Life After JAI

2025 JAI Fest, 18th December, Imperial College

TALITHA BROMWICH

Pine Marten photo by Ott Rebane: https://www.flickr.com/photos/158940298@N08/

Mphys Physics

University of Sussex
Dark matter direct detection
DEAP-3600 experiment

Postdoc Bioinformatics

University of Edinburgh
Causal link between DNA variations and complex genetic diseases

Rewilding Britain

International standards for monitoring nature recovery, and biodiversity indicators for rewilding

Leverhulme Centre for Nature Recovery

University of Oxford
Nature Positive and NATURE Impacts project with WWF-UK

Schmidt Fellowship

University of Oxford
ML-enhanced pipelines for estimating food product environmental footprints

2010 - 2014 | **2014 - 2018** | **2018 - 2021** | **2021 - 2022** | **2022** | **2022-2024** | **2023 - now** | **2025 - now** | **2026 +**

DPhil JAI

University of Oxford
FONT – feedback on nanosecond timescales for future linear colliders

MSc Biodiversity Conservation

University of Sussex
Over-road habitat connectivity for reintroduced pine martens

Wild Business

Biodiversity footprinting + developing community-led nature recovery guidance

Senior Research Associate in Food Metrics & Biodiversity

University of Oxford
Environmental footprint of food systems

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2010 - 2014 | 2014 - 2018 | 2018 - 2021 | 2021 - 2022 | 2022 | 2022-2024 | 2023 - now | 2024 - now | 2025 - now

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Environmental footprint of
food systems

Pine Martens

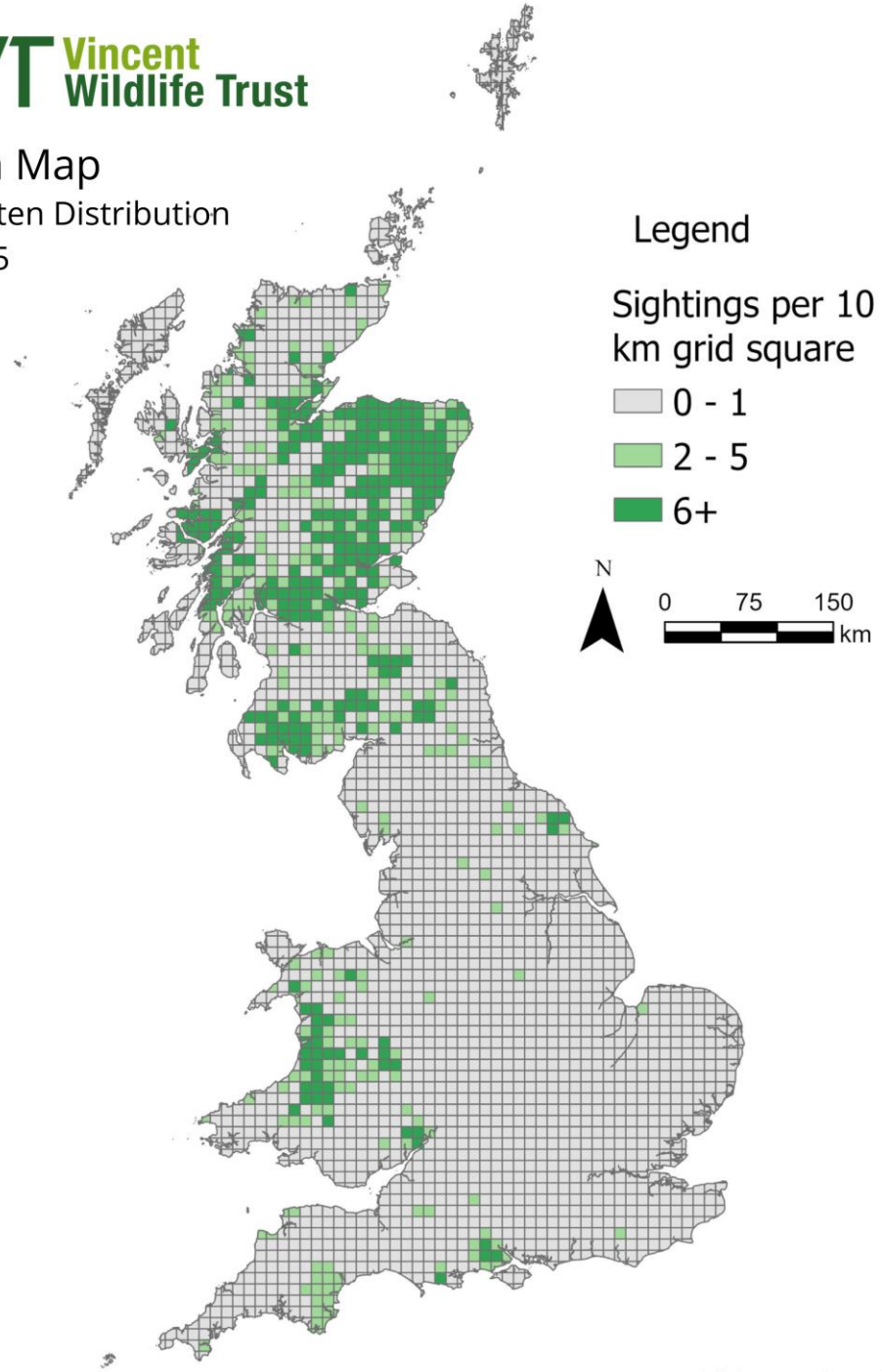
Over-road canopy connectivity mapping

Vincent Wildlife Trust

Marten Map

Pine Marten Distribution

June 2025



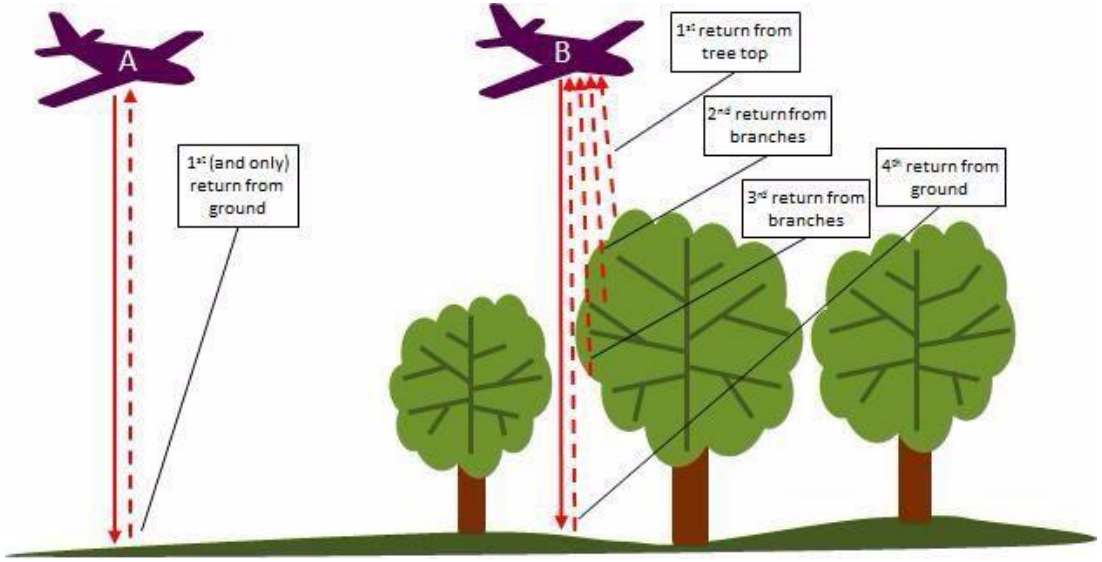
© Vincent Wildlife Trust (2025)

Video: © Terry Whittaker / naturepl.com
https://www.youtube.com/watch?v=INgeVOen1Ps

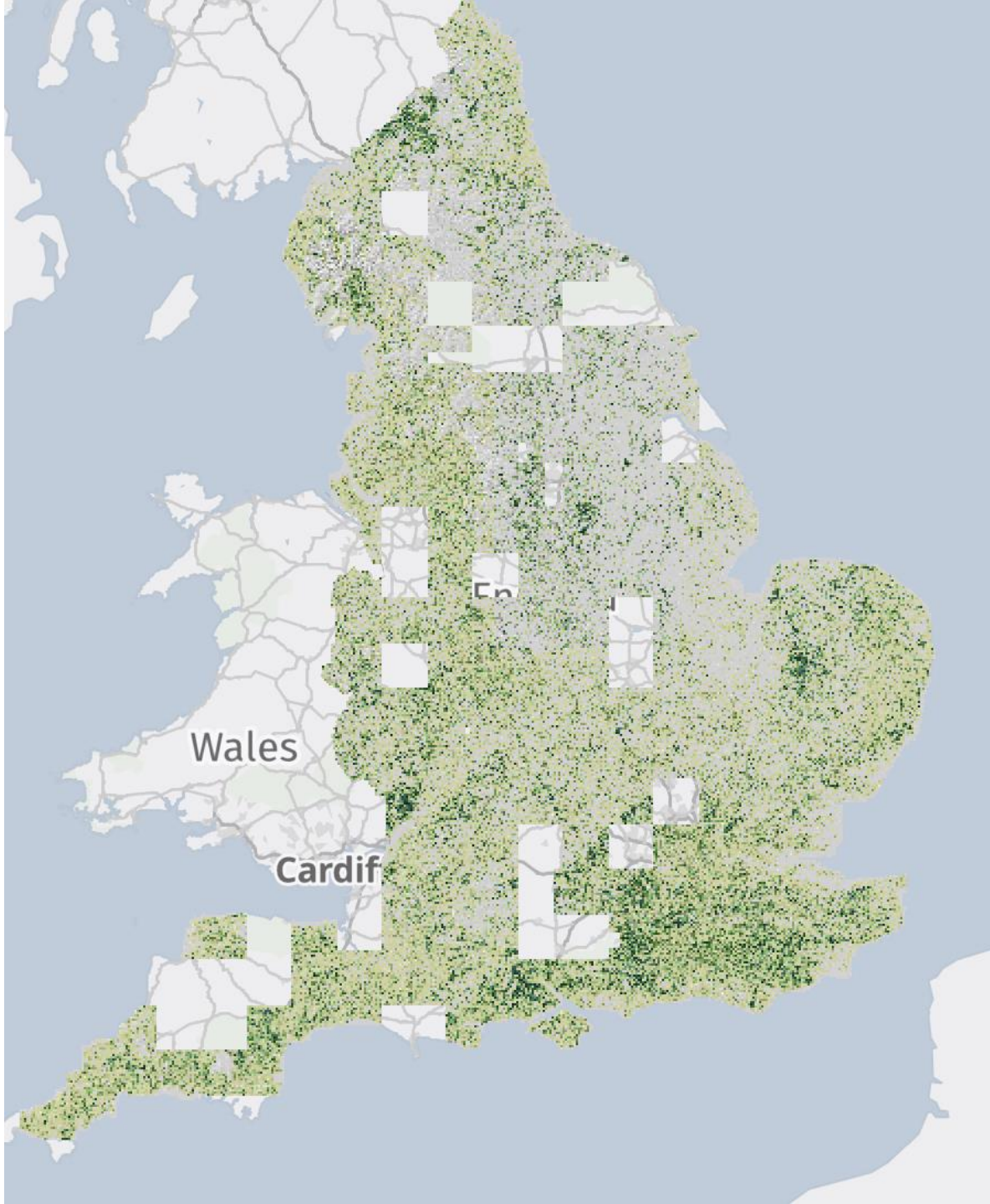
LIDAR MAPPING OF VEGETATION HEIGHT

Vegetation Object Model - GIS modelling using the National LiDAR programme 1m-resolution data with spatial proximity comparisons with OS maps and Sentinel 2 imagery to classify vegetation. Final raster is $1m^2$ pixels of canopy height above ground for all vegetation above 2.5m.

