Introduction to PLH Systematic Literature Search, Global Pest Distribution and Climate Suitability Analysis

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EUROPEAN FOOD SAFETY AUTHORITY

SECTION ON CLIMATE SUITABILITY

Time	Item	Presenter
14:45	A framework for Climate Suitability in EFSA Plant Health Risk Assessment	Alex Gobbi, CREA - ITA
15:15	Break	
15.45	Methodological workflow from Systematic Literature Search to Pest Distribution	Alex Gobbi, CREA - ITA
16:15	Koppen-Geiger climate classification and tools available (R4EU Platform)	Alex Gobbi, CREA - ITA
16:45	Exercise Koppen-Geiger application	Alex Gobbi, CREA - ITA
17:30	End of Day 1	

A framework for Climate Suitability in EFSA Plant Health Risk Assessment

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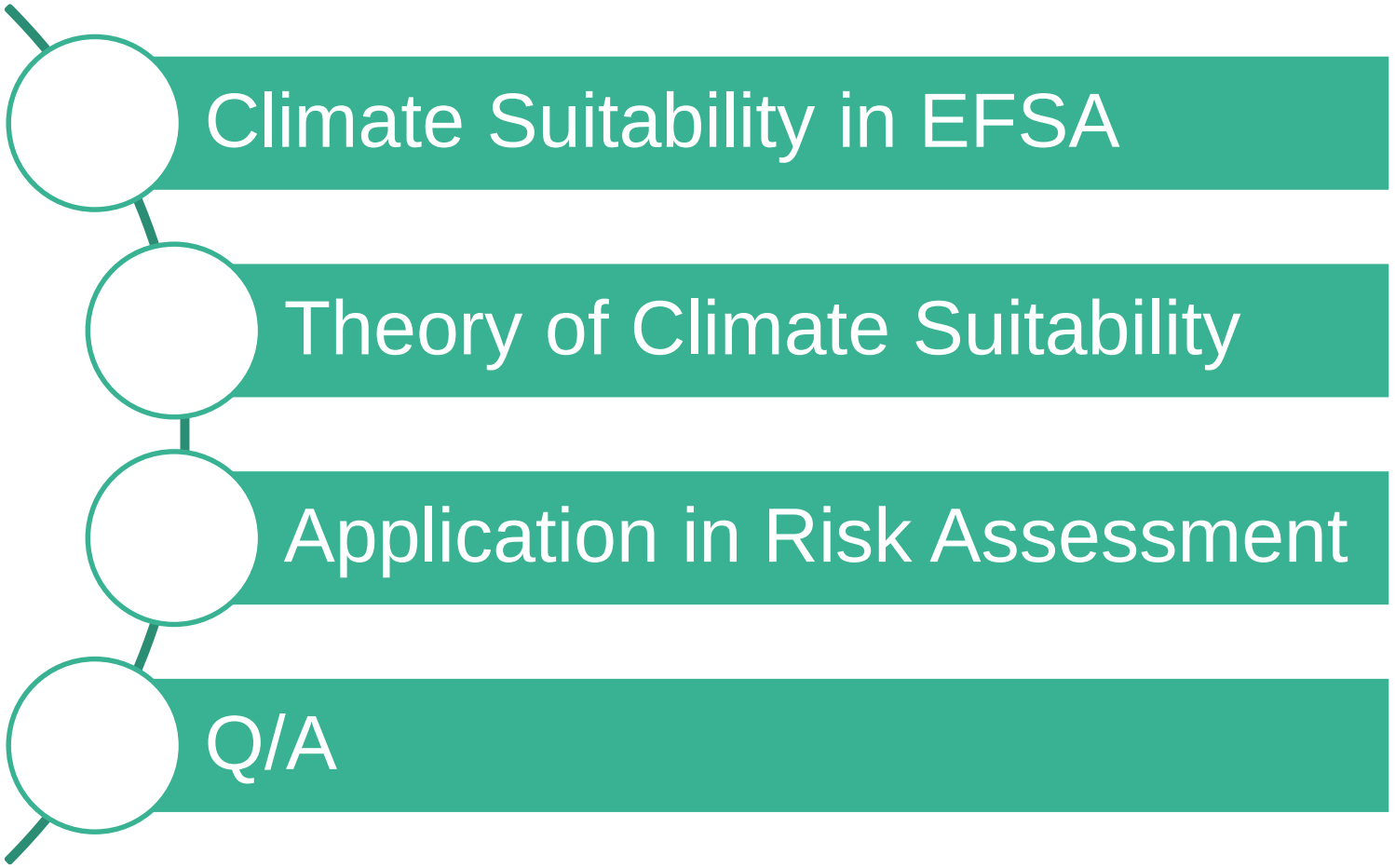
OUTLINE OF THE LECTURE



1. A FRAMEWORK FOR CLIMATE SUITABILITY IN EFSA

- Pest Risk Assessment
- Risk of Establishment
- Climate Suitability
- Literature Review

1. A FRAMEWORK FOR CLIMATE SUITABILITY IN EFSA

Pest Risk Assessment

- The pests we assess are **not present in Europe** or if they are their presence is **limited**
- We focus on plant **Pathogens** (fungi, bacteria, virus, nematodes) and **Arthropods** (insects)
- The **Methodology is Shared** among different EFSA PLH Risk Assessment products such as:
  - Pest Categorisations (**PC**)
  - Pest Risk Assessment (**PRA**)
  - Quantitative Pest Risk Assessment (**QPRA**)

1. A FRAMEWORK FOR CLIMATE SUITABILITY IN EFSA

Pest Risk Assessment

- The key-aspects highlighted in such a report are the following:
  - Pest Identity, Taxonomy, Identification Methods
  - Quantitative Assessment of Impact
  - Entry-Pathways
  - Evaluation of Spread Risk
  - Evaluation of Control Measures
  - **Risk of Establishment**

1. A FRAMEWORK FOR CLIMATE SUITABILITY IN EFSA

Risk of Establishment

- Despite the entry-pathway we focus on the possibility of the pest to **establish** and **reproduce** in Europe
- we focus on the **climate suitability** and host-availability

1. A FRAMEWORK FOR CLIMATE SUITABILITY IN EFSA

Climate Suitability

- Relies on the collection and use of **GIS** Data and **Physiological** Data
- Full Climate suitability generates a variety of simulation models based on the available info on pest-**distribution** and pest-**physiology**

1. A FRAMEWORK FOR CLIMATE SUITABILITY IN EFSA

Literature Review

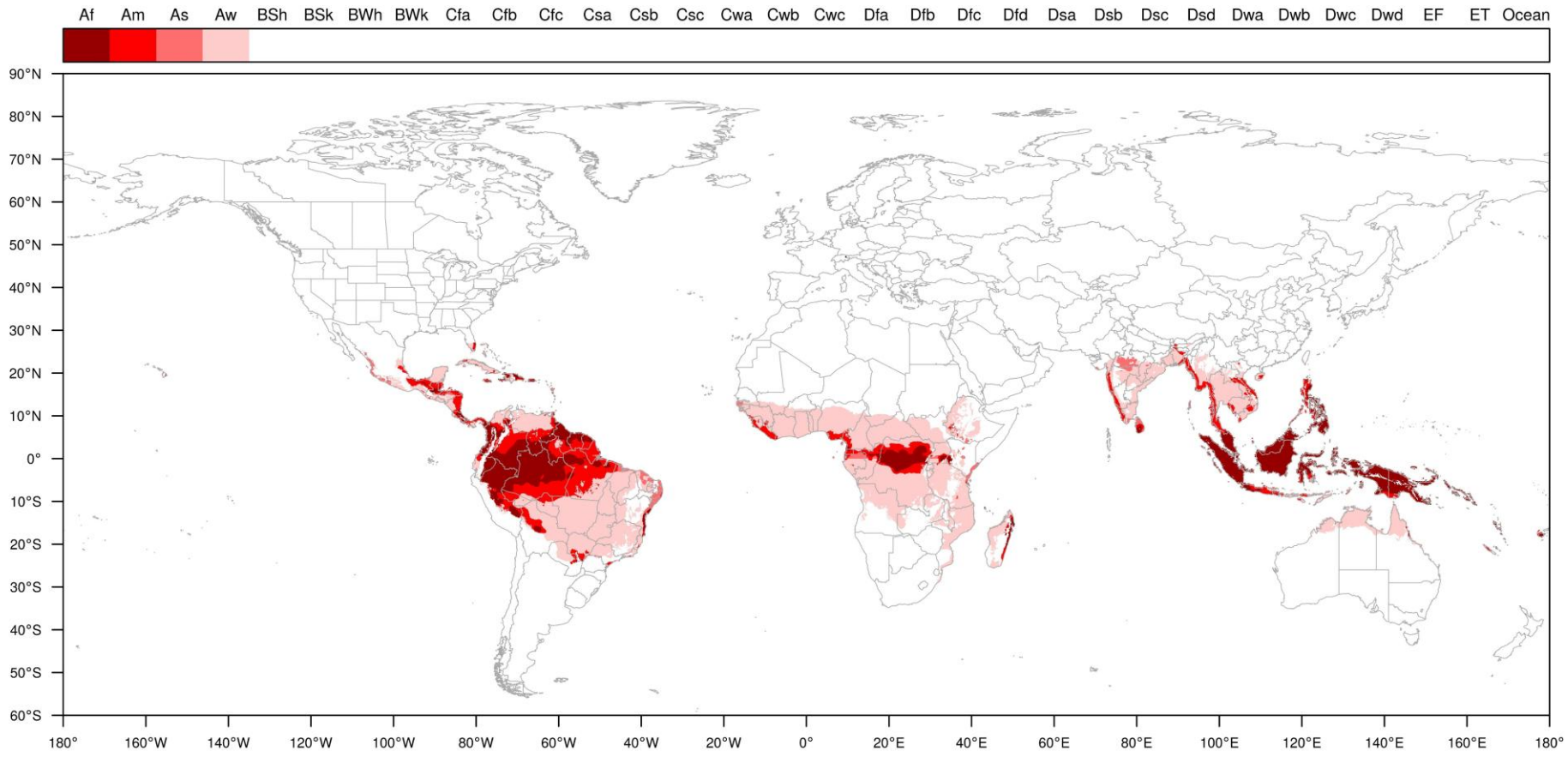
- **Systematic** screening of the available scientific (and not only) literature
- Collect information about Pest Distribution and Eco-physiological parameter

WHAT DOES IT MEAN CLIMATE SUITABILITY

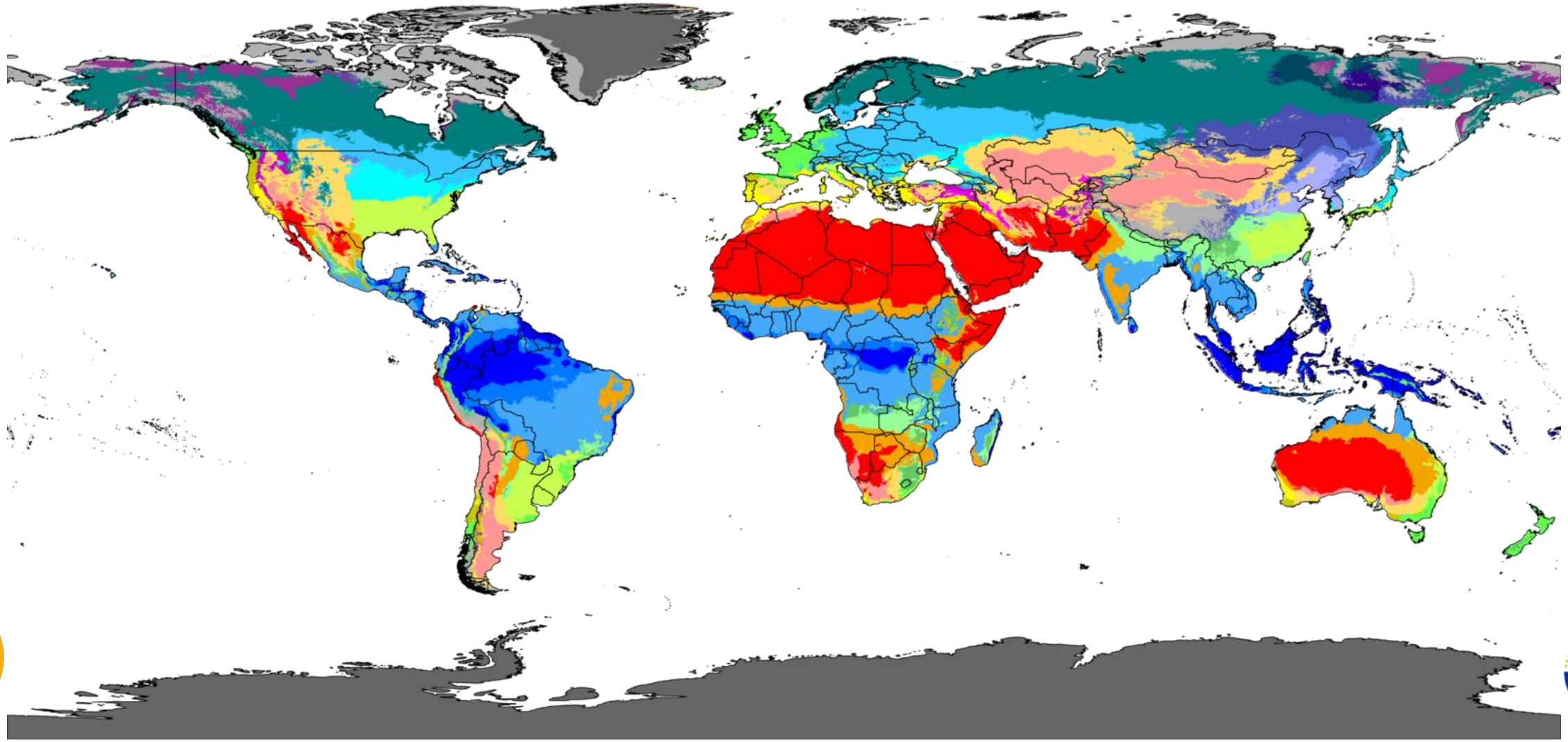
- What is your Climate Suitability?

PHYSIOLOGICAL-BASED HUMAN CLIMATE SUITABILITY

- What is your Climate Suitability?



DISTRIBUTION-BASED HUMAN CLIMATE SUITABILITY



Source: Beck et al.: Present and future Köppen-Geiger climate classification maps at 1-km resolution, Scientific Data 5:180214, doi:10.1038/sdata.2018.214 (2018)

WHAT DOES IT MEAN CLIMATE SUITABILITY

- What is your Climate Suitability?
- It depends on **heat**, **humidity**, **wind**, **time** and **physiological needs** (cardinal temperatures, heat-loss etc…)
- It also depends on **adaptation strategies** and **survival skills** which makes it difficult to establish within a given range

WHAT DOES IT MEAN CLIMATE SUITABILITY

- Same applies to **plant pests**!
- There are studies that identifies **cardinal temperature and conditions** for a pest (T, RH, Photoperiod…)
- Alternatively, we can try to **infer** these conditions from known **pest distribution** based on the assumption that if we know where the pest is established we can retrieve climatic information from those areas
- Both these approaches are not 100% correct

CLIMATE SUITABILITY BIASES

- The studies identifies cardinal conditions in **experimental setup** (laboratory, greenhouse…**)**, in a natural ecosystem other factors may apply (sheltering…)

- While you can infer climate suitability based on the pest distribution, **pest absence** does not necessarily means that the organism cannot establish elsewhere (spread-limitation, host-availability, containment measures in place, lack of surveying effort…)

- Simulation models can encompass different climatic variables at once, agrometeorological indicators may give you a “score” but often we miss aspects related to the biological fitness of the organism

CLIMATE SUITABILITY PRODUCTS

- Agrometeorological indicators

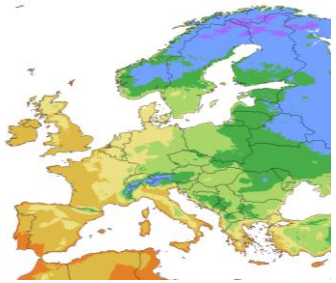
- Simulation Models
  - Correlative Models (SDM)
  - Process-Based Models
    - Physiologically Based
    - Population Dynamic Models
    - Agent-Based Models

CLIMATE SUITABILITY ANALYSIS

Suitable climate conditions for the organism to establish in the EU?

