

**Review of biodiversity research results from Finland that
directly contribute to the sustainable use of biodiversity in
Europe**

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1. Introduction.....	2
2. Description of main findings of the selected studies	4
2.1 Identifying high value farmland (and forest) areas.....	4
2.2 Influence of national plans of CAP implementation on biodiversity, including aspects of cross-compliance.....	5
2.2.1 The impacts of the agri-environmental scheme on biodiversity	6
2.2.2 The impacts of the CAP reform (2003) on biodiversity	8
2.2.3 Ongoing research projects.....	9
2.3 Develop indicators and monitoring schemes	9
2.3.1 Key research results	9
2.3.2 Ongoing research projects.....	11
2.4 Participation of civil society in Environmental Impact Assessment (EIA) and other processes	12
3. Conclusions.....	13
3.1 Main message of the review.....	13
3.2 Broader context: How does research contribute to a sustainable Europe?	14
3.3 Gaps of knowledge and need for further research - in a national as well as European context	14
4. References.....	16
Annex 1.....	18
Annex 2.....	19

1. Introduction

As instructed, we will first briefly address the question what kind of biodiversity research contributes directly to the sustainable use of biodiversity in Europe.

The role of research is vital in promoting sustainable use of biodiversity in Europe. For this purpose it is important to support interdisciplinary and sociological research into all aspects of use and conservation of biological diversity so that policymakers can apply a variety of research results. In fact, it has been stated that policymakers tend to apply sociological research more often than research based on natural sciences. In Finland's case (and probably in other European countries as well) enhancement of interdisciplinary and social sciences-related research should be of uppermost importance since biodiversity research has to a large extent focused on natural sciences which alone is only a partial basis for decision making.

Development of biodiversity indicators and appropriate monitoring schemes is essential for observing changes in biodiversity. Follow-up data can be used to evaluate the effects of different policy measures, to increase common understanding of biodiversity and promote participation of citizens in follow-up measures. Monitoring biodiversity is, however, insufficient without adequate knowledge of species diversity. Hence, taxonomic research should be considered a prerequisite for effective follow-up measures.

Agricultural genetic diversity has developed through thousands of years of domestication of plants and animals, but research has revealed that this resource is now declining rapidly all over Europe. Genetic diversity is the foundation of our well-being, since it enables extensive food production. However, loss of genetic diversity has alarmingly been connected among others to increasing infertility and poor health of domesticated animals and loss of resistance of cultivated plants. Fortunately, research on genetic diversity has enabled to increase genetic diversity of domesticated plants and animals, and thus ensure sustainability of food production and other benefits. Research to develop molecular biological methods to protect and monitor genetic diversity should be seen as a prerequisite for sustainable development, but has unfortunately not got the deserved attention.

It is also important to promote research on sustainable use of biodiversity in developing countries because destruction of habitats (wetlands, forests) and illegal hunting in developing countries affects directly many European migratory species.

However, it must be realized that biodiversity research alone is not sufficient for reaching sustainable use of biodiversity. Placing objectives and forming policies including their implementation must be based on high-quality research results and thereby on understanding of biodiversity and factors affecting it. During the Finnish Biodiversity Research Programme (FIBRE) (1997-2002) it became evident that there is a lack of co-operation between scientists and decision makers, which has to a large extent left biodiversity related scientific research outside decision making. There is a need to link research into the decision making processes to ensure that the results of research inform and guide international and national policies and decisions. Biodiversity platforms should be promoted to increase interaction between researchers and decision makers. It is equally important to encourage active collaboration between scientific researchers to create synergism. Research networks should be developed at the national as well as the European level.

Next we will present the selection criteria of publications and main topics for the review.

Many of the publications chosen for this review have been produced by the Finnish Biodiversity Research Programme¹ 1997-2002 (FIBRE), mainly from a project called Biodiversity Implications of Agricultural Policies: an Integrated Approach (BIAPIA). The main objective of the BIAPIA project was to identify the most likely biodiversity effects of agricultural policy reforms and to examine the essential features of biodiversity management decisions at the community level. Many studies have also been included from the Research Programme for Environmental Policy² established in 2002 by the Finnish Environment Institute (SYKE). Some studies have also been included from Finnish Biodiversity and Monitoring Programme 2003-2006 (MOSSE).

References have only been made to scientifically published papers or reviews. Also some reports and compilations have been used mainly in the purpose to provide background information and are with certain exceptions not referred to. Many interesting studies, related to the review, have only recently started or have been planned to start in the near future. Preliminary results from on-going research projects have been included in the review. Most attention has been paid to biodiversity research related to the given policy fields. Priority has also been given to most recently conducted studies, interesting new results and studies that have clearly influenced policies. Only two surveys published earlier than year 2000 have been included in the review.

This review is a contribution to the German EPBRS meeting "Shaping European Biodiversity Research for a Sustainable Europe" where, as one topic, aspects of sustainable use of biodiversity in the "wider EU countryside" is discussed. The objective is to contribute to the Action Plan of the EU Communication from the Commission (2006) 216 on "Halting the loss of biodiversity until 2010 and beyond". As instructed, the review focuses on two objectives of the Action plan:

- To conserve and restore biodiversity and ecosystem services in the wider EU countryside (objective 2)
- To reinforce compatibility of regional and territorial development with biodiversity in the EU (objective 4).

Priority in the Finnish review has been given to objective 2 of the Action plan and research results under this objective have been assembled and discussed in the following fields: 1) Identifying high value farmland areas, 2) Influence of national plans of CAP implementation on biodiversity, including aspects of cross-compliance, and 3) Developing indicators and monitoring schemes. Main attention has been given to research on the influence of national plans of CAP implementation on biodiversity, since it is considered to be a relatively important field regarding sustainable use of biodiversity. Research carried out to implement objective 4 has only been reviewed in the following field: Participation of civil society in Environmental Impact Assessment (EIA) and other processes. Although many other fields under these objectives (among others genetic diversity of crop varieties, livestock breeds and races) have been studied significantly and would have been interesting to discuss in the review, have been left outside the review due to lack of time.

