


Biodiversity Footprints for Food Chains

Feasibility Assessment and Stakeholder Input

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Summary

Co-learning between stakeholders and science leads to useful data and tool development. The AKRIBI project held three workshops with food industry stakeholders to discuss the potential need for biodiversity footprints in the context of ongoing monitoring activities. We found a clear desire for better incorporation of biodiversity considerations in food sourcing practices. Expanding mainstream criteria and norms to include biodiversity as well as complementary methods to assess land use risk would be welcomed. This report presents the outcomes of the stakeholder workshops and explores the feasibility of a footprint monitoring approach--based on regional assessment of biodiversity risk. The report is augmented by key literature sources arguing for the urgent and widespread uptake of biodiversity criteria in responsible food chain management.

- Food systems are both **dependent** on biodiversity *and* a **major driver** of biodiversity loss.
- Long distance supply chains **displace impacts** from consumers.
- Changed practices to incorporate and conserve biodiversity can and are **making a difference.**

→ How can the good practices be both **scaled-up** and **communicated** to customers?

Table of Contents

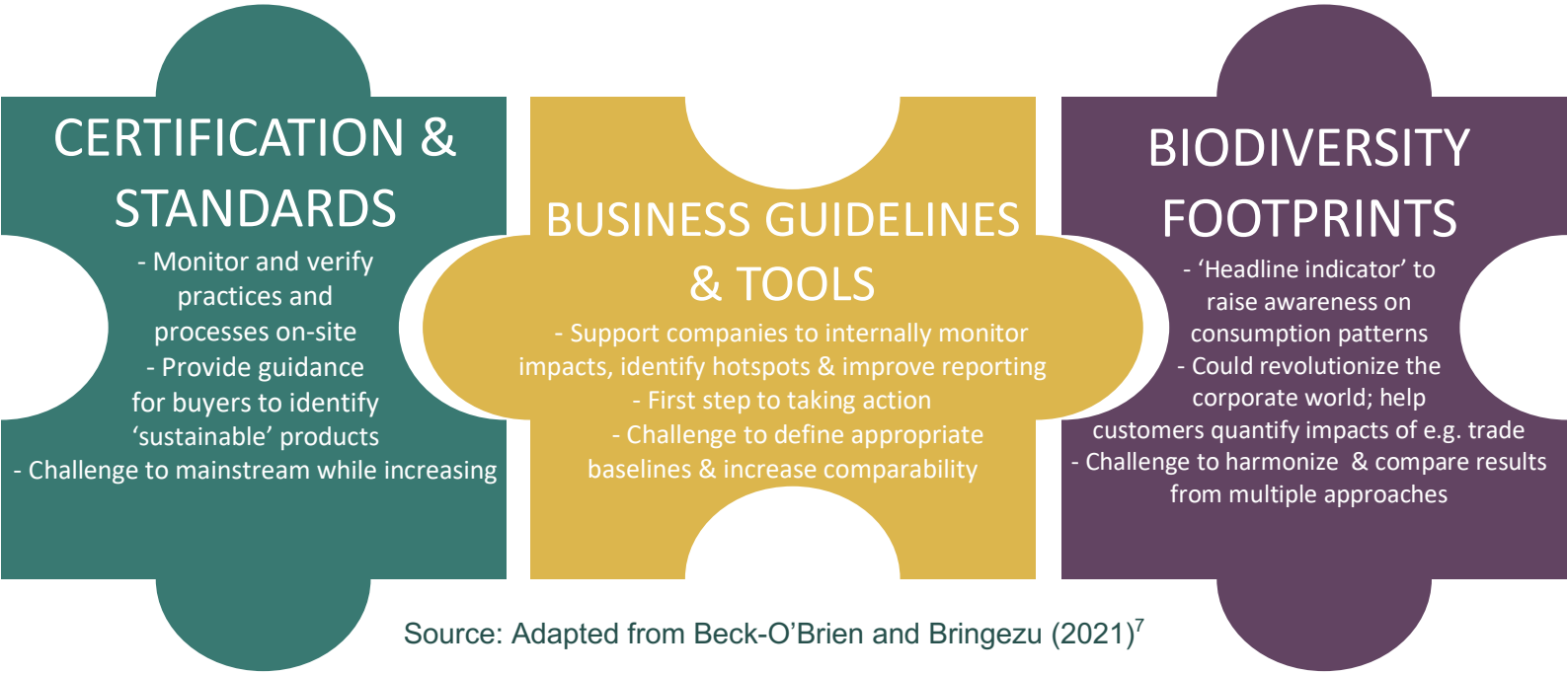
Introduction

There are a host of new tools, methods and initiatives tackling biodiversity monitoring from different angles and perspectives. However, we are not always 'speaking´ the same language. Expertise is built and deepened in different research arenas and it is a challenge to cross sectors, **match needs to appropriate indicators** and keep the big picture in sight. The AKRIBI[1] project explicitly aimed to collect and learn from the input of stakeholders at the beginning of the scientific processes. The objective was to understand the needs of stakeholders and to gather their input on whether a monitoring approach--based on regional assessment of **biodiversity risk**--could provide a useful tool for responsible food sourcing. It was intended that this tool would complement ongoing activities.

