MANUAL ON BIODIVERSITY ACTION PLAN FOR CHILLI PRODUCTION

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MANUAL ON BIODIVERSITY
ACTION PLAN FOR

Chilli Production

Content

1. Biodiversity and its importance for Agriculture

Biodiversity means the variety of life on Earth at all its levels, from genes to ecosystems. It builds the basis for all ecosystems services, which humans depend on; for example, clean air, clean water and fertile soils for farming. Today, nearly one-third of the world's land area is used for agricultural production. Thereby, agricultural biodiversity provides not only food and income but also raw materials for clothing, shelter, medicines, breeding new varieties, and performing services such as maintenance of soil fertility and biota, and soil and water conservation, all of which are essential to human survival. (www.cbd.int/agro).

Diverse cultivation systems like agroforestry, crop rotation and intercropping systems support biodiversity and, in the past, made agriculture a main factor in conserving it. The sustainable agriculture, however, was exchanged in many places of the world by a land use model that segregates agricultural production from areas managed for biodiversity conservation. Thus, favoring monocultures and high intensive production systems depending heavily on chemical inputs.

These systems altered agriculture into one of the main drivers of biodiversity loss, globally. Activities such as tillage, drainage, grazing and extensive usage of pesticides and fertilisers have significant implications for wild flora and fauna (above- and belowground), which is essential for plant growth and resilience. Neglecting the importance of biodiversity for farming, the dependency of these systems on external inputs rises continually.

However, biodiversity improves the farming performance. The belowground biodiversity which includes innumerable microbial diversity and other forms of living organisms like fungi and algae is crucial for soil fertility. A functioning system of flora and fauna also triggers natural pest control and beneficial ecosystem services like pollination and water purification. Such ecosystem services increase crop yields and resilience against climate change and other weather extremes. Erosion and soil compaction are but a few of the things an abundant fauna and flora counteracts.

For farmers it has a high value to support biodiversity on landscape level but also within their fields.

This manual guides farmers at developing a Biodiversity Action Plan to implement a stronger biodiversity management within the agricultural production system and to use agricultural practices that are biodiversity friendly. By the implementation of biodiversity measures, the farmer shall enjoy positive effects to their cultivation system.

2. The Biodiversity Action Plan

A Biodiversity Action Plan (BAP) is a strategic framework and road map for measures to improve biodiversity on the farm. The BAP will support farms, consultants and advisors, to define relevant measures for 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 managers and consultants to give advice regarding the improvement of the quality and effectivity of biodiversity measures.

SCOPE

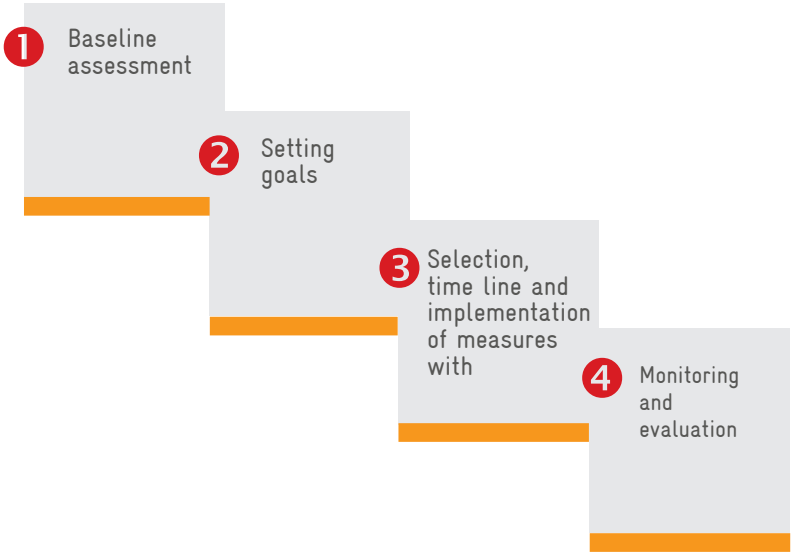
The Biodiversity Action Plan should focus on the two aspects for protection of biodiversity with the intention to benefit producers:

1. The protection of existing biodiversity as well as the creation of potential for increasing biodiversity on the farm and its surroundings, in order to increase resilience of productivity of agricultural ecosystems
2. The continuous reduction of negative impacts on biodiversity produced by agricultural activities (=Very good agricultural practices for more biodiversity)

The person responsible for the agricultural operations needs to be aware that both aspects are interdependent and are of equal importance for biodiversity conservation.

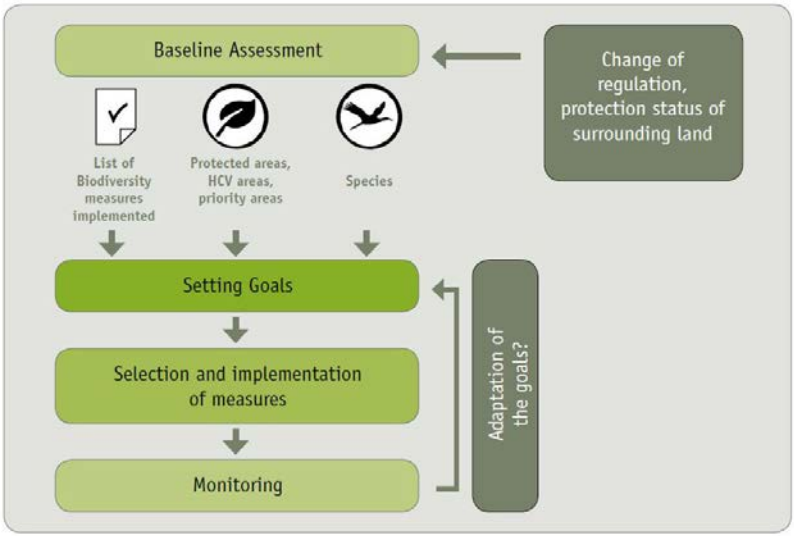
2.1. The four elements of a BAP

A Biodiversity Action Plan includes four steps:



The BAP includes a proposed timeline for implementation of measures following a set of feasibility criteria. It is expected that a farmer will review and update the plan every three years.

Farmers do not need to implement the full range of measures all at once but rather can start with a couple of activities and then show a continuous improvement for the next years.



3. Baseline Assessment

At the beginning of a Biodiversity Action Plan, a baseline needs to be assessed. The baseline assessment is a mapping of information of sensitive and protected biodiversity areas, endangered and protected species and semi-natural habitats on or around the farm or the collection area. It includes fallow/set aside land as well as cultivated and non-cultivated areas. Existing biodiversity measures (measures, which the farmer implemented to support biodiversity e.g. flowering plots, buffer areas around water bodies etc.) should also be marked in the map. This information will help to identify priorities, define measurable goals, assess the impact of implemented measures and if necessary, select approaches that are more effective.

As a farmer, you may use satellite images, aerial photographs of your properties or sketch your farm to develop the map for the baseline assessment. Small-scale farmers may prefer sketching their farm. Satellite images and aerial photographs may come with costs, which can be avoided.

