



Multifunctional Wetlands and Stakeholder Engagement: Lessons from Sweden

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**BALTIC
COMPASS**

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SUMMARY

Wetlands construction and restoration has been adopted as an agri-environmental measure in some of the Baltic Sea Region countries to help make agriculture more environmentally sustainable. However, Sweden's experience shows that despite great efforts, the country only achieved 60% of its target of adding 12,000 hectares of wetlands in the agricultural landscape between 2000 and 2010.

The main objective of this study, conducted within the EU-financed project Baltic COMPASS, was to draw lessons from Sweden's wetland implementation and identify key enabling and disabling factors, especially in the governance system. Of special interest is to what extent wetlands can generate multiple benefits. The study is based on a participatory analysis involving interviews with professionals from governmental agencies, civil society organizations and the private sector, carried out in January to June 2012.

The main purpose of wetlands construction as an agri-environmental measure has been to remove nutrients (i.e. nitrogen and phosphorus), but also, to some extent, to enhance biodiversity. However, wetlands bring many other benefits, including reduced flood risks, the availability of irrigation reservoirs, recreation and landscape improvements, new fishing and hunting opportunities, biomass production for potential biogas generation, and nutrient recycling. This raises the question of whether emphasizing the full range of benefits from wetlands would encourage a stronger commitment from stakeholders and attract new actors, improving outcomes.

The Swedish Government has prioritized wetlands construction for 20 years, to compensate for the loss of natural wetlands that were drained over the centuries to gain agricultural land. These measures are voluntary; landowners decide whether to participate. The main channel for financial support for these projects is the partly EU-financed Rural Development Programme (RDP). The RDP offers an investment support for costs related to wetlands construction (up to €22,000/ha) and maintenance support (€165-550/ha per year). The County Administrative Boards (CABs) manage permits and financial support. Complementary national funds are available, of which the most significant is the Marine Environment Grant; in some cases financial support is also provided by municipalities and NGOs.

In Sweden, these wetlands measures have been implemented at four different levels: led by individual farmers, by organized farmers, by municipalities, and by CABs. The *individual farmer* initiative is the main development scheme under the Rural Development Programme; interested farmers can approach the CAB, or the CAB does outreach campaigns. The result of this scheme is generally quite weak and scattered. Initiatives led by *organized farmers*, normally dependent on motivated and knowledgeable key persons or NGOs, has shown high potential to achieve large-scale projects. Sweden also has successful cases with *municipality-led* initiatives, taking a river basin approach. *CAB-led* initiatives are less common; they can facilitate the permitting and financial-support process, but may put the CABs in conflicting roles. Another potential approach not yet applied in Sweden is wetlands restoration through land exchanges or expropriation.

The key barriers and limitations for progress in Sweden expressed by the interviewees are:

- Coordination challenges make it difficult to implement large-scale projects to benefit entire water basins.

- The emphasis on nutrient retention may impede implementation, since this is often a criterion to be eligible for financial support, even if the wetlands could generate other important benefits.
- CAB and Swedish Board of Agriculture (SJV) regulations are often changing. Restrictive interpretations of guidelines by CABs limit the diversity of wetlands and reduce the flexibility for functions and use. An example is irrigation; normally the financial support is reduced by the CABs if the wetland will be used for irrigation.
- There are conflicts of interest due to diverging development and natural conservation goals (e.g. old drainage permits, biotope protection, and fishing interests).
- There is not enough agri-financial support to farmers. In most cases the loss of income for transforming productive cropland to wetland will not be fully covered by the RDP payments.

Key enabling factors identified in interviews are:

- Wetlands are prioritized among a large number of authorities and organizations.
- Diverse groups of stakeholders (e.g. farmers, local and national NGOs, municipalities and CABs) are collaborating to implement these measures.
- The existence of a strong knowledge base through agri-environmental advisors within the 'Focus on Nutrients' initiative facilitates the process between the CABs and farmers.
- Financial support is not limited to RDP. Providing additional support can contribute to long-term communication with farmers while compensating for investments not covered by the RDP. It can also give funders a chance to help plan and optimize the siting of wetlands.

These findings suggest that the way projects are structured and financed is very important. Drawing on these lessons, the following factors are suggested for successful large-scale wetlands project implementation:

- Involve key actors who will maintain a local presence and develop long-term relationships with farmers. It is crucial to recognize farmers' positive contributions to the environment, but without forgetting that farms are also businesses.
- Provide comprehensive support to farmers, including access to information and technical advice, and also competitive financial compensation.
- Implement a system that supports the development of large-scale projects with a water basin approach. This way, different stakeholders can be involved by considering the multi-functionality of wetlands (e.g. flood prevention). Payments for ecosystem services may be a promising way forward to generate a platform for a broader stakeholder approach.
- Wetlands initiatives should promote multiple benefits, not focus less narrowly on nutrient retention. In general, the agriculture sector (and society as a whole) should focus more on reuse and recycling of nutrients, and efficient on-field (both management and technical) measures to prevent nutrient leakage. Wetlands, meanwhile, should be recognized more for their long-term functions and benefits, e.g. as a natural buffer and sink, and for the full range of environmental services they provide.

SAMMANFATTNING [SUMMARY IN SWEDISH]

Restaurering och anläggning av våtmarker har blivit en vedertagen miljöåtgärd i några av Östersjöregionens länder för att bidra till ett mer hållbart lantbruk. Trots stora insatser i Sverige nådde man enbart 60% av det uppsatta målet att anlägga 12,000 hektar våtmark mellan år 2000 och 2010.

Studien genomfördes inom det EU-finansierade projektet Baltic COMPASS och huvudsyftet var att sammanställa svenska erfarenheter från anläggning av våtmarker i jordbrukslandskapet. Faktorerna som varit drivande och de som hämmat utvecklingen identifierades, speciellt med avseende på förvaltningssystemet, där även det civila samhället ses som viktig aktör. Våtmarkers möjlighet att bidra med en mängd olika ekosystemtjänster har varit av extra intresse. Studien är baserad på en analys där berörda parter deltagit, genom intervjuer med representanter från myndigheter, intresseorganisationer och den privata sektorn, som genomförts mellan januari och juni 2012.

Det främsta motivet till anläggning av våtmarker som miljöåtgärd i Sverige har varit att hindra läckage av näringssämnen (kväve och fosfor), men även i viss utsträckning att skapa bättre förutsättningar för biologisk mångfald. Våtmarker kan dock även ha andra viktiga funktioner, såsom att minska översvämningsrisk, att fungera som bevattningsmagasin, bidra till rekreation och förbättrad landskapsbild, nya fisk- och jakt- möjligheter, produktion av biomassa och växtnäringsåtervinning. Därför ställs frågan: om våtmarkens alla fördelar får mer utrymme, skulle det kunna skapa ett större engagemang från berörda parter och få med nya intressenter, och på så sätt förbättra resultatet?

Svenska regeringen har prioriterat anläggning av våtmarker under de senaste 20 åren för att kompensera för den förlust som skedde när naturliga våtmarker blev dränerade under de senaste två århundraden för att vinna ny odlingsbar mark. Denna miljöåtgärd är frivillig; markägaren beslutar själv om han eller hon vill anlägga eller restaurera en våtmark. Det viktigaste finansiella stödet för dessa projekt sker genom det delvis EU-finansierade Landsbygdsprogrammet (LBP). LBP har ett investeringsstöd för kostnader relaterade till anläggning av våtmarker (med ett tak på 200,000kr/ha) och ett skötselstöd för underhåll av våtmarker, en s.k. miljöersättning (1,500-5,000kr/ha per år). Länsstyrelserna handlägger våtmarksärenden och det finansiella stödet. Det finns även andra stöd tillgängliga för anläggning av våtmarker, där det viktigaste är Havsmiljöanslaget; i vissa fall kan även finansiellt stöd erhållas från kommuner och intresseorganisationer.

I Sverige har våtmarker som miljöåtgärd anlagts med fyra olika angreppssätt: enskilda lantbrukare, lantbrukare i samarbete, med kommuner och med länsstyrelser. Initiativ av *enskilda lantbrukare* är den vanligaste formen och hanteras inom Landsbygdsprogrammet; intresserade lantbrukare anmäler sitt intresse till länsstyrelsen, eller länsstyrelsens söker upp markägare i områden som är intressanta för anläggning av våtmarker. Resultat har generellt varit svagt och osamordnat. Initiativ som bygger på *lantbrukare i samarbete*, vanligtvis lett av en motiverad och erfaren nyckelperson eller intresseorganisation, har visat en stor potential för att åstadkomma storskaliga projekt. I Sverige finns också exempel på framgångsrika projekt med *kommunalt drivna* initiativ, som har genomförts på avrinningsområdesnivå. *Länsstyrelse-drivna* initiativ är mindre vanliga; dessa kan underlätta handläggnings- och finansieringprocesserna, men kan också skapa motstridiga roller för länsstyrelserna. Ett potentiellt alternativ som inte har tillämpats i Sverige är anläggning av våtmarker genom byte eller expropriering av mark.

De viktigaste hinder och begränsningar för utveckling i Sverige som de intervjuade uttryckt är:

- Koordineringsutmaningar gör det svårt att få till storskaliga projekt som ger fördelar ur ett avrinningsområdes perspektiv.
- Ett alltför stort fokus på näringssreduktion kan begränsa satsningen, då detta ofta är ett huvudkriterium för att få finansiellt stöd, även om våtmarken kan ge andra viktiga fördelar.
- Länsstyrelsernas och Jordbruksverkets regler ändras ofta. Länsstyrelsernas strikta tolkning av riktlinjer begränsar variationen av våtmarkerna och minskar flexibiliteten för funktion och användning. Ett exempel är bevattning; normalt minskar stödet från länsstyrelserna om lantbrukarna vill nyttja våtmarker för bevattning.
- Det finns en intressekonflikt mellan olika sektorer, t ex mellan jordbruksproduktion och naturvård (t ex dräneringsföretag, biotopskydd och fiskeintresse).
- Det finansiella stödet för våtmarker genom LBP är generellt för lågt. I de flesta fall täcker inte stöden inkomstförlusten för att ta mark ur produktion och anlägga våtmark.

