

BioSpace25 - Biodiversity insight from Space  
10 - 14 February 2025 | ESA-ESRIN | Frascati - Italy

# A satellite-supported service to monitor the habitat suitability of agricultural land and to evaluate the impact of agri-environmental policies on farmland birds





**Intensive agriculture has been leading to the decline in the number of farmland birds in the EU**

- **EU Policies (CAP, EU Biodiversity strategy, Nature Restoration Law, ...)**
- **Need for monitoring services**
- **Evaluation of actions and impact**
- **Planning / adjustment of measures**
- **Support tools**





**Geospatial  
Data**

**Optimization**

**Species  
Distribution  
Modeling**

**Online  
Platform**





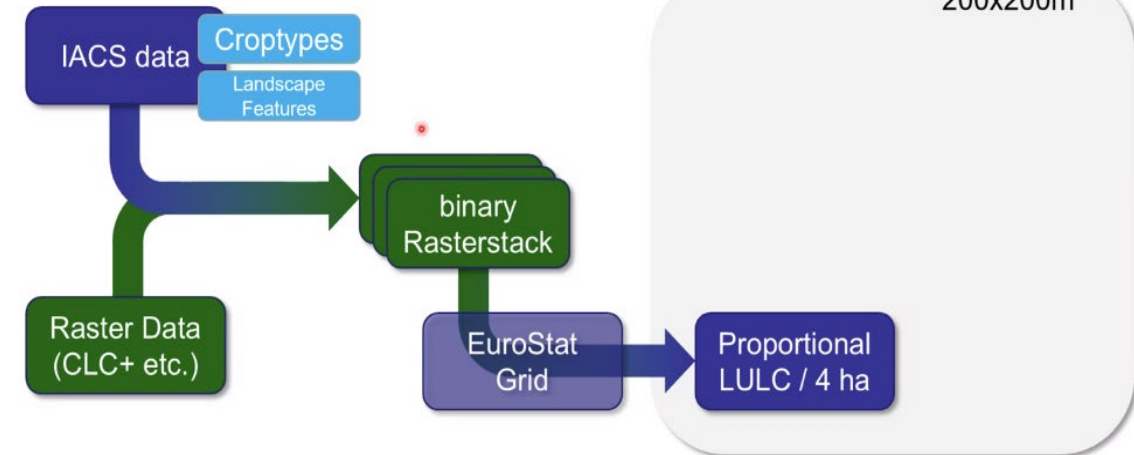
