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Constructed wetlands in Finnish agricultural environments: balancing between effective water protection, multi-functionality and socio-economy

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Abstract

This case study summarizes the current knowledge in Finland on the efficiency of constructed wetlands to improve water quality at the same time providing multiple benefits. The efficiency is highly dependent on the wetland's relative size compared to the upstream catchment area, and on the amount of agricultural land in the upstream catchment. The case study analyses the incentives designed to motivate landowners to construct wetlands in Finland such as the non-productive investment support and the agri-environment payment support for wetland management. Farmers think that the support system is heavy and bureaucratic, and thus the target number of new constructed wetlands is far from being met. Individual projects have been more successful in wetland construction than the official support system. General wetland plans drafted for hotspot areas is an example of enabling factors and strict eligibility rules form one of the barriers of wetland construction identified in this case study. In spite of the criticism of the current wetland incentives, a support system for wetland construction is needed. One option would be to give regional authorities more freedom to select priority areas according to e.g. River Basin Management Plans.

Key words: *agricultural, constructed wetlands, contamination, rural areas*

INTRODUCTION

Natural wetlands are globally endangered ecosystems important for their biodiversity values, but also since they regulate water and nutrient balance [MITSCH, GOSSELINK 2007]. In Finland, many natural wetlands have been dried to increase the efficiency of agriculture and forestry during the last few centuries. In agricultural areas, drainage has considerably reduced the number of wetlands along creeks and on lakeshores [KESKINARKAUS *et al*. 2009].

Draining has changed the originally slow motion of water into faster runoff with increased concentrations of eroded material and nutrients. Particularly in agricultural catchments, intensified production with more efficient field drainage and increased fertilizing has further increased the loading of suspended solids and nutrients, which has contributed to the degradation of water quality in Finnish water bodies [KOSKIAHO 2006].

By building wetlands it is possible to bring back some of the lost capacity of agricultural catchments to retain floods, erosion and nutrient transport. It has been estimated that there is potential for establishing up to 50 000 agri-environmental wetlands in Finland [PUUSTINEN *et al.* 1994]. Obviously, the construction work would take several decades. In the River Basin Management Plans, the construction of approximately 1600 wetlands is planned for the whole Finland by 2015 [TATTARI, VÄISÄNEN 2011].

In Finland and in some other EU countries like Sweden, Denmark and the Netherlands, incentives are in use to support the construction of wetlands either for water or biodiversity protection, or the combination of these [ANDERSSON 2012; BERNINGER 2011]. The efficiency of these incentives to reach the targets of wetland construction and the desired environmental effect needs to be evaluated for each country. The countries may also learn from each other.

This case study has been conducted within the Baltic Compass (Comprehensive Policy Actions and Investments in Sustainable Solutions in Agriculture in the Baltic Sea Region) interreg project with the objective of

1) summarizing the Finnish research about the ability of constructed wetlands to improve water quality;
2) analyzing the implementation of incentives designed to enhance the construction of wetlands;
3) suggesting improvements for the incentives in order to boost wetland construction.

MATERIAL AND METHODS

The methods used for this case study included a literature review on the functioning and efficiency of constructed wetlands and key documents on wetland incentives in Finland. Also five key persons involved in wetland construction either in projects promoting wetlands or in administration were interviewed, four face-to-face and one by telephone. They were thematic interviews with no pre-set questions, but topics to be dealt with in each interview. Some clarifying questions were added during the work in order to better understand the situation and get the story right. Nutrient retention processes and the efficiency of wetlands were reviewed based mostly on the experimental, monitoring and literature studies made by one of the authors of this article (J. Koskiaho).

RESULTS AND DISCUSSION

ORIGIN AND CHARACTERISTICS OF LOADING FROM AGRICULTURAL CATCHMENTS

In the Finnish climatic conditions, flood periods usually occur during snow melting in the spring and after autumnal rainstorms. In midsummer and in midwinter, runoff is usually low. Recently, however, mild winters with snow recurrently falling and melting and even with rainfalls have become more common in southern Finland [KORHONEN, KUUSISTO 2010]. Even if the flood periods may be short, they contribute considerably to annual loading since pollutant concentrations increase with increasing runoff [PUUSTINEN *et al*. 2007a].

Major factors affecting the diffuse loading from agricultural catchments are their (i) land use, (ii) slope gradients (iii) soil properties and (iv) cultivation practices. The more there is agricultural land, steep slopes and fine-grained soils, the higher the loading (e.g. VUORENMAA *et al*. [2002]). In the most intensively cultivated southwestern and western parts of Finland most of the fields are clayey. The P content – and hence the susceptibility of dissolved P leaching – of cultivated soil depends a lot on its fertilization history. The use of commercial fertilizers in Finland increased strongly after the 2nd World War and reached its peak at early 1990s [KEMIRA 1992]. Since then the use has decreased [MATTILA *et al*. 2007]. Nevertheless, as the input of P was higher than the output during four decades since the late 1940s, the P content of the Finnish arable soils was elevated and became a long-lasting source of P loading to surface waters.

