strateginen TUTKIMUS

Biodiversity footprints – current situation and opportunities for companies

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BIODIVERSITY-RESPECTFUL

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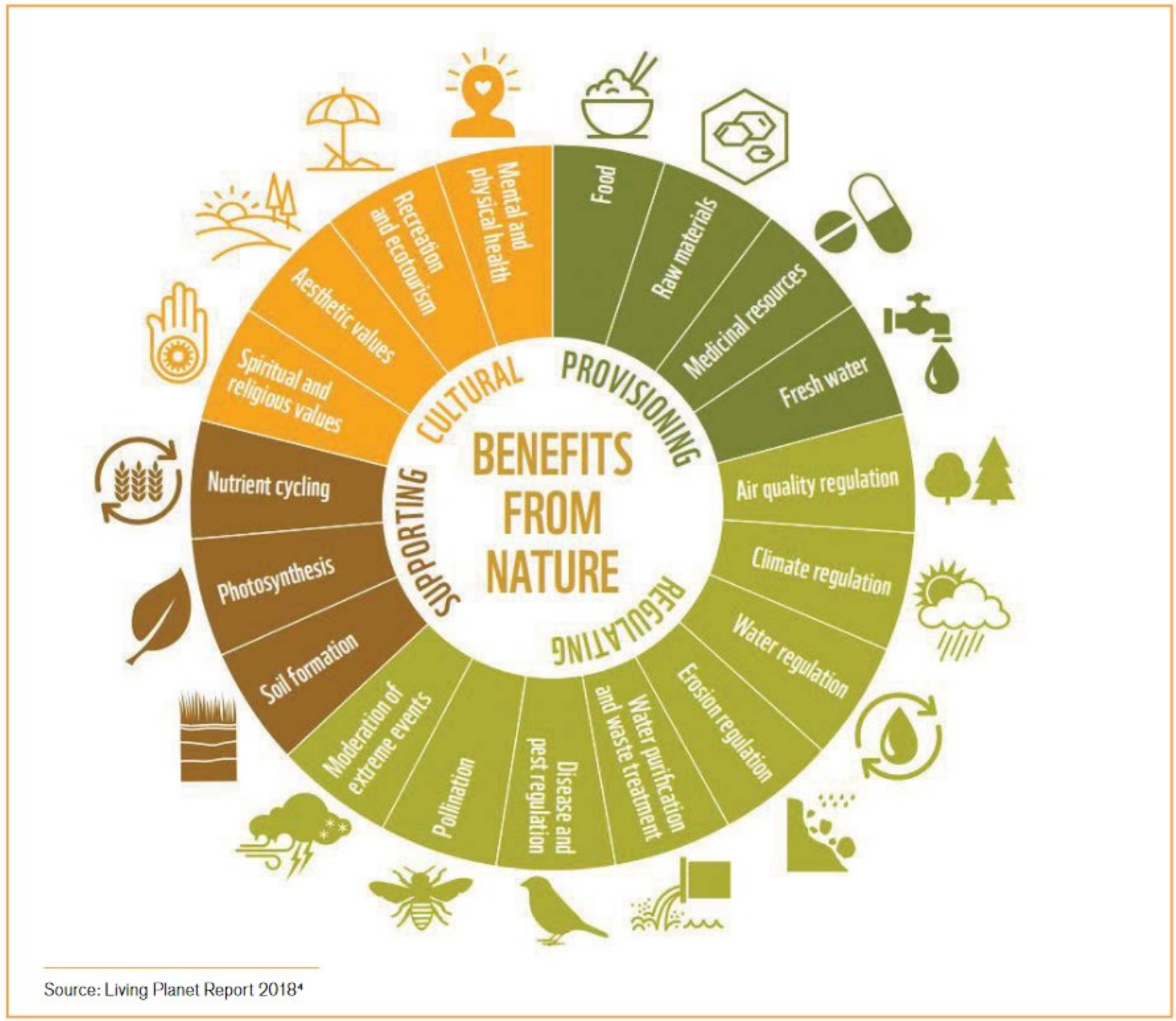
IMPORTANCE OF BIODIVERSITY



Source: Living Planet Report 2018[4]

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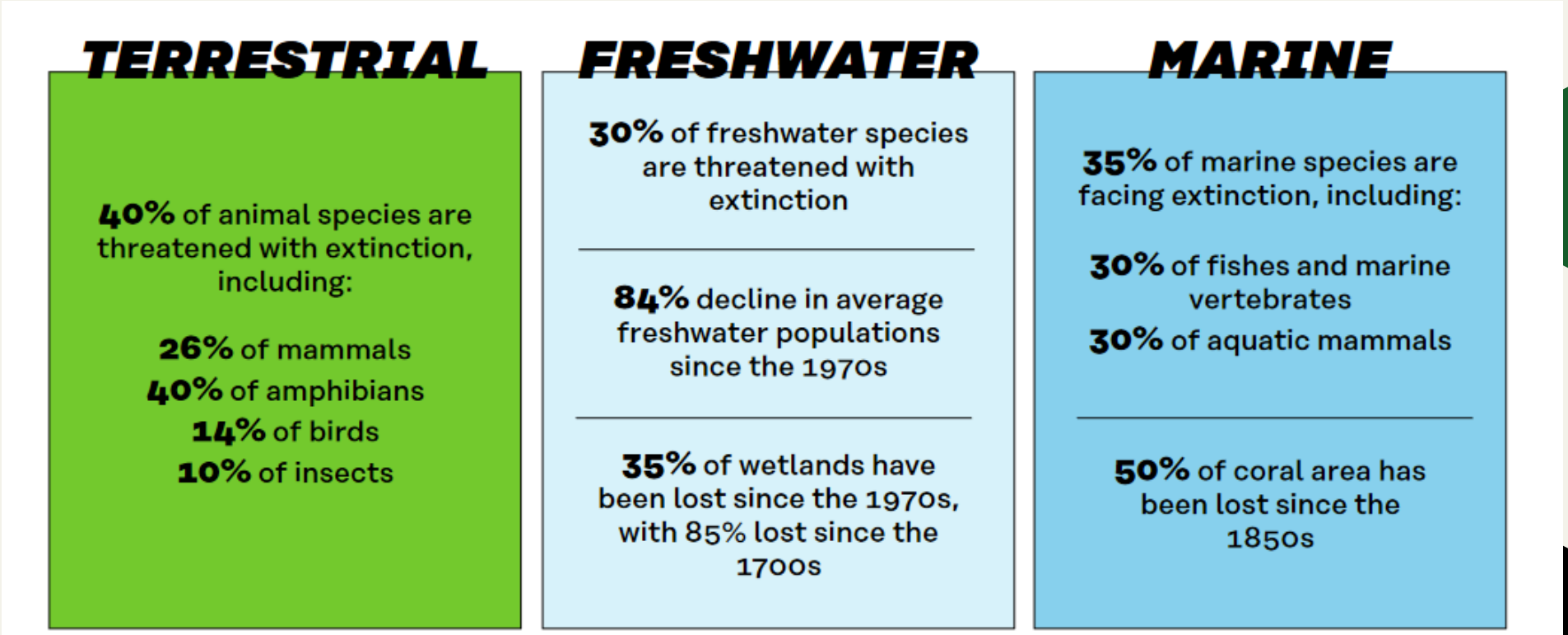
https://pubs.iied.org/sites/default/files/pdfs/migrate/17636IIED.pdf

CURRENT STATE OF BIODIVERSITY



(SITRA 2022)

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Source: https://www.sitra.fi/en/publications/tackling-root-causes/

