WETLANDS
IN AGRICULTURAL AREAS

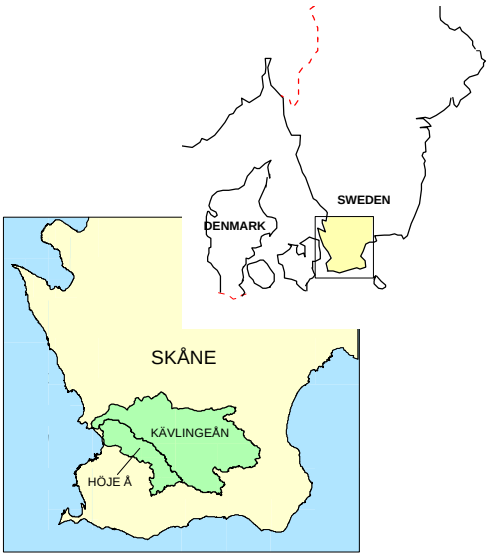
Experiences from a Life-project

Summary of Final report
May 2000

Project No:
LIFE96ENV/S/346

Presentation

The main purpose of the project is to improve water quality, reduce nutrient transport and increase biodiversity in intensively cultivated farmland. In a regional co-operation between ten municipalities, establishment of wetlands and bufferstrips, which improve the nutrient reducing capacity of the landscape, is used as complementary measures to efforts within sewage treatment and agriculture. The measures are implemented in large scale within the watersheds of Höje and Kävlinge rivers in the south part of Sweden. The project has been sponsored by the European commission by the Life-fund during the period July 1996 – Oct 1999. In the watershed of Höje river the work started prior to the Life project in 1991. In both watersheds the work will continue after the Life-period.



Working area

The working area of the Life-project includes the two adjoining rivers Kävlingeån and Höje å, situated in the west part of the province of Skåne in the south of Sweden. Their total drainage area is about 1500 km^2 and is relatively densely populated and holds many villages and towns. The land-use is dominated by farming. A number of lakes are situated in the area.

Project management

Politicians from all municipalities are involved in the steering committee of the project while environmental officers manage the practical work through a working group. A consultant is responsible for the implementation of measures within the project.

New wetlands

During the project period 65 wetlands with a total area of 74 ha have been constructed. Regarding the location of the wetlands, priority has been given to areas with a high nutrient concentration in the water and with impoverished biological diversity. The size of the constructions range between 0.2 and 6.1 ha with an average size of 1.1 ha. Buffer-strips, a non-cultivated area with a permanent vegetation of grass, herbs and bushes (see picture to the right), have been established and prepared along 59 km (36 ha) of the streams. Buffer-strips have priority where the risk of erosion and surface run-off is great, along streams with intensively used farmland in close connection to open water and along stretches with a need of recreational areas.

Recommendations /general characteristics of the constructed wetlands

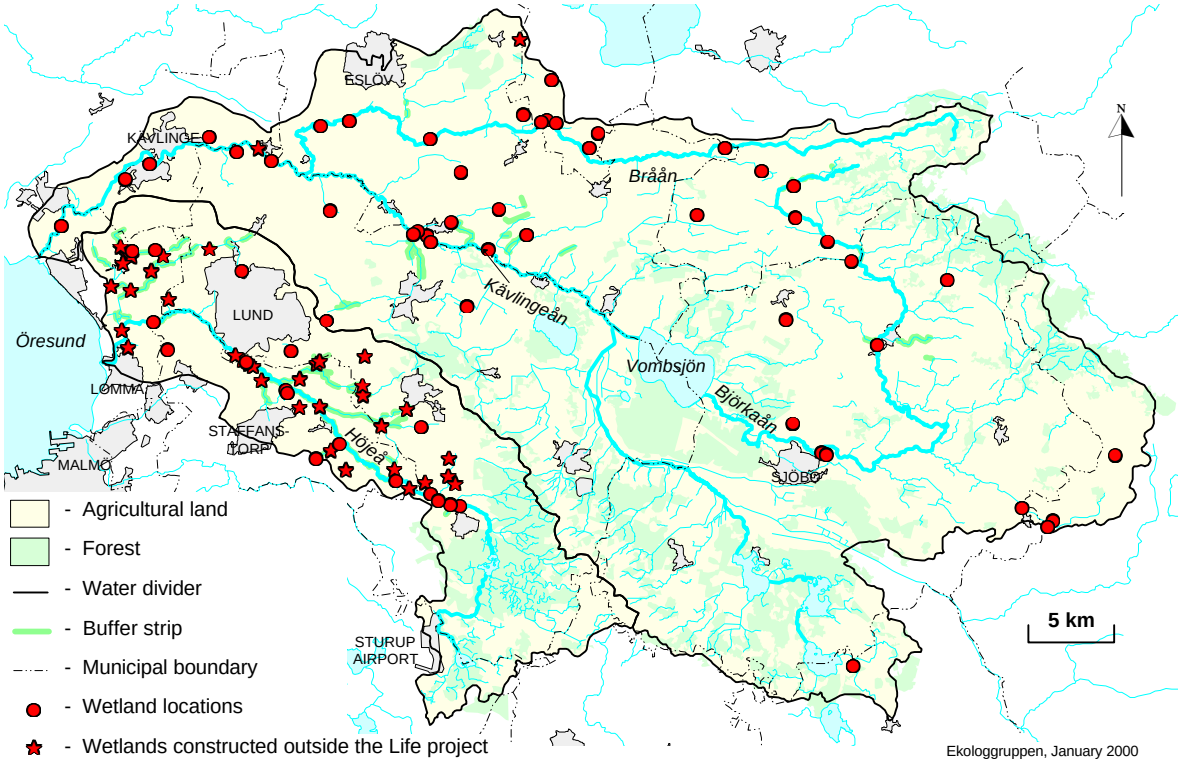
Every wetland constructed within the project is unique and its shape depends on the main purpose and the situation at the specific site.

