Neobiota 2026
OneSTOP Posters



Highlights of the project’s work
on detection, prioritisation and
management of invasive alien species

Funded by the European Union

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Novel technology approaches to assess the spread of invasive plants and insects

Vehicle-mounted cameras (CamAlien) and automated moth traps (AMI) are already detecting invasive plants and insects at scale, with over 13,000 validated plant records published to GBIF.

Mark A.K. Gillespie[1,*], Toke T. Høye[1]
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[1] *University of Aarhus*

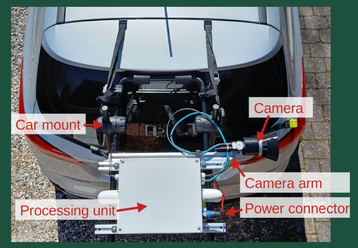
Introduction

The OneSTOP project and the Biodiversa+ IAS pilot both aim to pioneer innovative approaches to biosecurity for terrestrial invasive alien species using cutting-edge technology. They deploy camera systems and computer vision to detect target invasive plants, insects and vertebrates, developing and road-testing these approaches to enable rapid, continental-scale IAS detections.

The devices

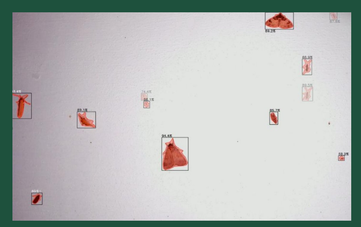
CamAlien is a vehicle-mounted camera system, recording high-resolution roadside images, which are processed using an advanced deep learning pipeline developed in collaboration with Pl@ntNet.





AMI (Automated Monitoring of Insects) is a camera system designed to capture images of night-active insects, particularly moths, with onboard tracking and classification capability.

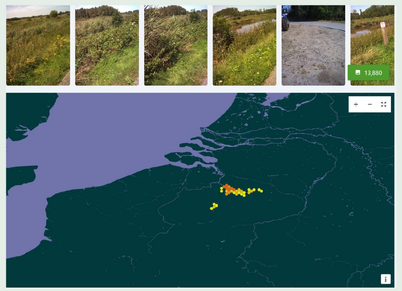




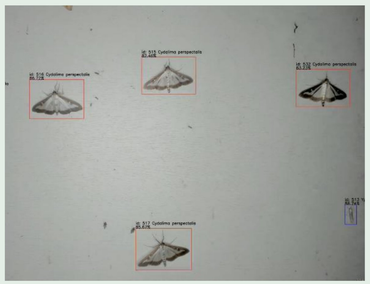
Initial results

Detections from the **CamAlien** system have gone through an expert validation process, leading to a publication of over 13,000 invasive plant species occurrences to GBIF (left).

Work is also underway to detect and classify vertebrate roadkill from images (right).



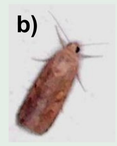


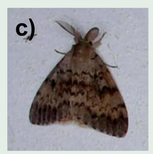


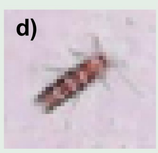
Detections from the **AMI** system have been deployed in botanical gardens in 14 countries across the two projects, and have detected numerous instances of the damaging Box Tree Moth (*Cydalima perspectalis*; left).

Also detected (right) were other IAS such as a) *Epiphyas postvittana*, b) *Spodoptera exigua*, c) *Lymantria dispar* and d) *Cameraria ohridella*.









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Bjerge, K., Nielsen, J. B., Sepstrup, M. V., Helsing-Nielsen, F. & Høye, T. T. (2021). An automated light trap to monitor moths (Lepidoptera) using computer vision-based tracking and deep learning. *Sensors* 21(2), 343. https://doi.org/10.3390/s21020343

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Engaging stakeholders in the detection and monitoring of alien species – the OneSTOP Living Lab network

Five OneSTOP Living Labs bring together more than 100 people from about 50 organisations to test detection technologies and shape how results are used locally.

Katharina Dehnen-Schmutz[1], Helen R. Bayliss[1], Alex Franklin[1] et al.

