

Biotope vulnerability and impact of NIS species

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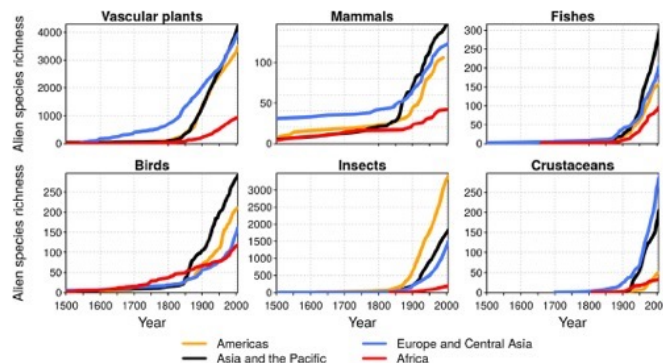
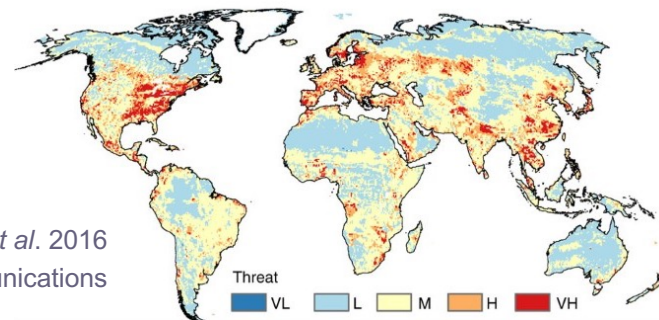
Why a biotope vulnerability workflow?

Invasive Alien Species
ranked 5th
among direct drivers of change
in nature with the largest
relative global impacts

Bondrizio *et al.* 2019 IPBES Global
Assessment Report on Biodiversity and
Ecosystem Services

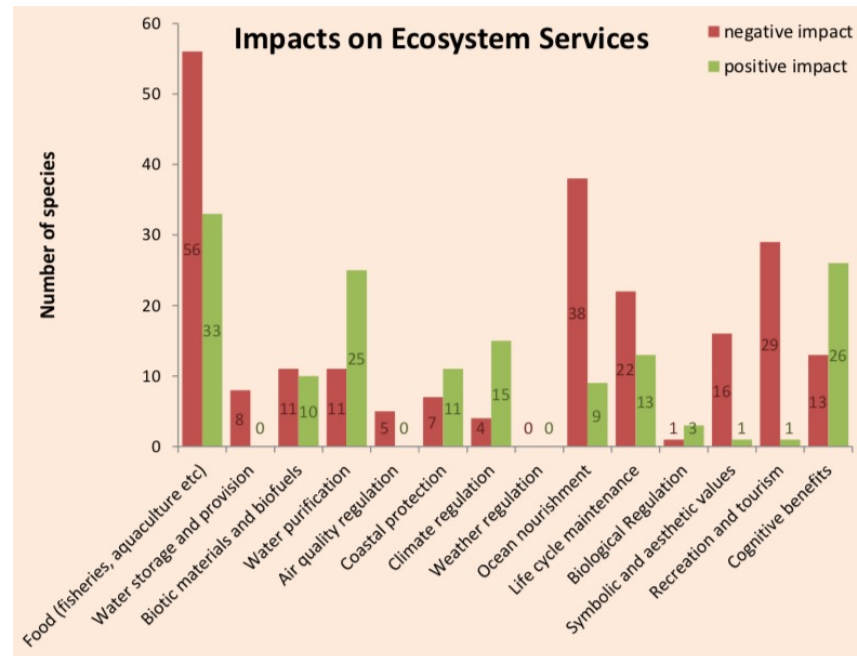
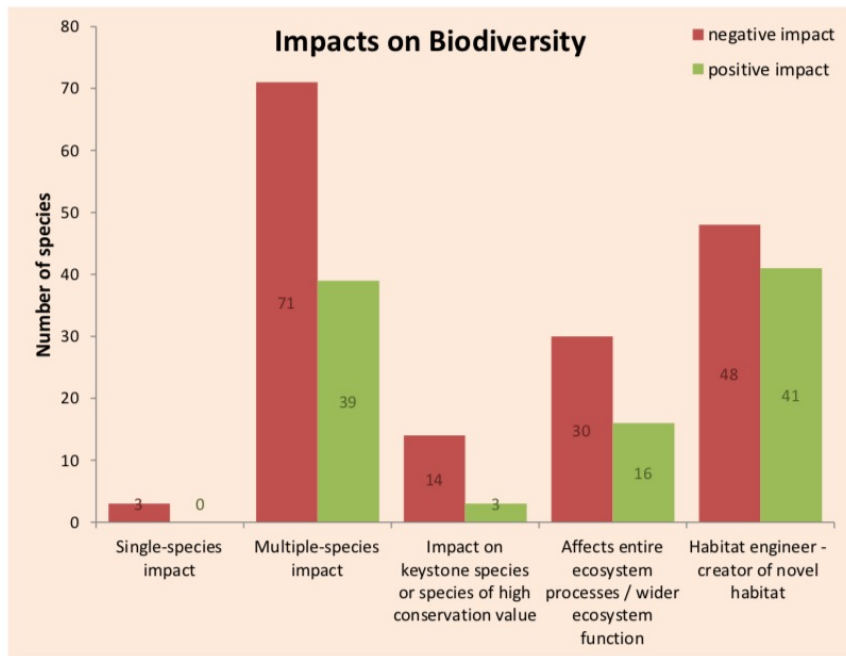
Biological invasions
Environmental & Societal Challenges

Early *et al.* 2016
Nature Communications



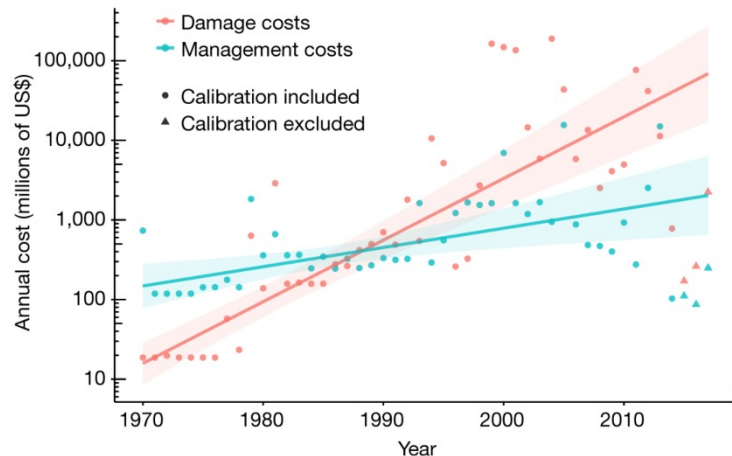
Pyšek *et al.* 2020
Biological Reviews
Seebens *et al.* 2017
Nature Communications

Environmental impacts



Economic impacts

Temporal trends of global damage and management costs
(in millions of US dollars)



economic losses due to direct and/or indirect impacts of invaders, such as yield loss, illness, land alteration, infrastructure damage or income reduction

economic resources allocated to actions to avoid the invasion or to deal with more or less established invaders such as prevention, control, research, long-term management or eradication

InvaCost

a public database of the economic costs of biological invasions worldwide

Diagne *et al.* 2020 Scientific Data

Policy & Regulatory context

National <
Regional Seas <
European Seas <
All European Ecosystems <
Global

and other sectoral requirements...



... **at levels** that do not adversely alter the ecosystems

... prevent **adverse alterations** of the ecosystem by minimising, to the extent possible, new introductions

... **Reduce and manage** human mediated species **introductions**

... **Impacts** of non-indigenous **invasive species** at the level of **species, habitats and ecosystem**

... **current** and potential **range** of IAS, having regard [...] (e) a description of **adverse impact of the species on biodiversity**

... IAS and **pathways** are identified and **prioritized**, **priority species** are controlled or [...] to **manage pathways** to prevent their introduction ... (e.g.

Trends in **extent**, condition and **vulnerability** of ecosystems, biomes and **habitats**)

NIS research needs spatio-temporal context

The impact of non native species depends on:

where it is observed:

Impact is not always negative

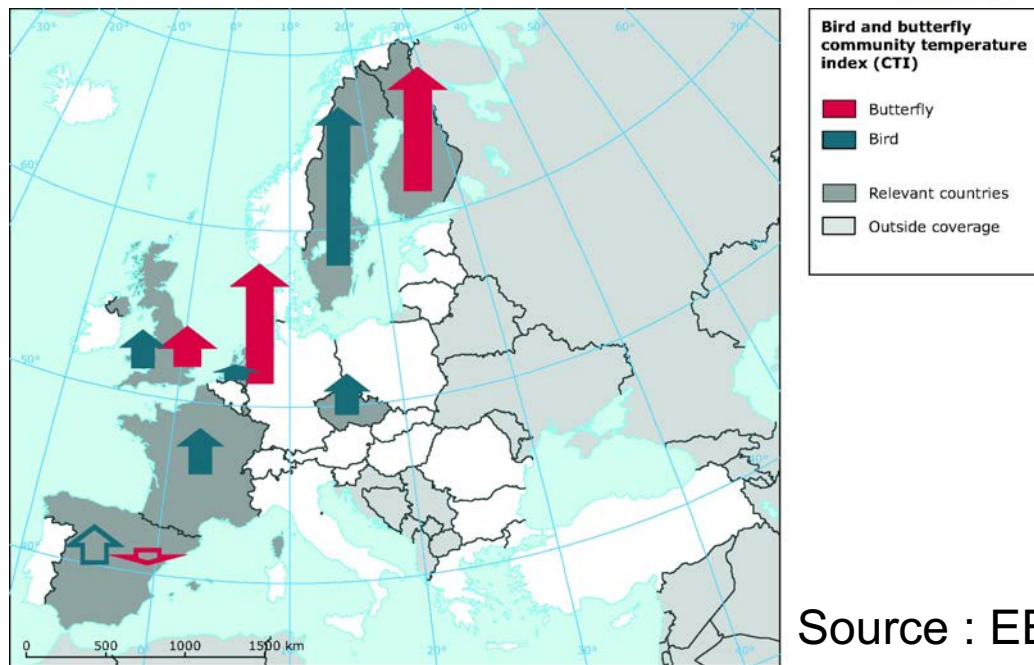
Ecosystem resilience

when it is observed:

Adaptation to climate change

Trends are important

Punctual events



Source : EEA

Pre-implementation Workflow Analysis Phase

- **Schematic Representation** of the Workflow
- **Collection** of Input & Output Examples for each Step
- Collection of Existing Software
- **Analysis** of Software and Datasets
- **Categorization** of Software and Dataset Types
- **Multiple Meetings** with the Scientific Experts