To this end, the project team reviewed existing studies and published a "method report" in early 2021[2]. The report looked at how food products are related to biodiversity impacts at the beginning of their upstream production. It aimed to provide clarity into the scope of different types of biodiversity monitoring activities, improve understanding of how those methods complement one another and highlight potential gaps from **a systems perspective**. Three main categories of approaches were identified and discussed: certification and standards, business guidelines and tools, and biodiversity footprints (Figure 1). This paper provided a common basis to discuss the scope of activities across multiple scales in three stakeholder workshops.

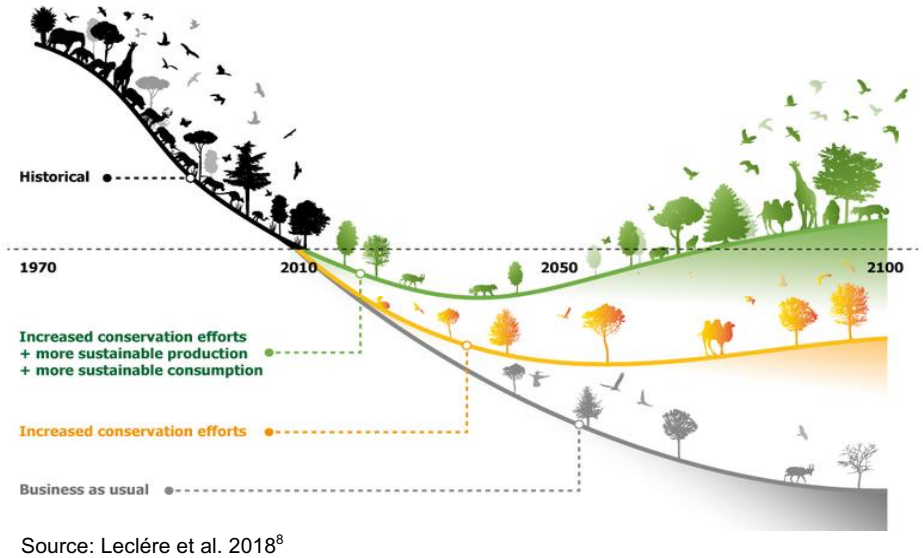
The stakeholder workshops were attended by 46 stakeholders representing food retailers, standard organisations, producer cooperatives, associations, public service authorities, and science and environmental organisations. Many of the stakeholders attended multiple workshops, enabling deeper discussions and more targeted feedback. This short paper reviews and compiles the key inputs gained in those workshops. It also discusses the feasibility and need for biodiversity footprints based on regional trend assessment. Altogether, we recommend further investing in methods to strengthen biodiversity monitoring and in investigating how risk related to land use and land use change is understood, evaluated and communicated. A **food-system transformation** that incorporates biodiversity conservation across all scales and practices is needed. This is the only way to keep agriculture within the planetary boundaries and meet the needs of future generations for resilient, robust and regenerative models of agriculture, business and consumption.