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[1] *Coventry University*

The Living Lab network

- Five Living Labs were established in 2025
- Involving more than 100 individuals
- Representing ca. 50 regional stakeholder organisations

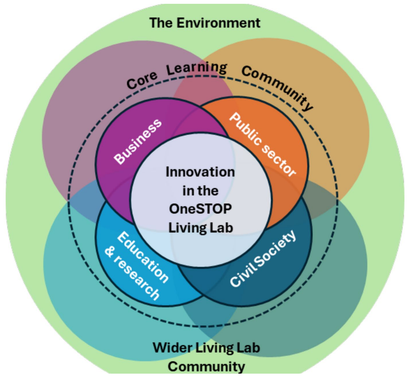


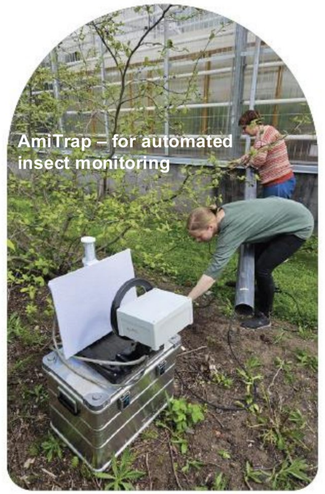
Fig 1: The quintuple helix innovation model used for the mapping of stakeholders actively engaged with the management and prevention of IAS within each Living Lab area, where the fifth helix of the diagram is the natural environment (after Carayannis and Campbell, 2010).



Living Lab activities

- Core groups meet 2–3 times a year.
- First steps: identification of key areas and species and further stakeholders to involve.
- Decide on areas for deployment of detection and monitoring technologies.
- Engagement with the public & citizen science (Sentinel Gardens).
- Interactions with OneSTOP research activities, e.g. how modelling works and how results can be used in local Living Lab contexts.

Ongoing Living Lab experimentation











Living Labs next steps

- Continue using the technologies and discuss results with Living Lab communities.
- Feedback loops: collecting and implementing feedback from Living Lab communities.
- Sentinel Gardens: Plant Alert and Flatworm Watch.
- Scenario workshops.
- Testing the OneSTOP Alert System.
- Developing a best practice handbook for Living Labs for invasive species management.

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Sentinel gardens for the early detection of invasive species using Shiny Apps

Gardeners can act as an early-warning network: the Plant Alert app lets people across Europe report invasive garden plants, with all records openly available in iNaturalist.

Katharina Dehnen-Schmutz[1], Helen R. Bayliss[1], Dave Hudson[2], Laura Abraham[3], Tim Adriaens[4] et al.

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[2] *University of Exeter*
[3] *Meise Botanic Garden*
[4] *Research Institute for Nature and Forest (INBO)*

Introduction

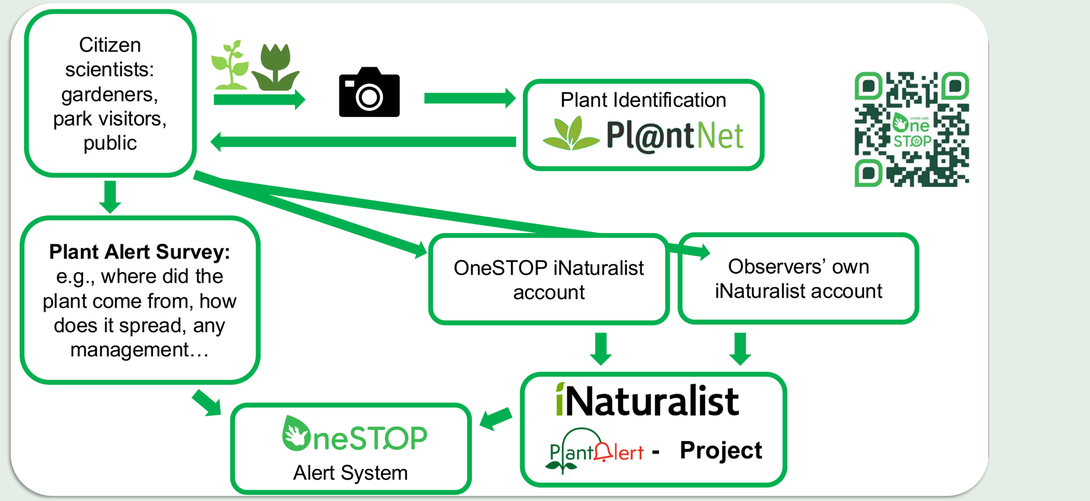
- Gardens are the point of introduction for most invasive plants, but also for several invertebrate species introduced through the plant trade.
- Gardens can be difficult to access for researchers.
- Gardeners are well aware of which species are spreading.

