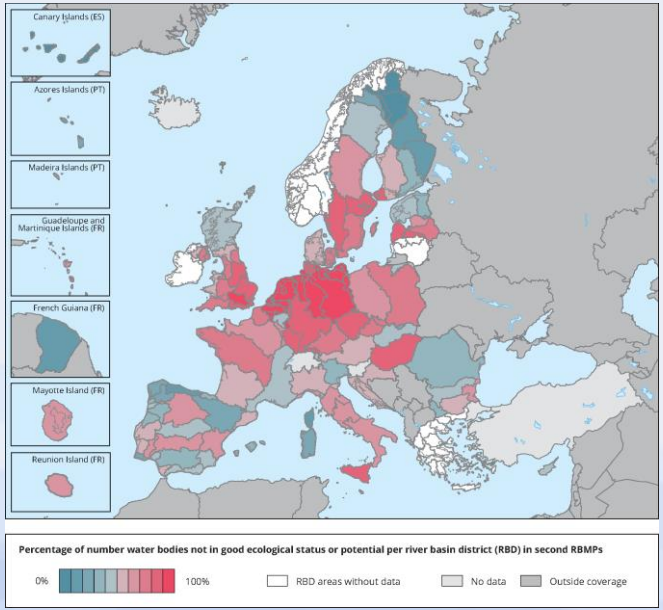
LIFE GoodWater IP approach to planning and implementing measures for improvement of water quality in forest land

Zane Lībiete, LSFRI Silava

EU LIFE Programme integrated project

"Implementation of River Basin Management Plans of Latvia towards good surface water status"

Water quality in European waterbodies

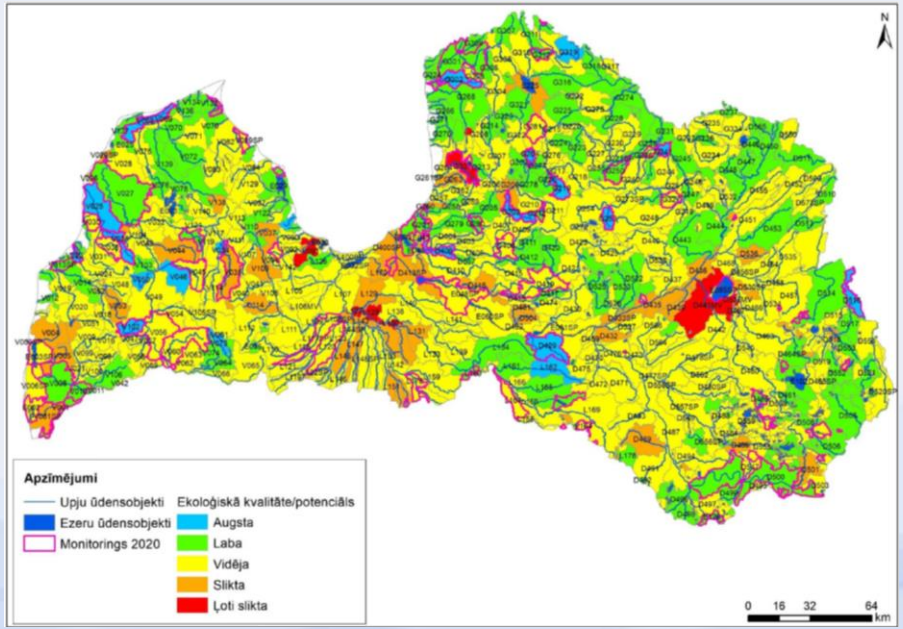


EEA, based on information reported under the second River Basin Management Plans of the Water Framework Directive

- Around 44% of the surface water bodies in Europe are of good or high ecological status or potential (EEA, 2020).
- At EU level, 36% of rivers and 32% of lakes are reported as eutrophic (EC, 2021)
- While the status of some individual elements (biological quality elements and supporting physico-chemical and hydromorphological quality elements) that make up the ecological status improves over time, ecological thresholds are frequently exceeded.