# Monitoring approach



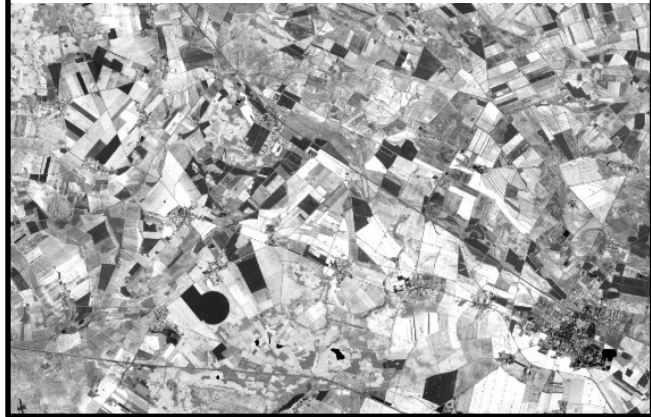
Texture



Landscape Elements



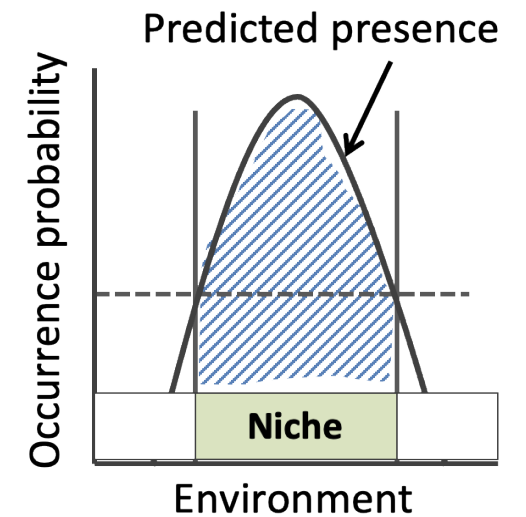
Vegetation Indices



Croptypes



**Species Distribution Models**  
(biomod2 R package)





# Nation-wide habitat suitability monitoring

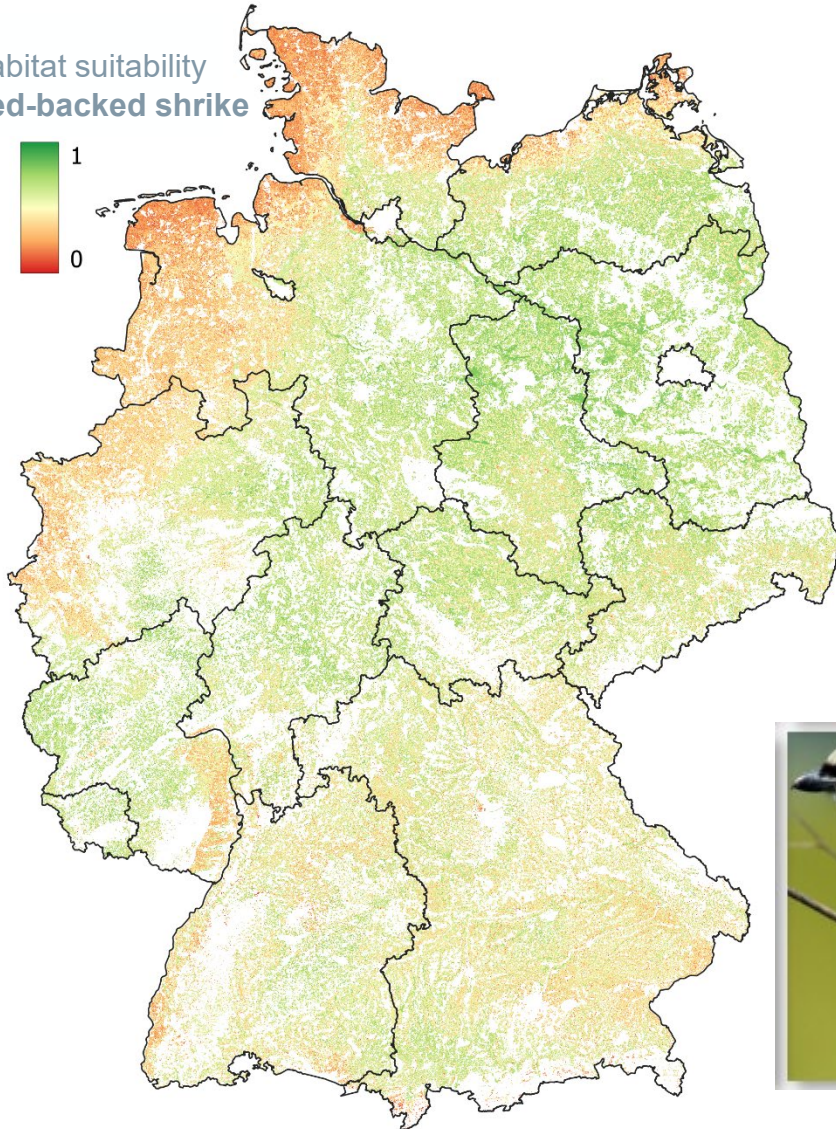
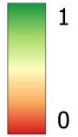


GEOBON

CEOS

esa

Habitat suitability  
Red-backed shrike



## SDM Model Input:

- **Bird data:** Observational data from national monitoring framework
- **Environmental data:**
  - Climate data (ERA5)
  - Crop type data (Thuenen Institute's crop type maps or from LPIS)
  - Digital Elevation Models
  - Mowing data (Sentinel-2)
  - Soil moisture (Sentinel-1 & Landsat 8)
  - Land cover data (CLC+, etc.)