¹ List of all publications and summaries of research results can be found from the homepage of the Finnish Biodiversity Research Programme: <http://fibre.utu.fi/>

² More information from the Research Programme for Environmental Policy can be found from the following webpage of the Finnish Environment Institute: <http://www.environment.fi/default.asp?node=18674&lan=en>

2. Description of main findings of the selected studies

2.1 Identifying high value farmland (and forest) areas

In 1992, the Ministry of the Environment of Finland launched a project to identify all valuable traditional rural biotopes³. During 1992-1998 traditional biotopes were identified by extensive field studies that mainly focused on the examination of the vascular plant composition. In year 2001, the **National survey of traditional biotopes** was published. Altogether less than 19 000 hectares of traditional rural biotopes were identified in 3695 sites. This area was considerably smaller than previously thought, considering that in late the 19th century there were an estimated 1,6 million hectares of meadows. Most of the traditional biotopes were situated in South-West Finland. Since 1995 the agri-environmental scheme enabled farmers to apply for support for the management of traditional biotopes (see chapter 2.2). However, the study highlights that the state of all different types of traditional biotopes is weak and the current level of management will not be able to secure their maintenance, nor the species that depend on them. It was estimated that the area of traditional biotopes should be tenfold in order to prevent threatened species from extinction. (Vainio et al. 2001)

Several studies have shown that satellite-based land cover images combined with topographic data are useful in identifying farmland areas important for biodiversity. Landsat TM satellite images from South-West Finland were studied and found useful for mapping semi-natural grasslands (Toivonen & Luoto 2003), which are considered highly important for biodiversity. Other studies have shown that environmental variables derived from Landsat TM images and topographic data can be used to assess plant species diversity (Luoto et al. 2002) and bird species richness (Luoto et al. 2004) in agricultural landscapes. Remote sensing data has been used during the period 2000-2006 to identify high biodiversity farmland areas and to monitor recent changes of land use in the MYTVAS follow-up study of the biodiversity effects of the agri-environmental scheme (see chapter 2.2). The results suggest that satellite images and GIS provide an approximate cost-efficient method to estimate the biodiversity status of wide areas on a broad scale thus have given rise for a new tool for sustainable land use planning. These studies can be considered as a starting point for further studies that have been made to identify HNV farmland discussed below.

At this stage it is important to elaborate the work of the European Environmental Agency (EEA) on identifying HNV farmland areas on a pan-European scale (EEA 2004)⁴, since it is closely related to the recent Finnish attempts to identify HNV farmlands. The EEA used the satellite-based land cover data approach (CORINE) to create a map of potential HNV farmlands. It is important to note that farming system data and species data was also used, but land cover data was regarded superior. The map was considered to be useful for a general impression of the distribution of HNV farmland, but was to be regarded as indicative only. The identification of HNV farmland led to failure in northern areas of Finland and Sweden since land cover classes, which are not related to agriculture

³ Meadows, grazing lands, woodland pastures, moors and areas cleared and burnt-over for cultivation are called traditional rural biotopes. They have been formed by centuries of traditional pasturage and mowing, which has now ended. The species composition in traditional biotopes is highly diverse. However, 338 species living in traditional biotopes are considered to be threatened, which is a significant proportion (22 %) of all threatened species in Finland (Rassi ym. 2001).

⁴ The attempts of EEA to identify HNV farmlands is a part of the IRENA project of EEA to create indicators for monitoring the biodiversity of agriculture (Indicator reporting on the integration of environmental concerns into agricultural policy, IRENA). The project has created in total 35 indicators from which indicator number 26 deals with HNV farmlands.

in the northern Scandinavia were used thus maps wrongly indicate reindeer pastures, marshes and mountain areas as HNV farmlands (EEA 2004, Schulman & Luoto 2006).

In year 2004, the land cover of Finland was mapped as a part of the European CORINE2000 Land cover project (CLC-project). The Finnish Environment Institute (SYKE) was responsible for the data production in Finland. Satellite-based Landsat 7 ETM+ land cover images were combined with existing land use data, topographic data and field data to create a satellite image map and a raster land cover database with a 25m x 25m resolution covering the whole of Finland. Finland was one of the few countries that used automated satellite image interpretation. A total of 45 CORINE classes were created from which 4 classes compose agricultural lands: 1) arable land, 2) tree and bush plantations, 3) pastures and 4) heterogeneous agricultural areas. The CLC-project has created a comprehensive and up-to-date tool for monitoring land use and natural resources. The maps can also be used to display policymakers how land use planning has effected the environment. Although the CORINE maps gave now more accurate information about the location of HNV farmlands than the maps constructed by the EEA, they were still considered to require further development (SYKE 2005).

In 2005, The Finnish Environmental Research Institute (SYKE) started a survey to study the possibilities of combining CORINE2000 land cover data with other existing data (species data etc.) to create an effective and reliable method to identify potential HNV farmlands. The study showed that the accuracy of identifying HNV farmlands can be increased by combining land cover data from the CLC-project with data from field surveys, data on species richness and data on agri-environmental support measures. The national field survey of traditional rural biotopes (discussed earlier) was considered essential for identifying HNV farmlands in Finland. The map from the traditional field inventory was found surprisingly similar to the CORINE pastures -class. Regional inspection e. g. from the Oulu district shows that these two approaches complement one another (annex 1). It was recommended that national field surveys are used alongside land cover data in other countries to identify HNV farmland areas, since they take into account local expertise. However, comparability between countries is probable to suffer, which is a problem requiring further research. The study also recommended that there should be a national working group consisting of researchers, farmers and politicians who are familiar with agri-environmental issues to enhance the collaboration of the HNV farmland theme. In spite of all the weakness of both traditional field surveys and the satellite-based land cover data is that they don't reveal anything about the present state of management and use. The study has, however, given valuable information in identifying HNV farmlands from a national point of view and contributes directly to the sustainable use of biodiversity. (Schulman & Luoto 2006).

2.2 Influence of national plans of CAP implementation on biodiversity, including aspects of cross-compliance

In Finland, as well as in other EU countries, agricultural support plays a significant role in the composition of farmers' income. The agricultural support scheme of Finland consists of CAP support, compensatory allowances paid for less favored areas (LFA support), agri-environmental support and national aids. In this chapter we will only focus on two support forms. First we will discuss the biodiversity effects of the agri-environment scheme included in the two horizontal rural development plans of Finland (continental Finland and Åland Islands). After that we will consider the effects of CAP-support on biodiversity following the Common Agricultural Policy reform (2003).

