FOOD & BIODIVERSITY

Handbook for assessors

Biodiversity Monitoring-System

Image by OliverKepka from Pixabay

Content

1. Introduction

Standards for the food sector certify a certain quality of the production process or product, and guarantee legal compliance. But today, an increasing number of food processing companies and retailers as well as society are requesting more than legal compliance regarding environmental and social aspects – including biodiversity. Currently, standard organizations and companies lack of a common, objective and transparent monitoring system to claim improvements on biodiversity conservation. Hence, comparable data on biodiversity are not available and large-scale transparency regarding the state of biodiversity and its development cannot be provided.

The Global Nature Fund, Lake Constance Foundation, Agentur AUF! (Germany), the Fundación Global Nature (Spain), Solagro and agoodforgood (France) and Instituto Superior Técnico (Portugal) have therefore initiated the EU LIFE Project "Biodiversity in Standards and Labels for the Food Industry". The main objective is to improve the biodiversity performance of standards and labels within the food sector by supporting standard organizations to include efficient biodiversity criteria into their schemes; and motivating food processing companies and retailers to include biodiversity criteria into their sourcing guidelines.

As part of the EU LIFE Project the Biodiversity Monitoring-System was developed and shall enable the monitoring of impacts on biodiversity that are achieved through certification of standards and labels for the food sector. The focus thereby lies on monitoring:

- Reductions of negative impacts on biodiversity; and
- Creation of potentials for more biodiversity on the farm and its surrounding

as a result of improved agricultural practices in support of biodiversity.

The aim of the Biodiversity Monitoring-System is to enable detecting changes towards favourable conditions for biodiversity as a consequence of implementation of sound biodiversity management and very good agricultural practices. The development of agricultural practices with relevance for biodiversity is recorded with help of a dedicated indicator set (see chapter 5). 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 II.

A structured overview and visualisation of the data in the Biodiversity Monitoring-System facilitate an evaluation of agricultural practices with the aim of drawing conclusions regarding the development of the potentials for biodiversity. A baseline is established by the initial data collection that describes the current state of the farms. Changes are monitored by subsequent data collection in replicated time series i.e. if the key data of the Biodiversity Monitoring indicators are gathered again after a certain time span (every 1-3 years).

Beside the Biodiversity Monitoring-System, the Biodiversity Performance Tool was developed in the EU LIFE project. It is closely related to the Biodiversity Monitoring-System and aims at identifying and assessing the state of the potential for biodiversity on a farm. The further objective is to propose an action plan comprised of sustainable actions to reduce impacts on, preserve and promote biodiversity into the system of production. For further information on the Biodiversity Performance Tool visit www.biodiversity-performance.eu.

The Biodiversity Monitoring-System of the EU LIFE Food & Biodiversity project is designed in a way that it can interact closely with the Biodiversity Performance Tool but is also applicable as a stand-alone, independent monitoring system. In table 1 below, the features of both tools are summarised to provide a quick overview.

The time to complete the data in the monitoring questionnaire will take about half an hour up to one hour. It depends on the production system (e.g. livestock included or not) and it depends on the data available. The Biodiversity Monitoring-System uses several key data and indicators that are also relevant for the Biodiversity Performance Tool. If a farm already uses the Biodiversity Performance Tool, only few more data need to be gathered in order to implement the Biodiversity Monitoring. For food companies, standards or producer associations who are interested in using both tools it may be interesting to take note of the table showing which questions from the monitoring questionnaire are also covered by the Biodiversity Performance Tool is presented in the annex.

The web-address of the Biodiversity Monitoring-System is: bms.biodiversity-performance.eu/

Terms with a dotted underline are defined in the Glossary section at the end of this document.

Table 1: Two complementary biodiversity tools developed within the EU LIFE project Food & Biodiversity

Biodiversity Performance Tool	Biodiversity Monitoring-System

• Assessing potential for biodiversity at farm level
• Supports farmers and assessors in biodiversity management and the elaboration of a sound Biodiversity Action Plan
• Collects information on farm environment, farm practises and cooperation (78 indicators with relevance for biodiversity)
• Evaluates the baseline of the farm: strengths, weaknesses and opportunities
• Recommends measures to improve biodiversity performance = input for the Biodiversity Action Plan
• By updating the baseline, the BPT provides an overview on the development of biodiversity on the farm (monitoring)
	• Comparing biodiversity performance trends in the long-term
	• Compiling 25 biodiversity performance indicators within a timespan or within sectors
	• Focused on users such as standard organizations, food companies with many suppliers or agricultural cooperatives with many members
	• Delivers information on 2 levels:
	  ○ Level 1: System wide monitoring. Data collected for every certified farm /supplying farm through certification applications (e.g. information self-reported by producers), audits and/or the Biodiversity Performance Tool. Collection and evaluation of 25 indicators.
	  ○ Level 2: In-depth sampled monitoring beyond the scope of the certification audit by data generated on selected farms (different geographical settings, different type of crops). Monitoring of few key indicator species. Level 2 monitoring will presumably be available in 2021.

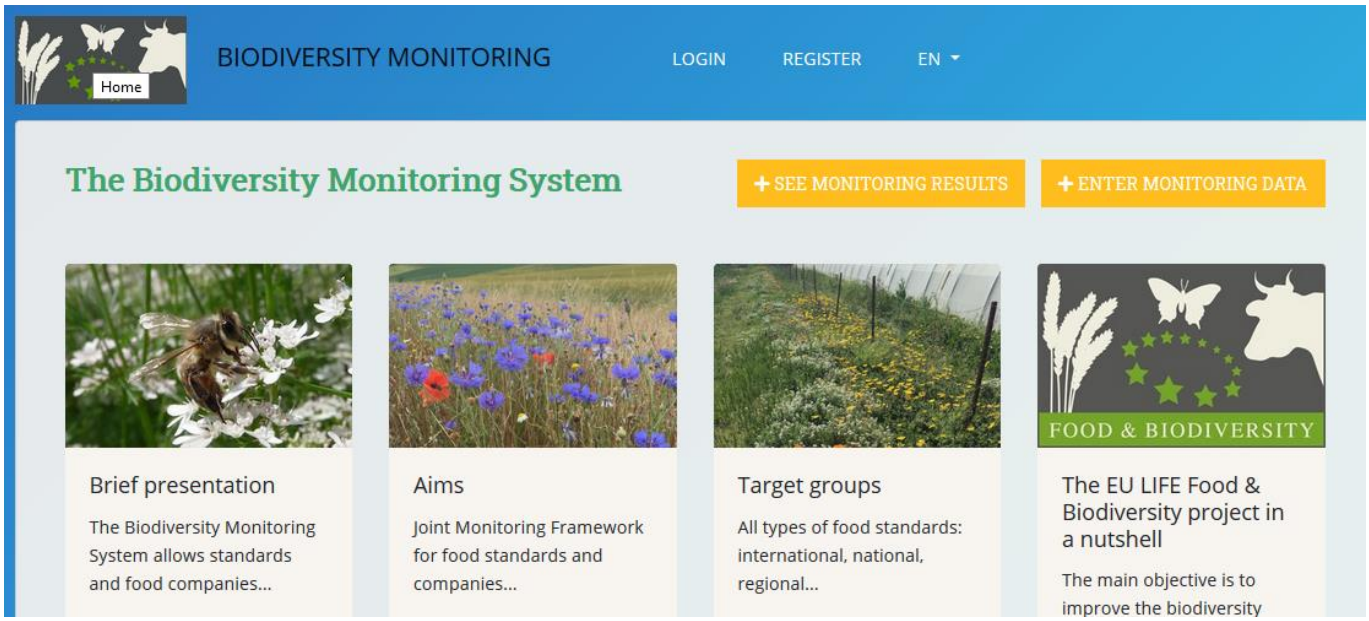

Figure 1: Landing page of the online Biodiversity Monitoring-System
(Source: own screenshot)

2. Registration procedure

Preparation before the registration of new users:

The organization/standard/company (referred to as "*organization*" in the following) gets in contact with Lake Constance Foundation: marion.hammerl@bodensee-stiftung.org or saskia.wolf@bodensee-stiftung.org. The email must contain the name of the organization in order to relate the data to the respective organization, and a list of all users of that organization who will register in close future (name and e-mail) in order to assess the validity of registration requests (this is important because of data security!). The users register themselves; Lake Constance Foundation approves each registration.