PURIFICATION PROCESSES IN WETLANDS

Wetlands disperse and slow down the inflowing water thus promoting settling and deposition of suspended particles. They are also highly productive ecosystems where plants and microbes break down, assimilate and cycle nutrients, organic matter and associated pollutants transforming them into less harmful forms. The soil of a wetland may be beneficial for chemical binding of P. Thus, the retention mechanisms in wetlands can be categorized to physical, biological and chemical processes.

Perhaps the most important physical retention process is sedimentation settling both the suspended solids of input waters and the dead cells of wetland biota. The subsequent accumulation of solid material onto the wetland bottom is considered the major long-term nutrient storage in wetlands (e.g. REDDY *et al.* [1993]). However, part of the accumulated nutrients may be dissolved into the overlying water by decomposition of the organic material [REDDY, D'ANGELO 1994] and by release of P from inorganic particles [GOMEZ *et al*. 1999].

Biological nutrient retention processes in wetlands include immobilization via uptake by macrophytes [TOET *et al*. 2005], algae [HAVENS *et al.* 1999] and microorganisms [WAISER 2001], as well as denitrification [XUE *et al*. 1999] of N. Although a part of the nutrients consumed by biota is released during the decomposition, another part can be sustainably retained through burial into the sediment. In the runoff waters from arable land, N is mostly in the form of NO_3-N [KOSKIAHO *et al*. 2003]. Hence, in the treatment of agricultural runoff waters, denitrification (i.e. microbial reduction of NO_3-N into gaseous nitrogen N_2 and N_2O) irreversibly removing N from the system, is regarded as the most important single nutrient removing process in wetlands (e.g. REDDY, D'ANGELO [1994]). Denitrification requires anoxic conditions [MARTIN, REDDY 1996] as well as a supply of organic carbon and NO_3-N [REDDY, D'ANGELO 1994] which are all present in wetlands with varying water depths, abundant vegetation, and nitrate-rich agricultural input waters. Moreover, the denitrification rate increases with increasing temperature [XUE *et al*. 1999].

The main chemical retention process in wetlands is the adsorption of dissolved P into the wetland soil. Attachment of P to the soil particles may offer a more long-term storage for P than vegetation. However, the P storage to soils will eventually become saturated [PANT, REDDY 2003], which weakens the functioning of wetlands. The saturation point depends on the amount of the available sorption capacity left in the soil. In general, the less there is P and the more there are sorptive components – Fe and Al – in the wetland soil, the more efficient and longer-lasting is the P retention capacity.

Since all the processes described above need time, residence time of water is the crucial factor of wetland design and dimensioning. A useful, easily calculable benchmark for water residence time is the wetland-to-catchment area ratio. A survey of several studies [PUUSTINEN *et al*. 2007b, p. 60] shows that if this ratio is below 0.5%, the nutrient retention performance of a CW often remains low. In the USA, HAMMER [1992] recommended that 2% of agricultural catchments should be covered with wetlands for substantial treatment of runoff waters.

EVIDENCE FOR THE EFFICIENCY OF WETLANDS IN NUTRIENT RETENTION

Finnish research conducted since late 1990's has produced information on the efficiency of wetlands in nutrient retention. Year-round monitoring with manual and/or automatic water sampling was performed during 1996–1998 in a sedimentation pond (Rautalampi) and during 1998–2000 in two wetlands (Alastaro and Flytträsk). However, perhaps the most intensively studied wetland in Finland is the Hovi wetland, which was monitored with both automatic water samplers (ISCO™) and manual sampling during 1999–2002. In 2007, automatic monitoring system with continuously recording sensors (s::can™) was assembled at Hovi. Sediment and P retention in this generously dimensioned (wetland-to-catchment area ratio 5%) wetland has been high (60–70%) right from the beginning. In the recent years, also dissolved nutrient fractions (phosphate and nitrate) have been retained at similar or even higher rate. Figure 1 shows an example of the results obtained from the automatic monitoring at Hovi.

Rantamo-Seitteli wetland has been automatically monitored with sensors since 2010. As an example of this, Figure 2 shows inflow and outflow nitrate concentration time series recorded in 2010–2011. According to these preliminary calculations, this large (24 ha) wetland appears to retain nutrients rather effectively.

All of the studied wetlands presented here are located in southern Finland.