2.2.1 The impacts of the agri-environmental scheme on biodiversity

The rural development policy of Finland is a part of the Common Agricultural Policy (CAP) of the European Union (EU). The Horizontal Rural Development Plan of Continental Finland (2000-2006) includes two co-financed accompanying measures: the scheme for less favoured areas (LFA) and the agri-environment scheme. Åland Islands has an own horizontal rural development plan that covers the measures for setting up young farmers, less favoured areas and agri-environment. The obligatory agri-environment scheme plays the leading role in the efforts to limit harmful environmental impacts of agriculture. However, the emphasis has long been on the protection of waters, but the role of biodiversity is gradually growing. The scheme for less favoured areas (LFA) has been created to secure the continuation of environmentally sustainable agriculture in the nordic conditions of Finland, but in this context we will not discuss the effects of this support form on biodiversity. The two new Horizontal plans (continental Finland and Åland Islands) for the coming period 2007-2013 are now being processed by the EU Commission.

During the present programme period (2000-2006) the agri-environment scheme of continental Finland consists of three types of measures (annex 1). **Basic measures** require a commitment period of 5 years and they will assure environmental protection measures in different conditions. In addition to basic measures, a farmer must select one **additional measure** to be applied in his/her farm. Additional measures take into account farm-specific environment. **Special support forms** are also additional to basic measures. They are very farm specific and their implementation requires significant inputs. 90 % of all the farms, which covers 95 % of all farmland, are within the agri-environmental scheme (Maa- ja metsätalousministeriö 2004).

The impacts of the agri-environmental scheme on biodiversity have been monitored since 1995. MYTVAS (Follow-up Study on Effects of the Finnish Agri-environmental Scheme) is the most extensive and coherent follow-up study of the agri-environmental scheme. Follow-up studies have been carried out in two periods: MYTVAS I (1995-1999) and MYTVAS II (2000-2006). During the first period (1995-1999), the follow-up focused mainly on the strain on the water system (Grönroos et al. 1998, Palva et al. 2001). Some observations were made about the link between landscape structure and biodiversity, and the effects of certain support measures (edges and border strips) on biodiversity (Palva et al. 2001).

The impacts on biodiversity have been studied in more detail in the latter period (2000-2006) of MYTVAS. Only preliminary results are available, as yet the final report has not been published. According to the intermediate report based on the period 2000-2003 three of the basic measures are considered to have positive effects on biodiversity: *headlands and filter strips*⁵, *maintaining biodiversity and landscape*⁶ as well as *environmental planning and monitoring in farming*⁷. Of the voluntary special support forms only two are considered significantly to biodiversity: *traditional biotopes*⁸ and *other measures to enhance biodiversity*⁹. However it is not clear what is the effect of *organic production*¹⁰. The species richness is greater in the areas of organic production than in

⁵ This basic measure requires that a headland of one meters width must be left along river sides and a filter strip of three meters width along other bodies of water.

⁶ This basic measure requires the farmer to keep the landscape open and the surroundings of the buildings managed.

⁷ The third basic measure considered important for biodiversity directs farmers to make a cultivation plan, fertility analyses and follow-up. It also includes training of farmers.

⁸ This is a voluntary special support form that is considered to be the most important measure for biodiversity conservation. Traditional biotopes are managed by mowing and cattle grazing, and are extremely rare.

⁹ This special support form enables the protection of special biotopes considered valuable for biodiversity.

¹⁰ Organic farming prohibits the use pesticides and agrochemical fertilizers, and requires diverse farming.

those with traditional farming, but it is debatable if it stems from the agri-environmental scheme or environmentally friendly farming prior to the agri-environmental scheme. (Kuussaari et al. 2004)

In the evaluation of the Finnish National Programme of Biodiversity (1997-2005) attention has been paid more clearly on profitability and cost efficiency of the agri-environmental scheme. The study highlights that the agri-environmental support lacks maintenance commitments thus greatly weakening its effectiveness. If the commitments are not defined, they can not be monitored and the farmer has no economical incentives to implement the measures. The study also recognizes that the measures do not take into account that agricultural productivity and environmental sensibility vary largely from region to region. In the view of political efficiency the measures should be remoulded to reflect varying environmental circumstances. (Hildén et al. 2005)

The Mid-term evaluation of the Horizontal Rural Development Programme of Continental Finland covers the years 2000-2003. It is based on provisions concerning monitoring and evaluation set out in Section 5 (Articles 53-57) of Commission Regulation (EC No 445/2002). The evaluation is built on statistical data, studies and responses given by farmers and the authorities to questionnaires addressed to them. The evaluation covers inter alia the impact of agri-environmental support on biodiversity. The study uncovers that only 2-3 % of the payments are used for measures, which primarily enhance biodiversity and stresses that emphasis on biodiversity should be increased considerably. Even though the basic measures cover most of the agricultural land in Finland, the voluntary special measures are considered to be more efficient in maintaining biodiversity. The most important single measure in terms of biodiversity is considered to be the special measure for the management of traditional biotopes, but the measure still covers too few of the most valuable and species rich habitat types. The authors conclude that the agri-environmental support will not be enough to preserve farmland biodiversity, because it cannot prevent a reduction in the diversity of farmland habitats or guarantee a sufficient level of management for traditional biotopes. (Maa- ja metsätalousministeriö 2004)

Through research it is coming more evident that only few measures in the agri-environment scheme contribute to halting the loss of biodiversity. These are mainly the voluntary special support forms discussed earlier: *traditional biotopes* and *other measures to enhance biodiversity*. The effectiveness of these two support forms has been studied in detail by the Finnish Environmental Institute and the Northern Ostrobothnian Environmental Institute. Although the support for *traditional biotopes* was shown effective the support for the *measures to enhance biodiversity* was found to be poorly carried out with no likely positive effects on biodiversity. More guidance should be given to farmers and authorities to ensure the effectiveness of the measures. (Schulman et al. 2006)