De viktigaste faktorerna för att främja våtmarkssatsningen i Sverige som identifierats genom intervjuer är:

- Våtmarker är högt prioriterade av många myndigheter och organisationer.
- En bred grupp av aktörer (bl a lantbrukare, lokala och nationella intresseorganisationer, kommuner och länsstyrelser) samarbetar för att genomföra denna miljöåtgärd.
- Kunskapsbasen kring våtmarker är god; bland annat underlättar rådgivningsinitiativet Greppa Näringen processen mellan länsstyrelserna och lantbrukarna.
- Det finansiella stödet är ej begränsat till Landsbygdsprogrammet. Kompletterande stöd kan främja en långsiktig kontakt med markägare och kompensera för investeringar som ej täcks av LBP. Det kan också stödja myndigheternas arbete med att planera och optimera lokaliseringen av nya våtmarker.

Resultatet tyder på att det är av stor vikt hur våtmarksprojekt struktureras och finansieras. Med stöd av dessa samlade erfarenheter kan följande faktorer rekommenderas för en förbättrad storskalig implementering av våtmarksprojekt:

- Involvera nyckelaktörer som kan bidra till en kontinuerlig närväro och utveckla en långsiktig relation med lantbrukare. Det är avgörande att värdera lantbrukarnas positiva bidrag till miljön, samtidigt som man måste komma ihåg att lantbruk drivs som företag.
- Ett komplett stöd måste finnas tillgängligt för lantbrukare, både vad gäller information och teknisk rådgivning, samt en konkurrenskraftig ekonomisk kompensation.
- Satsning på ett system som främjar storskaliga projekt med avrinningsområdesperspektiv. På detta sätt kan diverse aktörer involveras genom att man tar hänsyn till den mångfald av funktioner som våtmarker har (t ex att förebygga översvämnningar). Ersättning för ekosystemtjänster kan vara en intressant lösning för ett bredare samarbete mellan aktörer.

- Våtmarksinitiativ bör befrämja den diversitet av fördelar som de kan bidra till och inte begränsas till näringssreduktion. Generellt sett bör jordbrukssektorn (och samhället i stort) fokusera mer på återvinning av näringssämnen och effektiva åtgärder på åkrarna (både vad gäller brukningmetoder och tekniska lösningar) för att minska läckage av näringssämnen. Våtmarker bör värderas för sina långsiktiga funktioner och fördelar, bl a som naturlig buffer, och för det kompletta utbudet av ekosystemtjänster som de kan bidra till.

INTRODUCTION

Some Baltic Sea Region countries have adopted the restoration and construction of wetlands as an agri-environmental measure to help make agriculture more environmentally sustainable. Denmark, Finland and Sweden, for example, have actively promoted the creation of wetlands in the agricultural landscape. Yet despite great efforts to scale up wetlands construction, between 2000 and 2010, Sweden only managed to achieve 60% of its national target of adding 12,000 hectares of wetlands in the agricultural landscape (Environmental Objectives Portal 2012).

Furthermore, recent studies show that there are sub-national differences not only in terms of wetlands area added, but also in terms of their effectiveness in removing nutrients from agricultural runoff (e.g. Swedish EPA 2009b). These issues encourage a deeper assessment of wetlands-related policies and their implementation in Sweden.

The main focus of wetlands initiatives in Sweden, promoted through the part-EU financed Rural Development Programme, is the removal of nutrients, i.e. nitrogen and phosphorus (Swedish Board of Agriculture 2004). However, wetlands are valuable in many other ways, generating benefits or ecosystem services such as biodiversity improvement, recreation opportunities, landscape enhancement, water storage for irrigation purposes and flood control. Hence, a key issue identified in this study was the need to emphasize the broad range of benefits from wetlands, which could elicit a stronger commitment among stakeholders and attract and involve new stakeholder groups that can strengthen the process.

This study reviews Sweden's experiences with wetlands management and construction as an agri-environmental measure in Sweden and examines opportunities for introducing the concept of multifunctional wetlands. It is part of Baltic COMPASS Work Package 6, which aims to increase the legitimacy of adaptive governance processes in integrated agricultural-environmental policy development and deepen that integration in the Baltic Sea Region.

Objective

The main objective of the study was to examine governance issues in wetlands management and implementation¹ as an agri-environmental measure. It grew out of a Baltic COMPASS stakeholder workshop in Sweden in December 2010, where participants suggested that wetlands initiatives required more attention. They called for an increased focus on the multiple benefits of wetlands, including climate change adaptation and mitigation, environmental protection and conservation, and human recreation, among others. This review also examined the potential for 'win-win' situations with benefits to both farmers/landowners and other sectors. Apart from generating national lessons, this Swedish case study aims to facilitate the exchange of institutional knowledge within the Baltic Sea Region.

Methodology

This study is based on a participatory analysis of wetlands implementation, involving interviews with professionals from governmental agencies, civil society organizations and the private sector. It was carried out in January to June 2012. Participants were selected to broadly represent the public, private and civil society sectors and were emailed with requests for consultation. Semi-structured interviews were conducted with 20 persons; Table 1 provides their names and affiliations. A visit to a larger wetland project was conducted to

¹ Wetlands implementation in this report should be understood as the whole process aiming at restoring and constructing wetlands, including policies, regulations, programmes, plans and projects.

facilitate direct communication with farmers and other professionals working hands-on to build and restore wetlands; in addition, documents for other projects were reviewed. The field research was supplemented by a literature review, including materials recommended by interviewees.

In order to encourage interviewees to speak freely, and to ensure that all relevant views and experiences could be explored, no statements are attributed to specific individuals in the report. At the same time, only a sampling of key stakeholders was consulted, since the goal was to highlight key lessons and insights from Sweden's experience, not to present a comprehensive survey.

As a final step, two rounds of reviews were conducted as part of the process, to strengthen the document and give the interviewees a say in how their views and conclusions were presented. The first review round involved eight experts within the Baltic COMPASS project, while the second round (carried out after the integration of comments from the first round) offered the opportunity to all the interviewees to comment on the report, which most did. This final version of the report reflects both rounds of feedback.

Table 1: List of interviewees, including roles and organizations

Name	Role	Organization / Project
Ann Wahlström	Former coordinator for national wetland objective	Swedish Environmental Protection Agency
Johan Kling	Hydro-morphologic expert in the water unit, Planning division	Swedish Agency for Marine and Water Management (SwAM)
Arne Joellsson	Official: Environment unit – CAB / Good water quality, Measure division – SwAM	County Administrative Board (CAB) Halland / Swedish Agency for Marine and Water Management
Emma Svensson	Official in the Agri-environmental Support Division	
Peter Wallenberg	Official in the environmental analysis division	Swedish Board of Agriculture
Rune Hallgren	Water coordinator	Federation of Swedish Farmers
Lennart Gladh	Expert on eutrophication in the Baltic Sea	WWF Sweden
Gösta Regnell	Wetlands coordinator	County Administrative Board, Skåne
Helena Sigsgård	Official in the rural development unit	County Administrative Board, Skåne
Hans Bjuringer	Official in the rural development unit	County Administrative Board, Halland
Ulrika Geber	Director for agricultural unit	County Administrative Board, Stockholm
Karin Brink	Project coordinator	County Administrative Board, Södermanland
Stefan Weisner	Wetlands scientist	Wetland Research Centre, Halmstad University
Poul-Erik Jensen	Wetlands expert	Swedish Wetlands Fund
Jonas Johansson	Project coordinator	Municipality of Lund, Kävlingeå Project
Johnny Carlsson	Project coordinator	
Sten Ericsson*	Farm manager	
Bertil Såneson*	Farmer	Tullstorpsån Project
Magnus Svenson*	Wetland constructor	
Jenny Hedin*	Consultant	

*Only brief conversations were conducted with the indicated persons during a field visit.

WETLANDS CONSTRUCTION AS AN AGRI-ENVIRONMENTAL MEASURE

Brief history

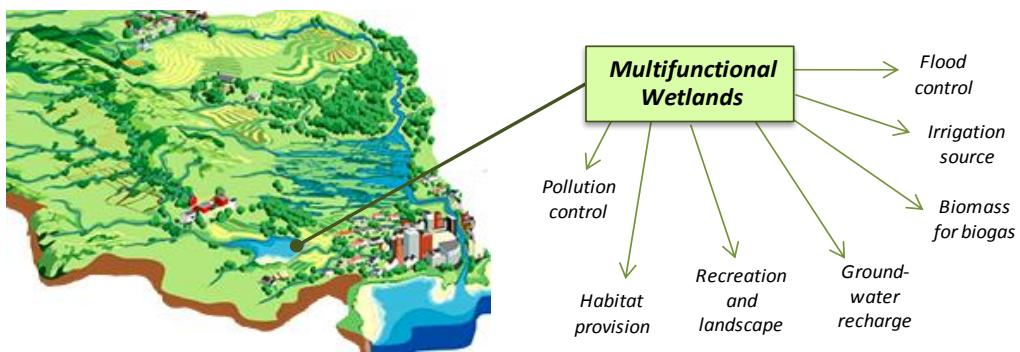
In the agricultural plains of Sweden, up to 90% of the natural wetlands were drained over the last centuries to make room for highly productive agriculture. The Swedish government financially supported these drainage projects until the 1970s. At the same time there was a growing awareness of the value of wetlands. “*Wildlife waters*” (*viltvatten*) was the term used for constructed wetlands when they were first implemented in Sweden in the 1950s, mostly initiated and financed by private landowners. From then until the 1980s, the main purpose was to create wetlands for wildlife and game hunting. In the late 1970s and early 1980s, however, research from both Sweden and abroad also showed that wetlands could have an important impact as nutrient sinks (Fleischer et al. 1991; Fisher and Acreman 2004), which led to the development of pilot projects with constructed wetlands in the agricultural landscape.

In the late 1980s, Sweden set up its first financial support system for wetlands construction, called NYLA (*nya inslag i landskapet*, “new features in the landscape”). NYLA aimed at increasing biodiversity and reducing the areas dedicated to crop production in the agricultural plains; it was later transferred into Conversion 90 (*Omställning 90*), and remained there until Sweden entered the European Union in 1995. Since 1996, financial support for wetlands projects has been available through the Rural Development Programme (RDP), which is partly financed by the EU. In addition, wetlands support was included in an important financial effort by the National Parliament, the Local Investment Programmes (LIP), which sought to transform Sweden into an ecologically sustainable society. LIP ran from 1998 to 2007 and was led by the Swedish Environmental Protection Agency (*Naturvårdsverket*, hereafter referred to as Swedish EPA) and locally implemented by municipalities. More than 270 wetlands were constructed or restored under the programme. The Swedish EPA has continued to provide supplemental funds for wetlands projects since then, mainly through the Marine Environment Grants (*Havsmiljöanslaget*).

