## Supplementary Information for

# Dietary change is not a prerequisite for effective biodiversity conservation but reduces socioeconomic obstacles

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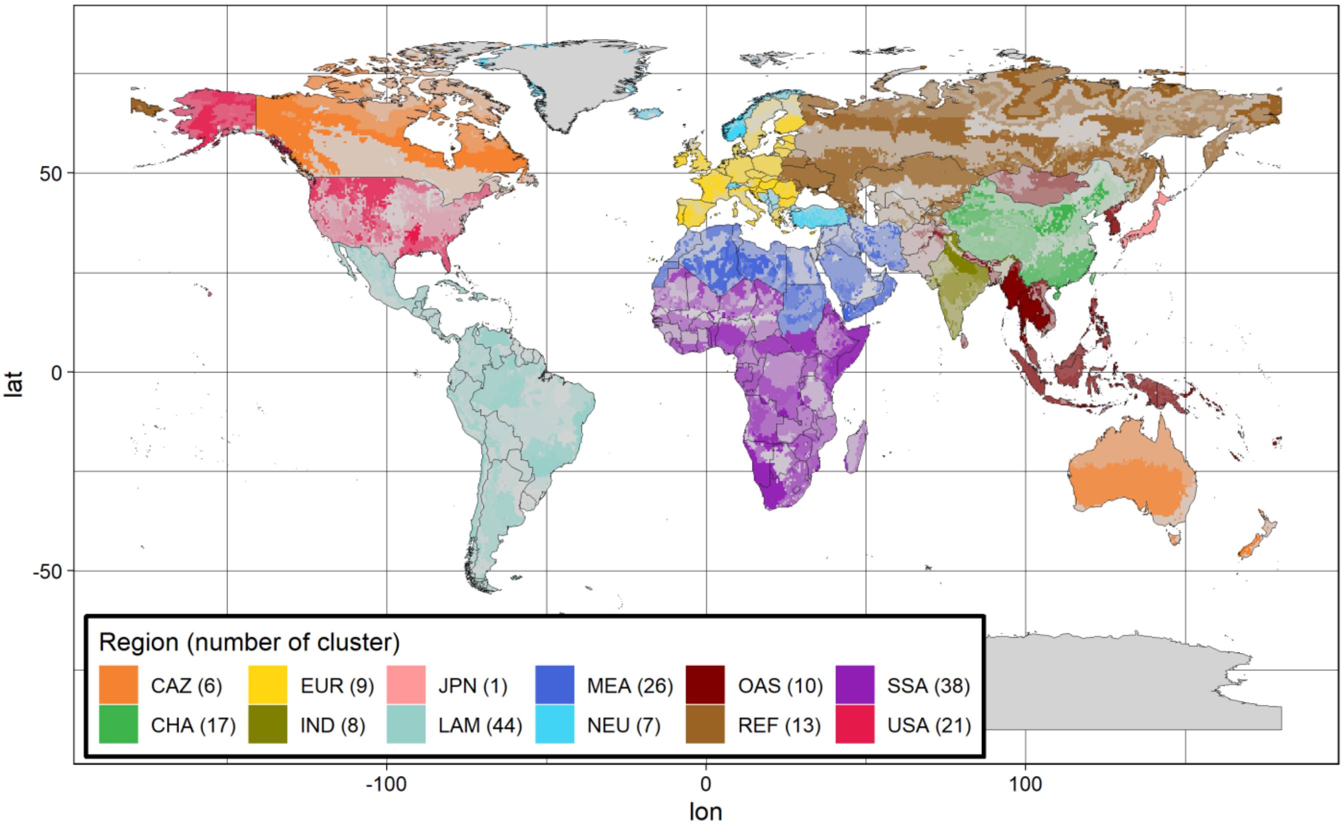
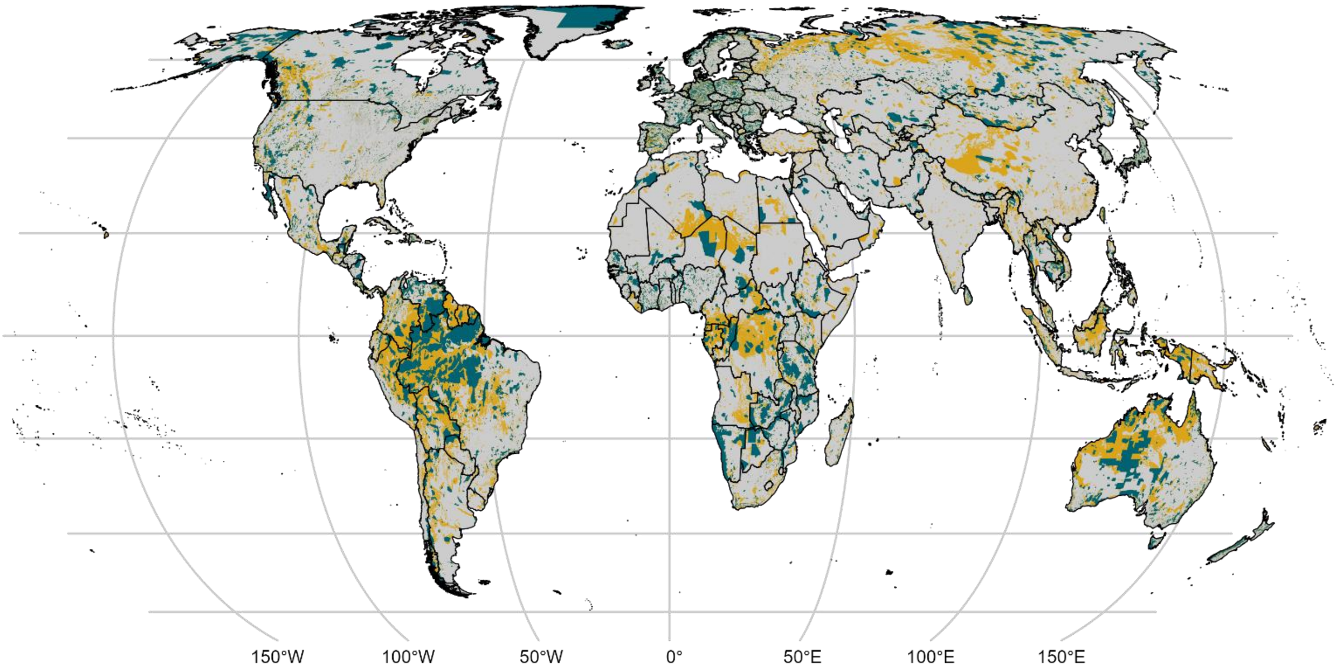


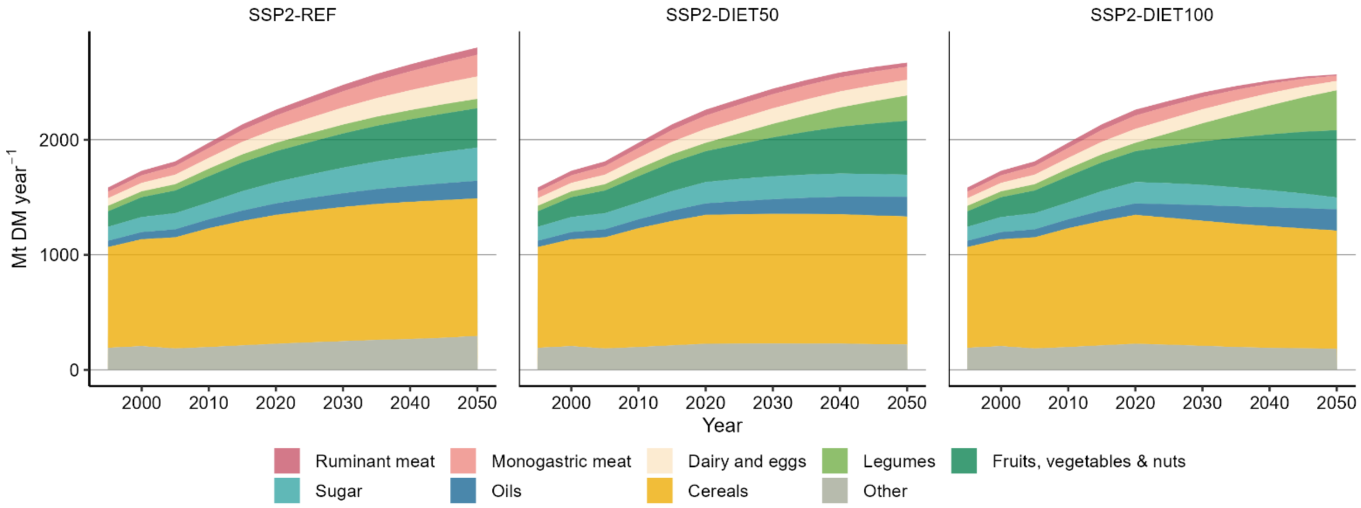

**Supplementary Figure 1: MAgPIE world regions and spatial clusters (number in brackets) in each world region.** The MAgPIE model operates at two spatial levels, including a coarse level of twelve regions with similar socioeconomic features, and a more detailed level of spatial clusters[1]. Process like land competition are modelled at the cluster level and depend on biophysical information at a 0.5 degree spatial resolution, such as cropland suitability, crop yield potential, irrigation water requirements, or proximity to urban markets. Inputs at the 0.5 degree spatial resolution are aggregated to the cluster level based on a k-means clustering algorithm due to computational constraints[2].