Registration for the website with the data entry mask:

a) Go to the website https://bms.biodiversity-performance.eu/register
b) Fill in the registration form as shown below
c) For the organization, type in the first character of the name and choose the organization you belong to in order to be able to choose your organization
d) Accept the General Conditions of Use
e) Click on "Register"
f) Your registration is now sent to Lake Constance Foundation. They proof whether the registration is valid (e.g. whether the person registered in fact belongs to the organization she chose)
g) After approval you get a confirmation e-mail and can log in with your chosen password and start entering data

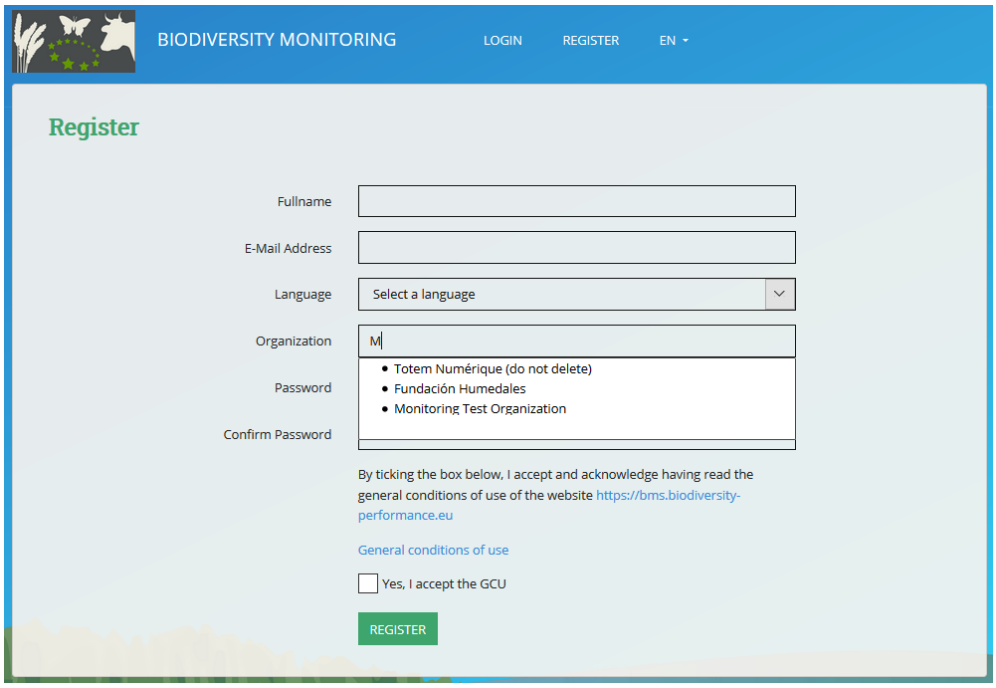

Figure 2: Screenshot of the registration page
(Source: own screenshot)

3. Entering data and access to existing data sets

To enter data in the database of the Biodiversity Monitoring-System, login to the website for data entry. Clicking the button “enter monitoring data” will open a new data entry mask in which you can fill your data. You can submit the entry form after you have included all necessary information (then it will be visible in the results in Metabase), or you can save the form to continue entering data later. You can view your finished assessment by clicking on “diagnostics” and then clicking on the name of the assessment. Note: You can edit a draft assessment by clicking on the small arrow to the left of the assessment name and selecting “edit” from the menu (see figure 3). Only clicking on the assessment name will not enable you to alter or add information.

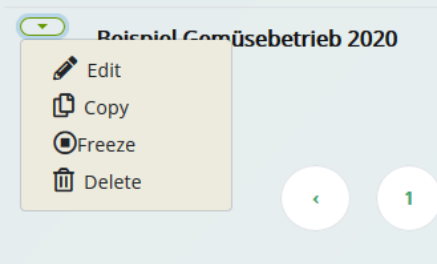

Figure 3: Screenshot of the available menu for assessments
(Source: own screenshot)

You can copy an existing data set which is useful to transfer data, e.g. the size of the farm (ha), the presence of water bodies on the farm, the participation of the farm operator in biodiversity-relevant trainings in the past, etc. for the subsequent monitoring.

4. Practical advice

The information in the "farm" tab cannot be changed after the first saving of the data.

For many indicators it is possible to gather exact values to fill in the questionnaire, e.g. whether the farm operator and the farm workers have participated in a biodiversity-relevant training. There are other indicators or key data for which the exact values might be more difficult to identify. If, due to a lack of known data or due to practicability reasons, you have to estimate values, try to do it as correct as possible. It is necessary to make a note of how you estimated the value so that you can estimate them in the same way, if necessary, in the next monitoring period. Avoid missing values in the questionnaire by filling all relevant fields, even if the correct value for your farm is “0”.

If you face the problem that you have different values for one question concerning a farm, e.g. from different applications, try to follow this guideline:

1. If you source data from applications, focus on the EU CAP application where possible.
2. Assess if the divergence is large so that it may lead to a different evaluation in the biodiversity monitoring result (e.g. if the divergence of the farm area is smaller than 0.1 ha, the value taken for the Biodiversity Monitoring-System can be decided by the person entering the data; for SNH even small values have relevance for the monitoring evaluation, therefore, the farmer shall be asked for the exact area).
3. If the divergence may have an impact on the monitoring evaluation, ask the farmer directly why there are different values and which value is correct for the biodiversity monitoring.
4. If it is not possible to get the correct value from the farmer, write a note how the data is collected: for the next monitoring audit, it is important to know how it was decided on the value(s) in question (transparency!) so that the data collection can be done in the same manner and discrepancies can be avoided. It is strongly recommended to harmonise the data collection for each farm and over time, i.e. the data in one farm are collected in the same way over time. If possible, the data of all farms of an organization should be harmonised to increase the quality of the results, i.e. the organisation could define that for certain questions the information from the CAP applications should be entered in the biodiversity monitoring questionnaire. For example, the list of questions for the Biodiversity Monitoring-System (see annex) could be used to indicate for each question from which source the data should be taken.

5. Explanations of the single indicators and key data

In the following chapter, all indicators for the Biodiversity Monitoring of the EU Life Project Food & Biodiversity are described. For each indicator the following information is provided:

Indicator statement and relevance: Impact statement that can be made by the respective indicator and its relevance for biodiversity
Aim of this indicator: Describing the current situation of an aspect with relevance for biodiversity.
Key data that compose the respective indicator and how they should be gathered: List of single key data that form the respective indicator and explanations how these parameter values can be gathered/calculated.

Indicator 1: Mapping of the farm

Indicator statement and relevance: A precise description of the farm and its surrounding through a map contributes to comprehensive sustainability reporting and forms the basis for monitoring, reporting and verification. In addition, a regular update of this map allows for tracking of land-use changes and land conversion and provides important basic documentation, which helps to assess and verify other farm key data that are part of the Biodiversity Monitoring system. Such a map provides a good overview of the farm and the location/presence of farm structures that affect biodiversity e.g. size and location of agricultural plots, wooded areas, aquatic ecosystems, semi-natural habitats (SNH), etc.

Aim of this indicator: The aim of this indicator is to complement a good documentation of the respective farm and to gain an overview of all farm areas on which biodiversity is or can be affected.

Key data of this indicator and how they should be gathered:

- The delineation of the following areas shall be evident on the map:
    - Farm boundary: The boundary that covers all areas that belong to the farm. These can be areas that are legally owned or leased. In general, all areas are included, where the farm operator has the permission to manage.
    - Utilised agricultural area (UAA)
    - Non-utilised agricultural area (NUAA)
    - Production plots
    - Semi-natural habitat areas
    - Protected areas on or adjacent to the farm

In Europe, public authorities require all map content for the areas concerning this Key data from the farm operator in the frame of the Common Agricultural Policy (CAP). In Germany for example, such software tools, which often enable map export functions for farm areas as requested here, are provided by local ministries (e.g. the software FIONA is provided by the local ministry for rural areas and consumer protection in the state of Baden-Wuerttemberg/Germany). In Spain, most of the information required (such as UAA, NUAA, protected areas, lad use, etc.) can be found in the SIGPAC system from the Ministry by introducing the land register reference.

Please make sure all questions in this indicator are filled in the entry mask as this question is mandatory for the Biodiversity Monitoring-System.

Figure 4 shows the questions related to indicator 1 in the online questionnaire. The answers required are simple yes or no questions concerning the availability of the information on the map.

Figure 4: Questions related to indicator 1 in the online questionnaire of the Biodiversity Monitoring System
(Source: own screenshot)

Indicator 2: Preservation and creation of semi-natural habitats (SNH)

Indicator statement and relevance: There is evidence, which shows that the intensification of land use associated with repar-celling and a strong dependence on agrochemical inputs is decreasing environmental quality and threatening biodiversity. The ratio of SNH compared to the total farm size is a normative indicator revealing the overall potential of a farm for hosting wild species. Thus, this indicator describes created potentials for on-farm biodiversity through SNH. These SNH should preferably be located adjacent and inside (large) agricultural plots to maximise the edge effect and the dispersion of beneficial arthropods between crops and these habitats. The areas should be designed according to defined quality aspects[1] and to form a habitat network.

Aim of this indicator: A minimum share of SNH is defined and is larger than the legally required minimum. A minimum of 10% of SNH at farm level should be mandatory. EU research findings[2] state that a sufficiently large proportion of SNH and landscape features in farmland, between 10% and 20%, could largely buffer the negative effects of agriculture intensification on biodi-versity and decrease its sensitivity to climate change.

Key data of this indicator and how they should be gathered: The following key data constitute the described indicator and enable an even more detailed monitoring and distinction of the types of SNH that are present on the farm:

- Total farm area (FA) and total utilised agricultural area (in ha): This information is known by the farmer and also evi-dent from the plot register that every farmer in the EU has to maintain in order to receive subsidies in the frame of the Common Agricultural Policy (CAP). The free map tool https://www.doogal.co.uk/polylines.php can be used to calculate these areas in case it is not known.
- Area covered by temporary SNH (ha): This area includes all temporary SNH e.g. annual flower strips or field margins that will change in short time frames (<= 1 year). The free map tool https://www.doogal.co.uk/polylines.php can be used to calculate these areas in case it is not known. (Area belonging to the farm area, both, tenant and owned land.)
- Area covered by permanent SNH (ha): This area includes permanent structures such as hedgerows, solitary trees or tree lines, riparian buffer zones, extensive grasslands and others. These permanent structures are designed and im-plemented for the longer term (≤ 1 year). (Area belonging to the farm area, both, tenant and owned land.)

Calculation: The Share of SNH compared to total farm area (in %) is calculated as follows:

[1] *Quality aspects of SNH areas can be species composition, requirements in size and location on the farm to be effective for biodiversity, etc. More detailed descriptions on effective quality aspects of SNH are described in the Action Fact Sheets for Landscape elements that are available at: https://www.busi-ness-biodiversity.eu/en/biodiversity-training/advisors*

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

$$Share\ of\ SNH\ (\%) = \frac{SNH\ area\ (temporary + permanent)}{total\ farm\ area} * 100$$

Please make sure all questions in this indicator are filled in the entry mask as this question is mandatory for the Biodiversity Monitoring-System.