Wetlands' potential for multiple functions

Wetlands are defined in many different ways in the literature. An internationally accepted definition, developed by the Ramsar Convention on Wetlands, says they are “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres” (Ramsar 1994). An alternative definition adopted by the Swedish Environmental Protection Agency states that “wetlands are areas where the water table for the main part of the year is close below, at, or above the ground level, including vegetation-covered lakes. A site is called a wetland when at least 50% of the vegetation is hydrophilic, i.e. water loving. An exception is periodically flooded shores along lakes, seas and rivers, which are classified as wetlands despite a lack of vegetation” (Swedish EPA 2009c). This latter definition is considered applicable to wetlands in the agricultural landscape.

In recent years the main purposes of constructing wetlands in the agricultural landscape in Sweden have been nutrient retention and biodiversity promotion; as a result there are abundant reports on wetland functions and performance regarding these issues (Swedish EPA 2009b, Swedish Board of Agriculture 2010a; 2011a, etc.). What follows is a brief overview of key functions served by wetlands and their corresponding potentials.

Figure 1: The multiple functions of wetlands

Adapted from an image by the Canadian Ministry of Public Works & Government Services.

Retention of nutrients

The input of excess nutrients, especially of phosphates and nitrates, to water bodies stimulates excessive plant growth and algae blooms, a state referred to as eutrophication in which high levels of organic matter and the decomposing organisms lead to oxygen depletion and dead bottoms. This is a common problem in the Baltic Sea. Nitrogen is normally the limiting factor to algae growth in open sea, while phosphorus is the limiting factor in many lakes and coastal areas (Bydén et al. 2003).

Wetlands have a capacity to retain and remove nutrients present in water. The main processes for nitrogen retention are nitrification and denitrification; in the latter process bacteria transform nitrite mainly into nitrogen gas, which evaporates into the atmosphere. Other retention processes are plant and algae assimilation and sedimentation of organic matter and particle-bound nutrients, which normally are more significant for the phosphorus retention. The assimilation or uptake of nutrients is part of the biomass production of plants and algae. How long those nutrients are retained depends on continuous biomass growth in the wetland, biomass harvesting, and permanent incorporation of organic matter in sediments. Sedimentation occurs when the water flow is slowed down in the wetland, enabling particles to deposit on the bottom. In the decomposition phase, nutrients may be released from the sediments again. Many factors, such as hydraulic retention time, oxygen levels, pH, and presence of bottom-living animals, determine the conditions for nutrient retention in a wetland.

Wetlands can be planned, designed and managed to facilitate the retention of nutrients. The siting of wetlands – in terms of share of arable land, size of catchment area, proximity to lakes and sea – is a determining factor in total retention. An example of important design parameters is the creation of a deeper section to support the sedimentation of particle-bound phosphorus; the presence of vegetation, meanwhile, is important to reduce resuspension and for the denitrification process, which requires access to decomposable organic material.

An evaluation of restored and constructed wetlands in Sweden concluded that the potential for nutrient load reduction by wetlands constructed for this purpose (under the former Local Investment Programmes) was 500 kg of per hectare per year for nitrogen, but only 0.2-12 kg/ha per year for phosphorus (NV 2004). However, the capacity for phosphorus retention has been re-evaluated in recent research; a more recent estimate is that the average retention should be 4-12 kg P/ha (Weisner 2012). The current assessment states that with optimal siting and design, it should be possible to reach a retention of 100kg P/ha annually in the agricultural landscape.

Recently, ponds have been developed especially for sedimentation of phosphorus. This system is intended for small catchment areas, with high P-concentration in runoff water, and should be designed with a deeper section followed by a shallow, densely vegetated zone (SJV 2010). Experiences from Norway suggest a potential annual retention capacity of 440 kg P/ha in phosphorus sedimentation ponds. (For more reading on nutrient retention and design, see SJV 2004 and Swedish EPA 2009.)

Biodiversity enhancement

The restoration and construction of wetlands can greatly contribute to biodiversity enhancement especially in the agricultural plains, where a majority of natural wetlands have been drained and transformed into productive land with low biodiversity and even monocultures (SNV 2004). Wetlands can serve as habitats for migratory birds, vulnerable amphibians and invertebrates, among others. As with nutrient retention capacity, however, the design of wetlands is a key factor in their effectiveness at increasing biodiversity. The design criteria depend on the types of species to which priority is given, but generally, diverse landscapes attract a wider range of species. Desirable features can include shallow banks, long irregular beach lines, and ensuring an uncultivated buffer zone around the wetland. Furthermore, active wetland management by grazing animals or cutting of reeds is proven to have an important impact on biodiversity (Eriksson et al. 2009).

Since the capacity for nutrient retention has been the main focus in wetland implementation, the potential for enhancing biodiversity has not been fully exploited in the agricultural landscape (SJV 2011a). The Swedish Board of Agriculture (*Jordbruksverket*, “SJV”) analyzed the synergies and conflicts between promoting biodiversity, nutrient retention, and cultural heritage in wetlands projects, and found that in most cases, the three objectives can be reached simultaneously (SJV 2004). Some conflicts may still occur, depending on which functions are prioritized. Examples of wetland features that can enhance both biodiversity and nutrient retention are variation in water levels, low gradient slopes, small islands and shallow sections (Focus on Nutrients and Skåne County Administrative Board/*Greppa Näringen och Länsstyrelsen i Skåne*, 2011). An indication that biodiversity is now getting more attention is a recent government publication on new methods to evaluate and monitor biodiversity (SJV 2011a).

Reducing flood risk

The large-scale drainage of wetlands in the agricultural landscape and the channelling of rivers and creeks have had severe impacts on natural water regulation. The natural buffering capacity is partly lost, and the water is rapidly drained from the land, creating high flows and high water levels with increased flood risks in the receiving rivers and water bodies. From a flood-control perspective, wetlands construction is an important measure to restore some of the natural buffering capacity in the agricultural landscape. In the design of wetlands it is possible to take into consideration this water regulating function and enhance the buffer capacity at high flows (SNV 2009a). For effective flood control, it is important to create large wetland areas in a river basin, which in most cases means that it is most feasible and cost-efficient to restore former wetland areas. This is possible since Sweden has well documented historical maps on the distribution of wetlands. To maximize flood risk reduction benefits, it will also be necessary to combine wetlands with other measures that support water buffering and regulation, such as controlled flooding of grazing areas through flood or water meadows (*översvämnings- eller översilningsängar*) in the agricultural landscape. The 2010 revision of the Rural Development Programme more explicitly stated the significant role of wetlands in

the response to climate change – for example, in adapting to changes in precipitation (Ministry of Agriculture/Jordbruksdepartementet 2010).

Irrigation reservoirs

Constructed wetlands may be used as irrigation reservoirs to support agricultural production during the dry season. This measure is generally considered to provide competitive advantages for the farmer. Consequently, authorities are less willing to financially support wetlands meant for this purpose. However, the multiple benefits that can be generated through irrigation wetlands have not been comprehensively explored. Extracting water from wetlands for irrigation can enhance their function as buffers during peak water flows, hence contributing to water regulation and reduced flood risk. If irrigation can support improved crop growth during the dry season, this will ensure higher nutrient uptake by plants on fertilized fields, and more nutrients will be removed through the harvest. In contrast, a poorly developed crop will leave a higher quantity of unused nutrients in the soil, which may be carried off by erosion and leach with runoff during heavy rainfall (Ekelöf and Albertsson 2009).

One of the key guiding documents for wetlands implementation in Sweden, *Quality criteria for wetlands in agricultural landscapes* (SJV 2004), recognizes the importance of water regulation and emptying of wetlands to maintain their functions. However, the guidance does not link water regulation to the function of wetlands as irrigation reservoirs, even though this has good potential as a win-win situation, where the farmers can secure their production during dry seasons and also support nutrient retention and biodiversity enhancement. This insight has also been noted by the Swedish Environmental Protection Agency and the Swedish Board of Agriculture (Swedish EPA 2007). Still, it is important to restrict water withdrawals from wetlands to maintain minimum levels to support wildlife and downstream water demands.

Recreation and landscape

Although recreational value does not receive the same attention as nutrient retention and biodiversity, authorities also consider it as a criterion for wetlands implementation support (e.g. Swedish EPA 2009). These benefits are seldom cited as the motivation for wetlands projects, but farmers interviewed for this study said they see the creation of wetlands as an investment in the local environment and a way to provide new experiences for themselves and younger generations, e.g. for skating and wildlife encounters. For example, in recent promotional materials, Skåne stresses the multiple benefits generated by wetlands, including the improvement of recreational opportunities and the cultural landscape (Focus on Nutrients and Skåne County Administrative Board 2011). Under national wetlands guidelines, in the allocation of financial support, the recreational aspect is valued according to the proximity of the wetland to urban centres (Swedish EPA 2009). Given the farmers' appreciation of wetlands' recreational value, it may be advisable to reconsider this distinction between rural and peri-urban areas.

Fishing and hunting

In general, fishing and hunting are allowed in restored and constructed wetlands. However, restrictions regarding active breeding and planting or feeding of animals are often stipulated in wetland permits. The main reasons for these restrictions are that the presence of large populations of wild fowl or fish can generate an excess of nutrients from their excreta. Bottom-feeding species (e.g. crayfish and certain birds and fish species) can also contribute to

the resuspension of nutrients deposited in sediments (SJV 2004). Fish and crayfish are part of the natural biodiversity, but their predation pressure can contribute to reductions in the number and diversity of animals.

Diversity in wetland types, in this case some with fish and crayfish and others without, could be an important strategy to promote both biodiversity and fishing in a river basin. The opportunities for fishing and hunting should be taken into consideration in wetlands implementation, since it represents added values that may appeal to landowners and generate complementary economic incomes, according to interviewed farmers and some farmer interest organizations.