3.1. Mapping ecosystems and biodiversity on and around your farm

- Important areas for biodiversity and ecological structures at the operation site/farm and adjacent to it e.g., water bodies including:
  - Protected areas. (Source for areas protected by public/community, national and regional laws) (number and size "m^2")
  - Semi natural habitats such as biotope, corridors, fallow land, hedges, shrubs, trees (number and size "m^2")

- Location of water bodies, swamps, wetlands, rivers, streams and springs plus an indication as to which of these are protected by riparian areas or patches of indigenous vegetation, as well as information on the water holding status at different times of the year (number and size "m^2")
- Location of other areas of natural vegetation within the farm (number and size "m^2/ha")
- Location of areas on the farm that are not used for production (number and size "m^2/ha")
- Location of areas that are used for production/ sourcing (number and size "m^2/ha")
- Boundary areas, for example between fields or at field edges or roadsides that may already be, or have the potential to become, wildlife corridors (number and size "m^2")

- Endemic animal and plant species on your farm or adjacent to it
- Animal and plant species classified by the government as a protected species or have been placed on a national Red List and/or the Red List of IUCN (www.iucnredlist.org) (number of species)
- List of biodiversity measures already implemented (number and kind of measure; see for further information the section of biodiversity measures)
- List of biodiversity friendly farming practices for more biodiversity already implemented (number and kind of measure; see for further information the chapter **Very Good Agricultural Practices for More Biodiversity**)

3.2. Where to get this information? Who can help?

For further information on the characteristics of the region you are farming in, you may contact:

- Standard/company technical advisors
- Local Forest Office/ Krishi Vigyan Kendra
- Local, regional or national authorities with responsibilities for nature, forests, wildlife, waterways or other aspects of biodiversity
- Local or national wildlife or nature-protection NGOs. Local representatives of the NGOs can provide detailed information on the current situation and give recommendations regarding priorities for biodiversity protection on local or regional level
- Other farmers, within your organisation or your neighboring community

- Elders or other people in the community with knowledge of the natural vegetation and fauna in the region
- Manager or staff of the closest nature reserve
- Use the Peoples' Biodiversity Register if available for your region or ask for it
- Webpage www.hcvnetwork.org for more information about High Conservation Value areas and on IUCN Red List http://www.iucnredlist.org/ for protected and endangered species and see links above

4. Setting measurable goals to protect and improve biodiversity

The baseline assessment allows setting goals, to quantify these goals with indicators, to identify priorities and to evaluate the impacts of the measures implemented.

4.1. How to identify priorities?

To identify the priorities and related goals, consider two central aspects for the creation of potential for biodiversity:

- Identify main impacts of your farming activities on biodiversity.
- Identify main opportunities for biodiversity, protect existing biodiversity elements and influence others positively

IDENTIFYING MAIN IMPACTS ON BIODIVERSITY:

The following list shows major causes for biodiversity loss. You may check if your farming activities contribute to one of the following points:

- Degradation or destruction of ecosystems and habitats (land use changes)
- Overexploitation of natural resources
- The expansion of alien invasive species
- Pollution/contamination of the environment (soil and water)

MITIGATION HIERARCHY

The mitigation hierarchy is a stepwise process for managing biodiversity impacts and averting risk. It is widely recognised as best practice for management of biodiversity. Through this mitigation process an emphasis is placed on avoidance of impact, and where this is not possible impacts need to be reduced or minimised and then restored or repaired, and where any residual impact remains, offset or compensated for (CBD, 2014).

Measures for the hierarchy steps are defined as follows:

Avoidance	Avoid impacts on biodiversity from the outset
Minimisation	Reduce the duration, intensity and / or extent of negative impacts to biodiversity
Rehabilitation/ restoration	Rehabilitate degraded ecosystems or restore cleared ecosystems
Offset	Compensate for any residual significant, adverse impacts that cannot be avoided, minimised and / or rehabilitated or restored, in order to achieve no net loss or a net gain of biodiversity

It is of utmost importance to emphasise the first two aspects of the mitigation hierarchy. As a farmer, you should try to avoid negative effects on biodiversity from the beginning. You should also try to minimise the negative effects farming as much as possible.

CHECK IF YOUR FARMING ACTIVITIES CONTRIBUTE TO THESE ASPECTS

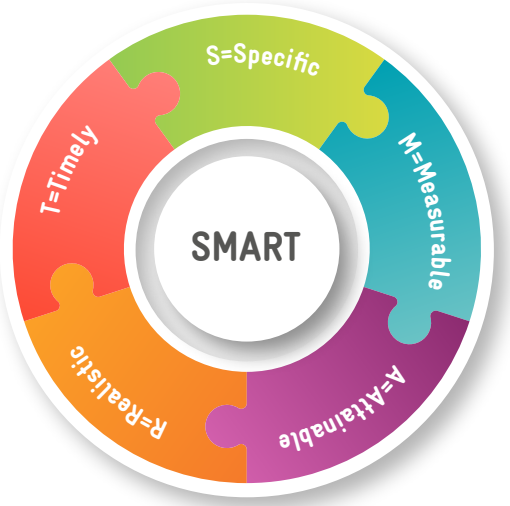
Following the mitigation hierarchy, the priorities of the BAP are to avoid and minimise negative impacts of agricultural/ sourcing activities on biodiversity and to create and manage habitats, e.g. through:

- The protection of areas of high ecological value on and in the surroundings of the farm
- The protection of endangered/protected species on and in the surroundings of the farm
- The creation of habitat on and in the surrounding of the farm
- The connection of habitats on your farm and with natural areas/habitats in the neighborhood of your farm
- The protection of soil and water on and in the surrounding of the farm

Furthermore, you should identify and try to contribute with own initiatives to local, national/international initiatives and biodiversity strategies, which target the drivers of biodiversity loss. You may ask your technical advisor, local NGOs or governmental institutions for more information on such initiatives and international conventions and agreements (e.g. CBD, Nagoya Protocol, CITES etc.).

4.2. Setting measurable goals

After the creation of your baseline assessment and checking the farm practices, which have a negative impact on biodiversity, define SMART goals for your farm.



The following list shows some possible goals, which might suit your farm. Note that this list is not complete and you are free to come up with additional aspects.

Examples of possible goals:

- Increase of priority areas for biodiversity (% of the total farm area)
- Increase of connectivity between habitats
- Increase of areas connecting habitats / ecosystems (size / % of corridors)
- Promotion of endemic and protected / endangered species - occurrence on farm operations will increase within xy years (number of species). It will be difficult to measure the achievement of goals focusing on animal species, because animals move and will not always be present on the farm. But the monitoring of plant species could be a good way – see **Monitoring**
- Continuous increase of implementation of biodiversity friendly farming practices
- Increase soil organic matter on your cultivation area
- Strengthening of protected areas in the neighborhood of the farm
- Creation of a round table on biodiversity with the farmers in the region in order to join efforts and to contribute to the regional Biodiversity Strategy
- Establishment of a practicable and meaningful monitoring of biodiversity
- Support the agro-biodiversity by growing and keeping traditional regional crops and animal breeds
- Selection and implementation of measures for biodiversity management

Respecting your operational timetable, we recommend that you distinguish between short-term goals and medium-term goals. You should also name priority goals that can be achieved in a short time and that have a big positive impact on biodiversity. Whenever possible, priority goals should be achieved in a short term.

4.3. Selection and implementation of measures

After defining goals, identifying and describing appropriate indicators to evaluate progress is the next step.

As a farmer you should list the following points for every measure:

- objective
- resources needed
- responsible person and;
- a timetable need to be set

Goals and measures can be prioritised by an estimate of the efforts needed to implement (**easy, medium, difficult**) by an estimate of cost **(cheap, costly**) and of the benefits for biodiversity (**low, medium, high**).

