

Species Distribution Models (SDMs)

SDMs combine observations of species and environmental information to estimate where environmental conditions may be suitable for a species and how suitability could change across space and time or under future environmental scenarios. They deliver science-based insights to better prevent, detect and manage invasive alien species—today and for the future.

1

OBSERVATION DATA



GBIF

Global Biodiversity Information Facility records



Research surveys

Field observations from scientific studies



Citizen science

Platforms such as iNaturalist

2

ENVIRONMENTAL DATA



Climate

Temperature and precipitation layers



Land cover

Habitat and vegetation classes



Topography

Elevation and terrain shape

3

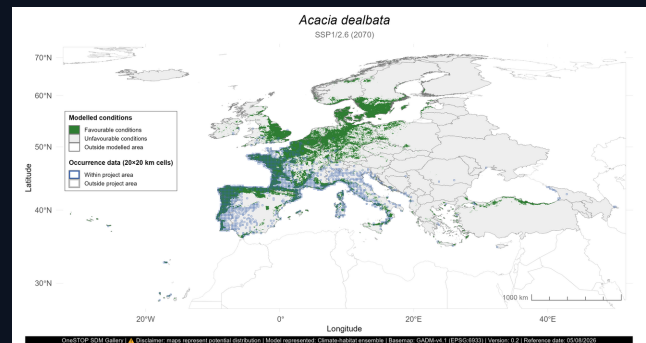
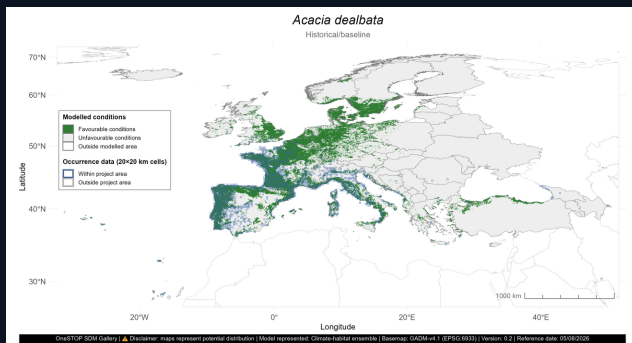
MODELLING

The models use machine learning or statistical algorithms to explore species-environment relationships.



4

OUTPUT



HOW SDMs SUPPORT INVASIVE ALIEN SPECIES (IAS) MANAGEMENT



Identify areas at risk

Highlight areas suitable for IAS establishment



Monitor expansion

Track changes in suitable habitat through time



Prioritise surveillance

Focus resources on high-risk pathways and areas



Assess drivers

Understand factors influencing invasion risk



Evaluate scenarios

Explore climate and land-use change impacts



Inform early warning

Enable proactive, rapid response decisions

Prioritisation framework for Invasive Alien Species (IAS)



Deciding which IAS to tackle first is difficult. The framework gives a transparent, repeatable answer that accommodates different users' needs.



A researcher, a municipality, a public health agency and a protected area authority are not asking the same question — the framework is organised into profiles, each with its own assessment dimensions.

GENERAL RESEARCH

Broad spatial scales, for research and reporting

- Impact
- Management cost/effort
- Invasiveness traits
- Drivers/pathways
- Geographical spread
- Detectability

MANAGEMENT

National to local scales, for on-the-ground control and eradication

- Feasibility of control
- Urgency
- Management cost/effort
- Effectiveness of options
- Stakeholder acceptance
- Operational constraints

IMPACTS

Ecological, social, health and economic effects

- Ecological integrity
- Socio-cultural values
- Public health
- Food security
- Environmental regulation and climate
- Economic infrastructure

IUCN RED LIST

Focus on conservation of threatened species and protected areas

- Threatened species distributions
- Protected areas
- Threatening IAS
- Spatial overlap

IMPLEMENTED IN THE INVADERS TOOLBOX

A browser-based application requiring no installation or programming skills
User-adjustable weightings, to reflect different national or regional priorities
Confidence intervals, so results are reported as intervals not single figures
Transparent and repeatable, an auditable process from data to decisions