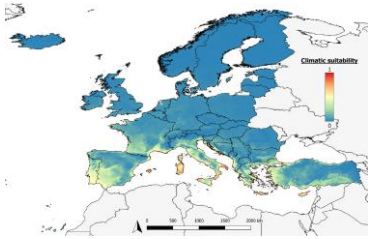
Agrometeorological indicators → Correlative models → Process-based models → Physiologically-based population dynamics

- Degree-days
- Temperature
- Precipitation - Snow
- Köppen-Geiger
- Hardiness zones
- Bioclimatic variables

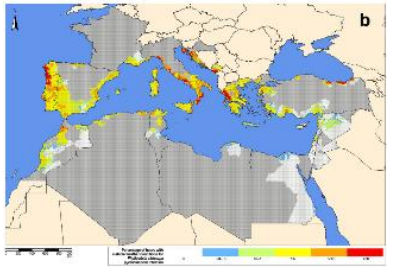


Species Distribution Models

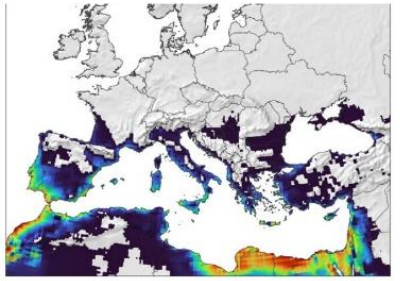
- BART
- Bioclim
- MaxENT



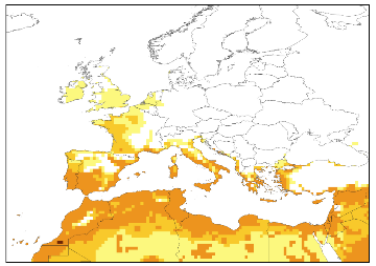
- Magarey



- PBDM



- CLIMEX

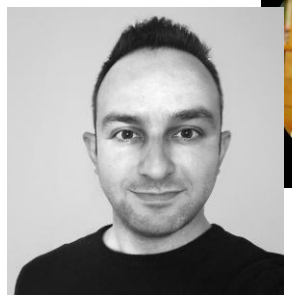


PLH-RA GEOCLIM ACTIVITIES GROUP

PLH RISK ASSESSMENT – GEOCLIM ACTIVITIES

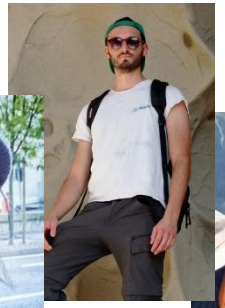
Andrea

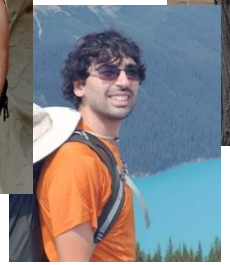
Rachel



Alex (CREA)

Chiara (CREA)





Simone, Roberta, Sofia, Elisabetta, Giovanni, Lorenzo, Eleonora

Ana (Entomologist)

Erika (Phytopathologist)

Malayka (Entomologist)

Stella (Entomologist)

Yara (Nematologist)

Susana (Nematologist)

Marie (Mycologist)

External Experts (ISA)

SECTION ON CLIMATE SUITABILITY

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Methodological Workflow from Systematic Literature Search to Global Pest Distribution

Alex Gobbi

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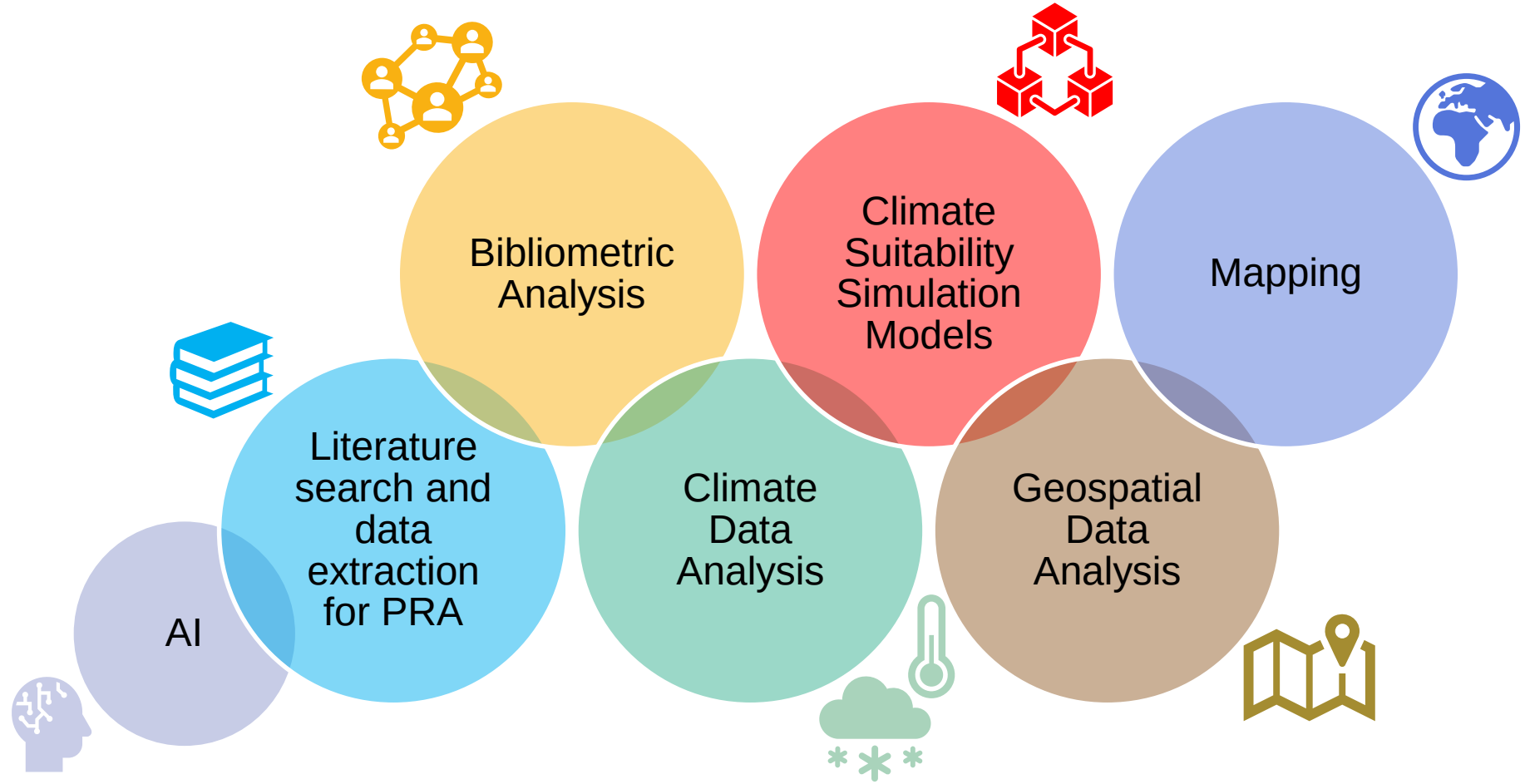
PLH-RA GEOCLIM ACTIVITIES



Automation

SYSTEMATIC LITERATURE SEARCH

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1. A FRAMEWORK FOR CLIMATE SUITABILITY IN EFSA

Systematic Literature Review

- **Systematic** screening of the available scientific (and not only) literature
- Collect information about Pest Distribution and Eco-physiological parameter
- Reconstruction of Global Pest Distribution and a lot more

SYSTEMATIC VS TRADITIONAL LITERATURE SEARCH

Traditional Literature Search

- Purpose-oriented
- Expert-driven keyword-selection
- One database mostly
- Not reproduceable
- Not complete

Systematic Literature Search

- Topic-oriented
- **String-based** (expert-driven keyword selection)
- Several databases
- Recorded database entry-date, string etc…
- As complete as it can be

Context

- Consultation
- Quick topic exploration

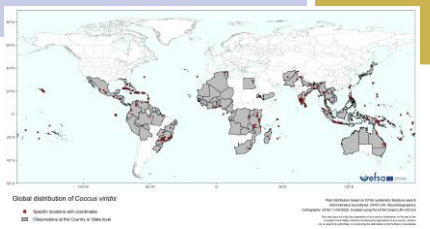
Context

- Medical, Legal and Policy-oriented
- Widely used in risk-assessment activities
- Meta-analysis and review

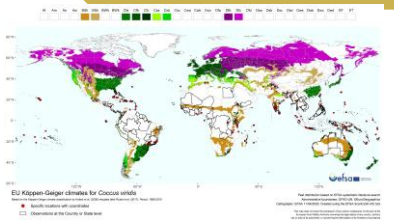
GENERAL WORKFLOW FOR CLIMATE SUITABILITY FOR PRA

Systematic Literature Search

Data extraction



Köppen-Geiger Climate Matching



Working Group Draft -> Adoption by EFSA PLH-Panel

Publication of EFSA Journal

LITERATURE SEARCH AND CLIMATE SUITABILITY WORKFLOW - TODAY

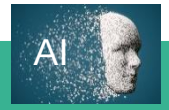
START

Planning phase
- Estimate workload
- Estimated date of PRA adoption
- Selection of ISA(s) and kick-off

Literature search
Data extraction
Pest distribution
Bibliometrics

WG starts working on organism

Working group



Systematic Literature Search

Data extraction

Climate suitability analysis

Publication of data and results + report

Bibliometric analysis

Experts' dashboard

zenodo

SEED

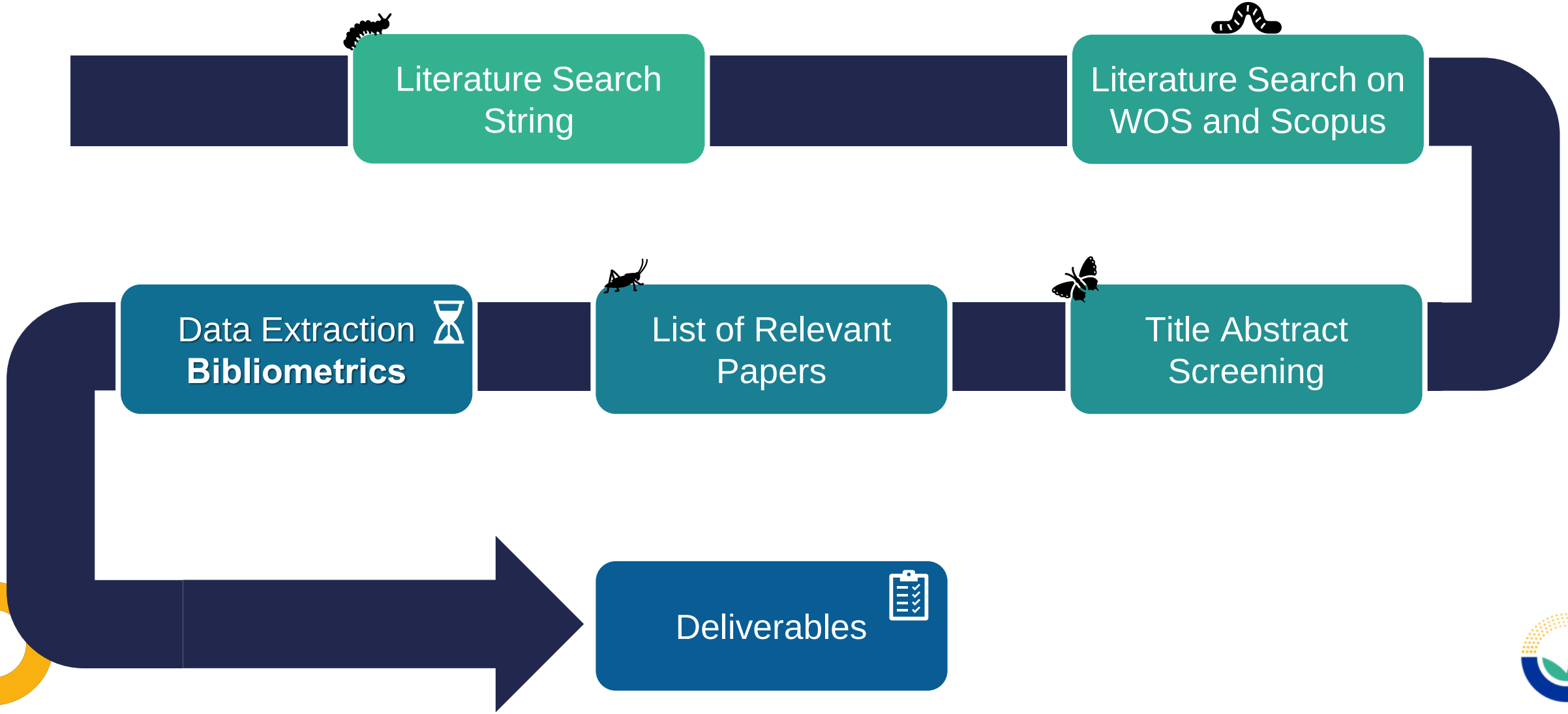
Automation script under development

~ 2 weeks - 3 months

~1-3 months

~1-2 months

WORKFLOW FOR LITERATURE SEARCH AND DATA EXTRACTION



LIT SEARCH AND DATA EXTRACTION

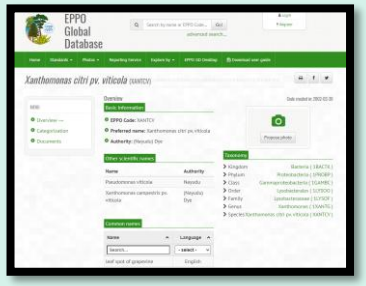
Literature Search

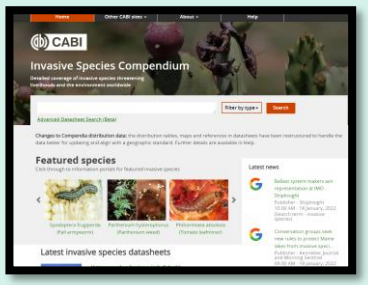
Very generic search string using scientific name(s) and international common names from EPPO and CABI

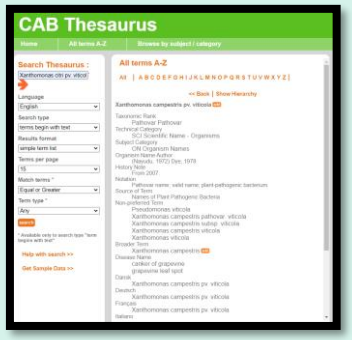
Clarivate Web of Science™

Scopus®

Check on other databases + info from experts







DistillerSR

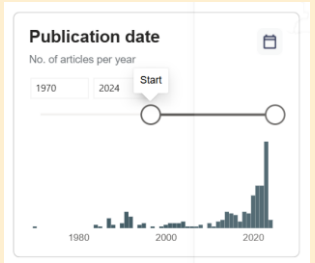
Data extraction

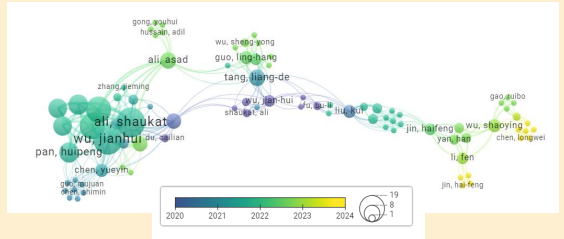
Two-Level screening:

- Title and Abstract
- Full Text

1. Pest Distribution
2. Pest Host-Range
3. Pest Biology & Eco-physiology *
4. Pest Impact *
5. Pest Spread *
6. Pest Control Methods *
7. Pest Climate Suitability *
8. Pest Vector*

Bibliometric analysis





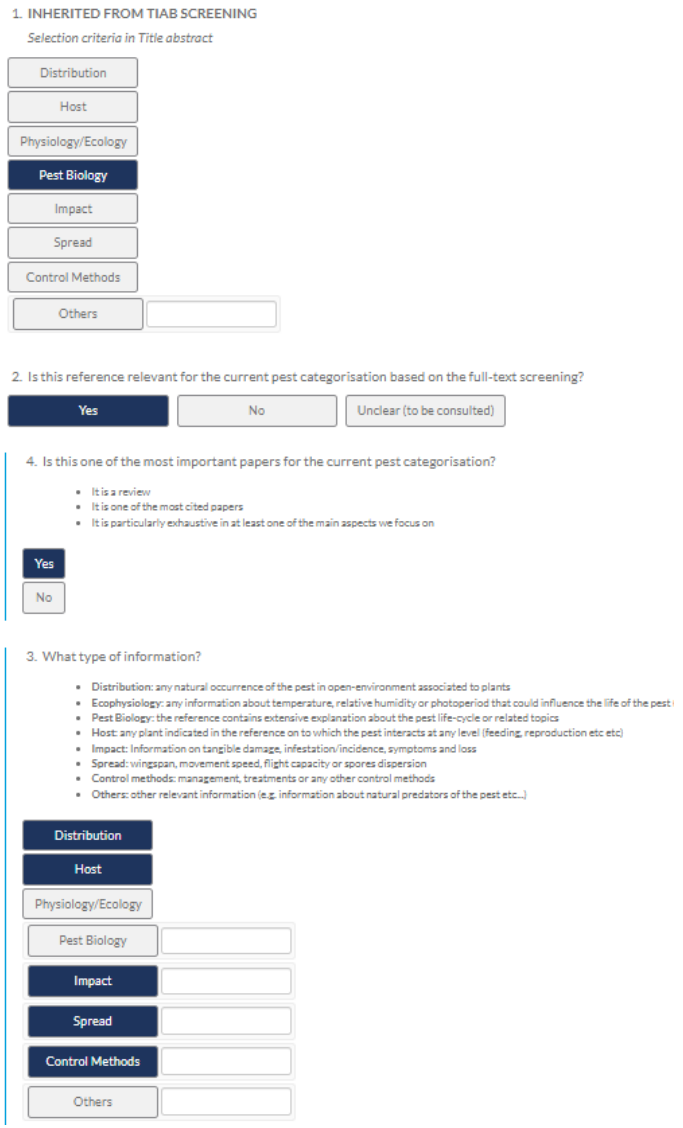
LITERATURE SCREENING AND DATA EXTRACTION

DistillerSR

Two-Level screening:

- Title and Abstract (TIAB)
- Full Text (FULLTXT)

We extract information from PDFs following a **structured questionnaire** on DistillerSR

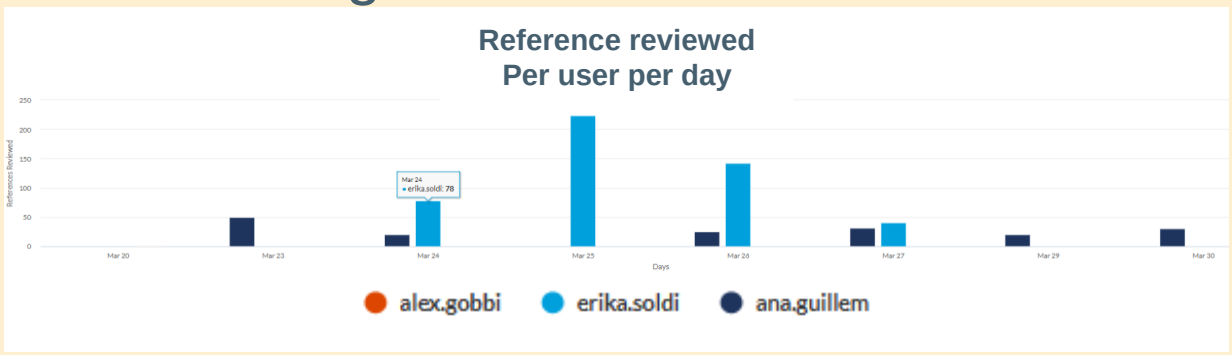


1. Distribution
2. Host-Range
3. Pest Biology & Eco-physiology
4. Impact
5. Spread
6. Control Methods
7. Climate suitability studies
8. Vector info

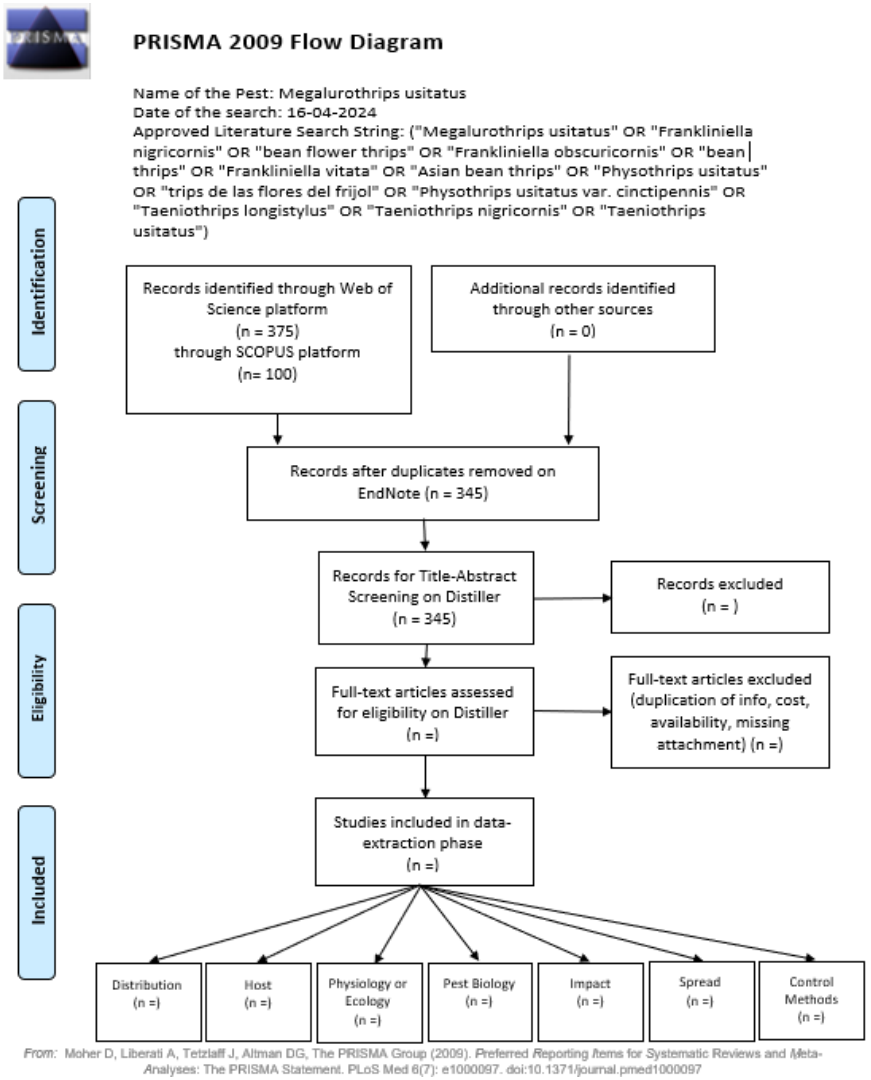
TRANSPARENCY, TRACEABILITY AND REPRODUCIBILITY

Keep track of **who** did **what** and **when**:

- Standard and structured process in DistillerSR
- PRISMA diagram



DistillerSR analytics



BIBLIOMETRIC ANALYSIS

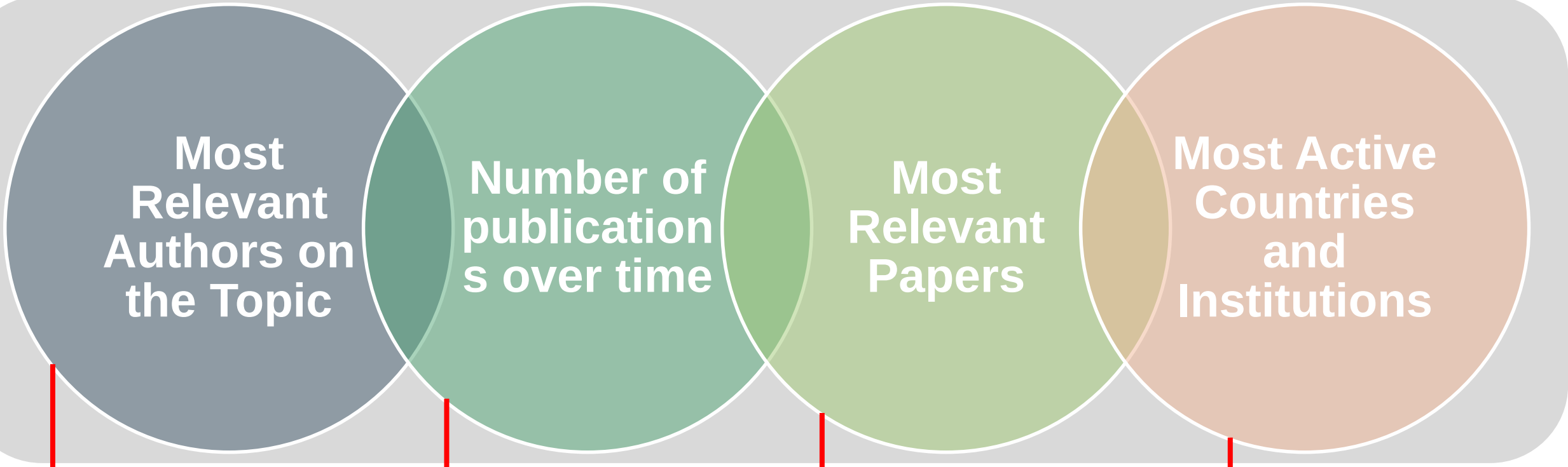
BIBLIOMETRICS ANALYSIS

Bibliometric analysis: “the branch of library science concerned with the application of mathematical and statistical analysis to bibliography; the statistical analysis of books, articles, or other publications”
(Oxford English Dictionary)

Developed in collaboration with CREA Bologna

Based on References **Included AFTER TIAB-Screening**

BIBLIOMETRIC ANALYSIS



Which hearing experts to contact?

How is, and how has evolved, the attention of the Scientific Community?

What are the reference papers on the organism and/or on a specific topic?

Which countries are the most active? Any EU country?

BIBLIOMETRICS ANALYSIS

Data

Author's name
Bibliography
Citations and References
Author's affiliations
Year of publication
Journal of Publication

Analysis

Most Cited Authors
Most Cited Papers
Co-occurrence patterns
Location of the study
Publications/Year

Information

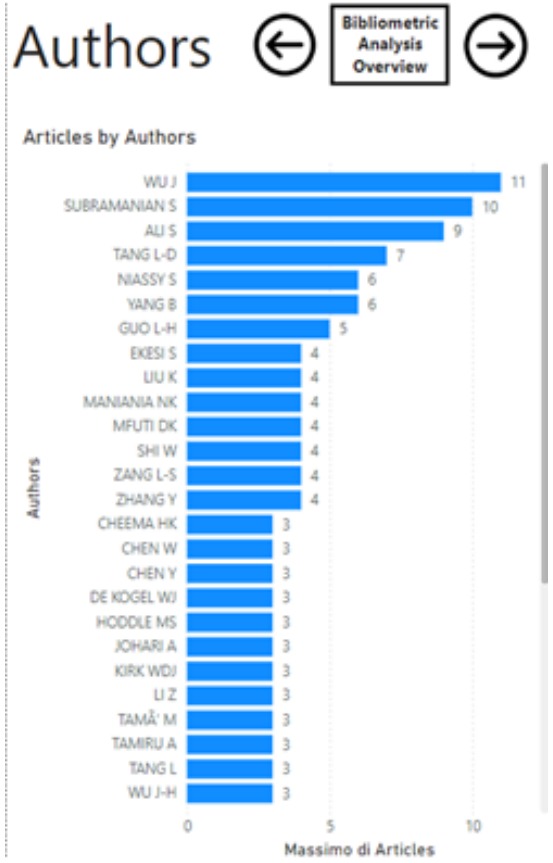
Hearing Experts for WG
Core-Knowledge for WG
Network Analyses
Impact on Scientific Community

Interactive Dashboard
Bibliometrics Report

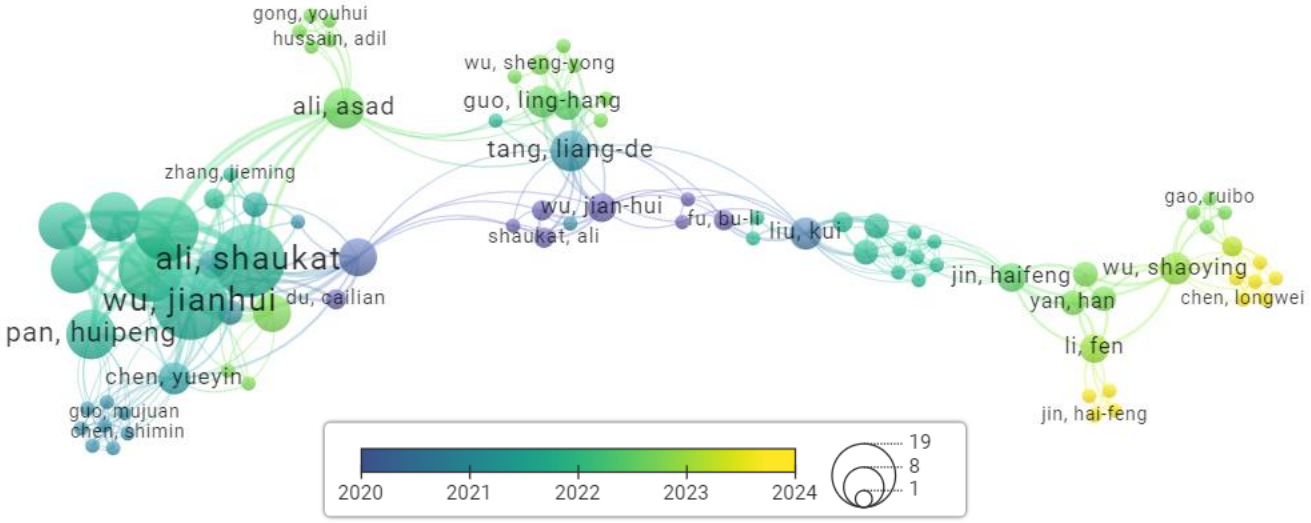
Power BI

WHICH POTENTIAL HEARING EXPERTS TO CONTACT?

