Biodiversity Monitoring-System

An exemplary monitoring report on the farming of arable crops, livestock and grasslands

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 15 farms is used to create the exemplary monitoring report. These are farms that produce arable crops, livestock and maintain grasslands. They are located in Germany, Spain and Portugal.

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

4.1 Cluster 1: semi-natural habitats

Permanent semi-natural habitats make on average 73.9 ha and temporary semi-natural habitats cover on average 0.8 ha. The share of semi-natural habitats compared to the total farm area is on average 8.7% (see table 1). The minimum share of semi-natural habitat areas compared to the total farm area is 0% and the maximum is 47%.

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

Parameters	n*	Average	Sum	Minimum	Maximum
Farm area (ha)	15	549.7	8,245	2	3,518
Utilised agricultural area (ha)	15	498.6	7,479	2	3,158
Temporary semi-natural habitats (ha)	15	0.8	12	0	7
Permanent semi-natural habitats (ha)	15	73.9	1,108	0	535
Semi-natural habitats, total share (%)	15	8.7	-	0	47

* n = number of responses to the respective question

On 13.3% of the farms, semi-natural habitats are connected so that they build a biological corridor. On 73.3% of the farms the semi-natural habitats are connected but show discontinuities, and on 13.3% of the farms there are no connections between semi-natural habitats (see figure 1). None of the farms apply pesticides, and 6.7% apply fertilizers on semi-natural habitats (see figures 2a and 2b).

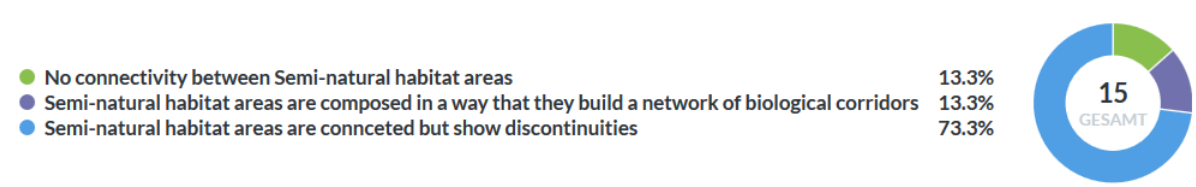
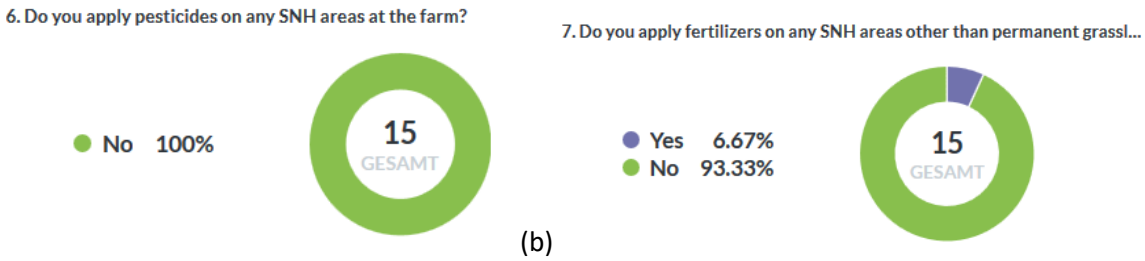


Figure 1: Connectivity of semi-natural habitats



(a) (b)

Figure 2: Application of (a) pesticides and (b) fertilizers on semi-natural habitats

4.2 Cluster 2: management and training

An important management tool are farm maps. Regarding the maps of the farms, 100% include the farm boundary, 100% the utilised agricultural area, 100% the non-utilised agricultural area, 50% semi-natural habitats, 100% production plots, and 78.6% protected areas on or adjacent to the farm (n=14 for all parameters).