Short-term goals with a high benefit for biodiversity should receive a high priority.

In the following chapters, there is an abundant list of measures from which you may choose those, which are most suited to your local conditions. Be aware that not all measures need to/can be implemented and that the implementation shall happen step by step. e.g. –

- the creation of a water body only makes sense if the visiting wildlife does not harm the farm and its crops.
- an organic farm does not need to care on the measures of reducing chemical fertilisers or synthetic chemicals. The farm will find surely other measures to improve its biodiversity.

Note that you may come up with additional measures that are not included in this document. Feel free to bring them into practice, too.

Note that within the implementation of measure, collaboration with different stakeholders is one of the main factors for success. Collaboration should be started whenever possible or needed. Farmers must not be left alone with complex tasks.

5. Measures for Biodiversity Management

In general, farms with 0-4ha agricultural land, are considered as small-scale farms. Farms with 4-10 ha agricultural land are seen as medium scale farms and farms with more than 10 ha land are considered large scale farms.

However, this partitioning should be adapted to the local reality.

Some of the following measures may suit all farm sizes; others may be too costly for small and medium scale farms but could be dealt with on large scale.

Whenever biodiversity management measures rely on a larger scale or are too big a burden for small scale farming, farmers should deal with them in a cooperation.

5.1. Protection of natural and semi-natural ecosystems

WHY?

Natural and semi-natural ecosystems are essential for the conservation of biological diversity. At the same time they provide us with important ecosystem services that would be lost if these ecosystems were destroyed or converted to intensive use.

Semi-natural ecosystems have been altered by human actions to a limited extent, but haven´t lost their structure and are very similar to natural habitats. Semi-natural ecosystems play an important role for providing clean water, air and food. Beneficial insects like pollinators often depend on ecological structure for breeding. Hence, the more semi-natural ecosystems are on the farm, the more beneficial insects can be found, which help to reduce pests and promote crop yields.

WHAT TO DO?

- Do not use/convert natural ecosystems, pristine ecosystems into agricultural area
- Use semi-natural ecosystems and areas of high value for biodiversity e.g. HCV areas in a sustainable way, only. This means to maintain and support natural processes in these areas and to prevent damages caused by the use.
- Prevent negative impacts to neighboring natural ecosystems and protected areas. Negative impacts can arise from fertilising, spraying pesticides, use of heavy machinery, disposal of waste, etc.

- Implement a minimum share of ecological structures/ semi-natural habitats on your farm (a minimum of 10 % is recommended)
- Use natural soil drainage rather than installed water canals and pipes. Only drain if it is inevitable.
- If farming occurs on peatland, make sure that agricultural activities are compatible with biodiversity protection. If biodiversity friendly farming is not possible, set aside this land. Check for subsidies in order to take this area out of production.
- Do not drain marshes; do not extract peats
- Build back water drainage canals wherever possible and restore former wetlands
- Keep a buffer zone of primarily native vegetation along seasonal and permanent water bodies. The buffer zone should be of minimum 10 m width and kept free of fertilisers and pesticides.
- Do not dispose materials and substances inappropriate for the environment and biodiversity such as oil, CPPs, CPP packaging or containers, medicines, animal manure, and construction rubble, in rivers, streams or other surface or ground waters
- Do not burn vegetation (including vegetative waste) in order to create new agricultural land (or clear crop residues)

Air is seen in this regard as a natural ecosystem too. Any negative impacts on air quality of the agricultural activities/ sourcing must be identified. Measures are taken to counteract these negative impacts.

5.2. Creation of priority areas for biodiversity (type, size and minimal quality)

WHY?

Priority areas promote biodiversity on the farm. They provide habitat/refuge for animals and plants. Well-managed priority areas can compensate for the loss of biodiversity caused by agricultural activities. Farmers can set aside land and leave it to natural succession or they can re-cultivate it. Farmers should connect single plots with biotope corridors to increase the potential for biodiversity.

WHAT TO DO?

- Cover a minimum 10% of your farm with native vegetation; 15% in case of growing shade tolerant crops
- Conserve semi-natural habitats/ecological structures
- Manage fallow land in order to enhance biodiversity or the provision of ecosystem services. This includes:
  - Do not use pesticides and fertilisation (on these areas)
  - Plant or manage native species to create habitats of high biodiversity value (see also 5.3 – 5.6)
  - Provide services such as water table management, flood control, nesting and foraging sites for insectivorous birds or plants used by species that predate on pests
- Support reversion to natural vegetation
- Cooperate with local experts regarding the conservation and restoration of degraded habitats and the quality of priority areas for biodiversity
- If areas were recently converted into farmland, compensate for/restore the lost biodiversity

5.3. Establishment of natural structures in combination with measures to promote regional characteristic species

WHY?

Regional characteristic species can be iconic for a landscape or habitat type. If conditions are good, these species will occur regularly in their typical habitat. They are indicators for biodiversity. Farmers can detect the state of biodiversity on the status of these species. Thus, indicating the functionality of the biodiversity. A high functionality benefits the farmer as it suppresses pest and diseases. Often, natural structures like flower stripes, hedges, single trees support the population of characteristic species.

WHAT TO DO?

- Maintain vegetated zones adjacent to aquatic ecosystems
- Restore zones adjacent to aquatic ecosystem
- Protect or restore linear structures in the landscape such as hedges, stone walls or water ditches
- Do neither: use fertiliser nor plant protection products on any ecological structures/semi-natural ecosystems
- Only use native species for new hedges
- Promote nesting places for birds or bats
- Create ponds that are attractive for wildlife
- Use border plants or live fencing plants which can be used commercially for some purpose and may add value to the Private Business Action, e.g. Hibiscus as a live fence in cardamom plantations

More activities are described in the chapter “Very good practices for more biodiversity

5.4. Measures promoting protected and endangered animal- and plant species

WHY?

Populations of protected animals and plants are often decreasing. The farmer should implement measures or combination of measures in order to counteract the main causes and to protect and conserve those species. Often, identification of endangered species is not easy. The same applies for the identification of measures. As a farmer, you should cooperate with local experts from the early beginning.

WHAT TO DO?

- Obtain information about protected and endangered species in the region and identify protected and endangered animal and plant species on or adjacent to the farm (see baseline assessment)
- Report the presence of protected and endangered plant and animal species to the certifying standard/company and/or regional environmental protection agencies
- Seek cooperation with local experts to identify measures promoting this species
- Take part in local, regional or national initiatives for the protection of agro-biodiversity
- Seek traditional information on practices linked to the sourcing of species and ingredients
- Take measures to preserve and restore the traditional practices linked to sourcing of species and ingredients that promote sustainable use of biodiversity

5.5. Avoiding practices disturbing or compromising protected and endangered species

WHY?

– see explanation in 5.4

WHAT TO DO?

- Maintain/manage linear structures (e.g. trimming of hedgerows, clearing /cleaning of drainage channels) and other activities in a way that minimises damage to habitats, flora and fauna (e.g. trimming of hedges outside breeding seasons of birds).
- Do not fell trees, cut off hedges during mating/nesting season for birds; if nesting season occurs all year around, do not fell trees which are used for nesting at that moment
- Do not hunt/fish/collect endangered and protected species
- More activities useful for this aspect described in the chapter "Very good practices for more biodiversity"

5.6. Establishment of wildlife corridors / ecosystem connectivity

WHY?