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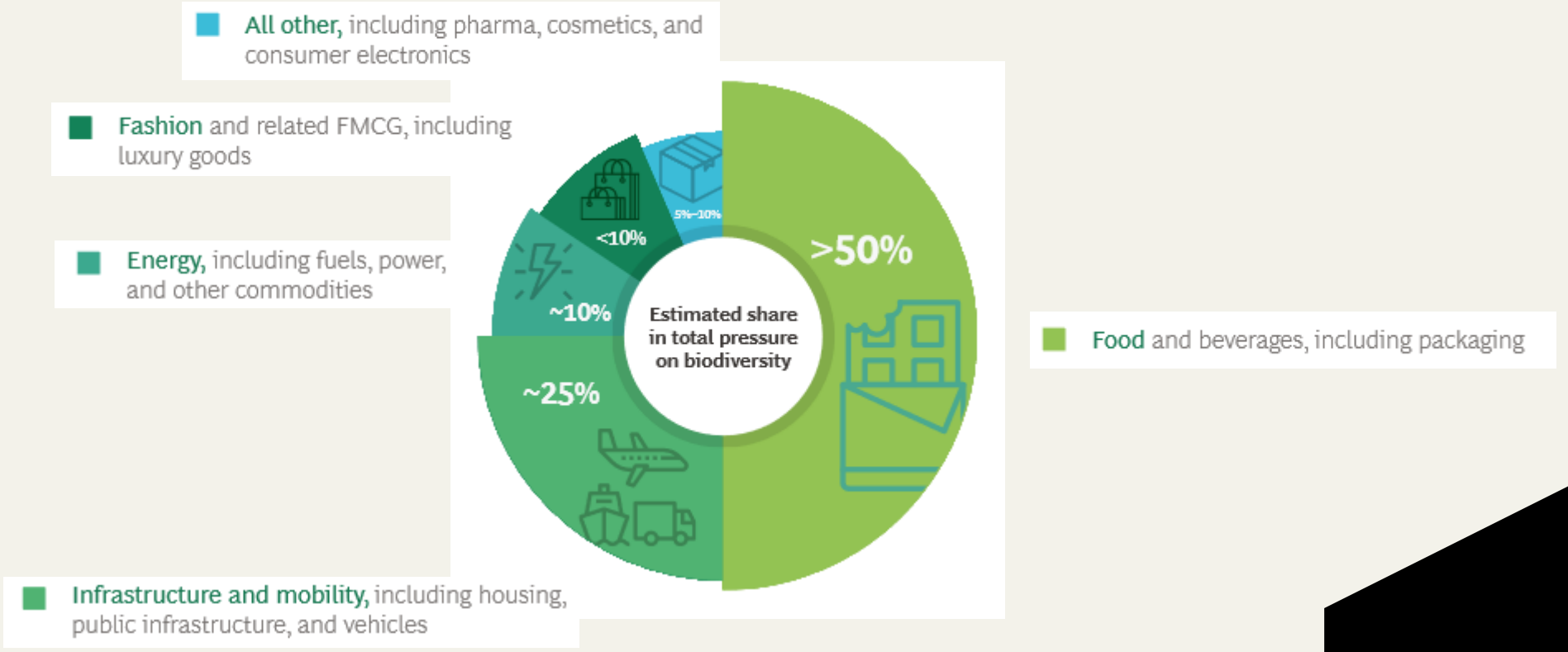
FOOD HAS A KEY ROLE IN BD IMPACTS OF OUR CONSUMPTION



(BCG 2021)

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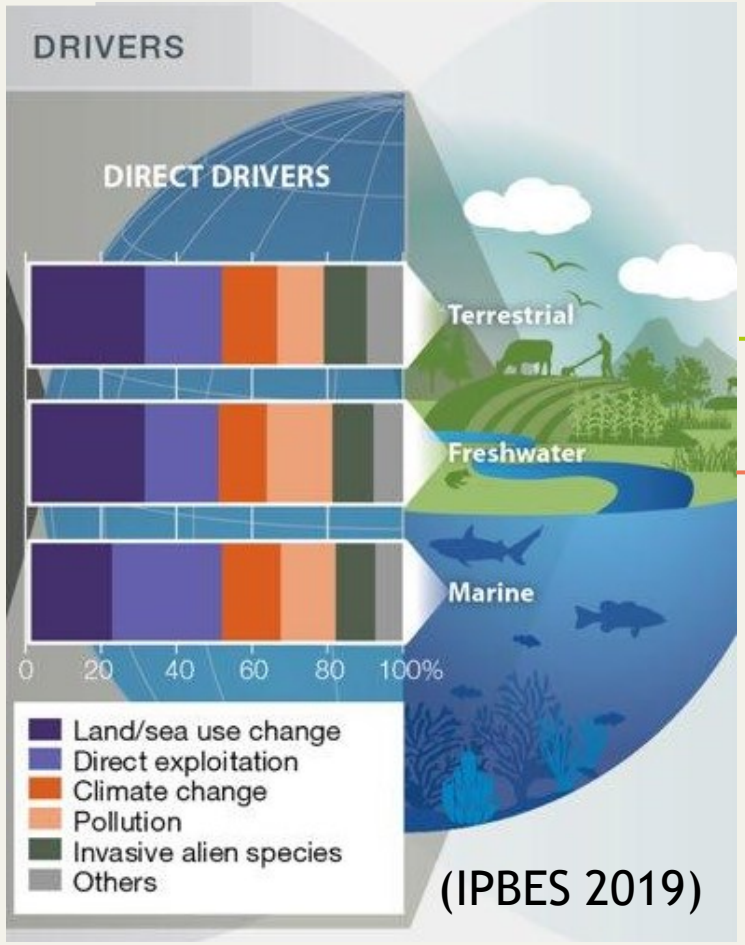
BCG. 2021. The Biodiversity Crisis Is a Business Crisis

MULTIPLE DRIVERS FOR BIODIVERSITY LOSS



(IPBES 2019)

Greenhouse gas emissions and pollution to oceans have global level impacts

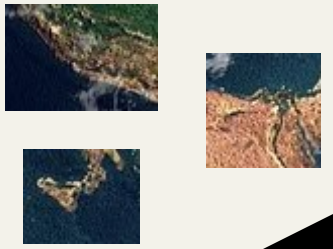
Location of emissions is not important

GLOBAL IMPACTS

Local context is important for majority of the drivers behind biodiversity loss

Location of emissions is important

LOCAL IMPACTS



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IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES secretariat, Bonn, Germany. 56 pages.