Another tool for biodiversity management are Biodiversity Action Plans. 33.3% of the farms have already made a Biodiversity Action Plan for their farm (see figure 3). A Biodiversity Action Plan contains measures selected according to the baseline of the farm to protect biodiversity and create potential for biodiversity. On average 72% (n=5) of the measures were already implemented. The minimum was 10% of the measures specified in the Biodiversity Action Plan were already implemented.

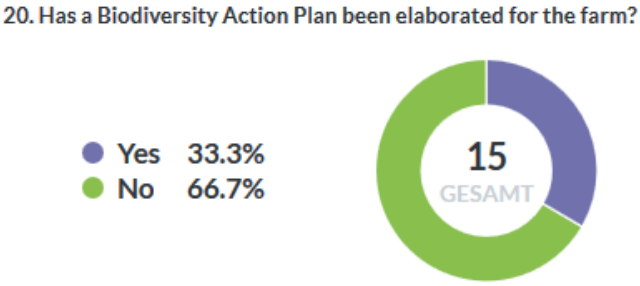


Figure 3: Availability of a Biodiversity Action Plan for the farm

A further management measure to ensure biodiversity conservation and potential creation is training. On 10 out of 15 farms, farm operators did participate in a training in the past, and on one farm the operator does so regularly. On four farms out of 15, workers participated in a training in the past and on none of the farms workers do so regularly. On 11 farms, 9.6% of permanent staff participated in a training with biodiversity-relevant contents.

4.3 Cluster 3: livestock

Ten of the farms in the subsample have livestock. On those farms, the average livestock density is 2 LU/ha/year. The maximum is 6 LU/ha/year. Eight farms are able to produce 51-80% of the required forage for their livestock on farm. One farm produces more than 80% of the forage for their livestock on the farm.

4.4 Cluster 4: animal feed and deforestation

The ten farms that keep livestock have an average share of 7.1% soy-based feed concentrate in their entire animal feed composition. The maximum here is 25%. None of the farms source certified deforestation-free soy. Of seven farms, the average share of animal feed that is based on soy which

originates from a manufacturer located in the EU where there is transparent commitment to sustainable production is 28.6%. The minimum is 0% and the maximum 100%.

4.5 Cluster 5: water

Of the 15 farms, nine (60%) have water bodies on their farms (see figure 4). On these nine farms, on average 11.6% of the shore lines have no buffer zone, 44% of the shore line have a buffer zone of 1-4 metres width, and 55.6% have a buffer zone of 5-9 metres width[1]. The range of responses is large here with minimums of 0% and maximums of 100% in all categories. On the nine farms, there is no buffer zone along water courses with 10 metres or more.

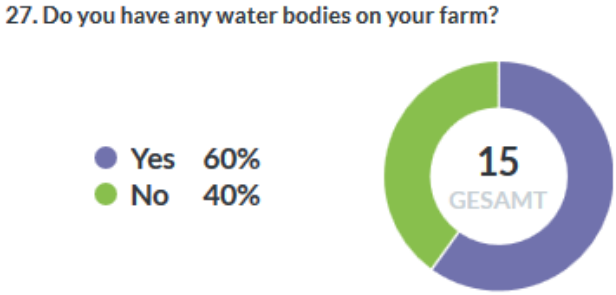


Figure 4: Presence of water bodies on the farms

Of the ten farms that use irrigation, three apply a decision support tool to assess the appropriate amount of irrigation (see figure 5). Three farms are involved in a water management programme to increase the water use efficiency and sustainability.

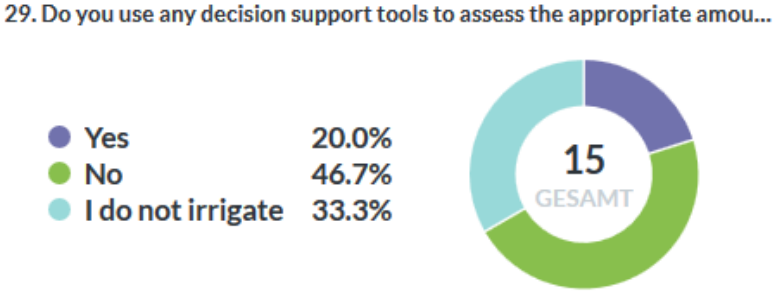


Figure 5: The application of decision support tools for irrigation

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 three (20%) of the 15 farms, alien invasive species are observed (see figure 6). On one farm, measures are taken to fight the alien invasive species. None 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.

