Modelling biodiversity friendly practices with CAPRI-Spat: possibilities and limitations

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Modelling biodiversity friendly practices

Agricultural practices have created and maintain agri-ecosystems that are real biodiversity hotspots. Agriculture covers almost half of the EU surface, therefore halting biodiversity loss requires proper management of agricultural lands.

Known characteristics of agricultural management supporting biodiversity are: low input, presence of semi-natural vegetation, low grazing pressure, crop and land cover diversity.

This type of information is provided (to a good extent) by agricultural statistics and is currently used in economic and environmental models.

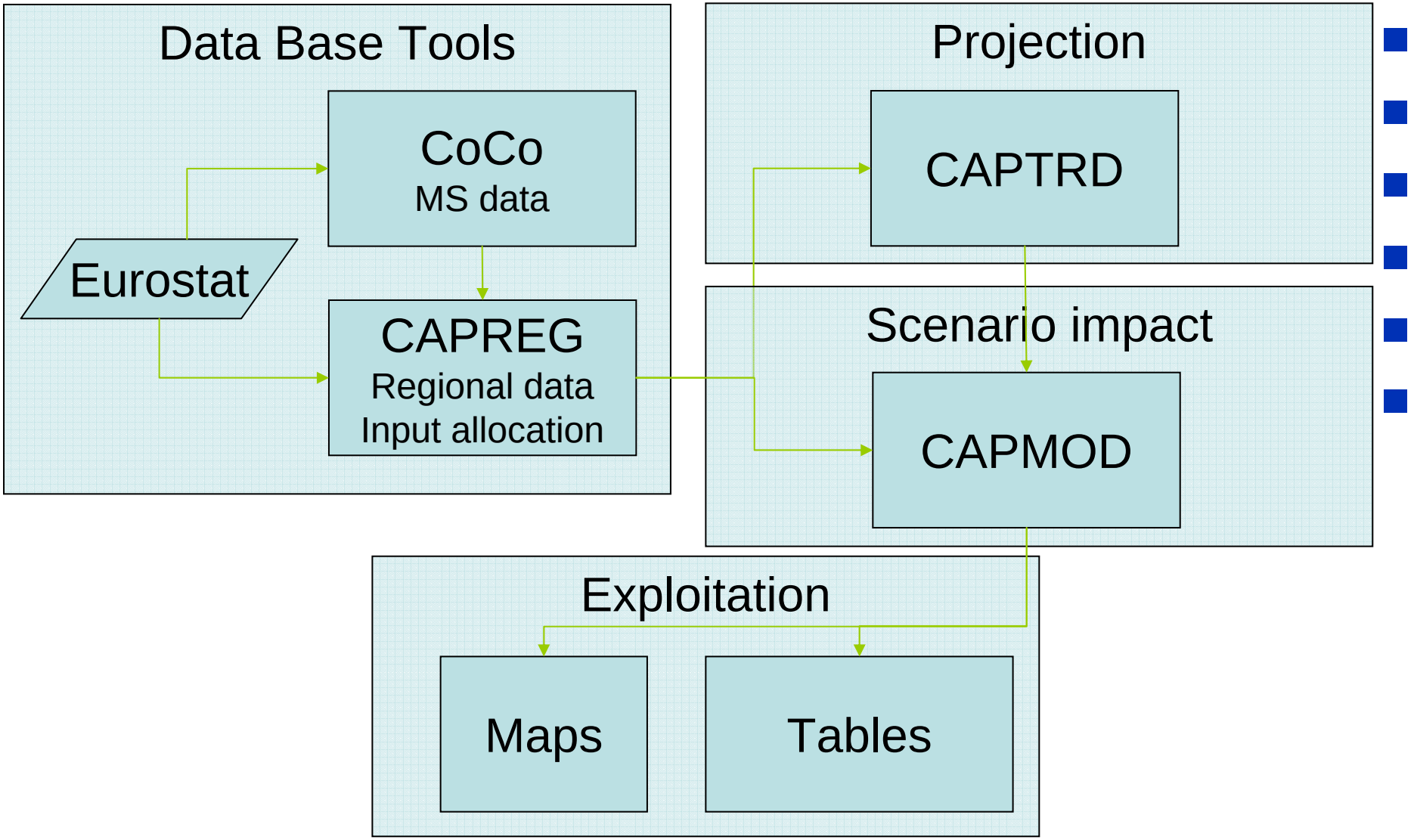
What is CAPRI ?

- CAPRI: the acronym means “Common Agricultural Policy Regionalised Impact”
- Comprises:
  - The underlying data base
  - The economic model
  - The software tools/code

What is CAPRI ?

- A “multi-purpose” modeling system for EU’s agriculture, allows to analyze
  - market policies (administrative prices/tariffs/preferential agreements)
  - Premium systems/quotas/set-aside at regional level
  - Environmental policies (standards/market solutions)
  - Changes in exogenous drivers (population/inflation/exchange rates/consumption behavior/technical progress)
- Regarding
  - supply/demand/trade flows
  - hectares/herd size/yields/input use
  - Producer & consumer prices, income indicators
  - Environmental indicators
  - Welfare effects including the EU budget for the Common Agricultural Policy (CAP)

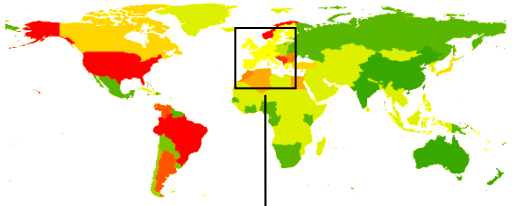
What is CAPRI ?



What is CAPRI ?