Figure 1. Complementary approaches to monitor biodiversity across food supply chains



Source: Adapted from Beck-O'Brien and Bringezu (2021)[7]

Figure 2. Bending the biodiversity curve



Source: Leclére et al. 2018[8]
Note: The artwork illustrates the main findings of the article, but does not intend to accurately represent its results

Modelling has shown that turning around trends in biodiversity loss is both possible and necessary. It requires changes in both production *and* consumption.

Three virtual workshops took place on the 23rd November 2020, the 19th January 2021, and the 25th February 2021. The workshops addressed three questions:

- What are the stakeholders' expectations regarding the biodiversity impacts of land use of agricultural products at home and abroad?
- Are the indicators and assessment criteria, generated by the scientific work (and presented in the method paper), understood by stakeholders, e.g. in business and trade sectors?
- How do stakeholders judge the usability of the indicators and criteria with regard to motivation and implementation of changes in their own fields?

Stakeholders from the food industry in Germany were invited to participate. Target groups included:

- Companies in the food industry, including food manufacturers and retailers
- Industry associations
- Standard organizations for international food standards
- Industry initiatives like the Association of Organic Food Manufacturers, Sustainable Palm Oil Forum, Sustainable Cocoa Forum, Sustainable Coffee Forum, etc.
- Governmental institutions and initiatives
- Environmental organizations including WWF (Worldwide Fund for Nature), GNF (Global Nature Fund), Oro Verde (rainforest foundation), IUCN (International Union for Conservation of Nature)
- Scientific institutions including the German coordination office of the IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services), iDiv (German Centre for Integrative Biodiversity Research) and Fibl (The Research Institute of Organic Agriculture).

Within the companies, employees, responsible for sustainability aspects and those responsible for purchasing and product quality were addressed. The Bodensee-Stiftung used its address pool and invited 172 people from 111 Organisations.

Stakeholders brought different levels of expertise and experience to the table. All had experience using standards in some form and some had applied life-cycle-assessment approaches, hot spot analysis or used tools such as GRAS (www.gras-system.org).

Workshop 1: Expectations

The first Workshop took place in November 2020 with 34 stakeholders from multiple types of organisations (Table 1). It started with an introduction to the problem and an overview of the approaches to monitor biodiversity in supply chains. The term biodiversity, the role of the food industry and an overview of accounting approaches (like standards, business guidelines and biodiversity footprints) were discussed.

Stakeholder discussions were conducted in three break-out groups. The discussions focussed on what type of information is needed as relates to aspects of biodiversity, the geographical scope, targeted product groups, usability, supply chain communication, and cost. The following summarizes stakeholder responses to the questions.

Table 1 Stakeholder breakdown

Organisation	Participants
Certification organization	2
Company	16
Consulting	1
Governmental institution	3
Industry association	3
NGO	7
Research	2
Total Number	**34**

"Meeting the world's increasing demand for food while still reducing agriculture's environmental impacts is one of the defining challenges of our times."

- IPBES 2019[9]

Aspects of biodiversity

Which aspects of biodiversity should be included, and in what level of detail?

- The importance of aspects of biodiversity can vary from **region** to region. A distinction is necessary: cross-regional biodiversity aspects and local impacts.
- Biodiversity aspects also depend on the raw material - there are **different challenges** and different levels of importance of raw materials for the company. An in-depth analysis may not be necessary for all raw materials.
- Soils/soil biodiversity, **habitats,** land use, quality of agro-forest systems, and deforestation should be assessed. In the case of important raw materials, all aspects of biodiversity should be included in detail, i.e. also fauna and flora, especially insects.
- The assessment should also take into account **social aspects** related to biodiversity. Example: Development of water resources = aquatic ecosystems and their importance for the local population.
- Consider the effects of **climate change.**
- Consider **political framework** conditions (e.g. legal requirements, government management initiatives/projects).
- So far, expectations have only been met for **hotspot analyses** for certain raw materials and procurement regions.