Indicator 3: Biodiversity Action Plan

Indicator statement and relevance: A Biodiversity Action Plan (BAP) is a strategic tool and road map to improve biodiversity on the farm. It helps advisors and farmers to bundle activities for promoting biodiversity, to allow an overview over existing approaches and to facilitate an evaluation of these approaches with respect to the local situation and issues for local fauna and flora. Furthermore, by defining a baseline, the BAP is a good basis for giving advice regarding the improvement of the quality and effectivity of biodiversity measures. In addition, the process described for developing and implementing a BAP[3] makes it easier for the auditor to check whether a biodiversity criterion has been implemented and in which quality. Food standards and companies with own sourcing requirements starting to request Environmental Management Plans of which a Biodiversity Action Plan can be part of. For some standards e.g. UEBT, the BAP already forms an integrated part of the standard scheme. For the purpose of this monitoring, the existence and implementation of a BAP is an important indication that a farm or cooperative is actively addressing the topic of Biodiversity with concrete actions that lead to a reduction of negative impacts and to the creation of potential for more biodiversity.

Aim of this indicator: A BAP has been elaborated and all identified and agreed measures have been successfully implemented to 100%. A monitoring of the measures is in place.

Key data of this indicator and how they should be gathered:

- Has a BAP has been elaborated for the farm? It is strongly recommended to use the guideline[3] for the elaboration of a BAP. A BAP can also be elaborated otherwise, however, it should include at least a map showing the farm area, protected areas, semi-natural habitats and high nature value areas, a set of specific objectives and related actions, and indicators for monitoring the progress are defined. If a BAP for the respective farm has been elaborated, then this parameter can be answered with “Yes”. Otherwise the parameter leads to a “No” answer. This is a Yes/No question that requires no further data.

- Implementation degree (%) of the BAP: The implementation degree of the BAP refers to the measures that have been identified and agreed for the respective farm. If a measure is implemented, then this increases the implementation degree of the BAP.
  Calculation Example: A farm defines and agrees on implementing 5 measures as part of its BAP. At the time of data collection for the Biodiversity Monitoring, 3 measures are already implemented.
  $$Implementation\ of\ the\ BAP = \frac{3}{5} * 100\ \%$$
  The implementation degree of the BAP at the time of data collection is 60%.

[3] *Guideline on elaborating a Biodiversity Action Plan can be found here: https://www.business-biodiversity.eu/en/biodiversity-training/advisors*

Indicator 4: Forage autonomy

Indicator statement and relevance: The ability to provide the forage for livestock by grazing areas or autonomous fodder production on the farm is not directly related to biodiversity. Forage autonomy gives information on the balance between livestock and local micro-climatic soil conditions with regard to ecological intensification. Pasture preservation and management is strongly linked with the forage autonomy at farm scale. Forage sufficiency thereby relies on two main goals[4]: (i) increasing current forage production in order to reduce or even avoid hay purchases and (ii) improving resistance and resilience to disturbances and climatic stresses, forage production in the mountain regions (e.g. the Alps, or Mediterranean areas) being increasingly affected by recurrent summer droughts and late frosts in spring[5]. Addressing this issue, of increasing forage production while improving its resilience and environmental quality, is a relevant ecological intensification process[6].

Aim of this indicator: The aim of this indicator is to achieve a forage autonomy that is preferably >80% in order to mitigate biodiversity loss outside of the farm.

Key data that compose the respective indicator and how they should be gathered:

- Proportion (%) of required animal forage (per season) that can be produced on farm or that can be sourced within the region (50km radius)

  Calculation: The following formula can be used to calculate the degree of forage autonomy:

$$forage\ autonomy\ (\%) = \frac{forage\ harvested\ and\ grazeod\ on\ the\ Farm\ (t\ DM)}{total\ forage\ consumption\ (t\ DM)} * 100$$

whereby:

$$total\ forage\ consumption\ (t\ DM) = forage\ harvested\ on\ the\ farm\ (t\ DM) + forage\ grazed\ (t\ DM) + forage\ bought(t\ DM) - forage\ sold\ (t\ DM) + start\ stock\ (t\ DM) - end\ stock(t\ DM)$$

(t DM = tonnes of dry matter)

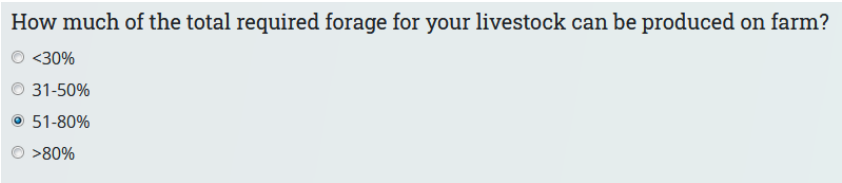

Figure 5: Question related to indicator 4 in the online questionnaire with exemplary answer in the online Monitoring System Tool
(Source: own screenshot)

Indicator 5: Livestock density

Indicator statement and relevance: The livestock density for land-based systems is an important parameter to describe the pressure of livestock farming on the environment, and thereby also on biodiversity. Through manure production and methane emissions, livestock contributes to climate change (nitrous oxide, methane) and nutrient leaching into water and air. A higher livestock density means that a higher amount of manure is available per ha of UAA, which increases the risk of nutrient leaching.

[4] *Dobremez et al. 2013*
[5] *Sérès, 2010.*
[6] *Loucougaray G, Debremez L, Gos P, Pauthenet Y, Nettier B & Lavorel S, 2015. Assessing the effects of grassland management on forage production and environmental quality to identify paths to ecological intensification in Mountain grasslands. Environmental Management 56 (5).*

The actual impact on the environment of livestock farming is thereby not only depending on the amount of livestock, but also depends on farming practices.

Aim of this indicator: The aim of this indicator is to monitor the state of overgrazing and destruction of agro-forestry ecosystems. Therefore, the Livestock unit (LU)/ha is subject to a continuous reduction over time, until an optimum level is reached. As the Biodiversity Monitoring-System does not set mandatory thresholds, some values that shall serve as an orientation are provided below:

The average livestock density should according to EU organic farming not exceed 2 LU/ha.
The maximum livestock density of the main fodder area according to the document „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“ is set to 1.4 LU/ha.
As a further orientation the Biodiversity Performance Tool also uses this indicator and has set four threshold ranges for assessing the performance of this parameter. The threshold ranges of the Biodiversity Performance Tool for the average livestock density are:

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

Key data that compose the respective indicator and how they should be gathered:

- Average livestock density (LU/ha) of the main fodder area. Below is a table that shows coefficients by which livestock densities can be calculated as per species.

$$\frac{LU}{ha} = monthly\ average\ number\ of\ animals * Livestock\ unit\ coefficient$$

Table 2: Livestock unit coefficients

Bovine animals	Under 1 year old	0.400
	1 but less than 2 years old	0.700
	Male, 2 years old and over	1.000
	Heifers, 2 years old and over	0.800
	Dairy cows	**1.000**
	Other cows, 2 years old and over	0.800
Sheep and goats		0.100
Equidae (e.g. horses)		0.800
Pigs	Piglets having a live weight of under 20 kg	0.027
	Breeding sows weighing 50 kg and over	0.500
	Other pigs	0.300
Poultry	Broilers	0.007
	Laying hens	0.014
	Ostriches	0.350
	Other poultry	0.030
Rabbits, breeding females		0.020

(Source: Eurostat 2019)

Indicator 6: Off-site ecosystems loss and degradation related to animal fodder production (dependence on soy as animal feed)

Indicator statement and relevance: Global population and economic growth resulted in an overall increase in livestock products such as meat, milk and eggs. Soybean is thereby the crop source that represents more than 30% of the feed basket for all livestock categories[7]. There is a direct link between the use of soy meal as protein-based feed in livestock production and land use change, which negatively effects biodiversity globally (in 2011, 33% of Central and Southern America and 26% of Africa's biodiversity impacts were driven by consumption in other world regions)[8]. Therefore, we use this indicator as a proxy to assess whether or not the production of procured soy-based feed concentrate has contributed to biodiversity loss through land conversions such as deforestation for establishing arable land for animal fodder production.

Aim of this indicator: Shift towards soy that is responsibly produced and did not lead to deforestation and related biodiversity loss.

Key data that compose the respective indicator and how they should be gathered:

- Share of soy-based feed concentrate (%) from the total animal fodder composition.
  Calculation example: If feed concentrate constitutes one third of your total animal fodder composition and if all your feed concentrate is based on soy, then your share of soy-based feed concentrate from the total is: 0.33 multiplied by 100 = 33%.
- Share of animal feed based on soy certified as deforestation-free (e.g. Round Table on Responsible Soy certification) in % compared to total soy-based food concentrate.
  Calculation example: If for example a third, half or all of your soy-based feed concentrate is certified as deforestation-free, then the answer to this parameter is 33%, 50% or 100% respectively.
- Share of animal feed based on soy originating from a manufacturer based in an EU country where there is a transparent commitment to sustainable production (e.g. Europe Soya or Donau Soja or other equivalent certification) in % compared to total soy-based feed concentrate.
  Calculation example: If for example a third, half or all of your soy-based feed concentrate is certified as deforestation-free, then the answer to this parameter is 33%, 50% or 100% respectively.

Indicator 7: Buffer zones around water bodies

Indicator statement and relevance: Degree to which water bodies are protected by buffer zones from pollution through fertilisers and pesticides that would lead to a loss of biodiversity. Thereby risks are reduced so that water bodies are effectively protected from pollution as well as from sedimentation while at the same time potentials for more biodiversity are created.

Aim of this indicator: Presence of a buffer zone with a minimum width of 10 meters consisting of native species on each border of a water body.

