2024 Events
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Forum for the Future of Agriculture

Research lessons to inform future CAP reform

Exploring Data-Driven Models as Solutions in Agriculture

7th February 2024, Brussels
9:00 – 14:30, The Hotel

Forum for the Future of Agriculture

RISE Foundation
Rural investment for a Sustainable Europe

BESTMAP
Behavioural, Ecological & Socio-economic Tools for Modelling Agricultural Policy

Forum for the Future of Agriculture®

Research lessons to inform future CAP reform
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Words of welcome and keynote address

Policy design in challenging times – The role of analytical tools in the CAP Policy debate

Tassos Haniotis

Special Advisor for Sustainable Productivity, Forum for the Future of Agriculture, Senior Guest Research Scholar at IIASA, Former Director for “Strategy, Simplification and Policy Analysis” in the DG AGRI

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Policy Design in Challenging Times
The role of analytical tools in the CAP policy debate

Tassos Haniotis
Special Advisor for Sustainable Productivity, Forum for the Future of Agriculture
Senior Guest Research Scholar, International Institute for Applied Systems Analysis

Research Lessons to Inform Future CAP Reform
Rise Foundation/ForumforAg International Event
Brussels, 7 Februaary 2024

LinkedIn: Tassos Haniotis

It's a new world out there…

Of late, hardly a day passes by without a news reference on agriculture - mostly negative

- *During and just after COVID, some realisation that the food system was not broke after all, but in need of repair*
- *Then, with the war in Ukraine, food security and climate action became substitutes rather than complements*
- *Increasingly a combination of accumulated frustration led to the recent turmoil, with yet unknown consequences*

Agriculture has been at the forefront of a polarised, but poorly structured debate

- *On climate change action, farming has been asked to contribute to the efforts of other policies and sectors…*
- *…yet its own contribution on carbon sequestration appears as a footnote of exclusion, despite its significance!*
- *In most analytical work based on food systems approach, the economy is either absent or grossly assumed*

Have we reached a turning point?

- *In some ways yes, but we still need to address the long-term needs of food security and climate change*
- *There is a clear need to put the debate back on track – starting with the need for a credible baseline*
- *Several issues need to be addressed to get a better grasp of the interplay between economy and environment*

Some thoughts on the policy design in CAP analytical tools

It is about data…

- *There is too much information out there…its filtering and prioritisation is a must*
- *We are better off at basic economic data to assess the farm supply side, but the food chain is a black box*
- *Environmental data are in need of collection and harmonisation, and even more is needed on the “fork side”*

…it is about the use of data…

- *A model is a representation of reality, but in rough and aggregated terms – this does not need to change*
- *What needs to change is how models communicate with each other – starting with their basic assumptions*
- *Biophysical models need to get the economy in their structure; economic models to better prioritise environment*

…it is about the narrative of data

- *The potential for increasing productivity in a sustainable way is huge…plenty of best practices demonstrate this…*
- *…yet allergic reactions to productivity are also real – and not on its (more justifiable) social dimension*
- *There are plenty of issues that need to be addressed – soil health in land management is pivotal in linking them*

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Research lessons to inform future CAP reform
7th February 2024, Brussels

Examples from H2020 European research projects

Behavioural, ecological and socio-economic tools for modelling agricultural policy

The BESTMAP project

Tomáš Václavík
Palacký University Olomouc

James Bullock
UK Centre for Ecology & Hydrology

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BESTMAP
Behavioural, Ecological & Socio-economic Tools for Modelling Agricultural Policy

Palacký University Olomouc

BESTMAP
Behavioural, Ecological & Socio-economic Tools for Modelling Agricultural Policy

Behavioural, ecological and socio-economic tools for modelling agricultural policy

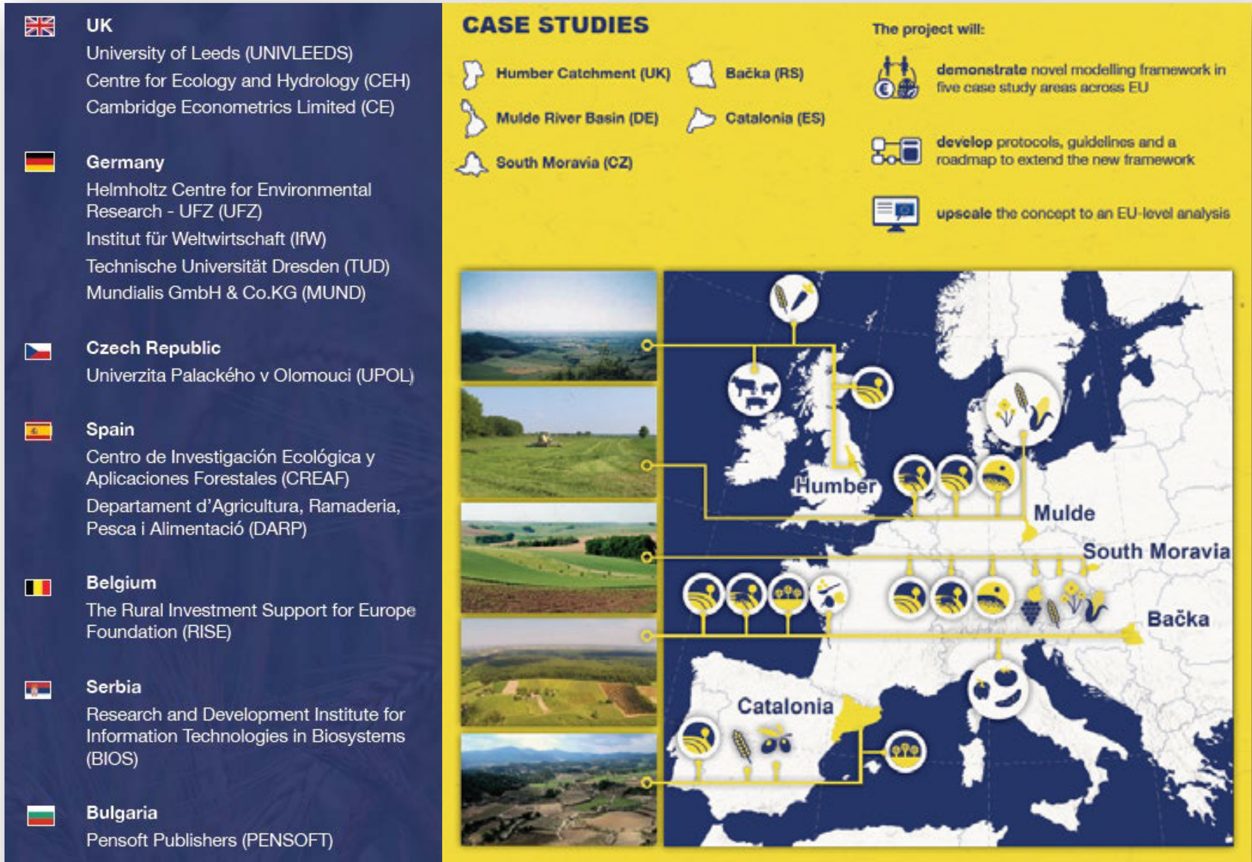
Tomáš Václavík[1] & **Guy Ziv**[2]

[1]*Palacký University Olomouc, Department of Ecology and Environmental Sciences*

[2]*University of Leeds, School of Geography*

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 817501

BESTMAP (2019-2024), Horizon 2020



http://www.bestmap.eu/

1. Develop a framework for modeling the impacts of agricultural policy, e.g. Agri-Environmental Practices
2. Link individual farm agent-based models with assessments of ecosystem services and biodiversity
3. Produce a simple-to-use dashboard to compare scenarios of Agri-Environment Practices adoption
4. **Improve the effectiveness of future EU rural policies**

M 10 Agri-environment-climate measures

Funding mechanism providing financial support to farmers to contribute to the protection or enhancement of biodiversity, soil, water, landscape, or air quality, or climate change mitigation or adaptation.

An important part of the **second pillar** of the **Common Agricultural Policy** (CAP)

Examples of AEM

- Integrated production / organic farming
- Buffer areas / vegetation (flower) strips
- Cover (catch) crops
- Fallow land
- Extensive grassland maintenance

Ecological focus areas (EFA) – so-called greening, part of the fist pillar of CAP

Vegetation strips, Šardice, Czechia

Methodological framework

Policy impact assessment models (PIAM) have their limitations:

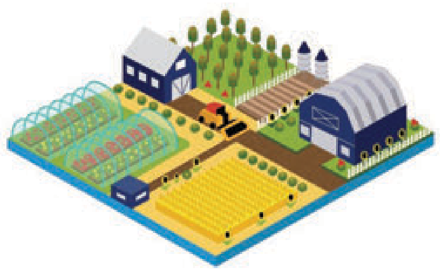
1. Based on mostly (socio)economic indicators
2. Ignore the complexity of farmers' behavior (decision making)

European rural landscape is managed mostly at the farm business unit level

1. Define and map Farming System Archetypes – typology of farms

Farmers decisions are not always economically rational

2. Use Agent-Based model capturing habitual / social behaviours



Environmental and socio-economic impacts of adopting AES depends on the type of farm and the specific geographic context

3. Model impact of AES scenarios using biodiversity and ES models

1. Typology of farms – Farming System Archetypes (FSAs)

- Assumption: similar farms will respond similarly to agricultural policies

- Two simple criteria
- Possibility to upscale to other parts of Europe based on FADN data

FARM SPECIALIZATION

"Type of farming" of FADN (defined in Annex IV of EU regulation 2015/220)

- General cropping (P1)
- Horticulture (P2)
- Permanent crops (P3)
- Grazing livestock(P4)
- Mixed (less than 2/3 of P1-4)

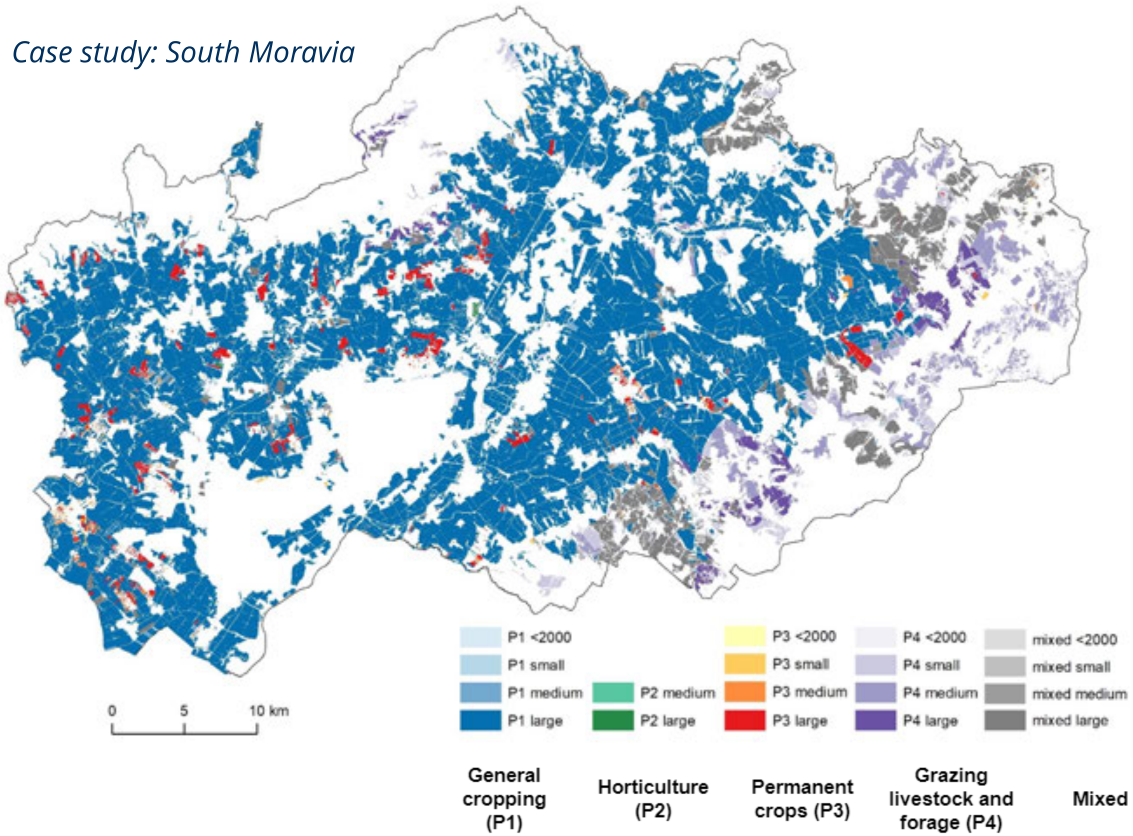
ECONOMIC FARM SIZE

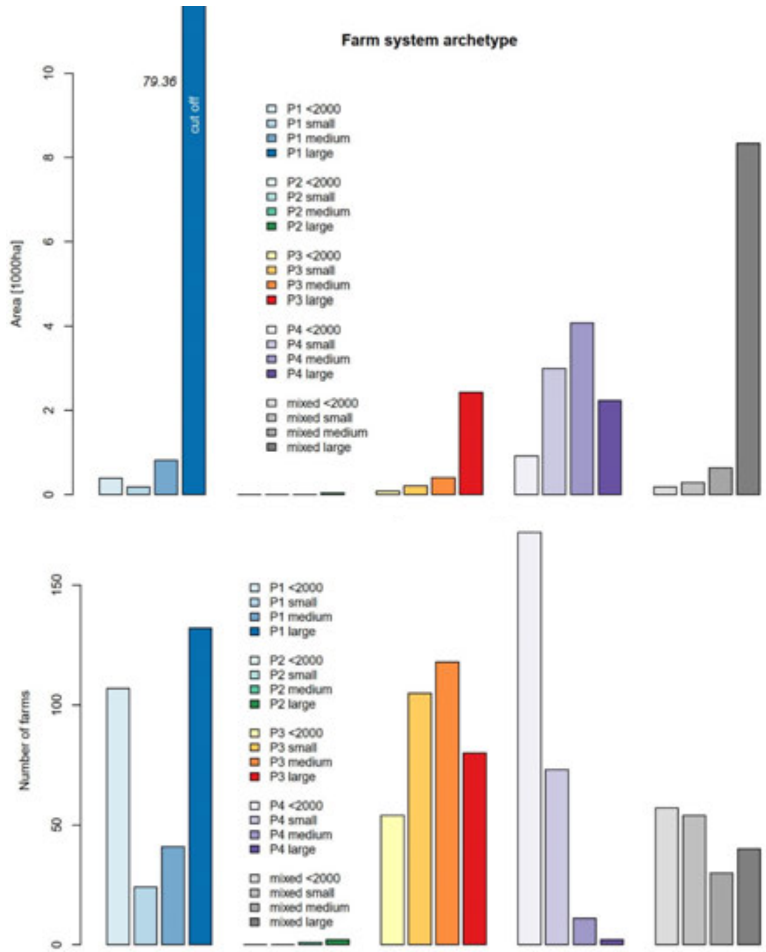
Standard Output Coefficients (EUR/ha, for ~90 crop types) 2013 (Eurostat) * Area
SOC: represent the average monetary value of the agricultural output at farm-gate price (€/ha) or per head of livestock.

- < 2000 €
- Small
- Medium
- Large

1. Farming System Archetypes (FSAs)

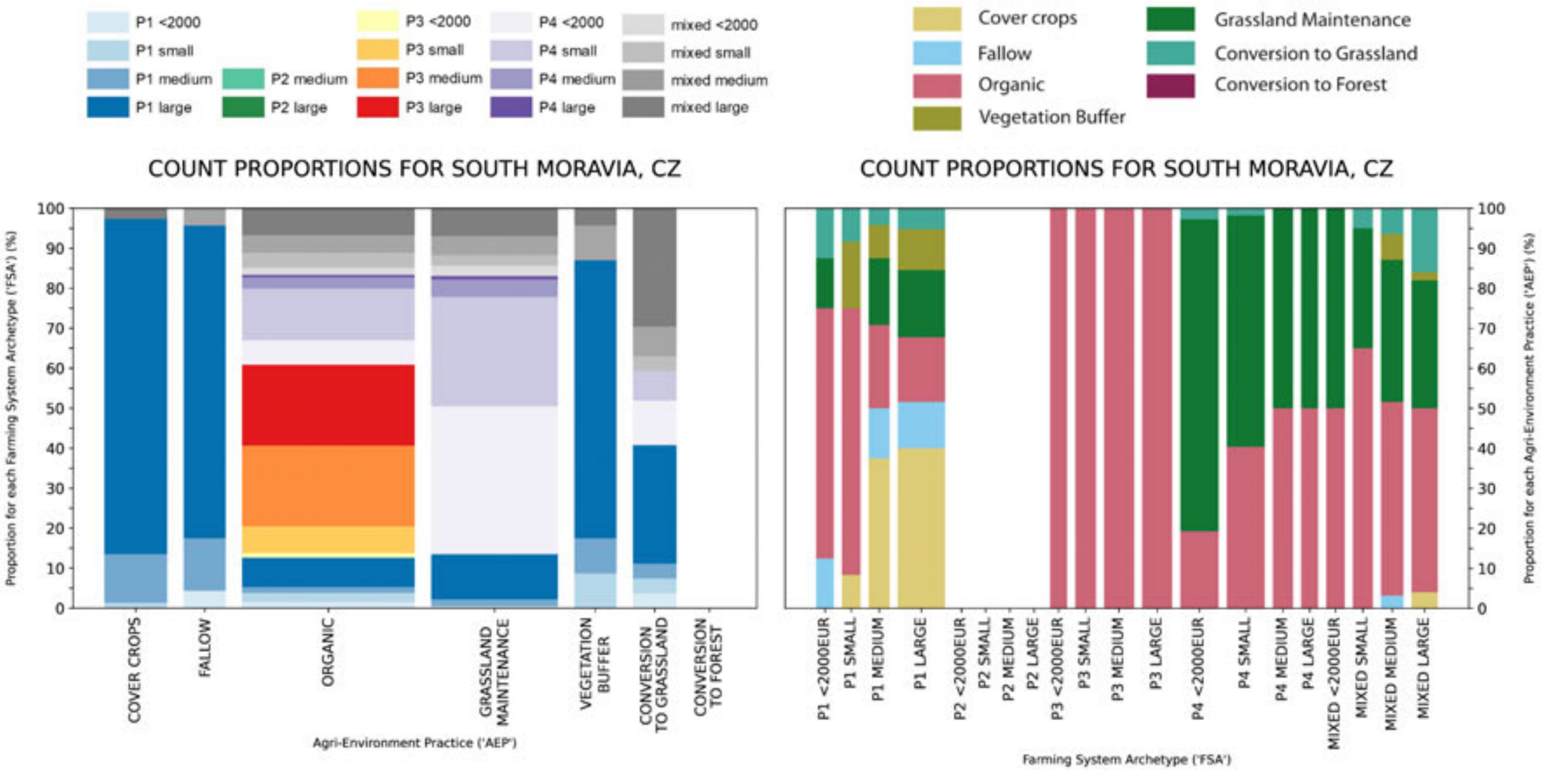
Case study: South Moravia



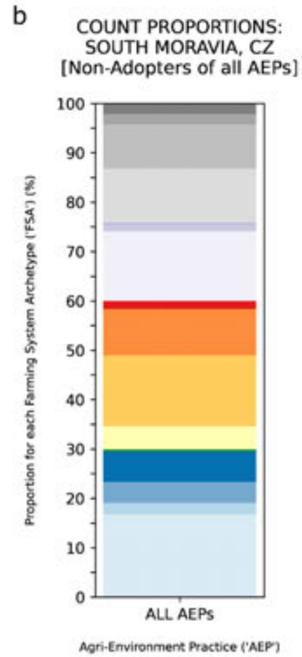


Which farms (and farmers) adopt AEP?

- Spatial association between FSA and agri-environmental practices (AEP)



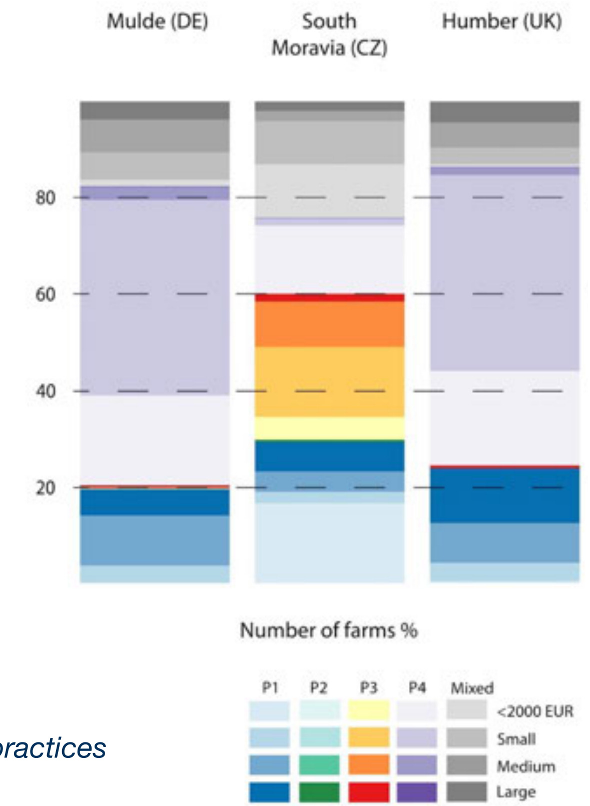
No AEP adoption



Which farms (and farmers) adopt AEP?

- Despite regional differences, found consistent trends in Agri-Environmental Practices (AEP) adoption across diverse contexts
- Economically large farms and those specialising in grazing livestock are more likely to adopt AEPs, with larger farms demonstrating an appetite for a wider range of measures
- Smaller farms usually focused on a narrower spectrum of AEPs and, together with farms with an economic value <2 000 EUR, accounted for 70% of all farms with no AEP uptake
- These insights indicate the potential of the FSA typology as a framework to infer key patterns of AEP adoption and policy development

No AEP adoption



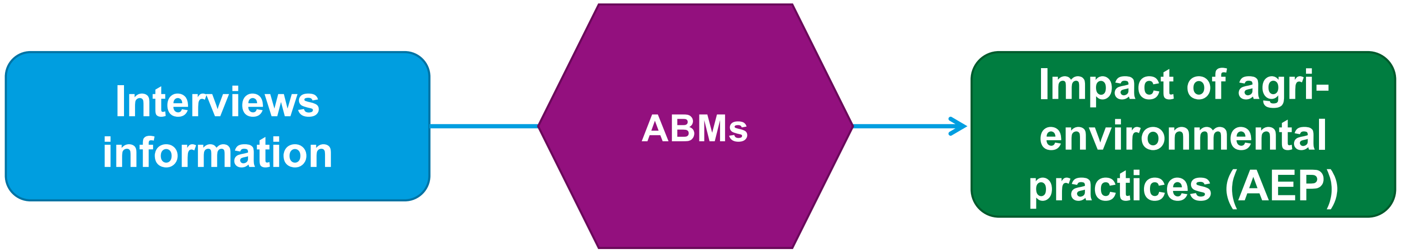
Publications:

Václavík T. et al. 2024. Farming system archetypes help explain the uptake of agri-environment practices in Europe, Environmental Research Letters (in revision)

2. Agent-based model / interviews – complexity of farmers' behaviour

Why do farmers (not) use agri-environmental practices?

