Technical summary
biodiversity footprint assessment
of leading companies

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Technical summary of the report in Dutch entitled

'Biodiversiteitsvoetafdruk koploperbedrijven'

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Biodiversity footprint assessment of leading companies

The Netherlands has lost much of its original nature and associated biodiversity, and the quality of the remaining nature areas is under pressure. In addition to the impact of activities within the country, there is the impact of imported raw materials and products on biodiversity elsewhere in the world. The impact of companies and individuals on biodiversity is referred to as their biodiversity footprint.

Companies are increasingly aware of their impact on biodiversity both locally and in their supply chains. There is awareness that unlimited use of natural resources and continuing degradation of ecosystems are not sustainable and will eventually have serious economic consequences. Thus, it is becoming increasingly important to assess how natural resources can be used sustainably to minimise potential damage to people and the environment, now and in the future. This is not an easy task because there are many factors at stake. For instance, greenhouse gas emissions contribute to climate change, excessive water use leads to drought and reduction in water quality, and imported raw materials lead to an increase in land use elsewhere. All of these factors contribute to degradation of ecosystems, reducing their capacity to provide valuable goods and services.

To identify effective measures to reduce impact on biodiversity, scientific models are used, such as the GLOBIO Global Biodiversity model developed by the Dutch Environmental Assessment Agency (PBL). GLOBIO is used to calculate the impact of different pressure factors in terms of one indicator. This is expressed as the Mean Species Abundance (MSA) index, which is a measure of naturalness or the extent to which biodiversity is intact. The MSA index ranges from 1 for biodiversity in the natural situation to 0.05 for biodiversity in highly impacted areas, such as an industrial area.

The Dutch Biodiversity, Ecosystems and Economy (BEE) Platform commissioned an assessment of the effectiveness of the GLOBIO method in several case studies. These case studies included the carpet manufacturer DESSO and the milk production sector in the Netherlands. In addition, a small study was carried out on production of dextrose from maize at DSM. In each study, data available on the environmental pressures were used as the starting point to calculate the impact on biodiversity. The analysis focused on three pressure factors that have an major impact on biodiversity, namely land use, greenhouse gas emissions, and nitrogen and phosphorus emissions to surface water.

A biodiversity footprint is expressed in MSA per ha and is divided into two components - a terrestrial footprint (impact of land use and greenhouse gas emissions), and an aquatic footprint (impact of nitrogen and phosphorous emissions in surface water). The effect of measures taken by the companies to reduce their impact on biodiversity was calculated by subtracting the footprint of the desired future situation from the current footprint.

Carpet manufacturer
A number of options to reduce the biodiversity imprint of carpet manufacturer, DESSO, were considered for the company and its suppliers. These options were extracted from the DESSO report entitled Cradle to Cradle Roadmap Vision 2020. The calculations indicate that the terrestrial biodiversity footprint results largely from the production of raw materials used in carpet production.

Before the case study, the carpet manufacturer considered land use to be a secondary factor in its biodiversity footprint because most raw materials used are of fossil origin. Nevertheless, the calculations indicated that in 2012, 45% of the total biodiversity footprint was related to land use (Figure 1), and 55% of greenhouse gas emissions mainly originate from emissions in the supply chain (Figure 2). Even though wool accounts for only 2% of all raw materials used in 2012, wool accounted for 97% of the total land use impact. Thus, there is indication that the company's biodiversity footprint could be greatly reduced with careful re-consideration of its wool sourcing.

The impact of land use and greenhouse gas emissions in the production chain, are presented in Figures 1 to 3 for both 2012 and the proposed situation in 2020. Various wool sourcing scenarios were studied. Based on the MSA index, the measures proposed in Vision 2020 lead to 30% reduction in the greenhouse gas-related footprint, and to 20% reduction in the aquatic footprint.