Key data that compose the respective indicator and how they should be gathered:

- Presence of water bodies on the farm.
  This is a Yes/No question that requires no further data. Please make sure this question is answered in the entry mask as it is mandatory for the Biodiversity Monitoring-System.

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[7] *Manceron, Stéphane & Ben Ari, Tamara & Dumas, Patrice (2014): Feeding proteins to livestock: Global land use and food vs. feed competition. DOI: https://doi.org/10.1051/ocl/2014020*

[8] *Marques, Alexandra et al. (2019): Increasing impacts of land use on biodiversity and carbon sequestration driven by population and economic growth. Nature Ecology & Evolution volume 3, pages 628–637 (2019). DOI: https://doi.org/10.1038/s41559-019-0824-3.*

- Share of water courses in % that have no buffer zone in comparison to total shore line.
  Example calculation (also applicable for the other three categories of buffer zone width): The total shore line is the length (stream) or circumference (lake, pond) in metres of the water element that is located on the farm area. If for example a third, half or the entire shore line located on the farm has no buffer zone, then the answer to this parameter is 33%, 50% or 100% respectively.
  Response for the example (see figure 6): 33% because approximately a third of the stream shore line has no buffer zone.
- Share of water courses that have a buffer zone width between 1-4 meters in comparison to total shore line.
  Response for the example (see figure 6): 33% because approximately a third of the stream shore line has a buffer zone width of between 1-4 metres.
- Share of water courses that have a buffer zone width between 5-9 meters in comparison to total shore line.
  Response for the example (see figure 6): 33% because approximately a third of the stream shore line has a buffer zone width of between 5-9 metres.
- Share of water courses that have a buffer zone width of ≥10 meters in comparison to total shore line.
  Response for the example (see figure 6): 0% because no part of the stream shore line has a buffer zone width of ≥10 metres.

Hint: If you have to estimate the values, please try to estimate as correct as possible and make sure that the sum is 100%. Please fill the fields for all questions on buffer zones around water bodies. If the value is "0" for one or more questions, fill in "0".

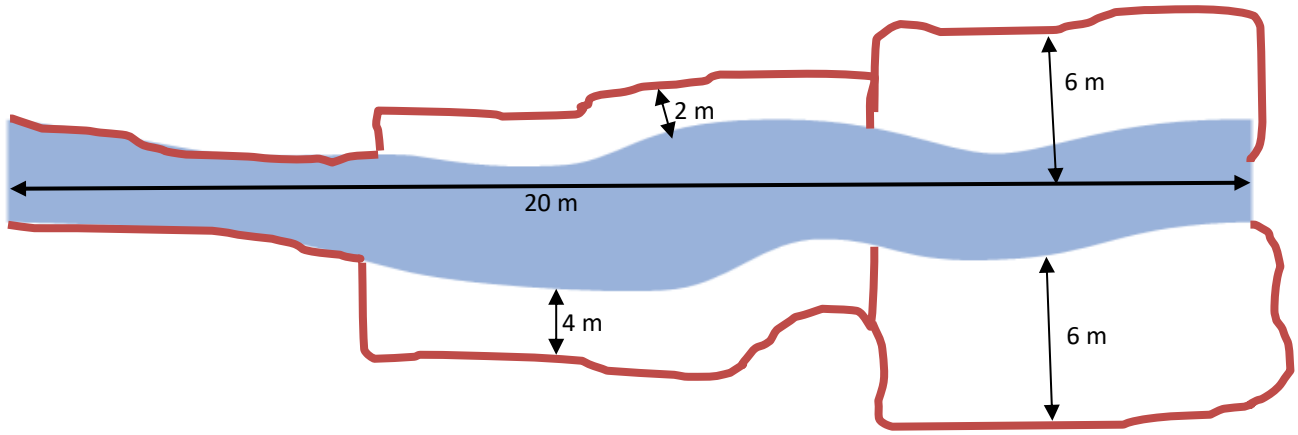

Figure 6: Visual example for buffer zone widths along a stream
(Source: Flexible River made in ConceptDraw DIAGRAM app)

Indicator 8: Pesticide and fertilizer pressure on semi-natural habitats

Indicator statement and relevance: To be most functional for biodiversity, SNH areas should receive neither pesticides nor fertilisation on their surface areas.

Aim of this indicator: No pesticides are applied on SNH areas. No fertilisers are applied on SNH areas except for SNH types: permanent grassland under extensive management, agroforestry systems, silvopastoral systems.

Key data that compose the respective indicator and how they should be gathered:

- Application of pesticides on any SNH areas that are located on the farm.
  This is a Yes/No question that requires no further data.
- Application of fertilizers on any SNH areas other than permanent grassland under extensive management, agroforestry systems, silvopastoral systems.
  This is a Yes/No question that requires no further data.

Indicator 9: Connectivity of semi-natural habitats

Indicator statement and relevance: Promoting the implementation of the EU Strategy on Green Infrastructure through nature-based solutions and the Aichi Target 5 of the Convention on Biological Diversity[9] aims at improving and enhancing habitats to support beneficial organisms in farming landscapes. As communicated among the EU institutions[10] and by the study of Harvey et al. (2016)[11], the idea is to promote a strategically planned network of natural, semi-natural areas and food webs to achieve goals of conserving and enhancing biodiversity, ecosystem functioning and ultimately at landscape-scale the delivery of ecosystem services. The network of ecological infrastructures that refers here to habitat connectivity is composed of three basic elements with distinct functions[12]:

1. Permanent habitats of fauna and flora (e.g. large surface areas of low intensity grassland, poor grassland, forests with edges, ruderal vegetation areas and high-stem tree orchards).

Figure 7: Example pictures of permanent habitats of fauna and flora: permanent forest lots (left), poor grassland (right)
(Sources: Alb Gold (left), Lake Constance Foundation (right))

2. Stepping stones (rather concentrated and small sized structures like woodland patches, stone piles or ponds) are smaller habitats allowing the build-up of temporary animal populations.

Figure 8: Example pictures of smaller sized habitats, so called stepping stones: pond (left), stone pile (right)
(Source: Lake Constance Foundation)

[9] https://www.cbd.int/subnational/aichi-biodiversity-targets
[10] http://eur-lex.europa.eu/resource.html?uri=cellar:d41348f2-01d5-4abe-b817-4c73e6f1b2df.0014.03/DOC_1&format=PDF
[11] *Harvey E, Gounand I, Ward C L & Altermatt F, 2016. Bridging ecology and conservation: from ecological networks to ecosystem function. J Appl Ecol. doi:10.1111/1365-2664.12769.*
[12] *Boller EF, Häni F & Poehling H-M, 2004. Ecological infrastructures: Ideabook on Functional Biodiversity at the Farm Level Temperate Zones of Europe. English-German, 1st edition August 2004.*

3. Corridor structures (e.g. hedges, grass strips, wildflower strips, ditches and brooks) assist animal species in moving between large habitats and small stepping stones.

Figure 9: Example pictures of corridor structures
(Source: Lake Constance Foundation)

Aim of this indicator: SNH areas are composed in a way that they build a network of biological corridors.

Key data that compose the respective indicator and how they should be gathered:

This indicator needs to be assessed individually for each farm. The question that needs to be answered is:

- Are the SNH areas on your farm in some way connected so that they build a network of biological corridors?

There are three categories from which the assessor (e.g. the farmer, agricultural advisor) has to choose an answer that describes best the actual situation in regards of the above question:

- No connectivity between SNH areas.

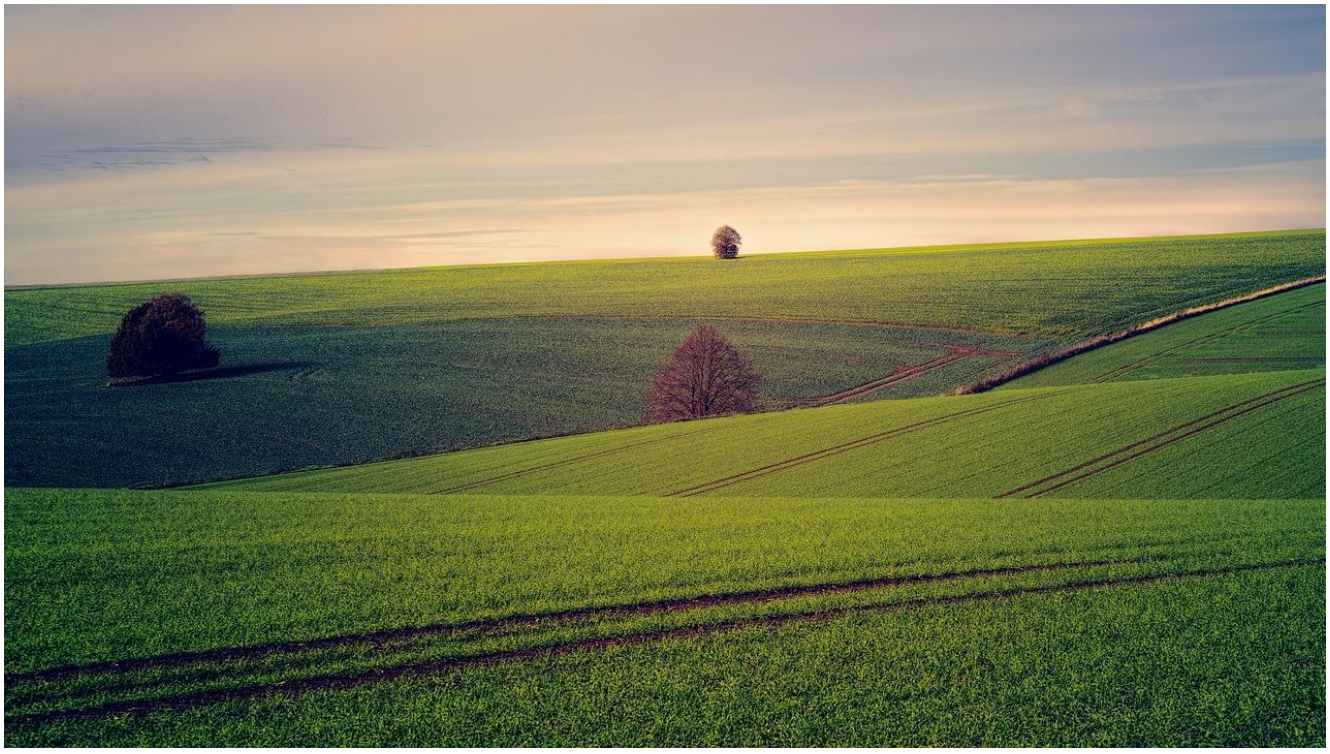

Figure 10: Example picture of no connectivity between SNH areas on the farm
(Source: Pixabay)

- SNH areas are connected but show discontinuities.

