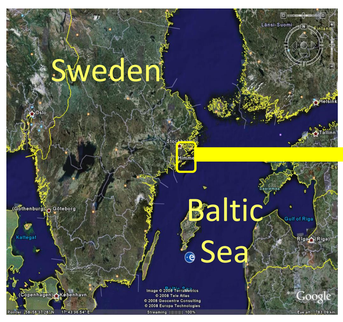
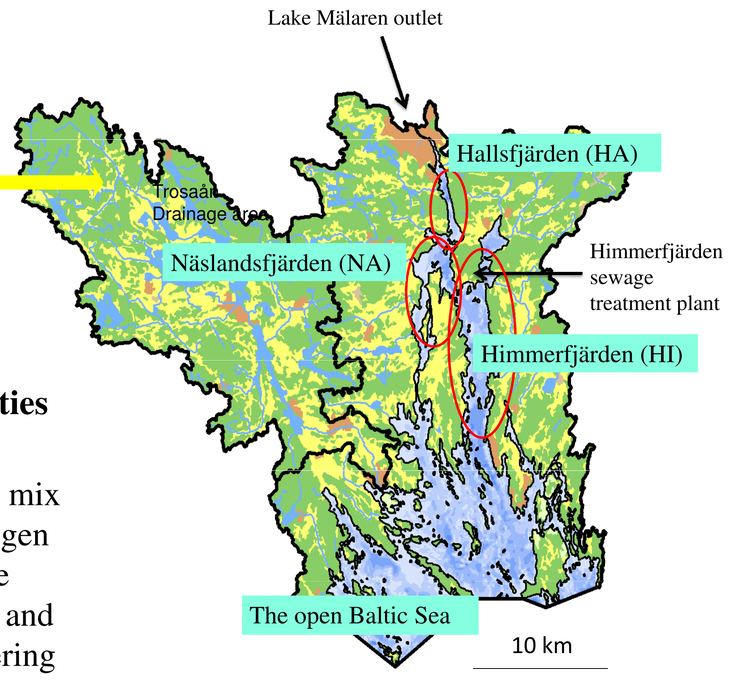
# Study Site Application No. 04 - HIMMERFJÄRDEN

**- Conclusions from Appraisal step, approaching Output step**

SPICOSA




## Uniqueness of approach

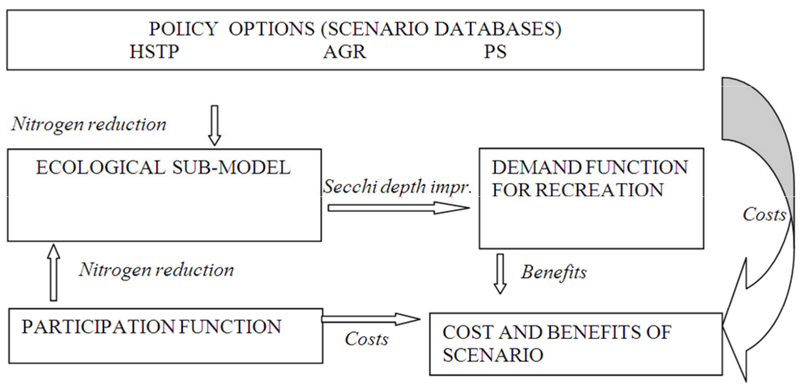
The model is characterized by the close linking of the ecological, economic and social systems, developed in close cooperation with local stakeholders.

SIXTH FRAMEWORK PROGRAMME

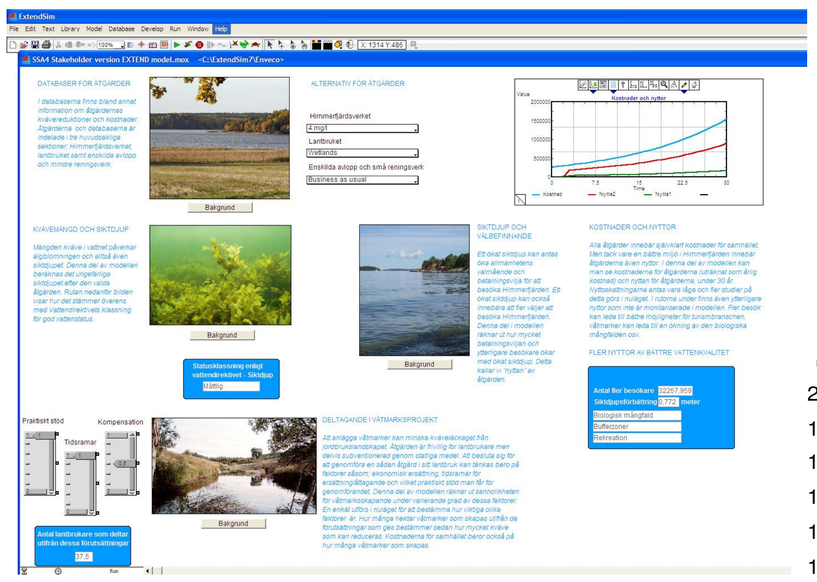
## The SSA, policy issue and human activities

