TEHO Plus
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TARGETED MEASURES BRING THE GREATEST BENEFITS FOR ENVIRONMENTAL PROTECTION IN AGRICULTURE

FINAL REPORT OF THE TEHO PLUS PROJECT (2011–2014)

TEHO Plus

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More effective water protection in agriculture

Publication of the TEHO Plus project 9/2014

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Final report of the TEHO Plus project (2011–2014)

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Figure 1. One of the priorities of the TEHO Plus project was the advancement of agri-environmental advice. Advice provision was tested and developed together with participating farmers. Material needed for providing environmental advice was also produced, including maps and guides, and training was arranged for environmental advisers. Photo: Janne Heikkinen

1. INTRODUCTION

In order to improve the ecological status of the Baltic Sea, the countries bordering the Baltic Sea have undertaken to reduce nutrient inputs from land. The reduction target set for Finland by the Helsinki Commission in October 2013 is 2,430 tons of nitrogen and 330 tons of phosphorus a year over seven years, compared to the situation in the period 1997–2003. Finland has also undertaken to promote the protection of biodiversity and the sustainable use of natural resources. The aim is to halt biodiversity loss and secure the healthy functioning of ecosystems.

The activities of the preceding TEHO project were referred to in the Baltic Sea commitment made by the Finnish Government in 2010 in the context of improving the ecological status of the Baltic Sea. The work that began under the TEHO project was continued on funding provided by the Ministry of Agriculture and Forestry and the Ministry of the Environment in a project titled TEHO Plus, More effective water protection in agriculture. The purpose of the TEHO Plus project was to adapt the outcomes of the earlier project to a form that would lend itself to national application through the Rural Development Programme for Mainland Finland 2014–2020 and for the river basin management planning period 2016–2021. Particular priority areas of the project included the targeting of agri-environmental measures, provision of farm-specific advice, compiling an information package on agri-environmental issues and making use of nutrient balances in the provision of advice.

The TEHO Plus project was launched in June 2011 and, including an additional period granted to it, will extend until October 2014. The implementers of the project are Southwest Finland Centre for Economic Development, Transport and the Environment, MTK-Satakunta and MTK-Varsinais-Suomi. Cooperation between producers and the environmental administration was found to work well in the TEHO project, and it was continued in TEHO Plus. Working together with farmers was vital for the success of the project. A total of 175 farms in Southwest Finland participated in the project, for instance by testing and developing the provision of agri-environmental advice. The Archipelago Sea has been designated as a hot spot of efforts to protect the Baltic Sea, and this determined the selection of the project area. While the project's actual operating area comprised Southwest Finland (provinces of Satakunta and Varsinais-Suomi), the outcomes of the project can be exploited nationally.

Until the end of 2013, the activities of TEHO Plus focused on advice and experiments related to measures that reduce the emissions caused by farming on water bodies and air, and increase biodiversity on individual farms. The project also focused on developing water quality monitoring, the planning and practical implementation of adviser training, and developing tools that improve the targeting of agri-environmental measures. Advisers from various parts of Finland participated actively in improving the advisory activities.

Materials on various themes were prepared for national use during the project. The materials were published on the project website at www.ymparisto.fi/tehoplus and some also as printed guides. Some of the guides were translated into Swedish. The project also submitted initiatives to the working group and sub-groups preparing the new agri-environmental support scheme for 2014–2020 and proposals to the working group preparing the Nitrates Decree. For a list of the initiatives and proposals, see Appendix 1 or the project website. In 2014, the project will focus on national training and information activities.

We would like to thank the funding providers for the financing, the parties involved in project implementation for their valuable support and cooperation, and the participating farmers for their positive attitudes to the experiments, advisory services and feedback surveys that were part of the project.

2. AGRI-ENVIRONMENTAL ADVICE

Farm-specific agri-environmental advice is the best way to identify measures and targets that are the most cost-effective in terms of both the environment and the farm's finances. Agri-environmental advice makes it possible to target agri-environmental measures at areas where they are needed the most. Development of advice provision for individual farms in the TEHO Plus project continued from where the preceding TEHO project left off. In the TEHO project, the advice focused on water protection, while in the new project, the subject area was expanded to cover also issues relevant to climate change and biodiversity.

In the model for providing agri-environmental advice developed by the TEHO Plus project

- the aim of the advisory visit is to identify key development targets for environmental management and to prepare recommendations for the required measures together with the farmer
- if necessary, a second and more specialised advising visit is made for example to discuss biodiversity or the handling of manure, or the farmer is referred to a special adviser
- a follow-up visit takes place in 3–5 years to monitor how the measures have been implemented and to set new targets.

2.1 Use of background material in the provision of farm-specific agri-environmental advice

The TEHO Plus project tested and developed various sets of material and tested their usefulness and interest to farmers. Different types of maps of actual and modelled scenarios were presented to the farmers.

Figure 2. The maps and other farm-specific material spark discussion with the farmer, after which the farmer and the adviser can work together to find suitable methods for implementing agri-environmental measures on the farm. Photo: Satu Puustinen

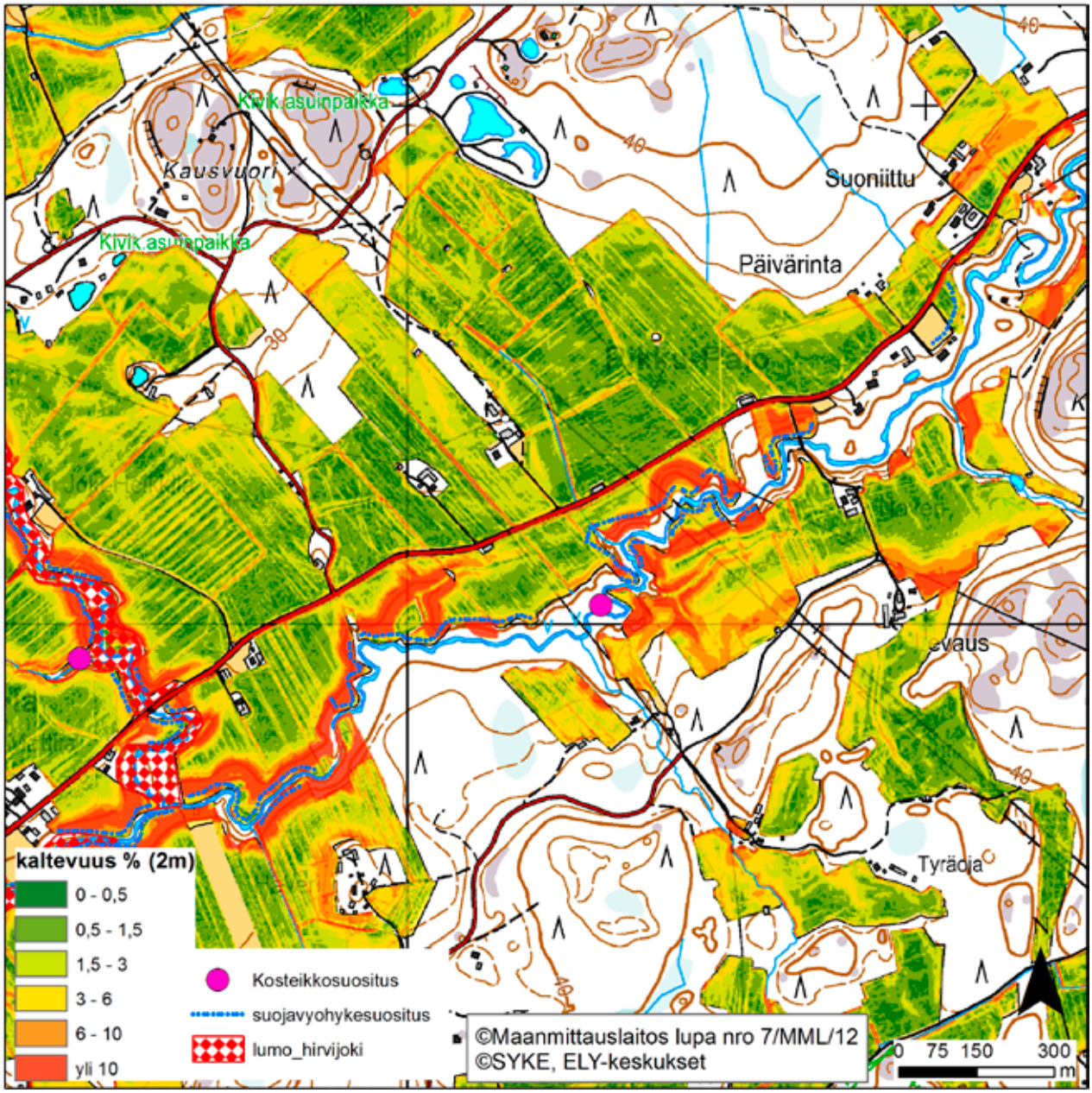

Figure 3. An example of maps used in the project. This map visualises the slopes in parcels and the buffer zones recommended in the general plan. Photo: Joni Koskinen

Based on experience gathered in the course of the project, the following background material will be necessary in the future to guarantee the quality of agri-environmental advice:

- a map describing the ecological status of waters
- a slope map of arable land; in the future, the RUSLE erosion model will be used
- a general plan of buffer zones, wetlands and biodiversity
- nutrient balances for each parcel over a few years, a comparison with reference values
- crop rotation data for individual parcels over several years
- fertility data for individual parcels (P, pH, soil type)

Experience gathered during the project indicates that theoretical models, including the one describing biodiversity potential of arable land, did not work well in advice provision on farms. It appears that at the moment, they are too theoretical to motivate farmers to take practical measures. However, the models should be developed further, with a view of adapting them to practical situations. Phosphorus balances were also shown on a map, but these maps were left out. The phosphorus balances did not give a reliable enough indication of the actual situation, as phosphorus may also be applied as reserve fertilization. The usability of the phosphorus balances can be improved by looking at the average figure for the phosphorus balancing period and taking into account the P value of the soil.

2.2 Collection of background materials

At the moment, many sets of background material used for the provision of advice in the TEHO Plus project, including general plans, the field slope model and agreements on special agri-environmental support are only available for persons who can access the databases of the environmental or the agricultural administration. Access to such materials would be crucially important for the provision of farm-specific environmental advice, however, and their better and more open accessibility in the future should thus be secured. Some of the material, including general plans, does not as yet cover the entire country. The RUSLE system for modelling the erosion sensitivity of soil, which is being developed at MTT Agrifood Research Finland, is probably the best available model in Finland for describing erosion. In addition to the slope, the model factors in the length of the slope, the rain factor, the soil, plant cover and the impacts of the cultivation method/protection factor. The coverage of the model will improve as progress is made with laser scanning. No policies have as yet been formulated on the sharing of the RUSLE material, and various options are being examined. More detailed information about this model is provided in the report on map-based erosion classification of Finnish fields by MTT Agrifood Research Finland to be published later.

In the course of the TEHO and TEHO Plus projects, comparative data were collected on nutrient balances by crop. The nutrient balances yielded regional reference data for these balances by year and by crop. Farmers found the reference data highly interesting and motivating. By comparing their nutrient balances to the balances on other farms, farmers can find out how successful they have been in nutrient use. An easy-to-use tool should be developed for collecting and maintaining this type of data for the use of both farmers and advisers. The nutrient balances can already be obtained directly from cultivation planning software, but they are little used in advisory services, and reference data by crop is not available.

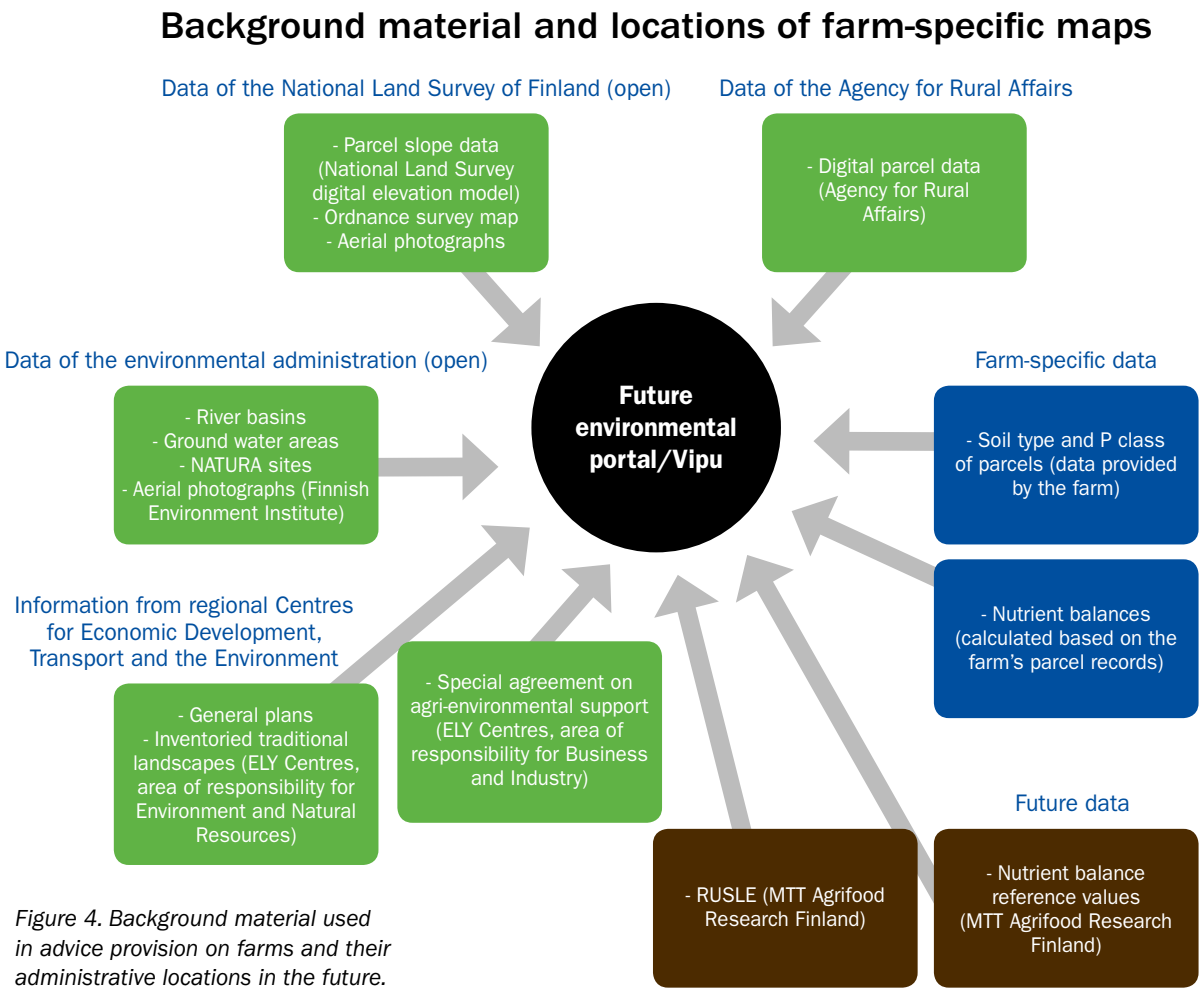

Figure 4. Background material used in advice provision on farms and their administrative locations in the future.