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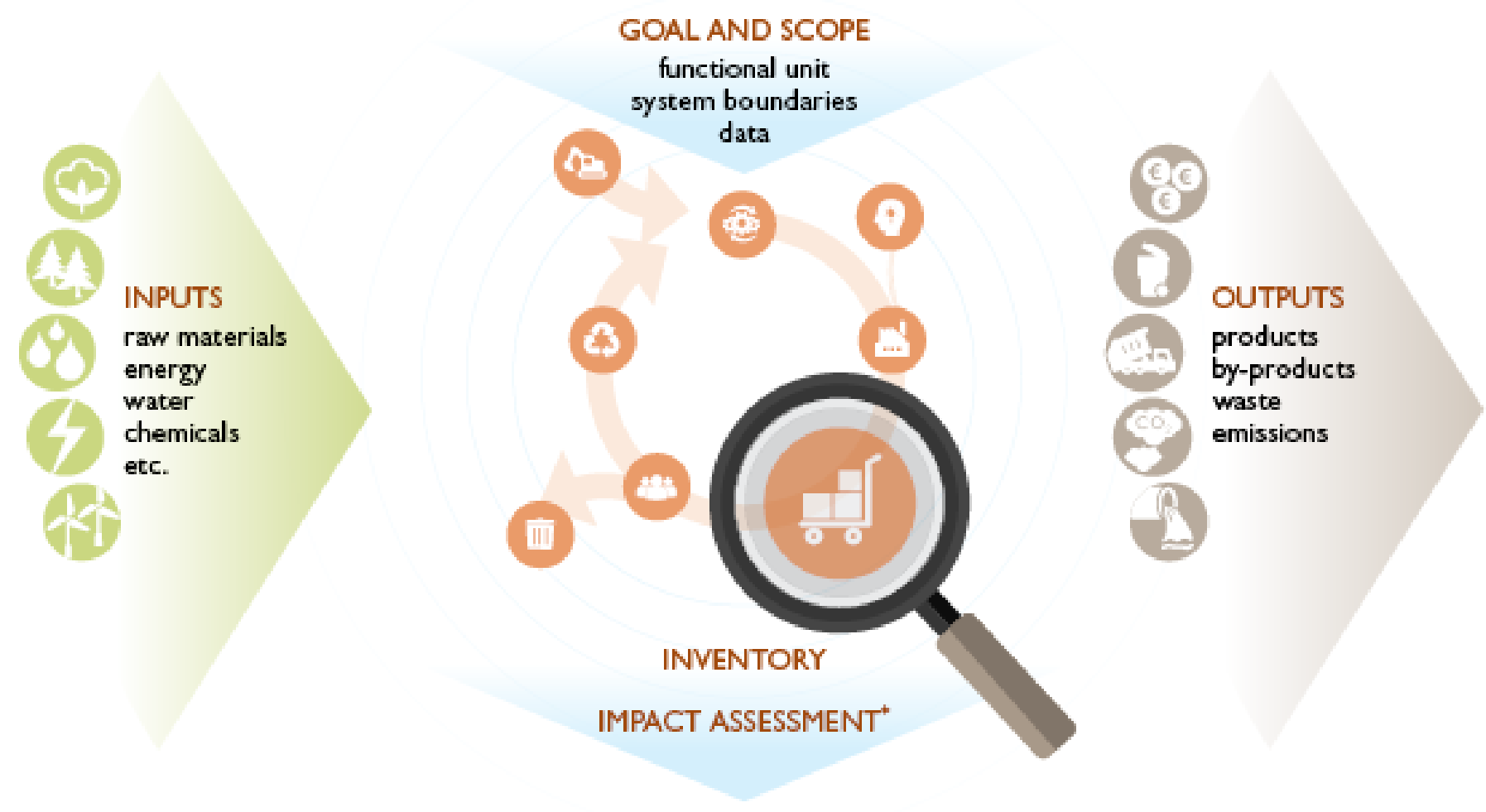
METHODS TO ASSESS IMPACTS ON BIODIVERSITY ALONG LIFE CYCLES ARE DEVELOPING

- There is a **growing interested** in understanding, measuring and setting goals for biodiversity
- Methods, tool and metrics to measure impacts on biodiversity are **rapidly evolving**
- Methods have **differences** in scope, scale, BD loss drivers included, metrics, taxa included etc.
- Focus in these methods is especially on **land use**

How to measure a biodiversity footprint?



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https://www.syke.fi/en-US/LCA

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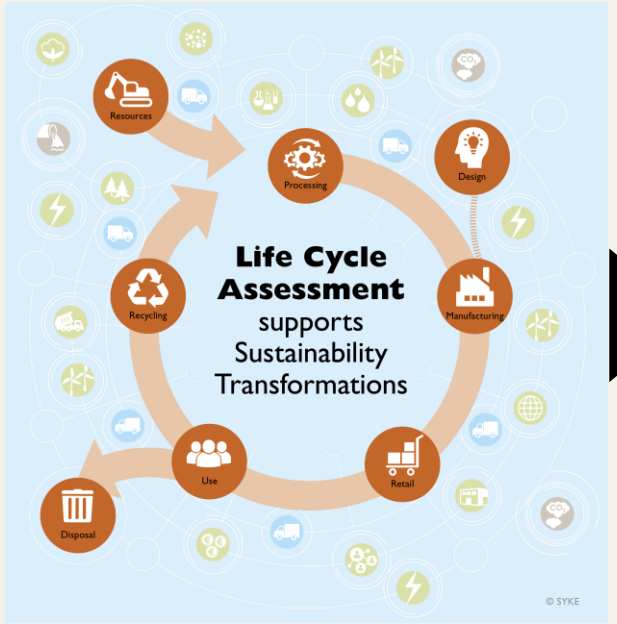
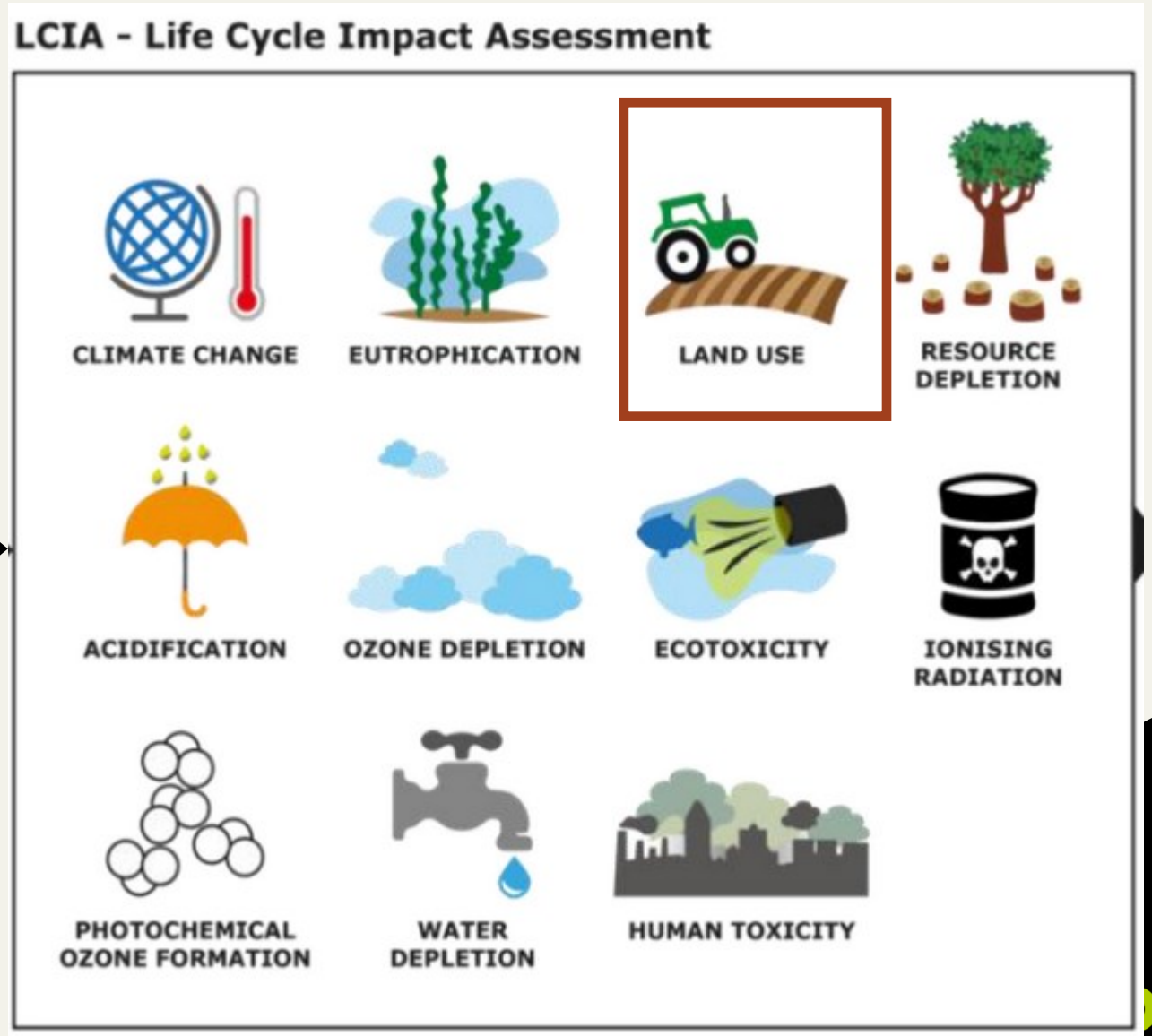
Linking flows to impact categories





