



Human-induced landscape changes and geo-hydrological risk: the Rupinaro catchment, Liguria, Italy

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Small and steep watersheds are typical of Liguria, northern Italy. In these small watersheds, geo-hydrological hazards, including flash floods and shallow landslides, caused by high intensity rainfall are frequent and abundant. In the coastal valleys of Liguria, narrow flood plains have hosted human settlements and communication lines since the protohistoric period. Since then, a variety of human activities have modified the natural landscape significantly, and chiefly through land-use changes first in the flood-plains, and next along the slopes. We have studied the 11-square km Rupinaro catchment, west of Chiavari, which has been inhabited since the 8th century BC. Progressive human actions have modified the main river and its tributaries, which have become narrower and canalized, and locally they were covered completely. Human actions have also contributed to the increase in the runoff coefficients, and to the progradation of the main river into the Ligurian Sea. Demographic growth, socio-economic development and urbanization are the main drivers for the land use changes occurred in the Rupinaro catchment. Through a combined analysis of archaeological and palynological data, and the multi-temporal analysis of historical maps, aerial photographs and satellite imagery of different vintages, we have reconstructed phases of modifications of the river and the tributaries. We determined the land use changes calculating the loss of soil, analyzing statistics of buildings and demography for the last 150 years, and interpreting historical maps and aerial and satellite imagery. We found that land reclamations, the construction of embankments, and the rectification of rivers are the main human actions performed to obtain building areas along the main river course. Expansion of urban settlements in flood prone areas, and even in the main riverbed, have reached a critical limit has shown by the destructive flood event that has affected the Rupinaro catchment, and chiefly the town of Chiavari, in November 2014.