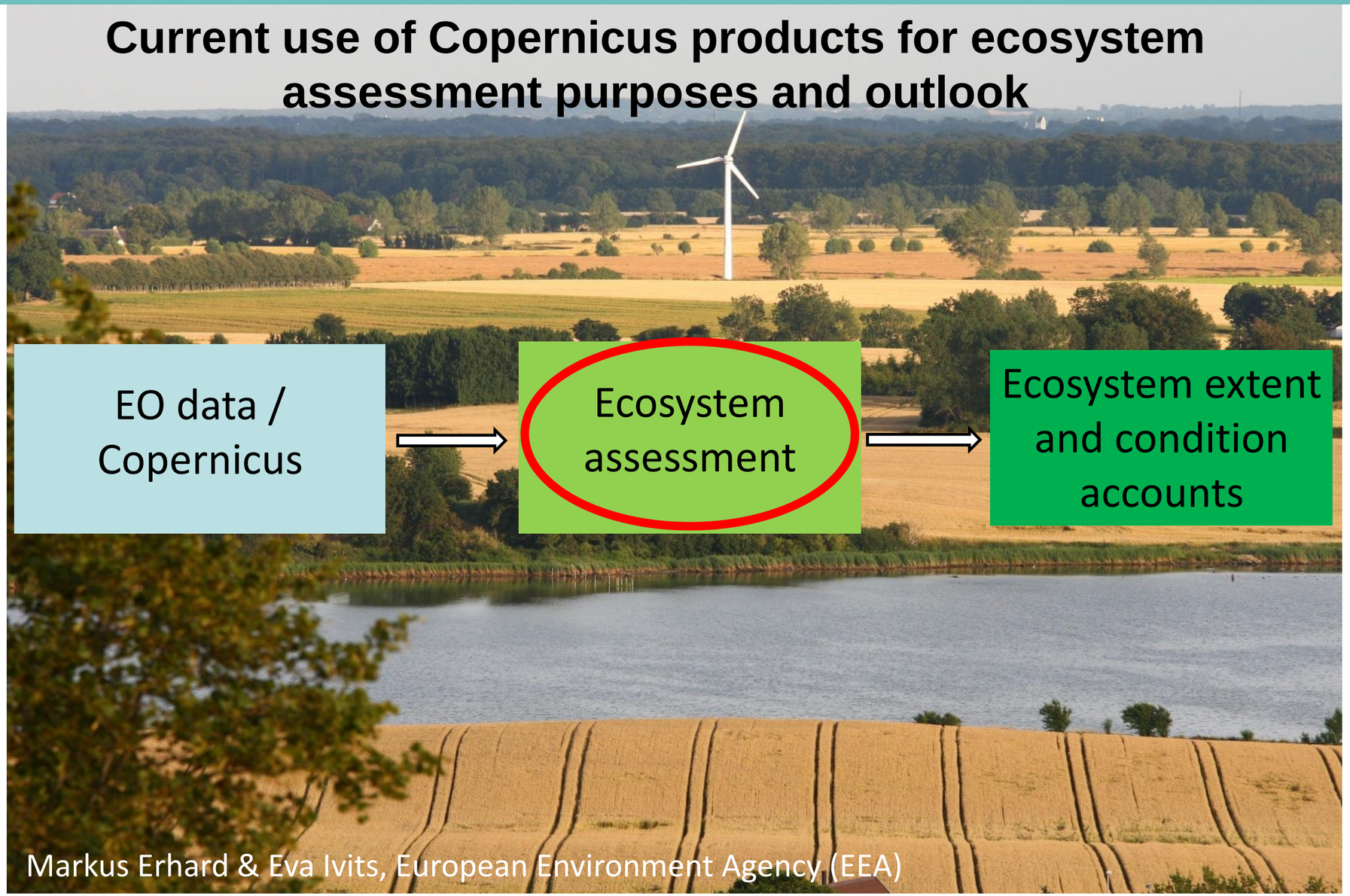
Meeting on use of satellite observation data (of the Copernicus programme) for EU ecosystem accounting

EEA, Copenhagen, 16 April 2018

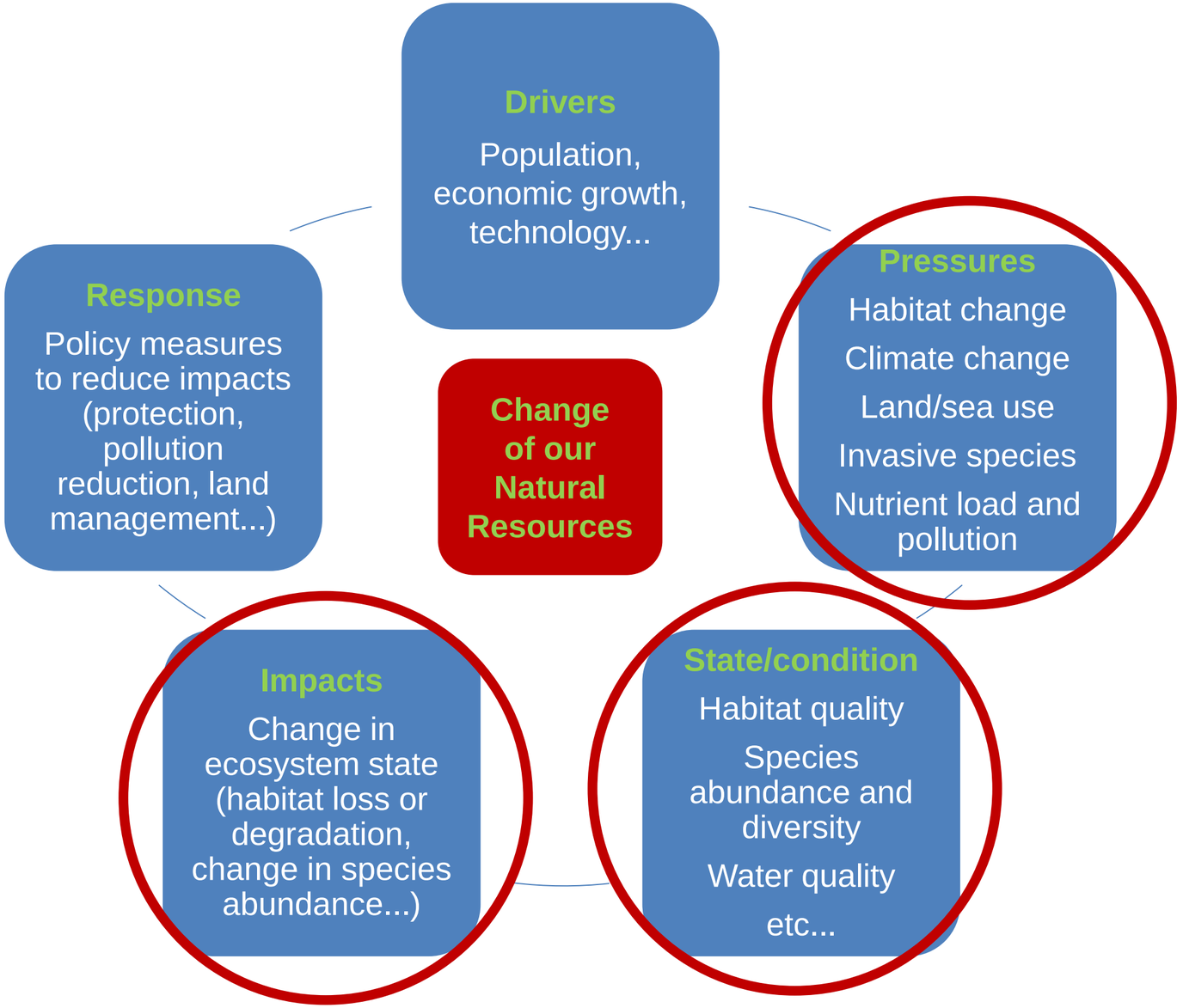
Current use of Copernicus products for ecosystem assessment purposes and outlook