- 2 campaigns with farmers: direct interviews and online questionnaires (discrete choice experiment)



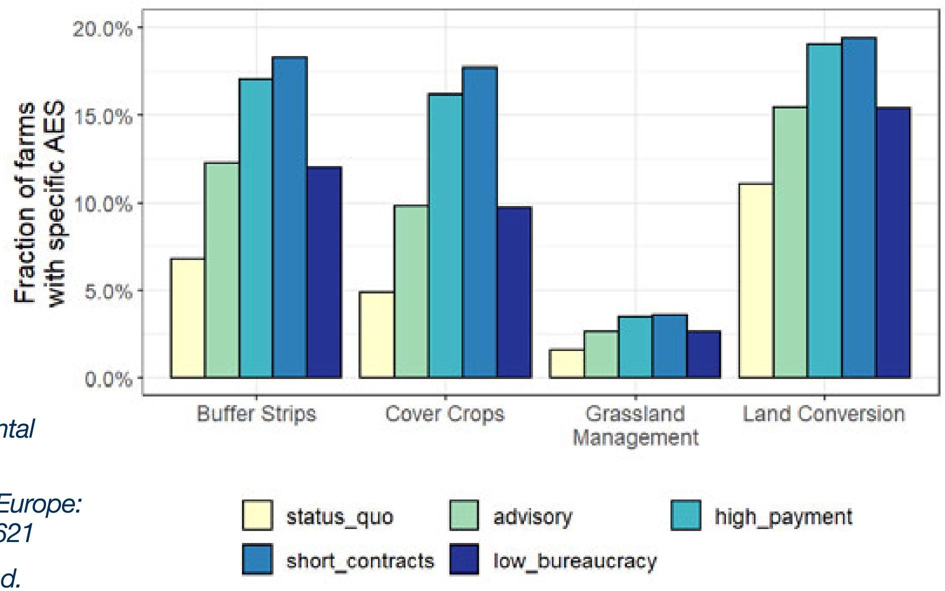
Lessons learned:

- Main motivation: **economic compensation** and **income diversification**; environmental impact of farming is secondary; economic benefits of AEP more significant for conventional than for organic farmers
- Farmers tend to apply only those AEPs that are **consistent with their established farming practices**
- AEP generally adopted on larger fields and farms that feature **marginalized and unproductive land**
- Farmers' motivation largely related to the **duration of the support**; for permanent grassland measures, farmers prefer longer contracts, whereas for arable measures they prefer shorter or more flexible contracts
- Awareness about AEP implementation is good, but farmers criticise **high bureaucratic burden** which, due to the lack of administrative capacity, constraints especially smaller farms

2. Agent-based model / interviews – complexity of farmers' behaviour

Why do farmers (not) use agri-environmental practices?

Example: Adoption rates in Catalonia (ES)



Largest effect:

- Shorter contract duration
- Increased compensations

Further analyses:

- Effects of advisory
- Effects of social network
- Effects on mean area per adopting farmers

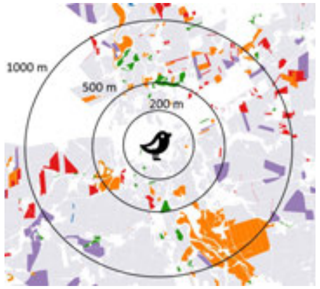
Publications:

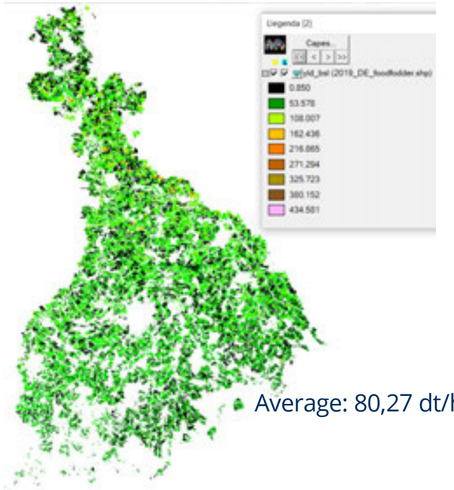
Wittstock, F. et al. 2022. Understanding farmers' decision-making on agri-environmental schemes: A case study from Saxony, Germany. Land Use Policy, 122, 106371

Bartkowski, B. et al. 2023. Adoption and potential of agri-environmental schemes in Europe: Cross-regional evidence from interviews with farmers. People and Nature, 5, 1610-1621

Will, M. et al. 2024. How to inform representations of farmer behaviour in agent-based. Ecology and Society (2nd round review)

3. Modeling impact on biodiversity and ecosystem services





Average: 80,27 dt/ha

Biodiversity

- Impact of AEP on selected taxonomic groups
- Species distribution modelling

Food/fodder production

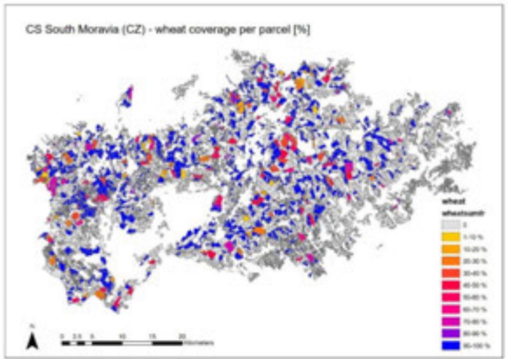
- Impact of AEP on production area of specific crops
- Model WOFOST (WOrld FOod STudies)

Nutrient/sediment retention

- Impact on nutrient retention by semi-natural vegetation with respect to water quality
- Model Nutrient Delivery Ratio model – INvEST NDR

Carbon sequestration

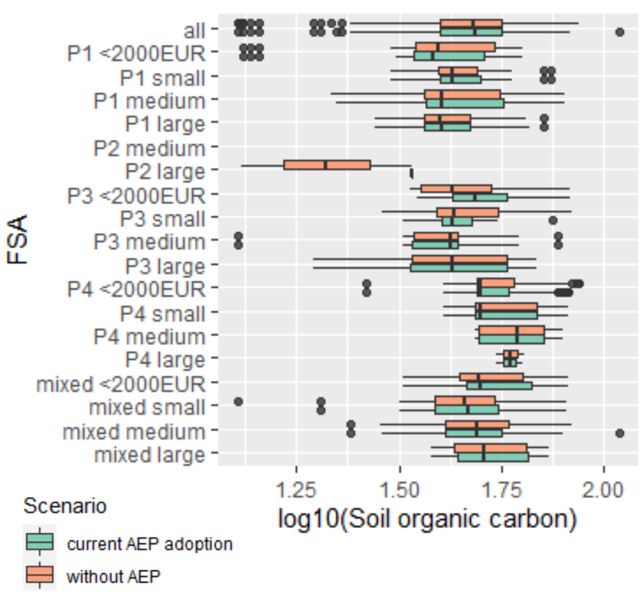
- Impact on C storage and sequestration above and below ground
- InVEST Carbon model



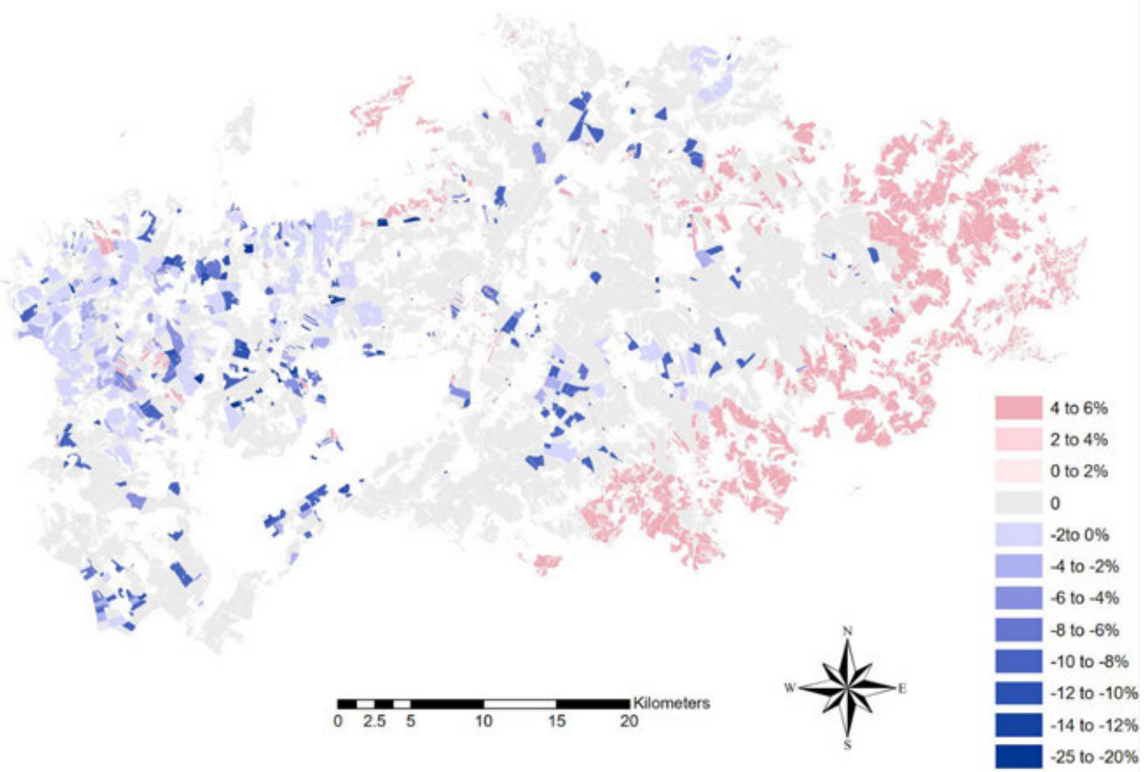
3. Modeling impact on ecosystem services - soil carbon

Carbon sequestration

- Impact of AEP on soil organic carbon

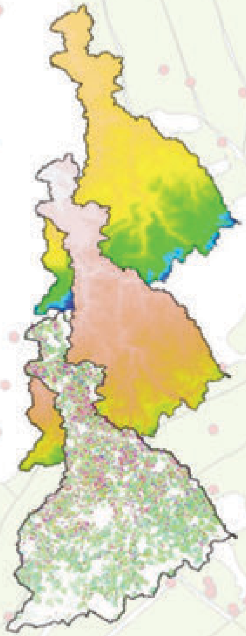


Relative difference in SOC (current vs. no AEM scenario)



3. Modeling impact on biodiversity – farmland birds

Bird observations (NDOP – presence points) of 15 farmland bird species



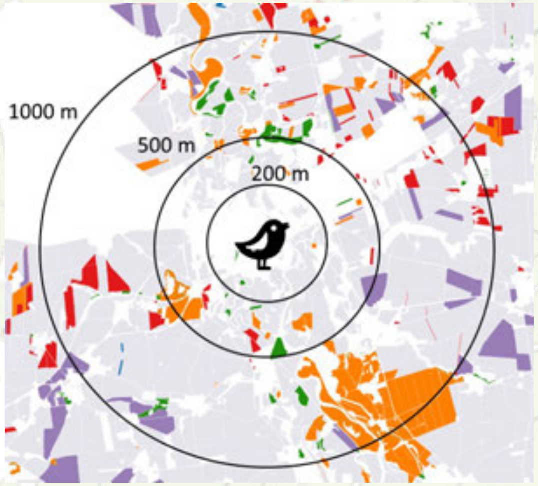
Topography: elevation, slope

Distance metrics: to forest, to highways

Land-use/cover: % cover of grassland, small woody features (SWF), urban area, arable land, buffer areas, cover crops, extensive grassland management, fallow land, organic farming

Heterogeneity: Shannon diversity index for crops

High resolution data: 20x20 m

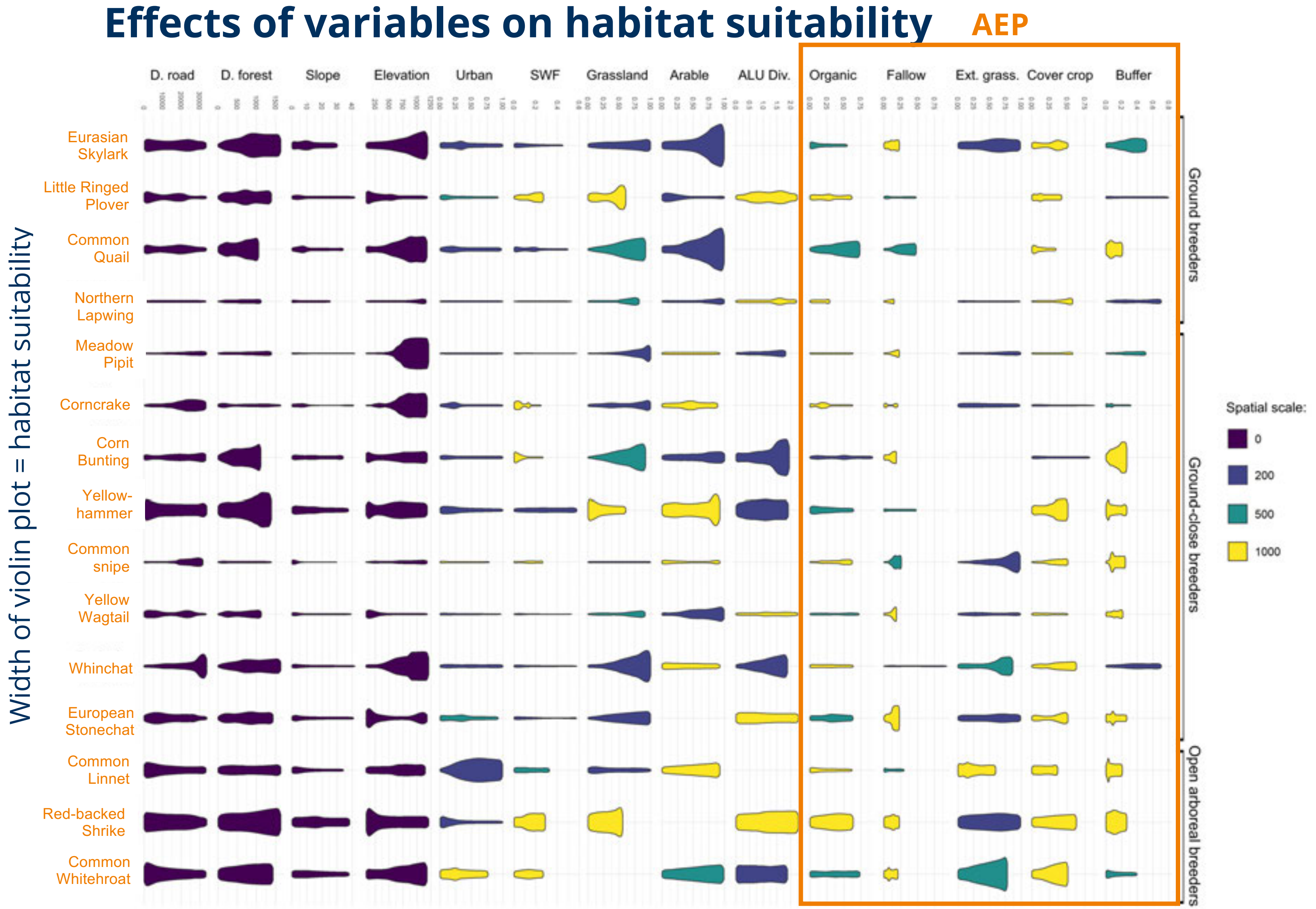


Land-use/cover variables calculated at 3 buffer sizes

Best scale for each uncorrelated variable selected based on AICc

Multi-scale ensemble SDM (GLM, GAM, MAXENT, RF, BRT); 10 model repetitions with 70% training, 30% testing data.

Effects of variables on habitat suitability



Positive effect of buffer areas, cover crops and extensive grassland

Assessed AEMs had mostly positive impact but organic farming had negative impact on some species

All AEMs (except extensive grassland) had the strongest effect at the landscape scale (1 km)

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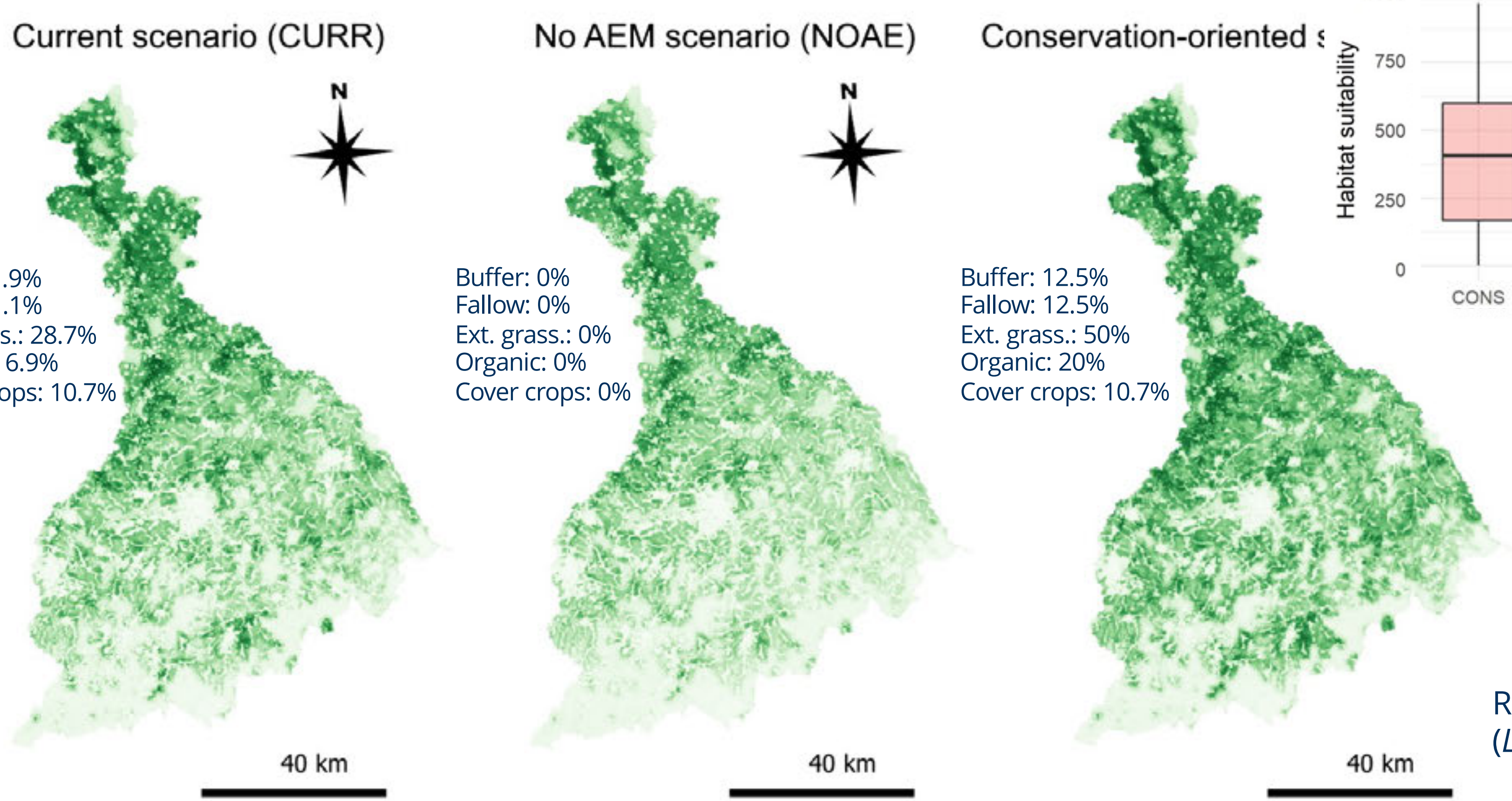
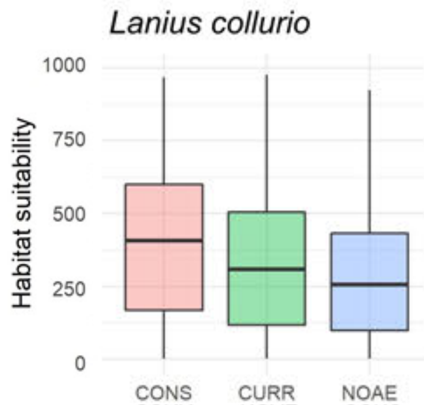
Projection to different AEP adoption scenarios



Buffer: 1.9%
Fallow: 1.1%
Ext. grass.: 28.7%
Organic: 6.9%
Cover crops: 10.7%

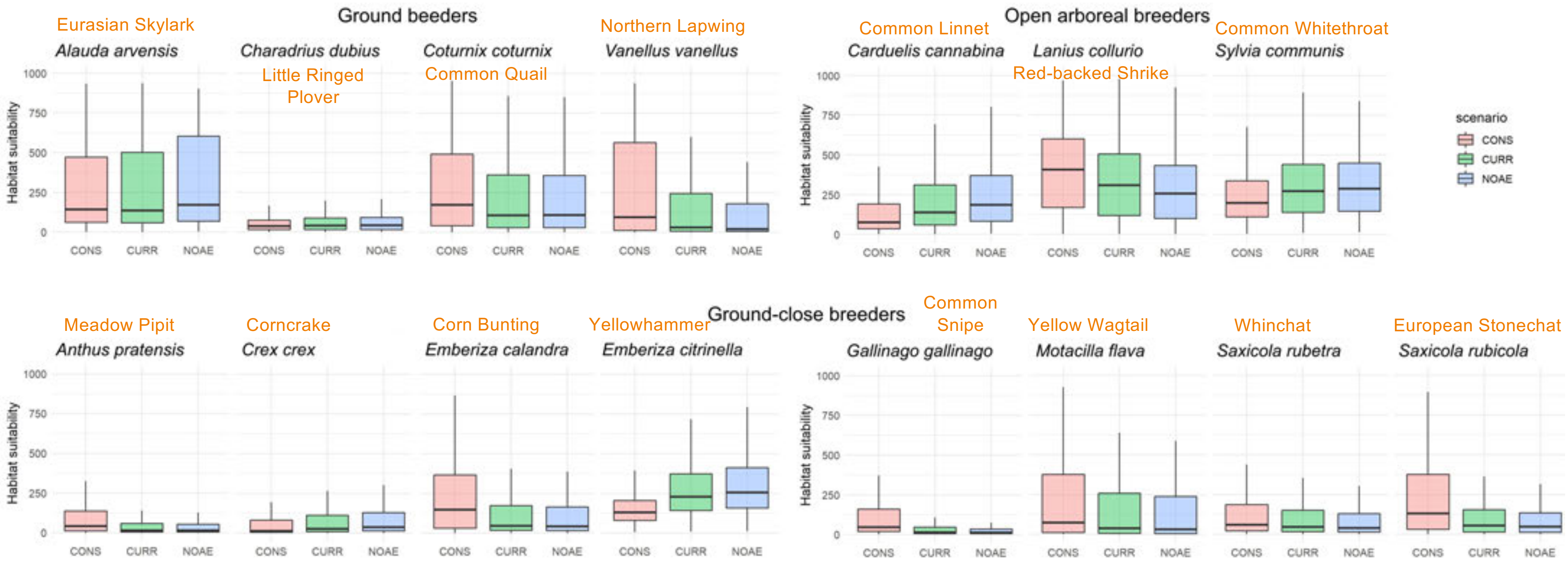
Buffer: 0%
Fallow: 0%
Ext. grass.: 0%
Organic: 0%
Cover crops: 0%

Buffer: 12.5%
Fallow: 12.5%
Ext. grass.: 50%
Organic: 20%
Cover crops: 10.7%



Red-backed shrike (*Lanius collurio*)

Impact of AEM scenarios on habitat suitability of farmland birds



- Larger AEM % (CONS scenario) increased habitat suitability for 9 species and reduced it for 6 species
- The scenario simulating complete removal of AEM did not differ substantially from the current situation

3. Modeling impact on biodiversity - implications

- AEP have a generally positive but weak effect on habitat suitability for farmland birds
- Varying AEM effects across species and spatial scales → need to **implement a diversified set of measures across the agricultural landscape**, ensuring a varied mix of habitat types and resources
- Better spatial targeting of the measures will improve their effectiveness
- Need to increase AEP uptake by farmers, through e.g. environmental conditionality, collaborative design of future AEP or results-based incentives

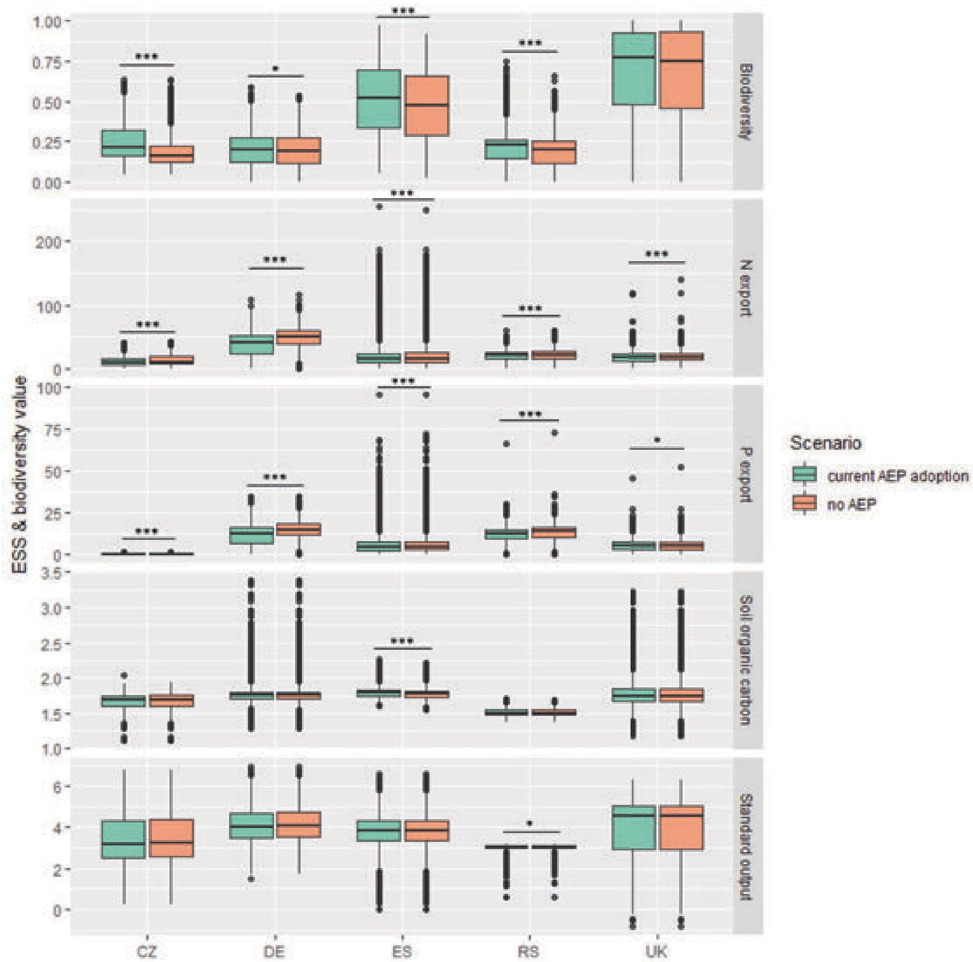
Publications:

Jungandreas, A., Roilo, S., Strauch, M., Václavík, T., Volk, M., & Cord, A. F. 2022. Response of endangered bird species to land-use changes in an agricultural landscape in Germany. Regional Environmental Change, 22(1), 1-14.

