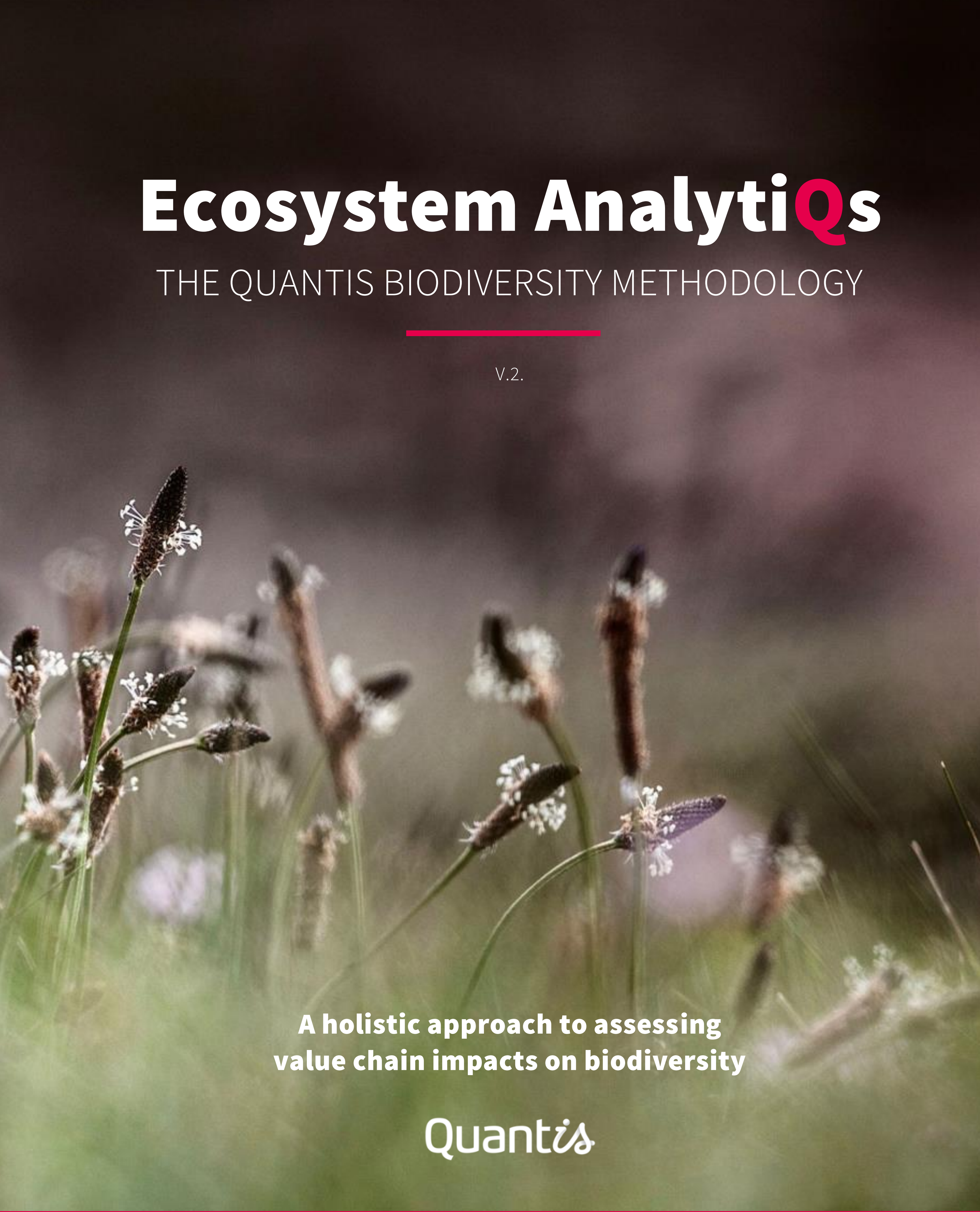

Ecosystem AnalytiQs

THE QUANTIS BIODIVERSITY METHODOLOGY

V.2.

A holistic approach to assessing value chain impacts on biodiversity

Quantis

PURPOSE OF THIS DOCUMENT

This document, authored by Quantis, explains our methodology for evaluating companies' impacts on biodiversity across the entire value chain using the latest scientific developments available, to inform our clients and partners.

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ABOUT QUANTIS

Quantis guides top organizations to define, shape and implement intelligent environmental sustainability solutions. In a nutshell, our creative geeks take the latest science and make it actionable. We deliver resilient strategies, robust metrics, useful tools and credible communications for a more sustainable future.

DID YOU KNOW?

+ Quantis is a member of the expert committee and reviewed the Science Based Target Network for Nature (SBTN) initial guidance for business[1]. Quantis is continuously improving its biodiversity impact assessment methodology in order to enable companies to set science-based targets to operate within planetary boundaries.

The approach proposed by Quantis is fully in line with the work carried out by the SBTN.
The SBTN defines five steps to building a biodiversity strategy:

1/ Assess
2/ Interpret and prioritize
3/ Measure, set & disclose
4/ Act
5/ Track

In order to prioritize (2/) and define a robust baseline (3/), Quantis' methodology enables companies to identify their impacts along the entire value chain taking a life cycle assessment (LCA) approach, with regionalized specificities and consideration for the main biodiversity loss drivers defined by the IPBES.

+ Quantis is an active participant in the European Union's Align Project, which aims to standardize the metrics used to quantify companies' biodiversity impacts[2].

CO-AUTHORS

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[1] SBTN: https://sciencebasedtargetsnetwork.org/wp-content/uploads/2020/09/SBTN-initial-guidance-for-business.pdf
[2] The Align Project: https://ec.europa.eu/environment/biodiversity/business/align/index_en.htm

1. Introduction

1.1. Context

Facing profound disruption, the need to **drastically shift the way** we grow, govern, produce and consume as companies, governments and individuals has never been clearer. The **ecological collapse** represents dire consequences, not only for wildlife, but also for human health and survival.

KEY FACTS[3]

+ Global economic growth since World War II has resulted in exponential improvement for humankind, at the expense of the stability of the earth's production systems, upon which we depend for survival. Change in land use, including where and how we produce food, clothes, energy and so on, is one of the greatest threats to biodiversity.
+ Humans are now overexploiting the earth's biocapacity by at least **56%**.
+ **75%** of the terrestrial environment is severely altered to date by human actions (marine environments 66%).
+ **300-400 million tons** of heavy metals, solvents, toxic sludge and other industrial waste is dumped into the world's waters annually.
+ The ocean is also under pressure from overfishing, pollution, coastal development and climate change, to the increasing detriment of marine ecosystems.

[3] IPBES report 2019: https://ipbes.net/global-assessment

Biodiversity loss has now exceeded its planetary boundary[4]. Pressure on the natural functioning of ecosystems is largely driven by production-consumption systems[5].