Changes in policies and markets

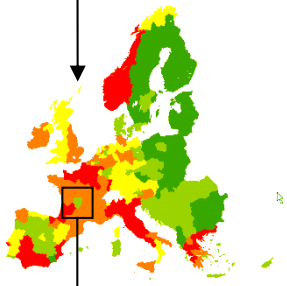
Globe Nation



Global market model

Economic with CAPRI

NUTS 2



Regional economic models

1x1 km

CAPRI Dynaspat

Spatial downscaling

Bio-Physical modeling

Indicator calculators

What is CAPRI ?

CAPRI results are mostly available at NUTS2 level, but for environmental analysis, local factors as soil, slope, climate or surrounding land use matter.

The Spatial Downscaling module in CAPRI (CAPRI-SPAT) distributes consistently major results (i.e. N input, livestock, crops) at regional level for EU27 to ~150.000 clusters of 1x1 km grid cells. This allows the link to bio-physical models and specific analysis e.g. regarding the characteristics of agricultural landscapes.

Input data

Some of the key characteristics of agricultural management supporting biodiversity (crop shares, stocking densities, yields, mineral and organic fertilizer application rates) are available in CAPRI-SPAT results, with some limitations:

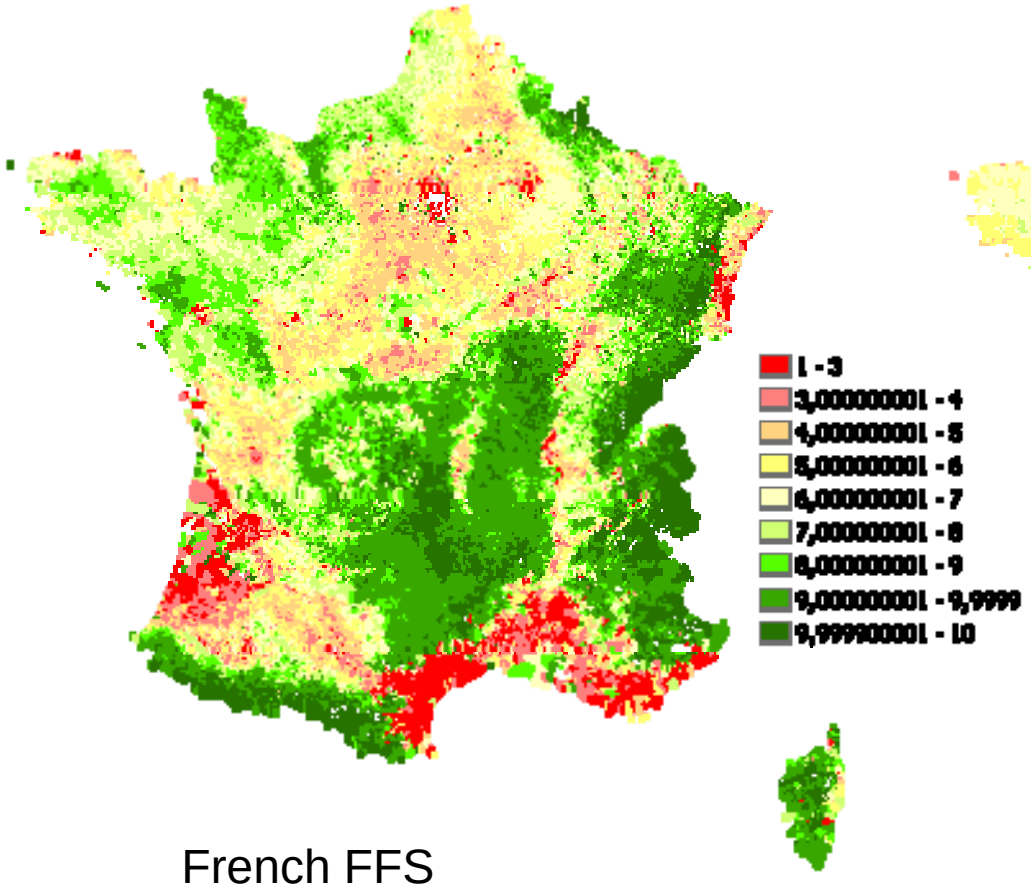
- available statistics such as the Farm Structure Survey (FSS) do not cover key management information, such as fertilizing practice and pesticide input;
- Data sets on crop shares, yields, stocking density are only available for larger administrative units;
- No harmonised data on linear landscape elements are available at EU level.

The aim of the study is:

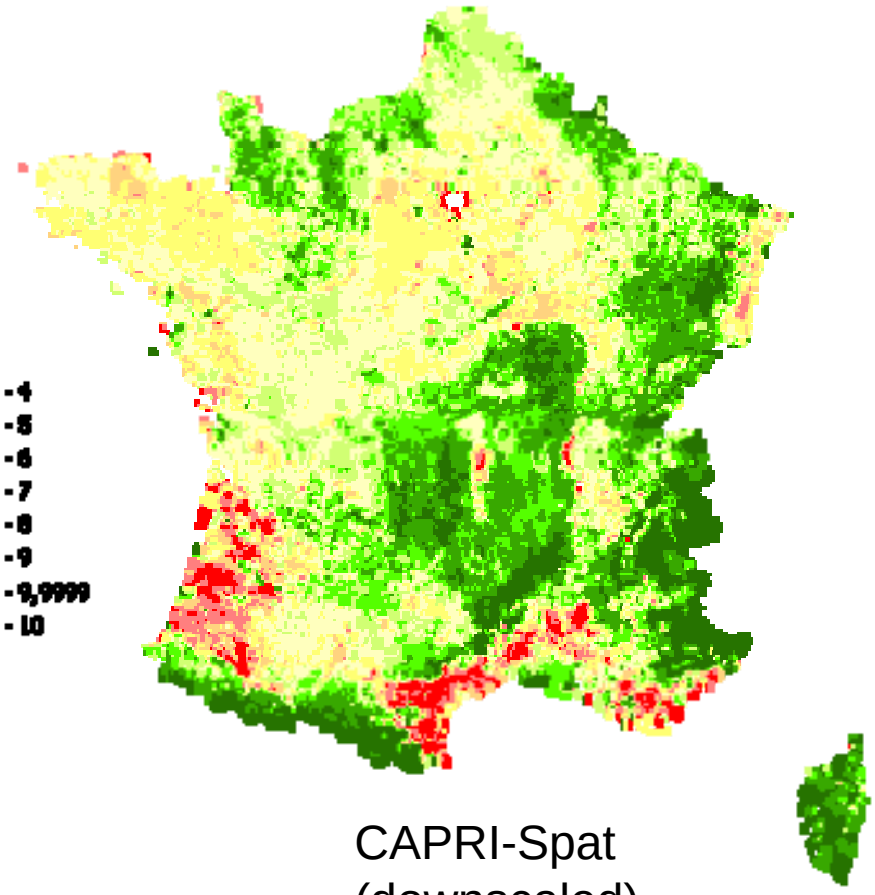
- The development of an indicator which measures impacts of farming practices on biodiversity
- Drawing on established scientific findings linking farm management to biodiversity
- Sourced by results of an economic model for agriculture that delivers ex-post data or simulates ex-ante impacts at NUTS 2 level, downscaled to 1 km x1 km pixel clusters

FSS – CAPRI comparison

Crop diversity and share of grassland index

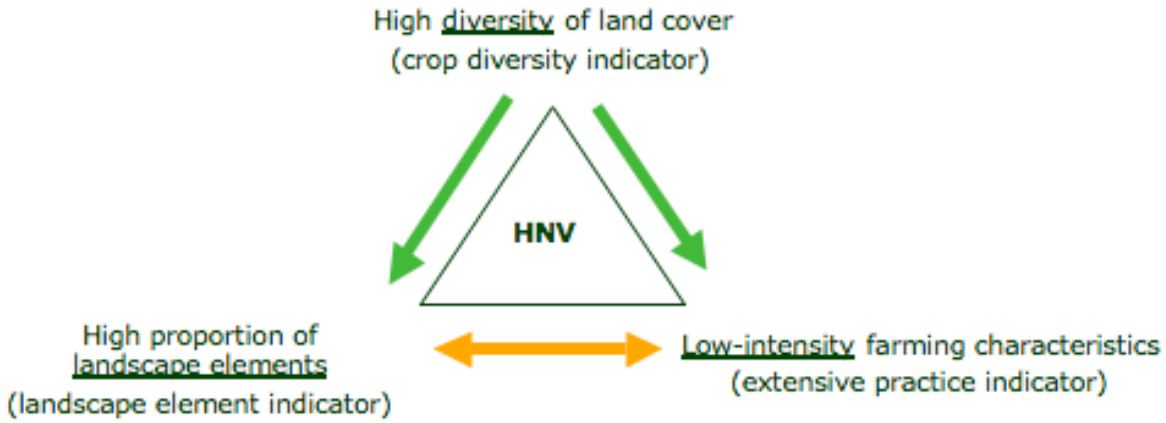


French FFS
(~30.000 communes)



CAPRI-Spat
(downscaled)

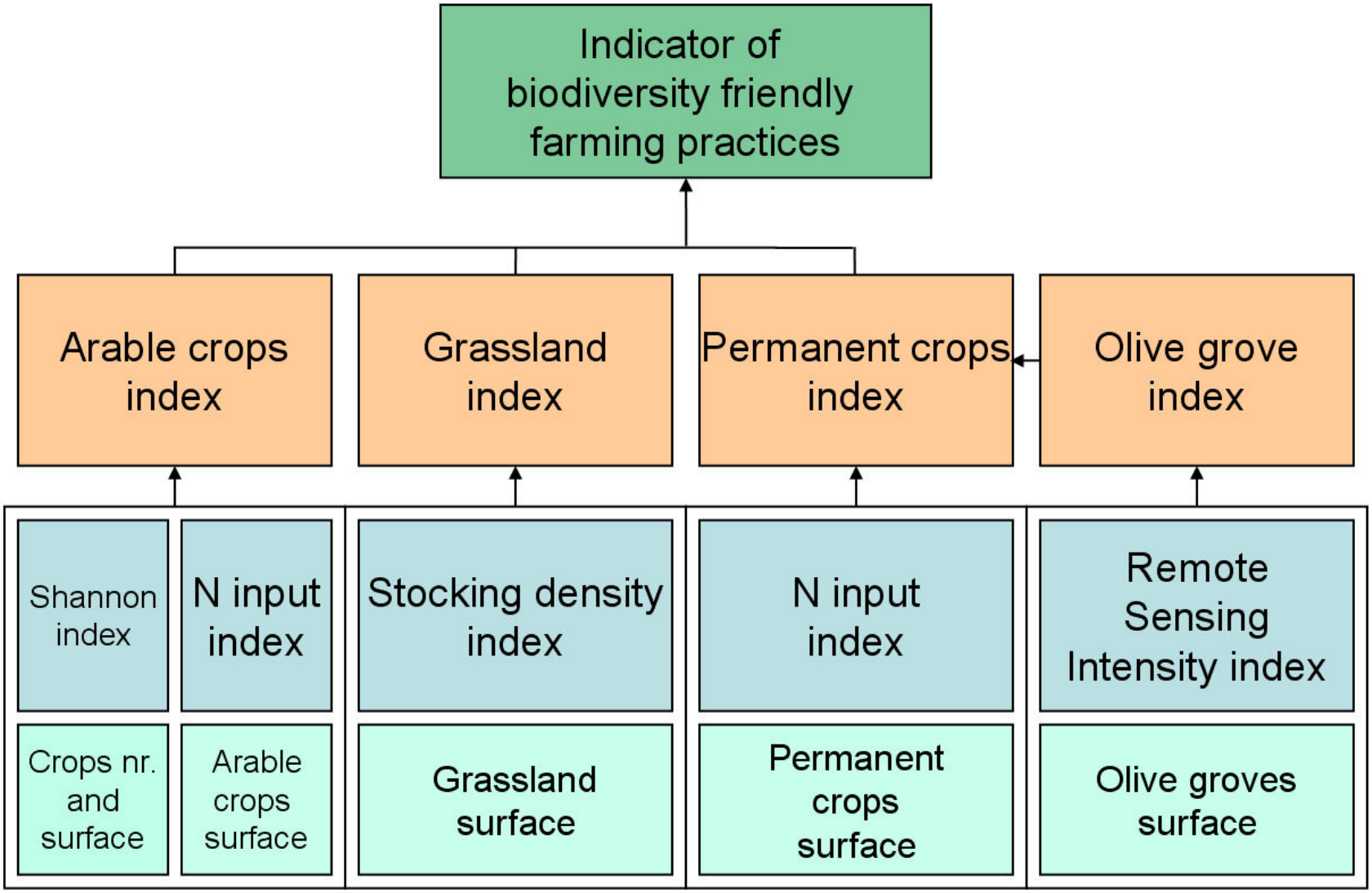
Indicator of biodiversity friendly practices



