}^{2}-$, ${HCO_3}^{-}$), biogenic compounds (nitrogen and phosphorous) and heavy metals (Zn, Cu, Ni, Cd, Pb, etc.) content in water and sediments (riverbed and suspended).
The results indicate that various types of mining activities provide significant changes in suspended or dissolved load. Suspended load along Tuul River increased from 8110 kg/day at the upstream point to 334000 kg/day below Ulaanbaatar and Zaamar gold mining. Open-cast gold mines of Tuul and Orkhon river basin lead to significant increase of SSC and suspended load. While both suspended and dissolved material is provided from different sources, the total annual mass flow mostly depends on specific hydrological events. Flooding can breach thin strips of land separating dredge pits from river channels, resulting in massive sediment loading, as it was observed in the studied river. Increased loading of dissolved ions was observed below ore mining and ore processing factory of the Erdenet in the Khangal River. At the same time low water discharge of the Khangal River provides fast decrease of dissolved solids concentration downstream along river network (below Khangal River confluence with the large Orkhon River).