The five direct drivers of the biodiversity collapse for land, freshwater, and sea or oceans, according to the IPBES[6], are illustrated in the figure below:

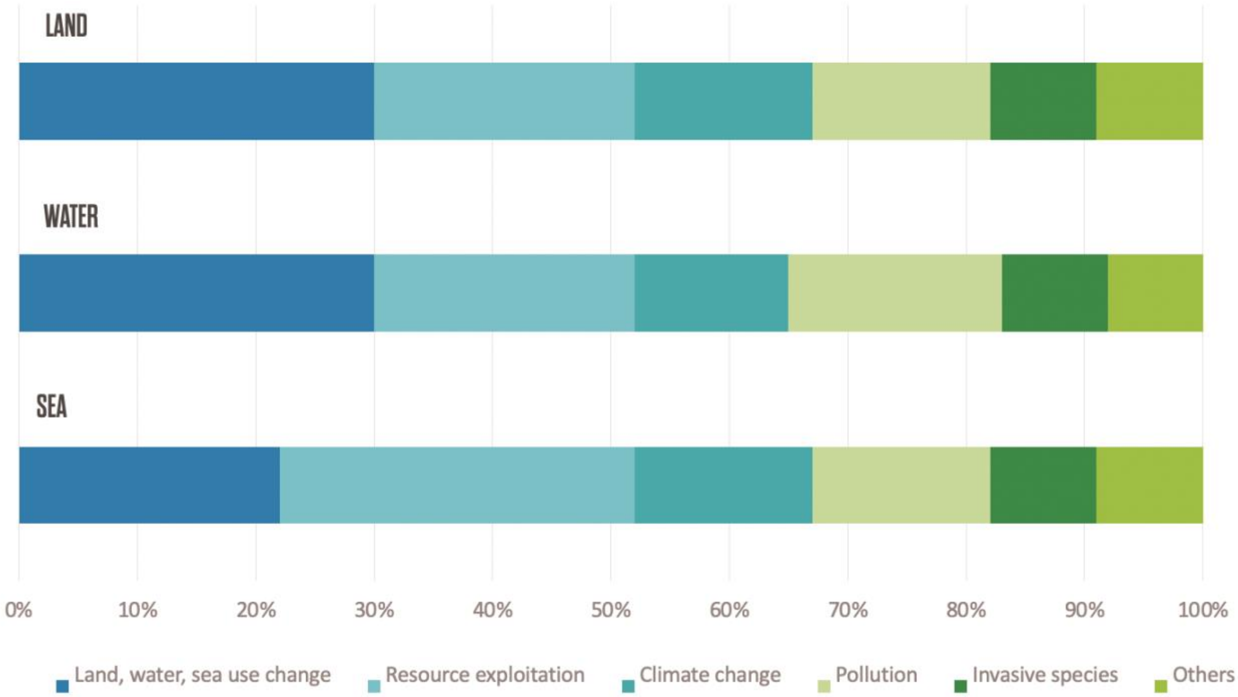

Figure 1: Contribution of each pressure on biodiversity per type of habitat (Source: IPBES report 2019)

Those five direct drivers result from an array of underlying causes – the indirect drivers of change – which are underpinned by societal values and behaviors that include:

+ Production and consumption patterns
+ Human population dynamics and trends
+ Trade
+ Technological innovations
+ Global governance

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[4] Newbold T, Hudson LN, Arnell AP, et al. 2016. Has land use pushed terrestrial biodiversity beyond the planetary boundary? A global assessment. *Science* (6296) 353:288–291. doi: 10.1126/science.aaf2201
Mace G, Reyers B, Alkemade R, et al. 2014. Approaches to defining a planetary boundary for biodiversity. *Global Environmental Change* http://dx.doi.org/10.1016/j.gloenvcha.2014.07.009
[5] Crenna E, Marques A, La Notte A, & Sala S. 2020. Biodiversity Assessment of Value Chains: State of the Art and Emerging Challenges. *Environmental Science & Technology*, 54(16), 9715-9728. doi:10.1021/acs.est.9b05153
[6] IPBES report 2019: https://ipbes.net/global-assessment

A decline in essential services underpinned by biodiversity may lead to severe socio-economic consequences, both in the short and the long term[7]. Although life cycle impact assessment methodologies exist to quantify impacts on biodiversity (i.e., ecosystem quality), in practice, a standardized approach to quantifying corporate biodiversity footprint hasn't been developed yet. Hence, there remains a gap between knowledge and practice when it comes to assessing impact and prioritizing actions which address this impact on biodiversity. Nonetheless, multiple methodologies have been developed on specific topics in recent years, so we can start working on reducing biodiversity impacts[8].

There are several major challenges when measuring and managing biodiversity — which is very site-specific — at a corporate scale. For example, conservation efforts for certain species in specific areas where production is halted or reduced, cannot easily be linked to corporate value chains. Another major challenge is that companies that buy and sell hundreds — or even thousands — of products, do not always know the precise location of their supply chain activities. Often, they will only know the country of origin, or perhaps even just the commodity name if sourced from a global market.

NOTE

Biodiversity impacts are inherently local. This aspect must be addressed when choosing the scale of measurement in order to ensure meaningful actions are prioritized.

1.2. Purpose of the document

To make our methodology — and biodiversity measurements in general — actionable for companies, we have developed an innovative and holistic approach based on life cycle assessment to enable a streamlined analysis of companies' biodiversity impacts. The Quantis Ecosystem AnalytiQs (QEA) methodology enables the quantification and monitoring of company-driven loss of biodiversity, and aspires to fill the gap between knowledge and practice to allow companies to prioritize their actions around this fast-evolving issue. It represents a stepping stone to better assess value chain impacts on nature and aims to serve as a strong foundation for effective biodiversity strategies.

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[7] Kurth T, Wübbels G, Meyer zum Felde A, et al. 2020. The Biodiversity Imperative for Business. NABU - Bundesverband. Berlin, Germany
[8] Biodiversity measures for business report:
https://www.researchgate.net/publication/348311212_BIODIVERSITY_MEASURES_FOR_BUSINESS_-_Corporate_biodiversity_measurement_reporting_and_disclosure_within_the_current_and_future_global_policy_context

1.3. Acronyms

+ **EU B@B Platform:** European Business and Biodiversity Platform
+ **FAOSTAT:** Food and Agriculture Organization Corporate Statistical Database
+ **GHG:** Greenhouse Gas
+ **iLUC**: Indirect Land-Use Change
+ **IPBES:** Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services
+ **LCA:** Life Cycle Assessment
+ **LUC:** Land-Use Change
+ **NCS:** Natural Climate Solutions
+ **PDF.m2.year:** Potentially Disappeared Fraction of species in a square meter within a year
+ **QEA:** Quantis Ecosystem AnalytiQs
+ **WALDB:** World Apparel & Footwear Life Cycle Assessment Database
+ **WFLDB:** World Food LCA Database