Figure 11: Example picture of SNH areas that are connected but show discontinuities
(Source: Pixabay)

- SNH areas are composed in a way that they build a network of biological corridors.

Figure 12: Example pictures of SNH areas that are composed in a way that they build a network of biological corridors
(Source: Pixabay)

Indicator 10: Alien invasive species

Indicator statement and relevance: This indicator provides information on alien invasive species pressure on the farm. Alien invasive species are considered as one of the main drivers of biodiversity loss by the Millenium Ecosystem Assessment[13].

Aim of this indicator: No alien invasive species present on the farm.

Key data that compose the respective indicator and how they should be gathered:

- Presence of alien invasive species on the farm.
  This is a Yes/No question that requires no further data. Please make sure this question is answered in the entry mask as it is mandatory for the Biodiversity Monitoring-System.
- Application of measures combating alien invasive species on the farm.
  This is a Yes/No question that requires no further data.
- Consultation of any support from NGOs, research institutions or other relevant authority combating alien invasive species on your farm. This is a Yes/No question that requires no further data.

Indicator 11: Number of crop plant species

Indicator statement and relevance: The number of crop plant species or the crop diversity at farm level is considered by Billeter et al (2008)[14] to be positively associated with the species richness of arthropods, particularly of bees, carabids and bugs. As an orientation, this very same parameter is also gathered in the Biodiversity Performance Tool where the highest score is obtained when more than seven crop species are cultivated on farm, and the lowest score when less or equal to three crop species are cultivated on farm. It is referred only to the biological term of species, thus not including variety. For example, having three varieties of apples is not acceptable in this measure, but having three different species of permanent crops (apple, pears and peaches) works.

Aim of this indicator: Monitor and increase the diversity of crop plant varieties in order to achieve a better resistance profile against pests and to promote agro-biodiversity on the farm.

Key data that compose the respective indicator and how they should be gathered:

- Number of crop plant species cultivated on the farm this year.
  Including:
  - temporary grassland; and
  - permanent grassland not under extensive management

  which are both considered as crops.

  Excluding:
  - Catch crops; and
  - Permanent grassland under extensive management.

Required value: The total absolute number of crop species cultivated in the same agronomic season is required for providing this parameter value.

[13] *Millenium Ecosystem Assessment Biodiversity Synthesis (2005): Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC. https://www.millenniumassessment.org/documents/document.354.aspx.pdf*

[14] *https://doi.org/10.1111/j.1365-2664.2007.01393.x*

Indicator 12: Number of breeds (animals)

Indicator statement and relevance: A larger diversity of animal breeds supports genetic diversity preservation and increases agro-biodiversity on the farm.

Aim of this indicator: Increase the diversity of animal breeds on the farm.

Key data that compose the respective indicator and how they should be gathered:

- The number of animal breeds kept on the farm.
  Required value: The total absolute number of livestock breeds is required for providing this parameter value.
  Example: A farm has three different livestock species: cattle, pigs and goats. For cattle they use the breeds German Simmental and Holstein-Friesian, for pigs they use Duroc and Pietrain, and for goats they use Boer. Hence, the farm's answer to indicator 12 would be that they have five breeds.

Indicator 13: Number of traditional crop species

Indicator statement and relevance: In agriculture as well as in horticulture, global cultivation is more and more limited to a few crop types, most importantly due to prevalent market competition, low demand for traditional varieties and breeds and hence missing value opportunities. Also breeding programmes put their focus on economically viable species. But if breeding programmes for traditional species are not continued and cultivated on-farm then a loss of agro-biodiversity is inevitable. Hence, on-farm conservation of traditional crops can provide an important contribution to agro-biodiversity protection and to develop and operate in new niche markets. Furthermore, in times of climate change we will come to the point when we have to refer back to these traditional species: with a much larger gene pool they are better vested to adjust to weather extremes like droughts and floods as compared to the common high-performance varieties.

Aim of this indicator: Presence of traditional crop species and varieties (e.g. autochthonous varieties) in support of agro-biodiversity and preservation of traditional species and varieties that are often endangered and may otherwise become extinct.

Key data that compose the respective indicator and how they should be gathered:

- Number of traditional crop species and varieties.
  Required value: The total absolute number of traditional crop species and varieties as a sum is required for providing this parameter value.

Indicator 14: Number of traditional breeds (animals)

Indicator statement and relevance: In agriculture global livestock rearing is more and more limited to a few species and breeds, most importantly due to prevalent market competition, low demand for traditional breeds and hence missing value opportunities. Also breeding programmes put their focus on economically viable species. But if breeding programmes for traditional species are not continued and cultivated on-farm then a loss of agro-biodiversity is inevitable. Hence, on-farm conservation of traditional breeds can provide an important contribution to agro-biodiversity protection and to develop and operate in new niche markets. Furthermore, in times of climate change we will come to the point when we have to refer back to these traditional species: with a much larger gene pool they are better vested to adjust to weather extremes like droughts and floods but also to diseases as compared to the common high-performance varieties.

Aim of this indicator: Presence of traditional animal breeds in support of agro-biodiversity and preservation of these traditional breeds that are often endangered and may otherwise become extinct.

Key data that compose the respective indicator and how they should be gathered:

- Number of traditional breeds (animals).
  Required value: The total absolute number of traditional livestock breeds is required for providing this parameter value.

Figure 13 shows the question related to indicator 14 in the online questionnaire of the Biodiversity Monitoring-System.

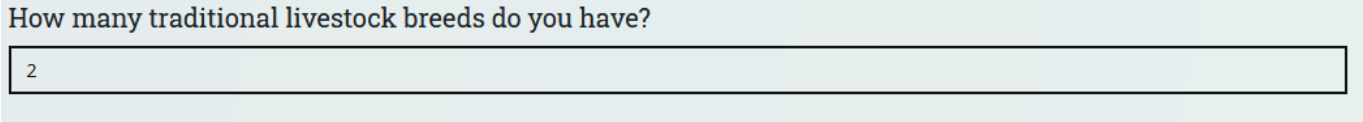

Figure 13: Question related to indicator 14 in the online Monitoring-System with exemplary answer
(Source: own screenshot)

Indicator 15: Genetically Modified Organisms in crops and livestock breeds

Indicator statement and relevance: Genetically Modified Organisms (GMOs) lead to a reduction of natural biodiversity and furthermore poses unknown risks to human health and the environment.

Aim of this indicator: Absence of GMO on the farm.

Key data that compose the respective indicator and how they should be gathered:

- Presence of GMO on the farm.
  This is a Yes/No question that requires no further data.
- Proportion of UAA on which GMOs are cultivated (%):
  Calculation:

$$\text{Proportion of UAA where GMOs are cultivated (\%)} = \frac{area\ where\ GMO\ is\ cultivated\ (ha)}{total\ UAA\ (ha)} * 100$$

- Presence of animal breeds that are genetically modified.
  This is a Yes/No question that requires no further data.
- Share of animal breeds that are genetically modified (%):
  Calculation:

$$\text{Share of animal breeds that are genetically modified (\%)} = \frac{\text{Number of breeds genetically modified}}{total\ \text{number of breeds}} * 100$$

Indicator 16: Presence of Genetically Modified Organisms in animal feed

Indicator statement and relevance: The productivity increase of arable land explains much of the continuous increase in total livestock production since the 1960s. Thereby feed production benefited from vast increases in major feed crops yields such as rapeseed, corn, wheat, soy and other cereals[9]. Much of this productivity increase originates from intensified agricultural practices such as the increased and improved application of fertilizers and pesticides but also from genetic modification of these feed crops.

Aim of this indicator: Absence of animal feed concentrate that is of GMO origin.

Key data that compose the respective indicator and how they should be gathered:

- Proportion of total used animal feed concentrate certified to be GMO free (e.g. Pro Terra, Europe Soya, or Donau Soja certified or other equivalent certification).
  Example calculation: If for example a third, half or all of your animal feed concentrate is certified as GMO-free, then the answer to this parameter is 33%, 50% or 100%, respectively.

Indicator 17: Sustainable and efficient water use

Indicator statement and relevance: Where there is water there is life, and its efficient and responsible use in agriculture is essential to the biodiversity and health of the ecosystem, being a fundamental, scarce and vulnerable resource. The balance between water demand and availability has reached a critical level in certain areas of Europe, where surface and groundwater

levels have lowered and wetlands have been dried out, affecting also fish and bird life. Where the water resource diminishes, a deterioration of water quality normally follows, because there is less water to dilute pollutants and a simplification of the ecological processes usually occurs. The challenge is to reduce water consumption, increase the efficiency of the systems and re-use and recycle water as much as possible.

Aim of this indicator: Active involvement of a farm in water management activities/programmes where the aim is to reduce and avoid the overexploitation of water for agricultural production.

