Description for the general public

The project focuses on recognition of the controls, course and spatial scale of the 20th-century development of riparian forest in the valleys of Polish Carpathian rivers and of the formation of vegetated islands in these rivers. In the 19th century valleys of the main rivers of the Polish Carpathians practically lacked riparian forest, but in the 20th century its remarkable development took place. Over the 20th century, only few river reaches saw development of wooded islands, whereas in most of the rivers the conditions favouring the formation of the islands disappeared. Particular aims of the project comprise: (1) recognition of the causes, extent, and the pattern of development of riparian forest and mutual relations between forest development and changes in channel morphology and dynamics of mountain rivers, (2) determining the rate of long-term delivery of shrubs and trees fallen to river channel in the course of erosion of riparian forest by laterally migrating mountain river as an important factor in flood risk, (3) identification of causes of the contemporary decrease in the formation of vegetated islands in Polish Carpathian rivers, (4) determining the mode of development of large islands with complex structure and the islands overgrown with willows/alder and spruce, and (5) evaluation of feasibility of the restoration of modified mountain rivers facilitating re-establishment of vegetated islands and determining the rate of islands development in a mountain river undergoing restoration. .

The project will comprise five research tasks. The analyses of riparian forest dynamics will be performed for three rivers from different parts of the Polish Carpathians: the Czarny Dunajec (a river in the foreland of the Tatra Mountains), middle course of the Raba (a foothill reach of a river draining flysch area) and upper course of the Biała Tarnowska (a river draining a low-altitude mountain range underlain by flysch). Changes in the extent of riparian forest in the valleys of these rivers and the rate of these changes over the 20th century will be determined through the analysis of maps and aerial photos. To infer about the conditions of riparian forest development between particular time horizons, we will determine: changes in the forest cover of the catchments and in a degree of channel regulation of the studied rivers as the factors affecting the river dynamics, and also the extent of lateral channel migration on the valley floors .

The analysis of long-term delivery of fallen trees to the channel of a mountain river will be performed for the Czarny Dunajec. Comparison of aerial photos of the river valley from different years will allow to determine the area of riparian forest and wooded islands eroded between the dates as a result of lateral channel migration. In turn, the amount of wood in trees growing on a unit area of the forest will be determined with terrestrial laser scanning of the trees and a traditional method used in forestry.

The analysis of archival aerial photos of selected river valleys from successive decades in the second half of the 20th century and field investigations with use of dendrogeomorphological method will be used to determine long-term dynamics of vegetated islands in the rivers. These trends will subsequently be compared with the course of channel regulation works in the rivers and land use changes in the catchments to infer about the causes of decline in the occurrence of islands in Polish Carpathian rivers and factors facilitating their formation in mountain rivers. .

The mode of formation of large islands with complex structure and those overgrown with willows/alder and spruce will be determined on the basis of analysis of archival aerial photos from different years, dendrochronological dating of a large number of trees and sedimentological analysis of the cover of fine-grained deposits on the islands. Each of these methods provides different information and their paired use should allow a detailed reconstruction of the development of such islands. We will compare the mode of island development in Carpathian rivers and in rivers with different catchment and channel characteristics.

The formation and development of wooded islands will be monitored in a reach of the upper Raba River undergoing restoration. These observations, together with comparison of hydraulic conditions between the restored reach and the neighbouring channelized reaches, will be used to determine the conditions and rate of re-establishment of islands following abandonment of a channelization scheme in a mountain river.

Research conducted in the project will allow recognition of changes in the occurrence of riparian forest and wooded islands in the valleys of Polish Carpathian rivers over the 20th century as well as some effects of these changes on the river functioning. The occurrence of forest communities in river corridors is known to favour an increase of biodiversity of the rivers and the valley floors, thus amplifying their environmental values. However, detailed recognition of the causes of riparian forest development in the Carpathian valleys and its dynamics in the 20th century have been lacking. An important component of the project is also research allowing identification of the cause of the 20th-century disappearance of vegetated islands from most Polish Carpathian rivers and recognition of the feasibility and rate of their re-establishment in river reaches subjected to restoration. The project will also provide information about the amount of large wood debris delivered to a mountain river as a result of lateral migration of its channel and representing a factor of flood risk associated with the potential formation of wood jams at bridge cross-sections. Moreover, outcomes of the project will help to formulate recommendations for improved management of Carpathian rivers within Natura 2000 areas and allow to evaluate the feasibility of re-establishing wooded islands in the rivers favouring the increase in biodiversity of the river corridors.