Newsletter Nr. 3

A service to measure and improve biodiversity using satellite data for monitoring, evaluation and optimization of CAP greening initiatives

Horizon Europe Research and Innovation Programme

Grant agreement number: 101082634

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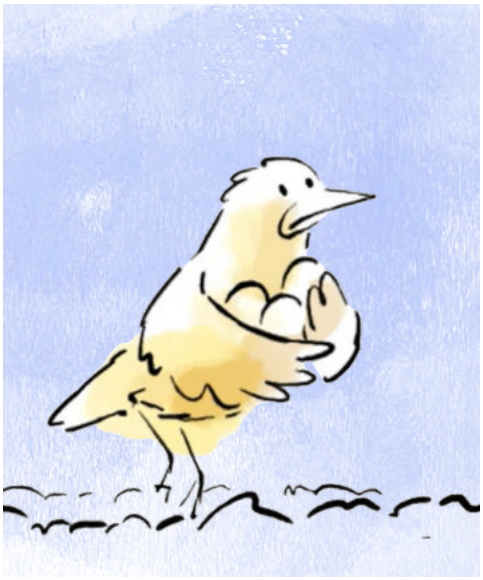


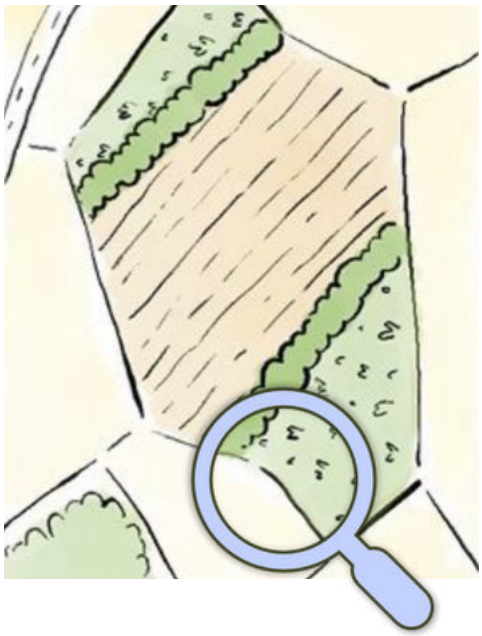
In our last newsletter, we introduced you to our target bird species and their preferences, especially when it comes to farmland habitats.

So how do we decide if a specific habitat is suitable for them?

Since we cannot ask them, we need to infer it from observations.

In the first part of the newsletter, we show you how we do this.

HABITAT HUNTING IN SOUTH TYROL



Researchers from the Institute of Earth Observation and the Institute for Alpine Environment at Eurac Research as well as from the Natural Museum of Bolzano are currently developing habitat models for South Tyrol to test the influence of the assumed habitat size on habitat suitability.

We show you first outcomes of their collaboration.

BIRDWATCH ON THE ROAD

Communicating about what we are doing is also an important aspect in the BirdWatch project.

Apart from the newsletter, we spread the word (or picture) at conferences, workshops or fairs, as we exemplify in this issue of our newsletter.

Please don't hesitate to get in touch! Contact details are at the end of the newsletter.

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HOW TO CHECK FOR SUITABLE HABITATS?

In our last newsletter, we stressed that in Bird-Watch, farmland bird habitat suitability is at the front and centre. We also described the preferences of our target bird species and what they need to be able to live their lives.

Since we cannot ask them if an area is suitable or not or what specifically it is that they do not like, we have to find this out by ourselves.

To do this, we use species distribution models (SDM). These allow to quantify habitat suitability with comparably simple data inputs. Input information for these models mainly consist of species occurrence data and geographic information describing the environment of the habitat, such as the types of landcover it has.

