Biodiversity Monitoring-System

An exemplary monitoring report comparing the biodiversity performance of German and Spanish farms


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CONTENT

1 Introduction

The Biodiversity Monitoring-System allows standards, producer associations and food companies to monitor the biodiversity performance of their certified farms, members and/or supplying farmers. The monitoring results provide indications regarding the baseline situation on the farms and whether the biodiversity requirements of standards or companies are contributing to a continuous improvement on farm level. The monitoring is based on 25 indicators, with high relevance for the protection and creation of potential for biodiversity (e.g. habitat creation) and the reduction of negative impacts (e.g. reduction of chemical pesticides and fertilizers). The indicators are collected by 50 questions, mainly on agricultural practice but also on farm management and structural elements of the area, such as water bodies and semi-natural habitats. The indicators are described in detail in the handbook (available for download at: https://bms.biodiversity-performance.eu).

One of the strengths of the monitoring system is that it is applicable on a global level and for all types of products and production systems. Moreover, with only 25 indicators major threats to biodiversity with global relevance are addressed. Hence, the complex topic of biodiversity can be monitored and evaluated with an acceptable cost-benefit ratio. Another clear strength of the Biodiversity Monitoring-System is the user-friendly visualization of the aggregated monitoring data which facilitates the identification of regional and thematic challenges and provides information for fact-based reporting and communication.

2 Features of the Biodiversity Monitoring-System

The Biodiversity Monitoring-System addresses three of the five main drivers of biodiversity loss: degradation or destruction of ecosystems, overexploitation of natural resources and alien invasive species. Furthermore, loss of genetic diversity, biodiversity management and training are considered. The 25 indicators are a compromise between practicability and scientific demands within a global scope.

Indicators:

- Mapping of the farm
- Biodiversity Action Plan
- Biodiversity training for farm operators
- Biodiversity training for farm workers
- Pesticide pressure on agricultural land
- Alternative measures against weeds and pests
- Nitrogen application
- Crop rotation length
- Reduced soil erosion (soil coverage)
- Number of crop plant species
- Number of breeds (animals)
- Number of traditional crop species
- Number of traditional breeds (animals)
- Genetically modified organisms in crops and livestock breeds
- Genetically modified organisms in animal feed
- Forage autonomy
- Livestock density
- Sustainable and efficient water use
- Irrigating the appropriate amount of water
- Preservation and creation of semi-natural habitats
- Pesticide and fertilizer pressure on semi-natural habitats
- Connectivity of semi-natural habitats
- Buffer zones around water bodies
- Alien invasive species
- Off-site ecosystems loss and degradation related to animal fodder production (dependence on soy as animal feed)

With these indicators the Biodiversity Monitoring-System generates a data basis for decision-making that -hopefully- helps to induce the following positive changes: *the creation of potentials for biodiversity, a reduction of the direct pressures on biodiversity by implementation of very good agricultural practice, the identification and reduction of further risks for biodiversity loss and degradation, the creation and protection of habitats, and the increase of agrobiodiversity*. A table that links the indicators to the desired impacts can be found in annex iv.

3 Frame of the test monitoring

Overall, the data of 55 farms were gathered in the test phase of the Biodiversity Monitoring-System. Included in the complete sample are farms located in Germany, Spain, France and Portugal that produce arable crops, livestock, vegetables, grasslands, agroforestry systems and permanent crops.

A subsample of 19 farms in Germany and 23 farms in Spain is used to create the exemplary monitoring report. The data for the 23 farms in Spain were collected by Fundación Global Nature. The data of the farms in Germany were collected by Lake Constance Foundation and Global Nature Fund. The focus on a comparison of biodiversity performance of the farms in different countries.

The data were collected by farmers supported by the project team. In the future, data will be collected by assessors, auditors or other persons designated by the user of the Biodiversity Monitoring-System. Most of the data requested in the questionnaire can be taken from applications for EU Common Agricultural Policy funds or from other certifications, and therefore, little additional effort is necessary. The duration of data collection and data entry was between 40 and 120 minutes, depending on the available documentation of the farms.

4 Monitoring results

The results are presented in nine thematic clusters. Several questions from the monitoring questionnaire deliver information to each thematic cluster. In the presentation of the results, the questions are not shown to keep the chapter brief. The complete set of questions: See annex iii.

4.1 Cluster 1: semi-natural habitats

Permanent semi-natural habitats make on average 16.7 ha in Spain and 41.8 ha in Germany. Temporary semi-natural habitats cover on average 0.8 ha in Spain and 8.1 ha in Germany. The share of semi-natural habitats compared to the total farm area is on average 19.7% in Spain and 22.8% in Germany (see table 1).

Table 1: Results for farm area, utilised agricultural area, and semi-natural habitats

Parameters	Country	n*	Average	Sum	Minimum	Maximum
Farm area (ha)	Spain	23	39.8	915	1	55
	Germany	18	314.1	5,654	13	3,518
Utilised agricultural area (ha)	Spain	23	32.3	742	1	232
	Germany	18	282.4	5,083	10	3,158
Temporary semi-natural habitats (ha)	Spain	23	0.8	18	0	15
	Germany	18	8.1	146	0	76
Permanent semi-natural habitats (ha)	Spain	23	16.7	384	0	232
	Germany	18	41.8	752	0	535
Semi-natural habitats, total share (%)	Spain	23	19.7	-	0	100
	Germany	18	22.8	-	0	100

* n = number of responses to the respective question

On 26.1% of the farms in Spain and 27.8% of the farms in Germany, semi-natural habitats are connected so that they build a biological corridor. On 56.5% of the farms in Spain and on 61.1% of the farms in Germany, the semi-natural habitats are connected but show discontinuities, and on 17.4% of the farms in Spain and on 11.1% of the farms in Germany, there are no connections between semi-natural habitats (see figures 1 and 2). None of the farms in Spain and Germany apply pesticides on semi-natural habitats. None of the farms in Spain apply fertilizers on semi-natural habitats, while on 5.6% on the farms in Germany fertilizers are applied on semi-natural habitats.