1

ASSESS SPECIES

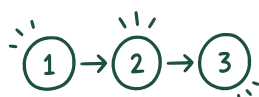
Score species across the selected dimensions



2

SNAPSHOTS OVER TIME

Record assessments at successive points in time



3

TRACK CHANGE

See how priorities evolve and what is driving change



4

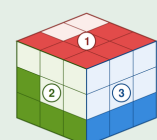
PRIORITISE

Get ranked species lists with confidence intervals

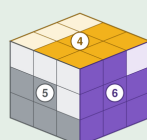


KEY BENEFITS

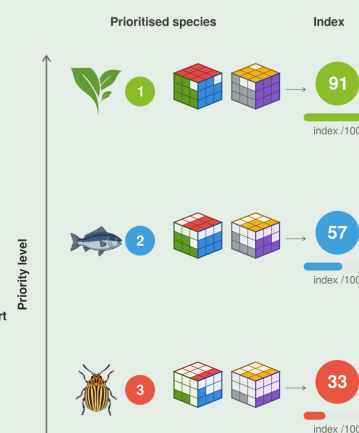
- Integrates multiple perspectives in one coherent framework
- Supports evidence-based and efficient allocation of resources
- Adapts to different users, scales and priorities
- Tracks change over time and improves learning
- Open, transparent and designed for collaboration



- Front faces
- 1. Impact
 - 2. Invasiveness traits
 - 3. Geographical spread



- Reverse faces
- 4. Management cost/effort
 - 5. Drivers/pathways
 - 6. Detectability





Horizon scanning is an important tool to (i) assess the risk of invasive species entering new areas and (ii) allow development of effective species monitoring and management strategies.

WORKFLOW: FROM OPEN DATA TO HORIZON SCANNING LISTS

1 DATA SOURCES

Open source & global datasets



Invasion status

SInAS
(invasive/non-invasive)



Species interactions

GloBI
(who interacts with whom)



Presence/absence of interactors & taxonomy

GBIF



Climate niche

Open-Meteo
(current & future climate)



Trade flows

BACI
(bilateral trade between countries)

2 FEATURE ENGINEERING

Country & species characteristics



Species traits & interactions



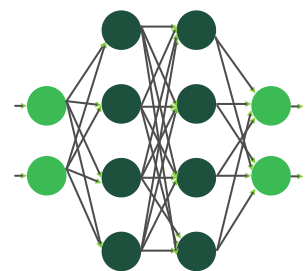
Climate suitability in recipient country



Trade exposure between source and recipient



Country characteristics (e.g. area, GDP, biodiversity)



Neural network

Trained on known invasions to learn patterns of invasion risk

Model performance evaluated & validated

4 OUTPUT

For any given country
Ranked list of species
by predicted
likelihood of invasion

1



2



3



New data & outcomes feed back to continuously improve the model

WHY THIS MATTERS: ACCELERATING AND INFORMING INVASION PREPAREDNESS

FASTER HORIZON
SCANNING

FOCUS RESOURCES ON
SPECIES WITH HIGHEST
PREDICTED INVASION RISK

UNDERSTAND DRIVERS OF
INVASION RISK

SUPPORT RISK-BASED
DECISION-MAKING

IMPROVE EARLY DETECTION
AND PREVENTION OF
FUTURE INVASIONS

Our data-driven horizon scanning tool delivers rapid, transparent and actionable insights to help protect ecosystems, economies and communities from future invasive species threats.

Prioritisation maps for Red List species protection


EU BIODIVERSITY STRATEGY FOR 2030

Reduce by 50% the number of IUCN Red List species threatened by Invasive Alien Species (IAS) by 2030

INTEGRATED WORKFLOW: FROM DATA TO SUITABILITY MAPS

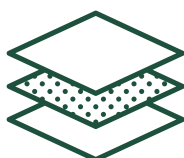
1

COLLECT & INTEGRATE DATA


2

MODEL SPECIES

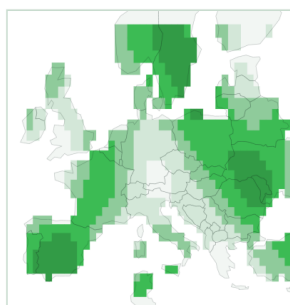
One reproducible workflow for every native and invasive species in the list.