Biotope Step Label	Naming	Description	TRL	Type	Input	Input Type
GBIF extractor	Biotope GBIF Extractor	Harvests species occurrences from GBIF	4	Web Service	GBIFparams.json	json
Dataset Uploader	Occurrences Dataset Uploader	Enables dataset uploading from the user	2	Web Service	Species_occ_biotope.csv	CSV
Syntax Normalizer	Occurrences Syntax Normalizer	Normalizes the user datasets to be consistent with the accepted formats	2	Web Service	Alien_taxa_list.csv	CSV
Taxonomic Checker	Biotope WoRMS Taxonomic Checker	Check the validity of input	2	Web Service	Species_occ_biotope_normalized.csv	CSV
Geo-Checker					Alien_taxa_list_normalized.csv	CSV
DataCube Builder	Occurrences	Web Service		CSV		CSV
Ecoregion Tabulator		Native App.		XLSL		CSV
DataCube Analyst	Occurrences	Human Interaction		TSV		CSV
				json		CSV
				XML		CSV
				RDF		CSV
				FASTA		CSV
				FASTQ		CSV
				DwC		CSV
				JPG		CSV
				TIFF		CSV
				SHP		CSV
				ZIP		CSV
				URL		CSV
				GRD		CSV
				DB		CSV
				TXT		CSV
				Parameters		+

Workflows Reconciliation and Metadata Harmonization

- **Standardization** of Schematic Representation
- **Identification** of Similarities Across Workflows
- **Metadata Harmonization** across workflows & Integration with **Metadata Catalogue**
(<https://metadatalogue.lifewatch.eu/>)
- **Reduction** of Implementation **Redundancies**

```
"title": "Vulnerability Workflow - Risk assessment"
"abstract": "Assessing ecosystem and habitat type"
"containsServices_workflow":
  "WoRMS taxon match webservices"
```

Component ID	Label	Description	Input Type	Output Type	Merged
LW.1	CSV Content Selector	Selects specific Columns/Rows from CSV / TSV	CSV / TSV	CSV / TSV	ARMS-2.0.c1 ARMS-3.0.c1 MGN-1.5.c1 MGN-3.0.c1 Crust-4.0.c1
LW.2	Taxonomic Checker	Checks the taxon validity of input using worms	CSV	CSV	ARMS-8.0.c1 Bio-2.0.c1 Crust-1.0.c1

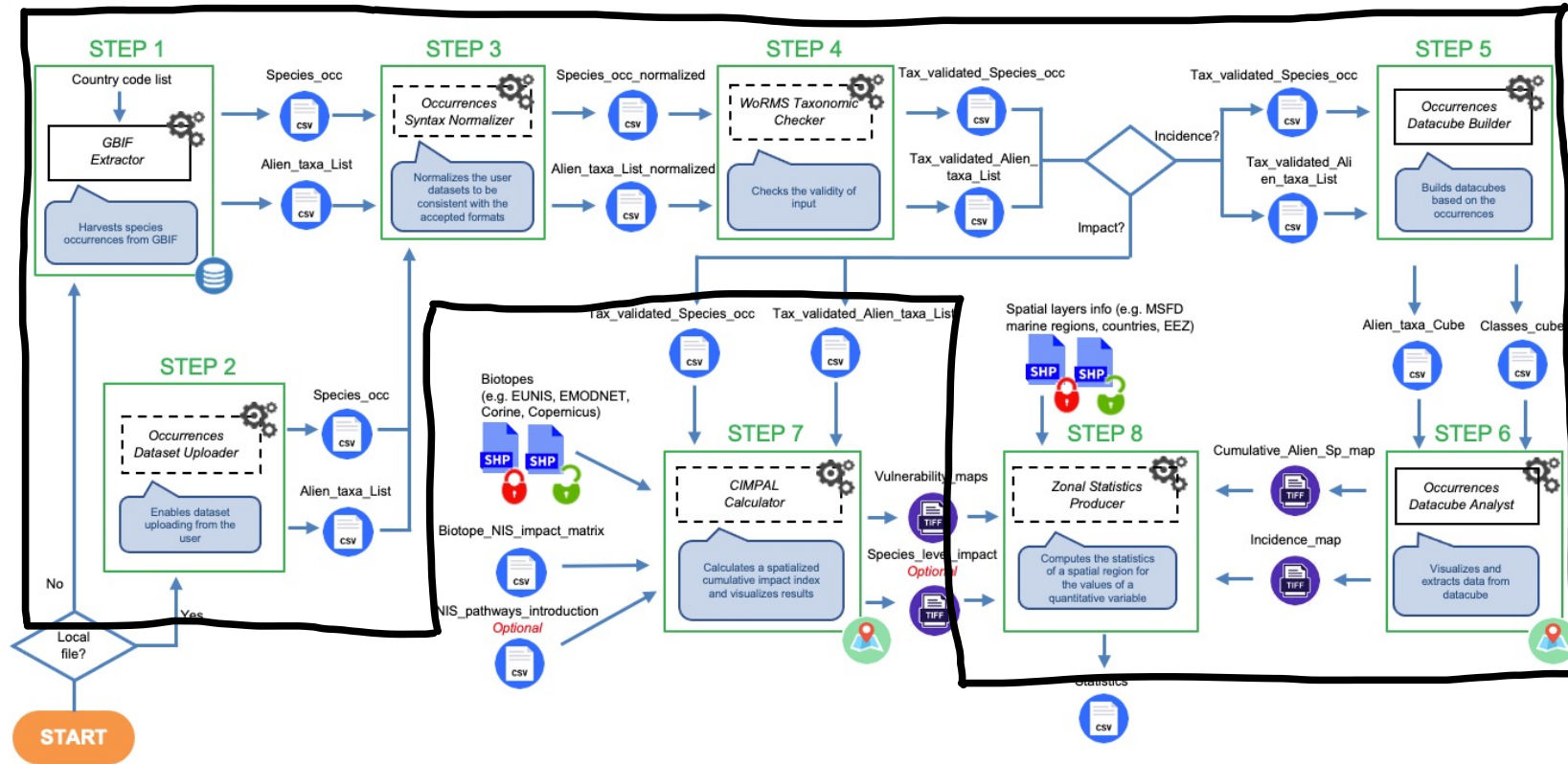
Metagenomics					Allanthur				
Step	C ID	Component	Input	Ouput	Step	C ID	Component	Input	Ouput
1.1	MGN.1.1.c1	Correct Errors	Sample_metadataA.tsv fastq.gz Reference db	Sample_metadataC.tsv fastqC.gz	1	ALIAN.1.0.c1	FAO Labeler	Training_multiclass_FAO.csv	Training_multiclass_1-12.csv Lookup_FAO_1-12.csv
1.2	MGN.1.2.c1	Pairwise Alignment	Sample_metadataA.tsv fastqC.gz	Sample_metadataA.tsv fastqA.gz	2	ALIAN.2.0.c1	SHP Converter	Training_multiclass_1-12.csv	Training_multiclass_shape.shp
1.3	MGN.1.3.c1	Pre-filter	Sample_metadataA.tsv+	Sample_metadataA.tsv	3	ALIAN.3.0.c1	Image Stacker	Image1_PrePeak.tiff Image2_Peak.tiff Image3_DrySeason.tiff Image4_PostPeak.tiff	Stack_4dates_S2_10m.tiff
1.4	MGN.1.4.c1	De-replicate	Sample_metadataA.tsv fastqA.gz Reference db	Sample_metadataD.tsv fastqD.gz	4	ALIAN.4.0.c1	Stack Classifier	Stack_4dates_S2_10m.tiff Training_multiclass_shape.shp	LC_map_1-12_10m.tiff
1.5	MGN.1.5.c1	Attribute-Filter	Sample_metadataA.tsv+	Sample_metadataD.tsv	4	ALIAN.4.0.c2	FAO Labeler	Lookup_FAO_1-12.tiff LC_map_1-12_10m.tiff	LC_map_FAO_12cl_10m.tiff
1.6	MGN.1.6.c1	Clusters Information	Sample_metadataD.tsv Reference db+	Sample_metadataCL.tsv fastqCL.gz	4	ALIAN.4.0.c1	Stack Classifier	Stack_2dates_S2_10m.tiff Training_multiclass_shape.shp	LC_map_1-12_10m.tiff
1.6	MGN.1.6.c2	Produces OUT	Sample_metadataCL.tsv fastqCL.gz	speciesOUT.tsv	5	ALIAN.5.0.c1	Map Validator	LC_map_FAO_12cl_10m.tiff Validation_multiclass_shape.shp	ConfMatr_12cl.txt
1.7	MGN.1.7.c1	Searches DB	Reference db+	species.tsv	6	ALIAN.6.0.c1	Layer Extractor	LC_map_1-12_10m.tiff	Deciduous_Vegetation_layer.tiff
1.7	MGN.1.7.c2	Identifies Species	Sample_metadataCL.tsv species.tsv	Sample_metadataID.tsv	7	ALIAN.7.0.c1	Image Stacker	Image3_WV2_2m_DrySeason.tiff Image4_WV2_2m_PostPeak.tiff	Stack_2dates_WV2_2m.tiff

Implementation Phase

- **Agile** Implementation Approach
- **Refactoring** of Existing Software
- Implementation of **new Components**
- Creation of **Wrappers** to Incorporate the Services in **Drama** (an asynchronous workflow executor engine)
- **Deployment** and **Execution** of Drama
- Implementation of a **User Friendly GUI**
- **Feedback** Sessions and **Refinements**

C ID	Component	Input	Ouput
BIO.1.0.c1	GBIF extractor	GBIFparams.json	Species_occ_biotope Alien_taxa_List
BIO.2.0.c1	SyntaxNormalizer	Species_occ_biotope Alien_taxa_List	Species_occ_biotope Alien_taxa_List
BIO.3.0.c1	Taxonomic Checker	Species_occ_biotope Alien_taxa_List	Species_occ_biotope_validated Alien_taxa_List_validated
BIO.4.0.c1	DataCube Builder	Species_occ_biotope_validated Alien_taxa_List_validated	Alien_taxa_Cube.csv Classes_cube.csv
BIO.4.0.c2	DataCube Analyst	Alien_taxa_Cube.csv Classes_cube.csv	Incidence_map.tiff Cumulative_Sp_map.tiff alien_taxa_map
BIO.5.0.c1	CIMPAL Calculator	Species_occ_biotope_validated Alien_taxa_List_validated NIS_pathways_introduction Biotopes_NIS_impact_matrix Biotopes.zip	vulnerability_maps.tiff Species_level_impact
BIO.6.0.c1	Zonal Statistics Producer	Incidence_map.tiff Cumulative_Sp_map.tiff alien_taxa_map Spatial layers info	Statistics