Number of Publication/Authors

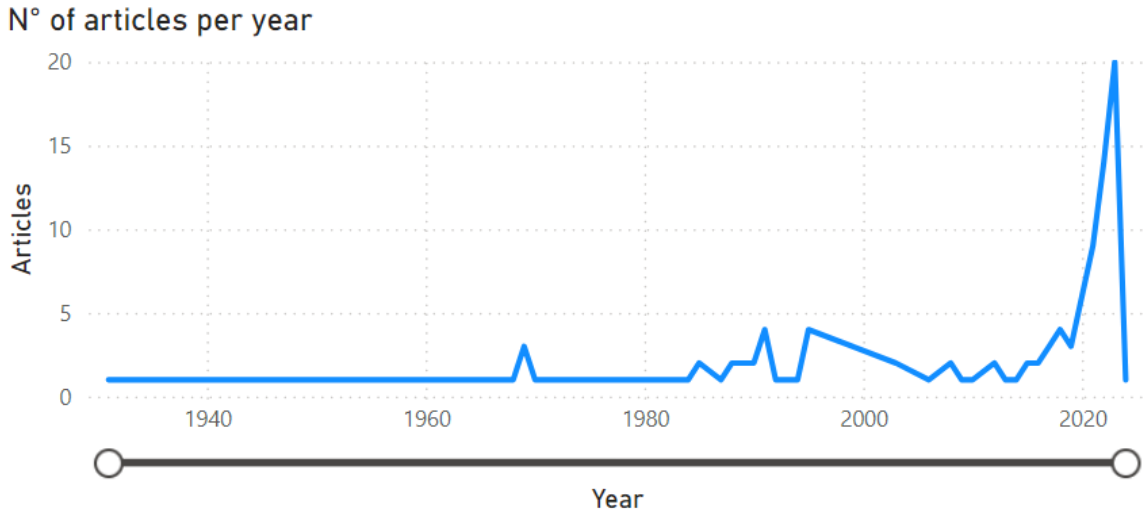


Co-occurrence Network of Authors



Tang Liang-De, **Wu Jianhui**, and **Wu Shaoying** are among the most productive authors and does not belong to the same Network. Also, their production spans over slightly different time-ranges

WHAT IS THE ATTENTION OF SCIENTIFIC COMMUNITY?



The attention on *Megalurothrips usitatus* have been **increasing** in the past 5 years. Nothing was published before 1969.

WHAT ARE THE MOST RELEVANT PAPERS ON THE TOPIC?

Documents

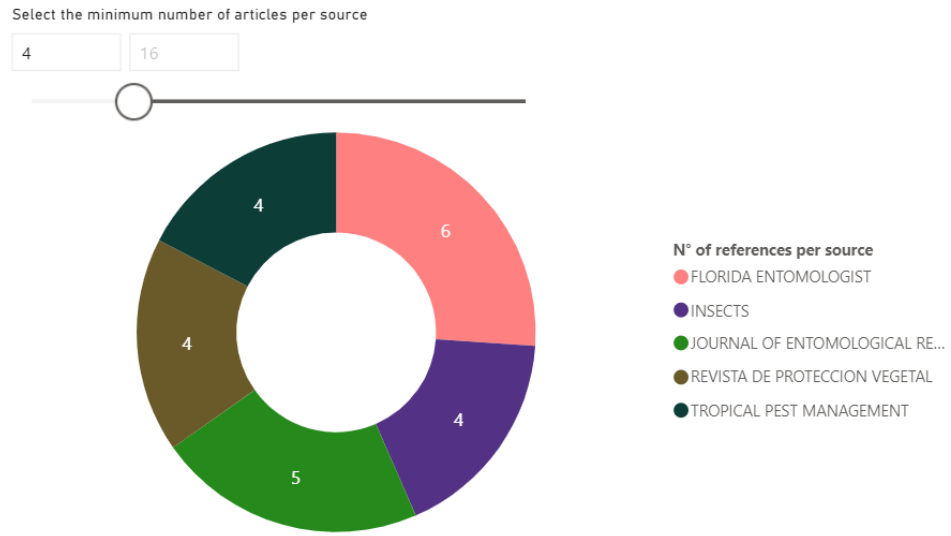
Bibliometric Analysis Overview

Pest selected

Megalurothrips usit...

Most cited references

Paper	DOI	TC
PRASADA RAO RDVJ, 2003, ANN APP BIOL	10.1111/j.1744-7348.2003.tb00262.x	61
RAO RDVJP, 2003,	NA	49
TANG L-D, 2015, FLA ENTOMOL	10.1653/024.098.0235	38
CHU C-C, 2006, FLA ENTOMOL	10.1653/0015-4040(2006)89[47:DAETFM]2.0.CO;2	30
TANG LD, 2016, NEOTROP ENTOMOL	10.1007/s13744-015-0334-1	23

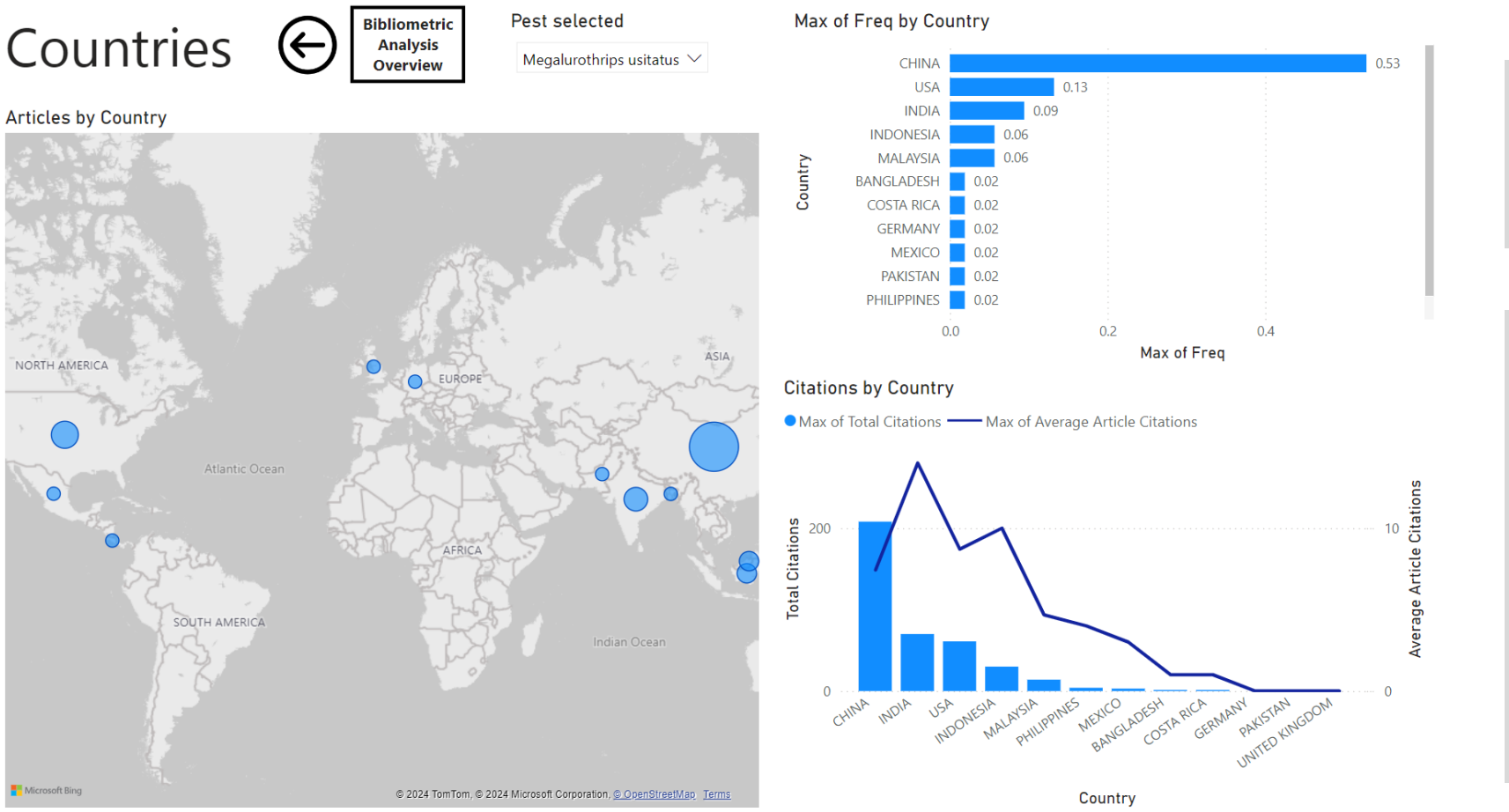


Given the total number of citation these are the top-4 most relevant papers on the topic:

- Prasada Rao et al 2003
- Tang Liang-De et al 2015 and 2016
- Chu et al 2006

Pie-Chart shows which journals have most publications

WHICH COUNTRIES ARE THE MOST ACTIVE?



China is by far the most active country on the topic, followed by **USA** and **India**

Germany is also associated to some scientific publication!
Maybe it is advisable to backtrace the reference. Eventually contact the German NPPO about info on the Pest Status

Data Extraction: Distribution

Alex Gobbi

- CREA Researcher

WHAT TYPE OF DATA DO WE WANT?

- We need to retrieve information from literature about **where** the Pest have been **detected/observed** interacting with the **Plant-Host.**
- We do not consider for **Distribution** data about human infections, pathogens grown in the lab and artificial experiments. If it is a **natural outdoor occurrence of the pest,** we record that.

In case of **non-experimental** evidences (reviews, reference in the introduction/discussion and generally cited literature) we proceed this way:

- **Reviews** and **Observations cited in Introduction and Discussion**: We collect the information as **Cited (C) Observations**, most of them could be already present. If in the end we notice something strange we may trace it back to the original reference (i.e. country/host appearing only once)

Greenhouses/nursery occurrences may be relevant for identifying entry-pathways but they NEVER contribute to the definition of climate suitability.

WHAT TYPE OF DATA DO WE WANT?

GIS Coordinates

- If not

FAO.GAUL Code

- If not

Google Earth Coordinates

There is a clear **hierarchy** in the quality of information we extract about **Distribution** for **Pest Risk Assessments**

WHAT TYPE OF DATA DO WE WANT?

GIS Coordinates

If **provided** directly in the paper either in DD or SD format

Example: Pest was located in Italy at 46°34'36" N and 10°12'24"E

- If not

FAO.GAUL Code

- If not

Google Earth Coordinates

GIS COORDINATES

- **Decimal Degree Coordinates (DD)**

They are measured as **decimal number**, the **sign** reflect the position from the origin (Greenwitch Meridian and Equator)

The first number is the **Latitude**, the second one is the **Longitude**

Latitude (Y)

- From –90 to 90 (N)
- Es: -86.765

Longitude (X)

- From –180 to 180 (E)
- Es: 165.659

Remember, **minutes (') and seconds (") CANNOT be higher than 60.**

To simplify follow the rule of the clock. You can have as many Hours as you want (°) but only 60 minutes (')/hour and 60 seconds (")/minutes

- **Sexagesimal Degree Coordinates (SD)**

They are measured in **Degrees (°)**, **Minutes (‘)** and **Seconds (’’)** while the **Letter (N,W,E,S)** identifies the cardinal direction. Always positive

Latitude (Y)

- From 90°S to 90°N
- Es: 52° 12' 43.33" N

Longitude (X)

- From 180°W to 180°E
- Es: 12° 44' 33" E

WHAT TYPE OF DATA DO WE WANT?

GIS Coordinates

- If not

FAO.GAUL Code

If there are **general** information about an area/administrative unit

Example: the Pest is located in Italy(0), Veneto (1) or Verona (2)

- If not

Google Earth Coordinates

FAO.GAUL CODE

- **FAO.GAUL Codes** are referring to the catalogue of Administrative Units proposed by FAO in 2015 and now updated to 2024.
- It contains **3-levels** of Resolution
  - 0: Countries
  - 1: Regions
  - 2: Provinces

Continent	GAUL_0	GAUL_0_C	GAUL_1	GAUL_1_C	GAUL_2	GAUL_2_C	GAUL_2_Shape_Area
Africa	Abyei	102	Administra	124	Administra	125	0.818949
Asia	Afghanista	1	Farah	277	Qala-e-Kal	3505	0.336144
Asia	Afghanista	1	Farah	277	Pushtrod	3504	0.041174
Asia	Afghanista	1	Farah	277	Shibkoh	3506	0.263788
Asia	Afghanista	1	Farah	277	Farah	3499	0.326499

WHAT TYPE OF DATA DO WE WANT?

GIS Coordinates

- If not

FAO.GAUL Code

- If not

If there are **specific** information about a place **(1)**, or **general** information of areas not listed in FAO.GAUL **(2)**

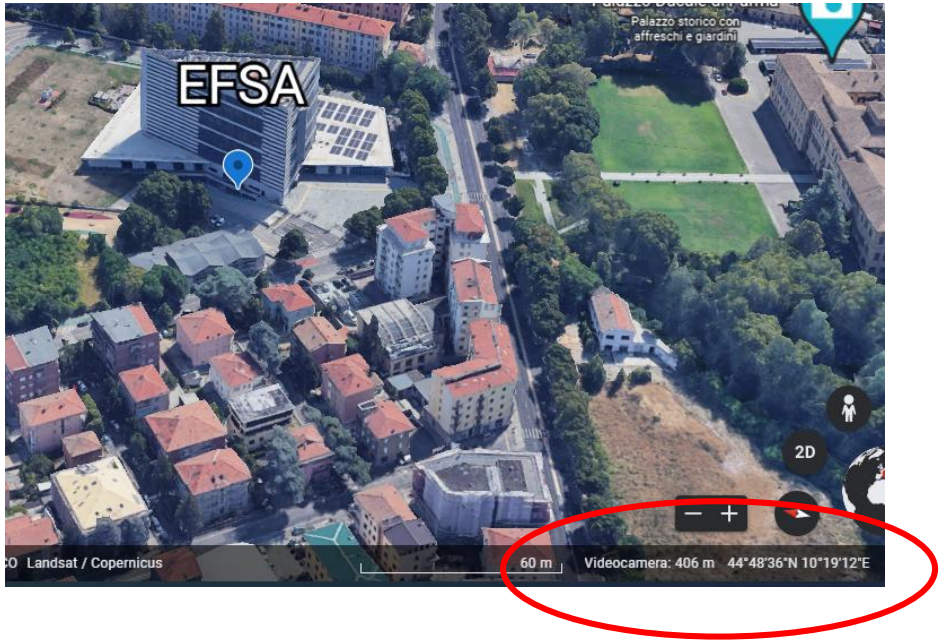
Example

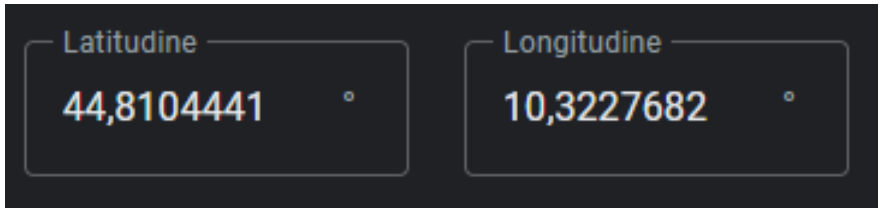
1) Pest was located in the EFSA garden (Italy)

2) Pest was located in Vicofertile (Italy)