**Supplementary Table 1: ISO3 codes of countries grouped to MAgPIE world regions**

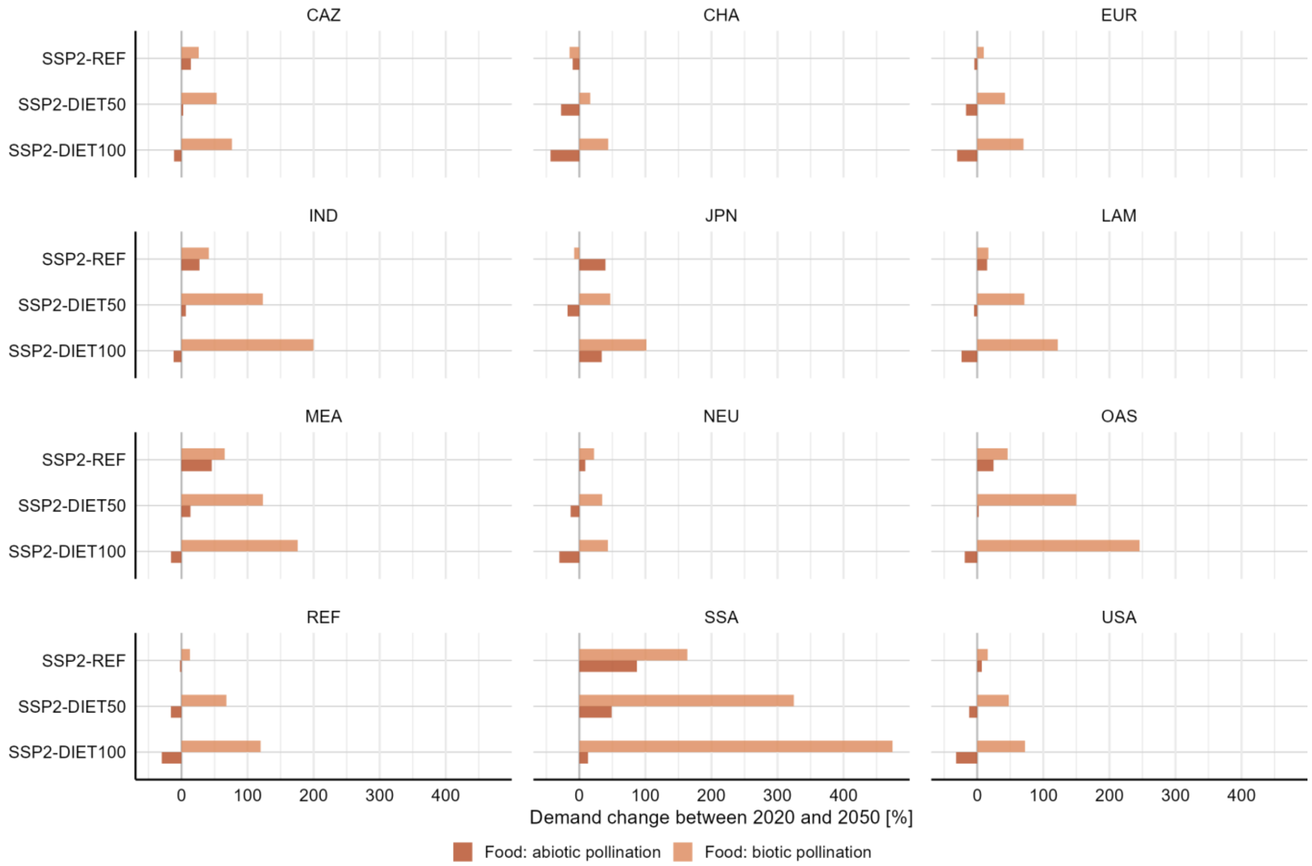
| MAgPIE region | ISO3 country codes |
|---|---|
| CAZ | AUS, CAN, HMD, NZL, SPM |
| CHA | CHN, HKG, MAC, TWN |
| EUR | ALA, AUT, BEL, BGR, CYP, CZE, DEU, DNK, ESP, EST, FIN, FRA, FRO, GBR, GGY, GIB, GRC, HRV, HUN, IMN, IRL, ITA, JEY, LTU, LUX, LVA, MLT, NLD, POL, PRT, ROU, SVK, SVN, SWE |
| IND | IND |
| JPN | JPN |
| LAM | ABW, AIA, ARG, ATA, ATG, BES, BHS, BLM, BLZ, BMU, BOL, BRA, BRB, BVT, CHL, COL, CRI, CUB, CUW, CYM, DMA, DOM, ECU, FLK, GLP, GRD, GTM, GUF, GUY, HND, HTI, JAM, KNA, LCA, MAF, MEX, MSR, MTQ, NIC, PAN, PER, PRI, PRY, SGS, SLV, SUR, SXM, TCA, TTO, URY, VCT, VEN, VGB, VIR |
| MEA | ARE, BHR, DZA, EGY, ESH, IRN, IRQ, ISR, JOR, KWT, LBN, LBY, MAR, OMN, PSE, QAT, SAU, SDN, SYR, TUN, YEM |
| NEU | ALB, AND, BIH, CHE, GRL, ISL, LIE, MCO, MKD, MNE, NOR, SJM, SMR, SRB, TUR, VAT |
| OAS | AFG, ASM, ATF, BGD, BRN, BTN, CCK, COK, CXR, FJI, FSM, GUM, IDN, IOT, KHM, KIR, KOR, LAO, LKA, MDV, MHL, MMR, MNG, MNP, MYS, NCL, NFK, NIU, NPL, NRU, PAK, PCN, PHL, PLW, PNG, PRK, PYF, SGP, SLB, THA, TKL, TLS, TON, TUV, UMI, VNM, VUT, WLF, WSM |
| REF | ARM, AZE, BLR, GEO, KAZ, KGZ, MDA, RUS, TJK, TKM, UKR, UZB |
| SSA | AGO, BDI, BEN, BFA, BWA, CAF, CIV, CMR, COD, COG, COM, CPV, DJI, ERI, ETH, GAB, GHA, GIN, GMB, GNB, GNQ, KEN, LBR, LSO, MDG, MLI, MOZ, MRT, MUS, MWI, MYT, NAM, NER, NGA, REU, RWA, SEN, SHN, SLE, SOM, SSD, STP, SWZ, SYC, TCD, TGO, TZA, UGA, ZAF, ZMB, ZWE |
| USA | USA |



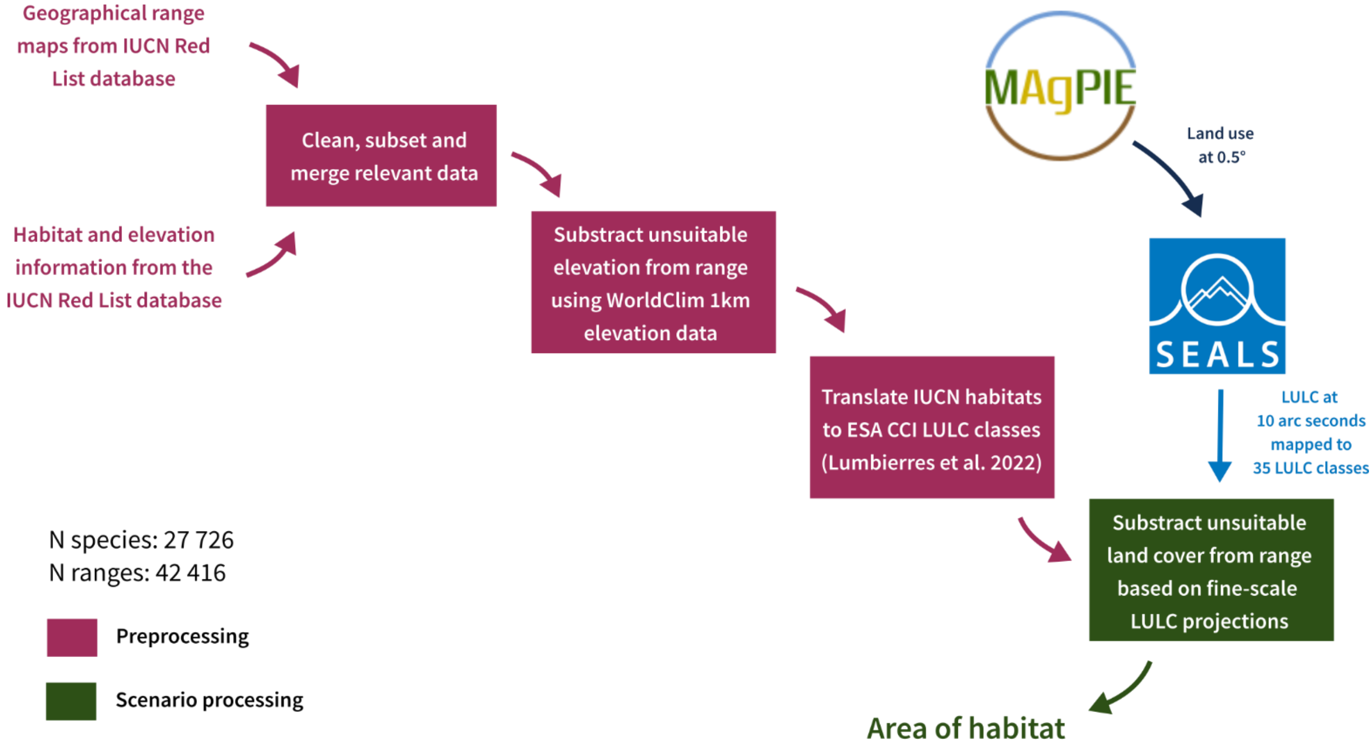

**Supplementary Figure 2: Baseline protected area (green) and simulated enlargement of protected areas in conservation priority areas (orange).** The protected area baseline was taken from the WDPA Database and held constant after 2020. Conservation priority areas include Key Biodiversity Areas (KBAs), Biodiversity Hotspots (BHs) and Ecoregions with a high beta-diversity (EBDs), as well as the Critical Connectivity Areas (CCAs) (see Methods).




**Supplementary Figure 3: Projected food demand until 2050 separated across different food groups and different convergence levels to the healthy reference diet (see Methods).**




**Supplementary Figure 4: Food demand changes (%) separated into food crops dependent on abiotic and biotic pollination.** Food crops mediated by biotic pollination include oil crops such as sunflower or rapeseed, legumes and fruits, vegetables and nuts.

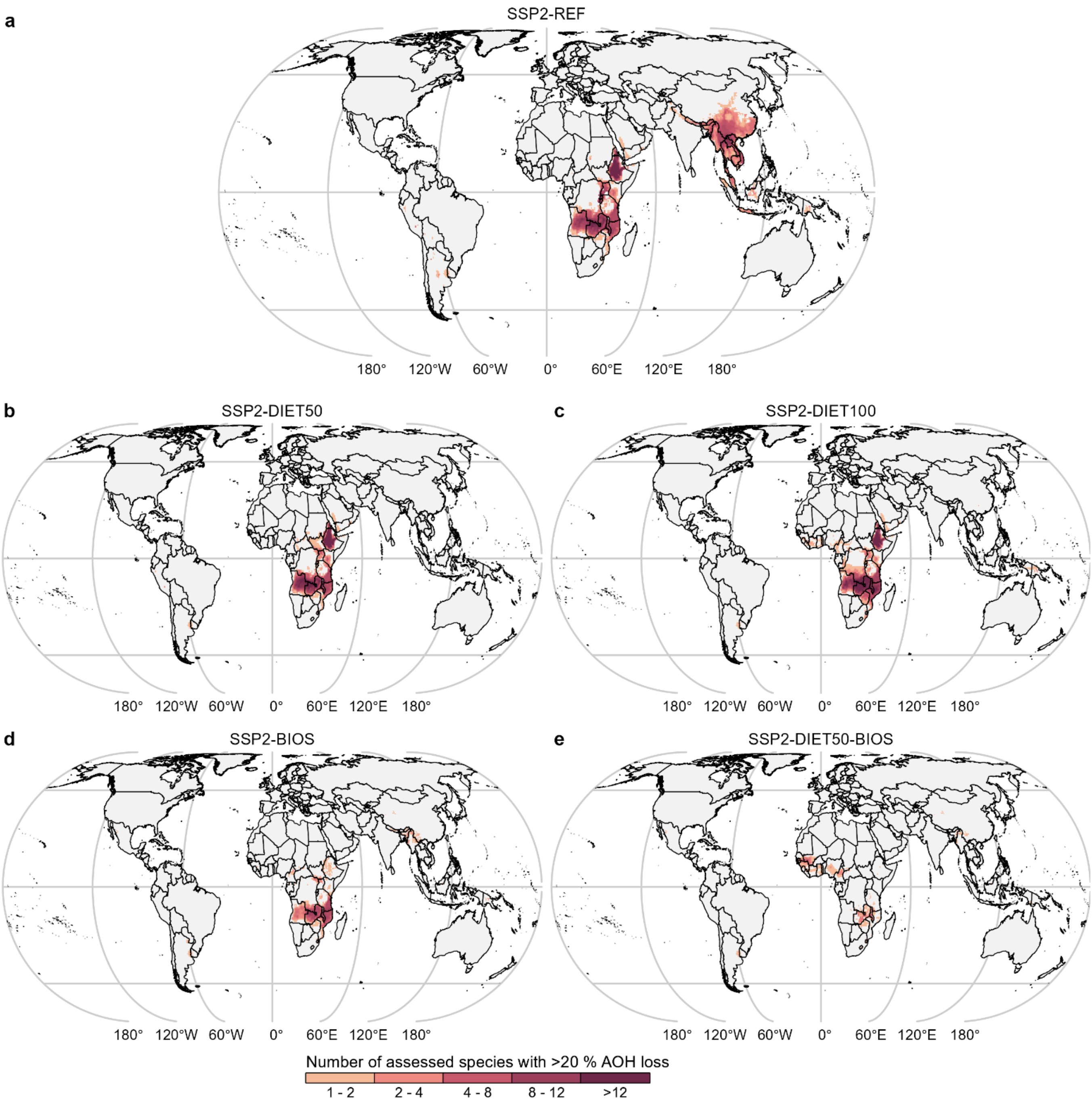



**Supplementary Figure 5: Overview of the methodology for deriving species' area of habitat.** The pre-processing step includes data preparation and substracting unsuitable elevation areas from specie's range polygons. The scenario processing step unsuitable areas are also substracted based on species' habitat preferences and land cover projections from MAgPIE-SEALS to derive area of habitat estimates.