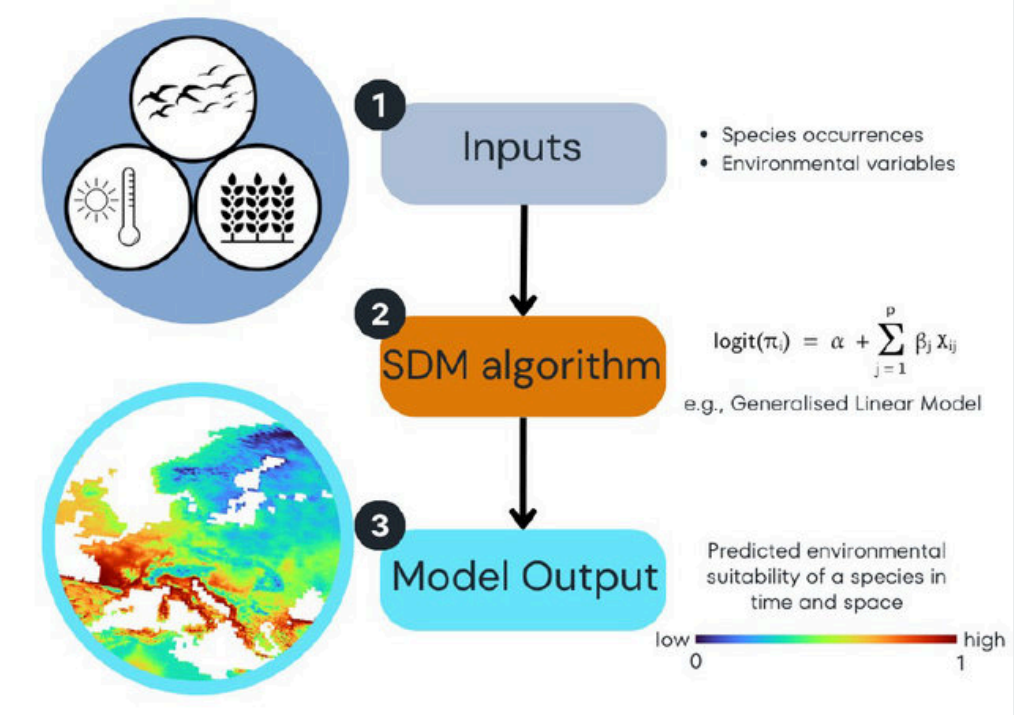

Figure 1: SDM concept. First, it has to be determined which environmental conditions a species experiences. Second, a species-environment relationship is identified using a model algorithm. Third, this relationship is used to predict habitat suitability. Based on the habitat suitability a species potential distribution can be determined

Figure 1 shows a simplified schematic how SDMs work.

SDMs are used to determine the environmental conditions that limit species distributions. It is important to consider that ecology is highly hierarchical and species distributions are limited by different environmental conditions at different spatial scales.

At large spatial scales, climate is the main driver of most species distributions, whereas at smaller spatial scales other factors, like land use and habitat availability are more important (Guisan & Thuiller, 2005).

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HOW TO CHECK FOR SUITABLE HABITATS?

In BirdWatch, one goal is to establish SDMs for different farmland bird species and assess how different land uses and land use intensities affect species distributions. We fit spatially coarse SDMs to climatic data and then use the resulting climatic suitability as a predictor within the spatially finer SDMs additional to predictor variables related to land use and land use intensity.

Figure 2 summarises this "nested" approach.

We use five different algorithms to fit SDMs: generalised linear models (GLM), generalised additive models (GAM), random forest (RF), boosted regression trees (BRT), and Maxent. GLMs and GAMs belong to regression-based methods. RF, BRTs and Maxent belong to non-parametric machine learning techniques.