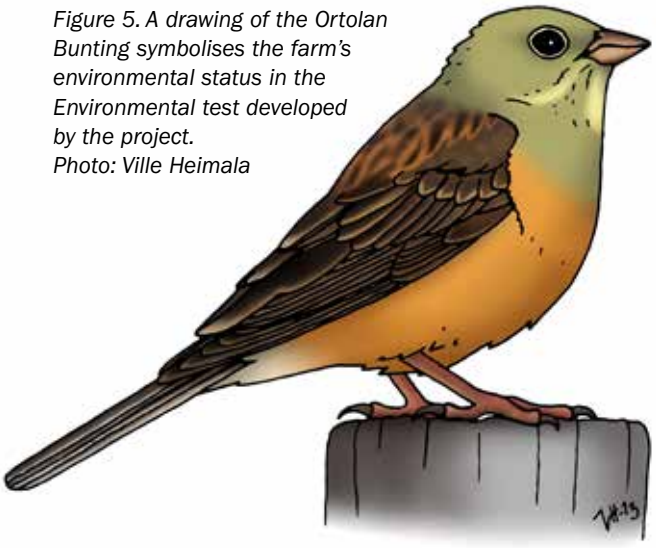

Figure 5. A drawing of the Ortolan Bunting symbolises the farm's environmental status in the Environmental test developed by the project. Photo: Ville Heimala

2.3 Environmental test for farms

For the purpose of farm visits, the project developed the Environmental test for farms which can be completed online (www.ymparisto.fi/tehoplus > ympäristökäsikirja). Completing the test only takes a couple of minutes, and based on the farmer's responses, it returns five development suggestions, among which the farmer and the adviser may together choose the most suitable development areas for the farm. The bias of the questions ensures that the most basic aspects are prioritised. Based on user experiences, the test works well and offers a quick general picture of the development needs. The test is not adequate on its own, however, and other material must also be used to provide farm-specific advice.

2.4 Environmental handbook and counters for farms

The Environmental test for farms is supported by the Environmental handbook for farms. This handbook with a practical approach covers key factors affecting the environment. The handbook serves as an information source for advisers and a general reference book for farmers. In addition, separate publications and reports were produced where the various topics are discussed in detail. Several counters were developed to support advice provision, including a counter intended for comparing fertilization costs incurred when using commercial fertilizers and manure. The counters can be used to illustrate and compare the benefits derived from the measures.

The environmental materials and counters devised in the course of the TEHO Plus project can be accessed on the project website at www.ymparisto.fi/tehoplus.

2.5 Costs of farm-specific advice

Table 1 shows the cost of a single farm visit based on various assumptions. The duration of a farm visit depends on a number of different factors, including the available material, preparatory work carried out and the size and production type of the farm. The table uses three different farm visit durations, which also include preparatory work: 1 day (8 h), 1.5 days (12 h) and 2 days (16 h). The average salary of a TEHO Plus project expert including overheads and associated costs is some EUR 30/h. The hourly fee charged by advisory organisations and private advisers is higher. For the purposes of this calculation, it is presumed to be in the range of EUR 50–80/h. In addition, the calculation assumes that the travel costs are EUR 0.45/km, and two different distances are compared.

To improve cost-efficiency, focus should be on automatic features and the easy availability of various sets of material. In the interest of equal treatment of farmers, the different materials and reference data should be available nationwide. During the project, a farm visit including preparations took approx. 1.5 days on average. More efficient preparation for a farm visit, for example by means of ready-made and easily accessible sets of material, shortens the time spent on a visit and reduces its costs.

Table 1. Cost of a farm visit based on different assumptions.

Duration of visit	Adviser's fee	Distance (return) 50 km	200 km
Farm visit 8 h	€30/h	€263	€330
	€50/h	€423	€490
	€80/h	€663	€730
Farm visit 12 h	€30/h	€383	€450
	€50/h	€623	€690
	€80/h	€983	€1,050
Farm visit 16 h	€30/h	€503	€570
	€50/h	€823	€890
	€80/h	€1,303	€1,370

The material produced by the TEHO Plus project will be available on the project website for a few years. In order to keep the material up to date and to exploit material produced by different projects, a single national portal should be set up (for example at maaseutu.fi), where such material produced by projects could be placed. This way, overlapping efforts regarding materials can be avoided in future projects, and good sets of material can be used more efficiently. The background materials used in advisory services must also be collected at a single location. The most practical option in terms of recognizability and ease of updating the data is the Agency for Rural Affair's Vipu service, where new maps would also serve online aid applications.

2.6 Environmental adviser training

In 2013, the TEHO Plus project tested a training model for environmental advisers. The objective was to train environmental advisers who can analyse agri-environmental issues on a farm as a whole. The training consisted of six days focusing on different themes, three of which were mandatory. Each training day attracted 73–87 participants.

Adviser training development needs

The organisation of training days by theme was found a good practice, and in the future, at least seven training days should thus be offered. Two of these should be mandatory to ensure a uniform advisory process. The remaining theme days would be optional, and the advisers could attend them as indicated by their information needs. The training should be followed by an

Figure 6. The environmental adviser training events arranged by the project were popular. Photo: Silva Wilander

examination covering all aspects to test the adviser's competence. This way, it can be ensured that the advisers have adequate knowledge of environmental issues to draw up a comprehensive general analysis. The training should also cover some of the psychological aspects of advice provision: the advisers should be taught to sell environmental issues and motivate farmers. The presentations on each day should include a review of topical issues that are being talked about on the media and among the farmers. Environmental advisers should also be required to take part in training that focuses on support schemes.

Mandatory training days for environmental advisers:

1. Causation of agri-environmental impacts

2. Environmental advice on a farm in practice: observation of environmental impacts, tools for advice provision and motivating farmers to undertake environmental measures

Themes of optional training days for environmental advisers:

- Controlling nutrient emissions
- Good agricultural condition of soil
- Biodiversity and landscape diversity
- Manure
- Climate impacts of agriculture

Regionally organised training facilitates the consideration of special regional features. The training could be provided by educational institutions or other regional actors. However, the national coordination of training should be entrusted to a single actor to ensure that training is similar in content and equitable in all parts of the country. The possibility of independent study should also be offered in case of the optional themes, for example by means of online studies. While the training should draw upon the most recent research-based information, this information should be formulated as practical operating instructions. Particular attention should be paid to this area, as it turned out to be the biggest stumbling block in the pilot training programme. Farmers' experiences and other practical examples also help to make the training more practically oriented.

In order to maintain the advisers' competence, continuing training should be available every year. Continuing training also promotes networking and provides a natural meeting forum for professionals. In order to keep up their competence, advisers need to both engage in provision of advice and attend training every three years. The advisers must also keep their knowledge of the support scheme up to date.

The total cost of the environmental adviser pilot training organised by the project was approx. EUR 25,000, the majority of which amount was spent on the lecturers' fees, catering and rental of facilities. The cost per participant was EUR 55/day. These amounts do not include the project employees' working time spent on the planning and implementation of the training. The pilot training was free of charge for the participants. A survey carried out at the end of the training programme indicated that some 64 % of the participants would be prepared to pay for the training if its quality was at least as good as that of the pilot training. According to the survey, the participants would have been willing to pay EUR 30–150/day for the training.

More information on the training, feedback received on it and development proposals are provided in a separate report on the training (Reports of the TEHO Plus project 1/2013).

2.7 Dedicated vs. cross-cutting environmental advice

Dedicated environmental advice means advice that focuses on environmental issues, whereas cross-cutting advice addresses environmental issues as part of general advice. In the interest of targeting the measures, there is a clear need for advice that helps to recognize issues on the farm that pose a risk to the environment, or otherwise pressures the environment the

most. Dedicated environmental advisory services are also a precondition for the efficient and appropriate exploitation of the agri-environmental support scheme. Advisory services can clear up misunderstandings related to the support scheme, dispel prejudices, and probably also reduce the number of payment cuts resulting from misunderstandings. In addition to general environmental advisers, advisers with specialised competence in such areas as biodiversity or energy issues are needed.

However, dedicated environmental advice does not eliminate the need to provide cross-cutting environmental advice and thus raise environmental awareness. It is possible that environmental advice attracts those farmers who already have a high environmental awareness and the environmental questions relatively well in hand. The farmers who need advice the most may experience it as unnecessary, and the advice thus fails to reach the farm.

If an incentive for cross-cutting environmental advice is created, the parties providing farm advice could offer services such as the Environmental test on farm visits. Environmental information could thus be disseminated to all farms in small doses, and the farmers could mull over the ideas, become interested and later request for an advisory visit. Completing the Environmental test could be a natural part of cultivation planning, as environmental advice often identifies factors with a negative effect on the farm's finances, including loss of nutrients and poor water management and soil structure. On most farms, plenty of action can be taken to protect the environment and support the farm's finances.

LESSONS LEARNT ABOUT ENVIRONMENTAL ADVICE

- ***Environmental advice is suitable for all farms.*** *The purpose of environmental advice is to make environmental management part of the farm's activities. The project's operating model includes a visit to analyse the farm's situation, a second visit for an in-depth analysis if necessary, and a follow-up visit 3–5 years after the first one.*

- ***New environmental materials have been developed.*** *The TEHO Plus project prepared an Environmental handbook for farms, which works as an information package on environmental management for farms. For national use on the actual advisory visit, the project drew up the Environmental test for farms. The project has also produced various counters that factor in the financial circumstances of the farm. All these tools are freely accessible on the project website at www. ymparisto.fi/tehoplus.*

- ***A single location for advisory materials is needed in order to provide high-quality advisory services.*** *In order to provide equitable environmental advisory services in all parts of the country, everyone must have equal access to the advisory materials. We propose that the Agency for Rural Affairs' Vipu service be set up as the portal for map materials. For the location of other environmental advisory material, including the Environmental test for farms and the Environmental handbook, we propose the maaseutu.fi site.*

- ***Agri-environmental advice produces great benefits for society.*** *During an advisory visit, the most efficient means of environmental protection can be identified for individual farms, and the measures can be correctly targeted. The costs of a farm visit will be reduced if all materials can be accessed at a single location and they are as ready to use as possible.*

- ***The training of environmental advisers is a guarantee of high quality advice provision.*** *The training should be tailored to take into account special regional features. National coordination of the training must be entrusted to a single party. Suitable training providers include educational institutions of the sector or other regional actors.*

3. FARM VISITS DURING THE TEHO PLUS PROJECT

3.1 Preparing for a farm visit

A set of farm-specific materials based on the parcel records submitted by farms in 2007–2011 was prepared in advance for farm visits in the TEHO Plus project. The material included maps, crop-specific nutrient balance calculations, parcel-specific notes and the crop distribution. In addition to parcel and crop specific levels, the farmers were shown a calculation of the financial values of the nutrient balances based on fertilizer prices in 2012. The information was set out in tables and diagrams that allowed farmers to compare their data to average values on TEHO farms.

The map material included three different maps: maps indicating the status of water bodies, maps showing the five-year average of nitrogen balances in different colours, and maps giving the field surface slope data, which also included the fertility data of phosphorus in the fields and existing and recommended sites eligible for special agri-environmental support, if such sites had been identified in the farm area, for example in connection with the drawing up of general plans.

3.2 Farm visit

The objective of the farm visit in the project was to identify issues on which the farm should focus primary attention. During the farm visit, the adviser and the farmer went through the farm-specific material, which led into a discussion of environmental issues on the farm. The maps provided a good introduction to the farm's cultivation data and gave a general idea of its operation.

During the visit, an Environmental test for farms devised by the project was completed, which contains questions addressed to both crop and livestock farms. The Environmental test has questions about nutrient use, soil structure, water management on fields, biodiversity, plant cover, livestock, production buildings, energy and waste management. The test was usually completed during the farm visit; the adviser saved the answers on a computer, and suggested measures were available immediately. While the test was being completed, the farmers and the advisers had an opportunity to discuss environmental questions relevant to the farm and the suitability of the suggested measures for the farm from many angles.

The nutrient balances prepared for the farms usually sparked the most discussion with the farmers. The review of financial questions in connection with the nutrient balances alerted farmers to considering their fertilizer use in concrete terms and their efficiency in terms of the inputs and the harvest. Almost systematically, all farms found the nutrient balances useful. The results of the balances and the reasons for results that were weighted in one direction or another were consistent with the farmers' ideas. During the visit, the fertilizer, manure, nutrient balance and phosphorus counters devised by the project were also introduced as necessary.

Feedback on the visit was given with the intention of providing advice in a concise form about how to make progress in environmental issues on the farm. The feedback could draw attention to such topics as soil structure, water management, use of catch crops, crop rotation, tillage, plant cover, drainage, naturally engineered agricultural drainage, maintaining biodiversity, nutrient use, manure use, working techniques and/or energy issues. An effort was made to take into consideration the circumstances of individual farms and cost-effectiveness in the suggested measures.

