Del campo al plato

RECOMMENDATIONS

For effective criteria for biodiversity protection in food standards and sourcing requirements of food companies in the banana and pineapple sector

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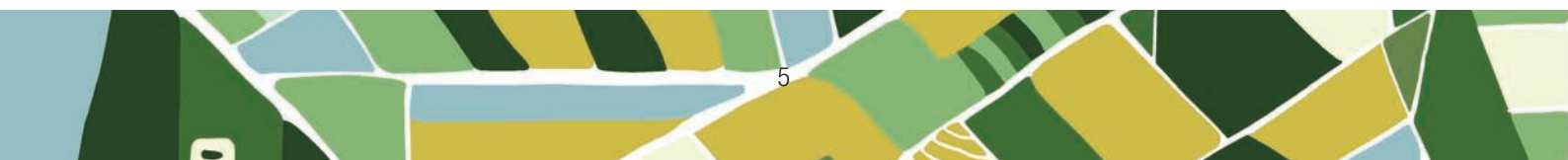


Introduction

According to the latest figures, there are approximately 8.7 million species on our planet. However, only about 1.8 million plants and animals have been officially classified. According to the IPBES 2019 Report, around 25 % of these species are threatened, with around 1 million species are already on the edge of extinction. It is not clear exactly how many species are lost each year, but we do know that species loss caused by human activities is 1,000 times faster than it would be under natural circumstances. Many more will vanish within the next decades unless action is taken to reduce the intensity of biodiversity loss.

The dramatic loss of biodiversity isn't only happening in the so-called „biodiversity hotspots", but all around the world. Many ecosystems that provide us with essential resources and services are at risk of collapsing. The conservation and sustainable use of biodiversity is thus not only an environmental issue, but also a central factor for human nutrition, agricultural production processes, services and the overall quality of life. Biodiversity in agriculture is essential for those ecosystem services that influence food security: Over 75% of the world's food crops, including fruits and vegetables and some of the most important cash crops such as coffee, cocoa and almonds, depend on natural pollination. Wild bees and other insects perform this ecosystem function. However their numbers are dwindling. The loss of these pollinators in money terms is estimated to cost between $ 235 and $ 577 billion per year.

In addition, land degradation has reduced productivity on 23 % of the planet's land surface. Marine and terrestrial ecosystems are the only sinks for anthropogenic carbon emissions, sequestering 5.6 gigatons of gross carbon per year (the equivalent of about 60 % of global anthropogenic emissions). Protecting such ecosystems is thus essential to counteract global warming. These are only a few examples of the value of biodiversity; there are many more.

Experts around the world agree that the following are the main drivers of biodiversity loss:

- Ecosystem degradation and destruction,
- Overexploitation of natural resources,
- Invasive alien species,
- Climate change and
- Pollution

The agricultural sector, including both the food producers and retailers, has a major impact on biodiversity. Unfortunately, however, the agricultural sector has not yet given adequate attention and value to biodiversity protection. This is huge challenge due to the complexity of reducing a food product's negative effects on nature within the complete food chain. This report contains recommendations on how this can be achieved. These recommendations are mainly directed towards organizations and agencies responsible for setting standards as well as companies in the food sector with sourcing requirements towards their suppliers. The goal is to support the organizations, agencies and companies in their efforts to improve biodiversity performance and provide an entire portfolio of effective measures that can be adopted. Therefore the recommendations provide valuable input to those responsible for revising standard criteria for companies' sourcing requirements, the managers responsible for product quality, and sustainability coordinators.

International Climate Initiative Project “From Farm to Fork”

The International Climate Initiative (IKI) project “From Farm to Fork” supports the key players in the banana and pineapple value chain in integrating biodiversity protection and ecosystem services valuation into their businesses. These include plantation owners and managers, cooperatives, food standards and certification bodies, exporters, importers and traders, agricultural education centers and final consumers. By implementing measures to protect ecosystems and species and to improve conditions for increasing biodiversity, it contributes to making the production of these two important tropical fruits more sustainable. Activities are carried out in Costa Rica and the Dominican Republic, as well as in Germany and other important European markets.

Measures and expected results

- Ensure that effective criteria for biodiversity protection are included in national and international standards and in food companies’ procurement requirements.
- Support banana and pineapple plantations to set up a baseline and carry out an analysis of the potential for biodiversity protection using the Agricultural Biodiversity Check (BCA). The BCA assists plantation operators in developing and implementing a good Biodiversity Action Plan.
- Implement a fund to support innovative measures for protecting biodiversity in agricultural production.
- Establish a model for the private financing of biological connectivity structures in intensive agricultural production areas. Motivate key players in the banana and pineapple value chain to financially support the implementation of these biological corridors.
- Increase the level of awareness among producers in the food sector and consumers about the value of biodiversity. Create demand for bananas and pineapples produced in a biodiversity-responsible manner.
- Systematize and disseminate best practices at the regional, national and international level. These documented practices will be presented in regional and international networks and forums.

Standards in the food industry help to qualify certain attributes of a product and the production process itself. They guide the purchasing decisions of companies and help ensure the quality of the product. They also provide consumers with information in terms of the quality of products, level of sustainability, and their impact on the environment. In addition to requiring certain governmental certifications, many food companies have their own requirements for suppliers and farmers, and implement internal audits to ensure they are complying with sustainability policies. This publication addresses these standards and companies in the food sector.

This project is a partnership between the German Development Cooperation (GIZ), the Global Nature Fund (GNF) and the Lake Constance Foundation along with partner organizations in Costa Rica and the Dominican Republic. The Ministry of Environment and Energy of Costa Rica (MINAE) and the Ministry of Environment and Natural Resources of the Dominican Republic are the political partners in the project. Funding was provided by the International Climate Initiative (IKI), with support from the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).

Baseline report

The GNF published an assessment of 14 food standards relevant to biodiversity protection carried out by an international team of experts in the baseline report “Biodiversity in Standards of the Banana and Pineapple Sector” (GNF 2019). The authors of the study provide a detailed overview of how biodiversity is currently addressed in these standards that are also used to certify banana and pineapple production, focusing on the extent to which biodiversity protection is currently addressed in the:

- Policy of sustainability standards in the food sector
- Specific criteria within these standards

The authors used this data to provide recommendations for setting up effective criteria for biodiversity protection. This chapter presents an overview of the conclusions drawn by the expert team.

Given the fact that agriculture is one of the main drivers responsible for global biodiversity loss, it is imperative that the agencies involved with setting standards and food companies themselves must set a target of zero net biodiversity loss on their certified farms and suppliers, following the acknowledged mitigation hierarchy of avoid - reduce - compensate. This commitment is particularly important viewed against the background of global food production forecasts, which predict an increased demand for food following a growth in population/wealth. It is thus essential that agriculture develops in a way that no longer contributes to biodiversity loss.
One positive outcome of the study was that 1/3 of the criteria for protecting biodiversity are effective. That means however, that 2/3 of the criteria need to be improved. Of the latter criteria, the results indicated that the food sector does not focus strongly enough on the zero net loss of biodiversity target. Many criteria do not help reach the target because they are either not mandatory for companies or not sufficiently effective. One of the best possibilities to improve the standards then would be to make the optional criteria relevant to biodiversity mandatory. This would be a major step in effectively protecting biodiversity.

The baseline report stresses the effectiveness of the criteria as an essential precondition for protecting biodiversity. In terms of the more than 50% of criteria that was considered ineffective, the authors found that they would be more effective by simply expressing them more clearly and/or more comprehensively. For example, a number of standards already require a plan for nature or biodiversity protection/conservation. However, there is often no guidance on how to determine the minimum content in such a plan (e.g., baseline description, measurable objectives, action plan with timeline, monitoring). Therefore, auditors might check whether such a plan is in place, but lack any clear indicators to assess the quality of the plan.

Verifiability is a basic requirement and challenge for companies’ internal procurement standards and guidelines. Auditors may not be experts on all the issues affecting biodiversity for all types of regions and species, but auditors are experts in assessing the quality of processes. Therefore, certification agencies and food companies could require certain processes and methods for biodiversity management and provide a thorough description of these processes and methods.

With regard to improving agricultural practices to reduce negative impacts on biodiversity, it would be useful to include a combination of processes and criteria with maximum or minimum values (such as a minimum percentage of ecological structures, more than legally requested, minimum width of buffer strips, or a maximum nitrogen balance: kg / N per hectare per year). Standards and companies must require performance-based indicators, such as nutrient balance or soil and plant analysis, and provide a valid method for calculating this. These are concrete and efficient measures with positive impacts on protecting biodiversity and climate. As mentioned earlier, many criteria in the analyzed standards

are positive examples of effective criteria and definitely contribute to helping protect and manage biodiversity. One such example involvesorganic standards, which are, in general, excellent and very clear in terms of avoiding overexploiting natural resources: using natural fertilizers, prohibiting chemical pesticides, and erosion control. These and other criteria of organic agriculture help alleviate the biosphere. Organic standards also generally prohibit genetically modified organisms and foster species protection. However, even in conventional agriculture, a number of standards have been advanced over the past years that are moving things in the right direction. The list of banned pesticides in the Fairtrade standard, based on the recommendations of the Pesticide Action Network, is one of these positive examples. A further example involves connecting habitats via biological corridors and collaborating with authorities/NGOs/experts to set up the sustainable management of water sources. Such examples should be taken into consideration by agencies responsible for setting standards and food companies.

The complete baseline report including the full set of findings and conclusions can be downloaded at the following websites:

www.delcampoalplato.com

www.fromfarmtofork.net

Recommendations: Preliminary remarks

Process of Elaboration

The recommendations presented in this report are based on the findings of the IKI's Baseline Report and the results of studies and pilot projects related to agriculture and biodiversity. These include an extensive consultation process we carried out with experts from international and national food standards organizations, certification companies, food companies, environmental organizations and scientific institutes in Europa, Costa Rica and the Dominican Republic.

Preliminary Comments

The recommendations focus on the main causes of biodiversity loss mentioned in the introduction: ecosystem degradation and destruction, overexploitation of natural resources, climate change, invasive alien species, and water and soil pollution. However, the lack of knowledge about biodiversity on farms and the surrounding landscapes is another key factor in the loss of biodiversity. Therefore, some of the recommendations focus on motivating producers (especially of bananas and pineapples) to analyze the existing biodiversity on their farms and the adjacent landscape.