The future wool footprint could only be roughly estimated and largely depends on land use management of the wool source. Currently, wool is sourced from intensively grazed grasslands, where little of the original biodiversity remains. By using wool produced extensively on mainly natural areas, the total terrestrial footprint could be reduced by as much as 19 to 49%, depending on grazing intensity. This reduction could be even greater if grazing plays a role in nature conservation. However, projections on the biodiversity footprint in 2020 are uncertain because insufficient data are available on the management of extensive sheep grazing. Nevertheless, it would seem that relatively simple measures regarding wool sourcing could achieve a considerable reduction in the biodiversity footprint.
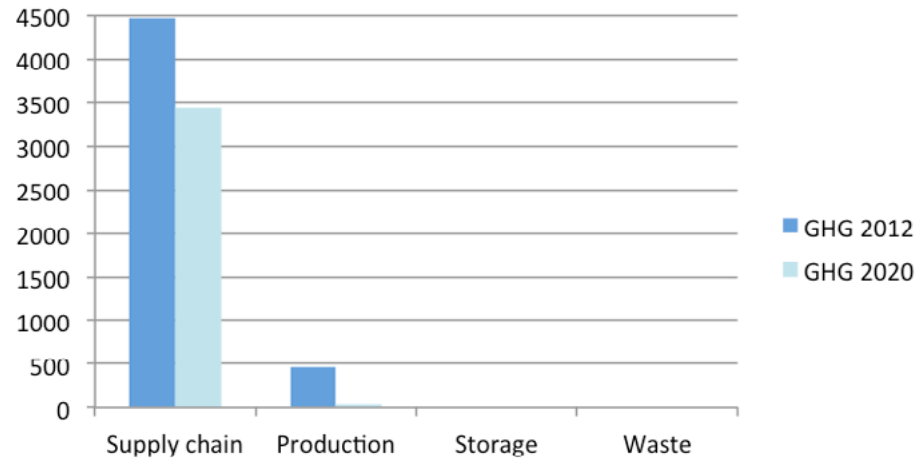
Biodiversity footprint: land use

Figure 1. Part of biodiversity footprint caused by land use in the carpet production chain in 2012 and in two scenarios for 2020 (MSA/ ha). Scenario 1 has a biomass utilisation rate of 34% in semi-grasslands, and scenario 2 assumes a biomass utilisation rate of 10%.
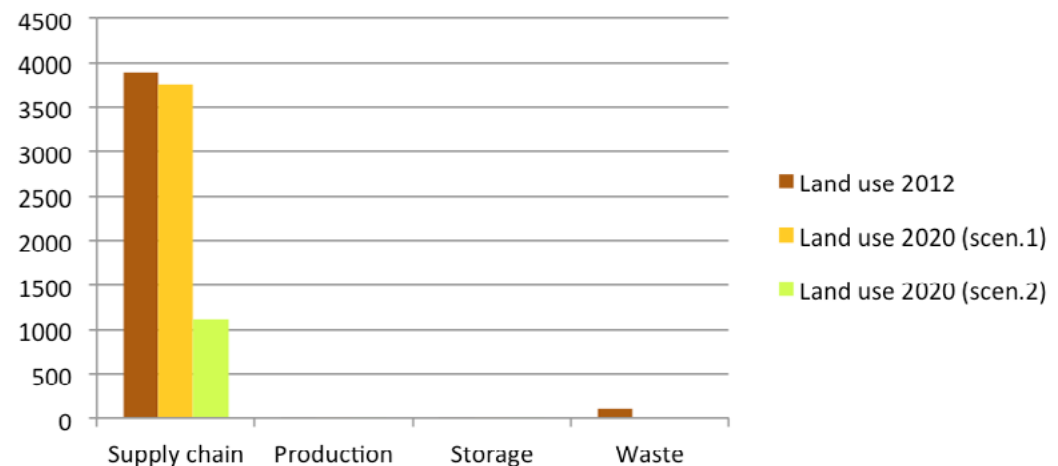
Biodiversity footprint: greenhouse gas emissions

Figure 2. Part of biodiversity footprint caused by greenhouse gas emissions for the carpet production chain in 2012 and 2020 (MSA/ha). As emissions from sheep grazing are relatively small compared with emissions from oil-based raw materials, the grazing intensity would not affect the greenhouse gas emissions footprint.