A mid-term evaluation was correspondingly made of the Horizontal Rural Development Program of Åland Islands. Surprisingly biodiversity has a significantly larger role in the agri-environmental scheme of Åland Islands compared to continental Finland: In year 2002 a total of 21 % of the agri-environmental support was used primarily on measures to conserve biodiversity, while in continental Finland the corresponding value was only 2-3%. Many threatened and endangered species are found to be more common in Åland islands than in continental Finland, which is likely a consequence of higher agri-environmental support for biodiversity measures. The agri-environmental support scheme in Åland Islands has specially addressed the *maintenance of natural pastures*, which in many studies has been connected to high biodiversity. However, the agri-environmental scheme does not adequately take into account regional variety thus biodiversity hot spots do not get enough special attention. The study also points out that the current strict

management requirements might make the farmers feel that his/her activities are restricted too much thereby causing opposition. (Schulman et al. 2005)

A research project was recently carried out by the Ministry of Agriculture and Forestry of Finland to understand how the agricultural policy has developed since Finland joined the EU in 1995. In connection with the research a group of Ostrobothnian farmers were interviewed to find out their opinion about the effectiveness of the agri-environmental scheme. In general the farmers found the scheme beneficial for the environment, but unexpectedly they responded that biodiversity aspects had not changed their cultivation methods. This could be explained by the fact that environmental management in the agricultural sector is traditionally associated to the protection of waters and only recently to biological diversity. Biological diversity as a concept is quite new among farmers and it is only recently achieving widespread recognition. The farmers also criticised that regional variation is not recognized in the terms of the agri-environmental scheme. This deficiency has already come up in previously discussed studies. However, the authors regarded the CAP reform (2003) as a positive action, seeing that it gives more emphasis to cross-compliance and detaches the support progressively from production. (Kaljonen & Kröger 2006)

2.2.2 The impacts of the CAP reform (2003) on biodiversity

The Common Agricultural Policy was reformed in 2003 through the Council Regulation (EC No 1782/2003). Two significant changes were made, which are probable to have an effect on biodiversity: firstly, direct aid payments were disconnected from production and secondly, cross-compliance was made obligatory. The new single payment scheme that is decoupled from production was brought into use in Finland in year 2006. Thus, it is too early to make any observations of their effects. However, a few studies have been made to estimate their future effects.

MTT Agrifood Research Finland and the University of Helsinki made a joint study and predicted the biodiversity effects of the CAP reform (2003) in which direct aid payments are disconnected from production and compared it with the effects of a policy in which CAP support is coupled to production. The extended Agenda 2000 represents the baseline scenario. The results indicate that decoupling CAP-support from production will make fallowing more lucrative than cultivating grain in submarginal areas, hence the amount of fallow land is estimated increase threefold by year 2015. This will decrease the diversity of agricultural land use at landscape level, but may not be harmful at species level since green fallow has some positive effects, especially on the densities and abundance of farmland birds. Instead, the study highlights that decoupling CAP-support from milk production will decrease the amount of bovine animals leading to reduced biodiversity, since it diminishes grazing and simplifies crop rotation. There are many shortcomings in the approach used, thus results should be regarded with caution. (Miettinen et al. 2004)

By the request of the Ministry of Agriculture and Forestry the MTT Agrifood Research Finland and Pellervo Economic Institute carried out a research about the effects of EU Common Agricultural Policy reform on the Finnish agriculture. Impacts of decoupling CAP support on crop production, beef production and milk production were studied separately. Although the study is engrossed in economical impacts, some conclusions of their environmental effects can be made. Decoupling CAP-support from arable crops is predicted to increase efficiency of grain production and make it easier for farmers to give up less profitable grain production. Reducing the tilled area on submarginal soils could thereby entail environmental advantages. However, the CAP reform will most likely bring down small cattle farms. Cattle farms play an important role in conserving biodiversity since grazing is the most common form of managing traditional biotopes. Decreasing

cattle farm will therefore diminish the amount of traditional biotopes, which will undoubtedly lead to decreasing biodiversity. (Lehtonen 2004)

2.2.3 Ongoing research projects

The most important ongoing follow-up study is the "Study on Effects of the Finnish agri-environmental Scheme 2000-2006" (MYTVAS II). It consists of two separate projects: "Nature-Mytvas" concentrates on the effects on biodiversity and landscape while "Water-Mytvas studies the effectiveness of the support scheme in enhancing water and air quality. Nature-Mytvas is further divided into two major parts: a large-scale species monitoring project conducted on a group of randomly selected study sites, and several smaller case studies on the biodiversity effects of specific supported measures. The project includes researchers from the Finnish Environment Institute (SYKE), the Finnish Game and Fisheries Research Institute (RKTL), the University of Helsinki (HY) and the Finnish University of Art and Design (TaiK).

Recently more attention has been paid to the cost efficiency of the agri-environmental scheme. The Finnish Environmental Institute is running a research project (MYTVANA) to analyse the current state and development needs of the Finnish agri-environment programme focusing mainly on the cost-efficiency of different measures. Preliminary results indicate that the overall effect on biodiversity has been modest. The voluntary special support measures have been effective but at the same time most costly. The study suggests creating an affective and extensive basic measure and setting up concrete objectives. The project will be completed in the near future.

2.3 Develop indicators and monitoring schemes

Monitoring farmland biodiversity in Finland is organized by a network of four institutes: The Finnish Game and Fisheries Research Institute (RKTL), the Finnish Environmental Institute (SYKE), Agrifood Research Finland (MTT) and the Finnish Museum of Natural History (LTKM). The Finnish Environmental Institute coordinates all monitoring projects. The projects consist mainly of monitoring farmland birds, swallowtail butterflies, weeds of spring cereals and farmland game. Farmland biodiversity monitoring has not been planned to encompass all components of biodiversity, thus monitoring is in many manners lacking. Data obtained through monitoring enables to make some rough estimates of the state of biodiversity, but it is inadequate for comprehensive illustrations or summations. Also farmland biodiversity indicators have been developed fairly little.