The objective of the recommendations is to avoid, reduce and offset negative impacts on biodiversity, to improve protection and to create more potential for biodiversity, especially in the production of bananas and pineapples.

The criteria and measures offer a compromise between the scientific requirements of nature conservation and the viability of implementing these measures in terms of standards and the businesses involved. In addition, the proposed measures have direct and indirect positive impacts on climate change mitigation and adaptation.

Setting Priorities

This extensive catalogue of recommendations presents a complete set of options for protecting biodiversity. It is important for standard-setting organizations, food companies and agricultural cooperatives to analyze these recommendations and compare them with own sets of criteria and implemented practices. The medium-term objective for companies and standard-setting organizations should be to integrate the full catalog of recommendations into own criteria and requirements. This process of integration will be a step by step process. There are various options for how the recommendations can be implemented, such as:

- Make recommended and optional criteria mandatory criteria.
- Set up a transition period in which the recommendations are optional.
- Select target measures and define a minimum number to be implemented.
- Provide economic and other incentives to support the implementation of key measures.

This process requires not only a strong commitment from standard-setting organizations and companies to foster and implement this process, but also knowledge about biodiversity. Therefore, farmers, advisors and managers all need to be aware of the value of biodiversity and how to protect and enhance ecosystems and species diversity.

Farmers that practice good biodiversity management must be rewarded for their efforts. The price for their products should cover the costs of the measures implemented and, at the same time, provide recognition for the value added by protecting a common good.
Single individuals cannot tackle the huge task of halting biodiversity loss alone. Therefore, farmers, standards organizations and food companies are all called upon to make use of the existing synergies and collectively contribute to make their experiences, approaches and solutions from many projects mainstream.

RECOMMENDATIONS FOR FOOD STANDARDS AND SUPPLY REQUIREMENTS OF FOOD COMPANIES

A - Recommendations for the policy of Standards Organizations and Companies

Introduction

The following recommendations focus on how biodiversity can be strengthened in standards organizations' and food companies' overall policy and strategy. They are intended for management and the individuals responsible for deciding and designing the organization's or company's approach and determining the purpose as well as the importance given to biodiversity protection. You can find some of the following policy-relevant aspects of the standard or company (e.g. pesticide use, agrobiodiversity) in the recommendations for biodiversity management and very good agricultural practices, listed according to specific criteria or measures.

A 1 Defining Biodiversity Terms

Recommendations for standards organizations and companies

- Use internationally recognized terms and definitions (see glossary).
- When using individual terms, standards organizations and companies should provide clear and understandable definitions. Stakeholders should be in agreement about those definitions.
- Standards and companies should have a glossary that defines all terms.

A 2 Biodiversity Focus: Standards and business must address all major aspects of biodiversity

Recommendations for standards organizations and companies

- Clarify which aspects of biodiversity they currently address and why they focus on them.
- Address all the major causes of biodiversity loss and show a commitment to promoting and supporting agro-biodiversity (e.g. diversity of varieties, see glossary).
- Provide transparency in the supply chain and the traceability of products and raw materials which is an important requirement for all social and environmental improvements, including the protection of biodiversity. Companies supported by standards should work to ensure the traceability of all agricultural products in the supermarket to at least the cooperative/region, ideally back to the farm. Traceability must be identifiable on the packaging and during the post-harvest process.

A 3 Taking a No-net-loss Approach

Introduction

As opposed to extensive agriculture, which contributes to the maintenance of cultural landscapes and diversity of flora and fauna, intensive agriculture is one of the main drivers of biodiversity loss. The food sector needs to take up this new challenge and aim for no net loss of biodiversity on its farms and certified suppliers. To achieve this goal, it is important to adhere to the hierarchy of mitigation: Avoid - Reduce - Compensate.

An increasing number of companies in many business sectors, such as the extractive industry or cosmetics, now emphasize "no net loss of biodiversity". This commitment is particularly important in view of the projections for the food production sector, which include growing populations, changes in global diets, and the accompanying increase in demand for food, leading to increased intensive agricultural production. In order for standards organizations and food companies to achieve a "no net loss of biodiversity" and incorporate a long-term holistic strategy for all certified farmers and suppliers, two important components of their strategy would be: documenting the baseline situation, carrying out a follow-up to implement measures that assess their impact (monitoring), and checking for continuous improvement.

Recommendations for standards organizations and companies

- Recognize that intensive agriculture has negative impacts on the environment and biodiversity and should therefore be avoided or reduced.
- Buy into the explicit objective of making a relevant contribution to halting biodiversity loss and creating the conditions that support no net loss of biodiversity.
- Create a framework for measuring contributions to biodiversity conservation, e.g. collecting baseline data and implementing a monitoring system (see section on Monitoring[1]). Require each farm to identify the baseline with respect to biodiversity on the farm.
- Require new farms to present a biodiversity risk assessment as well as a biodiversity management plan as a prerequisite for obtaining their first supplier certification/contract.
- Provide certified farms with information about successful examples of farms that have achieved no net loss of biodiversity, e.g. measures for habitat restoration or protection (see Biodiversity Management).
- Include references to the mitigation hierarchy in instruments such as risk analyses or biodiversity action plans.
- Assess risks to biodiversity before introducing new farming techniques, and inform certified agricultural companies as well as suppliers about potential risks and how to avoid them[2].
- Coordinate and/or finance regional biodiversity projects, involving certified farms and/or suppliers. Participating in regional projects would enable farm businesses/suppliers to compensate for unavoidable negative impacts on biodiversity caused by agricultural activity.
- Support round table discussions as well as training in biodiversity conservation in protected areas and/ or areas of high conservation value involving all relevant stakeholders. Develop strong regional biodiversity action plans in these round tables/training sessions.

For more information about the Biodiversity Check Agriculture and the Biodiversity Action Plan, see section „A 12 Continuous Improvement“.

Successful examples to encourage conservation
The creation of a category on biodiversity management in business in the Ecological Blue Flag Program. The technical basis is published in
https://www.aedcr.com/recurso/publicaciones/guia-para-la-gestion-de-la-biodiversidad-en-los-negocios

1 Biodiversity Performance Tool: www.biodiversity-performance.eu

2 Natural Capital Coalition Toolkit: https://naturalcapitalcoalition.org/protocol-toolkit/

A 4 Influence of standards organizations and companies on product quality requirements and legal regulations

Recommendations for standards organizations and companies

- Verify compliance with the legal regulations in currently in place.
- Motivate governments and policy makers to advance legislation and regulations to achieve greater and more effective protection of biodiversity.
- Establish criteria that go beyond legal requirements - especially criteria related to limit values, the use of chemical pesticides and fertilizers. Mark the criteria/requirements that are mandatory according to legislation.
- Exert influence in the food sector so that the protection of biodiversity is recognized as an important element of quality.
- Exert influence on companies in the food sector to ensure that quality, hygiene and aesthetic requirements do not have any negative impact on biodiversity.

Important note

Farmers often use pesticides to guarantee the high visual quality of products, so they can sell products without blemishes. The food sector needs to develop a new understanding of product quality where biodiversity protection, and not only appearance, is an important component in the overall concept of quality. At the same time, retailers must find a way to make vegetables and fruit with small blemishes in color or shape more attractive to consumers, such as through marketing campaigns or otherwise focusing on the significantly lower amount of pesticide use. By complying with standards, retailers could ignite a backlash and raise consumer awareness that small defects are a sign of environmental quality.

A 5 Protecting and Promoting agro-biodiversity

Recommendations for standards organizations and companies

- Commit to promoting and protecting agro-biodiversity (= variety diversity) in dialog with other key players in the sector. Regularly check the possibilities of successfully introducing traditional varieties of produce into the market, for example, a new product line based on traditional crop varieties.
- Encourage certified farms and suppliers to grow traditional varieties and to explore marketing opportunities in the regional and national market.
- Motivate certified farms and suppliers to combine banana cultivation with other traditional crops and/or provide land free of phytosanitary influence for employee families' own food production. This would support agro-biodiversity, improve the nutrition of smallholder families and could create additional income.
- Support local, regional or national initiatives for the protection of agro-biodiversity (e.g. support seed banks of traditional varieties, community gardens and fruit trees).
- Support biodiversity-friendly production methods, such as agroforestry systems, permaculture and organic agriculture.
- Exert influence to achieve legally binding regulations for the protection and support of seed diversity. Support initiatives to reduce barriers and facilitate the admission and trade of seeds of less standardized traditional species.
- Support initiatives for the development of traditional varieties to ensure that they meet current user demands. This will increase the chances that traditional varieties will successfully be grown and sold again.

See section "C 7 Agrobiodiversity"

A 6 Reducing Pesticide Use in the Entire Food Production Chain

Recommendations for standards organizations and companies

- Promote organic farming, integrated pest management (IPM) practices, as well as all innovative agricultural practices (e.g. use of drones and precision farming techniques) which contribute to the reduction of pesticide use.
- Introduce criteria/processes for pesticide use.
- Support research initiatives related to measuring the impact of pesticides on biodiversity and health.

See section C 3 Pesticide Management.

A 7 Banning Genetically Modified Organisms (GMOs)

Due to the vulnerability of the Cavendish banana to the TR4 fungus, the pressure to introduce resistant genetically modified banana is increasing.
See: https://agrozon.com.do/china-desarrollo-variedad-de-banano-resistente-al-fusarium-raza-4-2/
Some genetically modified varieties of pineapples are also available on the market: See: https://www.nbcnews.com/health/health-news/genetically-engineered-pink-pineapple-safe-sellfda-says-n696176.

Recommendations for standards organizations and companies

- Formulate a GMO policy that prohibits the use, breeding and planting of any GMO, and develop requirements for managing crops contaminated by GMO cross pollination.
- Develop a negative list for crop plants and animal feeds to avoid using genetically modified seeds.
- Do not allow parallel production with GMOs.