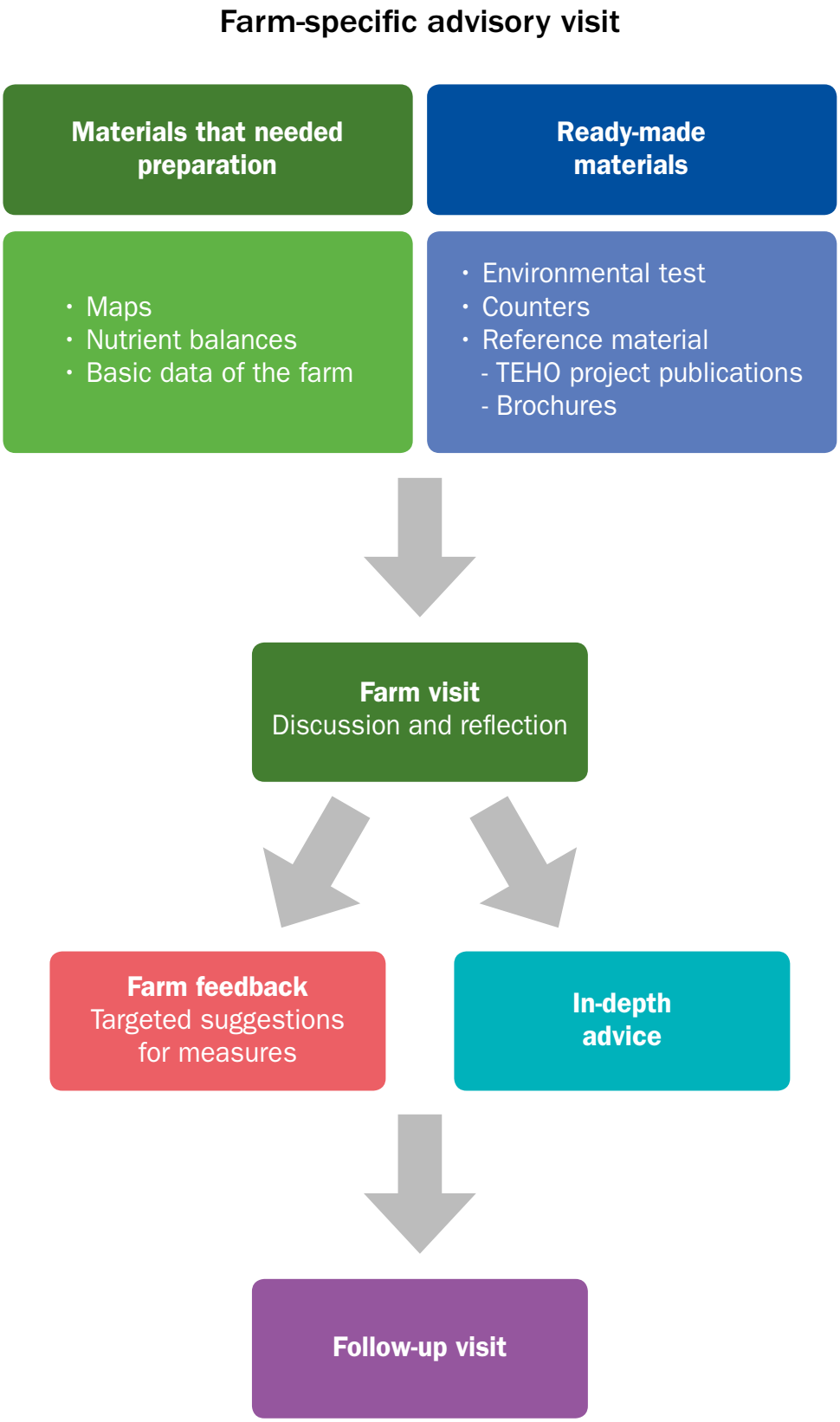

Figure 7. During the advisory visit, suitable agri-environmental measures for the farm were planned on the basis of the farm-specific material prepared by the adviser. After the farm visit, feedback and targeted suggestions for measures were given to the farm. A visit to provide in-depth advice is paid if necessary, and a follow-up visit takes place 3–5 years after the first farm visit.

3.3 Farmers' feedback on environmental advice

One of the key purposes of the TEHO and TEHO Plus projects was to serve as a line of communication between farmers and authorities. The farmers' opinions were heard during farm visits and at various events. Feedback on the advisory services and elements closely associated with them, including the material provided, were collected from the farmers.

Practicability of measures suggested on farm visits

The benefits of the environmental advice to the farms were evaluated by means of a survey addressed to the farmers. Two types of surveys were sent out: one for new farms, or those that joined the TEHO Plus project, and another for those that had already participated in the preceding TEHO project. The farms that had joined the TEHO Plus project were asked about the implementation of measures taken in consequence of the farm visit. The survey was sent to 46 farms, of which 27 responded. The feedback indicates that almost all of the farms had had an interest in the impacts the farm had on its immediate environment for some time that was not solely inspired by the project. The majority of the farmers had implemented, or were about to implement, at least one of the measures recommended by the adviser (Figure 8).

The second survey was addressed to the 73 farms that had already participated in the first TEHO project (2008–2011). No visits were made to these farms during the TEHO Plus project. The feedback from the farms shows that the desire to protect the environment is a key reason for implementing measures recommended by the environmental adviser. However, the practicability of the measures and financial aspects were regarded as more important than environmental protection (Figure 9). If the measure was not practical and workable on the farm, this was clearly the most important reason for a failure to implement measures recommended by the adviser (Figure 10).

The farmers had positive experiences of such measures as nitrogen-fixing plants, nature management fields, more accurate fertilizer application and timing of fertilization, as well as reduced tillage. In most cases, these measures are easy to implement and they make financial sense both on livestock and crop farms. On the other hand, crop farms found challenging such measures as buffer zones and other grasslands, grazing and manure use. They called for practical solutions for the final disposal of mowing waste in particular, if they had no use for it as fodder.

Many options that are effective for the environment are available for arable farms, including liming, the timing of nitrogen fertilizer application and reduced tillage. The decline in the number and the concentration of livestock

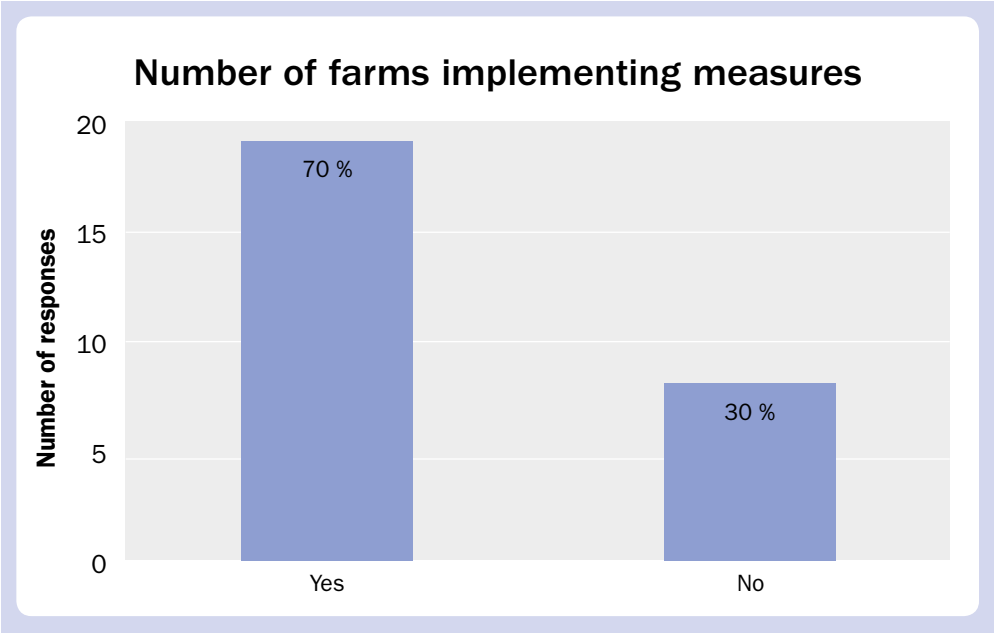

Figure 8. The majority of the farms that responded intended to implement or had implemented some of the suggested measures.

farms in certain areas also means that grazing concentrates in these areas and the recycling of nutrients in manure becomes more difficult. Mowing cannot take the place of grazing in traditional biotopes and other areas outside fields, and on the other hand, a use must be found for mowing waste.

Usefulness of the project and environmental advice

The participating farms felt that the project was necessary. Mainly positive feedback was received on the farm visits, even if they did not always provide new information. Farmers found talking to an outside expert productive, and the discussions with advisers reinforced the farmers' own experiences and supported their decisions. Farmers appreciate discussions and exchanges of views both with other farmers and experts in the sector. The feedback received indicates that in addition to theoretical information, the farmers would like more concrete advice on how a certain problem could be solved.

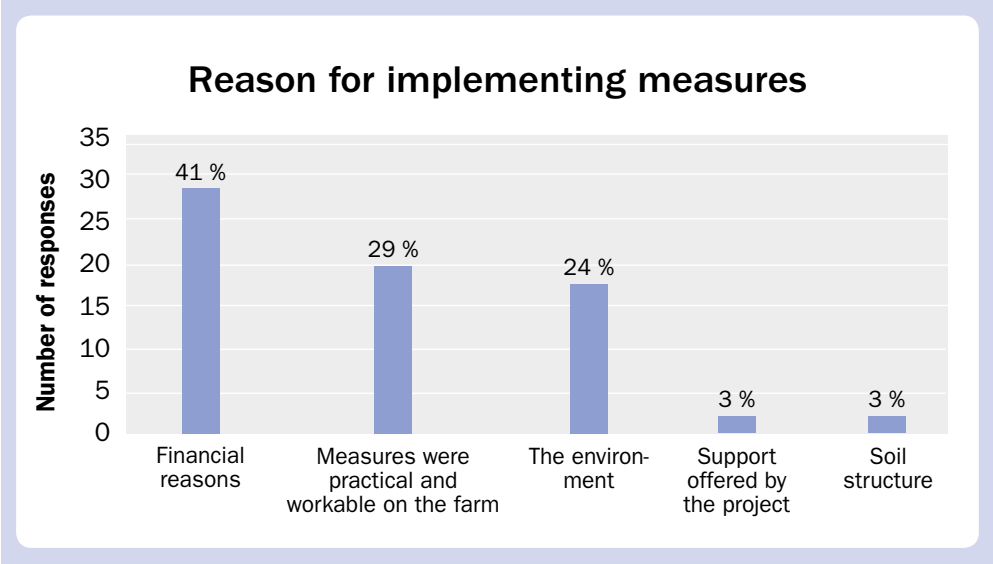

Figure 9. Reasons given by farmers for implementing suggested measures, a total of 70 respondents.

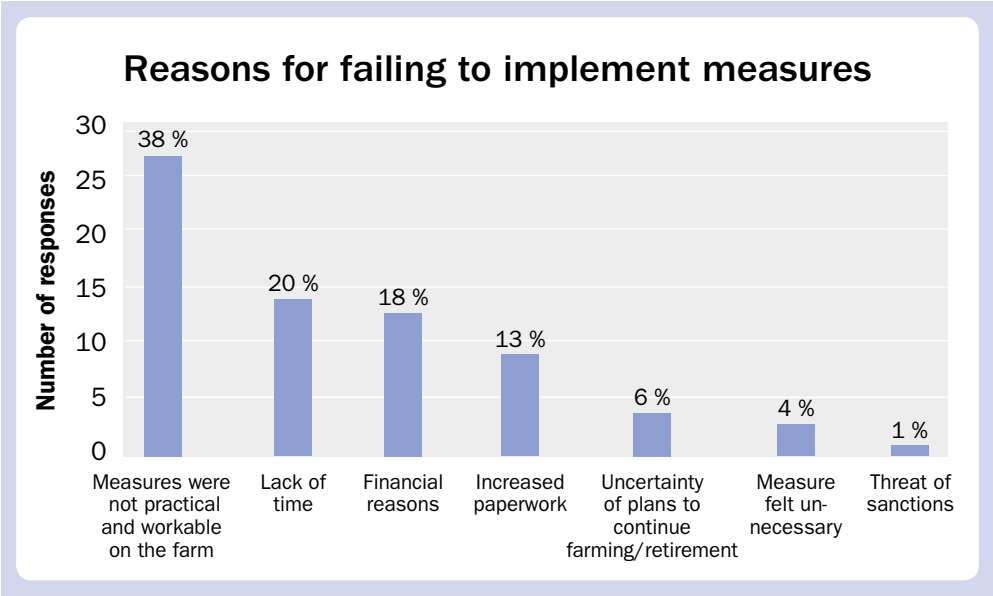

Figure 10. Reasons given by farmers for not implementing suggested measures, a total of 71 respondents.

In the feedback, farmers even expressed a wish for more farm visits. The farmers also saw the project and the farm visits as important channels for informing the authorities of practical experiences and improving the image of farming. In the dissemination of information, the newspaper Maaseudun Tulevaisuus was seen as an efficient instrument.

Most farmers are not prepared to pay for mere environmental advice whose benefits for the farm are less easy to justify than, for example, those of advice on support scheme. The interviews also indicated that even if over 60 % of the respondents said that the project had given them a new perspective or some new information, a large share, or 40 %, also felt that they had gained no new perspectives to environmental issues on their farms. Many participating farmers had already thought about environmental issues before the project.

The majority of the farms that had already participated in the first TEHO project supported the inclusion of environmental issues in other advisory services as a cross-cutting element (Figure 11). However, this alternative was seen to carry a risk of the environment being overlooked. On the other hand, environmental advice incorporated in other advisory services will reach a greater number of farmers. The advisers need solid professional competence to be able to identify aspects that are essential for the environment amidst other issues. An Environmental test for farms completed by the farmer before the visit is a good tool. It allows the farmer to think in advance about the environmental issues that should be discussed with the adviser. Without a test having been completed before the visit, providing environmental advice may be too much to take on during a single farm visit.

Advice provided to small groups, which farmers expressed an interest in, can help to find practical solutions. In addition to covering relevant and concrete topics, local small groups can also manage joint environmental projects, including pastures, wetlands or exchanges of fields or manure. Practical experiences of implemented measures, which farmers are anxious to hear about, are easy to share in small groups. The positive aspects of small group activities were seen to include not only the exchange of experiences but also the group's interactive nature. The challenge of advice provision and training provided for small groups lies in making these activities attractive enough to motivate busy farmers to take part.