Wildlife corridors connect habitats separated by human activities or structures, allowing animals to pass by. Thereby, wide corridors are better and are effected less from adjoining

land uses and associated edge effects. In general, the wider the corridor is the better for biodiversity.

WHAT TO DO?

- Inform yourself about habitat corridor networks and migratory routes and wildlife corridors in your region
- If your farm borders with a protected area, place the areas specified for biodiversity on the farm close to the protected area
- Connect areas specified for biodiversity at the farm operation to one another via habitat corridors
- Create, maintain and enhance a network of natural vegetation along live

Human – Wildlife Conflicts

Conflicts with wildlife may occur at all stages of farming and at times it may be increased through biodiversity measures on the farm. Whenever possible, such conflicts must be avoided. If the implementation of a specific measure is likely to increase such conflicts, this measure should be avoided. Wildlife is to be protected and farming has to adopt to natural conditions e.g. natural wildlife corridors.

fences, hedges, ditches, riparian strips, roadside and field margins across the landscape

- Minimise disruption of habitat/wildlife corridors by farm activities

5.7. Promoting beneficial organisms

WHY?

Diverse vegetation, natural or planted such as trees, flower strips etc. provide habitat, shelter and food for beneficial organisms such as ladybugs or wasps. By parasitism or predation, they reduce occurring pest species, which in turn reduce the need for plant production products. In the same way, the implementation of nest boxes supports insectivorous birds or bats to remain in the vicinity of the farmland, contributing to the reduction of pests as well.

WHAT TO DO?

- Plant vegetation to attract predators to help reduce pest-pressure
- Plant wild flowers to maintain pollinator populations
- Install solitary bee nest boxes to support bee populations
- Install nest boxes for insectivorous birds or bats
- Follow integrated weed management approaches
- Avoid monocultures
- For further biological pest control activities see the chapter “Very good practices for more biodiversity”
- Adopt ecological engineering wherever possible for designing the farm with inclusion of native wild species that are multi-beneficial

5.8. Requirements for wild harvesting

WHY?

The increasing demand for wild plants poses major ecological and social challenges. If wild collection is not done sustainably, it endangers the livelihood of the farmer/collector. Collection needs to be done in a way that populations remain stable and have enough time for reproduction and growing. Habitats must not be damaged or altered and no other plants or animals must be affected.

WHAT TO DO?

- If you harvest or collect wild plants, make sure your activities are in accordance to the International Standard for Sustainable Wild Collection of medicinal and

aromatic plants (you may also use the Union of Ethical Biotrade (UEBT) standard or the FairWild standard).

- Do not collect/fish rare, threatened or endangered species
- Inform yourself about the regeneration rate of the collected plants and ensure that harvest rates respect regeneration rates and the minimum viable population size. Collecting must be sustainable. Therefore, the population size must be known.
- Source natural ingredients from their native distribution area only
- Use appropriate collection practices in order to not destroy or damage the target species (species which do not reproduce easily or which grow slowly). If this cannot be assured, do not collect them.
- Do not hold wildlife in captivity
- Do not damage the environment within the collection and ensure best conditions for regeneration of the plant species harvested. Regeneration is guaranteed when enough flowers, seeds, leaves or roots stay untouched for reproduction.
- Seek traditional information on practices linked to the sourcing of species and ingredients
- Take measures to preserve and restore the traditional practices linked to sourcing of species and ingredients that promote sustainable use of biodiversity
- Engage local biodiversity experts (elder, local/regional NGOs, nature administration) in this task
- Protected areas are respected and must not be infiltrated

5.9. Identification and management of alien invasive species on farm

WHY?

Alien invasive species are organisms not native to a given place. Their presence or introduction causes economic, environmental harm, or harm to human health.

WHAT TO DO?

Identify invasive alien species on the site of the farm/ collection area.

- Where to get this information?
  - Ask the responsible agricultural advisor from the certifying standard or company
  - Ask local, regional, national authorities and research institutes
  - Contact local or national wildlife or nature-protection NGOs
- On the following homepage the World´s most adverse Invasive Alien Species have been identified **www.issg.org/worst100_species.html**
- Manage identified alien invasive species with appropriate practices. Further information are provided by the certifying standard/company
- During importing and exporting of products ensure that no alien invasive species enter or leave the farm (minimum visual inspection)
- Report cases or presence of invasive species on your land to regional environmental protection agencies
- Do not dispose invasive plant species and any of their parts or remnants in aquatic ecosystems

- Exchange information and raise awareness among the local population on potential risks and trends regarding exotic species etc.

6. Very good agriculture practices for more biodiversity

Biodiversity supports natural ecosystems which, for example, benefits water conservation, biological pest control and soil fertility, which also provide a buffer to mitigate and adapt to the effects of climate change. Diverse production systems, like agroforestry, permacultures and ecological farming contribute greatly to the protection of biodiversity.

Agriculture can negatively affect surrounding ecosystems by water use and pollution, nutrient overloads and corresponding eutrophication, pesticide buildup in soils and water supplies, compaction and eroding soils and by introducing invasive species.

The following recommendations are a selection of VERY good agricultural practices for more biodiversity, which protect and contribute to the recovery of biodiversity.

You may select a range of measures most suitable for your farm, if certified or not, in order to improve biodiversity. If your farm is certified, contact your technical advisor of the standard or any other knowing professional to adjust the measures with the certification goal. Note that you do not have to introduce all measures, but those that suit your farm. Furthermore, you do not need to implement all measures that suit your farm at once, but should rather follow a step by step approach and continuously increase your share of very good agricultural practices.

Chili is a popular spice grown in different regions of the world. In India it is one of the most valuable crops. It is grown largely for its spicy fruits all over the country. There is a high diversity in Chili varieties. Chili can be grown annually or multiannual.

6.1. Soil and Soil fertility

Belowground biodiversity and activities of soil flora and fauna are the index of soil fertility and productivity.

SOIL EROSION

WHY?

Soil erosion contributes to the degradation of soils, to the loss of soil biodiversity and to inputs from agriculturally used substances into the surrounding environment. It is also a cause of floods, since degraded land is less effective in holding water.

WHAT TO DO?

- Map areas with risk of erosion.
- Contact the standard/company technician or a technical institute for information regarding the risk of erosion of the regional soil type
- Implement soil protection measures where risk of erosion is high, i.e. reduced tillage, terracing, slope parallel crop cultivation, perennial vegetation
- Keep the ground cover on agricultural land as long as possible, at least during the periods prone to nutrient leaching and erosion (rainy seasons). During summer the cover crops dry up leaving thick organic mulch
- Inspect the soil protection measures annually in order to fix them in case of damage

SOIL FERTILITY

WHY?

A fertile soil can provide adequate amounts of nutrients for plant growth. This results in better crop yields and quality.

Soil organisms act as the primary driving agents of nutrient cycling, regulating the dynamics of soil organic matter, soil carbon sequestration and greenhouse gas emission. They modify soil physical structure and water regimes, enhancing the amount and efficiency of nutrient acquisition by the vegetation and enhancing plant health (FAO).

WHAT TO DO?