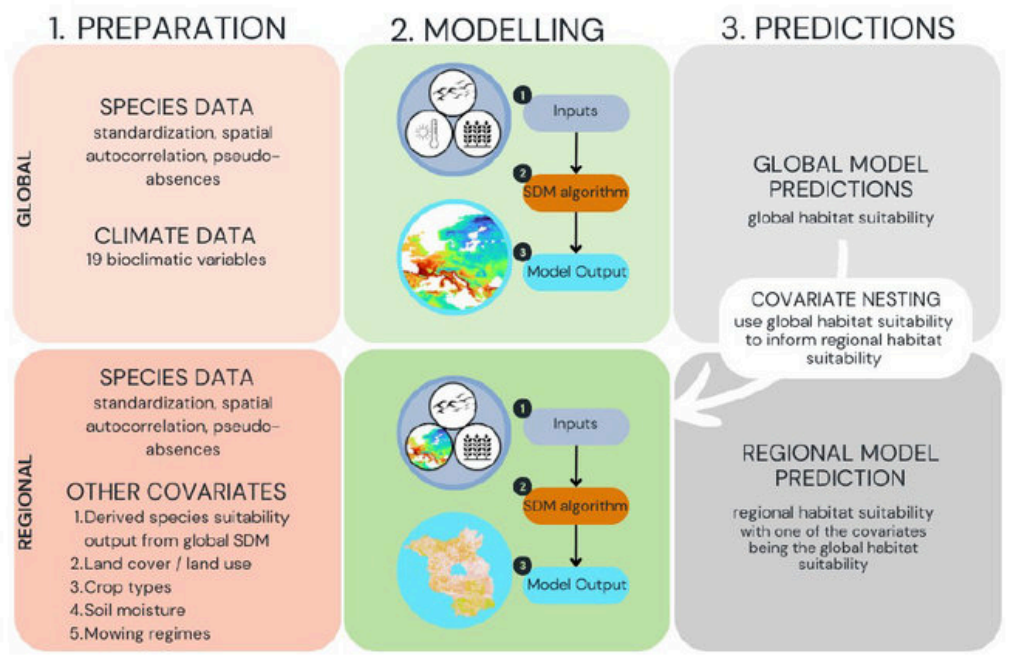

Figure 2: Nested SDM framework. The covariate nesting method is presented in which the habitat suitability output from a global SDM is used as one of the inputs for a regional SDM. The three panels at the top represent the workflow of the global SDMs, whereas the bottom three represent the workflow from the regional SDM. From left to right are the three main work steps: data preparation, model building and testing, and model predictions.

As with all modeling, a rigorous evaluation process is necessary. Once the models are ready, we will use five-fold cross-validation to evaluate model predictive performance.

Once all habitat models for our four test regions (Flanders, Germany, Lithuania, South Tyrol) are available, we will cross-predict the models to different test regions and validate the predictive performance against the occurrence data from those regions.

Fig. 3 is an example result of the SDM workflow, showing the habitat suitability for a region in eastern Germany.

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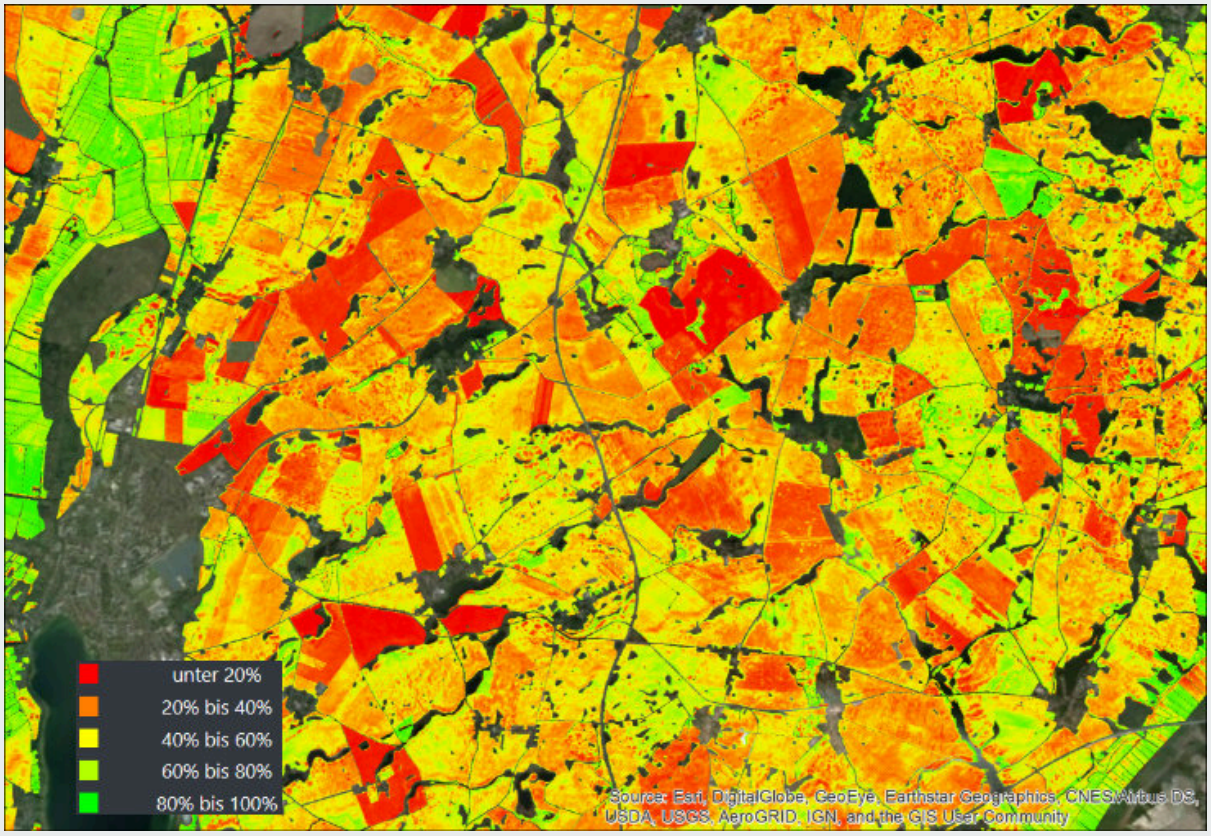

Figure 3: Example output of a habitat model, in this case for the German state of Brandenburg. The difference in habitat suitability of farmland parcels for a specific bird species are clearly visible and stem from the different properties (e.g., crop type, structural diversity) of the fields.