More information about farmers' feedback is included in TEHO Plus project report 2/2013 *Tilakohtainen ympäristöneuvonta TEHO ja TEHO Plus -hankkeiden aikana ja siitä saatu palaute* (Farm-specific environmental advice during the TEHO and TEHO Plus projects and feedback received) and Satu Paananen's thesis *Tilakohtainen neuvonta maatilojen ympäristönsuojelun edistäjänä, TEHO Plus -hankkeen raportti 2/2014* (The role of farm-specific advice in promoting environmental protection on farms, TEHO Plus project report 2/2014).

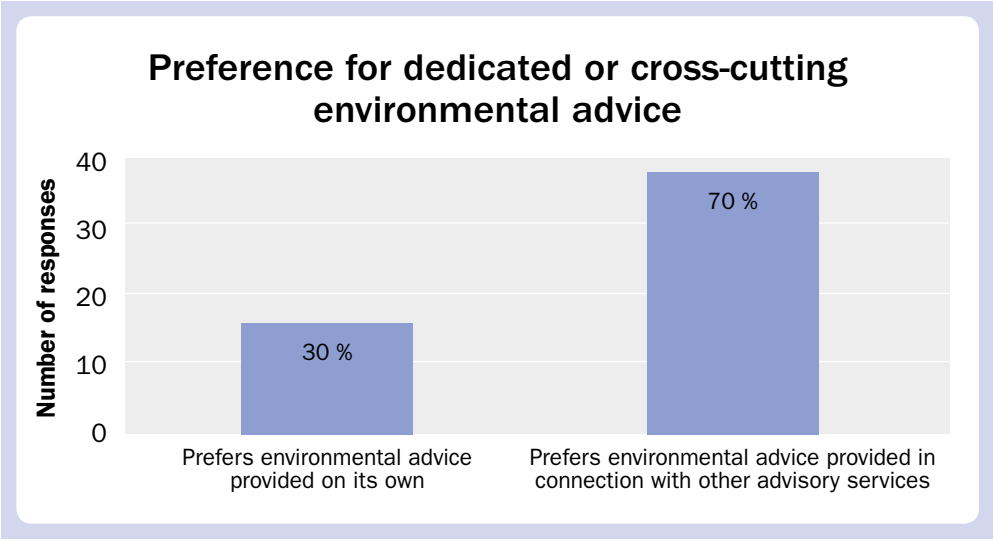

Figure 11. The majority of respondents preferred discussing environmental issues as part of other advice.

Figure 12. Farm walks are efficient events for small groups where farmers can exchange experiences and learn from each other. Photo: Aino Launto-Tiuttu

LESSONS LEARNT FROM ENVIRONMENTAL ADVISORY VISITS

- ***Farm-specific environmental advice is one of the most effective ways of taking information about best practices to the farm level.*** *Many farmers do not have time to get acquainted with the measures and their implementation on their own, or to take part in training events organised by the project and other parties. In the long run at least, taking the environment into consideration in the farm's activities also makes financial sense for the farmer.*

- ***Farm-specific advisory visit is an interactive event.*** *The farmers are the best experts regarding their own farms, whereas the advisers bring new perspectives to the farm's operating methods. Best practices for the environment can be promoted by combining various perspectives and practical experiences.*

- ***The Environmental test for farms developed by the TEHO Plus project can give a fast general idea of the status of environmental issues on the farm.*** *The test helps to identify the farm's key development targets.*

- ***The nutrient balance is a better tool than its reputation indicates.*** *The nutrient balance helps to determine suitable fertilization volumes for each crop and parcel, which makes sense both for the farm's finances and the environment. The experience gathered during the project indicates that farmers are highly interested in the nutrient balances of their farms and their success in nutrient use compared to other farms.*

- ***Maps are important on farm visits:*** *they make it easy to examine the farm's operation as a whole, and they provide a good start for the discussion. In the future, access to farm-specific thematic maps should be ensured for farmers and advisers.*

- ***The farmers would like the advisers to have a comprehensive approach to the farm's business, and also solutions for practical challenges.*** *An adviser familiar with the region knows other farms and finds it easier to offer solutions for such problems as using manure and managing buffer zones. The adviser may also play an important role in other cooperation between farms.*

- ***Farmers would like environmental measures to produce visible results.*** *It is easier to motivate farmers to implement environmental measures if their effects can be monitored over the long term, and the farmers can see the results of their own actions*

4. WATER QUALITY MONITORING

4.1 Vuohenoja

While the TEHO Plus project continued the monitoring of water quality with automatic sensors that began in the TEHO project, the focal point of the monitoring was moved away from large rivers to Vuohenoja, a minor tributary of River Aurajoki. The catchment area of Vuohenoja was selected as the target area because of earlier plans drawn up for the area and the landowners' interest. A general wetland plan was prepared for the catchment area of Vuohenoja in 2009.

Automatic water quality measuring started in the lower reaches of Vuohenoja in autumn 2010. The idea was to monitor the water quality and its changes after three small wetlands were established on the land of four different landowners in the upper reaches of the river in winter 2011. In spring 2012, another automatic sensor was installed upstream from the chain of wetlands, allowing the evaluation of the impact of wetlands on water quality in a small water body. Later in autumn 2012, further two wetlands were established upstream from this automatic measuring station in the middle part of the channel. Water quality monitoring at both stations continued until October 2013.

Water quality in Vuohenoja mainly is slightly poorer than in River Aurajoki, into which the river discharges. The specific nutrient load of a water system is obtained by dividing the annual volumetric flow rate of substances transported in the river by the catchment area surface. In 2011 and 2012, the annual specific nutrient load of Vuohenoja was greater than the figure calculated for the entire Aurajoki river basin for both solid matter and total phosphorus. While the specific nutrient load of nitric nitrogen in Vuohenoja was greater than in Aurajoki river basin in 2011, it was smaller in 2012. We may speculate about the reasons for the higher specific nutrient load in Vuohenoja. The relative share of agricultural land in the catchment area of Vuohenoja is larger than in the entire Aurajoki river basin. In addition, a larger proportion of the arable land contains clay soil. The catchment area of Vuohenoja is narrower, and the runoff water rapidly reaches the lower parts of the channel. The flows are stronger and channel erosion may be more significant in Vuohenoja than in River Aurajoki.

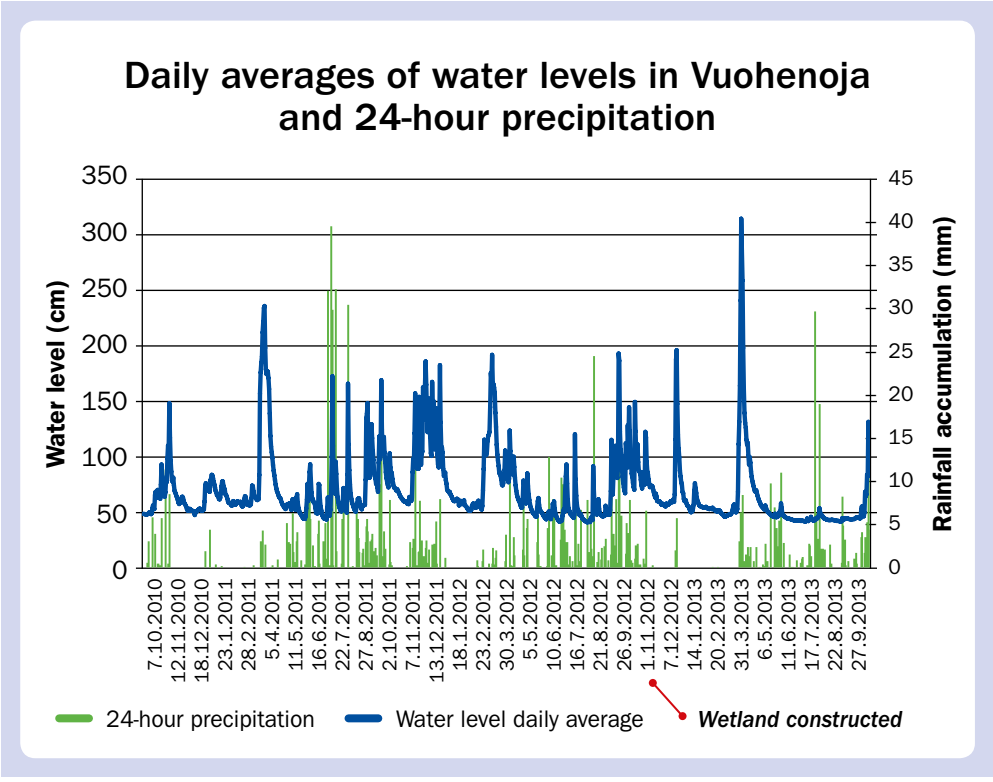

Figure 13. Water level and 24-hour precipitation results from the lower measuring point in Vuohenoja over the study period.

Figure 14. Automatic water quality sensors require maintenance, also in extreme conditions. Photo: Silva Wilander

The readings of the automatic sensors in Vuohenoja indicated that even small wetlands may have a major impact on evening out peak flow rates. The results showed that water level variations were smaller after the latest wetland was constructed (Figure 13). The impacts of the first three wetlands on water levels could not be evaluated as the measurements had not started early enough before the launch of wetland construction. However, it may be expected that their impact on water level fluctuations is similar.

The impact of wetlands on water quality was studied by measuring solid matter, phosphorus and nitrate contents upstream and downstream of the wetland chain. However, the measurements indicated that the wetlands had little impact on water quality. Only when solid matter contents where high did the wetland chain reduce this figure. This is probably due to the fact that the wetland surface area was small compared to the catchment area. On the other hand, the catchment area between the measurement points is also rather large, and the small Rähälänoja ditch also discharges into this section. This has an essential impact on measurements of the wetland's retention capacity. More information on the automatic water quality measurements in Vuohenoja will be provided in a TEHO Plus project report to be published in 2014.

Elisa Mikkilä, a student at the University of Turku, Department of Geography, wrote her Master's thesis on solid matter transported in Vuohenoja. In summer and autumn 2012, she measured Vuohenoja's flow rates, solid matter transported in the water and sediment composition. The study also evaluated channel ero-

sion using erosion markers and the role of surface run-off by interviews with farmers. Her study indicates that a large share of the solid substances in Vuohenoja is matter eroded from the channel. The river keeps changing its course and erodes the channel. In places, solid matter also accumulates in the channel. However, it was not possible to establish the relative shares of channel erosion and surface run-off in the solid matter transported in the river. The wetlands cause water levels in the channel to rise and the margins to become waterlogged, which may result in collapses and channel erosion.

Another interesting point was the relationship between the content and consistency of solid matter in the water. The study indicated that the amount of the finest clay material in the water only changes slightly even if the flow conditions change dramatically. When the flow is greater, the water has higher turbidity, but at those times larger particles are mixed in with the water. The relative share of smaller particles is in the same range as in low flow conditions. This phenomenon should be examined more closely in the future, as it has a key impact on the effectiveness of environmental measures on lands with clay soils and, on the other hand, on the expectations of water protection targets. For more information about the study of solid matter transported in Vuohenoja, see TEHO Plus project report 3/2014.

4.2 Automatic stations

While the TEHO Plus project did not continue water quality monitoring in large rivers, it did draw up a comprehensive report on the results of automatic measuring stations. This report will be published in 2014 in the publication series of the Centre for Economic Development, Transport and the Environment. The report examined the solid matter, nitric nitrogen and total phosphorus loads in Aurajoki, Eurajoki and Loimijoki river basins in 2009–2013 and compared a method based on automatic water quality monitoring to a method based on conventional manual sampling. This is likely to be one of the most extensive water quality data sets in Finland, and the results are interesting.

Figure 15. Vuohenoja measuring station was located in traditional landscape of regional importance. Photo: Joni Koskinen

Figure 16. Regular maintenance of automatic sensors guarantees reliable results. Photo: Eriika Lundström.

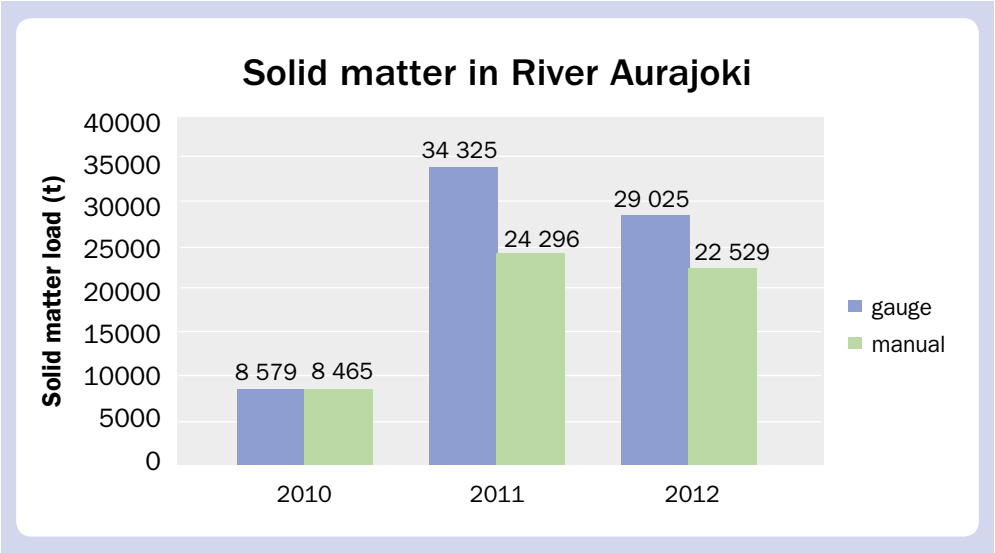

Figure 17. Comparison of solid matter flow results per year produced by automatic sensors and calculations based on manual sampling in the lower reaches of River Aurajoki (Halinen).

