An Ecosystem Services–Based Approach to Characterising Riparian Forests and Developing Management Solutions

Interreg Estonia – Latvia
Co-funded by the European Union

Sille Rebane[1], Floortje Vodde[1], Kalev Jõgiste[1]
[1] Chair of Silviculture and Forest Ecology, Institute of Forestry and Engineering, Estonian University of Life Sciences, Kreutzwaldi 5, 51006 Tartu, Estonia
E-mail: sille.rebane@.emu.ee

Estonian University of Life Sciences

BACKGROUND

Riparian forests play a crucial role in maintaining ecosystem services, including water quality regulation, bank stabilization, carbon sequestration, biodiversity support, and cultural values. Despite their importance, they are commonly classified using generalized forest typologies that fail to capture their functional roles, spatial variability, and strong links to hydrological processes. As a result, such approaches provide limited support for informed management decisions.

This study aims to develop an ecosystem services–based approach for characterising riparian forests and linking this characterisation to practical management solutions. Moving from a structure-based to a function-based perspective, the approach emphasises not only forest structure or site type, but also the capacity of forests to deliver ecosystem services, their sensitivity to disturbances, and their relevance for management. This conceptual framework supports a more holistic and decision-oriented understanding of riparian forest systems.

Vegetation plots were established and species were identified. 1 × 1 m plots were established in seven sample plots within two experimental site, with 10 quadrats recorded in each sample plot.

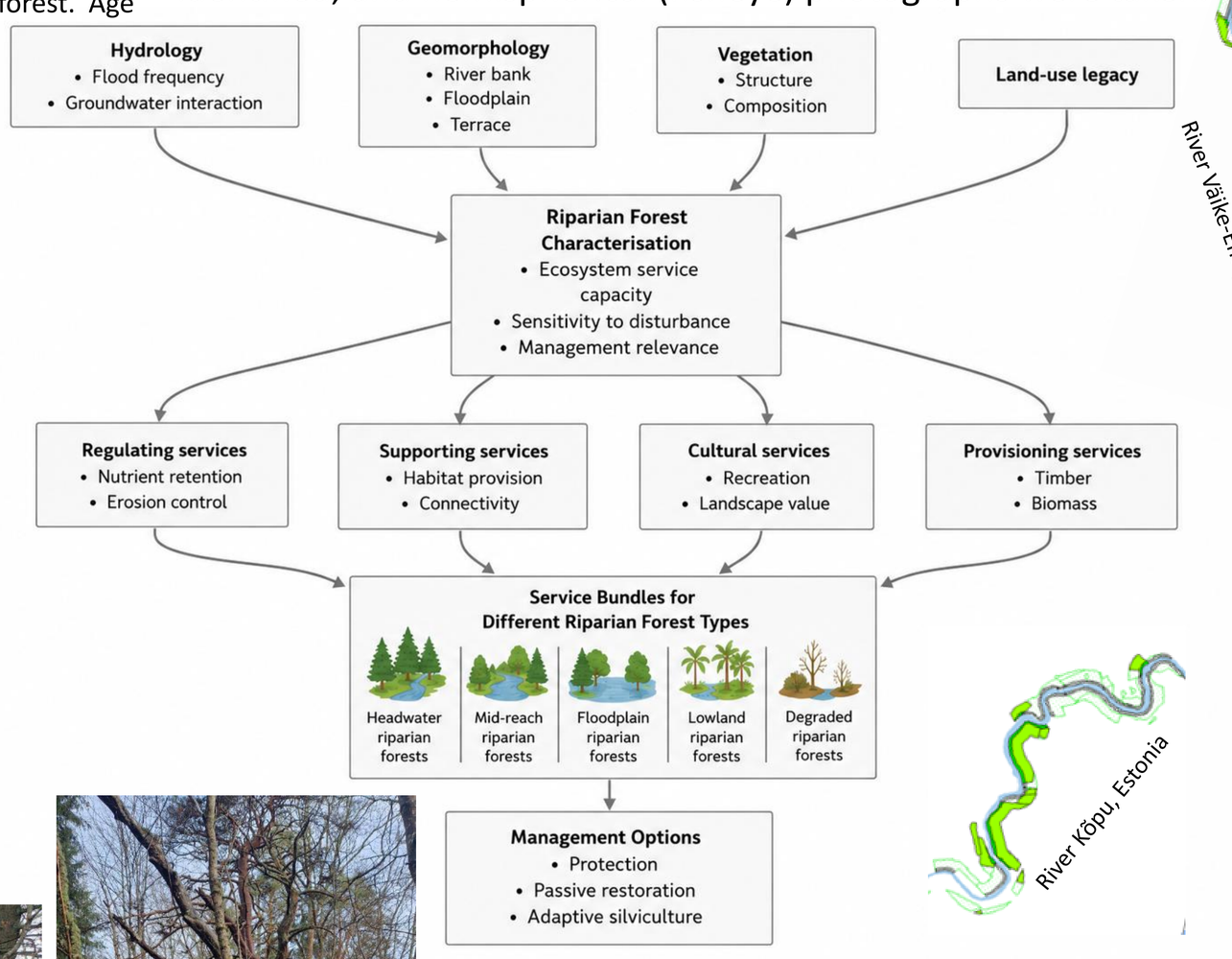
Demonstration site 1: site index class III, *Carex–Filipendula* (sedge–meadowsweet) site type, no drainage, dominant tree species grey alder, development stage mature forest. Age from 51 to 71 years.