2.3.1 Key research results

Research funded by the Finnish Research Programme for Biodiversity "Farmland biodiversity indicators and monitoring in Finland" identifies four national farmland biodiversity indicators: 1) the trend in the amount of semi-natural grasslands, 2) the trend in the number of threatened species, 3) threatened species in various farmland habitats, and 4) population trends in farmland butterflies. All four indicators show that Finnish farmland biodiversity is declining. The increase of the amount of threatened farmland species has been higher in the species of farmland habitats than in any other habitat type. The researchers conclude that there is a need for both national and landscape level

indicators in monitoring farmland biodiversity. Thus, information on more specific landscape level indicators may help to interpret and explain patterns in the more crude measures of national level farmland biodiversity indicators (Kuussaari et al. 2004b)

An extensive biodiversity monitoring project (MYTVAS) was started in 2000 in order to evaluate and further develop the effectiveness of the Finnish agri-environmental support scheme and thus contribute to sustainable use of farmland biodiversity (see chapter 2.2). An additional aim of this project was to identify a set of useful landscape-level indicators of Finnish farmland biodiversity. National level biodiversity indicators (described above) were considered too crude for detecting changes in biodiversity at smaller spatial scale. For example the number of threatened species may be a very useful indicator at the national level but almost useless at the level of an ordinary landscape of 10 - 100 km². Therefore landscape level indicators were developed and used to reliably and effectively monitor the effects of the agri-environmental scheme. In 2001, vascular plants, butterflies, bumblebees and birds were quantitatively surveyed in a 58 randomly chosen squares with size of 1 km². The results are discussed in chapter 2.2. (Kuussaari et al. 2004a)

Should biodiversity indicators be created at an international level to increase comparability between countries is discussed in detail from the Finnish point of view in a study recently published in *Ecological Indicators*. International institutes, among others the European Environmental Agency (EEA) have been involved in creating common agri-environmental indicators (including biodiversity indicators) for all EU member countries. The first proposal of EU-indicators was introduced in 2000 and since then, they have been constantly improved in order to reach concise methodologies for international comparisons. Although agri-environmental indicators are able to provide plenty of meaningful data about the agri-environmental policy issues, they are unable to recognize the specific properties of each case study. For example, farmland bird species abundance and distribution is widely recognized as a good indicator for farmland biodiversity, but in the Finnish case birds do not reflect the change in traditional biotopes, which are the most species rich agricultural habitats in Finland. Therefore, special caution is needed when results are compared for between regions with different climatic and natural conditions, and with different traditions of land use. The study concludes that international indicators are able to provide environmental statistics, but are not the appropriate tool for policy assessment. (Yli-Viikari et al. 2006)

The first extensive set of national biodiversity indicators was designed for the purpose to evaluate the Finnish Biodiversity Programme (1997-2005). Indicators were developed for all environments using the DPSIR framework (DPSIR, Driving Forces - Pressures - State - Impacts - Responses), which enables the indicators to illustrate causality of biodiversity changes. A total of 75 indicators were developed of which 11 were designed to specifically depict farmland biodiversity. Farmland biodiversity indicators are listed below:

- 1) Number of farms and average size of tilled area
- 2) Number of cattle and cattle farms
- 3) Volume of pesticide and fertilizer use
- 4) Area of clearing fields and forestation
- 5) Area of edges and border stripes
- 6) Area of traditional biotopes
- 7) Scale of management of traditional biotopes
- 8) Area of organic farming
- 9) Abundance and distribution of farmlands species
- 10) Status of threatened and/or protected species

11) Directive species associated with farmlands

The development of farmland biodiversity during the period 1995-2007 was evaluated using these indicators. According to results diversity of farmland landscapes is declining and species diversity is becoming poorer, although during the period 1997-2005 the rate of biodiversity loss was becoming slower. Underlying causes for biodiversity loss have been the pressure for agricultural productivity and the low emphasis on biodiversity of the agri-environmental scheme. However, the indicator study was restricted by an insufficient availability of information. The indicators were also considered to be preliminary and to require further development e. g. the absence of "power behind the scenes" -indicators describing social and political processes were considered to be a crucial deficiency. (Hildén et al. 2005)

2.3.2 Ongoing research projects

Indicators are now being further developed using the DPSIR framework. The Finnish Environmental Research Institute, in collaboration with several other research institutes, is conducting a research project to develop a comprehensive collection of biodiversity indicators by year 2008. The indicators are being constructed from the template of the indicators created in the evaluation of the Finnish Biodiversity Programme. In addition to 11 indicators designed to depict farmland biodiversity at least four new ones have been added. These include farmland birds, butterflies, weeds of spring cereal and agri-environmental support. Preliminary work on the indicators has produced two research reports. According to tentative results farmland biodiversity is becoming more rapidly endangered than in any other environments. The changes are most significant among insects, but remarkable also in other species groups. In the preliminary work on indicators efforts have been made to identify best practices in other countries. It is recommended that the examples of Great Britain and the Netherlands should be followed, where participation has been efficiently promoted by publishing monitoring results visibly. Therefore an Internet based data bank and an annual data sheet of the state of the environment should be created to encourage people effectively to participate in follow-up measures. The indicators under development will be taken into use in year 2008 and will have an important role in following the target to halt biodiversity loss until 2010. (Auvinen & Toivonen 2006, Auvinen 2006).

As biodiversity indicators at species level have been developed fairly little, in year 2003 four Finnish research institutes (RTKL, SYKE, MTT and LKTM) started a joint research project to construct a set of comprehensive and efficient national farmland biodiversity indicators. The indicators are built on three different species groups (birds, butterflies and weeds), which are believed to give a comprehensive picture of changes occurring in farmland biodiversity. The project is drawing to a close, and thus final results have not been published. The indicators are based on existing databases and monitoring schemes of farmland birds, butterflies and weeds of spring cereal. As earlier species indicators have only shown the changes in number of species and abundance, the new indicators under development go one step forward and enable to make ecological interpretations of changes. For example in the case of farmland weeds the intention is to create an indicator that shows the interaction with other farmland species (among others the relationship between seed-food plants and birds) thus enabling to monitor the changes occurring in the ecological condition of farmlands. Results indicate a tremendous decline in species richness between the 1960s and the 1980s. However, this decline has levelled off in the 1980s and the 1990s. Once in use the indicators will be extremely useful for monitoring the realization of the goal on halting the loss of biodiversity until 2010. The study is a part larger project co-ordinated The

Ministry of Agriculture and Forestry to create a comprehensive set of indicators on natural resources. (Hyvönen, T. Huusela-Veistola, J., Salonen, J. Kuusaari, M. & Tiainen, J.)