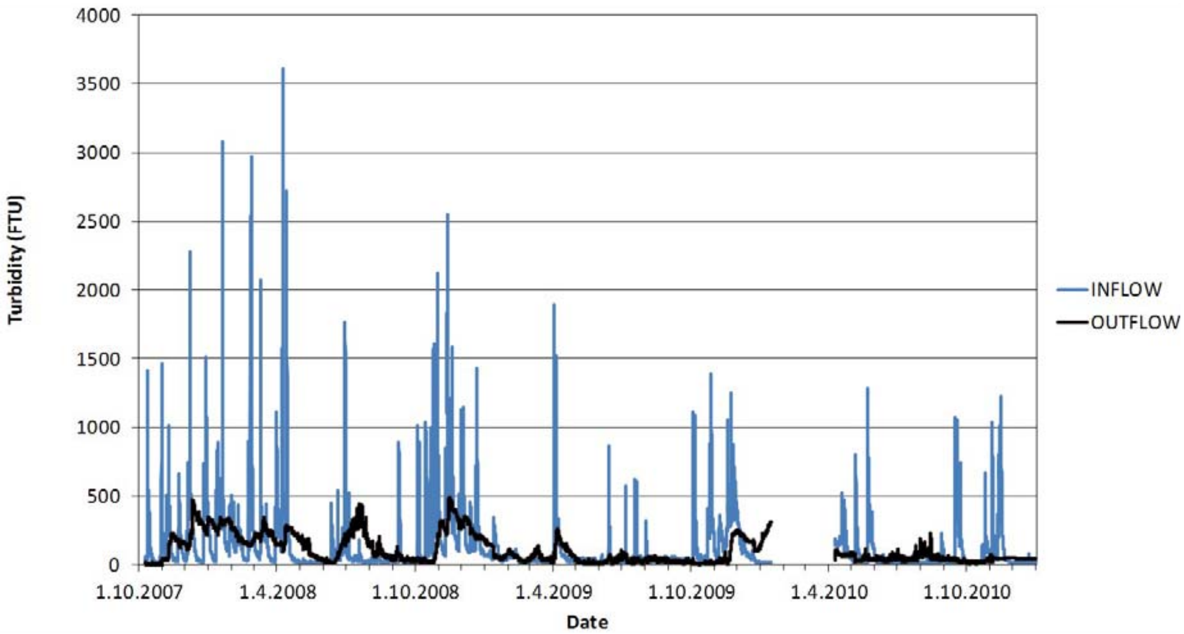

Fig. 1. Turbidity in the Hovi wetland between 1st October 2007 and 1st January 2011 as measured with sensors. Inflow and outflow turbidity were recorded at one-hour interval, i.e. each of the above time series consists of over 26 000 observations. Note excellent functioning of the wetland as suggested by very high inflow peaks followed by much lower outflow values. Also note the data gap during the winter 2009–2010, when sensors were taken out of the wetland to avoid freezing damages. Meanwhile winters 2007–2008 and 2008–2009 were so mild that the sensors were left measuring over the winters

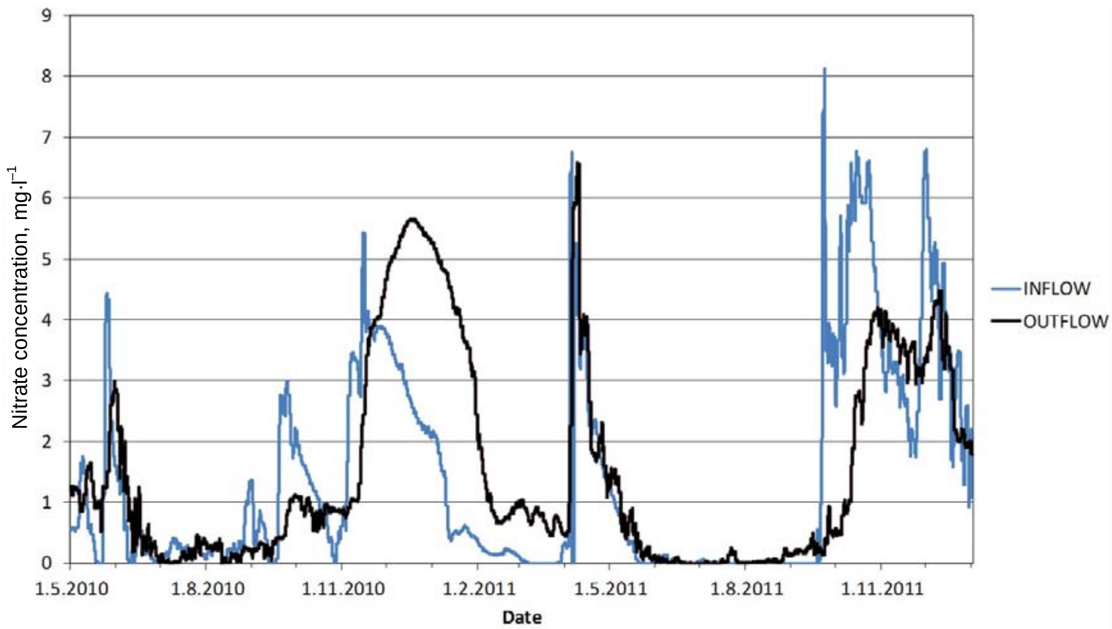

Fig. 2. Nitrate concentration in the Rantamo-Seitteli wetland between 1st May 2010 and 1st January 2012 as measured with sensors. Inflow and outflow concentrations were recorded at half-hour interval, i.e. each of the above time series consists of almost 30 000 observations. Note good functioning of the wetland as suggested by high inflow peak concentrations followed by lower outflow concentrations, except for the first winter and the following spring, when retention was poor due to combined effect of cold waters, yet sparse vegetation in the newly constructed wetland and – in terms of spring – short residence time of water. Also note that "extra" tile drainage waters are pumped into the middle of the wetland from neighbouring fields. This will be taken into account in final calculations of the efficiency of Rantamo-Seitteli wetland

Figure 3 illustrates how misleading it can be to consider the wetland efficiency only as the mass retained per a unit of wetland area. Maximum retention efficiency per hectare of wetland is reached in small wetlands. However, the objective of a wetland should be to retain as large a quantity of nutrients lost from the above fields as possible (blue curve in Figure 3). Well dimensioned wetlands are more efficient in this respect.

