



# Quantification of ecological services for sustainable agriculture

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Managing semi-natural habitats and on-farm biodiversity to optimise ecological services  
Collaborative Project

**Deliverable D3.5**  
**Report on “on-farm demonstrations” of the ecosystem services**



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## **This deliverable relates to Task 3.6 On-farm demonstrations**

- Task 3.6.1 Extension services and farmers' organization
- Task 3.6.2 On-farm demonstration

Authors:

Louis Sutter and Philippe Jeanneret (Agroscope Reckenholz-Tänikon Research Station, Switzerland)

Jozsef Kiss (Szent Istvan University, Hungary)

Contributions to this task were made by all case study partners.

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## 1 Executive summary

On-farm demonstrations and farmers training were conducted in 8 countries by project Partners from 2013 to 2016.

Though key targeted stakeholders were farmers, several Partners invited broader range of stakeholders (advisory people), or the events were sometimes linked to other ongoing research and development activities. In some cases, the press has been invited to increase advertising. One message from this is that linking specific demonstrations to other typical farmers' events may result in a win-win case, thus might be considered in the future.

Reports by Partners showed that SNH and functional biodiversity in general may be interesting for farmers but specific problems (for instance dealing with an economic pest, weeding potential of flowering strips, etc.) that are usual relevant topics for farmers attract them to such demonstration meetings. If (as expected in co-innovation programs) farmers are involved in the project preparations and problem formulations, they can contribute to field trial development, etc., they will feel themselves as important participants of and contributors to the knowledge and capacity development process. The participatory components (active involvement of farmers in the training and learning process, smaller group work and discussions, inputs by farmers in terms of topic selection, etc.) of the on-farm demonstrations were strengthened.

Based on reports by Partners, it is likely that direct and immediate/short term solutions to problems and benefits are more attractive for farmers than long term perspectives. However, ESs by SNHs and farming system approach (including off crop SNHs) should be placed into a broader temporal and spatial context, as medium or longer-term benefits can be expected only in such a context. Therefore, certain institutionalization of on-farm demonstrations and capacity development of farming communities seems to be desirable in the future.

## **2 Introduction and aims of on-farm demonstrations**

Farmers and farming communities are key actors of the practical implementation of innovations, execution of the policy related to sustainable rural development, food and feed safety, IPM of crops, etc. including the preservation and improvement of Ecosystem Services on their farms. Critical to this process is the need to raise awareness amongst farmers of innovation and policy and to invite them to try to adopt these on their farm, in other words to be a partner in the process. However, the “conventional” one-way information flow from researchers, advisors to farmers and subsequent knowledge development can only partly take into account the complex capacity development of farmers to find appropriate answers and solutions.

The QuESSA project with establishment of on-farm demonstrations for selected ecosystem services (pest control, pollination, soil fertility etc. improvement) by project Partners from various regions of the EU offered unique possibilities to work with stakeholders including farmers and learn from this cooperation for future improvement.

The on-farm demonstrations were organized in different regions (e.g. natural conditions), crops, pest problems, regional characteristics), in different socio-economic conditions, under various advisory/extension systems, thus offered “fit to purpose” regional solutions. The experiences that people gained along the on-farm demonstrations have been collected and will be shared within and outside of the project so that the broad public may benefit of it.

The "on-farm demonstrations" aimed at increasing farmers' awareness of ecosystem services, ecological functions and biodiversity and should improve capacity of farmers' communities to benefit from these services by future training activities.

## **3 Individual reports from case studies**

### **3.1 Italy**

In order to define, with a participatory approach, the aims and the contents of the demonstration activities, the two QuESSA Italian partners managing the case study on pollination in sunflower (i.e. Scuola Sant'Anna and CiRAA, University of Pisa) first organized on January 14th, 2015 a participatory workshop with 10 farmers involved in the experimental activities. The meeting, held at CiRAA headquarter in San Piero a Grado, Pisa, had the objective of constituting a focus group on the benefits and constraints provided by SNHs in the local context.

The focus group members were selected among the most representative farmers of the Pisa plain area. Actually, farmers are the most important actors in shaping and managing the rural landscape in the region and thus were considered as the most relevant stakeholders to be involved in demonstrations. The extent of the land managed by those farmers can be considered as representative of the majority of arable land in the region as those farmers are also contractors, taking care of neighboring farmer's fields.

Our farmers express almost no interest on the effects of off-crop SNHs on their own business nor on local society. This was also because they felt like being left alone by public governance bodies in

managing SNHs (e.g. for regular cutting/pruning/mowing of road margins, ditches or water channels), and this represents a significant cost for them both in terms of time and money. What was clearly attracting their attention was the inclusion of in-crop SNHs (e.g. cover crops, intercropping, field margins) in their cropping systems. This was basically due to the fact that these typologies of SNHs could be able to directly promote crop growth and soil fertility through, for instance, the release of biologically fixed N, protection of soil against water erosion, C sequestration from the atmosphere and C storage into the soil. Furthermore, SNHs like cover crops have strong link to the financial support provided within the current CAP to farmers adopting good agronomical practices able to prevent the risk of environmental pollution (e.g. EFAs, agro-environmental schemes under the rural development plans, etc.).