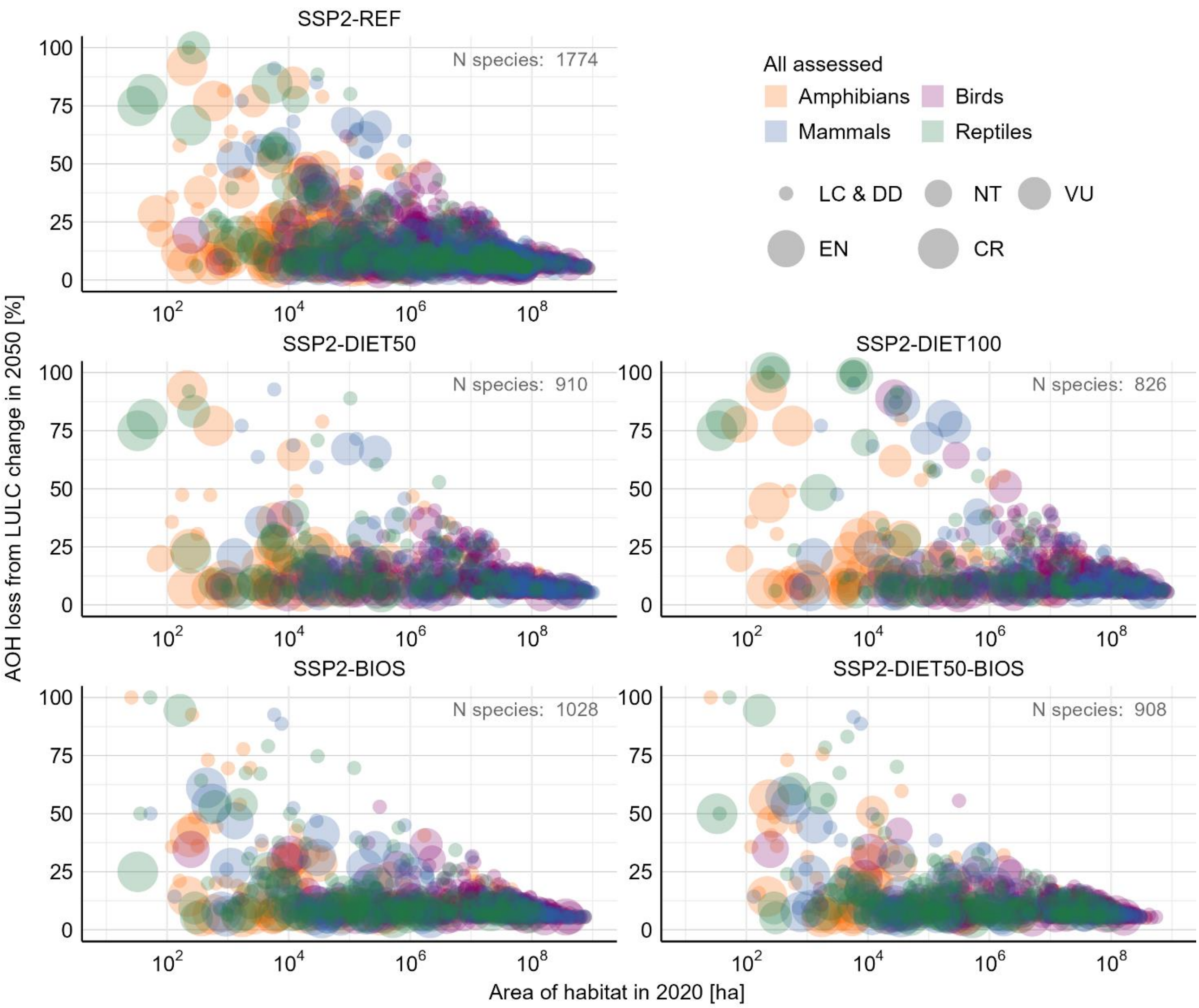
**Supplementary Table 2: Translation between habitats (level 1) based on the IUCN classification scheme and ESA CCI land cover classes.** The table is based on the habitat-land cover model by Lumbierres et al.[3] (see Methods) chosing the strongest association threshold for each habitat group.

| IUCN code | Habitat description | ESA CCI code | ESA CCI habitat description |
|---|---|---|---|
| 1 | Forest | 50 | Tree cover, broadleaved, evergreen, closed to open (>15%) |
| 1 | Forest | 60 | Tree cover, broadleaved, deciduous, closed to open (>15%) |
| 1 | Forest | 61 | Tree cover, broadleaved, deciduous, closed (>40%) |
| 1 | Forest | 62 | Tree cover, broadleaved, deciduous, open (15-40%) |
| 1 | Forest | 70 | Tree cover, needleleaved, evergreen, closed to open (>15%) |
| 1 | Forest | 71 | Tree cover, needleleaved, evergreen, closed (>40%) |
| 1 | Forest | 72 | Tree cover, needleleaved, evergreen, open (15-40%) |
| 1 | Forest | 90 | Tree cover, mixed leaf type (broadleaved and needleleaved) |
| 1 | Forest | 160 | Tree cover, flooded, fresh or brakish water |
| 2 | Savanna | 120 | Shrubland |
| 2 | Savanna | 121 | Evergreen shrubland |
| 2 | Savanna | 122 | Deciduous shrubland |
| 3 | Shrubland | 120 | Shrubland |
| 3 | Shrubland | 121 | Evergreen shrubland |
| 3 | Shrubland | 122 | Deciduous shrubland |
| 3 | Shrubland | 150 | Sparse vegetation (tree, shrub, herbaceous cover) (<15%) |
| 3 | Shrubland | 152 | Sparse shrub (<15%) |
| 3 | Shrubland | 153 | Sparse herbaceous cover (<15%) |
| 3 | Shrubland | 200 | Bare areas |
| 3 | Shrubland | 201 | Consolidated bare areas |
| 3 | Shrubland | 202 | Unconsolidated bare areas |
| 4 | Grassland | 130 | Grassland |
| 4 | Grassland | 140 | Lichens and mosses |
| 4 | Grassland | 150 | Sparse vegetation (tree, shrub, herbaceous cover) (<15%) |
| 4 | Grassland | 152 | Sparse shrub (<15%) |
| 4 | Grassland | 153 | Sparse herbaceous cover (<15%) |
| 5 | Wetlands | 20 | Cropland, irrigated or post-flooding |
| 5 | Wetlands | 80 | Tree cover, needleleaved, deciduous, closed to open (>15%) |
| 5 | Wetlands | 81 | Tree cover, needleleaved, deciduous, closed (>40%) |
| 5 | Wetlands | 82 | Tree cover, needleleaved, deciduous, open (15-40%) |
| 5 | Wetlands | 160 | Tree cover, flooded, fresh or brakish water |
| 5 | Wetlands | 170 | Tree cover, flooded, saline water |
| 5 | Wetlands | 180 | Shrub or herbaceous cover, flooded, fresh/saline/brakish water |
| 5 | Wetlands | 210 | Water bodies |
| 6 | Rocky areas | 70 | Tree cover, needleleaved, evergreen, closed to open (>15%) |
| 6 | Rocky areas | 71 | Tree cover, needleleaved, evergreen, closed (>40%) |
| 6 | Rocky areas | 72 | Tree cover, needleleaved, evergreen, open (15-40%) |
| 6 | Rocky areas | 130 | Grassland |
| 6 | Rocky areas | 150 | Sparse vegetation (tree, shrub, herbaceous cover) (<15%) |
| 6 | Rocky areas | 152 | Sparse shrub (<15%) |

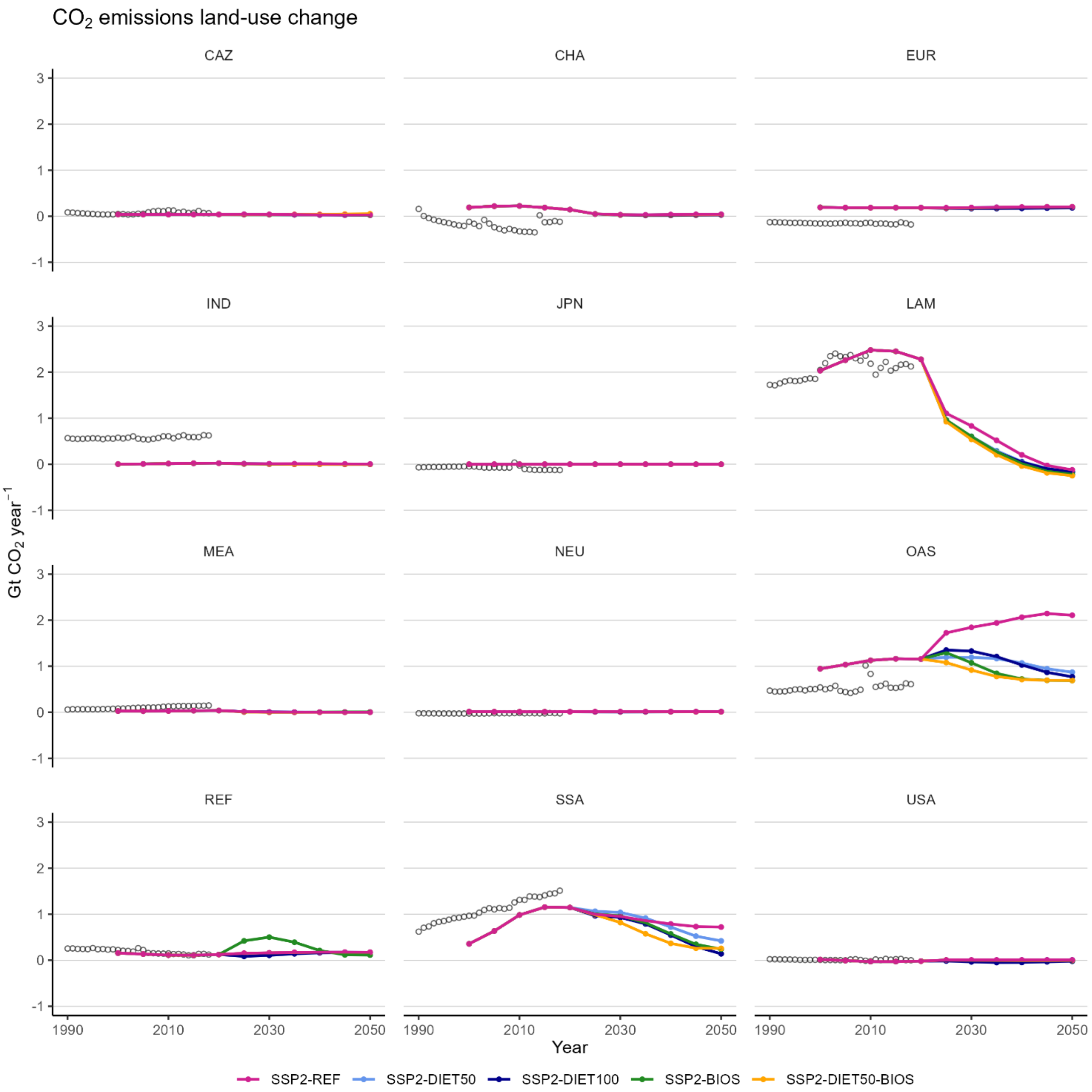
| | | | |
|---|---|---|---|
| 6 | Rocky areas | 153 | Sparse herbaceous cover (<15%) |
| 6 | Rocky areas | 200 | Bare areas |
| 6 | Rocky areas | 201 | Consolidated bare areas |
| 6 | Rocky areas | 202 | Unconsolidated bare areas |
| 8 | Desert | 150 | Sparse vegetation (tree, shrub, herbaceous cover) (<15%) |
| 8 | Desert | 152 | Sparse shrub (<15%) |
| 8 | Desert | 153 | Sparse herbaceous cover (<15%) |
| 8 | Desert | 200 | Bare areas |
| 8 | Desert | 201 | Consolidated bare areas |
| 8 | Desert | 202 | Unconsolidated bare areas |
| 9 | Marine Neretic | NA | NA |
| 10 | Marine Oceanic | NA | NA |
| 12 | Marine Intertidal | NA | NA |
| 13 | Marine Coastal/Supratidal | NA | NA |
| 14.1 & 14.2 | Artificial arable and pasture land | 11 | Cropland, rainfed, Herbaceous cover |
| 14.1 & 14.2 | Artificial arable and pasture land | 20 | Cropland, irrigated or post-flooding |
| 14.1 & 14.2 | Artificial arable and pasture land | 190 | Urban areas |
| 14.3 & 14.6 | Artificial degraded forest and plantation | 12 | Cropland, rainfed, Tree or shrub cover |
| 14.3 & 14.6 | Artificial degraded forest and plantation | 20 | Cropland, irrigated or post-flooding |
| 14.3 & 14.6 | Artificial degraded forest and plantation | 190 | Urban areas |
| 14.4 & 14.5 | Artificial urban areas and rural gardens | 190 | Urban areas |
| 15 | Artificial/Aquatic | 20 | Cropland, irrigated or post-flooding |
| 15 | Artificial/Aquatic | 160 | Tree cover, flooded, fresh or brakish water |
| 15 | Artificial/Aquatic | 170 | Tree cover, flooded, saline water |
| 15 | Artificial/Aquatic | 180 | Shrub or herbaceous cover, flooded, fresh/saline/brakish water |
| 15 | Artificial/Aquatic | 190 | Urban areas |
| 15 | Artificial/Aquatic | 210 | Water bodies |
| 16 | Introduced vegetation | NA | NA |
| 17 | Other | NA | NA |
| 18 | Unknown | NA | NA |
| 9.8.1 | Outer Reef Channel | NA | NA |
| 9.8.3 | Foreslope (Outer Reef Slope) | NA | NA |
| 9.8.4 | Lagoon | NA | NA |
| 9.8.5 | Inter-Reef Soft Substrate | NA | NA |
| 9.8.6 | Inter-Reef Rubble Substrate | NA | NA |