Terrestrial biodiversity footprint: land use and greenhouse gas emissions (msa/ha)

Figure 3. Total terrestrial biodiversity footprint of carpet production in 2012 and 2020
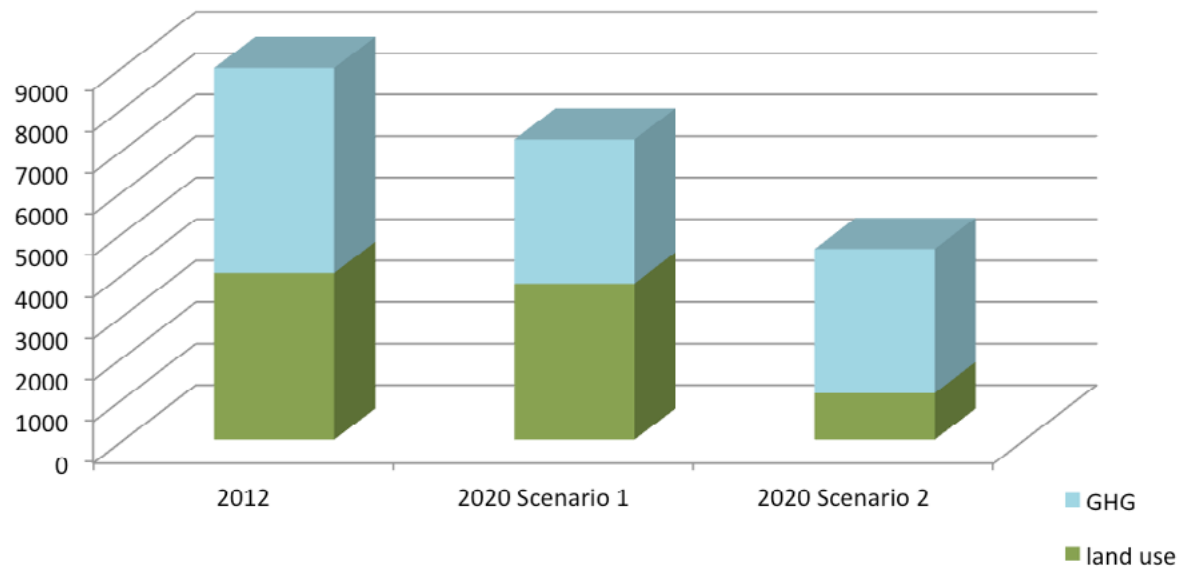
The GLOBIO aquatic footprint was calculated for nitrogen and phosphorous emissions to surface water only and excluded the impact of water extraction. Concentration increases were calculated in both the discharge stream of the production plant and the connecting river. Impact could be measured in the stream but as the water discharged in the much larger river is highly diluted, emissions in the river are relatively low and have no measurable impact. The relatively low emissions in surface water resulting from land use and sheep grazing were also excluded from the calculations. In 2012, the aquatic footprint, restricted to the impacted stream, was 0.6 MSA/ha. The water stewardship measures set out in the company's Vision 2020 report (a.o. such as improved purification) will decrease the aquatic footprint by 20% in 2020 (Figure 4).

Dextrose production
The biodiversity footprint was also calculated for the production of 1000 g dextrose from 1500 kg maize at DSM. As no scenario data and no data on an alternative production method were available, the footprints could not be compared. The total terrestrial footprint is mainly determined (92%) by the impact of land use and only slightly (8%) by the impact of greenhouse gas emissions. Production of raw materials is responsible for 96% of the footprint. The aquatic footprint is 25.5 m2 per 1000 kg dextrose and results from nitrogen and phosphorous used for fertilising the maize crop in the USA.

Aquatic biodiversity footprint resulting from nitrogen and phosphorous emissions

Figure 4. Aquatic footprint resulting from nitrogen and phosphorous emissions in nearby surface water in 2012 and 2020
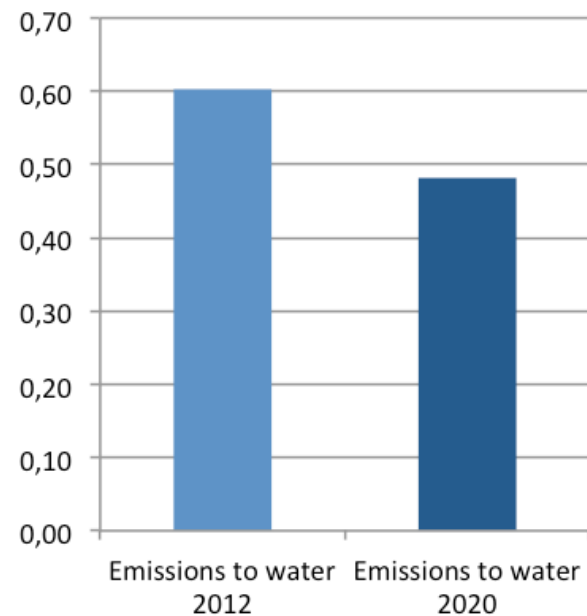
Milk production