The policy issue is nitrogen management. One main aim is to identify a cost-effective mix of measures to reduce human-induced nitrogen loads from the large Himmerfjärden sewage treatment plant (HSTP), agriculture (AGR) and private sewers (PS) in the study area. Lowering nitrogen loads will reduce phytoplankton biomass and increase the Secchi depth (water transparency). We also estimate the recreational benefits of an improved water quality.

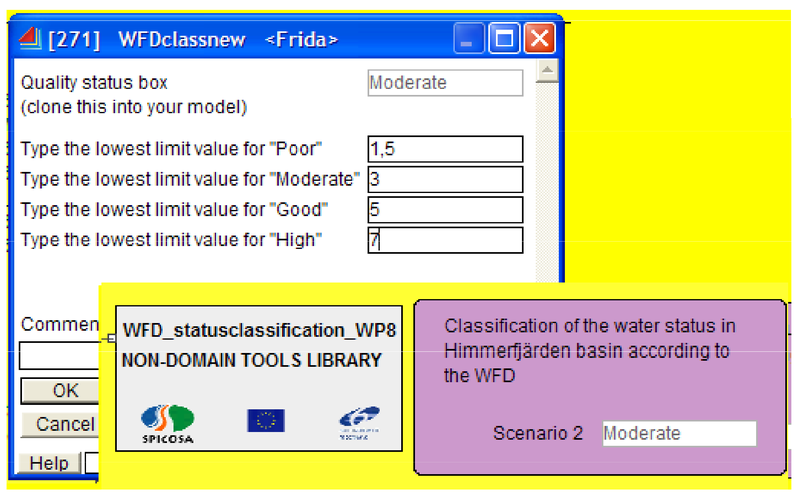
## Conceptual model for EXTEND




## User-friendly interface of EXTEND model




## New generic block for classifying water status according to the Water Framework Directive




This block will give the status of any ecological indicator according to the classification system of the Water Framework Directive. This image shows the block and its dialog box. In the dialog box you enter the lowest limit values for "Poor", "Moderate", "Good" and "High" status according to the ecological indicator you wish to manage with the block. In the example above the indicator is Secchi depth in the Himmerfjärden basin (HI) when running the main scenario (explained at right). This block links the ecological indicators back to the social system as the status classification can be used for evaluating policy options.

## An internal economic feedback loop

The monetary benefit estimates for a Secchi depth improvement are called ”CV1” and ”CV2” in the image at right. Two benefit estimates are used to bracket the uncertainty in the estimates. These estimates indicate the monetary value of the increase in human well-being due to the improved Secchi depth. A Secchi depth improvement also increases the demand for recreation in the study area, labelled ”Additional trips 1” and Additional trips 2” in the image at right. The additional visitors also partake of the increase in well-being due to the improved Secchi depth. These values are labelled ”CV additional trips 1” and ”CV additional trips 2” in the image at right. The total monetary benefits are then summed.

## Simulating a scenario

**Main scenario evaluated in Appraisal step– all sectors included (high nitrogen reduction effort of HSTP)**

The scenario is formed by the policy options chosen for each HA and each drainage basins
HSTP – 4 mg/ l
AGR (NA) – Wetlands (all sliders set at 1)
AGR (HI) – Catch crop (low)
AGR (HA) – Catch crop (low)
PS (HA, HI, NA) – 25 % connected