Defra Data Services Platform: https://environment.data.gov.uk/DefraDataDownload/



Photos: Environment Agency Geomantics
https://experience.arcgis.com/experience/753ad2ebd3554fa696885b8c366c3049/page/LIDAR/?views=LIDAR-Home



QGIS ANALYSIS

VEGETATION

Vegetation Object Model reclassified to isolate trees.
Threshold > 4m.

Contains: National LIDAR Programme Vegetation Object Model on Open Government Licence, https://environment.data.gov.uk/DefraDataDownload/?Mode=survey, Downloaded 2022-06-06.

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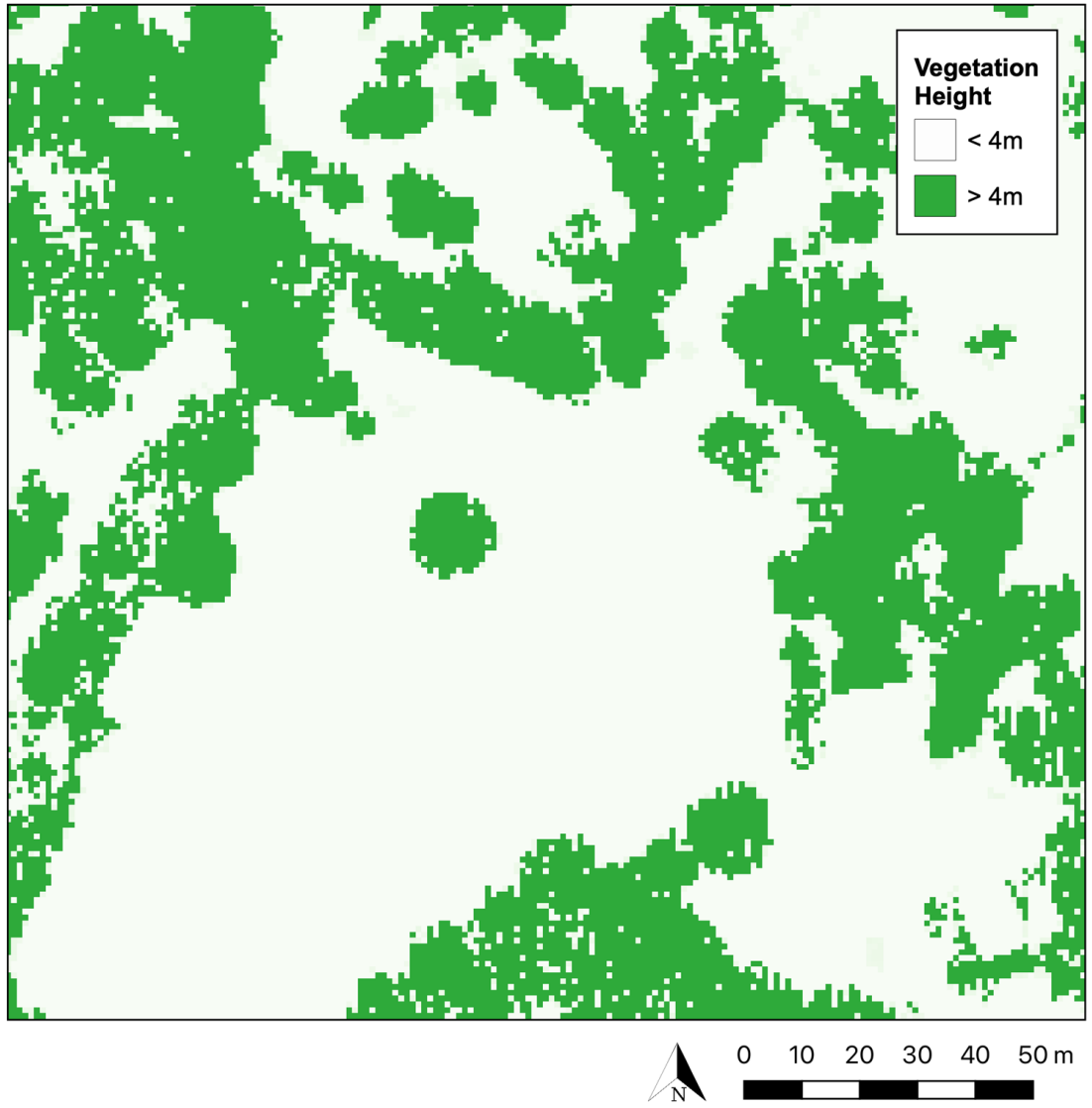

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ROADS

OS MasterMap Topography for road extent.
OS Open Roads for road types, names and lengths.

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OS MasterMap® Topography Layer [GeoPackage geospatial data], Scale 1:1250, Tiles: GB, Updated: 18 November 2021, Ordnance Survey (GB), using: EDINA Digimap Ordnance Survey Service, https://digimap.edina.ac.uk, Downloaded: 2022-06-07.

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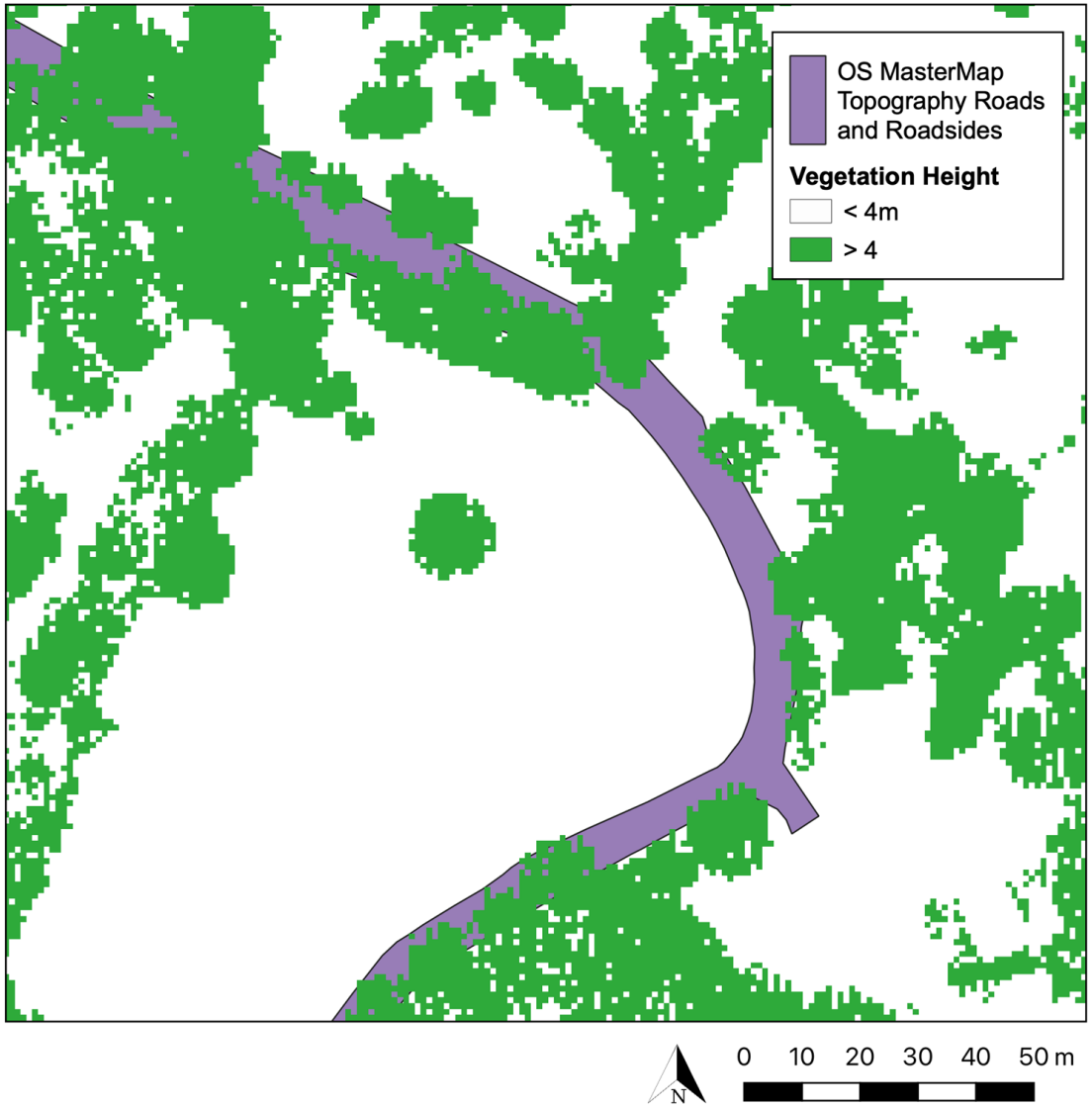

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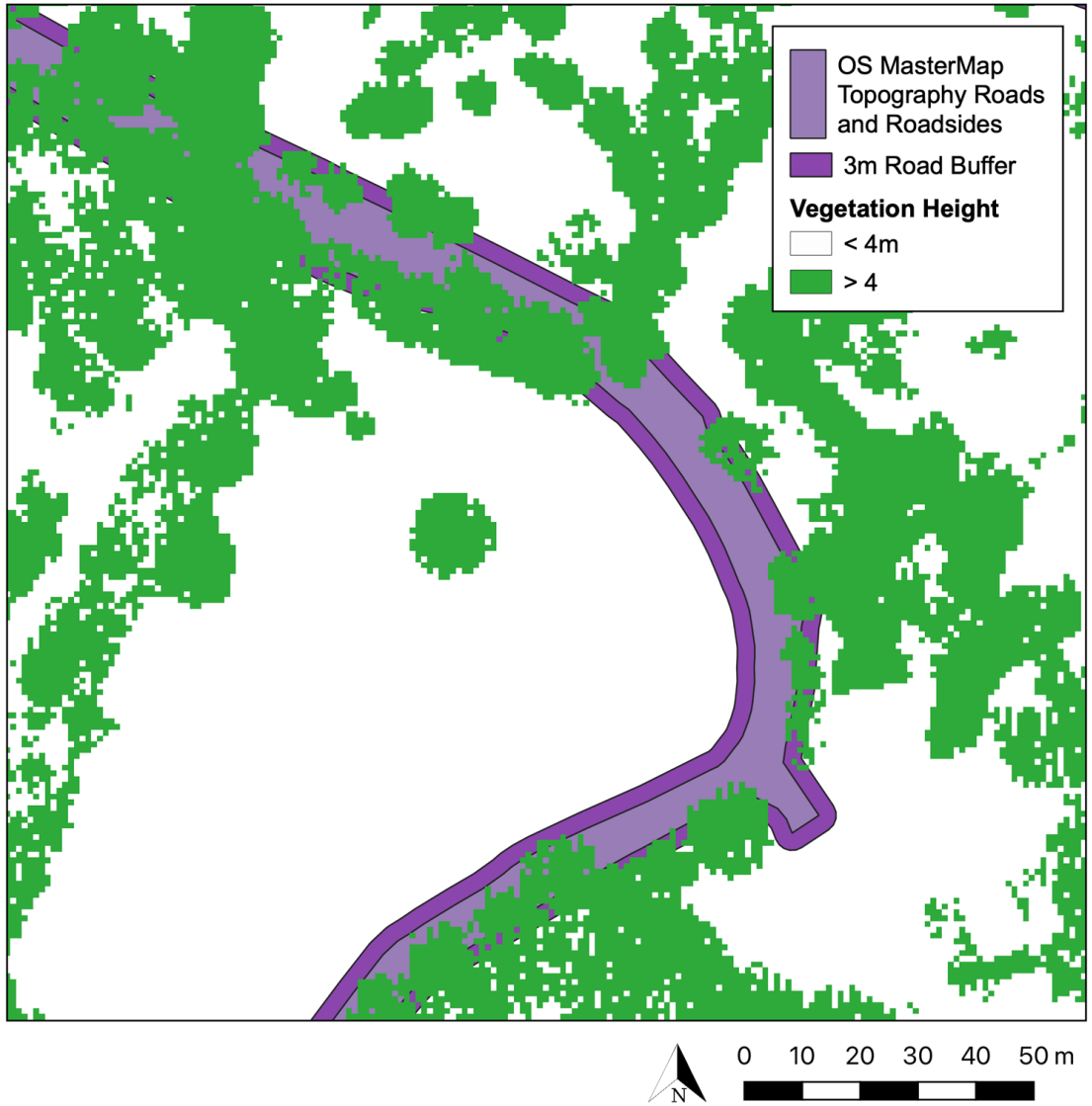
Add 3m road buffer.