# Nation-wide habitat suitability monitoring

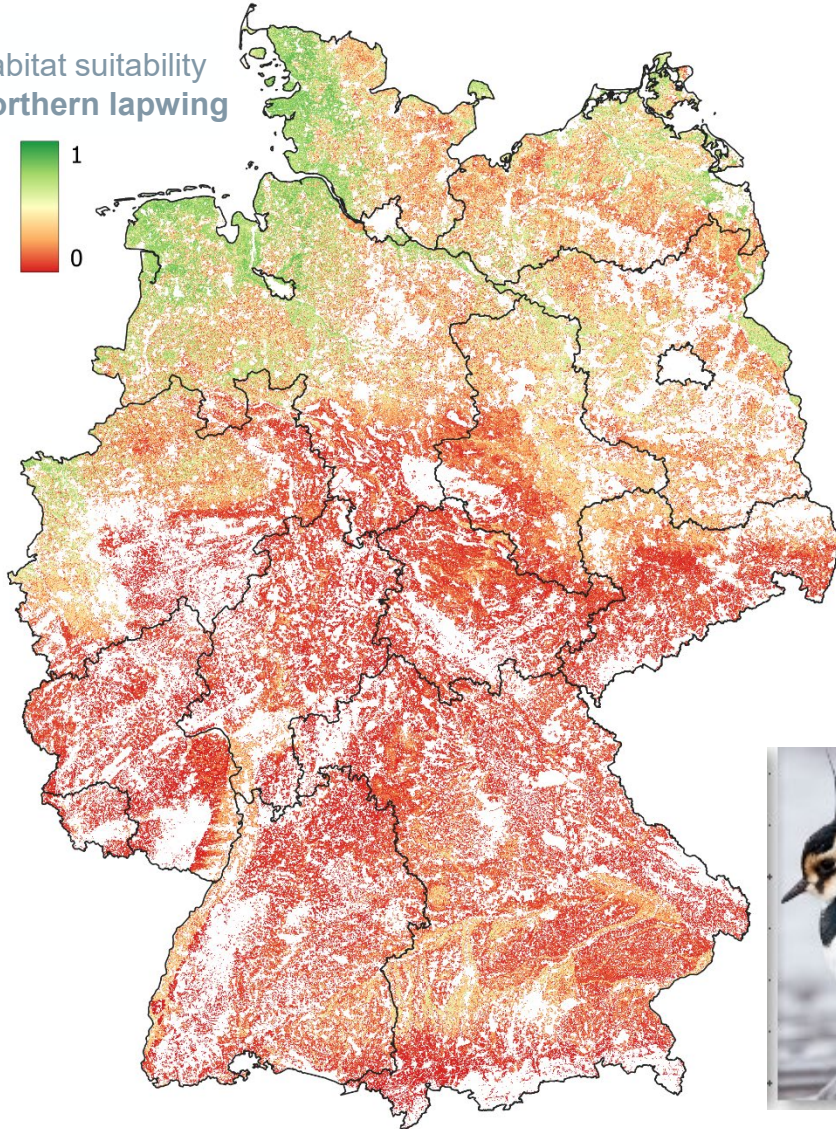


GEOBON

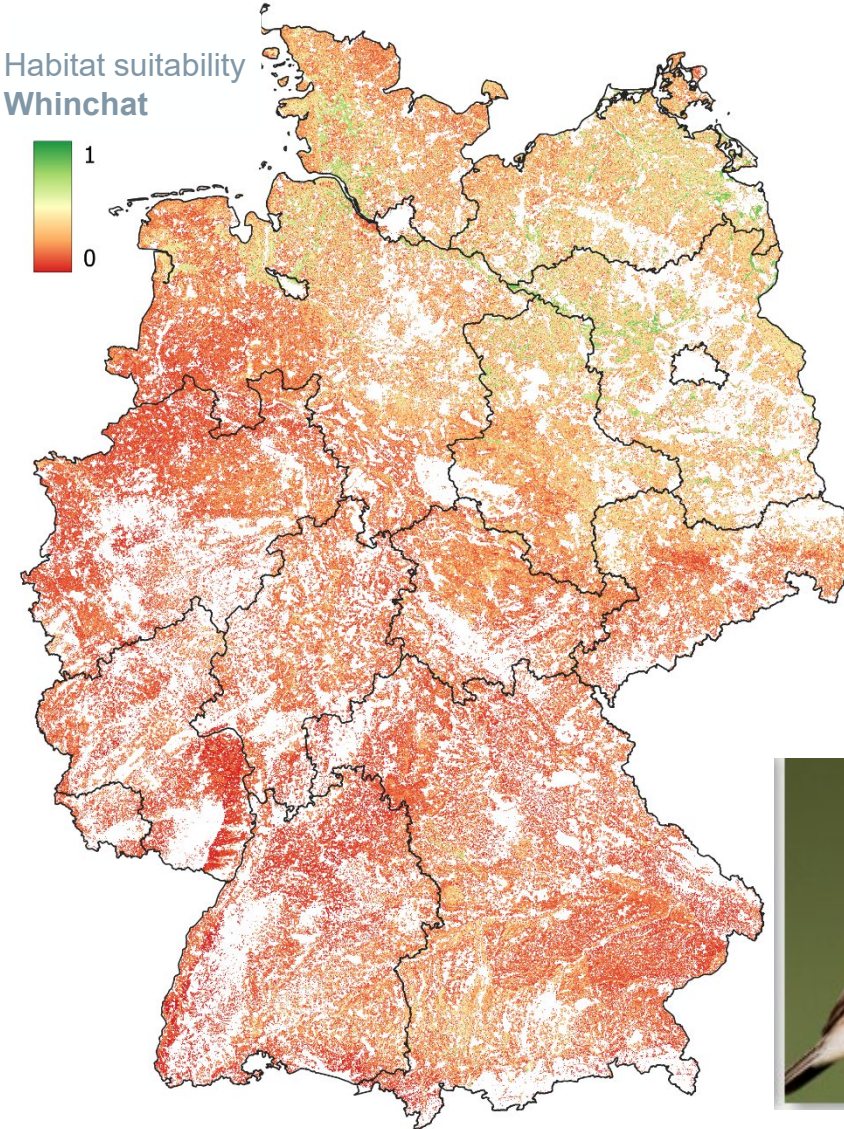
CEOS



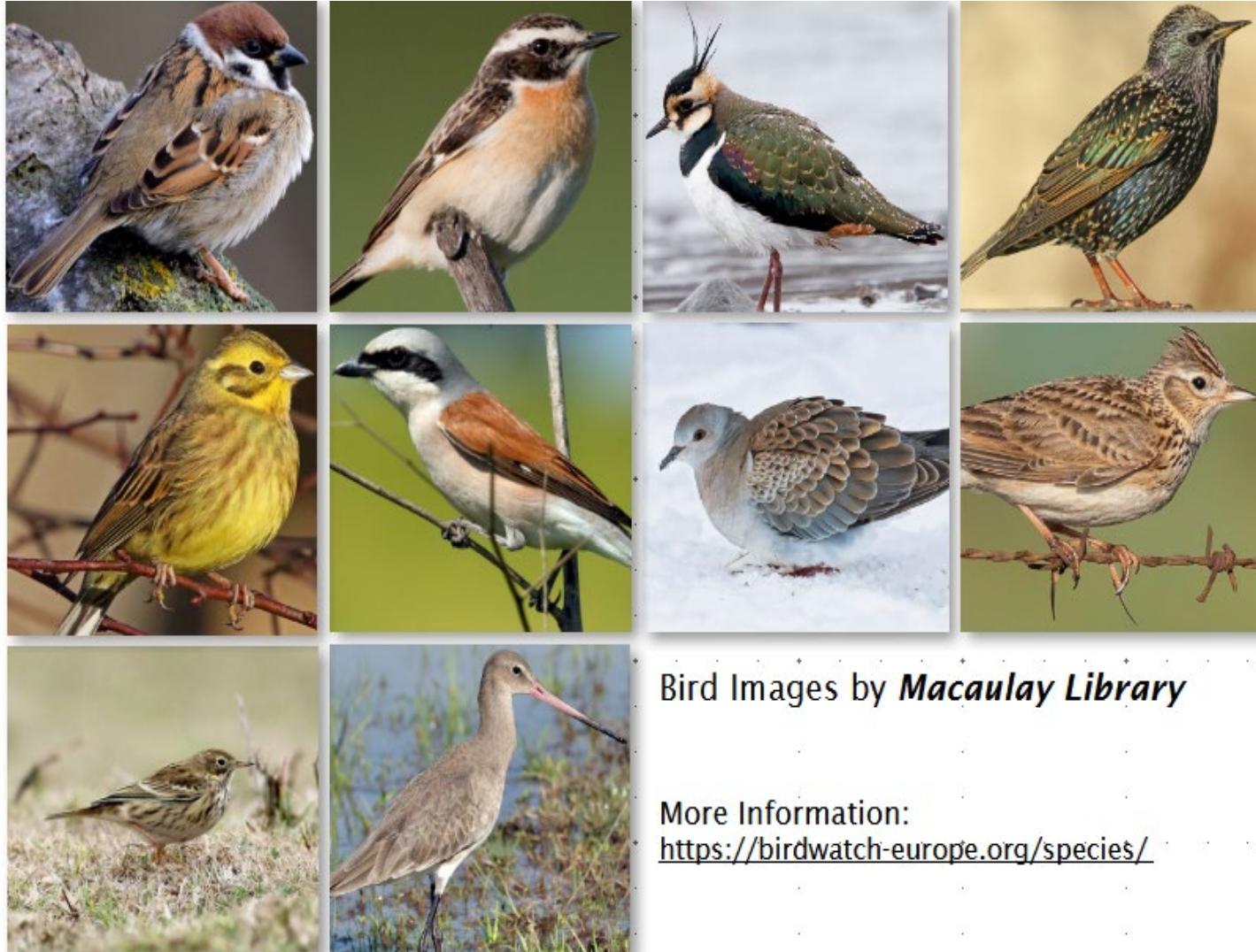
Habitat suitability  
Northern lapwing



Habitat suitability  
Whinchat







Bird Images by *Macaulay Library*

More Information:  
<https://birdwatch-europe.org/species/>

## Species selection criteria

- Indicator-Species
- Farmland Birds Index ("FBI")
- Part of an established monitoring scheme
- Observation data available
- Representing different habitat requirements
- Common to endangered
- Common to region-specific

# Deriving ecologically consistent measures

Development of **optimisation scenarios**, e.g.:

- Fixed target of species abundance
- Prioritising certain species in specific regions
- Fixed budget for measures
- Maximum percentage of profit-loss



- Water management
- Woody features restoration
- Extensive grassland management

**Initial results**

**Landscape conservation recommendations**

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## Scenario development – Optimised habitat suitability

### Subsidised conservation measures

- European Agricultural Fund for Rural Development for the compensation of implementing agri-environmental and climate measures
- Contract-based measures funded through federal and local resources
- ...