Approach

- Upscaling and streamlining existing national projects to European levels.
- Using existing citizen science platforms (iNaturalist, Pl@ntNet).
- Working with Living Lab communities in five European countries to identify priority invertebrate species (flatworms and slugs).



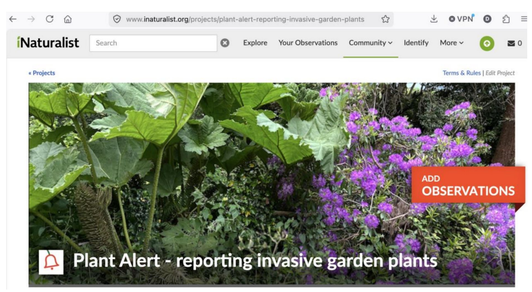
The Plant Alert Shiny App



Help us to use and promote the app

- The app works across Europe, currently available in English, Finnish, Dutch, French, Portuguese and Romanian, with more to come (Czech, German, Spanish).
- All records can be seen open access in iNaturalist.
- Similar app for flatworms to be launched soon.

bit.ly/Plant_Alert





Figures: Plant Alert project page on iNaturalist (left); Plant Alert records across Europe (right)

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Eradication is a marathon, not a sprint: a textual analysis of the structure and content of Large Language Model-generated invasive species management plans

Free LLMs produced plausible invasive species management plans, but their content varied between runs in ways that were sometimes contradictory – plans need independent checking against best practice before use.

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Introduction

Forms of generative AI such as large language models (LLMs) are increasingly being used to create content, reports and provide information across the environmental sector. However, concerns regarding the accuracy of information provided, hallucinations from the AI and the lack of transparency surrounding the materials used by LLMs have been raised. Here, we report on a textual analysis of invasive species management plans of real-world relevance generated using three commonly used, free-to-access LLMs to simulate real-world use by an environmental manager.

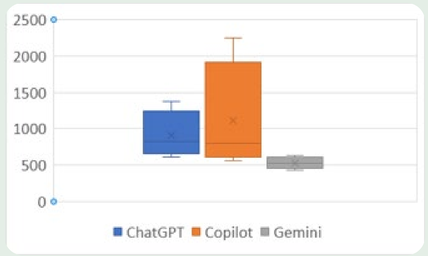


Fig 1: Word counts of management plans generated by three different LLMs (maximum, minimum, mean and median words)



Fig 2: Example word cloud showing top words used in sections of IAS management plans

Results

Over 100 management plans were generated across the three LLMs for the three species. Gemini consistently produced the shortest management plans. Copilot had the greatest variation in word count. Copilot had the highest mean number of words, yet ChatGPT had the highest median word count across all plans.

The main content across the three groups of management plans was similar, with some incorporating additional topics such as biosecurity or the legislative context. Some plans used repeated phrases, like “eradication is a marathon, not a sprint”, and some used militaristic language, for example “scorched earth approach”, “the killing phase” and “enemy territory”.

Management plans included deliberate variations introduced by the LLM. These affected the structure and content of the management plans, but also the detail regarding management and restoration activities, such as cut height and time to herbicide treatment, and removal or otherwise of chipped biomass for rhododendron.

Acknowledgements: Thank you for your interest! Thanks also to OneSTOP Living Lab partners and colleagues at CAWR for supporting this research. Image credits: Rhododendron: Eiffel, American mink: needsmoreritalin.

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Methods

1. Members of the UK’s OneSTOP Living Lab identified three invasive species of local interest (a plant, a vertebrate, and an invertebrate) and developed a prompt for a management plan for each.
2. Prompts were run multiple times simultaneously in three different large language models, OpenAI’s ChatGPT, Microsoft Copilot and Google Gemini, by colleagues at a workshop at CAWR, CU.
3. The resulting management plans were analysed for length, structure, content and consistency, and will be fed back to the Living Lab to evaluate.