2. Quantis Ecosystem AnalytiQs

2.1. Pioneering biodiversity assessments for business strategy and decision-making

By combining the latest sustainability science with extensive experience in value chain analysis, our scientists and business experts navigate the complexity of measuring nature loss to deliver tailored and actionable guidance for sustainable business strategies. Our innovative biodiversity assessments use a life cycle approach enriched with local considerations, to address climate change, water depletion, pollutant emission, land use and soil overexploitation. The Quantis methodology can be linked to a number of business applications proposed by the European Business and Biodiversity Platform (EU B@B Platform) supported by the European Commission[9]. The business applications that can be addressed include:

+ **BA 1:** Assessment of current biodiversity performance
+ **BA 3:** Tracking progress toward targets
+ **BA 4:** Comparing options
+ **BA 7:** Screening and assessment of biodiversity risks and opportunities
+ **BA 8:** Biodiversity accounting for internal reporting and/or external disclosure

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[9] EU Business @Biodiveristy platform supported by the European Commission https://ec.europa.eu/environment/biodiversity/business/assets/pdf/EU%20B@B%20Platform%20Update%20Report%203_FINAL_1March2021.pdf

2.2. Key steps for a comprehensive biodiversity strategy

2.2.1. Understand the role of biodiversity

Quantis helps businesses to train their teams and raise awareness of biodiversity issues by running workshops that leverage game-based learning. To demonstrate the potential instances of these issues throughout the value chain on this topic, Quantis developed a Biodiversity Discovery Game. This approach breaks down knowledge silos and fosters collaboration and communication between teams. An additional benchmark can be built to provide companies with insight into current activities in the market.

2.2.2. Identify hotspots, key sources and type of impacts in your value chain

Quantis uses existing carbon footprint-related data, where available, alongside supplementary location data, to map biodiversity issues throughout the entire value chain and identify potential hotspots. We use a holistic multi-criteria approach that quantifies impacts to inform strategy and decision-making.

NOTE

To ensure consistency between your climate and biodiversity strategies, we can assess the same categories of the GHG protocol across both perspectives.

This approach allows for:

+ A holistic approach to the issues along the value chain (Scope 1&2 and 3 — upstream and downstream)
+ Reporting methodology that is aligned with climate reporting (following the GHG protocol categories)

2.2.3. Set a biodiversity strategy with metrics-driven targets

Quantis assists companies in setting their biodiversity strategies by running tailor-made workshops to help define their level of ambition and focus areas based on SBTN. We guide your business in identifying the best metric-driven targets to set and ensure your strategy is effective and achievable.

2.2.4. Develop an action plan informed by robust metrics and science

After identifying your biodiversity hotspots and working with our leading experts on topics such as land-use change, deforestation-free supply chains and regenerative agriculture, we will co-develop a clear action plan to ensure you reach your biodiversity targets.

2.2.5. Inform and engage stakeholders

Communicating transparently and credibly on your biodiversity journey creates a trusted connection with your stakeholders and consumers, and helps build momentum towards greater positive change. Our experienced communications team works with you to increase awareness both internally and externally by co-developing communication materials and guiding you to make credible claims.

2.3. Quantifying biodiversity impacts: critical to a comprehensive sustainability strategy

Ecosystems provide many services, referred to as either ecological services or ecosystem services. These services can be classified into four types:

1. Provisioning services (agriculture, water, genetic resources, etc.)
2. Regulating services (clean air, filter water, flower pollination, tree roots retaining soil against erosion, etc.)
3. Cultural services (recreational areas, emblematic species, etc.)
4. Supporting services (ecosystem functioning such as photosynthesis, nutrient cycling, the creation of soil, the water cycle, etc.)

Any imbalance in these ecosystems has a negative impact on the whole chain. Ecosystems rich in biodiversity, wildlife, forests, wetlands, etc., are rich in ecosystem services but also under greater threat. In other words, preserving the most threatened ecosystem services means preserving biodiversity and wildlife, and vice versa.

Biodiversity is fundamental to long-term business continuity and resilience. It supplies the critical inputs and ecosystem services on which businesses rely. Furthermore, biodiversity underpins our food security, industry, economies and quality of life. Biodiversity is in free-fall owing to pressures from human activity. Biodiversity loss has now exceeded its planetary boundary, weakening ecosystem resilience and creating risks for the future of both nature and people on Earth. Businesses that integrate biodiversity impacts into decision-making (Figure 2) have an opportunity to future-proof their businesses and reverse the trend.

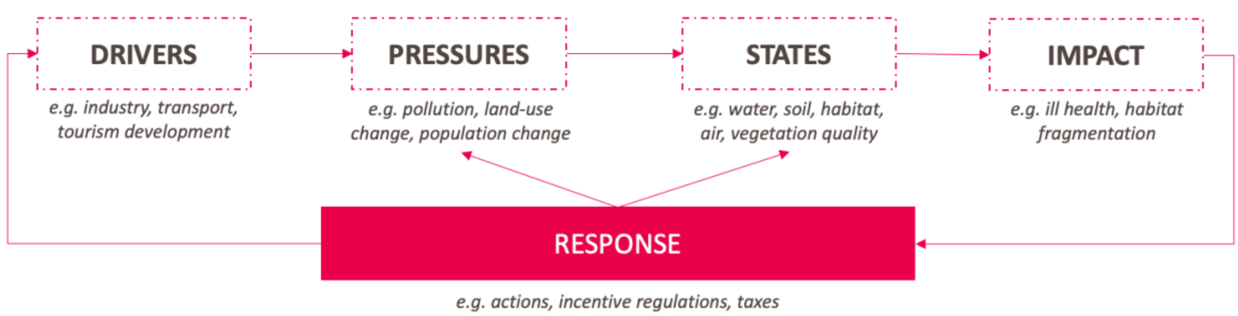

Figure 2: Links between drivers, pressures, states and biodiversity impacts

FOCUS BOX — Example: Palm oil in the food industry[10]

- **Driver**: increasing demand for palm oil in the food industry
- **Pressure**: land clearing for palm plantations, intensification of existing plantations, use of pesticides
- **State:** presence of pesticides in water, presence of plantations instead of forest, land transformation, erosion, soil degradation
- **Impact:** CO_2 emitted, species disappearing from certain areas (PDF), loss of carbon in the soil
- **Responses:**
  - **drivers**: reduce fat content of food
  - **pressure**: regulate land clearing and peat drainage, protect forests, ban certain pesticides, etc.
  - **state**: reforest, rewet peatland, treat water
  - **impact**: influenced by all other drivers, upstream actions will determine these outcomes

2.4. Quantis' biodiversity vision

According to the IPBES report[11], it is difficult to have a complete picture of the richness of species and genes that make up terrestrial and aquatic biodiversity and the diversity of ecosystems, and to then measure interconnections with precision. What we can understand and identify are the drivers of erosion, soil pollution and water pollution. Our approach is to thus quantify the specific implications of each driver on the whole value chain, consider the temporal dimension, and develop a full picture of the level impact on biodiversity, on the drivers and on the whole value chain, considering the impacts and the temporal dimension.