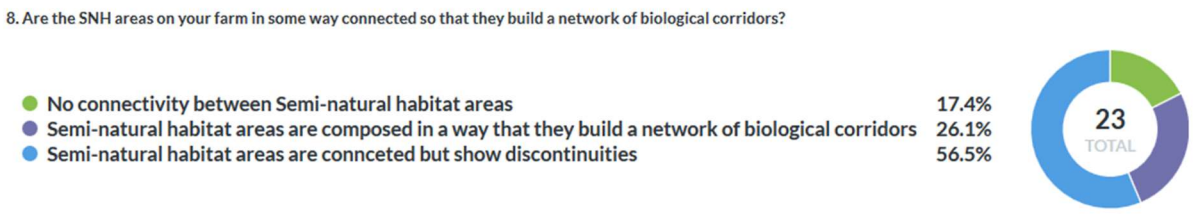

Figure 1: Connectivity of semi-natural habitats on the sample farms in Spain

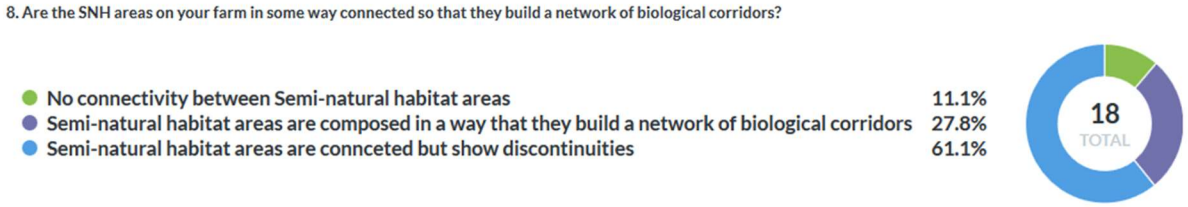

Figure 2: Connectivity of semi-natural habitats on the sample farms in Germany

4.2 Cluster 2: management and training

An important management tool are farm maps. Nearly all farms in Germany and in Spain include all important elements in the farm maps: farm boundaries, non-utilized agricultural area, semi-natural habitats and production plots.

Sound biodiversity management requires a Biodiversity Action Plan (BAP). A BAP contains measures selected according to the baseline of the farm to protect biodiversity and to create potential for biodiversity. 73.9% (n=23) of the farms in Spain have already made a Biodiversity Action Plan for their farm (see figure 4). On average 54.4% (n=17) of the measures were already implemented. Of the German farms 21.1% (n=19) have already elaborated a Biodiversity Action Plan and, on average, 56.3% (n=4) of the measures were already implemented.

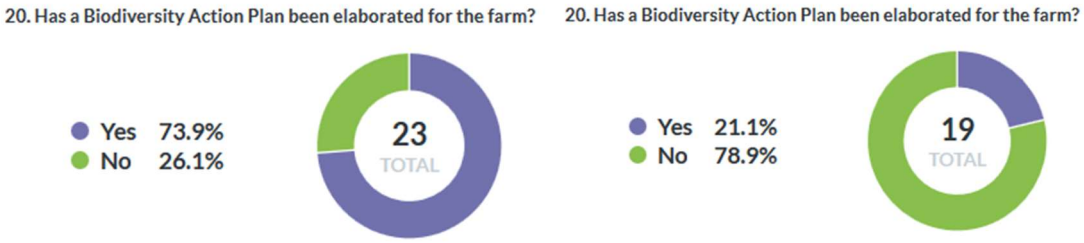

Figure 3: Availability of a Biodiversity Action Plan for the farms on Spain (left) and Germany (right)

A further management measure to ensure continuous improvement is training. On farms in Spain, on average 87% (n=23) of the farm operators did participate in a training in the past, and on farms in Germany the share was 66.7% (n=18). 34.8% of the farm operators in Spain participate in a biodiversity-relevant training regularly (n=23), and 53.3% (n=15) of the farm operators of the German farms do so regularly. 34.8% of farm workers in Spain participated in a training in the past, and 21.7% do so regularly (both n=23). 50% (n=18) of the farm workers in Germany participated in a training in the past, and 6.7% (n=15) do so regularly. 27% (n=23) of permanent staff[1] on the farms in Spain and 34% (n=11) of permanent staff on the farms in Germany participated in a training with biodiversity-relevant contents.

[1] *The test phase showed that the question is not fully clear since a definition of permanent staff and farm workers is missing. This issue will be resolved in the next version of the tool.*

4.3 Cluster 3: livestock

Two farms in Spain indicated to have livestock. For one of them the average livestock density is 3 LU/ha/year, and for the other one it is 8 LU/ha/year. They can produce on average 51-80% of the required forage for their livestock on the farm.

In Germany, 14 farms indicated to have livestock. The average livestock density on these farms is 1.7 LU/ha/year. 28.6% of the farms are able to produce more than 80% of the required forage for their livestock on the farms. The majority, 64.3% of the farms, can produce 51-80% of the forage on the farms, and 7.1% of the farms produce 31-50% of the forage themselves.

4.4 Cluster 4: animal feed and deforestation

The two farms in Spain which have livestock have no soy-based feed concentrate in their animal feed composition.

The average share of soy-based feed concentrate of the total animal feed composition of the 14 farms in Germany was 4.6%. On average 10% (of n=10) of the soy is certified deforestation-free. On average 20% (of n=10) of animal feed that is based on soy originates from a manufacturer located in the EU where there is transparent commitment to sustainable production.

4.5 Cluster 5: water

65.2% (of n=23) of the Spanish farms have water bodies on their land (see figure 5). On these farms, on average 27.5% of the shore lines have no buffer zone, 56.3% of the shore line have a buffer zone of 1-4 metres width, 3.2% have a buffer zone of 5-9 metres width, and 7.7% have a buffer zone width of 10 metres or more[2] which is the appropriate width for a sound buffer and biotope corridor.

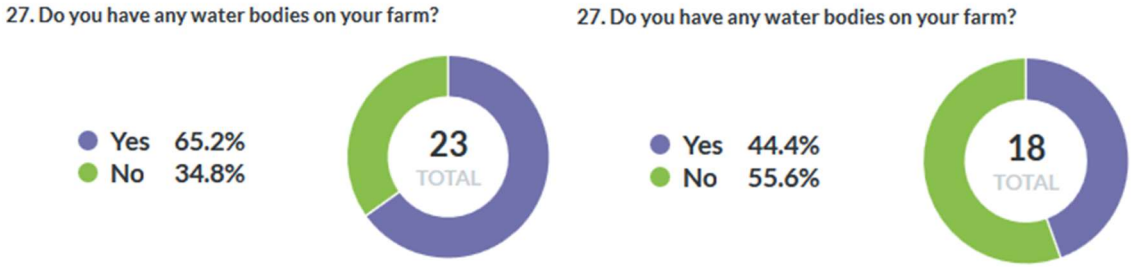

Figure 4: Presence of water bodies on the farms in Spain (left) and Germany (right)

44.4% (of n=18) of the farms in Germany have water bodies on their area. On these farms, on average 23.1% of the shore lines have no buffer zone, 27.0% of the shore line have a buffer zone of 1-4 metres width, 57.6% have a buffer zone of 5-9 metres width, and 22.2% have a buffer zone width of 10 metres or more (see table 2).