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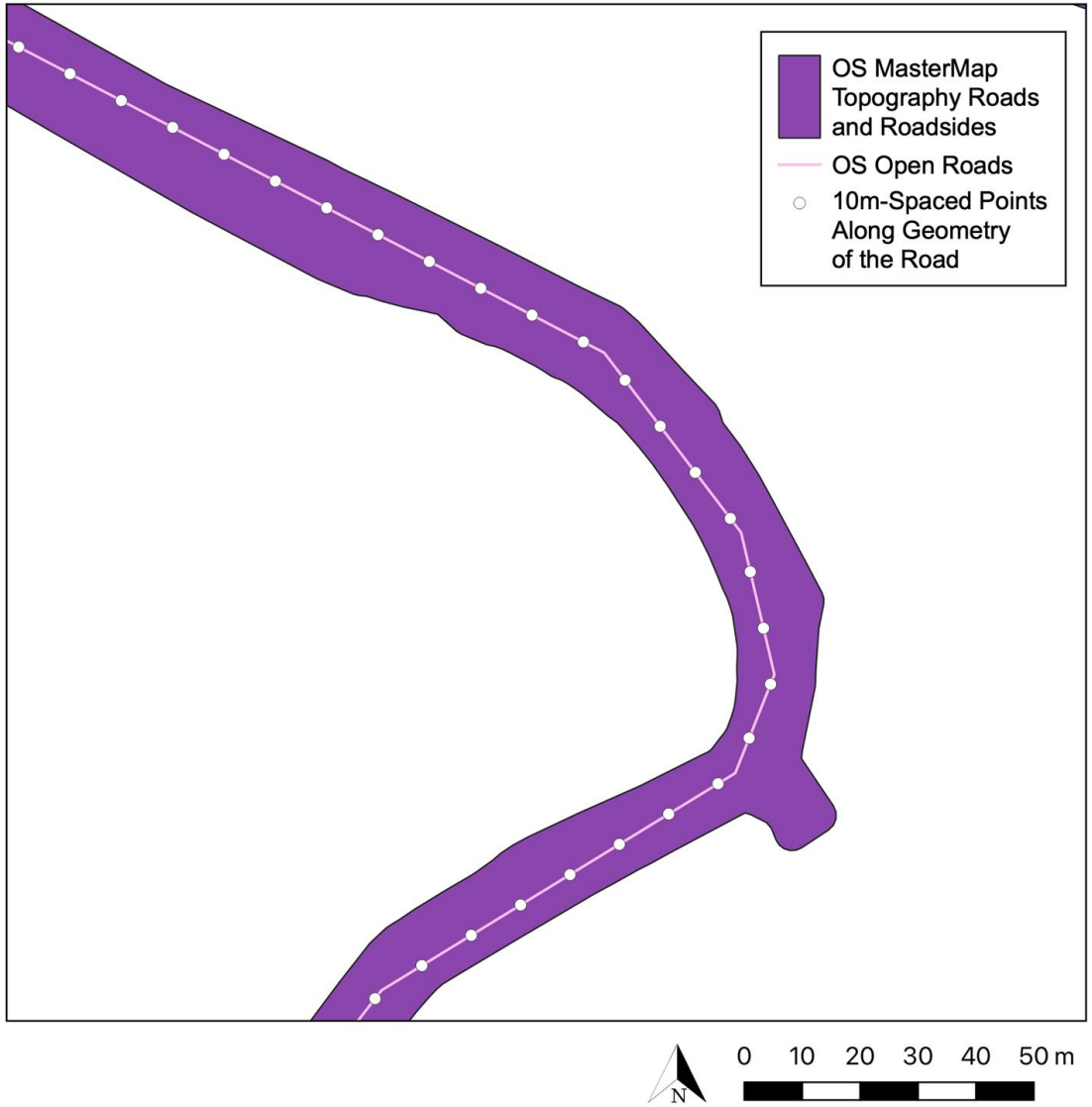
GENERATING ROAD SEGMENTS
Points at 10m intervals along OS Open Roads.



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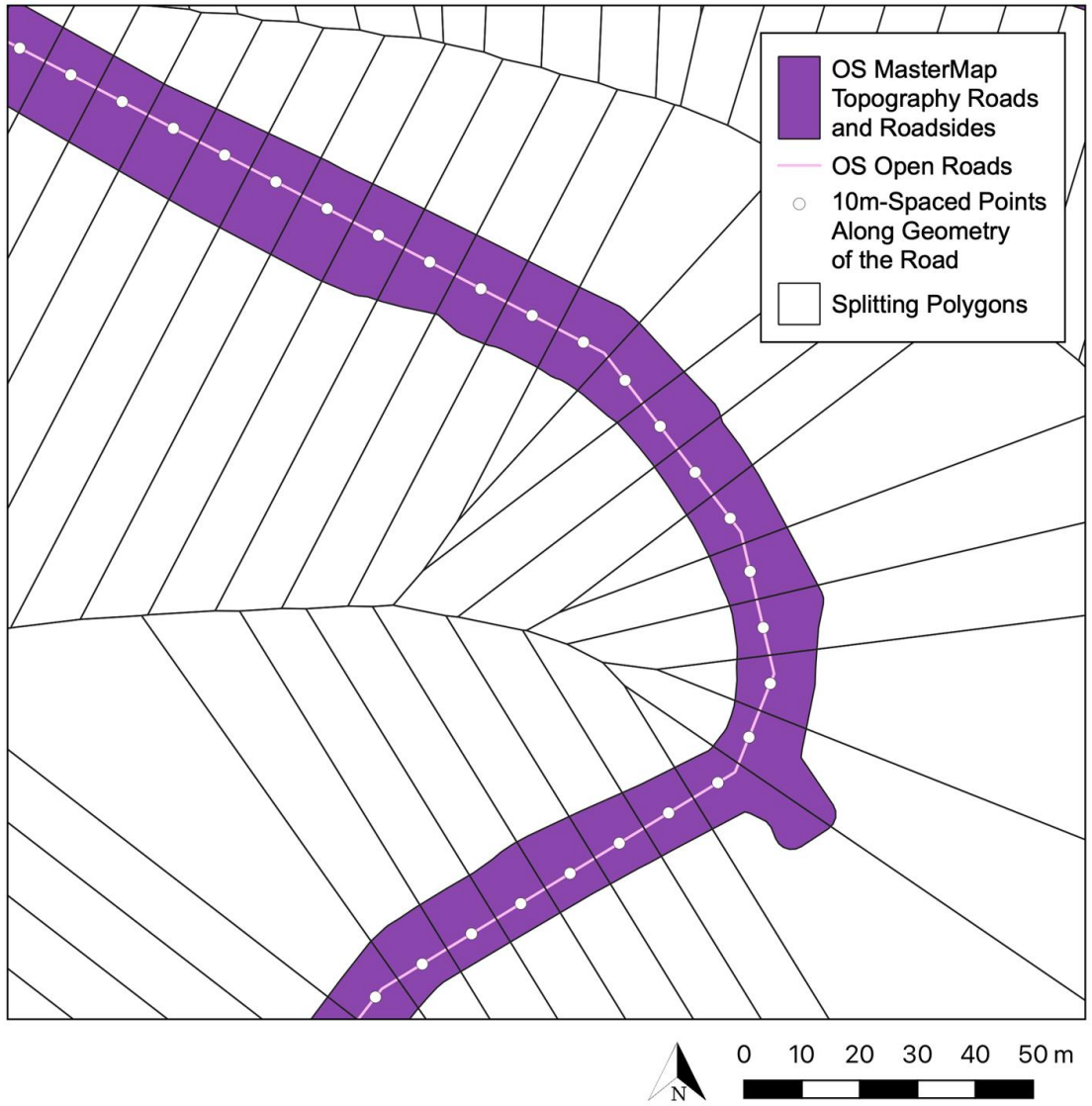
GENERATING ROAD SEGMENTS
Points at 10m intervals along OS Open Roads.
Polygons centred around points used to split the road.



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PERCENTAGE VEGETATION COVER
Clip vegetation to the extent of the road.
Calculate the percentage cover in each road section.

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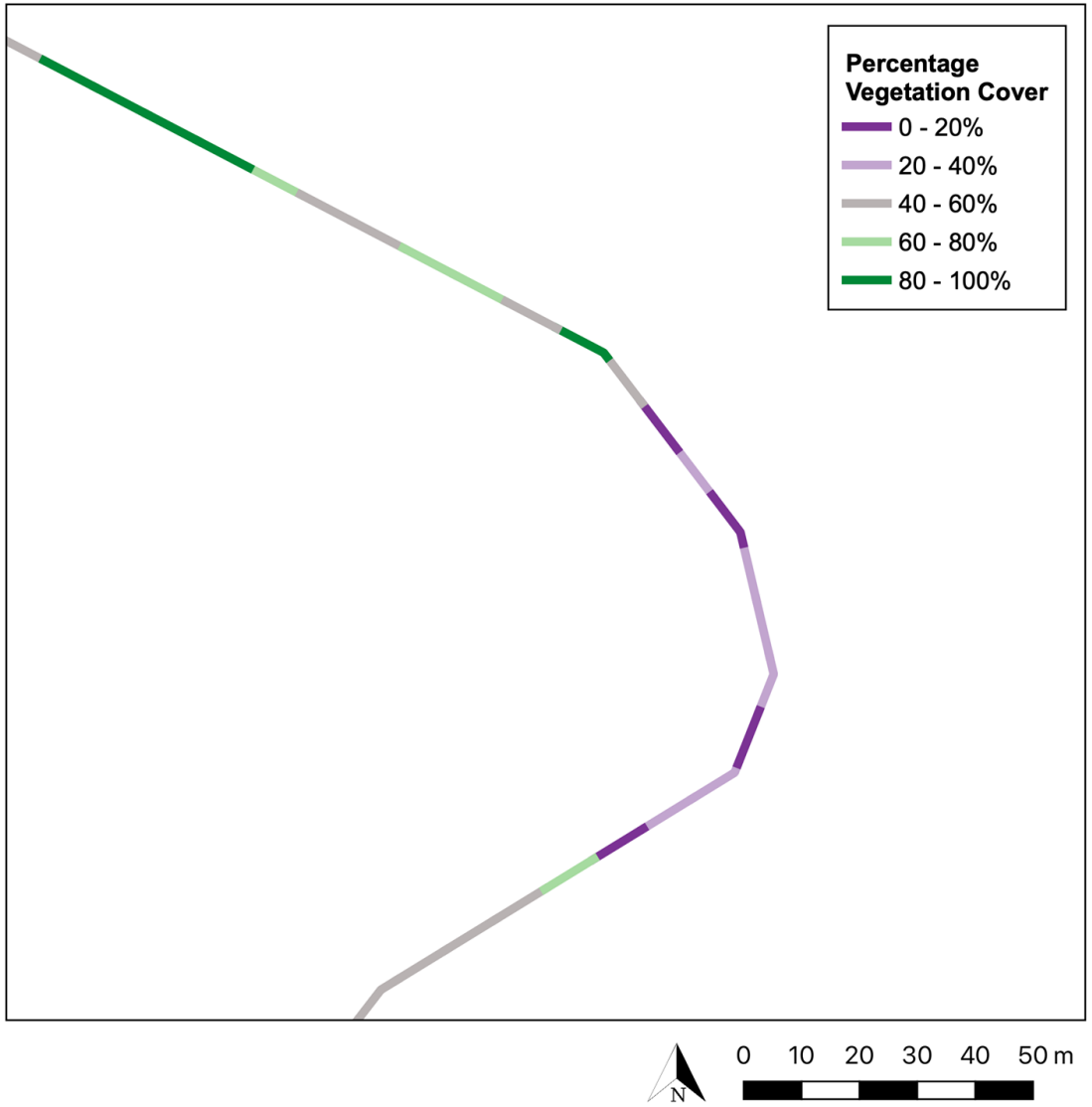
PERCENTAGE VEGETATION COVER
Clip vegetation to the extent of the road.
Calculate the percentage cover in each road section.
Overlay OS Open Roads with percentages.



