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Editorial

Fluvial Geomorphology, River Management and Restoration

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This Special Issue follows a previous SI titled "Fluvial geomorphology and river management", published in 2021, which addressed the role of fluvial geomorphology in landscape evolution and the impact produced by human activities on fluvial systems [1–3]. Within that SI, questions regarding river restoration and management were grappled with. At present, the fluvial system is the main morphological system strongly influencings the physical landscape. In fact, in recent decades, climatic changes have increased the discharge of rivers, thus increasing their potential erosive activity [4,5]. As a consequence, the short-term evolution of rivers is strictly controlled by climatic changes [5–7], and close to coastal zones, rivers interact with marine systems, thus contributing to the modification of these transitional zones [8–10]. The role of human activity as a geomorphic agent is also relevant to the modification and restoration of the fluvial ecosystem. In addition, the recent increases in global temperatures around the word have induced relevant modifications in fluvial discharges, with significant loss of life and infrastructures due to high-magnitude events. Human activities and climatic changes are relevant topics and represent new frontiers in fluvial system research [3,11,12].

This Special Issue is addressed to fluvial geomorphology researchers working in river restoration and management applications and who combine field surveys and modeling elaborations. Different natural and anthropogenic environments are approached by the authors, starting from rural and urban geomorphology and moving to natural river systems, particularly in mountain drainage basins. Finally, original and innovative approaches in the development of fluvial terraces and managing aquatic systems are proposed.

As a result, in this Special Issue, nearly three different research topics are raised by contributors from different parts of the world. The research papers all address the behavior of drainage basins placed at different locations from their mouth and related to different morphoclimatic regions. Three papers investigated the fluvial system of the Mediterranean area: one paper by Forno et al. (contribution 1) approached the fluvial Alpine environment of Northern Italy, and another paper by Putignano et al. (contribution 2) was related to an Apennine drainage basin in Central Italy. The third paper by Forno et al. (contribution 3) addressed the role of fluvio-glacial deposits in the urban geomorphology of Turin. Two papers are addressed the humid tropical climate of Brazil; one by Perez Filho et al. (contribution 4) concerned the development of Holocene fluvial terraces in Northeast Brazil, and the second by Basso et al. (contribution 5) detailed an assessment of water availability in rural communities in Central Brazil. Finally, the paper by Mielhaursen et al. (contribution 6) addressed a methodology for predicting fish passage in restored fluvial channels in the Ontario region in Canada.

The topics addressed by each paper are original and show interesting methods of investigation ranging from classical ones based on field surveys and sampling fluvial and glacio-fluvial deposits to modern ones such as investigating the minimum reference flow of a drainage basin or Vortex rock weirs, which provide physical channel stability, fluvial habitat enhancement and river hydromechanics.

The original paper by Mielhaursen et al. (contribution 6) uses the Vortex rock weir (WRW) methodology in order to provide a river restoration method suitable for the passage

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of small-bodied fish species in gap and low-water-level conditions. They realized best practices for the method, balancing channel stability and fish passage, thus contributing to management strategies in river restoration analyses. The availability of water resources in Central Brazil was addressed by Basso et al. (contribution 5) with the aim of estimating the minimum reference flow of representative hydrographic basins hosting rural communities. The authors used on-site measurements and three regionalization methods for a comparative analysis, showing, as a result, high variability between the minimum reference flows and the observed and measured minimum flows within 21 drainage basins. The enlargement of the monitoring network to sustain effective water security was proposed by the authors. In the same Brazilian region but in the northeast sector, Perez Filho et al. (contribution 4) developed a research study on the complex responses between tropical rivers and Holocene climate pulses in small river systems. In particular, the study aimed at to correlate low river terraces in different regions of Brazil with Holocene climatic changes. Based on field data, the Optically Stimulated Luminescence (OSL) dating of sampled deposits and cluster and correlation statistical analyses, relationships between the variables controlling the spatial distribution of the terraces were investigated. The authors showed how global climate changes were not responsible for the formation of low terraces, which could be attributed to local/regional event climate pulses driving the rearrangement of fluvial deposits and the abandonment of the ancient floodplains via fluvial incision. The reconstruction of a proglacial outwash plain in the physical context of the urban geomorphology of the Turin Town area (Italy) was realized by Forno et al. (contribution 3) using about 40 drilling boreholes. They analyzed the features of fluvial sedimentary deposits present in the subsoil by using boreholes and emphasized the belonging of fluvial successions to the LGM and late glacial episodes. Rock avalanche deposits cropping out in fluvial valleys of the Central Apennines of Italy were investigated by Putignano et al. (contribution 2). Geological field mapping, well-log examination and detailed stratigraphic, sedimentologic and morphometric analyses allowed the authors to constrain the depositional episode to a cold stage of the Late Pleistocene. A restoration of the potential source area and the propagation mechanism of boulders were also investigated using GIS analyses. This represents an original contribution to the knowledge of rock avalanche processes. The relationship between water emergence and Quaternary deposits in the western Italian Alpine was investigated by Forno et al. (contribution 1) within Mont Avic Natural Park. A geological field survey of bedrock and Quaternary deposits allowed the authors to define the geometry of the rock volumes and the hydrogeology of the Perrot spring, which is located at the boundary of glaciolacustrine and landslide deposits.

In conclusion, this Special Issue containing six research articles addresses many topics ranging from the management and restoration of fluvial reaches in rural and urban communities to the role played by climate change in the development of fluvial succession during the Holocene and historical times. The works presented herein are further contributions to the comprehension of fluvial dynamics and how natural/anthropic processes can modify a fluvial environmental system. Furthermore, the collected papers have increased knowledge of and attention to the fluvial system, which represents a relevant and vulnerable natural environment for life.

Conflicts of Interest: The author declares no conflict of interest.

List of Contributions

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