Toolkit

What information has priority for the "toolkit"?

- ecosystems/habitats,
- land use,
- deforestation,
- quality of agro-forestry,
- inventory of biodiversity (e.g. insects, small mammals, botanical diversity),
- new techniques of species monitoring, e.g. to detect insects using sound monitors,
- soil fertility/biodiversity,
- area relevance of the measures,
- drivers of biodiversity loss vs. impacts / real losses (impact endpoints); Suggestion: focus on the drivers in action planning/implementation.

These issues are complex. There is an expressed need for scientific input and support.

Geographical scope

Which countries/regions should be given priority?

- The knowledge base is different; therefore, regions should first be included for which there are little information (= developing countries).
- Regions from which the most important **raw materials are sourced** (e.g. palm oil, soy, coffee, bananas ...).
- Since supply chains work worldwide, **global applicability** is generally of interest. Almost all continents were mentioned: Europe (especially Germany), Asia, Latin America, Africa.
- In the case of fruits and vegetables, the first approach is to buy as regionally as possible. However, the suppliers here are also diverse and from different regions. For coffee, Vietnam and Brazil are classified as important countries.

"Bold changes to the direct drivers of the deterioration of nature cannot be achieved without transformative change that simultaneously addresses the indirect drivers." -- IPBES 2019[9]

- As many regions as possible should be covered, because companies mainly purchase from different regions because of the **security** of raw materials.
- Regions from which raw materials are obtained which are particularly **critical for biodiversity**.
- Regions with high potential for **restoring biodiversity** and **biodiversity hotspots.**
- Also due to the different regional challenges, the subject of biodiversity assessment is extremely complex in comparison to the climate.
- A map with an initial overview of "**no go areas**" / high-risk regions would be useful. For example, regions with a high proportion of **deforestation**.
- Of the existing instruments, the **GRAS tool**[3] had been used with positive experiences with it. **IBAT**[4]**, Globio**[5]**,** or **WWF Map of Biodiversity Hotspots**[6] had not yet been used, but were mentioned.

Product-related area of application

Are there product groups that should be given priority?

- Palm oil, soy, animal products (meat, milk, eggs) = high impact products.
- Products that use many pesticides.
- Monocultures (e.g. bananas, sugar cane, sugar beets, coffee).
- Grain because of the vast amount of land in which it is grown.
- Here, too, the question should be asked: **Which products pose a particularly high risk to biodiversity? Which products have great potential for creating biodiversity (possibly within the production systems)?**
- Non-food products are not yet very much in focus, but could also be considered more.

> *"…the food retail sector [is] in a privileged position to foster "sustainability by consumption" and to support the protection of biodiversity."*
> -European Business and Biodiversity Campaign 2014[10]

Usability

What are the key aspects related to usability?

- The method/instrument should provide data that the **user needs** for his or her decisions. The most important question is: who are the main users? A shopper? Who decides what is procured where?
- Risk analysis and **universally applicable** indicators are needed
- A **balanc**e between biodiversity issues, other environmental issues, but also all other production issues must be preserved.
- Implementation must take place in **cooperation with the certifiers and farmers**.
- So far, the approach has been to measure biodiversity via standards. Tightening and **streamlining** standards would be welcome instead of a new system/label.
- Secondary data and satellite images as a basis of information are easy to imagine, with expert evaluation providing **no extra burden** for the practitioner.

"Lessons from conservation project management suggest that a systems-based approach, linking indicators to goals in order to answer specific management questions, is most effective for monitoring biodiversity." -IUCN 2020[11]

Communication along the supply chain

What are the key aspects related to communication that must be included?

- Very close communication between **production and purchasing** (to ensure compliance with ecological and social requirements).
- Additional requirements (e.g. through the inclusion of information) must also offer **added value** at the beginning of the supply chain.
- Successes and achievements for biodiversity can be communicated to the **consumers**, if necessary a higher price can be achieved. But, it is also a challenge to convey the numerous and complex requirements and information on the product. Consumers need to trust the **retailer/**supermarket.
- A challenge is conveying the extra effort to **producers:** Integration of biodiversity into the existing standards is needed.

