

KLIV Research Report 2012

Climate-land-water changes and integrated water
resource management in coastal regions



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KLIV - Climate-land-water changes and integrated water resource management in coastal regions

Aim of the project

KLIV investigates critical questions for sustainable management of water resources, with main geographical focus on coastal regions. Main KLIV investigation sites include the Äspö HRL and wider Oskarshamn coastal region, and are more generally selected from or comprise the whole Swedish Water Management Districts of Southern and Northern Baltic Proper. Comparative catchment studies are also carried out in other regions and parts of the world. Main research questions, investigated across the different sites, catchments and regions, include:

- What are the time developments and spatial characteristics of regional climate and other environmental changes and their effects on water resources, and the anthropogenic loads of excess nutrients and pollutants to inland and coastal waters?
- What regional water resource changes (water availability/quality, flood/drought risks) should society prioritize and plan for adapting to?
- What measures in the landscape and what stakeholder behavior-participation changes can contribute to efficiently reducing anthropogenic nutrient and pollutant loads, and how much reduction can possibly be achieved at different times and landscape/coastline locations?

Based on the answers to these questions KLIV will provide new insights and knowledge on water systems and their management.

In particular, the KLIV research integrates the inland water system and its adjacent coastal waters, following the water flow and transport of tracers, nutrients and pollutants through their different water pathways from their respective entrance zones (sources of water, nutrient, pollutant) and through the hydrological catchments into the coastal waters. The main KLIV research hypotheses are then that:

- i) This water-following research approach will provide new advancements, methods and tools for efficiently detecting-monitoring, modeling-projecting and improving-controlling water resource and ecosystem conditions.
- ii) The results will contribute to efficient achievement of main environmental and water management goals, specifically regarding reduction of pollution and eutrophication, and protection, improvement and adaptation to climate change of waters and ecosystems in coastal regions.

Status of the project

The current, new KLIV project with G. Destouni as PI started in 2012 as a spin-off development from a previous KLIV project led by Kristina Lundberg and Anna Augustsson that ended in 2012. The new KLIV project extends over a 3-year period (2012-2015). During 2012, a new 2-year postdoc position with focus on KLIV was openly announced and filled at Stockholm University, with Andrew Quin as the successful candidate, starting his KLIV research in December 2012. The postdoc research will be focused on the variability and change in water flow and quality, their drivers and impacts, and needs and relevant measures - including in particular management of wetlands - for mitigating impacts and adapting to changes in participatory water management. This research aims at providing answers to such questions as: How have water flow and quality changed so far and why? What measures can efficiently reduce pollutant loads to water in the landscape? How are water flow and quality expected to develop in time under different scenarios of management measures, and climate and other changes in a region? The research will be carried out within the KLIV project, and also be linked to and co-supported by related strategic research programs at Stockholm University focusing on climate change effects on ecosystem services (EkoKlim) and Baltic ecosystem adaptive management (BEAM).

Furthermore, the core KLIV researchers have in 2012 published a series of relevant peer-reviewed publications listed explicitly below. Among these, we note for instance the high-profile paper published in *Nature Climate Change* on hydroclimatic shifts driven by human water use for food and

energy production (Destouni et al., 2012; <http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1719.html>). We note also that KLIV researcher G. Destouni has been awarded the Henry Darcy Medal of the European Geosciences Union (EGU), reserved for individuals in recognition of their outstanding scientific contributions in water resources research and water resources engineering and water resource management (<http://www.egu.eu/news/45/egu-announces-2013-awards-and-medals/>).

Literature

List of papers and articles published 2012

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- Mathurin, Frédéric A, **Mats E Aström**, **Marcus Laaksoharju**, Birgitta E Kalinowski, and Eva-Lena Tullborg. 2012. "Effect of Tunnel Excavation on Source and Mixing of Groundwater in a Coastal Granitoidic Fracture Network." *Environmental Science & Technology* 46 (23) (December 4): 12779–12786. doi:10.1021/es301722b.
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Spin-off

In general, KLIV is expected to provide new insights and knowledge on water systems and their management, and develop relevant decision-support methods and tools for efficient monitoring and mitigation of eutrophication and pollution, and adaptation to climate and other environmental changes.