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HUNTING FOR HABITATS IN SOUTH TYROL

An aspect which was not yet addressed regarding SDMs is the **size of the area** for which the habitat suitability is calculated. The parameters which describe the habitats need to be arranged in a grid, with each grid cell representing a habitat.

Since we have ten different bird species and several different regions for which we are developing BirdWatch, we decided to calculate the habitat suitability for an average habitat size of **200 m by 200 m.**

This is a compromise between the natural variety of bird habitat sizes and our ability to calculate habitat suitability over large areas.

Thus, it needs to be explored how habitat suitability is affected by the assumed habitat size.

We decided that a meta-study is necessary to explore the impact of the underlying assumption regarding habitat size.

In a close collaboration with the Museum of Nature South Tyrol* and the Institute for Alpine Environment at Eurac Research**, rigorous habitat modelling was conducted, testing a spatial resolution of both **50 m** and **100 m.**

Both institutions contributed their ecological expertise and bird occurrence data.

The team, consisting of ornithologists and remote sensing scientists, developed habitat models for six bird species, thus allowing to calculate the habitat suitability distribution for each of the species within the whole territory of South Tyrol (Fig. 4a).

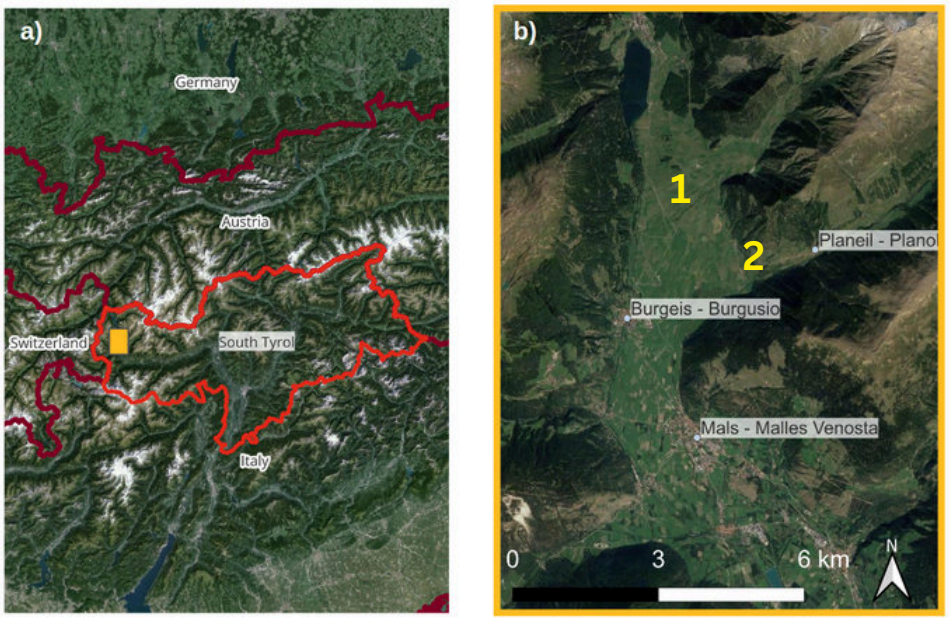

Figure 4: a) Location of the 1st sub-region within South Tyrol; b) **Vinschgau Valley**, 1st sub-region of the study, for which habitat suitability results are shown; Source: Jäger, L., Ceresa, F., Anderle, M., Sonnenschein, R., 2024: Habitat suitability maps for farmland bird species in South Tyrol, Italy. (Background: Google Satellite) *via direct communication*

*:Museum of Nature South Tyrol

**:Institute for Alpine Environment at Eurac

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HUNTING FOR HABITATS IN SOUTH TYROL

We first focus on the western part of South Tyrol (Fig. 4a), more specifically on the **Vinschgau Valley**. It includes the Mals Heath (German: Malser Haide), one of the largest ancient landslides in the Alps.

Nowadays the area is under agricultural cultivation and generally also a habitat for meadow birds.

Differences between the results for the six bird species are clearly visible. South Tyrol is a mountain region and therefore topography is an important factor determining habitat suitability. As an example, the **Eurasian Skylark** can be found in elevations up to 2700m above sea level, also in alpine grassland, while the **Eurasian Tree Sparrow** prefers to stay in lower elevations, usually up to 1800m absl.