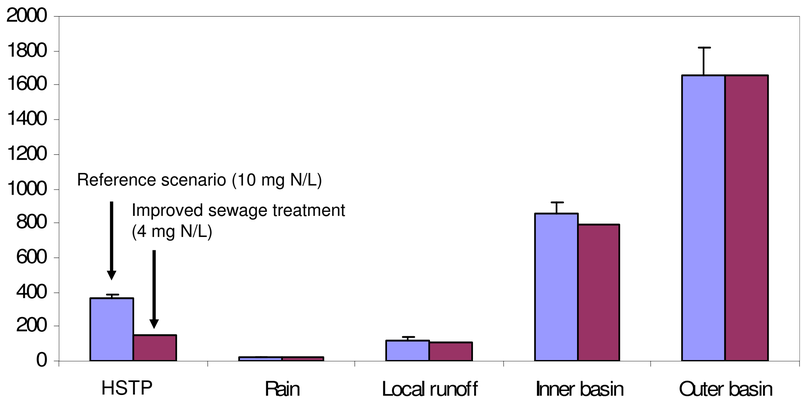
Scenario 2 was chosen as the main scenario. It includes policy measures for all human activities in every drainage basin areas (HI, HA and NA). It was also chosen as an ambitious but relatively likely scenario. It involves maximal nitrogen reduction in the HSTP. For agriculture the policy option “catch crop (low)” is chosen for Himmerfjärden (HI) and Hallsfjärden (HA) drainage basin areas. For Näslandsfjärden (NA) drainage basin area, where the most intense agriculture is to be found, the policy option “wetlands” is chosen. For private sewers the policy option “25% connected” to an STP is chosen for all areas.

**General model settings when running the scenario:**
- Simulation duration: 30 years
- Social discount rate: 4%
- Interest rate: 6%
- Economic growth: 2.2%
- Population growth: 1.4 %

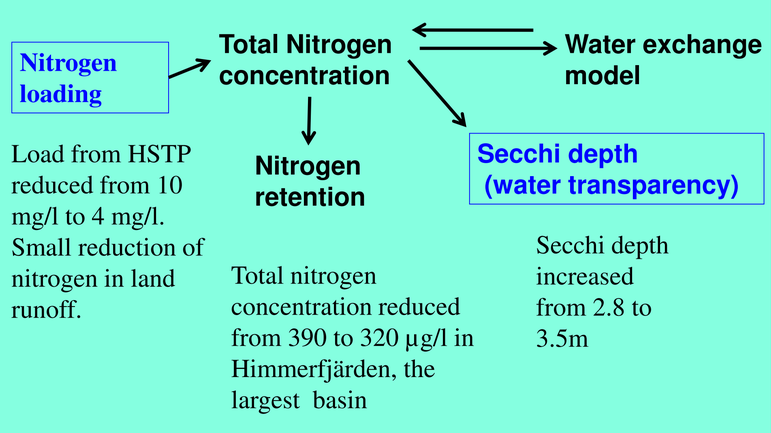
## Output from the scenario run

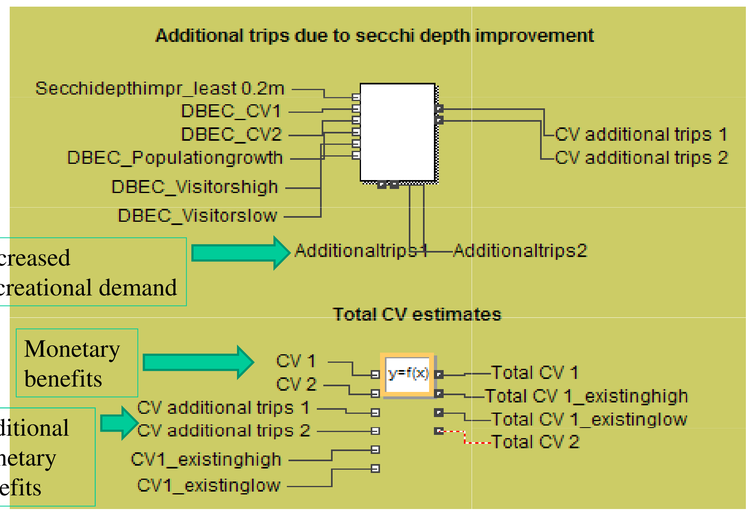
### Ecological model (November 2009 version)