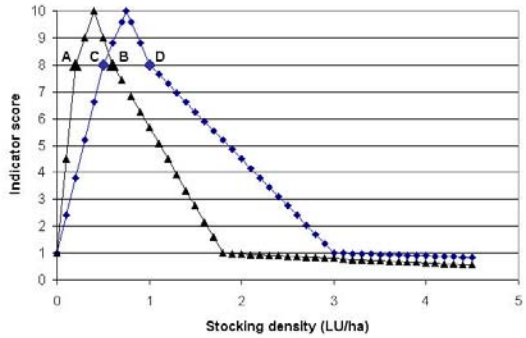
Previous research shows that three components of agricultural land management are favourable to biodiversity: a high crop diversity (long rotations); low-intensity practices (low inputs and low grazing density); high proportion of landscape elements and semi-natural vegetation.

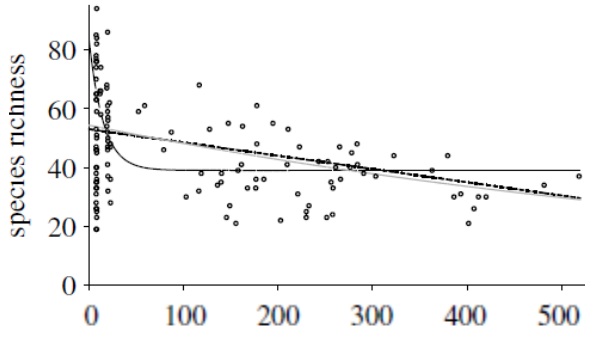
Two of these elements are embedded in CAPRI and can be used in building an indicator of biodiversity friendly practices. At the moment being no information is available on landscape elements, therefore the assumption is that the indicator models farming practices in the strict sense and that the indicator would have a higher value with the presence of landscape elements.

Indicator of biodiversity friendly practices

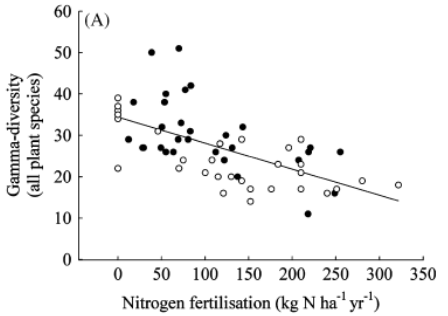


Agricultural land management / biodiversity



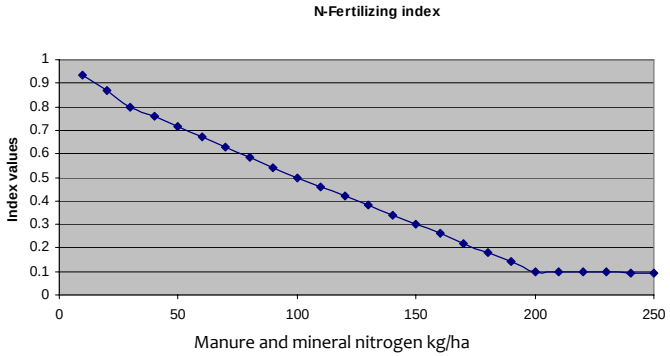


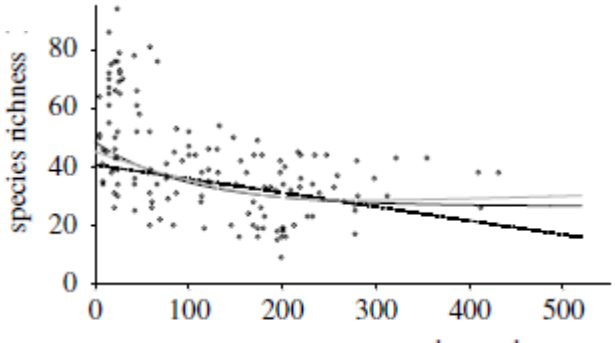
Biodiversity and land-use intensity D. Kleijn *et al.*