A varied outer **shape** of a wetland resulting in a long shoreline is promoted, but often restricted by the limited area of land available for pond/wetland construction. To imitate the qualities of natural wetlands, smooth, variable and not too steep **slopes** (1:4-1:20) are aimed at. The **depth** is varied with alternating deep (1.5-2.0 m) and shallow (0.3-0.5 m) sections that promote sedimentation as well as denitrification. Large areas with shallow water (<0.4 m) are rarely constructed, due to the risk of rapid over-growth. However, with grazing cattle available, a few successful shallow wetlands have been fulfilled.

The inlet /outlet may be constructed as an open ditch, pipe, adjustable culvert or a dam. The use of other technical solutions with artificial materials is minimised but in some cases necessary to solve problems such as leakage, erosion or regulation of water levels.

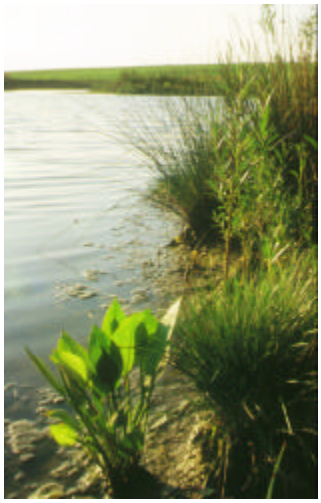
In order to achieve a sufficient hydrological load on the ponds/wetlands, a certain **drainage area /size** is recommended. A minimum of 75-100 ha agricultural land should be drained to each wetland, and the size of the wetland area should not exceed 0.5 - 1% of the drainage area. Ponds constructed for **irrigation** normally hold a larger volume of water than other ponds. The water is collected during high flow in wintertime and used during dry periods in summer time. A smaller part of the water (corresponding to low flow), from upstream areas, continuously passes by the pond and thereby the irrigation can be carried out without a negative effect on downstream areas during low flow periods.

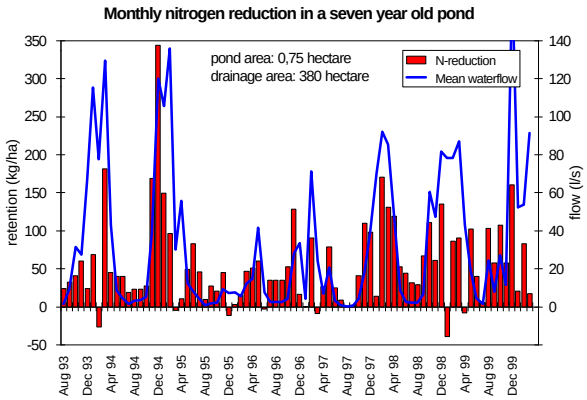
The shape, depth and localisation of inlets and outlets may be used to make the **water circulate,** in order to optimise the nutrient reduction. Moreover, the shape of the wetland and the establishment of **plants and vegetation** should as far as possible imitate the qualities of natural wetlands, in order to promote biological variation.