Roilo, S., Engler, J. O., Václavík, T., & Cord, A. F. 2023. Landscape-level heterogeneity of agri-environment measures improves habitat suitability for farmland birds. Ecological Applications, 33(1), e2720.

3. What is the impact of AEP on biodiversity and ecosystem services?

- Small but statistically significant beneficial effect of AEP on biodiversity (CZ ***, DE *, ES ***, RS ***),
- N export to waterways (all CSs ***),
- P export (CZ ***, DE ***, ES ***, RS ***, UK *),
- Soil organic carbon (ES ***)
- Farm income (RS *)



Publications:

Václavík T. et al. BESTMAP Deliverable 4.4 Systematic analysis of the case studies

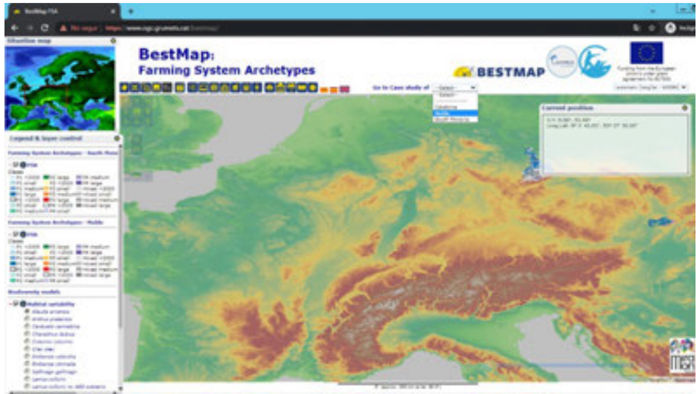
Gosal AS. et al. 2022. Understanding the accuracy of modelled changes in freshwater provision over time. Science of the Total Environment 833: 155042.

Dissemination of project findings

Online dashboard – interactive online tool:

- Data storage
- Analytical tools
- Visualization of results

https://www.ogc.grumets.cat/bestmap/



Story maps

- Simple web presentation
- Combination of text, figures and interactive maps

Policy briefs

- Brief summaries of main findings and policy implications

Thank you!

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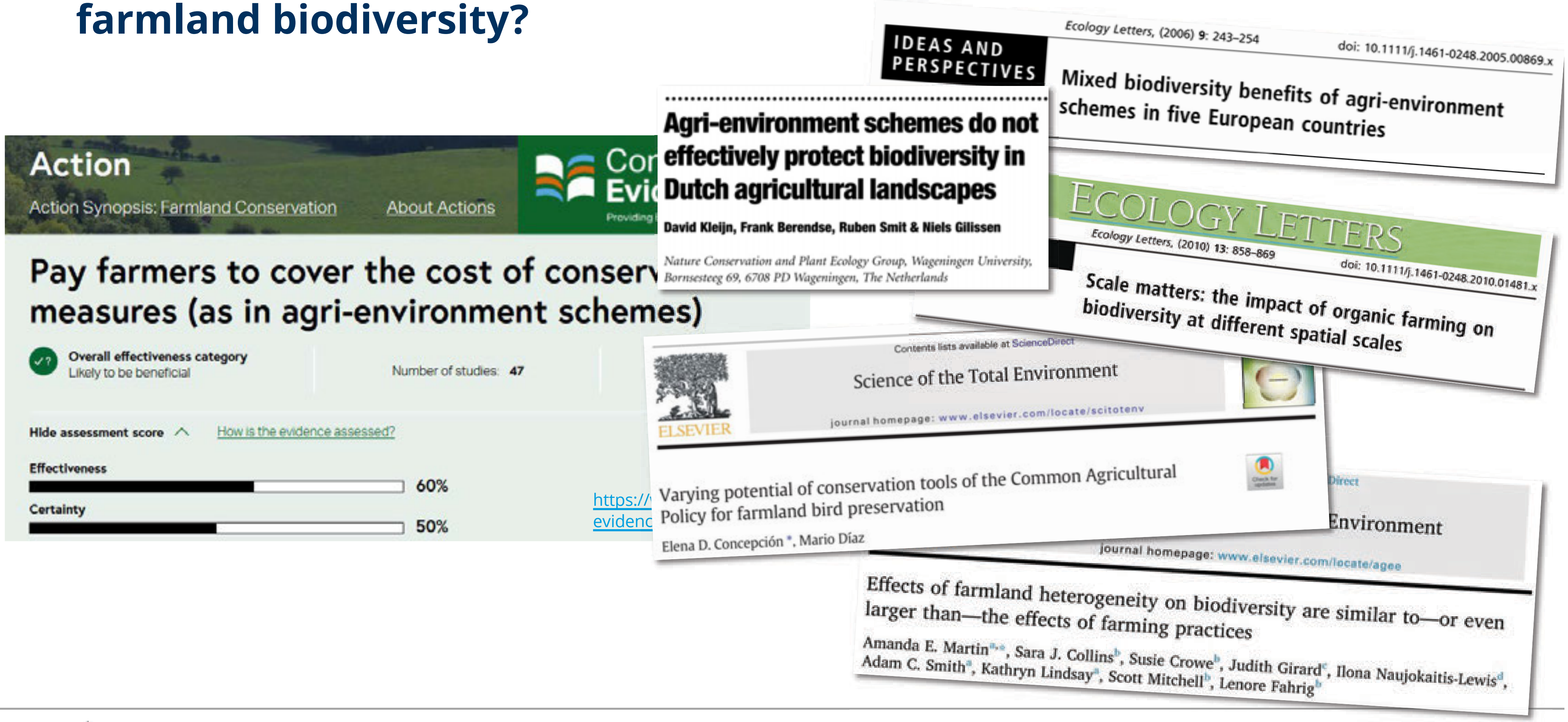
Are Agri-Environmental Measures (AEM) effective in preserving farmland biodiversity?



Approach and Objectives

Study area:

- Mulde river basin (5 000 km²), Saxony, Germany
- Jižní Morava (2 000 km²), Czechia

Approach:

- farmland birds as ecological indicators
- spatial data from LPIS at the field level
- ensemble Species Distribution Models (SDMs)

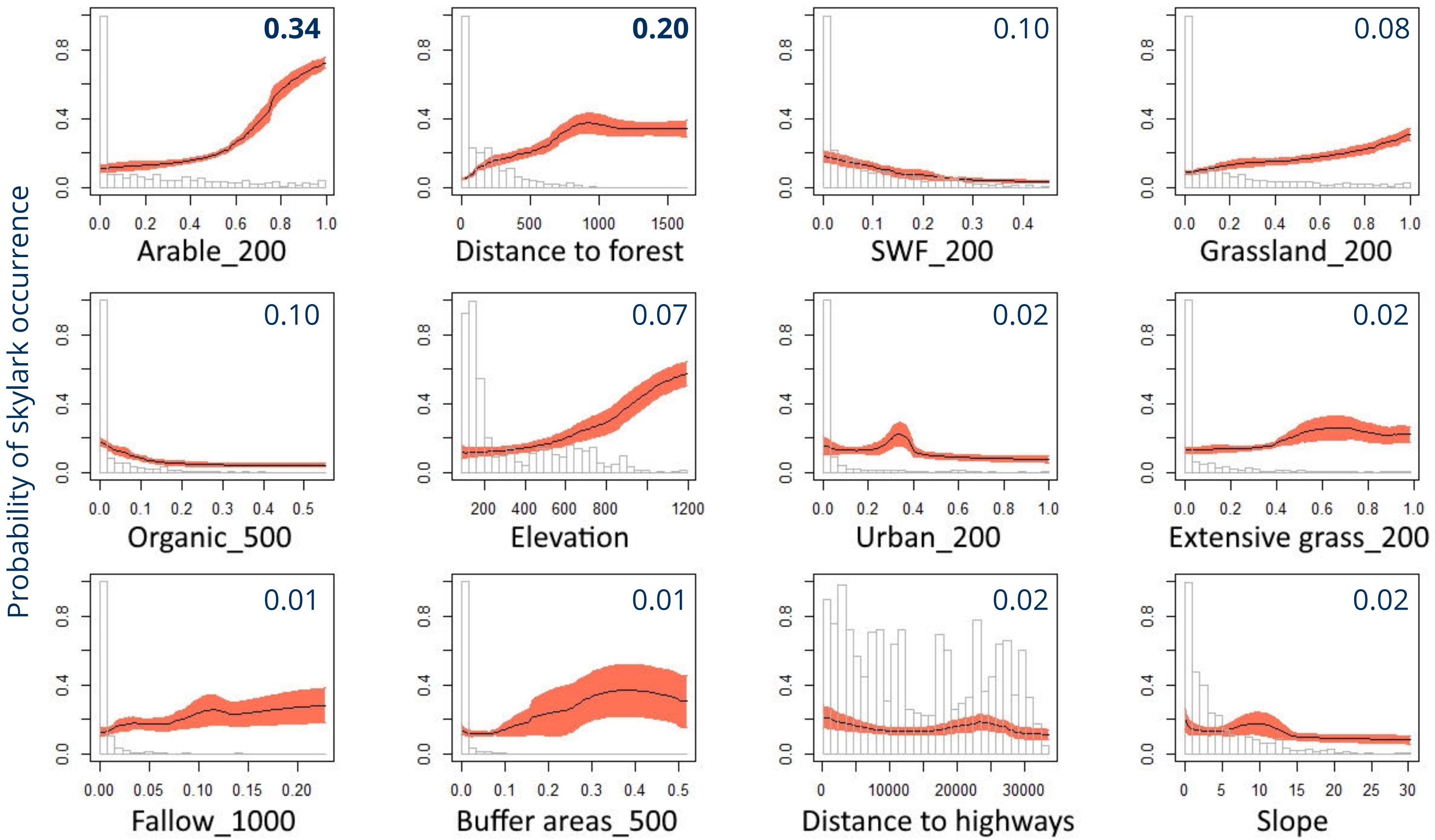
We aimed to investigate:

➢ the effect of five selected groups of AEM (i.e. **buffer areas, cover crops, extensive grassland management, fallow land and organic farming**) on habitat suitability for farmland birds

➢ at which spatial scale are AEM most effective

➢ how habitat suitability would change in varying AEM scenarios

Results: variable importance and response plots



Skylark (*Alauda arvensis*)

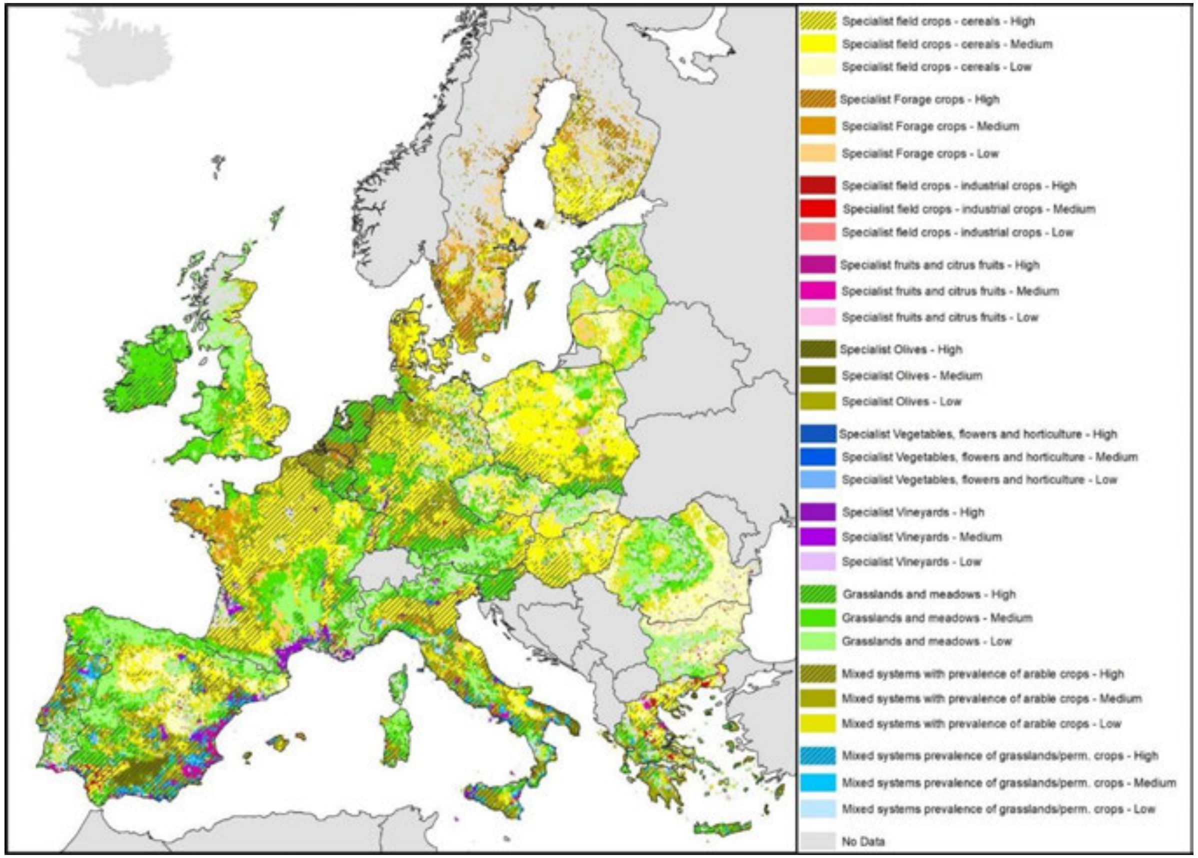
AUC = 0.89 ± 0.02

1. Archetypes of agri-environmental systems

Rega et al. (2020)

Recent typologies of agricultural systems in Europe (e.g. Andersen, 2017; Levers et al., 2018; Rega et al., 2020) – often specific focus (e.g. crop types and energy input)

General characterizations that rely mostly on biophysical factors (climate, topography, soils) have proved to be useful for modeling land use and policy impacts (Metzger et al. 2013)



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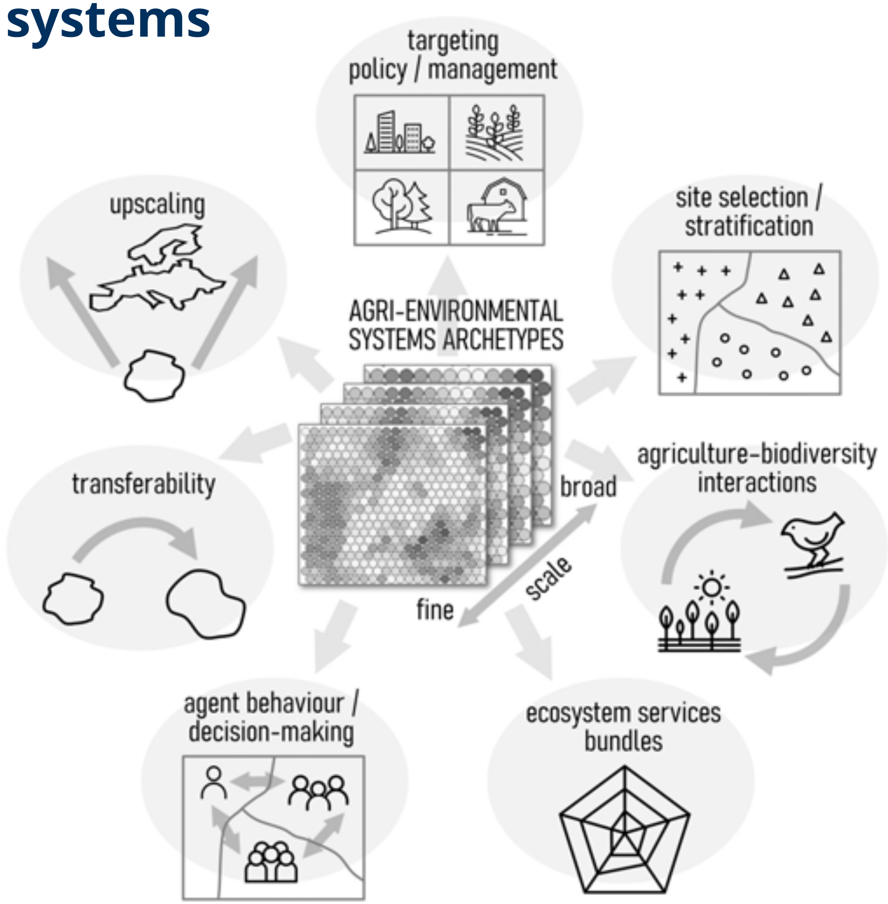
General characterizations that rely mostly on biophysical factors (climate, topography, soils) have proved to be useful for modeling land use and policy impacts (Metzger et al. 2013)

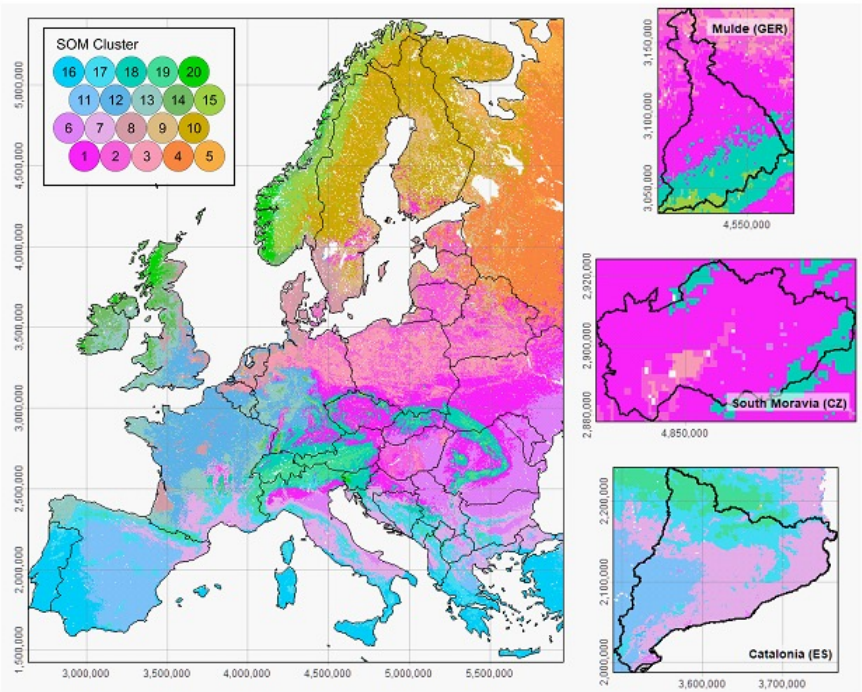
Agri-environmental archetypes

- Recent, agriculturally-important, biophysical parameters
- Data-driven and scalable

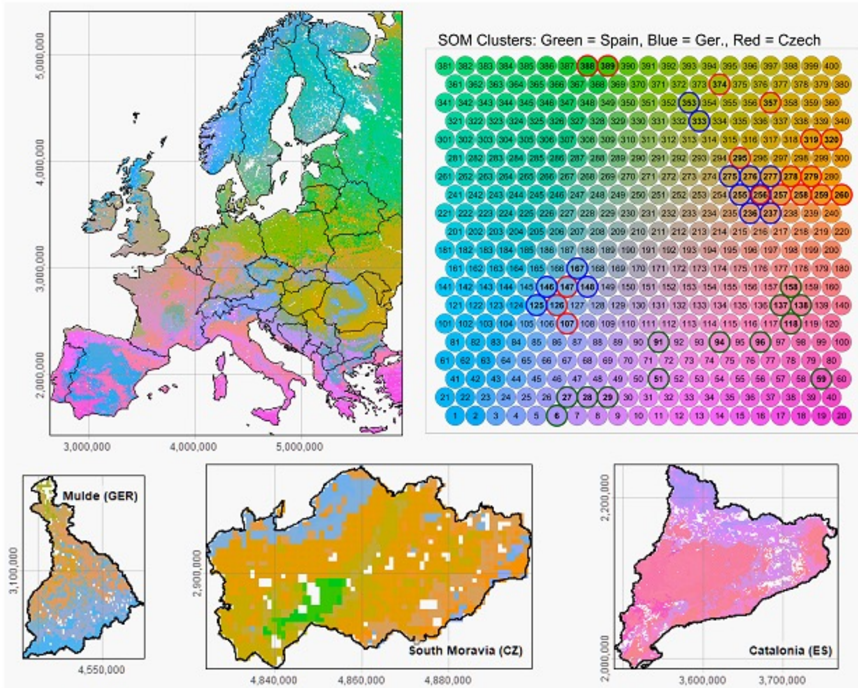


1. Archetypes of agri-environmental systems

Continental scale – SOM k20



Regional scale – SOM k400



Forum for the Future of Agriculture®

Research lessons to inform future CAP reform
7th February 2024, Brussels

Examples from H2020 European research projects

Modelling Agricultural Individual Decision making

The MIND STEP Model Toolbox

John Helming

Senior Researcher at Wageningen Economic Research

MIND STEP

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MIND STEP

MODELLING INDIVIDUAL DECISIONS TO SUPPORT THE EUROPEAN POLICIES RELATED TO AGRICULTURE

Modelling Agricultural Individual Decision making – The MIND STEP Model Toolbox

Presenter: John Helming (Wageningen Economic Research)