S. Klimek et al. / Basic and Applied Ecology 9 (2008) 626–634

Permanent grassland



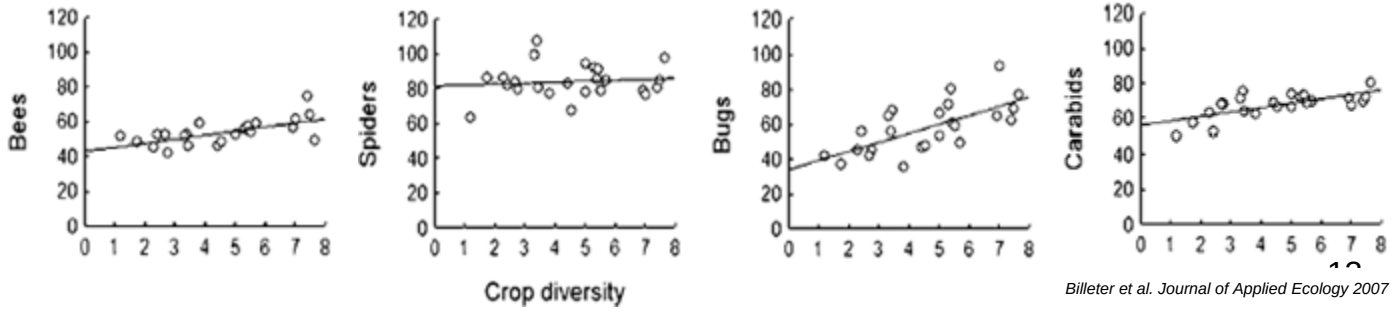


Biodiversity and land-use intensity D. Kleijn *et al.*

Arable crops

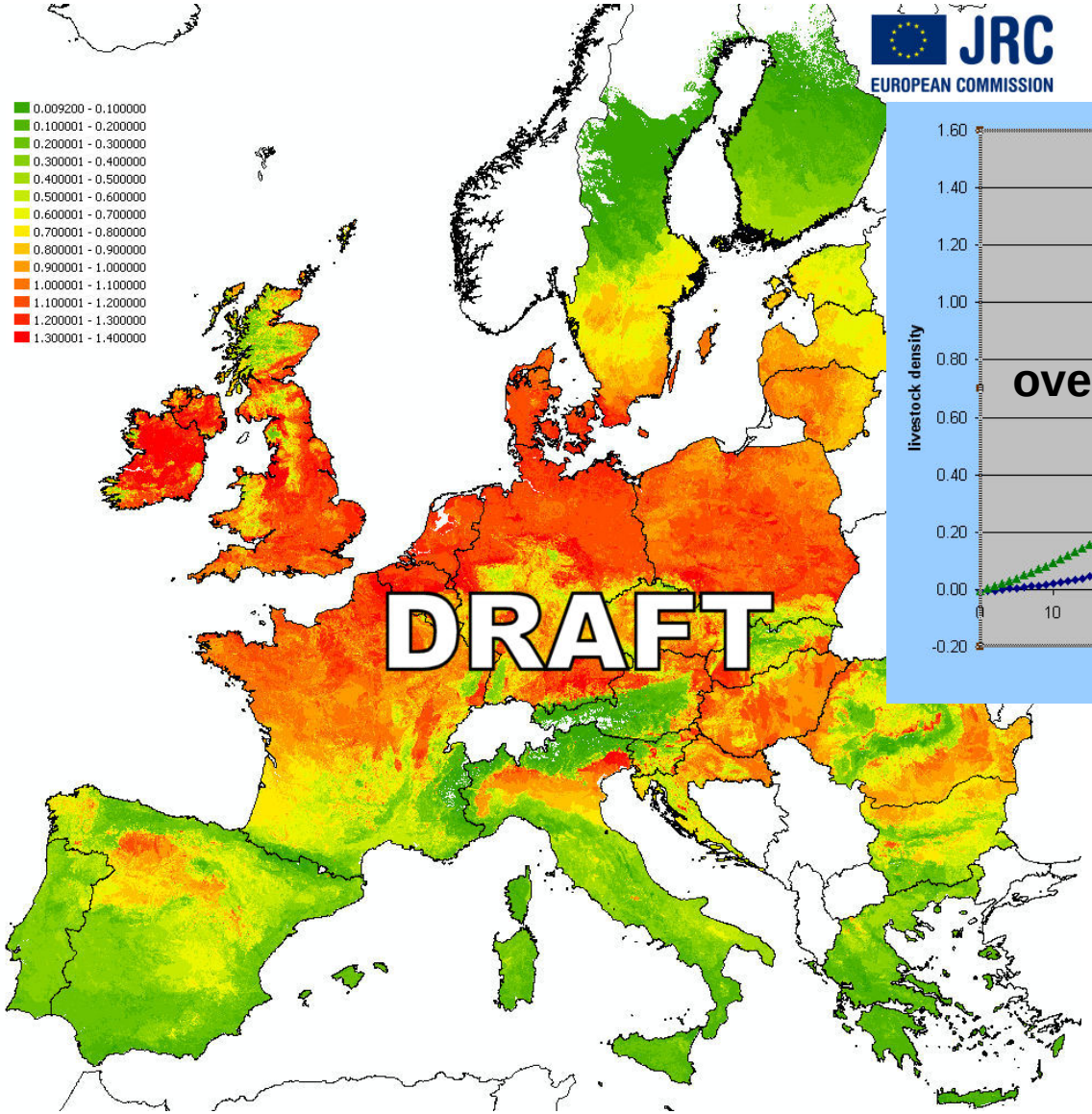
Shannon index

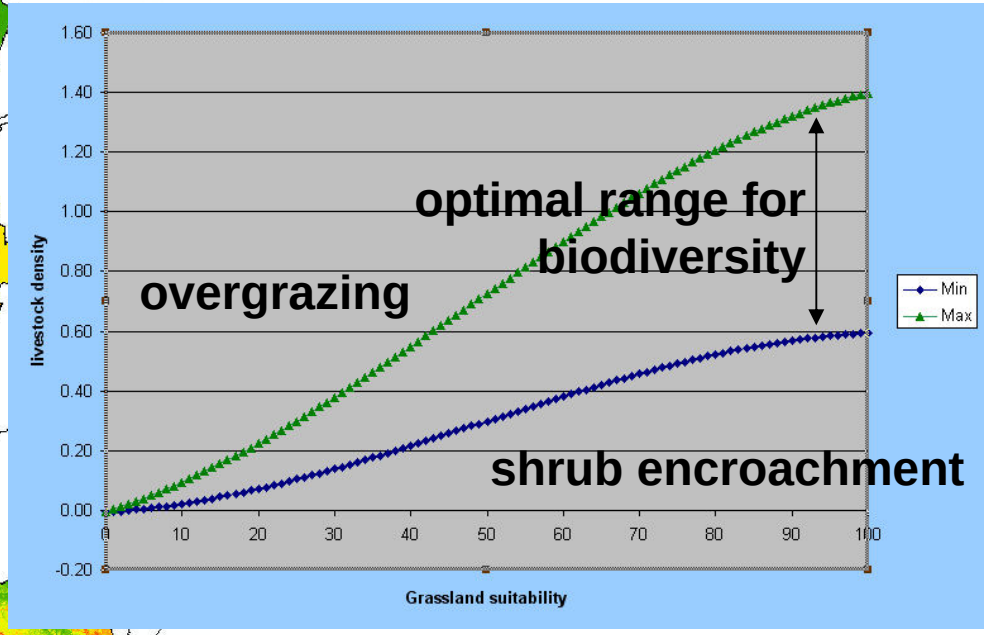
$$SHDI = -\sum_{i=1}^{m} (P_i * \ln P_i)$$