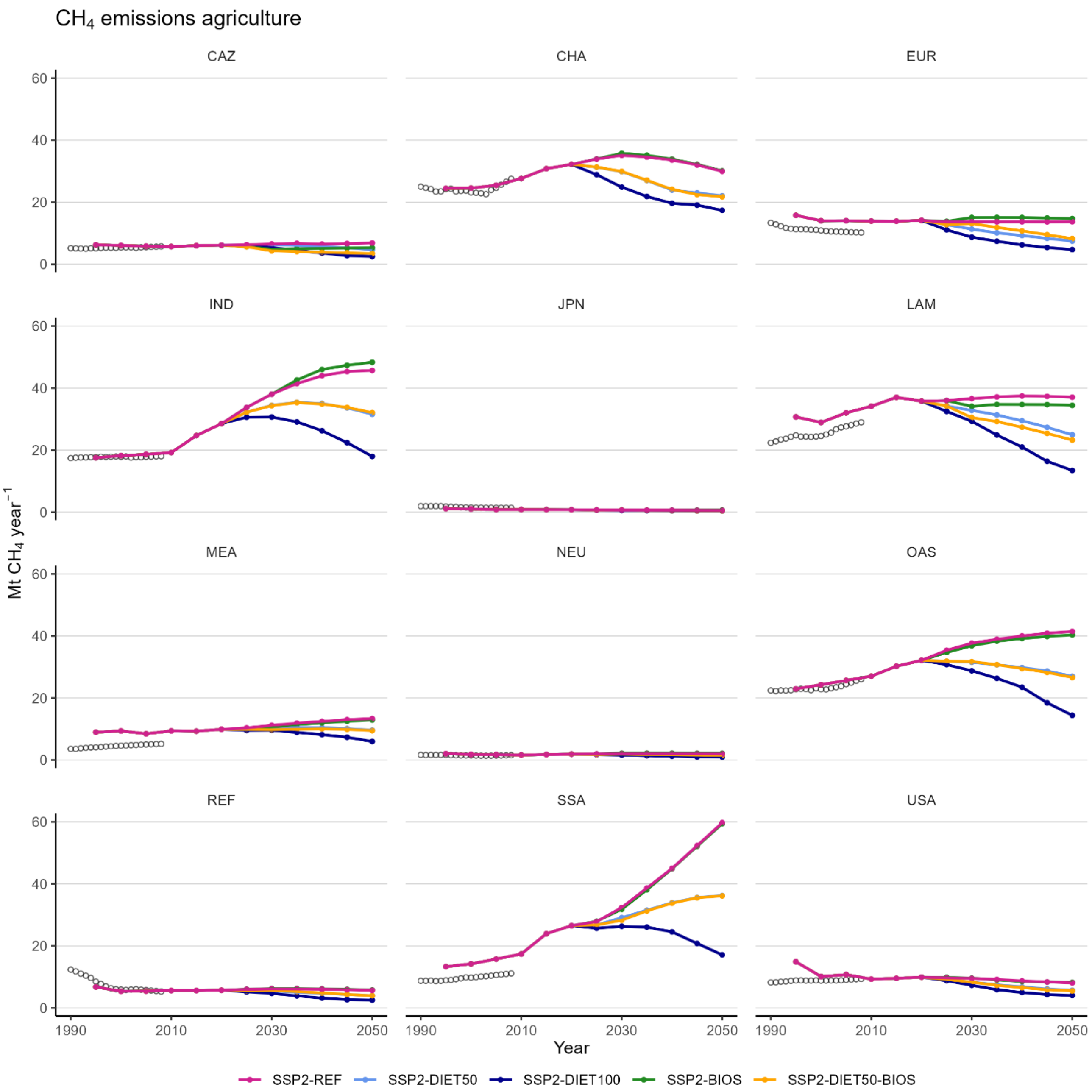

**Supplementary Figure 6: Number of all assessed species with more than 20 % habitat loss in 2050.** The map shows the number of overlapping range polygons of open habitat species affected by >20 % habitat loss



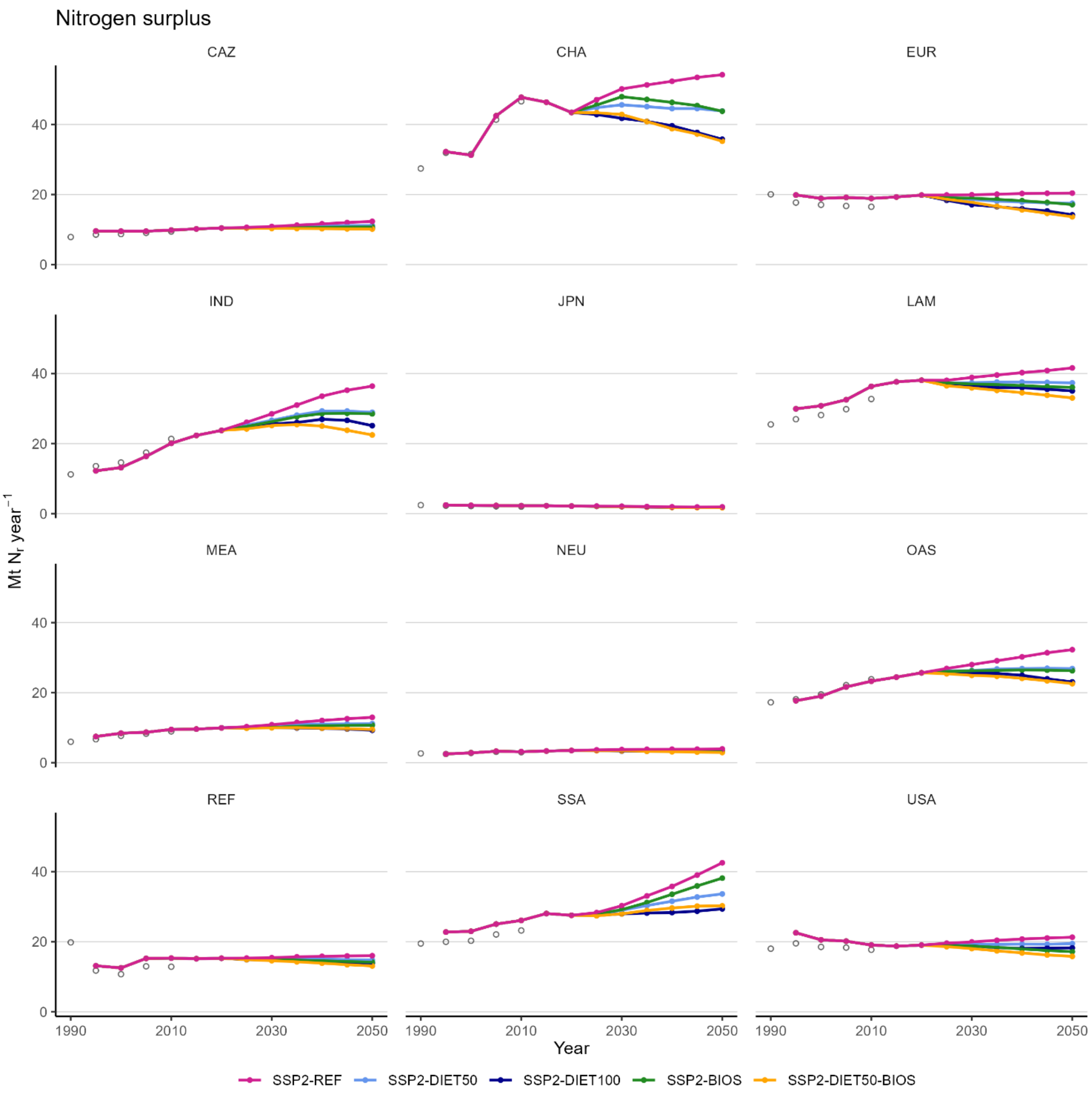

**Supplementary Figure 7: Projected AOH losses (%) of all assessed species in 2050 in relation to the estimated AOH in 2020.** The size of the circles indicates the species' conservation status in the year 2020 according to the IUCN Red List Database.LC & DD: Least Concern and Data Deficient, NT: Near Threatened, VU: Vulnerable, EN: Endangered, CR: Critically Endangered. Only species with more than 5 % AOH loss in 2050 are shown here.