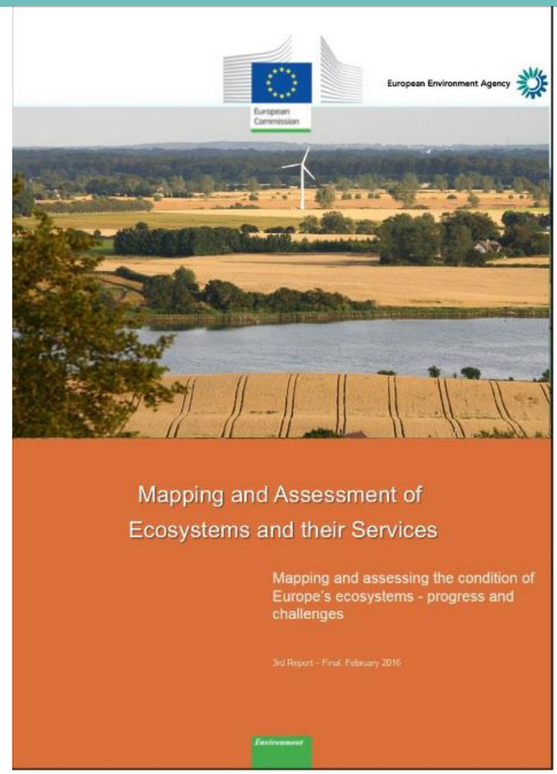


Markus Erhard & Eva Ivits, European Environment Agency (EEA)

European Environment Agency

DPSIR Framework – Understanding the Causalities



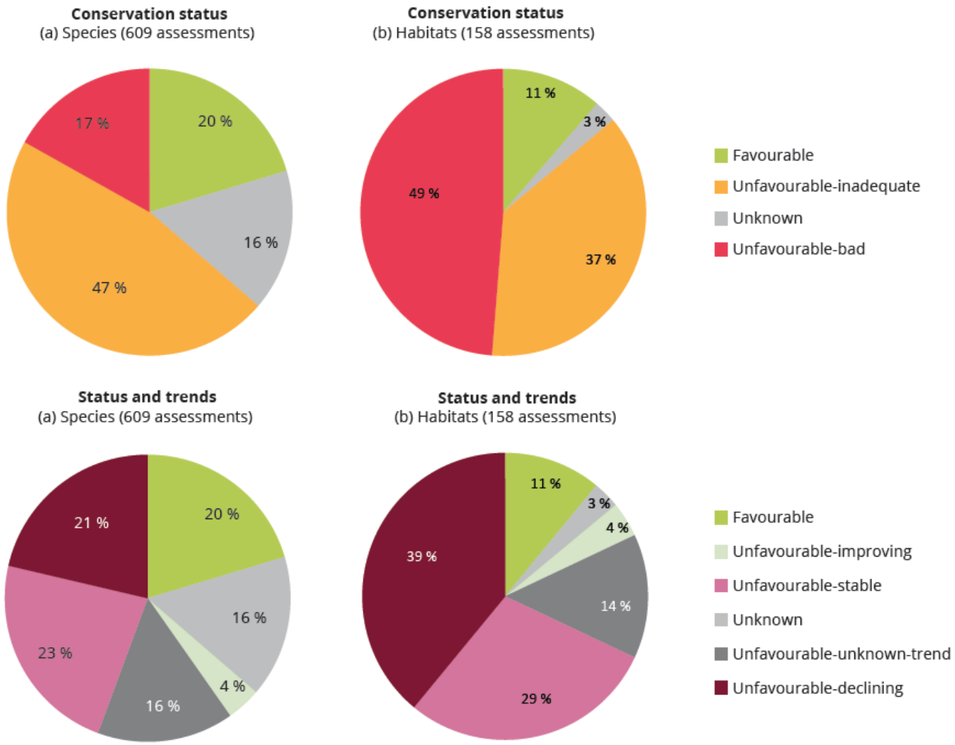


http://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/pdf/3rdMAESReport_Condition.pdf

European Environment Agency

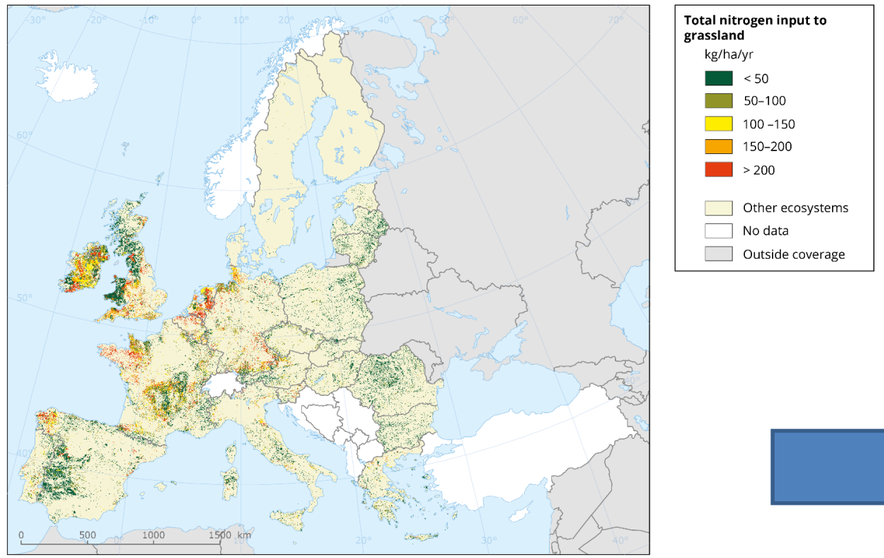
Causalities - developing story-lines e.g. grassland

Grassland ecosystems:
non-bird species and habitat conservation status and trends

