



## Human activities impact on mountain river channels (case study of Kamchatka peninsula rivers)

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Human-induced driving factors along with natural environmental changes greatly impact on fluvial regime of rivers. On mountain and semi-mountain territories these processes are developed in the most complicated manner due to man-made activities diversity throughout river basins. Besides these processes are significantly enhanced because of the disastrous natural processes (like volcanic and mud-flow activity) frequent occurrences in mountainous regions. One of the most striking example on the matter is Kamchatka peninsula which is located at the North-West part of Russian Federation. This paper contributes to the study of human activities impact on fluvial systems in this volcanic mountain region.

Human effects on rivers directly alter channel morphology and deformations, dynamics of water and sediment movement, aquatic communities or indirectly affect streams by altering the movement of water and sediment into the channel. In case study of Kamchatka peninsula human activities affect fluvial systems through engineering works including construction of bridges, dams and channel diversions and placer mining. These processes are characterized by spatial heterogeneity because of irregular population distribution. Due to specific natural conditions of the peninsula the most populated areas are the valleys of big rivers (rivers Kamchatka, Avacha, Bistraya (Bolshaya), etc) within piedmont and plain regions. These rivers are characterized by very unstable channels. Both with man-made activities this determines wide range of fluvial system changes.

Firstly bridges construction leads to island and logjam formation directly near their piers and intensification of channels patterns shifts. Furthermore rivers of the peninsula are distinguished for high water flow velocities and water rate. Incorrect bridge constructions both with significant channel deformations lead to the destructions of the bridges themselves due to intensive bank erosion.

Secondly, intensive water flow changes and channel deformations are connected with logjam formation, particularly on semi-mountain braided rivers. To prevent fluvial hazards channelization and check dams construction is implemented. These direct alternations of the channel usually have further sequences to the hydrological regime of the rivers. Examples include dams destroy after the first floods, water passing away from the new planning courses. In the case of the Avacha river there was constructed a dam to prevent the development of right branch, reduce right bank erosion and defend the downstream settlement from destruction. But for lack of information concerning characteristics of water flow and fluvial regime on this reach there was fixed filtration of riverine water through the dam and intensification of erosion processes on the contrary.

Placer mining is the other significant factor of human activities. Along mining sites direct impact on rivers is characterized by channel diversions construction which leads to river slope increase and intensification of vertical channel deformations. Indirect affect includes water flow reduction due to filtration of riverine waters and many-folds turbidity and sediment flow increase. Latter leads to the growth of islands and formation of new islands below mining sites.

Piedmont environment and mountain river channels are regarded to be the most precious for the human interventions. It is necessary to realize complex investigations before planning any human enterprise within river channels and valleys. Based on the overview of existing interactions between fluvial system and human activities the schemes of different stream types regulation was developed.