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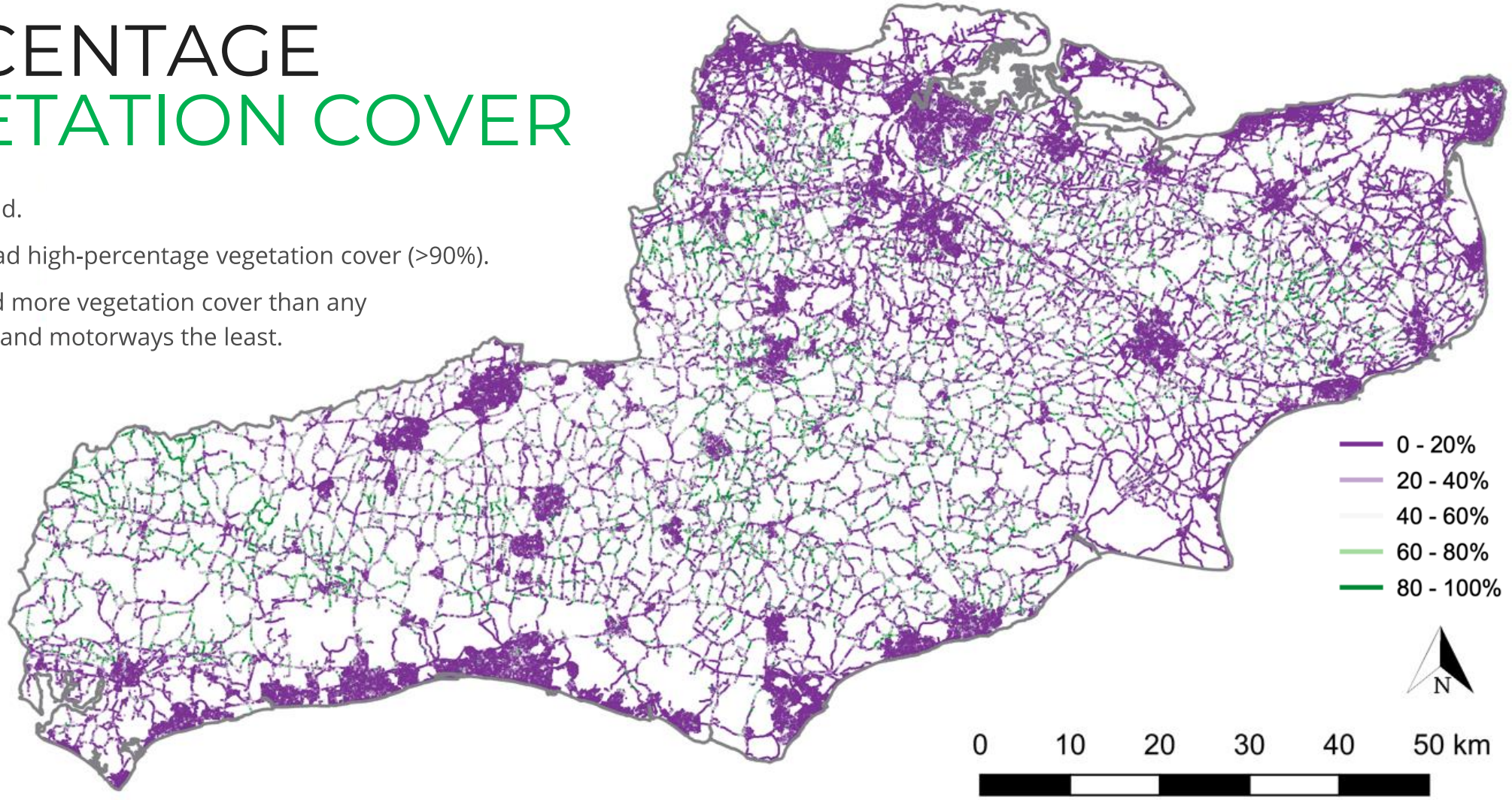
PERCENTAGE VEGETATION COVER

18,901km of road.

2.7% of roads had high-percentage vegetation cover (>90%).

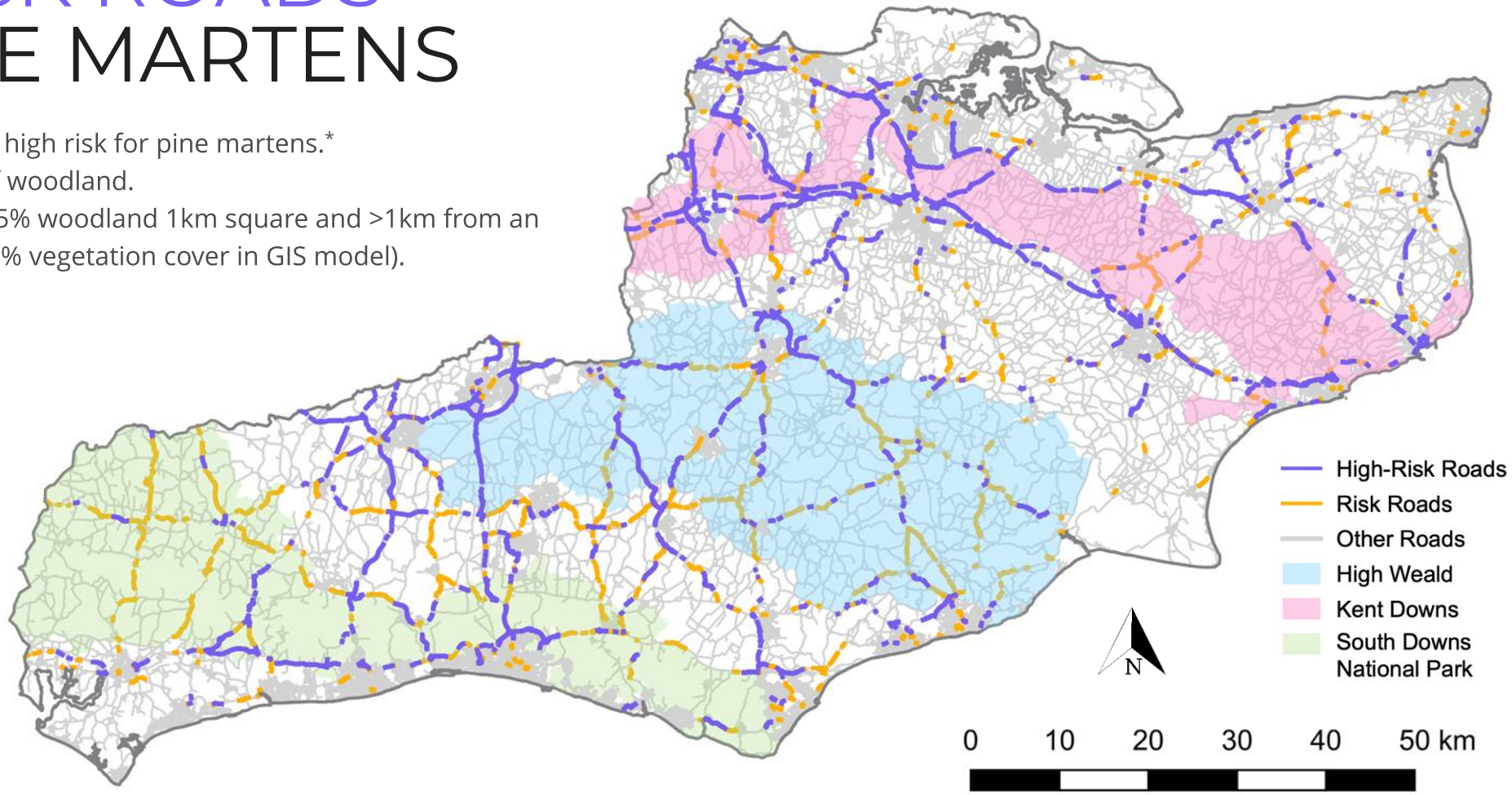
Minor roads had more vegetation cover than any other road type and motorways the least.



Contains: OS Open Roads, and Boundary-Line data © Crown copyright and database right 2022. OS MasterMap® Topography Layer [GeoPackage geospatial data], Scale 1:1250, Tiles: GB, Updated: 18 November 2021, Ordnance Survey (GB), Using: EDINA Digimap Ordnance Survey Service, https://digimap.edina.ac.uk, Downloaded: 2022-06-07. National LIDAR Programme Vegetation Object Model on Open Government Licence, https://environment.data.gov.uk/DefraDataDownload/?Mode=survey, Downloaded 2022-06-06.

HIGH RISK ROADS FOR PINE MARTENS

Motorways and A-roads are high risk for pine martens.*
Risk roads: Within 75m** of woodland.
High-risk roads: Within a ≥5% woodland 1km square and >1km from an arboreal road crossing (>90% vegetation cover in GIS model).



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Gregory, T. et al (2017).
Natural canopy bridges effectively mitigate tropical forest fragmentation for arboreal mammals.
Nature Sci Rep, 7(1), 3892

Biodiversity Footprints

Quantifying how, where, and how much pressure human activities place on nature

- Consistent framework for comparing environmental impacts
- Identifying major drivers of nature loss
- Prioritising actions to reduce harm and support recovery