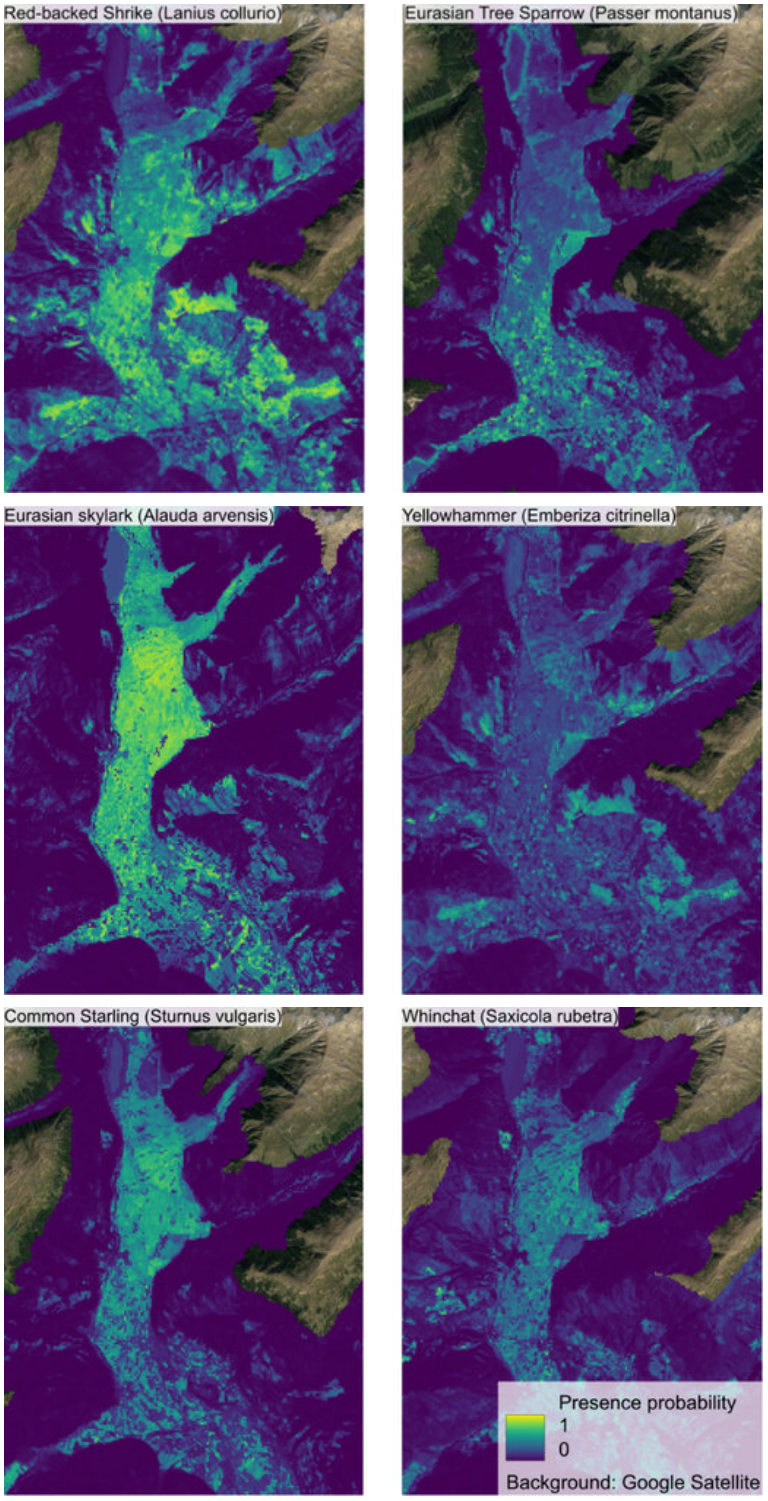

Figure 5:
Habitat suitability in the area of **Vinschgau Valley** calculated for six farmland bird species;

Source: Jäger, L., Ceresa, F., Anderle, M., Sonnenschein, R., 2024:
Habitat suitability maps for farmland bird species in South Tyrol, Italy. *via direct communication*

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Actually, most of the differences in habitat suitability between the species can be explained by each birds' ecology and the parameters which were included in the habitat modeling.