[2] *The sum of the averages is less than 100% due to different counts of answers for each buffer zone width. Every question on buffer zone widths should be answered even if the value is 0, if a farm has water bodies on the area. It is aimed to improve the monitoring questionnaire to ensure that all necessary data is entered by respondents.*

Table 2: Average share of buffer zone widths in Spain and Germany

Buffer zone width	Country	n	Average	Minimum	Maximum
No buffer zone	Spain	15	27.5	0	100
	Germany	9	23.1	0	100
1-4 metres	Spain	15	56.3	0	100
	Germany	8	27.0.	0	100
5-9 metres	Spain	14	3.2	0	40
	Germany	10	57.6	0	100
≥ 10 metres	Spain	13	7.7	0	100
	Germany	9	22.2	0	100

* n = number of responses to the respective question

Of the 20 farms in Spain that use irrigation, 10 apply a decision support tool to assess the appropriate amount of irrigation (see figure 6). Eleven farms are involved in a water management programme to increase the water use efficiency and sustainability.

Of the 10 farms in Germany that use irrigation, one farm applies a decision support tool to assess the appropriate amount of irrigation and two farms are involved in a water management programme to increase the water use efficiency and sustainability.

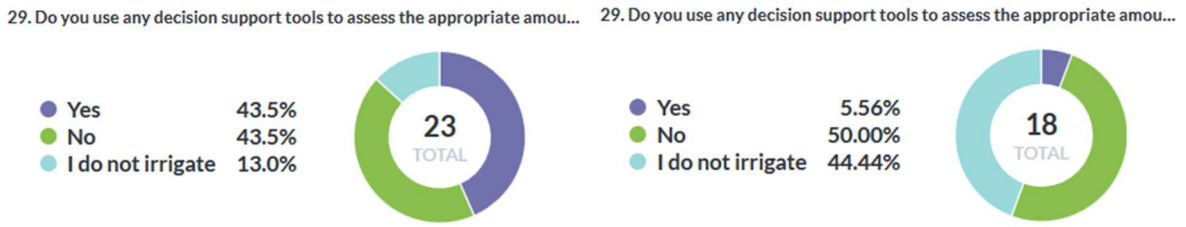

Figure 5: The application of decision support tools for irrigation on farms in Spain (left) and Germany (right)

4.6 Cluster 6: alien invasive species

Alien invasive species are a threat to local biodiversity. Therefore, the presence of alien invasive species on the farms is part of the biodiversity monitoring. On none of the 22 farms in Spain are alien invasive species present. In Germany, on five (27.8%) of the 18 farms alien invasive species are observed (see figure 6). On four farms, measures are taken to fight the alien invasive species. Two of the farms make use of consultancy through non-governmental organizations, research institutions or other relevant authorities for fighting alien invasive species on the farm.

Figure 6: Presence of alien invasive species on the farms in Spain (left) and Germany (right)

4.7 Cluster 7: genetic diversity

On the 23 farms in Spain, on average 3.4 different crops are cultivated of which 1.9 are traditional crops (see table 3). This represents a share of approximately 55.9% traditional crop species. Two farms

in Spain indicated to have livestock. They have on average 3 different breeds, of which 2 on average are traditional breeds. This represents a share of 66.7% traditional livestock breeds.

On the farms in Germany, 5.3 different crops on average are cultivated (n=17) of which 0.9 are traditional crops. On 15 German farms on average 2.4 different livestock breeds are kept, of which 1.2 are traditional breeds. Hence, on the German farms the share of traditional crops is approximately 17.0%, and the share of traditional breeds is 50.0%.

The farms in Spain and Germany neither have genetically modified crops nor genetically modified livestock breeds. The average share of certified GMO-free animal feed of the total animal feed concentrate is on average 56.3% in Spain and 70.8% in Germany.

Table 3: Results for parameters indicating genetic diversity

Parameter	Country	n	Average	Minimum	Maximum
Number of different crops cultivated[a]	Spain	23	3.4	0	20
	Germany	17	5.3	0	21
Number of traditional crop species cultivated	Spain	23	1.9	0	10
	Germany	17	0.9	0	10
Number of livestock breeds	Spain	2	3	3	3
	Germany	15	2.4	1	10
Number of traditional livestock breeds	Spain	2	2	2	2
	Germany	15	1.2	0	10
Share (%) of certified GMO-free animal feed	Spain	8	56.3	0	100
	Germany	12	70.8	0	100

[a] including temporary grassland and permanent grassland not under extensive management

* n = number of responses to the respective question

4.8 Cluster 8: soil

On the 23 farms in Spain, the share of farming area (UAA) that has soil cover (e.g. cover crops or mulching) at least during critical periods (e.g. peak precipitation months) is on average 46.8%. On the 18 farms in Germany, the share of UAA that has soil cover at least during critical periods is 75.2%. The average crop rotation of main crops on the Spanish farms (n=9) and on the German farms (n=15) is 3.9 years.

The average amount of nitrogen (organic and inorganic) applied on the 23 Spanish farms is 121.6 kg/ha/year. On the farms in Germany (n=18) the average amount of nitrogen applied is 150.1 kg/ha/year.

4.9 Cluster 9: pesticide management

The engagement of the 23 farms in Spain in the use of alternative measures (Integrated Pest Management, IPM) against weeds and pests with the aim to avoid and reduce pesticide application is high. On nearly 90% of the farms, IPM measures against weeds are used on the entire UAA and on close to 70% of the farms IPM measures against pests are conducted on 100% of the UAA. A small share of farms applies IPM measures on less than 100% of the UAA (see figure 8).

On the German farms, the use of IPM measures is more diverse. Approximately 30% of the farms do not use any IPM measures against weeds and more than 40% of the farms do not use IPM measures against pests. However, there are also farms, about 40% in the sample of German farms, which use IPM measures against weeds on all of their UAA, and nearly 30% of the farms in Germany use IPM measures against pests on all of their UAA.