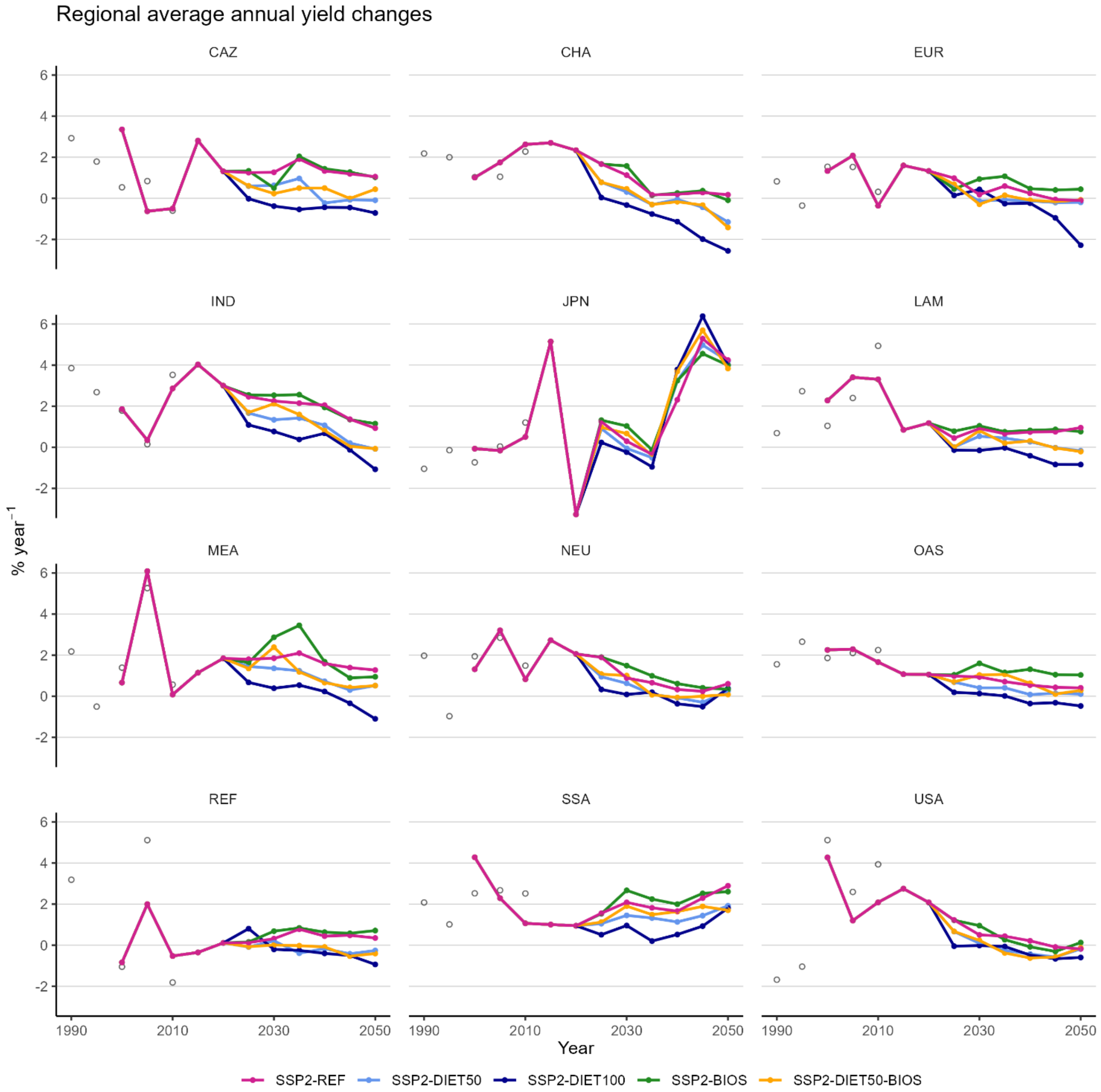

**Supplementary Figure 8: Projected regional changes in $CO_2$ emissions from land-use change compared to historical data from Gasser et al.[4].**



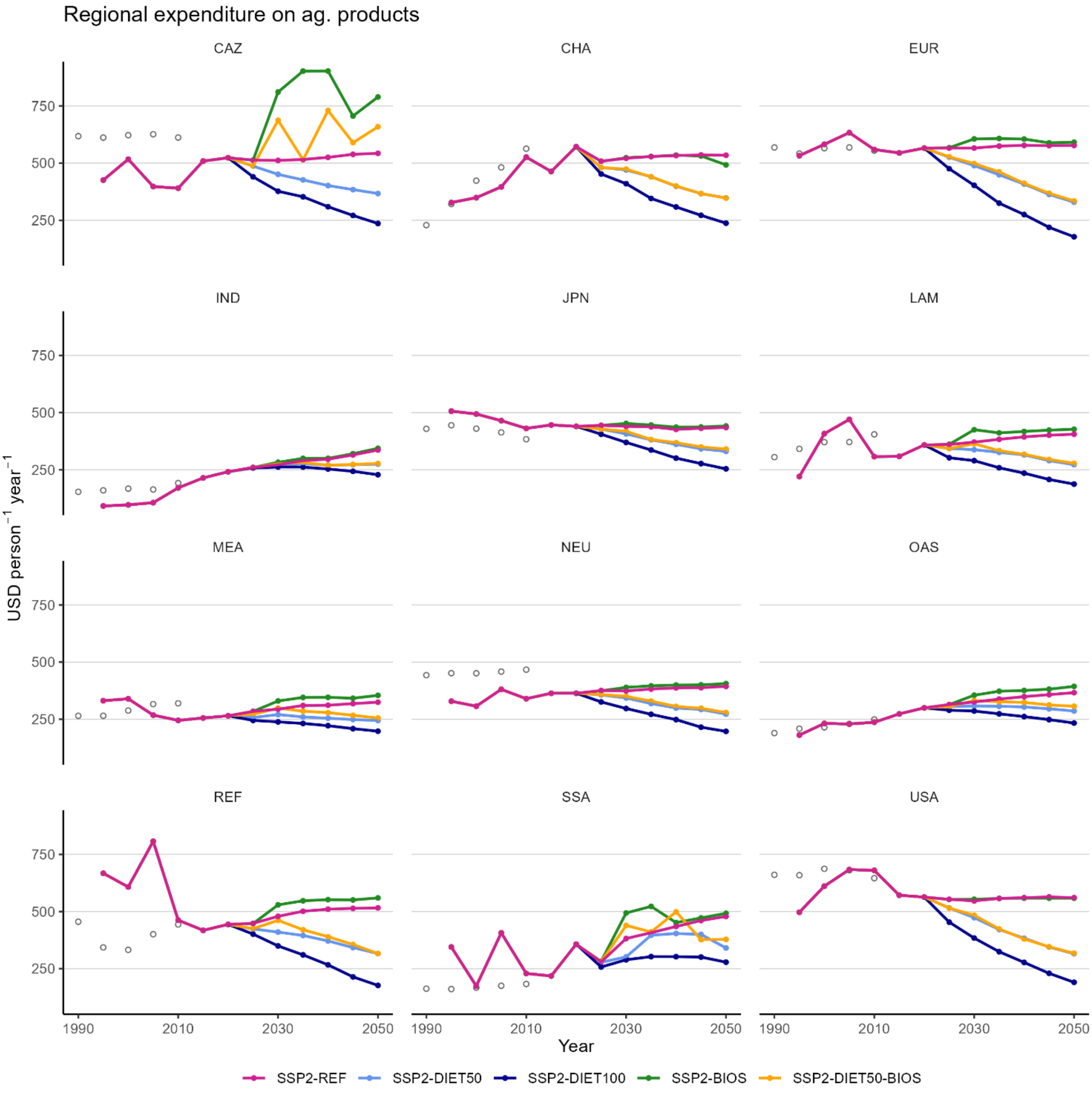

**Supplementary Figure 9: Projected regional changes in $CH_4$ emissions from agriculture compared to historical data from EDGAR[5].**



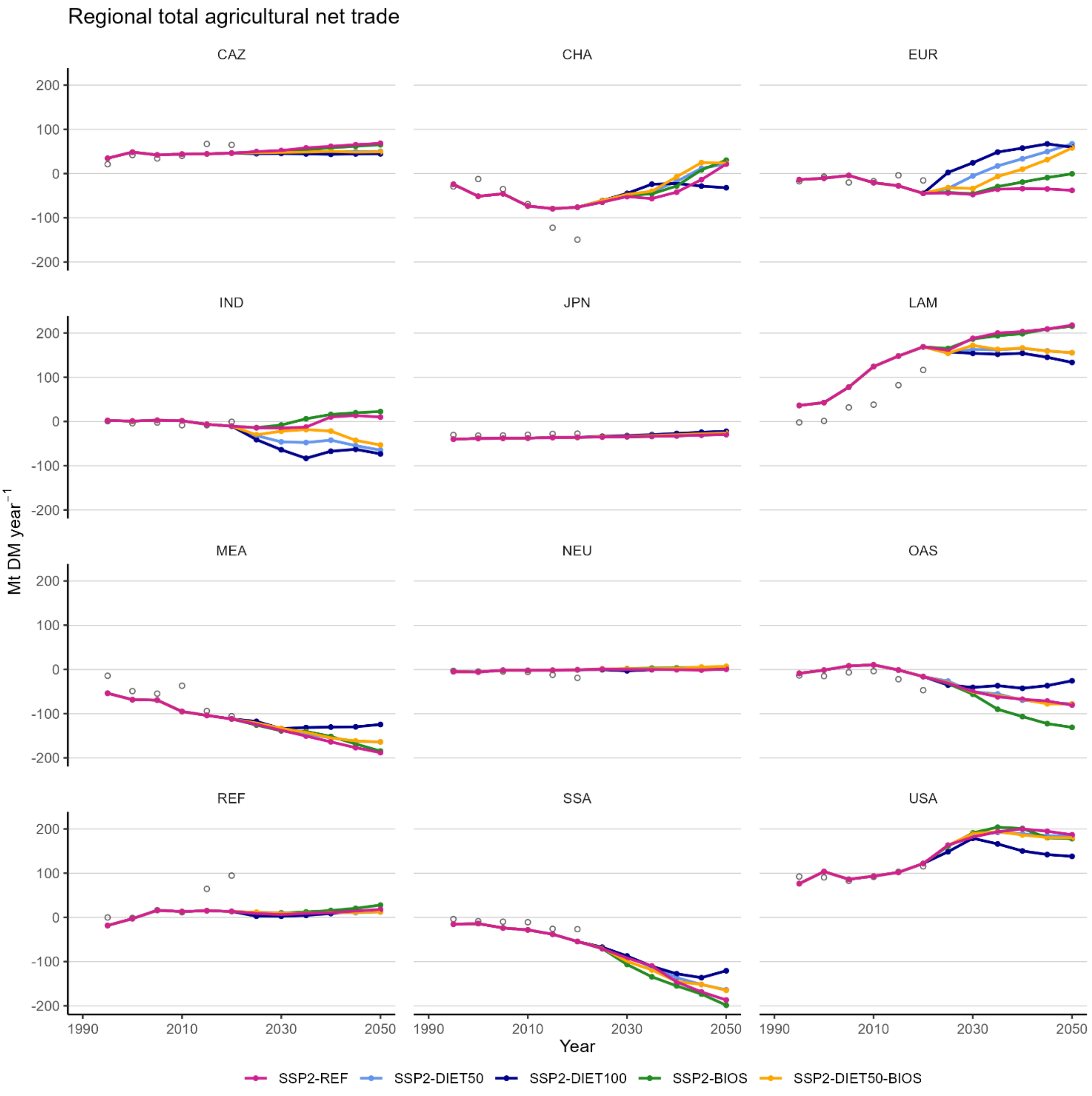

**Supplementary Figure 10: Projected regional changes in nitrogen surplus from agriculture compared to historical data from Bodirsky et al.[6].**