Event title: Research Lessons to Inform Future CAP Reform (7 February 2024 – Bruxelles)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 817566

https://mind-step.eu/

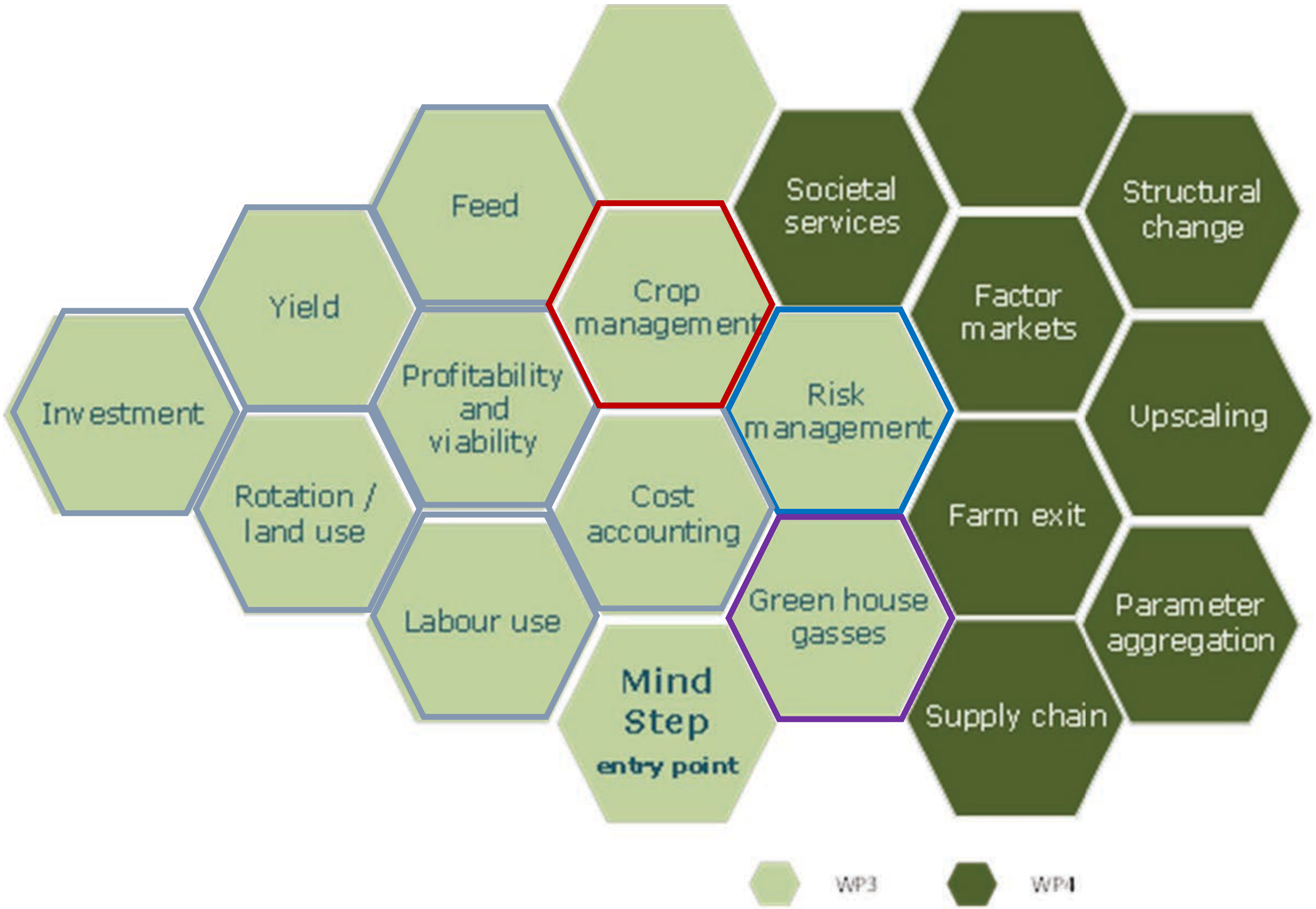
Overall objective

To support public decision making in agricultural, rural, environmental and climate policies taking into account the behaviour of individual decision-making (IDM) units in agriculture and the rural society.

MIND STEP has developed tools and models focusing on:

- Better representation of the diversity of farms heterogeneity in modeling
- Interactions between farms
- Improved interfaces between data and models at different scales (farm, regional, national, EU)
- Transparency of methods, sustainable software development, model validation and policy evaluation

Honeycomb of methods at farm-level



Working towards the honeycomb

Pre-requisite: Data integration

Interfaces/ data linkages — Interfaces to agricultural economic and management statistics, bio-physical, and environmental data

Data and Model Integration — Connect new data to models

Modelling decision making at farm level

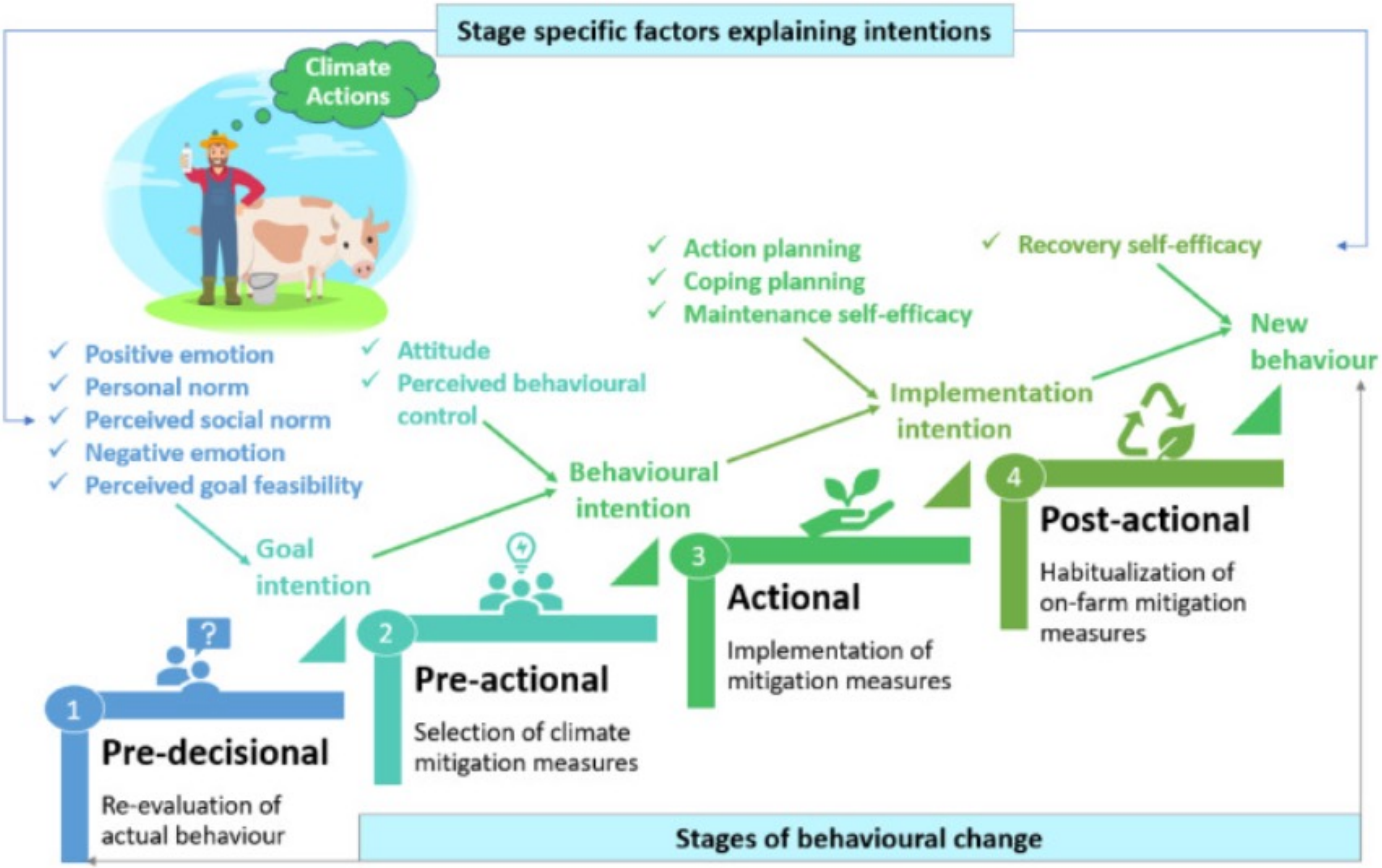
GHG Mitigation — Technology options and behavioural aspects of adoption

Crop manage-ment — Empirical models of crop management choices

Risk manageme nt — Empirical risk management models

Modular integration

Adoption behaviour of GHG mitigation technologies: increased readiness for change in four decision stages



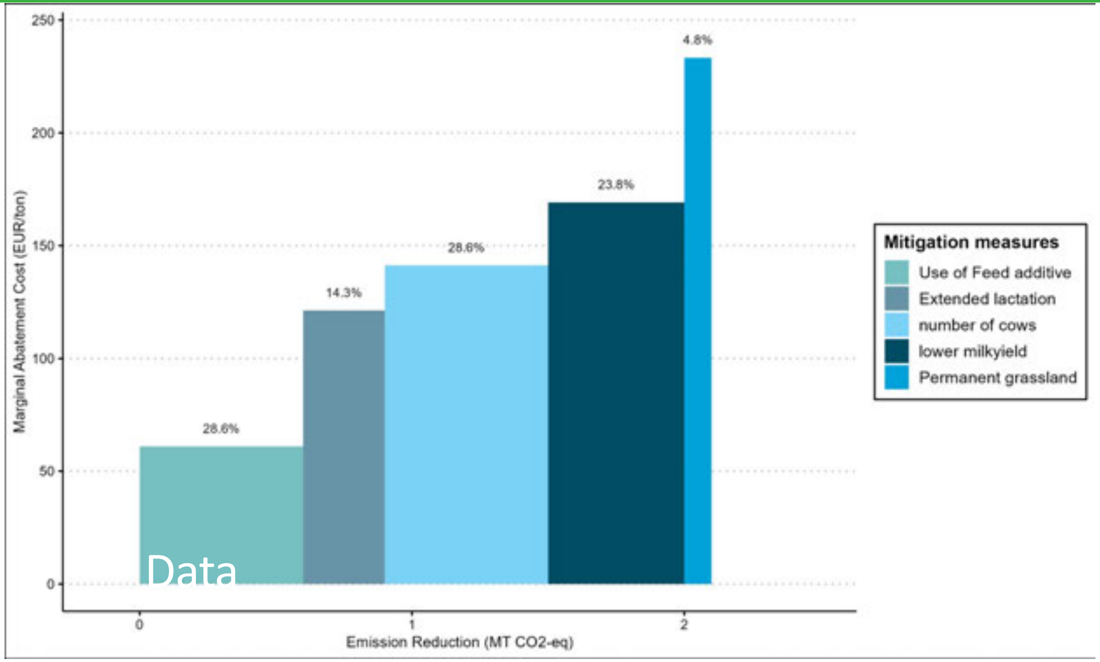
Technology options and behavioural aspects of adoption

	Dependent variable: Stage membership	
	Coefficients (SE)	Odds ratio
Cognitive factors		
Positive emotion	-0.186 (0.186)	0.831
Negative emotion	0.423** (0.178)	1.527**
Perceived social norm	0.110 (0.208)	1.116
Personal norm	0.185 (0.215)	1.203
Perceived goal feasibility	0.288 (0.177)	1.334
Attitude	-0.283 (0.226)	0.754
Behavioural factors		
Perceived behavioural control	0.163 (0.214)	1.177
Action planning	0.387** (0.169)	1.472**
Coping planning	0.362* (0.218)	1.436*
Maintenance self-efficacy	-0.144 (0.191)	0.866
Recovery self-efficacy	-0.283 (0.196)	0.754
Socio-demographic factors		
Age	0.107** (0.041)	1.113**
Age squared	-0.001** (0.0005)	0.999**
Basic agricultural education	0.379*** (0.025)	1.461***
Full agricultural education	-0.183*** (0.051)	0.833***
Yearly family farm income	-0.004 (0.013)	0.996
Livestock density	0.337* (0.175)	1.401*
Intercepts		
1|2	4.09***(0.00)	
2|3	5.70***(0.00)	
3|4	5.95***(0.00)	
Observations	100	
Note:	*p<0.1**p<0.05***p<0.01	

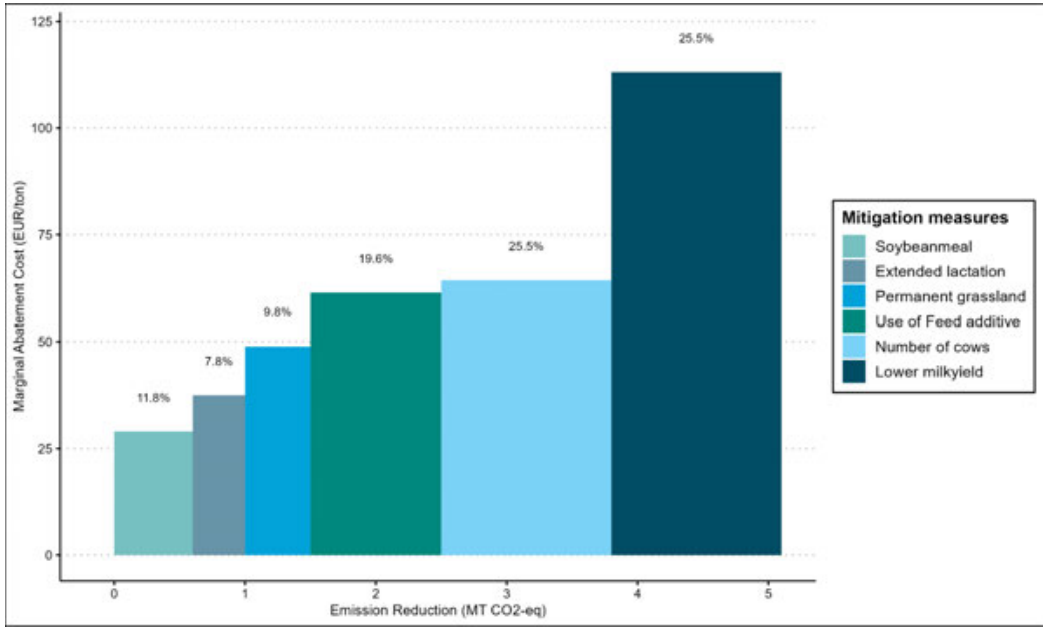
Residual Deviance: 186.666; AIC: 226.666

Observable from statistics

MACC Extensive farms

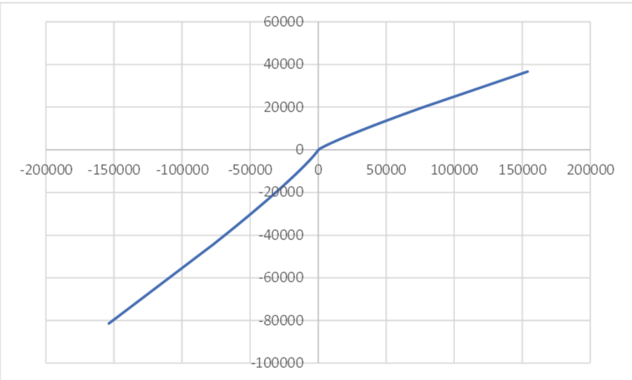


MACC Intensive farms



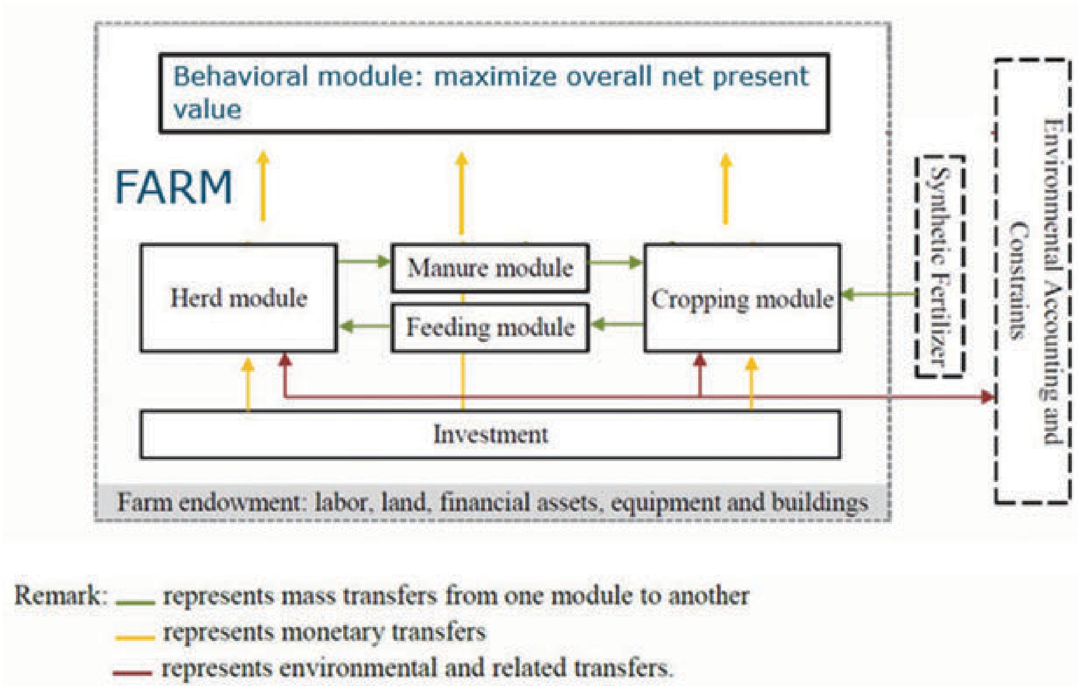
Empirical risk management models

Empirical work on risk behaviour: risk utility functions based on available data (FADN)



Empirical Tversky-Kahnemann Utility function

Data and model integration: Integration into established farm-level models (here: FarmDyn)



Source: Britz et al., 2016

Better representation of the diversity of farms heterogeneity in modeling

- Policy implications of farm level findings (I)
  - **Technology adoption**

    ➢ In order to strengthen farmers' goal intention in mitigating emissions, Dutch government and the dairy sector can collaborate in promoting the long-term benefits of mitigating GHG emissions and compensate the short-term costs that farmers may encounter.

  - **Crop management**

    ➢ farmers respond to economic incentives (even if their responsiveness display significant heterogeneity), implying that economic policy instruments could be useful for achieving the objectives of the EU Green Deal

Better representation of the diversity of farms heterogeneity in modeling

- Policy implications of farm level findings (II)
  - **Risk assessment**
    - ➢Risk behavior (loss aversion, use of heuristics) contributes to low insurance uptake
      - Improve communication of risks (reframing of probabilities)
      - Support multi-year contracts

What extra data we would like to have from FSDN

- Biophysical agronomic data
  - Soil type, soil carbon data, climatic zone, plant variety, cover crops, pesticides and fertilizer application per activity, planting date, etc.
- Environmental data
  - Greenhouse gas emissions by source, Nutrient surpluses, water quality, etc.
- Financial data
  - Modernity of the stables and equipment
- Socio-phsychological factors (e.g. related to environmental goals)
  - Positive and negative emotions from (not) receiving specific environmental goals, perceived social norm, personal norm, perceived goal feasibility, perceived behavioural control, maintenance self-efficacy, recovery self-efficacy, etc.

MIND STEP

Modelling interactions between farms

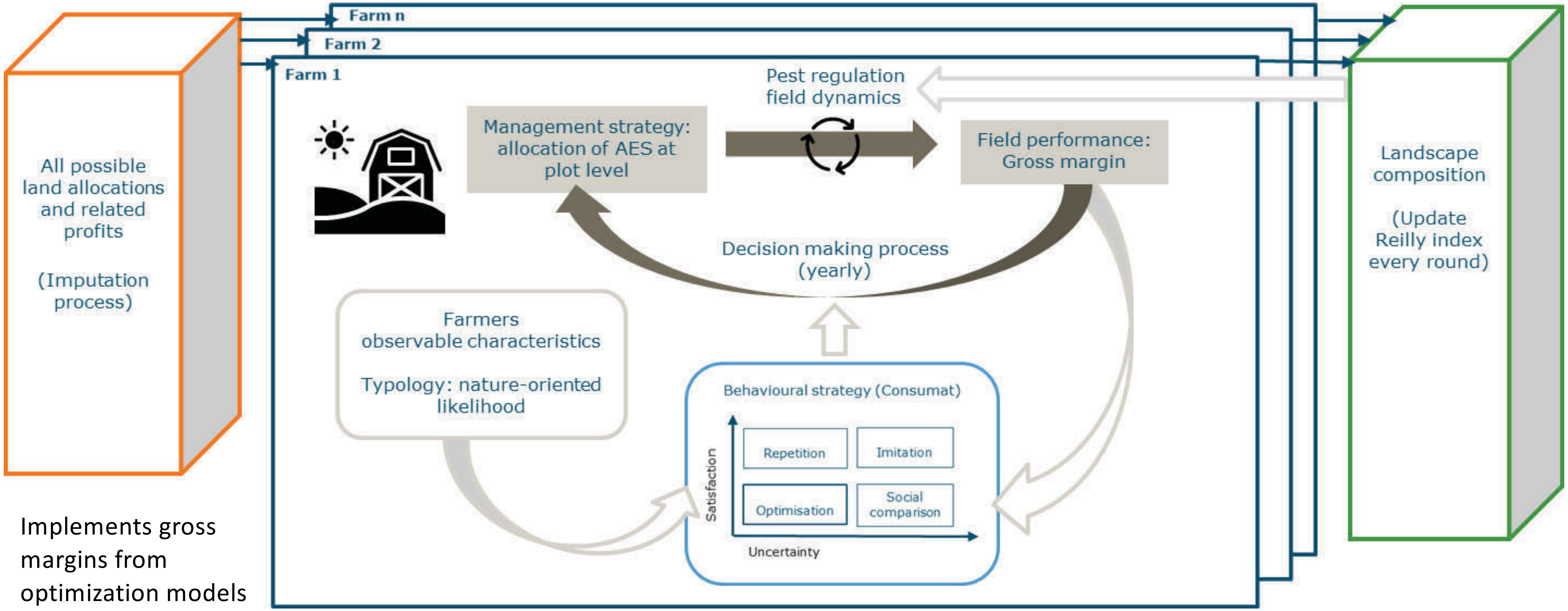
Empirical estimation of parameters for:

- **Structural change / Farm exit** — Interactions on the land market
- **Supply chains** — Interactions along the supply chain
- **Collective action** — Interactions between farms to participate in Agri-environment schemes

Novel approach for model linkages:

- **Upscaling** — Linking single-farm level models with Agent-Based Models

Overview of the Collective Ecosystem Services Model (CoESM)



Implements gross margins from optimization models (**FARMDYN**)