Features associated with certain types of land use can impact birds. For example, while the **Yellowhammer** and the **Red-backed Shrike** need hedges and other small-scale landscape features in an otherwise open area, other species, like the **Whinchat** or the **Skylark**, avoid exactly these features. Thus, it is the open meadows and grasslands which show a high probability for the occurrence of a Skylark (marked (1) in Fig. 4b), whereas transition zones with a mix of landscape features and open meadows increase the probability that the Yellowhammer will occur (marked (2) in Fig. 4b).

Similarly, grassland management has a strong influence on the modeled presence probability. In particular, the timing of the first mowing event is one of the most important variables for all species. This shows that our models are able to reflect that early mowing can destroy the nests of ground breeding species during their rearing time. It also proves the potential of satellite-derived information on land use management in modelling and analysing habitat suitability of different bird species.

The **second region** we will look at lies in the East of South Tyrol (Fig. 6), in the Valle di Tures.

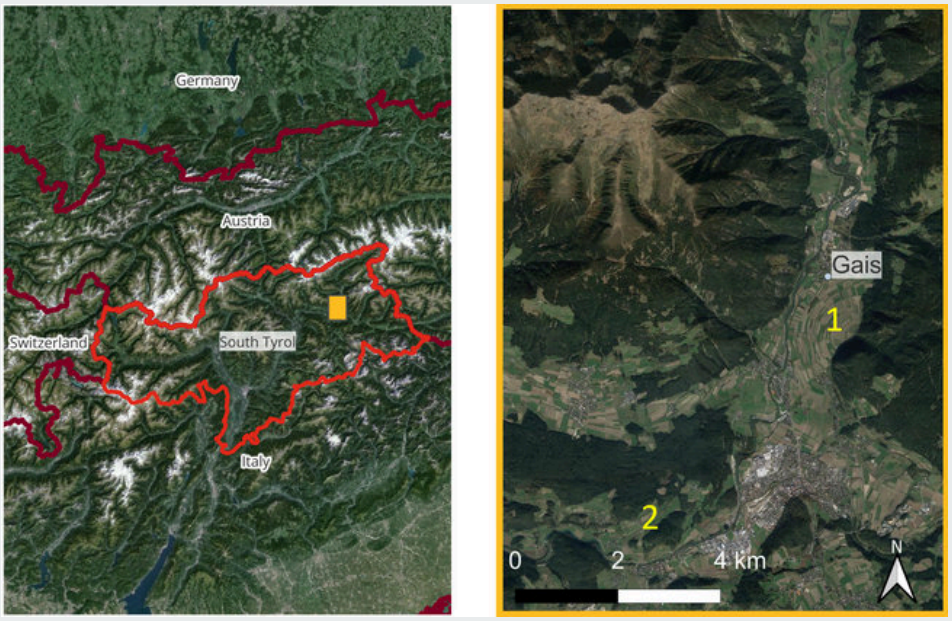

Figure 6: a) Location of the 2nd region within South Tyrol; b) **Valle di Tures**, 2nd sub-region of the study, for which habitat suitability results are shown; Source: Jäger, L., Ceresa, F., Anderle, M., Sonnenschein, R., 2024: Habitat suitability maps for farmland bird species in South Tyrol, Italy. (Background: Google Satellite) *via direct communication*

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In comparison this sub-region is less grassland dominated with a more heterogeneous landscape: forest patches, settlement area and cropland. Single farmland parcels can be clearly differentiated at the valley bottom (marked (1) Fig. 6b). The habitat suitability model response of the individual species also varies significantly. Again, for the **Red-backed Shrike**, suitable habitat is located near forest edges, in transition zones with landscape features – areas that are avoided by the **Skylark** (marked (2) Fig 6b). Striking is the absence of suitable **Whinchat** habitats in the whole region which overall agrees with the current state of the species in South Tyrol. In the past, the Whinchat could be observed in South Tyrol. Now, their population has severely declined over the past decades. Similarly, the modeled number of **Starling** habitats is also very low. This still needs to be investigated, since there is no obvious reason for this pattern.

Our predictions at **50m** resolution indicate differences almost on parcel level. Those small-scale differences would likely not be detectable in a prediction based on a grid size of **200m**. Modeling on a finer resolution allows us to get a more detailed understanding of the impact of land use management.