[1] *The sum of the averages is more than 100% here, 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.*

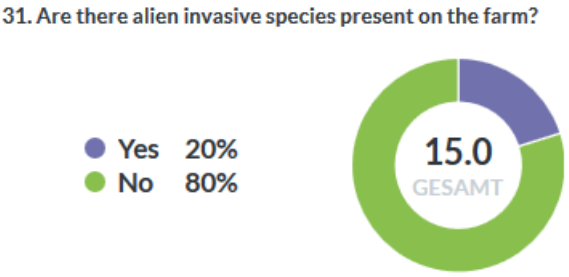


Figure 6: Presence of alien invasive species on the farm

4.7 Cluster 7: genetic diversity

Of on average 4.1 different cultivated crops on the farms in the sample, on average 0.5 are traditional crops (see table 2). This represents a share of approximately 12% traditional crop species. For livestock breeds, on average 1.6 different breeds are kept by the ten farms, of which 0.4 on average are traditional breeds. This represents a share of 25% traditional livestock breeds.

The farms in the sample neither have genetically modified crops nor genetically modified livestock breeds. The average share of certified GMO-free animal feed concentrate of the total used animal feed concentrate is on average 56.3%. The span ranges from 0% to 100% certified GMO-free animal feed concentrate.

Table 2: Results for parameters indicating genetic diversity

Parameter	n	Average	Minimum	Maximum
Number of different crops cultivated[a]	15	4.1	1	8
Number of traditional crop species cultivated	15	0.5	0	4
Number of livestock breeds	10	1.6	1	4
Number of traditional livestock breeds	10	0.4	0	4
Share (%) of certified GMO-free animal feed	8	56.3	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 15 farms, 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 50.5%. The minimum share of farming area that has soil cover during critical periods is 5% and the maximum is 93%. The average crop rotation of main crops is 4.1 years, with a minimum of 2 years and a maximum of 5 years.

The average amount of nitrogen (organic and inorganic) applied on the 15 farms is 192.3 kg/ha/year. The minimum is 85 kg/ha/year and the maximum 325 kg/ha/year. In sum, the 15 farms applied 2,885 kg/ha/year nitrogen on their areas.

4.9 Cluster 9: pesticide management

The engagement of the 15 farms in the use of alternative measures (Integrated Pest Management, IPM) against weeds and pests with the aim to avoid and reduce pesticide application appears to split the farm operators into two groups: one group has a high engagement with nearly half of the farms responding to use alternative measures on 100% of the utilized agricultural area (UAA). The other group, also nearly half of the farms, have a low engagement in the use of alternative measures against weeds and pests. They responded to apply alternative measures on 0% of the UAA. There are few

farms in between which applied alternative measures on 1-30%, 31-49%, 50-69% and 70% of the UAA (see figure 7).

The average share of UAA that is not treated with pesticides is 31.4%. The share ranges from 0% to 100% of UAA not treated with pesticides, confirming the large differences between farms. The difference is also reflected in the share of UAA on which broad-spectrum herbicides are used which ranges again from 0% to 100% of the UAA, with an average of 45.3% of UAA.