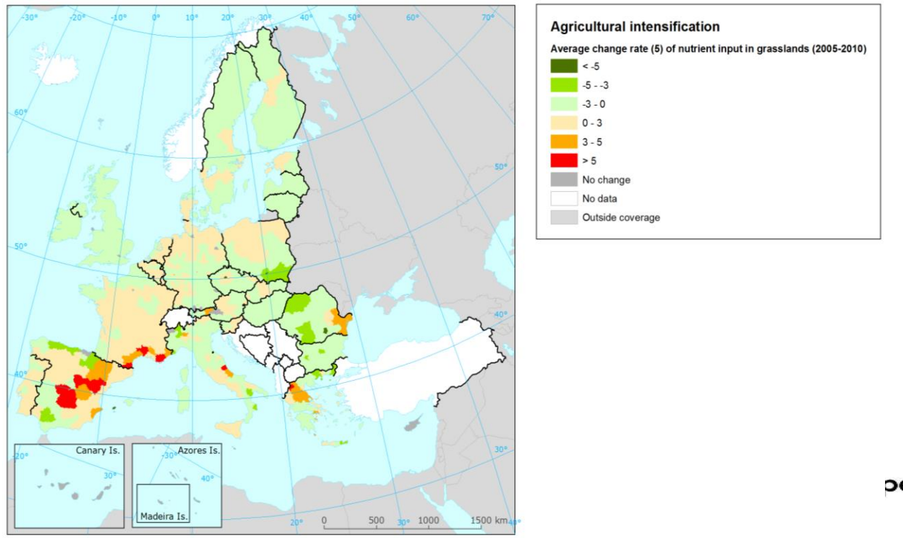


Nature report (EEA,2015)

Nitrogen input 2010



Change in nitrogen input 2005-2010



Joint data base for assessment and accounting

pean Environment Agency

Mapping and assessment - accounting

Ecosystem Assessment

(1) *Map ecosystems*

Urban	**Land use land cover data, e.g.**
Cropland	Corine Land Cover
Grassland	Copernicus high resolution data
Woodland and forest	Elevation data
Heathland and shrub	Seabed maps
Sparsely vegetated land	National datasets
Wetlands	
Rivers and lakes	Models for spatially delineating wetlands or natural, unmanaged systems
Marine inlets and transitional waters	
Coastal	
Shelf	
Open ocean	

(2) *Assess the condition of ecosystems*

Indicators	*Data*
Conservation status of habitats and species	Art.17 assessment
Ecological status of water bodies	WFD assessment
Environmental status of seas	MSFD assessment
Ecosystem status and biodiversity	data including air pollutant concentration, habitat connectivity, land use change, soil degradation, …

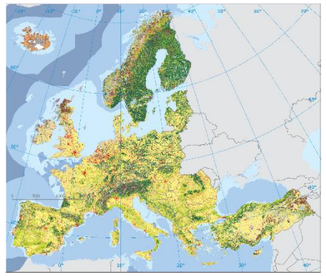
(3) *Assess te ecosystem services delivered by ecosystems*

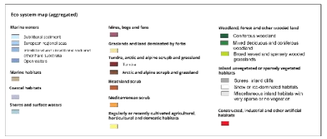
Indicators	*Data and models*
Supply indicators: Indicators of stock and flow of ecosystem functions and ecosystem services	Different sources of environmental data and models
Demand indicators: Indicators for the human demand for ecosystem services	Different socio-economic statistics

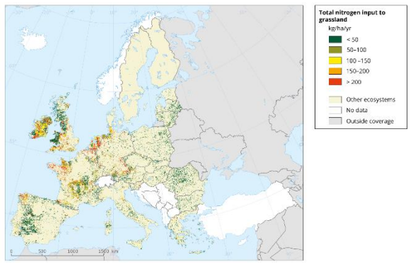
(4) *Integrated ecosystem assessment:*
How does condition relate to services provision?
How do the various ecosystem types interact to provide services?