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https://op.europa.eu/en/publication-detail/-/publication/ff42870e-d95b-11e6-ad7c-01aa75ed71a1

Simplified oats case

Life cycle perspective

Land use

Direct exploitation

Climate impacts

Pollution

Eutrophication

Terrestrial acidification

Fresh water use

Fossil fuels

Land

Tillage

Applying manure

Applying pesticides

Applying fertilizers

Irrigating

Sowing

Pollution (microplastics)

Transport

Invasive species

Processing

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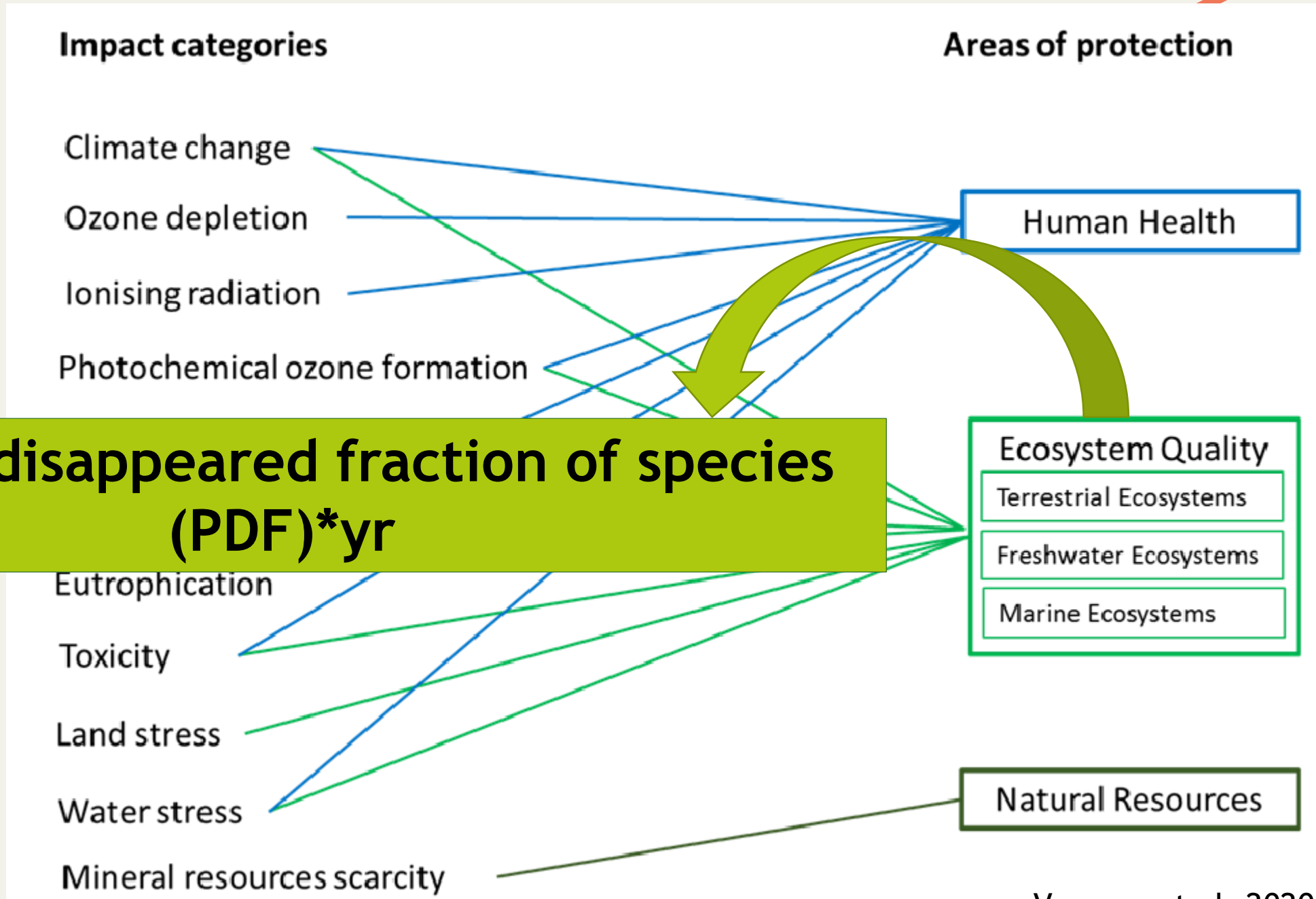
LC-IMPACT



Potential disappeared fraction of species (PDF)*yr

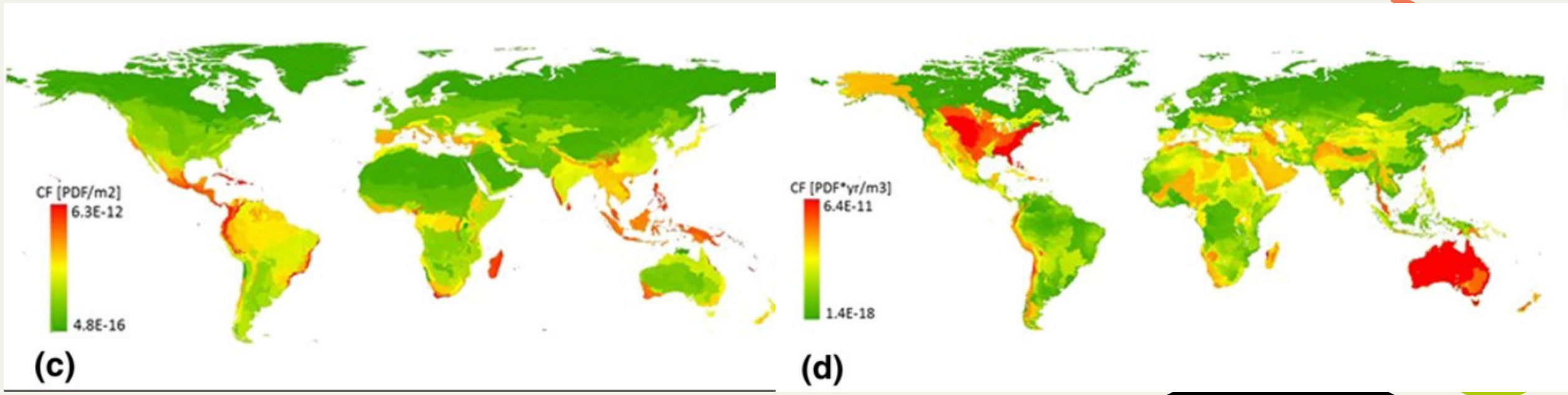
Verones et al. 2020

https://onlinelibrary.wiley.com/doi/full/10.1111/jiec.13018

Examples of characterization factors

Characterization factors for land use

Characterization factors for water use



Verones et al. 2020

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https://onlinelibrary.wiley.com/doi/full/10.1111/jiec.13018