GOOGLE EARTH COORDINATES

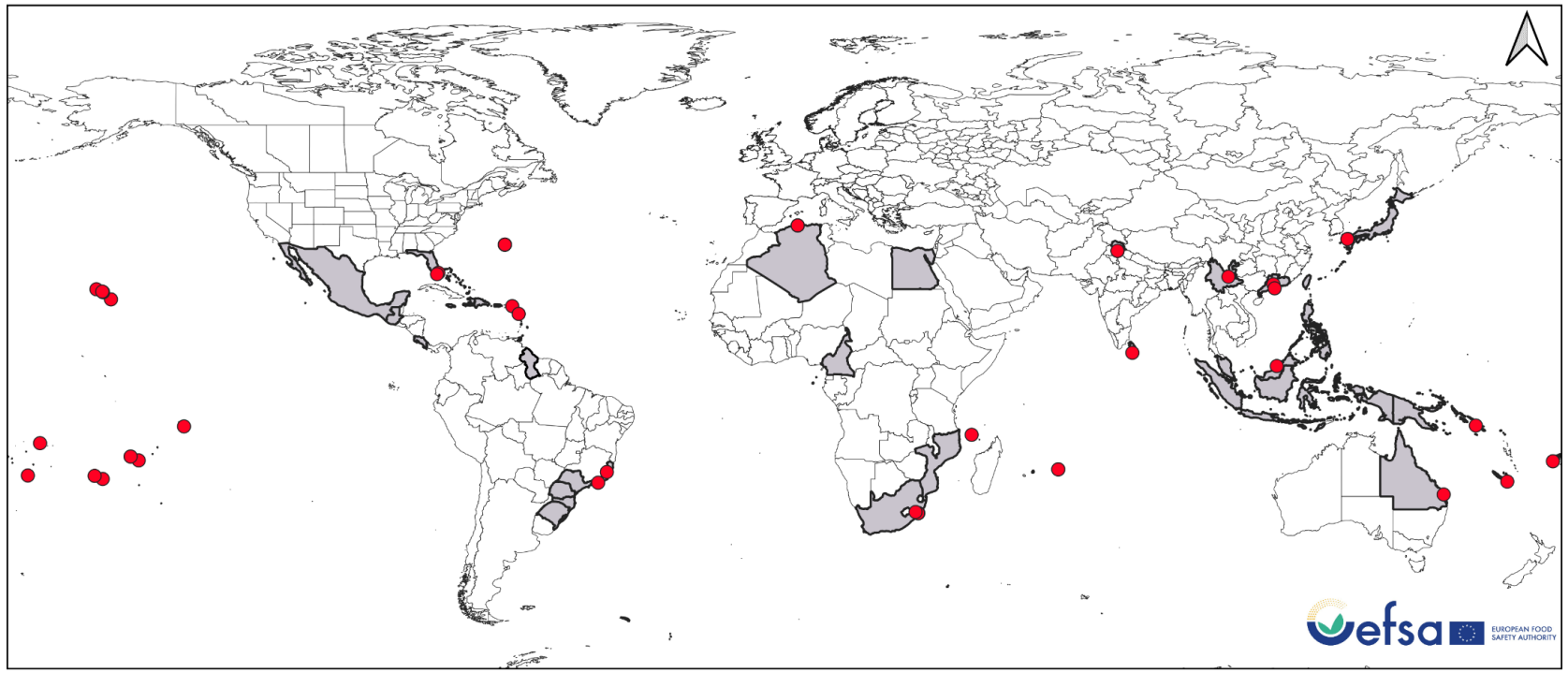
- On **Google Earth** (WebTool)
- Create a dedicated **Project** and save each occurrence
- Extract DD coordinates
- Keep track of Google Earth-based occurrences (centroids)





GLOBAL PEST DISTRIBUTION

Refid	Continent	Country	State	Observation	admin.sou	admin.lev	admin.cod	lat	long	Google_Ea	Notes	Type of evidence
1	Asia	China		southern China	FAO.GAUL	0	147295					Cross-referenced in text
2	Asia	China			FAO.GAUL	0	147295					Cross-referenced in text
2	Asia	China		Yongfa Town at Chengmai at Hainan	location			19.75	110.19	Yes		Actual observation
4	Asia	India	Karnataka		FAO.GAUL	2	1494					Cross-referenced in text
6	Asia	China	Hainan		FAO.GAUL	1	906					Cross-referenced in text
6	Asia	Taiwan			FAO.GAUL	0	147296					Cross-referenced in text



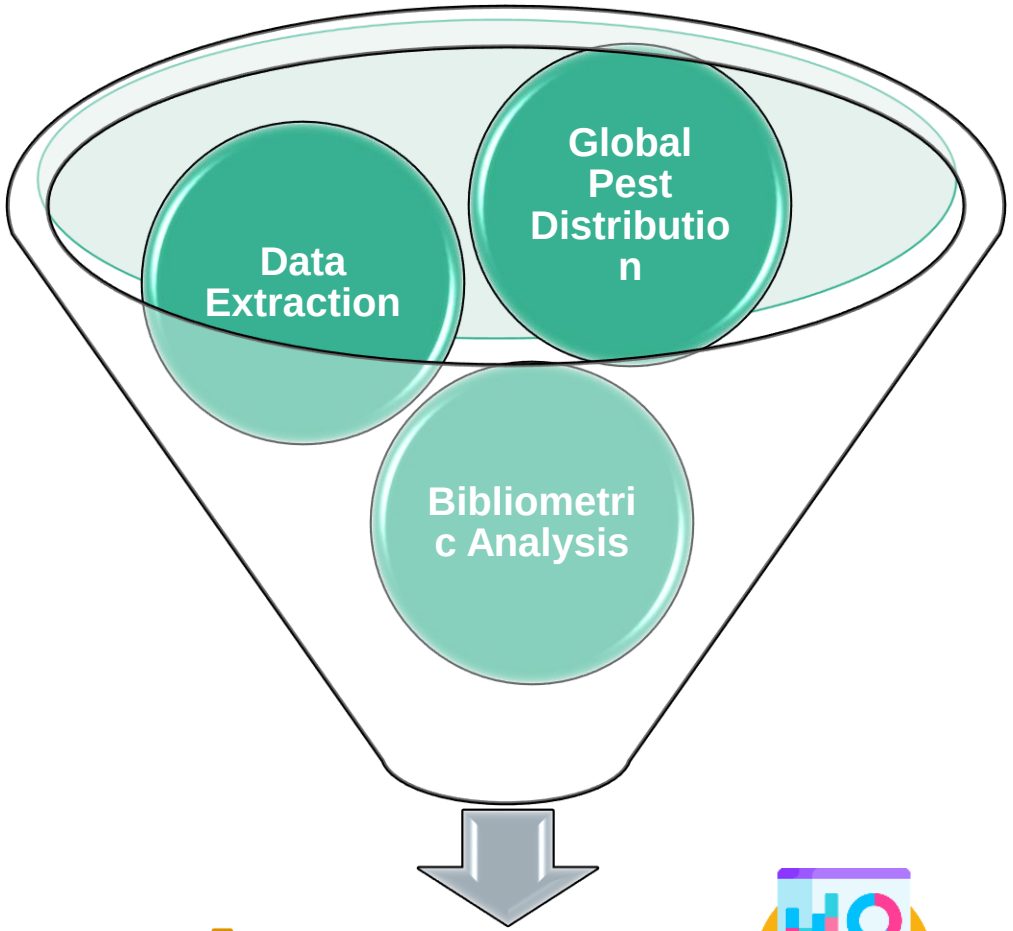
World distribution of *Morganella longispina*

- Specific locations with coordinates
- Observations at the Country or State level

Data source: EFSA Systematic literature search
Administrative boundaries: © FAO-UN, © EuroGeographics
Cartography: EFSA 11/2024

This map does not imply the expression of any opinion whatsoever on the part of the European Food Safety Authority concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries

EXPERTS' DASHBOARD



WG WILL RECEIVE FOR EACH PEST

Deliverables

- Master File
- PRISMA Diagram
- Host List
- Distribution Table
- Distribution Map
- Koppen Geiger Map
- Observation Notes
- PDFs

Access to Literature Search Dashboard

Power BI

Including some info from **Bibliometrics**

EXPERTS' DASHBOARD

Plant health dashboard

Reset all filters

Select pest

Megalurothrips usitatus

Impact

Spread

Disclaimer:

The data presented in this dashboard can be filtered to focus on specific subsets of information. Please be aware that applying filters will limit the view of the dataset and may result in incomplete or skewed interpretations. Use caution when drawing conclusions based on filtered data.

Article(s) selected

List of hosts observed

Host Name	Count	Source of evidence
cowpea	25	Multiple
Phaseolus vulgaris	24	Multiple
Vigna unguiculata	21	Multiple
Cajanus cajan	16	Multiple
Pigeon pea	11	Multiple
mungbean	10	Multiple

Publication date

No. of articles per year

1951 2024

1960 1980 2000

Contents

- Select all
- Biology
- Control.Methods

Title	Analysis	Distribution	Host	Impact	Spread	Phisiology	Biology	Control method
A new optical practice as an effective alternative to insecticides for controlling highly resistant thrips	●	Yes	Yes	Yes	No	Yes	No	Yes
A preliminary study on the regularity of outbreak of thrips in asparagus-bean interplanting fields	●	Yes	Yes	No	No	No	No	No
Abundance and diversity of thrips (Insecta: Thysanoptera) in conventional "carabao" mango orchard in piat, cagayan, philippines	●	Yes	Yes	No	No	Yes	No	No
An insight to thrips diversity in horticulture ecosystem of Mandya	●	Yes	Yes	No	No	No	No	No
Assessing the effectiveness of imidacloprid and thiamethoxam via root irrigation against Megalurothrips usitatus (Thysanoptera:Thripidae) and its residual effects on cowpea	●	Yes	Yes	No	No	No	No	Yes
Behavioral responses of Megalurothrips usitatus (Thysanoptera:	●	Yes	Yes	No	No	No	No	No

93%

LITERATURE SEARCH DASHBOARD

Here it is how it looks like now:

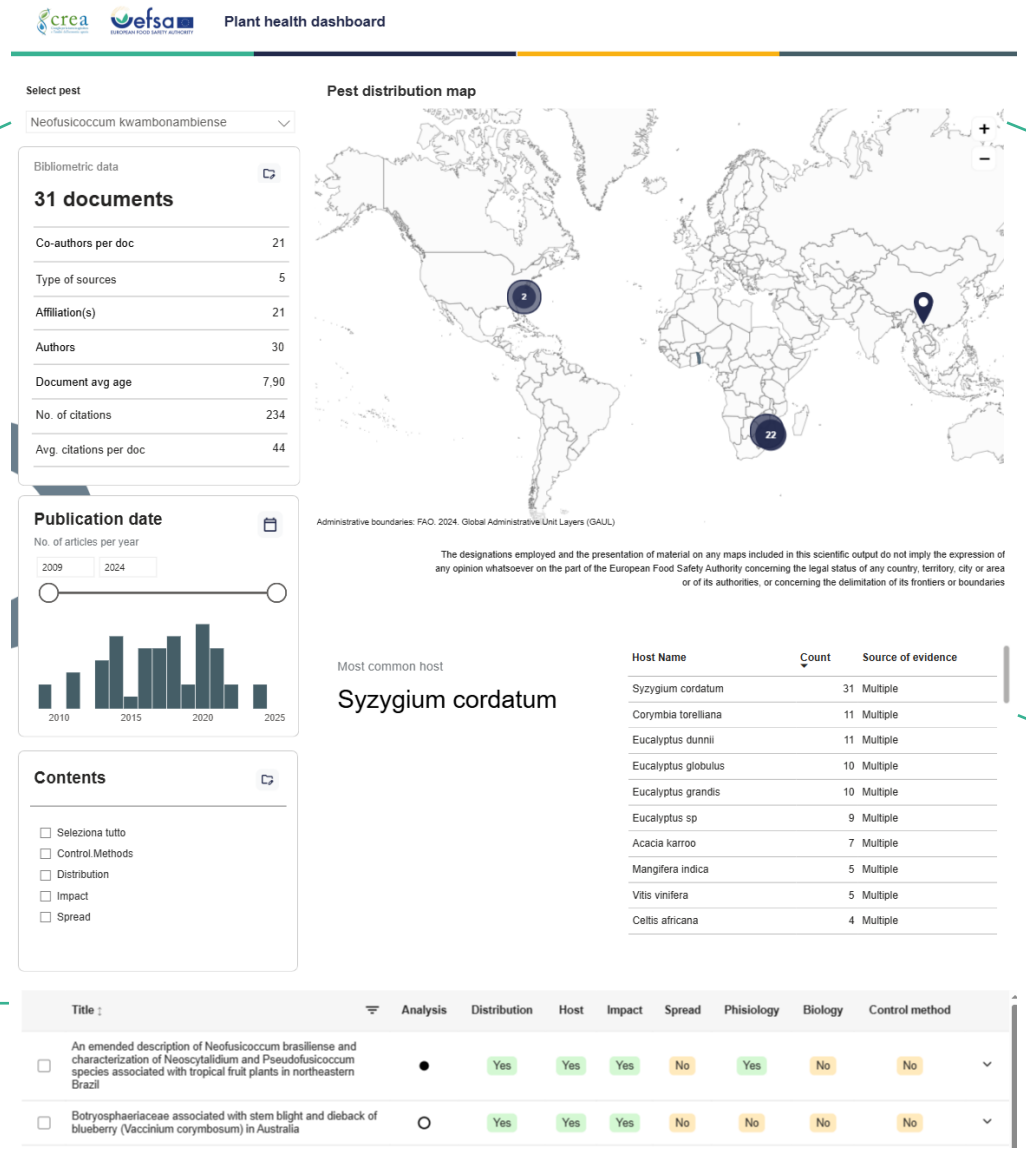
Pest Selection Menu

Bibliometrics Panel

Reference List Categorized By Content

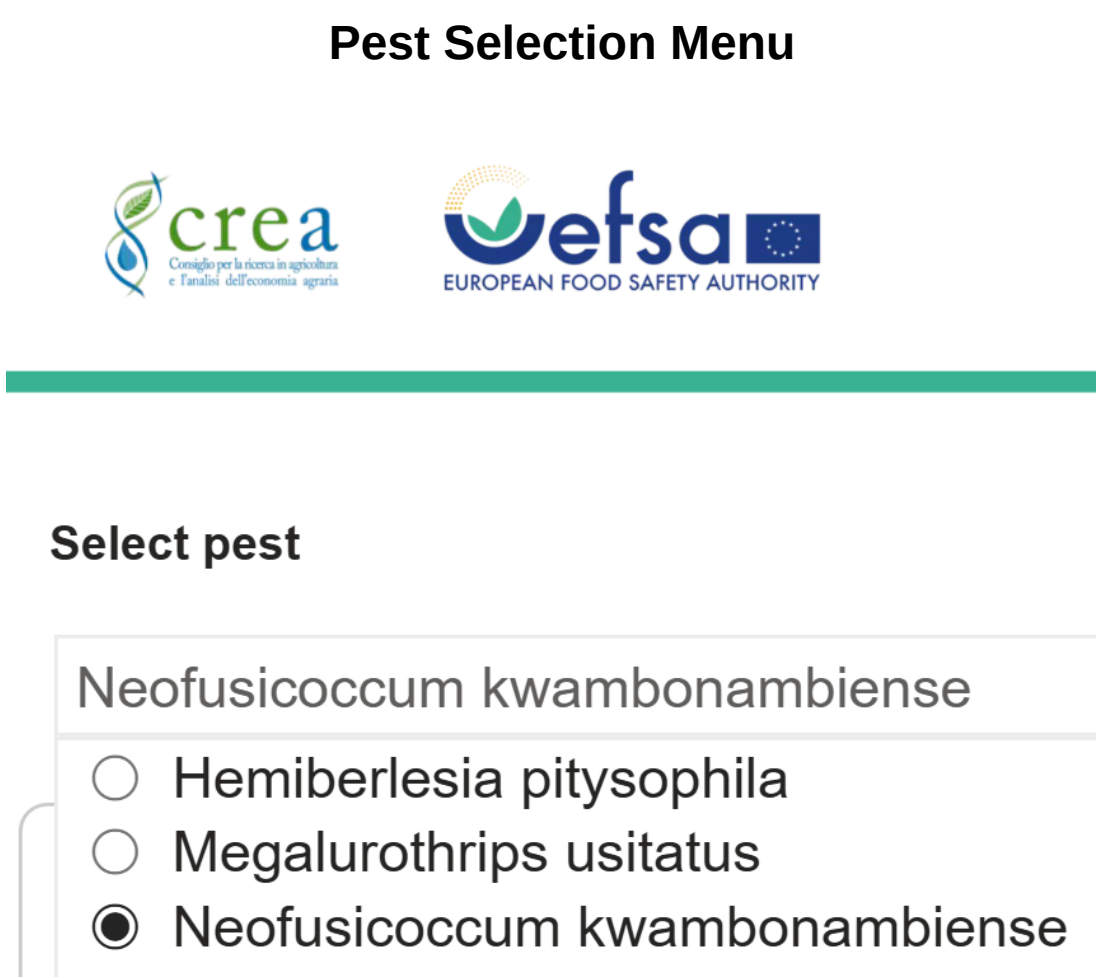
Interactive Distribution Map

Interactive Host List



LITERATURE SEARCH DASHBOARD

Here it is how it looks like now:



Useful if you are working on multiple pests at the same time

LITERATURE SEARCH DASHBOARD

Here it is how it looks like now:

Reference Table

	Title	Analysis	Distribution	Host	Impact	Spread	Phisiology	Biology	Control method
☐	An emended description of Neofusicoccum brasiliense and characterization of Neoscytalidium and Pseudofusicoccum species associated with tropical fruit plants in northeastern Brazil	●	Yes	Yes	Yes	No	Yes	No	No
☐	Botryosphaeriaceae associated with stem blight and dieback of blueberry (Vaccinium corymbosum) in Australia	○	Yes	Yes	Yes	No	No	No	No

Contents

- ☐ Seleziona tutto
- ☐ Control.Methods
- ☐ Distribution
- ☐ Impact
- ☐ Spread

Abstract:

Eucalyptus globulus, a non-native species, is currently the most abundant forest species in Portugal. This economically important forest tree is exploited mainly for the production of pulp for the paper industry. The community of Botryosphaeriaceae species occurring on diseased and healthy E. globulus trees was studied on plantations throughout the country. Nine species from three different genera were identified, namely Botryosphaeria (B. dothidea), Diplodia (D. corticola and D. seriata) and Neofusicoccum (N. australe, N. algeriense, N. eucalyptorum, N. kwambonambiense, N. parvum and Neofusicoccum sp.). Of these, N. algeriense, D. corticola and D. seriata are reported for the first time on E. globulus, while N. algeriense, N. eucalyptorum and N. kwambonambiense correspond to first reports in Portugal. The genus Neofusicoccum was clearly dominant with N. australe and N. eucalyptorum being the most abundant species on both diseased and healthy trees. In artificial inoculation trials representative isolates from all nine species were shown to be pathogenic to E. globulus but there were marked differences in aggressiveness between them. Thus, D. corticola and N. kwambonambiense were the most aggressive while B. dothidea and D. seriata were the least aggressive of the species studied.

How to read the table

○ Analysed only based on abstract ● Analysed based on full text

Categorization performed by **ISA experts** that can be used to **filter** all references by subject

Each reference has the **abstract** and **REFID** to lead you to the PDF if available

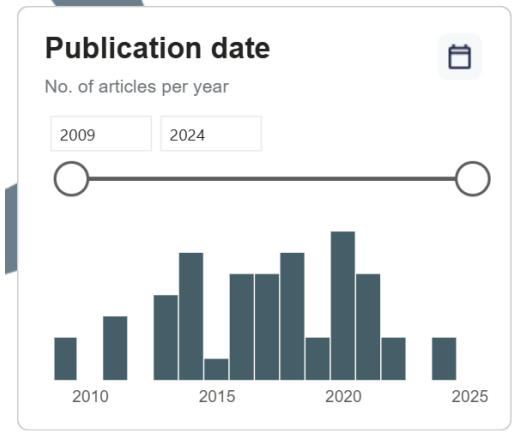
LITERATURE SEARCH DASHBOARD

Here it is how it looks like now:

Aggregate details of the **total bibliography** retrieved from literature search and data extraction

Interactive slider that shows how literature is spread in time and allow you to select **most relevant period**

Bibliometrics Panel



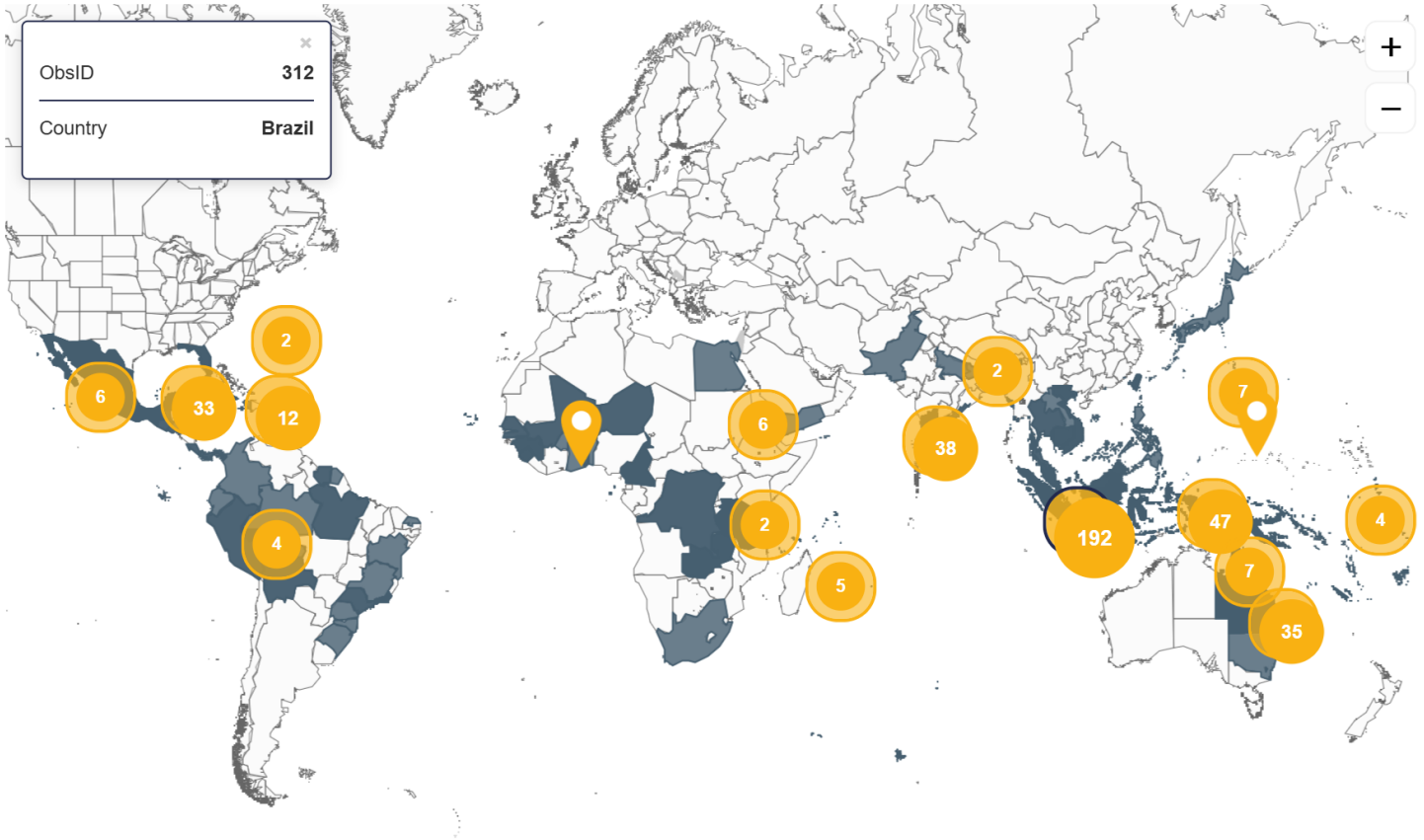
The slider **filters** the host-list and the reference table

LITERATURE SEARCH DASHBOARD

Here it is how it looks like now:

Each observation can **filter** the reference table and returns ObsID, REFIDs and Country

Interactive Distribution Map



Administrative boundaries: FAO. 2024. Global Administrative Unit Layers (GAUL)

Based on **FAO GAUL 2024**

LITERATURE SEARCH DASHBOARD

Here it is how it looks like now:

Most common host

Syzygium cordatum

By default shows the host with the **highest appearance** in the literature

Each occurrence **filters** the reference table below to allow you to retrieve the references where it was found

Interactive Host List

Host Name	Count	Source of evidence
Syzygium cordatum	31	Multiple
Corymbia torelliana	11	Multiple
Eucalyptus dunnii	11	Multiple
Eucalyptus globulus	10	Multiple
Avicennia marina	1	Original Observation
Azadirachta indica (Neem tree)	1	Original Observation
Blueberry	1	Cross-Referenced Citation

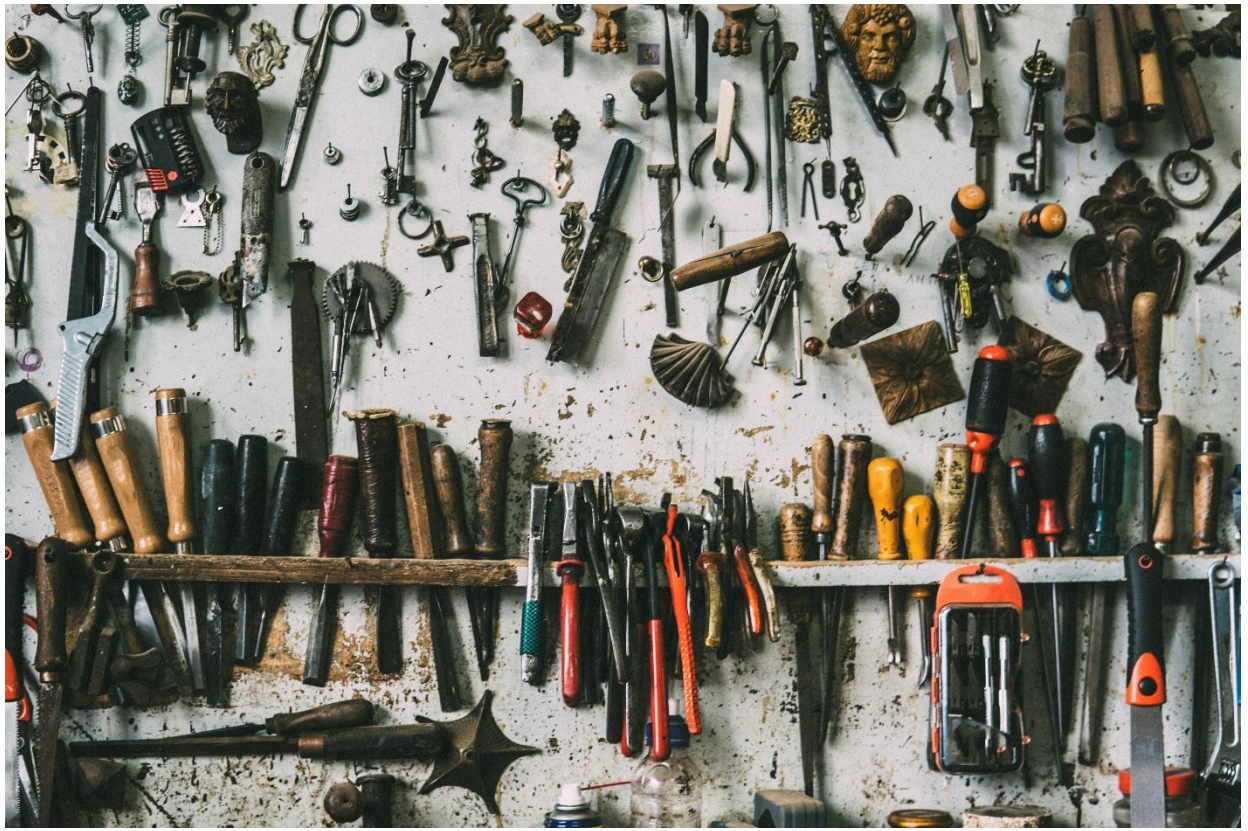
Rare occurrences also shows whether it was recorded originally, cited or mentioned

Tools to Support to EFSA Staff and Experts

Dashboard

Scanclim

Statistical tool



SDM-Generation

Data Sharing

Distribution Maps

Koppen-Geiger climate classification and tools available (R4EU Platform)

Alex Gobbi

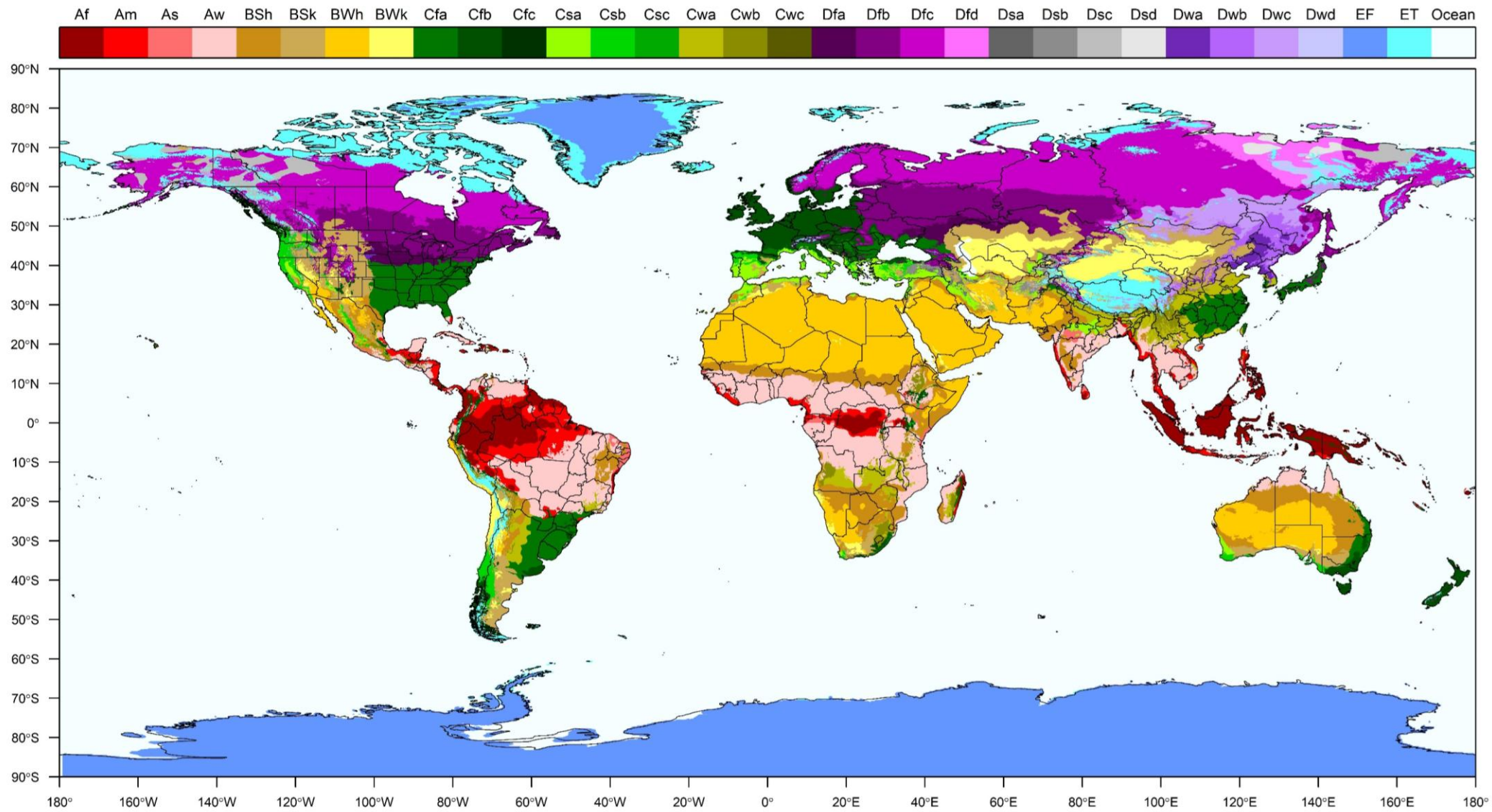
crea
Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