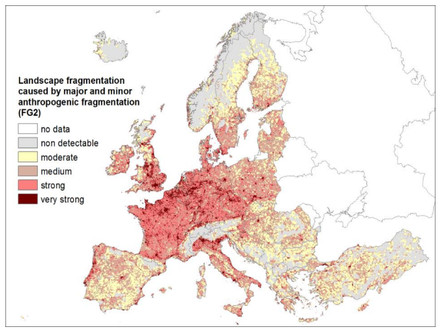
Maes et al., 2014

Spatial data

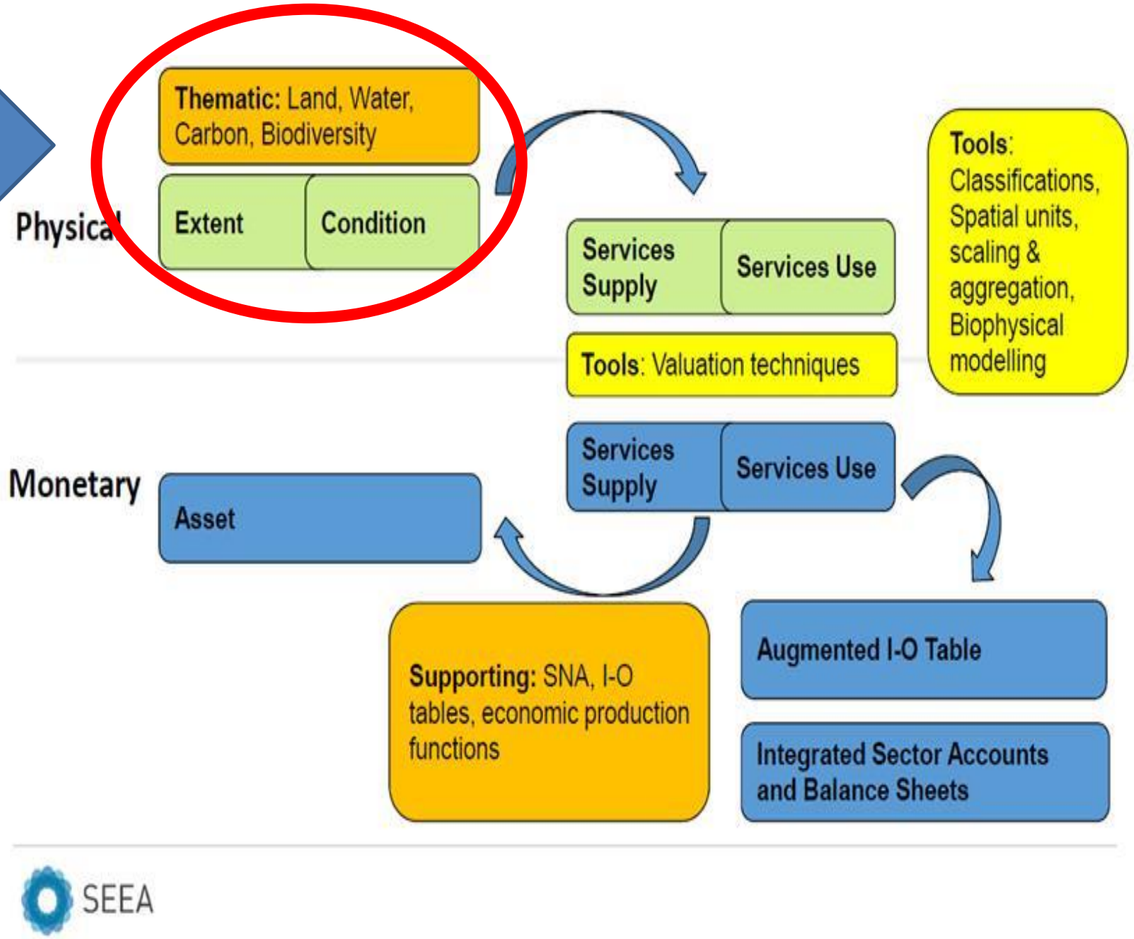








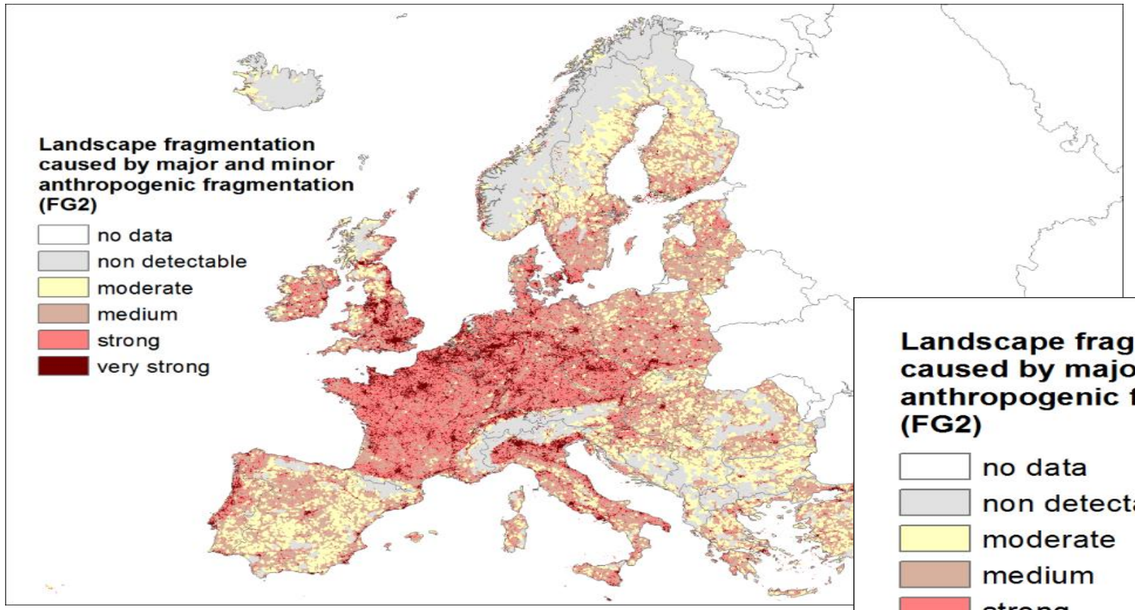
Accounting



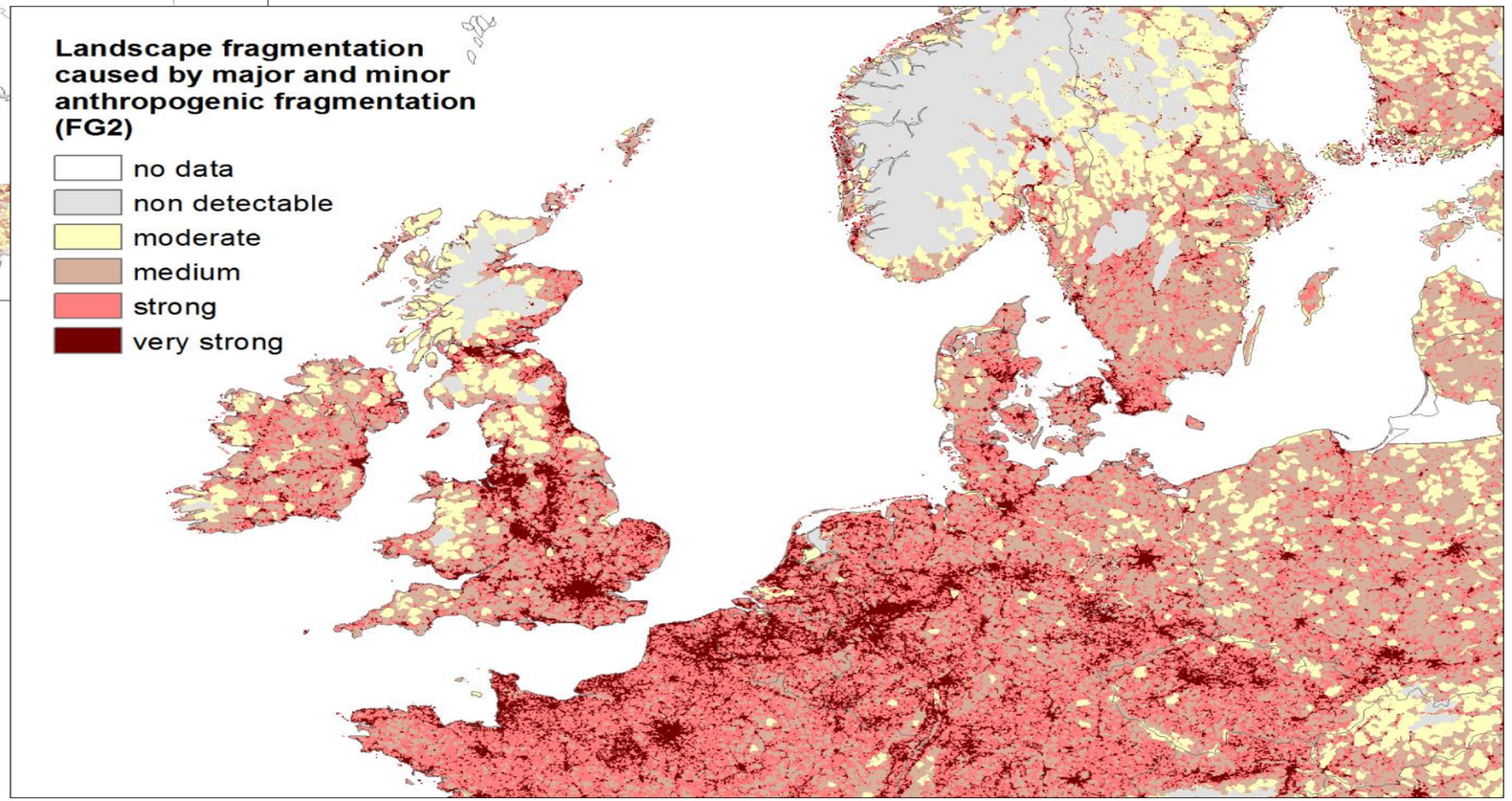
KIP-INCA, 2015

European Environment Agency

Effect of mobility and urbanisation on the fragmentation of ecosystems



→ Change in ecosystem extent and condition



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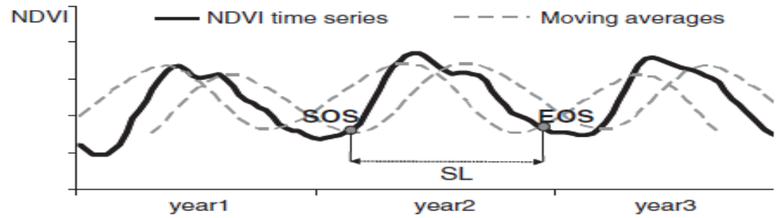
EEA Indicator

