



Environmentally friendly drainage measures

The use of two-stage profiles to improve diversity and water quality in agricultural streams

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The problem

- Adverse impacts of agricultural drainage in waterbodies:
 - Problems with water quality in dredged streams and in water bodies below them
 - Nutrient loading, suspended solids
 - Decreased diversity
 - Problems with erosion, sedimentation and overgrowth
 - Changes in hydrology
 - Expensive maintenance



Ecological values of agricultural brooks

- Important breeding and living environments for many species, even threatened migratory fish
- Upgrade landscape diversity
- Act as significant ecological corridors for wildlife



What is environmentally friendly drainage?

- Functioning agricultural drainage + improved ecological, morphological and hydrological state of the agricultural streams
- Main methods:
 - 2-stage channel profiles
 - Low flow channel to maintain the ecological and morphological diversity
 - Flood terraces to improve the water conveyance
 - Submerged weirs, sand traps and sedimentation pools
 - Constructed wetlands to stop the nutrient loading and suspended solids





Juottimenoja brook in Southern Finland before and after environmentally friendly dredging

Ritobäcken - a case study from Southern Finland

- Ritobäcken is a stream used as a drainage channel
 - Length 12 km
 - Catchment area 10m²
 - Some parts of the stream a part of Natura
 - Habitat for vulnerable migrating sea trout (*Salmo trutta m. trutta* L.)
- Problems:
 - Frequent flooding to the surrounding fields during the summer
 - How to increase the conveyance of the channel with minimal damage to the Natura area and sea trout population?

- A two stage channel profile was tested
 - The conveyance capacity was increased by digging a flood terrace
 - The existing channel stayed intact and works as a low flow channel
 - The cohesive sediment dynamics in a vegetated two-stage drainage channel



Benefits for the 2-stage channel in Ritobäcken (Kaisa Västilä, Aalto University)

- Decreased channel erosion during the excavation and after that
- No more flooding to the fields
- Developing of bank vegetation
 - decreased the channel erosion
 - Increased sedimentation to the flood terrace
- Improved water quality
- Ecological benefits when low flow channel stays intact
- Increasing biodiversity of the agricultural environment
 - Ecological corridors
- Channel more stabile => less maintenance
 - Cost-effectiveness
 - Ecological benefits

Further questions

- Comparison of examples in different circumstances
- Monitoring of fish and vegetation of flood terrace
- Maintenance of the two-stage channels
 - Vegetation
 - Increasing diversity for fish



References:

- Laitinen, L. & Jormola, J. 2008. Drainage and fishery needs in the restoration of agricultural brooks. 4th ECRR Conference on River Restoration. Italy, Venice S. Servolo Island. Pp. 357-364. <http://www.ecrr.org/archive/conf08/pdf/proceed8.pdf>
- Västilä, K. & Järvelä, J. 2011b Cohesive sediment dynamics in a vegetated two-stage drainage channel: the first year after floodplain excavation. Proceedings of River, Coastal and Estuarine Morphodynamics 2011 conference, 6-9 Sep 2011, Beijing.
- Västilä, K. & Järvelä, J. 2011c Environmentally preferable two-stage drainage channels: considerations for cohesive sediments and conveyance. Intl. J. River Basin Management. DOI: 10.1080/15715124.2011.572888.
- Västilä, K. & Järvelä, J. 2013 Suspended sediment transport in a vegetated agricultural channel. Proceedings, 8th Symposium on River, Coastal and Estuarine Morphodynamics RCEM, 9-13 June 2013, Santander, Spain.
- Siitonen, N. 2013. Cohesive sediment properties in an agricultural two-stage channel. Master's thesis at Aalto University.