- Undertake soil analysis of your farm to ascertain the kind and magnitude of requirement of fertilisers
- Keep a soil health card with periodical updated data with the help of experts
- Identify negative impacts of the agricultural activities/ sourcing on the soil quality (regularly deep tillage, compaction, nutrient overloads, pesticide build up)
- Use mulching (green leaf manure), compost, vermicompost and neem cake to enrich the soil with nutrients.
- Fertilise with organic matter prior to the use of mineral fertiliser
- Fertilise with farm yard manure
- Within an intercropping system use crop rotations in order to boost soil microbial biodiversity and productivity
- Follow a crop rotation plan of at least four years on the same plot. The main crop shall change every year.
- In case of multiannual chili cultivation, keep three different main crops after Chili on the same plot before you cultivate chili next time. Furthermore support intercropping
- Intercrop chili with garlic or onion (in coastal saline area)
- Use intercropping

- Cultivate legumes (e.g. Crotalaria, beans, soya, peanuts) as green manure and use further cover crops or intertillages such as grasses or oilseeds, whenever possible. Manage them to enhance humus in the soil and to increase the potential for beneficial biodiversity.
- Do not burn vegetation to improve the soil fertility nor to stimulate the regrowth of grasses or other vegetation
- Prepare your own compost and incorporate it into the soil regularly in order to increase the amount of humus in the soil and to support soil biota for healthy (resistant/resilient) plants. This improves the capability of the soil of holding water. You may also undertake compost analysis
- Use compost teas. It can be well distributed and micronutrients are easily absorbed by the plants
- Prepare and use Vermicompost if applicable

6.2. Nutrient Balances and Fertiliser Management

WHY?

Nutrient balances on farm-level are crucial to avoid over-fertilisation and thereby run-offs in water and groundwater. Farmers should establish nutrient balances with a proven method.

WHAT TO DO?

- Do not fertilise semi-natural habitats (do not apply neither chemical nor organic fertiliser)
- Prefer organic fertiliser over mineral fertiliser and use e.g. manure and compost

- Continuously improve the use of organic fertiliser and reduce the use of mineral fertiliser up to a minimum level.
- Farm yard manure is recommended for spice cultivation for building up humus in the soil
- Document all fertiliser applications and nutrient values of the fertilisers (at least N and P) in detail
- Post-harvest nutrient balances are performed either by a method, provided by standards/companies with documented figures or by another approved and specified method. See **OECD/EUROSTAT Gross Nitrogen Balance: https://circabc.europa.eu/webdav/CircaBC/ESTAT/agrienv/Library/nutrientsbalances/handbooks/NHB%2024%20Nov%2003_OECD.pdf**
- Perform an annual humus balance and back up with humus inspection every six years. The humus balance must never be negative and follows an approved approach
- Apply fertilisers in a way that is proportionate to the growth stage of the specific crop (timely fertilisation)
- Conduct soil testing for nutrient contents every three years and using a reliable method. Document results and test for pH, phosphorus, potassium and magnesium values in the soil.
- Conduct soil testing on pesticide residues and heavy metals before planting
- Conduct soil testing for nitrogen contents annually
- Respect crop specific nutrient limits given by the certifying standard.

6.3. Pest Management

WHY?

Pest management includes measures against pests, diseases and weeds. Today chemical treatments are the most common pest management tools worldwide. Many of the chemicals are highly toxic and require protective equipment and conditions for use. Several have already been banned in northern hemisphere countries for their toxic impact on ecosystems/humans.

Pesticides have a major effect on biological diversity and habitat loss. Pesticides can have short-term toxic effects on directly exposed organisms but also long-term effects from changes to habitats and the food chain.

Pesticides reduce biodiversity and with this, the environment's ability to regulate itself. Farmer should reduce the amount of pesticides used and exclude very harmful substances as the main strategies to reduce the negative impacts on biodiversity.

WHAT TO DO?

- Respect biological pest management as guiding principle
- Do not apply pesticides as a preventive measure
- Continuously reduce the application of pesticides up to a minimum level
- Cultivate only crops which suit the local conditions
- Apply alternative measures to reduce pests and the needed pesticide input (Integrated pest management):
    - Use adequate cultivation techniques, such as:
        - » Rotate crops (see above)
        - » Use intercrops (most green manure crops keep mycorrhizal counts high and suppress parasitic nematodes and reduce the incidence of thrips, aphids and whitefly.)
    - Support active organic matter, which reduces root rots and leaf diseases
        - » Sanitise seedbeds
        - » Adjust sowing dates and densities,
    - Apply conservational tilling
        - » Plant pest resistant/tolerant cultivars
        - » Use standard/certified seed and planting material
    - Use natural pesticides/ botanical preparations and herbal extracts
        - » Use border crops e.g. basil (serves for its optical effects and as repellent), sorghum, maize
        - » Use trap crops e.g. coriander (attracts beneficial insects), marigold and castor (against borers and nematodes)
        - » Use sticky traps and pheromone traps (attracting beneficial insects to the crop and fighting natural enemies)

- » Install bird perches
- » Use root dipping techniques
- » Use further traditional knowledge for pest control

- Only after all preventive measures (like mechanical weeding, the stimulation of beneficial organisms etc.) have been implemented and defined thresholds exceeded the application of pesticides is allowed.
- Follow the principles below if pesticides are applied:
  - » Apply the lowest practical rate of pesticides
  - » Apply pesticides uniformly
  - » Avoid double coverage (shut off the applicator when turning)
  - » Rotate herbicides to prevent weed resistances
  - » Spot treat when using high rates of herbicides
  - » Choose pesticide with less potential for leaching
  - » Apply insecticides only if economical thresholds of pests are met
  - » If rain is predicted, do not apply pesticides. To avoid washing-off of the active substances from the plant respect the specifications given by the product description regarding the application time before rains. If no specifications are given apply plant protection products latest two hours before rain is predicted to start.
  - » Minimise drift during application (avoid spraying when wind velocity is high)
  - Prevent spreading of harmful organisms by field sanitation and hygiene measures (e.g., by removal

of affected plants or plant parts, regular cleansing of machinery and equipment)

  - Protect and support beneficial organisms, e.g. by the utilisation of ecological infrastructures inside and outside production sites
  - Apply insecticides in the morning or in the evening and generally at times of reduced pollinator activity

- Record the occurrence of pests and diseases by mentioning the date spotted, area affected, measures taken and control established. A calendar made like this can help to prepare for timely preparations/actions in the following years
- Document the application of preventive and alternative measures to prevent/reduce the use of pesticides
- Document every pesticide application (at least the name and the amount of the substances used) and demonstrate a continuous improvement in the reduction of applied pesticides, up to a minimum level
- Do not use agrochemicals banned under Stockholm Convention on Persistent Organic Pollutants (POPs), WHO categories I and II, listed in the Rotterdam Convention on the Prior Informed Consent Procedure

for Certain Hazardous Chemicals and Pesticides in International Trade, as well as banned by any relevant national legislation

- Apply pesticides only if approved by Central Insecticide Board (CIB) to eliminate the chances of poisoning farm soil by spurious chemicals
- Follow the regulations of the Food Safety and Standards Authority of India (FSSAI)
- Apply the pesticide as per specification on the label
- Do not use any agrochemicals proven to have damaging effects on pollinators, beneficial insects, amphibians or fish e.g. Neonicotinoides
- Do not use pesticides in the interrow of permanent or multi-annual crops
- Do not use pesticides and fertiliser in riparian buffer zones (minimum of 10 m width)
- Store fertilisers and pesticides separately
- Inform yourself on the topic of pesticides. Contents should include, biodiversity impacts and reduction strategies
- Use treated seeds only if necessary. There must be a clear documentation detailing the reasons for using treated seeds (e.g. governmental obligation).
- Only use plant protection products of which the origin is known, do not use “no-name” products.
- Respect instructions for the proper use of pesticides that is given on the original packaging: storing, application technology (e.g. maintenance and proper equipment settings), cleaning of equipment and disposal of residual materials / packaging, PHI.
- Participate in capacity building activities on the topic of pesticides
- Use plant sprayers only (no aerial application of pesticides). Spraying equipment is calibrated every year.