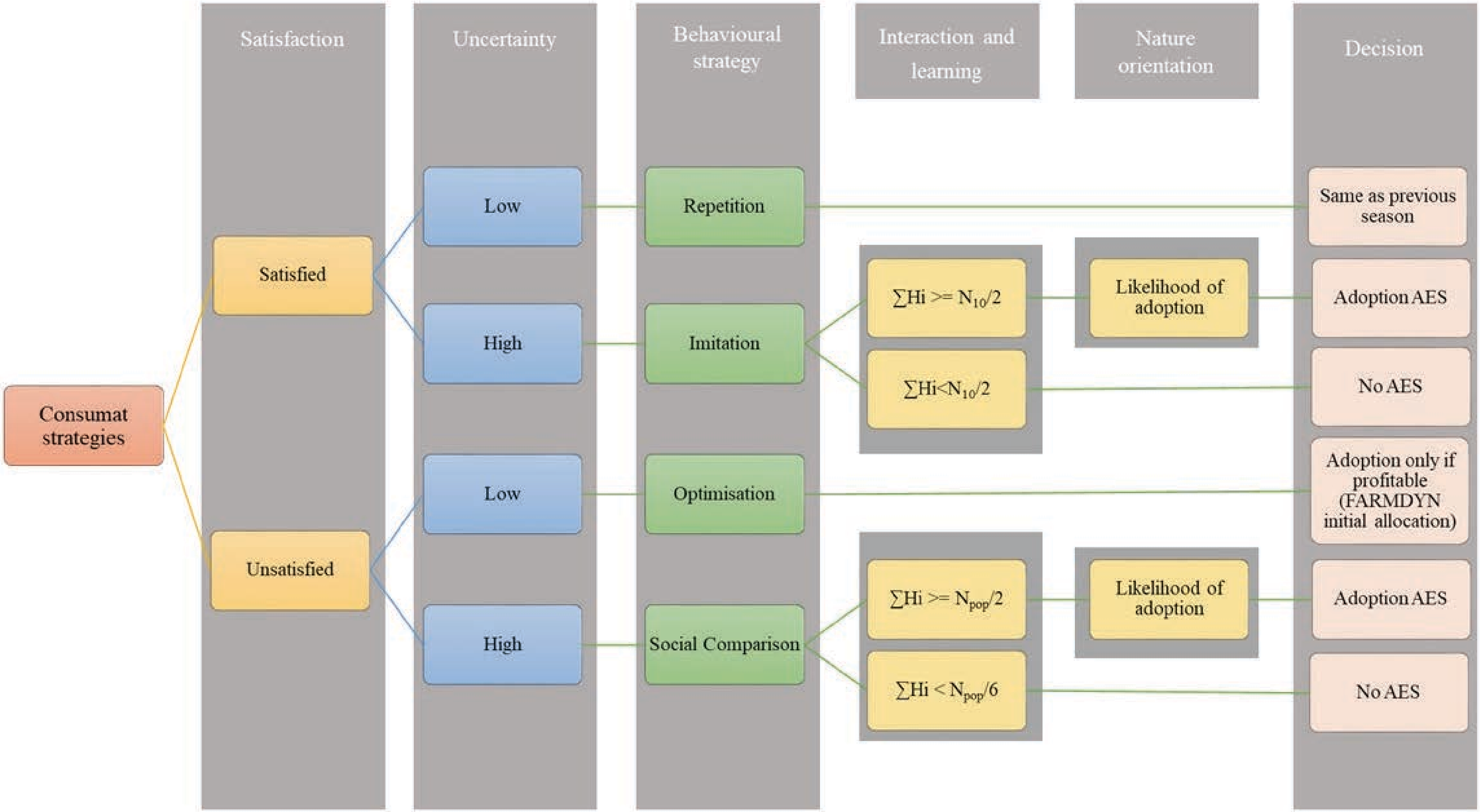
Considers farm and plot characteristics

Consumat approach: used to model farmers' interactions and behavioural strategies

Impact on the landscape and the ecosystem services returned by the landscape

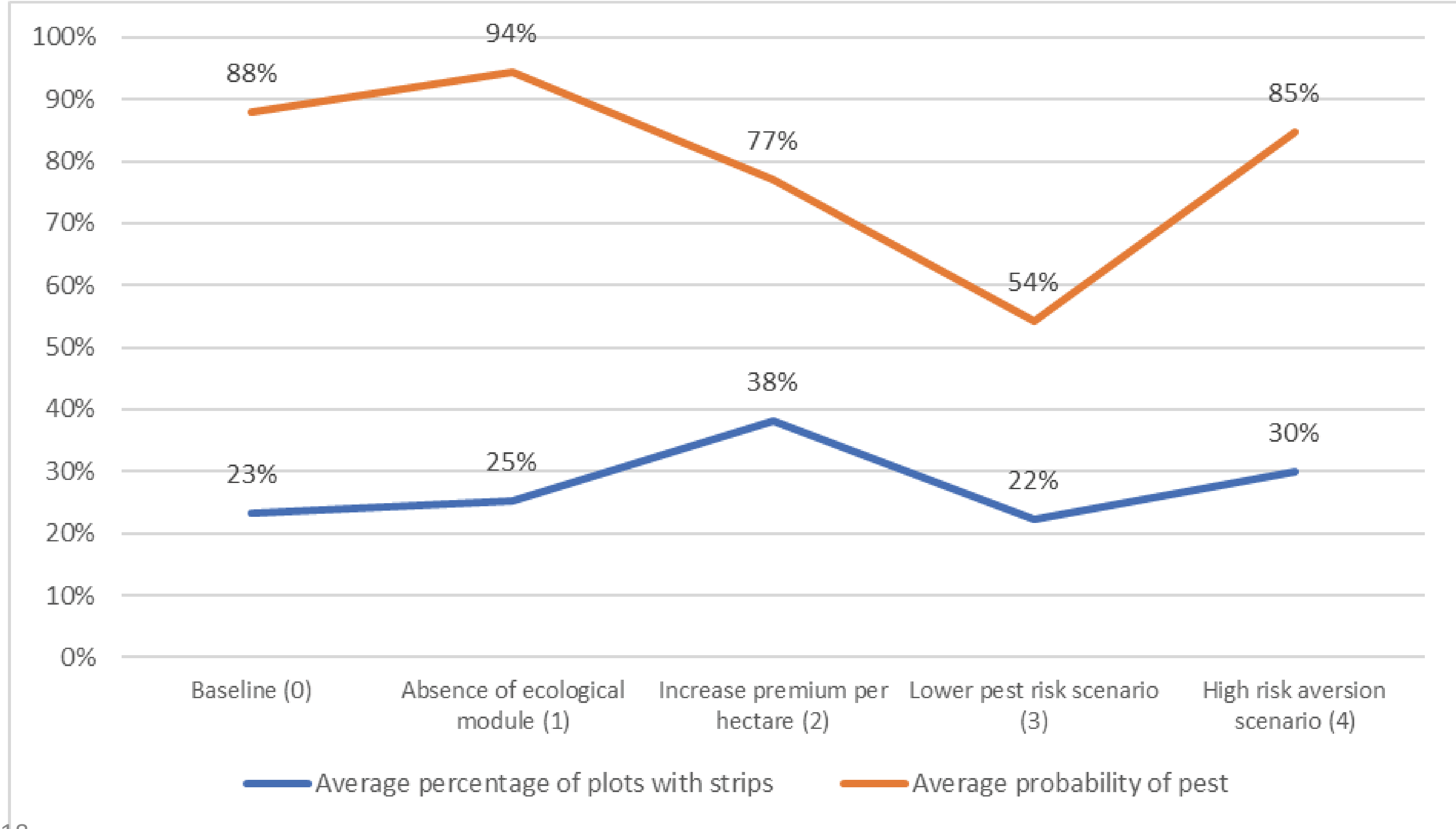
Collective actions (I)

Decision tree of the Consumat approach interactions and learning and farmers' decision based on nature orientation.



Collective actions (I)

Number of plots with flower strips and the probability of pests. Note: Monte Carlo simulation over 200 runs of 15 years.



Policy implications

- Adoption of flower strips is influenced by the value of the crops, risk, and premiums
- Importance of promoting collective action in ecosystem services (long-term benefits that farmers can receive from these investments)

Collective actions (II)

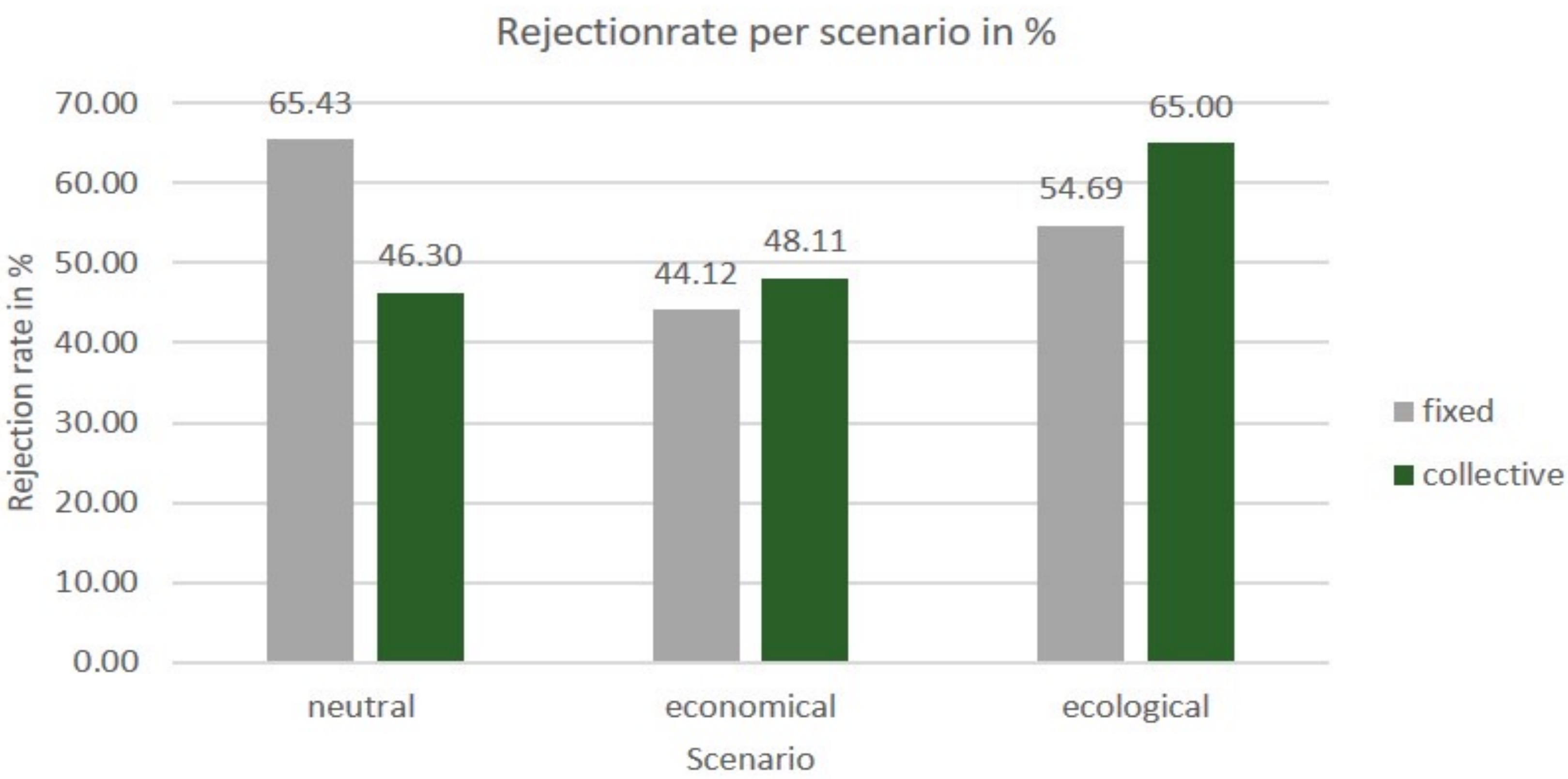
Approach

- Experimental study of acceptance of AES using FarmAgriPoliS participatory agent-based model

Collective actions (II)

Findings

- Rejection higher for fixed payment schemes then in collective payments (neutral framing)
- Framing (economic or biophysical) important for participants decision and connected with payment scheme



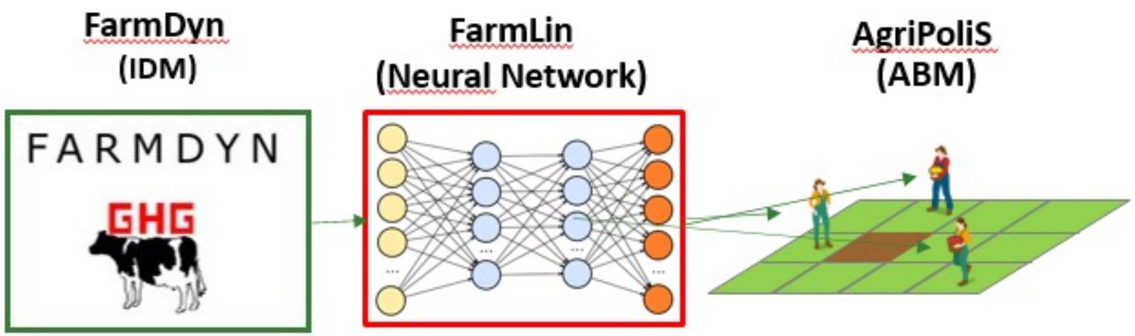
Upscaling single farm level models

Approach / Achievements

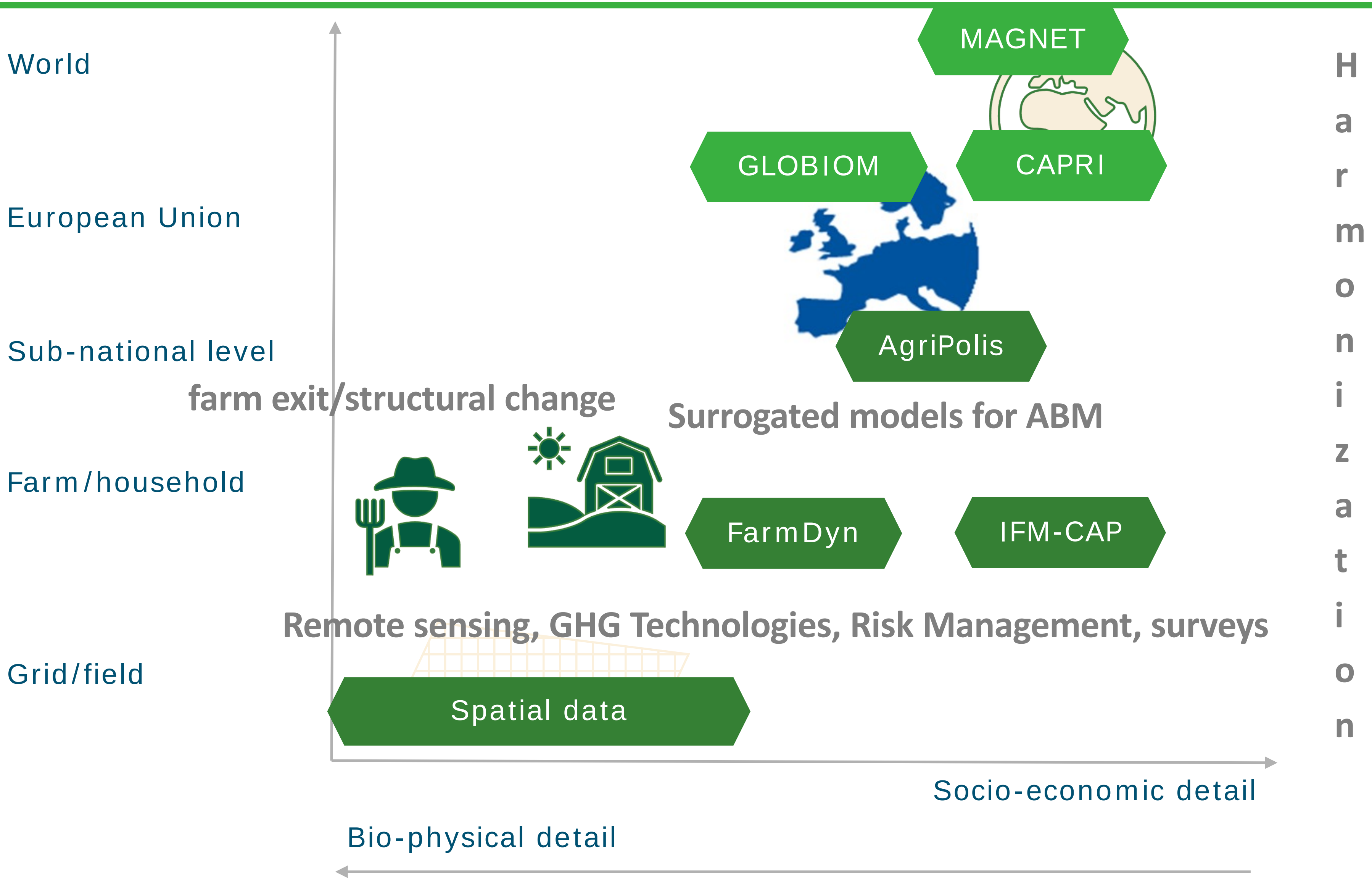
1) Interface alignment allowing conceptual integration of FarmDyn in AgriPoliS
2) Deep learning surrogate modelling for farm level models (FarmDyn)
3) Technical integration of FarmDyn as IDM in AgriPoliS using a surrogate

Implications

Policy assessment possible with detailed environmental indicators and technology (from FarmDyn) while considering farmers' interaction on the land market (AgriPoliS)



MIND STEP model toolbox



IDM Individual Decision Making models

RS = Remote Sensing data integration

Modules and Tools

Improved interfaces between data and models at different scales (farm, regional, national, EU)

- endogenous changes in farm size (a component of structural change) (IFM-CAP)
- harmonising production systems and farm typologies (GLOBIOM),
- splitting primary factors to include live animals (MAGNET),
- calibrating behavioural parameters (GLOBIOM),
- improving risk representation (GLOBIOM)
- addressing greenhouse gas emission reduction potentials and costs (GLOBIOM, MAGNET)

Two benchmark scenarios for EU agriculture in 2030

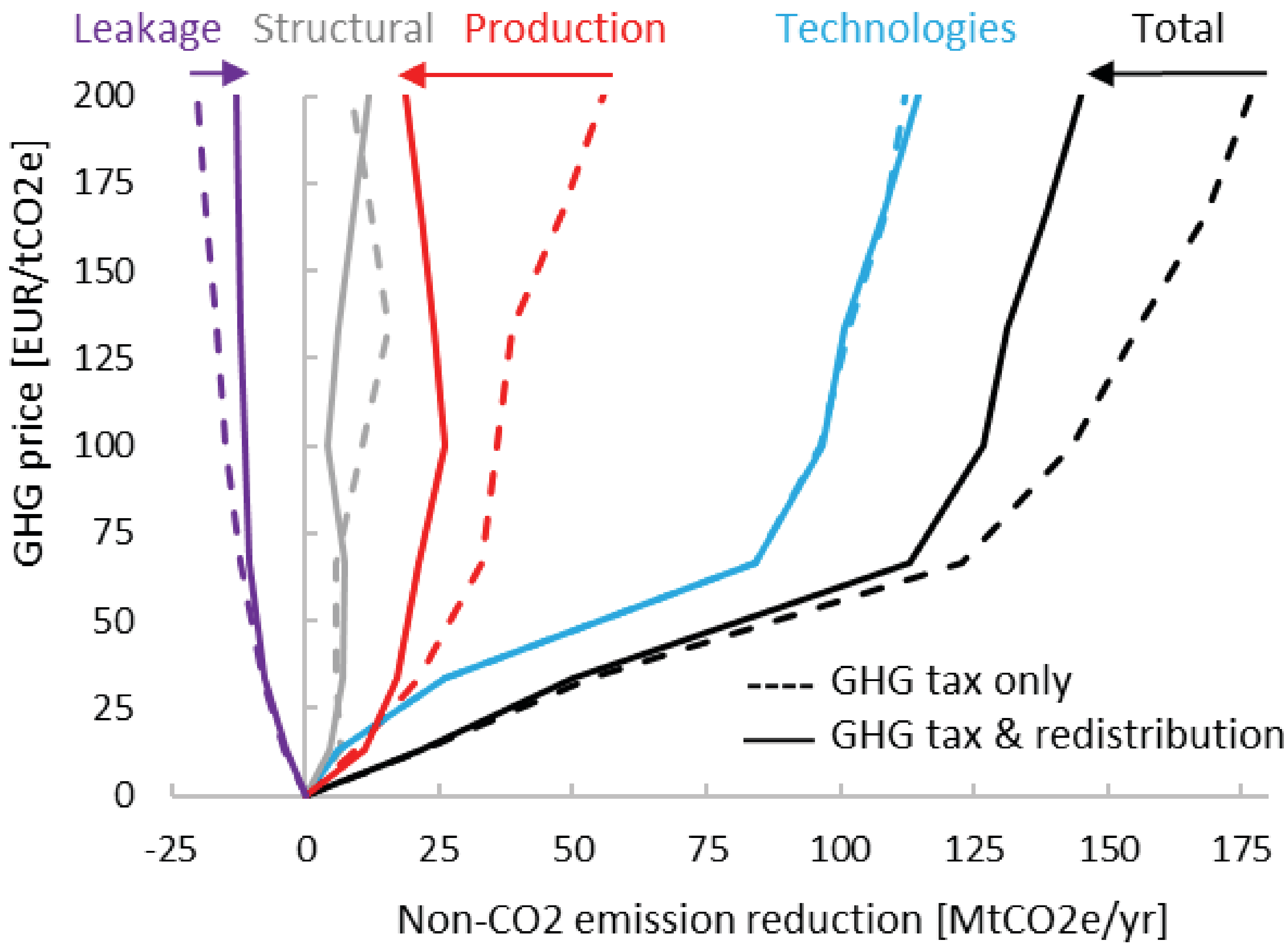
- Climate mitigation
  - Taxatation on CO2eq emission strategy
  - Performance based agricultural policy strategy
    - subsidy on CO2eq emission reduction strategy, financed by direct payment of Pillar 1 of the CAP
- Reduction of mineral nitrogen fertiliser use
  - Taxation strategy
  - Taxation strategy and area based redistribution
  - Taxation strategy and compliance base redistribution

Summary Results of EU27 (% change with respect to 2030 baseline) (MAGNET)

	65 CO2eq_ TAX	65 CO2eq_ SUB_DP	130 CO2eq_ TAX	130 CO2eq_ SUB_DP
Price Agri. Prim.	5.33	0.76	10.30	1.77
Production Agri. Prim.	-2.53	-0.35	-4.55	-0.80
Skilled labour (Agri. prim.)	-1.23	0.33	-1.94	0.74
Unskilled labour (Agri. prim.)	-0.75	0.29	-1.13	0.65
GDP	-0,43	-0,01	-0,82	-0,03
Total Emission (CO2eq)	-15,77	-1,34	-23,87	-1,82
Agri Emission (CO2eq)	-19,05	-12,63	-27,00	-17,12

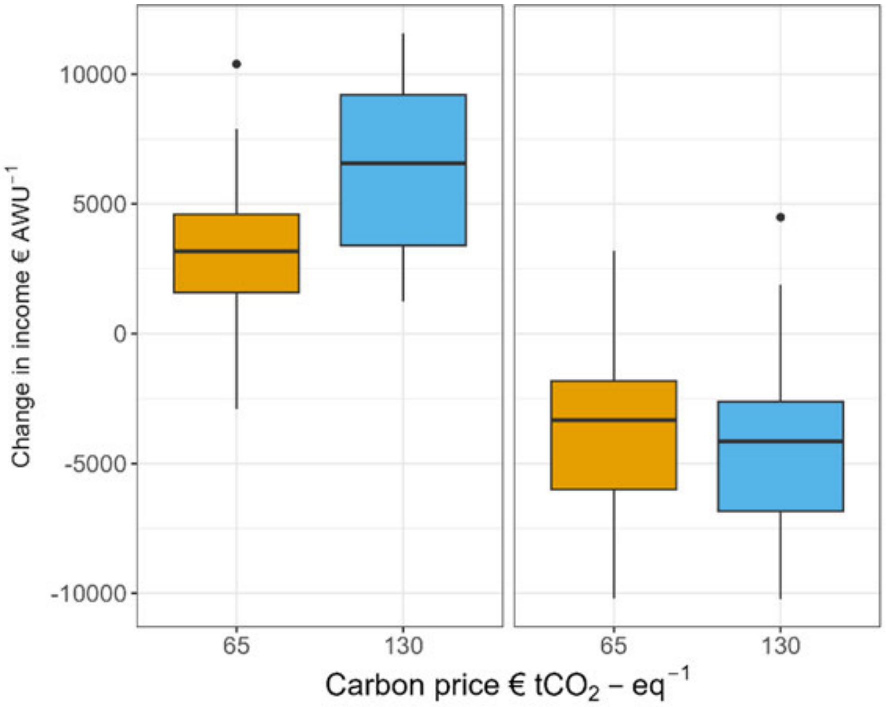
- At 130 euro per ton CO2eq
- GHG emission decline around - 30%
- 4.5 % reduction of agricultural production
- 0.8 % reduction in GDP.