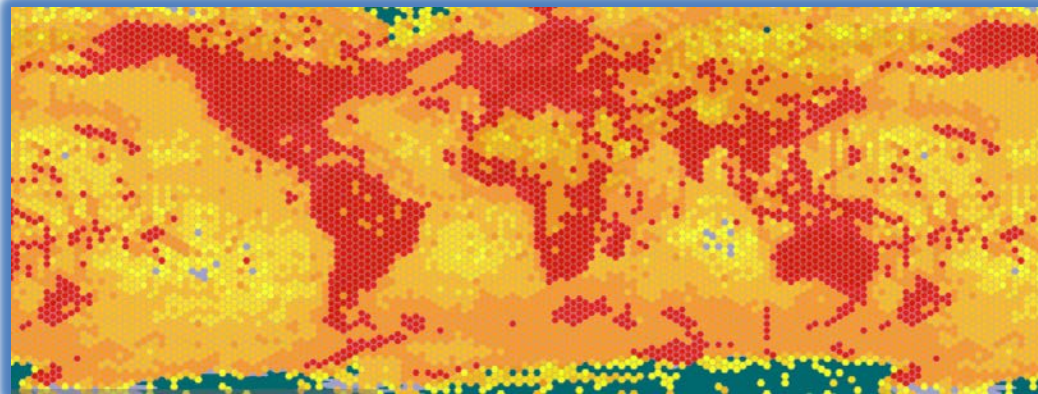
Biotope vulnerability Validation Case



Automating access to open data

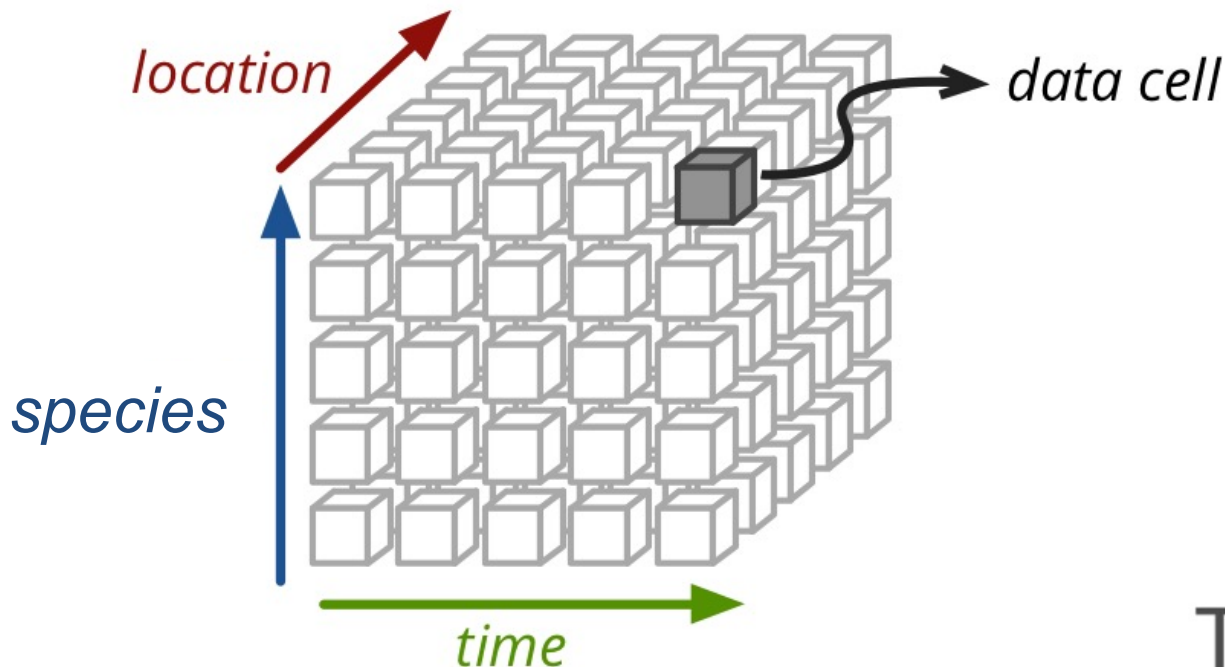
GBIF:

- Occurrences, including location and location uncertainty
- Global register of Invasive Alien Species (GRIIS): Checklist of invasive species



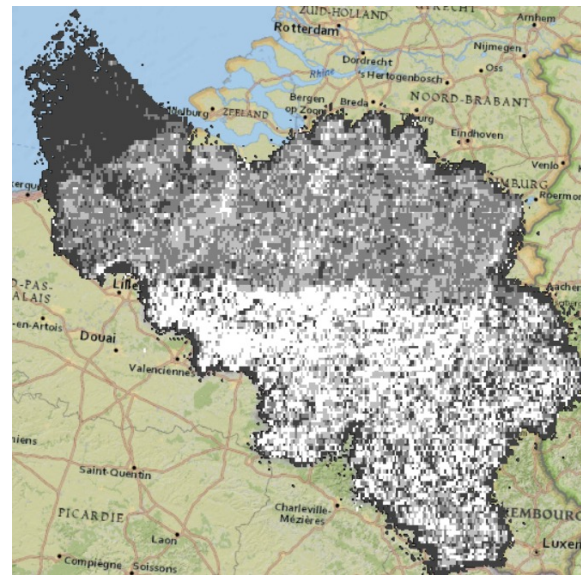
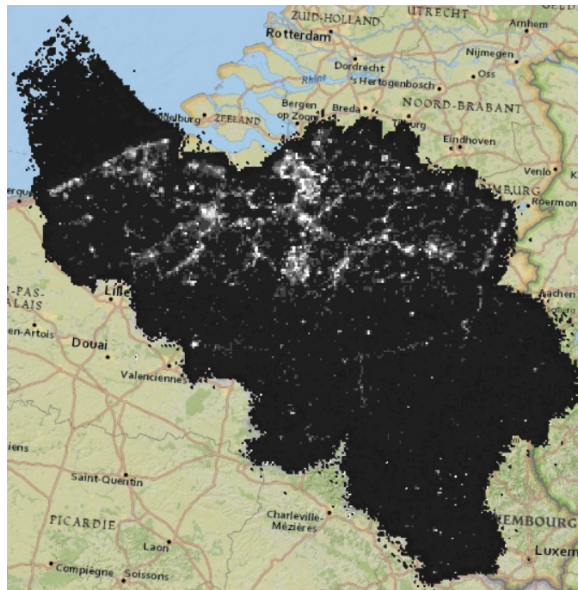
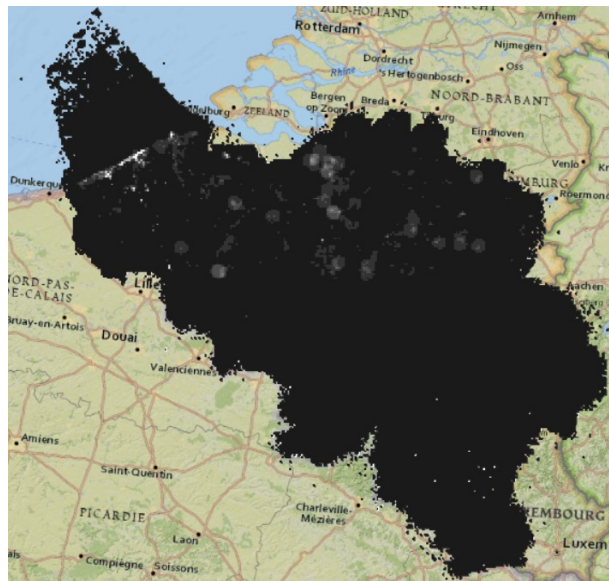
"Private" user inputs also allowed for flexibility

From table to datacube



Thanks to
Damiano
Oldoni and

Blind use of data leads to large sampling bias



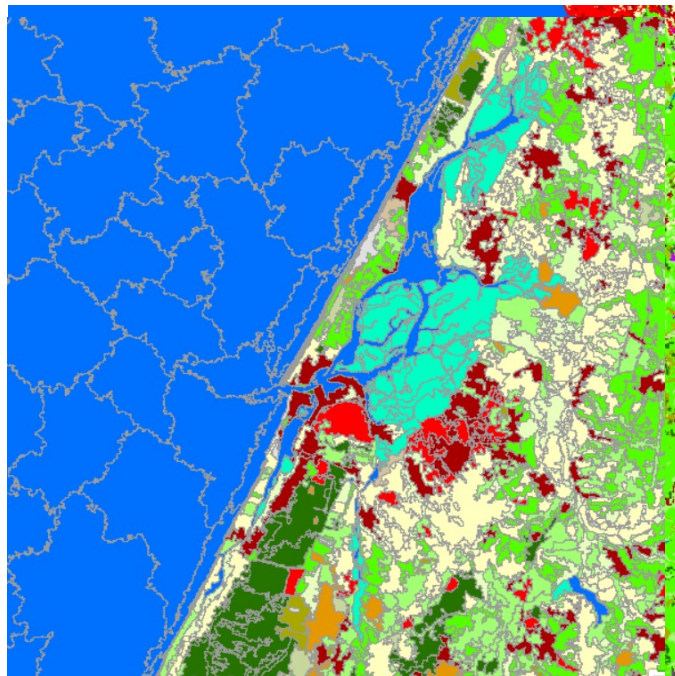
All occurrences

NIS occurrences

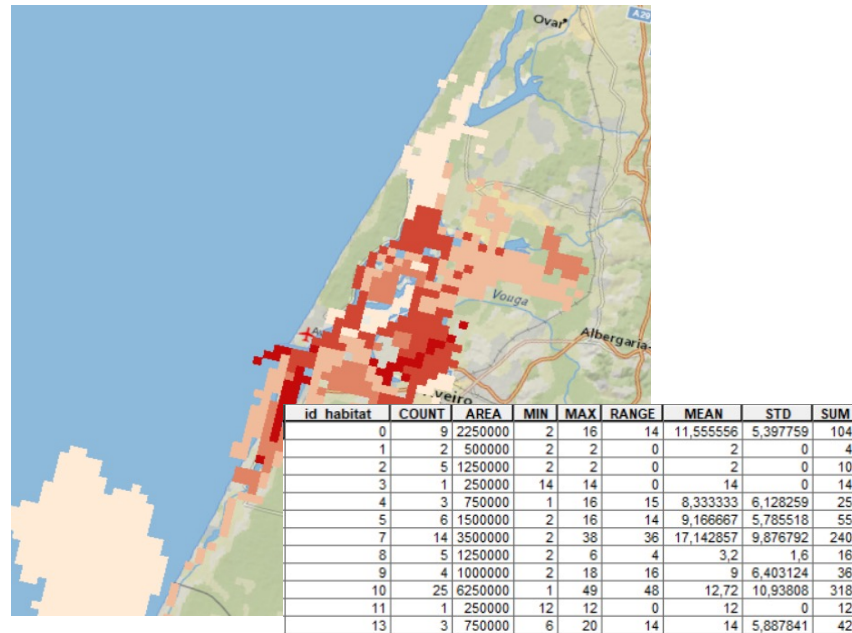
Ratio (incidence of NIS)