- Use adequate personnel protective equipment (as mentioned on the MSDS sheets of the chemical being sprayed) in order to protect yourself
- Only authorised and regularly trained staff uses the machinery and can spray
- Do not burn vegetation as a method for pest/disease reduction. It is allowed only if no other alternative measure exists. This must be documented.
- Collaborate with your community in order to find general solutions for common (pest) problems
- Remember: Contain the pest load and do not aim to control the pest absolutely

6.4. Weed management

- Use only mechanical weeding if possible
- Use selective mechanical weeding/uprooting to remove/reduce the Invasive/noxious species and increase the softer weeds. Slowly change weed flora.
    - Mulch with green leaves

- Do not use total/non-selective herbicides e.g. Glyphosate
- Do not use pre-emergence herbicides. Substitute pre-emergence herbicides by mechanical weeding

6.5. Water-Use

WHY?

Water is crucial to agriculture but also to biodiversity. Farming accounts for around 70% of water used in the world today and contributes to water pollution from nutrients run-off, pesticides and other pollutants. Overexploitation of water sources by agriculture is the main driver for the destruction of aquatic ecosystems such as rivers and wetlands.

Sustainable management of water in agriculture is critical

to secure the sustainability of the agricultural production as well as intact ecosystems.

WHAT TO DO?

- Try to harvest the rainwater if possible and save it for future by keeping in ponds or rice paddies
- Use the most efficient irrigation techniques and continually optimise irrigation methods (e.g. reduced evaporation at evening irrigation) taking into account the actual water need of the plants
- Identify negative impacts on water resources from your agricultural activities or sourcing
- Only use water strictly conformable to legal requirements and withdrawal limits
- Record the amount of water used for irrigation (time and flow rate)
- Record the rainfall you received on your farm
- Inform yourself on the situation of the water ecosystem in the relevant watershed.
- Screen the water quality of own water sources, streams and ponds every year and ensures that nitrate and pesticide levels are in accordance with legal compliance
- Cooperate in a regional water monitoring system and participate in regular information exchange with regional water experts to support the sustainable use of water and to ensure water quality and water equity of lakes, rivers and other water ecosystems
- Collaborate with regional nature protection authorities and authorities responsible for the management of watersheds and request the elaboration of sound and realistic watershed management plans (or similar), which take into account the impact of climate change

- Use decision support tools (meteorological stations, dedicated software, tensiometric probes etc.) for improving the irrigation performance
- Adopt the agricultural cultivation and animal husbandry to the regional and climatic conditions, so that no overuse or damage to local or regional water resources, natural wetlands or regional protected areas occurs
- Plant trees in your production area. Trees keep water within the plantations / systems.
- Increase water use efficiency with organics and approved polymer

6.6. GMO

WHY?

Since the first commercially offered genetically modified organism (GMO) was authorised for sale as food in 1994 in the USA (a delayed-ripening tomato), the international community has been divided over the costs and benefits of genetic modification (GM). Currently the impact of the use of GMO plants and animals on the environment cannot be estimated. Facing the uncertainty over potential impacts, the precautionary approach to prevent possible environmental harm, rather than to repair an environmental damage once it has taken place, is an essential foundation of sound development.

Up to now, Indian GMO production is concentrated in cotton production. Several GM-crops are approved for field trials. There are as many as 20 GM crops undergoing trials at various stages, so GMOs are not involved in food chain production on a big scale.

WHAT TO DO?

- Do not use GMO´s at any stage of the production, e.g. genetically modified chili pepper (*Capsicum annuum* L.), containing the *CMVP0-CP* (cucumber mosaic virus pathotype 0 – coat protein) gene
- Do not introduce or cause introduction of GMOs through your agricultural activities/sourcing
- Install a buffer zone to other conventional chili farmers for prevention of evident gene flow, in case growing GMOs is common
- Talk within your community to prevent the use of GMOs.

The certifying standard/company defines negative list of crops and feeds, which should not be used within the agricultural activities.

6.7. Agro-Biodiversity

WHY?

Agro Biodiversity is the outcome of thousands of years of effort by farmers in selection and breeding, and in developing appropriate production systems and methods. Plant and animal genetic resources are the source material for the further development of crop varieties and animal breeds by farmers and breeders.

Most of the spices farmers are small holders and they used to cultivate many local varieties. However, with the advent of the high yielding varieties and hybrids a slow and steady erosion of the gene pool is a reality.

WHAT TO DO?

- Use a diverse set of varieties of your spices (e.g. traditional varieties adapted to the local soil and climatic conditions that are resistant or tolerant to diseases and pests)
- Support local, national seed banks
- For keeping authentic Chili varieties, you may have to separate the growing plots with a min. distance of at least 200 m. Otherwise varieties can mix.
- Maintaining three to five beehives per ha to increase pollination and promotion of fruit sets
- Chili may be intercropped in the first years of a new Agroforestry system – before the system is getting too shady for Chili production
- Chili may be planted on the edges of agroforestry systems or on forest glades

7. Monitoring

Monitoring is necessary to evaluate the impact of the measures and the general development of biodiversity on the farm or the sourcing area. It is not necessary to implement a complex monitoring system; the challenge is to select few but meaningful key data and indicators, which provide a good overview.

FIRST LEVEL OF MONITORING

The first level of monitoring is very simple:

Have the selected measures been implemented timely?
☐ **Yes** ☐ **No**

Have they been implemented according to these guidelines?

☐ **Yes** ☐ **No**

Have corrections been agreed in case the measures have not been implemented?

☐ **Yes** ☐ **No**

This level of monitoring should be carried out every year.

SECOND LEVEL OF MONITORING

The second level focuses on the improvement of potential for biodiversity. The following data could be collected.

Numbers gained here are compared to the baseline assessment or the latest monitoring.

- Ecosystems/habitats on the farm or in the immediate surroundings (number and size)
- Priority areas for biodiversity on the farm (m^2)
- Perennial abundant fields on the farm (m^2)
- Biotope corridor created (m^2)
- Buffer zones created to protect aquatic ecosystems from erosion and agrochemical drift and runoff (m^2)
- Herbicide and pesticides untreated spots or stripes at the edge of the field to support the growth of local herbs (m^2)
- Annual flowering stripes at the edge of the field (m^2)
- Hedgerows (meter)
    - (Number of shaded trees per hectare)
    - Number of water sources protected by implementation

of a sustainability management plan

- Continuous reduction of chemical plant protection substances up to a minimum level (pesticides, herbicides) (Comparison of yearly consumption)
- Continuous reduction of synthetic fertilisers up to a minimum level (Comparison of yearly consumption)
- Continuous reduction of water consumption for irrigation up to a minimum level (m^3)

Furthermore, you may work with photos, satellite photos/Google Earth or videos in order to observe the development of the landscapes and/or specific lots over time. If you chose to work with any of these, define a unit (e.g. % of groundcover) to apply and to make the information comparable.This level of monitoring is recommended every 1 – 2 years.