Billeter et al. Journal of Applied Ecology 2007

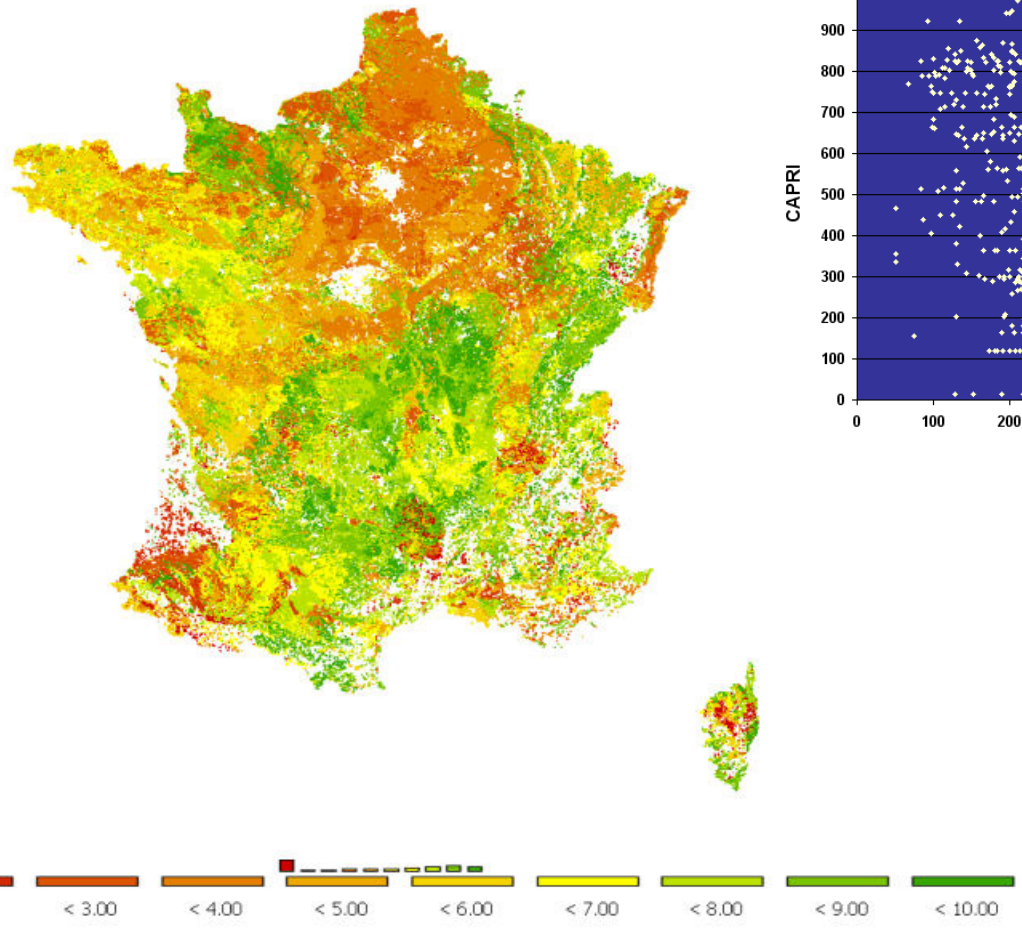
Livestock density ←→ biodiversity



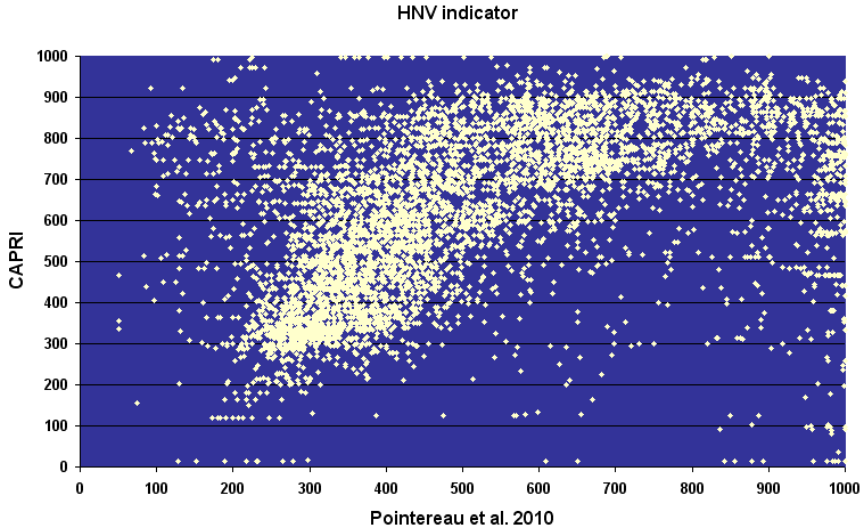


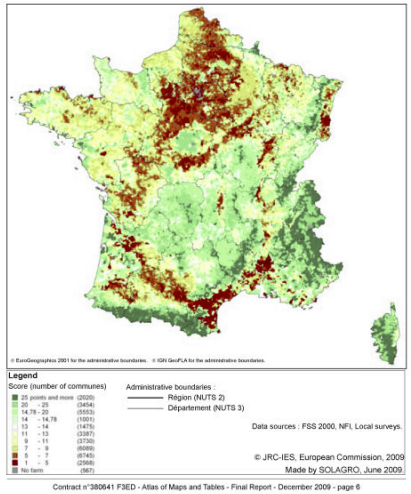
The grassland index is linked to variable thresholds of minimum and maximum ruminant