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[10] https://commons.wikimedia.org/wiki/User:Arbeck
[11] IPBES report 2019: https://ipbes.net/global-assessment

Table 1 details the links between the pressures and impacts at play in the biodiversity life cycle.

Pressure	Impact category covered	Impact not covered yet but under study
Land/sea use change	Land transformation	Sea use change
Climate change	Climate change	
Pollution	Ecotoxicity Acidification Eutrophication Photochemical Ozone formation Thermal pollution Ionizing radiation	Plastic pollution
Overexploitation	Water use Land occupation	Species exploitation
Invasive alien species	Not covered	

Table 1: Links between pressures and LCA impacts

3. Methodological guidelines

3.1. Biodiversity pressure

We use a holistic approach based on a peer-reviewed methodology (Impact World+[12]) that is supplemented to consider climate change, regionalized water depletion, pollutant emission, land transformation and occupation (Figure 3). To ensure accuracy when assessing the impact of land transformation on biodiversity we use a methodology based on the Dryad tool (refer section 3.2.2.) and the Natural Climate Solutions Guidance (NCS). The unit of this aggregated value is PDF.m2.yr, which is the Potentially Disappeared Faction of species in a square meter within a year (see below 'How to read the unit').

[12] Bulle C, Margni M, Patouillard L, et al. 2019. IMPACT World+: a globally regionalized life cycle impact assessment method. Int J Life Cycle Assess 24:1653–1674. doi: 10.1007/s11367-019-01583-0

The NCS Guidance provides a robust methodology to measure the GHG emissions from land, forest and soil across the supply chain that are embedded into corporate and product footprints, which can be used for science-based climate target-setting efforts. Based on this NCS expertise, and on country- and commodity-level inventory data detailing land transformation, we have developed a more accurate calculation of the impacts of land transformation on biodiversity aspects.

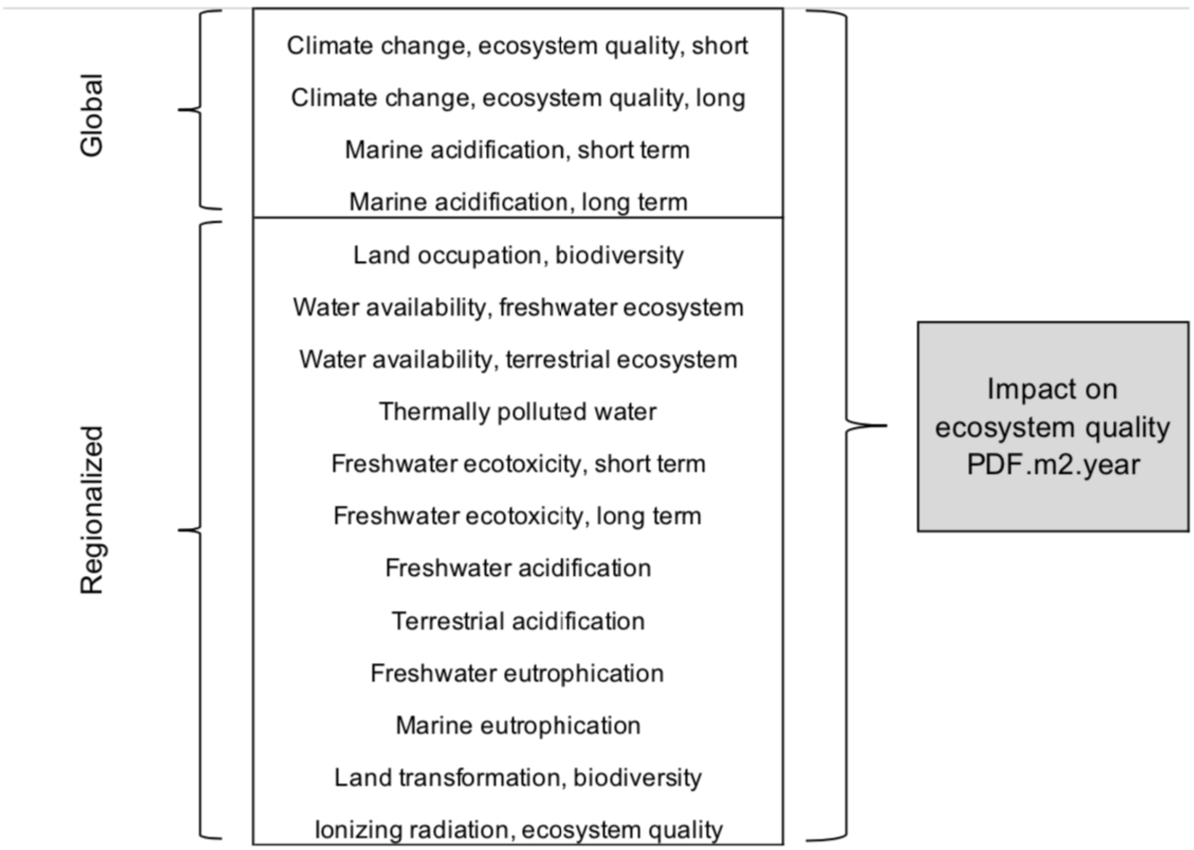


Figure 3: Ecosystem impact indicators as presented in Impact World+. The unit of this aggregated value is PDF.m$_2$.yr, which is the Potentially Disappeared Fraction of species in a square meter within a year.

HOW TO READ THE UNIT

PDF.m2.yr refers to the Potentially Disappeared Fraction of species in a **dedicated area** over a certain **period of time**. Below are the main components of the PDF.m2.yr:

>> SPECIES RICHNESS

PDF is a biodiversity-related metric that accounts for the fraction of species richness that can no longer be found in a given area due to human activity (drivers of biodiversity loss). There is a difference between 'species richness' and 'abundance of species.'

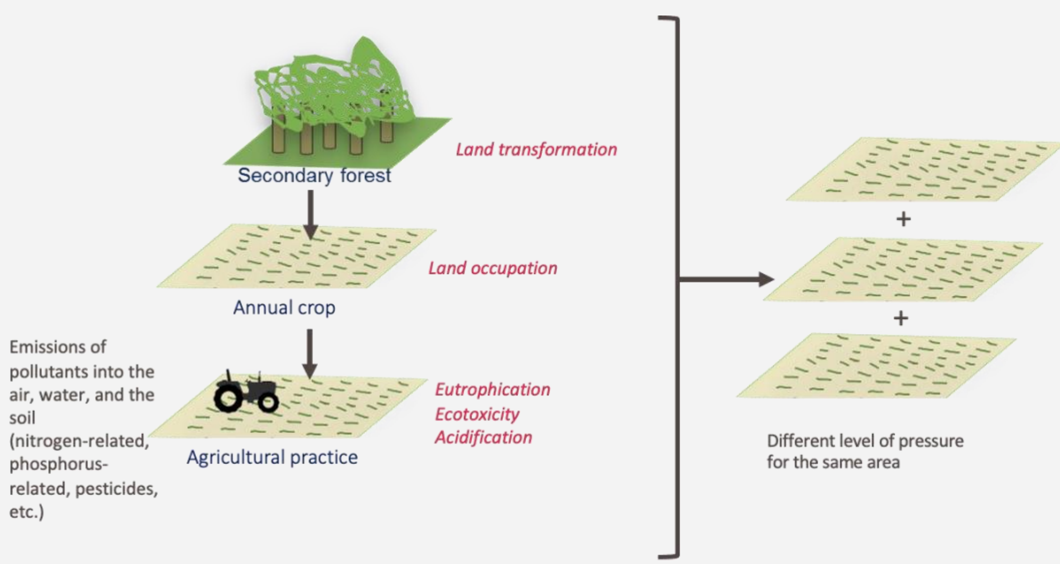
+ Species richness is the number of species in a given area
+ Abundance of species is the average number of individuals within each species (MSA reference unit)

