

Inundation Activity Enhanced by Abandoned Channels in Alluvial Plain (Po plain, Italy).

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Flood prone hazard is presented according to the flowability hierarchy defined by the space and time priority of overbank flow and the fluvial activity on the flooded areas. River Po territories are considered that have both natural boundaries of the flood river system and artificial boundaries.

The Po plain, which is among the greatest European alluvial plains, develops between the Italian Alps and the Apennines with a river course 600 km long flowing eastward, from the North-western Alps to the Adriatic sea near Venice. Urbanization and floods control works are cited since the Roman age and continued through the centuries to determine the present irregular flood corridor (0.7 to 4 km large) that extends for about 400 km from the river mouth. Destruction of properties and loss of human lives caused by flooding and levee breaches are recorded since the 12th Century.

Three flooding scenarios were identified that were characterized by different distribution and frequency of levee breaches, i. e.: a) numerous levee breaches, with water reflowing in the river channel and flooded areas not greater than 200 km²; b) occasional levee breaches, with water overflowing along the flood plain in trajectories divergent to the river course and flooded areas of 500 km²; c) rare levee breaches with water spreading from the river system and flooded areas of 1000 km².

The flooding behaviors are justified by the alluvial plain slope and by the morfodynamics of the river system developed during the last 2000 years. The first behavior corresponds to a flood plain generated by a meandering channel evolution, the second to a

flood plain generated by a multi-thread channel changes downstream of the tributaries and the last to a delta mouth progradation.

Investigation shows that the abandoned channels are associated with high velocity of water propagation and levee breaching sites, as well as with the extension of water spreading and duration of the flooding.

The abandoned channels have a hydrodynamic influence both when they appear as surficial relict of bed forms and when they are buried by alluvial sediment.

In the Po plain hazard is mainly produced by river channel changes from the multi-thread to the single-thread watercourse due to channel deepening and lateral single-thread channel migration due to watercourse shifting. At equal flood magnitude, the vulnerability of flood prone areas is recognized to be greater when the abandoned channels are present because of soil erosion and sediment deposition on the ground surface and levee breaches by saturated through flow at the buried channels crossing.

Parameters for flood prone areas zoning are proposed with reference to interaction of the flood plain with the river channel morphodynamics during the floods.