Key data that compose the respective indicator and how they should be gathered:

- Implementation or involvement in any water management programme/activities where the aim is to increase water use efficiency and sustainability.

  This is a Yes/No question that requires no further data. Please make sure this question is answered in the entry mask as it is mandatory for the Biodiversity Monitoring-System.

  Examples can be:
  - Using an irrigation recording sheet
  - Using decision-support systems for irrigation such as tensiometers, capacitance probes, satellite/drone monitoring systems
  - Keep soil cover at least during critical periods

Further information: www.business-biodiversity.eu/en/biodiversity-training/advisors
Guideline on Water Use and Biodiversity

Indicator 18: Irrigating the appropriate amount of water

Indicator statement and relevance: Decision support tools are technologies that can help farmers to make well-informed decisions regarding the irrigation of the crop. They are used for measuring different parameters regarding climate, soil and plant, and allowing the farmer to know with high accuracy the water needs of the plants and defaults in their irrigation systems.

Aim of this indicator: The amount of irrigation water used on the farm is sustainable in relation to the natural availability of water (i.e. water extraction <= water renewal).

Key data that compose the respective indicator and how they should be gathered:

- Use of any decision support tools to assess the appropriate amount of irrigation.

  This is a Yes/No question that requires no further data. Please make sure this question is answered in the entry mask as it is mandatory for the Biodiversity Monitoring-System.

Examples:
- Tensiometric probes, TDR / FDR measurements
- Suction probes
- Remote sensing

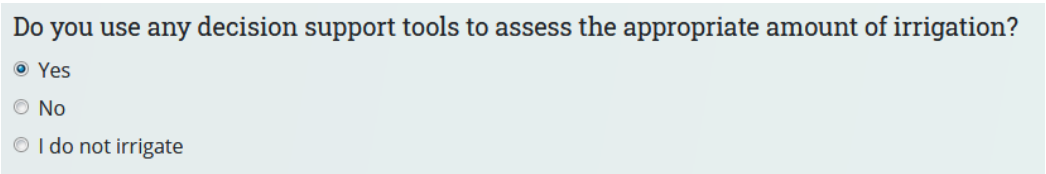

Figure 14: Question related to indicator 18 in the online Monitoring-System
(Source: own screenshot)

Further information: www.business-biodiversity.eu/en/biodiversity-training/advisors
Guideline on Water Use and Biodiversity

Indicator 19: Reduced soil erosion (soil coverage)

Indicator statement and relevance: The presence of soil cover in the form of cover crops, mulching or any other coverage shows many benefits that directly or indirectly affect biodiversity:

- Water and wind erosion reduction;
- Soil organic matter increment;
- Immobilization and storage of nutrients;
- Biological nitrogen-fixation (legume family);
- Increase of biodiversity;
- Management of soil moisture;
- Weed and pest suppression;
- Regulation of soil temperature;
- Soil compaction reduction;
- Reduction of greenhouse gas emissions into the atmosphere

Aim of this indicator: No bare soil during critical periods.

Key data that compose the respective indicator and how they should be gathered:

- Proportion of the UAA that has a soil cover (vegetative soil cover but also mulching) at least during critical periods (e.g. peak precipitation months) in %.
  Calculation:

$$UAA\ with\ soil\ cover\ (\%) = \frac{UAA\ with\ soil\ cover\ at\ least\ during\ critical\ periods\ (ha)}{total\ UAA\ (ha)} * 100$$

  Please make sure this question is answered in the entry mask as it is mandatory for the Biodiversity Monitoring-System.

Indicator 20: Crop rotation length

Indicator statement and relevance: The rotation of annual crops has been empirically developed by farmers to reduce and control soil-borne pests and diseases. By the mid-twentieth century, a well-developed rotation consisted of six to eight different crops in sequence15. An increase in economic pressure and food demand led farmers to make greater use of pesticides and to maximize land use. The rotation was shortened to very few crops, leading to an increase in pest proliferation and a decrease in biodiversity of beneficial species. Especially with a focus to soil biodiversity, crops rotation should be prolonged. A rotation with seven different crop families is desirable.

Aim of this indicator: A crop rotation system (length) that supports soil function, soil biodiversity and humus accumulation as well as alternative weed and pest control.

[15] *Häni FJ, Boller EF & Keller S, 1998. Natural regulation at the farm level. In Enhancing biological control - Habitat management to promote natural enemies of agricultural pests, (Pickett C.H., Bugg R.L., eds.), University of California Press, Berkeley - Los Angeles - London: 161-210.*

Key data that compose the respective indicator and how they should be gathered:

- Length of the crop rotation of the main crops in years, i.e. the time span until the same crop is planted again.
  Required value: The amount of years as an absolute number that describes the length of the rotation, e.g. 4 (years).

Indicator 21: Alternative measures against weeds and pests

Indicator statement and relevance: Integrated pest management means careful consideration of all available plant protection methods and subsequent integration of appropriate measures that discourage the development of populations of harmful organisms. Furthermore, the use of plant protection products and other forms of intervention should be kept to levels that are economically and ecologically justified and reduce or minimize risks to human health and the environment. 'Integrated pest management' emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. Along with the promotion of organic farming, IPM is one of the tools for low-pesticide-input pest management, which, according to legislation, must be implemented by all professional users.

Examples that we categorize as alternative measures are:

- mechanical weed control,
- bottom sowing
- cultivation of catch crop
- extended crop rotation
- diverse varieties

Further information: www.business-biodiversity.eu/en/biodiversity-training/advisors
Guideline on Pesticide Management

Aim of this indicator: Application of alternative measures to avoid and to reduce pesticide application.

Key data that compose the respective indicator and how they should be gathered:

- The share (%) of UAA on which alternative measures are applied against weeds to avoid and to reduce pesticide application (IPM measures) according to the following ranges:

0%	1-30%	31-49%	50-69%	70%	100%

Calculation:

$$UAA\ alternative\ measures\ against\ weeds\ (\%) = \frac{UAA\ alternative\ measure\ against\ weeds\ (ha)}{total\ UAA\ (ha)} * 100$$

The result shall then be assigned to the appropriate category.

The share (%) of UAA on which alternative measures are applied against pests to avoid and to reduce pesticide application (IPM measures) according to the following ranges:

0%	1-30%	31-49%	50-69%	70%	100%

Calculation:

$$UAA\ alternative\ measures\ against\ pests\ (\%) = \frac{UAA\ alternative\ measure\ against\ pests\ (ha)}{total\ UAA\ (ha)} * 100$$

The result shall then be assigned to the appropriate category.

Please make sure all questions in this indicator are answered in the entry mask as it is mandatory for the Biodiversity Monitoring-System.

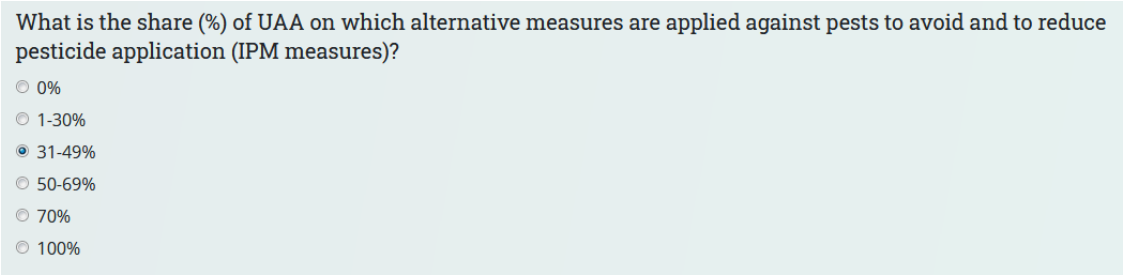

Figure 15: Question related to indicator 21 in the online Monitoring-System
(Source: own screenshot)

Indicator 22: Pesticide pressure on agricultural land

Indicator statement and relevance: The application of pesticides is common in conventional European agriculture and poses a tremendous risk to biodiversity in general. Every conventional crop is treated several times with a combination of active substances.
This indicator is composed of several key data, which are mostly considered as pressure parameters to natural resources (e.g. soil, water elements through pesticide drift, etc.) and biodiversity.[16]

Further information: www.business-biodiversity.eu/en/biodiversity-training/advisors
Guideline on Pesticide Management

Aim of this indicator: The amount of applied pesticides is continuously reduced and the most harmful active ingredients for biodiversity are avoided.

Key data that compose the respective indicator and how they should be gathered:

- Proportion of UAA (%) that is not treated with pesticides.
  Calculation:

$$UAA\ not\ treated\ with\ pesticides\ (\%) = \frac{UAA\ not\ treated\ with\ pesticides\ (ha)}{total\ UAA\ (ha)} * 100$$

- Provision of a list of active ingredients that are deployed on the farm.
  This is a Yes/No question that requires no further data.
- Provision of a list with the amount of each active ingredient deployed in litres/ha and/or grams/ha per year.
  This is a Yes/No question that requires no further data.
- Trend of the total amount of applied pesticides on the farm shows a continuous reduction over a period of the past 5 years.
  This is a Yes/No question that requires no further data.
- Proportion of UAA (%) where broad-spectrum herbicides (e.g. Glyphosate) are applied.
  Calculation:

$$UAA\ treated\ with\ broad-spectrum\ herbicides\ (\%) = \frac{UAA\ treated\ with\ broad-spectrum\ herbicides\ (ha)}{total\ UAA\ (ha)} * 100$$

[16] *Pesticide Action Network international provides a very detailed list of Pesticide still used per country worldwide: http://pan-international.org/pan-international-consolidated-list-of-banned-pesticides/*

Please make sure all questions in this indicator are answered in the entry mask as it is mandatory for the Biodiversity Monitoring-System.