A 8 Certification Scope

Introduction

The scope of criteria in standards organizations and food companies is usually limited to agricultural production itself. However, the impact of production on ecosystems, fauna and flora does not stop where the farm property ends. There is a wide variety of additional adverse effects, such as landscape fragmentation, pesticide contamination of water bodies and adjacent soils, erosion or alteration of the groundwater system regime in in terms of quality and quantity, which need to be taken into consideration in the standards.

Recommendations for standards organizations and companies

- Request a risk analysis to investigate the possible impacts each farm could have on biodiversity before establishing new farmland. Provide a recognized methodology for carrying out the risk analysis (e.g. RSB Conservation Impact Assessment Guidelines).
- Include criteria to avoid the degradation or destruction of ecosystems or other negative impacts on biodiversity beyond the boundaries of the farm (see section 6 Biodiversity Management).
- Motivate farmers to collaborate with their neighboring farms to conserve biodiversity, such as by creating ecological corridors to connect habitats and protect species, in order to increase the effectiveness of measures. Farmers can be promoters of regional biodiversity plans involving other stakeholders and the general population.
- Initiate or support the implementation of tools and/or criteria for the sustainable use of water resources, especially in regions with water deficits. Such criteria should include the management and regulation of water use, water balance, and measures to protect water quality and aquatic ecosystems in river basins (e.g. AWS - Alliance for Water Stewardship).

- Request that the basic biodiversity criteria be implemented for all agricultural production when it is only possible to certify part of the farm.
- Include „Chain of Custody“ in the sustainability criteria for washing, packaging, storing, ripening and transporting of products (e.g. constant reduction of GHG emissions).

A 9 Monitoring the Development of Biodiversity

Recommendations for standards organizations and companies

- Demonstrate the contribution made to protecting biodiversity. This requires collecting and analyzing data related to the direct and indirect impacts on biodiversity in the context of monitoring. The results of the monitoring should be transparent and accessible to local or regional authorities, NGOs and other experts.
- Agree on a common framework for monitoring and checking biodiversity in order to generate verifiable results. Monitoring should include the evaluation of data in the certification framework (potential for biodiversity and reduction of negative impacts) as well as data on long-term biodiversity development. This long-term developmental monitoring of biodiversity could be carried out using a few key indicator species, selected in cooperation with experts while taking regional specifications into account.
- Define benchmarks (average values and references) with the support of local authorities and nature conservation NGOs based on the results of the monitoring. These benchmarks would serve as a guideline for consultants and auditors. To motivate farm managers to achieve these benchmarks, set up a bonus system or other type of incentive program.
- If no monitoring system is in place, inform standards organizations and companies that follow-up and monitoring activities will be carried out in their production areas by environmental authorities and/or NGOs. Standards organizations and companies could participate in these regional monitoring initiatives, e.g. by providing data, encouraging their certified farms to participate, or by financially supporting biodiversity tracking and monitoring processes (e.g. through cooperation agreements).

Biodiversity Monitoring System

The Lake Constance Foundation and Global Nature Fund elaborated a “Biodiversity Monitoring System” for standards organizations, food companies and cooperatives. The system, developed within the framework of the EU LIFE Food & Biodiversity project, collects data on 25 indicators that are particularly relevant to biodiversity. The system aggregates data from all farms, and a filter allows the user to evaluate the biodiversity performance according to country, region, type of crop, etc. The results are presented in tables or graphs. You can find more information at the following website: www.biodiversity-performance.eu

A 10 Training Certifiers, Advisors, Farmers and Companies

Recommendations for standards organizations and companies

- Commit to developing competences in biodiversity conservation as a key aspect of sustainable agricultural production.
- Standards organizations should integrate biodiversity aspects into staff trainings on certified farms. Companies should integrate biodiversity aspects into supplier trainings.
- Standards organizations should ensure that certifiers/auditors and assessors are trained to improve their skills in regard to relevant biodiversity aspects.
- Encourage certifiers and assessors to share their experiences on biodiversity issues.

- Companies should ensure that their staff - product managers, heads of quality control and heads of purchasing departments - are trained in biodiversity-relevant aspects in order to take this important issue into account when making decisions.
- Seek the support of experts and competent organizations to ensure the quality of training on biodiversity issues and its suitability for different groups. There are many initiatives and pilot projects that have been carried out in the area of agriculture and nature conservation. Standard organizations and companies can use them to facilitate practical training in the field.
- Have an external expert regularly verify and evaluate the impact of trainings in order to establish continuous improvement processes and ensure high quality training and provide important information for improving future trainings.

A 11 Ensuring and improving the quality of biodiversity conservation measures

Recommendations for standards organizations and companies

- Establish guidelines outlining the processes and methods of biodiversity management. The guidelines should be developed with the support of competent environmental protection authorities, NGOs or research institutions.
- Support farmers to ensure that the measures are being properly implemented. This support could include specific trainings, regular visits and working groups where participants can share knowledge and experiences. The aim is to help farmers understand the agricultural and environmental benefits of the measures, solve practical problems, avoid misinterpretations, overcome difficulties when implementing the measures, and to propose alternatives when strict implementation of the measures is not feasible.
- Support studies to develop and improve knowledge about the positive and negative impacts of agricultural production (especially bananas and pineapples) on biodiversity. Update the criteria and requirements based on the results of these studies and pilot projects.

A 12 Continuous Improvement

Introduction

The principle of continuous improvement is a crucial objective in all quality management systems, e.g. ISO 14001, EMAS and ISO 9000 certifications. It seems logical to establish continuous improvement processes as a mandatory requirement for a number of aspects related to biodiversity. These include the required aspects contained in a Biodiversity Action Plan, such as habitat creation, connectivity through ecological corridors, and measures for the protection of species. It also applies to measures to reduce the quantity and toxicity of pesticides.

In principle, certified farms & suppliers have two ways of improving their biodiversity performance:

- Reduce negative impacts by implementing “very good agricultural practices”.
- Manage biodiversity by actively protecting existing biodiversity and creating the potential for greater biodiversity (habitats, species, and agrobiodiversity).

In the case of small hold farmers (up to 3 ha per farm), the description of baselines and measures for continuous improvement must be aligned and coordinated on a cooperative level and not only for each individual farm. Biodiversity Action Plans are much more effective at the regional level, with small farmers contributing to the objectives according to the characteristics of their respective farms and possibilities. One example might be a small hold farmer reducing the productive area on his or her farm to protect an ecosystem (e.g. river, stream, forest), and who receives compensation for doing so from the other producers in the association for the benefits received by all the farmers in the cooperative.

Recommendations for standards organizations and companies

- Require farms to provide a description of the baseline situation, and encourage farmers to promote continuous improvement in quantity (e.g. hectares of semi-natural habitat or kilometers of ecological corridors) and quality (e.g. increase in wild plant species at crop boundaries).
- For some aspects of biodiversity, it is useful to apply criteria containing maximum or minimum values. For example:
    - Minimum % of semi-natural habitats, habitats beyond legal requirements
    - Minimum width of buffer zones
    - Maximum nitrogen balance: kg/N per hectare per year
    - Maximum phosphorus balance: kg/P per hectare per year
    - Minimum number of shady trees per hectare
    - Minimum rate of forest regeneration in agroforestry systems
    - Maximum value of Treatment Index and Toxicity Index.

- These criteria would be even more effective if standards organizations and companies complemented these maximum and minimum values with references illustrating the best results achieved by farms in the area along with a reference framework for a given production system. Complying with these values should be rewarded using incentives.

Keep in Mind

An increasing number of European retailers organize particular supply chains for regional products to satisfy consumer's demand for regional products and information about the producers and the product. However, this is rarely the case for products such as bananas and pineapples. Retailers rarely opt for fixed supply chains, joint programs or long-term contracts for tropical fruits. Instead, retailers chose multi-channel supply chains to reduce risks caused by climate change, have a secure supply, and to be able to negotiate better prices. These short-term trading relationships do not encourage farmers to make an effort to protect biodiversity. Therefore, we recommend that food companies establish long-term trading relationships and support farmers in their efforts to improve production practices.

The Biodiversity Check Agriculture (BCA) tool supports farmers in developing a baseline and a Biodiversity Action Plan (BAP) in the productive area, at the farm and landscape level. With the support of an agricultural advisor, the farmer reviews the aspects relevant for biodiversity and reflects on the status quo in a „Baseline Report". The advisor recommends measures to improve the protection of biodiversity, and the farmer selects measures to implement in the framework of a "Biodiversity Action Plan (BAP)". The farmer can monitor the potential for biodiversity on his farm by regularly comparing the results of the measures taken with the baseline.
For more information: www.delcampoalplato.com; www.fromfarmtofork.net

The Biodiversity Performance Tool (BPT) supports the process described above with an instrument based on a database. The BPT presents the farm's strengths, weaknesses and opportunities and suggests measures for improvement. This provides the farmer with a tangible basis for the preparation of a Biodiversity Action Plan. By regularly updating the baseline, the BPT serves to monitor the potential for biodiversity on a given farm. See: www.biodiversity-performance.eu.

A 13 Communication and Raising Awareness

Introduction

Biodiversity is a striking, complex, diverse, colorful and emotional issue. Standards organizations and companies can use these qualities to attract consumers' attention and motivate them to buy more food produced in a biodiversity-friendly way and pay a fair price, which would allow farmers to cover the costs of measures implemented to protect biodiversity.

Recommendations for standards organizations and companies

- Use the variety of tools and communication channels to raise awareness among all players in the agri-food chain (processors, suppliers, associations, etc.) and consumers about the value of biodiversity and the need to improve its protection.
- Communicate to consumers the complexity of biodiversity using simple messages in order to increase their understanding and demand for products grown in a more biodiversity-friendly way.
- Communicate individual biodiversity protection activities in a transparent and fact-based manner to avoid accusations of greenwashing.
- Regularly publish information on the current state of biodiversity in banana and pineapple production in order to report on viable improvements.