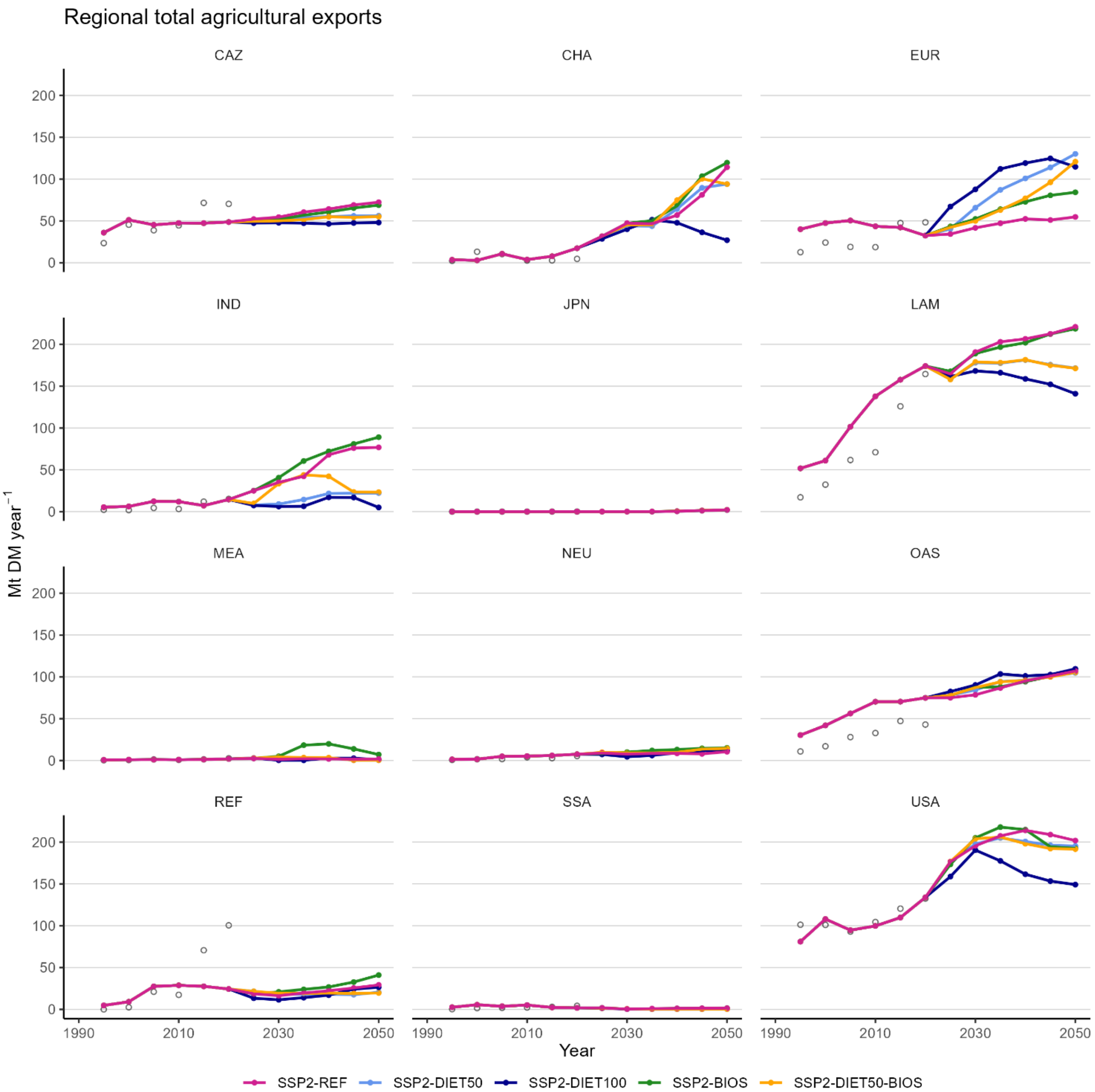

**Supplementary Figure 11: Regional projections of average annual crop yield changes compared to historical data from FAOSTAT[7].**



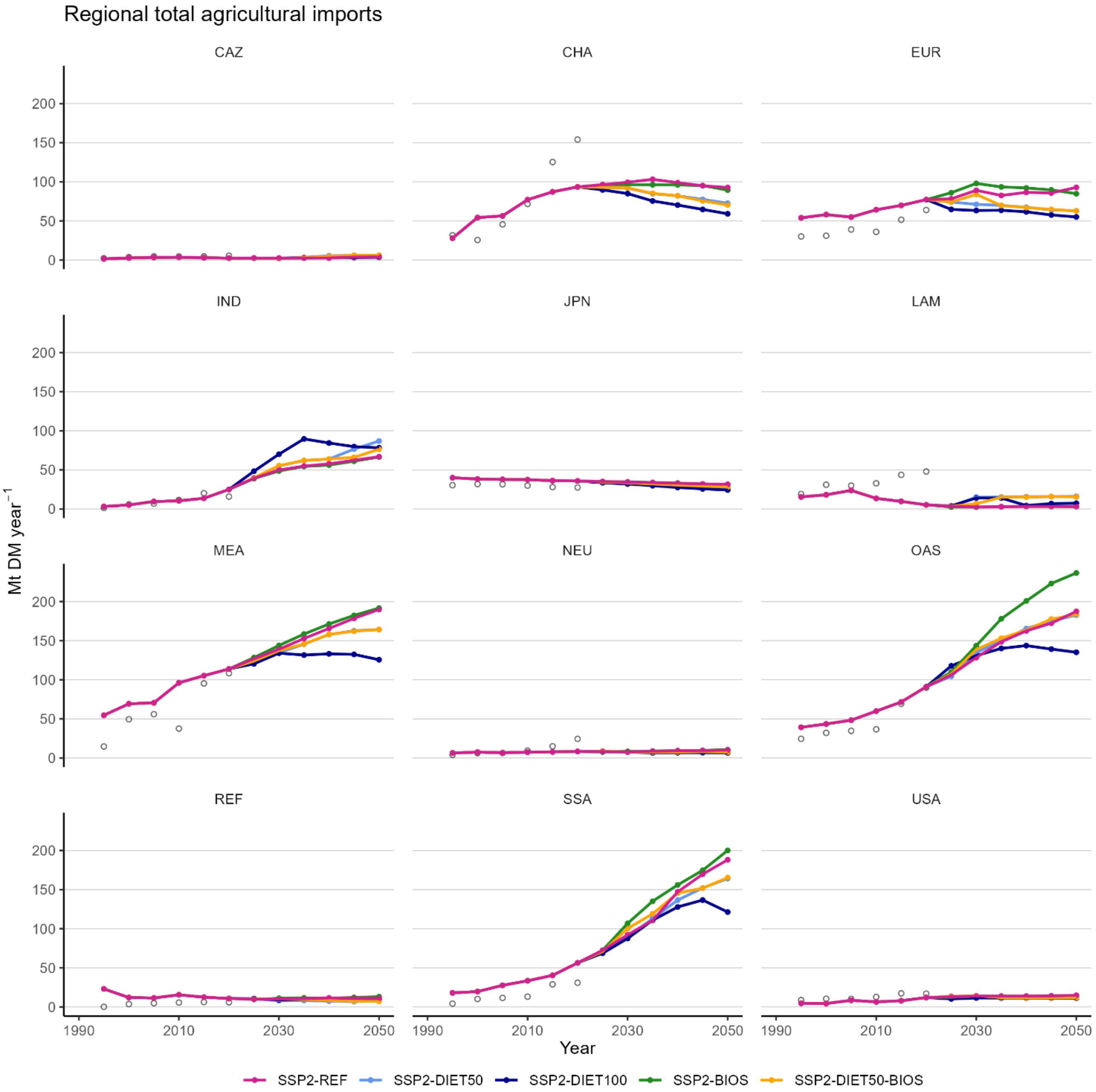

**Supplementary Figure 12: Projected regional changes in expenditure for agricultural products for food use compared to historical data from FAOSTAT[7].**