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Regional versus global

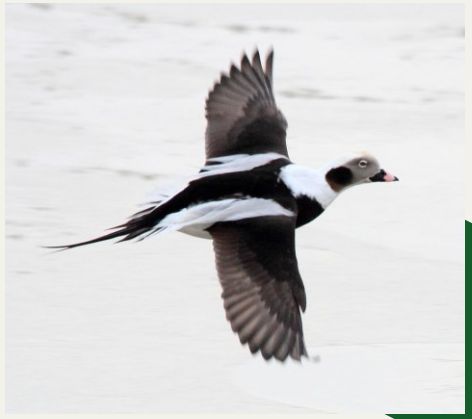
Siberian flying squirrel

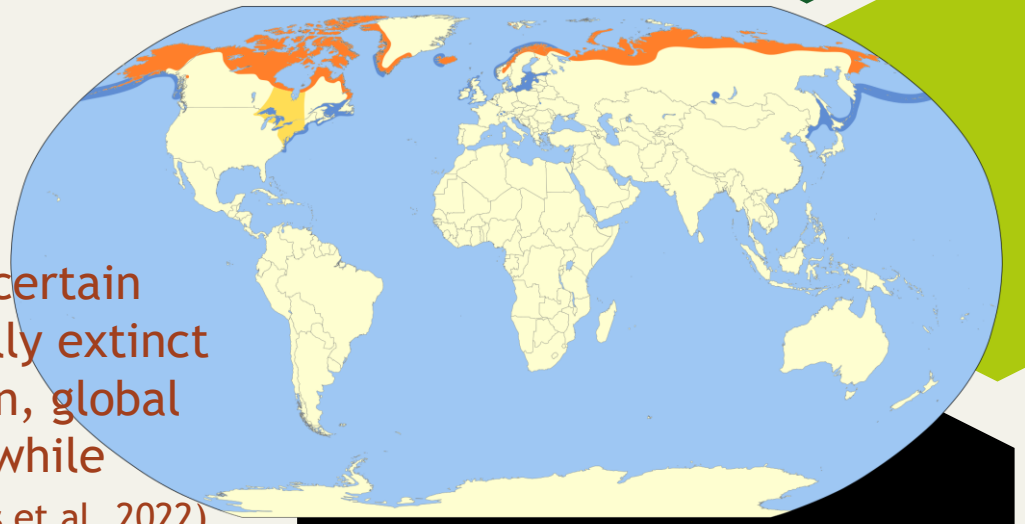
FI: Endangered
GL: Least concerned

Long-tailed duck (Alli)

Very common in winter is coastal areas.

FI: nearly threatened
GL: Vulnerable





"If a species is extinct in a certain region, it is not automatically extinct on a global level. In addition, global species loss is irreversible, while regional loss is not." (Verones et al. 2022)

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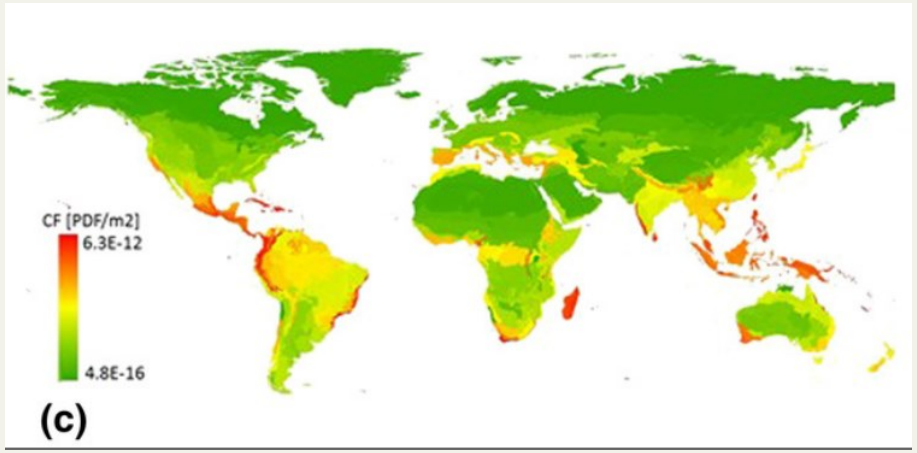
https://www.metsa.fi/wp-content/uploads/2019/06/Liito-oravahavainnot-Suomessa_alkaen-1995.png

By Cephas - BirdLife International. 2017. Clangula hyemalis (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2017: e.T22680427A112395330. https://dx.doi.org/10.2305/IUCN.UK.2017-1.RLTS.T22680427A112395330.en.

What determines your biodiveristy impact

- Where does the impact take place
- How does the impact take place



where versus how

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https://hfuuhi.org/what-is-regenerative-agriculture/

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Taking land management into account

Wheat									
Biodiversity value aggregated								1	**0.372566745**
	Metric		**Unit**	**Min**	**Max**	**Input**	**Contribution**	**Weighting**	**Weighted contribution**
A.1	**Diversity of weeds**					**2**	**0.53048318**	**0.2**	**0.106096636**
	A.1.1	Number of weed species in the cultivation area	[species/ha]	0	300	30	0.240956285		
	A.1.2	Existence of rarer species	[% time]	0	1	0.5	0.710468069		
A.2	**Diversity of structures**					**2**	**0.299939223**	**0.2**	**0.059987845**
	A.2.1	Elements of structure in the area	[% area]	0	1	0.03	0.424178091		
	A.2.2	Field size	[ha]	0	10	10	0.000149781		
A.3	**Soil conservation**					**2**	**0.256581352**	**0.2**	**0.05131627**
	A.3.1	Intensity of soil movement	[L/ha]	0	100	50	0.184127891		
	A.3.2	Ground cover	[% time]	0	1	0.25	0.006201775		
	A.3.3	Crop rotation	[points]	0	13	10	0.931213017		
A.4	**Material input**					**2**	**0.06810312**	**0.2**	**0.013620624**
	A.4.1	Share of farmyard manure	[% mass]	0	1	0	0.999999906		
	A.4.2	Share of manure/compost/fertilizers with low solubility	[% mass]	0	1	0	1		
	A.4.3	share of artificial/liquid fertilizers	[% mass]	0	1	1	-3.76041E-08		
	A.4.4	Share of artificial/liquid fertilizers out of season	[% mass]	0	1	0	1		
	A.4.5	Intensity of fertilizing	[kgN /ha*a]	0	300	150	0.136206245		
A.5	**Plant protection**					**2**	**0.707726853**	**0.2**	**0.141545371**
	A.5.1	Plant protection agents	[applications/a	0	12	3	0.10830326		
	A.5.2	Mechanical weed control	[% applications	0	1	0	0.995		

Lindner et al. 2019

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https://www.mdpi.com/2071-1050/11/20/5628/htm)