Agricultural non-CO_2 mitigation potential decomposed by mitigation mechanism across GHG **taxation** scenarios (GLOBIOM)



Climate mitgation

Changes in average dairy farm income per AWU (FarmDyn)



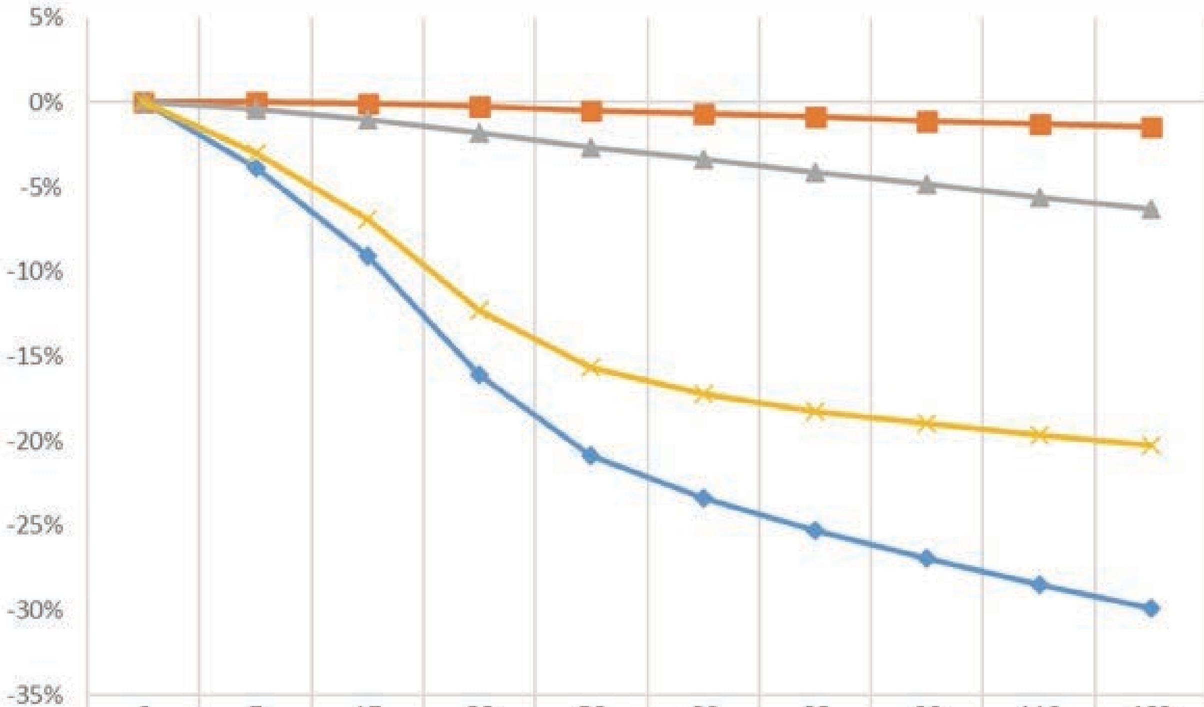
- Taxation of 130 euro per ton CO2eq emission
  - Decrease in dairy farm income of around 5000 euro per AWU (15%)

- Subsidy of 130 euro per ton CO2eq emission reduction (budget neutral)
  - increases in dairy farm income around 6000 euro per AWU

- .

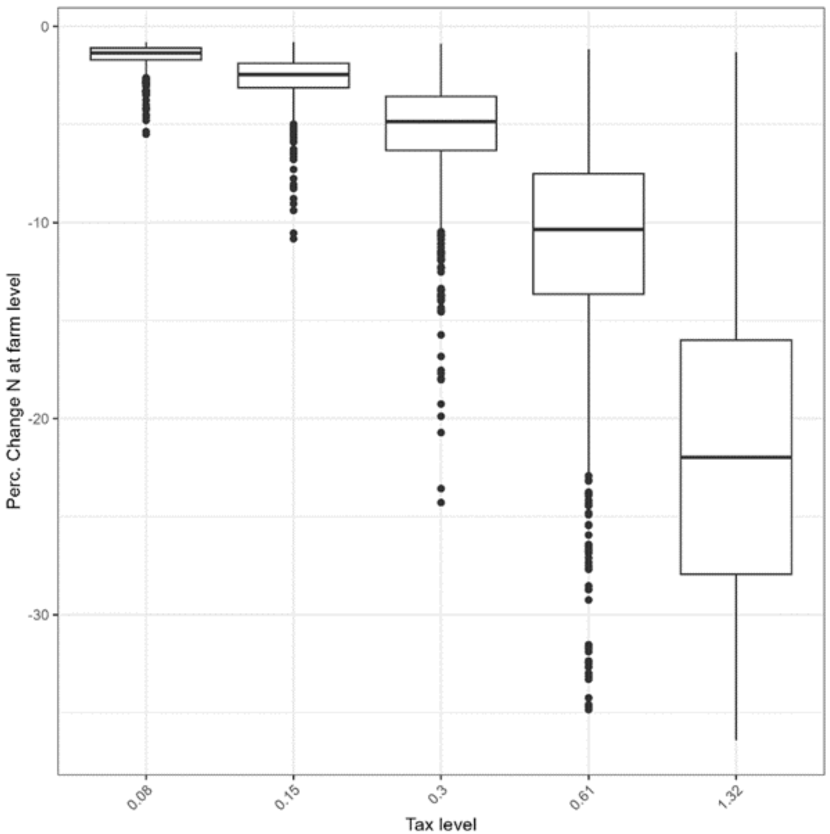
Reduction of mineral nitrogen fertiliser use

Reduced N fertilizer application in response to increased taxation of mineral N fertilizer in the EU, with mitigation technologies. (CAPRI)



	0	7	17	33	50	66	83	99	116	132
Mineral fertilizers	0	-3.92%	-9.07%	-16.07%	-20.83%	-23.39%	-25.30%	-26.88%	-28.44%	-29.86%
Manure	0	0.01%	-0.08%	-0.25%	-0.46%	-0.65%	-0.87%	-1.07%	-1.29%	-1.48%
Crop residues	0	-0.40%	-0.98%	-1.81%	-2.65%	-3.38%	-4.15%	-4.87%	-5.61%	-6.29%
Surplus total	0	-2.99%	-6.93%	-12.27%	-15.67%	-17.24%	-18.22%	-18.95%	-19.64%	-20.25%

Change in mineral Nitrogen fertiliser use at farm level. Italian arable crop farms (INRAE Model)



- The impact on mineral N fertiliser use on Italian FADN arable crop farms equal around – 22%.
- This compares to FarmDyn results for average NUTS2 arable farm
- reduction of mineral fertiliser use on NUTS2 average dairy farm equals around 50% (FarmDyn)

Effects on gross income under 132 % taxation of mineral N fertilizer variant. Percentage change compared to the base

Specialist COP (15)	**-10.30%**
Specialist other fieldcrops (16)	**-7.50%**
Specialist horticulture (20)	-3.20%
Specialist wine (35)	-2.50%
Specialist orchards - fruits (36)	-5.40%
Specialist olives (37)	-3.70%
Permanent crops combined (38)	-2.80%
Specialist milk (45)	-1.50%
Specialist sheep and goats (48)	-1.10%
Specialist cattle (49)	-1.70%
Specialist granivores (50)	-1.20%
Mixed crops (60)	-4.50%
Mixed livestock (70)	-2.10%
Mixed crops and livestock (80)	-5.00%
All farms	-3.80%

- Impact on gross income highest on specialist COP (-10.3%) and specialist other fieldcrops (-7.5%)

Policy recommendations

- Taxation of emissions seems preferred above subsidy on emission reduction
- Gradual implementation allowing farmers and markets the necessary time to adjust
- Redirecting tax revenues to supplement subsidies could help mitigate extreme income effects even though environmental benefits might be compromised
- Flexible phase-out strategies (once emission reduction goals are met)
- Acknowledging the crucial role of evolving technology and structural change

Many thanks! Any questions?

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 817566

MIND STEP

https://mind-step.eu/

Forum for the Future of Agriculture®

Research lessons to inform future CAP reform

7th February 2024, Brussels

Examples from H2020 European research projects

AGRICORE, an Agent Based support tool for the development of agricultural policies

Lisa Baldi

Researcher, Agricultural Economics, University of Parma

agricore

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agricore

AGENT-BASED SUPPORT TOOL FOR THE DEVELOPMENT OF AGRICULTURE POLICIES

The Agricore project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No. 816078

2024 Research lessons to inform future CAP reform event

07/02/2024

Lisa Baldi, UNIPR

UNIVERSITÀ DI PARMA

OUTLINE

1. AGRICORE at a glance
2. AGRICORE modelling approach
3. Next Steps

AGRICORE at a glance

AGRICORE at a glance: Project

The AGRICORE project

The Aim

AGRICORE addresses the environmental and climatic impact assessment of policies by means of a dedicated module aimed to establish links between targeted policies and the corresponding impact KPIs on farmers' practice.

The Project

The AGRICORE project proposes a novel tool for improving the current capacity to model policies dealing with agriculture by taking advantage of the latest progress in modelling approaches and ICT.

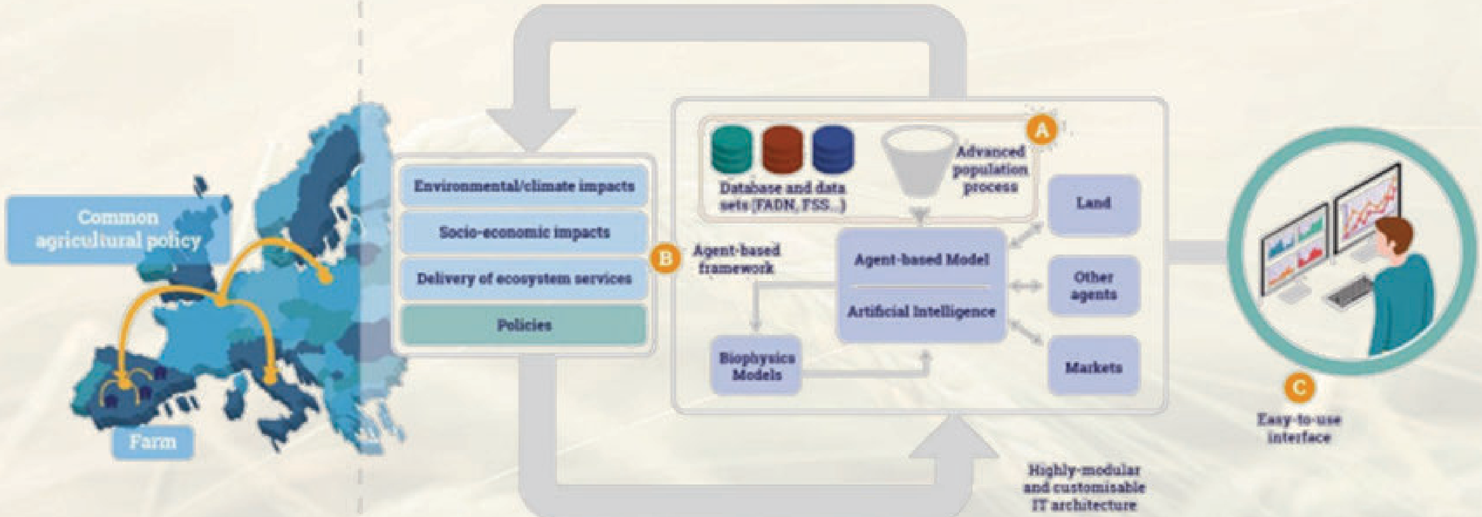
The Model

The main objective of the AGRICORE project is to develop a new generation of ABM tool taking advantage of the latest progress in computational science and ICT.

AGRICORE at a glance: Partners

- IDENER
- Aristotle University of Thessaloniki
- AXIA INNOVATION
- UNIPR
- STAM
- Institute of Agrophysics (IA PAS)
- AYESA
- Agrifood Cooperatives of Andalusia
- Akdeniz University
- UTP University of Science and Technology of Bydgoszcz

AGRICORE at a glance



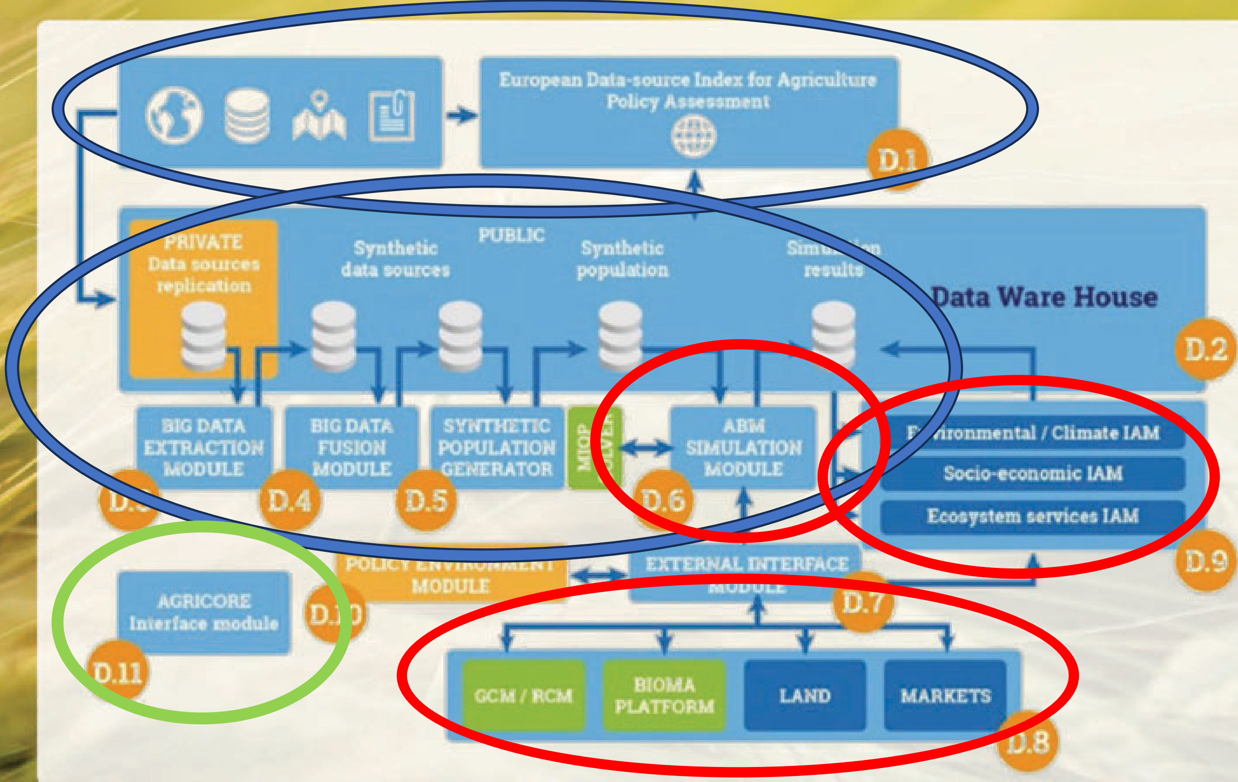
Main AGRICORE progresses compared to the state of the art

A Advanced population concept

B Agent-based model

C User friendly interface

AGRICORE Architecture



A Advanced population concept

1. Data source: identification & usage
2. Synthetic population

B Agent-based model

3. ABM Farm-level analysis
4. Biophysical and other modules interactions
5. Interaction with IAM

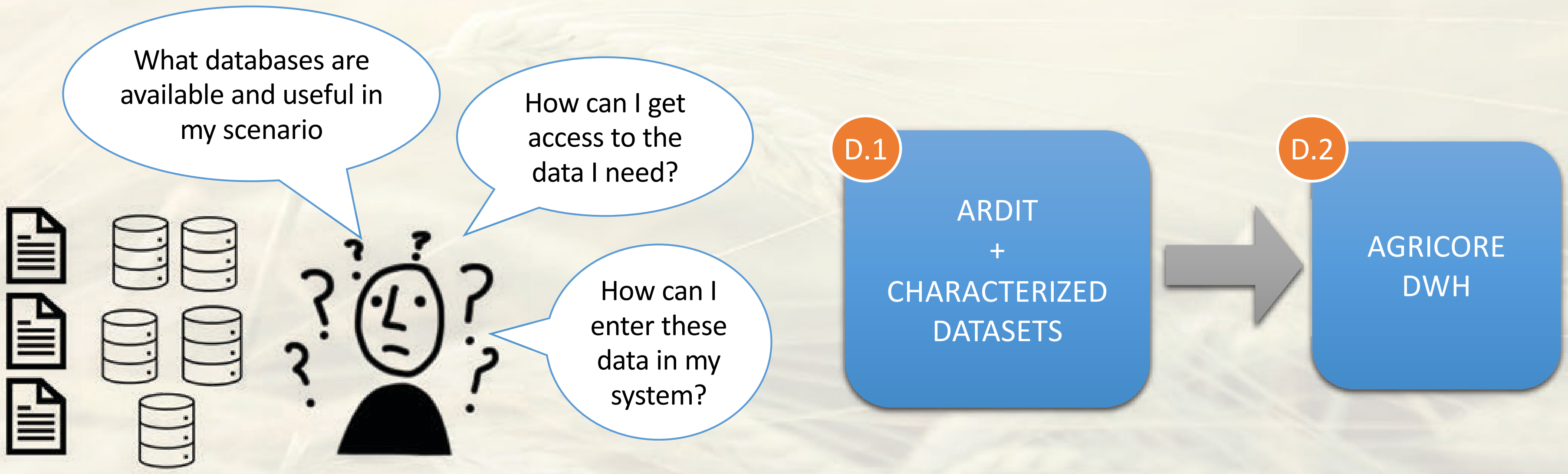
C User friendly interface

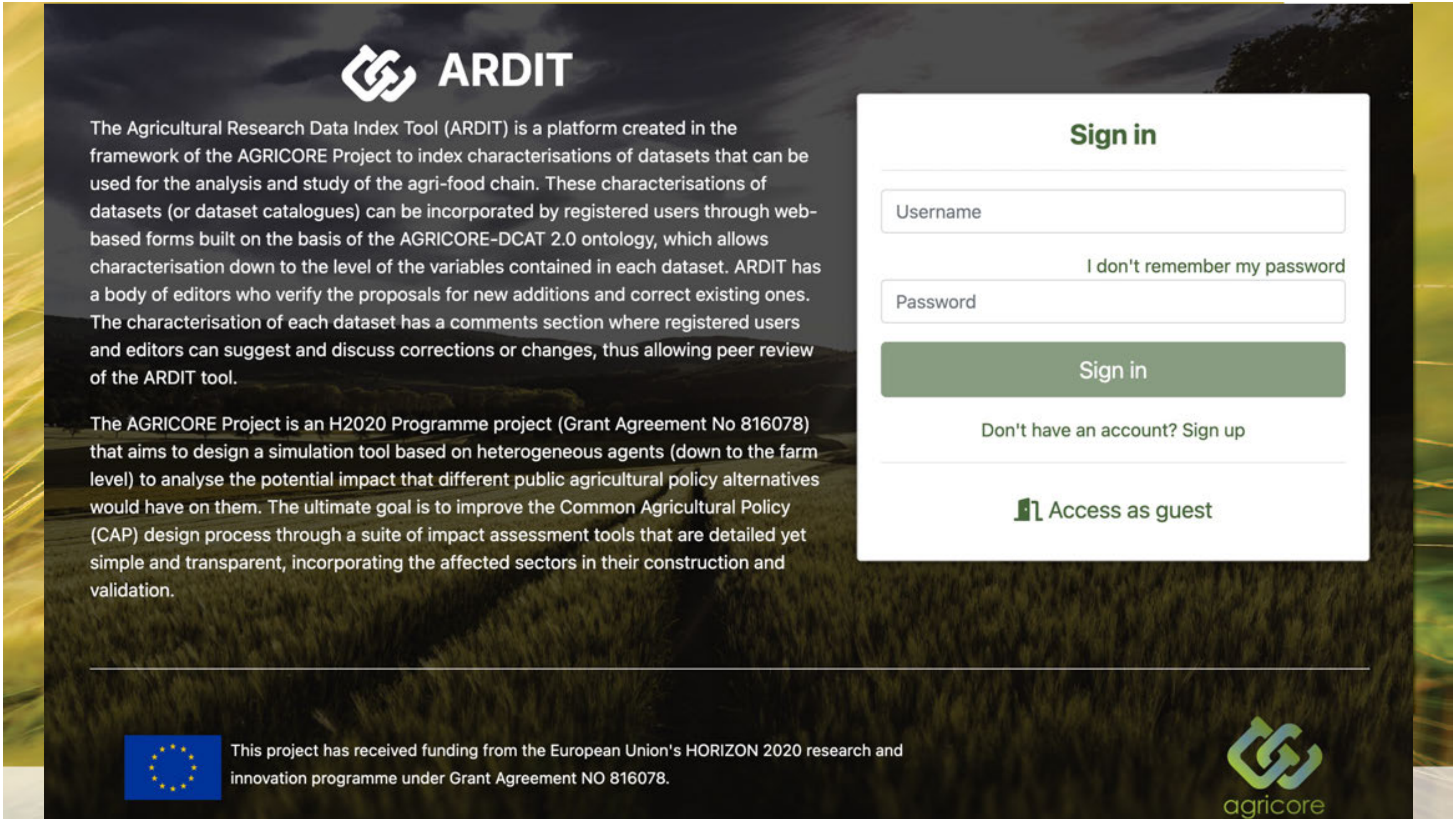
AGRICORE modelling approach

AGRICORE modelling approach

A Advanced population concept

1 DATASOURCE IDENTIFICATION AND USAGE




ARDIT
The Agricultural Research Data Index Tool (ARDIT) is a platform created in the framework of the AGRICORE Project to index characterisations of datasets that can be used for the analysis and study of the agri-food chain. These characterisations of datasets (or dataset catalogues) can be incorporated by registered users through web-based forms built on the basis of the AGRICORE-DCAT 2.0 ontology, which allows characterisation down to the level of the variables contained in each dataset. ARDIT has a body of editors who verify the proposals for new additions and correct existing ones. The characterisation of each dataset has a comments section where registered users and editors can suggest and discuss corrections or changes, thus allowing peer review of the ARDIT tool.
The AGRICORE Project is an H2020 Programme project (Grant Agreement No 816078) that aims to design a simulation tool based on heterogeneous agents (down to the farm level) to analyse the potential impact that different public agricultural policy alternatives would have on them. The ultimate goal is to improve the Common Agricultural Policy (CAP) design process through a suite of impact assessment tools that are detailed yet simple and transparent, incorporating the affected sectors in their construction and validation.
Sign in
Username
I don't remember my password
Password
Sign in
Don't have an account? Sign up
Access as guest
This project has received funding from the European Union's HORIZON 2020 research and innovation programme under Grant Agreement NO 816078.
agricore