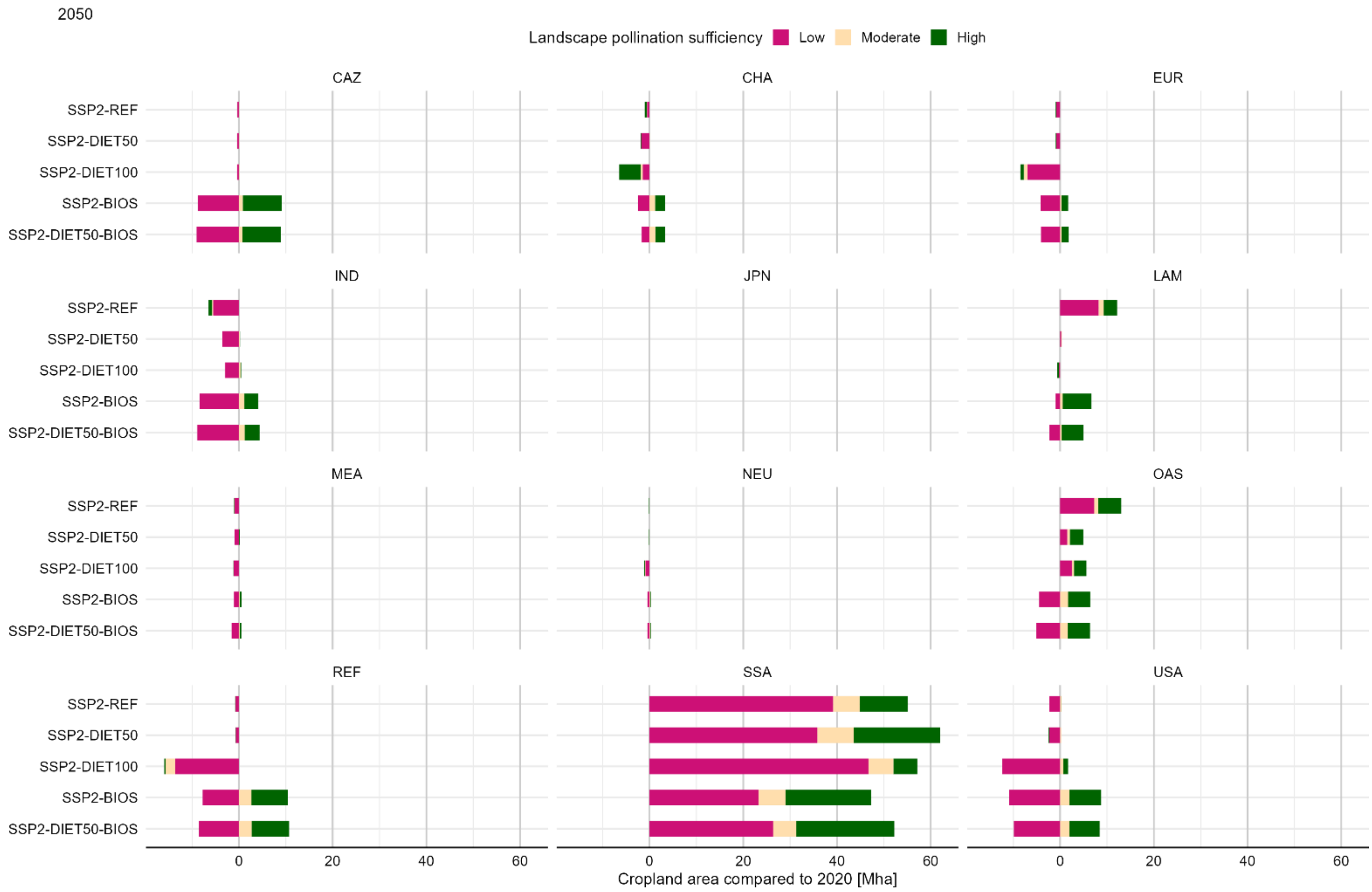

**Supplementary Figure 13: Projected regional changes in net trade, compared to historical data from FAOSTAT[7].**



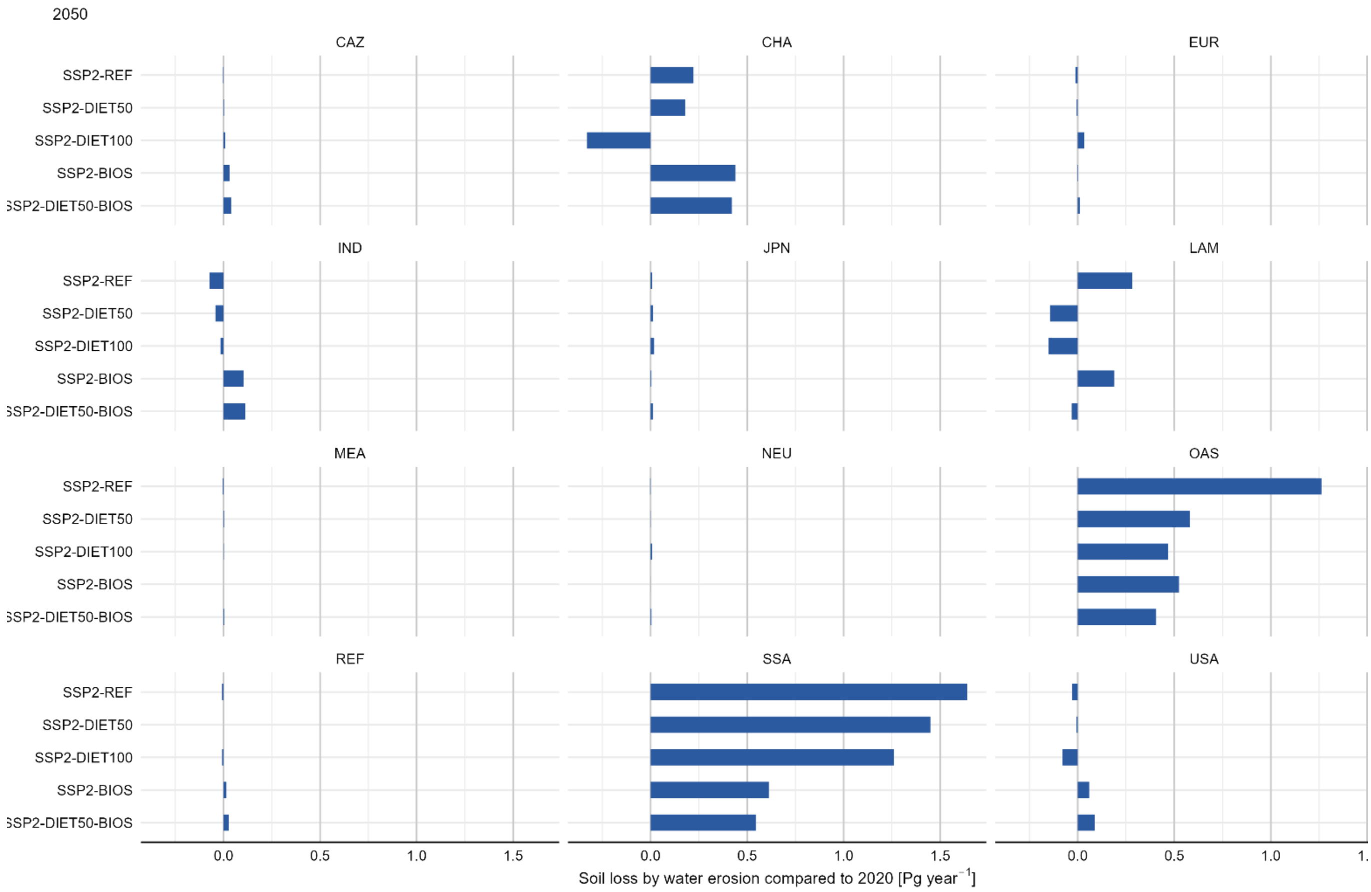

**Supplementary Figure 14: Projected regional changes in exports, compared to historical data from FAOSTAT[7].**



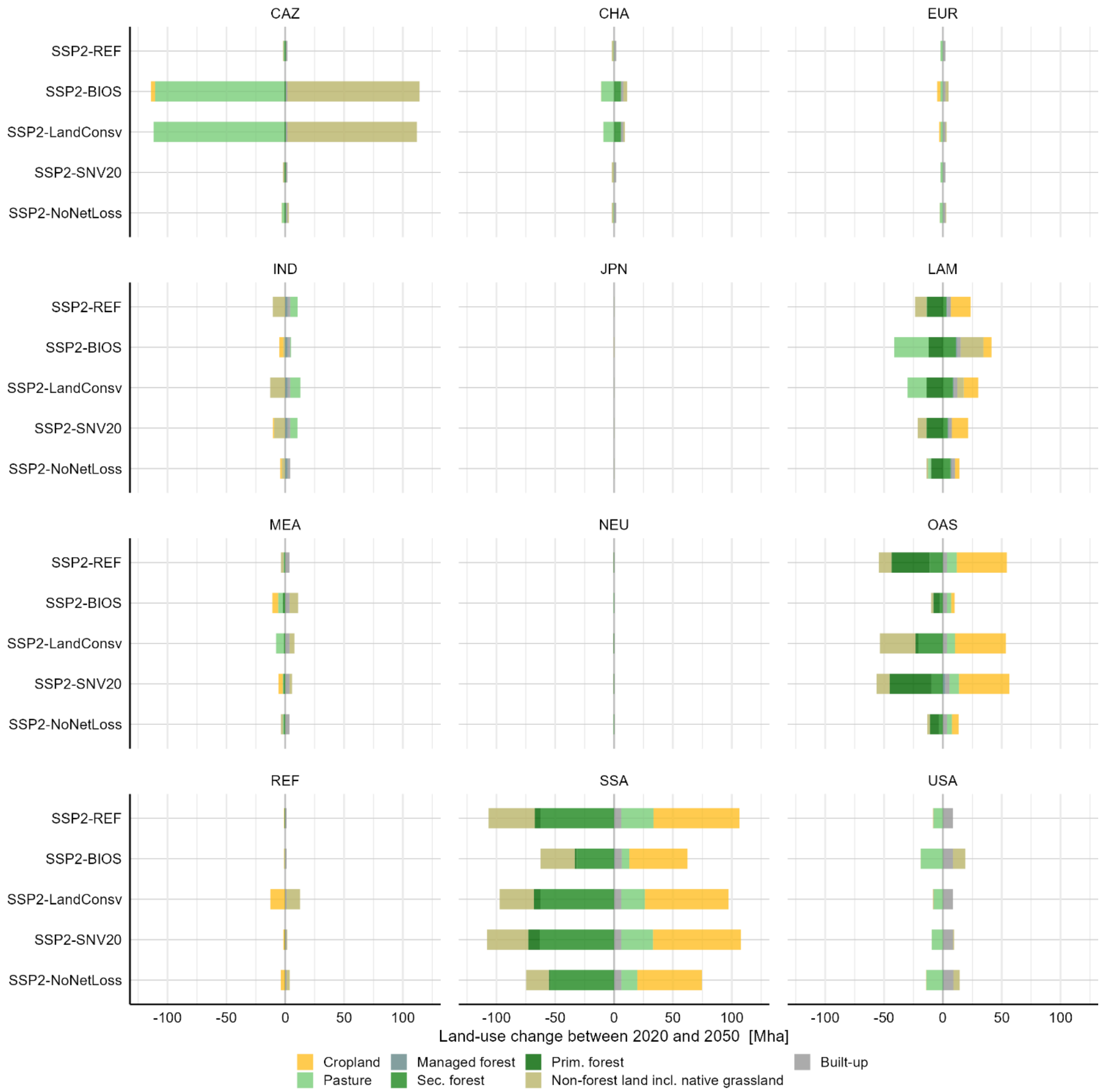

**Supplementary Figure 15: Projected regional changes in imports, compared to historical data from FAOSTAT[7].**



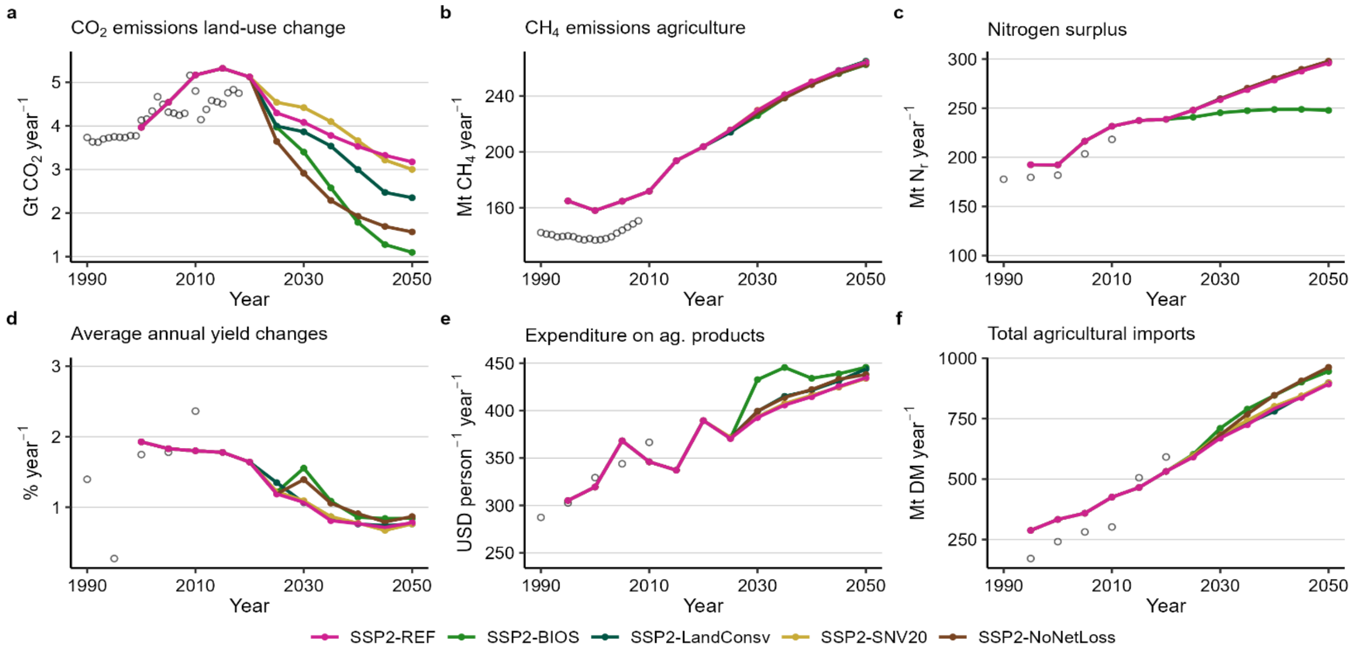

**Supplementary Figure 16: Projected regional changes in landscape pollination sufficiency.**



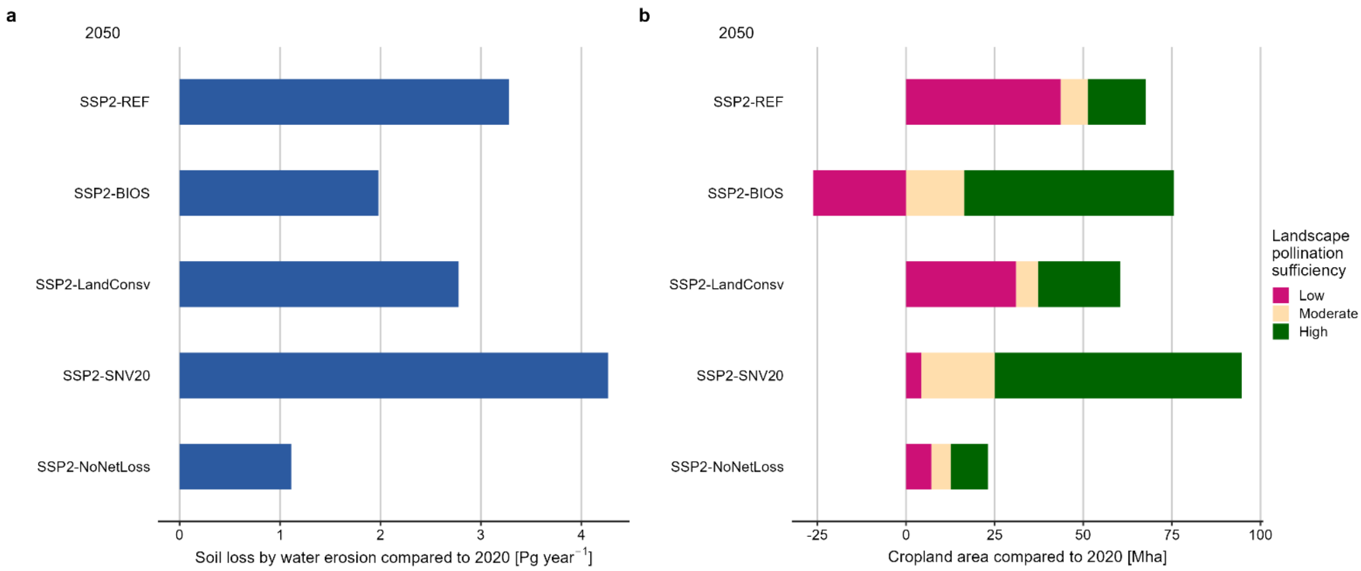

**Supplementary Figure 17: Projected regional changes in soil loss by water erosion.**




**Supplementary Figure 18: Projected regional land-use changes as a result of different biodiversity conservation measures.** *LandConsv*: enlargement of protected areas in Key Biodiversity Areas (KBAs), Biodiversity Hotspots (BHs) and Ecoregions with a high beta-diversity (EBDs), as well as the Critical Connectivity Areas (CCAs), *SNV20*: conservation of 20% semi-natural vegetation in managed landscapes, *NoNetLoss*: no net reduction of biodiversity intactness at the biome level.