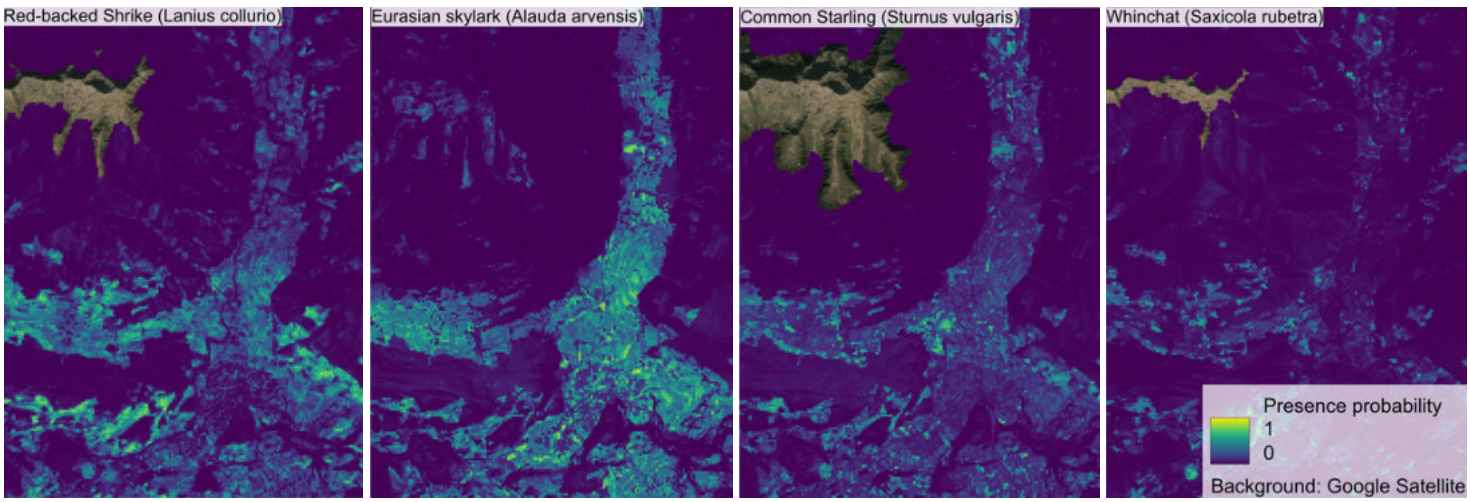

Figure 6: b) Habitat suitability in the area of **Valle di Tures** calculated for selected farmland bird species; Source: Jäger, L., Ceresa, F., Anderle, M., Sonnenschein, R., 2024: Habitat suitability maps for farmland bird species in South Tyrol, Italy. *via direct communication*

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BIRDWATCH ON THE ROAD

Once in a while we also go on the road to present BirdWatch and the idea behind it. We do this not only to advertise for BirdWatch but also to see how it can become part of a larger puzzle, assessing the impact of us humans on biodiversity and evaluating pathways towards the restoration and conservation of our ecosystems.

This spring, we attended several, quite different events, which focussed on a variety of topics, including the many use cases of Earth Observation via Copernicus data, new developments in biodiversity research and nature-based solutions and, of course, agriculture.

End of March, the **"National Forum for Remote Sensing and Copernicus"*** took place at the German Federal Ministry for Digital and Transport (BMDV).

The theme of this year's forum was to show how satellite data from the Copernicus Program is supporting research on climate change, the mitigation of and the adaptation to climate change or the monitoring of grassland, peatland and forests, to name only a few examples.

Of course, the discussions also included the discourse on how this data can be made actionable for decision-makers, something that is also being discussed in BirdWatch.

It became clear that the so-called "last mile" is an ongoing topic in the EO-services community. Working with satellite-derived indicators is still not where it could be, while the potential for policymakers is significant.

Figure 7: BirdWatch was presented in the poster session of this year's National Forum for Remote Sensing and Copernicus

*:National Forum for Remote Sensing and Copernicus

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A quite different event was the international agricultural exhibition **"Ką pasėsi"*** which took place in Kaunas, Lithuania, sponsored by the Ministry of Agriculture of the Republic of Lithuania.

It is the largest exhibition of innovation in the agro-sector in the Baltic States and thus attracts farmers and farmers organisations as well as policymakers who focus on agriculture.

Our partners from the National Paying Agency of Lithuania, the NPA, talked to policymakers and farmers and learned that the state of farmland birds is mostly considered to be good, a view not shared by the ecologists and ornithologists in Lithuania.

Thus, it became clear that BirdWatch could help raise awareness of how farmland birds are really faring.

Figure 8: BirdWatch was presented to farmers and policymakers at the largest agricultural fair in the Baltic States, *Ką pasėsi*; Source: NPA

*:Ka Pasesi

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At the conference on **"Empowering Biodiversity Research III"*** in Leiden, Netherlands, BirdWatch was honoured to get a spot among the keynote presentations.