METHODOLOGY

Three demonstration sites and two experimental sites were included in the study. At the demonstration sites, we illustrate how undisturbed forest stands, as observed within our project, provide a variety of ecosystem services. These stands differ greatly in their species composition, yet all are located along riverbanks. The experimental sites are areas where fieldwork was conducted. At the first experimental site, harvesting was carried out using gap cutting, while at the second site no harvesting took place. Across all experimental sites, tree height and diameter were measured, vegetation surveys were conducted, bryophytes were identified, and hemispherical (fisheye) photographs were taken.

Fisheye photographs from experimental site 1; all photos were taken from the same location as the vegetation plots.

Demonstration site 2: site index class I, *Oxalis–Vaccinium vitis-idaea* (wood sorrel–lingonberry) site type, no drainage, dominant tree species pine, development stage intermediate-aged forest stand, mean age 80 years.



Experimental site 1, stand condition before gap cutting: *Filipendula* (meadowsweet) site type, no drainage, dominant tree species birch, development stage mature forest, mean age 58 years.

Demonstration site 3: site index class II, *Hepatica* (liverleaf) site type, no drainage, dominant tree species grey alder, development stage mature forest.

Experimental site 1 after gap cutting: two large gaps were created, where the first gap covered half of one sample plot and the entire second sample plot, while a third plot with similar conditions remained untreated. The riparian sample plots along the riverbank were also left untouched.

Experimental site 2: two sample plots were established. No harvesting was carried out along the riverbank, while in the surrounding area harvesting was conducted and the stand has already been regenerated. Before harvesting, the stand was classified as site index class I, *Oxalis* (wood sorrel) site type, no drainage, dominant tree species grey alder, and development stage mature forest. Mean age 55 years.

CONCLUSION

The demonstration sites illustrate the strong contribution of riparian forests to **cultural ecosystem services** such as recreation, aesthetic value, and landscape diversity. Despite differences in species composition and site conditions, all sites enhance scenic quality and support nature-based experiences along river corridors.

Forests provide important regulating, supporting and provisioning services, including water quality regulation, bank stabilization, and habitat provision. Together, the sites demonstrate how riparian forests deliver multiple ecosystem services simultaneously, with cultural values closely linked to their ecological functions.

The main goal would be to recognize and value the diverse ecosystem services in riparian forests without prioritizing any single one of the services.

The project's ecosystem service evaluation tool will be integrated into the LVM GEO platform for public use.