To show the potential beneficial effects of cover crops on soil fertility but also on functional biodiversity (i.e. pollinators), two demonstration events were organized in Spring 2016 at CiRAA (14/03/2016) and at Martello Nadia Farm (27/05/2016).

In the first event, a full day meeting with about 30 stakeholders (farmers, advisors, students) was organized at CiRAA Research Centre of University of Pisa. Farmers were mostly organic growers of arable crops and field vegetables coming from Tuscany, but also from other Italian regions (e.g. Lombardia). In the first half of the day, a plenary room session was held with presentations from scientists involved in QuESSA, in order to give an overview on the issues of soil fertility mostly relevant for farmers and that could be potentially improved by cover crop cultivation. Practical tools for soil quality assessments were also demonstrated to the attendees with the aim of providing them with simple methods for self-assessment of soil fertility. In the afternoon, the participants were transferred to the MASCOT (Mediterranean Arable System COmparison Trial) site, where a training session was organized on adjacent fields where winter cover crops (i.e. a mixture of barley and vetch in full vegetative growth stage) were grown or not. The participants were divided in two small groups who had to assess different aspects of soil fertility affected by the presence or absence of the cover crops. The assessment tools used for this practical session were:

- the spade test (VESS methodology): a simple but comprehensive methodology for the assessment of soil structure and porosity, stratification of organic matter along soil profile, qualitative assessment of plant rooting and quantification of presence of earthworms and other beneficial soil animals
- the pitfall traps: placed on the centre of the fields and at decreasing distances from the hedgerows separating organic and conventional fields. The pitfalls were installed two days before the meeting date with the aim to catch carabids, staphylinids and spiders, considered as indicators of soil biodiversity as predators
- the mat traps: placed close to the pitfalls, in order to catch slugs present on the fields and able to feed several other predators

Each group was equipped with the necessary tools for the assessment (e.g. evaluation forms, guidelines, reference pictures, etc.) and at the end of the day the results of their assessment were jointly discussed directly in the fields. The main result of the day was that farmers became more aware on the crucial importance of preserving soil fertility (above all physical and biological aspects). The cover crops showed a clear potential for sustaining soil fauna and also attracting biodiversity coming from the surrounding

fields at certain periods of the year (e.g. in winter) when the soils are usually not so attractive for it (e.g. bare soil without no cover crops).

The second event was organized at the farm selected as demonstration site for UNIPI and SSSA (i.e. the Martello Nadia commercial farm, Ceppaiano, Pisa). The farm, having a total acreage of about 300 ha, has a long experience on conservation agriculture techniques. The managers are actually two agronomists (father and son) highly skilled in cover crop cultivation and reduced tillage, and were also involved in the activity of the sunflower-pollination case study and in the focus group. In two adjacent fields of about 5000 m<sup>2</sup> each two different cover crops (i.e. a mixture of hairy and common vetch, and a mixture of white and squarrosom clover) were winter grown and left alive until flowering, in order to observe the species-specific attractiveness of several specimens of pollinators (mainly wild bees, bumblebees and honeybees). Five farmers and a bee-keeper attended the event. The low level of attendance was mainly due to high level of business experienced by the invited farmers in that specific period of the year, with many of them dealing with hay-making and spring crop sowing. The participants were first introduced to basic identification of bees and main genera of the most common wild bees in the area. A PhD student from SSSA showed the participants many pictures representing the most frequent bees in the area and also some exemplars from entomological collections. In the second half of the morning, the farmers were equipped with nets, an identification booklet and evaluation sheets and brought to the fields where they did practical training on how to sample and account pollinators. Two different methodologies were used: standardized transect walks and observation plots. In any case, the farmers learnt how to distinguish bees from other insects present on the plants and, with the help of the researchers, tried also to identify the most important species. Concerning the contribution of each cover crops species, the vetches resulted to be much more attractive for pollinators than the clovers, mainly due to the fact that vetches were in full flowering stages, whilst the flowers of the clovers were already in an early senescence stage.

## **3.2 Hungary**

### **3.2.1 Background**

The aim of “On farm demonstration” activity is to increase farmers’ awareness for ecosystem services, ecological functions and biodiversity, and improve capacity of farming communities to benefit from these services.

### **3.2.2 Activities conducted**

Altogether six training meetings were held in three regions in Hungary in 2015-2016 by SZIE.

Quessa research activities were conducted in Jasz-Nagykun-Szolnok County. In this region in hall training meetings were held for two different groups in February, with the aim to inform farmers about Quessa purposes and activities. On these meetings scientific questions of Quessa project, were “translated” to the language of farmers and linked to the EU CAP-greening program and ecosystem services provided by SNHs. During these meetings we have reached about 40 farmers. Field activities started in the beginning of June in this region; 21 farmers were invited, and nine of them were present. Three persons from SZIE

held the training (M. Szalai, F. Toth and J. Papp Komaromi), and one of our PhD. students was also present.

Meeting started with a short summary of Quessa activities focusing on biological pest control service. As next step, farmers filled in the pre-training questionnaire (Appendix 1). Then the field activities were started with the farmers: sentinels (Ephestia eggs and Calliphora larvae) and Oulema leaf damage on the isolated and open plants, i.e. pests isolated from or exposed to their natural enemies, were demonstrated to farmers. The damage of Oulema adults and larvae were discussed; moreover, the relationship of pest damage and presence of SNHs adjacent to the fields as well as the importance of SNHs on landscape level were also covered.