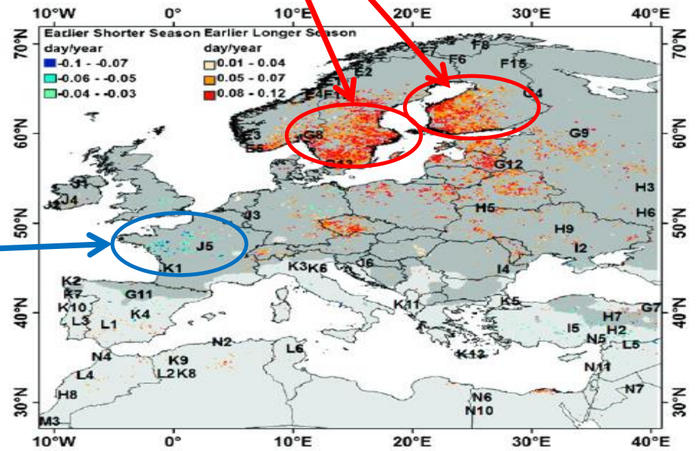
Ecosystem integrity - phenological shifts in European ecosystems

(AVHRR GIMMS3g 1982-2006)

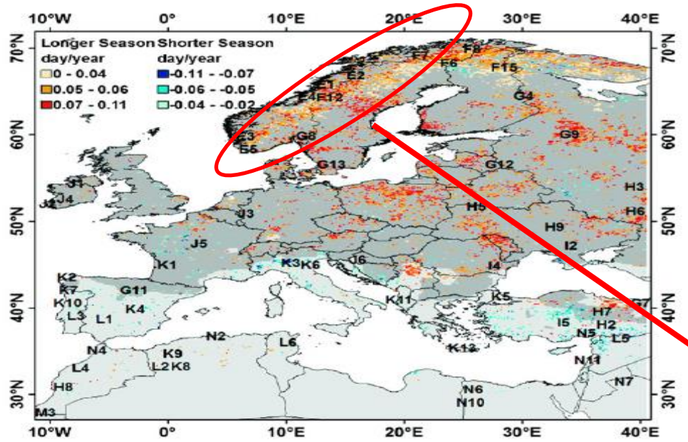


earlier and longer season

earlier and shorter season



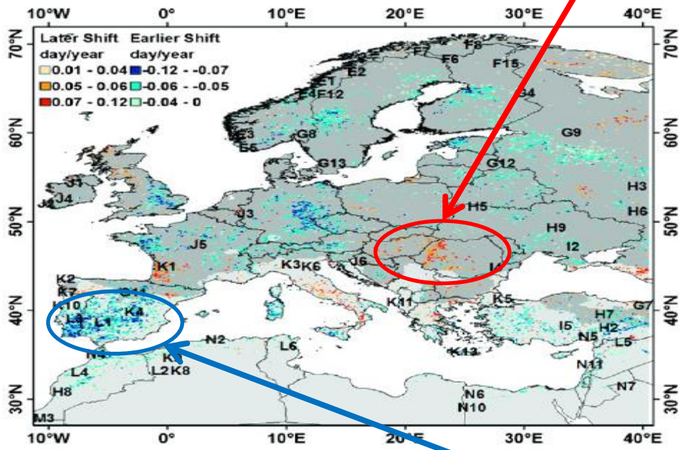
A: Earlier Longer Seasons and Earlier Shorter Seasons. Grey shaded areas: not significant trends and/or not significant spatial agglomerations



C: Longer Seasons and Shorter Seasons. Grey shaded areas: not significant trends and/or not significant spatial agglomerations.

start of season unchanged
the growing season is longer

season length unchanged
entire season shifts later



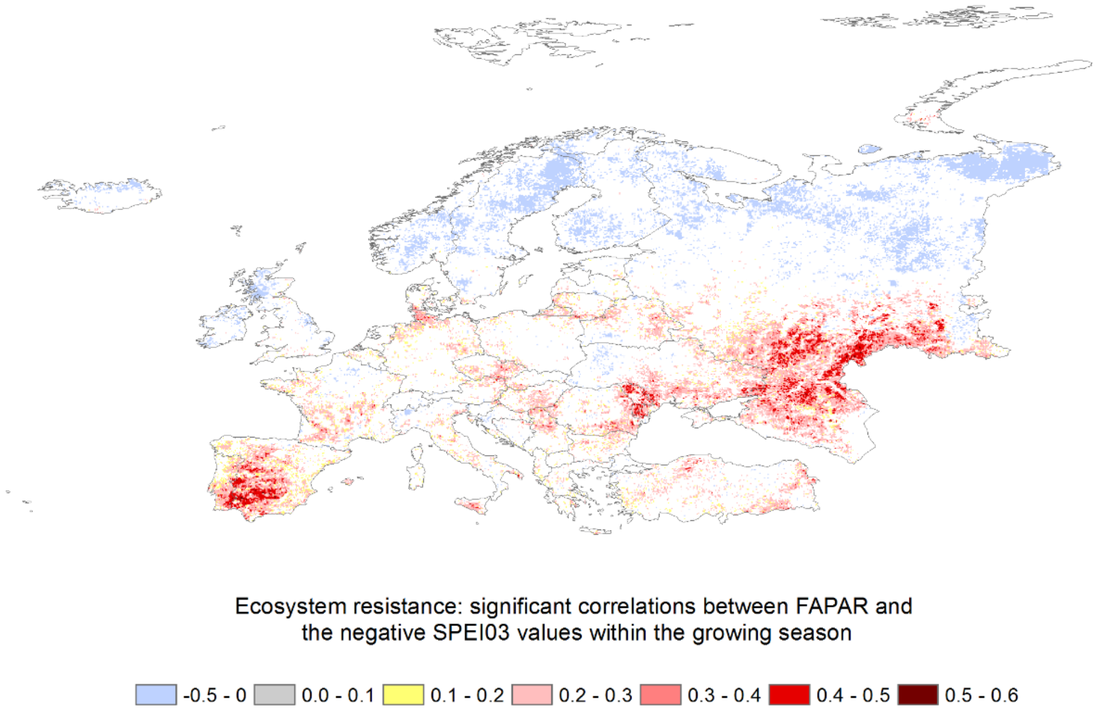
B: Earlier Shift of Season and Later Shift of Season. Grey shaded areas: not significant trends and/or not significant spatial agglomerations.