2.4 Participation of civil society in Environmental Impact Assessment (EIA) and other processes

The participation of civil society in environmental planning in Finland has been enacted in several laws of which the most important one is the law on Environmental Impact Assessment (EIA) that entered into force in 1994. The EIA Act requires the developers to prepare an assessment programme for projects that are likely to generate significant environmental impacts. A main purpose of the EIA law has also been to improve the possibilities of civil society in participation. In year 2005 the law on environmental assessment of plans, programmes and policies (= the SEA Act) entered into force. According to the SEA Act, a specific environmental assessment has to be carried out on certain plans and programmes. The Act also improves the flow of information of plans and programmes promoted by authorities, and increases opportunities to participate in the preparation of plans. Finally the Land Use and Construction Act enable the civil society to participate in planning affecting land use.

The participation of civil society has been studied from the early stages of the EIA Act. Altogether seven projects were studied from the period between 1995-1996. It was found out that the Environmental Impact Assessment had significantly increased access to project information and promoted public discussion. Also the possibilities to give feedback had improved although the threshold to give feedback had remained high. Most noteworthy is that the possibilities of civil society to affect planning were found to be insignificant if planning was made to fulfill formal requirements and get approval for desired solutions. But then again if the intention of the EIA was to get a comprehensive picture of the effects of the project and different views, and to weigh one plan against another the possibilities to affect planning was considerably higher. Also the attitude of the project manager was found out to be a significant factor in the outcome of participation (Karvinen 1997).

The effectiveness of written addresses and arguments made in the EIA process has been evaluated in a study made by the Central Finland Environment Centre. The research consists of two EIA case-studies: a comparatively small road project and a large nuclear waste final placement project. In both cases social impacts were emphasized in the citizens' arguments. Interest based arguments were most prevalent, although value based arguments were almost equally popular. From the viewpoint of effectiveness of public participation the evaluated cases diverged from each other. In the road case public participation obviously had an effect on planning and decision-making. The planners and authorities saw the EIA as a value based planning and interaction process. Instead, the effectiveness of public participation was low in the nuclear waste case. The EIA was mainly used as a tool to manage and control the opinion of the civil society. In both cases the interest based arguments came into the EIA agenda, unlike the value based arguments, which were not allowed to be included in the EIA agenda. (Hokkanen & Ruuskanen 2005)

The treatment of biodiversity issues in Finnish environmental impact assessment between 1995–2001 was evaluated in 38 projects by the Finnish Environment Institute using qualitative document analysis and an ecological biodiversity index. All reviewed projects represented types that usually cause the most severe impacts on biodiversity. The results demonstrate a number of shortcomings in ecological impact assessment practices in Finland. The most severe shortcoming was a weak connection between the base-line surveys and impact prediction, which arose primarily from a lack of an adequate scoping stage. Also the consideration of biodiversity components was

only partial, since in most cases only effects on most obvious components of biodiversity (plants and large animals) were evaluated. In addition it was found out that the majority of the assessment reports did not present the results of the assessment explicitly and adequately, which implies their use in decision making is constantly disregarded. It was concluded that raising awareness of the authorities, developers, consultants and their ecologists who are involved in the EIA should result in better treatment of biodiversity in the assessment process. Detailed guidelines for that purpose are now being prepared by the Finnish Environment Institute. (Söderman 2005)

3. Conclusions

3.1 Main message of the review

The identification of HNV farmland areas should be made by using several sources of information and by studying the areas on such a spatial scale that it does not lose fine scale variation. The weakness of national field inventories is the toilsomeness of data collection and thereby the difficulty of monitoring. Therefore, it is attempting to use satellite based land cover data that in the case of Finland does not give true data of biodiversity if data from field surveys are not used alongside.

National plans of CAP implementation have contributed to the preservation of biodiversity, but current measures are not likely to be sufficient to halt the negative effects of long continued intensive agriculture. The agri-environmental scheme has been used as the main tool to promote sustainable use of biodiversity, although the emphasis has long been on the protection of waters. Only two of the voluntary support measures, but none of the obligatory measures, were considered effective in terms of sustainable use of biodiversity. In the view of political efficiency the measures were found ineffective since they do not take into account regional variation. Early studies on the effect of the 2003 CAP-reform indicate changes that are partly beneficial and partly negative to biological diversity, but results should be regarded by caution.

Finland has a long tradition of monitoring farmlands species. Monitoring agricultural biodiversity has concentrated on farmland birds, swallowtail butterflies and weeds of spring cereals. Monitoring has, however, lacked co-ordination and lead to scattered information that does not allow making comprehensive conclusions. Existing species monitoring data is now being used to develop indicators for farmland biodiversity. In addition, a comprehensive collection of biodiversity indicators for all environments is being constructed using the DPSIR framework. Results indicate that farmland biodiversity is becoming more rapidly endangered than in any other environments, however, with a gradually slowing rate from the 80s.

The findings indicate that the Environmental Impact assessment does not meet the requirements of the Finnish EIA Act with respect to biodiversity impact assessment. Detailed guidelines for biodiversity impact assessment were considered crucial to improve sustainable use of biodiversity in planning. Although only little research is directed to assess the effects of participation in the outcome of the project, research results indicate that the role to civil society in the EIA process is more or less limited. The EIA seems to be suitable mainly for small projects, where the citizens are given the possibility to affect planning and decision making concerning their own environment.

3.2 Broader context: How does research contribute to a sustainable Europe?

HNV farmlands are extremely important since they are the biodiversity hot spots of Europe and, therefore, research to identify HNV farmlands contributes directly to a sustainable Europe. Identifying HNV farmlands is important since sufficient knowledge of their location will enable to secure the sufficiency of ecological corridors that many threatened species depend on. There are unfortunately no simple methods to identify HNV farmlands, but once the areas have been located they can be managed sustainably and monitored. Research is important in giving more reliable and effective methods to identify HNV farmlands. New methods should be disseminated to other European countries through efficient co-operation.