Biomass for energy and nutrient recovery

A fairly recent and unexplored concept is the use of wetlands for production of biomass through the harvesting of plants, which also offer a removal of nutrients from the wetland. The harvested plants, e.g. common reed, can function as a substrate for biogas generation. The energy output from biogas through anaerobic digestion of reeds has been shown to be about 4.36 MJ/kg dm² (Fredriksson 2002). Incineration would give a higher energy output, but the potential for nutrient recovery for nitrogen would disappear. The potential for energy production offers an added economic value, which gives further incentives for an active management of the wetland with harvest. Apart from the generation of renewable energy, using the biomass for biogas generation also increases the potential to recover nutrients assimilated by plants, if the remaining process sludge is returned as a soil fertilizer. The spreading of sludge from anaerobic digestion has been demonstrated to be an efficient way to supply the arable land with a highly plant accessible fertilizer (Hansson and Fredriksson 2003), which may be a viable strategy to reduce the use of chemical fertilizers.

WETLANDS IMPLEMENTATION IN SWEDEN

This section provides an overview of wetlands implementation in Sweden, describing financial support systems, implementation processes, key stakeholder groups, and applied implementation schemes for constructed and restored wetlands in the agricultural landscape. This description is based on the information provided by interviewees, which has been complemented by available literature.

The Swedish government is committed to reducing eutrophication in the Baltic Sea (Ministry of Environment 2011). In 1999 and 2005 the Swedish Parliament adopted 16 environmental quality objectives for different areas guiding the development of the National Environmental Policy.³ The environmental quality objectives linked to wetlands include:

- Thriving wetlands: The ecological and water conserving function of wetlands in the landscape must be maintained and valuable wetlands preserved for the future (Swedish EPA responsible).
- Zero eutrophication: Nutrient levels in soil and water must not be so high as to adversely affect human health, the conditions for biological diversity or the possibility of varied use of land and water (Swedish Agency for Marine and Water Management – SwAM responsible, “*Havs- och vattenmyndigheten*”).

² MJ/kg dm = Megajoules per kilogram of dry matter. As a comparison, the energy content in 1 litre of gasoline is 32MJ.

³ Swedish Environmental Protection Agency: <http://www.miljomal.nu/Environmental-Objectives-Portal/>.

- Flourishing lakes and streams: Lakes and watercourses must be ecologically sustainable, and their variety of habitats must be preserved (SwAM responsible).

Financial support for wetland implementation

The Rural Development Programme allocates financial support for the restoration and construction of wetlands. Other important financial mechanisms include the Marine Environment Grant. In some cases municipalities have supported and invested in wetland projects. Below the financial support mechanisms through the RDP and the Marine Environment Grant are presented.

Rural Development Programme

The Rural Development Programme (RDP) in Sweden is financed by nearly 50% by the EU.⁴ Different support mechanisms have been running over the years, and the current programming period is 2007-2013. The County Administrative Boards (CABs) are responsible for the implementation of agri-environmental measures in the RDP. Wetlands implementation and management are mainly covered under the two categories: non-productive investments (*miljöinvestering*) and agri-environmental payments (*miljöersättning*).⁵ Non-productive investments can be used for construction and restoration of wetlands but also for other restoration projects in water bodies, such as terrace ditches (*tvåstegsdiken*). Another financial instrument is the EU Leader programme, which may offer financial support to activities related to wetland and stream restoration projects, e.g. information campaigns.

Non-productive investments

Wetlands project support is considered “payment for regional priorities” (*utvald miljö*) in the RDP, which makes restoration and construction of wetlands a measure entitled to financial support through non-productive investments. The County Administration Board decides which measures are to be regionally prioritized and can obtain financial support; however, this strategy should be developed and updated in partnership with key stakeholders (Ministry of Agriculture 2010).

The investment support available for landowners generally covers up to 90% of the actual cost, to a maximum of 200,000 SEK/ha. Projects with high priority can receive 100% (but never exceed 200,000 SEK/ha), but it is also possible for a lower-priority project to receive less than 90% support. The “willingness to pay” (*betalningsvilja*) is decided by the CABs (see section on eligibility for more details). Only costs related to actions regarded as contributions to environmental improvements are qualified for support. Since 2010 the investment support can cover all relevant project costs, such as design and application expenditures, even if the project for a reason cannot be approved. Today, the only exception on the upper limit is for the construction of ponds for phosphorus sedimentation, which are entitled to a maximum investment support of 300,000 SEK/ha. The support is given as a reimbursement after the expenditures have occurred, on a periodic basis, or once the construction project has been completed.

⁴ Swedish Board of Agriculture: <http://www.jordbruksverket.se/amnesomraden/mojligheterpalandsbygden/landsbygdsprogrammet/vadarlandsbygdsprogrammet.4.7a446fa211f3c824a0e8000171998.html>.

⁵ Non-productive investments and agri-environment payments are instruments under 2nd Axis, Pillar 2 in the Common Agricultural Policy of the EU.

⁶ 1 SEK ≈ €0.11 EUR (SEK: Swedish crowns).

SJV representatives report that the Swedish government is considering removing the 200,000 SEK/ha cap and allowing for payment in advance for wetland projects, both to facilitate implementation. The changes could be made as soon as this year.

Agri-environmental payments

As a means to ensure the appropriate maintenance of restored and constructed wetlands it is possible for farmers to receive agri-environmental payments. These also aim to compensate farmers for their higher costs due to the changed land use; the payments are calculated based on lost revenue and reduced income. The contracts for agri-environmental payments for wetland maintenance are made for a five-year period. During the previous programming period and the one before that, contracts were made for 10 and 20 years, respectively.

The level of payment depends on the type of land use prior to the wetland implementation and to what national support category the area belongs to; the latter is based on land value and agricultural productivity. Cropland that has been transformed to wetlands can receive a payment of 4,000 SEK/ha. This can be complemented with 1,000 SEK/ha as an extra payment for loss of harvest, in certain areas (Support Area 9) and in areas with high land prices. For wetlands on former grazing land the payment is 1,500 SEK/ha. For the non-wet wetland area being maintained through livestock grazing or hay cutting it is possible to receive an additional single farm payment (gårdsstöd) and agri-environmental payments for pasture or meadow.

It is also possible to apply for agri-environmental payments for wetlands that have not been constructed or restored with non-productive investment support. However, the maintenance of these specific wetlands should contribute to the general objectives of wetlands in the agricultural landscape that have been set by the CABs (e.g. nutrient retention, biodiversity enhancement).

Eligibility for financial support

The national distribution of financial support through the RDP, led by the Swedish Board of Agriculture, is based on two overall criteria: i) areas with excessive nutrient leakage and/or ii) areas that suffered extensive loss of wetlands over the last centuries. The CABs, guided by national regulations and guidelines, make support decisions for individual wetland projects. The CABs make decisions and define their “willingness to pay” mainly based on the potential to contribute to nutrient retention and enhanced biodiversity. Examples of criteria that the CABs can include for wetland support are (e.g. NV 2009; SJV 2004):

- Relation between water surface area of wetland and the runoff area captured by the planned wetland. Highest priority is given to catchment areas larger than 50 hectares.
- Percentage cropland within the runoff area. Priority given to areas with share of cropland above 70%.
- Proximity to the sea or prioritized lakes (e.g. protected raw water source).
- The design and the size of the wetland (priority is generally given to large wetland areas).
- Cost-efficiency (cost per treated kg of nitrogen or phosphorus).

However, there is generally no direct specification made regarding criteria for ecological status. Furthermore, certain restrictions for complementary uses or functions often apply that may lower or remove the financial support. For example, when uses such as irrigation, fish and crayfish farming, and feeding and breeding of wildfowl are desired by the farmer, CABs

often reduce or deny support – a fact that may restrict multi-functionality and reduce interest from landowners.

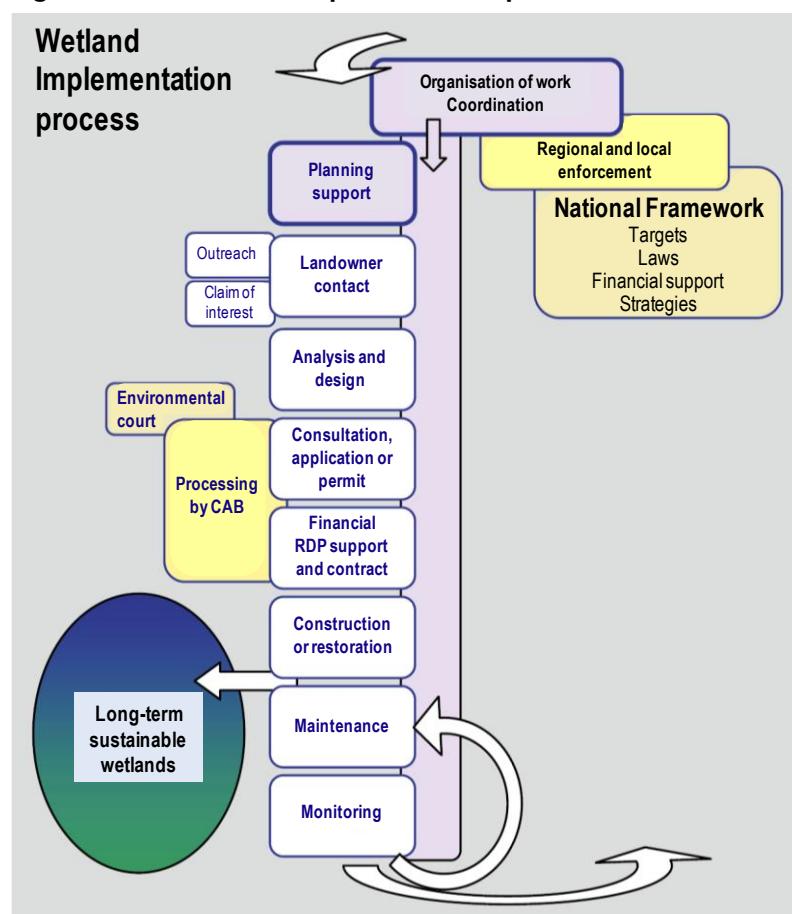
Marine Environment Grant and LOVA

The Marine Environment Grant is another source of funding managed by the new Swedish Agency for Marine and Water Management (earlier managed by the Swedish EPA) through which support to the CABs is provided for priority planning and outreach for wetlands implementation. Grants are also available for non-profit organizations (*ideella föreningar*) and municipalities to support projects aiming at the improvement of status of the marine environment, including the restoration and construction of wetlands in the agricultural landscape. An example is the LOVA grant (lokala vattenvårdsprojekt) that was initiated in 2009 to support local water conservation projects. This fund is not directly intended for the construction of wetlands, but can be used to remove certain obstacles and achieve more efficient wetlands. For instance, organizations have used grants to finance detailed studies to optimize the siting of wetlands from a nutrient retention perspective, and also to complement the funds of the RDP, enabling a higher degree of compensation for farmers participating in a specific wetland project. Co-financing is a prescribed requirement, since only 50% of the total project cost can be covered by LOVA support.