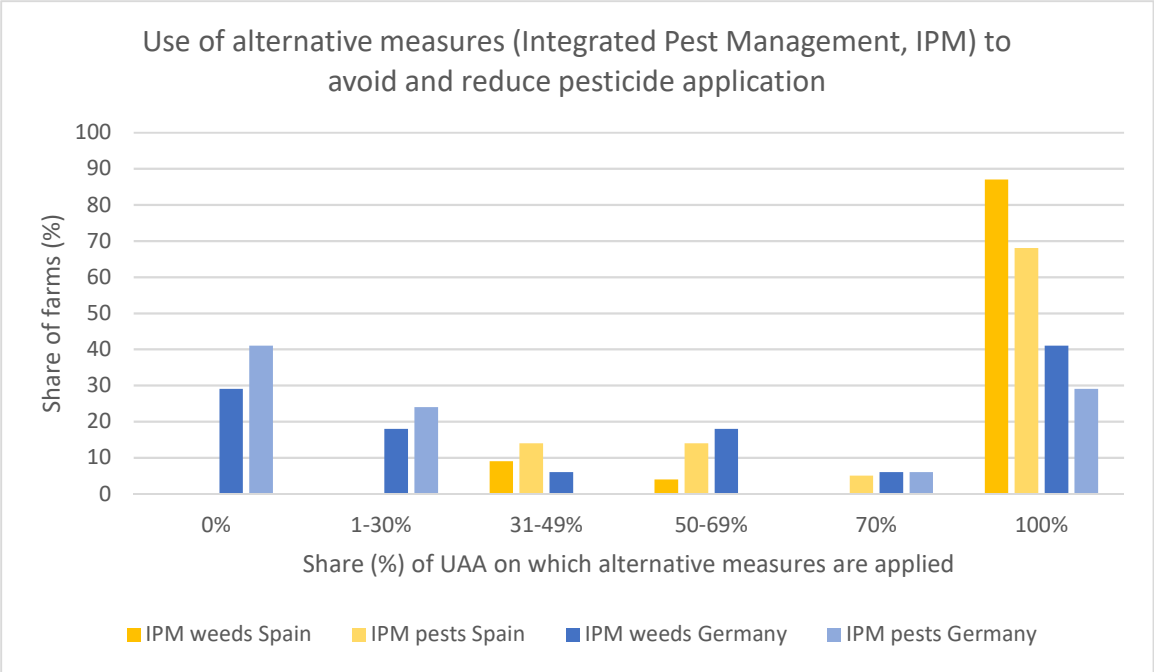

Figure 7: Distribution of responses regarding the use of alternative measures against weeds and pests to avoid and reduce pesticide application in Spain and Germany

The average share of UAA that is not treated with pesticides is 57.8% in Spain and 45.4% in Germany. The share of UAA on which broad-spectrum herbicides are applied is on average 18.3% in Spain and 23.2% in Germany.

90.9% of the farms in Spain and all farms in Germany had a list of active ingredients that are deployed on the farm, as well as a list of the amount of each active ingredient deployed in litres/ha or grams/ha. On 14.3% of the farms in Germany and on 50.0% of the farms in Spain, the total amount of applied pesticides showed a continuous reduction over a period of the past five years.

5 Evaluation of the monitoring results

In the following, a table gives an overview of the evaluation of the results in the countries in a very compact way. In the table, a traffic light system is used which is the result of a manual evaluation. This overview can provide insights on the clusters to focus on for an improvement of the biodiversity performance in each country.

Table 4: Evaluation of the countries in each cluster

Cluster	Spain	Germany
Semi-natural habitats		
Management and training		
Livestock		
Animal feed and deforestation		
Water		
Alien invasive species		
Genetic diversity		
Soil		
Pesticide management		

A dedicated section on the evaluation of the results in each country discusses the results more in detail. In these following sections, concrete suggestions are made for ways on how to achieve improvements in biodiversity performance.

5.1 Spain

Semi-natural habitats:

A measure to create potential for biodiversity is to maintain semi-natural habitats and ensure that the proportion of semi-natural habitats and landscape features in farmland is sufficiently large, i.e. between 10% and 20%[3] since then the areas could largely buffer the negative effects of agriculture intensification on biodiversity and decrease its sensitivity to climate change. The farms in Spain have an average share of 19.7% semi-natural habitat area compared to the total farm area which is close to 20% and thus a very positive result. Since the range is large, there is still room for improvement on individual farms. One option might be to approach farms with 0% semi-natural habitat area with incentives or consultancy to increase their share to 10%-20%. It is important to note that farms with 0% semi-natural habitat area are possibly not in legal compliance. In the EU, for instance, farms with 15 ha or more must manage at least 5% of their farm area as Ecological Focus Area[4]. Semi-natural habitat areas belong to the measures accepted for Ecological Focus Areas.

For wildlife, it is important to have biological corridors in order to find food and to breed. Connecting the semi-natural habitats increases their ecological value considerably. On the majority of farms in Spain, the semi-natural habitats show discontinuities in their connectivity (56.5%). On 17.4%, semi-natural habitats are not connected. Here is potential for improvement, i.e. measures should be taken to increase the degree of semi-natural habitat connectivity. Considering the importance of biological corridors, standards, companies and cooperatives should support the creation of corridors by information, training and best-practice examples. Companies could establish a fund to support biological corridors financially.

The agricultural practice regarding the application of pesticides and fertilizers on semi-natural habitats is satisfying and provides little room for improvements.

Management and training:

Further potential for improvement lies in the elaboration of Biodiversity Action Plans (BAPs). 73.9% of the farms in Spain have a BAP, and have already implemented 54.4% of the measures specified. Training in practices conserving or enhancing the potential for biodiversity of farm operators and workers is a further key to biodiversity-friendly farming. Most farm operators of the Spanish farms (87%) have already participated in a biodiversity-relevant training but only about a third do so regularly. Hence, the farm operators should be motivated or invited regularly to participate in a training. Only about a third of workers on Spanish farms took part in a training but most of them do regularly.

The farm maps available are satisfying regarding the information they contain, as they show most of the information important for biodiversity management. The least present on the maps of the farms in Spain are protected areas on or adjacent to the farm with 65%. Here is room for improvement for Spanish farms.

3 Billeter et al., 2008; Indicators for biodiversity in agricultural landscapes: a pan-European study. Journal of Applied Ecology 45: 141-150.

4https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/income-support/greening_en, Accessed on 30.06.2020

Livestock:

The average livestock density on the two farms in Spain is too high. One farm indicated to have 3 LU/ha/year and the other one 8 LU/ha/year. This is clearly above the recommendation, i.e. the allowed density of the EU organic farming scheme is 2 LU/ha/year, and the threshold of the EU Life Project "Biodiversity in Standards and Labels for the Food Industry" is 1.7 LU/ha[5]. The following table serves as a guide. Measures should be taken to decrease the average livestock density and the farmers could be supported by consultants.

Table 5: Thresholds for evaluation of the average livestock density

Average livestock density (LU/ha/year) of the main fodder area			
> 1.7	1.7 – 1.1	1.1 – 0.5	< 0.5

The farms in Spain produce 51%-80% of the forage for livestock on their farm, which is a satisfactory level. But also here is still potential for improvement by increasing the share of forage produced on farm for farms with a lower self-sufficiency level.

Animal feed and deforestation:

On the farms in Spain, no soy at all is fed. This can be assessed as a very good result. However, taking into account the very high livestock densities on the main fodder areas, a consultation may help to optimize the production system.