By means of research it has come more evident that agri-environmental schemes can play an important role in conserving biodiversity if biodiversity aspects are emphasized. Research has also helped to find the most efficient measures for sustainable use of agricultural biodiversity, as well as identify the soft spots that require further development. Understanding of social aspects has improved significantly through research, where farmers and specialists have been interviewed or they have filled questionnaires. Research has lately increasingly focused on cost-efficiency and profitability giving new viewpoints for further development. Research has enabled to improve horizontal rural plans of Finland and therefore contribute directly to sustainable use of biodiversity.

Comprehensive indicators and monitoring schemes is essential for effective follow-up of biodiversity effects of current policies and should thereby be used as fixed information ground to form new policies. Follow-up data should be used to understand further conservation needs, promote sustainable use, and develop protection, management and rehabilitation of biological diversity. In this context research to create comprehensive farmland indicators and efficient follow-up measures is an imperative for sustainable use of biodiversity.

3.3 Gaps of knowledge and need for further research - in a national as well as European context

There have been efforts to find indicators for monitoring farmland biodiversity and methods to identify High Value Farmlands in the pan-European scale. These efforts should be considered important because they increase comparison between countries; however, in Finland's case neither the indicators nor the methods for identifying HNV farmlands give reliable data on biodiversity, since fine-scale variation is lost. As abundance and distribution of birds is considered a good indicator in the European level, in the Finnish case it does not give a reliable picture. The Finnish farmland species indicators under construction give accurate information about species richness but are country specific and not suitable for comparison between countries. The efforts of EEA to identify farmland indicators failed in Finland's part since land use classes which are not connected to farmlands were used. Finnish research on identifying HNV farmlands suggests the combination of traditional field surveys and the satellite based land cover approach, however, again the possibilities for comparison between countries will be lost. Further research is needed to find internationally congruent indicators, follow-up measures and methods to identify HNV farmlands.

Research of the biodiversity effects of Common Agricultural Policy in Finland has focused mainly on the agri-environmental scheme. Little research if any has been done to compare agri-environmental schemes of Finland with corresponding schemes from other EU-countries. This would be important in order to identify best practices. Even a short comparison between the agri-environmental scheme of continental Finland and Åland Islands in this review shows interestingly

that biodiversity is emphasized more clearly in the agri-environmental scheme of Åland Islands. This indeed might be a reason why biodiversity loss is not as eye-catching in Åland Islands as it is in continental Finland. Conclusions of this kind, however, can not be made with certainty without further research.

Although the participation of civil society in planning is enacted in several laws, very little research has been done to find out how participation in reality affects planning and the outcome of projects. Without monitoring and more exact research on the Environmental Impact Assessment it will be difficult to evaluate the role of participation in planning and decision making. Therefore in the future it will be important to do more research in this area and further develop the EIA process in the light of new research results.

In addition to the findings of this review further research needs of farmland biodiversity can be found from existing surveys and compilations. The Finnish Biodiversity Research Programme (1997-2002) produced three books of which one deals with Finnish agricultural biodiversity (Tiainen et al. 2004). The book is a compact survey of all farmland biodiversity research carried out during the research programme. A summary of research needs is included in the book. Among others the following research needs were considered important:

- Research about the economical and social effects of political measures aimed at promoting biodiversity.
- Improving cost-efficiency of the agri-environmental support scheme and finding new alternative measures that are more mindful in relation to biodiversity
- Research that aims to find new solutions to prevent the impoverishment of the diversity at landscape level
- Improvement of the cropping system and grazing to secure farmland biodiversity from harmful effects of growing production units and specialization
- The significance of the decomposer ecosystem for farmland biodiversity and productivity

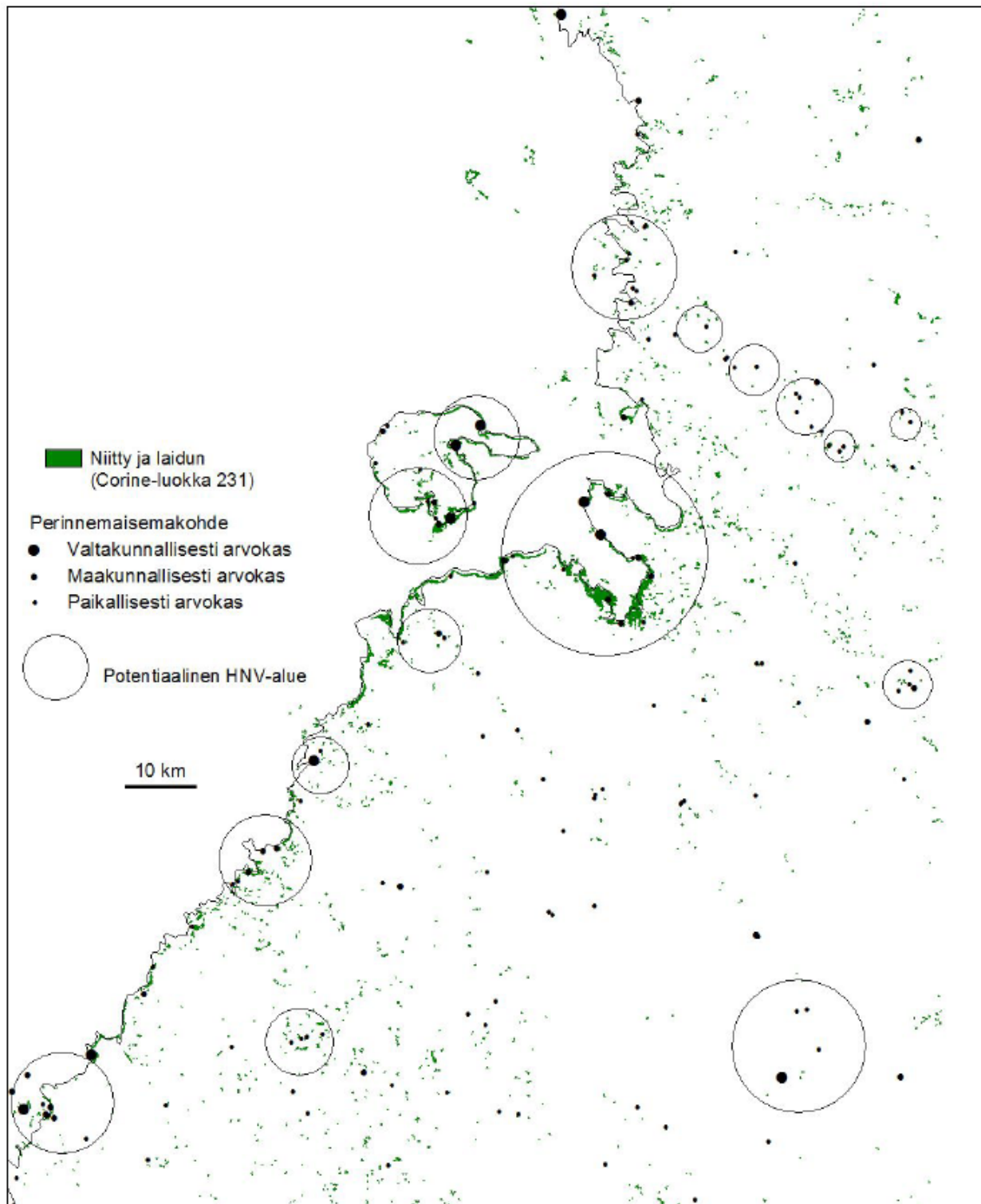
In 2004, a survey on the Ecosystem Approach was published by the Ministry of the Environment of Finland (Jäppinen et al. 2004). The publication aims at making ecosystem approach better known and at integrating the ecosystem approach into the discussion on the protection, management and sustainable use of biodiversity. The survey brought fourth that research information about the connection between the condition of ecosystems, biodiversity and ecosystem services is inadequate. Further research should be made to understand the significance of ecosystem services related to agricultural environments (pollination of food plants, biological nitrogen fixation and nutrient cycling) and their economical value. It was found important and at the same time challenging to focus research so that it will give new and effective practical tools for sustainable management and use of ecosystems.

