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Erosion Processes, Sediment Transport and Hydrological Responses Due to Land Use Changes in Serbian Ski Resorts

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The construction or improvement of Serbian ski resorts provoked intensive erosion processes, sediment transport and hydrological responses due to land use changes, affecting the surrounding environment and even endangering the functionality of the built objects. The dominant disturbing activities (clear cuttings, trunk transport, machine grading of slopes, huge excavations, and access road construction) were followed by the activities during skiing and non skiing periods (skiing, usage of snow groomers, moving of vehicles and tourists, forestry activities and overgrazing). These activities put a lot of pressure on the environment, including the removal or compaction of the surface soil layer, the reduction of the infiltration capacity, the destruction or degradation of the vegetation cover, the intensifying of the surface runoff and the development of erosion processes. The most affected ski runs were surveyed (scale 1:1000) and all damages were mapped and classified during the summers of 2007-2010. The development of rills and gullies was measured at experimental plots (100x60 m), and the survey data were entered into a GIS application. The area sediment yield and the intensity of erosion processes were estimated on the basis of the "Erosion Potential Method"(EPM). The changes in hydrological conditions were estimated by comparing the computed values of maximal discharges in the conditions before and after massive activities in the ski resorts, as well as by using the local hydrological records. The determination of maximal discharges was achieved using a combined method: the synthetic unit hydrograph (maximum ordinate of unit runoff, qmax) and the Soil Conservation Service (SCS, 1979) methodology (deriving effective rainfall, Pe, from total precipitation, Pb). The determination was performed for AMC III (Antecedent Moisture Conditions III: high water content in the soil and significantly reduced infiltration capacity). The computations of maximal discharges were based on the regional analysis of lag time (Ristić, 2003), the internal daily distribution of precipitation (Janković,1994) and the classification of soil hydrologic groups for runoff curve numbers (CN) determination (Đorović, 1984). The applied restoration and erosion control measures have stopped the degradation processes and helped to rehabilitate the appearance and functions of the landscape. The findings of this survey highlight the importance of considering geomorphic and hydrological factors under the conditions of significant changes in land usage. The results of this investigation can contribute to the improvement of planning processes and the implementation of development projects in ski areas.