Water:

Most of the shore lines of the water bodies on the farms in Spain have a buffer zone. This is a satisfactory state. However, about 28% of the shore lines in Spain have no buffer zone and are possibly in conflict with legal compliance. It is recommended to check the legal compliance of the farms and to support farms to reach legal compliance. Further, about 8% of the shore lines in Spain have a buffer zone ≥10 metres - the minimum width for an effective buffer which can serve also as a biotope corridor. The farms should be supported in the biodiversity-friendly management of their water bodies, e.g. through consultancy and/or incentives.

About half of the farms in Spain that irrigate their crops, use a decision support tool to assess the appropriate amount of irrigation and are involved in a water management programme to increase the water use efficiency and sustainability. Since climate change is projected to lead to a decrease in precipitation in Southern Europe and, hence, effect water availability and irrigation demand[6], it is strongly recommended to further improve the water use sustainability on the farms in Spain.

Alien invasive species:

There are no alien invasive species present on the farms in Spain. Depending on the regional threat through alien invasive species, farmers could be provided information on the respective species, i.e. how to identify them and how to combat them, in order to be prepared.

[5] *„Recommendations to improve biodiversity protection in policy and criteria of food standards and sourcing requirements of food companies and retailers" published by the partner consortium of the EU Life Project "Biodiversity in Standards and Labels for the Food Industry"*

[6] *Lüttringhaus, Sophia; Noleppa, Steffen; Gornott, Christoph; Lotze-Campen, Hermann: Climate change impacts on European crop production - A literature review; HFFA Research Paper 01/2019*

Genetic diversity:

On the Spanish farms, about 56% of the crops used were traditional varieties, and about 67% were traditional livestock breeds. This is a quite satisfactory state. To support a further increase in the use of traditional crops and breeds networking activities and markets for traditional seeding/planting material and traditional breeds could be organized. Furthermore, farmers not yet using traditional varieties/breeds could be informed about the benefits and sources of supply, as well as invited to field days on farms that can present their traditional varieties/breeds.

It is also a positive result that none of the farms in Spain used genetically modified varieties or breeds. More than half of the animal feed concentrate is GMO-free. This is already satisfactory, however, it should be aimed to increase the share even more.

Soil:

The share of UAA that has soil cover at least during critical periods should be increased since it is currently 46.8%. To protect soil from soil erosion and soil degradation as much UAA as possible should be covered during, e.g. strong rainfall. Standards, companies and producer associations could support farmers with information on measures to cover and protect soil and, even more, could create a soil protection fund to pay benefits to farmers with very good performance in soil protection.

The average crop rotation length is satisfactory but biodiversity could benefit from an increase in length and quality of the crop rotation. An information activity, also about long-term benefits, ecological as well as financial, of high quality crop rotation plans could support farmers in developing their own high quality crop rotation plans.

With 121.6 kg N/ha/year the farms in Spain are clearly below the threshold of 170 kg/ha/year of the EU Nitrates Directive. This is a very positive result.

Pesticide management:

IPM measures against weeds and pests are widely used by the farmers in Spain. This is a very good result. It is also a good result, that about 57% of the UAA of the farms in Spain is not treated with pesticides. On 28.3% of UAA broad-spectrum herbicides are used. A further positive result is that on half of the farms pesticide use showed a continuous negative trend during the last five years. Standards, companies and producer associations could communicate this good result and offer incentives for a further increase of UAA not treated with pesticides and decrease of UAA on which broad-spectrum herbicides are used.

5.2 Germany

Semi-natural habitats:

The farms in Germany have a share of 22.8% semi-natural habitat area compared to the total farm area which is close to 20% and thus a very positive result. Since the range is large, there is still room for improvement on individual farms. One option might be to approach farms with 0% semi-natural habitat area with incentives or consultancy to increase their share to 10%-20%. It is important to note that farms with 0% semi-natural habitat area are possibly not in legal compliance. In the EU, for

instance, farms with 15 ha or more must manage at least 5% of their farm area as Ecological Focus Area[7]. Semi-natural habitat areas belong to the measures accepted for Ecological Focus Areas.

On 11.1% of the farms in Germany, semi-natural habitats are not connected. Here is potential for improvement, i.e. measures should be taken to increase the degree of semi-natural habitat connectivity. Considering the importance of biological corridors, standards, companies and cooperatives should support the creation of corridors by information, training and best-practice examples. Companies could establish a fund to support biological corridors financially.

The agricultural practice regarding the application of pesticides and fertilizers on semi-natural habitats is satisfying and provides little room for improvements.

Management and training:

In Germany, only 21.1% of the farms have a BAP. At the same time, the farms that have a BAP have implemented 56.3% the specified measures, a share similarly high as on the Spanish farms. The BAP is the key element of a sound biodiversity management based on the individual baseline with strengths and weaknesses of the farm. The farms in Germany should be supported in the development of farm-specific BAPs, e.g. by providing them access to the online Biodiversity Performance Tool which could be promoted by the standard, company or cooperative. The Biodiversity Performance Tool as well as well-trained farm assessors contribute to the elaboration and implementation of high quality BAPs.

In Germany, fewer farm operators have had an initial training in biodiversity topics (66.7%) than in Spain but most of them take part in trainings regularly. In case of the German farm operators it can be recommended to increase information activities on trainings and the ease of access to trainings. About half of the workers took part in a training but very few do regularly. Therefore, regular reminders for trainings for workers could be a way to increase the share of workers that take part in trainings regularly.

There is a knowledge pool and comprehensive training material on biodiversity in the food sector available on www.food-biodiversity.eu.

On the maps of the farms in Germany, which overall provide a satisfying level of information, the least present were information on semi-natural habitats with only 36.8% of the farm maps that included this information. It seems to be worthwhile investigating why this value is remarkably low, compared to the presence of other types of information. Possibly there is a misunderstanding regarding the content of the question asked to retrieve the data. For farms in Germany there is also room for improvement regarding the inclusion of information on protected areas on or adjacent to the farm as 73.7% of the farm maps included this type of information.

Livestock:

On the German farms, the average livestock density is on a satisfactory level with 1.7 LU/ha/year. A further decrease, however, would be beneficial for biodiversity. Therefore, it is recommended to provide farmers with information material (e.g. factsheets on livestock production and grazing management on the website www.business-biodiversity.eu).

The majority of farms in Germany produce 51%-80% of the forage for livestock on their farm, which is a satisfactory level. But also here is still potential for improvement by increasing the share of forage produced on farm for farms with a lower self-sufficiency level.

7https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/income-support/greening_en, Accessed on 30.06.2020

Animal feed and deforestation:

For the evaluation, it is difficult to assess the magnitude of soy use for animal feed if the animal type is not known, as is currently the case in the Biodiversity Monitoring-System, because usually different shares of soy are used for different livestock types. For poultry the share of soy cake in the feed composition is approximately 20%-25%[8], for pigs 10%-20%, and for dairy cows 6%[9].