Focal species and prompts

1. **Rhododendron *Rhododendron ponticum***: Provide a management plan to locally eradicate Rhododendron ponticum on a woodland site in the West Midlands, UK, or prevent encroachment into a neighbouring conservation area, providing multiple realistic options
2. **Demon shrimp *Dikerogammarus haemobaphes***: Provide a summary of effective eradication methods and their associated costs for Demon shrimp Dikerogammarus haemobaphes suitable for a water course in the West Midlands, UK
3. **American mink *Neogale vison***: Provide a full, spatially explicit management plan for the eradication of American mink Neogale vison from watercourses across the Coventry and Warwickshire region, UK

Conclusions

- Small variations deliberately introduced into the content by the LLMs provided different, and sometimes contradictory, instructions, and therefore may impact on the success of management or restoration activities undertaken.
- LLMs could help contribute to the development of local management plans for IAS but content should be independently verified and ideally checked against best practice (where this exists) before any management activities are undertaken.
- Living Labs can provide a useful environment for developing research questions of relevance to the real world, and in particular to the local context.

Accelerating EICAT Assessments Using AI & Evaluating Inter-Annotator-LLM Agreement

An LLM agent classified EICAT impacts with F1 0.71 against GISD records, but human annotators also disagreed substantially – LLM extraction should feed a human-in-the-loop decision.

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[2] *Stellenbosch University*

Introduction

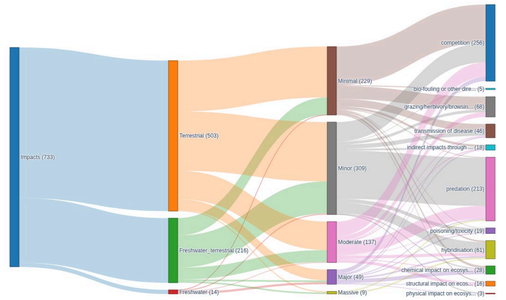
EICAT (Environmental Impact Classification for Alien Taxa) is the IUCN's standard for classifying how alien species affect native biodiversity. Each impact is identified by mechanism (competition, predation, hybridisation…) and severity, from Minimal Concern to Massive. Producing an assessment means a person reading the available literature for a species, finding passages that describe an impact, determining the mechanism and category, work that can be slow in a literature review of hundreds of potential papers. We test whether a large language model, given the EICAT guidelines and a paper's text, can perform the same extraction and classification.

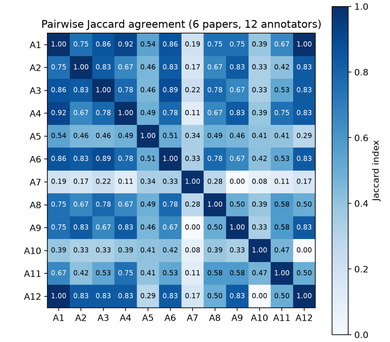
Objectives

- Develop an end-to-end system (PDF upload, document conversion, and an LLM agent) that extracts impact evidence from ecological literature and classifies it against EICAT categories and mechanisms via a schema-constrained agent, not free-text prompting.
- Benchmark the pipeline's precision, recall, and F1 against impact records drawn from the Global Invasive Species Database (GISD), using a stratified sample that reflects the real distribution of systems, categories, and mechanisms.
- Measure how consistently human annotators agree with each other on the same evidence, so LLM performance is judged against human variability rather than an assumed-perfect single gold label.

Methods

The extraction agent is a schema-constrained Pydantic AI agent (Claude 3.7 Sonnet, AWS Bedrock) whose output is a typed list of impacts; EICAT category and mechanism enums are encoded directly in the schema and system prompt, so outputs are structurally constrained to valid EICAT values rather than merely prompted. The pipeline converts each paper from PDF to TEI XML (GROBID) to Markdown before extraction. For the inter-annotator agreement (IAA) study, we pooled evidence quotes from 12 annotators across 6 papers, clustered them into distinct impacts with an LLM judge (where evidence quotes were not verbatim), and scored pairwise Jaccard overlap and Krippendorff's alpha. We also compared each paper's maximum EICAT category directly across annotators.





Figures: GISD EICAT impact distribution (Sankey), Pairwise Jaccard agreement between annotators.