B Recommendations for Standard Criteria and Company Requirements

B 1 BIODIVERSITY MANAGEMENT

Introduction

This section provides a series of recommendations intended to both preserve the current level of biodiversity on farms and in their surroundings and to raise the potential for increasing biodiversity. This can be done using a Biodiversity Action Plan (BAP) that includes measures related to biodiversity management. Ideally the BAP would be part of a management plan required by standards organizations or food companies (e.g. an Environmental Management Plan), and which would only require minimal extra work for the farmer. The BAP lists the biodiversity management measures and provides a framework for implementing these in a structured manner. It should also present the farmer with a clear overview of the starting point and the potential for improvements.
The standard and/or company should clearly describe the scope of the BAP, as well as the mandatory elements in the plan. In addition, they should define the process for developing and implementing the BAP to facilitate the auditing process and to verify the quality of the BAP and the respective implementation. As with other aspects of sustainability, harmonizing criteria and requirements is also extremely important in biodiversity management in general. When standards organizations and companies agree on the common basic requirements, this greatly improves the effectiveness of the measures and the positive impacts at the regional level, while helping to facilitate controlling and monitoring.

As important as the Biodiversity Action Plan is, we do not recommend its use on individual small farms. It would be more effective for such farms to develop a BAP on a landscape (larger-scale) level with other member farmers in a cooperative / association. The objectives of the cooperative would take the interests of each smallholder farmer into consideration.
One of the key issues in such a cooperative BAP is compensation for taking steps to protect biodiversity. The small-scale farmers responsible for enacting measures such as protecting rivers, streams or other water bodies by establishing buffer zones on their farms must be compensated by the cooperative/association for any loss in yield. The compensation could be funded by private donations or public subsidies managed at the cooperative level. Ideally, compensation should come from farmers who do not directly contribute to the protection of ecosystems and ecosystem services, but who nonetheless benefit from the implementation of these measures.

B 1.1 Biodiversity Action Plans for Farms

Recommendations for standards organizations and companies

- Require that farms complete a BAP: the BAP should contain baseline data (including, at a minimum, information about natural and semi-natural habitats), measurable objectives and key indicators. The plan should be reviewed and updated every three years.
- Provide information on the scope of the BAP, the aspects that should be taken into consideration, as well as the implementation process (e.g., consult with authorities or NGOs responsible for nature protection). Including clear specifications on the measures in the Biodiversity Action Plan (e.g. percentage of semi-natural habitats, minimum connectivity through ecological corridors) are helpful and contribute to the quality of the plan.
- Request evidence that the farmer is informed about protected and threatened flora and fauna species in their surroundings.
- Request continuous improvement in biodiversity performance. Farmers that reach the highest performance level are not required to improve further, but to maintain the high level of biodiversity on their farms.
- Provide methods on how to develop and describe a risk analysis. The RSB Roundtable on Sustainable Biomaterials describes the components of a comprehensive risk analysis in the RSB Conservation Impact Assessment Guidelines.

- Offer support in developing and implementing the BAP via training, guidelines, studies, publications and references that provide additional information, contacts, etc. See: Standards Policies - Trainings.
- Cooperate with conservation administrations, NGOs and scientific institutions in order to assist farms in the development and implementation of the BAP, especially in areas of high ecological value and in areas where ecosystems and biodiversity have been highly degraded.

Recommendations for farm operators / producers

- Define areas of high biodiversity value on and around the farm and integrate this information into a map (either from a public source or a drawn map). Such areas include protected areas
- (e.g., national parks, RAMSAR wetlands), High Conservation Value Areas (HCV), primary (natural) ecosystems and semi-natural habitats.
- Include additional information on the map about:
  - Agricultural production areas
  - Aquatic ecosystems (marshes, wetlands, rivers, etc.)
  - Semi-natural habitats such as
    - ecological corridors
    - fallow land
    - non-productive areas
    - boundaries, e.g. between plots or along plots or roads that can be converted into ecological corridors
    - hedges, bushes, trees.
- Provide farms close to protected areas with information regarding the conservation status of threatened species and how this is developing. If necessary, consult with experts (e.g. nature conservation authorities, regional NGOs, scientific institutions).
- Establish conservation measures for protected and/or threatened species in the area (farm and surroundings). Request support from experts (e.g. nature conservation authorities, regional NGOs, scientific institutions).
- Describe potential risks to biodiversity from agricultural activities or other secondary activities, both on the farm and in adjacent areas (e.g. contamination from untreated sewage or illegal dumping).

B 1.2 Selecting MEASURES

Recommendations for standards organizations and companies and farmers / farm operators

- Include measures that farmers can develop and implement to protect and create potential for biodiversity. The measures should be derived from the baseline assessment and cover all aspects of protecting and promoting biodiversity.
- Provide guidelines for growing different crops that include the most effective measures, and support farmers select the most appropriate measures according to the farm's baseline situation [3]. The guidelines should include all relevant aspects described in the sections below.
- Include recommendations / criteria listed in the section "Very Good Practices".

3 The Biodiversity Performance Tool supports the elaboration of a Biodiversity Action Plan. See: www.biodiversity-performance.eu. The Biodiversity Check Agrícola helps the farmer evaluate the situation on their banana or pineapple farm and makes recommendations on measures that could help improve it. See: www.delcampoalplato.com.

B 1.3 Minimum Share of Semi-natural Habitats

General recommendations:

- The standards or companies must define a minimum percentage of natural and semi-natural habitats on the farms. If possible, they should also define elements of habitat quality.

For agricultural production areas:

- Set the minimum proportion of semi-natural habitats higher than what is legally required.
- The requirement is that farms should conserve at least 15% of natural and semi-natural habitats. These should preferably be located adjacent to and within (large) farms to maximize the edge effect and spread of beneficial arthropods between crops and these habitats. Ideally, these areas should be part of a connectivity network.
- Standards organizations or companies should define, in collaboration with experts, the qualitative aspects of natural and semi-natural habitats. Regional and crop differences need to be taken into account. A guide with positive examples is available.

For newly established production areas

- Standards organizations or companies should emphasize the goal of *No Net Loss of Biodiversity* and recommend measures to compensate for negative impacts, e.g. by participating in or supporting biodiversity conservation projects in the region. In regions where various standards and companies are active, joint projects for protecting or restoring ecosystems and/or species should be developed, and farmers should be motivated to participate.

B 1.4 Establishing Biotope Corridors

Recommendations for farm operators / producers

- Connect areas of the farm dedicated to biodiversity conservation via corridors, where possible. To create effective corridors, the farmers can get support from the regional nature protection authority, regional NGOs or other experts.
- Ensure that the natural and semi-natural habitats on the farm are connected to protected natural areas around the farm, where these exist.
- Map corridors and include them in the BAP.
- Locate regional corridor networks and connect the farm corridors to these, where possible (e.g. migration routes).

B 1.5 Grassland PRESERVATION

Recommendations for farm operators / producers

- Avoid farming on permanent pasture or converting pasture to farmland, to be used for new pineapple or banana plantations.

B 1.6 Managing Natural and Semi-natural Habitats

Recommendations for standards organizations and companies

- Develop a catalog of measures to protect and restore typical habitats in the region for the most important crops (e.g., in regions of high biodiversity value, with a high number of certified farms).
- Provide advice on how to prioritize measures, taking the diversification of habitats into account in order to achieve better results.
- Define the basic measures to be implemented on each farm (e.g. by creating ecological corridors).

Recommendations for farm operators / producers

- Use only native species on the boundaries and (floral) strips of protection. It is also important to allow for the natural revegetation of linear structures and habitats.
- Preserve linear green structures and small habitats (e.g. hedges, stone walls, ditches) and avoid damaging them (e.g. by dumping waste water or using heavy machinery). Use only native species for new hedges.
- Maintain green infrastructure (e.g. pruning hedges, cleaning drainage channels) and other adjacent areas to minimize damage to habitats, flora and fauna.
- Avoid fertilizing or treating natural and semi-natural habitats with pesticides.
- Ensure an adequate density of trees and guarantee regeneration in agroforestry areas, whether by natural or artificial means (grazing management, protecting young trees, minimum scrub areas, etc.)

Agroforestry elements for banana plantations

- Contour strips to reduce soil erosion
- Windbreak plantations and protection belts to reduce damage caused by high-speed winds; they create a better microclimate and increase production.
- Intercropping of trees (coconut, citrus, avocado or forest species), using more space than in orchards (40 x 40 feet or more)
- Interleaving of coffee or cocoa
- Vegetable cover (preferably herbaceous legumes)

Agroforestry elements for pineapple plantations

Pineapples do not demand high soil fertility, but they do require sunlight to produce saleable fruits. Therefore, agroforestry is not an option here in the long term. Pineapples could be planted for a limited time in early phases of agroforestry systems.
Instead, you can combine pineapples with other crops as a background crop. In particular: coffee, cocoa, coconut, cashew, coconut and date palms, avocado and mango.

Important Note

The process of changing from a conventional production system to a type that integrates agroforestry elements needs to be done in a step-by-step manner and will vary depending on the crop and region. Farmers need to find customers for their newly produced products, and the higher production costs of the agroforestry system must somehow be balanced out. However, in addition to the benefits the agroforestry elements provide for the ecosystem, it also makes the agricultural system more resilient, which creates other long-term advantages.

B 1.7 Specific Measures for Protecting Species

When standards organizations and companies assess farms and find protected and endangered species of flora and fauna, this should be viewed as a sign of high-quality farm management and high-level sustainable production. Therefore, farms with protected and endangered species on site must be rewarded for the additional protection measures they are taking (e.g. by receiving a higher price for the product). Companies could also use the protected species as additional product value in their marketing campaigns.

Recommendations for farm operators / producers

- Identify protected and/or endangered species of flora and fauna present in the production area and develop measures to ensure the protection of the species. The measures should include both direct protection measures and the implementation of farming practices that are more respectful to nature.
- Avoid practices that might harm protected and threatened fauna and flora, such as logging or pruning during birds' breeding seasons, or harvesting or making hay when pollination is taking place.
- Report protected species to the regional environmental protection authorities.
- Request help and advice from nature protection authorities for conflicts of interest between protected animals and their agricultural activities in order to resolve such conflicts appropriately.
- Do not keep wildlife in captivity. Captive wild animals present on the farm before the first certification date must be displaced to professional facilities or must be kept only for non-commercial purposes in accordance with the five freedoms of animal welfare[4].
- Keep working animals (horses, donkeys, dogs, etc.) under good conditions that guarantee the five freedoms of animal welfare.