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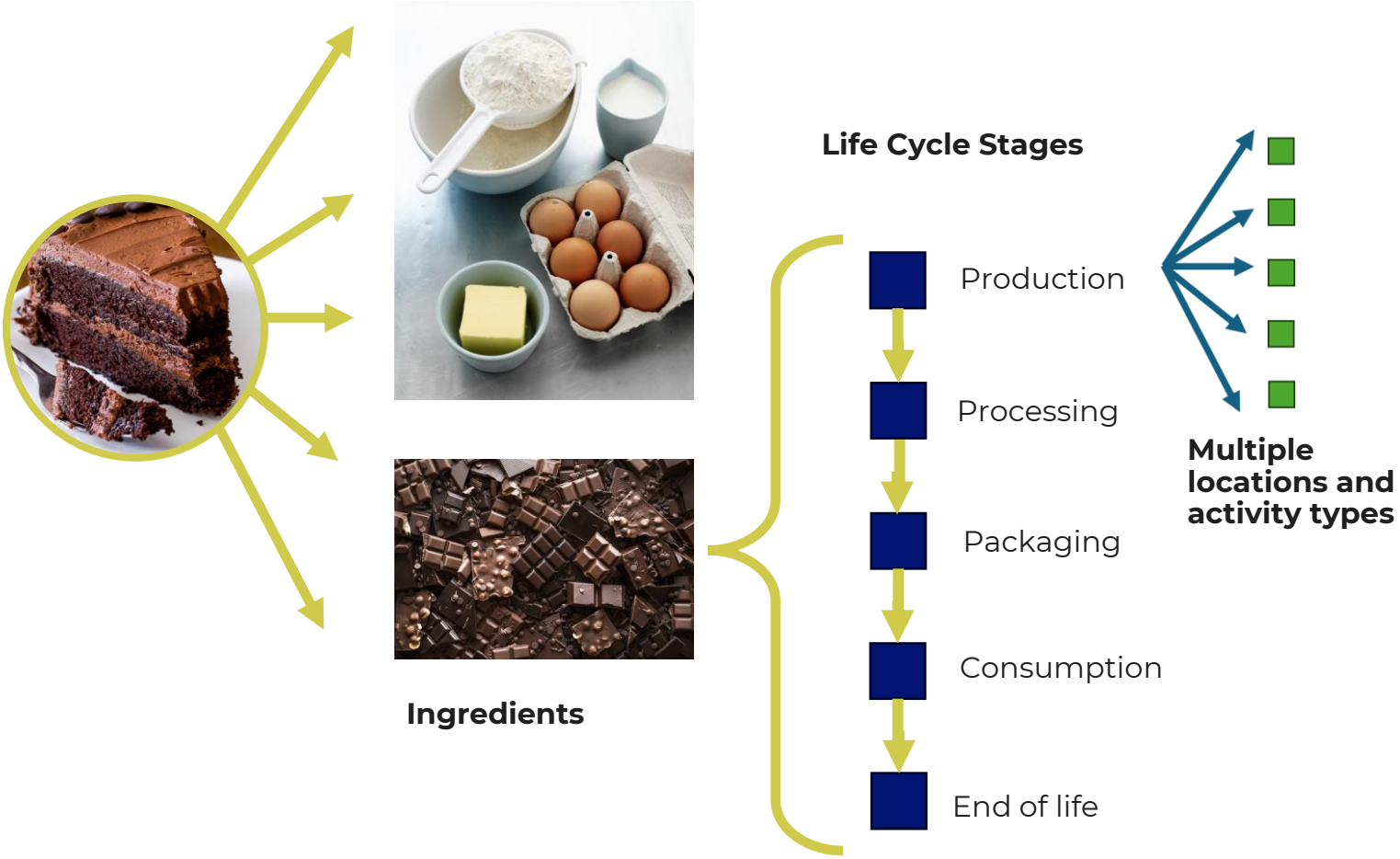
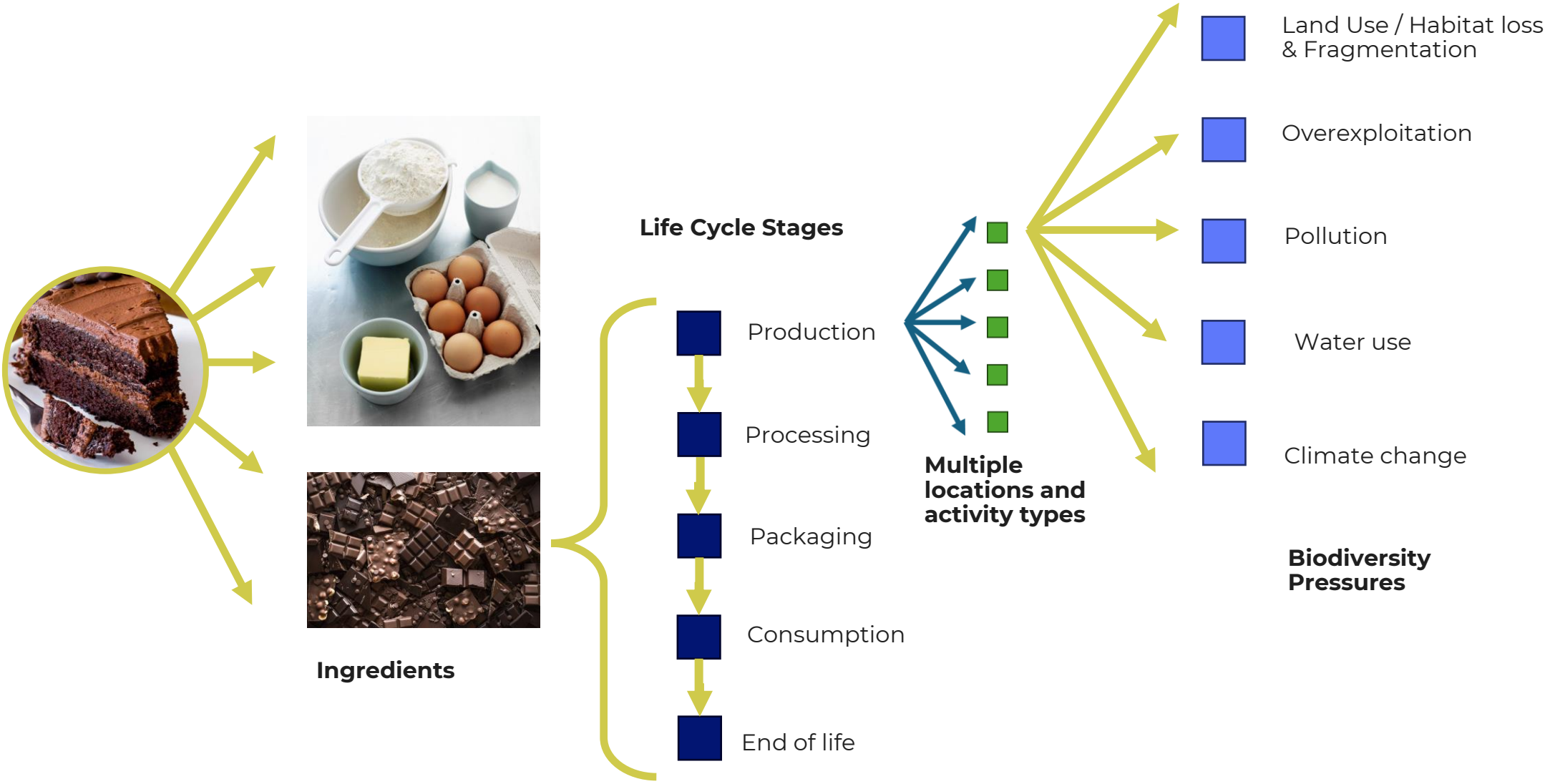
Ingredients

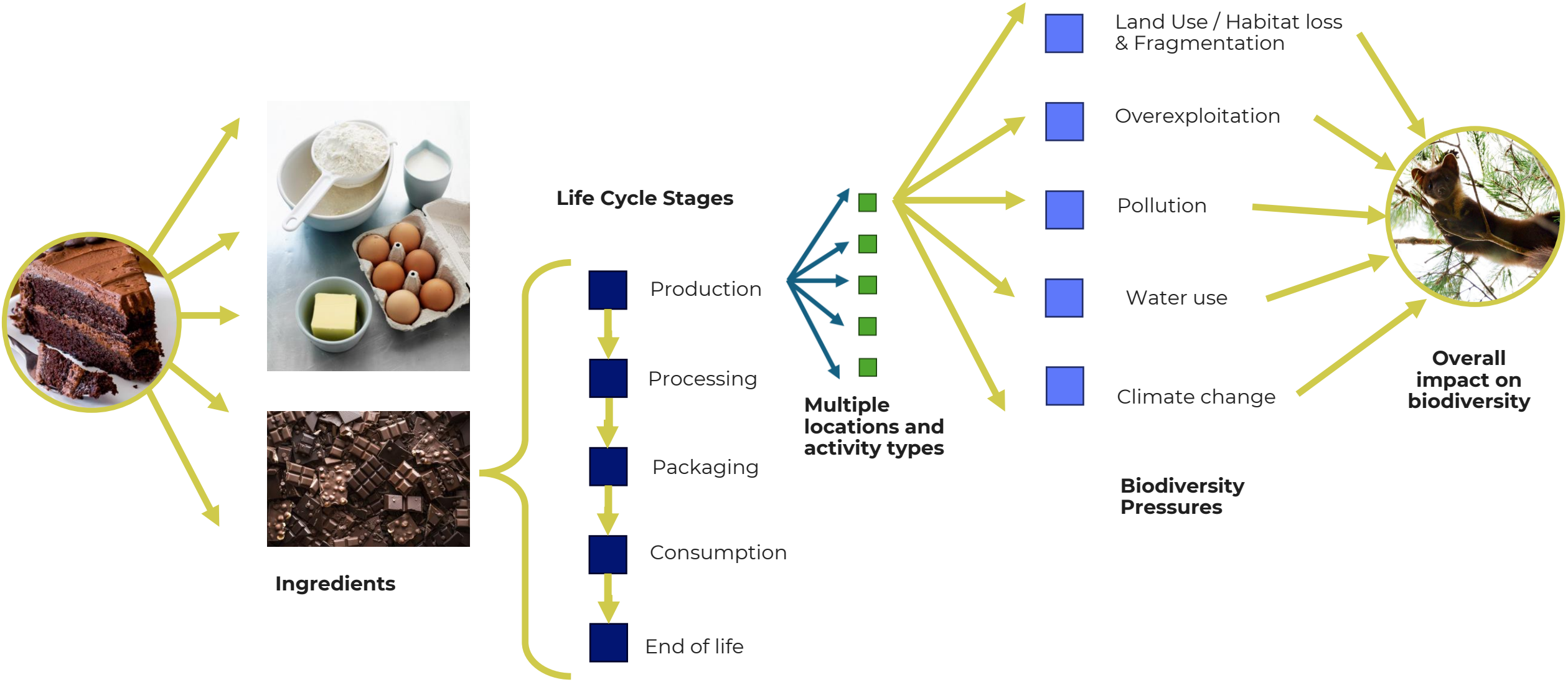
Ingredients

Life Cycle Stages

- Production
- Processing
- Packaging
- Consumption
- End of life


Life Cycle Stages
Production
Processing
Packaging
Consumption
End of life
Multiple locations and activity types
Ingredients


Ingredients
Life Cycle Stages
Production
Processing
Packaging
Consumption
End of life
Multiple locations and activity types
Land Use / Habitat loss & Fragmentation
Overexploitation
Pollution
Water use
Climate change
Biodiversity Pressures


Ingredients
Life Cycle Stages
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Processing
Packaging
Consumption
End of life
Multiple locations and activity types
Land Use / Habitat loss & Fragmentation
Overexploitation
Pollution
Water use
Climate change
Biodiversity Pressures
Overall impact on biodiversity