Common data collection practices would increase the relevance of case studies

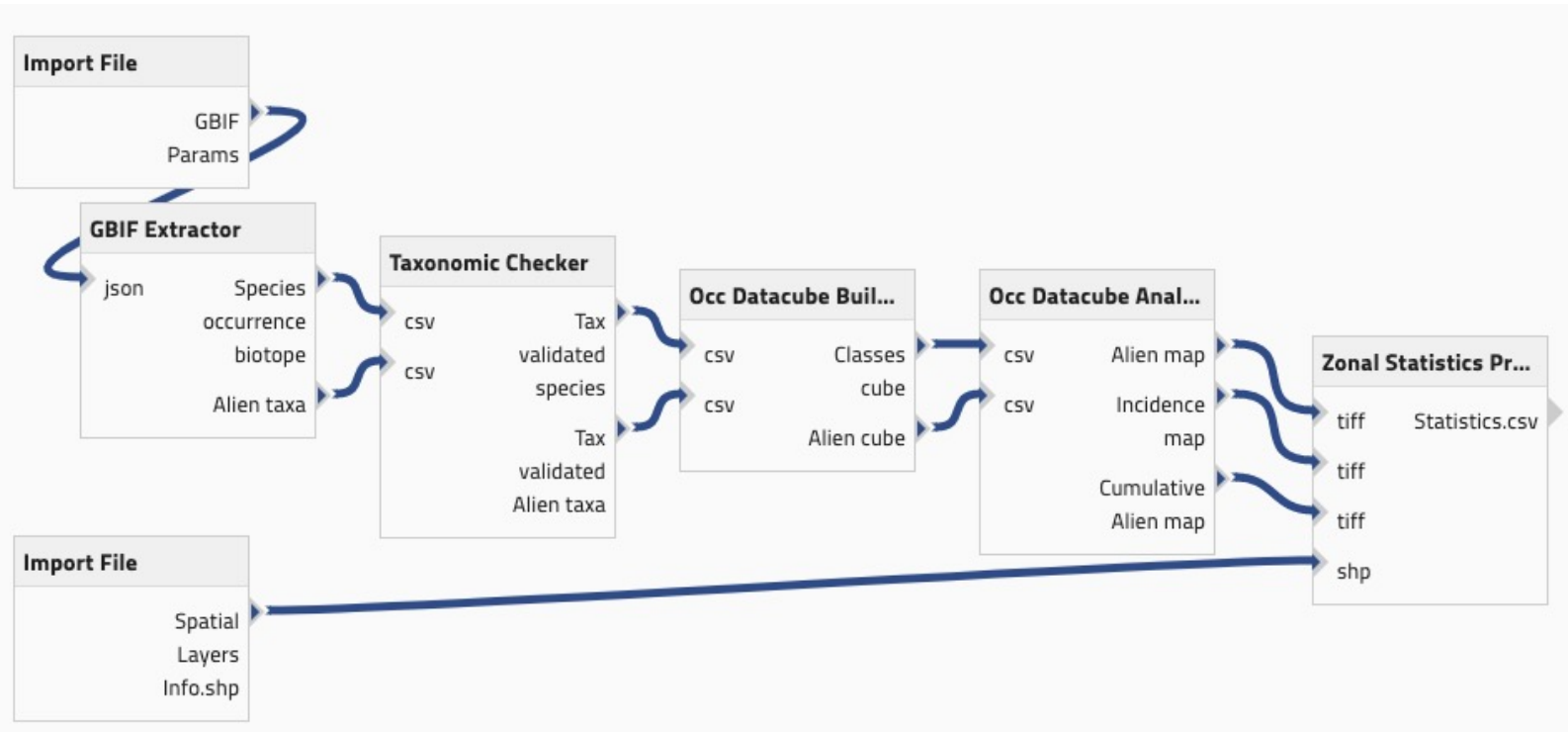
Spatial aggregation of high resolution, with statistics



Ecopatches



E.g. Sum of NIS impacts per patch



GBIF Extractor

Label: GBIF extractor

Description: Sends a query to GBIF to build a file with species occurrences in one or several countries, and download this file for further processing.

Input: GBIFparams (json)

Output: Species_occ_biotope (csv), Alien_taxa_List (csv)

Metadata Harmonized: YES

TRL: 4

GUI Integration: YES

Technology: R / Python

GBIF extractor	GBIFparams.json	
		Species_occ_biotope
		Alien_taxa_List

Technical Functionality: Based on a specific download key it produces a zip file containing species occurrences. It sends a request on the GRIIS dataset stored on GBIF, where the country keyword is composed of "country_{iso code 2 letter}".

Syntax Normalizer

Label: Syntax Normalizer

Description: Normalizes the user datasets to be consistent with the accepted formats

Input: Species_occ_biotope (csv), Alien_taxa_List (csv)

Output: Species_occ_biotope (csv), Alien_taxa_List (csv)

Metadata Harmonized: YES

TRL: 3

GUI Integration: YES

Technology: Python

SyntaxNormalizer	Species_occ_biotope	
	Alien_taxa_List	Species_occ_biotope
		Alien_taxa_List

Technical Functionality:

- 1) Normalizes Custom Input using json mapping files
- 2) Converts input files to csv format
- 3) Converts coordinates to decimal format
- 4) Merges all the "taxon" files of the input into a single "alien_taxa_list" file.

Taxonomic Checker

Label: Taxonomic Checker

Description: Checks the validity of Input

Input: Species_occ_biotope (csv), Alien_taxa_List (csv)

Output: Species_occ_biotope_validated (csv),
Alien_taxa_List_validated (csv)

Metadata Harmonized: YES

TRL: 2

GUI Integration: YES

Technology: Python

Taxonomic Checker	Species_occ_biotope	
	Alien_taxa_List	Species_occ_biotope_validated
		Alien_taxa_List_validated

Technical Functionality: Taxomic Checker service takes as input a csv with species names and validates them using a taxonomic service. This service is reused also in Crustacean and Ailantus.

DataCube Builder

Label: Occurrences Datacube Builder

Description: Spatially aggregates species occurrences in order to build a datacube with densities per grid cells, years and species (or classes)

Input: Species_occ_biotope_validated (csv),
Alien_taxa_List_validated (csv)

Output: Alien_taxa_Cube (csv), Classes_cube(csv)

Metadata Harmonized: YES

TRL: 2

GUI Integration: YES

Technology: R, Python Wrapper

DataCube Builder	Species_occ_biotope_validated	
	Alien_taxa_List_validated	Alien_taxa_Cube.csv
		Classes_cube.csv

Technical Functionality: Validates the input given and generates an sqlite database, queries the data to calculate the uncertainty, assign occurrences within the uncertainty circle, provides sufficient results and updates the database. Queries the database to provide the proper classes of species and builds the datacube for alien species.

DataCube Analyst

Label: DataCubeAnalyst

Description: Aggregates species occurrences for cells and year to summarize the datacube in a single band raster + compute the incidence of invasive species

Input: Alien_taxa_Cube (csv), Classes_cube(csv)

Output: alien_taxa_map (tiff), Incidence_map (tiff), Cumulative_Alien_Sp_map (tiff)

Metadata Harmonized: YES

TRL: 2

GUI Integration: YES

Technology: : Python

DataCube Analyst	Alien_taxa_Cube.csv Classes_cube.csv	Incidence_map.tiff Cumulative_Sp_map.tiff alien_taxa_map

Technical Functionality: Gets as input the results of Datacube Builder, aggregates species occurrences for cells and year to summarize the datacube in a single band raster and computes the incidence of invasive species (ratio of the invasive species occurrence by the total observed species). Generates tiff files, which represent cumulative species observation map (tif) and incidence map (tif).

Tiff Viewer

- Visualizes EXIF metadata of Biotope output.
- Tree visualization of EXIF metadata (information from a GeoTIFF file)

Dashboard

+ Run new workflow

Workflow information

ARMS

Dashboard

+ Run new workflow

Workflow information

Biotope

Dashboard

+ Run new workflow

Workflow information

+ Result explorer

Crustaceans functional biogeography

Dashboard

+ Run new workflow

Workflow information

Geographical validation

Metabarcoding

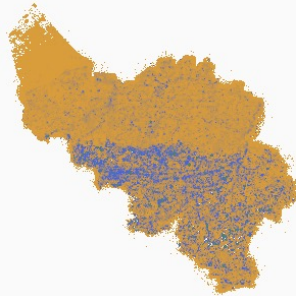
Dashboard

+ Run new workflow

IJI NIS Workflow Environment **BETA**

Result explorer

Select a file to analyse ✓



Exif metadata

Collapse all

Expand all

exif

ImageWidth

ImageLength

BitsPerSample

Compression

PhotometricInterpretation

id: 262

value: 1

description: 1

StripOffsets

Zonal Statistics Producer

Label: Zonal Statistics Producer

Description: Computes the mean, sum and standard deviation of the values from a raster for each zone provided as input

Input: Incidence_map (tiff), Cumulative_Sp_map (tiff), alien_taxa_map (tiff), Spatial layers info (shp)

Output: statistics (csv)

Metadata Harmonized: YES

TRL: 2

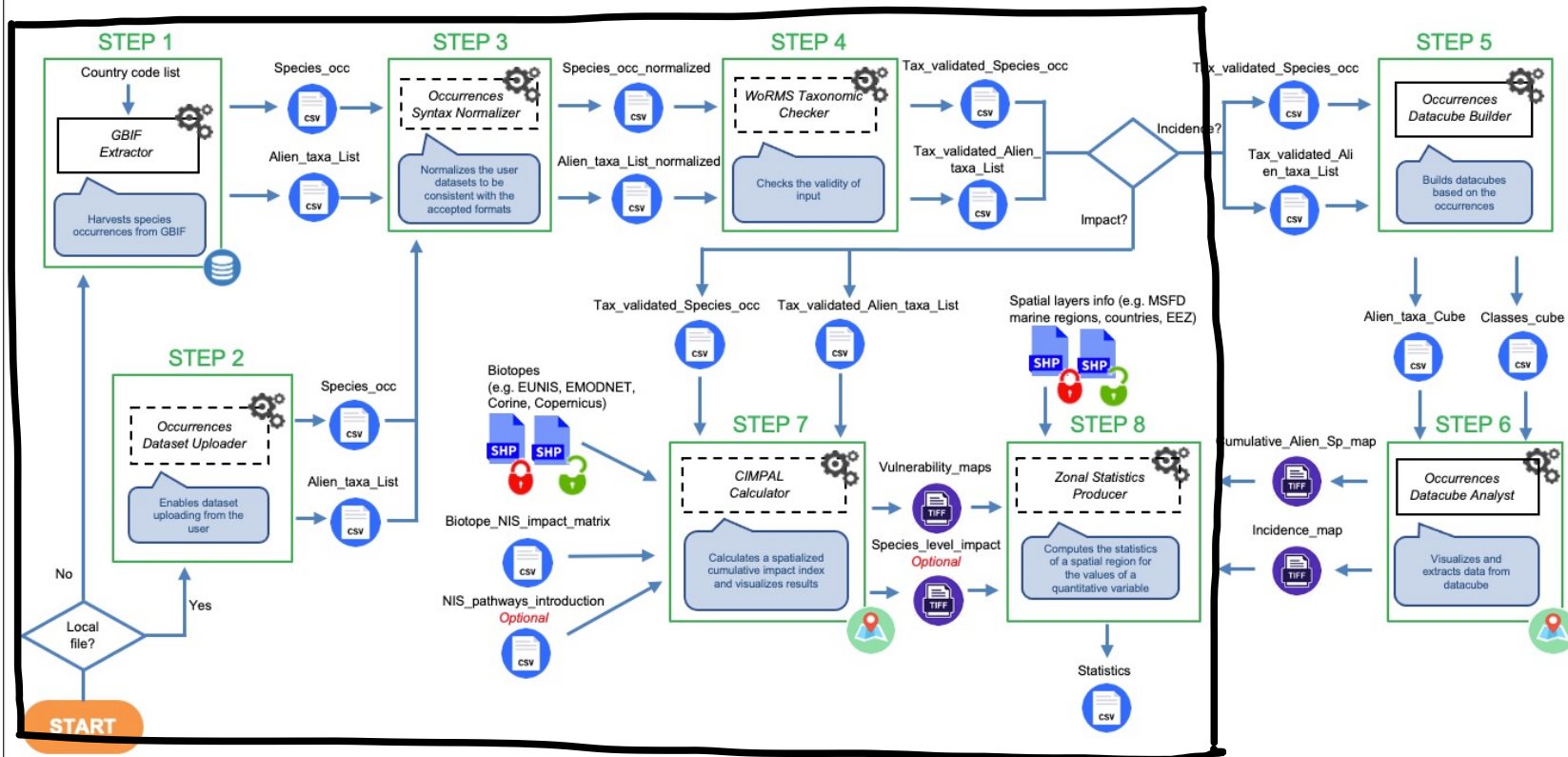
GUI Integration: YES

Technology: Python

Zonal Statistics Producer	Incidence_map.tiff	
	Cumulative_Sp_map.tiff	
	alien_taxa_map.tiff	
	Spatial layers info	Statistics

Technical Functionality: Takes as input the Zone dataset which consists of shape files and the value dataset, in tiff files. The code computes the mean, sum and standard deviation of the values from a raster for each zone provided as input. Produces a file with statistics.