B 1.8 Protecting Primary (natural) Ecosystems, Semi-natural Habitats and Protected Areas

Recommendations for standards organizations and companies

- Prohibit the conversion of natural ecosystems into agricultural land. A reference year should be defined.
- If land use is allowed, natural and semi-natural habitats and protected areas may only be used with sustainable methods. Here, the term "sustainable use" must be specified clearly.
- Prohibit the draining of marshes and the extraction of peat (climate protection, carbon sink).

Recommendations for farm operators / producers

- Opt for natural soil drainage rather than installing drainage channels - if the level of rainfall allows for this.
- Cover drainage channels with vegetation where possible, enable and support the restoration of wetlands and other habitats.
- Familiarize yourself with legal restrictions for protected area management and respect them.

4 The five freedoms of animal welfare: https://www.fawec.org/en/fact-sheets/28-general-welfare/106-what-is-animal-welfare

B.1.9 Protecting Aquatic Ecosystems; Managing Riparian Strips

Recommendations for farm operators / producers

- Maintain buffer zones[5] of native vegetation along all river banks and permanent and seasonal aquatic ecosystems. Buffer zones must be at least 10 meters wide to be effective and ideally 10% wider than legally required in the respective countries.
- Avoid using pesticides and fertilizers in buffer zones.
- Prohibit the discharging of inappropriate waste into open water and ground water bodies (e.g. oil, polypropylene containers, medicine, or animal manure).

B 1.10 Preventing the Introduction and Spread of Invasive Alien Species

Recommendations for standards organizations and companies

- Inform auditors, certifiers and farm employees about invasive species, how they are introduced and then spread out.
- Include requirements and measures to prevent the spread of invasive seeds, plant parts, etc. in the BAP.

Recommendations for farm operators / producers

- Carry out inspections to ensure invasive species do not enter or leave the farm when products are being imported or exported.
- Learn about invasive alien species in the region. Identify invasive species that appear on the farm, and inform the nature protection authorities of their presence.
- Implement measures to eliminate and manage invasive alien species in accordance with the recommendations provided by nature protection authorities or regional environmental NGOs. Ensure that these measures do not harm native species.

5 Rainforest Alliance Impact Report 2018, Chapter 5 Conserving Natural Ecosystems: https://www.rainforest-alliance.org/sites/default/files/2018-03/RA_Impacts_2018.pdf

C - Best-Practice Recommendations for More Biodiversity

Soil and Fertilization

Introduction

The term soil biodiversity refers to the variety of organisms living in the soil, ranging from microorganisms (e.g. bacteria, fungi, protozoa and nematodes) to larger mesofauna (e.g. mites and springtails), and macro-fauna (e.g. worms and termites). Plant roots are also considered soil organisms in view of their symbiotic relationships and interactions with other soil components. These diverse organisms interact with one other and with the various plants and animals that contribute to providing essential ecosystem services. This makes the protection of soil biodiversity an essential aspect of sustainable agriculture.

C 1 Maintaining and Improving Soil Fertility - The Role of Standards and Companies

C 1.1 Requirements for Nutriens Balance and Providing Approved Methods

Recommendations for farm operators / producers

- Develop a nutrient management plan based on an analysis of the soil and crop nutrient demand.
- Document all fertilizer applications (kg/ha) and the nutrient values of the fertilizers (at least N and P) in detail.
- Evaluate a crop's precise nutrient demand prior to applying the required amount of nutrients.
- Determine the farm's annual net nutrient balance (input and output).
- Carry out an annual soil analysis using a reliable method to determine the nutrient content and need.
- Ensure that the analysis of soil samples includes organic matter, N, P, K, pH and micronutrients. Ideally, samples would be collected for each field or plot. Small hold farmers in low-income countries can take samples together.
- Perform the soil analysis before new crops are planted on a field. Repeat the analysis at least every three years for perennial crops, or as recommended by a specialist.
- Archive the soil analysis documents, and include them in the nutrient management plan.
- Calculate the post-harvest nutrient balance using documented figures with approved and specified methods.
- Carry out an annual humus balance (analysis of organic matter content) on all productive sites, supplemented by a humus inspection every six years. The humus balance should never be negative and should follow a conventional approach. Having a balanced supply of humus is fundamental for intensive plantations. Agroforestry systems have the potential to increase humus content and fertilizers by themselves.
- Plant and sow native trees, shrubs and grasses to maintain and increase soil fertility. This helps to create diverse habitats and increases the number of beneficial insects. Planting ground cover plants, such as legumes and grasses, can have multiple positive impacts as well.
- Ensure that all productive areas and their surroundings are covered with vegetation throughout the year.

C 1.2 Regulating Crop-specific Nutrient Limits, Combined with Tolerance Thresholds and Time References

Recommendations for standards organizations / companies

- Define crop-specific nutrient limits adjusted according to plant requirements and - where necessary and applicable - related to site and tolerance thresholds. The thresholds must be based on scientific research and must be appropriate for the respective region.
- Provide guidelines for crop rotation. Diversified crop rotation improves biodiversity and soil fertility while reducing the intensity of plant pests and diseases.
- Identify crops suitable for short-cycle rotation with pineapple production.

Recommendations for farm operators / producers

- Resume planting non-perennial crops (including pineapple) in appropriate rotation cycles using various crops with different rooting depths and soil use in order to disrupt pest and disease cycles and improve soil cover and health.
- Introduce crop rotation methods such as alley cropping, intercropping and hedgerows in perennial cropping systems to support biodiversity.
- Integrate intercropping or catch crops, such as grasses, oil seeds or legumes into the crop rotation.
- Banana plantations should also integrate intermediate crops into the crop rotation.
- Grow a minimum of three different crops on the entire utilized agricultural area (UAA) of the farm. Whenever possible, the main crop should cover a maximum of 75% of the total UAA of the farm. The first two main crops should constitute a maximum of 90% of the total UAA, with legumes and mixtures including legumes on at least 10% of the farm‘s UAA.
- Set aside any fields, plots and parts of fields which are difficult to cultivate because of nature conservation efforts.
- Avoid fertilizing natural and semi-natural habitats, and set aside land or allow it to become fallow.

Crop rotation

Peanuts, beans, rice and vegetables are commonly included in the rotation with pineapples after the harvest to give the soils some rest. In addition, to prepare the soil for pineapple production, green manure plants, such as cowpea, can be grown and ploughed into the soil prior of planting pineapples.
Crop rotation in general is an important measure to avoid the accumulation of root knots and other nematodes that contribute to large crop losses and thus impose the use of nematicides. When the land is at rest or in fallow areas, legumes such as mucuna or velvet bean (Mucuna pruriens), kudzu (Pueraria phaseoloides) are appropriate intercrops for pinapple. With ploughing into the soil before flowering, farmers improve organic matter and provide nitrogen, which supports to control arvens and pathogens, improves soil fertility and reduces overall resting time.

Important Note

Introducing crop rotation measures in conventional production requires systematic change and thus needs to be done in a step-by-step manner. It is likely that new work steps will have to be added to the complete production process, and that costumers for the new products like beans will have to be found. However, there are many benefits from crop rotation, including reducing erosion and making the entire agricultural system more resilient.

Increasing organic matter in the soil

The soil's organic matter content is of great importance in tropical and intensive perennial crops. Cover plants, such as legumes and herbaceous plants are suitable for improving soil structure. You can also cover the soil with banana leaves and return them to the soil. The key is that the soil always has a plant cover. (Agroforestry systems have a great, natural ability to supply themselves with nutrients).

1.3 Defining Requirements for Improving Soil Quality

Recommendations for both actors

- Grow ground cover crops if the cultivated land is fertilized with organic matter in the form of manure or compost. We recommend using bioferments or biols and worm compost where applicable.

C 1.4 Establishing Requirements for Recognizing and Preventing Soil Damage

Recommendations for standard organizations / companies

- Provide information about erosion risks for the most important sourcing regions in regions without official erosion maps.
- Offer guidelines and training for analyzing erosion risks and for setting up appropriate measures to avoid and minimize erosion.
- In regions with high risk of erosion, farmers must apply soil protection measures, i.e. reducing tillage, terracing, parallel cultivation of slopes, perennial vegetation.
- Apply techniques to improve or maintain the soil structure and avoid soil compaction.

Living Barriers

One way to conserve soils and balance water supply on farms is via living barriers. These could be crops left over in unharvested areas or planted along drainage channels to prevent erosion, like vetiver or lemon grass.

C 2 Improving Fertilizer Management

C 2.1 Defining Crop-specific Requirements for Fertilizer Application

Recommendations for the farm operator

- Apply only one-third of the total nitrogen before seeding.

C 2.2 Increasing Amount of Organic Fertilizers:

- Organic fertilizers (manure, but also organic pellets) are preferable to mineral fertilizers.

C 2.3 Demonstrating Continuous Improvement in Fertilizer Use

- The producer must demonstrate that they are continuously trying to find the optimal, most efficient use of organic and mineral fertilizers.
- Implement a nutrient management plan to document all applications. Yearly updates will provide the following information: overview of the nutritional requirements of all crops on the farm; soil type(s); analysis of soil samples per plot/productive area; rates and intervals mineral or organic fertilizers have been applied in accordance with national and regional legislation; crop requirements; a simple nutrient input/output balance using the best available information; nutrient content of manure and compost applied.

C 3 Pest Management

Pesticides are used to protect crops from pests, but also have a negative effect on biodiversity. Therefore, the goal is to reduce the use of pesticides as much as possible to lessen the impact on biodiversity. The general principle and long-term goal in pest management is to combine biological pest management with site-specific cultivation. This is done by implementing the principles of integrated pest management (see recommendations below), focusing on continually improving pesticide use, which equates to reducing the quantity used and the level of toxicity. This includes excluding or strictly restricting the use of pesticides particularly harmful to biodiversity. Farmers that use pesticides should participate in regular trainings and should be motivated to achieve the reduction target.

C 3.1 General Principle of Biological Pest Management in Combination with Locally Adapted Crops

Recommendations for standards organizations / companies

- Declare biological pest management as a general principle.
- Promote planting crops that are adapted to local conditions, with an adequate density of healthy and resistant plants to avoid the preventive use of pesticides.
- Require that the producers develop and implement an Integrated Pest Management Plan (IPM) for the entire farm.