The share of soy-based feed concentrate of the entire feed composition of the farms in Germany is 4.6%. Hence, it can be assumed that the share of soy in the animal feed composition is on a rather low level for dairy cows. However, the sources of soy should be investigated since only 10% of the farmers used certified deforestation-free soy and 20% sourced soy from a producer within the EU with a transparent commitment to sustainable production. The share of concentrate fed to ruminants, for example, could be further reduced by increasing grazing and hay quality or by reducing production objectives (e.g. liter of milk per cow). Farmers could be supported in finding ways of reducing the share of soy and imported feed or by increasing the share of sustainably produced soy by consultancy or by organised field days with the possibility to exchange information with other farmers, and maybe the development of cooperation between farmers for this purpose.

Water:

Most of the shore lines of the water bodies on the farms in Germany have a buffer zone. This is a satisfactory state. However, about 23% in Germany have no buffer zone and are possibly in conflict with legal compliance. It is recommended to check the legal compliance of the farms and to support farms to reach legal compliance. Further, about 22% in Germany have a buffer zone ≥10 metres - the minimum width for an effective buffer which can serve also as a biotope corridor. There is potential for improvement regarding the widths of the buffer zones along water bodies. Standards, companies and cooperatives should support farmers in the creation of sound buffer zones, and could provide information and positive examples on how to do it. Companies could create a fund to support farmers financially if they go beyond the legally required buffer zones.

Decision support tools to assess the appropriate amount of irrigation and water management programme to increase the water use efficiency and sustainability are used by very few German farmers. In Germany, an overall increase of precipitation amounts due to climate change is projected. However, while in the winter period precipitation will increase, it will decrease in the summer period, the main timeframe of crop growth and irrigation demand[10]. Water shortages and falling groundwater levels were reported in the past. Therefore, it is, also for German farmers, strongly recommended to optimize their water use. Standards, companies and producer associations could support farmers, e.g., by providing information and organising field days to learn about decision support tools and water management programmes on-field.

Alien invasive species:

On less than a third of the farms in Germany, alien invasive species are present, and all but one of these farms take measures to fight the alien invasive species. However, little use of support by specialized organisations to combat alien invasive species is made. Some countries publish good lists on alien invasive species. Standards, companies, cooperatives should realize an information activity (leaflet, email, or other) with the aim to increase awareness for alien invasive species, to spread

[8] *https://orgprints.org/24970/1/soja_fuetterungsfibel.pdf*
[9] *https://milchindustrie.de/sojagebrauch-2/*
[10] *BMU/ UBA (editors) (2018): Water Resource Management in Germany. Fundamentals, pressures, measures. Dessau-Roßlau. Publications in pdf format:www.uba.de/en/water-resource-management*

knowledge about measures against alien invasive species, and to motivate farmers to ask nature protection authorities and NGOs for support.

Genetic diversity:

The share of traditional crops used is, with only 17%, on a low level compared to the farms in Spain. For livestock, the share of traditional breeds is higher (50%) but also here is potential for improvement through an increase in the share of traditional breeds. Companies /standards /producer cooperatives should promote traditional varieties as they increase not only agrobiodiversity, but could also result to be more resilient to impact of climate change.

Companies /standards /producer cooperatives could:

- make efforts to create better market access for traditional varieties,
- reward farmers/suppliers who grow these varieties,
- support farms to apply for funding from public programmes for projects that contribute to the improvement of agrobiodiversity,
- support initiatives for the development of traditional varieties in order to meet current user expectations,
- support classical techniques rather than genetic modification of biotechnology,
- seek collaboration and exchange with local and national research institutions, farmers as guardians of biodiversity, as well as other stakeholders,
- promote the transfer of knowledge and technology to the field.

Concerning genetically modified organisms (GMO), a very positive result is that no genetically modified crops of livestock breeds are used on the farms in Germany. The share of certified GMO-free fodder is also on a satisfactory level with 70.8%. There are however, also farms that have a share of 0%, i.e. none of the feedstuff is certified to be GMO-free. A consultancy may help farmers to explain the negative impacts on GMO on biodiversity and to explore ways of sourcing certified GMO-free fodder.

Soil:

About 75% of UAA is covered at least during critical periods on the German farms. This is a very good result. However, for the sake of soil protection as much soil as possible should be covered during critical periods to avoid soil erosion and degradation. The average crop rotation is on a good level with 3.9 years. Standards, companies and producer associations could try to motivate farmers to improve their already good performance with incentives. These could also be in form of free entrance to agricultural fairs or other events providing the possibility for further education/training.

With on average 150.1 kg N/ha/year, the farms in Germany lie above the threshold of 170 kg N/ha/year of the EU Nitrates Directive. Hence, the farms should be supported to identify the plot-specific optimal amount of nitrogen by a post-harvest N-balance and to find solutions how the amount of nitrogen applied can be reduced. The company/ standard/ producer association could require nutrient balances and provide proven methods to support farmers. Further, the company/ standard/ producer association could regulate crop-specific nutrient limits, combined with tolerance thresholds and time references and provide guidelines for crop rotation. The company/ standard/ producer association could also establish requirements for the recognition and prevention of soil damage.

Pesticide management:

30% of the farms in Germany do not apply any IPM measures against weeds and 40% do not apply any IPM measures against pests. This group could be approached with an invitation to a field day to meet other farmers with a higher engagement to facilitate an exchange about practices among farmers and

to demonstrate techniques on the field. 45.4% of UAA that is not treated with pesticides and on 23.2% of UAA broad-spectrum herbicides are applied. On 14.3% of farms, the total amount of applied pesticides show a continuous reduction. Standards/ companies/ producer associations should strengthen their focus on an improvement of pesticide management in order to meet the aims of recent EU policies such as the Green Deal, the EU Farm to Fork Strategy or the EU Biodiversity Strategy 2030. The EU Commission has announced to support the implementation of these policies and strategies with legislation.

6 Final remarks

The person responsible for biodiversity monitoring in the standard/company or cooperative has access to Metabase, which provides an overview over all associated farms. The aim of the exemplary monitoring report is to show how the output of the Biodiversity Monitoring-System looks like and how it could be used for an evaluation. The evaluation of results needs to be done individually by each user. It will be very useful to confirm existing strategies of the standard, company or producer association or to define a new one: e.g. to develop support or consultancy for specific aspects, to create incentives for certain measures or to reward farmers with a high biodiversity performance.

The monitoring is repeated regularly to be able to detect changes. This report is based only on one point in time, since at the time of preparation of this document there were no data on different years available.