Indicator 23: Nitrogen application

Indicator statement and relevance: Nitrogen is an important plant nutrient and an important factor to plant growth in temperate climatic zones. As a result of intensive nitrogen input (inorganic fertilisers) and intensified and locally concentrated livestock rearing (organic N-input) Nitrate concentrations in surrounding water bodies as well as ground water resources became a problem, leading to a degradation of many natural ecosystems and threatening biodiversity and potentially also human health. The EU Nitrates Directive is the regulatory answer to this development but the problem is still far from being solved.

Aim of this indicator: Reduction of the total amount of Nitrogen (N) applied on the farm towards a continuous improvement in the efficient use of organic and mineral N-fertiliser to achieve an optimum level. The optimal level can be identified plot-specific based on a post-harvest N-balance.
The recommendation for standards and companies here is to go beyond legal requirements when setting threshold values.

Organic fertilizer is preferably used and it is recommended to reduce the fertilization of mineral fertilization first.

Key data that compose the respective indicator and how they should be gathered:

- The entire amount of Nitrogen applied on the farm (including inorganic and organic sources) in kg/ha/year.
  Note: Inorganic fertilizer products state the N-content on the package. These values have to be considered for calculating the total amount of N. For organic fertilizer, there are specific tables that provide N-contents for different types of organic fertilizer (e.g. manure, compost) that shall be considered.
  Please make sure this question is answered in the entry mask as it is mandatory for the Biodiversity Monitoring-System.

Indicator 24: Biodiversity training for farm operators

Indicator statement and relevance: Successful protection and increase of biodiversity depends on effective measures and the quality of implementation of these measures. So far, the protection of biodiversity is not a priority in capacity building for farm operators and workers and is often not addressed at all. In order to anchor biodiversity aspects in standards and procurement criteria in the long term and to implement them correctly in the field, farm operators as well as workers need more knowledge and support regarding the implementation of biodiversity-friendly measures.

Aim of this indicator: Increase and keep up-to-date the knowledge and skills of farm operators with relevance to biodiversity by ensuring a regular participation in appropriate training activities.

Key data that compose the respective indicator and how they should be gathered:

- Previous participation of the farm operator in a training/education/workshop with relevance to biodiversity.
  This is a Yes/No question that requires no further data. Please make sure this question is answered in the entry mask as it is mandatory for the Biodiversity Monitoring-System.
- Current participation of the farm operator in a training/education/workshop with relevance to biodiversity on a regular basis.
  This is a Yes/No question that requires no further data.

Indicator 25: Biodiversity training for farm workers

Indicator statement and relevance: See indicator 24.

Aim of this indicator: Increase and keep up-to-date the knowledge and skills of workers (ideally 100% of permanent staff) with relevance to biodiversity by ensuring a regular frequency in the participation of appropriate education units.

Key data that compose the respective indicator and how they should be gathered:

- Past workers' participation in a training/education/workshop with relevance to biodiversity.
  This is a Yes/No question that requires no further data.
- Current workers' participation in a training/education/workshop with relevance to biodiversity on a regular basis.
  This is a Yes/No question that requires no further data.
- Proportion of the permanent staff (in %) that already participated in a training unit with relevance to biodiversity.
  Calculation:

$$Permanent\ staff\ that\ participated\ in\ training\ (\%) = \frac{Number\ of\ workers\ that\ participated\ in\ biodiversity\ training}{total\ number\ of\ permanent\ staff} * 100$$

6. Glossary

Note: Every term that has a dotted underline within this document is defined in the glossary chapter.

Agro-Biodiversity: The variety and variability of animals, plants and micro-organisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries. It comprises the diversity of genetic resources (varieties, breeds) and species used for food, fodder, fibre, fuel and pharmaceuticals. It also includes the diversity of non-harvested species that support production (soil micro-organisms, predators, pollinators), and those in the wider environment that support agro-ecosystems (agricultural, pastoral, forest and aquatic) as well as the diversity of the agro-ecosystems. (FAO, 1999a).

Alien species: A species, subspecies or lower taxon, introduced outside its natural past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce (Secretariat of the Convention on Biological Diversity, 2002).

Alien invasive species: Alien invasive species are non-native species, which cause harm to the environment and potentially cause species extinction, modify ecosystem processes and act as disease vectors. The problems caused by invasive, alien species have potentially large economic consequences. They are also one of the main drivers of biodiversity loss.

Arthropod: Any invertebrate of the phylum Arthropoda, with the main characteristics of a segmented body, jointed limbs, and usually a chitinous shell that undergoes moltings, including insects, spiders and other arachnids, crustaceans, and myriapods.

Autochthonous: Originating from the respective place of observation, down-to-earth (for example, rocks in geology, animal and plant species in nature conservation, or woody individuals in forestry); indigenous (Glossary – Federal Office for Nature Conservation (BfN) Germany, web address: https://www.bfn.de/glossar/unterteilung-nicht-im-menue/glossar-a-c.html).

Biodiversity: 'Biological diversity' means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems. (Convention on Biological Diversity, 1992)**.**

Biodiversity Action Plan (BAP): A plan to conserve or enhance biodiversity (Earthwatch, 2000).

Further Information on the elaboration of Biodiversity Action Plan (BAP) you may find here: https://www.business-biodiversity.eu/de/wissenspool/biodiversity-action-plan)

If a farmer already implements relevant measures that create potentials for Biodiversity or that reduce negative effects on biodiversity, then these measures can be integrated into a BAP that is still to be established. Examples of well-established and tested measures that are either easy to implement or that show a high relevance for biodiversity are the establishment of:

- Flower strips sown with wild flowers;
- Light fields – drill gaps and reduced sowing densities – promoting wild herbs;
- Catch crops kept over winter – providing wintering habitat;

- Stone- and deadwood piles – supporting heat-dependent animals.

Further field tested measures with a high relevance for biodiversity that can be part of a BAP can be found on the EU Life Food & Biodiversity website here: https://www.business-biodiversity.eu/en/biodiversity-training/advisors

Biological pest control: Method of controlling pests, diseases and weeds in agriculture that relies on natural predation, parasitism or other natural mechanisms that restrain the development of pathogenic organisms (FAO, 2019).

Biotope corridors /habitat corridors: It is an area of habitat connecting wildlife populations separated by human activities or structures (such as roads, development or logging, production sides on farms etc.). This allows an exchange of individuals between populations, which may help prevent the negative effects on inbreeding and reduced genetic diversity that often occur within isolated populations. (NSW Government, Office of Environment & Heritage).

Buffer zones: The region adjacent to the border of a protected area; a transition zone between areas managed for different objectives. (Convention on Biological Diversity, Glossary).

Crop rotation: The practice of alternating the species or families of annual and/or biannual crops grown on a specific field in a planned pattern or sequence so as to break weed, pest and disease cycles and to maintain or improve soil fertility and organic matter content. (FAO, 2009).

Ecosystem: A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit. (Convention on Biological Diversity, 1992).

Ecosystem services: Benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other non-material benefits. (Millennium Ecosystem Assessment).

Fauna: All of the animals found in a given area. (Convention on Biological Diversity – Glossary)

Flora: All of the plants found in a given area. (Convention on Biological Diversity – Glossary).

Genetically Modified Organism (GMO): Any organism, with the exception of human beings, in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination. (European Union, 2001)**.**

Habitat: It is a place or type of site where an organism or population naturally occurs. (Convention on Biological Diversity, 1992).

Herbicide: Pesticides that kill weeds and other plants that grow where they are not wanted. (US Environmental Protection Agency).

Hotspots of Biodiversity: An area on earth with an unusual concentration of species, many of which are endemic to the area, and which is under serious threat by people. (Convention on Biological Diversity – Glossary).

Integrated Pest Management (IPM): 'means careful consideration of all available plant protection methods and subsequent integration of appropriate measures that discourage the development of populations of harmful organisms and keep the use of plant protection products and other forms of intervention to levels that are economically and ecologically justified and reduce or minimise risks to human health and the environment. Integrated pest management emphasises the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. (EU Directive Plant Protection Framework (2009/128/EC)).

Intercropping: Intercropping is the cultivation of two or more crops simultaneously on the same field. It also means the growing of two or more crops on the same field with the planting of the second crop after the first one has completed its development. (PAN-Germany).

Livestock unit (LU or LSU): The livestock unit, abbreviated as LSU (or sometimes as LU), is a reference unit which facilitates the aggregation of livestock from various species and age as per convention, via the use of specific coefficients established initially on the basis of the nutritional or feed requirement of each type of animal (Eurostat).

Main Crop: The crop, which is grown throughout the longest period of the current year. Crops grown between two main crops are called catch crops.

Metabase: The data analysis platform linked to the diagnostic and farm database.

Native species: Flora and fauna species that occur naturally in a given area or region. Also referred to as indigenous species. (Convention on Biological Diversity – Glossary).

Natural ecosystems: Ecosystems that can or would be found in a given area in the absence of significant human management impacts. This includes all naturally occurring flowing and still water bodies (streams, rivers, pools, ponds...), all naturally occurring wetlands, and forests (rainforest, lowland, montane, broadleaf forest, needle leaf forest....) or other native terrestrial ecosystems like woodlands, scrublands, etc.

Non-utilised agricultural area (NUAA): Area previously used as an agricultural area and, during the reference year of the survey, no longer worked for economic, social or other reasons and which is not used in the crop rotation system, i.e. land where no agricultural use is intended. This land could be brought back into cultivation using the resources normally available on an agricultural holding. (adapted from European Commission – Glossary item ‚Unutilised agricultural land').

Permanent grassland: Permanent grassland is land used to grow grasses or other herbaceous forage, either naturally (self-seeded including 'rough grazing') or through cultivation (sown), and which is more than five years old. (Glossary; Scottish Government, Rural Payments and Services).