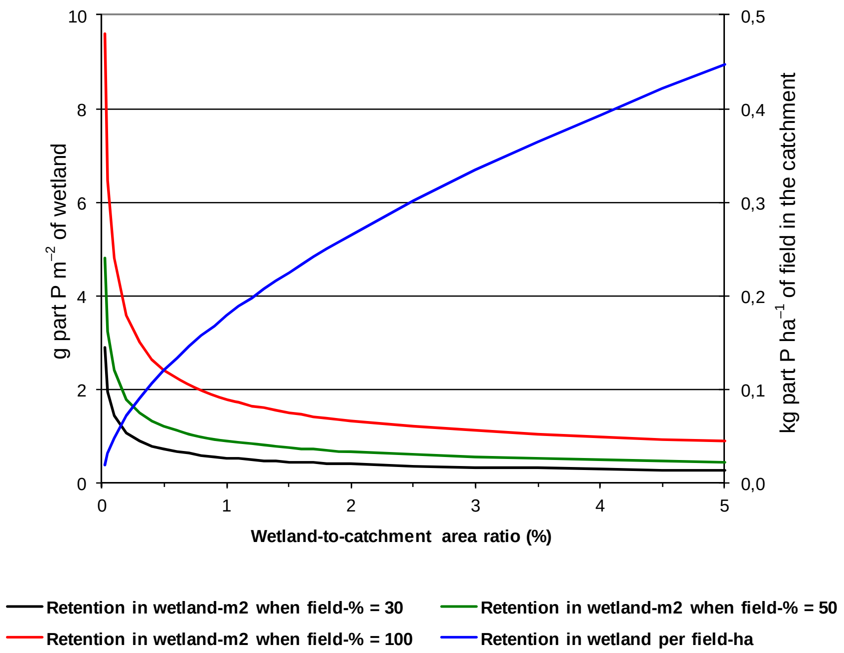

Fig. 3. Retention of particle-bound phosphorus per m^2 of wetland (left axis, declining curves) and per a field-hectare of the above catchment (right axis, ascending curve) in differently dimensioned wetlands. The size of the catchment area is 100 ha for all curves; specific loading and retention percentages of particle-bound phosphorus come from the VIHMA-model

ECONOMIC INCENTIVES FOR WETLANDS

Current incentives

In Finland, economic incentives for building and management of wetlands are part of the Rural Development Programme (RDP) [MoAF 2007]. The *Non-productive investment support for establishment of multifunctional wetlands* is designed for areas where agricultural fields cover more than 20% of the catchment area. It is targeted to areas where the measure can considerably decrease the nutrient load or increase biodiversity. Support may be used for the establishment of wetlands or wetland-like flooding areas in places where they would be naturally formed, on arable areas susceptible to flooding and on terraced drainage areas, and the restoration of a natural streambed. The size of the wetland must be at least 0.5% of the upstream catchment area. The maximum support level is 11 500 €·ha^{-1} of wetland or 3226 € per wetland for small wetlands of 0.3–0.5 ha. The support is paid afterwards according to the real costs of the project, and against receipts only; landowners' own work or the use of own machinery is not compensated. Until 2010 the maximum support was 4000 €·ha^{-1}, and there was no specific support for small wetlands. The receiver of this investment support must sign a contract for its management under agri--environment payment system. The work has to be carried out within two years of the decision date.

The special measure *Management of multifunctional wetlands* under the agri-environment payments is eligible in areas where fields cover at least 20% of the catchment area. The contracts for this measure are made either for 5 or for 10 years. Management must be based on a management plan. Annual management may include removal of sediment, dam maintenance or removal of vegetation either by cutting or grazing. Management diary must be kept. The amount of support is defined according to a cost estimate that must be submitted as a part of the application. Maximum support is 450 €·ha^{-1}.

The application is sent to the Centre for Economic Development, Transport and the Environment (ELY Centre) of the region where the project is located. The application should include a map of the area specifying the location of the project/wetland to be managed as well as a construction/management plan and a budget. The construction plan must include an estimate of a predicted impact area and a description of the foreseen benefits of the project to the water quality, biodiversity, landscape etc. [PUUSTINEN *et al.* 2007b] Within the ELY Centre, the economic section evaluates the eligibility issues and other aspect related to the feasibility of the project, whereas the environmental section evaluates the project for its impacts on nature values.

Wetlands up to 1 ha in size may also be financed through the special measure *Enhancing of biological and landscape diversity* under the agri-environment payments. Priority is given to Natura 2000 areas and sites considered valuable in general biodiversity plans.