The second field activity took place in July, when 28 farmers were invited, and three farmers were present. From SZIE two trainers (J. Papp Komaromi and F. Toth) and two of our students were participating. Field activities focused on the pollinators and the flowering field edges. Main aims of QuESSA and methodology of the assessments were also described. During field activity farmers also observed the beneficial arthropods being present in the SNHs. An evaluation training meeting was held in early December of 2015 with the farmers group.

On farm demonstration and training was held in two other regions as well (Bekes and Tolna County). In Bekes County nine, while in Tolna County eleven farmers attended the meeting. The meeting was focusing on the pollinators and the linkage between pollination of cultivated crops and SNHs.

### **3.2.3 Methods**

Participatory training methods were used during the meetings. The idea of these methods is to involve participants in field activities instead of giving them talks in classrooms. During on farm demonstrations farmers were invited to conduct agro-ecosystem analyses when crops, weeds and pests were visually checked in the field and in the SNH. Farmers also checked traps and sentinels similar to the ones established in the QuESSA project. After observing the situation on the field, subsequent discussion was held on the preliminary results of QuESSA in parallel with the role of SNHs in biological pest control and insect pollination.

### **3.2.4 Farmers' perceptions**

#### **Scientific aspects**

Greening was introduced in Hungary in 2015 and most farmers were more familiar with the role of green manure, leguminous crops, etc. in the greening process but were less familiar with SNHs. They mostly refused the beneficial role of SNHs and their contribution to the biological pest control service. The most skeptic and active members of our farmer groups believe that Oulema larval damage primarily depends on the soil quality of the field (and therefore the vigor of wheat plants), and not on the presence, absence or any other parameters of semi-natural habitats. They accepted the correlation between the presence of SNHs and the rate of damage, but refused our argument of the activity of natural enemies being crucial for the damage level. Instead, they stated, that remarkable damage occurs only in high quality fields, i.e. on vigorous wheat plants, while land users tolerate the presence of uncultivated

patches of vegetation (that we call “semi-natural habitats”) only in the region of low quality fields where much lower Oulema damage can be observed because of the pest preference.

#### **Training point of view:**

Some farmers already participated in other programs as well. They miss the information feedback from those researches. They asked us to organize a final meeting with them, when all relevant results and conclusions of QuESSA project will be shown them. They also pointed out, that they were interested in outcomes, but their key question is how these results could be adopted to local conditions.

#### **3.2.5 Partners involved**

- Local agricultural officer (Jászszág region)
- member of agricultural extension service (Tolna region)
- Local agricultural cooperatives
- Agricultural chamber representative

We contacted the representative(s) of the National Agricultural Chamber, which organization is responsible for providing information on the subsidies for newly established SNHs for the farmers. Our aim is to have collaboration with the chamber, and to provide information on QuESSA results on some meetings organized by the chamber. We also asked them to share Farmers guideline leaflets for farmers. Moreover, we can reach more innovative farmers with this collaboration for further activities.

#### **3.2.6 Outcomes**

Altogether 72 farmers were reached and were present in our meetings. With most of the farmers we were able to build up a good and fruitful relationship, they were active during meetings. We succeed to increase their interest for the role of SNHs, however this success is very much linked with the fact, that establishment of new SNHs is subsidized in Hungary.

#### **3.2.7 Further challenges**

On farm demonstrations are one of the first steps to involve farmers in research activities. Farmers, as our prior experience showed, were easy to reach during winter time, however their attendance was much weaker in summer. They were busy with some other urgent activities (eg. harvesting of oilseed rape and winter wheat) and they had less capacity to focus on other activities. Farmers are aware that understanding of SNHs is important for them, and that is their interest as well (in Hungary farmers get extra subsidy for establishing new SNHs) but important things are often overwritten by urgent tasks.

If we would like to have their full contribution, full support of their knowledge and real perceptions in the future, we should enhance farmers involvement. Research projects are not important tasks, “problems” for farmers, if they are just invited to see the activities without having possibility to impact the activities. But it is more likely that they would actively participate if we can raise awareness of the importance of their contribution right from the beginning of the project. Besides that with this approach we could achieve that farmers would participate with more passion and effort.

If farmers would be involved from the beginning, with knowing the whole research process, timing of the activities, with the awareness that it was their decision to join, undertaking the tasks of participations (considering that important and urgent tasks can be close to each other) from the beginning, we could

reach more farmers with more responsibility. It is important to have cooperation with frame institutions (e.g. agricultural chamber) but success of farmers' involvement depends on the relationship with farmers at local level.

A post-training meeting was held with 15 farmers in early December of 2015. As one type of the evaluation meeting, farmers were requested to redesign the landscape on blank map (also considering, potentially establishing SNHs (see photo1 and 2 below).

Farmers requested final meetings once all project results (from Partners) will be available so that experiences from other regions could be shared with them. Therefore SZIE in cooperation with National Agric. Chamber plans final meetings with farmers in late autumn of 2016.