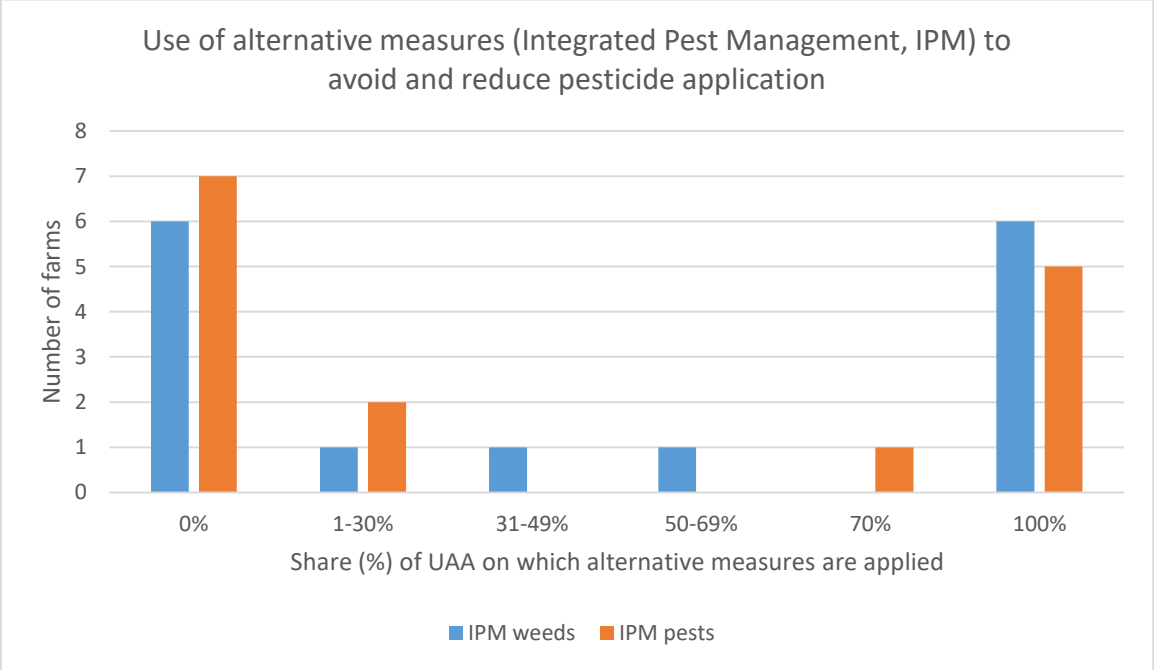


Figure 7: Distribution of responses regarding the use of alternative measures against weeds and pests to avoid and reduce pesticide application

All farms 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 4 farms (26.7%), the total amount of applied pesticides showed a continuous reduction over a period of the past five years (see figure 8).

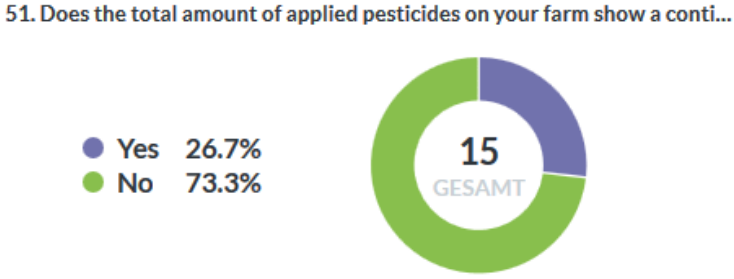


Figure 8: Share of farms with a continuous reduction of the amount of applied pesticides during the last five years

5 Evaluation of the monitoring results

The following table gives an overview of the evaluation of the results in each cluster 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.

Table 3: Evaluation of the results in each cluster

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

In the following part of the section the results in each cluster are discussed in more in detail and concrete suggestions are made for ways on how to achieve improvements in biodiversity performance.

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%[2] 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 this subsample have an average share of 8.7% semi-natural habitat area compared to the total farm area. This value is close to 10%, however, efforts should be made to increase the average share to at least 10%. Since the range is large, 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[3]. 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 the value of this semi-natural habitat considerably. On the majority of farms, the semi-natural habitats show discontinuities in their connectivity (73.3%). On 13.3% of the farms, 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 positive examples. Companies even 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:

Also the farm maps available are satisfying, showing most of the information important for biodiversity management. Only protected areas on or adjacent to the farm could be added by some of the farms.