Biotope vulnerability Validation Case



An index to assess the cumulative negative impacts of invasive alien species Step 7 workflow

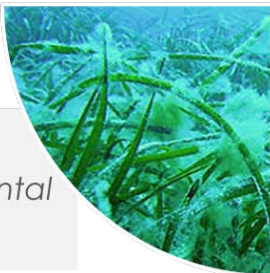
A list of
invasive alien
species



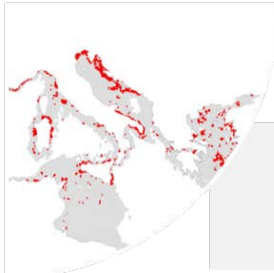
Species
occurrences



IAS
environmental
impacts



Habitats
mapping



A cumulative impact
assessment (CIA) approach

sensu Halpern *et al.* 2008 Science

Flexibility

*Any environment or
geographic scale, any
taxonomic group and any
type of impact!*

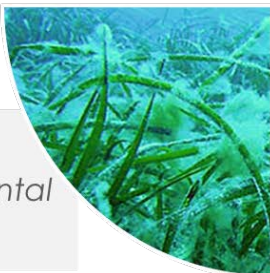
Example of invasive algae *Lophocladia* sp in *Posidonia oceanica* beds in the Mediterranean sea

CIMPAL index cumulative **IMP**act of invasive **AL**ien species

A list of
invasive alien
species



IAS
environmental
impacts

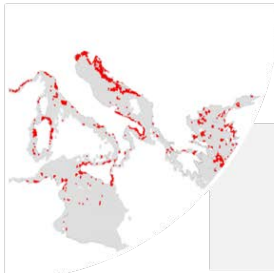


$W_{i,j}$



Species
occurrences

A_i



Habitats
mapping

H_j

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

A_i status of invasive alien species (IAS) i

H_j index of the extent of habitat j

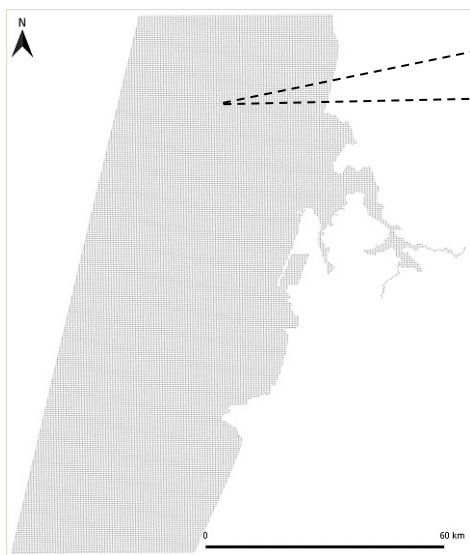
$w_{i,j}$ impact weight for IAS i and habitat j

n number of invasive alien species

m number of marine habitats

CIMPAL index LW IJI NIS improvements

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

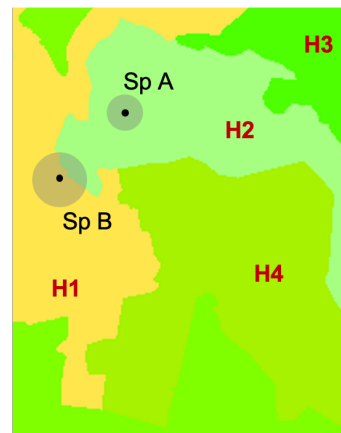




Impact weight considered according to the presence/absence of a given IAS and habitat in a same cell

Katsanevakis *et al.* 2016

per grid cell

Sp A	Sp B
H1	H1
H2	H2
H3	H3
H4	H4



Species occurrence
 Species occurrence
 "Home range"

high resolution approach

Sp A	Sp B
	H1
H2	H2
	
	

a posteriori aggregation

in Step 8 workflow

Impact weight $w_{i,j}$

$w_{i,j}$: impact weights for species i and habitat j

		Magnitude of Impact				
		Minimal	Minor	Moderate	Major	Massive
Strength of Evidence	Robust	0	1	2	4	8
	Medium	0	0	1	2	4
	Limited	0	0	0	1	2

no or negligible

individual fitness

population level

community level reversible

community level irreversible

experiments
modelling
observations
correlations
exp. judgement

Two decision-making strategies:

a precautionary approach

an uncertainty-averse approach

Flexibility in CIMPAL

Any other way of assessing impacts and deciding on impacts weights can be used!

IAS impact assessment protocols

	Geography	Target	Type of impact Environmental / Socio-Economic	
Invasive species assessment protocol: evaluating non-native plants for their impact on biodiversity --	USA	Plants	Morse et al. 2004	
Biopollution assessment scheme --	Baltic Sea	Aquatic taxa	Olenin et al. 2007	
Conceptual framework for prioritisation of invasive alien species for management according to their impact ++ --	Global	Generic	Kumschick et al. 2012	
Generic ecological impact assessments of alien species in Norway --	Norway	Generic	Sandvik et al. 2013	
Review of impacts of invasive alien marine species on ecosystem services and biodiversity ++ --	Europe	Marine taxa	Katsanevakis et al. 2014	
EICAT (Environmental Impact Classification for Alien Taxa) --	Global	Generic	Blackburn et al. 2014 Hawkins et al. 2015	
GISS (Generic Impact Scoring System) --	Europe	Generic	Nentwig et al. 2016	
SEICAT (Socio-Economic Impact Classification of Alien Taxa) --	Global	Generic		Bacher et al. 2018
InSEAT (INvasive Species Effects Assessment Tool) ++ --	Global	Generic	Martinez-Cillero et al. 2019	

Pathways of introduction of NIS

(optional)

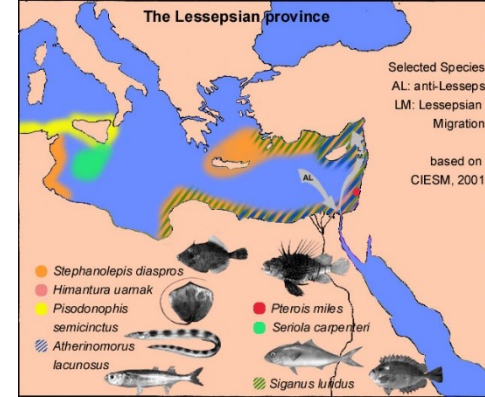
ballast water



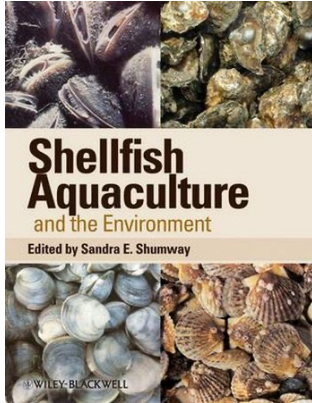
fouling



Suez Canal



aquaculture



bait



"mystery seeds"



Global trade



Global pet trade

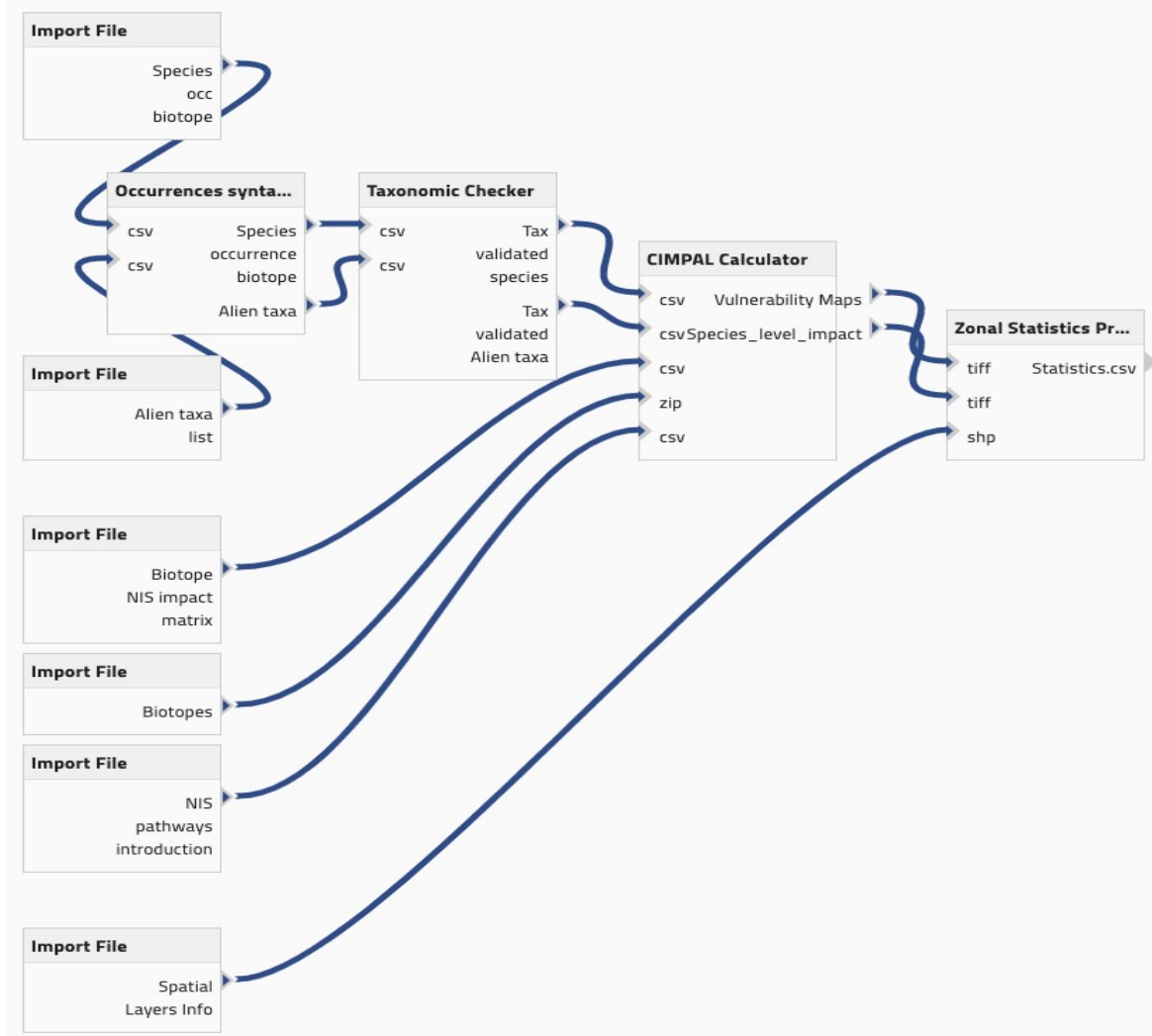
TRANSPORT - STOWAWAY

TRANSPORT - CONTAMINANT

RELEASE IN NATURE

ESCAPE FROM CONFINEMENT

CORRIDOR



Personal space

Files:

✕ Collapse all ⇅ Expand all

- ▼ ☁ dummy-testing-data ⋮
 - > 📁 ARMS ⋮
 - > 📁 Ailanthus Altissima mapping ⋮
 - > 📁 Crustacean ⋮
 - > 📁 Metabarcoding ⋮
- ▼ ☁ nikos.minadakis ⋮

+ Add folder

☁ Upload file

Add folder

New folder name *

BiotopeDemo-RunFolder

Cancel

+ Add

CIMPAL Calculator

Label: CIMPAL Calculator

Description: Computes the impact of invasives species on the environment.