AGRICORE modelling approach

A Advanced population concept

2 USE OF PRIVACY-FRIENDLY SYNTHETIC POPULATIONS

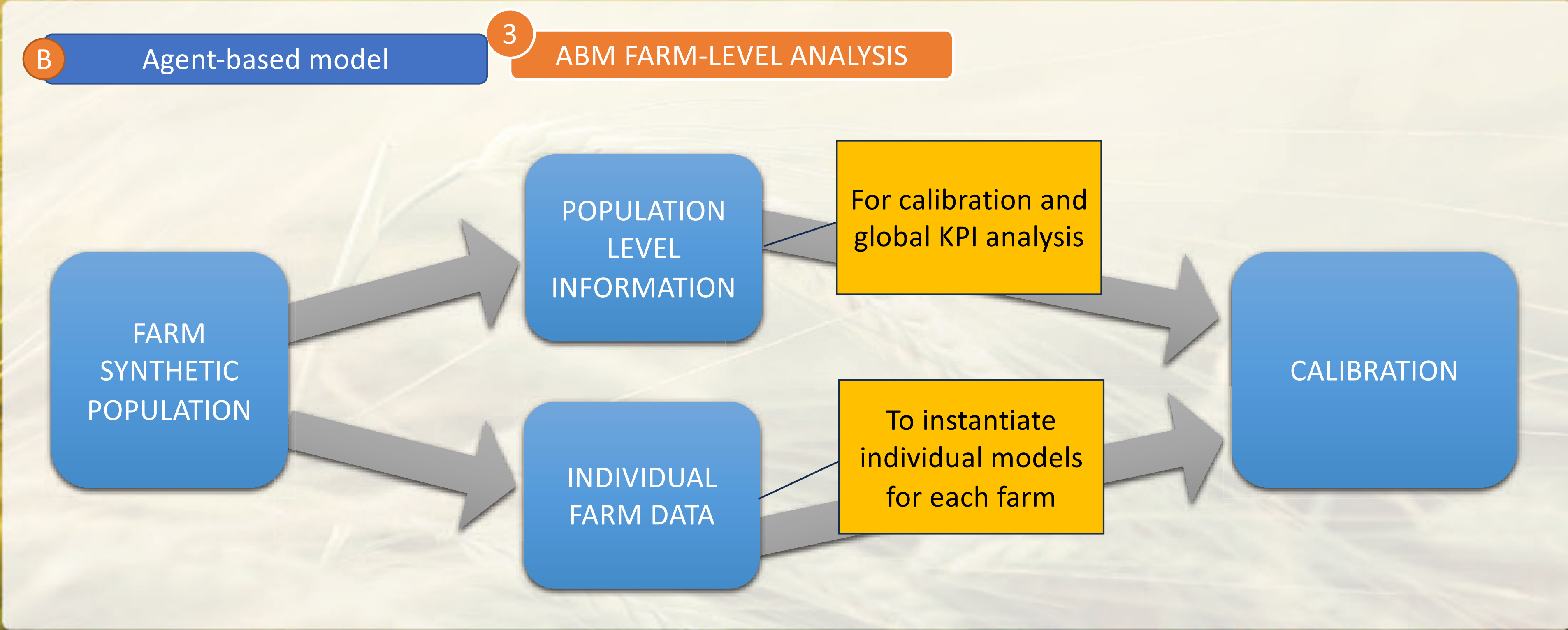
CENSUS-LIKE DATA SOURCES

SAMPLE DATA SOURCES

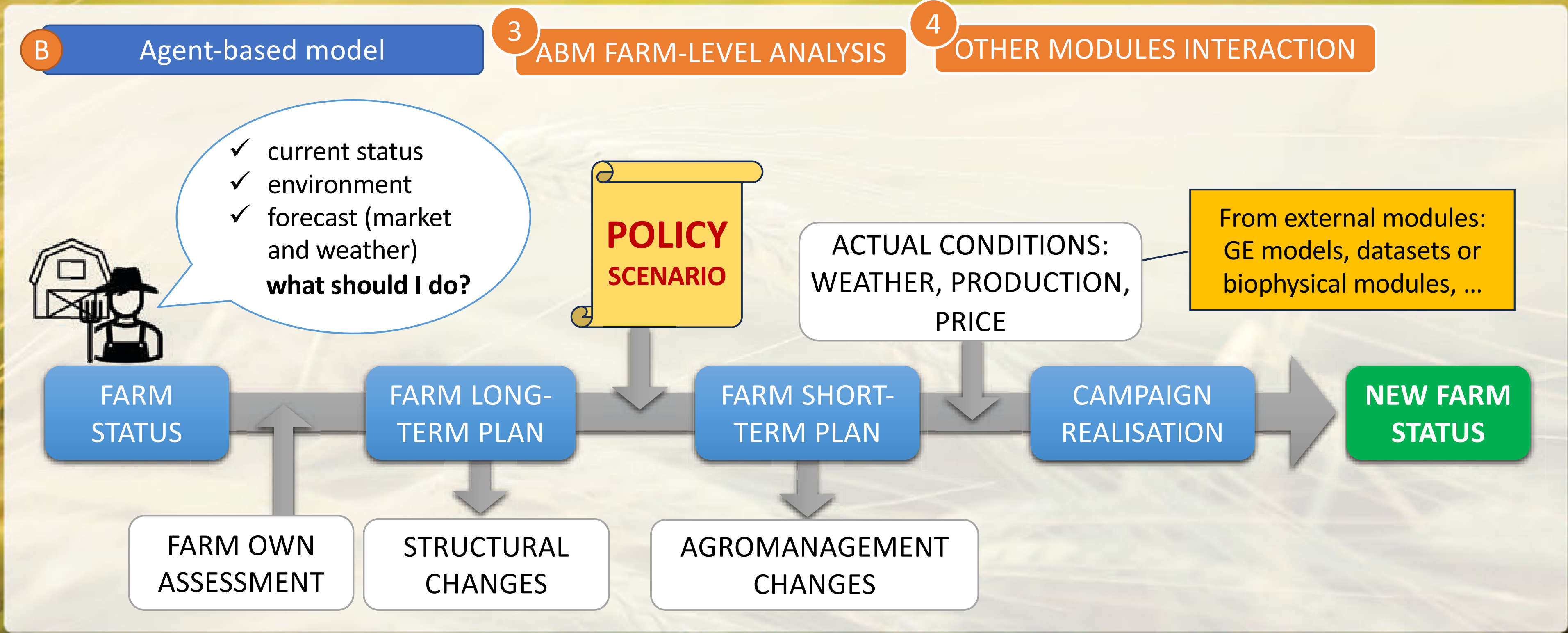
AGRICORE DWH → FARM SYNTHETIC POPULATION

- ✓ Automated population generation
- ✓ Reusable data for other simulations
- ✓ Remove data protection constrains

AGRICORE modelling approach



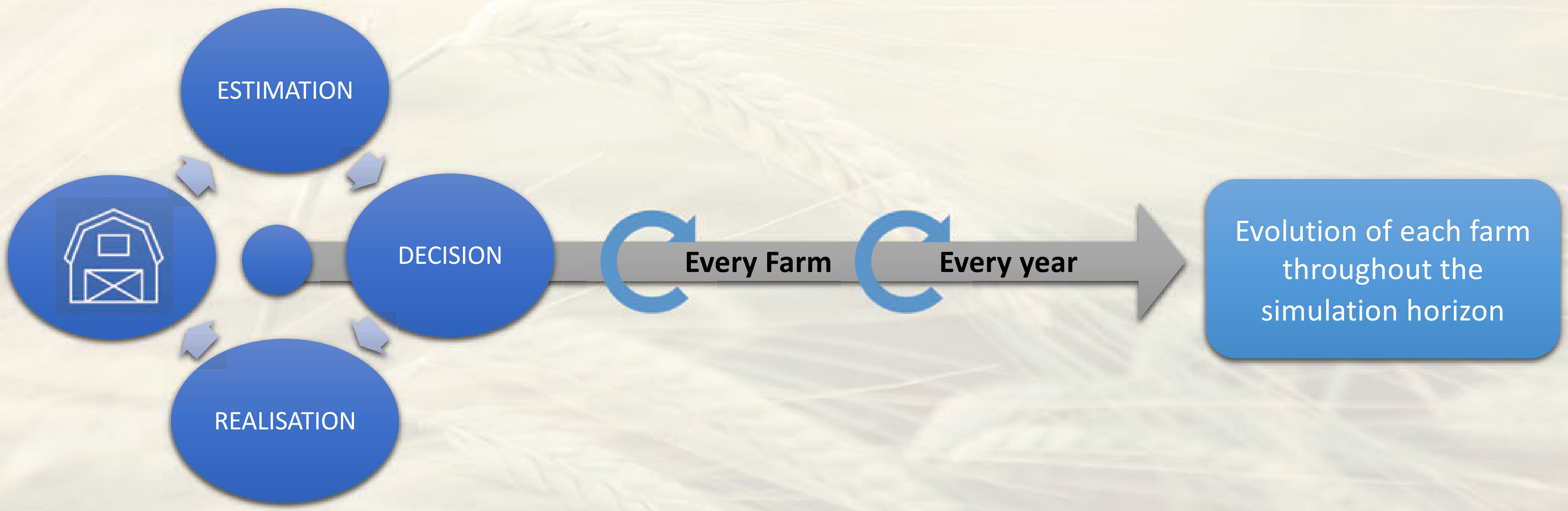
AGRICORE modelling approach



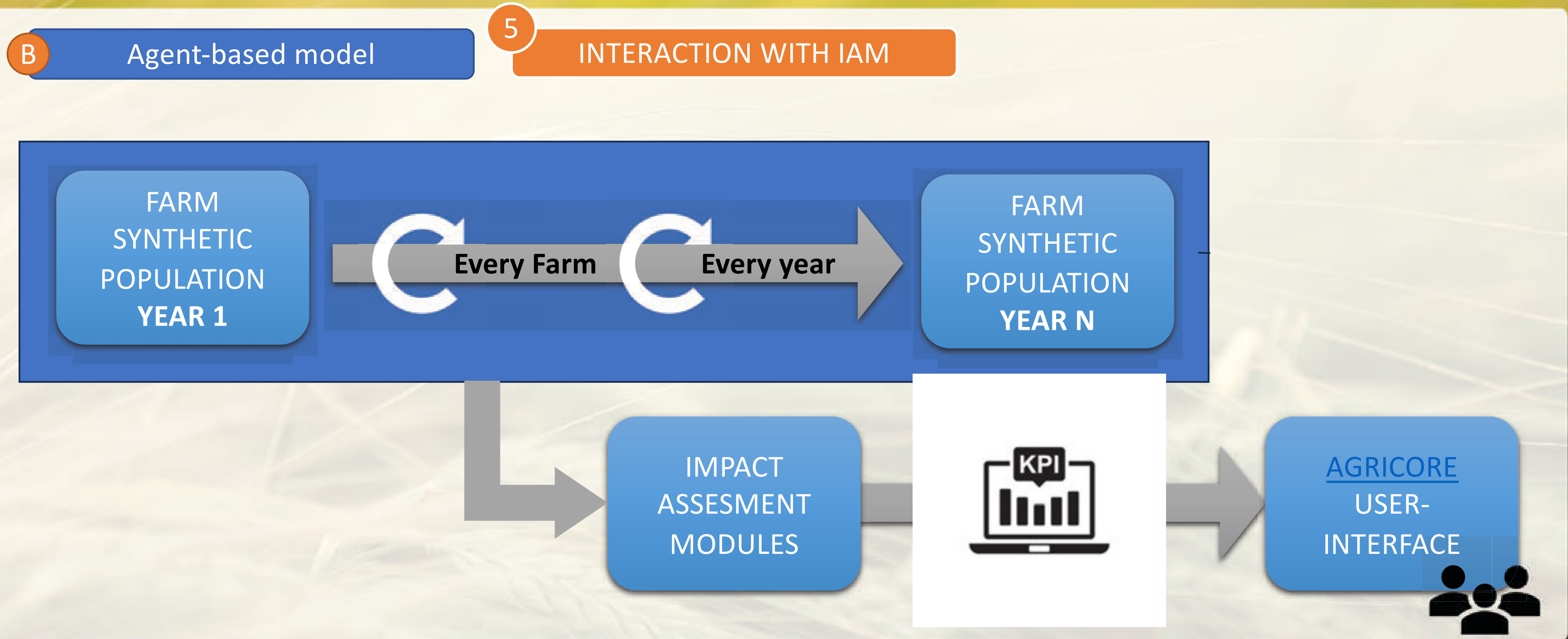
AGRICORE modelling approach

B Agent-based model

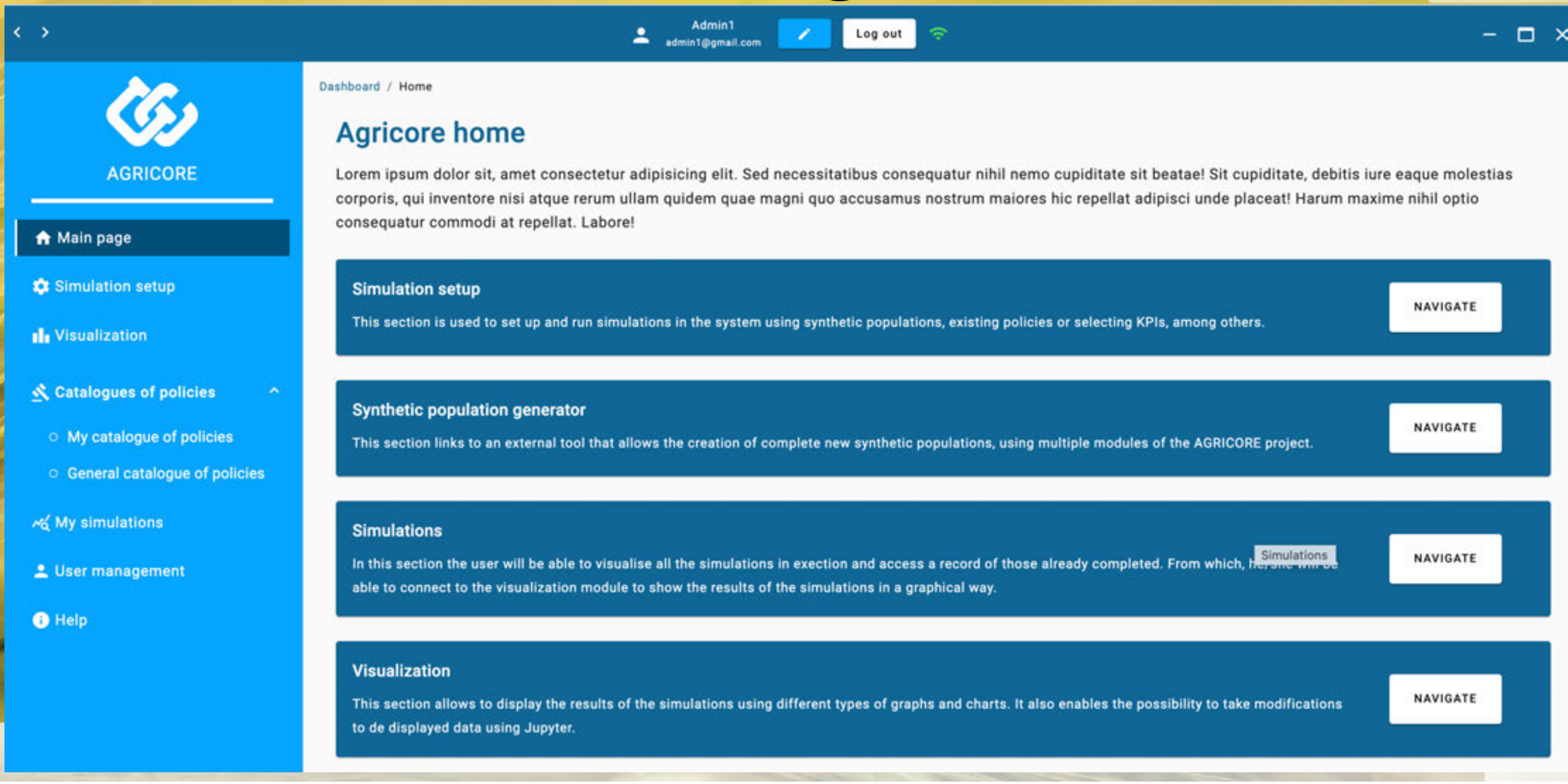
3 ABM FARM-LEVEL ANALYSIS



AGRICORE modelling approach



AGRICORE modelling approach



Next steps

Next steps

2024

Integration LP/SP

End of February

Completion of the technical work:
- Final debugging LP-SP flow
- Integration of the IAM (KPIs)
- Testing of the complete flow

March – April 2024

Dissemination activities:
- Configuration of the 4 UC
- ARDIT workshop
- AGRICORE Presentations to policy makers

Final Consortium meeting

End of May 2024

End of the project

Next steps

Use cases scenario design and testing

[UC#1] M11 – Ecological Agriculture

[UC#3] M6.1 – Settlement of Young Farmers

[UC#2] M10.1 Agri-environment-Climate Commitments

[UC#4] Extra: CO2 Emissions reduction through inc. taxes

USE CASES DEMONSTRATING THE TECHNOLOGY AND PROVIDING IMPACT ASSESSMENT ON SPECIFIC MEASURES

Thank You!

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The Agricore project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No. 816078

Forum for the Future of Agriculture®

Research lessons to inform future CAP reform
7th February 2024, Brussels

From regional case studies to European policy recommendations

Tomáš Václavík

Palacký University Olomouc

James Bullock

UK Centre for Ecology & Hydrology

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BESTMAP
BEHAVIOURAL, ECOLOGICAL & SOCIO-ECONOMIC TOOLS FOR MODELLING AGRICULTURAL POLICY

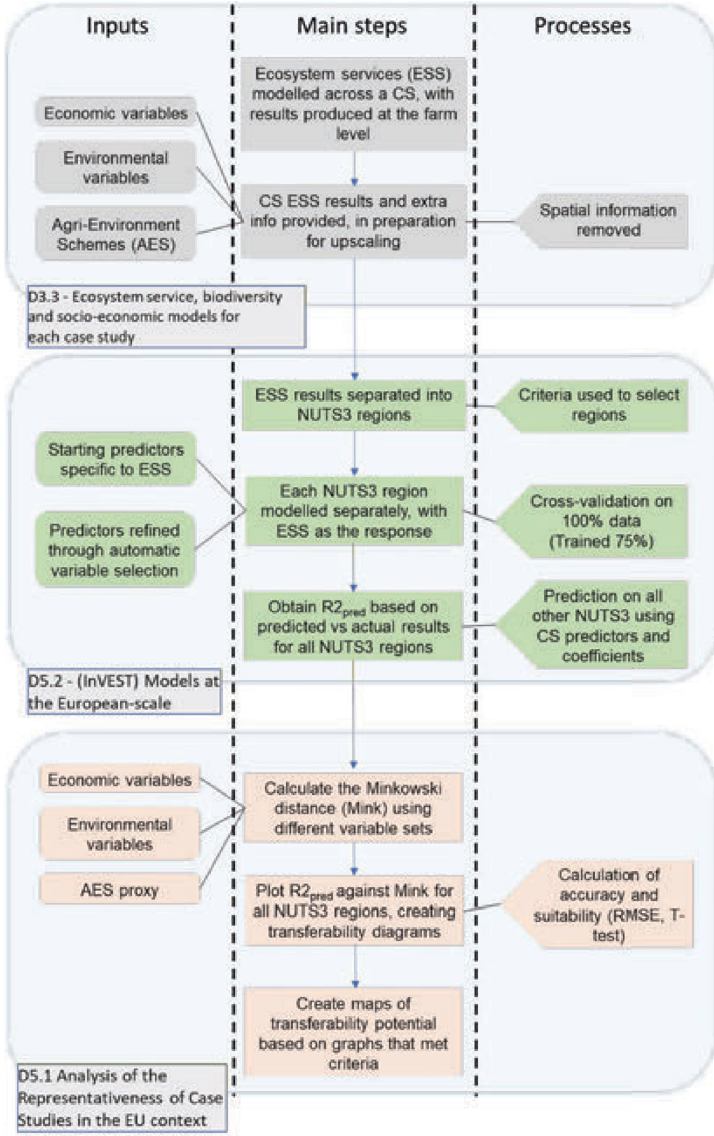
From regional case studies to European policy recommendations

James Bullock*, Guy Ziv, & the BESTMAP team
[*]UK Centre for Ecology & Hydrology

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 817501

Part 1: Scaling up from Case Studies to Europe

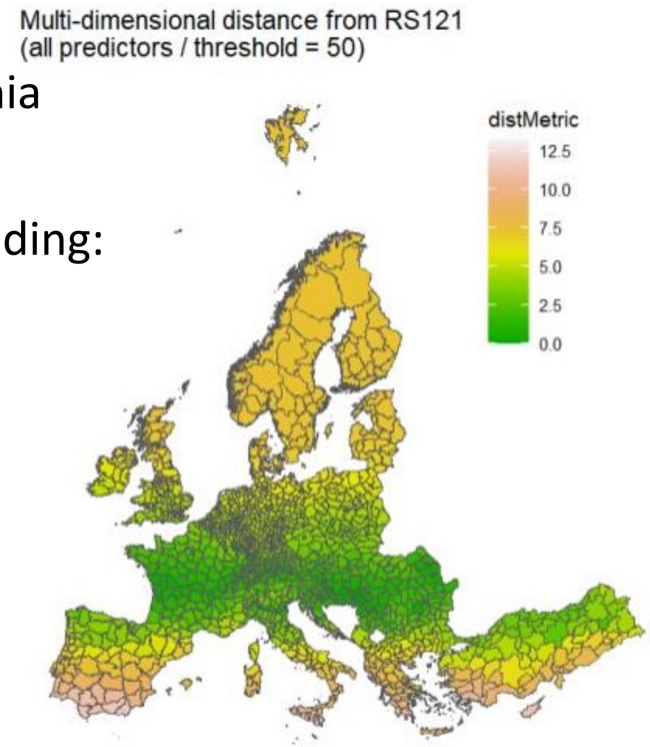
- Case studies give detailed knowledge to understand impacts of AES and socio-ecological drivers
- But it would be prohibitively expensive to do case studies everywhere in Europe
- Can we transfer findings from case studies to other parts of Europe?
- And how might we target future case studies most effectively?