>> ENDEMIC AND NON-ENDEMIC SPECIES

PDF may consider both endemic (species that are specific to a given ecosystem) and non-endemic species (species that can be found elsewhere).

>> AREA

The unit PDF.m2.yr takes into account the superposition of drivers of biodiversity loss on the same surface.



>> TIME INTEGRATION
When a degradation occurs, the ecosystem will be impacted until the degradation has fully regenerated. The PDF evaluates the impact of a degradation from the moment at which it occurs to the moment at which the ecosystem is fully regenerated.

Let's take the example of the cutting down of part of a primary forest such as the Amazonian Forest. Even if no human activity remains afterwards, the ecosystem will take time (decades or even centuries) to fully regenerate. The initial degradation therefore continues to impact the functioning of the ecosystem.

This persistent impact is accounted for in the '.yr.'

In short, 10 PDF.m2.yr can be interpreted as follows:
+ 10m2 has lost all its species over a year
+ 100m2 has lost 10% of its species over a year
+ 10m2 has lost 10% of its species over 10 years

NOTE
When considering 1m2, the biodiversity loss can be higher than 100 PDF.m2.yr as some ecosystems can take more than 100 years to fully regenerate.

3.2. Scope of environmental footprint

This methodology enables consistent calculation of the various impact pathways on ecosystem quality as PDF.m2.year. This allows corporations to compare between and across their product and service value chains and identify both hotspots — measured in PDF.m2.year — and levers for change related to the impact pathways. The scope of an environmental footprint represents all the life cycle stages required to fulfil the functional unit throughout the whole value chain.

Nowadays, thanks to considerable work by a number of expert groups, an initial mapping of the value chain is quite straightforward. The GHG protocol Standard details the requirements and guidelines for organizations to assess their carbon impact along the value chain, defining scope 1&2 and 15 distinct reporting categories in scope 3.

This structure provides a comprehensive view of the different levels of responsibility along the value chain and a simplified view of the issues to be addressed. Through this categorization, it becomes easier to explore indicators beyond climate, and to translate activity data into potential impact on biodiversity. It's an approach that requires attention to some specific data, such as geographical data, and extraction and cultivation methods. In the case of a corporate footprint, the functional unit is a year of activity.

Value chain categories for biodiversity footprint

Value Chain Categories	Included activities	Level of regionalization
Scope 1&2	Energy consumption of all sites Manufacturing of product	**Medium**
Purchased goods and services	Resource extraction, agricultural production and practices, recycled material for all company products, services and packaging	**High**
Upstream transportation	Transportation of all purchased goods and services to different manufacturing sites	**Low**
Waste in production	On-site waste treatment and waste transportation	**Medium/high**
Product distribution & storage	Transportation of products to end users	**Low**
Use phase	Use of the products and services	**Medium/high**
End of life of sold product	End of life after-usage of products	**Medium/high**
Investments	Level of responsibility of the company through its investments in different sectors	**Medium** (depending on the type of companies or sectors of investment)

Table 2: Corporate footprint categories and level of regionalization

3.3. What's behind our method?

The calculation of an environmental footprint relies on databases that quantify the impact of each life cycle stage. Specifically, data that captures the impact of activities located both upstream (e.g., material production, energy production, etc.) and downstream (e.g., use phase, incineration, landfilling, recycling) in the value chain. With land transformation and occupation as key drivers of biodiversity loss in this framework, Impact World+ examines data from life cycle inventory databases (WALDB, WFLDB, Ecoinvent) and land-use change (LUC) flows are modelled using existing guidance for LUC accounting[13].

3.3.1. Impact World+

IMPACT World+[14] is a globally regionalized method for life cycle impact assessment (LCIA), integrating multiple state-of-the-art developments as well as damage to water and carbon areas of concern within a consistent LCIA framework.

Most of the regional impact categories have been spatially resolved and all the long-term impact categories have been subdivided between shorter-term damages (throughout the 100 years after the emission) and long-term damages.

Impact World+ is based on a midpoint-damage framework with four distinct complementary viewpoints to present an LCIA profile:

+ Emissions to the environment and extraction of resources (e.g., CO2)
+ Midpoint impacts (e.g., contribution to climate change)
+ Damage indicators (e.g., impacts of climate change on ecosystems)
+ Areas of Protection (e.g., Ecosystem Quality, which combines the damage impacts to ecosystems from climate, land transformation, and other pressures on biodiversity)

[13] Quantis 2020. Accounting for Natural Climate Solutions - guidance for measuring GHG emissions from land, forests, and soils across the supply chain. Accessed 1 December 2020. https://quantis-intl.com/strategy/collaborative- initiatives/accounting-for-natural-climate-solutions/..
[14] Impact World+ Framework: http://www.impactworldplus.org/en/methodology.php