Momentary peak loads can be more conveniently and accurately observed by automatic sensors than by manual sampling. As calculations of substance flows transported by rivers are currently based on manual sampling, it was interesting to see to what extent the load figures obtained from automatic sensors, which reflect the reality better, differ from results based on manual samples. The best correspondence between measuring methods was found in case of nitric nitrogen loads. For solid matter and phosphorus, differences between the methods were larger. Continuous water quality sensors mainly produced higher load figures than manual samples (Figure 17). Based on the results we can say that while the water system load estimates currently in use are in the correct range, the actual load is likely to be greater than we presently think, depending on circumstances. In 2011 and 2012, for example, the actual solid matter load in River Aurajoki was some 30–40 % greater than the results based on official manual samples indicate.

Automatic sensors also facilitated accurate comparisons of the loads in various seasons and at other

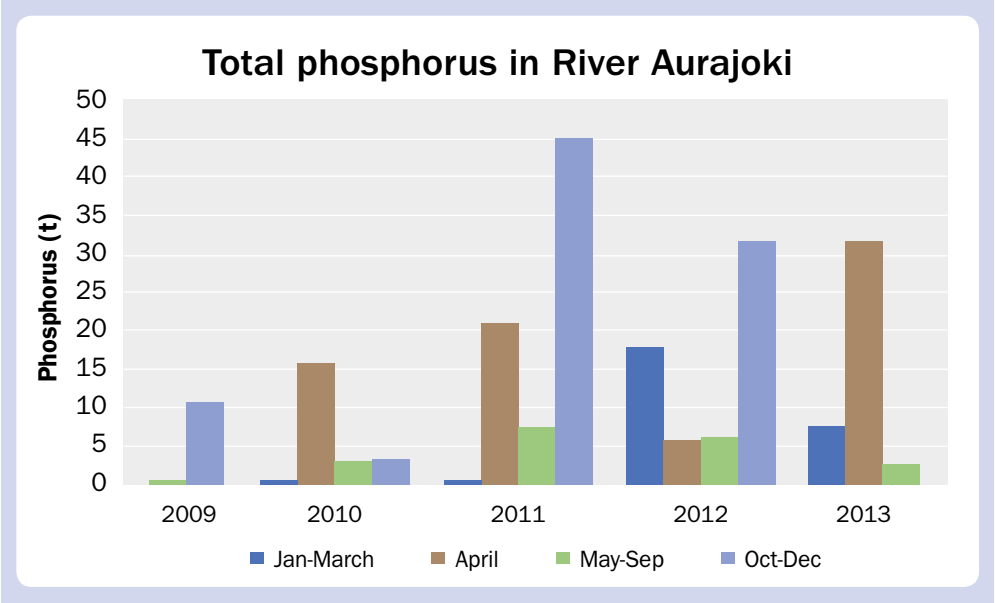

Figure 18. Total phosphorus flows in the lower reaches of River Aurajoki (Halinen) divided by annual hydrological periods.

points in time. Load variations caused by dry or rainy autumns were obvious in the results of all catchment areas. There may be substantial differences in the annual nutrient load figures, and the greatest factor affecting these is the weather. In River Aurajoki, for example, the total phosphorus load in 2010 was approx. 21 t and in 2011 approx. 74 t. If we compare the timing of peak loads in years 2010 and 2011 shown in Figure 18, we see that while the total phosphorus load was greater in all periods in 2011, the biggest dissimilarity between these two years is due to the difference in loads in the period October-December. The main part of the nutrient load occurs outside the growing season, mainly in spring and towards the end of the year, regardless of the year under scrutiny.

LESSONS LEARNT FROM WATER QUALITY MONITORING IN THE TEHO PLUS PROJECT

- ***Establishing small wetlands is cost-effective.*** *Small wetlands not only increase biodiversity but also improve water management. Based on measurements carried out during the project, even small wetlands stabilise flow rates and reduce major spikes of substances transported in the water. Building small wetlands can often also be completed with little effort and at a low cost.*

- ***In clay soils, there is always fine silt in the water.*** *The study at Vuohenoja indicates that the relative volume of fine particles in a water body has a weak correlation with the flow rate. Further studies are needed to examine this question.*

- ***The annual substance flows in Rivers Eurajoki, Aurajoki and Loimijoki are mainly greater than presumed so far.*** *Based on data collected with automatic sensors, the loads of solid matter, total nitrogen and total phosphorus are, depending on the conditions, mainly greater than what manual samples indicate. The measurements show that more monitoring data will be needed to establish more accurately the load figures and the factors that influence them. This will also permit more realistic estimates of targets and sites selected for efforts to reduce the loads.*

- ***The factor with the greatest influence on loads is annual weather conditions.*** *Based on the measurements, there may be variations amounting to hundreds of per cent in the load figures of consecutive years. This is dependent on the weather conditions and the timing of precipitation in terms of the time of the year and the growing season.*

- ***The greatest loads are recorded outside the growing season.*** *The measurements indicate that a clear majority of the loads occurs outside the growing season. Such factors as the timing of precipitation and a long mild autumn affect this situation. However, it would be a good idea for farmers to take as much action as possible to prevent erosion outside the growing season. The best method for achieving this is plant cover in winter and a more naturally engineered drainage network.*

5. EXPERIMENTS CARRIED OUT IN THE TEHO PLUS PROJECT

The TEHO Plus project organised various experiments in cooperation with farmers in their fields. The main objective was to test new agricultural water protection measures in practice.

The experiment with the highest profile during the project was the catch crop trial. Experiments launched in the TEHO project were continued on individual farms during TEHO Plus. In some of these catch crop parcels, greenhouse gases were also measured in 2011. In addition, solutions were sought for dealing with nitrogen in run-off waters from the exercise yard of an organic dairy farm. In 2012, deep-rooted plants were sown on three TEHO farms, and the experiences of their cultivation were presented in 2013 at various practical advisory events for farmers, giving farmers an opportunity to discuss their experiences. Cooperation with projects in other provinces was part of the experiments.

5.1 Using catch crops

During growing seasons 2011–2013, the project tested the suitability of various catch crops in practice and measured changes in the soluble nitrogen contents on the relevant parcels. Catch crops were tried out with a number of different cash crops and with various methods of establishment. In summer 2011, experiments were carried out on nine participating farms, and in summer 2012, on 13 farms. In 2013, there were also 13 participating farms.

As catch crops fodder radish, white mustard, Italian ryegrass, Phacelia and clover were used following early potatoes and carrots, onions and peas, as well as Italian ryegrass and clover as a follow-on crop for barley and oats. Farmers' experiences were collected in all three years of the experiment. The aim was to gather experience of the various sowing techniques and sowing times of catch crops. Another objective was to observe the impacts of the catch crop on the following year's crop and the weed situation. The results were compared with those obtained by MTT Agrifood Research Finland and the outcomes of experiments carried out in the Ra-Ha project.

The growing season 2011 was favourable for catch crop experiments, and the crops were mostly highly success-

Figure 19. Italian ryegrass sown as a follow-on crop provides the field with green cover after the harvest. By observing a parcel with no follow-on crop, the farmer can monitor the impacts of the follow-on crop on weeds and ease of tillage. Photo: Janne Heikkinen

Figure 20. The farm walks organised by the TEHO Plus project focusing on deep-rooted plants and their possibilities of improving soil structure attracted interest among farmers. Photo: Aino Launto-Tiuttu

ful. The year 2012 was rainy and cool, which was reflected as poor growth of catch crops sown after the main crop. In 2013, drought had a negative impact on the germination and growth of catch crops. Where enough water was available, the catch crops were good in 2013. The greatest challenges to achieving even and adequately dense follow-on and catch crops were weather conditions during the growing season, in particular long periods of dry weather in the emergence phase. The autumn is not always warm enough to achieve a dense crop, which is why sowing the crop early enough, especially in case of catch crops sown after a cash crop, is crucial.

Based on feedback obtained in the TEHO Plus project, farmers currently have little knowledge and experience of using catch crops. They found the improved soil structure and the reduction in the number of weeds in the catch crop parcel the greatest benefits. Catch crops also evened out soil moisture levels by drawing and evaporating water from deeper down in the ground, making it possible to till the soil later in the autumn. The follow-on crop was not found to have an impact on the cash crop, and the catch crops were considered to reduce disease pressure on the cash crop. According to farmers, the greatest problems were caused if the crop was lodged, in which case the lush follow-on crop made harvesting even more difficult. Farmers considered a secondary benefit that the catch crop transmitted nitrogen to the subsequent cash crop.

Soil samples indicate that white mustard works well as a follow-on crop for potato: thanks to its fast growth rate, deep roots and large plant mass, mustard fixes nitrogen and adds organic matter to the soil. Peas release plenty of nitrogen in the soil, making Italian ryegrass a highly suitable catch crop to follow peas. Both catch crops reduced the content of nitrogen in the soil by some 40 kg/ha. For more information about the catch crop trial, see the TEHO Plus project publication on catch crops.

5.2 Measuring greenhouse gases in parcels with catch crops

The purpose of the experiment was to study the volumes of air emissions of nitrous oxide (N20) after harvest per catch crop parcel in fields used for early potatoes and peas. The experiment was carried out in cooperation with MTT Agrifood Research Finland to be used as input data for a forthcoming MTT Agrifood Research Finland study.

The first measurement of gases was conducted as soon as the catch crop had been sown in July, with subsequent measurements every two weeks until the beginning of October, at which time the catch crops were terminated. For the purposes of the measurement, frames were placed on the field, on top of which a dome was placed during the measurement. Three gas measurement points were set up in each parcel. The experiment was unable to establish the impact of the catch crop on gas formation.

5.3 Deep-rooted plants

On three farms participating in the project, perennial deep-rooted plants were sown in spring 2012. The farms gathered experiences of the cultivation of deep-rooted plants as part of crop rotation. The project organised farm walks on these farms in 2013. In addition to catch crops, other deep-rooted plants were also introduced at events for farmers. Deep-rooted grassland seed mixtures contained alfalfa, lucerne, reed fescue, and red and alsike clover.

The farmers' experiences of deep-rooted plants showed that these plants have a positive impact on improving and maintaining soil structure. The biggest problem was establishing a diverse crop of deep-rooted plants. The wet autumn in 2012 resulted in poor overwintering of legumes and their slow start in spring 2013. The seed mixture should contain both legumes and grasses to ensure good plant cover. For more information on the experiment with deep-rooted plants, see the TEHO Plus project publication on catch crops.

5.4 Phosphorus contents in arable soil, forest soil and boundary strip soil

The phosphorus contents of surface soil in Vuohenoja catchment area were studied by collecting linear samples on arable land and in the forest, buffer strip and ditch margins. The easily soluble phosphorus was deter-

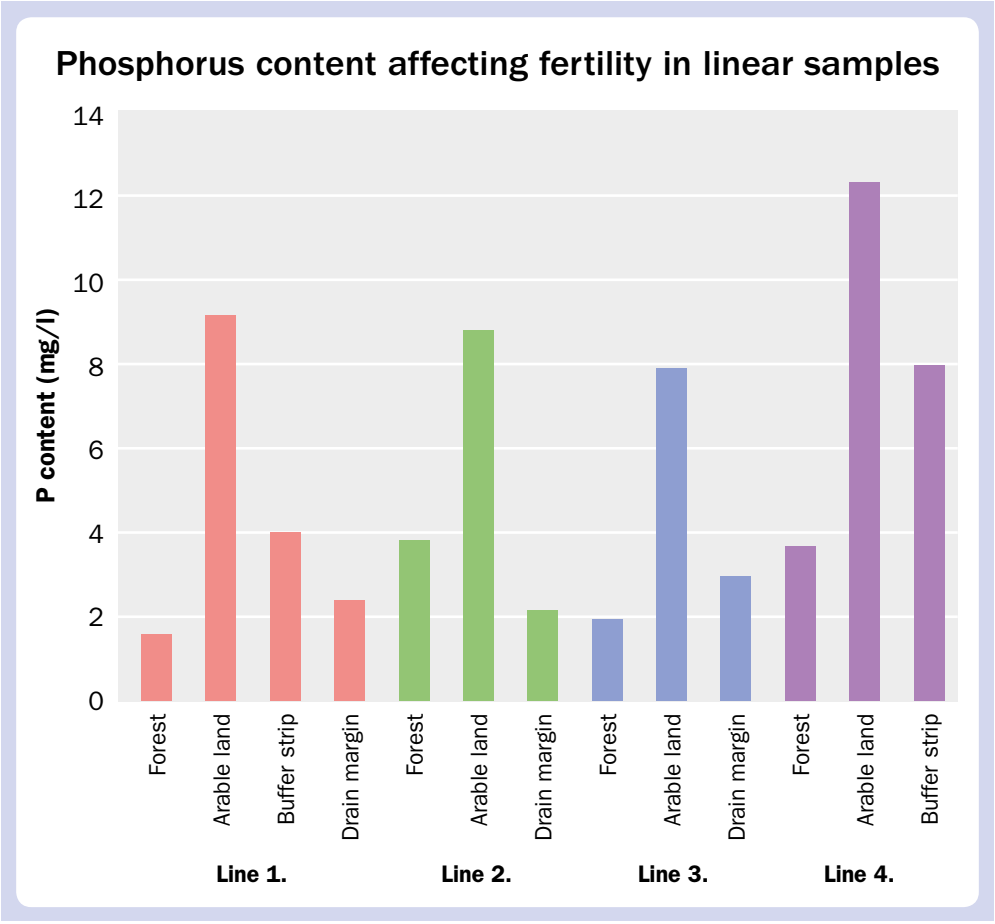

Figure 21. Soluble phosphorus content in soil on four different lines (forest-arable land-drain margin).

mined by water-soluble P and acid ammonium acetate extraction which is a method used in the routine advisory soil test in Finland. The experiment was also analysed iron and aluminium tightly bound phosphorus and total P. The purpose of the experiment was to establish to what extent the phosphorus contents vary on different sites in the same catchment area.

Clearly the highest phosphorus content was found in soil on arable land (Figure 21), while forest soil contained the lowest quantity of highly soluble phosphorus. Depending on the fine silt content of the forest soil, however, its content of highly soluble phosphorus could be equally high as in drain margins. The content of tightly bound phosphorus was also the greatest in soil on arable land. Attempts to prevent the erosion of soil on arable land into a water system plays a key role for the environment, as the volume of phosphorus bound in soil on arable land is higher than that in forest soil.