As explained, the task of the Biodiversity Monitoring System is to provide an overview on a group of farms (on regional or national level, of a certain production type). The Biodiversity Performance Tool is a complementary instrument which allows – within other functions – monitoring of biodiversity on farm level. For further information on the Biodiversity Performance Tool visit www.biodiversity-performance.eu.

7 Annexes

i. How does the Biodiversity Monitoring-System work?

The responsible person for the monitoring (e.g. sustainability manager of a company, impact assessor of a standard, in the following: project leader) fills the registration form on the website: https://bms.biodiversity-performance.eu/. The registration will be approved by the operators of the Biodiversity Monitoring-System.

Via the entry mask of the Biodiversity Monitoring-System data from associated farms can be collected by authorized persons asigned by the project leader (person responsible for monitoring in the standard /company or another entity). On a separate website, only the project leader can view the aggregated results which delivers an overview of all included farms. There are different filter options available which help to customize the presentation of the results.

Until the end of 2020, the use of the Biodiversity Monitoring-System is free of charge. From 2021 on, a fee will be charged for the use of the Biodiversity Monitoring-System to finance the maintenance, regular update and improvement of the system. For further information contact Marion Hammerl at Lake Constance Foundation, email: marion.hammerl@bodensee-stiftung.org .

ii. Further information

Information on the Biodiversity Monitoring System can be found on this website: www.biodiversity-performance.eu

The development and implementation of the Biodiversity Monitoring-System is an important component of the EU project "Biodiversity in Standards and Labels for the Food Sector". Further information on the EU project at: www.food-biodiversity.eu

The LIFE Food & Biodiversity Project is directed at standard setting organizations and companies with individual sourcing requirements. A European consortium of Global Nature Fund, Lake Constance Foundation, Fundación Global Nature, Instituto Superior Técnico, Agentur auf!, Solagro, agence good for good provide practical support to biodiversity performance of the food industry by

- Supporting standard-setting organisations to include efficient biodiversity criteria into existing schemes; encouraging food processing companies and retailers to include biodiversity criteria into their respective sourcing guidelines
- Biodiversity trainings for advisors and certifiers of standards as well as product and quality managers of companies
- Implementing a Biodiversity Performance Tool and a cross-standard monitoring system on biodiversity
- Communicating strongly to raise awareness among all stakeholders in the industry
- Implementing Sector Initiatives on Biodiversity
- Contributing to national and European Polices such as the EU Pollinators Initiative.

iii. Indicators with related questions and answer options

Table 6: Clusters, indicators and questions of the Biodiversity Monitoring-System

Cluster	Indicators	Questions
Semi-natural habitats (SNH)	• Preservation and creation of semi-natural habitats • Pesticide and fertilizer pressure on semi-natural habitats • Connectivity of semi-natural habitats	• What is the total farm area (FA) (in ha)? • What is the total utilised agricultural area (UAA) of the farm (ha)? • Which area is covered by temporary SNH (ha)? • Which area is covered by permanent SNH (ha)? • What is the share of SNH compared to total farm area (%)? • Do you apply pesticides on any SNH areas at the farm? • Do you apply fertilizers on any SNH areas other than permanent grassland under extensive management, agroforestry systems, silvopastoral systems (located on UAA or other farm areas)? • Are the SNH areas on your farm in some way connected so that they build a network of biological corridors?
Management and training	• Mapping of the farm • Biodiversity Action Plan • Biodiversity training for farm operators • Biodiversity training for farm workers	• Do you have a geospatial mapping of the farm and surrounding areas that outlines the delineation and/or location of: - Farm boundary - Utilised agricultural area - Non utilised agricultural area (NUAA) - Semi-natural habitat areas (e.g. buffer zones around aquatic ecosystems, hedges, tree lines, biotope corridors, wetlands, waterbodies, fallow land, reforested areas, etc.) - Production plots - Protected areas on or adjacent to the farm • Has a Biodiversity Action Plan been elaborated for the farm? • If a Biodiversity Action Plan has been elaborated, specify the degree of its implementation on the farm (% of implemented measures that were agreed in the BAP) • Did the farm operator participate in a training/education/workshop with relevance to biodiversity?

		• Does the farm operator you participate in a training/education/workshop with relevance to biodiversity on a regular basis? • Did your workers participate in a training/education/workshop with relevance to biodiversity? • Do your workers participate in a training/education/workshop with relevance to biodiversity on a regular basis? • Which share of your permanent staff already participated in a training unit with relevance to biodiversity?
Livestock	• Forage autonomy • Livestock density	• How much of the total required forage for your livestock can be produced on farm? (%) • What is the maximum average livestock density (LU/ha/year) of your main fodder area?
Animal feed and deforestation	• Off-site ecosystems loss and degradation related to animal fodder production (dependence on soy as animal feed)	• What is the share of soy based feed concentrate (%) from the total animal fodder composition? • Which share of your animal feed that is based on soy is certified to be deforestation free (e.g. Round Table on Responsible Soy certification)? • Which share of your animal feed that is based on soy originates from a manufacturer based in an EU country where there is a transparent commitment to sustainable production (e.g. Donau Soja)?
Water	• Buffer zones around water bodies • Sustainable and efficient water use • Irrigating the appropriate amount of water	• Do you have any water bodies on your farm? • What is the share (%) of water courses that have… - no buffer zone in comparison to total shore line? - a buffer zone width between 1-4 meters in comparison to total shore line? - a buffer zone width between 5-9 meters in comparison to total shore line? - a buffer zone width of >=10 meters in comparison to total shore line? • Do you implement or are you involved in any water management programme/activities where the aim is to increase water use efficiency and sustainability? • Do you use any decision support tools to assess the appropriate amount of irrigation?
Alien invasive species	• Alien invasive species	• Are there alien invasive species present on the farm?