The wetlands implementation process

This section presents an overview of the main phases of the wetland implementation process, which is illustrated, in a simplified fashion, in Figure 2 below.

Figure 2: The wetland implementation process



Adapted from SNV (2009).

Initial project initiatives

Within the current scheme the implementation of wetlands in the agricultural landscape is dependent on a voluntary decision by the farmer (or landowner). In general, there are two ways for the farmers to get involved in a support process for wetland implementation: 1) outreach activities conducted by CABs or other organizations (e.g. specific projects, advisory services); and 2) an expression of interest by the farmer.

Many of the CABs provide free advisory service to the interested farmers through the initiative “Focus on Nutrients” (Greppa Näringen). The free advisory service, normally conducted by contracted consultants, involves a half-day’s work to sketch out the wetland project. Based on this information and a field visit, the CAB can give a preliminary approval, which means that the project is apparently feasible. The next step is to develop the application and the designs.

Notification and permit process

Anyone wishing to restore or construct wetlands is required to file an official application with the CAB. For wetlands smaller than 5 ha, the application normally results in a notification process according to the Environmental Code (anmälan enligt Miljöbalken), which can be handled within the CAB. The application needs to include maps, a schematic wetland design, and written opinions from local concerned actors (neighbours, drainage projects, etc.). The applicant must also demonstrate that no conflict of interest or risk for damages exists. The proposal is sent to municipal authorities and other organizations for comments. In most CABs, the environmental unit processes applications, and it consults with and takes into consideration different existing areas of interests, including cultural landscape and heritage, fishing, biotopes and biodiversity protection. Public consultations are a basic requirement for all types of wetland projects.

For wetlands larger than 5 ha or where the measure is considered to pose a conflict of interest or interfere with a Water Rights Court ruling (vattendom), it is necessary to apply for a legal permit. The permits are processed by the Land and Environment Courts (Mark- och Miljödomstolarna). An exemption from permit application for larger projects can be made when the CAB determines that it is evident that no public or private interests are at risk due to the proposed water project. However, if water right conflicts occur after the implementation of a wetland, the case can still proceed to court.

Applying for support from the Rural Development Programme

After approval from the CAB or the Environmental Court, the farmer can apply for the non-productive investment support and continue developing the more detailed project plan and design for the wetland, normally conducted by a wetland consultant; this expense also qualifies for non-productive investment support.

Once the wetland has been constructed or restored, it is inspected by the CAB to verify its size, which is the basis for the calculation of agri-environmental payments. Restrictions and terms for management are also established. In most CABs the environmental unit is in charge of the process of approval, while the rural development unit administers the non-productive investments and agri-environmental payments.

Stakeholder roles and interests in wetland implementation

Table 2 presents the key stakeholders currently involved in wetland implementation and their roles and main interests. In order to achieve multi-functional wetlands and potential win-win situations, it will be necessary to identify new actors, which could include organizations for nature conservation and recreation, civil contingency agencies, insurance companies, and others.

Table 2: Key stakeholders and roles in implementation of wetland projects in Sweden

Farmers	Farmers have a key role because participation in wetlands projects is voluntary, and landowners have to actively choose to allow a wetland to be built on their land. Under the regular RDP scheme they are in charge of the design and construction of wetlands, even if this work in most cases is carried out by wetland consultants and construction firms.
Swedish Environmental Protection Agency (Naturvårdsverket)	The Swedish EPA plays a strategic role in wetland implementation in Sweden and allocates funds from the national government. It is also accountable for strategies and monitoring of the environmental quality objective 'Thriving Wetlands' and provides guidelines to the CABs, e.g. for planning and monitoring.
The Swedish Agency for Marine and Water Management (Havs- och vattenmyndigheten)	SwAM is responsible for the overall planning and administration of water resources in Sweden. SwAM was established in 2011 and took over the responsibility for sea and fresh water issues from the Swedish EPA, and is responsible for the environmental quality objectives 'No eutrophication', 'A Balanced Marine Environment', and 'Flourishing Lakes and Streams'. It develops national priority maps and planning material for the implementation of wetlands, and also distributes financial support through the Marine Environment Grants. SwAM provides general guidance for management of fresh and marine water resources to the CABs.
The Swedish Board of Agriculture (Jordbruksverket)	SJV is responsible for the implementation of the environmental quality objectives related to agricultural landscape. SJV develops the regulations associated with financial support to wetland implementation within the Rural Development Programme and distributes funds to the CABs. It also provides guidelines and support to the CABs for the implementation of the RDP. An important unit in SJV is the Water Division that provides experts for drainage project cases in the Land and Environment Courts.
Land and Environment Courts	The Land and Environment Courts handle environmental and water-related issues, including permits for wetland construction, governed by the Environmental Code.
Legal, Financial and Administrative Services Agency (Kammarkollegiet)	This is the public authority that represents environmental interests in permit processes in the Land and Environment Courts.
County Administrative Boards	Along with farmers, the CABs play the most important roles in wetland implementation in Sweden, since they are in charge of developing regional strategies and plans, process applications, and administer financial support programmes. The CABs are also responsible for the regional environmental quality objectives. In the application process they represent many different interests, e.g. cultural heritage, nature conservation, and human recreation.
Municipalities	The municipalities do not have a formal regulated role in wetland implementation. Still they can choose to play a key role in supporting large-scale wetland projects and also as landowners to achieve wetland construction on municipal properties.
Non-governmental organizations	A few NGOs have played important roles. WWF has been actively involved in wetland implementation for more than 20 years, mainly as initiators of wetlands projects. The Federation of Swedish Farmers (Lantmännen Riksförbund - LRF) has supported wetland implementation, representing the interests of farmers with regard to general conflicts and overall regulations.
Advisory services	Focus on Nutrients (Greppa Näringen) is a collaborative initiative between SJV, LRF, CABs and wetland consultants. Financed through the RDP programme, it offers free advisory services to farmers on measures related to greenhouse gases, reduced nutrient leakage and safe pest control.
Wetland consultants	Consultancy firms play an important role in Focus on Nutrients and in the technical support to farmers.
Academia and research institutes	Academia and research institutes support the evaluation of wetland efficiency and the knowledge development and strengthening of capacity among professionals.

Wetland implementation at different levels

Wetlands projects are initiated at different levels in Sweden: by individual farmers, by organized groups of farmers, by municipalities, and by CABs. This section compares implementations at different levels, based on interviews and project documentation. Other options suggested by stakeholders or that have been implemented in other EU member

countries, are land exchanges or eminent-domain takings for wetlands construction led by the public sector, not yet applied in Sweden.

Individual farmers

This is the only formal mechanism for wetland implementation. Under the Rural Development Programme, farmers wishing to construct wetlands can apply for a permit from the CAB, and CABs also sponsor outreach campaigns to build interest among farmers. Farmers and other stakeholders interviewed for this study said there is a certain level of resistance among farmers to initiating the process. The stated reasons are that it is a cumbersome bureaucratic process; that it is hard to gain the support and interest of the CAB for a project that may involve only an isolated and relatively small wetland area; and that RDP financial resources are limited.

A recent study on landowners' reasons for willingness to construct wetlands concluded that they will primarily consider land that already has low productivity, and they consider it very positive if the wetland can generate additional benefits (Hansson et al. 2010). It is also clear that it is difficult to attract farmers with broad outreach campaigns and without establishing more long-term communication processes. More targeting may also be appropriate, to engage farmers willing to construct wetlands in areas that have been identified as optimal in the CABs' planning and priority mapping process.

Figure 3: Constructed wetland on the river Tullstorpsån



Photo by Johnny Carlsson.

Organized farmers

On the river Tullstorpsån in the county of Skåne, more than 50 farmers and landowners have joined an association to develop a wetland and river restoration project initiated by an influential farmer and a former municipal environmental official. The project has gained political interest and financial support outside the RDP and has been given regional priority with national relevance due to its innovative profile, working at the water catchment level in a small, 19 km long river. To date, 21 wetlands have been constructed, and other river restoration measures have also been implemented.

Key success factors have been a strong leadership with knowledge about how to deal with political interactions and drive complex processes, enthusiastic farmers, and strong support from politicians and authorities. The financial support complementing the RDP (e.g. LOVA funds) has allowed a full recovery of costs for farmers involved in the project. The combination of wetland implementation and river restoration has generated innovative solutions that to a certain extent are defying the existing regulations on buffer zones and related agri-environmental payments. Since the project has been driven by the motivation and knowledge of a couple of key persons, it may not be easily replicable. An alternative in this case could be implementing projects through water councils and by involving other key stakeholder groups.

Municipality-led initiatives

There are some interesting examples from Skåne and Halland (on the rivers Kävlingeån, Höjeå, Segeå and Smedjeån, among others) where municipalities have led large-scale wetland implementation projects. Kävlingeån and Smedjeån projects reviewed in this study have both developed on a river basin scale; nine municipalities have been collaborating on the river Kävlingeån and two on the river Smedjeån. Through the involvement of municipalities it was possible to obtain financial support from LIP (now the corresponding funds source would be LOVA).