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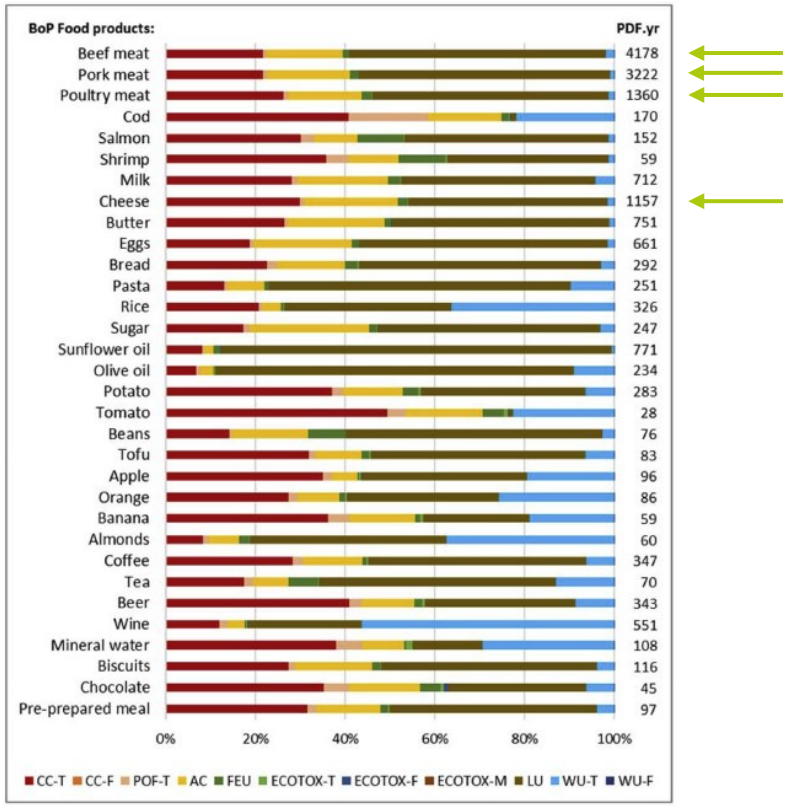
RESULTS:
BD IMPACTS DUE TO FOOD CONSUMPTION IN EU

Climate change, terrestrial acidification, land use and water consumption have high importance



CC-T: Global warming, Terrestrial ecosystems; CC-F: Global warming, Freshwater ecosystems; POF-T: Ozone formation, Terrestrial ecosystems; AC: Terrestrial acidification; FEU: Freshwater eutrophication; ECOTOX-T: Terrestrial ecotoxicity; ECOTOX-F: Freshwater ecotoxicity; ECOTOX-M: Marine ecotoxicity; LU: Land use; WU-T: Water consumption, Terrestrial ecosystem; WU-F: Water consumption, Aquatic ecosystems

Fig. 4. Contribution of the midpoint impact categories to the impacts on biodiversity by product, applying ReCiPe 2016. Absolute results in terms of species lost per year are reported on top of each impact category.

Meat and cheese production have highest biodiversity impacts (60%)

(Crenna et al. 2019)

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Crenna., E., Sinkko, T., Sala, S. 2019. Biodiversity impacts due to food consumption in Europe. Journal of Cleaner Production 227, 378-391.

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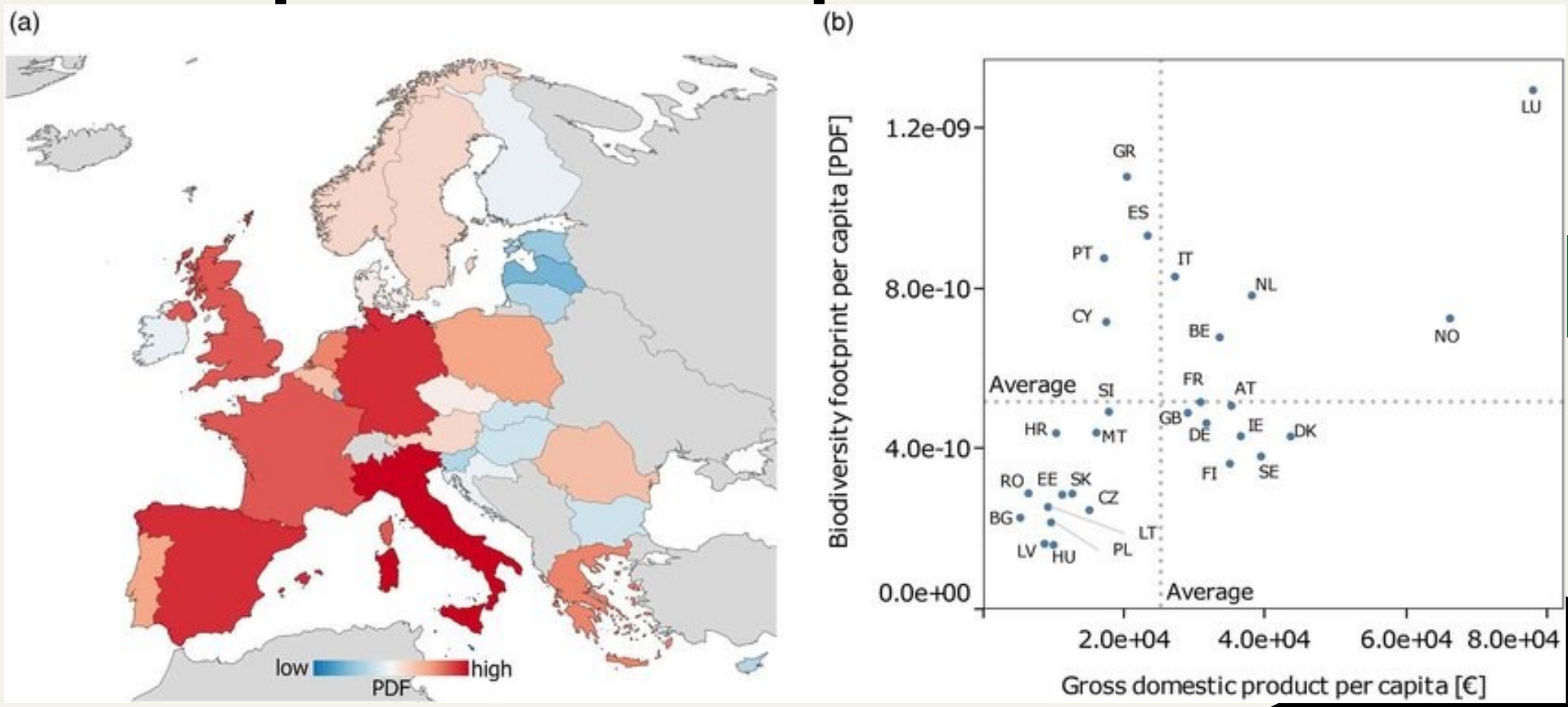
European BD footprints



LC-IMPACT biodiversity footprints of EU28 + Norway for 2010. (a) shows absolute national biodiversity footprints and (b) shows per capita biodiversity footprints against the per capita GDP per country. The dotted lines in (b) represent the per capita footprint and GDP averages (Koslowski, 2020)

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dx.doi.org/10.1017/sus.2019.23

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Challenges in measuring biodiversity impact of food products

1. Biodiversity is complex, how do you measure this
2. Not all impacts are included within LCA method:
   - Most methods are focused on land use
   - There are no methods available for many impacts that contribute to biodiversity losses, most noticable is invasive species
3. Specific challenges in modelling flows to and from the environmental for agricultural practices
4. Lots of data required for site specific impact assessment