ADVANCED MONITORING

For farms ready to carry out an advanced monitoring on the real impacts on biodiversity, the following indicators can be added:

- Endangered/protected species on farm (number of species)
- Development of the abundance of three taxonomic groups (vascular plants, butterflies and breeding birds) as indicators for the health of ecosystems and biodiversity increase on the farm and its direct surroundings
- If respective soil maps are available it shall be determined if the farm is in an area where soil loss-rates are higher than 1 t/ha/y. If soil loss rates are higher then it must be documented, which and how many measures are implemented to minimise erosion. An erosion map for soil loss rates in arable lands for India is available here: http://www.ciesin.columbia.edu/docs/002-413/fig1.gif. Advanced monitoring should be done every three years.

Biodiversity conservation is a challenge and requires deepened knowledge on environmental circumstances and interrelations. Usually, the farmer is the expert on the environmental conditions of his/her fields. He/she is the first one to notice changes on the farm due to the implementation of biodiversity measures. If a measure is obviously not going to help the farmers productivity or does not serve to conserve biodiversity (e.g. by attracting pests rather than minimising them) the farmer is in the position to judge a measure successful or not. In such a situation the farmer shall discuss the unsuccessful measures with an external expert and adapt or exchange it.

In general, farmers must be rewarded for their efforts to protect and enhance biodiversity. At times, implemented biodiversity measures may decrease the yield for various reasons; a burden that should not lie on the farmer´s shoulders only. Private business needs to take a share in this situation. In order to do so and to add value for the private sector, too, the efforts taken and the continuous implementation of biodiversity measures must be visualised on the market for the consumer. Standards and certification logos are an important and established option to do so.

For the farmer the participation in certification systems such as UEBT and RA has many benefits like the expertise gaining from the certification body, the knowledge exchange with other certified farmers and particular market access to a better payed certified market.

Besides the monetary aspects, it is important that the farmer and the technical advisor he/she is working with aim at introducing those biodiversity measures, which truly suit the local conditions. Only if the farmer and the environment profit from the implemented measures, incentives for continuity are given, kicking off

a conservation process and motivating neighboring farmers to explore similar activities. In a diverse set of activities, success comes only with a collaboration on community and landscape level.

One such measure is the buildup of a seed-bank to preserve gene pools. Communication, networking and collaboration are crucial and should at all times be one of the aspects running along the implementation of biodiversity measures.

8. Glossary

Agricultural 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)
Agro-Forestry	Agroforestry systems include both traditional and modern land-use systems where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals. They are dynamic, ecologically based, natural resource management systems that diversify and sustain production in order to increase social, economic and environmental benefits for land users at all scales. (FAO)
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)
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)

Beneficial insects	Some insects have beneficial roles for nature: 1= plants reproduction (pollinators), 2) waste biodegradation (decomposers), and 3) natural resistance of agroecosystems/natural control of harmful species (natural enemies, predators, parasitoids). They also have beneficial roles for humans as edible insect species in nutrition, insect valuable products (e.g. silk and honey) and biomimicry among others (FAO, 2013)
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	A plan to conserve or enhance biodiversity. (Earthwatch, 2000)
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)
Characteristic species	Species that are special to or especially abundant in a particular situation or biotope. These are species that are well known and can easily be identified.

Crop wild relatives	Crop wild relatives are wild plant species that are genetically related to cultivated crops (Biodiversity International). It may be a wild ancestor of the domesticated plant, or another closely related taxon. Wild relatives of crop plants constitute an increasingly important resource for improving agricultural production and for maintaining sustainable agro-ecosystems.
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 matte content. (FAO, 2009)
Convention on Biological Diversity (CBD)	The objectives of the CBD are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies. (CBD)
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)
"Farm-gate" nutrient balance	The farm-gate nutrient balance compares the applied amounts of nutrients (Nitrogen (N), phosphate (P205) and potash (K2)) on a farm with the amounts of nutrients, which are exported from the farm within the framework of one year. (Glossary; Ministry of rural development and consumer protection Baden-Württemberg)

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	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)
Green manure	Catch crops or similar plants, left on the field to wither and, which are incorporated into the soil to rise to SOM content.
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)
High Conservation Value Areas (HCV)	High Conservation Value Areas (HCVAs) are natural habitats, which are of outstanding significance or critical importance due to their high biological, ecological, social or cultural values. These areas need to be appropriately managed in order to maintain or enhance those identified values. (https://www.hcvnetwork.org/)
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)
Humus balance	The comparison of the input and exit of humus/organic matter on a field, including the natural depletion of humus in the soil. Taking into account the organic fertiliser applied, the left overs of crops and the removal of crop material by the farmer in a calculation scheme.

Indicator species	A species whose status provides information on the overall condition of the ecosystem and of other species in that ecosystem. They reflect the quality and changes in environmental conditions as well as aspects of community composition. (United Nations Environment Programme, 1996)
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 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)
Invasive, alien species	Invasive alien species are non-native species which cause 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.
Main crops	The crop, which is grown throughout the longest period of the current year. Crops grown between two main crops are called catch crops.

Mitigation hierarchy	The mitigation hierarchy is defined as: » Avoidance: measures taken to avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity. » Minimisation: measures taken to reduce the duration, intensity and / or extent of impacts (including direct, indirect and cumulative impacts, as appropriate) that cannot be completely avoided, as far as is practically feasible. » Rehabilitation/restoration: measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/ or minimised. » Offset: measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimised and / or rehabilitated or restored, in order to achieve no net loss or a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity. A key principle is that offsets cannot provide a justification for proceeding with projects for which the residual impacts on biodiversity are unacceptable. This means that the avoidance options have to be considered seriously in harmful cases. (Glossary European Commission and Business and Biodiversity Offsets Programme (BBOP))
Natural Ecosystems	In natural ecosystems, the human being has currently and historically no impact on the functioning of the ecosystem. Species composition and species numbers are uninfluenced. There is no exploitation, no hunting, even no indirect way like changing of watercourse.
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)

No-net loss of biodiversity; Net gain of biodiversity	See definition mitigation hierarchy.
Nutrient balance	The difference between the nutrient inputs entering a farming system (mainly livestock manure and fertilisers) and the nutrient outputs leaving the system (the uptake of nutrients for crop and pasture production). (Glossary; OECD)
Pathogens	An agent causing disease or illness to its host, such as an organism or infectious particle capable of producing a disease in another organism. Pathogens are mostly microscopic, such as bacteria, viruses, protozoa and fungi. (biology online)
People's Biodiversity Register	The Biological Diversity Act in India imposed in 2002 to establish a biodiversity management committee on local body scale (panchayat). These committees prepare the Peoples' Biodiversity Registers. The Register contains comprehensive information on availability and knowledge of local biological resources, their medicinal or any other use or any other traditional knowledge associated with them.
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)

Primary (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 ....
Protected areas	Protected areas are a clearly defined geographical space, recognised, 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).
Protected/ endangered species	Seedfast variety = a variety is seedfast when plants grow from their seeds that have the same characteristics and shape as their parent plants. This means that the variety can be reproduced naturally as in the past. It is pollinated by wind or insects. Hybrids are phenotypically uniform and often more fertile (e.g. as in corn) but not seedfast. That means, seeds produced from hybrid varieties does not produce a stable variety, but plants with very different properties that no grower can really use. (From Seedfast).