C 3.2 Consistent Implementation of all Integrated Pest Management (IPM3) principles

Recommendations for standards organizations / companies

- Provide preventive measures based on crop and damage thresholds in accordance with the basic principles of Integrated Pest Management:
    - o Apply intercropping methods.
    - o Rotate crops (e.g. for pineapple).
    - o Adopt specific cultivation techniques, e.g. seedbed sanitation, sowing dates and densities. Applying sampling methods to identify pest cycles and seasons with greater pest development also contributes to effective pest control.
    - o Use pest-resistant, pest-tolerant varieties, certified seeds, and planting material.
    - o Balance soil fertility and water management well, making optimal use of organic matter.
    - o Prevent the spread of harmful organisms via sanitation and hygiene measures in the field (e.g., removing affected plants or plant parts, or regularly cleaning machines and equipment).
- Promoting beneficial organisms is a key measure that can be advanced by standards organizations /companies and should be a main objective of the farm operator‘s preventive pest management strategy. Develop a biological control plan.
- The preventative use of chemical pesticides should in general be prohibited. It should only be allowed if there are no other alternatives.

Bioinputs

Bioinputs are products based on beneficial microorganisms in the soil, especially bacteria and fungi, which can be used in Integrated Pest Management. Microorganisms such as Trichoderma, Beauveria, Metarhizium, Azotobacter and Bacillius T. are used on pineapple plantations, depending on the type of pest.

Important Note

Many authorities provide guidelines about Integrated Pest Management (IPM). Make use of these services and inform yourself!

Recommendations for farm operators / producers

- Develop and implement an IPM plan based on pest prevention efforts; careful pest monitoring can help balance economically significant crop losses when reducing the negative impacts of pesticides. The operator determines the steps to be taken in pest management based on pest monitoring records. Pests should be managed by using biological controls and other non-chemical methods whenever possible. When pesticides are used, preference should be given to unrestricted, low toxicity pesticides. Generally, pesticides should only be applied to the affected parts of the crop. All workers involved in pest management should receive training based on the content of the IPM plan.
- Pesticide use must only be allowed if all other preventive measures are set in place and the defined damage thresholds have been exceeded. The use of preventive and alternative measures must be documented.
- Biological pest management must take priority over the use of any chemical alternatives.
- Use only highly-efficient spraying devices and apply the pesticide directly to the plant to avoid any drift. Spray equipment should be calibrated at least every three years.

C 3.3 Burning Vegetation

Burning vegetation has a negative impact on biodiversity and the soil, causes erosion, depletes nutrients, moisture and more. It also has a negative impact on the environment in general (loss of beneficial organisms, risk of major fires). Therefore burning vegetation must be carefully planned and should only be done under very specific circumstances.

Recommendations for standards organizations / companies

- Prohibit the burning of vegetation in order to create new agricultural areas.
- Only permit vegetation to be burned as a plant protection measure if no other alternative measures exist. This must be demonstrated by documenting all possible preventive and alternative measures. Farm operators in or near protected areas may only burn vegetation if this is done in agreement with and with the technical assistance of the nature conservation authorities.

Example of a regulation for controlled agricultural burning

In Costa Rica, fires are only allowed under controlled conditions. All fires must be approved by the authorities. (N ° 35368-MAG-S-MINAET)

C. 3.4 Managing Highly Critical Substances for Biodiversity

Recommendations for standards organizations / companies

- Define a negative list of all pesticides, i.e. nematicides, insecticides, fungicides, herbicides that may not be used.
- The negative list of pesticides should be developed with the support of the Pesticide Action Network (PAN): http://rap-al.org/.
- Include any pesticides that have been shown to have harmful effects on bees, pollinating insects, beneficial insects, amphibians or fish.
- Define clear sanctions and a mandatory action plan for redress in case of violations.
- If pesticides from the negative list are still being used, the standards organization/company should define an exit strategy to ban these substances within one year. They should also clearly define use restrictions for the last year of use (e.g. prohibited for flowering crops).
- Actively promote alternatives to herbicide[6] application. Wild flora can usually be contained by:
- (1) mulching with natural material; (2) mowing grass; (3) cattle grazing; (4) manual weeding and mechanical cultivation; (5) flames, heat, or electrical means; or (6) plastic or other synthetic mulches - as long as they are removed from the field at the end of the growing or harvesting season.
- Herbicides shall not be permitted in the rows between plots and at headlands.
- Prohibit the use of fertilizers and pesticides in the buffer zones.
- Provide information on the minimum size and quality of the buffer zones (height, width, native vegetation and vegetation density). The size should be set at 10% more than is legally required.
- The height must be defined according to the height of the crop and the method of application.
- Provide the farmer with specific rules for cultivating crops and applying pesticides adjacent to aquatic ecosystems.
- Define the maximum size of agricultural land that may be treated with pesticides per year (e.g. maximum 80 %). The remaining 20% of the area should be pesticide-free and managed with alternative techniques (mechanical and/or biological pest control).

Buffer zones:

(Excerpt from Costa Rica's Forestry Law N° 7575)

- For permanent springs, in a radius of 100 m measured horizontally, only natural regeneration is permitted.
- For rivers, streams or creeks, a strip of 15 m in rural areas and 10 m in urban areas, measured horizontally on both sides if the land is flat, and 50 m horizontally if the land is broken.
- For natural lakes or reservoirs, as well as for artificial reservoirs made by the State, 50 m must be left on each side, measured horizontally.
- Recharge areas and spring aquifers are officially delimited.
- The recommendation is a minimum of 10% more than the legally required distance!

6 PAN Alternatives to glyphosate: https://pan-germany.org/download/pan-europe-report-alternatives-to-glyphosate/

C 3.5 Continuous Improvement and Documentation of Pesticide Use (Treatment-Index, Toxicity-Index)

Recommendations for standards organizations / companies

- Use the treatment index approach as a quantitative measure to describe the intensity of chemical pest management.
- Complement the treatment index with a toxicity index (e.g. the toxic load indicator, TLI4)
- Use the treatment index in general and at the regional level to reduce the intensity of pest management; communicate successful reduction strategies and encourage exchange and comparison between agricultural operators. Calculate the treatment index and toxicity index annually to contribute to continuous improvement (long-term trend, e.g. 5 years).
- Introduce an exit strategy for the use of substances which are not prohibited but on the negative list contained in the standard and harmful to humans and the environment (see PAN[7] and FAO[8] list).
- Agree on amendments to the negative list with other standards organizations/companies to help farms manage fulfilling certification criteria on different negative lists.
- Provide knowledge and guidance for dealing with the most important pests. This includes knowledge about diseases caused by pests and how it affects crops, conditions that may put the crop at risk, affected plant parts, where the pest normally develops, and potential host plants.

Recommendations for farm operators / producers

- Continuously document the use of pesticide applications, alternative control measures and other procedures carried out to manage weeds and pests.
- Demonstrate continuous improvement in pesticide management and application (equating to reduction and optimization).
- Get advice and training regarding the issue of pesticides. This should address the impacts on biodiversity and reduction strategies. The advice should be from sources independent of the pesticide industry.
- Avoid the accumulation of resistance to pesticides, e.g. by implementing an appropriate pesticide application program where actions are modified and active matters are evaluated. Document well all measures and applications of pesticides used against a specific pest or disease.

C 3.6 Appropriate Use of Pesticides

Recommendations for standards organizations / companies

- Require that only authorized and regularly trained personnel may use machinery and apply pesticides. Personal protective equipment should always be required.
- Require and verify the proper use of synthetic chemical pesticides: proper labeling/identification, storage, preparation, application technology (e.g. adequate maintenance and adjustment of equipment), cleaning of equipment and recycling or proper disposal of waste materials/ packaging.
- Fertilizer and pesticide storage facilities should be separate, closed and accessible to authorized personnel only.
- Storage buildings must comply with national or local building codes and guidelines or with the IPCS Manual on Safety and Health in the Use of Agrochemicals and/or the FAO Manual on Storage and Stock Control of Pesticides.

7 Pesticide Action Network Latin America: Highly hazardous pesticides:
https://rap-al.org/wp-content/uploads/2017/09/HHP-Lista-PAN-2016-actual-traducida-espa%C3%B1ol_29agosto17.pdf
8 See FAO/WHO 2016: International Code of Conduct on Pesticide-Management. Guidelines on Highly Hazardous Pesticides.
http://www.fao.org/3/a-i5566e.pdf

- Require that equipment is available to handle accidents and spills in areas where pesticides and other hazardous chemicals are prepared or mixed so that they do not seep into the soil or water. The equipment can be very simple, such as absorbent material.

Pesticide Reduction

Insecticides are extensively used to protect the fruit from being attacked by certain scratching insects including birds or bats, which would damage or stain the fruit's skin and thus affect the aesthetic appearance of the bananas. (Insecticides applied to covers or plastic bags include: buprofesin, chlorpyrifos and bifenthrin.)
Advice: Use bags that do not contain insecticides! A study showed that placing bags without insecticide on banana plantations had the same effect as those with insecticide. Another option is to use bags treated with natural repellents based on garlic, hot pepper, mustard and other plant extracts.
Pineapple farmers commonly use Paraquat to dry out the pineapple residuals after harvest more quickly. This has negative impacts on biodiversity as well as on the health of workers. It is possible and much healthier to dry pineapples without the use of chemicals. Paraquat is prohibited in more than 50 countries due to its adverse effects on the environment and humans.
For more information on the toxicity of pesticides, see:
pan-international.org/wp-content/uploads/PAN_HHP_List.pdf; http://pan-international.org/pan-international-consolidated-list-of-banned-pesticides/

C 3.7 Consulting / Training / Information

Recommendations for standards organizations / companies

- Commit to producing and distributing information materials (e.g. from FAO[9]), and offer information workshops on pesticide reduction.
- Provide training on pesticide management and use for farm operators led by unbiased experts (not representatives from pesticide companies).