In addition, the impact of the Dutch milk production on biodiversity was assessed. As expected, land use is the dominant factor throughout the milk production chain and accounts for 55% of the total biodiversity footprint. Greenhouse gas emissions accounted for the remaining 45%.
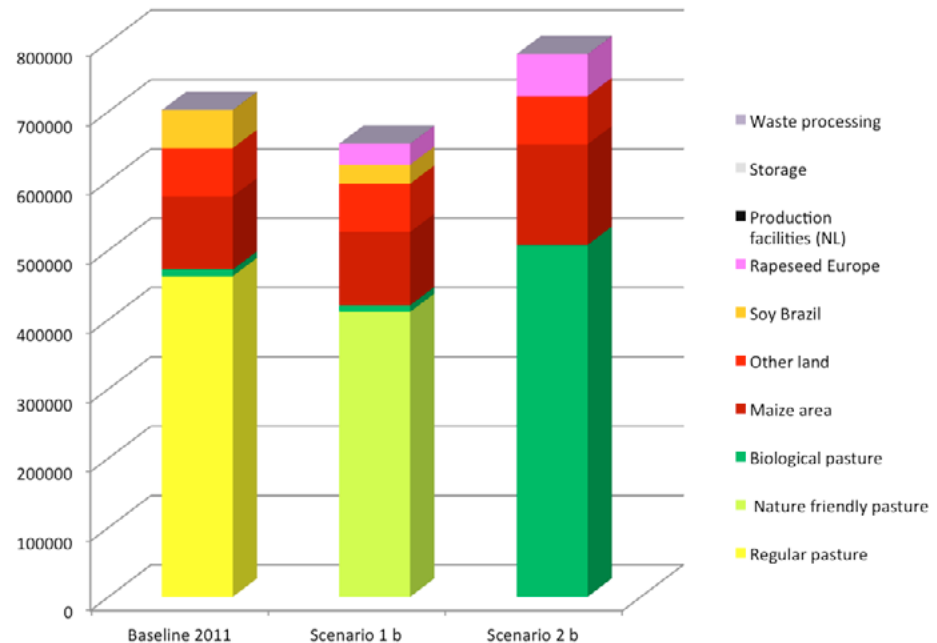
The impact of three management systems was calculated for the same total milk production, namely regular, nature friendly and biological production. In regular milk production, few nature friendly measures are taken, and use is made of the standard fertiliser application, soya concentrate and pesticides. Nature friendly production incorporates biodiversity friendly measures,

such as less pesticide use, consideration of the breeding season, and inclusion of herbs in the grass mix, maintenance of hedgerows, and adjusted mowing strategy. To achieve the same milk production per hectare, fertiliser was used in nature friendly production. In biological milk production, the requirements with regard to nature conserving measures were stricter, for example, fertiliser and pesticides were not used.

Under biological milk production, the biodiversity of the extensively managed pastures is higher but milk production per hectare is lower, thus requiring more land to achieve the same production. This trade-off between area and quality can be calculated using the MSA.
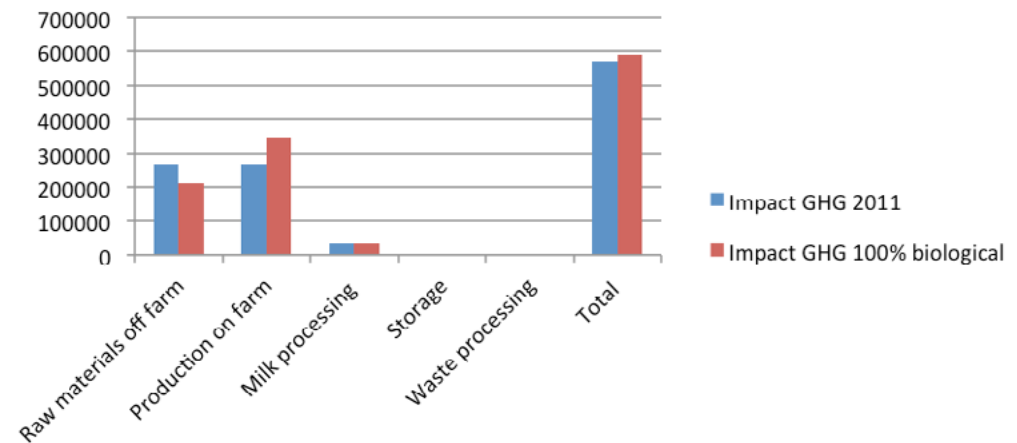
Biodiversity footprint of land use: milk sector