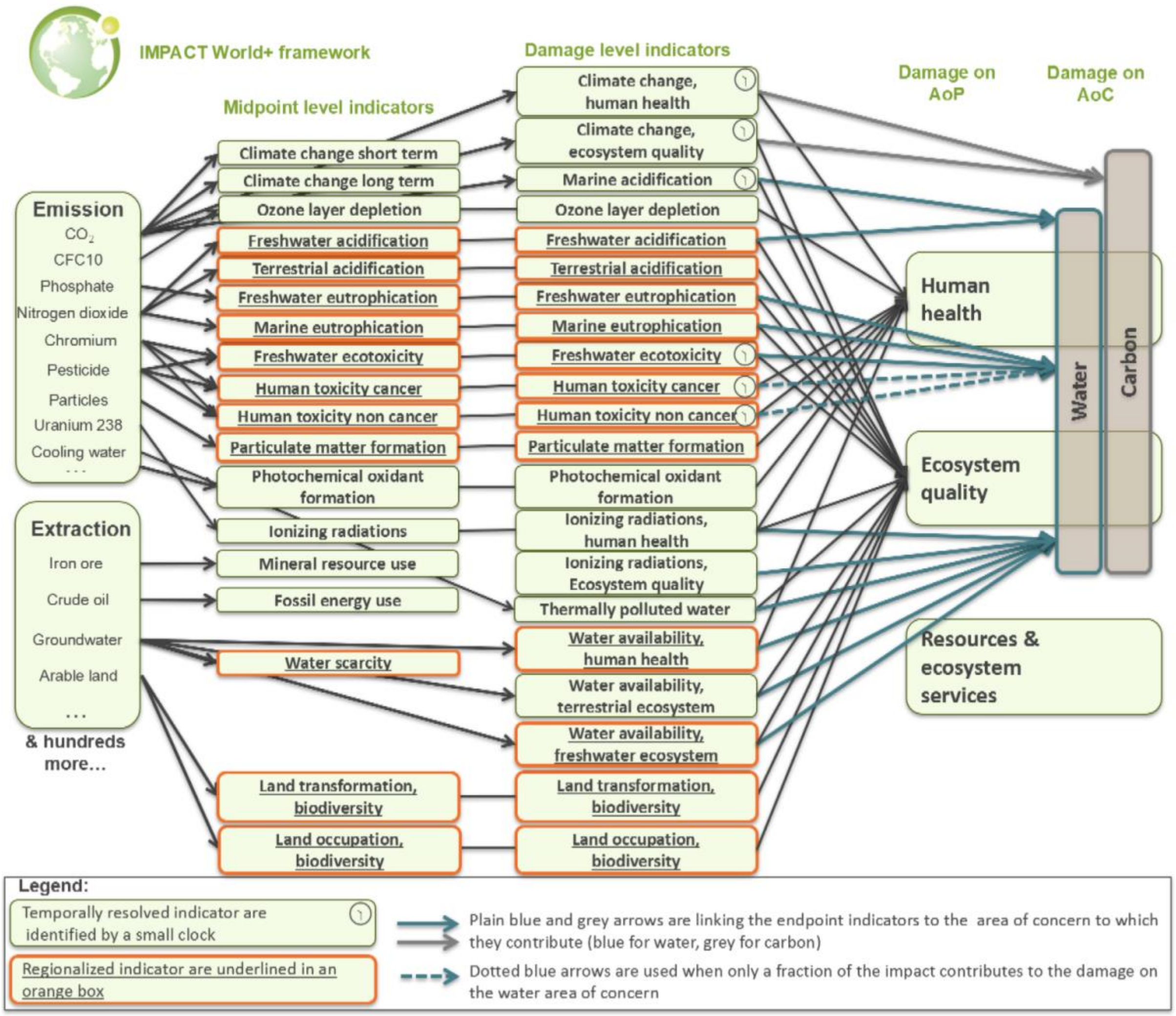


Figure 4: Ecosystem impact indicators Midpoint and Damage level, Impact World+ framework

IMPACT World+ enables the practitioner to parsimoniously account for spatial variability and to identify the elementary flows to be regionalized in priority to increase the discriminating power of LCA.

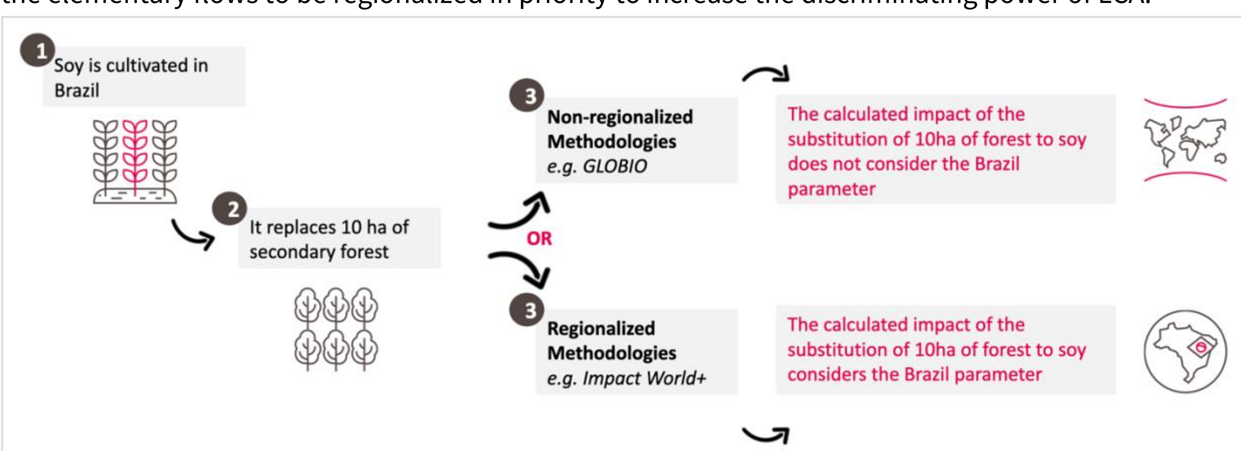


Figure 5: Impact Word+ framework regionalized vs non-regionalized

3.3.2. Dryad: Statistical Land Use Change

How to assess land use change

Dryad is our internal land-use-change (LUC) calculation tool focused on LUC legacy (timeline of 20 years) and calculates the average carried impacts of a crop for a given year with reference to past LUC. It is therefore not a prospective tool and does not calculate the anticipated potential impacts during a given year. It uses an attributional approach to determine a proxy for indirect land-use change (iLUC)and does not use a consequential approach nor does it assess large policy changes.

Dryad gives statistical LUC for a **given crop** in a **given country** (how the crop has evolved and at what cost to land use has it expanded). Dryad uses primarily FAOSTAT and IPCC carbon default values data. The impacts of this LUC are calculated based on IPCC 2006 methodology, under default and customizable assumptions. The results can be determined by measuring soil organic carbon change, vegetation change, erosion and peatland drainage.

Land use change drivers included in Dryad (see Figure 6):

- Increasing area
- Land degradation

The benefits of Dryad:

- Uses publicly available statistical data from FAOSTAT
- Clear visualization of land-use change per archetype typology (see Figure 7)
- Applicable for any crop and in any country
- Uses conventional non-discounted 20-year allocation
- Takes into account all carbon stock changes