Semi-natural habitats	Semi-natural habitats are habitats which are influenced by human activities but haven´t lost their structure and are very similar to natural habitats e.g. reforested areas. Semi-natural habitats are also artificially created habitats that have been largely left to develop naturally and host typical native plant and animal species, excluding permanent grassland and agroforestry. 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 stripes not used for grazing
Soil biodiversity / Below-Ground 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).
Soil Health	the continued capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain biological productivity, maintain the quality of air and water environments, and promote plant, animal, and human health
Soil Organic Carbon	Soil organic carbon (SOC) refers to the carbon component of organic compounds.
Soil Quality	The capacity of a soil to function, within land use and ecosystem boundaries, to sustain biological productivity, maintain environmental (air and water) quality, and promote plant, animal and human health
Species	A group of organisms capable of interbreeding freely with each other but not with members of other species. (Convention on Biological Diversity – Glossary)

Toxicity Load Indicator	A qualitative indicator for pesticide active ingredients which translates numerical and non-numerical values (toxicological endpoints, classifications) into a scoring system and which is applied to pesticide use data to measure and compare pesticide use (current use and trends). (Toxic Load Indicator. A new tool for analysing and evaluating pesticide use)
Treatment Index	Quantitative measure describing the intensity of chemical crop protection. It represents the number of pesticide application on an operational area, in a crop or in a farm, taking into account reduced application rates and partial area treatments. In tank mix applications, each pesticide is counted separately. (National Plant Protection Plan – Germany)
Water-Stewardship	The use of water that is socially equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that involves site and catchment-based actions.
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)

9. TABLES: BASELINE ASSESSMENT AND MONITORING

Biodiversity Action Plan

Baseline Assessment

Table 1

Column 1	Column 2	Column 3	Column 4
Plot list			
Please enter information going along with the map (drawn or printed from satalite photo/Google Earth)			
Location	Plot-Nr.	Size of plot (in acre/ha)	Cropping system - Agroforestry (AF) - Arable cropping (AC) Cultivated crops and in case of a crop rotation the crops of the last four years
x	1		
y	2		
z	3		
	...		
	...		

Column 5	Column 6	Column 7	Column 8
Agroecological structures and areas of high value for biodiversity on the field of next to it (semi-natural habitats, areas with high value of biodiversity, aquatic ecosystems, boundaries, fallow land); please state the size of it in acre/ha, m² or sqft	Is the plot located in an protected area? Please name the protected area	What kind of cultivation management is applies on the plot? (organic, conventional) is it certified?	Remarks

Table 2

Production areas and semi-natural habitats			
Column 1	Column 2	Column 3	Column 4
Please enter the following information		Number and size in m²/ sqft; acre/ha	Are these structures protected by agroecological practices?
Terrestrial semi natural habitats	Biotop corridors		
	Fallow land		
	Hedges and shrubs		
	Trees		
Aquatic ecosystems	Ponds		
	Swamps		
	Wetlands		
	Rivers/ Streams/ Springs		
Areas of natural vegetation on the farm			-
Areas on the farm that are not used for production			-
Areas that are used for production/ sourcing			-
Boundary areas, for example between fields or at field edges or roadsides that may already be, or have the potential to become, wildlife corridors			-

Table 3

List of indicator species animals and plants			
Column 1	Column 2	Column 3	Column 4
	Number of species	Species name(s) (in Latin, English or local language)	Rough size of populations
Endemic animal and plant species on your farm or adjacent to it			
Animal and plant species classified by the government as a protected species or placed on a national Red List and/or the Red List of IUCN (www.iucnredlist.org) (number of species)			

Baseline Assessment

Measure for the protection of biodiverstiy

List of measures to be implemented during the following 3 years

Table 4

Biodiversity Management				
Measures to promote and enhance ecological structures	Size in acre/ ha; number	Timeframe for implementation/ Deadlines	Responsible person	Resources needed
...				
...				
...				
Agroecological Practices				
List of agroecological practices for more biodiversity and its planned size in acre/ha	Size in acre/ ha; number	Timeframe for implementation/ Deadlines	Responsible person	Resources needed
...				
...				
...				

Biodiversity Action Plan
Monitoring

Table 5

1st level of monitoring				
1st level of monitoring should be carried out every year				
List of measures that have been selected for the next 3 years				
Measures for biodiversity management	Priority of measure according to the BAP A / B / C	Have the selected measures been implemented on time? (Yes/No) If not, why?	Have they been implemented according to these guidelines? (yes/no) If not, why?	Have corrections been agreed in case the measures have not been implemented?
x				
y				
z				
Measures for agroecological practices for more biodiversity	Priority of measure according to the BAP A / B / C	Have the selected measures been implemented on time? (Yes/No) If not, why?	Have they been implemented according to these guidelines? (yes/no) If not, why?	Have corrections been agreed in case the measures have not been implemented?
x				
y				
z				

Biodiversity Action Plan

Monitoring

Table 6

2nd level of monitoring		
2nd level of monitoring should be carried out every 2 - 3 year		
Record the creation of potential for biodiversity		
Potential for biodiversity created		
List measures that have been selected for the next 3 years	Number and size in m²/ft² or acre/ha	Difference to the baseline or previous monitorings
Biodiversity Management		
a		
b		
c		
Agroecological Measures		
a		
b		
c		

Biodiversity Action Plan
Monitoring

Table 7

3rd level of monitoring		
3rd level of monitoring should be carried out every 2 – 3 year		
Evaluate the development of characteristic species		
List animal and plant species		
	List number and names of known species. (You may use names used commonly for the species)	Changes in the area with regard to earlier measurements
Endemic animal and plant species, characteristic species on the farm or adjacent to it		
Animal and plant species classified by the government as a protected species or have been placed on a national Red List and/ or the Red List of IUCN (www.iucnredlist.org) (number of species)		
Development of the population of 2–3 regional characteristic species (plants and/or animals) as indicators for the health of ecosystems and biodiversity increase		

[1] Endemic species are species that are found in a particular place like a particular mountain range at a certain elevation zone, a particular lake, a single river or a small island and nowhere else. Endemic species do not proliferate in all kinds of environment.		

Examples for units to be documented		
Protected area (Source for areas protected by public/ community, national and regional laws)	number, size in "m²"or sqft	
Semi-natural habitats on the farm or in the immediate surroundings	number, size in "m²"or sqft	
Perennial abundant fields on the farm	number, size in "m²"or sqft	
Ecological corridor created	number, size in "m²"or sqft	
Buffer zones created to protect aquatic ecosystems from erosion and agrochemical drift and runoff	number, size in "m²"or sqft	
Herbicide and pesticides untreated spots or stripes at the edge of the field to support the growth of local herbs	number, size in "m²"or sqft	
Perennial flowering stripes at the edge of the field	number, size in "m²"or sqft	
Hedgerows	number, size in "m²"or sqft	
Shade trees	number, size in "m²"or sqft	
Water sources protected	number, size in "m²"or width of stream;	
Continuous reduction of chemical plant protection substances (pesticides, herbicides)	Comparison of yearly consumption	
Continuous reduction of synthetic fertilizers	Comparison of yearly consumption	
Continuous reduction of water consumption for irrigation	cuft³	

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