Input: Species_occ_biotope_validated (csv), Alien_taxa_List_validated (csv), NIS_pathways_introduction (csv), Biotope_NIS_impact_matrix (csv), Biotopes.zip (shp)

Output: Vulnerability Maps (tiff), Species_level_impact (tiff)

Metadata Harmonized: YES

TRL: 2

GUI Integration: YES

Technology: Python

CIMPAL Calculator	Species_occ_biotope_validated	
	Alien_taxa_List_validated	
	NIS_pathways_introduction	
	Biotope_NIS_impact_matrix	
	Biotopes.zip	vulnerability_maps.tiff
		Species_level_impact.tiff

Technical Specifications: Based on given validated species occurrences and validated alien taxa list from GBIF, Biotope maps in shape files, invasion paths and a weight matrix produces a set of tif files with impact values per cells for each path.

Zonal Statistics Producer

Label: Zonal Statistics Producer

Description: Computes the mean, sum and standard deviation of the values from a raster for each zone provided as input

Input: Vulnerability Maps (tiff), Species_level_impact (tiff), Spatial layers info (shp)

Output: statistics (csv)

Metadata Harmonized: YES

TRL: 2

GUI Integration: YES

Technology: Python

Zonal Statistics Producer	Vulnerability Maps.tiff	
	Species_level_impact.tiff	
	Spatial layers info	Statistics

Technical Functionality: Takes as input the Zone dataset which is shape files and the value dataset, provided in tiff files. The code computes the mean, sum and standard deviation of the values from a raster for each zone provided as input. Produces a file with statistics.

What can you explore from CIMPAL outputs?

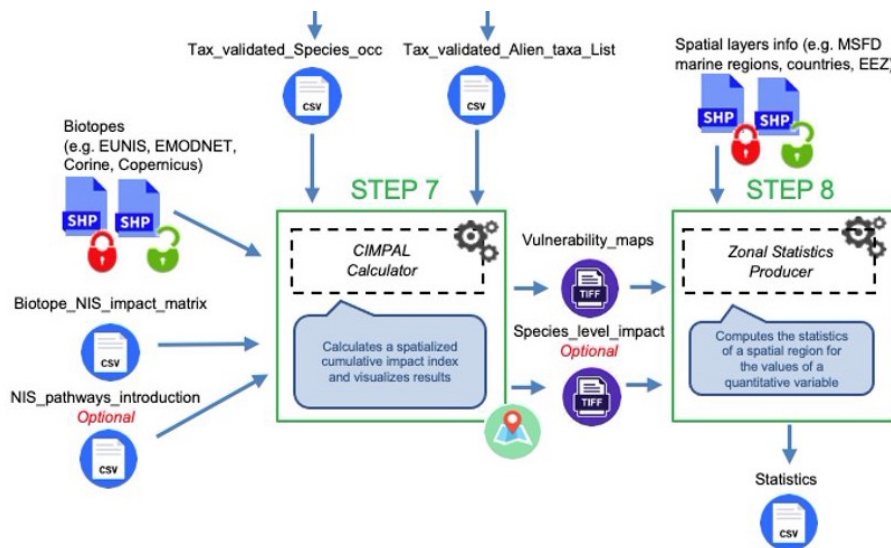
Spatially

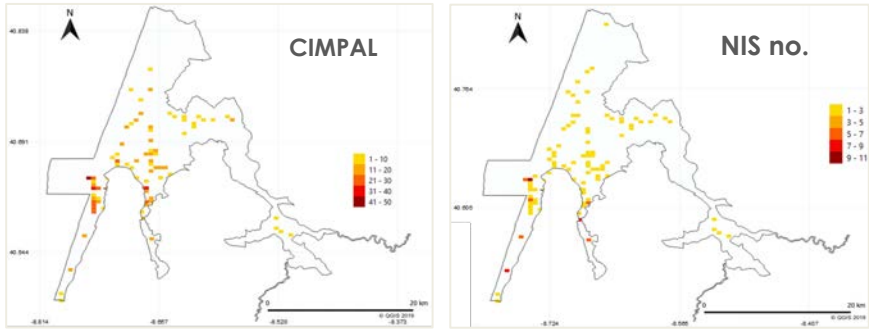
- Identify areas at risk, hotspots of invasions with highest potential negative impacts
- Rank habitats according to vulnerability
- Focus on priority habitats
- Aggregate per e.g. Country, Protected areas
- Provide a grid e.g. EEA, user defined

Species level

- Cumulative impact map per species
- Rank species according to highest threat

Per Pathway of introduction (*optional*)





Pinheiro 2019, MSc Thesis

Figure 3.7: European seas cumulative impact score (CIMPAL) of 81 invasive alien species to marine and coastal habitats, based on the uncertainty-averse strategy. See Appendix A for the data layer description

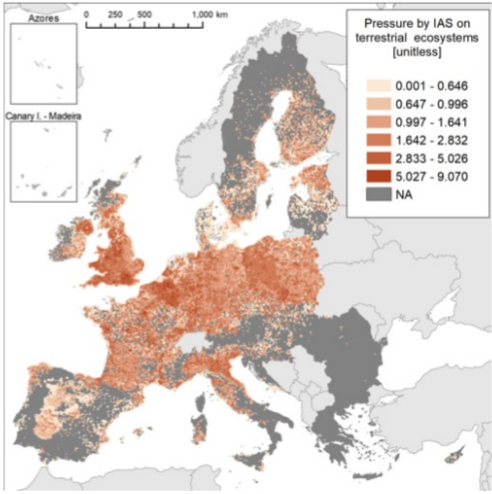
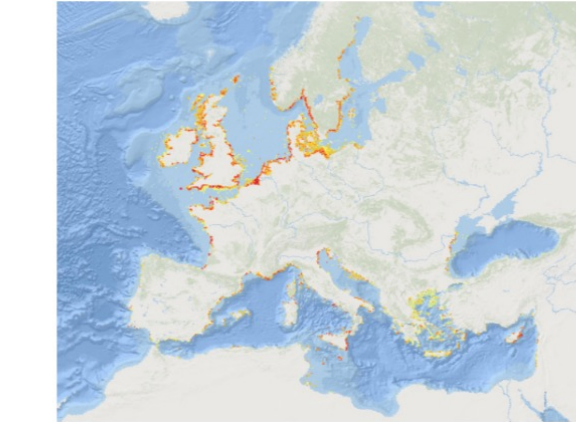
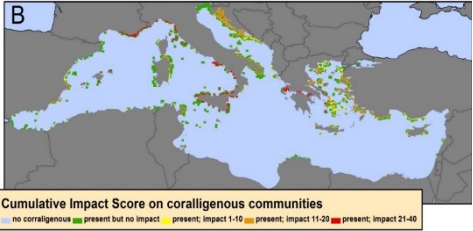


Figure 4.2.1. Cumulative pressure by the 49 invasive alien species of Union concern on terrestrial ecosystems. Dark grey indicate areas where presence of IAS is not reported. Values are grouped in geometric intervals.

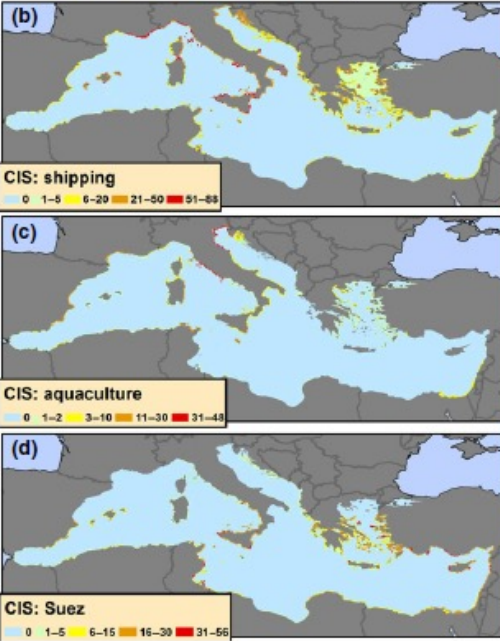


Korpinen *et al.* 2020
ETC/ICM Report 4/2019

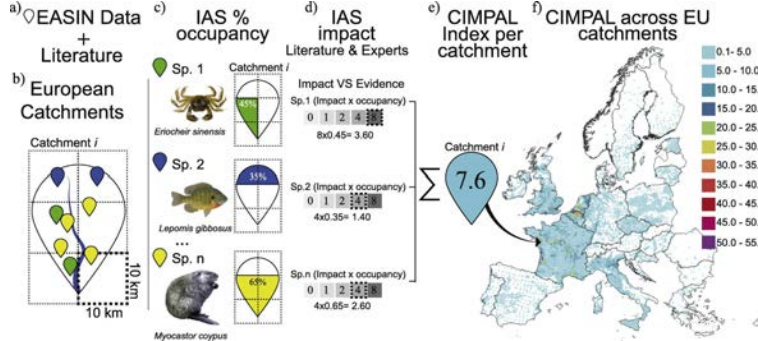
Maes *et al.* 2020
MAES EU JRC Report



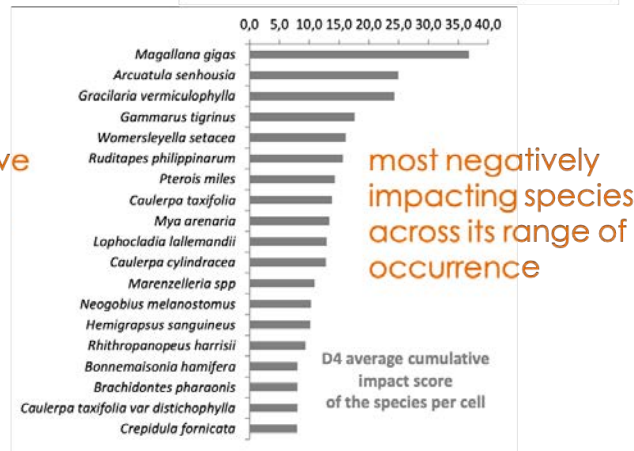
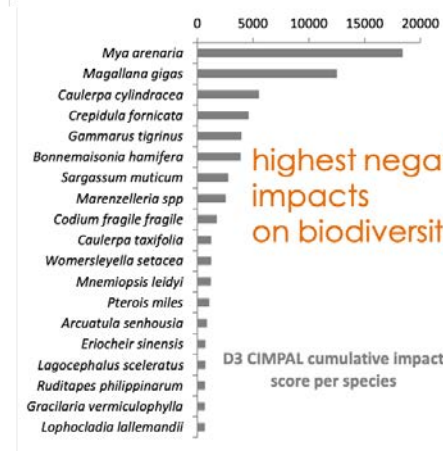
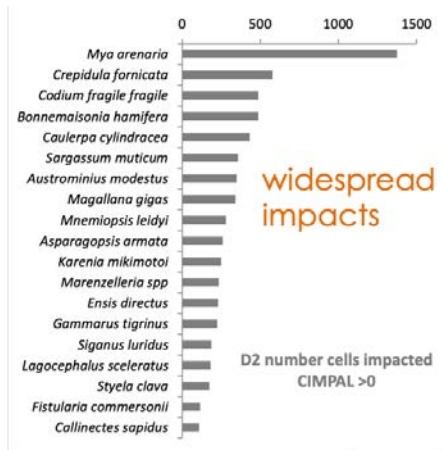
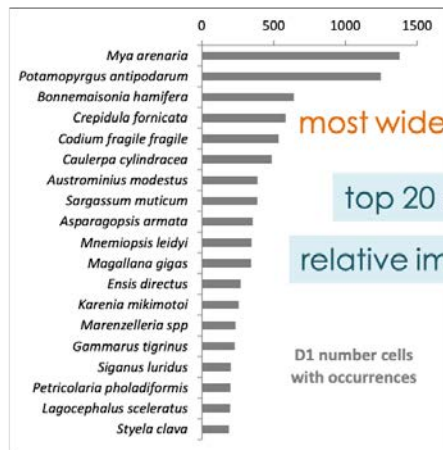
Cumulative Impact Score on coralligenous communities
46% under IAS impact
100% impacts with high confidence
Katsanevakis
et al. 2016