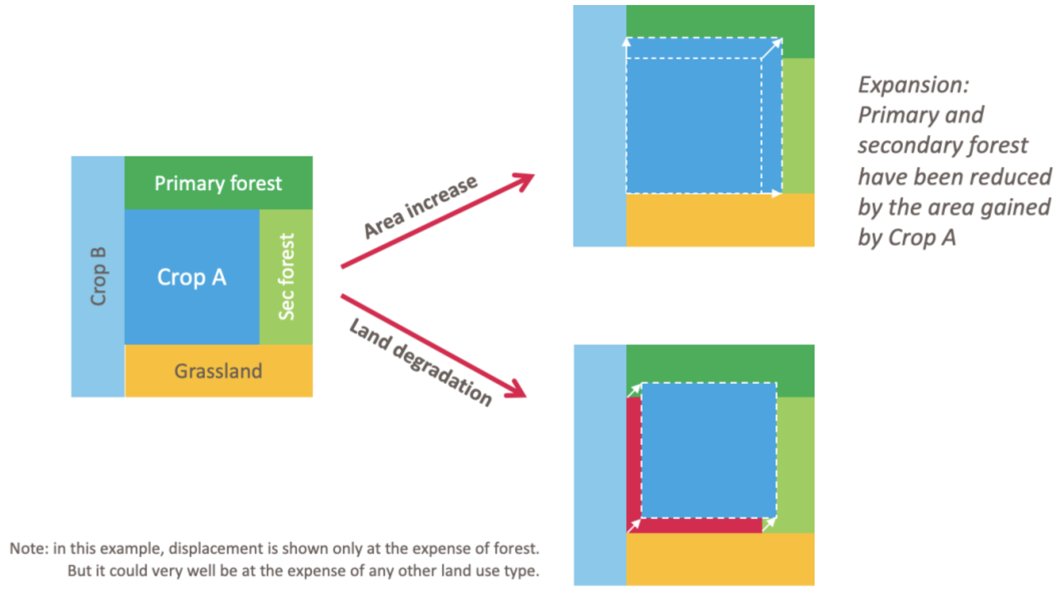


Figure 6: Land-use change modelling in Dryad

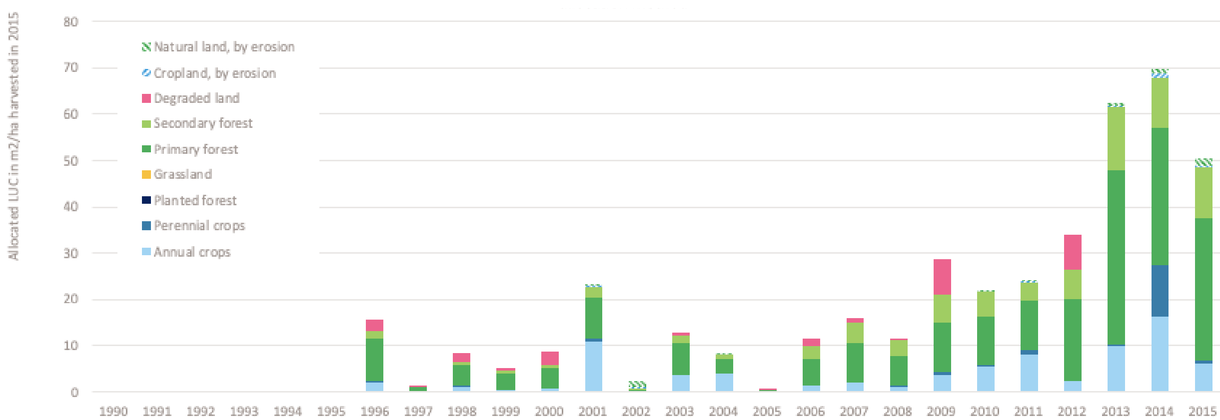


Figure 7: Crop-specific LUC caused by avocados in Peru over 20 years, at the expense of different former LU, scaled and allocated with the equal allocation method

How to transform land-use change into a biodiversity impacts unit (PDF.m2.yr)

Dryad's results currently focus on climate aspects but our team of experts has developed an addendum to the tool to assess biodiversity issues on the basis of Dryad data.

This approach makes it possible to:

+ Accurately visualize the impacts of land transformation
+ Understand the origin of these impacts
+ Maintain a precise regionalized approach
+ Define land transformation issues on a crop basis
+ Spot any incoherence in land-use types data reported by countries

QUANTIS' EXPERTISE IN SPECIFIC DATABASES

World Apparel and Footwear Life Cycle Assessment Database

Life cycle assessments provide a comprehensive and holistic way to assess environmental impacts over the full value chain, yet credible data on the environmental impacts in supply chains in the apparel and footwear industry is still limited.

The WALDB[15] was founded by Quantis together with a pre-competitive consortium of leading organizations and companies from the apparel and footwear sector to solve this data challenge and to deliver robust data for environmental impact assessment and footprinting. It brings together partners from the industry in an open and pre-competitive dialogue to address the needs and challenges of environmental footprinting. The partners work together to expand the database with reliable data on the processes along the apparel and footwear value chains.

The WALDB enables apparel and footwear companies to identify environmental hotspots along their value chain as well as to quantify the benefits of improvement and reduction measures. In addition, credible communications and marketing efforts can be built on sound metric-based footprint data, which can be used for sustainability reporting in full compliance with relevant ISO Standards. Our work on the European Commission's Product Environmental Footprint (PEF) initiative will be used to update the methodology to ensure harmonization.

World Food LCA Database

Food-related activities account for an estimated 28% of global GHG emissions and are key drivers of land-use change, water scarcity, biodiversity loss and eutrophication. Aligning current production and consumption models in the agri-food sector with planetary boundaries is vital for building a resilient food system and ensuring companies continue to thrive in a resource-constrained world.

To accelerate this shift, companies need ambitious science-based sustainability strategies built on robust metrics. The World Food LCA Database[16] provides players across the agri-food value chain with high-quality emissions factors and environmental footprint data (including carbon, water, and land) to help them better understand the impacts of their products and bolster decision-making.

Ecoinvent Database

The Ecoinvent database[17] is the world's leading LCI database recognized for both transparency and consistency. It provides robust process data for thousands of products, helping to make truly informed choices about environmental impact.

3.4. Examples of results

Quantis' biodiversity methodology allows for the consistent calculation of the various impact pathways on ecosystem quality in the frame of PDF.m2.year (Potential Disappeared Fraction of species in a square meter within a year). This allows corporations to compare between and across their product and service value chains and identify both hotspots (PDF.m2.year) and levers for change (related to the impact pathways).

FOCUS BOX - Example: Coconut milk biodiversity impact

What is the aggregated footprint of a volume of coconut milk?

The total biodiversity impact of a volume of coconut milk is **2.4 PDF.km2.year**. See the impact broken down per midpoint impact indicator in Figure 8 below.