Figure 5. Land use footprint (MSA/ha) in the production chain for scenario 1b and 2b compared with the reference situation in 2011. Scenario 1b shows the biodiversity footprint of a complete switch from regular to more nature friendly production, and scenario 2b, from regular to biological milk production.


Legend:
- Waste processing
- Storage
- Production facilities (NL)
- Rapeseed Europe
- Soy Brazil
- Other land
- Maize area
- Biological pasture
- Nature friendly pasture
- Regular pasture

Categories: Baseline 2011, Scenario 1 b, Scenario 2 b

Biodiversity footprint greenhouse gas emissions: milk sector

Figure 6. Biodiversity footprint (MSA/ha) resulting from greenhouse gas emissions in the production chain for the reference situation in 2011 and for a complete switch to biological milk production (scenario 2b).


Terrestrial biodiversity footprint: milk sector

Figure 7. Effect of changes in scenario 1b and 2b on the impact on land use and greenhouse gas emissions on the biodiversity footprint compared with the reference year 2011 (in MSA/ha)
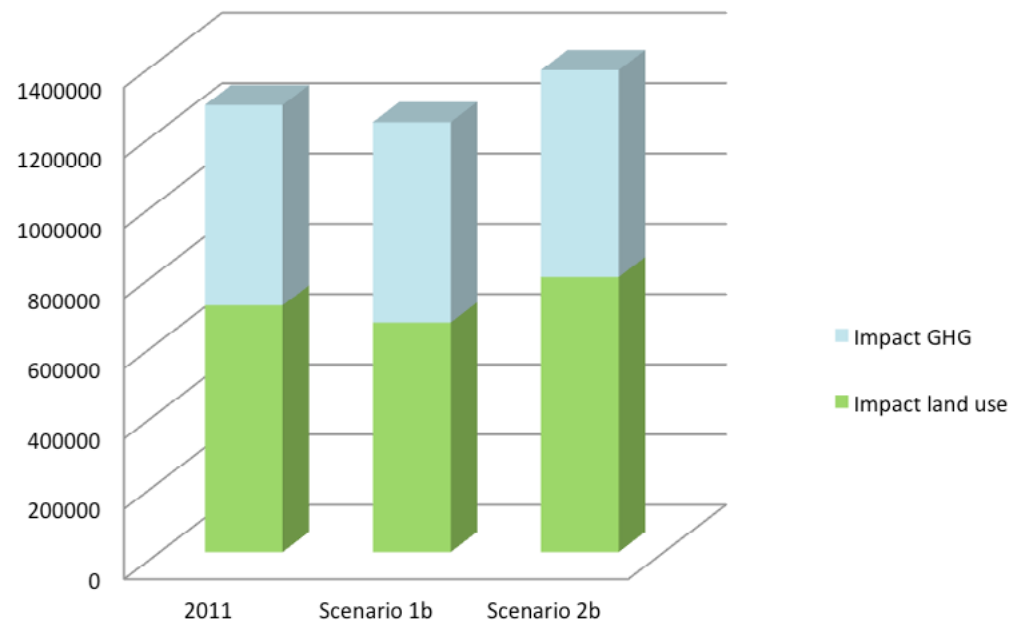
Aquatic biodiversity footprint: nitrogen and phosphorous emissions from pastures to surface water