Regional RDPs may also finance wetland projects if they fit in the regional objectives and strategy, and have broader rural development benefits [PUUSTINEN *et al.* 2007b]. The share of RDP funding through local Leader groups is maximum 90% of the total costs for development projects, and an investment support is available for a maximum 50% of the total costs [HAGELBERG *et al.* 2010]. In practice, the share of own funding required has been even 30% for development projects, which is too high for most associations.

History of incentives and wetland activities

The economic incentives for wetlands have evolved in time following changes in the political climate, stakeholder objectives, or new research results. Figure 4 shows a time scale of the major wetland activities in Finland since 1995.

The first Finnish agri-environment payment scheme was in use during the programming period 1995–1999 after Finland joined the EU in 1995. Wetlands and sedimentation ponds were then part of the special measure *treatment of runoff from fields*. The objective was then purely water protection. The support was based on costs detailed in a specific plan, and the maximum support level was 3600 FIM·ha^{-1} (about 605 €·ha^{-1}). [Government of Finland 1995]. Support was paid for all fields in the catchment area of the wetland; in the following planning periods the support has been limited to the land in the wetland area itself.

During the programming period 2000–2006, the agri-environment payment scheme included a special measure *Building and management of wetlands and sedimentation ponds* [MoAF 2000]. The multifunctional nature of wetlands was mentioned in the objectives. The measure was targeted to areas with a high share of nutrient load coming from agriculture: areas where a significant portion of the land area is under cultivation. However, no specific limit was set for the share of fields of the catchment area. The support was based on costs detailed in a specific plan with a maximum support level of 450 €·ha^{-1}, much lower than during the previous programming period. During that planning period very few wetlands were established.

The results published by KOSKIAHO *et al.* [2003] and KOSKIAHO and PUUSTINEN [2005] showing that small wetlands and retention ponds are not very efficient in nutrient retention, and that nutrient retention efficiency depends on wetland-to-catchment area ratio

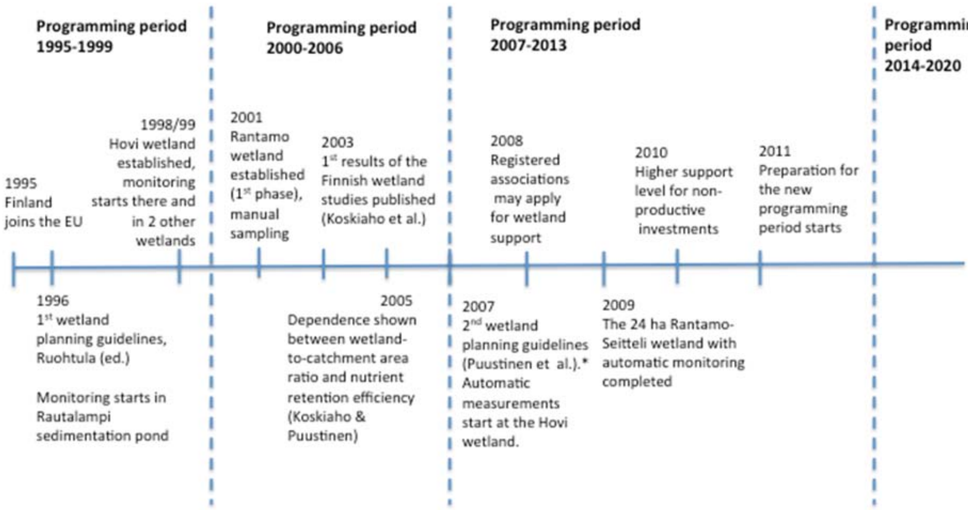

Fig. 4. Time scale of wetland activities in Finland; * = includes recommendations for wetland dimensioning and field area of upstream catchment

had a considerable effect on the preparation of the new incentive system for the programming period 2007–2013. At the moment the new Rural Development Programme for the programming period 2014–2020 is under preparation.

About 70 wetlands have been constructed during 1995–2006. Most of them were constructed during the first programming period when the wetlands had only water protection objectives [AAKKULA *et al*. 2010].

KEY PLAYERS

Wetland construction involves several groups of people and organizations from the farm level through agricultural advisors and planners to regional and national level administration. Not all actors agree about the type of wetlands that should be supported.

Farmers are the ones expected to establish wetlands on their land, and most incentives are targeted to them. Farmers are increasingly interested in wetlands after following discussion about the multiple benefits of wetlands and attending field excursions to demonstration wetlands. Farmers feel frustrated about the strict eligibility rules and the long application process of the incentive system. They feel that the incentive system is so complicated and heavy that establishing a wetland requires a very strong individual motivation [KESKINARKAUS *et al*. 2009]. Motivating factors for farmers who have applied support for wetland construction include improving water quality in a nearby lake, improvement of the landscape, recreation and hunting [KESKINARKAUS *et al*. 2009].