7 http://www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/code/en/

C 4.1 Optimizing Water Use for Irrigation

Recommendations for farm operators / producers

- Design irrigation and processing systems in order to optimize crop production and to minimize water use, waste water, erosion and salinization. Farm managers who use water for irrigation and processing respectively, must implement measures to reduce water consumption per unit of product produced or processed. Farmers must document water consumption and reduction progress. Future needs and availability of water need to be assessed and targets set to improve efficiency and reduce consumption.
- Processing water must not be contaminated with pesticides and other substances, causing bacteria or parasites, or contaminating the final product. In case of doubt, water quality testing is required to ensure that the water meets Ministry of Health discharge permits. The water used for processing must be treated properly in a treatment plant before being discharged into the soil or aquatic ecosystems. This can be done for example via a process of separating the water from the solids and applying decomposing bacteria. For this treatment of wastewater, the operator needs to make use of the appropriate technologies[10].

9 http://www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/code/en/
10 Green filters: Effective low-cost technologies:
https://www.globalnature.org/bausteine.net/f/9134/FiltrosVerdes_Latinoamerica_2019.pdf?fd=0

C 4.2 Integrated Water Resource Management: Source, Use and Discharge

Recommendations for farm operators / producers

- Strictly adhere to all legal requirements concerning water extraction and do not exceed the authorized extraction limits (legal compliance).
- When legally required, valid permits/licenses for water extraction on the farm or in the surrounding area, water storage infrastructure, on-farm use and, if applicable, subsequent water discharge are available.
- Document the amount of water extracted and inform yourself about the status of the aquatic ecosystems in the respective watershed.
- Water use should not interfere with the quality and functioning of aquatic ecosystems.
- Use an irrigation sheet to document the water used for each irrigation activity to prove efficiency (e.g. date, cycle length, actual or estimated flow and volume per water meter or per irrigation unit).
- Take advantage of all opportunities to collect, store and use (rain) water, depending on local conditions and the situation on the farm.
- Annually demonstrate that the water in open bodies of waters on and adjacent to the farm comply with legal regulations (nitrate and pesticide levels). If the local water authority does not monitor water quality, the farm operator is responsible for carrying out an annual analysis.
- Provide a map with the location of the water source(s), fixed installations and the flow of the water system (including retention systems, reservoirs or any water captured for reuse). Permanent fixtures, including wells, gates, reservoirs, valves, returns, and other above-ground features that make up a complete irrigation system, must be documented in such a way as to allow them to be located in the field.
- The groundwater level around wells must be measured annually and recorded in the water management plan.
- All operators of certified farms in a region should cooperate on a monitoring system to ensure the sustainable use of water resources. Farm operators should regularly exchange of information with regional experts who are responsible for ensuring good water quality as well as the minimum quantity of water in lakes, rivers and other aquatic ecosystems to guarantee their ecological functioning. See also policy recommendations.
- Latrines with septic tanks as well as wastewater treatment facilities should be located, designed and managed in accordance with legal requirements. Any risk of contamination of aquatic ecosystems and drinking water supplies must be avoided.

Orientation values for water consumption and efficient irrigation systems

Recommendations for standards organizations / companies

- Support farmers to adapt to regional and climatic conditions so that they do not overuse or damage local or regional water resources, water ecosystems or protected areas.
- Request that each farm/cooperative elaborates and implements a water management plan.
- Request that certified producers commit to continuously optimizing processing techniques (e.g., by reducing water consumption, optimizing wastewater treatment).
- Support farms in continuously optimizing their irrigation techniques (e.g. reducing evaporation during nighttime irrigation), taking into account the real water needs of plants.

C 4.3 Definition and Regular Adaptation of Water Use Threshold Values

Recommendations for standards organizations / companies

- Suggest/request the implementation of instruments to manage water in rivers and lake basins (e.g. WWF[11], Alliance for Water Stewardship).
- Calculate water consumption benchmarks (e.g. best in class in certain regions and for certain crops) based on the analysis of consumption data in a region. Certified operations should receive an incentive to meet these benchmarks.
- Create a free advisory service on effective irrigation systems and other water-saving technologies.

C 5 Waste Management

Recommendations for farm operators / producers

- Have a waste management plan in place that includes measures for reducing, separating, recycling, reusing and appropriately disposing waste.
- Organic waste should be composted or otherwise processed for use as organic fertilizer.
- Producers of hazardous materials (e.g. pesticides, batteries) must collect packaging and waste materials for recycling or proper disposal. Consider the practice of triple washing.
- Check/apply for guarantees that the company‘s methods of recycling oil, plastic, etc. as well as the service for emptying septic tanks are being carried out correctly, are in accordance with laws, and do not pose risks to natural ecosystems or the health of the population.

C 6 Climate Change

Climate change, which involves rising temperatures, prolonged droughts, heavy rains and other extreme weather events, exacerbates the loss of ecosystems and species. Thus, climate protection measures also serve to protect biodiversity. At the same time, many measures taken to protect biodiversity also help adapt to the impacts of climate change and/or increase carbon sequestration. Only intact ecosystems are resilient to the negative consequences of climate change and can continue to provide important ecosystem services.

Recommendations for standards organizations / companies

- Select a methodology to calculate the carbon and other greenhouse gas (GHG) footprint.
- Establish targets for the reduction of CO_2 and other absolute and net GHG emissions on certified farms (in %).
- Provide producers with technical advice.

Recommendations for farm operators / producers

- Use a methodology recognized and recommended by the standard/company to calculate a baseline of the carbon footprint, including all greenhouse gases listed in the Kyoto Protocol.
- Acquire third party verification of the operation’s baseline carbon footprint.
- Calculate a carbon footprint baseline for short-term climate pollutants.
- Set emission reduction targets which include both absolute targets (e.g. reduction of x tons of CO_2) and/or intensity targets (e.g. reduction of x tons of CO_2 per hectare x tons of CO_2 per $ income, etc.).
- Observe and monitor climate changes: record extreme weather conditions, assess the risk to production on the farm, and develop a plan on how to adapt to climate change and how to react in emergency situations.
- Minimize the direct or indirect effects of biomass use (if being used) on natural ecosystems through appropriate actions:

11 Alliance for Water Stewardship: https://www.worldwildlife.org/projects/alliance-for-water-stewardship

- When purchasing biomass, ensure that it originates from sustainable sources without logging or any other destruction of natural ecosystems.
- Install efficient energy drying and processing infrastructure.
- Support increased energy efficiency in domestic wood burning by workers, farmers and their families through training or facilitating access to energy-efficient cooking stoves.

C 7 Agrobiodiversity

Introduction

This chapter focuses on traditional plant varieties, which represent a key element of agrobiodiversity. Traditional varieties are well adapted to climatic conditions and thus have the potential to grow sustainably in their original area. These varieties are one key to food sovereignty and local development for local people. Traditional regional varieties are often more resilient and therefore crucial in adapting to the impacts of climate change. It is therefore very important to recognize the role of agro-ecological farmers as guardians of biodiversity and landscapes and to support their efforts to protect and restore agrobiodiversity.

Varieties of Bananas

The gene bank in Leuven, Belgium lists more than 1,500 banana varieties, mainly from Southeast Asia (https://www.crop-diversity.org/mgis/). However, the Cavendish variety is being grown on most plantations due to its popularity in international trade. However, only growing one variety of banana, often originating from a single clone, means a lack in genetic diversity. This makes the Cavendish variety very sensitive of the threat of the banana fungus TR4. In order to avoid the extinction of Cavendish, the genetic diversification of plantations needs to be increased. This kind of (agro-) diversity creates more security and resilience to pests. In Costa Rica, the national banana corporation provides 108 varieties of bananas (http://www.corbana.co.cr/) which can be tested for this purpose.

Pineapple Varieties

There are 1,400 varieties of pineapple worldwide (https://interiordr.com/pineapple/). However, only 4-5 categories are registered in the international market: Cayenne, including MD2/Golden Pineapple and Sweet Cayenne, Queen, Abacaxi (Pernambuco), Española, Perolera (Ananas Rosadas). Two of these varieties, Smooth Cayenne and Golden Pineapple (MD2 from Del Monte), are the most well-known around the world. Agrodiversity creates more security and resilience to pests and market fluctuation in the long term.

Important Note

The low number of banana varieties grown and sold internationally is surprising given the global experience with the Gros Michel banana variety which failed in the 1970s due to the Panama disease. Today, many experts fear that the Cavendish variety may experience the same fate due to the current virulent strain of Panama disease TR4. Growing different varieties, using different clones, native seeds and increased cultural biodiversity could help to mitigate such disasters.

The use of traditional varieties by applying classical plant breeding techniques is an alternative that does not alter the natural genome and allows farmers to increase the resistance of agro-ecological systems. The combination of traditional knowledge and modern research is also necessary, as more agrobiodiversity will increase the resistance against the negative impacts of climate change (e.g., long dry seasons, new pests).

Recommendations for standards organizations / companies

- Make efforts to create better market access for traditional varieties. Farmers/suppliers who grow these varieties should be rewarded, for example, via incentives.
- Reward operators/suppliers who complement agricultural production with educational, cultural, social and touristic activities aimed at promoting knowledge about agrobiodiversity.
- Support farms to apply for funding from public programs to carry out projects that contribute to improving agrobiodiversity.
- Support initiatives for the development of traditional varieties in order to meet current user expectations.
- Support classical plant breeding techniques rather than biotechnological genetic modification.
- Seek collaboration and exchange with local and national research institutions, farmers as guardians of biodiversity, as well as other stakeholders.
- Promote the transfer of knowledge and technology to the field.

References

These recommendations were developed within the framework of the European LIFE Food & Biodiversity[12] project which aims to increase the protection of biodiversity through standards in the food sector and procurement rules for food companies.

The authors of this report selected effective criteria to analyze standards (see Baseline Report[13]) and took the results of studies and projects with similar objectives into account.

These recommendations were discussed with representatives of the food standards organizations, companies, scientific institutions, cooperatives and NGOs in diverse workshops and working groups. We would like to express our sincere appreciation to the participants and experts who shared their knowledge and extensive experiences.