In the Kävlingeån project, which started in 1995, more than 360 ha of wetlands were constructed, on 148 sites. The Smedjeån project started in 2001 and resulted in 83 wetlands with a total area of 122.5 ha (Strand and Weisner 2010; Laholms kommun 2007). The municipalities have had an administrative role, while the implementing work to a great extent has been led by consultancies. Through the complementary funds it has been possible to invest in preparatory studies to identify optimal locations for wetlands in the catchment area and develop a long-term dialogue with farmers and other landowners. An expressed challenge in the Kävlingeån project has been to motivate all municipalities and to generate understanding for a holistic project, which means that the measures may not be evenly distributed between municipalities: some will invest money in the project but may not receive wetlands within their territory.

CAB-led initiative

Few wetland projects in Sweden have been led by the CABs themselves. An example is the river Svartå project in the county of Södermanland (Södermanland County Administrative Board 2011). The positive lessons from this project are the fact that the application and financial support systems are within the same organization, which has the potential of facilitating more efficient administration and prioritization. At the same time, this may generate an intricate situation since the CAB represents different interests, including outreach, permits, control, monitoring, funding, and regulatory. In this sense it may be preferable for water councils or even municipalities in some cases to take on a more central or leading role in wetland implementation schemes. In any case, CABs have a good overview of the needs in the county as a whole, and how to prioritize rivers and water basins; hence their active participation is essential.

The following section, which looks at the performance of projects financed under the LIP and RDP mechanisms in terms of nutrient removal efficiency, provides some indication of the relative effectiveness of implementing wetlands projects at different levels.

OUTCOMES OF WETLAND IMPLEMENTATION

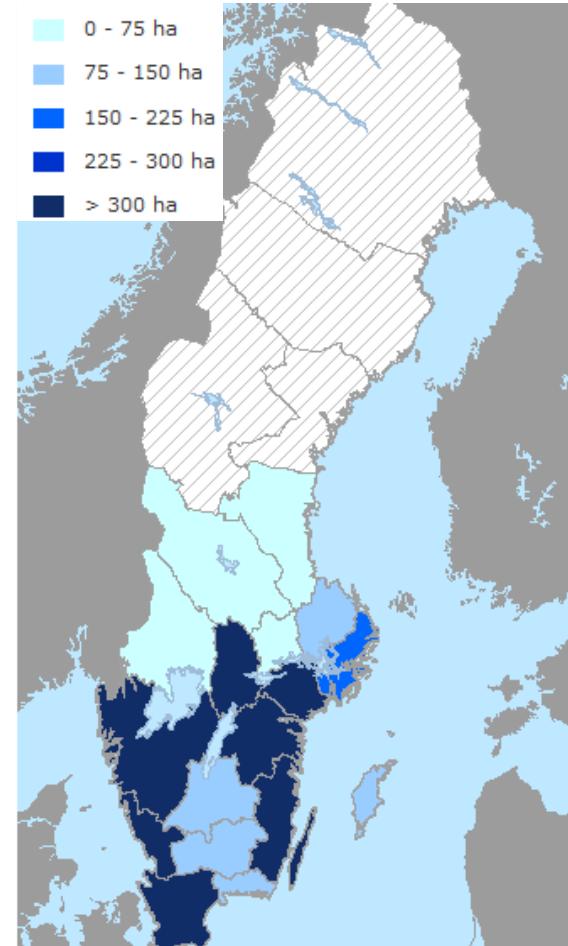
The evaluation of the success of wetland implementation in the agricultural landscape in Sweden, led by the Swedish Board of Agriculture and Swedish Environmental Protection Agency (SJV and NV), has focused on the number of hectares of wetlands added, the achieved reduction of nutrient leakage, and biodiversity enhancement, while other benefits are not generally considered or measured.

National environmental quality targets

The former official national target for wetlands, for which the Swedish Environmental Protection Agency was responsible, was to establish or restore 12,000 ha of wetlands on agricultural lands between 2000 and 2010. This target was not achieved; only about 7,300 ha of wetland had been added by 2010.⁷ The result incorporates all wetlands implemented under the different financing programmes available under this period. Figure 4 shows the result of the wetland implementation in the counties of Sweden. The target was area-based, but this should only be seen as an indicator, as the overarching environmental objective is achieving and maintaining “thriving wetlands”, with high diversity of wetland types, preserved biodiversity, cultural heritage, and high recreational values (SNV 2007). The interim targets are now partly being replaced by revised specifications of the environmental quality objectives. The specifications spell out what each objective entails, and should serve as criteria in follow-up of the objective. For “thriving wetlands” the specifications underline the importance of re-establishment of wetlands especially in regions where drainage has resulted in loss and fragmentation of wetland habitats (Ministry of Environment / Miljödepartementet 2012). The new specification also recognizes the ecosystem services produced by wetlands, and explicitly mentions biological production, carbon storage, water management, water purification, and water flow regulation.

For the current RDP period, 2007-2013, a target of 6,000 ha of new wetlands was set, but only about 2,000 ha have been added so far (SJV 2011b). Regarding the phosphorus sedimentation ponds for which financial support has been available since 2010, the result is still very limited, since only a few of these ponds have been set up throughout the country.

Figure 4: Wetland areas added in each Swedish county, 2000-2010



⁷ See <http://www.miljomal.se/Environmental-Objectives-Portal/11-Thriving-Wetlands/Interim-targets/Wetlands-on-agricultural-land/>.

Drawing together information from available reports on new and restored wetland areas that received government support as agri-environmental measures the total area of projects implemented from 1990 to 2010 is about 10,500 ha (SJV 2004, SNV 2011). However, this area does not include wetlands projects implemented with municipal or private financing.

Reduction of nutrient load

The Swedish Board of Agriculture has identified the need for wetlands as an agri-environmental measure to help reduce nutrient leaching to the sea through wetlands. The nutrient reduction target for wetlands is a capacity to reduce the nitrogen loss to the sea by 2,100 tons per year by 2020. Based on the targets for wetland area this gives a required average retention capacity of 175 kg N/ha per year.⁸

The capacity of wetlands to retain nutrients has been quite comprehensively evaluated in Sweden. These evaluations show that there are large variations in the retention efficiency of wetlands. It is important to point out that measuring average retention is a complicated task, since wetlands are complex systems where biochemical and geophysical conditions change constantly over the year (most significant for nutrient retention are the variations in water flow, nutrient concentration and temperature). In a long-term project in the river Kävlinge, where more than 360 ha of wetlands area have been constructed, nitrogen retention was estimated at 194-330 kg/ha per year, and phosphorus retention at 1.1-21 kg/ha per year (Strand and Weisner 2010). Another, more general evaluation, of wetlands projects implemented in southern Sweden between 1996 and 2006 (about 4,135 ha), the local retention capacity was estimated to be only 34 kg N/ha per year and 2.9 kg P/ha per year using a catchment hydrochemical model (Brandt et al. 2009). Thus the wetlands' contribution to reducing nutrient loads to the sea would be very low; however, the researchers acknowledged deficiencies in the availability and accuracy of data.

It is important to note that quite a few of those wetlands have not been constructed in locations that are optimal for nutrient removal. Also, the construction and restoration of wetlands is only a fraction of the wetland area lost due to the last centuries' drainage schemes, which means that Sweden is still a long way from fully restoring wetlands in the agricultural landscape.

There are also studies comparing the nutrient retention capacity from wetlands implemented under different payment schemes. The wetlands implemented through the Local Investment Programme (LIP) generally show higher retention efficiency (e.g. 500 kg N/ha per year under LIP versus 100 kg N/ha per year under the RDP); where the main explanation is more optimal siting from a retention perspective (Swedish EPA 2004). The LIP was managed by municipalities, which in many cases included strategic planning of the whole implementation process, while the implementation through the RDP is driven by individual request from farmers.

It is also important to remember that the main criterion for design may not always be nutrient retention. This together with not having the full control of localization of wetlands to achieve reduced nutrient leaching can partly explain the poor retention capacity. A recent study on six wetlands constructed mainly for nutrient reduction in the county of Skåne showed that the average retention capacity was as high as 593-654 kg N/ha per year (SJV 2010a).

⁸ See <http://www.miljomal.se/Miljomalen/Alla-indikatorer/Indikatorsida/Fordjupning/?iid=8&pl=1&t=Land&l=SE>.

Impact on biodiversity

The potential that wetlands have for enhancing biodiversity and also supporting vulnerable species in the agricultural landscape has not been fully utilized. A recent evaluation of 36 wetlands conducted under the direction of the Swedish Board of Agriculture (2011a) showed that the physical conditions (wetland design and surrounding environment) were intermediate, while the biological conditions (vegetation and groups of animal species) were generally unsatisfying. However, when exploring the age factor, there was a clear trend that older wetlands showed higher biodiversity.

Nevertheless, specific project experiences show that enhanced biodiversity can be achieved. The biodiversity evaluation of the river Kävlingeån project, which over the years strengthened the biological ambitions, showed that the project significantly contributed to improved biodiversity, including the establishment of red-listed species in the implemented wetlands, for both bird and benthic fauna (Strand and Weisner 2010). In the river Smedjeån project the number of bird species in the river area increased by 50% after project implementation (Aquarius 2010).

According to interviewees, just minor changes and improvements on the design are necessary to gain important improvements for biodiversity.

ENABLING FACTORS IN WETLAND IMPLEMENTATION

This section examines the key factors that have contributed to the adoption and advancement of wetland implementation in Sweden; the information is mainly based on the interviews. The examples presented show the diversity of opinions shared by stakeholders representing different interests and views linked to the role and function of wetlands.

Prioritized issue among a broad set of actors

Wetland implementation has been given political priority, with broad support for wetlands as an agri-environmental measure among both governmental authorities and NGOs. Evidence of this strong support includes:

- Significant national budgets have been allocated for the restoration and construction of wetlands in the agricultural landscape for more than 20 years. More than 10,500 ha of wetlands have been restored or constructed with state subsidies during this period.
- Funds have been available from different authorities (e.g. marine environment funds, nature conservation funds and the Rural Development Programme) and also from some NGOs (e.g. WWF and Swedish Wetland Fund).
- Long-term targets for wetland implementation at the national and regional levels.
- Planning support for wetland implementation at the national and regional levels.
- Large number of authorities and organizations working to promote the implementation of wetlands in Sweden, as described above in Table 2.