season length unchanged
entire season shifts earlier

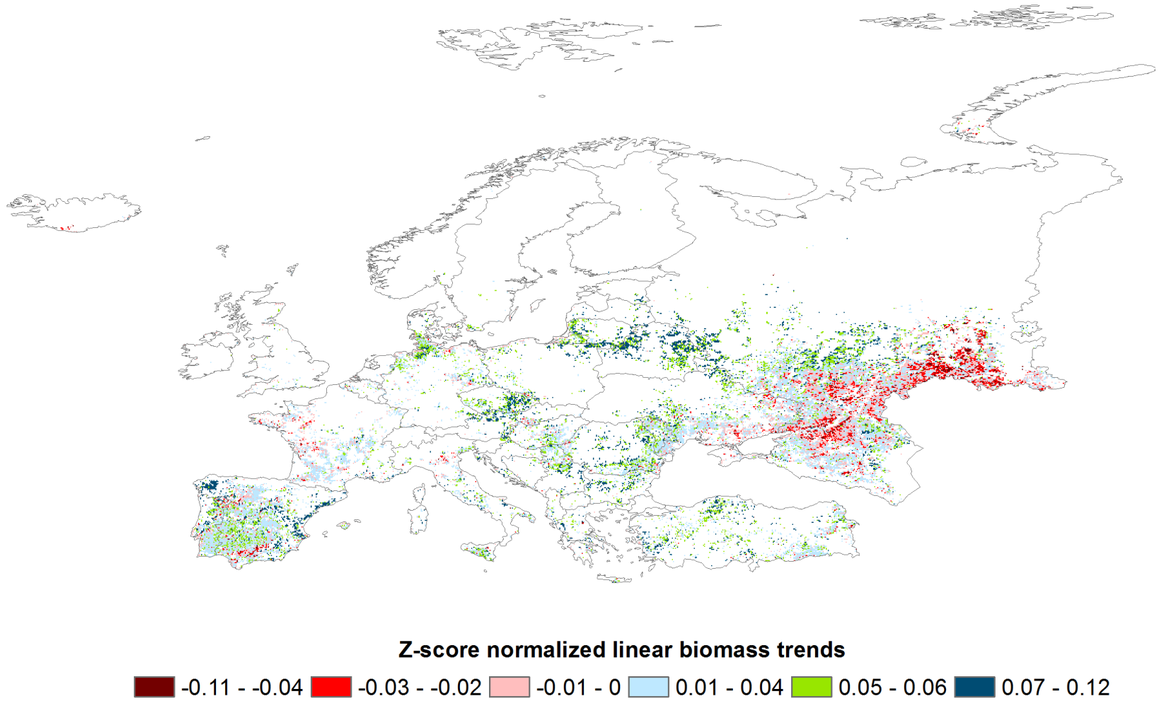
Ivits et al. / Global and Planetary Change (2012)

Drought footprints on European ecosystems

Ecosystems vulnerable to drought



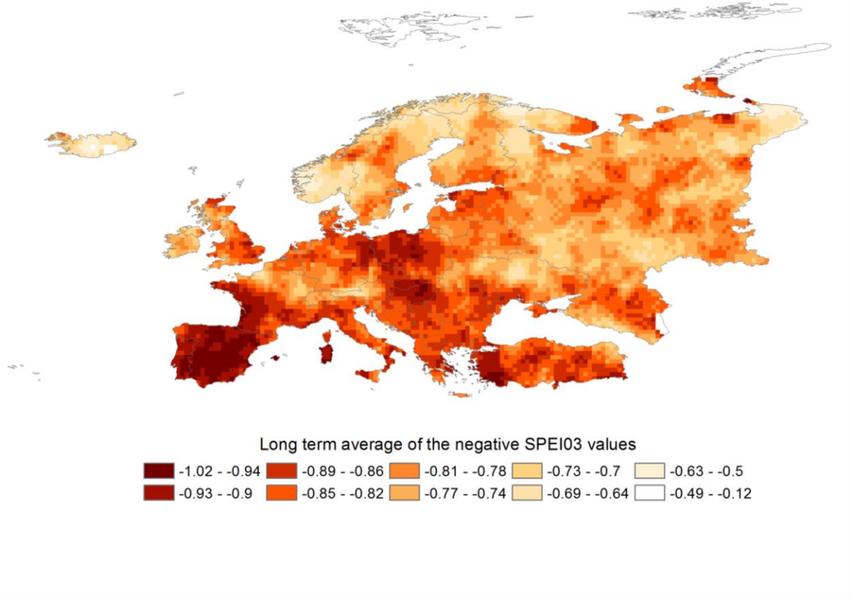
Long term biomass loss due to drought



Ivits et al. / Global Change Biology (2013)

