OSCAR results in a nutshell

Most rivers in forested ecoregions like Central Europe are naturally bordered by trees. These woody buffers along rivers impact multiple ecosystem functions through shading and reducing water temperature, retaining nutrients from agricultural areas, providing leaves and wood as food and habitat for aquatic insects and fish, which in turn enhances biodiversity but also increases the recreational value of the river landscape. The OSCAR project synthesized and complemented the knowledge on the local effects of single woody patches and investigated how the effects add up at larger spatial scales in two large-scale empirical studies and by modelling effects in case-study catchments.

For two main functions of woody buffers, so called “Bayesian Belief Networks” were developed to assess the effect on nutrient retention and water temperature (interactive versions available at http://www.freshwaterplatform.eu/index.php/oscar-tools.html). Applying these models in case-study catchments revealed largest effects of restoring woody buffers along small streams. In small streams, effects on water temperature are highly relevant, especially at low discharges and water depth, and daily maximum temperature is reduced by up to -5°C. In addition, the reduction of total phosphorous is at a relevant scale, reducing emissions on average by -40% and concentrations by -20%, while the effect on total nitrogen was minor. However, nutrient retention is highly variable, depending on local woody buffer characteristics like hillslope and soil conditions, and large parts of the nutrient load enter the streams via pathways that cannot be controlled by woody buffers. Therefore, the average effects at the catchment scale are smaller compared to what is usually found in reach-scale studies. This may partly explain why biodiversity did mainly depend on overall catchment land use and woody buffers had a surprisingly low effect in the large-scale empirical studies that addressed France and three Federal States of Germany. In addition, other pressures (potentially extensive agriculture and impoundments) seem to override or mask woody buffer effects at larger spatial scales.

It is most promising to develop continuous woody buffers along small agricultural streams prone to soil erosion with a low summer discharge and water depth, but in combination with reducing large-scale pressures. This would also maximise overall ecosystem services, which peaked at moderate woody cover and did not substantially decrease even if the whole riparian area was assumed to be forested. Further research is needed to identify the causal pathways which and how pressures at larger spatial scales limit the potentially much higher effect of woody buffers on biodiversity.