Figure 8. Aquatic biodiversity footprint due to the impact of raw materials used in milk production for reference year 2011 and scenario 1b and 2b (MSA/ha).
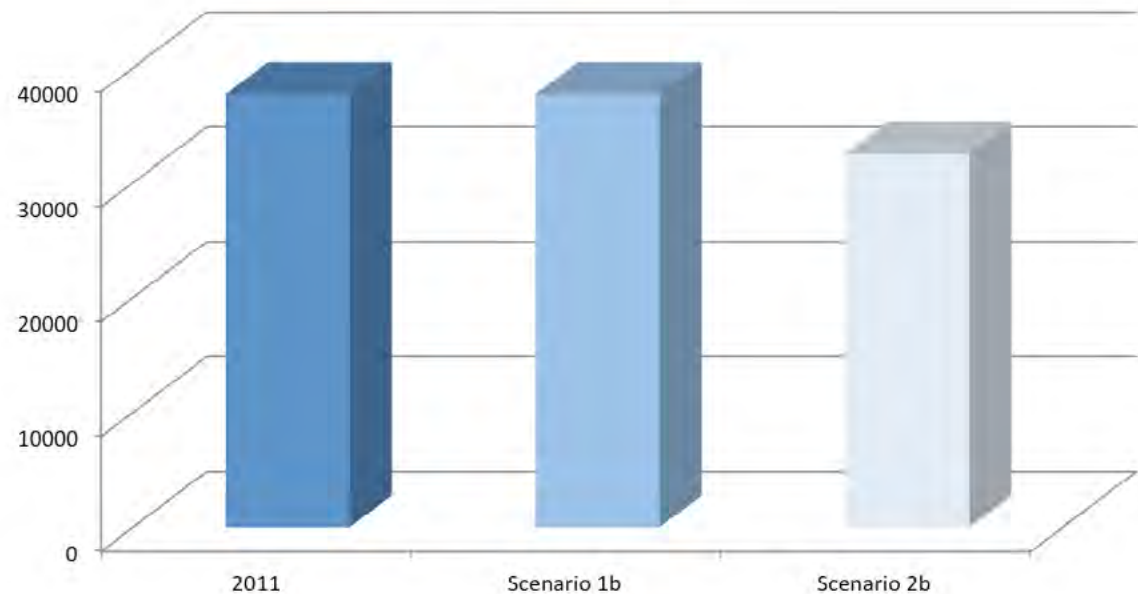
A switch to biological production without imported soya in the Netherlands would require more grassland to maintain milk production at the same level. As a result, the land related footprint would increase by 11% (Figure 5, scenario 2b). In addition, the greenhouse gas-related footprint would increase by 3%, partly because methane emissions per litre milk produced are higher in biological milk production.

The aquatic footprint resulting from nitrogen and phosphorus emissions (expressed in MSA/ha) decreases with the switch to biological milk production by 14% compared to the reference year. The aquatic footprint has not been added to the terrestrial footprint, because the surface water area is relatively small compared with the land area for grass production, and the impact depends on aquatic characteristics, such as depth and flow.

If milk production becomes more nature friendly, including replacing half of the soya with rapeseed, the land related footprint reduces by 7% (Figure 5, scenario 1b). The greenhouse gas-related footprint remains the same.

The land use related biodiversity footprint increases with a switch from regular to biological milk production because the footprint is not only determined by the quality of land used, but also by the increase in area used. While extensive land use results in higher local biodiversity than under intensive land use, more

land is needed to achieve the same production. As there is less land available for nature, more species are threatened. Biological milk production requires about 38% more land than regular milk production to achieve the same production level. Also, because of the higher protein level in soya, more land is needed if soya is replaced by another crop, such as rapeseed.

In spite of these trade-offs, maintaining and increasing local biodiversity can be a policy goal. A change from intensive to more extensive production not only increases local biodiversity but also has a positive effect on the surrounding nature, especially in those areas close to nature areas. In addition, the fertiliser strategy and lower levels of nitrate and phosphate in biological grassland have a positive effect on soil life, which in turn has a favourable effect on animal life. Similarly, the lower nitrogen and phosphorus emission levels in pastureland have a favourable effect on biodiversity in the

surrounding ditches because of less runoff. As habitats, for example of meadow birds, are becoming ever smaller, extensively managed land can serve as transition areas where birds find additional feed with minimum disturbance from the immediate surroundings. This transition function has not been incorporated in the current footprint determination.

This study shows the individual and collective impact of the environmental pressures on biodiversity and gives new insights into their relative impact in the production chain. As the method has not yet been fully developed, far-reaching conclusions should not be drawn. Nevertheless, it can be concluded that the MSA based methodology for biodiversity footprint calculation enables companies to test relatively easily the effectiveness of their measures designed to reduce the future impact on biodiversity.

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