stocking density calculated on the basis of land suitability for grassland

Indicator of biodiversity friendly practices 2004



CAPRI result





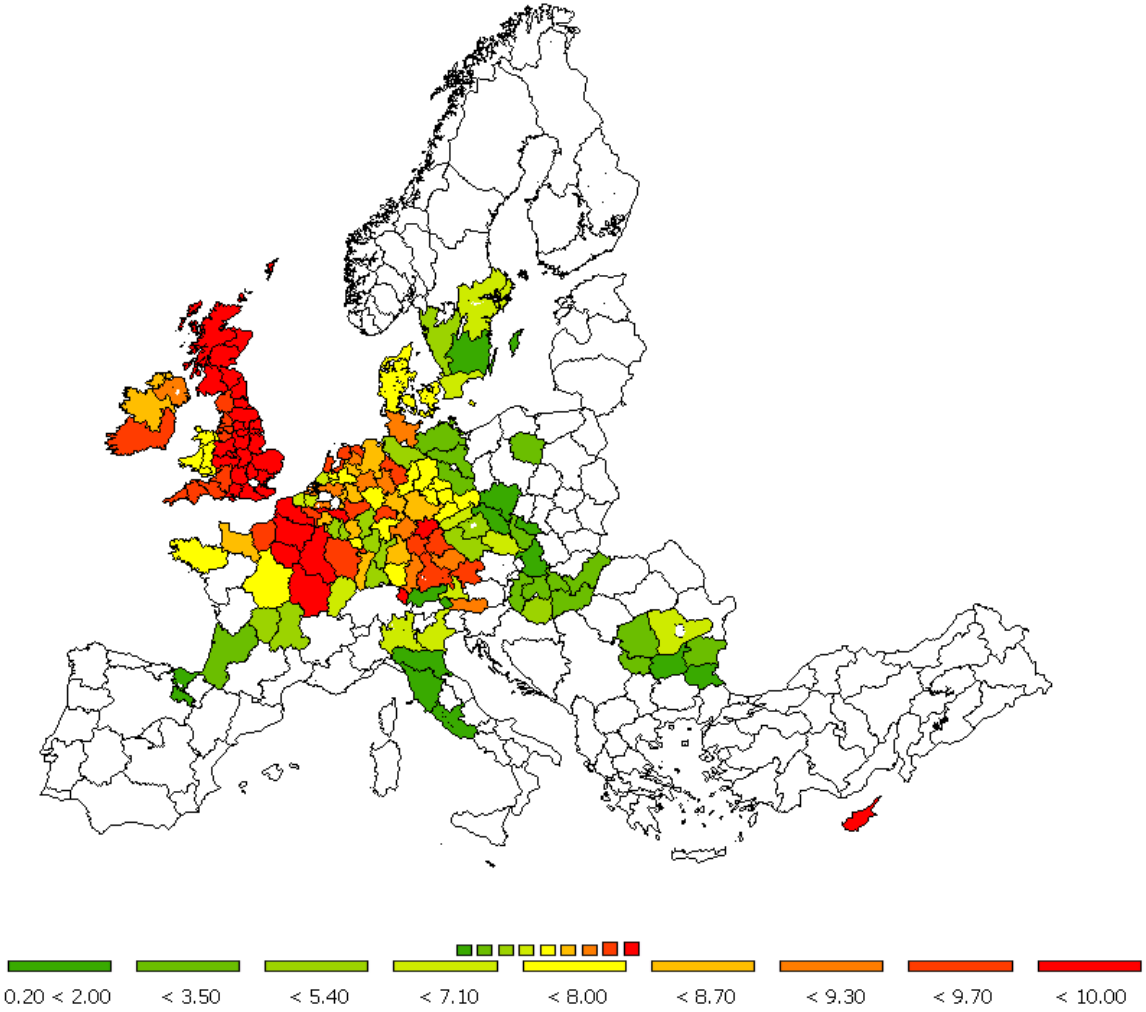
HNV score using statistics and farm practice surveys at municipal level (Pointereau et al., 2010 – in press)