During 2012, the KLIV research group has in collaboration with researchers from several other Swedish universities proposed and got support approval from the Swedish Research Council (VR) for developing a National Geosphere Laboratory (NGL) in the Oskarshamn region, including the Äspö Hard Rock Laboratory and surroundings, and associated other laboratory facilities and databases, with major participation by the other core KLIV researchers (read more, in Swedish, at http://www.skb.se/Templates/Standard_35327.aspx). Furthermore, The Swedish research council FORMAS has in 2012 approved support for another KLIV research group proposal, on "Basin-scale hydrological spreading of pollutants and wetland opportunities for reducing them under different hydroclimatic and other regional conditions" for the project time 2013-2015.

In addition, the KLIV research group has a leading role in the development and coordination of a newly formed international research network: GWEN - Global Wetland Ecohydrology Network: An Agora for Scientists and Study Sites (<http://people.su.se/~gdest/gwen/>), including scientists and study sites across many different parts of the world, including the main KLIV study site of the coastal Oskarshamn-Simpevarp catchment area (Figure 1-10).

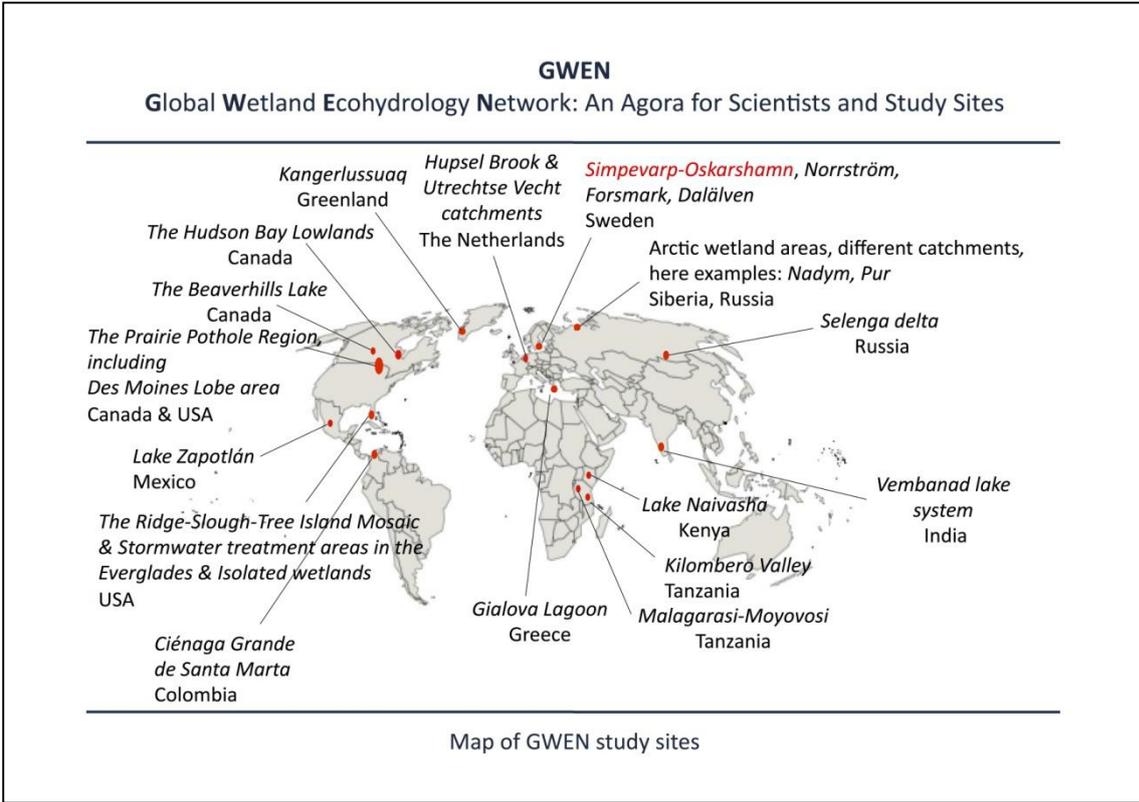


Figure 1-10: Map of GWEN study sites in different parts of the world, including the main KLIV study site of the coastal Oskarshamn-Simpevarp catchment area.