### 3.2.8 Appendix 1

#### Pre and post training test for participants of on-farm demonstration

##### 1) Background and qualification of the stakeholder

Type:

- farmer,
- adviser,
- administration,
- NGO (environmental, consumer)
- tourism, recreation, hunting or:
- other, please specify:

Gender:

- male
- female

Age:

- less than 30
- 30 to 40
- 40 to 50
- 50 to 60
- more than 60

**1.) What is the effect of semi-natural habitats (hedgerows, woods, grassy strips, fallow, etc.) on your field?**

- rather positive
- rather negative
- less positive
- less negative
- both

Please describe your answer:

**2.) Please write 3 to 5 words that come into your mind when hearing «semi-natural habitat» (please label with + or – sign your judgement for that)**

- 1.)
- 2.)
- 3.)
- 4.)
- 5.)

**3.) Please write 3 to 5 words that come into your mind when hearing «ecosystem service» (please label with + or – sign your judgement for that)**

- 1.)
- 2.)
- 3.)
- 4.)
- 5.)

**4.) Do natural enemies decrease the number of pests in your field?**

- yes  
 no

**5.) Do natural enemies decrease the damage caused by pests in your field?**

- yes  
 no

**6.) Do natural enemies decrease the number of weed seeds in your field??**

- yes  
 no

**7.) Do you know any cultivated plant which could be pollinated only by insects?**

- yes  
 no

If yes, please indicate:

**8.) Please list five beneficial insects:**

- 1.)
- 2.)
- 3.)
- 4.)
- 5.)

If you know, please indicate what their role is?

**9.) Are these insects beneficial or harmful?**

	beneficial	harmful	don't know
<i>Carabidae</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Elateridae</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Asilidae</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Syrphoidea</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Cicadidae</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bombus spp.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



## 3.3 Germany

### 3.3.1 General

We conducted an on-farm demonstration titled “Nützlingsförderung mit Feldrandstrukturen” (Support of beneficial animals by field margins) on 12 July 2016. Location was the organic farm of Ralf Gensheimer, a participating farmer in WP 3 (Bio-Gemüsebetrieb Gensheimer, Hauptstraße 97, 76877 Offenbach an der Queich). The on-farm demonstration was done in collaboration with Pascal Paulsen, a staff member of the service center for rural areas in the federal state of Rhineland-Palatine (DLR, Dienstleistungszentrum Ländlicher Raum Rheinpfalz). The event was announced several weeks before on the homepage of the DLR. Target audience was farmers, agricultural advisors and advisors for nature conservation. In total, 22 participants joined the on-farm demonstration including Prof. Martin Entling, Dr. Jens Schirmel and Sonja Pfister from UKL.

The on-farm demonstration was media-effective. A journalist of the radiostation “Deutschlandfunk”, Germany's largest public service broadcasting, participated in the on-farm demonstration and aims to give a contribution in the consignment “Umwelt und Verbraucher” (Environment and consumers). In addition, there was a newspaper report on 14 July in the local newspaper “Rheinpfalz” and a contribution will follow in the local radiostation “Antenne Landau”.

The course of action of the on-farm demonstration was (i) an introduction by Prof. Martin Entling (5 min), (ii) a power-point presentation of the main results of the QuESSA project related to pollination and pest control in pumpkin and results of related projects (collaboration with agroscope, CH) (50 min), (iii) a power-point presentation by Pascal Paulsen (DLR) on the importance of flower strips for pollinators and subsidizing options for planting flower strips for farmers (35 min) and (iv) an excursion to different flower strips on the farm (60 min).

#### **Summary of the presentation by Prof. Martin Entling, UKL**

The presentation of Prof. Martin Entling (Fig. 1) was divided into three parts: pollination on pumpkin (QuESSA), aphid control in pumpkin (QuESSA) and pest control in wheat and potato (agroscope, CH). Martin Entling started his talk with an overview of the global importance of wild bees for crop pollination. He presented the aims of the QuESSA project and described the general methodology. Regarding pollination, results showed that honey bees were the most frequent flower visitors (79%) followed by bumblebees (14%) and halictid bees (7%). The amount of pollen in the female flowers was not related to the number of visiting honey bees but, in contrast, significantly increased with the abundance of bumble bees. Moreover, bumblebees transferred by far the most pollen per single flower visit and had the lowest handling time in the flowers. One bumblebee is therefore as efficient in pumpkin pollination as 15 honey bees or 190 halictid bees. Both the number of bumblebees and the number of transferred pollen were highest in heterogeneous landscapes and significantly decreased towards landscapes with a high proportion of arable crops in the 1 km radius. However, results also showed that pumpkin is currently not pollen limited in the case study region. Based on these results Martin Entling presented implications to ensure pollination by supporting bumblebees.

In the second part of his talk, Martin Entling presented results of aphid control in pumpkin. Results showed that major pest control agents (ladybirds, lacewings, spiders, gall midges) had highest abundances in fields adjacent to herbaceous field margins. Lacewings and (as a trend) ladybirds and the number of parasitized aphids increased with flower richness in the field margins. Implications for the support of aphid control agents were provided.

In the third part Prof. Martin Entling presented results of the potential of flower strips for pest control in wheat. Results were from the dissertation thesis of Matthias Tschumi (in collaboration with agroscope, CH) who tested a newly developed seed mixture for an annual flower strip to support pest control agents. Results showed that the number of cereal leaf beetle larvae and adults and the plant damage was significantly reduced in wheat fields adjacent to the flower strip compared to control fields without a strip. Similar results were found in potato fields, and in fields adjacent to perennial flower strips. Yield in wheat fields was about 10% higher adjacent to perennial flower strips compared to control fields. With an outlook to future research and projects Martin Entling finished his talk.