Collect potential measures and associated cost

Conservation measures	Subsidy cost (€/ha)
No conservation measure	€0/ha
Flower field	€1998/ha
Seed-yielding crops (not harvested)	€2053.0/ha
1 <sup>st</sup> crop: seed-yielding crops 2 <sup>nd</sup> crop alfalfa + herbaceous grassland	€2027/ha
Botanical grassland	€2000/ha



# KEY RECOMMENDATIONS



GEOBON

CEOS



**Availability, quality and quantity** of bird observation and *in situ* data is key

**Ecological knowledge** on bird species and their requirements is key

**Funding schemes** that allow for the development of „multi-disciplinary“ services is needed





# THANK YOU!



**Team:** Annett Frick, Nastasja Scholz, Sascha Gey, Felix Kessler, Pierre Babeck, Rik Hendrix, Ine Rosier, Ruth Sonnenschein, Bartolomeo Ventura, Basil Tufail, Nika Oman-Kadunc, Nejc Vessel, Tomas Orlickas, Martynas Rimgaila, Prof. Damaris Zurell, Levin Wiedenroth, Lena Jäger, Francesco Ceresa, Matteo Anderle, Luc DeBruyn, Katharina Schertler, Janosch Fiedler, Heidi Lehmann

**Illustration:** Susanne Seidel, Rémy Schaepman



<https://birdwatch-europe.org/>



**Dr. Annett Frick**

Mail: [annett.frick@lup-umwelt.de](mailto:annett.frick@lup-umwelt.de)

**Dr. Nastasja Scholz**

Mail: [nastasja.scholz@lup-umwelt.de](mailto:nastasja.scholz@lup-umwelt.de)



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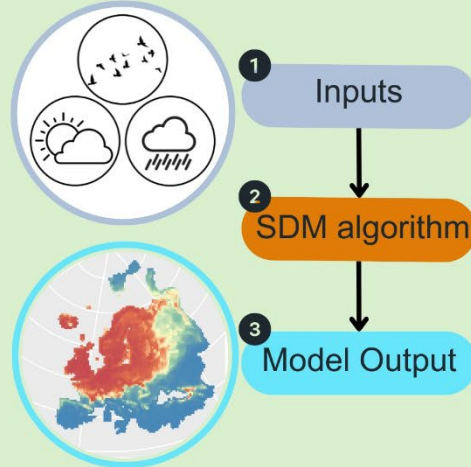
## 1. PREPARATION

EUROPEAN

**SPECIES DATA**  
standardization, spatial autocorrelation, pseudo-absences

**CLIMATE DATA**  
19 bioclimatic variables

## 2. MODELLING



## 3. PREDICTIONS

**EUROPEAN MODEL PREDICTIONS**  
European habitat suitability

**COVARIATE NESTING**  
use global habitat suitability to inform regional habitat suitability

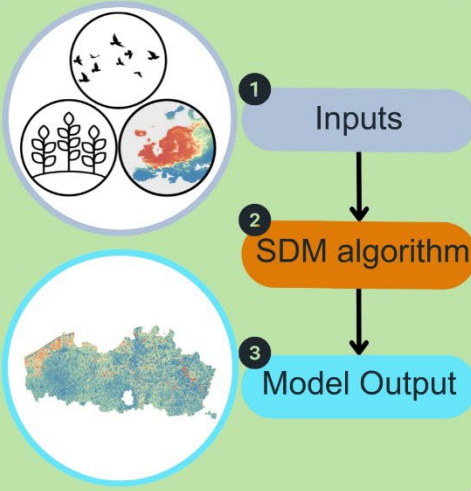
**REGIONAL MODEL PREDICTION**  
regional habitat suitability with one of the covariates being the European habitat suitability

REGIONAL

**SPECIES DATA**  
standardization, spatial autocorrelation, pseudo-absences

**OTHER COVARIATES**

1. European climate suitability
2. Land cover / land use
3. Crop types
4. Soil moisture
5. Mowing regimes



# Nested SDMs

