

## **Trade-offs and ecosystem services in landscape planning and governance – a case study of the implementation of the EU Water Framework Directive**

Authors: Mona Petersson<sup>1</sup>, Monica Hammer<sup>1,2</sup> & Ulla Mörtberg<sup>3</sup>

- 1) School of Natural Sciences, Technology and Environmental Studies, Södertörn University, S 141 89 Huddinge, Sweden
- 2) Centre for Baltic and East European Studies, (CBEES), Södertörn University, S 141 89, Huddinge, Sweden
- 3) Department of Land and Water Resources Engineering, Royal Institute of Technology, S 100 44 Stockholm, Sweden.

### ***Abstract***

Land- and waterscapes simultaneously produce multiple ecosystem services that interrelate in complex, dynamic ways and a key challenge is how to manage bundles of ecosystem services. In this case study we focus on the implications of the ongoing implementation of the EU Water Framework Directive (WFD) for landscape planning. This case study focuses on the Northern Baltic Sea River Basin District in Sweden. This district covers the Lake Mälaren drainage basin and Stockholm archipelago region constituting an ecological and geographic gradient from inland to freshwater archipelago and further to the brackish archipelago in the Baltic Sea. The drainage basin represents an area with a long history both in agricultural and mining still affecting the present landscape. Historic mining remnants from at least the 12<sup>th</sup> century leaking metals and acid water into rivers and creeks in the western upstream parts of the catchment, and intense agriculture in the lowland areas in the vicinity of the lake in the downstream parts is leaking nutrients adding to eutrophication. Most rivers within the area have been modified during the history; dammed for mills, rivers straightened and wetlands dredged to increase the land matching the increase of inhabitants. Also, the present day situation show differences in land-use within the lake Mälaren catchment. The north western part is rural and low populated, and at the same time one third of the Swedish population is found within the lake Mälaren catchment. The densest population is found in cities at the shore of the lake, with an increasing density towards the urban Stockholm region. At regional level future scenarios due to climate change varies, but in some simulations there is an increased precipitation in the area creating a risk scenario of flooding that may result in a transgression in the lowland areas, degraded water quality and increased nutrient levels. The study is based on document analyses, interviews, hydrological and ecological data of the river basin analyzed using GIS techniques. Studying the drainage basin of Lake Mälaren therefore makes it possible to compare different water issues between sub-catchments within the same drainage basin, and also at different geographical scales since water quality priorities can be scale related. At regional scale eutrophication mitigation is the main target, but in the eastern densely populated area local scale mitigation is related to storm water run-off. In the light of the EU Water Framework Directive, the study points to the need for increased attention to trade-offs between water uses, mitigation measures and how different ecosystem services are affected in ecosystem based landscape management. Further the importance of flexible river basin management allowing for differentiated targets and solutions in catchments is discussed.