Costs

How much can and should a tool cost?

- Depends on the scope/details of the information.
- The **cost-benefit ratio** must be right.
- Large companies can afford to commission hotspot analyses for certain raw materials. SMEs often have fewer resources, i.e. the **costs should be manageable**.
- The challenge is the increasing costs for the acquisition of the data with increasing sharpness of detail. The source data for the assessed indicators must remain affordable. Evaluation of satellite images could be very promising. The identification of the species is more difficult because a lot more effort is required from **experts.**
- A good tool needs to work with **updated** information; that is a cost.
- The combination with other topics makes it even more complicated and therefore possibly more expensive. Nonetheless, it is of great importance. However, there may also be **synergy effects** through parallel data acquisition, etc., or similar measures that are e.g. good for the climate and biodiversity, such as reforestation/agroforestry systems in some cases.

Workshop 2: Criteria

The second workshop took place in January 2021 with 32 stakeholders. At the beginning of the workshop an overview of the existing instruments, indicators and assessment criteria was given. In three breakout groups, evaluation criteria for sourcing agricultural raw materials was discussed (Table 2). The question of which criteria were considered to be important, dispensable or missing and which evaluation criteria need clarification, guided the discussions.

The resulting discussion focused on themes related to the topics of land use and land use change, the use of chemicals and water, land management, habitats, and environment and biodiversity management. The restoration and creation of habitats was noted to be of great importance. The key challenges identified included the identification of **habitat quality** and costly expert inputs to monitoring and evaluation. The interconnectedness (or isolation) and share of habitats can provide a measure to evaluate biodiversity. Wide buffer zones along water bodies may serve as biological corridors between habitats. Diversity of use at the **landscape level** adds important valuation criteria for biodiversity. Diversification can be achieved through diversification at an area level, a low share of monoculture areas, or the adoption of agro-forest systems, among others.

Additionally, the share of organic and other biodiversity-friendly cultivation methods can support the evaluation of a regions' biodiversity. While the use of pesticides and mineral fertilizers is **measurable and identifiable**, these are expressed rather per production unit than area, requiring expertise to evaluate impacts. Altogether, **management tools** can be used to address the specific conditions in a company. The tools can allow the continuous monitoring of improvements. Therefore, the adoption of management or action plans can provide relevant criteria on operational and regional levels.

Table 2 Overview of key stakeholder input related to evaluation criteria

Evaluation criterion / measure	Reasons for importance	Needs for clarification
Land use changes	Measurable and identifiable	Which ecosystems are worth protecting and must not be destroyed/degraded? Forests, wetlands, moors, savannas, Grassland / permanent grassland ... How do you deal with changes in land use allowed by law?
Deforestation - free supply chains	Measurable and identifiable	Which cut-off date should be chosen? Are there reliable instruments (GIS etc.) that can be used to differentiate between primary and secondary forests?
Exclude hotspot regions	Easily identifiable when it comes to protected areas. Difficult when there is no protection status and / or with High Conservation Value Areas (HCVA) that first have to be identified	Most tools and maps that identify hotspots are chargeable. There are also still large gaps.
Pollinators / insects	Insect loss is very present in the industry. Monitor key indicator species.	Are experts needed for inventory and monitoring? Cost factor.
Restoration/creation of habitats	Not only the protection of the existing ecosystems/habitats is important, but also the restoration and creation.	How can the quality of habitats be determined?
Governance of the sourcing regions	Review of compliance with environmental and nature conservation laws; Monitoring; transparent reporting….	European Commission for an assessment framework on environmental governance in the EU Member States; abroad?
Use of pesticides	Easily measurable and identifiable	Not per area but per production unit.
Implementation of integrated pest management (IPM)	Consistent implementation leads to a reduction in the use of pesticides	Verification that all elements of the IPM are implemented.
Mineral fertilizer use	Easily measurable and identifiable	Not per area but per production unit