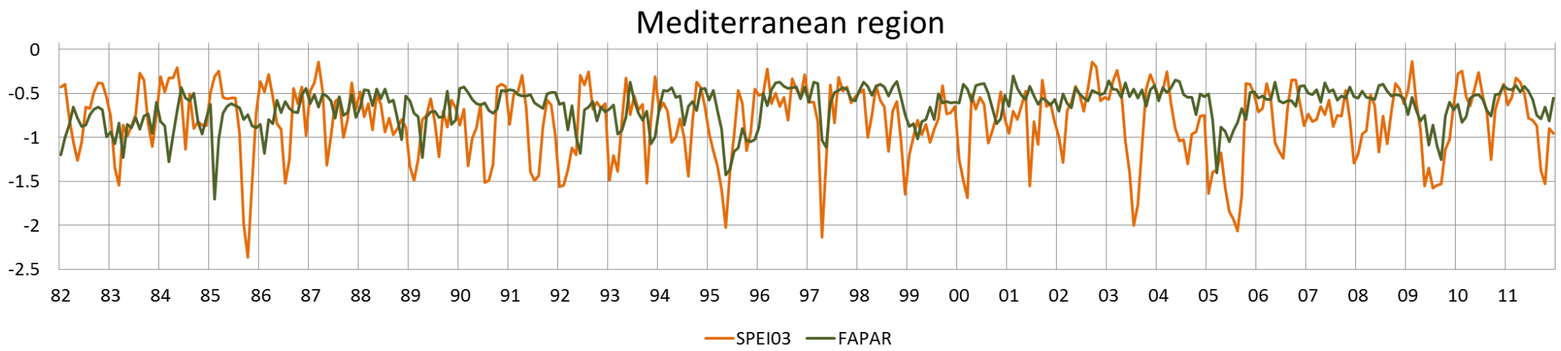
European Environment Agency

Impact of climatic extremes on ecosystems and land cover

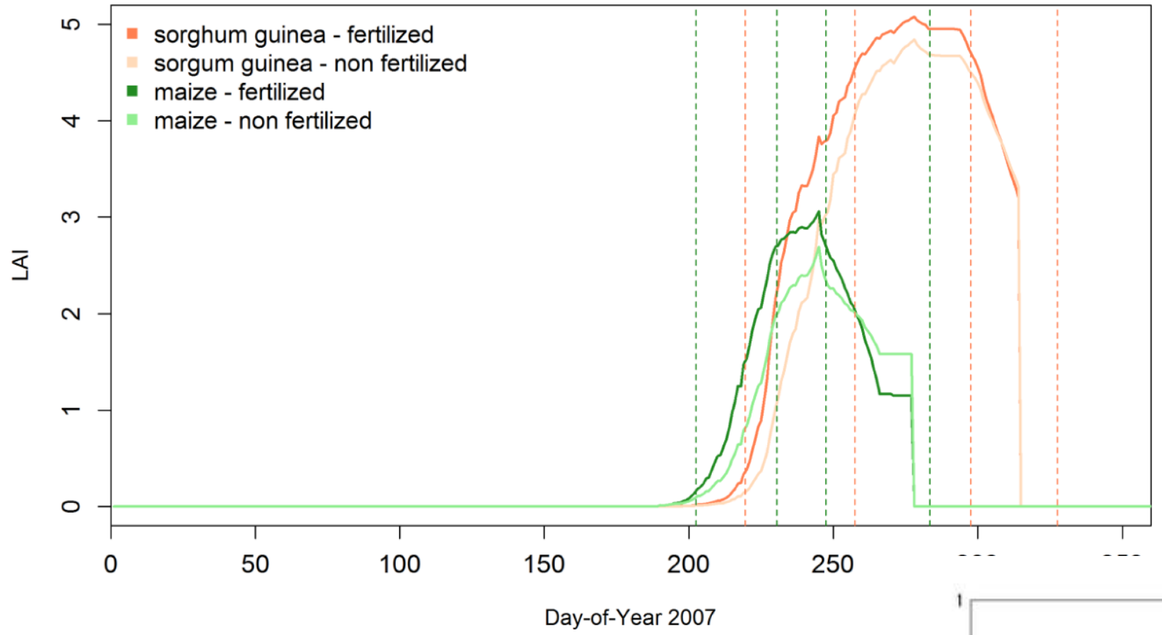


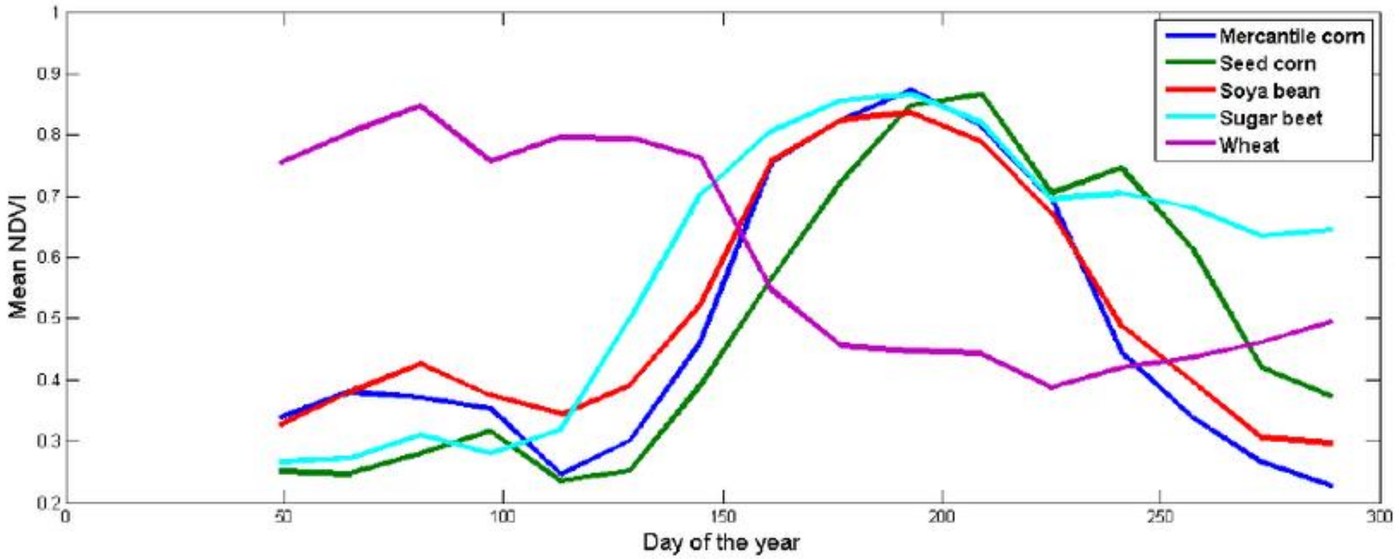
Assessment of negative anomalies:

Location: where (agriculture?)
Timing: when (within growing season?)
Duration: how long
Frequency: how many times
Intensity: how strong