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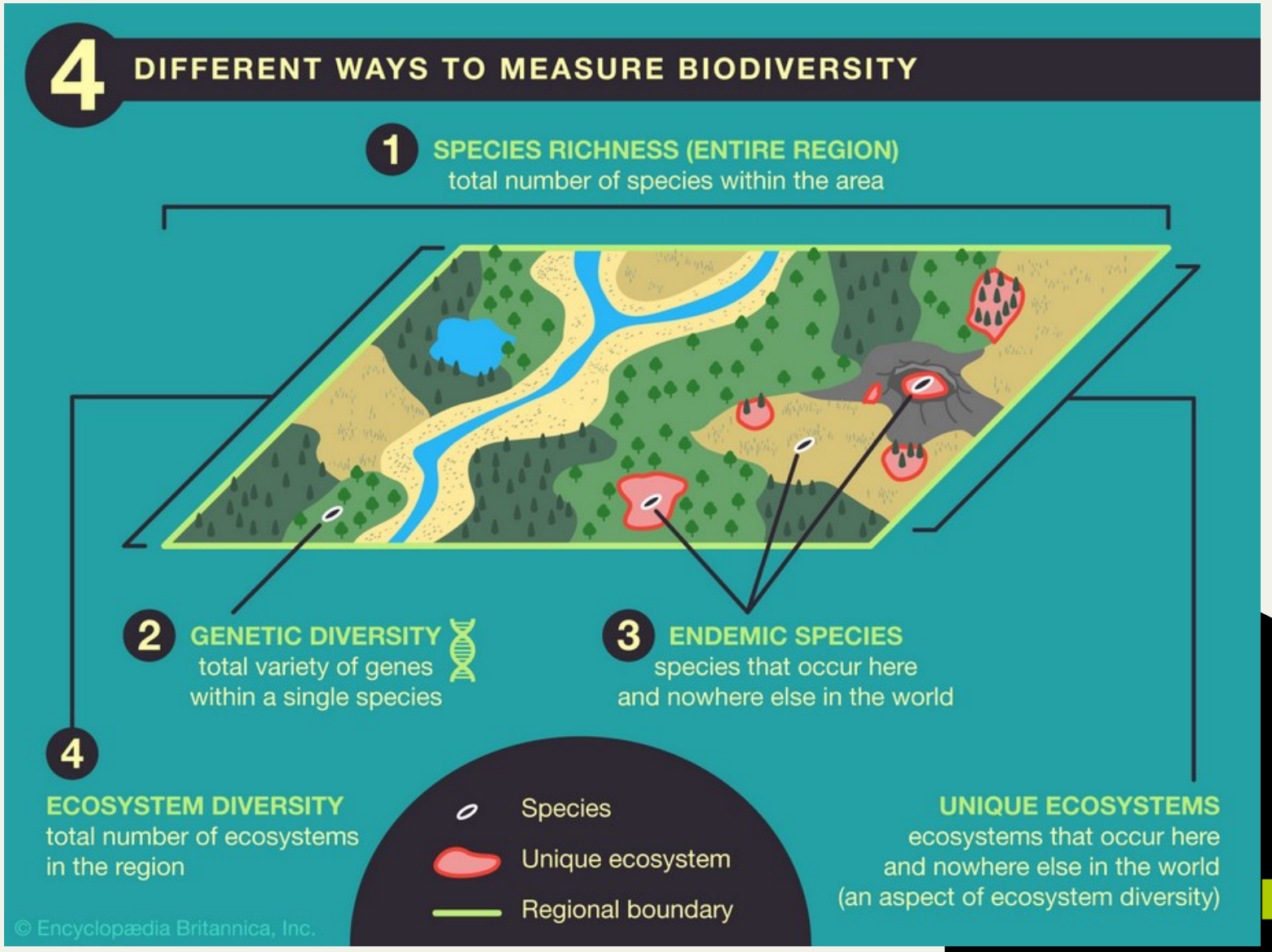
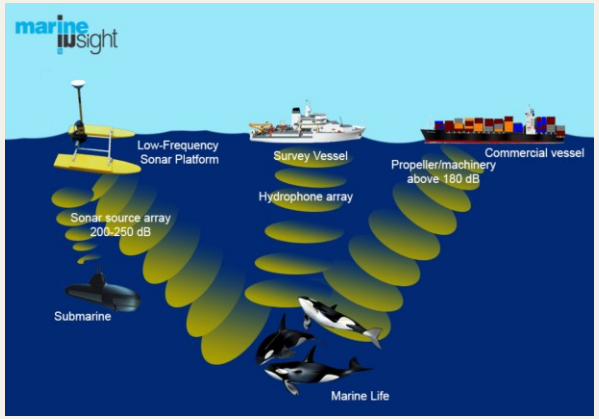
1. Complexity of biodiversity

"The analysis of 119 indicators shows that 4% of indicators represent genetic diversity, 40% species diversity and 35% ecosystem diversity" (Winter et al. 2017)



2. Missing impacts

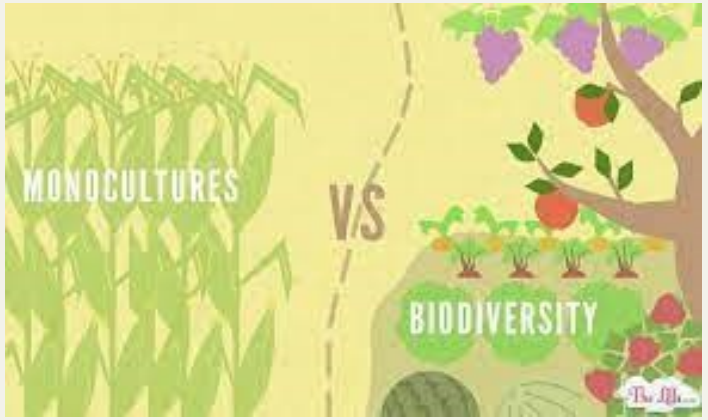
Invasive species



Noise

Direct exploitation

Artificial light



Monoculture

(micro)-plastic pollution

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https://www.marineinsight.com/environment/effects-of-noise-pollution-from-ships-on-marine-life/

