

# ADAPTIVE WATER MANAGEMENT IN RESPONSE TO HYDRO-CLIMATIC CHANGE EFFECTS ON ECOSYSTEM SERVICES AND BIODIVERSITY OF THE SWEDISH NORRSTRÖM DRAINAGE BASIN (SWEDEN)

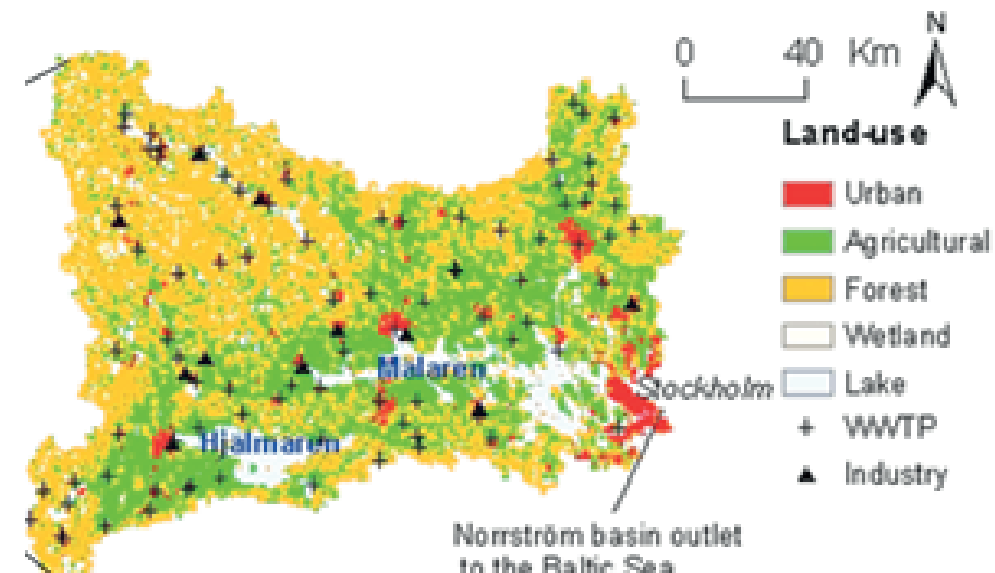
## Demosite description

### Lithology / Geochemistry

Granitic and gneiss-granitic bedrock covered by clay deposits and mostly thin till deposits



59°20'N, 18°03'E



## Main description:

- ▶ **The Norrström drainage basin is a low-land coastal basin including the capital Stockholm:** it is the most densely populated region of Sweden with more than 1,5 million people.
- ▶ The basin consists of 4% built-up areas, 36% agricultural and open land, 49% forest, 1,5% wetlands and 9,5% inland waters. **Lake Mälaren (fig.1) is the only water supply for Stockholm.**
- ▶ The Baltic Sea and the Stockholm archipelago are impacted ecosystems.

Conserve Ecohydrological processes in natural ecosystems

✓ YES

Enhance Ecohydrological processes in novel ecosystems

✓ YES

Apply complementary Ecohydrological processes in high impacted systems

✓ YES

## Ecohydrology Principles and Solutions

### EH IMPLEMENTATION PRINCIPLES

\* Quantification of the hydrological processes at catchment scale and mapping the impacts;

### EH SOLUTIONS

Observation-based and model quantification and interpretation of water flow and nutrient transport processes, drivers, impacts and changes



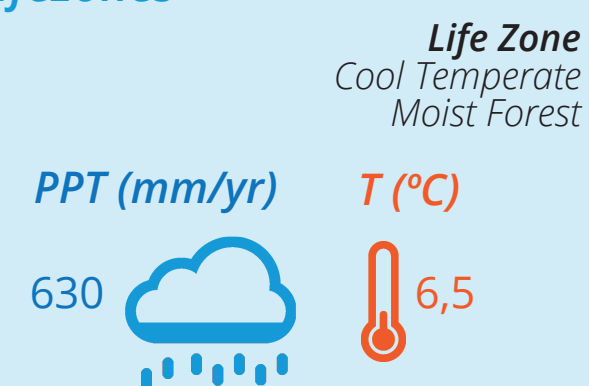
Assessment of drivers and ecohydrological effects of hydro-climatic and land-use changes through time



Management analysis regarding nutrient loading to inland and coastal water ecosystems, including focus on regulating ecosystem services of wetlands (fig.2)



## Lifezones



PET ratio: 0,61  
Elevation: 86 m  
Humidity: humid



Fig.1 - Lake Mälaren Bay (courtesy of G. Destouni)

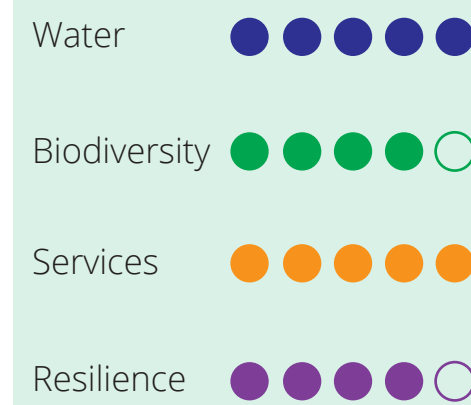
## Major Issues

- \* The relatively heavy population, agriculture and industry in the basin put large eutrophication and pollution pressures on its inland and coastal waters
- \* Presence of contaminated land

## Social-Ecohydrological System

### Catchment Ecohydrological sub-system

#### EH Objectives



Are inputs to:

#### EH Methodology

- \* Multi and trans-disciplinary research
- \* Model development and scenario projections of hydro-climatic and land-use changes and their impacts

Set conditions for:

#### Objectives

- \* Efficiently reduce eutrophication impacts of population, agricultural and industrial pressures
- \* Understand and efficiently mitigate and adapt to impacts of hydro-climatic and land-use changes

Set conditions for:

### Catchment Sociological sub-system

#### Stakeholders

- \* Researchers of multiple disciplines
- \* Swedish water, environmental and ecosystem management authorities

Participate in:

### ACTIVITIES

- \* Quantitative assessment and projection of ecohydrological changes and processes under multiple pressures of hydro-climatic and land-use changes
- \* Academic research and societal applications, channelled through the strategic Stockholm University program Ekoklim
- \* Development of models and scenario projections of hydro-climatic and land-use changes and their ecohydrological impacts – for the basin itself and as node in worldwide catchment network

## Results

### MAIN EXPECTED OUTCOME

Quantification and projection of ecohydrological change – understanding the role of and responses to various change drivers

### LATEST RESULTS

- ▶ **Large nutrient pool legacy** of past inputs is a major current diffuse source of excess nutrients to surface and coastal water ecosystems.
- ▶ **Negligible large-scale nutrient retention by wetlands** – in spite of considerable retention in the small flow fraction through an individual
- ▶ **Human land- and water-use changes are major drivers** of local to global hydro-climatic change
  - **Locally** within the basin, increased hydrological and agricultural drought risk, in spite of increased precipitation
  - **Globally**, breach of freshwater planetary boundary
  - **Norrström basin** developed to **key pioneering study node in worldwide multi-catchment investigation** network for long-term, past and future hydro-climatic change and its drivers and key uncertainties.



Georgia Destouni  
Stockholm University - [www.zoologi.su.se/ekoklim/study\\_region.html](http://www.zoologi.su.se/ekoklim/study_region.html)  
[georgia.destouni@natgeo.su.se](mailto:georgia.destouni@natgeo.su.se)

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