5.5 Comparison of fertility samples between laboratories

Six different homogenised soil samples where sent for testing to four laboratories producing fertility analyses. The objective was to compare the differences in fertility analyses between laboratories.

The greatest differences between laboratories were found in the sensory determination of soil type. The higher the organic content, the greater the differences between the laboratories in the sensory assessment of soil organic content. The loss-on-ignition of the soil, on the basis of which the correct organic matter content could be defined, was determined at three laboratories. In this respect, the differences between the laboratories were minor. There were no major differences between the nutrient content analyses carried out as part of the fertility analysis, which is why diffusion tests of fertility produced similar results at different laboratories. However, the fertility class of phosphorus could vary up to two units between different laboratories, as the P value, soil type and soil organic matter content all influence the fertility class of phosphorus. Attention should be paid to the consistency of laboratory results, as the fertility class is tied to the fertilization limits, and changes in it have both financial and environmental significance.

5.6 Interviews with manure contractors

In 2012 the TEHO Plus project interviewed manure contractors from different parts of Finland. The distribution was as follows: North Savo 2, South Savo 2, North Ostrobothnia 2, Central Ostrobothnia 1, South Ostrobothnia 1, Satakunta 2 and Varsinais-Suomi 4. The purpose of the interviews was to survey the current practices and trends of manure application, map potential problem areas and collect development suggestions from actors directly engaged in the practical work of manure application.

In general, the contractors had bright expectations on their future – more and more farms use contractor services due to the increasing farm sizes and the short period available for applying manure. In addition, special agri-environmental support for injection of slurry into the soil have increased the demand for contractor services. Contractors consider increasing the storage volume in remote tanks the most sensible solution in the future, especially for slurry. The distance of the slurry tank from the application site is the factor that has the greatest impact on the time used for application. Sensible regional storage arrangements of slurry would allow an efficient use of the short period available for applying slurry in the spring. At the same time, the pressures of applying slurry in the autumn would be reduced. Remote tanks should be set up on crop farms, which could be promoted by also supporting the remote tank investments of crop farms.

5.7 Interviews with farmers about areas for applying manure

In 2013, the TEHO Plus project interviewed eight livestock farmers. The farmers were asked about the area they had at their disposal for spreading manure, data in the farm's parcel records, and the farmers' views of how far and at what price the farm could find additional areas for spreading manure. The results of the interview were used as input data for a study commissioned by MTT Agrifood Research Finland. In the draft version of the agri-environmental support scheme (from August 2013), the application limits of phosphorus and soluble nitrogen are more stringent compared to the conditions in programming period 2007–2013. The draft of the reformed Nitrates Decree proposes an amendment under which the average of the manure analysis and the table

Figure 22. In natural agricultural drainage, the channel is restored by using bends, flood plains, and structures that slow down the flow rate. Photo: Janne Heikkinen

value must be applied to nitrogen and phosphorus in cultivation planning.

Based on this data, the need for areas for manure application will increase by 19–49 % on poultry farms compared to the conditions valid in 2007–2013. On dairy farms, this area will increase by 26–48 %, and on pig farms, by 47–51 %. The interviewed farmers believed that they could find additional areas for manure application at a reasonable distance, and the total costs of manure application would thus not increase greatly. In case of many farms in this data, the receiving fields were closer than the most remote ones of the farmer's own fields, and the total costs of providing manure to another farm would be lower than the costs of applying it in the farm's own fields. In this case, the total manure application costs on livestock farms would be reduced by more than the price of the nitrogen and potassium purchased to replace the nutrients in manure. According to MTT Agrifood Research Finland, however, we can presume that in areas with high concentrations of livestock farming, the price of additional field areas will be high, and procuring additional areas for manure application will thus be expensive. For more information on the study conducted by MTT Agrifood Research Finland, see TEHO Plus project report no 5/2013.

5.8 Cultivation experiment of autumn-seeded flax

Flax was sown in Nousiainen in autumn 2012. This experiment was conducted in cooperation with Elixi Oil Oy. The purpose of the experiment was to establish wheth-

er autumn-sown flax overwinters in Southwest Finland. If it does, it could provide another new autumn-sown crop option for farmers and help to increase plant cover on fields in winter. As the harvest was late, the flax could only be sown at the beginning of September. In late November just before it snowed, the plants appeared viable, although small.

All flax plants died over the winter. On the basis of this experiment, at least, this species will not provide a new option for autumn sowing in the crop rotation. The plants might have overwintered much better if it had been possible to sow them considerably earlier in the autumn already in early August. A warm spell at the turn of the year left a layer of ice on the ground that contributed to the poor overwintering of the flax.

5.9 Using modified vermiculite in treating run-off water from an exercise yard

The initiative for using modified vermiculite in treating run-off water came from a farmer who was looking for a method of treating run-off waters from the exercise yard on their organic dairy farm. The objective was to examine the absorption in modified vermiculite of nitrogen contained in run-off waters from an exercise yard paved with asphalt, and in the future, possibly also study the containment of phosphorus in a suitable phosphorus removal substance. The experiment was carried out in 2011 in cooperation with the University of Turku, which was responsible for sample taking. Modified vermiculite has been tested for treating waste waters from a landfill, for example, but a similar study of treating run-off waters from an exercise yard had not been carried out in Finland previously. The content of nitrogen bound in vermiculite remained low in the experiment, which was at least partly due to the low volume of water from the yard and its low nitrogen content.

5.10 Phosphorus removal from run-off water using iron sulphate precipitation

The project continued in 2013 the maintenance of three iron sulphate dispensers in the catchment area of Paimionjoki River that started in the Active Wetlands project. The dispensers were used during the spring and autumn run-off periods. The project funded the laboratory analysis of water samples. The Paimionjoki River Association interviewed the farmers on whose land the iron sulphate dispensers were placed.

The price of removed phosphorus per kg was EUR 100–200 depending on the site. The price per kg would be smaller in a water system where the volumetric flow rates are low and the content of soluble phosphate in the water is high. The farmers participating in the study were not particularly enthusiastic about chemical methods. They were concerned over what will happen to the iron precipitate if it is not removed from the water system. The farmers were uncertain about the lowered water pH values downstream from the dispenser and the reuse of precipitated phosphorus in the field. For more information about phosphorus precipitation and the farmers' views, see TEHO Plus project report 3/2013.

5.11 Natural water retention methods

In the Pajulanjoki river basin in Somero, flood protection in the area and the possibilities of natural water retention methods in agricultural drainage were discussed with the landowners. With funding from the TEHO Plus project, a plan for run-off water retention in two tributaries of Pajulanjoki was drawn up. The measures used aim for slowing down the volumetric flow rate and containing solid matter.

When the plans for Pajulanjoki were being prepared, it turned out that environmentally favourable water engineering is currently not a particularly familiar concept even for engineers, who in this case needed detailed instructions. When preparing plans and contemplating the restoration of drains, it is important to look at the actual need to restore the channel and only focus on problem areas. The principles of naturally engineered agricultural drainage in particular should be part of engineer training to ensure that a sustainably developing network of channels can be achieved. Contractors also need training that would facilitate the practical implementation of plans and reduce any damage to the water system during the construction period.

5.12 Impacts of structural liming to improve soil

Together with Nordkalk Oy and MTT Agrifood Research Finland, a farm-level experiment was planned to examine the impacts of structural limestone on the ability of soil on arable land to retain phosphorus by improving the granular structure. As the late summer was extremely wet and rainy, the experiment did not go ahead in 2011. Neither could structural limestone be spread in the fields in autumn 2012 because of a late harvest and wet conditions. Only in autumn 2013 was it possible to apply structural limestone in the field of a farm in Pöytyä, and the results will thus only be available after the project's conclusion.

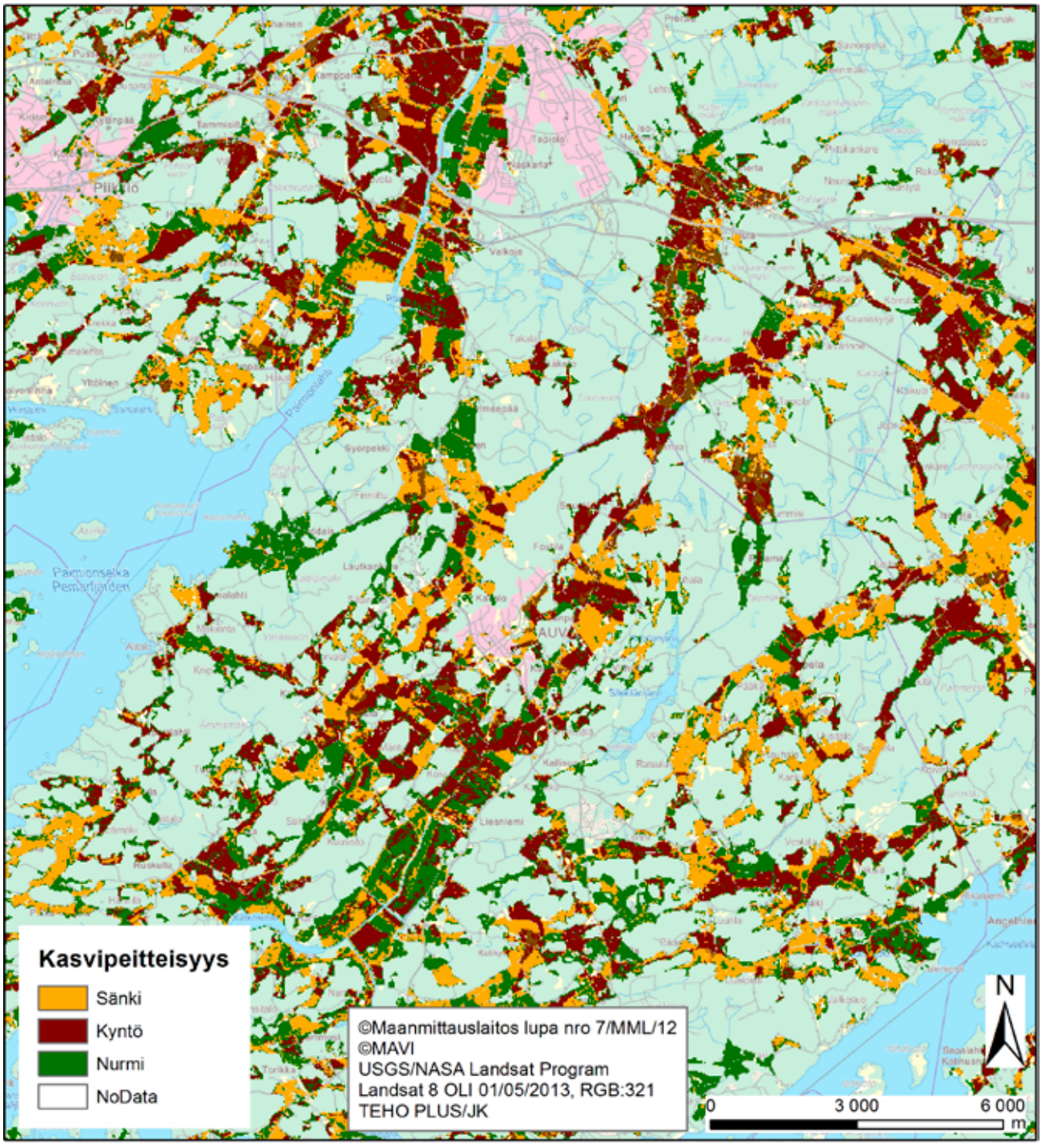

Figure 23. A model describing wintertime plant cover in Sauvo. Photo: Joni Koskinen

Figure 24. Arable land slope data from several provinces were presented at the Farmari 2013 agricultural fair in Seinäjoki. Photo: Aino Launto-Tiuttu

5.13 Satellite-based remote sensing of plant cover in winter

The project tested the application of satellite-based remote sensing to the mapping of plant cover in winter. The study was conducted in cooperation with the area of responsibility for Environment and Natural Resources at Southwest Finland Centre for Economic Development, Transport and the Environment, and its purpose was to establish if satellite-based remote sensing could be used to replace resource-intensive field supervision.

The results indicate that satellite-based remote sensing could be used for supervising plant cover in winter with rather a high level of accuracy if areas under reduced tillage do not need to be kept separate. In this case, reduced tillage would be included either in the tilled field area or the area with plant cover. However, satellite-based remote sensing does not produce exact surface areas of plant cover, but if the payment scheme for plant cover will be based on staggered payments, remote sensing data can be used for eliminating borderline cases. A map of plant cover in winter with classification based on satellite images would be a good tool that would also support supervisors in field work. The problem with satellite-based remote sensing is the uncertainty of whether or not images will be available at a given time. At the time the images are taken, the sky must be clear and the ground free of snow. Regardless of these challenges, the possibilities offered by the method in the future should be examined. For more information about the study, see TEHO Plus project report 4/2013: *Talviaikaisen kasvipeitteisyyden kaukokartoitus Landsat-satelliittisensorin kuvista* (Remote sensing of plant cover in winter based on Landsat satellite sensor images). The report was also forwarded to the remote sensing team at the Agency for Rural Affairs to support the planning of supervision.

5.14 RUSLE WMS

The project tested farmers' attitudes to the RUSLE model developed by MTT Agrifood Research Finland, which describes the soil's sensitivity to erosion. The farmers participating in the TEHO Plus project were e-mailed a link that gave them access to the RUSLE model results

for their parcels from their home computers. The farmers were asked to give feedback on the model and the functioning of the map service. Based on the feedback, whether farmers find applying new electronic materials to the practical work meaningful varies from one farm to another. However, we can state that the model, and online access to it, represent a new perspective in agricultural water protection as well as in managing cultivation practices. In the future, the use of the available geographical information is likely to become more widespread in supporting the practical work, but at the moment the technology does not yet enable the public utilisation of such data.