Farmers who had entered the process of wetland establishment sought for help from civil servants, advisors, planners or hunters organizations. They contacted a person they knew and trusted. They felt that the planning costs were high and it was not fair that the farmer had to take a financial risk by paying the planning before knowing whether the support was approved. Most got the planning services for free, paid by a project, or the cost was tied to the funding decision [KESKINARKAUS *et al*. 2009].

Establishment of a wetland requires consent of the neighbours, and in order to construct a larger wetland, co-operation between several landowners is required. In some cases relationship between neighbours has been a positive driving force and in some other cases wetland projects have not come true because of a single landowner being against the project.

Hunters' organizations promote wetlands for biodiversity and especially waterfowl species. Many farmers belong to local hunters' association, and their motive for constructing wetlands is related to hunting. The organizations don't build wetlands since it requires landownership, but individual members do. Hunters' organizations criticize the policy for supporting wetlands only for their water quality effects, and focusing on large and expensive wetlands [ALHAINEN 2009].

Planners and advisers promote wetlands and draft construction plans. They may also help in the application process. Marketing wetlands for farmers requires personal contacts and a lot of effort. Sometimes the limiting factor is the lack of knowledgeable planners. On the other hand, the market situation is such that it is not profitable to specialize in wetland planning. If the planning were paid for, there would soon be enough qualified planners.

The civil servants in the *regional* economic development and environmental *administration*, have a key role in the incentive system. They evaluate the projects, decide on the support, and supervise the contracts. The environmental section also evaluates the need for water permit. The civil servants and their respective organizations were not up to their tasks in the beginning of the programming period. The non-

-productive investment support was a new type of subsidy and there were at first no instructions on how they were supposed to be administered [KESKINARKAUS *et al*. 2009]. According to the interviews conducted during this case study and those conducted by KESKINARKAUS *et al*. [2009], the length of the process, the type of projects that are accepted, and how smoothly things move depends a lot on the region, or the person responsible for these issues in the regional administration.

Several *projects and foundations* have promoted and even financed the construction of wetlands in Finland. The projects like TEHO (More effective agricultural water protection) and Järki (Sensible enhancement of water protection and biodiversity in agriculture) have promoted wetlands in various events, organised training sessions for wetland planners, advised farms interested in wetlands, helped them with planning and ordered a few plans for larger wetlands. The have also drafted general wetland plans for key catchment areas. The TEHO Project has also published a practical guide for wetland planning [HAGELBERG *et al*. 2009].

Return of Rural Wetlands project aims at establishment of a nationwide network of more than 30 demonstration wetlands, at least one wetland for each of the 15 Game Management Districts. The project focuses on wetlands important for biodiversity, especially for waterfowl brood habitats.

The wetland project of WWF Finland both finances construction of demonstration wetlands and provides help for landowners in establishing wetlands from the planning to the building phase including supervising contractors. The project has been involved in the construction of 25 wetlands in various parts of Finland. Most of the cases were not eligible for the non-productive investment support

Vesijärvisäätiö is a foundation financing activities related to the improvement of the water quality of Lake Vesijärvi. They have been involved in the construction of about 20 wetlands. Vesijärvisäätiö has taken full responsibility of the projects from financing and planning to official noticing procedures as well as ordering and supervising contractors. These wetlands have not been eligible for the non-productive investment support.

OUTCOME: HOW DID THE SUPPORT SCHEMES SUCCEED?

In the beginning of the programming period 2007–2014, it was expected that the new non-productive investment support would increase considerably the number of wetlands in Finland. The target was to reach 1626 new wetlands by the end of the programming period. However, the implementation rate has been much lower than expected: between 2008 and 2011 165 positive decisions have been made about the non-productive investment support for wetlands (Fig. 5). If most projects with a positive funding decision are carried out, about 10% of the target will be reached. However, the number of positive funding decisions has increased considerably from the early years of the non-productive investment support.

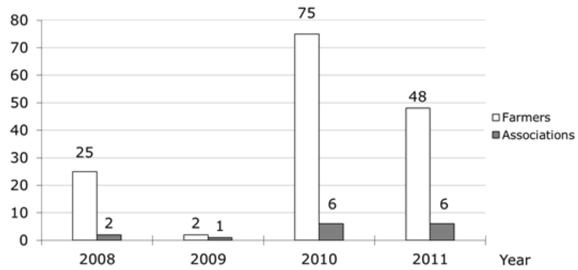

Fig. 5. Number of positive decisions on non-productive investment support for wetlands between 2008 and 2011

As the support is paid after the construction work is completed, only 11 farmers and 2 associations had received non-productive investment payments by the end of 2010 [MoAF 2011].

Regarding agri-environment payments, there were 291 special support contracts for management of multifunctional wetlands in 2010 covering 226 hectares. Only 38% of the area target has been met [MoAF 2011].

The 334 wetlands established with agri-environmental support are scattered around the country, i.e. not concentrated in the coastline where most of the agricultural land is located, and where water protection measures should be first targeted. Only 60 of these wetlands were registered to have a 5 or 10 years contract for their management. The difference reveals that many contracts of CWs and ponds established during the 1st support period (1995–1999) have not been renewed.