Scenario definition

- Baseline:
  - 2020, based on recent outlook studies
  - Health Check implemented: sugar reform, no dairy quotas, very little coupled support left; price well above EU safety net levels
- Counterfactual scenario:
  - ensure that 10% of arable land is used for ecological purposes (SFU 2009), High Nature Value (HNV) farmland and Natura2000 sites already subtracted

  ⇒ **results show higher set-aside rates in high yielding regions**

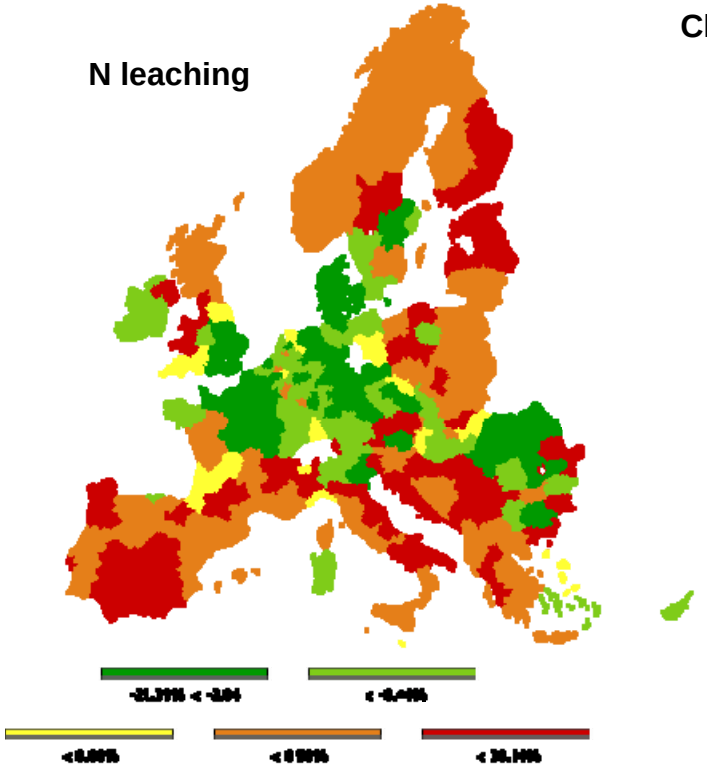
Ecological set-aside rate on arable land %

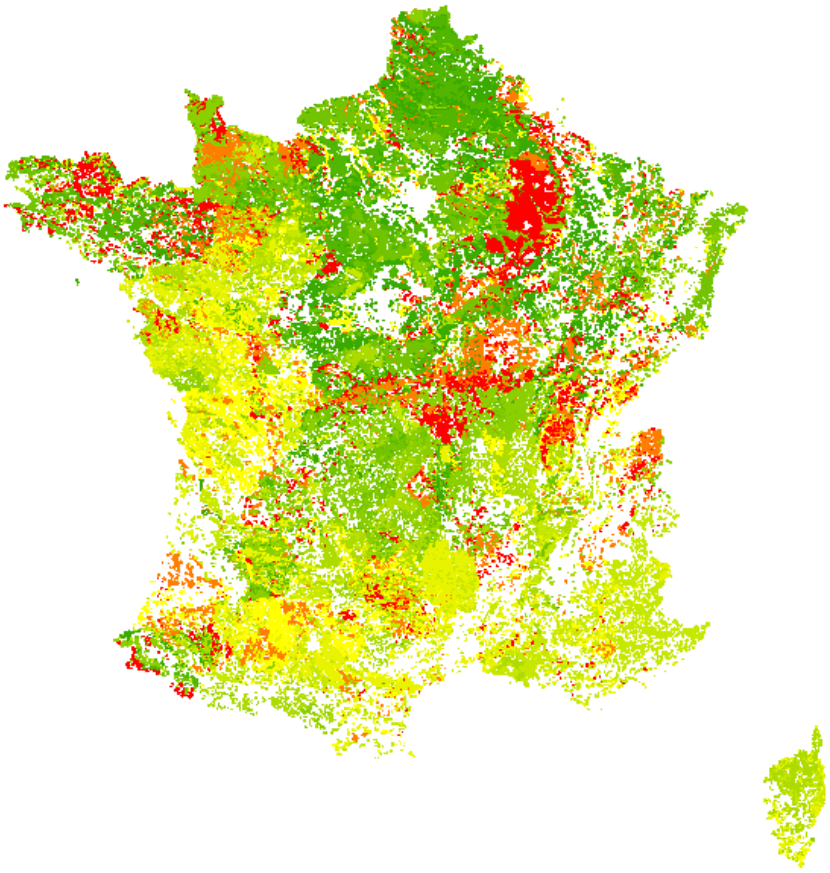


Scenario analysis

Change in indicator value, ecological set-aside compared to baseline

N leaching





-8.08 < -0.12 | < -0.05 | < -0.02 | < -0.00 | < 0.01 | < 0.05 | < 0.11 | < 0.28 | < 0.64 | < 8.41

The CAPRI approach

Pros

- it is based on a relatively simple and robust approach
- it is linked to the results of an established tool for policy impact analysis
- therefore allows policy scenario analysis
- provides results on a continuous scale, showing also changes at the "intensive" end

Cons

- needs however more evaluation, and complementing data, e.g. on common lands or fertilizing practices
- does not cover all components of HNV farmland but focuses on cultivated land (UAA at the present time) and on farming practices and their relation to biodiversity friendliness

Data need

- **Statistics (at least at NUTS2 level) on common lands**
- **Statistics (at least at NUTS2 level) on pesticide use**
- **More detailed data on fertilizing practices (at the moment N input is disaggregated to 1 km cells)**
- **Data on landscape elements**


THANK YOU