5.15 Presentation of digital slope maps

In the TEHO Plus project, a model that describes the slope of arable land in squares of 10 m x 10 m was devised. The model covered the entire area of Finland. The TEHO Plus project presented arable land slope maps produced on the basis of the digital model at agricultural fairs (OKRA 2012, Farmari 2013). Customers could navigate to an area of their choice and examine the field slopes. They could also access general planning data for the area and data on the status of water bodies. This way, landowners received direct information from the authorities about environmental issues in their area, and on the other hand, sensitivity to erosion of various fields could be more easily compared on the map. The feedback received was mainly positive, and fair visitors were interested in the data. They would have liked a similar service online to be able to access the data from their home computers. The fair customers received a glimpse of a future where digital material will be freely available and the planning of cultivation and environmental operations on the farm will increasingly be based on such data.

LESSONS LEARNT FROM THE EXPERIMENTS

- ***The impacts of individual methods should be assessed in a broader context.*** *Technical solutions in water protection should be planned so that the nutrient cycle is not broken. Similarly, the life span of individual methods should be taken into account to be able to assess the methods' overall environmental impacts.*

- ***A catch crop seeded after a cash crop must be sown at the latest in mid-August.*** *If the sowing takes place any later than this, an adequate catch crop cover is not guaranteed if the remainder of the growing season is not warm enough. A catch crop sown after the cash crop works well as follow-on for early vegetables. The catch crop protects the field surface from rain in the late summer and competes with weeds.*

- ***Catch crops are suitable as follow-on crops for cereals.*** *A follow-on crop that is seeded in the spring has time to grow and provide adequate cover after the cereal has been harvested and to fix nitrogen remaining in the field.*

- ***The release of nitrogen contained in lush vegetable mass for a subsequent cash crop should be studied in more detail.*** *Farmers do not take the soil's nitrogen resources into account by reducing the nitrogen fertilization for the following cash crop. It is not possible to show how much nitrogen the soil will release for the growing plants as the soil warms up on the basis of soil samples taken early in the spring.*

- ***Farmers are increasingly interested in the soil structure of their arable land and possibilities of improving it.*** *Deep-rooted plants, in addition to catch crops, are of interest to farmers. This is why deep-rooted plants and catch crops should not be kept categorically separate, as the same plant may represent both types.*

- ***Awareness of natural agricultural drainage should be raised.*** *More training is required to plan this type of drainage, and training materials about the principles of environmentally favourable agricultural drainage are needed. This would also help to increase awareness of alternative ditch restoration methods. The best way of illustrating the importance of containing run-off waters is demonstration sites.*

- ***Well-planned and thoroughly thought out experiments yield the most reliable outcomes.*** *An experiment should be repeated over several years, or the monitoring period should be long enough, to allow reliable conclusions to be drawn about the possibilities offered by the methods in question. Even small-scale experimentation takes up a surprising amount of working time.*

- ***When planning experiments with farmers, the trials should be made as practical as possible*** *to ensure that the farmers can easily implement them using their existing equipment.*

Figure 25. The project had a stand focusing on environmental themes at various farmers' events. Photo Aino Launto-Tiuttu

6. THE PROJECT'S OBJECTIVES AND THEIR ACHIEVEMENT

The project got off to a slow start. The original plan was to launch it in early 2011 and conclude it at the end of 2013. The application for project funding was based on this schedule. However, the project only got to a gradual start in June 2011, and it was unable to employ a single person on funding provided by the Ministry of the Environment in the entire year 2011.

In the course of the project, it was necessary to rethink its activities and division of labour several times due to the frequent turnover of project staff. Originally, the project was to have eight employees for its entire term, but this could only be achieved for one third of the period. The project was granted an extension until the end of October 2014, at which time one to three persons will be employed.

The delays in completing the Rural Development Programme and the reform of the Nitrates Decree impeded the completion of material for farmers and advisers. It would have been preferable to include up-to-date information on the new support schemes and the Nitrates Decree in the project publications, but no decisions had been made on these schemes by the end of 2013.

The project achieved the objectives set for it, excluding two exceptions. A national pilot training programme was set up for agri-environmental advisers, a model for farm-specific environmental advisory services was created, and material was prepared for both farmers and advisers. Geographical information was adapted for farm and parcel specific use, but a location now needs to be found for all the data where it would be easily accessible for advisers and farmers. In order to spread good practices, the project website contains ten interviews with farmers that describe the agri-environmental measures completed on their farms. The project has submitted a number of proposals to the working groups preparing the agri-environmental support scheme and the Nitrates Decree, and the material has also been uti-

lised in the preparation of the Marine Strategy. Additionally, the project has organised environmentally-themed seminars for farmers.

As an exception to the project plan, the project did not prepare a regional nutrient use plan, as Southwest Finland Centre for Economic Development, Transport and the Environment set up a project titled General nutrient use plan for the Archipelago Sea Area, which prepared a relevant pilot plan and proposals for measures. However, nutrient recycling played a major role in practical advice provision on farms, and the project devised a counter that farmers can use to compare the impacts of using manure and commercial fertilizers on the farm's finances. Bioenergy studies have been conducted in various projects at the national level, and it was thus felt that the topic did not offer new areas of interest for the current project.

The project found cooperation between various projects and actors crucial, and it organised the first national forum for environmental projects in Tampere. Coordination of project cooperation has now been assigned to the Rural Network Unit. News about each project's achievements is exchanged at the events, which improves information flows and supports networking between projects.

Projects must be familiar with farmers' operation and needs and strive to work as closely together with them as possible to ensure that project operations will also be viable after the conclusion of the project. An environmental project should work together with parties who are already involved in advice provision for farms, making sure that the available methods and tools are familiar and that environmental issues can also be incorporated in other advice after the project ends.

The project's background organisation must have adequate resources for implementing and administrating the project. Even if the project has its own staff, the project administrator's input is needed to guarantee successful project implementation. The support and knowledge of the background organisation is required in particular in the areas of communication, financial management and procurements to make sure that the financial aspects and procurements of the project can be managed smoothly. Communication is an important part of the project, and the administrating organisation's support is thus needed in this area. If the project is administrated by a party with a large expert organisation, it should also be possible to draw on the expertise of the background organisation in the project, and on the project's expertise in the background organisation. This would put the competence of the background organisation at the project's disposal, and the project would not be left alone to solve problems to which others already have answers. This aspect is highlighted especially if there is a great turnover of the project staff. When project staff changes, the background organisation always represents permanence and is in charge of getting the wheels in motion when things change.

The environmental administration is a good background organisation for a project that exploits various types of geographical information. Its employees have access to the environmental administration's geographical information database, in which data produced by several public organisations are stored in a compatible format. This is a big advantage in that it saves time and makes possible the development of a geographical information application.

7. CONCLUSIONS - WHAT NEXT?

Finland is a country with a large surface area, and managing agri-environmental issues in its various parts requires varying measures that depend on the regional special features. Different guidelines are required for the cultivation of acid sulphate soils, organic soils and clay soils. In addition, the production structures of various regions set their own requirements to the environmental advice. The scarcity of grasslands suitable for crop rotation in Southern Finland is an environmental risk, especially as precipitation outside the growing season is increasing, and soil and nutrients are transported to the water systems with the run-off. On the other hand, environment payments have promoted reduced tillage and thus plant cover in winter. The varying regional challenges can be faced by the correct targeting of measures on each farm, supported by high-quality environmental advice.

7.1 Sustainable farming through environmental advice

High-quality environmental advice is an effective way of promoting more sustainable farming. A comprehensive approach and integrating the environmental perspective in other activities on the farm increase the impact of the advice. Providing advice for small groups is cost-effective, and group advice is likely to become more widespread. Farmers are interested in exchanging experiences, and the adviser has a guiding and inspiring role in the group. Good practices can be disseminated widely and rapidly in a group, and advisers can also learn from this process and spread the new practices further. Group members teach each other, and the group offers peer support to its members.

The key achievement of the TEHO Plus project is developing a model for environmental advice provision together with farmers and in collaboration with other environmental projects. The project has developed a training package for environmental advisers that is applicable nationwide, and created a platform on which environmental advisory services can grow.

The project's experiences indicate that farm-specific environmental advice can influence practical cultivation measures on the farm. During a farm visit, the adviser and the farmer can discuss many ideas for measures that are only taking shape and that can be developed during the discussion. In other words, advisory services also have long-term impacts.

7.2 Organising access to materials for farmers and advisers

Up till now, no uniform material and tools existed for the provision of agri-environmental advice. The Environmental handbook for farms and the Environmental test developed by the TEHO Plus project respond to this shortfall. Advisers and farmers everywhere in Finland have access to this material. As an adviser visits a farm, the environmental test can lead the conversation to issues that are important for the farm and suggest recommended measures. The Environmental handbook, on the other hand, provides the farmers and the adviser more detailed information about the suggested measures. The same measures may benefit both the farm's finances and the environment. Careful planning of the farm's operation is needed to ensure this.

The TEHO Plus project has been a pioneer in drawing on geographical information for the provision of agri-environmental advice and guided many other parties that provide environmental advice in the exploitation of this information. The project prepared various types of electronic map materials for the needs of agri-environmental advice, including a slope model that covers the entire country. A practical achievement in the utilisation of geographical information is that the proposal for the geographical targeting of measures in the new agri-environmental support scheme is based on map data prepared by the project.

A dedicated environmental portal is needed for advisers and farmers, with a map service and environmental material arranged by region. Experiences gathered in the project indicate that both farmers and advisers would find the Vipu service the best location, at least for the maps. For the rest of the material, a single location must be found where the material can also be updated. The project considers the website www.maaseutu.fi a possible location for the environmental portal.

Nutrient balances and their reference values are an important tool for advisory activities that, so far, has not been fully exploited. The project continued the collection of nutrient balance data on the farms, which had started during the preceding TEHO project, and thus put together an extensive set of reference data on nutrient balances. When advisers met farmers to provide advice, the nutrient balances sparked a lot of discussion. The nutrient balance data (without farm identifiers) collected by the project is now being used by MTT Agrifood Research Finland to provide as comprehensive a set of data as possible for a study aiming to determine nutrient balance reference values. The reference values will be needed as soon as possible as a tool for advisers.

7.3 Knowledge and motivation from adviser training

Farmers would prefer practical advice that takes into account the entire farm operation, rather than advice focusing on a single issue. This sets major demands on the skills and expertise of the environmental advisers. The advisers need psychological sensitivity in order to also motivate farmers in using a new, environmentally friendly operating model. In addition to teaching skills related to the substance matter, environmental advisers should be trained to motivate farmers to implement environmental measures.

In the future, the training for environmental advisers will be arranged by the Agency for Rural Affairs. In practice, training related to biological factors relevant to farming could be provided by a handful of regional actors, including educational institutions or advisory organisations. Experiences of the pilot training for advisers organised by the TEHO Plus project and adviser feedback should be exploited in the planning of future adviser training.

7.4 Consideration for regional special features

As a result of natural conditions, agricultural policy and market development, Central and Northern Finland have become major areas for dairy farming and other cattle farming. On the clay fields of Southern Finland, farmers concentrate on producing cereals and special crops, while grasslands are not a natural part of the crop rotation. Plant cover in winter is now being increased by measures under the agri-environmental support scheme. Increasing plant cover by means of perennial crops and catch crops and introducing direct seeding is important in order to reduce erosion and to increase

Figure 26. Environmental management can also become a social event. In the photo, a group of volunteers building a fence is having a coffee break. Photo: Aino Launto-Tiuttu

biodiversity, especially in Southern Finland where there are few grasslands. The increased leaching risk of soluble phosphorus in grasslands adds its own challenges to the agri-environmental practices, however.

The concentration of livestock farms also results in a concentration of nutrients in certain regions. Pig and poultry farming centers around Southwest and Western Finland, while livestock farming is mainly found in Central and Northern Finland. The application of manure is restricted by high phosphorus levels of fields and the transport distances. Livestock farms could provide manure for crop farmers who need it, but they may be unwilling to give up the nitrogen and potassium contained in the manure. Livestock farms have to replace the nitrogen and potassium they hand over with commercial fertilizers. Based on interviews conducted during the project and according to a calculation prepared by MTT Agrifood Research Finland for the project, however, a livestock farm did not incur additional costs for purchasing mineral nitrogen. Presumably, in regions with a high concentration of livestock farming, the price of additional land is high, and acquiring additional areas for manure application is also expensive.

Due to the forthcoming agri-environmental support scheme and the reformed Nitrates Decree, the area needed by livestock farms for the application of manure will increase. This will bring additional pressures to transport manure over longer distances. According to interviews with contractors conducted during the project, long transport distances during the short period available for spreading manure is a major cost factor. If manure could be transported to remote storage tanks outside the peak season, this would bring savings on transport times in the busy application season. Crop farmers should also be entitled to investment payments when setting up remote storage facilities for manure. Cooperation between farms will be needed to get the nutrients contained in manure to beneficial use in parcels where they are needed.

By separation, the dry fraction containing phosphorus and the liquid fraction containing nitrogen can be separated in slurry. The dry fraction can be economically transported to parcels that are located far away from the farm centre and that usually have a lower phosphorus figure than parcels closer by. A separator is an expensive investment for a single farm, which is why the separation of slurry has not become widespread. In the future, contractor activities may make separation possible for an increasing number of farms.

7.5 Farms produce food and maintain biodiversity

The transparency of Finnish food production and consumer awareness of food production should be increased to enhance the appreciation of sustainable farming. Consumers should be informed more widely of the environmental measures already completed on farms. They can thus be made aware of the environmental impacts of food production, which also encourages farmers to continue and step up their efforts for the environment.

The focus of environmental protection in agriculture has traditionally been on water protection. The importance of water protection should not be underestimated, but the results are slow to materialise and also greatly dependent on weather conditions, which are beyond the farmers' control. To improve their impact, the measures should be comprehensive and cover adequate areas in river basins. A farmer implementing an individual water protection measure may become frustrated as the results are not necessarily obvious, and demands for reducing leaching of nutrients are getting more prominent in the media. The advantage of biodiversity measures is that the results are easy to see and achieve. In the future, agri-environmental measures should focus on multifaceted impacts. When assessing the impacts of measures, the climate, biodiversity and water protection should all be taken into account.