Results

Piloting against gold-standard GISD data gave F1 0.71 (precision 0.87, recall 0.62): early evidence the agent finds real impacts and classifies most correctly, not just plausible-looking output. Across 12 annotators and 6 papers, pairwise Jaccard on impact presence averaged 0.54 but Krippendorff's alpha was only 0.34 (Fair) once chance agreement is corrected for, and no paper had unanimous agreement on its maximum EICAT category (alpha 0.54, Moderate; mean spread 1.7 category steps where annotators disagreed). Human annotators disagree with each other substantially on this task. This motivates the need for human-in-the-loop to make a final decision based on what is extracted by an LLM.

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Spatio-temporal impact prioritization of IAS on European threatened species

Coupling IUCN Red List threat coding with distribution maps (the CIMPAL-RL index) will map current and future impacts of invasive species on Europe's threatened species, to guide spatial prioritization.

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[3] *Instituto Politécnico de Viana do Castelo, Portugal*
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[5] *University of Lisbon, Portugal*
[6] *Associate Laboratory TERRA, Portugal*

Introduction

Reducing the impacts of invasive alien species (IAS) is a global priority, as recognized by the Global Biodiversity Framework and the EU Biodiversity Strategy. **A priority of the EU Biodiversity Strategy is to reduce by 50% the number of IUCN Red List native species threatened by IAS by 2030**. To achieve and track progress towards this goal, we need to understand the current and future distributions of both the native threatened species and the invasive aliens negatively impacting them.

Objectives

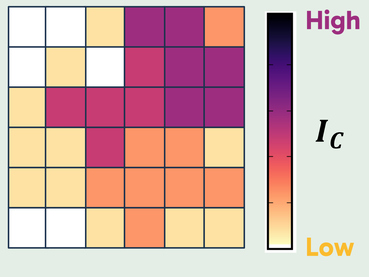
- Inform on **spatial prioritization** towards achieving the EU Biodiversity Strategy target on invasive alien species impacts
- Develop a **semi-automated workflow** using FAIR principles and ensure adaptability and repeatability
- **Leverage IUCN Red List data** to translate assessment information into quantitative outputs

The CIMPAL-Red List (RL) Index (adapted from Katsanevakis *et al.* 2016)

WORK IN PROGRESS

$$I_c = \sum_{i=1}^{n}\sum_{j=1}^{m} A_i * N_j * w_{i,j}$$

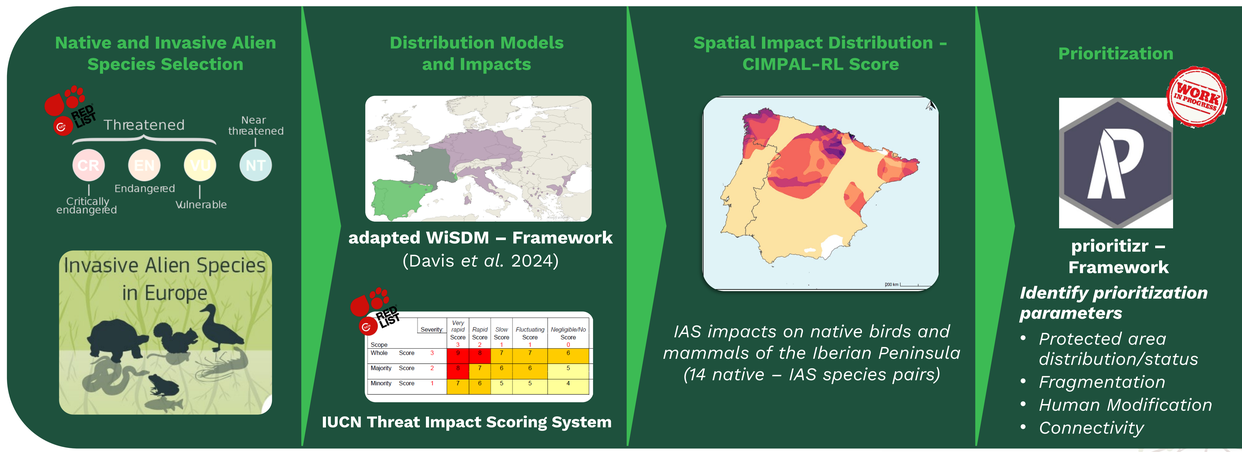
I_c = ***Cumulative impact score***
A_i = *State of IAS i in cell (pres/abs)*
N_j = *State of the IUCN RL species j in the cell (pres/abs)*
w_{ij} = *Impact weight for IAS i and IUCN RL species j*