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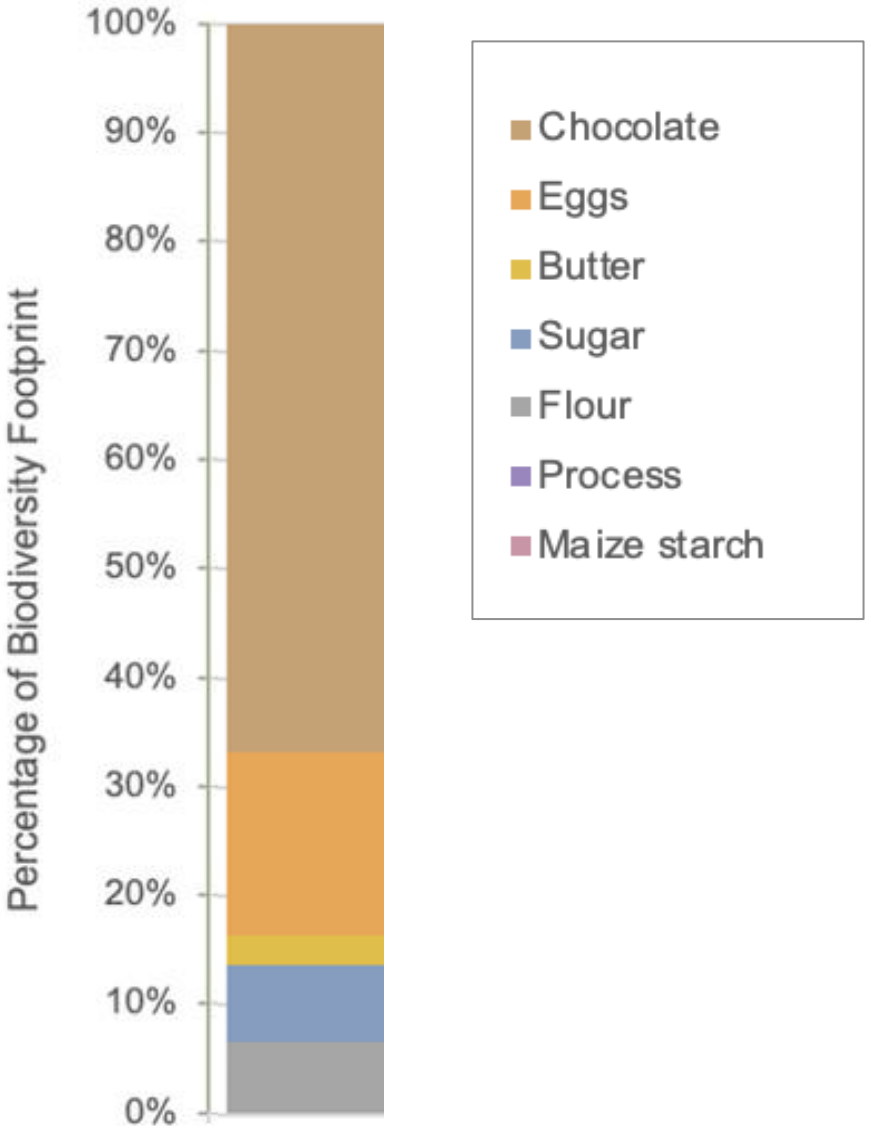
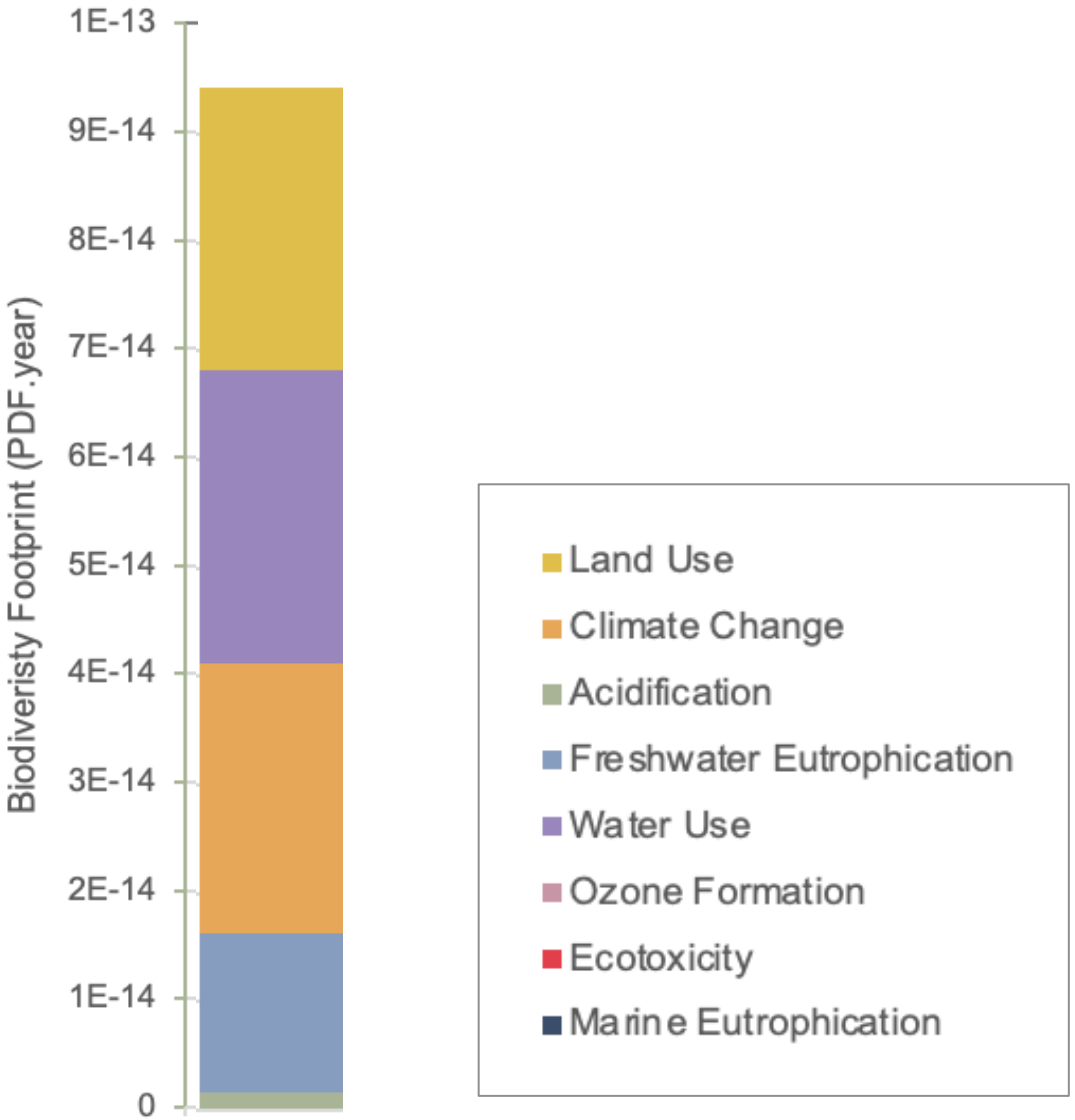
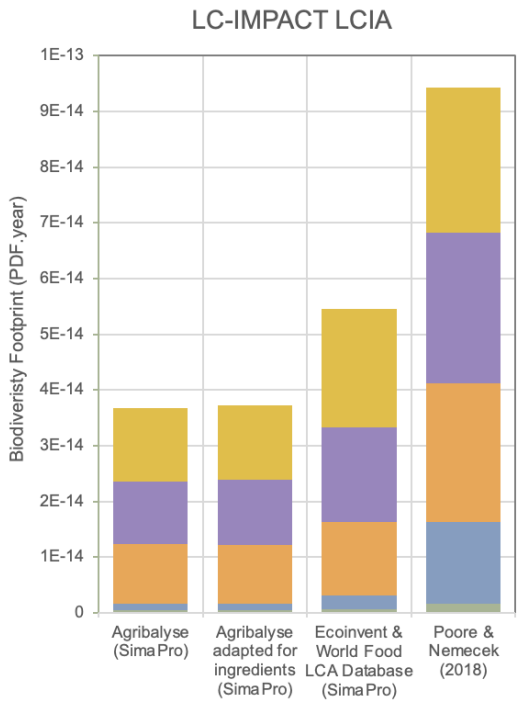

Percentage of Biodiversity Footprint
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Chocolate
Eggs
Butter
Sugar
Flour
Process
Maize starch

© Sally's Baking Addiction


Biodiveristy Footprint (PDF.year)
1E-13
9E-14
8E-14
7E-14
6E-14
5E-14
4E-14
3E-14
2E-14
1E-14
0
Land Use
Climate Change
Acidification
Freshwater Eutrophication
Water Use
Ozone Formation
Ecotoxicity
Marine Eutrophication

s Baking Addiction


LC-IMPACT LCIA
Biodiveristy Footprint (PDF.year)
1E-13
9E-14
8E-14
7E-14
6E-14
5E-14
4E-14
3E-14
2E-14
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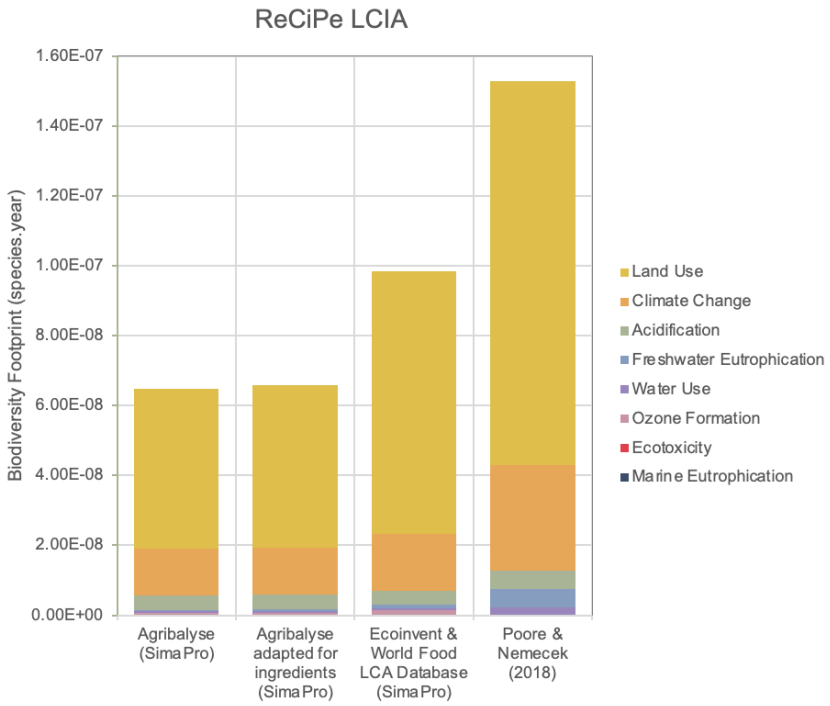
0
Agribalyse (Sima Pro)
Agribalyse adapted for ingredients (Sima Pro)
Ecoinvent & World Food LCA Database (Sima Pro)
Poore & Nemecek (2018)


ReCiPe LCIA
Biodiversity Footprint (species.year)
1.60E-07
1.40E-07
1.20E-07
1.00E-07
8.00E-08
6.00E-08
4.00E-08
2.00E-08
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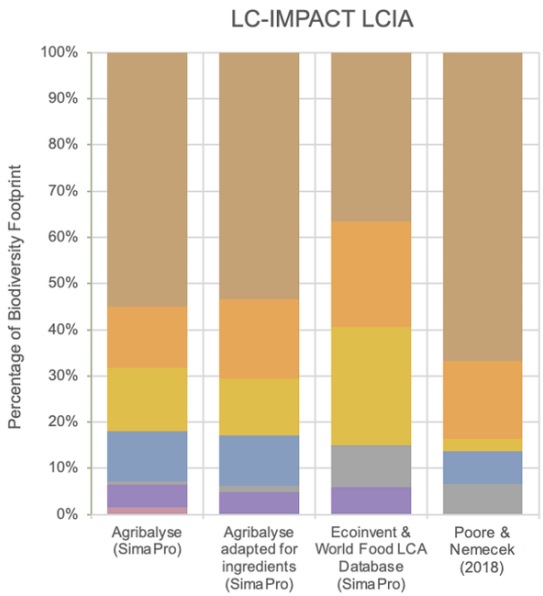
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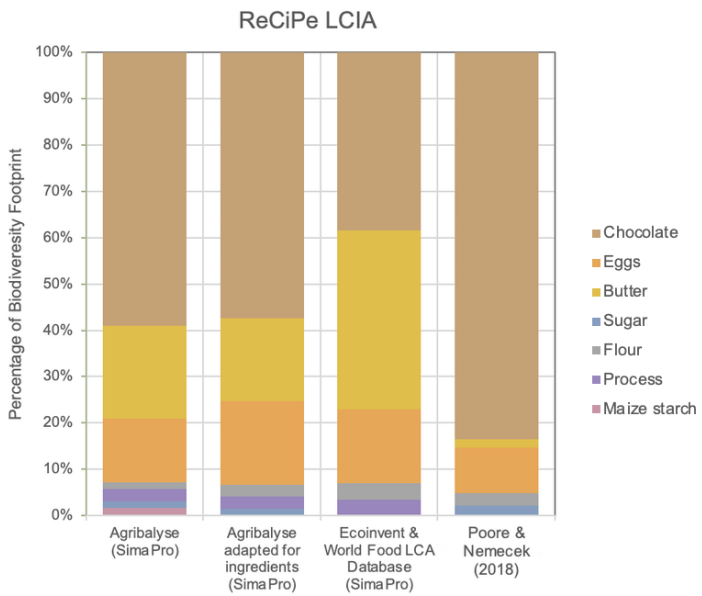
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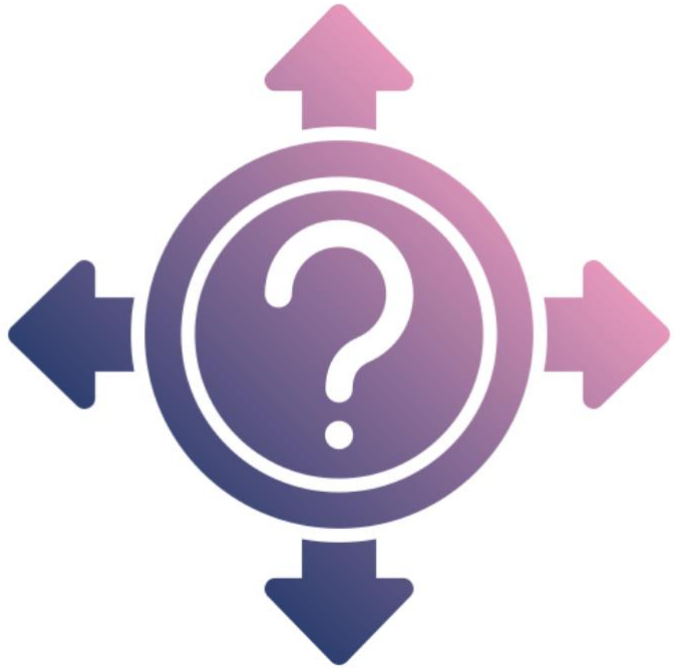