https://phys.org/news/2019-05-overfishing-ocean-stocks-plummet.html

3. Challenges related to agricultural products

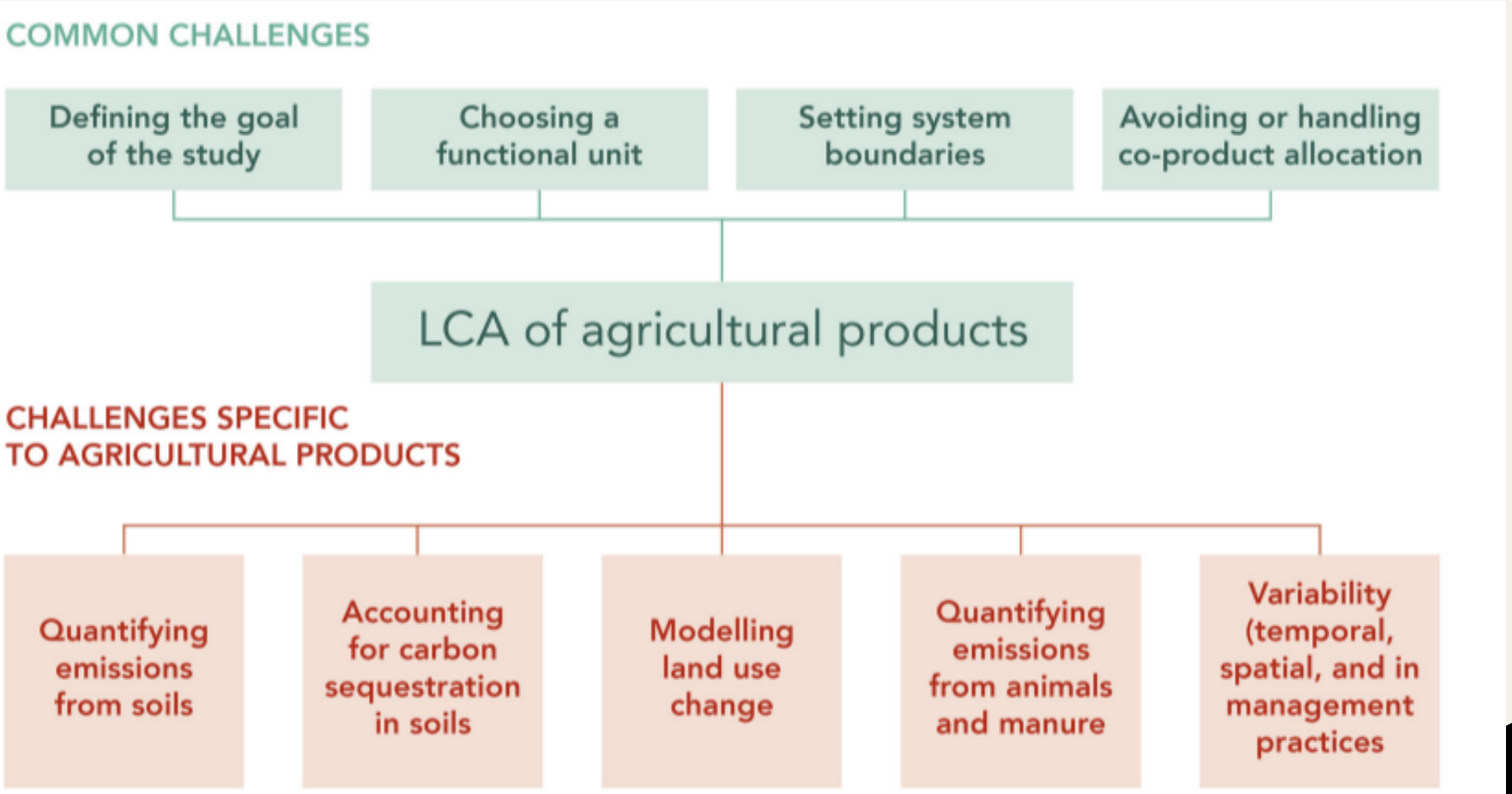
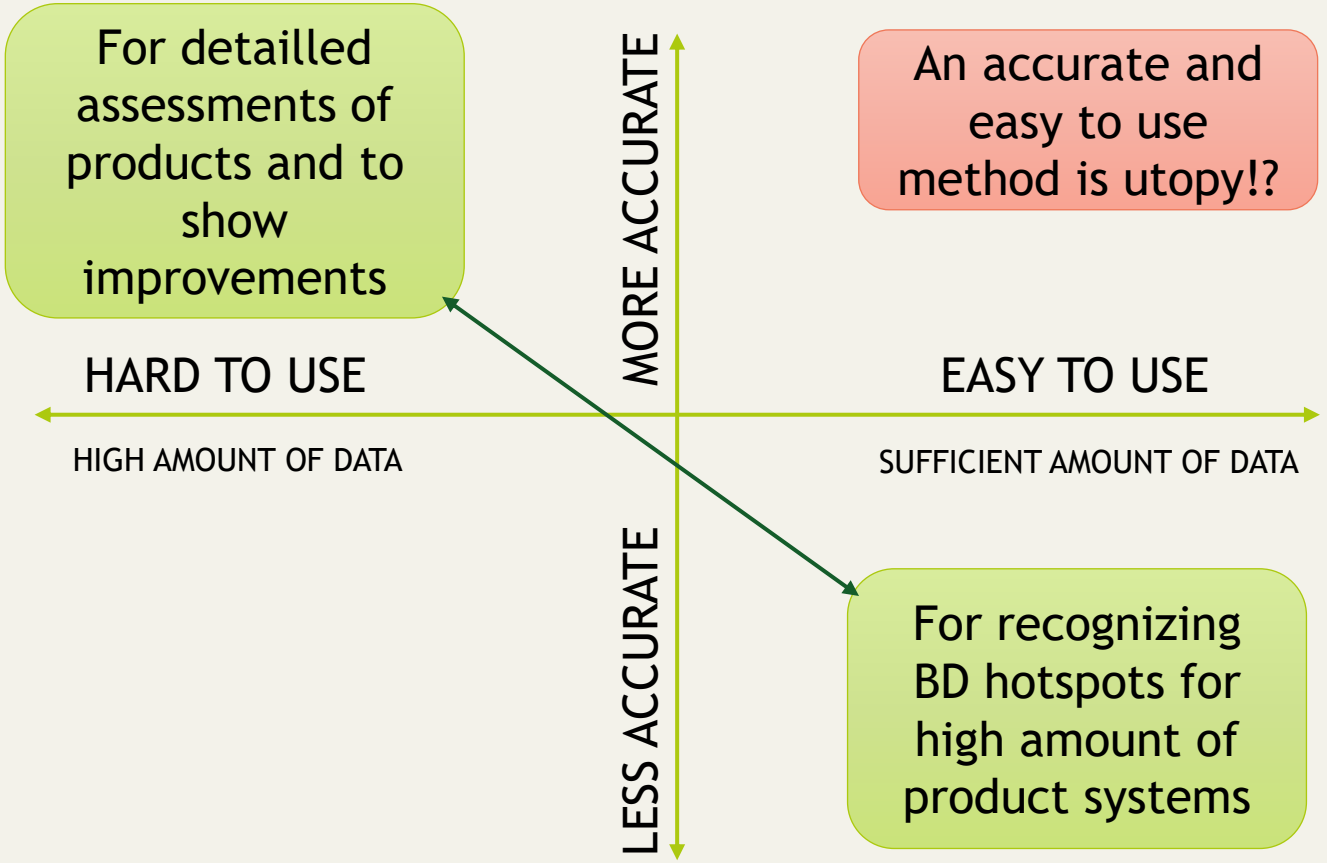


Figure 9: Challenges in lifecycle assessment of agricultural products.

Source: FCRN and Dr Elin Röös.

https://www.tabledebates.org/sites/default/files/2021-11/Foodsource_Chapter_2.pdf

4. ACCURACY VS. USABILITY



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What does this mean for organic products?

- Accuracy is important when distingishing from conventional agricultural methods
- Some benefits of organic farming or regenerative farming are not yet reflected in current methods. This applies especially for soil
- Important to include as many damage pathways as possible.
  - For example, a focus on land use will mean an increase in biodiversity loss due to lower yields, while the benefit of organic farming is in the limitation of pesticides and artificial fertilizers which reduces impacts through eutrophication, pollution and climate change
- This also means that not all methods will be equally suitable or lead to similar results. Important to understand what is included in the method

Conclusion

- Measuring biodiversity is complex
- As practitioners this may come across as discouraging. However, taking biodiversity into account is extremely important
- Scientists are constantly trying to up date methods and add new pathways
- Practitioners one needs to be aware of the methods available and choose one that best reflects ones needs:
  - Regional characterization factors or global
  - Land management taken into account?

SUMMARY

- Our consumption leads to biodiversity impacts globally
- Food consumption in Finland has BD impacts e.g. in South America, Africa and Asia
- Methods for BD impact assessment are being constantly developed
- Changes in consumption and production systems have many opportunities for reducing negative BD impacts
- More research is needed related to BD impacts of our consumption and to possibilities for reducing these impacts

Questions?