As the non-productive investment system excluded most of the potential wetlands, individual projects started to promote, plan and even finance wetlands.

ENABLING FACTORS

The non-productive investment support has enabled the construction of a few large wetlands (about 20 ha of size and with a budget of over 100 000 €), which would not have been possible without this funding mechanism.

General wetland plans have been drafted for several catchment areas vulnerable to nutrient leaching (e.g. ESKOLA *et al*. [2009] and KEMPPAINEN, KARHUNEN [2011]). These plans introduce examples of natural wetland locations aiming at showing typical cases for the region. They are useful tools in deciding where to plan wetlands, and help in targeting support for the most important projects. They have also been used as a tool for promoting interaction between different actors. Discussion on potential locations for wetlands with farmers and other actors enables the use of local knowledge.

Some regions have their own wetland expert, an active individual, who advises both civil servants and farmers [KESKINARKAUS *et al*. 2009]. These exceptional individuals have a vision of a larger area and how a combination of wetlands could function together. They also talk to farmers and promote wetlands. A countrywide network of wetland experts could be created to promote them and help in their construction.

Several projects have been established in Finland in order to provide advisory services and plan wetlands. Some projects also finance them and provide support to landowners during the entire project up to supervising the construction work.

Various demonstration wetlands of different sizes have been constructed in Finland. Field visits and talks in different events as well as the model from landowners who have constructed wetlands have inspired a raising number of interested farmers and other landowners willing to consider establishing a wetland.

Research on the effect of wetlands on water quality has been conducted in Finland since late 1990s. This research has produced new information and understanding on how wetlands function and which qualities they need in order to be efficient from a water protection point of view. The understanding gained helps to plan efficient water protection wetlands.

Researchers of different fields like water quality, biodiversity, game management and environmental politics have learned to understand each other and work together. It has taken a long time to speak the same language, but now real collaboration is possible. This has on its part contributed to the creation of a multifunctional wetland definition. The discussion on wetlands is not as polarized into groups promoting water protection or biodiversity goals as it used to be. It can be concluded that different actors now agree on the objectives of wetlands more than they did when the current programming period was under preparation.

BARRIERS

The strict eligibility rules for the non-productive investments and agri-environment support for the construction and management of multifunctional wetlands restrict the implementation of these measures. For example, in the Lake Vesijärvi region the regional CW plan has identified about 80 potential wetlands, and less that 10 of them are eligible for the support. The TEHO project visited 49 farms interested in wetlands, and an eligible site was found on 5 farms [LUNDSTRÖM *et al*. 2011].

As an agricultural incentive, wetland support is not available if fields cover less than 20% of the catchment area even if the nutrient load coming from existing fields is high. There are several such points in regions where early vegetables, herbs and/or berries are cultivated or in intensive cattle farming areas. Establishment of wetlands in these locations would bring a high nutrient retention effect. [LUNDSTRÖM *et al*. 2011].

Support is not available for small wetlands with an area less than 0.3 ha. There are cases with interested farmers and planned wetlands fulfilling the requirement of being 0.5% of the upstream catchment area, but the size was too small [LUNDSTRÖM *et al*. 2011]. Special support within the agri-environment scheme cannot be paid if it is below the lowest payable support sum. This administrative rule is applied regardless of the estimated effects.

Applications for special support within the agri-environment scheme have been rejected after a long process because the project is deemed not to have sufficient effect on water quality. However, it should also be possible to build wetlands for maintenance or promotion of biodiversity [AAKKULA *et al*. 2010].

Farmers criticize the fact that the incentives for wetlands are tied to other agricultural subsidies. Farmers are afraid of mistakes in the construction or maintenance of wetlands that would affect their other subsidies [KESKINARKAUS *et al*. 2009].

The rules are not clear enough about the compensation of the value of fields that are permanently under water after wetland establishment, which makes implementation of large wetlands more difficult. The system compensates lost subsidies to some extent, but a simple system based on the real value of fields is lacking [LUNDSTRÖM *et al*., 2011].

The application process for the non-productive investments takes a long time: according to KESKINARKAUS *et al*. [2009] from 9 to 15 months. In some cases the application process has been shorter, in Etelä-Savo one case took only 5 months. The long waiting time slows down the process considerably. In some cases the decisions have come too late in the year so that the construction work has been postponed to the following year. The non-productive investment support is a new incentive, and the civil servants making decisions do not have much experience on it. The procedure varies from one ELY Centre to another. There is a need for a better coordination of this measure in the regional administration.

The non-productive investment support is paid against receipts only. Thus the possibility to receive compensation for landowners' own work of the use of own machinery is excluded.

The non-productive investment support is paid after the project has been completed. It may also take several weeks, or even months, from the end of the construction work until the money is finally received. This means that the landowner ties his/her funds for a long time or for bigger projects has to take a bank loan for the initial financing of the project. The planning costs are on the risk of the landowner: in the case of a negative funding decision, the farmer has to pay the planning costs. The planning costs for small wetlands may exceed construction costs. The maximum acceptable costs do not cover the current real costs of digging or planning (e.g. ORTAMALA [2012]).