Table 2 Overview of key stakeholder input related to evaluation criteria

Evaluation criterion / measure	Reasons for importance	Needs for clarification
Soil fertility/humus formation	High relevance for soil biodiversity	Measurement methods that can also be used by small farmers. Soil fertility at the regional level? How can that be measured?
Water consumption and water pollution	Great importance for biodiversity	Water Risk Filter as a good tool for data usage/processing, the criteria of Sustainable Program for Irrigation and Groundwater Use (Global G.A.P) could be considered.
Eutrophication of water bodies	An important factor for the quality of the water. It also reflects non-point agricultural pollution.	Who is responsible for monitoring the waters? How are the monitoring results taken into account? Will agriculture be reduced if necessary?
Ecological services related to water	Provisioning services for biodiversity	Who is responsible for monitoring? How are the monitoring results taken into account?
Diversity of use at the landscape level	Diversification of the landscape for species	
Share of monoculture areas in the region	The higher the proportion, the greater the negative impact on biodiversity	
Diversity of use on the area (e.g. crop rotation)	Diversification of acreage for species	
Diversity in agro-forest systems (shade trees)	The more diverse, the more potential for biodiversity	
Cultivation methods in the region	Share of organic and other biodiversity-friendly cultivation methods	
Extensive grassland management / extensive grazing	Diversification of acreage for species	
Habitats / biotopes / (conservation and creation)	High degree of relevance for species	
Food supply for insects	A high degree of relevance for species	How can small areas / other offers be recorded - on the farm? For the region?
Interconnectedness of habitats	A high degree of relevance for species	Share of networked habitats in percent.
Wide buffer zones along bodies of water	Protection of aquatic ecosystems and biological corridors.	Information at a regional level? The water authorities? Protecting small bodies of water?
Biodiversity index values	For example shows range rarity rated richness	Very laborious to record, but increasingly feasible with new technologies (e.g. maps)
Ecosystem health	*Key indicator species could be used.*	Monitoring must be carried out with the support of experts = expensive
Biodiversity management on the operational level with baseline and monitoring	Management tools can be used to address the circumstances of the operation. Appropriate for a living system. Continuous improvements can be monitored.	How do you ensure that all relevant elements are taken into account? Quality of the management plans? Evaluation of the results? Data would have to be recorded. A biodiversity risk filter (Global G.A.P.) for water?
Biodiversity Action Plan	Output from management. See above.	Record the baseline (structured, all important elements). Monitoring plan implementation.
Training of farmers	Further training helps to raise awareness and improve the quality of the implementation of measures	Recording / evaluating the quality and frequency of the training?
At the regional level: How many companies have a management/action plan?	Management tools can be used to address the circumstances of the operation. Appropriate for a living system. Continuous improvements can be monitored.	Could be recorded via the certified companies = standards with management criteria. Question of quality see above.

"More work is required before biodiversity will be mainstreamed and systematically applied in business decision making." -Neveux et al. 2018[12]

Workshop 3: Applicability

Eleven stakeholders participated in the final workshop in February 2021. Based on the findings of workshops 1 and 2 the key questions discussed entailed: Are the methods and tools presented being used? If so, on what occasions? Which specific aspects ensure applicability? What framework conditions are needed?

Methods and tools

Stakeholders identified the use of „Biodiversity Performance Tools" on a farm level, providing hot spot analysis and supporting farmers with Biodiversity Action Plans. To integrate biodiversity, add-ons to existing standards have been developed for specific crops. The extensions aim at enabling water and biodiversity assessments beyond the farm level.

Usability

Biodiversity indicators are underrepresented in existing standards and pioneering companies with international supply chains act in isolation and therefore lack the coverage in respect to geographical area and supply chain participants. Due to the large number of systems, a **risk of audit fatigue exists**. The requirements must be easy to understand and implement with clear benefits for the user.

Communication

Consumers are unable to keep track of all processes across the value chain of all the products they use in daily life. The tool should be aimed more at professionals and producers. However, benefits should be made visible to consumers. Therefore, an extensive dialog with retailers is required.