		• If yes, do you apply any measures for fighting these alien invasive species on your farm? • If yes, do you consult any support from NGOs, research institutions or other relevant authority for fighting alien invasive species on your farm?
Genetic diversity	• Number of crop plant species • Number of breeds (animals) • Number of traditional crop species • Number of traditional breeds (animals) • Genetically modified organisms in crops and livestock breeds • Genetically modified organisms in animal feed	• How many different crops do you cultivate (including temporary grassland and permanent grassland not under extensive management, which are considered as crops)? • How many livestock breeds do you have? • How many traditional crop species do you cultivate? • How many traditional livestock breeds do you have? • Do you have genetically modified crops on your farm? • What is the share of your UAA on which GMO crops are cultivated? • Do you have animal breeds that are genetically modified? • What is the proportion of animal breeds that are genetically modified compared to the total breeds? • Which proportion of the total used animal feed concentrate is certified to be GMO free (e.g. Pro Terra certified)?
Soil	• Reduced soil erosion (soil coverage) • Crop rotation length • Nitrogen application	• What is the proportion of your farming area (UAA) that has a soil cover (e.g. cover crops but also mulching) at least during critial periods (e.g. peak precipitation months)? • How long is the crop rotation of your main crops in years i.e. the time span until the same crop is planted again? • What is the entire amount of Nitrogen applied on your farm (including inorganic and organic) in kg/ha/year?
Pesticide management	• Alternative measures against weeds and pests • Pesticide pressure on agricultural land	• What is the share (%) of UAA (ha) on which alternative measures are applied against weeds to avoid and to reduce pesticide application (IPM measures)? • What is the share (%) of UAA (ha) on which alternative measures are applied against pests? to avoid and to reduce pesticide application (IPM measures)? • What is the proportion (%) of UAA that is not treated with pesticides? • A list of active ingredients that are deployed on the farm is provided? • Is the amount of each active ingredient deployed in litres/ha and/or grams/ha provided in form of a list?

		• Does the total amount of applied pesticides on your farm show a continuous reduction over a period of the past 5 years? • What is the share of UAA (%) where broad-spectrum herbicides are applied?

iv. Indicators linked to desired impacts

Table 7: Indicators, questions and desired impact of the Biodiversity Monitoring-System

Indicator	Questions	Impact
	Farm management	
Mapping of the farm	Do you have a geospatial mapping of the farm and surrounding areas that outlines the delineation and/or location of: - Farm boundary - Utilised agricultural area (UAA) - Non utilised agricultural area (NUAA) - Semi-natural habitat areas (e.g. buffer zones around aquatic ecosystems, hedges, tree lines, biotope corridors, wetlands, waterbodies, fallow land, reforested areas, etc.) - Production plots - Protected areas on or adjacent to the farm	Creating potential for biodiversity
Biodiversity Action Plan	Has a Biodiversity Action Plan been elaborated for the farm? If a Biodiversity Action Plan has been elaborated, specify the degree of its implementation on the farm (% of implemented measures that were agreed in the BAP)	
Biodiversity training for farm operators	Did the farm operator participate in a training/education/workshop with relevance to biodiversity? Does the farm operator you participate in a training/education/workshop with relevance to biodiversity on a regular basis?	
Biodiversity training for farm workers	Did your workers participate in a training/education/workshop with relevance to biodiversity? Do your workers participate in a training/education/workshop with relevance to biodiversity on a regular basis? Which share of your permanent staff already participated in a training unit with relevance to biodiversity?	
	Very good agricultural practices	
Pesticide pressure on agricultural land	What is the proportion (%) of UAA that is not treated with pesticides? Is a list of active ingredients that are deployed on the farm provided? Is the amount of each active ingredient deployed in litres/ha and/or grams/ha provided in form of a list? Does the total amount of applied pesticides on your farm show a continuous reduction over a period of the past 5 years? What is the share of UAA (%) where broad-spectrum herbicides are applied?	

Alternative measures against weeds and pests	What is the share (%) of UAA (ha) on which alternative measures are applied against weeds to avoid and to reduce pesticide application (IPM measures)? What is the share (%) of UAA (ha) on which alternative measures are applied against pests to avoid and to reduce pesticide application (IPM measures)?	**Direct pressures on biodiversity by common agricultural practice have been reduced**	
Nitrogen application	What is the entire amount of Nitrogen applied on your farm (including inorganic and organic) in kg/ha/year?		
Crop rotation length	How long is the crop rotation of your main crops in years i.e. the time span until the same crop is planted again?		
Reduced soil erosion (soil coverage)	What is the proportion of your farming area (UAA) that has a soil cover (e.g. cover crops but also mulching) at least during critial periods (e.g. peak precipitation months)?		
Number of crop plant species	How many different crops do you cultivate (including temporary grassland and permanent grassland not under extensive management, which are considered as crops)		
Number of breeds (animals)	How many livestock breeds do you have?		
Number of traditional crop species	How many traditional crop species do you cultivate?		
Number of traditional breeds (animals)	How many traditional livestock breeds do you have?	**Agrobiodiversity increases**	
GMO in crops and livestock breeds	Do you have genetically modified crops on your farm? What is the share of your UAA on which GMO crops are cultivated? Do you have animal breeds that are genetically modified? What is the proportion of animal breeds that are genetically modified compared to the total breeds?		
GMO in animal feed	Which proportion of the total used animal feed concentrate is certified to be GMO free (e.g. Pro Terra certified)?		
Forage autonomy	How much of the total required forage for your livestock can be produced on farm?		
Livestock density	What is the average livestock density (LU/ha/year) of your main fodder area?		
Sustainable and efficient water use	Do you implement or are you involved in any water management programme/activities where the aim is to increase water use efficiency and sustainability?		
Irrigating the appropriate amount of water	Do you use any decision support tools to assess the appropriate amount of irrigation?		
Biodiversity management			

Preservation and creation of semi-natural habitats	What is the total farm area (FA) (in ha)? What is the total utilised agricultural area (UAA) of the farm (ha)? Which area is covered by permanent SNH (ha)? Which area is covered by temporary SNH (ha)? What is the share of SNH compared to total farm area (%)?	**Creation and protection of habitats**	
Pesticide and fertilizer pressure on semi-natural habitats	Do you apply pesticides on any SNH areas at the farm? Do you apply fertilizers on any SNH areas other than permanent grassland under extensive management, agroforestry systems, silvopastoral systems (located on UAA or other farm areas)?		
Connectivity of semi-natural habitats	Are the SNH areas on your farm in some way connected so that they build a network of biological corridors?		
Buffer zones around water bodies	Do you have any water bodies on your farm? What is the share of water courses that have no buffer zone in comparison to total shore line? What is the share of water courses that have a buffer zone width between 1-4 meters in comparison to total shore line? What is the share of water courses that have a buffer zone width between 5-9 meters in comparison to total shore line? What is the share of water courses that have a buffer zone width of >=10 meters in comparison to total shore line?	**Further risks for biodiversity loss and degradation are identified and reduced**	
Alien invasive species	Are there alien invasive species present on the farm? If yes, do you apply any measures for fighting these alien invasive species on your farm? If yes, do you consult any support from NGOs, research institutions or other relevant authority for fighting alien invasive species on your farm?		
Off-site ecosystems loss and degradation related to animal fodder production (dependence on soy as animal feed)	What is the share of soy based feed concentrate (%)? Which share of your animal feed that is based on soy is certified to be deforestation free (e.g. Round Table on Responsible Soy certification)? Which share of your animal feed that is based on soy originates from a manufacturer based in an EU country where there is a transparent commitment to sustainable production (e.g. Donau Soja)?		

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