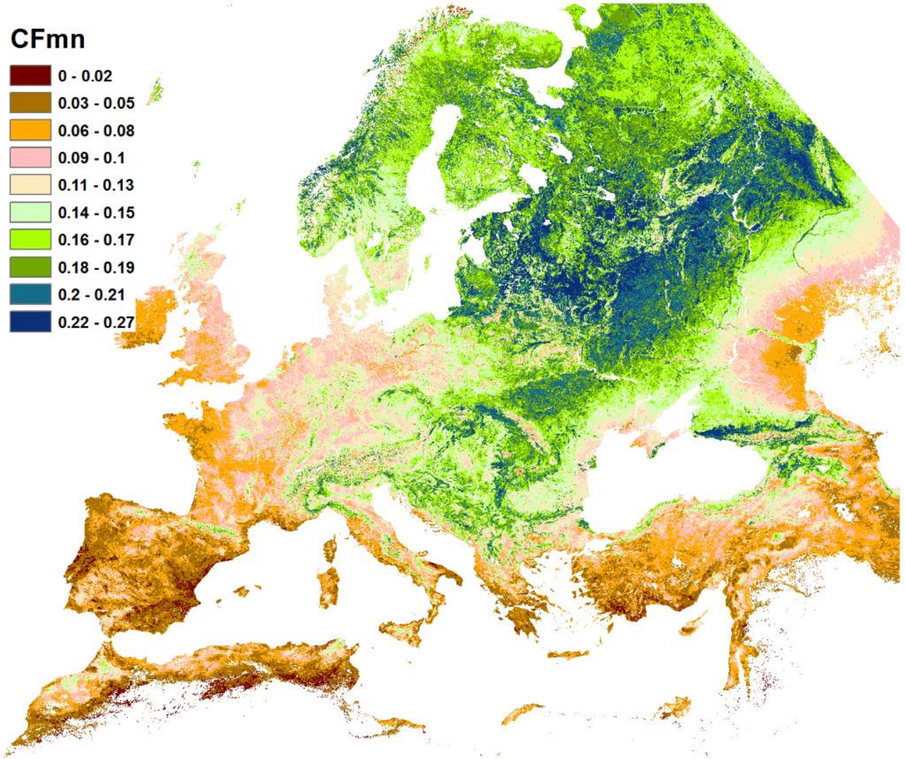


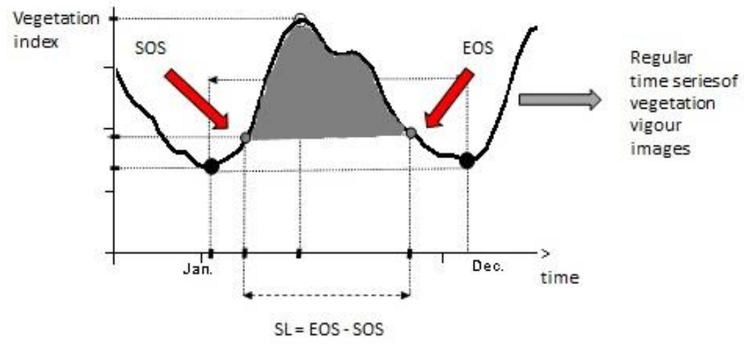
Mapping crop types

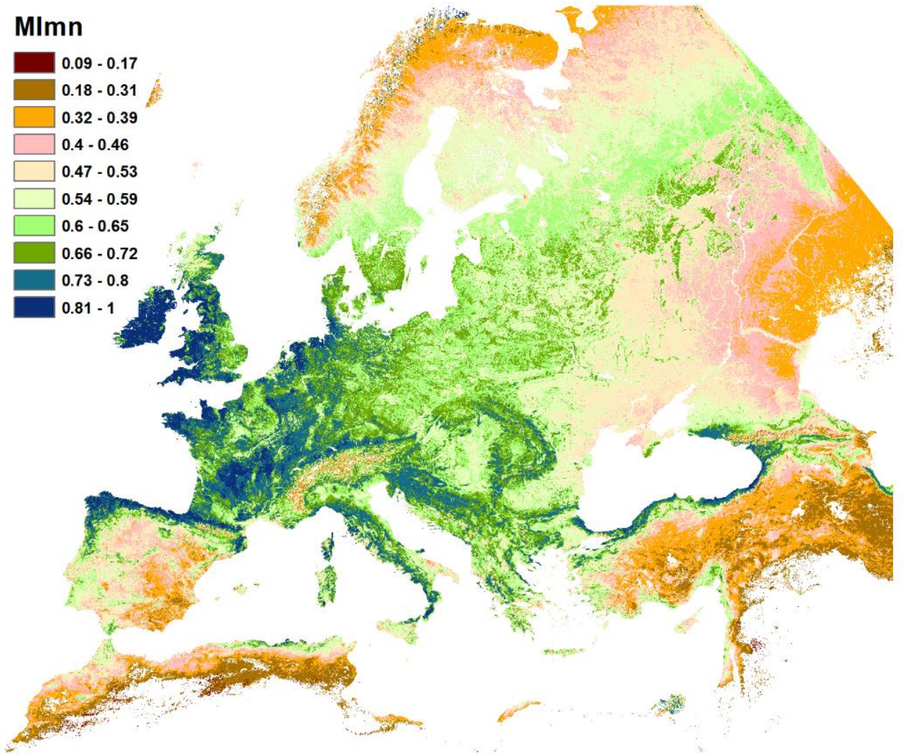


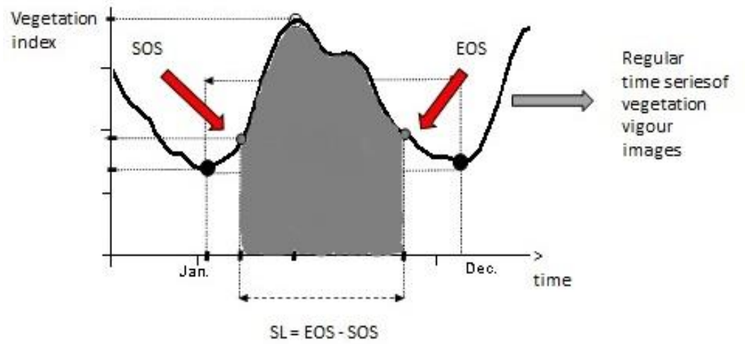


Approximation of growing season biomass (NPPapprox)



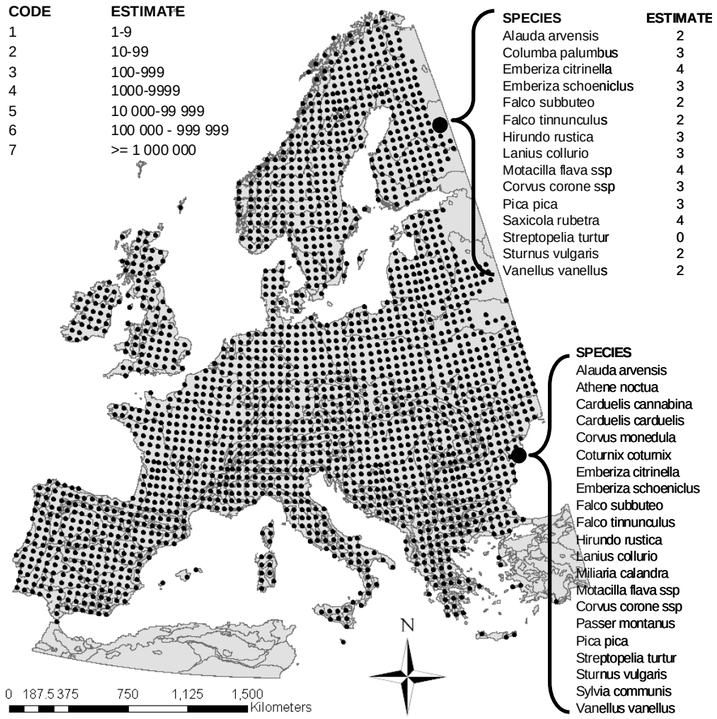




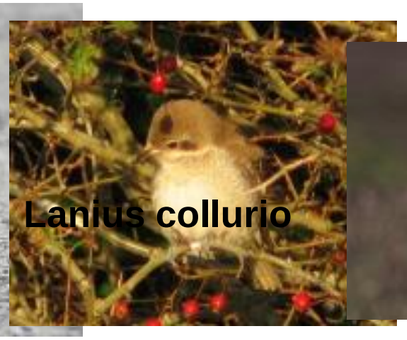


Correspondance with distribution of European Farmland Birds

Ordination, Partial Redundancy Analysis (RDA)
23 farmland bird species as dependent variables, phenological indices as explanatory variables, log area of the sampling plots as co-variables.




```
Axes                                    1       2       3       4  Total variance

Eigenvalues                        :  0.334   0.151   0.020   0.013          1.000
Species-environment correlations   :  0.854   0.868   0.833   0.731
Cumulative percentage variance
    of species data                :   42.3    61.5    64.0    65.6
    of species-environment relation:   63.2    91.8    95.5    97.9

Sum of all                eigenvalues                                      0.790
Sum of all canonical      eigenvalues                                      0.529

The sum of all eigenvalues is after fitting covariables
Percentages are taken with respect to residual variances
                i.e. variances after fitting covariables


**** Summary of Monte Carlo test ****

Test of significance of first canonical axis: eigenvalue =    0.334
                                              F-ratio    =   48.433
                                              P-value    =    0.0010

Test of significance of all canonical axes  : Trace      =    0.529
                                              F-ratio    =   16.716
                                              P-value    =    0.0010
```



Environment Agency

Eva Ivits, NSS3

Where we are going in Europe?

✓ Ecosystem extent – spatial delineation of ecosystems and habitats

- quantitative, operational and improving
- land cover monitoring revision (CLC+ 2022 onwards), improving delineation of habitats (Copernicus land services), riparian zones, urban atlas, small woody features, Natura2000...

✓ Ecosystem condition

- qualitative, operational and improving e.g. phenology, drought stress
- more work on characterisation of ecosystems (land use, forest stocks)
- Knowledge transfer and co-creation for parameterisation of productivity assessments (beyond NPP)

✓ Ecosystem extent and condition change

- Sentinel time series upcoming, more systematic use of existing data (e.g. Landsat) for trends

Thank you very much for your attention

markus.erhard@eea.europa.eu (ecosystem assessment)

eva.ivits@eea.europa.eu (remote sensing)

European Environment Agency