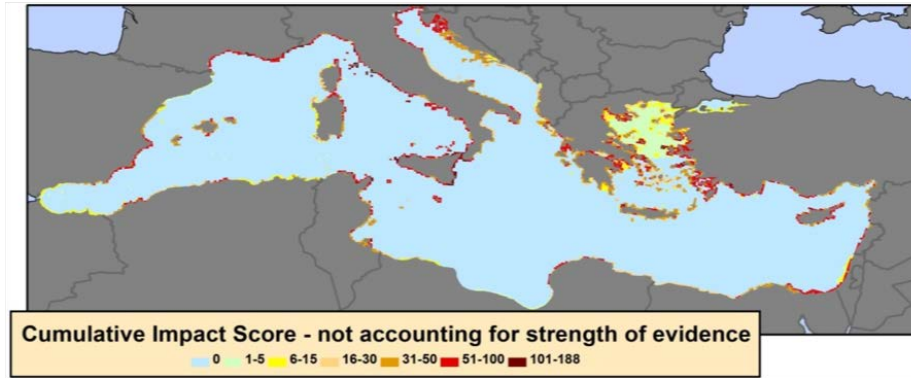
Magliozzi *et al.* 2020 STOTEN



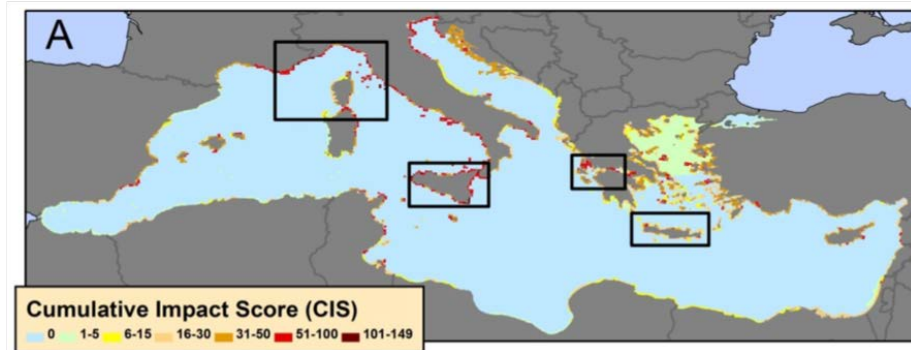
Prioritize species



Precautionary approach



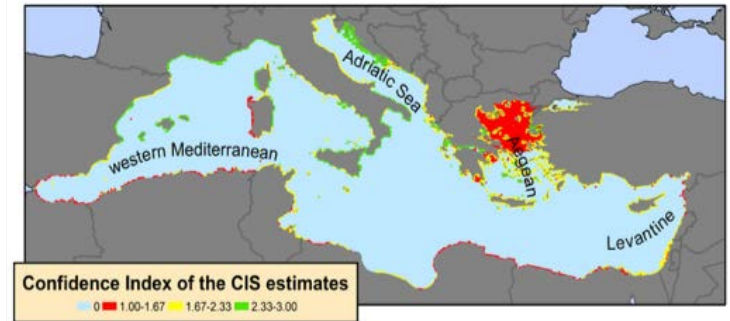
Uncertainty-averse strategy



Sources of uncertainty

e.g. due to strength of evidence of impact

Map of confidence in impacts estimates



Further reading:
"Options for reducing uncertainty in
impact classification for alien species"
Clarke *et al.* 2021 in *Ecosphere*

Using the workflow to enable long term Environmental Planning Strategies to control and mitigate IAS impacts.



HikingArtist.com

Bridging the GAP between DATA,
INFORMATION andinformed
management strategies and actions

An opportunity for plant IAS in terrestrial ecosystems.

Framing the Impacts



IAS colonise biotopes,
affecting ecosystem processes and functionality.

Decreasing conservation status
of habitats.

Impacting **Key Ecosystem Services** to
local livelihoods.

Reducing **value of the Natural Capital**
of the spatial units biophysical or
administrative (e.g. regions, provinces,
municipalities, plots, PROPERTIES).

Need to plan within a **regional or bioregional**
context.

Ensuring plans and policies reach local and site
level.

Effective among governments, owners, private
land **holders and market.**

Addressing direct **drivers of change** (pressures)

Integration of INCIDENCE and IMPACT indicators in **Cadastral references** for properties to enable implementation policymaking, Environmental planning and management.

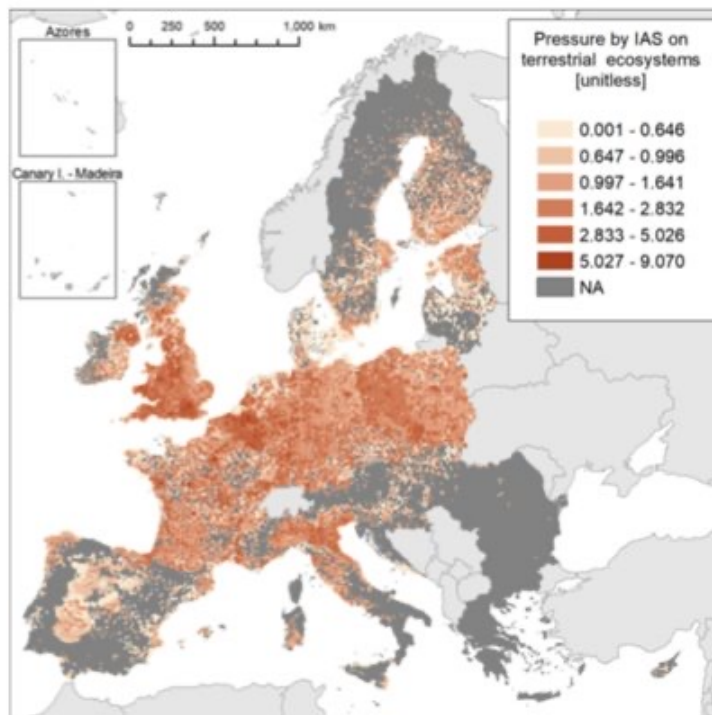
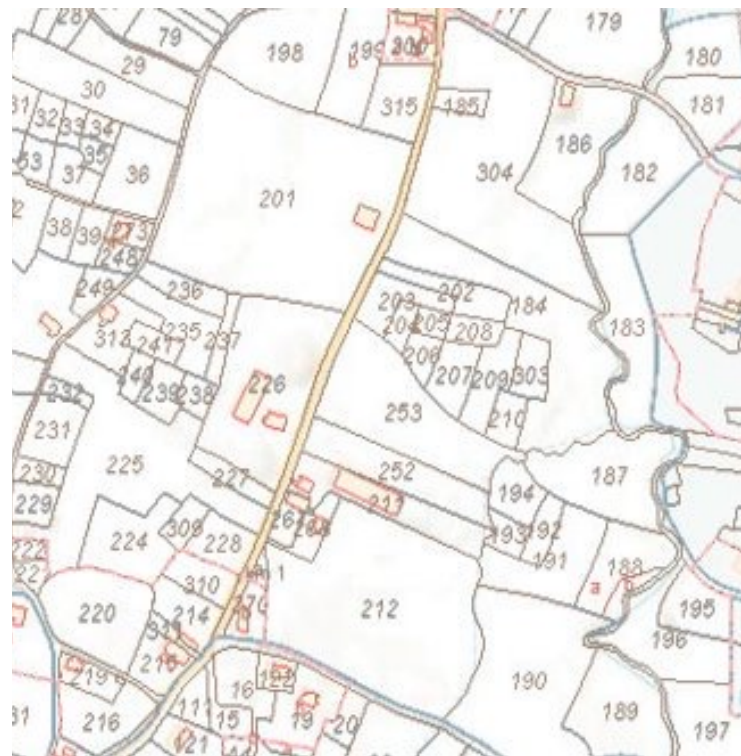


Figure 4.2.1. Cumulative pressure by the 49 invasive alien species of Union concern on terrestrial ecosystems. Darker indicates areas where presence of IAS is not reported. Values are rounded to one decimal.