Institutional collaboration and adaptation

The priority given to wetland implementation among many key stakeholders is also reflected in inter-institutional, cross-sector collaboration and in the search for efficient development models:

- Collaboration between key authorities in the formulation of strategies and knowledge sharing associated with wetland implementation. An example is the Focus on Nutrients initiative for capacity-building and advisory services for wetland construction, among other things – a collaboration between the Swedish Board of Agriculture (SJV), the Federation of Swedish Farmers (LRF), the County Administrative Boards and wetland consultants.
- Continuous national processes to improve the regulatory and financial system to render more efficient implementation. Authorities and key NGOs are invited to comment on regulatory proposals for wetland implementation.
- Some CABs have seen benefits in adapting oversight of wetlands within the CAB. For example, the County Administrative Board of Skåne is administrating the entire wetland implementation process within its environmental unit, instead of having divided functions between the environmental unit managing the application process and the rural development unit managing the investment support. The same official is responsible for a wetland case from the first claim of interest until the moment when the wetland has been constructed. However, the other units (e.g. nature conservation, rural development, and cultural heritage) are still involved in the case and have the opportunity to impact the process according to the interests they are monitoring. The CAB of Skåne has experienced that this model facilitates administration and makes the process more efficient.
- The fact that wetland projects are being implemented at different levels in Sweden indicates that there is interest in collaborating and searching for an efficient development model among a diverse group of stakeholders (e.g. farmers, local and national NGOs, municipalities and CABs). For example, interviewed farmers clearly stated the importance of receiving support from a large-scale project (sponsored or run by authorities) instead of running an individual wetland project alone.

Strong knowledge base

The strong national commitment and the relatively long experience of wetland implementation in Sweden have contributed to raising awareness and generating a wide knowledge base among key stakeholders. There have been significant investments in capacity-building activities by authorities, organizations and universities. Major efforts to support wetland research and evaluations of projects have generated an abundance of reports and documents. The combined efforts have raised the general level of knowledge on wetlands, which has facilitated implementation.

Focus on Nutrients is also a good example in this regard. One of the services offered through the Focus on Nutrients is the advisory service for wetland implementation available free of charge to farmers in many counties. This activity supports the initial engagement and the first initiative taken by the farmer. In addition, the CABs have experienced that farmers who received this free service from wetland consultants better understand wetland-related concepts and technical issues. The initiative has thus facilitated communication, permit procedures, and financial support agreements between the CABs and farmers.

Flexibility and availability of financial support

A key factor for the success of wetland implementation in Sweden is the availability of national funds for their restoration, construction and management. According to interviewees from authorities responsible for the financial support, the national budget available for

wetlands has not been the primary limiting factor for implementation. Specific financial components that have been especially important to achieving new wetland areas in the agricultural landscape are:

- Different sources for financial support available for wetland implementation, e.g. Rural Development Programme, Local investment Programmes and Marine Environment Grant. A fact that has enabled the set up of projects with integrated water basin approach, through the financing of the different steps in the implementation process, which has facilitated overall planning and optimization of wetland localisation. Furthermore, complementing financial support can contribute to -an often necessary- long-term communication process with farmers and can also compensate for investments that are not covered by the RDP.
- Two key adjustments in the financial support terms in the current RDP have generated improved incentives for the farmers. The first corresponds to the possibility to obtain financial support for the elaboration of proposal and technical designs, but also to cover costs related to eventual permit application process in the Environmental court. These specific expenditures can in some cases exceed 100.000 SEK. The second is the increase in the share of financial support. Earlier it was common that the CABs only covered 50% of the construction cost, but now the support in most cases reimburses 90-100% of verified expenditures. According to the interviewees these adjustments have been indispensable to reduce the burden for farmers, since they earlier had to cover a significant part of the investment by themselves.
- Another financial aspect of importance is the possibility to obtain a combination of different agri-environmental payments for wetland areas. The base is the agri-environmental payment for wetland management, which can be complemented with additional single farm payment and agri-environmental payment for pasture or meadow through livestock grazing or hay cutting, for the non-wet wetland area. This mechanism is important to offer better compensation for farmers' loss of profit when cropland is transformed into wetland.

BARRIERS TO AND LIMITATIONS OF WETLAND IMPLEMENTATION

This section summarizes the key barriers and limitations to progress in wetland implementation in Sweden that were described by interviewees.

Limitations in the Rural Development Programme

Employing the RDP as the main channel to finance wetlands in the agricultural landscape makes it difficult to coordinate the implementation of wetland projects, because RDP support is directed to individual landowners who take the initiative to restore or construct wetlands. It is especially difficult to achieve wetlands in priority locations where benefits can be optimized. Furthermore, RDP subsidies alone generally do not facilitate constant support and communication with farmers, which is needed to convey the benefits and advantages of wetland implementation. It has been experienced that without this long-term interaction process it is difficult to attract the interest of farmers.

The length of contracts for agri-environmental payments for wetland management has been reduced, first from 20 years to 10 years, and now only 5 years in the current programming period. A farmer who decides to construct a wetland is taking an economic risk and needs to be sure that the investment is rentable in the long term. Hence, the reduced agreement period

of 5 years does not generate the same economic security for the farmer as the former long-term agreements, especially since the farmers are committed to preserving the wetland for 20 years after receiving investment support.

Farmers interviewed for this study also said the financial support is insufficient. This is because productive land is too valuable, and crop sale prices are high. Thus, in most cases, the loss of income for transforming productive cropland to wetland will not be fully covered by the payment through the RDP. This often leads to a non-optimal siting of wetlands from a nutrient removal perspective, since less productive areas will be selected.

The lost-income gap is exacerbated by the single payments (*gårdsstöd*), which are entitled for farmers undertaking agricultural activity and have eligible agricultural land. Combined with the income from crop production, the single payments will generate income levels that the agri-environmental payment for wetland management in most cases cannot compete with. In other words, given the current subsidized production system, the support level for wetlands is often too low to be effective.

Part of the problem is that EU regulations to prevent giving farmers unfair advantages (per World Trade Organization requirements) restrict these payments. Farmers cannot be paid for more than the actual cost of doing environmental good, for example, or for generating ecosystem services or other benefits. This is an issue that requires further analysis, since it is not clear how paying for ecosystem services will distort the market, since farmers are not rewarded for producing more. Sweden should consider bringing this up for review by the EU.

Specific projects on river basin management have also experienced conflicts between the financial support through the RDP and the support through LOVA. When the focus is an integrated river basin management there are uncertainties about what can or cannot be included within river restoration and wetland implementation under the different financial support schemes. For example, is it unclear whether rivers and river protection areas can be included within the wetland area to protect them for 20 years.

Furthermore, some actors expressed concerns that the RDP subsidy system could be vulnerable, since it is strongly dependent on financial support from the EU.

Financial support not comprehensive

The high availability of national funds for wetland projects in Sweden does not mean the financial support is comprehensive. The following limitations have been cited:

- There is limited financial support for outreach and river basin-based project management. Since the general RDP arrangement requires individual farmers to take action, there is an immense need for outreach activities that to a large extent are the responsibility of the CABs. However, the funds available for outreach are limited and provided on a year-to-year basis, which obstructs planning of more long-term efforts. Outreach is also time-consuming, a CAB official said; for example, for every 20 farmers targeted by an outreach effort, typically only one will proceed with the wetland application process. However, the national authorities are aware of the needs and are providing extra funds to CABs for 2012 and 2013 to strengthen outreach activities.
- The per-hectare cap on RDP support for non-productive investments are too low to cover the cost of smaller wetland projects, farmers and other interviewees said. Many farmers can only afford to construct small wetland areas on their property, but many of the project costs will be the same as if they were building larger wetlands (e.g.

proposal and design cost, and construction of inlets and outlets). Therefore, the smaller the project, the more difficult it may be to make the financial equation work out. In some regions, the CABs also provide a lower level of financial support for small wetland areas, 75% instead of 90-100% of actual costs. In cases where the wetland construction or restoration requires extensive digging, e.g. phosphorus sedimentation ponds, the financial support will generally be insufficient to cover the expenses.

Farmers' situation not fully recognized

Farmers have a key role in wetland implementation, but regulations and the way officials treat farmers often do not reflect an understanding of their situation and needs:

- According to some of the interviewees, the environmental authorities often consider and treat farmers as producers of negative environmental impacts. This often stems from the fact that the legislation concerning water operations does not separate exploitative operations that are detrimental to the environment from measures aiming at generating positive environmental effects. Hence, when they apply for approval for construction of wetlands, the case is handled as any project with negative environmental impacts. This can partly be reflected in the high number of requirements in the terms of references set by the CABs that the landowner has to follow, which can discourage farmers from investing in wetlands.
- The state supported and financed the drainage of the agricultural plains in Sweden; it can be argued that it should also now pay for constructing and restoring wetlands to help undo the damage. It cannot be expected that farmers, who are running businesses, should make large investments in wetlands on a voluntary basis. However, the latest changes in the financial support terms have taken important steps towards higher compensation to farmers.
- In general, farmers do not have a full grasp of the benefits and the full implications of wetland projects (Hansson et al. 2010); they also may not understand the financial and legal risks that they must take on. As business owners, farmers worry about the potential for sudden significant changes in rules and regulations that could alter the conditions for economic activities, especially in the case of the RDP, which is set for a limited period. Furthermore, there was also an expressed fear among interviewed farmers of not being able to achieve the cross-compliance (*tvärvillkoren*), which can have an important impact on other farm subsidies. An example is restrictions in the time period when harvest of wetland plants should be carried out according to the terms of reference established by the CAB. High water levels due to precipitation may complicate harvest during the prescribed period.
- The land ownership structure may restrict wetland implementation. If farmers are leasing the agricultural land and are not the formal property owners, they do not have the authority to decide on wetland projects.

Complex water legislation

In general, the interviewed actors agree that the existing drainage projects and Water Rights Court's rulings represent an obstacle for wetland implementation. The water legislation and old permits for land drainage are impeding the implementation of wetland projects. The legal procedures (generally requiring significant data inputs) slow down the process or may even lead to rejection of proposals. Drainage projects are often complex not only technically, but

also administratively, since they can be more than 50 years old and have a large number of members without updated records. Proposed changes to land drainage permits require acceptance from the members of the drainage project. Firstly, the member record has to be settled, and secondly the members have to be contacted, and have to agree on the plans. If a single member is against a wetland project, it is normally impossible to proceed. Sometimes landowners reject proposals for sentimental reasons, not wanting to break up old drainage projects, for example due to the fact that the family once might have invested large efforts to carry out the drainage project. The environmental and agricultural authorities are aware of this problem and are investing in capacity-building to improve the situation. However, despite 15 years of acknowledging the limitations in the existing legislation, no concrete actions have been taken by the national government to reform the system.