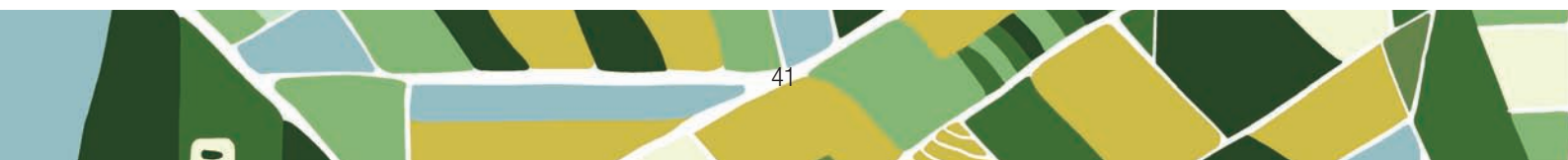
This is a „living document“, which means that we will be reviewing the recommendations in a few years, adding new knowledge and methods that will contribute to the protection of biodiversity.

12 Proyecto Europeo LIFE Food & Biodiversity: www.food-biodiversity.eu
13 CAP - Informe de Referencia: https://www.business-biodiversity.eu/es/iniciativas/del-campo-al-plato

Glossary

Agrobiodiversity	The variety and variability of animals, plants and micro-organisms used directly or indirectly for food and agriculture, including crops, livestock, forests and fisheries. It includes the diversity of genetic resources (varieties, breeds) and species used for food, feed, fiber, fuel and medicines. Agrobiodiversity also includes the diversity of species that support production (soil microorganisms, predators, pollinators) and species which support agro-ecosystems in general (agricultural, grazing, forest and aquatic), as well as the diversity of agro-ecosystems (FAO, 1999a).
Alien Species	A species, subspecies or lower taxon introduced outside of its natural past or present distribution; includes any parts, gametes, seeds, eggs or propagules of these species that might survive and consequently reproduce (Secretariat of the Convention on Biological Diversity, 2002).
Arthropod	Any invertebrate of the Arthropoda taxon, which has a segmented body, jointed limbs, and usually a molting chitinous shell; includes insects, spiders and other arachnids, crustaceans, and myriapods.
Beneficial Insects	Insects are crucial for almost all ecological processes in terrestrial ecosystems: 1) plant reproduction (e.g. pollinators), 2) biodegradation of waste (decomposers) and 3) natural resistance of agro-ecosystems/ natural control of harmful species (natural enemies, predators, parasites). The term “beneficial insects” refers to the benefits for humans. In addition to the functions mentioned above, edible insect species provide nutritional benefits, valuable insect products (e.g. silk or honey) and are used in biochemistry, among others (FAO, 2013).
Biodiversity	„Biological diversity“ means the variability among living organisms in all ecosystems, terrestrial, marine and limnic aquatic ecosystems and the respective ecological processes and interactions. Biodiversity includes diversity within species, diversity between species and the diversity of ecosystems (Convention on Biological Diversity, 1992).
Biodiversity Action Plan (BAP)	A plan to conserve and promote biodiversity, including creating a baseline, setting concrete and significant measures and progress monitoring (Global Nature Fund & Lake Constance Foundation, 2020).
Biological Pest Control	A method for controlling pests, diseases and weeds in agriculture based on natural predation, parasitism or other natural mechanisms that limit the infection from pathogenic organisms (FAO, 2019).
Biotope Corridors / Habitat Corridors	Ecological structures that connect natural habitats separated by human infrastructure, arable land and human activities (such as roads, buildings or logs, farm production areas, etc.). Habitat corridors allow exchange of individuals between populations, and mitigate negative effects (e.g. on reproduction and breeding) and the loss of genetic diversity in isolated populations. http://www.environment.nsw.gov.au/resources/nature/landholderNotes15WildlifeCorridors.pdf.

Buffer Zones	Region adjacent to a protected area; a transition zone between natural and managed areas with different objectives (Convention on Biological Diversity, Glossary).
Crop Rotation	The practice of alternating annual and/or biannual crop species or families on a particular plot according to a planned pattern or sequence 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 communities of plants, animals, microorganisms, and their inanimate environment, interacting as a functional unit (Convention on Biological Diversity, 1992).
Ecosystem Services	Benefits mankind receives from ecosystems. These include 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).
Net Nutrient Balance (of a farm)/ "Farm-gate" Nutrient Balance	The net nutrient balance of a farm compares the amounts of nutrients supplied to a farm (Nitrogen (N), phosphates (P2O5) and potash (K2)) with the amounts of nutrients exported from the farm over a period of one year (Glossary; Ministry of Rural Development and Consumer Protection, Baden-Württemberg).
Genetically Modified Organism	Any organism, with the exception of human beings, whose 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 and tilled into the soil to increase organic matter.
Habitat	Characteristic living area of a particular animal or plant species or the habitat determined by specific abiotic and biotic factors where the species lives at a stage in its life cycle.
High Conservation Value Areas	High Conservation Value Areas (HCVAs) are natural habitats of outstanding or critical importance due to high biological, ecological, social or cultural value. Such areas need to be appropriately managed in order to maintain or enhance those identified values (https://www.hcvnetwork.org/).
Biodiversity Hotspot	Regions of the world in which a large number of endemic plant and animal species occur and whose nature is particularly threatened.
Humus Balance	Comparison of the input and output of humus/ organic matter in a plot, including natural depletion of soil humus. Humus balance calculates organic fertilizer applied, crop residues and removal organic matter with harvest.
IIndicator Species	A species whose status provides information on the overall condition and other species in a given ecosystem. They indicate quality and changes of environmental conditions, as well as aspects of species composition (United Nations Environment Program, 1996).



Integrated Pest Management IPM	The objective of IPM is to combine the various methods of biological and chemical pest management as well as physical and biotechnical measures in the most optimal way. IPM proposes a hierarchy of intervention to prevent plant diseases. This includes the analysis of plant protection methods and the consequent integration of appropriate measures other than pesticides first. The target is to interrupt the dynamic of populations of harmful organisms by natural means and to economically balance the use of plant protection products and other forms of intervention with the loss in yield. IPM reduces and minimizes risks to human health and the environment. Integrated Pest Management fosters 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 or growing two or more crops on the same field in a sequence. (PAN-Germany).
Invasive Alien Species	Invasive alien species are non-native species that damage the environment and potentially cause species extinction, modify ecosystem processes and act as vectors of diseases. Problems caused by invasive alien species have potentially large economic consequences. They are also one of the drivers of biodiversity loss.
Main Crop	Crops which dominate the annual cropping cycle; crops between two main crops are referred to as catch crops.
Mitigation Hierarchy	The mitigation hierarchy is defined as: **Avoid**: measures to avoid severe impacts in advance. Spatial or temporal placement of infrastructure elements in order to completely preclude negative impacts on biodiversity. **Minimize**: measures taken to reduce duration, intensity and extent of impacts (including direct, indirect and cumulative impacts, as appropriate) which cannot be avoided. **Restore**: measures to restore degraded and destroyed ecosystems after exposure to impacts that cannot be avoided and minimized. **Compensate/offset**: measures to counteract residual adverse impacts that cannot be avoided, minimized or rehabilitated. It aims to achieve no net biodiversity loss or gain in a given area trough positive activities such a restoring habitats, halting degradation; or by effectively protecting habitats at risk of a loss of biodiversity. A key principle is that offsets cannot justify projects with unacceptable residual impacts on biodiversity. All options to avoid damages have to be examined in depth. (Glossary European Commission and Business and Biodiversity Offsets Programme (BBOP))
Native Species	Flora and fauna species that live naturally in a given area or region. Also referred to as indigenous species (Convention on Biological Diversity - Glossary).

Nutrient Balance	The difference between nutrient inputs entering an agricultural system (mainly animal manure and fertilizers) and nutrient outputs leaving the system (nutrient uptake for crops and pasture production) (Glossary; OECD).
Pathogens	An agent that produces a disease in its host, such as an organism or particle capable of producing a disease in another organism. Pathogens are mostly microscopic, such as bacteria, viruses, protozoa and fungi (online biology).
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 transportation. The term includes, among others, herbicides, fungicides, insecticides, growth regulators, and biocides (European Commission).
Primary (Natural) Ecosystems	Ecosystems that are or would be in a given area in the absence of significant human management impacts. This includes all bodies of water that are stationary or naturally moving (streams, rivers, ponds, lakes...), all natural wetlands and forests (tropical forest, scrubland, hardwood forest, evergreen forest...) or other indigenous terrestrial ecosystems such as scrubland.
Protected Areas	Protected areas are a geographically clearly defined, recognized, committed and managed space, through legal or other effective means, for 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 classified as threatened and endangered by national legislation or classification systems, or indicated as threatened or seriously endangered by the IUCN Red List of Threatened Species ™, and/or listed on Appendix I, II or III of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).
Semi-natural habitats	An ecosystem with most of its processes and biodiversity intact, though altered by human activity in strength or abundance relative to the natural state (https://ipbes.net/glossary/semi-natural-habitats). E.g. hedges, bushes, rows of trees, single trees, buffer strips, fallow lands, flower strips, slopes, reforested areas, water spaces (creeks, streams, ditches), unmanaged borders or strips, not used for grazing.
Soil Biodiversity	Uncountable numbers of microbial and animal species contribute to the soil biodiversity, discompose organic matter and thus produce productive soils: bacteria, fungi, mites, beetles and earthworms that vary depending on the environment make up for an immense diversity in soil. This diversity allows for a great variety of ecosystem services that benefit not only these species, but also people who use it.

Toxic Load Indicator	Qualitative indicator for pesticide active ingredients that translates numerical and non-numerical values (toxicological extremes, classifications) into a scoring system and applies to pesticide use data to measure and compare them (current use and trend). (Toxic Load Indicator. A new tool for analyzing and evaluating pesticide use).
Treatment Index	A quantitative measure to describe the intensity of chemical crop protection. It represents the number and amounts of pesticide applications in a given area, on a crop or on a farm, taking into account reduced application rates and partial area treatments. In mixed applications, each pesticide is assessed separately (National Plant Protection Plan – Germany).
Water-Stewardship	Socially equitable, environmentally sustainable and economically beneficial use of water achieved through a process of stakeholder participation involving actions in specific locations and catchment areas.
Wetlands	The Convention on Wetlands defines wetlands as: „areas of marsh, fen, peat land 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).

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