Farmers will take part in measures that they feel are workable on the farm and useful both for the farm and the environment. The objectives of environmental protection set for farmers must also be achievable in practice to ensure that the task is not impossible from the start. Water protection and biodiversity issues should be considered as a whole, also taking into account the farm's operation. Finnish farms promote rural diversity, enhance the viability of the countryside and maintain the rural landscape structure. Sustainable farming and a well-managed rural landscape maintain ecosystem services, the effectiveness of which is a precondition for all activities in society.

APPENDIX 1

Proposals submitted by the TEHO Plus project to the working groups preparing the agri-environmental support scheme in the forthcoming Rural Development Programme (2014–2020) and the reform of the Nitrates Decree. The proposals can also be found at www.ymparisto.fi/tehoplus

- *Proposal on the structure of the agri-environmental support scheme to the main working group preparing the scheme in October 2011.*

- *Utilisation of geographical information for environmental protection in agriculture, a proposal to the sub-group on information systems of the working group preparing the agri-environmental support scheme in February 2012.*

- *Nutrient balances and utilisation of nutrients, recommendations of the TEHO Plus project to the sub-group on nutrients in February 2012.*

- *Using geographical information systems to detect biodiversity values of fields: Halikonjoki river basin as an example, or the introduction of the so-called LUMO index, a proposal to the sub-group on biodiversity preparing the agri-environmental support scheme in April 2012.*

- *Proposals of the TEHO Plus, Järki and RaHa projects on nutrient measures under the agri-environmental support scheme to the sub-group on nutrients in April 2012, and also the report on efficient nutrient use and fertilization determined by crop needs as the perspective of the TEHO Plus project on the agri-environmental support scheme.*

- *Targeting of environment management grasslands by methods based on the geographical information system, a proposal to the working group on plant cover in June 2012.*

- *Proposals of the TEHO Plus and VELHO projects on environmental investments and agri-environment payments to the sub-group on treatment of run-off waters and environmental investments in June 2012.*

- *The role of buffer zones grasslands in support for increasing organic matter, a proposal to the sub-group on treating run-off waters in November 2012.*

- *TEHO Plus project's environmental advisory service model as a targeting tool, a proposal to the working group on targeting in November 2012.*

- *Areas with restrictions on the surface application of cattle manure determined on the basis of parcel slopes obtained by using a geographical information system; example for the working group preparing the Nitrates Decree, December 2012.*

- *Report on the comparison and use of elevation models in the application of the Nitrates Decree to the working group preparing the Nitrates Decree in May 2013.*

- *Report on identifying Natura fields and fields in immediate vicinity of Natura fields in the parcel register to the subgroup preparing the agri-environmental support scheme in September 2013.*

- *Report to provide background for the discussion on targeting to the targeting sub-group preparing the agri-environmental support scheme in September 2013.*

- *A proposal concerning the determination of organic content in soil by loss-on-ignition test to the sub-group on nutrients in September 2013.*

- *A report on the possibilities offered by data on the status of waters and targeting tools to the sub-group on targeting preparing the agri-environmental support scheme in October 2013.*

- *Report on the use of data on the status of waters in the targeting of measures, river basins/administrative boundaries to the sub-group on targeting in October 2013.*

APPENDIX 2

Publications and reports of the TEHO Plus project.
The publications and reports can also be found on the project website at www.ymparisto.fi/tehoplus > julkaisusarja

TEHO Plus project publications	***Publication no***	***Author***
Maatilan ympäristökäsikirja	*1/2013*	*TEHO and TEHO Plus projects employees*
Viherlannoitusopas	*2/2013*	*Jouko Kleemola*
Gårdens miljöhandbok	*3/2013*	*TEHO and TEHO Plus project employees*
Huolehdi pellostasi – vinkkejä vuokranantajalle ja vuokralaiselle	*4/2013*	*Susanna Kaasinen and Airi Kulmala*
Gröngödslingsguide	*5/2013*	*Jouko Kleemola*
Kruusilan kosteikko - yhteistyön tulos	*6/2013*	*Susanna Kaasinen*
Ta vara på din åker - tips för arrendegivaren och arrendatorn	*1/2014*	*Susanna Kaasinen*
Maatilaluonnon monimuotoisuus – pientareilta pelloille, kedoilta kosteikkoihin	*2/2014*	*Kimmo Härjämäki*
Kohdentamalla suurin hyöty maatalouden ympäristönsuojeluun – TEHO Plus -hankkeen (2011-2014) loppuraportti	*3/2014*	*Aino Launto-Tiuttu, Janne Heikkinen, Joni Koskinen, Eevakaisa Lankinen, Eriika Lundström, Satu Puustinen, Jaana Röytiö, Elisa Vartiainen, Silva Wilander and Katariina Yli-Heikkilä*
Esikasvin vaikutus viljojen, öljykasvien ja perunan viljelyyn	*4/2014*	*Marjo Keskitalo, Kaija Hakala, Erja Huusela-Veistola, Heikki Jalli, Marja Jalli, Lauri Jauhiainen ja Sari Peltonen*
Ekosysteemipalvelut maatiloilla	*5/2014*	*Ilppo Vuorinen, Janette Fröberg, Janne Heikkinen, Juha Hiedanpää, Aino Launto-Tiuttu ja Timo Vuorisalo*
Kerääjäkasvit - hyötyä viljelijälle ja ympäristölle	*6/2014*	*Riitta Lemola, Elena Valkama, Terhi Suojala-Ahlfors, Hannu Känkänen, Eila Turtola, Janne Heikkinen ja Kari Koppelmäki*
Perunan, porkkanan ja sokerijuurikkaan viljelykiertojen vaikutukset kasvintuhoojiin ja ravinnetaseisiin	*7/2014*	*Asko Hannukkala, Tapio Salo ja Janne Heikkinen*
Fånggrödor - nytta för odlaren och miljön	*8/2014*	*Riitta Lemola, Elena Valkama, Terhi Suojala-Ahlfors, Hannu Känkänen, Eila Turtola, Janne Heikkinen ja Kari Koppelmäki*
Targeted measures bring the greatest benefits for environmental protection in agriculture	*9/2014*	*Aino Launto-Tiuttu, Janne Heikkinen, Joni Koskinen, Eevakaisa Lankinen, Eriika Lundström, Satu Puustinen, Jaana Röytiö, Elisa Vartiainen, Silva Wilander ja Katariina Yli-Heikkilä*

TEHO Plus project reports	***Raportin nro***	***Author***
Maatalouden ympäristöneuvojakoulutus -pilotti	*1/2013*	*Anna Setälä*
Tilakohtainen ympäristöneuvonta TEHO- ja TEHO Plus -hankkeiden aikana ja siitä saatu palaute	*2/2013*	*Eriika Lundström and Satu Puustinen*
Viljelijähaastattelut – Paimionjoen rautasulfaatti-annostelijoiden käyttökokemukset	*3/2013*	*Päivi Joki-Heiskala*
Talviaikaisen kasvipeitteisyyden kaukokartoitus Landsat-satelliittisensorin kuvista	*4/2013*	*Joni Koskinen*
Ympäristökorvausjärjestelmän ja nitraattiasetuksen uudistus: lannoitusrajojen muutosten vaikutus karjatilojen lannanlevitysalaan ja kustannuksiin	*5/2013*	*Olli Niskanen, Pellervo Kässi and Kauko Koikkalainen*
Maatalouden ympäristötukineuvonnan hyötyjen arviointi	*1/2014*	*Joel Karlsson*
Tilakohtainen neuvonta maatilojen ympäristönsuojelun edistäjänä	*2/2014*	*Satu Paananen*
Liedon Vuohenojan eroosio ja aineskuljetus	*3/2014*	*Elisa Mikkilä*
Viljely muuttuvassa ilmastossa – miten peltoviljely sopeutetaan onnistuneesti	*4/2014*	*Kaija Hakala, Pirjo Peltonen-Sainio, Katariina Yli-Heikkilä*
Vuohenojan vedenlaatumittausten tuloksia	*5/2014*	*Joni Koskinen*
Att odla i förändrat klimat – hur åkerbruket kan anpassas framgångsrikt	*6/2014*	*Kaija Hakala, Pirjo Peltonen-Sainio, Katariina Yli-Heikkilä*
Jatkuvatoimiset vedenlaatumittarit vesistökuomituksen arvioinnissa	*ELY-keskus Raportteja 31/2014:*	*Vartiainen, Elisa; Yli-Renko, Maria; Laamanen, Leena; Elo, Riikka; Koskinen, Joni*

For other reference material, see also www.ymparisto.fi/tehoplus > ympäristökäsikirja

Maatilan ympäristötesti
Miljötestet

Sopimusmallipohja lannanluovutukseen
Avtalsmall för överlåtelse av stallgödsel mellan landsbygdsföretagare

Pientareet ja kaistat (päivitetty TEHO-hankkeen aineistosta)

Vesistöalueen numeron hakeminen

www.ymparisto.fi/tehoplus > laskurit
Phosphorus counter
Fertilizer and manure counter
Nutrient balance counter

DESCRIPTION PAGE

Publisher:	TEHO Plus project			
Date of publication:	September 2014			
Authors:	Aino Launto-Tiuttu, Janne Heikkinen, Joni Koskinen, Eevakaisa Lankinen, Eriika Lundström, Satu Puustinen, Jaana Röytiö, Elisa Vartiainen, Silva Wilander & Katariina Yli-Heikkilä			
Name of publication:	Targeted measures bring the greatest benefits for environmental protection in agriculture final report of the TEHO Plus project (2011–2014)			
Publication series name and number:	Publication of the TEHO Plus project 9/2014			
Abstract:	Targeted measures bring the greatest benefits for environmental protection in agriculture final report of the TEHO Plus project (2011–2014). Particular priority areas of the project activities included creating a training package for agri-environment advisers and testing it, farm-specific advisory services and exploitation of experiences of advice provision, putting together an information package of agri-environment issues, farm-level experiments, and development of water quality monitoring. The recommendations issued by advisers on targeting environmental measures were based on utilising geographical information material and nutrient balances. The project was implemented in cooperation by Southwest Finland Centre for Economic Development, Transport and the Environment, MTK-Satakunta and MTK-Varsinais-Suomi. The project received funding from the Ministry of Agriculture and Forestry and the Ministry of the Environment. Participating farmers, with whom environmental advice was developed and experiments were carried out, were important partners for the project. The operating area of the project was Satakunta and Varsinais-Suomi in Southwest Finland, but its outcomes can be exploited nationally. A national perspective was ensured by close cooperation with actors in different provinces. This final report describes project experiences and outcomes including environmental advisory services, training of agri-environmental advisers, farm visits and the feedback received from farmers on agri-environmental advice, development of water quality monitoring, experiments and project work.			
Keywords:	agriculture, environment, environmental projection, water protection, agricultural advice, targeting, water quality			
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KUVAILULEHTI

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Tekijät:	Janne Heikkinen, Joni Koskinen, Eevakaisa Lankinen, Aino Launto-Tiuttu, Eriika Lundström, Satu Puustinen, Jaana Röytiö, Elisa Vartiainen, Silva Wilander & Katariina Yli-Heikkilä			
Julkaisun nimi:	Kohdentamalla suurin hyöty maatalouden ympäristönsuojeluun – TEHO Plus -hankkeen (2011-2014) loppuraportti			
Julkaisusarjan nimi ja numero:	TEHO Plus -hankkeen julkaisu 9/2014			
Tiivistelmä:	TEHO Plus, Maatalouden vesiensuojelun tehostaminen -hanke jatkoi TEHO-hankkeen aloittamaa työtä vuosina 2011-2014. Hankkeen toiminnan painopistealueina ovat olleet maatalouden ympäristöneuvojien koulutuspaketin luonti ja koulutuksen kokeileminen, tilakohtainen neuvonta ja neuvonnasta saatujen kokemusten hyödyntäminen, tietopaketin kokoaminen maatalouden ympäristöasioista, tilatason kokeilutoiminta ja vedenlaadun seurannan kehittäminen. Ympäristötoimia on neuvonnassa suositeltu kohdennettavaksi paikkatietoaineistoja ja ravinnetaseita hyödyntäen. Hanke toteutettiin Varsinais-Suomen ELY-keskuksen, MTK-Satakunnan ja MTK-Varsinais-Suomen yhteistyönä. Hanketta rahoittivat maa- ja metsätalousministeriö sekä ympäristöministeriö. Tärkeänä kumppanina hankkeessa olivat yhteistyöviljelijät, joiden kanssa kehitettiin ympäristöneuvontaa ja toteutettiin kokeilutoimintaa. Hankkeen toiminta-alueena oli Satakunta ja Varsinais-Suomi, mutta hankkeen tulokset ovat valtakunnallisesti hyödynnettävissä. Valtakunnallista näkemystä haettiin tiiviillä yhteistyöllä eri maakuntien toimijoiden kanssa. Tähän loppuraporttiin on koottu hankkeen kokemuksia ja tuloksia ympäristöneuvonnasta, ympäristöneuvojien koulutuksesta, tilakäynnistä ja viljelijöiden antamasta palautteesta ympäristöneuvonnasta, vedenlaadun seurannan kehittämisestä, kokeilutoiminnasta sekä hanketyöstä.			
Asiasanat:	maatalous, ympäristönsuojelu, ympäristöneuvonta, kohdentaminen, neuvojakoulutus, vedenlaatu, kokeilutoiminta, ympäristökäsikirja, ympäristötesti			
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Julkaisun kustantaja:	TEHO Plus -hanke			

The project TEHO Plus: More effective water protection in agriculture continued the work started by the earlier TEHO project in 2011–2014. The priority areas of the project were creating a training package for agri-environmental advisers and testing it, farm-specific advice and drawing on the experiences of advice provision, putting together an information package about agri-environmental issues for farmers and advisers, farm-level experiments, and developing water quality monitoring. The project also produced tools for national environmental advice provision, including the Environmental test for farms.

The farmers with whom environmental advice was developed and experiments were carried out were important partners in this project funded by the Ministry of Agriculture and Forestry and the Ministry of the Environment. This final report describes the experiences and outcomes of the project.

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More effective water protection in agriculture

TEHO Plus