Prioritization Workflow

Leveraging IUCN Red List threat coding, we outline a pathway to **translate threat assessment information into quantitative inputs** such as IAS-specific pressure layers. Coupling these data with maps of potential distribution will enable **spatially explicit assessments of current and future IAS impacts on native threatened species**. These impact maps will underpin **spatio-temporal prioritization informing**

- **prevention and management** (e.g., areas of high cumulative IAS pressure)
- and **conservation** (e.g., candidate refugia to support native species in-situ conservation).



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Katsanevakis, S., Tempera, F. and Teixeira, H. (2016), Mapping the impact of alien species on marine ecosystems: the Mediterranean Sea case study. Diversity Distrib., 22: 694-707. https://doi.org/10.1111/ddi.12429

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Can internet platform activity data systematically accelerate detection of alien species invasions across the EU?

Online platform activity reflects real-world invasions only weakly (true positive rate ≈ 40 %), giving it limited potential for systematic, automated early detection across the EU.

Simon Reynaert[1]
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[1] *Meise Botanic Garden*

Introduction

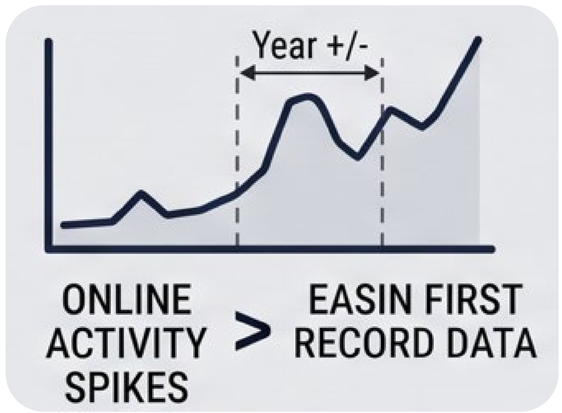
- Case studies → potential for IAS detection from online data
- **Systematic evaluation** of automated online monitoring

Data mining

- Online pageviews, images, videos, mentions
- 88 species of Union concern between 2016 and 2025
- Custom **software package** using APIs

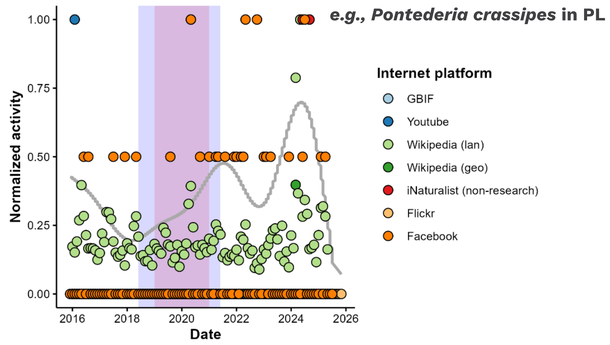
Analysis

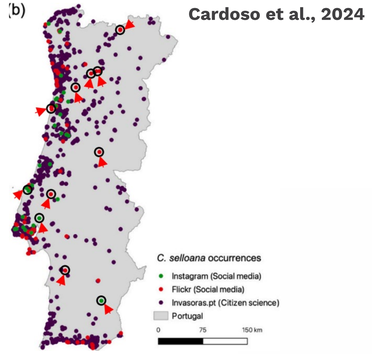
- **EASIN** and **GBIF** occurrence data as 'ground truth'
- Online activity ~ GBIF occurrences?
- Activity spikes ~ invasion window?
- Sensitivity analysis using GAM



Results

- Limited and variable reflection of real-world occurrences: Wikipedia >> Flickr
- Bias: active, charismatic and visible organisms more popular (Mammals > Plants)
- Poor sensitivity to invasions: **TPR ≈ 40 %**





Conclusions

- Variable **data quality** (AI content, lack of geolocation, bias)
- **Limited sensitivity** towards detection of first records
- **Eroding researcher access** to online data
- **GDPR** prevents large-scale data collection without user consent outside of specific contexts

→ **Limited potential** for systematic upscaling with automated monitoring and data publication pipelines.

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