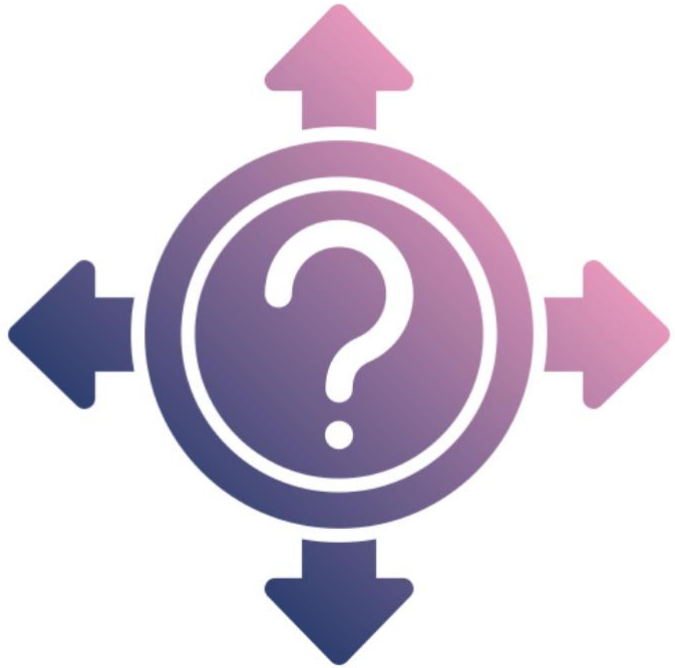

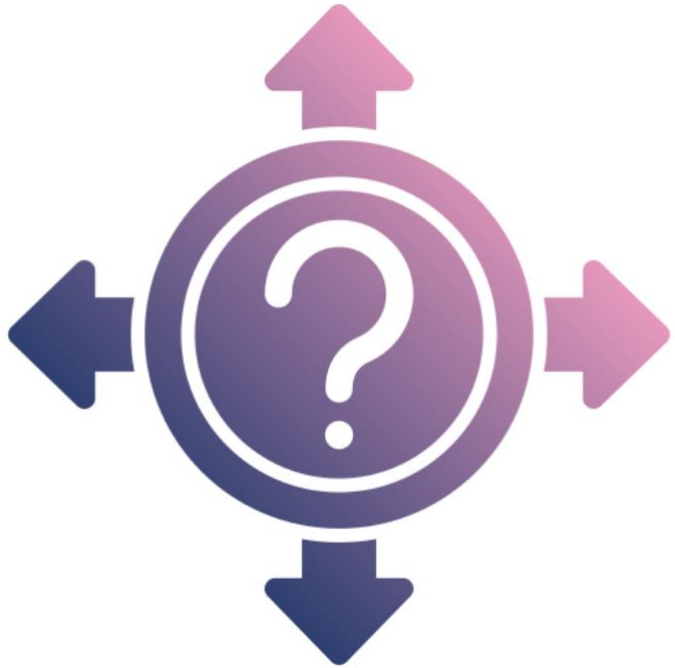

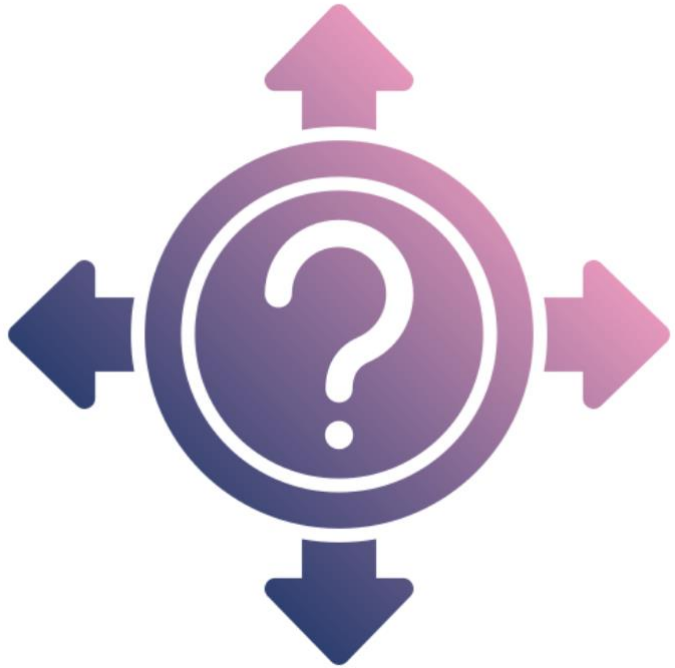

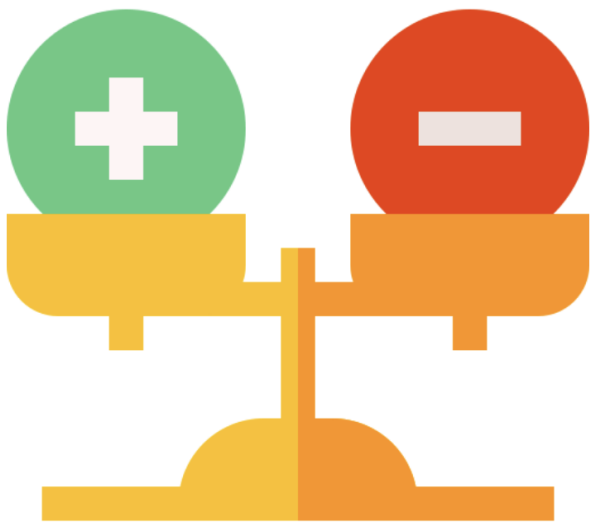

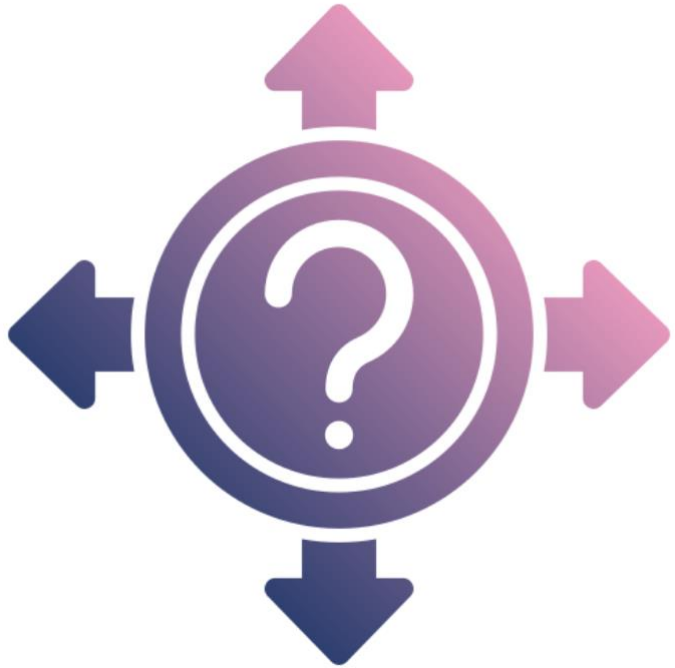

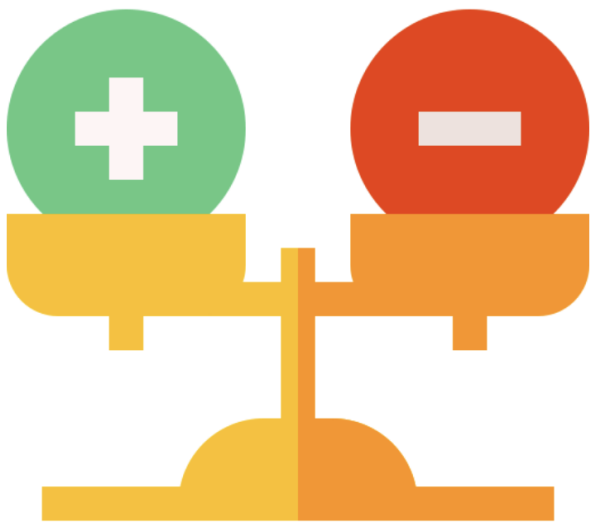

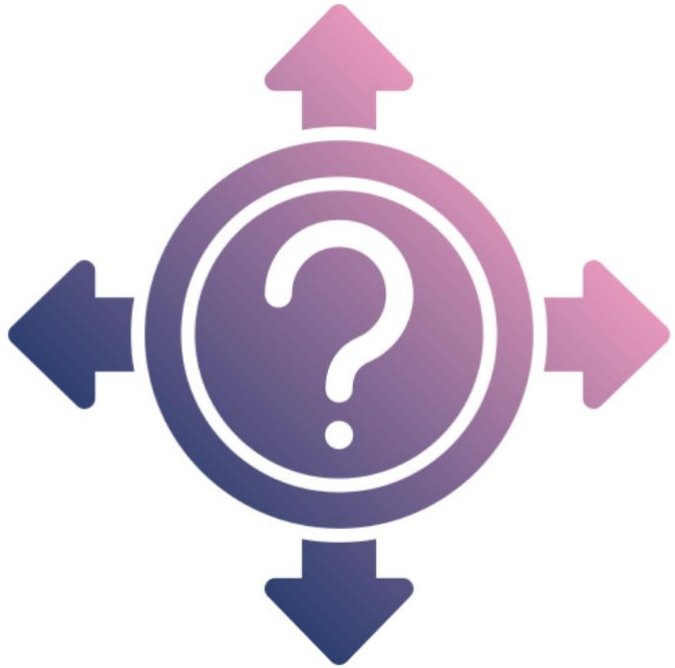

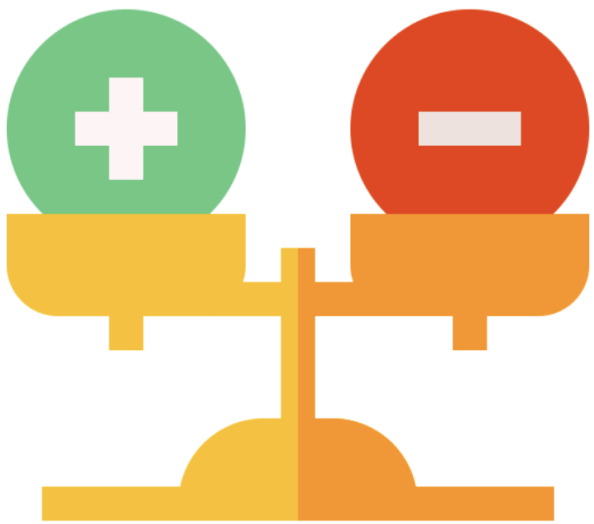

CASE
STUDY

DUBAI
BBC NEWS
BBC NEWS

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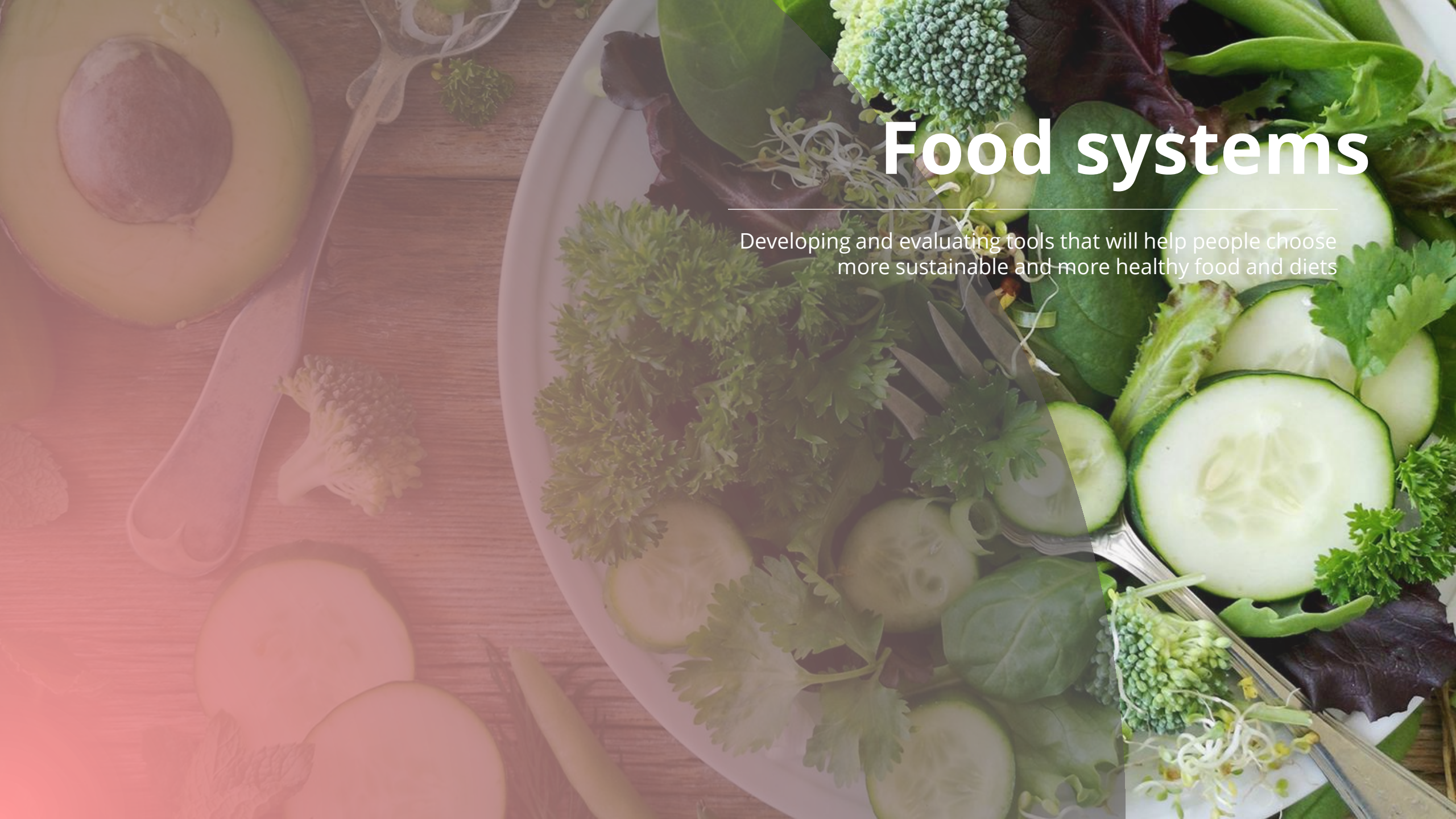
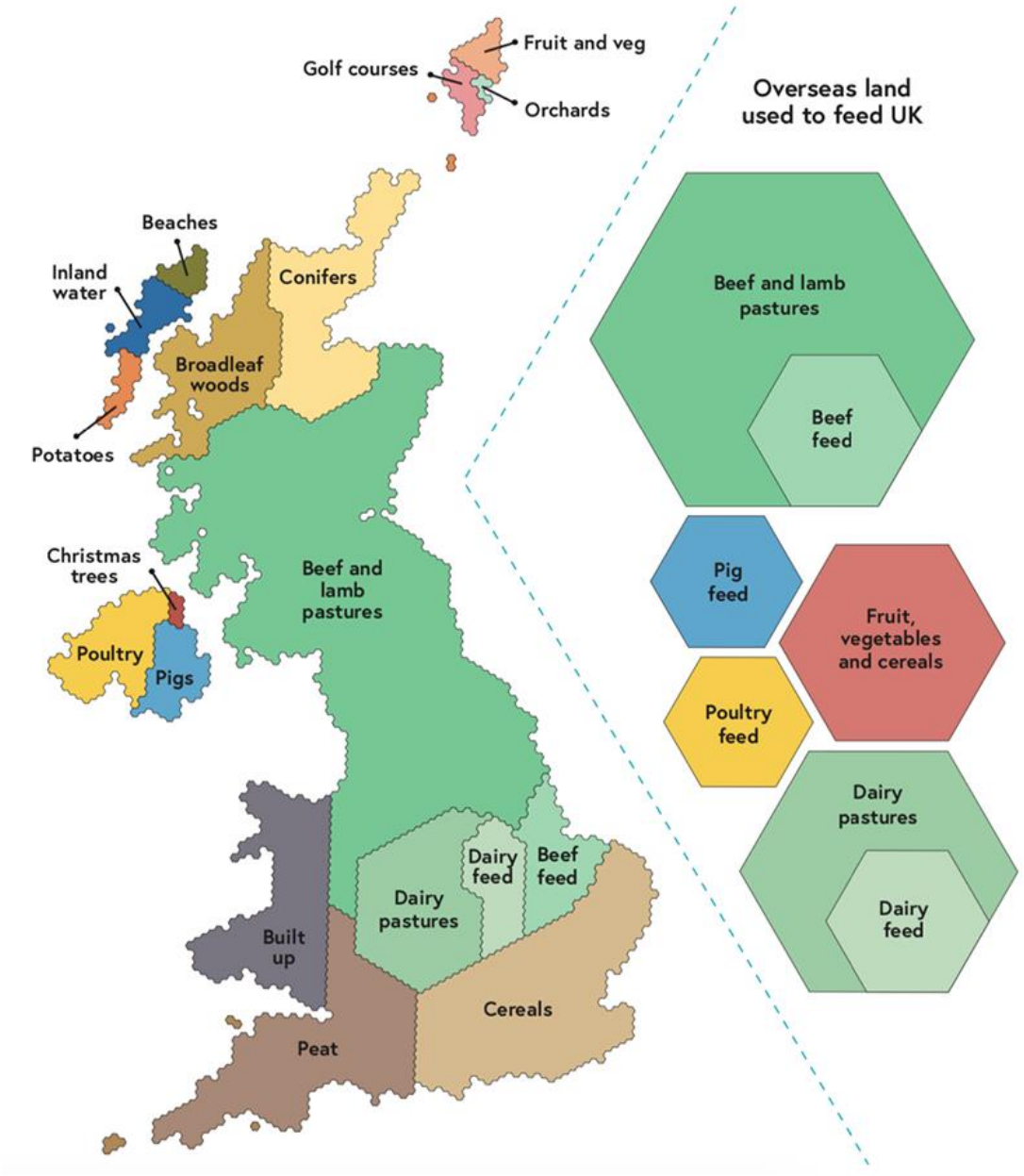
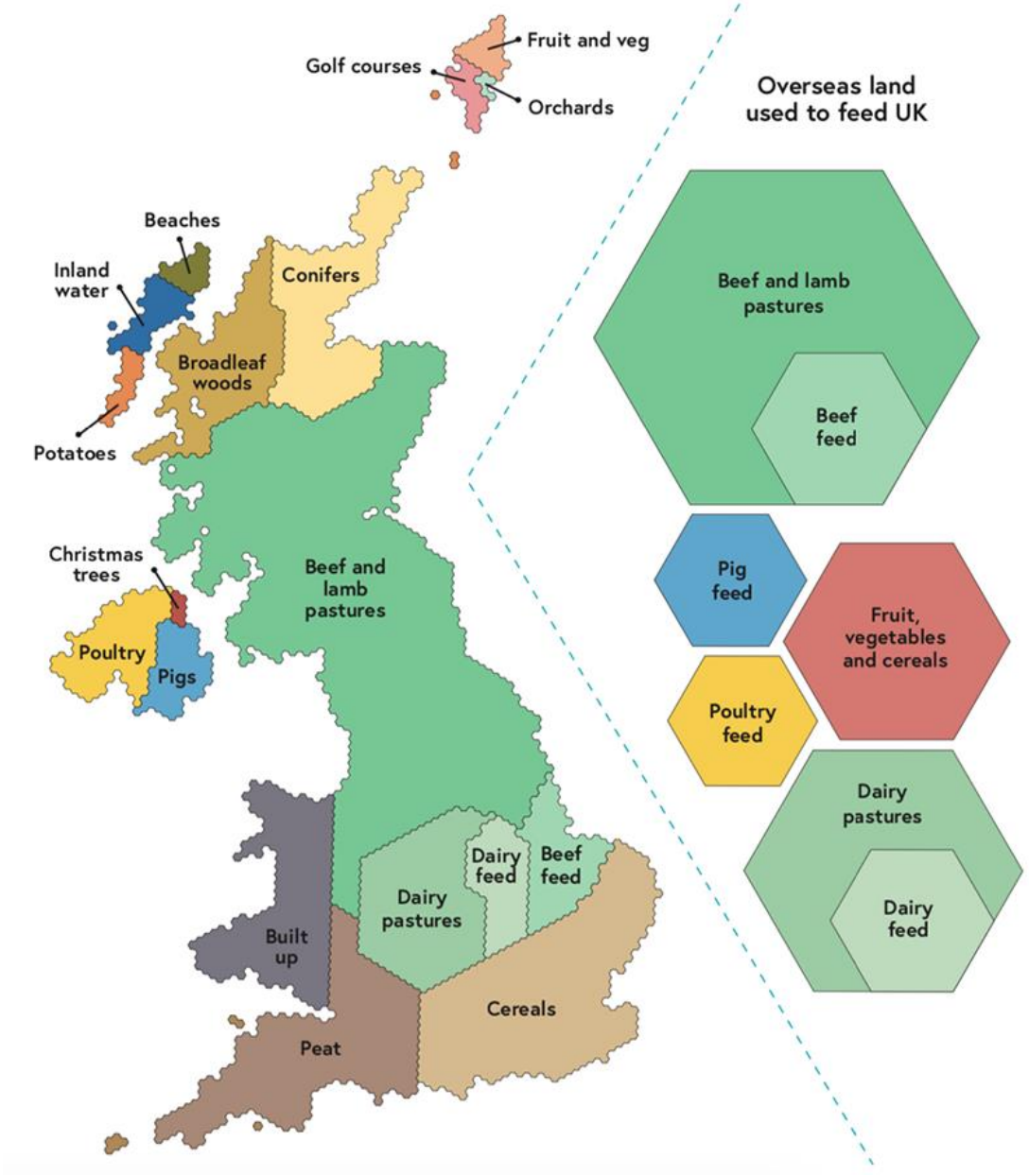


Food systems

Developing and evaluating tools that will help people choose more sustainable and more healthy food and diets



Source: ***The National Food Strategy***, *Part II*



Source: ***The National Food Strategy***, *Part II*

L. Greenspoon, et al, ***The global biomass of wild mammals****, Proc. Natl. Acad. Sci. U.S.A. 120 (10) e2204892120*

kg GHG

m^3 water

m^2 land

per bar?

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Very large & diverse food datasets...

Inconsistent

Retail product names and categories are not standardised

Incomplete

Only **~10%** of ingredients have percentage composition visible on-pack → **90% must be inferred**

Scale

120 UK food categories vs **100,000+** UK products

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Scale

120 UK food categories vs **100,000+** UK products

Goal

- Better match new products at scale to known environmental impact data
- Improve categorisation
- Infer likely ingredient compositions
- Represent uncertainty

The application changed; the analytical approach has stayed the same…

- Systems-scale thinking and model-based reasoning
- Working rigorously with uncertainty and assumptions
- Extracting signal from large, messy, incomplete data

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