**Sources of nitrogen loads (ton/year) to the model basin Himmerfjärden**



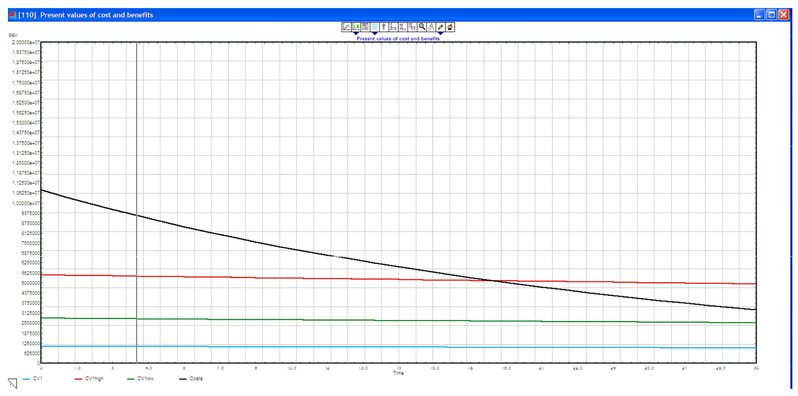

## A rough overview of the ecological model when running the main scenario




## Economic and social output from the scenario run

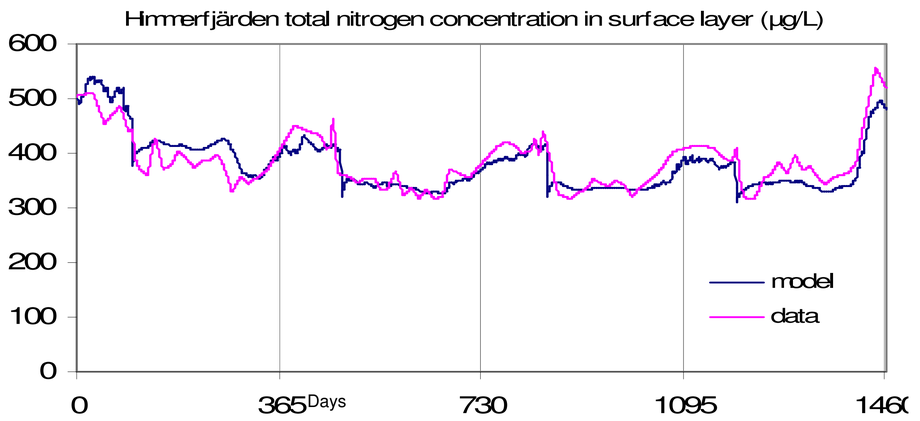
Present values of costs and benefits of the main scenario are indicated below. The vertical axis indicates monetary values, the horisontal axis time. The area under the blue, red and green curves respectively give present values of different benefit estimates. The area under the black curve represents the present value of all costs. The area under the cost curve is larger than any of the areas under the different benefit curves, which means that in the preliminary analysis the total cost of the main scenario exceeds all benefit estimates for the main scenario.




The box below is a snapshot from the EXTEND model showing a rough cost-effectiveness estimation for the human activities. The box below also shows qualitative benefits arising from the reduced nitrogen loadings.

| SEK per kilo nitrogen reduction | | Qualitative values |
|---|---|---|
| AGR | 79,69 | Phosphorus reduction |
| PS | 8558,29 | Biodiversity |
| HSTP | 9,5 | Aesthetic values |

## Hindcast run of ecological model (November 2009 version)




Variations in boundary conditions, nitrogen input and water exchange explain most of the variations in total nitrogen concentration. The biology added is a loss of nitrogen during the spring bloom, seen as a sudden drop in modeled nitrogen concentration (blue line) in spring.

## Summary comments from the Stakeholder group

**- screening survey November 2009**

*What is the most urgent environmental problem in the Himmerfjärden study area?*
Eutrophication

*What do you think is important for reducing the eutrophication in Himmerfjärden in the future?*
Measures for improving the environmental conditions in the Baltic Sea. Continue to work in similar projects. A close collaboration between scientists and stakeholders. Refined cost-effectiveness analyses. The activities at Himmerfjärden STP.

*How have you benefited from participating in the stakeholder group?*
Improved knowledge on modeling, the WFD, coastal waters, current research projects in the area and understanding of the factors that determine nitrogen levels. The opportunity to provide input. A good network of contacts. Personal contact with the research team. Participation in the stakeholder group has given me hope of better understanding complex environmental problems in the future.

Stakeholder group forum at the Enveco office in November 2009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