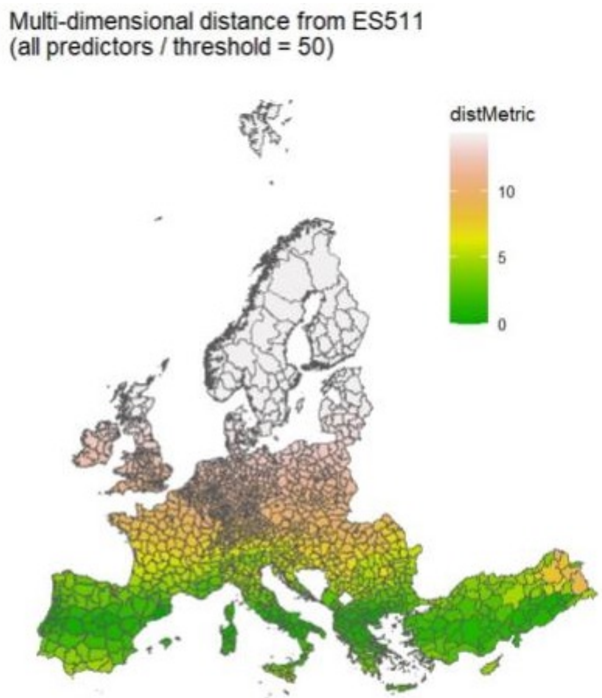


Mapping socio-environmental similarities

- *Minkowski* distances between every NUTS3 region & case studies for Serbia & Catalonia
- Distance calculated using Europe-wide variables including:

Parameter
Seasonal max temp
Land cover
Seasonal soil moisture
Soil properties
Elevation
Farm economy
Farm size
Farm specialisation





BESTMAP

Creating meta-models for ES & biodiversity

- Create statistical models of each of the predicted ES & biodiversity values in each of the 19 NUTS3 regions across the case studies:

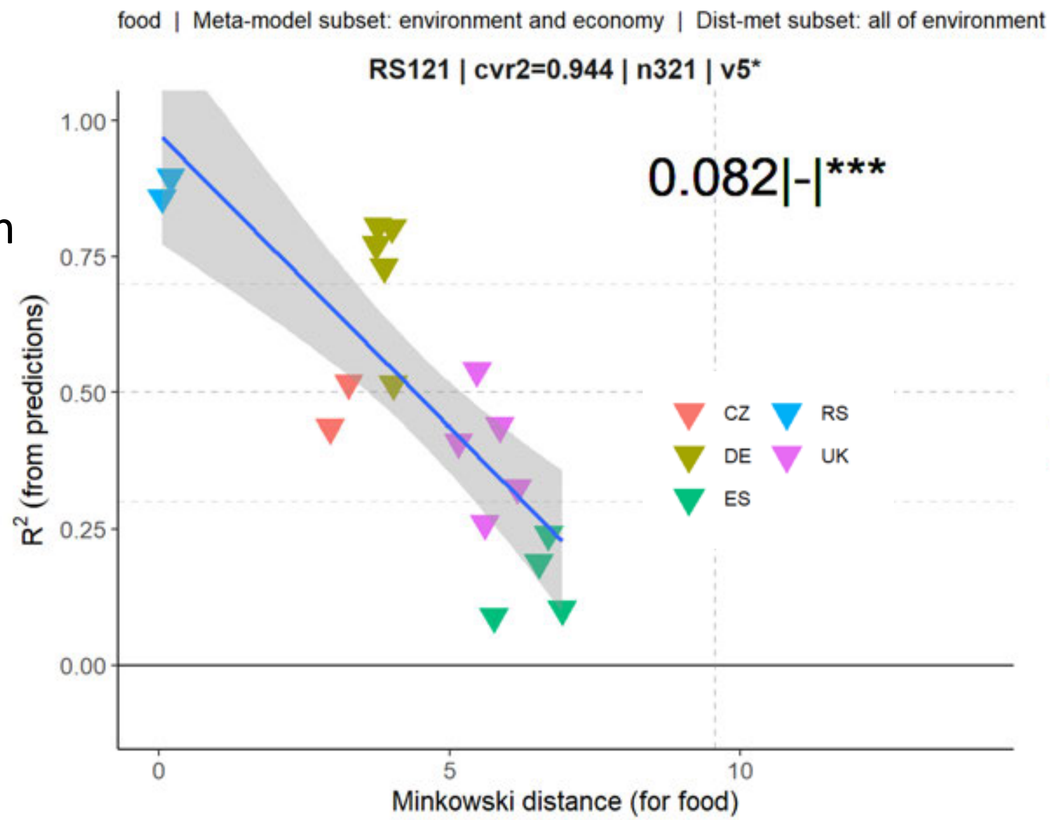
$$ESS_{log} = \beta_0+\beta_1 \cdot v_1+\beta_2 \cdot v_2+\ldots+\beta_n \cdot v_n+\epsilon$$

- Using available Europe-wide data, to allow transfer from case studies to all over Europe
- Europe-wide farm-level data for AES, economic size, and farm specification from synthetic FADN data (created by the Thünen Institute)

Predictor groups in the meta-models
AES actions
Economic size
Farm specialisation
Soil properties
Elevation
Hydrology: PET, AWC
Land cover
Rooting depth

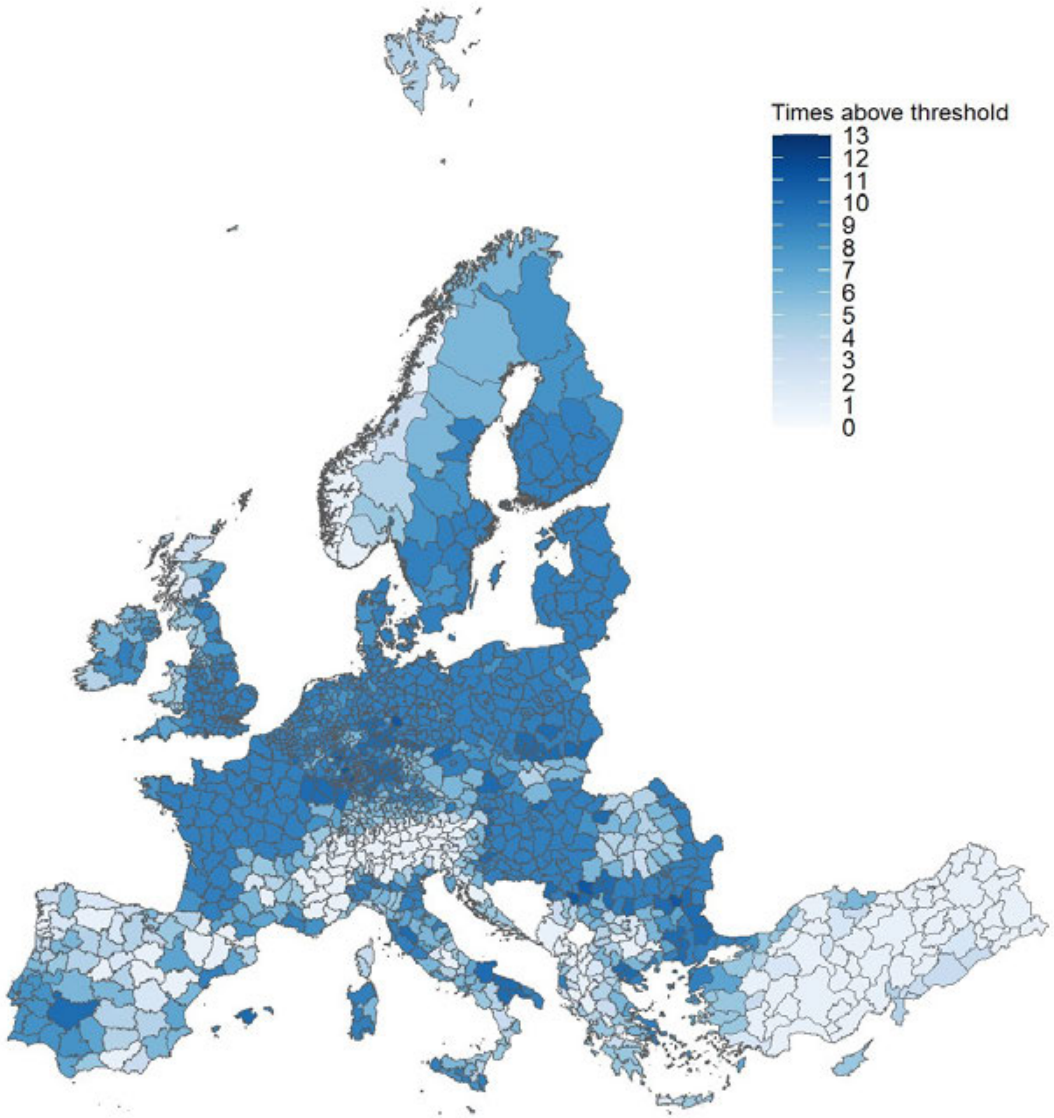
Constructing ’Transferability Diagrams’

- *Hypothesis:* Minkowski distance, as a measure of the similarity of conditions between regions, is a robust predictor for the accuracy of a meta-model developed for one region in predicting the ES values in another region
- Calcuate accuracy of the meta-model for a specific case study NUTS3 is predicting the ES for each of the other 18 NUTS3 regions
- Plotted against Minkowski distance
- In many cases the hypothesis was supported



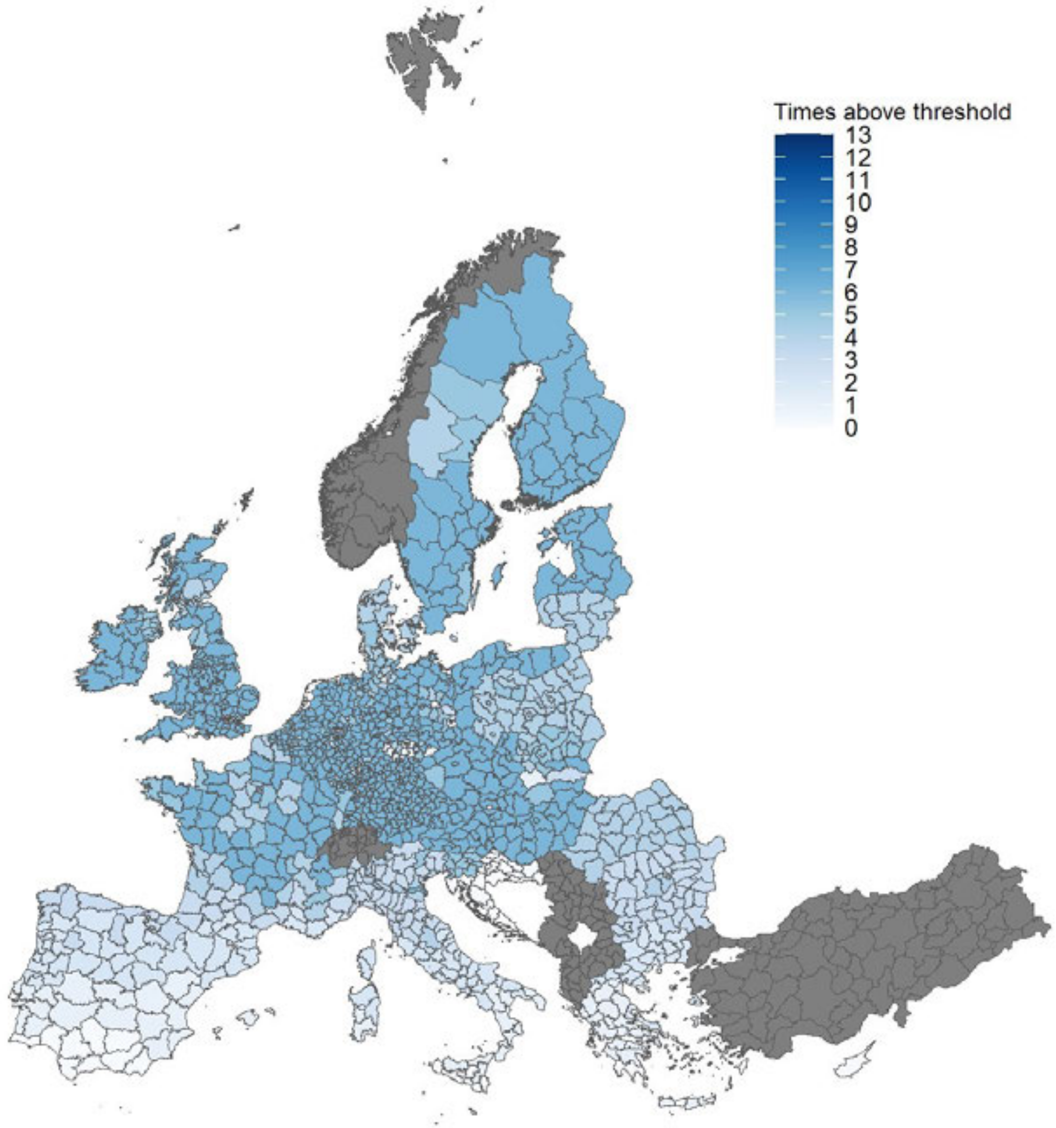
Mapping transferability of meta-models

- Transferability map for the nitrogen retention ecosystem service using only environmental variables
- Based on the transferability diagrams we used the Minkowski distance threshold corresponding to an R^2 value of 0.5 to identify suitable (above the threshold) NUTS3 regions in terms of transferability from our case studies



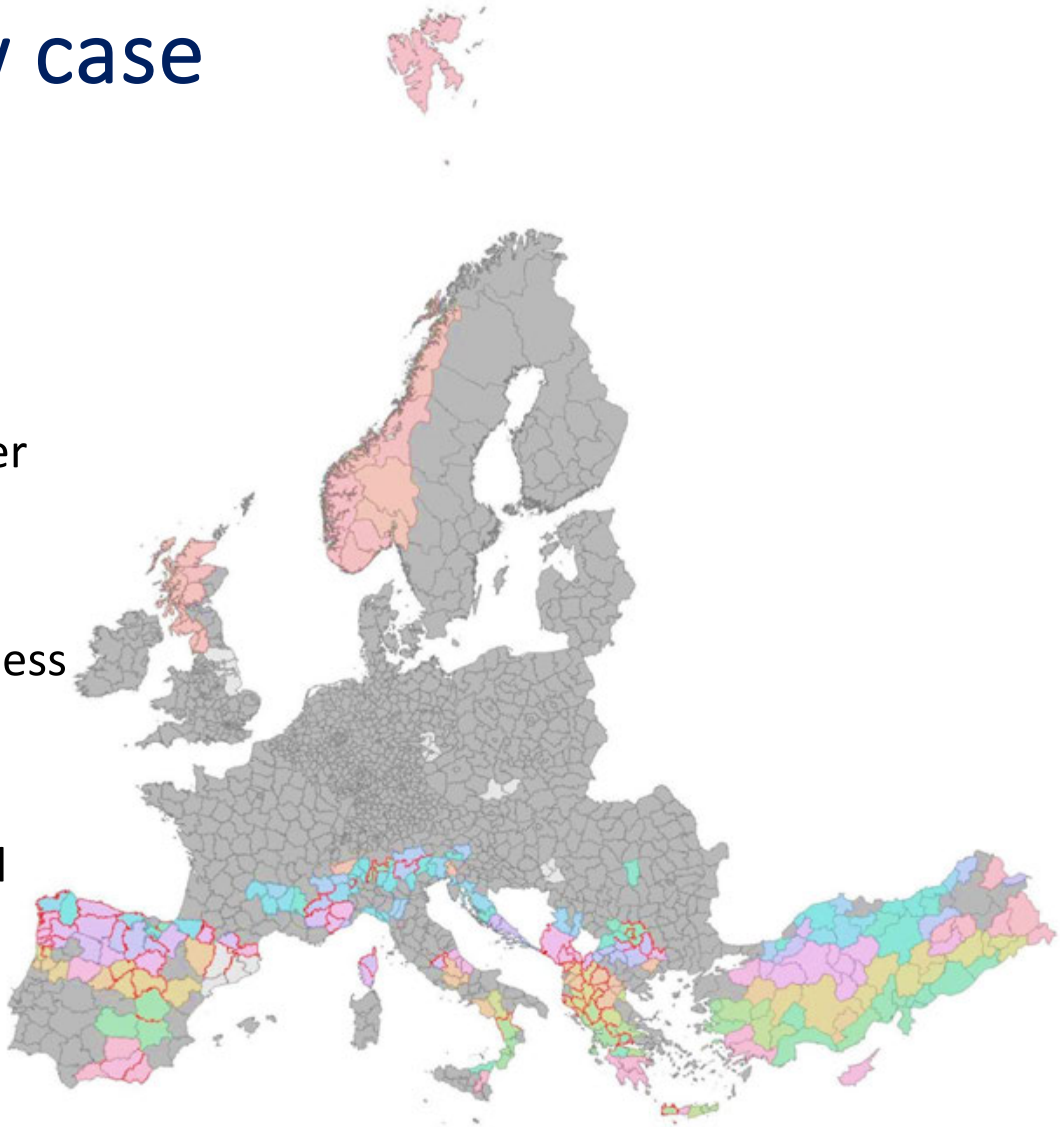
Mapping transferability of meta-models

- Transferability map for the food ecosystem service based on environmental and economic variables.
- The shaded areas are regions with a lack of economic data



Mapping potential new case study regions

- NUTS3 regions clustered by similarity (Minkowski distance)
- Coloured = NUTS3 clusters that met the transferability criteria less than five times per ES
- Outlined = potential new case study NUTS3 clusters that met the transferability criteria less than three times per ES (Turkey excluded)
- Is the 1st step in identifying new case study regions; it is also crucial to engage with local stakeholders, and ensure access to regional data



BESTMAP

Part 2: European policy recommendations

Why are AES insufficient to support biodiversity and ecosystem services in Europe?

1. Too little adoption
2. Not in the right place
3. Ecological trade-offs
4. Lack of monitoring data

BESTMAP

Adoption of AES is insufficient

- Few farmers implementing AES
- Few AES options taken up
- Too much bureaucracy
- Poor advice
- Lack of flexibility
- Poor financial incentives

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Spatial allocation of AES is productivity/economically-driven: not for greatest AES benefit

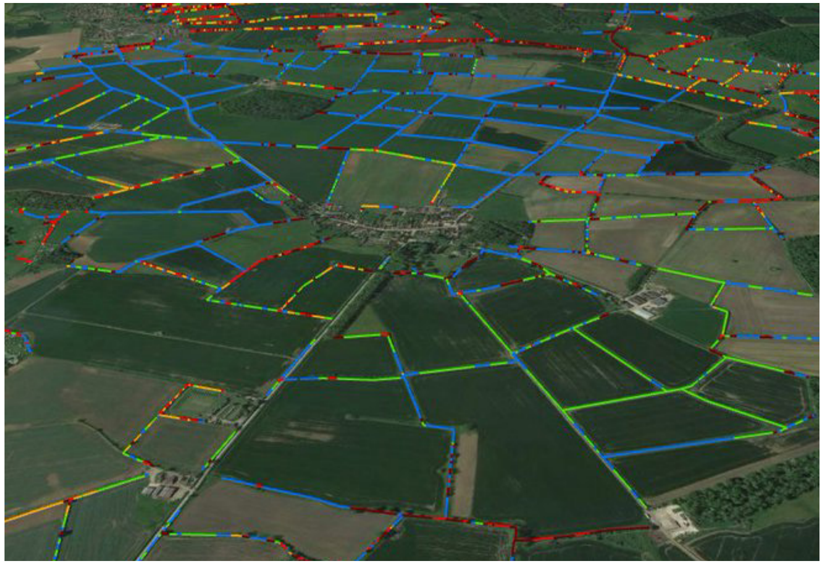
- AES placed into least productive areas
- Many farmers accept subsidies for measures they voluntarily did before
- In field measures disliked
- Reversible short-term AES preferred

Ecological trade-offs are common

- Positive effects for some AES & for some type of birds
- But, other AES have inconsistent effects
- Different species need different resources
- AES need to be in place for longer & need to be managed

Lack of monitoring hinders policy improvement

- Farmers ‘know’ certain AES are not effective
- Modelling needs extensive fine-grained data
- Lack of models hinders policy impact assessments
- CAP impact indicators are insufficient



What are the solutions?

1. Better regional and national land use framework and coordination
2. Improved spatial targeting of AES
3. Co-design and bottom-up (collaborative) AES options
4. Improved advice
5. Payments for public goods
6. High throughput monitoring
7. Agile & adaptive policy cycle

Better regional and national land use framework and coordination

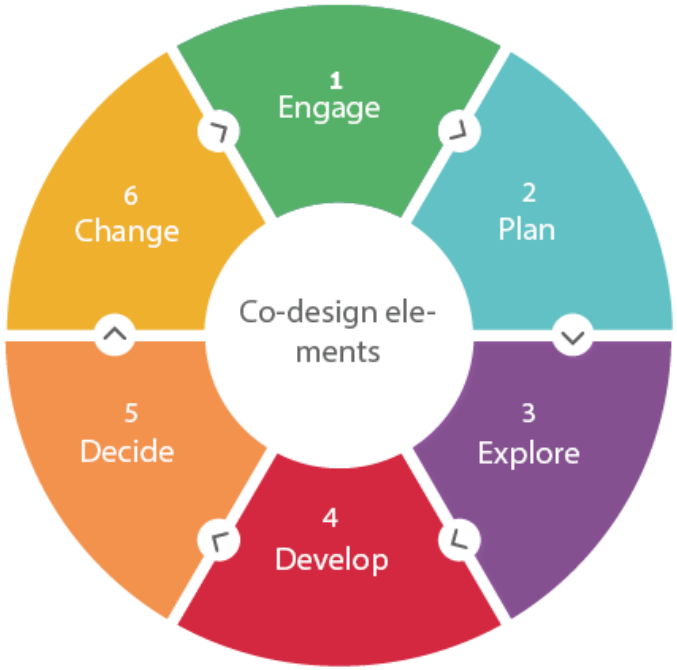
- Many policies are impacting land use - CAP, Nature, Water Framework (WFD), and Nitrates Directives, the European Climate Law, the Renewable Energy Directive (RED II), (upcoming) Soil Health, and Nature Restoration Directives
- Need a regional and national land use framework
- Learn from experience - e.g. Scottish Land Use Strategy and Regional Land Use Partnerships

Improved spatial targeting of AES

- Prioritize funding for different AES measures
- Build a consistent farming system archetype classification to allocate resources where ecological additionality is maximized
- Use models and data to target AES to maximise returns on biodiversity and ecosystem services

Co-design and bottom-up (collaborative) AES options

- Adapt AES to local environmental and farming conditions
- Give farmers more autonomy
- Co-design to increase buy-in, trust in schemes, and adoption
- Collaborative schemes (e.g. new Landscape Recovery scheme in England) can deliver economies of scale



Improved advice to farmers

- Farmers struggle in finding suitable AES that fit their farm management
- Advisory services can help with reducing load and with spatial targeting of AES
- Advisors need to be knowledgeable and trusted
- Government-funded services are preferable

Payments for public goods

- ‘Cost incurred/income foregone’ is not enough
- In private-funded schemes higher payments drive increases in uptake
- UK is leading on transition for public money for public goods
- Amber Box to alleviate issues with WTO (in longer term address the issue by changing WTO rules for Green Box)

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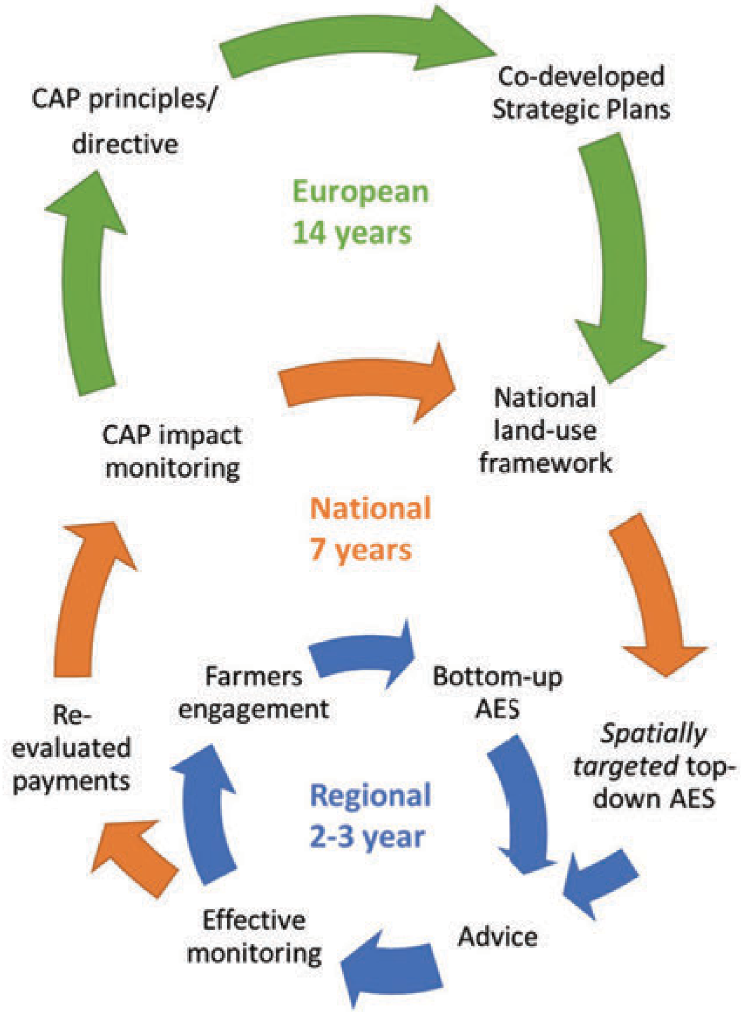
High throughput monitoring

- Poor evidence for impact of AES on soil carbon, pollution, etc
- Share and utilize data that farmers, soil testing labs, water companies etc, collect
- Monitoring will increase adoption
- New tech: audio recorders, eDNA, AI cameras can scale up monitoring
- Farmers happy to deploy and support with new tech

Agile adaptive policy cycle

- Instead of the current “top down” policy approach, which updates every 7 years with a new CAP
- A more adaptive, agile, and multi-scale approach



Agile adaptive policy cycle

- Smallest scale - region or county, engagement with farmers produces bottom-up AES which evolve every 2-3 years to allow effective learning
- Embedded within national 7 yr cycles, updating a land-use framework, bringing together EU and national policies: spatially-targeted top-down AES to complement the bottom up
- European policy can take a longer timescale, that would involve new CAP Directive, with monitoring etc allowing evidence-based policy making

Panel discussion and dialogue

Ignacio Perez-Dominguez
Scientific Officer, Joint Research Centre, European Commission

Tassos Haniotis
Senior Guest Research Scholar at IIASA, Former Director for "Strategy, Simplification and Policy Analysis" in the DG AGRI

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7th February 2024, Brussels

Reaction by EU Project Coordinators

James Bullock

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John Helming

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Lisa Baldi

Researcher, Agricultural Economics, University of Parma

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Networking Lunch and Poster Session

Poster session: Impact of agro-environmental policies in regional case studies across the UK, Germany, the Czech Republic, Spain, and Serbia

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