Environmental benefits

Studies of nutrient retention in four of the wetlands indicate that wetlands are effective nutrient traps. Depending on nutrient load the reduction capacity varies in the different wetlands. The nitrogen reduction ranges between 400 and 4000 kg/ hectare and year, with a mean of 1700 kg/ hectare and year. The relative retention in terms of nitrogen ranges between 5-50 %. The reduction of phosphorus varies between 20 and 80 kg/hectare and year which corresponds to 10 – 45 % of the incoming phosphorus and for suspended matter (particles) the reduction ranges between 1800 to 14200 kg//hectare and year (33-50 %).





Biological studies illustrate the positive effect of wetlands in intensively used agricultural areas. Already during the first year after construction the invertebrate fauna comprises a large number of species and individuals. Plant colonisation shows the same pattern and on an average 32 wetland plants were found per pond. Consequently bird life shows a quick response to the constructed habitats and more than 25 breeding species have been observed in the studied ponds/wetlands. A total number of 19 threatened species of animals and plants from the Swedish red list was recorded in the studies.

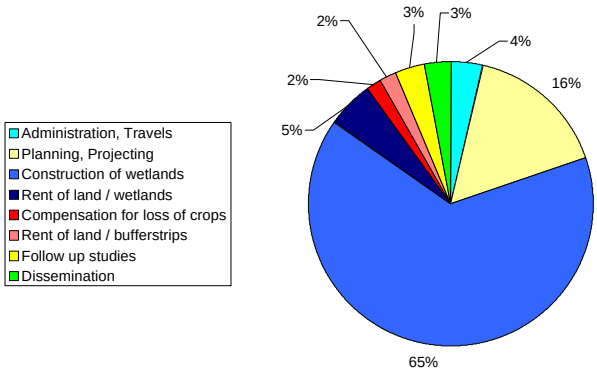
Within the Life project a total area of about 100 ha of arable land has been transformed into areas that can be available for recreation.

Costs

The costs included in the Life project amounts to 25 million SEK (eligible costs - 17 million SEK). The rent of land converted to wetlands and buffer-strips is not included in the Life budget and neither are compensation for loss of crops, internal information and a fund for future management etc. An apportion of the total costs of the project is shown in the figure to the right.

With an assumed nitrogen capacity of 1000 kg N/ha and year, an interest rate of 6% and a writing off period of 30 years, the average cost of nitrogen retention amounts to 24 SEK/kg N in the wetland project. This is lower than, or equal to, other measures with comparable environmental gain. In addition to the value of nitrogen retention, the environmental benefits of the wetlands are significant concerning biological variation and increased recreational area, other major aims of the project.

Thus, the cost effectiveness of nitrogen retention supports the conclusion that wetland creation in agricultural areas gives great value for money



Conclusions

The experiences from the project are principally good. Considerable environmental gain may be achieved by implementation of measures in the agricultural landscape through the methods and the organisation used in the project. The main results and experiences are:

- The project has successfully implemented ponds, wetlands and buffer-strips in the agricultural landscape.
- Technical problems as well as different landscape interests complicate the implementation of wetlands.
- Some limiting factors of large scale implementation of measures may be overcome by increased compensation for land or possibilities given for land exchange, to the landowners.
- Wetland construction in modern agricultural landscape is difficult to achieve without excavation. The localisation depends more on were modern agricultural practices will allow wetlands, than where wetlands historically were situated and where the physical conditions are best.
- A legal demand of bufferstrips along all open waters is desirable to reach better effect on biological diversity as well as on nutrient reduction.
- Regional co-operation within a watershed, with many municipalities involved, is an appropriate method to solve water related environmental issues.
- Environmentally less optimal, still more expensive, constructions may be the result if time limits for implementation of measures are to tight.
- A more rational and cost effective fulfilment of measures is possible if construction may be directed to localities with the best physical conditions and expected environmental gain. Any geographical restrictions due to administrative borders or local interests within in a watershed ought to be avoided.
- Voluntary participation of landowners vouch for an engagement in the project.
- Nutrient retention and sedimentation of particles may be considerable in constructed wetlands.
- Biological diversity may increase significantly after construction of ponds and wetlands in the intensively used agricultural landscape. Colonisation of plants and animals is spontaneous and relatively fast in these “virgin waters”.
- The mean costs of construction of the measures established in this project are comparable to other available measures with similar environmental gain.

More information

Further information about the project is available through: Lars Jacobsson, Lunds kommun, Sweden (Life-co-ordinator), e-mail: lars.jacobsson@lund.se and Ekologgruppen i Landskrona AB (Consultant and author),
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