Pesticide: A pesticide is something that prevents, destroys, or controls a harmful organism (pest) or disease, or protects plants or plant products during production, storage and transport. The term includes, amongst others: herbicides, fungicides, insecticides, growth regulators and biocides. (European commission). In organic agriculture chemical synthetic pesticides are not allowed for application. However, a list of certified pesticides are allowed. These are naturally occurring substances such as plant extracts or, on a microbial basis, such as fungal spores. Nevertheless, these substances may have a very toxic impact on living organisms.

Protected areas: Protected areas are a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. A protected area can be under either public or private ownership. (IUCN, 2008).

Protected/endangered species: Species of plants, animals, and fungi designated as threatened and endangered by national laws or classification systems or listed as endangered or critically endangered by the IUCN Red List of Threatened Species™ and/or listed in Appendices I, II, or III of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Semi-natural habitats (SNH): Semi-natural habitats are

a) originally natural habitats which are influenced by human activities but haven´t lost their structure and are still very similar to natural habitats, e.g. reforested areas (permanent semi-natural habitats), and

b) artificially created habitats that

i) have been largely left to develop naturally and host typical native plant and animal species, e.g. planted tree lines (permanent semi-natural habitats), or

ii) are regularly (once a year or more) influenced by human activities but, during this period, have characteristics similar to a natural habitat, e.g. managed flower stripes, managed buffer stripes (temporary semi-natural habitats)

Examples could be but are not limited to:

- hedges, shrubs, tree line, alley,
- single trees (living and dead), buffer stripes, fallow land, flower stripes, slope, balk, reforested areas, water elements (ravine, stream, ditch),
- unmanaged edges or strips not used for grazing

For the purpose of the Biodiversity Monitoring and related indicators, the following distinction of SNHs is made:

- **Temporary SNH:** Are SNH areas that will change in short time frames (<= 1 year) e.g. fallow land, flowering strips, field margins.
- **Permanent SNH:** Are SNH areas that are implemented and designed as permanent structures (>=1 year) e.g. solitary trees, hedges, forest edges, shrub patches, woodlot patches, extensively managed grassland (< 1.5t dry matter production per ha/year), riparian strips, water bodies, tree lines, alleys, reforested areas.

Soil biodiversity: Millions of microbial and animal species live in and make up soils, from bacteria and fungi to mites, beetles and earthworms. Soil biodiversity is the total community from genes to species, and varies depending on the environment. The immense diversity in soil allows for a great variety of ecosystem services that benefit the species that inhabit it, the species (including humans) that use it, and its surrounding environment. (Global Soil Biodiversity)**.**

Species: A group of organisms capable of interbreeding freely with each other but not with members of other species. (Convention on Biological Diversity – Glossary). It is referred only to the biological term of species, thus not including variety. For example, having three varieties of apples is not acceptable in indicator 11 (number of crop species), but having three different species of permanent crops (apple, pears and peaches) works.

Traditional crop species/livestock breeds: These terms refer to indigenous domestic breeds, either crop plant or livestock species, that were selected by humans due to their physical traits and that are genetically closely related to their wild ancestors.

Tree line: At least five trees planted in a line of at least 50 metres. The trees are not used for agricultural purposes.

Utilised agricultural area (UAA): The utilised agricultural area (UAA) is the total area taken up by arable land (including temporary grassland and fallow land), permanent grassland, permanent crops and kitchen gardens. (Eurostat Glossary, 2014).

Wetlands: The Convention on Wetlands define wetlands as: "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters". (Convention on Wetlands, Ramsar)

Wild species: Organisms (animal, plants or fungi) captive or living in the wild that have not been subject to breeding to alter them from their native state. (Convention on Biological Diversity – Glossary).

7. Annex

Annex I: Full list of questions and indication of the overlap with questions from the Biodiversity Performance Tool (BPT)

Note: Yellow fields mark questions that are also exactly contained in the Biodiversity Performance Tool. Other questions may have a similar content, but cannot be transferred one by one.

Indicator	Question	BPT
1	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. bufferzones 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	No
2	What is the total farm area (FA) (in ha)?	General description of the farm
	What is the total utilised agricultural area (UAA) of the farm (ha)?	Can be calculated from tenant and owned farm area
	Which area is covered by temporary SNH (ha)?	section A2
	Which area is covered by permanent SNH (ha)?	sections A 1,3,4,5
	What is the share of SNH compared to total farm area (%)?	Can be calculated from values included in the BPT
3	A Biodiversity Action Plan has been elaborated for the farm?	BPT aims to develop a Biodiversity Action Plan
	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)	No

4	How much of the total required forage for your livestock can be produced on farm?	section B7
5	What is the average livestock density (LU/ha/year) of your main fodder area?	section B7
6	What is the share of soy-based feed concentrate (%)?	No
	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)?	No
	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)?	No
7	Do you have any water bodies on your farm?	section A3
	What is the share of water courses that have no buffer zone in comparison to total shore line?	No
	What is the share of water courses that have a buffer zone width between 1-4 meters in comparison to total shore line?	No
	What is the share of water courses that have a buffer zone width between 5-9 meters in comparison to total shore line?	No
	What is the share of water courses that have a buffer zone width of >=10 meters in comparison to total shore line?	No
8	Do you apply pesticides on any SNH areas at the farm?	section A Manage-ment
	Do you apply fertilizers on any SNH areas other than permanent grassland under extensive management, agro-forestry systems, silvopastoral systems (located on UAA or other farm areas)?	section A Manage-ment
9	Are the SNH areas on your farm in some way connected so that they build a network of biological corridors?	section B quality SNH

10	Are there alien invasive species present on the farm?	section B quality SNH
	If yes, do you apply any measures for fighting these alien invasive species on your farm?	No
	If yes, do you consult any support from NGOs, research institutions or other relevant authority for fighting alien invasive species on your farm?	No
11	How many different crops do you cultivate (including temporary grassland and permanent grassland not under extensive management, which are considered as crops)	section B1
12	How many livestock breeds do you have?	section B1
13	How many traditional crop species do you cultivate?	section B1
14	How many traditional livestock breeds do you have?	section B1
15	Do you have genetically modified crops on your farm?	section B1
	What is the share of your UAA on which GMO crops are cultivated?	section B1
	Do you have animal breeds that are genetically modified?	section B1
	Do you have animal breeds that are genetically modified?	section B1
	What is the proportion of animal breeds that are genetically modified compared to the total breeds?	section B1
16	Which proportion of the total used animal feed concentrate is certified to be GMO free (e.g. Pro Terra certified)?	No
17	Do you implement or are you involved in any water management programme/activities where the aim is to increase water use efficiency and sustainability?	section B3
18	Do you use any decision support tools to assess the appropriate amount of irrigation?	section B3
19	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)?	No
20	How long is the crop rotation of your main crops in years i.e. the time span until the same crop is planted again?	section B5
21	What is the share (%) of UAA (ha) on which alternative measures are applied against weeds to avoid and to reduce pesticide application (IPM measures)?	section B2
	What is the share (%) of UAA (ha) on which alternative measures are applied against pests to avoid and to reduce pesticide application (IPM measures)?	section B2

	What is the proportion (%) of UAA that is not treated with pesticides?	section B2
22	A list of active ingredients that are deployed on the farm is provided?	No
	Is the amount of each active ingredient deployed in litres/ha and/or grams/ha provided in form of a list?	No
	Does the total amount of applied pesticides on your farm show a continuous reduction over a period of the past 5 years?	No
	What is the share of UAA (%) where broad-spectrum herbicides are applied?	No
23	What is the entire amount of Nitrogen applied on your farm (including inorganic and organic) in kg/ha/year?	No
24	Did the farm operator participate in a training/education/workshop with relevance to biodiversity?	section C2
	Does the farm operator you participate in a training/education/workshop with relevance to biodiversity on a regular basis?	section C2
25	Did your farm workers participate in a training/education/workshop with relevance to biodiversity?	section C2
	Do your farm workers participate in a training/education/workshop with relevance to biodiversity on a regular basis?	section C2
	Which share of your permanent staff already participated in a training unit with relevance to biodiversity?	can be calculated from BPT values

Annex II: Indicators, questions and desired impacts 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	
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)	**Creating potential for biodiversity**
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?	**Direct pressures on biodiversity by common agricultural practice have been reduced**
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)?	
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?	**Agrobiodiversity increases**	
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?		
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?	**Further risks for biodiversity loss and degradation are identified and reduced**	
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?		
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)?		

8. Overview of the Project EU LIFE Food & Biodiversity

Food producers and retailers are highly dependent on biodiversity and ecosystem services but also have a huge environmental impact. This is a well-known fact in the food sector. Standards and sourcing requirements can help to reduce this negative impact with effective, transparent and verifiable criteria for the production process and the supply chain. They provide consumers with information about the quality of products, environmental and social footprints, the impact on nature caused by the product.

The LIFE Food & Biodiversity Project "Biodiversity in Standards and Labels for the Food Industry" aims at improving the biodiversity performance of standards and sourcing requirements within the food industry by:

A) Supporting standard-setting organizations to include efficient biodiversity criteria into existing schemes; and encouraging food processing companies and retailers to include biodiversity criteria into respective sourcing guidelines;
B) Training of advisors and certifiers of standards as well as product and quality manager of companies;
C) Implementation of a cross-standard monitoring system on biodiversity;
D) Establishment of a European-wide sector initiative.

Within the EU-LIFE Project Food & Biodiversity, a Knowledge-Pool with background information linked to agriculture and biodiversity is provided. You can access the Knowledge Pool under the following link:

www.business-biodiversity.eu/en/knowledge-pool

Author: LIFE Food & Biodiversity; Lake Constance Foundation.

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