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Annex 1. The picture indicates that traditional landscape inventories and CORINE land cover data support each other and thus should be used together to identify HNV farmlands. The dot size shows only the value (national, regional or local importance) of each traditional rural biotope area. Valuable traditional rural biotopes are concentrated in areas with a large amount of CORINE class 2.3.1 (pastures). Large circles indicate potential HNV farmlands. The picture is from Oulu area. (Source: Schulman & Luoto 2006)



Annex 2. Basic measures, additional measures and special support measures for environmental support and their objectives in the Finnish agri-environmental scheme. (Source: <http://www.mtt.fi/mtts/pdf/mtts127.pdf>)

Basic measures for environmental support and their objectives in Finland	
Basic measures (BM)	Objectives
BM1) Environmental planning and monitoring in farming - Cultivation plan - Fertility analysis - Follow-up and notes per parcel - Training of farmers	Planning and monitoring system, which helps to allocate the environmental protection measures effectively; taking into account the needs of individual farms; facilitate the monitoring of measures.
BM 2) Basic fertilisation levels of arable crops	Decrease the nutrient loading by focusing the nutrient utilisation on lots.
BM 3) Plant protection	Focus the use of herbicides and pesticides to decrease their environmental and health risks; herbicides and pesticides are used only when need is identified.
BM 4) Headlands and filter strips	Prevent and decrease nutrient leaching and erosion; support biodiversity, game and fishing industry.
BM 5) Maintaining biodiversity and landscape	Support the natural species and habitats; conserve open, clean and well-managed agricultural landscape.
BM 6) Basic measures on livestock farms	Decrease the emissions from storage and handling of dung to air and runoff to waters.
Additional measures for environmental support and their objectives in Finland	
Additional measures (AM) Min. one has to be implemented	Objectives for additional measures
AM 1) More accurate fertilisation	Decrease the nutrient loading by adjusting fertilisation for cultivated plant and plot capacity.
AM 2) Plant cover in winter and reduced tillage	Protect field surface against erosion caused by rainfall, melt and runoff waters; decrease nutrient leaching, and improve survival of natural species over the winter.
AM 3) Biodiversity on farms	Enhance farmers knowledge of the natural vegetation and animal species on his/her farm, their habitats and management; increase the biodiversity and landscape diversity with long-term fallow agreements.
AM 4) Additional measures on livestock farms 1a. Decrease the ammonia emissions from the dung container/tank 1b. Capture the gases from animal dung 2. Improve the wellbeing of the livestock 3. Management of the dairy room waters	Decrease the nutrient loading, promote the domestic animal care true to species and increase biodiversity with grazing; decrease the ammonia emissions from the dung storage.
AM 5) Additional measures on horticultural farms (optional, not more than one has to be selected) - Adjusted nutrient follow-up - Adjusted nitrogen fertilisation by measuring the soluble nitrogen - Cover utilisation to control weeds on	Decrease the nutrient loading and environmental and health risks of herbicides.

perennial crops	
Special support measures and their objectives	
Measures (SS)	Objectives
SS 1) Establishment riparian zones	Decrease erosion and nutrient leaching, increase biodiversity and enhance game and fishing industry.
SS 2) Establishment and management of wetlands and sedimentation ponds	Decrease erosion in small water channels, improve sedimentation and extract humus and nutrients from water, increase biodiversity and enhance game and fishing industry.
SS 3) Other methods for the treatment of runoff water	Decrease nutrient leaching.
SS 4) Organic production	Decrease environmental loading and loading of water systems.
SS 6) Efficient use of manure	Improve local utilisation of animal dung for cultivation and prevent emission and runoff of manure nutrients to air, ground waters and water systems.
SS 7) Traditional biotopes	Enhance biodiversity of agricultural environment, cultural heritage of rural areas and landscape values.
SS 8) Other measures to enhance biodiversity	Enhance biodiversity of plant and animal species, ecosystems and habitats in agricultural environments.
SS 9) Improvement and management of landscape	Increase diversity and openness of agricultural landscape, strengthen characteristics of landscape and look after valuable agricultural landscapes.
SS 10) Raising local breeds	Secure existence of local animal breeds and their genetic variation.
SS 11) Cultivation of local crops	Enhance conservation of genetic material of native and old grain and grass varieties adapted to Finnish conditions.
SS 12) Reduction of acidity in certain areas	Decrease environmental damages in water conservation areas caused by acid sulphate soils, especially by decreasing acid runoff from plots.