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

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

More potential for improvement can be found in the elaboration of Biodiversity Action Plans (BAP) since only a third of the farms have already developed a BAP or a similar plan. The BAP is the key element of a sound biodiversity management based on the individual baseline with strengths and weaknesses of the farm. For support in developing a BAP, we refer 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 Biodiversity Action Plans.

Two thirds of the farm operators have already participated in a biodiversity-relevant training but very few do so regularly. Hence, farm operators should be motivated or invited regularly to participate in a training. Also farm workers should be motivated or offered regularly training sessions on biodiversity since only 9.6% of permanent staff participated in a biodiversity-relevant training. There is a knowledge pool and comprehensive training material on biodiversity in the food sector available on www.food-biodiversity.eu.

Livestock:

The average livestock density on the farms is on a satisfactory level since it is 2 LU/ha/year, which is also the allowed density of the EU organic farming scheme. However, according to the EU Life Project "Biodiversity in Standards and Labels for the Food Industry" the acceptable threshold should be set to 1.4 LU/ha[4] pointing to potential for improvement. The following table also serves as a guide.

Table 4: Average livestock density

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

The majority of the farms produce 51%-80% of the forage for livestock on their farm, which is a satisfactory level. But also here is still potential for improvement.

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%[5], for pigs 10%-20%, and for dairy cows 6%[6].

The share of soy-based feed concentrate of the entire feed composition of the farms is 7.1%. Hence, it can be assumed that the share of soy in the animal feed composition is on a normal level. However, the sources of soy should be investigated since none of the farmers used certified deforestation-free soy and only 28.6% 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 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 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.

[4] *„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"*
[5] *https://orgprints.org/24970/1/soja_fuetterungsfibel.pdf*
[6] *https://milchindustrie.de/sojagebrauch-2/*

Water:

Most of the shore lines of the water bodies on the farms have a buffer zone. This is a satisfactory state. There is potential for improvement, since 11.6% of shore lines have no buffer zone and are possibly in conflict with legal compliance. None of the shore lines have a buffer zone ≥10 metres - the minimum width for an effective buffer which can serve also as a biotope corridor. Only three of ten farms using irrigation were involved in a programme or activity to increase water use efficiency or used a decision support tool for assessing the appropriate amount of irrigation. Here, as well, is potential for improvement.

Taking into account the increasing risks regarding water sources because of contamination and water scarcity, standards, companies and cooperatives should support farmers in the creation of sound buffer zones. They 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.

Alien invasive species:

A positive result is that only on three of 15 farms, alien invasive species were present. The farms which found alien invasive species made effort to fight them and they did not make use of support to combat alien invasive species. 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 knowledge about measures against alien invasive species, and to motivate farmers to ask nature protection authorities and NGOs for support.

Genetic diversity:

The average number of cultivated crops is on a satisfactory level. The share of traditional crops is, however, on a low level. For livestock, the share of traditional breeds is higher (25%) 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. The share of certified GMO-free fodder shows potential for improvement as currently on average 56.3% of the fodder is certified to be GMO-free. 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:

Only 50.5% of the UAA is on average covered at least during critical periods. In order to prevent soil erosion, measures should be taken to increase the average share by especially supporting farmers at the lower end of the range to keep soil covered. The average crop rotation is on a good level with 4.1 years.

With on average 192.3 kg N/ha/year, the farms 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:

About half of the farm operators show a low engagement in the usage of alternative measures against weeds and pests to reduce the amount of applied pesticides. 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. The average share on 31.4% of UAA that is not treated with pesticides and the application of broad-spectrum herbicides on 45.3% of UAA underlines the potential for improvement here. However, it is also worth mentioning that on 26.7% of farms, the total amount of applied pesticides show a continuous reduction. More farms should be facilitated to achieve this development.

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. For different years, the users have the possibility to compare the values for different years.

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 5: 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 6: 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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