efsa
EUROPEAN FOOD SAFETY AUTHORITY

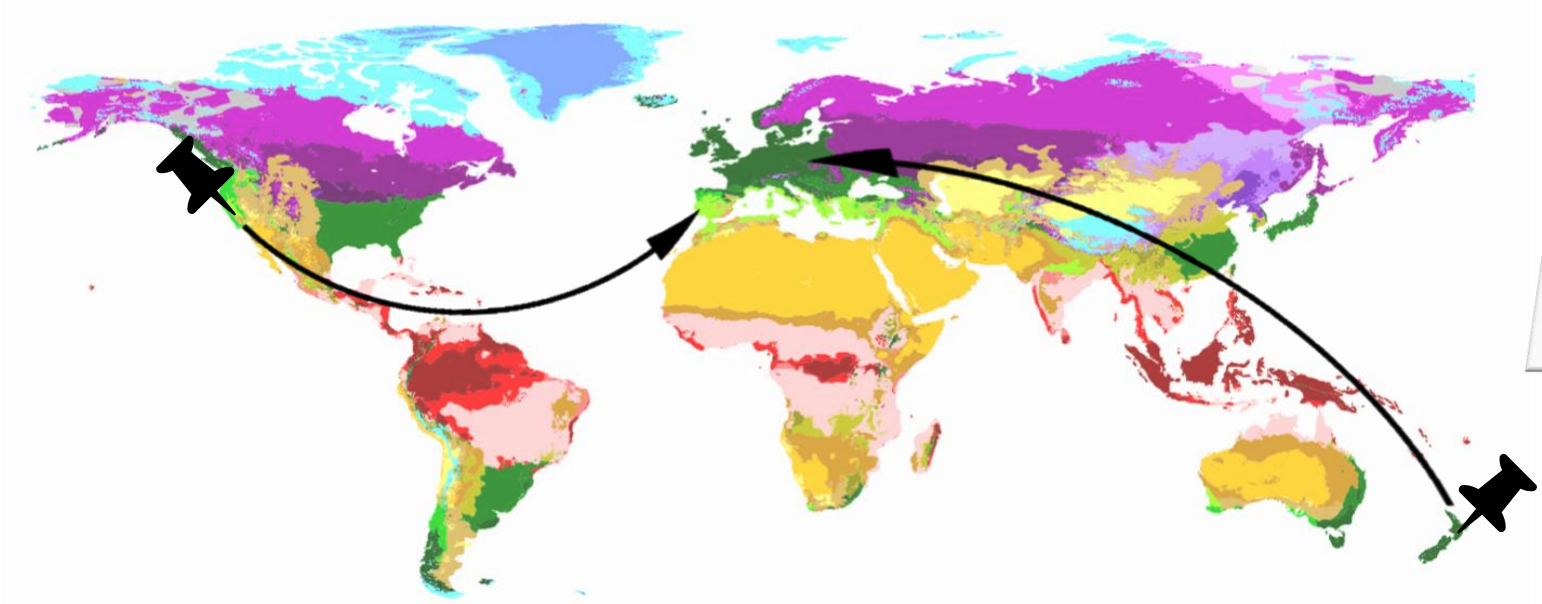
KOPPEN-GEIGER HISTORY

- **Vegetation** depends on **seasonal** and **annual averages** of **temperature** and **precipitation**
- **Empyrical**, based on observation
- Developed by Koppen in late-1800, refined by Geiger til 1954
- Initially made by only 5 climate categories (A,B,C,D,E)
- Second letter was added for dry-season (precipitation)
- Third letter was added for temperature (warm to cold)
- **Kottek** in 2006 made the first digital, global KG

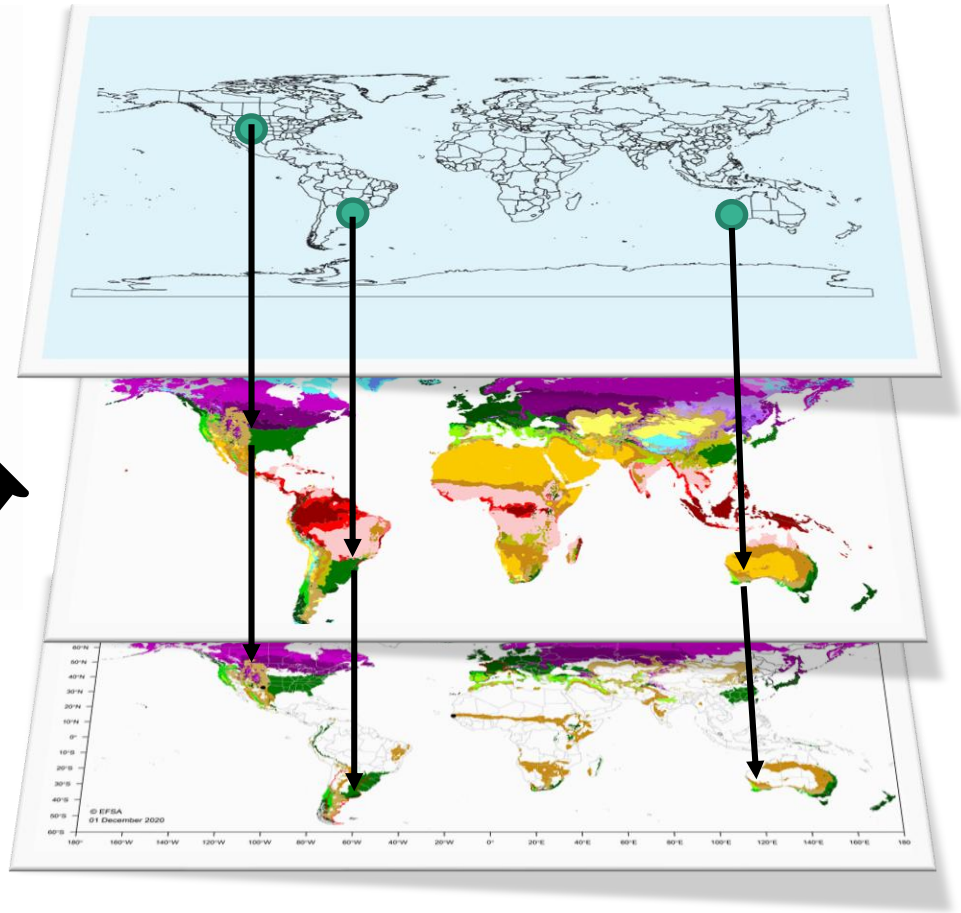
KOPPEN-GEIGER KOTTEK ET AL. 2006 – RESCALED AFTER RUBEL 2017



KÖPPEN-GEIGER CLIMATE CLASSIFICATION MATCHING



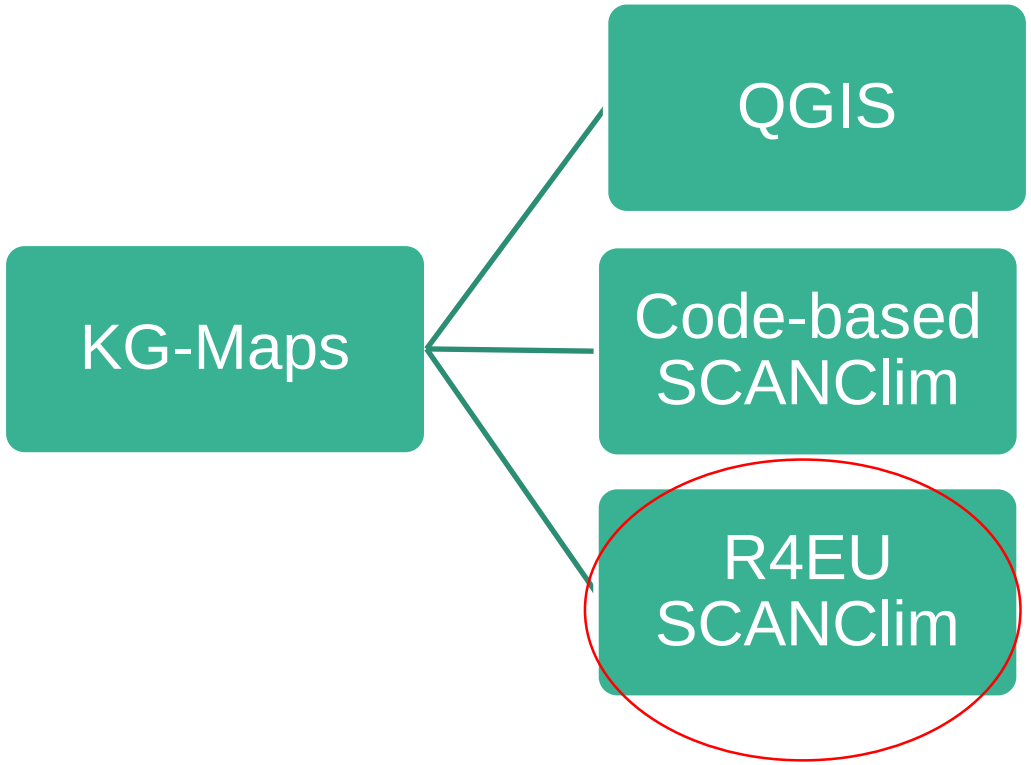
http://koeppen-geiger.vu-wien.ac.at/present.htm

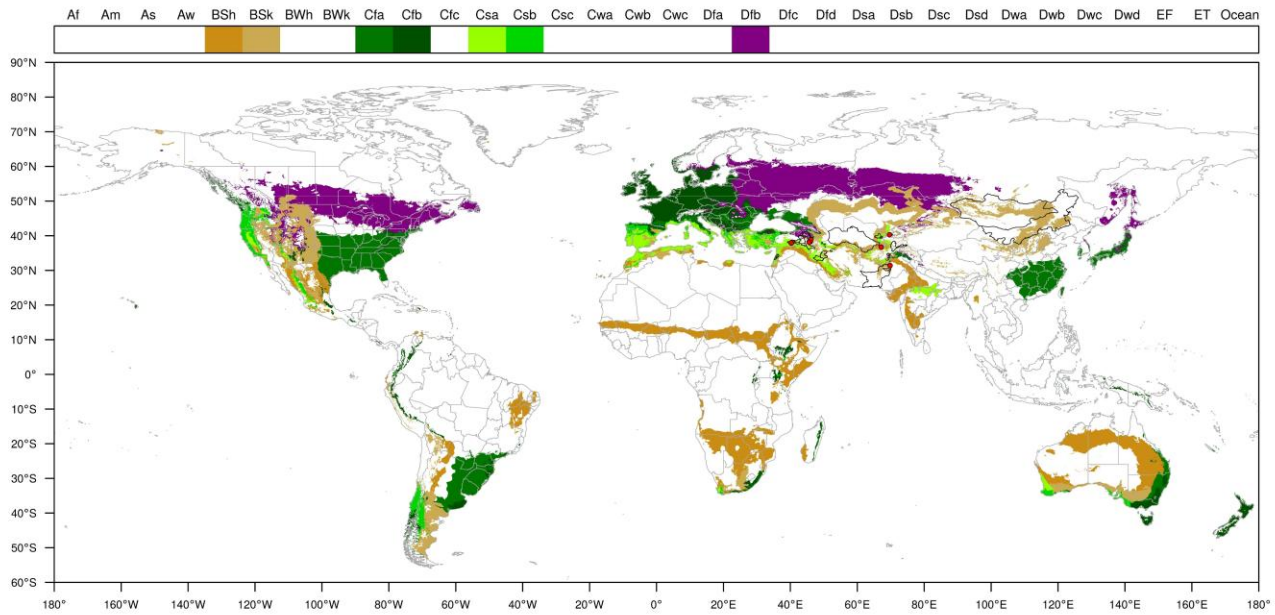


- Based on Kottek 2006 – Rubel 2017 First indicator for climate suitability in EFSA PLH
- Starting from the retrieved **Global Pest Distribution**
- We include in the output map only climates present in Europe

BUILDING KOPPEN-GEIGER MAPS

There are 3 ways to make Koppen-Geiger maps in PLH



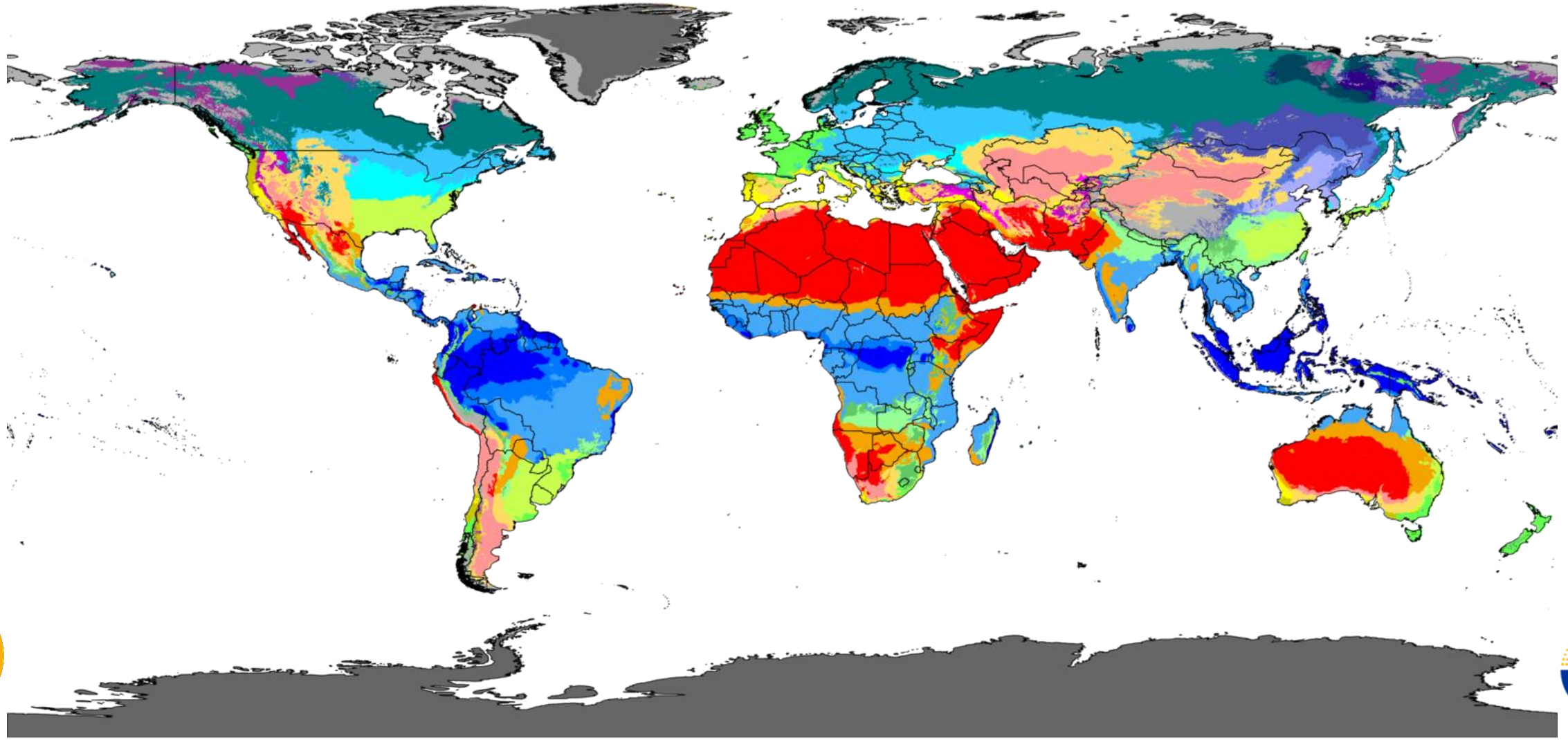


Currently undergoing changes and updates (software and KG reference map)