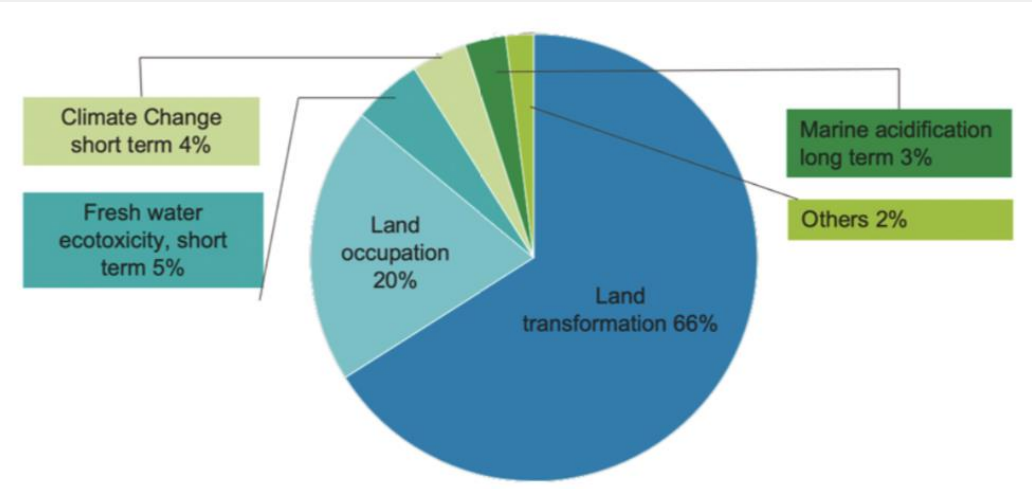


Figure 8: Impact contribution of coconut milk broken down per midpoint impact indicator excluding long term climate change & long term ecotoxicity.

The results show that land transformation is the indicator that has the largest contribution to the impact on nature, followed by land occupation.

FOCUS BOX - Example of insect-based food biodiversity assessment

What is the aggregated footprint of insect-based food?

Insects are a new, natural, sustainable and responsible source that, if bred properly, may have a lower environmental impact compared with other sources of protein for animal nutrition.

Diet for farmed fish based on mealworm

The larval form of the Tenebrio Molitor beetle is a food source popular for its nutritional value.

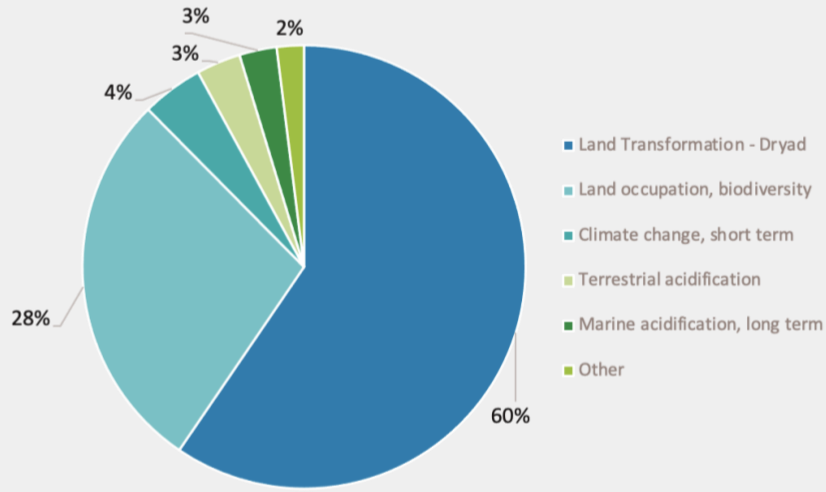


Figure 9: Impact contribution per impact indicator excluding long term climate change and long term ecotoxicity.

The total aggregated footprint equals 14 PDF.m2.yr per kg of production

+ Land transformation has the largest contribution to the impact on nature, followed by land occupation.
+ The mealworm is made from two thirds wheat and one third sunflower. These agricultural commodities have a land footprint that causes the most impact.

To conclude, for corporations to identify the main drivers of biodiversity throughout their value chains it is paramount to have a streamlined method with which to identify and calculate them. Our holistic and coherent approach represents a stepping-stone towards the improvement and scaling of corporate accounting for biodiversity, and is a key first step toward meaningful corporate strategies on biodiversity.

4. Comparing our approach to existing methods

We have designed our methodology to assess the main biodiversity erosion drivers for the key sectors in our network (food & agriculture, apparel, cosmetics and finance). We can adapt the method employed to the needs of the specific company or sector. We are currently in discussion with CDC Biodiversité about undergoing a cross review of our tools, to be disclosed soon.

Driver	Impact Category	Globio	Global Biodiversity Score ™	ReciPe	Ecosytem AnalytiQs (based on Impact World+ and Dryad)
Land use / Land use change	Land transformation	x	x	x	x
	Land occupation	x	x	x	x
Climate change	Climate change	x	x	x	x
Pollution	Freshwater ecotoxicity		x	x	x
	Terrestrial ecotoxicity		x	x	
	Terrestrial acidification			x	x
	Freshwater acidification				x
	Marine acidification				x
	Terrestrial eutrophication	x	x		
	Freshwater eutrophication	x	x	x	x
	Marine eutrophication			x	x
	Photochemicals				
	Ozone formation				
	Ionizing				x
	Thermal pollution				x
Over-exploitation	Water use	x	x	x	x

Table 3: Method and impact category comparison

5. Further development

5.1 Specialization via geoFootprint

geoFootprint is accelerating sustainable agriculture by transforming the measurement and management of corporate supply chain footprints. It is the first platform to bridge remote sensing data with leading edge environmental footprinting science based on life cycle assessment.

This powerful combination of high-integrity data and rigorous methodology is projected onto an interactive, online world map. This approach facilitates the modelling and calculation of the footprints of fifteen key agricultural commodities and their co-products, for any country in the world and across various geographical scales.

Granular visibility — down to 10x10 km — allows an instantaneous understanding of the impacts of a company's sourcing decisions, the identification of the factors contributing to the company's environmental footprint and the simulation of interventions to reduce it.

The geoFootprint tool has significant potential to provide robust data at the regional, national and field level. These geographical aspects are essential for the implementation and monitoring of biodiversity actions.

5.2 Adaptability of the approach

To ensure that our approach remains consistent and aligned with business issues, we are continuously engaged and involved with the progress of the SBTN's work. Our methodology adheres to the steps defined by their guidelines for business (1/ Assess; 2/ Interpret & prioritize; 3/ Measure, set & disclose). Qualitative approaches that are based on materiality assessments and the mapping of material value chain risks are essential elements to set up a robust evaluation of hotspots.

5.3 Scalable databases and methods

All databases evolve and expand over time (Ecoinvent, WALDB, WFLDB etc.). As data becomes more and more precise, the coverage of new cultivation methods, new materials and new sectors is made possible. Without these databases, the most complex businesses and value chains could not be studied.

Quantis has very strong links with the CIRAIG (International Reference Centre for the Life Cycle of Products, Processes and Services) teams, and through this relationship, raises awareness of important issues for the continuous improvement of the Impact World+ method.

The evolution of Dryad will also allow Quantis to integrate more data and respond to the temporal challenges of land use change.

5.4 Limitations of the Methodology

Some of the indicators used in the Impact World+ methodology present a higher uncertainty than others, such as long-term freshwater ecotoxicity and long-term impacts on climate change. Accordingly, we remove these two impact categories from our results in most cases, and are working closely with the CIRAIG to ensure robustness and consistency.

Our Dryad tool gives precise insights into land-use change caused by agricultural commodities, however we are yet to achieve the same level of detail in key sectors such as forestry or mining. geoFootprint's development will enable us to tackle those issues with even greater data granularity in the coming months.

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