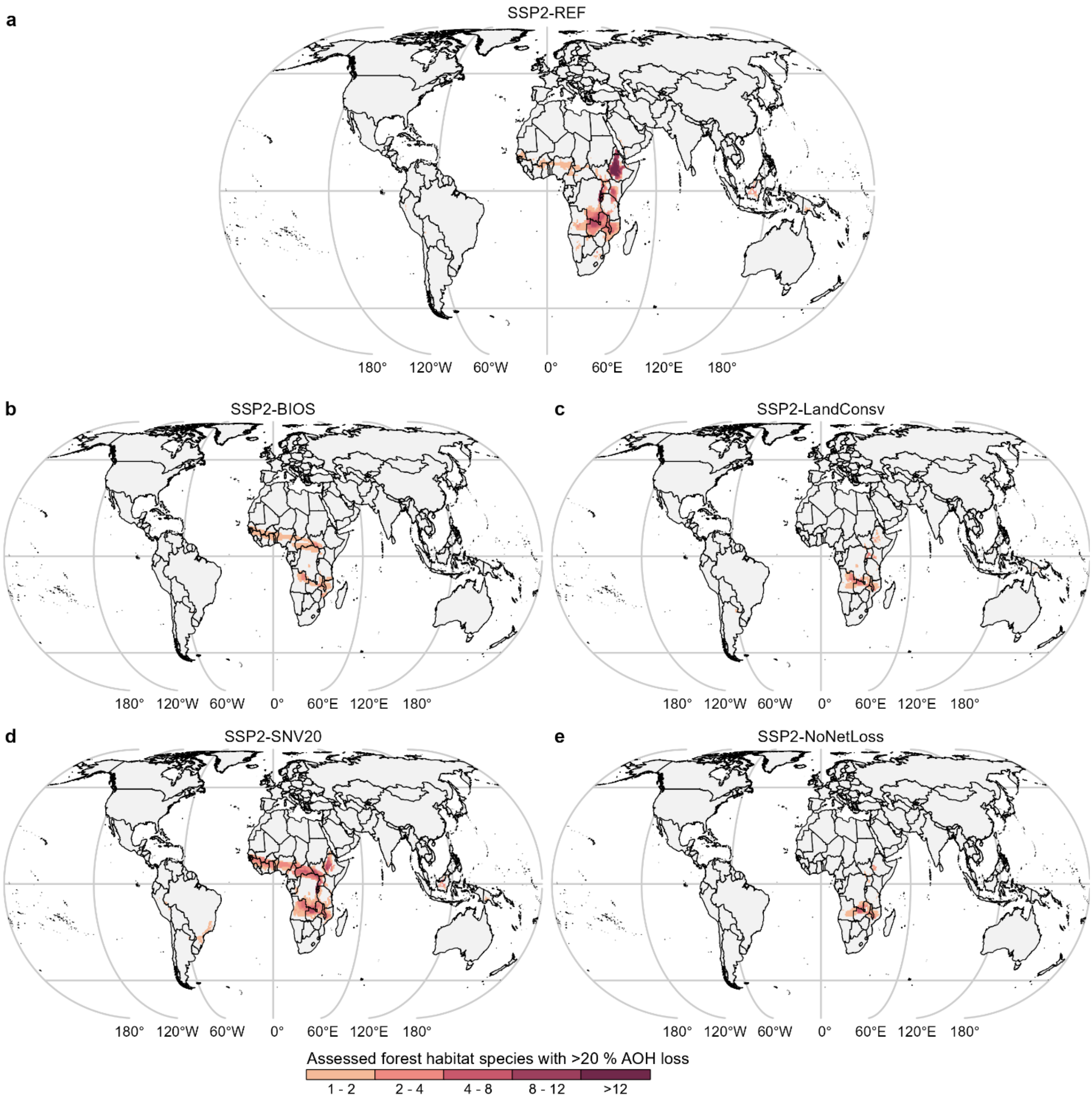



**Supplementary Figure 19: Global changes in environmental indicators, land productivity and food accessibility as a result of different biodiversity conservation measures.** *LandConsv*: enlargement of protected areas in Key Biodiversity Areas (KBAs), Biodiversity Hotspots (BHs) and Ecoregions with a high beta-diversity (EBDs), as well as the Critical Connectivity Areas (CCAs), *SNV20*: conservation of 20% semi-natural vegetation in managed landscapes, *NoNetLoss*: no net reduction of biodiversity intactness at the biome level.

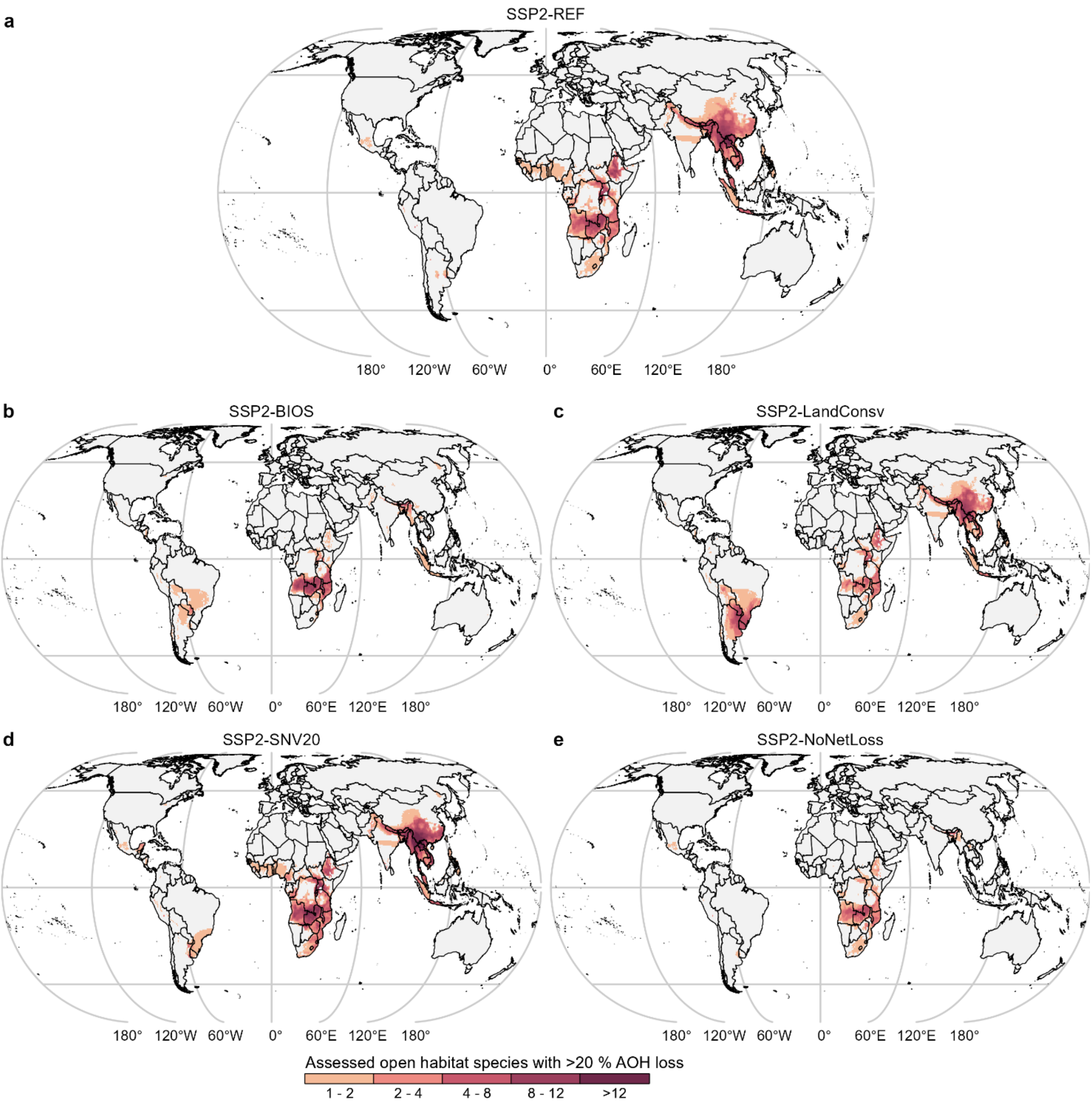



**Supplementary Figure 20: Global changes in soil loss by water erosion and landscape pollination sufficiency as a result of different biodiversity conservation measures.** *LandConsv*: enlargement of protected areas in Key Biodiversity Areas (KBAs), Biodiversity Hotspots (BHs) and Ecoregions with a high beta-diversity (EBDs), as well as the Critical Connectivity Areas (CCAs), *SNV20*: conservation of 20% semi-natural vegetation in managed landscapes, *NoNetLoss*: no net reduction of biodiversity intactness at the biome level.


**Supplementary Figure 21: Number of species with more than 20 % AOH loss by 2050 across different biodiversity conservation measures.** *LandConsv*: enlargement of protected areas in Key Biodiversity Areas (KBAs), Biodiversity Hotspots (BHs) and Ecoregions with a high beta-diversity (EBDs), as well as the Critical Connectivity Areas (CCAs), *SNV20*: conservation of 20% semi-natural vegetation in managed landscapes, *NoNetLoss*: no net reduction of biodiversity intactness at the biome level.




**Supplementary Figure 22: Number of forest species with more than 20 % habitat loss in 2050 across different biodiversity conservation measures.** *LandConsv*: enlargement of protected areas in Key Biodiversity Areas (KBAs), Biodiversity Hotspots (BHs) and Ecoregions with a high beta-diversity (EBDs), as well as the Critical Connectivity Areas (CCAs), *SNV20*: conservation of 20% semi-natural vegetation in managed landscapes, *NoNetLoss*: no net reduction of biodiversity intactness at the biome level. The map shows the number of overlapping range polygons of open habitat species affected by >20 % habitat loss.




**Supplementary Figure 23: Number of open habitat species with more than 20 % habitat loss in 2050 across different biodiversity conservation measures.** LandConsv: enlargement of protected areas in Key Biodiversity Areas (KBAs), Biodiversity Hotspots (BHs) and Ecoregions with a high beta-diversity (EBDs), as well as the Critical Connectivity Areas (CCAs), SNV20: conservation of 20% semi-natural vegetation in managed landscapes, NoNetLoss: no net reduction of biodiversity intactness at the biome level. The map shows the number of overlapping range polygons of open habitat species affected by >20 % habitat loss.

## References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