If the raising interest in wetlands is to be put into practice, there are not enough qualified planners to provide planning services outside the projects, which are promoting wetlands.

The Agency for Rural Affairs (Mavi) maintains a GIS based register of wetlands with their location. This data does not include wetland dimensioning (CW area and the related catchment's area) that would be essential for assessing the effect of a set of CWs in a certain catchment area. The database should also include data on field-%, soil type and slope in order to enable assessment of wetland efficiency.

POLICY RECOMMENDATIONS

The results of this case study show clearly that the current incentive system created to promote wetlands does not work properly. Wetland construction through non-productive investment support is far below target, and more wetlands have been constructed through independent projects. The current system has been criticized a lot. However, a support system for wetlands should be maintained, but renewed.

One possibility would be to modify the current system by fixing the most problematic parts. The wetland support should be based on a fixed average sum, and the laborious budgets could be left out. In that way the farmer could also use his/her own machinery and labour and still receive subsidy for the work, and the bureaucracy of the support system would be considerably lighter. The system should be changed in a way that the farmers don't have to take the financial risk for wetland planning. For example, a preliminary decision on the support could be made before the project enters a detailed planning phase. Also sufficient administrative resources are needed in order to shorten the time of the application process. Instructions should be clear so that all parties have a common view on what a wetland plan should include.

Another option would be to externalize the management of wetland support. In each region, an organization is selected through competitive bidding to promote wetland construction among farmers and other landowners, to give advice, and to decide on the incentives. A network of wetland planners would be available to help throughout the process.

In both cases the current strict eligibility rules should be changed and support should be made available also for small wetlands under 0.3 ha, and for wetlands built for biodiversity reasons. Also chains of smaller wetlands should be eligible for water protection reasons when their combined effect was considered. Research on these combined effects is needed. There could also be a higher support level for catchments or projects with an especially large potential to reduce nutrient load.

A third option would be to set only general frames for this measure at a national level, and give more freedom to regions (coordinated by ELY Centres) to select their priority locations according to River Basin Management Plans and general wetland plans. This would enable consideration of specific conditions in each region. In this case sufficient regional resources are needed.

A fourth option would be to finance regional wetland projects through regional RDPs. The projects would then promote and finance wetlands. In this case the share of own funding required should be lower than today to enable associations to put up wetland projects.

In any case, there is a need for a special support for collaborative projects involving several landowners. Farmers also need help during the whole process, writing the plan is just the start. Planners should take the responsibility of the whole process; the project plan may also include costs for the supervision of the construction etc.

There should be a more formalized education for wetland planners both as a part of vocational degree, and as further education. Also teachers of vocational schools need further education on this subject.

The NGOs and projects have had a very active role in promoting wetlands, identifying suitable sites as well as in wetland planning and construction. This potential should be fully utilized and supported for example in collaborative projects.

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Małe sztuczne zbiorniki wodne w krajobrazie rolniczym Finlandii: ochrona jakości wody na tle wielozadaniowych funkcji tych zbiorników i aspektów socjalno-ekonomicznych

STRESZCZENIE

Słowa kluczowe: *małe zbiorniki wodne, obszary wiejskie, rolnictwo, zanieczyszczenia*

Artykuł stanowi podsumowanie stanu wiedzy w Finlandii na temat wielofunkcyjności niewielkich sztucznych zbiorników wodnych, w tym szczególnie poprawy jakości wody. Efektywność takich zbiorników w ochronie wód w dużym stopniu zależy od stosunku wielkości tych akwenów do obszaru zlewni bezpośredniej i wielkości powierzchni użytkowanej przez rolnictwo w tej zlewni. Badania obejmowały analizę takich czynników, jak pomoc w planowaniu i organizacji lub udzielanie wsparcia finansowego w ramach programów rolnośrodowiskowych w motywowaniu rolników do budowy niewielkich zbiorników wodnych (ang. „constructed wetlands”) na cele ochrony jakości wody na terenach rolniczych. Farmerzy uważają, że system wsparcia jest zbyt zbiurokratyzowany i dlatego liczba nowych zbiorników jest dużo mniejsza od spodziewanych.

Indywidualne projekty podejmowane z inicjatywy rolników są dużo efektywniejsze w stosunku do oficjalnego wsparcia. Ogólnokrajowe plany skierowane głównie na obszary „hot spots” są przykładem jednej z barier ograniczających szerokie zastosowanie małych zbiorników do ochrony jakości wody. Mimo dość krytycznej oceny, oficjalny system wsparcia jest jednak niezbędny. Szersze zastosowanie niewielkich zbiorników wodnych do ograniczenia zagrożeń wody w wyniku dopływu zanieczyszczeń z obszarów użytkowanych rolniczo wymaga zwiększenia uprawnień władz lokalnych do typowania obszarów, na których celowa jest budowa tego typu urządzeń. Zadania związane z budową zbiorników do oczyszczania wody powinny być uwzględniane w zlewniowych planach gospodarowania wodą.