The audience was very interested in the presentation of Prof Martin Entling. Several questions were asked during the talk and a lively discussion arose. The participants provided helpful information and gave suggestions for further research.

#### **Summary of the presentation by Pascal Paulen, DLR**

The talk of Pascal Paulen (Fig. 1) was divided into two parts. First, he presented the importance of different flower strips for pollinators. Thereby, he showed the advantages and disadvantages of annual vs. perennial flower strips. Then he presented results showing the value of thirteen different seed mixtures promoted in Rhineland-Palatinate. This should help the farmers to find the most suitable and economically attractive seed mixture. In the second part, Pascal Paulen presented subsidizing options (EuLLA programme of the federal state) for farmers for the plantation of flower strips and how this is compatible with greening of the EU common agricultural policy.

After the talk several farmers formulated problems with getting subsidies. These problems mostly related to the high administrative effort.

#### **Summary of the excursion to different flower strips**

We visited a flower strip of a seed mixture of Rhineland-Palatinate (Fig. 2) and the seed mixture used by Tschumi in Switzerland. We sampled relevant beneficial insects (parasitic wasps, syrphids, ladybird larvae, lacewings, etc.) and explained their functions as pest control agents.

Farmers were generally positive towards the flower strips. One big concern, however, was the potential of flower strips to enhance weed pressure in adjacent fields or in following crops. This might be especially crucial in organic systems without herbicide applications.



Fig. 1: Oral presentation by Prof. Martin Entling (UKL, left) and Pascal Paulsen (DLR, right).



Fig. 2: Excursion to flower strips on the organic farm of Ralf Gensheimer (standing right).

## 3.4 Switzerland

### 3.4.1 On-farm demonstration event

We organized an on-farm demonstration event on 19 August 2014 in the QuESSA case study region focusing on experiences of farmers and other stakeholders with a new type of ecological focus area, “flower strips to promote bees and other beneficial arthropods”. Increasing awareness of the considerable potential of ecosystem services delivered by mobile arthropods, such a pollination and pest control services, to contribute to more sustainable agricultural production (“ecological intensification”) through the targeted provision of food, shelter and overwintering resources in agricultural landscape,

has led to this new element of the Swiss agri-environment scheme (AES) promoted by direct payments to farmers. The aim is to enhance beneficial densities through the provision of a mixture of specifically selected floral resources and other resources to pollinators and key natural enemies of crop pests requiring floral resources during their life history, and thus to increase pollination and pest control services in nearby crops through functional spillover.



Figure 1. New Swiss AES type aimed at promoting natural enemies of pests through targeted promotion of floral and other resources.

This new AES type is still in a pilot phase of its nation-wide implication, and a participative approach involving farmers and other stakeholders directly is key for the further improvement of seed mixes and management, and the acceptance and uptake by farmers. The goal of this on-farm demonstration event was to bring farmers, agricultural advisors and other stakeholders together with agro-ecologist to contribute to this practical improvement of the new AES type.

We announced the event to farmers, agricultural advisors, seed-growing industry, nature conservation NGO's. Roughly 20 people attended the on-farm demonstration event. The event was organized together with AGBA, a Swiss national working group consisting of agricultural advisers and farmers, as well as representatives from the industry (e.g. seed-growing companies), nature conservation NGO's and the administration, and agro-ecologists.

The event included a forum part in the morning, during which Dr. Matthias Albrecht and Dr. Katja Jacot (FEDEA-Art) presented the aim and first results of the QuESSA project, together with two other national projects aimed at an improved understanding of how semi-natural habitats, including ecological focus areas, drive pollination and pest control services in Swiss agricultural landscapes. A broad discussion of these results in a context of current practical, societal and political challenges followed the presentations. In the afternoon, several farms were visited together with the respective farmers, and

practical (e.g. good vs. sub-optimal location of flower strips and other EFA on the farm, management of flower strips and other EFA and semi-natural habitats, how to reduce weed pressure and other dis-services) were discussed at site.



Figure 2. On-farm demonstration event visiting several flower strips and other semi-natural habitats to discuss their potential and practical challenges with respect to the promotion of pollination and pest control services in Swiss agricultural landscapes.

### 3.4.2 Farmer interviews in the case study region

In addition to the on-farm demonstration event, we performed interviews with 44 farmers from the case study region, including farmers involved in other QuESSA WP3 case study work, to learn from their experiences with the new type of Ecological Focus Area targeted on the promotion of pollination and pest control services in Swiss agro-ecosystems (see 2.4.1.). The feedback and suggestions of the farmers will help to further improve the new Swiss AES type aimed at the promotion of pollinators and natural enemies of pest, and pollination and pest control services they deliver.

The overall experiences of the farmers with the sown flower strips to promote pollination and pest control services were very positive (average score of 8.5; highest possible score 10). Of the interviewed farmers, 93% said they think they will continue to sow such flower strips on their farm. A total of 81% of conventionally producing farmers said that they consider to change to a semi-organic or organic production of key arable crops (e.g. wheat, potato, oilseed rape), if pest densities can be reduced to below economic thresholds through the establishment of targeted flower strips to promote pest control services. The promotion of ecosystem services, such a pollination or pest control services, was for the

most farmers a more important argument to establish such a flower strip than the promotion of farmland biodiversity.

