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Floodplain forest dynamics in a hydrologically altered mountain river

P. Molnar, M. Sturzenegger, M.V. Birsan, W. Ruf, P. Perona and P. Burlando
Institute of Environmental Engineering, ETH Zurich, Switzerland (molnar@ifu.baug.ethz.ch)

Widespread river training and flow regulation in Europe has led to the disappearance of most floodplain forests. In the Swiss Alps water extraction for hydropower purposes has changed the natural streamflow regime of many rivers. Yet it remains unclear how these changes may have affected downstream riparian ecosystems, in particular floodplain forests, in the long term. Here we document some observed changes in flow and floodplain vegetation of the Maggia River, which is one of the few remaining natural alluvial rivers with a braided gravel bed stream and riparian floodplain forest in Switzerland.

The construction and operation of a complex hydropower system in the headwaters of the Maggia Basin has led to a drop in the average annual streamflow in the Maggia River by about 75%. This loss of water is seasonally dependent, the natural seasonal peak in June runoff due to snowmelt is practically eliminated and seasonal variability is largely dampened. Changes affect predominantly moderate flows, since low flows are supplemented by the minimum flow requirements imposed on the hydropower operator. Because the hydropower system consists of many relatively small reservoirs, large floods are not substantially affected. As a result of these hydrological alterations, the floodplain forest is likely to be affected by a drop in groundwater levels in the riparian area, by a change in the inundation dynamics, and by a decrease in the geomorphological activity of the river bed.

A time series of 9 aerial photograph scans between 1933 and 2001 was analysed for a 2 km section of the valley to document changes in the riparian vegetation cover. Results show that the alluvial zone exhibits large interannual changes in response to floods. For example, the total vegetated (grass, shrubs and trees) area of the reach ranged between 95 and 50% depending on the time since the last flood. Documented

changes from one year to another following a flood showed a substantial increase in pioneer vegetation stages due to evident channel reworking, and a subsequent maturing of the floodplain forest, thus confirming that the dynamics of riparian vegetation establishment and growth are fundamentally dependent on flow properties. There appears to be a tendency in the study area for a loss in the natural floodplain dynamics accompanied by a decrease in the average active width of the floodplain. Drought, that is a decrease in the groundwater tables due to flow regulation, appears not to affect the riparian forest significantly.