EBRIII took place at the impressive Naturalis Biodiversity Centre, which is worth a visit in itself. Focus of this conference was to connect biodiversity research to policy-making, which included informing on biodiversity data standards and tools and the latest developments in Biodiversity Informatics.

Among the other keynote speakers was Frank Vassen from the European Commission DG-ENV, who reflected on the biodiversity research needs for EU nature policy and legislation.

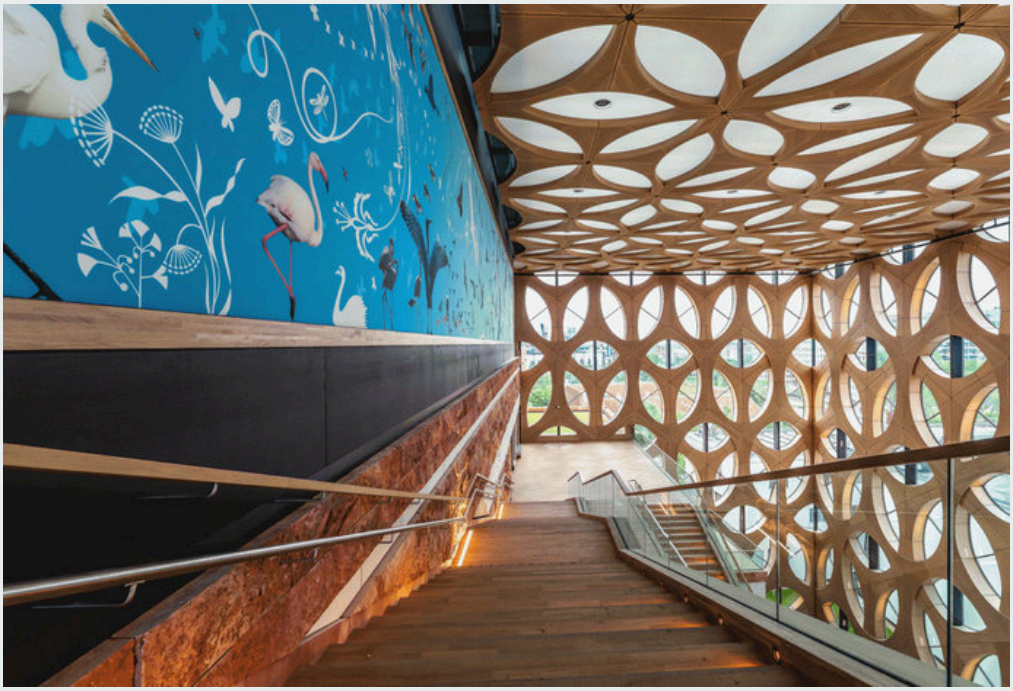

Figure 9: The Naturalis Biodiversity Center, where the EBRIII Conference took place. Definitely worth a visit!
Source: https://www.museum.nl/de/naturalis

Figure 10: BirdWatch was among the keynotes of the EBRIII conference!
Source: LUP

*:Empowering Biodiversity Research III

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BIRDWATCH ON THE ROAD

The EBRIII exemplified the many dimensions of biodiversity research and research needs, from country-scale monitoring down to genetic diversity and the importance of data and collaboration.

BirdWatch was also brought to the **European Geoscience Union** in Vienna, in a session on nature-based solutions*.

of ecosystem health, which is a prerequisite to any services or solutions further down the line. The premise of the talk was to support actions for the improvement of

Finally, our partners from the Lithuanian National Paying Agency presented BirdWatch at the **"Panta Rhei" conference of EU CAP paying agencies** and received very positive feedback.

This conference is organised biannually with the participation of the European Commission and the JRC and plays a crucial role in developing ways to make the CAP (Common Agricultural Policy) more effective and environmentally friendly.

Figure 10: Before we can expect nature-based solutions or ecosystem services, we need to ensure that our ecosystems are healthy.
Image source: Susanne Seidel, Rémy Schaepman

Figure 11: BirdWatch was presented at "Panta Rhei" conference of the EU CAP Paying agencies
Source: NPA

*:European Geoscience Union 2024

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LAST BUT DEFINITELY NOT LEAST

BirdWatch finally has its own short film.
Please check it out on our website and see what farmer Maurice is doing to help birds:
https://birdwatch-europe.org/

Farmer Maurice definitely loves birds!
Image source: *Susanne Seidel, Rémy Schaepman*

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Guisan, A., & Thuiller, W. (2005). Predicting species distribution: Offering more than simple habitat models. Ecology Letters, 8(9), 993–1009. https://doi.org/10.1111/j.1461-0248.2005.00792.x

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