Some farmers were concerned about potential weed problems, which turned out to be the main concern of farmers regarding the establishment of flower strips. The interviews revealed that for the main weed species a total cover of 5 to 10% was considered acceptable, while higher covers were considered problematic.

Table 1 summarizes the suggestions made by the interview farmers to improve the composition, management and general implementation of the flower strips targeted on the promotion of pollination and pest control services

Suggestions	Number of farmers	Percentage
<b>No suggestion</b>	22	50%
<b>A higher amount of seeds would be preferred</b>	10	23%
<b>Faster and better ground coverage by sown species (= lower potential for weed problems)</b>	5	11%
<b>More colourful seed mix</b>	5	11%
<b>Less restrictions regarding total sown area</b>	3	7%
<b>Seed mix that does not require rolling after sowing</b>	1	2%
<b>No plant species in the seed mix that may persist after ploughing</b>	1	2%

### 3.5 Netherlands

During the QuESSA pear case study in the Netherlands, there was intensive interaction with fruit growers and their advisors.

**Purpose of on-farm demonstrations was to discuss with the farmers and other stakeholders:**

- the ecological service of pest control by natural enemies and the ecological service of pollinators;
- the contribution semi-natural habitats can play in supporting these natural enemies and pollinators as service providers;
- the potential to implement semi-natural habitats and vegetation elements in and around the orchard;
- other ways to stimulate the presence and impact of natural enemies;
- the use of these methods in an integrated crop protection system;

#### Methods, results

In 2014, 2015 and 2016 several growers meetings were organised in the main fruit growing regions in the Netherlands. For most of the meetings we invited:

- fruit growers in the region
- advisors from independent advisory services
- representatives of local crop protection companies
- representatives of the fruit growers organisation, both at national and regional level

In some of the smaller field meetings, only the growers and their local advisors were invited. Dates on which on-farm meetings were organised:

- 13 February, 28 April and 2 June 2014
- 30 January, 23 April and 21 May 2015,
- 15 March, 8 June and 27 June 2016

Topics discussed during the meetings:

- sustainable management strategies for the control of pear psylla
- impact of SNH like hedgerows and woody areas on pest control (ecological service)
- impact of SNH like herbal flowering field margins on pollination (ecological service)
- impact of SNH like hedgerows on bird damage (ecological disservice)
- impact of SNH on farm image/ fruit growers image (social service)

The meetings in winter (February-March) were mainly indoor meetings. The large meetings started with introductory presentations by researchers and advisors, followed by a discussion. The smaller meetings had a different character. Usually, they were attended by growers that had attended a large winter meeting before. Therefore, and because of the smaller group size (18 persons maximum) meetings were more interactive and in-depth. Small indoor meetings took place in one of the farmer's canteens. The set-up for the indoor meetings was as follows:

- Start with very short introduction by researcher.
- Interactive: each individual grower tells about his experiences on pest control, use of natural enemies, pollination, and interaction with SNH. Researcher or advisor asks questions to keep discussion on-topic. Other growers are invited to ask questions as well.
- Discussions on how to improve pest control, pollination, use of SNH.
- Ending with evaluation, informal discussion, and drinks and food.

**The spring and summer meetings were as follows:**

- Start in the orchard of one of the growers involved, usually one of the QuESSA farms. Very short welcome, with outline of the objectives of the afternoon or (mostly) evening. The grower whose farm is being visited gives a short introduction about his farm, crop protection measures taken and SNH present in or near the orchard. Visiting growers are invited to estimate fruit setting or levels of pests and natural enemies in the orchard.
- Walk through one or more orchards, discussion in the field.
- Indoor continuation of discussions: what where the observations, suggestions to the grower visited by colleagues, own experiences. Alternated with explanation of technical backgrounds by researcher on specific topics if needed (presentation with technical results of experiments at hand).
- Plans, outlook, observations to be done
- End of the formal part of the meeting: evaluation of the meeting, what was good, what should be improved.
- Informal continuation with drinks, food.

**Some observations by and feedback from growers:**

- Perception of ecological services differed between growers. Most growers were open for implementation of SNH on their farms only if clear positive effects were to be expected. Farmland is expensive: planting hedges or sowing herbal strips with unclear financial benefit gets less preference than planting more fruit trees with predictable financial benefit.
- Growers were more interested in SNHs as a source of natural enemies of pests than in the pollination effects. They did see the benefits of a good pollination, but pest control was felt more as a problem. Some growers stated that pollination can be managed sufficiently by hiring bee hives during the flowering period.

- As during the project the effects of earwigs on the control of pear psylla became clearer, growers showed interest in ways to stimulate their presence. In the last part of the project this became an important part of the discussion.
- Bird damage as an SNH disservice was an important item for growers. Woody SNHs nearby the orchards clearly increase the damage by birds short before harvest. Some growers in the project experimented with low, open hedgerows near their pear orchards, in order to stimulate natural enemies without having the negative effects of increased bird damage. The hedgerows were planted in the first year of the project and were too small still to measure effects during the project.
- Growers appreciated the interaction with colleagues, advisors and researchers in a small group. It helped them to take management decisions on the topic.