A common conflict issue in wetland implementation expressed by various actors is the fishing conservation interest. Wetlands are often favourable habitats for larger predator fish species, e.g. pike (*gädda*), and their predation pressure can negatively impact valuable salmon species with conservation status (Olsson et al. 2009). As a result, proposed wetland projects often face objections by fishing associations and can later be rejected in the Land and Environment Court. At the same time, wetlands close to the sea can provide key habitats for spawning and breeding of declining coastal fish populations, e.g. pike and perch (Ljungren et al. 2005).

Diverging development goals

Another issue mentioned by a majority of the interviewees is the conflict between various goals represented by different national authorities. This conflict of goals is also experienced between the different units within the County Administrative Boards. Generally speaking, a unit within the CAB represents the main interests of a specific national authority according to the following list:

<i>Rural development unit</i>	→	<i>Board of Agriculture</i>
<i>Nature conservation unit</i>	→	<i>Environmental Protection Agency</i>
<i>Water unit</i>	→	<i>Swedish Agency for Marine and Water Management</i>
<i>Cultural heritage unit</i>	→	<i>National Heritage Board (Riksantikvarieämbetet)</i>

Various consulted actors mentioned that there is a lack of a common holistic perspective between and within the concerned authorities. The equal weighing and consideration of different goals and interests can result in the obstruction of many projects. In many cases a specific biotope protection can be decisive for the rejection of a proposed wetland project. For example, if a planned wetland will affect an open ditch in the agricultural landscape, the CAB has to give a formal exemption if the reasons are strong enough, since the open ditch is prescribed with a general biotope protection according to the Swedish Environmental Code (*Miljöbalken*). However, interviewees stated that the nature conservation unit often rejects the proposal due to this conflict, without considering the long-term potential and positive impact a new wetland will have in the area.

Several interviewees also sense a certain level of divergence in the messages on wetland implementation from the different national authorities. However, when reviewing key documents (e.g. SNV 2007 and SJV 2004) produced by the concerned authorities no clear conflicts could be identified, but only a slight difference in messages could be detected between the Environmental Protection Agency and the Board of Agriculture. The former has been more open to promoting the different functions offered by wetlands, while the latter have been more focused on nutrient retention and, to some degree, also biodiversity enhancement.

Current framework limiting multi-functionality

The regulations for financial support and general terms for wetland implementation are to a certain extent restricting the promotion of multifunctional wetlands. Key limiting factors identified through the reviewed literature and interviews are as follows:

- High priority has been given to nutrient retention by the implementing authorities, which has limited the willingness to financially support wetlands based on other functions and benefits.
- The terms of reference for wetland management prescribed by the CABs are often stringent and limit the diversity of wetlands in the agricultural landscape, and also reduce the flexibility for farmers regarding functions and use. These limitations are in many cases benefit neither farmers nor biodiversity.
- Restrictions in water use for irrigation are an example of this limitation. Despite the potential for improving wetlands' nutrient retention and flood control, the use of wetlands for irrigation is not formally recognized in the regulation for financial support within the RDP. As a result, the approval for financial support is normally rejected or the support is reduced.
- As noted above, the national authorities involved in wetland implementation have, to some extent, diverging goals and interests. The diverging interests and approaches are even more evident when considering "new" potential wetland functions, such as prevention of floods. For example, the authority with a mandate for flood risk management, the Swedish Civil Contingencies Agency (*Myndigheten för Samhällsskydd och Beredskap - MSB*) is mainly focusing on emergency protection measures, such as embankments, which can contribute to increased risk of floods on agricultural lands (Johannesson 2012). Obtaining long-term measures for flood prevention will require a river catchment approach for water management; consequently it is important to invite MSB and other actors to discuss strategic water basin planning.

Organizational limitations

In general, interviewees said the authorities function well, and that there is good competence within key organizations. The comments expressed regarding main organizational limitations were:

- There is limited follow-up and feedback on the success of wetland projects. The results of wetland implementation (considering different ecosystem services/functions) on a national and regional level are not comprehensively communicated to all key stakeholders involved.
- There are only a few key or experienced persons on wetland implementation within key authorities, making these institutions vulnerable to staff alternation.
- The interpretation of national guidelines regarding wetland implementation is usually very restrictive. What is supposed to be guidance is interpreted as law; hence the diversity of wetland types is reduced and the flexibility to encounter the best solution for each specific case is not achieved.

LESSONS LEARNED AND CONCLUSIONS

This section synthesizes the findings of this study, including key lessons learned about potential ways to enhance the success of wetlands initiatives.

Wetlands bring multiple benefits, and their establishment should be recognized as a public good.

The Swedish state has historically supported the drainage of natural wetlands to increase agricultural land areas, and also the high input of chemical fertilizers to produce more and cheaper food. This resulted in ecological degradation, such as eutrophication. Restoring and constructing new wetland areas can help undo some of the damage. Moreover, wetlands also offer a wide range of ecosystem services, including nutrient retention, flood control, enhanced biodiversity, recreational opportunities, and cultural heritage and landscape improvement.

Sweden needs to scale up wetlands initiatives to add more wetlands overall, and to promote larger, more ambitious projects.

Sweden has made important progress with wetland construction and restoration in the last 20 years. However, the new wetland areas are only a fraction of the wetland area lost to drainage over the last 100 years. To scale up wetland construction, Sweden should consider a water basin perspective and seek to engage new actors and sectors.

Wetlands initiatives should promote multiple benefits, not focus less narrowly on nutrient retention.

The strong focus on nutrient retention in wetlands, almost as if they were water treatment plants, is not helping make agriculture more sustainable. In general, the agriculture sector (and society as a whole) should focus more on reuse and recycling of nutrients, and efficient on-field (both management and technical) measures to prevent nutrient leakage. Wetlands, meanwhile, should be recognized more for their long-term functions and benefits, e.g. as a natural buffer and sink, and for the full range of environmental services they provide.

Recognizing the multiple benefits of wetlands could increase incentives for farmers.

To achieve a living countryside there is a need to generate benefits and improve the rural environment in all possible aspects. If farmers can gain multiple benefits from wetlands on their property, they are likelier to construct them. For example, if they can use wetlands as irrigation reservoirs, this will help them with their productive agricultural activities, and at the same time improve nutrient retention and create better buffers against flooding. Recognizing the full range of ecosystem services provided by wetlands, meanwhile, could lead to enhanced financial support for farmers who establish them. To accomplish the latter, however, it would be necessary to review the constraints regarding “unfair advantages” (*otillbörliga fördelar*), which now restrict payments for non-productive investments and ecosystem services.

It is important to recognize farmers as potential contributors of positive environmental change.

This means that for permitting purposes, wetland projects should be considered beneficial to the environment, and not exploitation projects. Farmers are in general interested in contributing to the improvement of the environment. At the same time, it is important to remember that they are businesses that need to be financially sustainable. It cannot be expected that a small enterprise voluntarily invest in actions that most probably lead to a minor loss of income. The authorities need to be more supportive in wetland implementation projects; at present farmers need to invest their time, cover initial costs and take on uncertainties of creating negative impacts in water balances upstream or downstream of the wetland, that eventually can lead to legal implications.

National funds for wetlands should be invested in ensuring integrated and optimal wetland implementation.

Stronger support should be provided for outreach activities and the generation of coordinated projects, preferably on a river basin scale. This will also require that the work between responsible authorities is coordinated efficiently, to ensure that prioritized issues from different sectors, including agriculture, natural environment, cultural heritage, among others, are taken into consideration.

There is a need for continued capacity-building and knowledge generation and exchange.

There is a strong knowledge base on wetland implementation in Sweden. However, to take full advantage of this situation it is important to enhance capacity-building and continuous knowledge exchange among key institutions working with wetland implementation. A challenge here is to ensure and maintain human resources within the authorities. It is also necessary to ensure that experience and knowledge transfer includes the end-user, including the farmers.

Sweden can learn from its most successful large-scale wetland projects.

What all the successful projects reviewed in this study have in common is that they took a water basin approach. The models for project development varied, but key identified factors in all projects have been the involvement of different actors, maintaining a local presence, and development of long-term dialogue with farmers. A challenge in this respect is how to better promote and support the development of larger project schemes, by creating necessary guiding frameworks and adapted financial support for this type of projects.

A national discussion is needed to clearly prioritize among sometimes-conflicting objectives.

In many wetlands permit processes, conflicts between development and natural conservation goals (e.g. old drainage permits, biotope protection, and fishing interests) impede progress. Furthermore, CABs often set stringent terms of reference for wetland implementation, which may discourage farmers, but also restrict the diversity of wetlands and the potential for multi-functionality. Hence, it is of great importance to initiate a participatory national discussion to enable a clearer prioritization between different objectives and more flexibility in regulations regarding wetland design and functions.

The benefits of wetlands should be further explored to engage new stakeholders.

The multiple known functions served by wetlands could help attract new stakeholders to these projects. At the same time, there is a great deal that is not known about some of those functions, and there is a need to explore functions which have not been considered so far. For example, it would be useful to investigate how well wetlands retain nutrients and prevent other kinds of damage during floods. If wetlands are shown to be valuable for the prevention of flood damage, this could attract additional financial support and engage municipalities and new sectors.

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Baltic Compass

Baltic COMPASS promotes sustainable agriculture in the Baltic Sea region. The region's 90 million inhabitants anticipate both high quality food produced in the region and a healthy environment, including a cleaner Baltic Sea. Baltic Compass looks for innovative solutions needed for the future of the region and its agriculture, environment and business.

Baltic Compass has a wide approach to the agri-environmental challenges, covering agricultural best practices, investment support and technologies, water assessment and scenarios, and policy and governance issues.

Baltic Compass is financed by the European Union as a strategic project for its support to investments and policy adaptation. The 22 partners represent national authorities, interest organizations, scientific institutes and innovation centres from the Baltic Sea Region countries. Baltic Compass is a three year project running until December 2012.



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