Water quality in Latvian waterbodies

- In Latvia, 3% of waterbodies correspond to high ecological quality, but 33% correspond to good ecological quality (2015-2020)
- Most waterbodies in Latvia correspond to average ecological quality status (LECMC 2021)



Ecological quality status in surface water in Latvia in 2020 (LEGMC, 2021)

Pressures on water quality

- Main pressures on water quality in Europe are **hydromorphological pressures** (34% of all water bodies) and **diffuse pollution** (33% of all water bodies) (EEA, 2021).
- Water quality risks strongly depend on the **land use**. Agriculture poses a significant risk, but water interconnects all land use types. Therefore, water protection measures should be implemented in all areas where intense land management takes place.

The role of forests

- Latvia is a country of **forests** (52% of the land area) and **water** (> 12 000 rivers and streams, > 2000 lakes); these ecosystems constantly interact
- Appropriately designed and implemented water protection measures in forest are not only able to **prevent** the risks to water quality arising due to forest management operations (FMO) but also to **mitigate** the adverse impact caused by other land uses.
- Water protection measures can be implemented **along the waterbodies** and **in the stream network**.

FMO potentially affecting water quality the most

- Effects are strongly **site- and scale-dependent**
- May be altered and amplified by **meteorological factors**
- **Hydrological connectivity** of the sites plays a key role


Uniform regeneration felling with subsequent soil preparation


Forest infrastructure development and renovation

- Water quality protection measures in forestry aim **to reduce the transport of nutrients and soil particles** to watercourses and **to prevent eutrophication and sedimentation**.

Blue-green infrastructure (BGI) and nature-based solutions (NBS)

The framework of nature-based solutions (IUCN, 2020)

- **BGI**: 'an interconnected network of natural and designed landscape components, including water bodies and green and open spaces' (Ghofrani et al.)
- **NBS**: 'actions to protect, sustainably manage and restore natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits' (IUCN, 2016)
- **Integrating** both concepts and **applying a cross-scale planning networks** including both urban and rural areas has been suggested (Langemeyer and Baro, 2021)

Benefits provided by forested riparian buffers

- Protect water **quality**
- Provide and protect terrestrial and riparian **habitats**
- Provide **food and shelter** for aquatic species
- Provide **deadwood** ashore and in the stream
- Protect the **soil** and stabilize banks

Ecologically functional forested riparian buffer

- **Multi-layered** and **uneven-aged forest** provides diverse benefits (deadwood, patchy shading, well-developed vegetation layer)
- **Broadleaved trees** in the proximity of water are more valuable than conifers
- Pure stands of **grey alder should be avoided** – N-fixing trees, increased risks of soil erosion and sediment leaching
- **Beaver activity** should be **monitored**

Environmentally friendly drainage system elements

Three main goals of implementation:

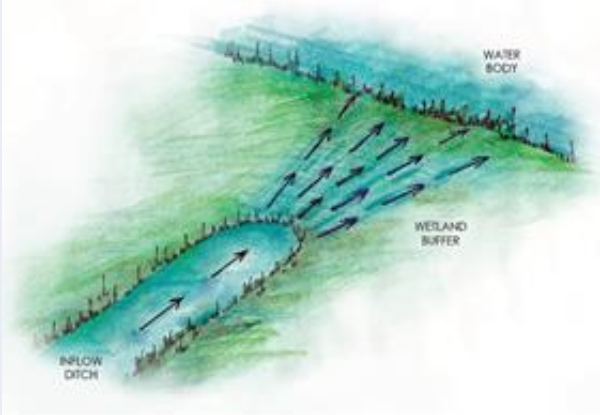
- to **control** drainage intensity (length, depth, width and slope steepness of the ditches to be cleaned);
- to **reduce** flow velocity and erosive power in the ditches;
- to **trap** nutrients and soil particles before they reach the watercourse.

Ditches and ditch segments left uncleaned

Goal: to reduce flow velocity and enhance filtration

- A **simple, effective and cost-efficient** method
- Only if **soil aeration** in the tree root zone remains satisfactory
- Preferably implemented **in main ditches** carrying larger volumes of water and also **before the inflow** in the main ditch
- **Problematic** in Latvia, due to the flat conditions
- Should not interfere with the **primary functions** of the drainage system – to ensure optimal moisture regime for the trees