## 3.6 United Kingdom

### 3.6.1 Workshop

An interactive session with stakeholders was conducted with the following objectives: 1) identify and rank ecosystem services according to their value for agriculture; 2) explore how to manipulate SNH to exploit ES to benefit production and the environment.

The group of 33 stakeholders were asked to perform two tasks matching the two objectives above. The process took 2 hours.

For task 1 the stakeholders were split into 6 groups comprised of 4-6 persons and each allocated specific type of semi-natural habitat (SNH). They were asked to list the ecosystem services associated with their given SNH in order of importance. This task was completed in 10 minutes. Each group gave a brief summary of the conclusions to the other groups. For task 2 the same groups were maintained and each group was asked to redesign two landscapes. They were provided with maps of 400 ha landscapes, for which one was comprised primarily of arable crops whilst the others had landscapes that included grassland. On each landscape they could add in extra SNH and crops if they supported ES but had to retain permanent features such as hedgerows but not necessarily farmed grassland/woodland. Agri-environment scheme habitats were permitted taking into account current financial support (See Fig. 1). They were asked to take into account:

- crop rotations
- natural features and ensure resource protection
- practicalities – mechanisation and profitability

The groups used coloured pens and card to indicate the type and placement of new features or crops. One person in the group acted as the recorder and made notes on: 1) For crops give the reasons for choosing it, ES it supports and the buffer zone of influence whether this is just within the field or metres beyond if any. 2) For habitats give the number and name of the habitat, ES it supports and the buffer zone of influence metres beyond if any. 3) For crops and habitats score its likely effectiveness 1-10 (1=no idea, 10=very confident, scientific data available to confirm). After one hour each group in turn

presented their landscapes and explained their decision making to the other groups. The reasoning behind the decisions included eg. yield increase, biological control, improved pollination, reducing carbon emissions and protection of water.

### 3.6.2 On farm demonstrations

Dr John Holland gave presentations at two events (8 and 10th March 2016) organised the Campaign for the Farmed Environment on “Managing Margins for Maximum Benefit.” Each event comprised of four talks by speakers on related topics followed by a farm walk to visit key habitats and further discuss their value and management options. The event was primarily attended by farmers, agronomists and other advisors (e.g. conservation, water protection). Feedback forms were distributed and the overall the level of satisfaction for all aspects of the event was either excellent or good (Table 1).

Further events are planned for the remaining 6 months of the project once more findings are available.

Figure 1. Example of map from Task 2.



**Table 1. Feedback scores from meeting on “Managing Margins for Maximum Benefit,”**

	Event 1				Event 2			
<b>How did you rate the event you attended?</b>	<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>	<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>
Presenters knowledge of subject area	73%	27%	0%	0%	85%	15%	0%	0%
Usefulness/relevance of information	60%	40%	0%	0%	46%	54%	0%	0%
Responses to questions raised	67%	33%	0%	0%	62%	38%	0%	0%
Signposting to sources of information	60%	33%	7%	0%	54%	46%	0%	0%
<b>Usefulness of the training/information received?</b>	<b>Very useful</b>	<b>Maybe quite useful</b>	<b>No, of little interest</b>	<b>Topic not applicable</b>	<b>Very useful</b>	<b>Maybe quite useful</b>	<b>No, of little interest</b>	<b>Topic not applicable</b>
Understanding how to enhance your greening measures and marginal land for on farm wildlife	87%	13%	0%	0	85%	15%	0%	0
Understanding the importance of margins for protecting your soil, nutrients and watercourses	87%	13%	0%	0	62%	31%	0%	0
Do you now feel more confident knowing how to create and manage margins on your farm?	80%	20%	0%	0	69%	31%	0%	0
<b>Effect on farm management?</b>	<b>Yes</b>	<b>No</b>			<b>Yes</b>	<b>No</b>		
Will you change any management on your farm following this meeting?	87%	13%			85%	15%		

## 3.7 Estonia

Authors: Eve Veromann, Gabriella Kovacs

### 3.7.1 General data

We carried out two on-farm demonstrations and a survey:

1. The first demonstration took place at Annikoru Cereals Centre, 07.02.2014. There were eight farmers, all conventional crop producers and all of them were focus group members (i.e. our experiments were carried out on their fields). Besides of conventional production one farmer practiced organic and low input farming as well. However, all farmers declared that they are farming as environmentally friendly as possible, taking the economic threshold of pest abundance and the environmental requirements into consideration in case of treatments.
2. The second on-farm demonstration was carried out at the Rõhu Field Station of the Estonian University of Life Sciences, 16.07.2015. There were 82 participants, the majority of them were oilseed rape growers but there were also farmers' consultants, policymakers and journalists. The demonstration was carried out jointly with the 'Open-Farm Day' organised by the Estonian company 'Oilseed Trade'.
3. In addition, we made a survey among organic and conventional farmers as well as advisers, to find out what kind of landscape elements in their agricultural land are the most important as ecosystem service providers (e.g. pest control and pollination service) in their opinion. A total of 59 farmers of different ages, educational background and farming sizes took part in the survey. We did not introduce the concept of ecosystem services and the potential benefits they can gain from them before the survey.