Framework conditions

Assessment costs are a key consideration, as the marketability of the products must be maintained. The tool must be based on flexible guidelines to be adopted by different companies and products. However, the requirement needs to be clearly defined to enable the application of biodiversity protection measures and identify their impact on biodiversity ranking.

Key factors for the adoption of biodiversity assessment tools are identified as:

- **Legal requirements are more effective than voluntary initiatives**. Therefore, supply chain-based legislation would be important to protect biodiversity.
- **Certification should extend to companies** and not be limited to specific products.
- Quantified results of certifications are required to enable the **communication of measures**.

Feasibility assessment

Valuable feedback was gained in the stakeholder workshops. There is a **clear need for expanding mainstream criteria and norms to include biodiversity**, which stakeholders report as having been insufficient and/or missing in most cases so far. The representatives of the food sector consider global maps with no-go areas to be important, as well as information on regions about which there is little information and/or from which the most important raw materials are sourced.

A method to complement standards by focusing on regions would be welcomed, especially if it helped **to fill knowledge gaps**, complemented or could be **integrated into existing tools** and helped to mainstream and **streamline processes** of qualification. Biodiversity footprints of source regions was a more novel concept, and general willingness and urgency on the need for change were widely expressed.

A regional biodiversity footprint tool could support the following scenarios:

- The improvement of the biodiversity performance of **existing supply chains** (e.g. better overview of the biodiversity footprint of producers and suppliers beyond the farm, risks for biodiversity in the region, and corresponding approaches for measures and programs);
- a change from or listing of **new suppliers** (e.g. comparison of biodiversity risks in the different cultivation regions)
- the supply of **increased demand** (e.g. effect of the increased production volume on the biodiversity in the region).

Adoption

The stakeholder-oriented risk classification system of agricultural export regions should be based on scientifically sound findings (on losses of biodiversity and soil fertility connected to different forms of land use and land-use change) and use socially relevant criteria for prioritizing protected goods and risk avoidance. Additionally, a key consideration for successful adoption is a close sustained collaboration with the stakeholders. The usability and transparency of the provided information must be tangible. Additionally, the knowledge basis on how biodiversity loss is currently perceived across supply chain management and related to supply chain risk requires attention.

Technical considerations

The biodiversity risks of agricultural commodity production must be quantified in a spatiotemporally explicit way and under consideration of data uncertainties, and application of these tools to provide a global database of agricultural biodiversity footprints/risks. Furthermore, the global database requires to include commodity-, region-, and year-specific biodiversity risk indicators for use in commodity footprint assessment. Additionally, suitable global spatial data sets and studies on the risks of soil degradation through agricultural land use (arable farming, grasslands) and the associated effects on biodiversity are available and can be merged as part of the system.

Challenges

The aim is to identify potential trade-offs and synergies between achieving multiple goals (e.g. reducing biodiversity loss and raising socio-economic benefits) in supply chain management. Specifically, an engagement with actors in the producing regions is required to assess opportunities for biodiversity recovery and threats to biodiversity as the result of shifts in demand.

Conclusions

The AKRIBI project design promoted **co-learning between stakeholders** (practice partners) and science (researchers). This is a model which could help to produce **usable and useful data** for stakeholders in the future. Trading companies, food producers, society at large and policy makers need better data on biodiversity impacts connected to their supply chains and levels of demand. The following questions should be further explored in multi-stakeholder workshops:

- How can the risk of biodiversity losses in different agricultural production regions around the world be determined and classified?
- How can stakeholders use this data to make decisions on how and where they source their direct and indirect raw materials?

The food industry is currently overwhelmed by a flood of labels. An additional approach should not add to confusion or dilute and/or erode trust. Incorporating tools to monitor biodiversity into existing standards and certification systems could help to promote uptake and strengthen **reliability and trust**. Specifically, a tool that enables retailers and food processing companies to better assess the sustainability of the places they source their raw materials from by providing information on the risk of purchasing from those regions with regard to the biodiversity and ecosystem services effects of land use would be valuable.

References and notes

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