Scripted, transparent and repeatable

3

SUITABILITY



low → high suitability

FUTURE SCENARIOS



Climate change



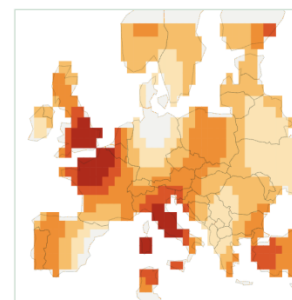
Land-use change

4

IAS IMPACTS

IAS suitability + Threat level (Red List)

Overlaid across Europe



low → high impact

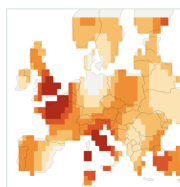
Spatial impact of IAS on threatened native species.

FROM IMPACTS TO PRIORITISATION MAPS

COUNTRY-SPECIFIC FACTORS

- Native species endemism
- Species' distributions
- Protection status of the protected-area network
- Other context layers

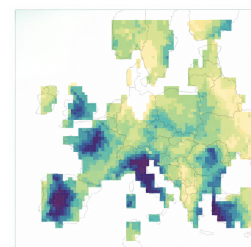
IAS IMPACTS



CONTEXT LAYERS



PRIORITISATION MAP



KEY BENEFITS

- Evidence-based and transparent
- Spatially explicit and actionable
- Accounts for future environmental change
- Supports coordinated action across Europe

By integrating Red List data, threat information and advanced modelling, we deliver prioritisation maps that help reduce the impact of Invasive Alien Species and protect Europe's most threatened biodiversity.

Species Distribution Modelling under Environmental Change Scenarios

WHY IT MATTERS

As new alien species emerge and ecological data continue to accumulate, predictions must be updated rapidly to ensure that management actions keep pace with changing invasion risks and are guided by the best available evidence.

NEW SPECIES AND MORE DATA

Emerging IAS and growing open ecological data



UPDATE PREDICTIONS RAPIDLY

Keep predictions current as conditions change



GUIDE MANAGEMENT ACTIONS

Use the best available evidence to reduce invasion risks



REPRODUCIBLE WORKFLOWS

Minimise bias and artefacts and lower technical barriers for practitioners



HOW ONESDM WORKS

OneSDM is an R package that makes Invasive Alien Species (IAS) distribution modelling faster, simpler and more accessible.

GET DATA

Automatically retrieve input data from trusted open sources (e.g., GBIF, EASIN)



VALIDATE & INTEGRATE

Check data quality and integrate occurrence and environmental data



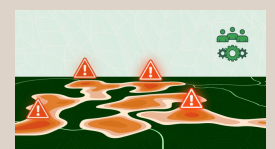
MODEL

Generate scientifically robust species distribution models



PREDICT

Produce spatial predictions of potential IAS distributions across Europe



Full control to adapt the analytical workflow to your research questions and needs.

WHY ONESDM MAKES A DIFFERENCE

BRIDGES SCIENCE AND PRACTICE

Transforms scientific advances into actionable insights for decision-makers

SUPPORTS BIOSECURITY PLANNING

Helps anticipate invasion risks and prioritise surveillance and actions

ACCESSIBLE TO A BROAD RANGE OF USERS

Designed for researchers, managers and practitioners with different skill levels

OPEN DATA, OPEN SCIENCE

Fosters transparency, reproducibility and collaboration

BETTER DECISIONS, LESS RISK

Informs timely and evidence-based decisions to manage biological invasions

By automating data preparation and modelling, OneSDM empowers users to produce reliable predictions quickly—supporting the management of IAS today and in a changing future.