### 3.7.2 Methodology

During the small scale on-farm demonstration, at first we introduced the concept of ecosystem services to the farmers. Then we introduced different ecosystem services that are in the interest of farmers (soil fertility, pest control, pollination, carbon sequestration, water purification, aesthetic value) more specifically and then we showed the link between these services and landscape elements. Based on the first year results of our experiments and previously published studies, we demonstrated the potential of different semi-natural landscape elements in the agricultural landscape to support pest control.

In the second, open-farm day, we gave a general overview about the QuESSA project, presenting the concept of ecosystem services, what are the services provided by nature that are important for agricultural producers, etc. After that we introduced the main results of the Estonian experiments from 2013 and 2014 of the QuESSA project, focusing on pest control and pollination services as well as pest abundance.

### 3.7.3 Main outcomes

During the field-day with small group of farmers we learnt that the main concern that is common for all farmers is soil fertility, because it is directly connected with yield and thus the income. C-sequestration or loss of carbon from the fields is also an important issue for farmers. In addition, they were well informed about the importance of pollinators and well aware about the pollinator crisis and the detrimental impact of pesticides on pollinators. Concerning the semi-natural landscape elements in the agricultural landscape, the main outcome was, that Estonia has a lot of nature (over 51% of Estonia is covered by woods) and farmers cannot see how field edges, that are relatively narrow can contribute to the pest control or pollination service. They thought that natural enemies of agricultural pests and pollinators migrate from wild/natural areas to their fields. However, after the heated discussion during which we explained the flight and moving distances of natural enemies and different pollinators and their habitat needs; they understood why it is important to preserve non-cropping areas nearby arable fields.

In conclusion, the producers present at this meeting realized that not only soil fertility but all ESs contribute to their everyday life.

The oilseed growers participated in the open-farm day were very interested in the issues connected with pest abundance, their distribution infield, economic threshold levels of different pests, the impact of insecticides and herbicides on the pollinators and other beneficial insects, and pest control services provided by natural enemies. The discussion revealed, that many farmers do not have time to do proper pest abundance monitoring in the fields and they apply pesticides according to the growth stage of the crop. However, they were well informed about the hazard of pesticides to pollinators and they do not treat oilseed rape during its flowering time. Also, as oilseed rape is a mass-flowering crop that attracts both honey bees as well as wild bees, the benefit from pollination for oilseed rape yield was a discussion point. Our results showed that oilseed rape yield can be greater if there would be more pollinators.

After the field-day, the attitude of farmers towards non-cropped areas in the agricultural landscape seemed to have been changed in a positive way. Many farmers used to consider herbaceous linear elements or other non-cropped areas near to cultural fields irrelevant or even adverse. But we were successful in showing that these landscape elements provide shelter, food and overwintering sites for massive numbers of predatory arthropods that can migrate to the cultural fields and provide pest control service and also favour the presence of pollinators in the oilseed rape fields.

3.3. Concerning the survey, the majority of farmers consider non-cropping areas and semi-natural habitats in the agricultural landscape important for crop production, only 3% of respondents thought that there is no need to keep any non-cropping areas near to the crops. The majority of respondents (63%) consider wide linear field margins (>1.5m) and forest edges the most important landscape elements that possibly provide benefits to them (respectively: 32% and 31%). 15% of respondents thought that the most important landscape element for producers is the narrow linear field margin.

### 3.8 France

Relevant training partners were identified during the construction of the vine-growers network in 2014. 18 farmers per CS were selected to host the experimental setup during 2 years and they were also selected for the representativeness of their farm at the local level (different appellations of origin and habit of growth). The organisation of on-farm demonstrations was then organised using local network of organisers responsible of the survey of diseases and pests associated to vineyards. Pest regulation is one of their main objectives and making use of biodiversity conservation using semi-natural habitats one of the relevant research issue for which they need information as well as vine-growers. Integrated Pest Management using pest survey was the main objective of meetings organised each year in different locations and QuESSA French partners were then added to these meetings and network to introduce first the general design of the project and then the first results of QuESSA measures in the field, and in each region.

In February and March 2014, in both sites, three oral communications (1 in Languedoc region and 2 in Gironde region) were organized to present the project and its objectives, with farmers potentially interested in the subject and with local stakeholders. First outcome of these initial meetings (beginning of the contract of Brice Giffard, mainly involved in these activities) was that vine-growers were particularly interested in the subject of "nature" (semi-natural habitats) and the relationship between vine fields and biodiversity. They were also aware of the potential of biodiversity to provide the ecosystem service of pest regulation and then really motivated to see our results and how they could influence the way in how they manage semi-natural habitats at local (in their farms) and at the landscape scale.

In the beginning of 2015, at both sites, three oral communications (2 in Languedoc region and 1 in Gironde region) were organized or co-organized with local IPM engineering office to show the first results of the project and the data collected in 2014. These meetings were principally organised for farmers directly involved in the project (vine fields). They were really interested in the first outcomes of first year results but also a little bit disappointed that the effects of SNH at the landscape scale are not as clear as they want.

These meetings were then completed by 3 different oral communications in different research units around Bordeaux between November 2014 and February 2015, in order to have also outcomes of the perception of other researchers working in agroecology on the general design of the experiment and the sentinel system measures that we used.