Overland flow area

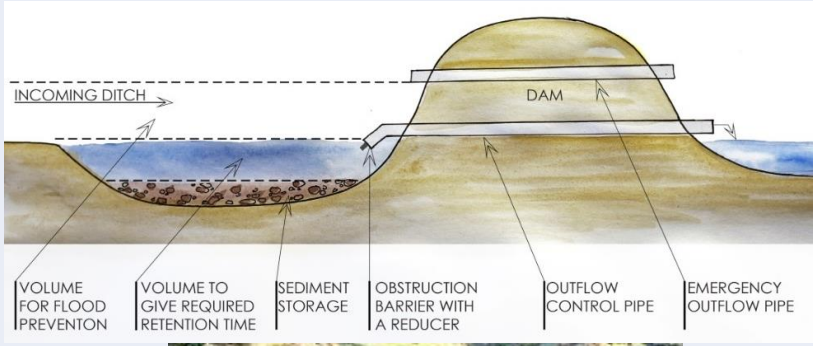


Goal: to divide flow and direct it to a wetland before the receiving waterbody

- **Most efficient** method of water quality preservation
- **Added benefits** (of, e.g., biodiversity)
- A **suitable wetland and sufficient slope** is necessary
- **Problematic** in Latvia, due to the flat conditions

Above: The operational principle of an overland flow area (drawing: I. Pauliņa)
Below: An experimental overland flow area in central part of Latvia before and after the ditch cleaning (photo: Z.Lībiete)

Peak flow control structures



Goal: to reduce flow velocity during the peak flow and to enhance sedimentation

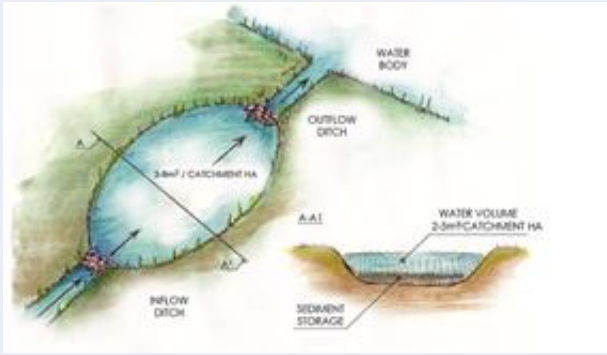
- **Highly efficient** (trap > 60% of suspended solids and > 40% of N and P on average)
- **Optimal groundwater level** is maintained during the vegetation season
- Preferably located **close to the receiving water body**, often **combined with a sedimentation pond**
- One of structures to be installed in the LIFE GoodWater IP demonstration site

Above: The operational principle of an overland flow area (drawing: I. Pauliņa)
Below: An peak flow control structure in Sweden (photo: L.Högbom)

Sedimentation ponds

Goal: to slow the waterflow and to trap eroded sediments

- **Least efficient**, but **simple** and **most frequently** used method
- Do not retain **peat**, and should not be used in areas with **easily eroded soils** (clay)
- **Several ponds** may be used in a drainage area, and the method should preferably be **combined** with other measures
- In suitable areas may deliver **additional benefits**
- A series of sedimentation ponds will be installed in the LIFE GoodWater IP demonstration site



Above: The operational principle of a sedimentation pond (drawing: I. Pauliņa)
Below: An experimental multi-functional sedimentation pond in scientific research forest in Latvia (photo: Z.Lībiete)

Conclusions

1. Surface water quality in Europe should be improved.
2. Hydromorphological alterations and diffuse pollution sources are the main pressures, and land use is an important factor.
3. Water quality should be taken into consideration in all economic activities, including forest management.
4. Targeted water protection measures in the forest may reduce the risks caused by forest management operations and also mitigate adverse impacts of other sectors.
5. These measures, implemented along or in the watercourses and drainage ditches aim to reduce the transport of nutrients and soil particles and to prevent eutrophication and sedimentation.

EU LIFE Programme integrated project
"Implementation of River Basin Management Plans of Latvia towards good surface water status"

Thank you for your attention!

goodwater.lv LIFEGoodWaterIP LIFEGoodWaterIP LIFEGoodWaterIP LIFEGoodWaterIP LIFEGoodWaterIP

The integrated project "Implementation of River Basin Management Plans of Latvia towards good surface water status" (LIFE GOODWATER IP, LIFE18 IPE/LV/000014) has received funding from the LIFE Programme of the European Union and the State Regional Development Agency Republic of Latvia.

www.goodwater.lv