SECRETARÍA DE ESTADO
DE HACIENDA

DIRECCIÓN GENERAL
DEL CATASTRO

DATOS DESCRIPTIVOS DEL INMUEBLE

Localización:

Polígono 16 Parcela 4
CÓPERO. 41700 DOS HERMANAS [SEVILLA]

Clase: RÚSTICO

Uso principal: Agrario
Superficie construida: 1.554 m²
Año construcción: 1968

Construcción

Destino	Escalera / Planta / Puerta	Superficie m ²
AGRARIO		61
AGRARIO		169
AGRARIO		124
AGRARIO		717
AGRARIO		483

Cultivo

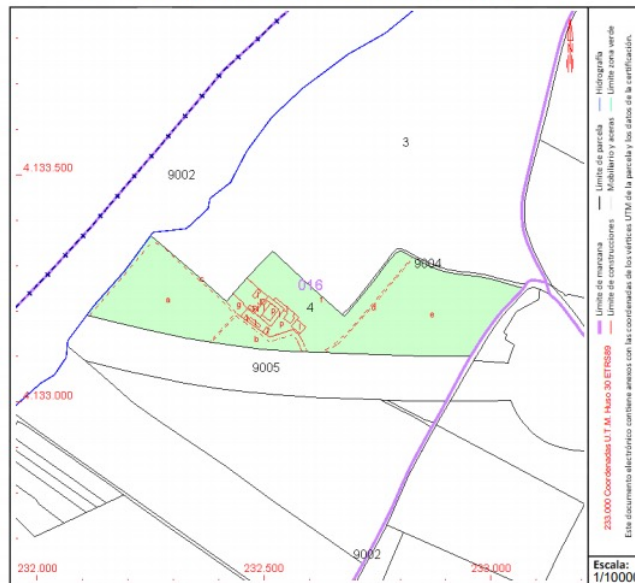
Subparcela	Cultivo/aprovechamiento	Intensidad Productiva	Superficie m ²
a	NR Agrios regadio	01	36.950
b	NR Agrios regadio	01	6.825
c	I- Improductivo	00	4.525
d	I- Improductivo	00	983
e	NR Agrios regadio	01	53.195
f	NR Agrios regadio	02	25.855
g	NR Agrios regadio	02	1.098

CONSULTA DESCRIPTIVA Y GRÁFICA DE DATOS CATASTRALES DE BIEN INMUEBLE

Referencia catastral: 41038A016000040000HQ

PARCELA

Superficie gráfica: 139.162 m²
Participación del inmueble: 100,00 %
Tipo: Parcela, a efectos catastrales, con inmuebles de distinta clase [urbano y rústico]



Este documento no es una certificación catastral, pero sus datos pueden ser verificados a través del "Acceso a datos catastrales no protegidos de la SEC"

Cadastral reference

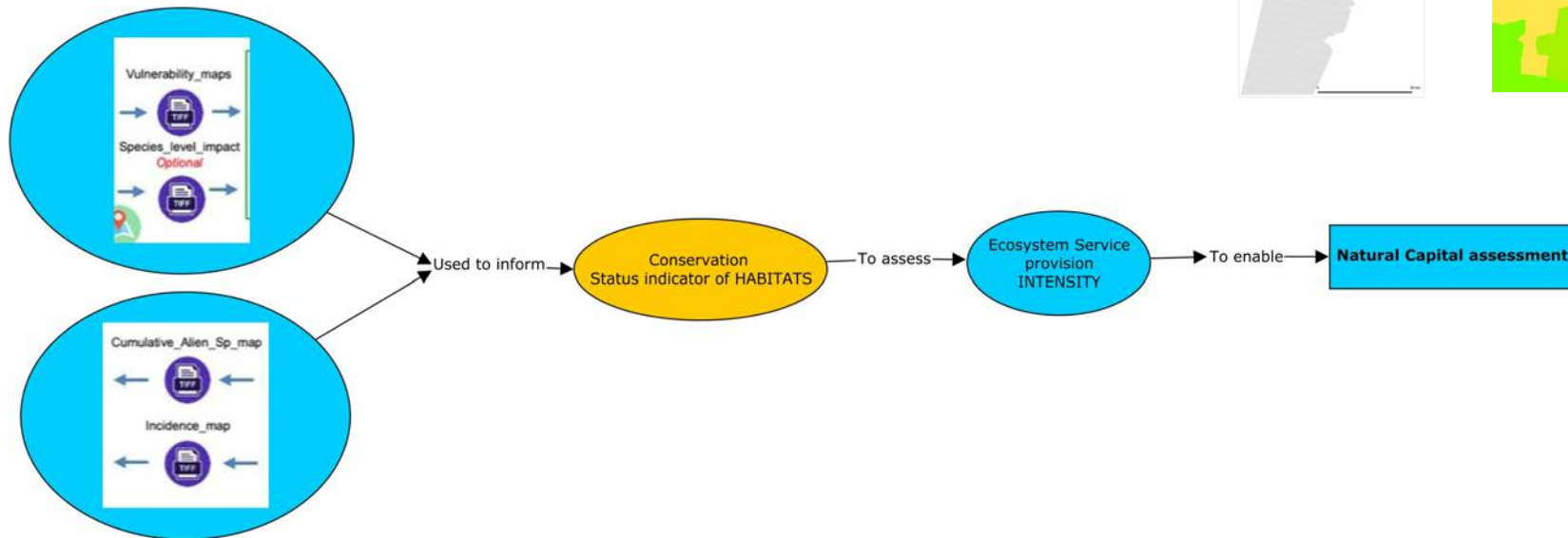
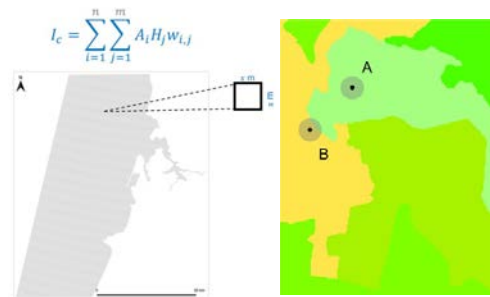
-Basic georeferenced database for properties

Includes data such as:

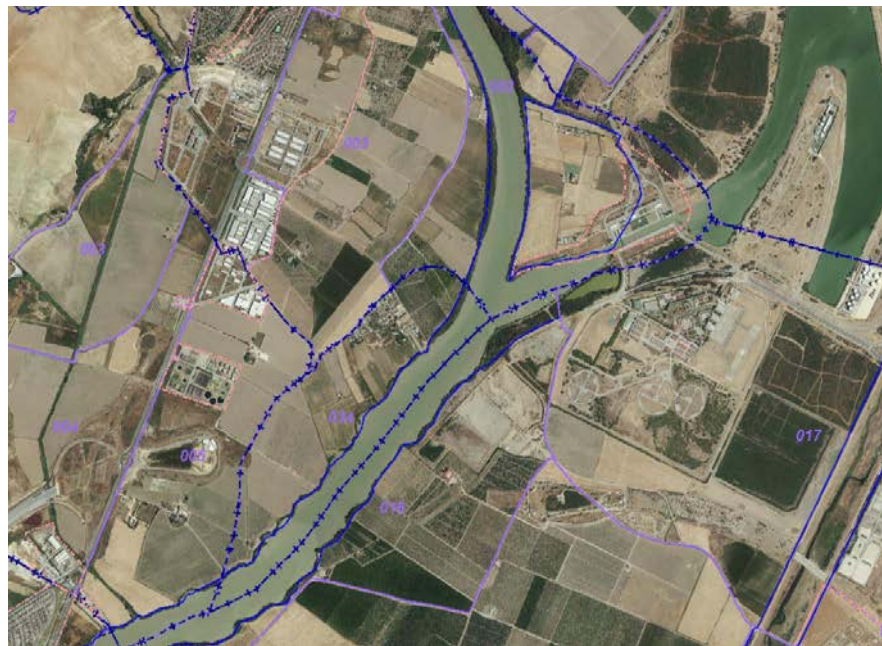
- Surface
- Land use type
- Building; etc.

Why not also?

- Habitats
- Conservations Status
- Cimbal and/or incidence
- Critical IAS incidences?



Land use policymaking, planning and management. A pragmatic approach for terrestrial management.



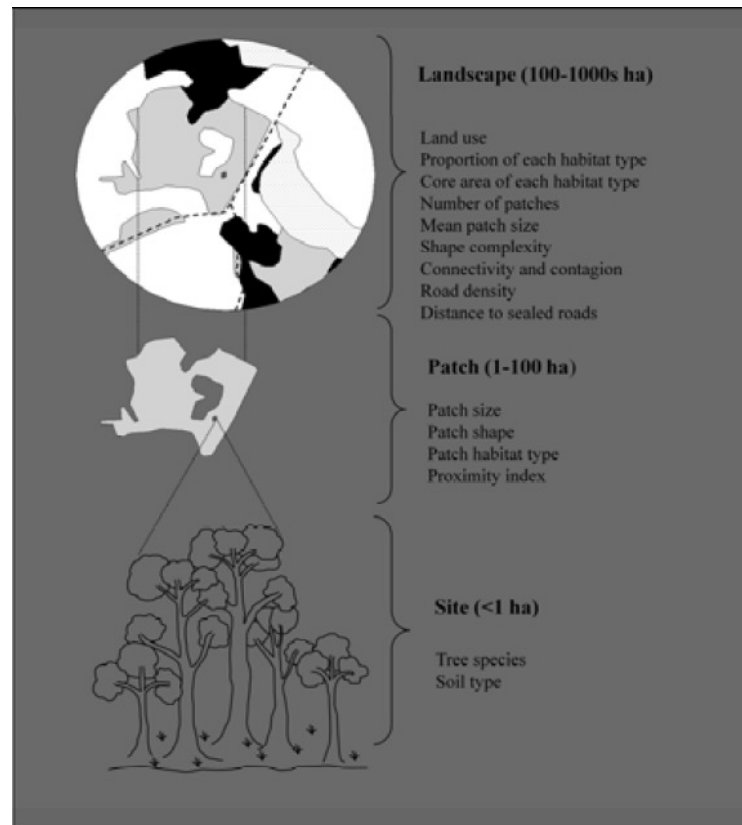


Opportunity to include:

- Cimpal (Impact) & Incidence
- Habitat Conservation Status
- Natural Capital assessment

Environmental Planning opportunities:

- Suitable to all EU countries
- Possibility to plan and regulate from Bioregions, to Landscapes and to Sites.
- Possibility to place the correct incentive to the correct stakeholder:
 - owner/user of the site?.
 - Affect market property value?
- Create market opportunities and employment.



Implementation opportunities

- Readily available system
- Possible to scalate and replicate in EU members
- Customization to each bioregion
- Possibility to adapt to a hierarchy of importance
- Transferability of policies through the lowest transaction cost.
- Opportunity to allocate incentives and penalties based on performance.



Funding programmes and open calls

Information about research and innovation funding programmes, including Horizon 2020, the Cohesion Fund, LIFE, ERDF, ESIF and RFCS

Next Steps

- ✓ Collection of **Feedback** and **Refinement**
- ✓ **Syntax Normalizer** extension (more formats)
- ✓ **Tiff Viewer** refinement
- ✓ Incorporation of all the components to the **GUI**
- ✓ **Workflow** Pausing & **Interaction**
- ✓ **Expose** all the services as **web services** to be reused by the community
- ✓ New component for the **flexibility** of the scientific approach
 - ✓ Data collection bias mitigation
 - ✓ Integrated habitat suitability and predictive models
 - ✓ More parameterization

Combining multi-purpose tools for wide range of application and studies

- Research infrastructures make possible the impossible
- Workflows are there to help, not to replace the scientist
- Workflows can be used for more than their original purpose

Thank you for your attention

Sources of uncertainty

Impact weights

- **Strength of evidence** of impact:
 - two decision making strategies How in practice? Run two workflows for each approach and compare their results!
 - but what if evidence changes through **time**?! Due to **knowledge**, the **stage of invasion**, etc... - *new technologies to speed up update and variance in evidence?*
- **Impact assessment protocol**, "Options for reducing uncertainty in impact classification for alien species" Clarke et al 2021 in Ecosphere
- **Weights scale**: arbitrary choice, User-tailored. A linear scale (1, 2, 3, 4) & logarithmic scale (1, 10, 100, 1000) tested and no substantial differences to the incremental one presented here.
- **Conservative additive model** - but synergistic & antagonistic effects exist! (Trade-offs if +ve & -ve are accounted for..) by adding interactive terms to the algorithm – unfortunately very little information exists yet for most cases
- Assumes **invariant** impact (weight) for habitat across biogeographic/environmental conditions (can be dealt with partially but not here, in abundance/occurrences as suitability from e.g. *niche models*).

IMPORTANT Understand what is under- or overestimating the final outcome of the index!

- for **reproducibility** purposes of course, but also
- further developments with increasing ecological knowledge and new-technologies capabilities!