KOPPEN-GEIGER MODERN HISTORY

Author	Spatial Resolution	Climate datasets	Period	Future projection
Kottek et al. 2006	0.5°	CRU TS 2.1 VASClimO v1.1	1951-2000	NA
Peel et al. 2007	0.1°	GHCN 2.0	1909-1983	NA
Rubel & Kottek 2010	0.5°	CRU TS 2.1 GPCC FDR V4	1901-2010	2001-2100
Kriticos et al. 2011	0.167°	WorldClim V1	1961-1990	2030-2080
Rubel et al. 2017	0.0083°	HISTALP EURO-CORDEX	1800-2010	2076-2100
Beck et al. 2018	0.0083°	CHELSA V1.2 CHPclim V1 WorldClim V1 & V2 CRU TS V4.01 GPCC FDR V7	1980-2016	2071-2100
Cui et al. 2021	0.0083°	CRU TS V 4.03 UDEL – NOAA PSL WorldClim V1 & V2 CHELSA V1.2 GPCC FDR V7 PREC/L GHCN_CAMS	1979-2013	2020-2100
Beck et al. 2023	0.0083°	WorldClim V2 CHELSA V1.2	1901-2020	2041-2099

KÖPPEN-GEIGER CLASSIFICATION UPDATE



Source: Beck et al.: Present and future Köppen-Geiger climate classification maps at 1-km resolution, Scientific Data 5:180214, doi:10.1038/sdata.2018.214 (2018)

KÖPPEN-GEIGER CLASSIFICATION UPDATE

Main Differences:

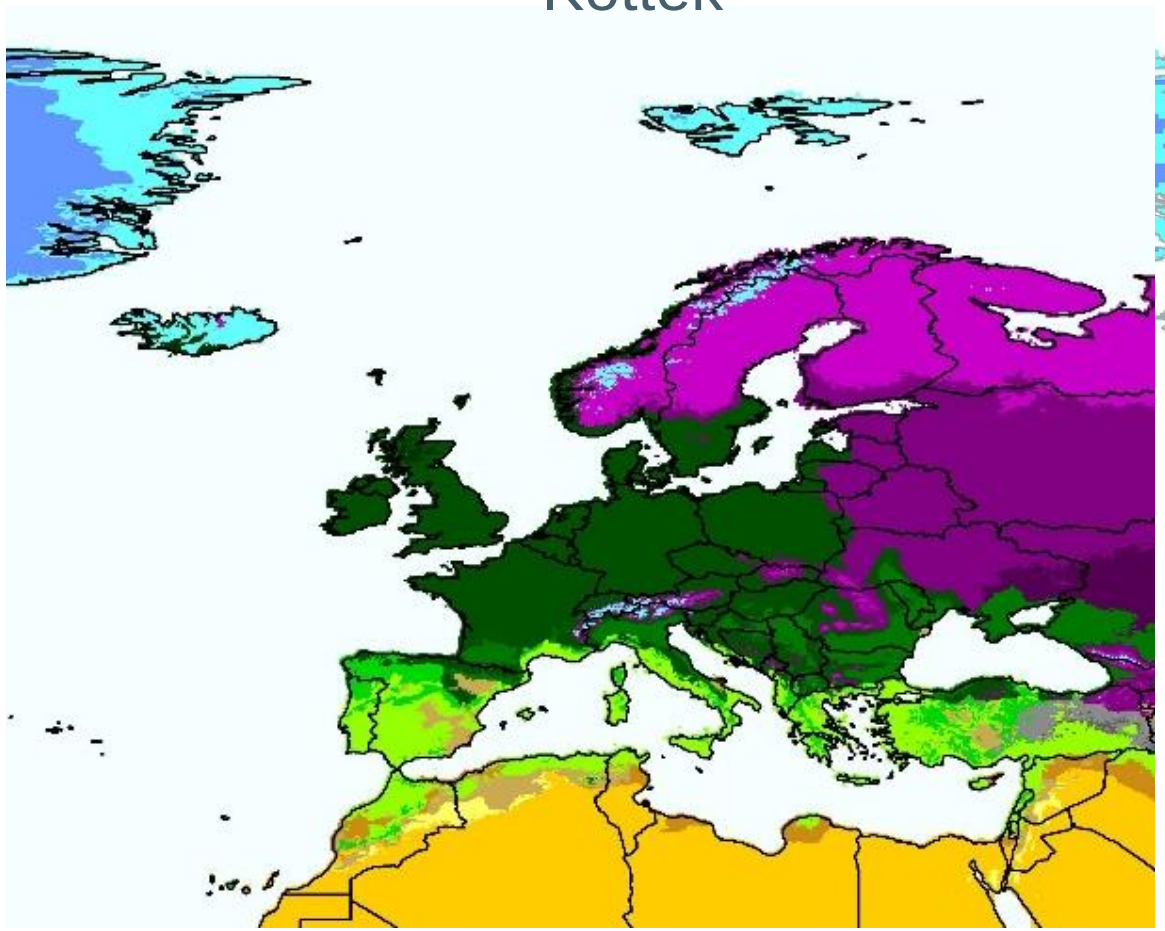
- Definition of C and D climates
  - **Threshold for C Tmin -3°C -> 0°C**
  - **Introduced by Peel 2007** - maintaned since then
  - Main differences in EU Cfb -> Dfb (Temperate -> Continental)
  - Classification has changed (also climate but opposite direction)

- Definition of B climate and subclimates
  - Threshold for precipitation pattern **70% -> 66.7% annual precipitations in summer/winter**
  - Main differences in EU Cfa/Csa -> BsK

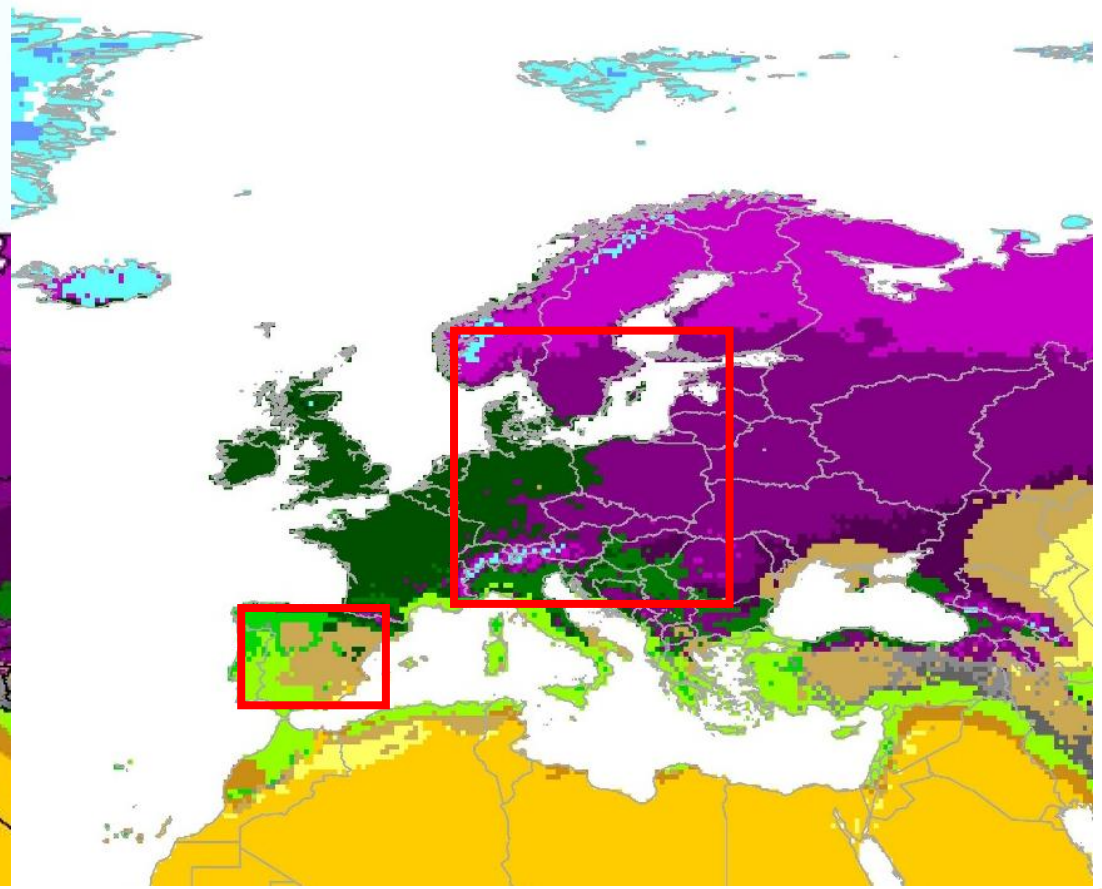
Letter Symbol				Criterion	
1st	**2nd**	**3rd**	**Description**	**Kottek et al. 2006**	**Beck et al. 2023**
A			Tropical	Tmin ≥ +18 °C	Tmin ≥ +18 °C
	f		- Rainforest	Pmin ≥ 60 mm	Pmin ≥ 60 mm
	m		- Monsoon	Pann ≥ 25(100−Pmin)	Not (Af) & Pmin ≥ 100-Pann/25
	s		- **Savannah Dry-Summer**	**Pmin < 60 mm in summer**	**-**
	w		- Savannah Dry-Winter	Pmin < 60 mm in winter	Not (Af) & Pmin < 100-Pann/25
B			**Arid**	Pann < 10 Pth	Pann < 10 × Pth
	W		- Desert	Pann ≤ 5 Pth	Pann < 5 × Pth
	S		- Steppe	Pann > 5 Pth	Pann ≥ 5 × Pth
		h	– Hot	Tann ≥ +18 °C	Tann ≥ 18 °C
		k	– Cold	Tann < +18 °C	Tann < 18 °C
C			**Temperate**	**−3 °C < Tmin < +18 °C**	**Not (B) & Tmax > 10 & 0 < Tmin < 18**
	s		- Dry Summer	Psmin < Pwmin, Pwmax > 3 Psmin and Psmin < 40 mm	Psmin < 40 & Psmin < Pwmax/3
	w		- Dry winter	Pwmin < Psmin and Psmax > 10 Pwmin	Pwmin < Psmax/10
	f		- Without dry season	neither Cs nor Cw	Not (Cs) or (Cw)
		a	– Hot summer	Tmax ≥ +22 °C	Tmax ≥ 22 °C
		b	– Warm summer	not (a) and at least 4 Tmon ≥ +10 °C	Not (a) & Tmon10 ≥ 4
		c	– Cold summer	not (b) and Tmin > −38 °C	Not (a or b) & 1 ≤ Tmon10 < 4
		d	– **Extremely continental**	**like (c) but Tmin ≤ −38 °C**	**-**
D			**Cold**	**Tmin ≤ −3 °C**	**Not (B) & Tmax > 10 & Tmin ≤ 0°C**
	s		- Dry summer	Psmin < Pwmin, Pwmax > 3 Psmin and Psmin < 40 mm	Psmin < 40 & Psmin < Pwmax/3
	w		- Dry winter	Pwmin < Psmin and Psmax > 10 Pwmin	Pwmin < Psmax/10
	f		- Without dry season	neither Ds nor Dw	Not (Ds) or (Dw)
		a	– Hot summer	Tmax ≥ +22 °C	Tmax ≥ 22 °C
		b	– Warm summer	not (a) and at least 4 Tmon ≥ +10 °C	Not (a) & Tmon10 ≥ 4
		c	– Cold summer	not (b) and Tmin > −38 °C	Not (a, b, or d)
		d	– Very cold winter	like (c) but Tmin ≤ −38 °C	Not (a or b) & Tmin < −38 °C
E			Polar	Tmax < +10 °C	Not (B) & Tmax ≤ 10
	T		- Tundra	0 °C ≤ Tmax < +10 °C	Tmax > 0 °C
	F		- Frost	Tmax < 0 °C	Tmax ≤ 0 °C

KÖPPEN-GEIGER CLASSIFICATION UPDATE IN EU

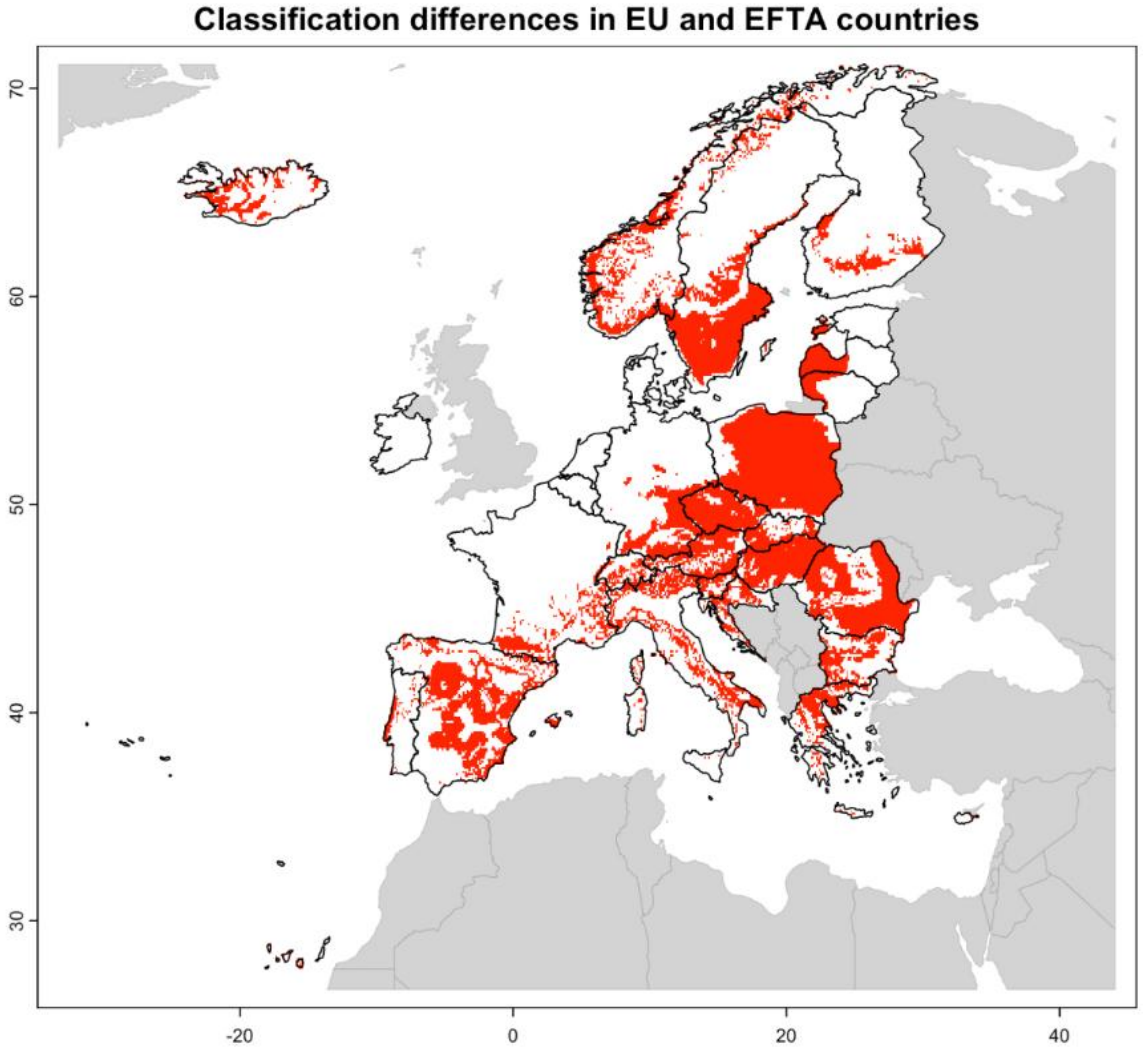
Kottek

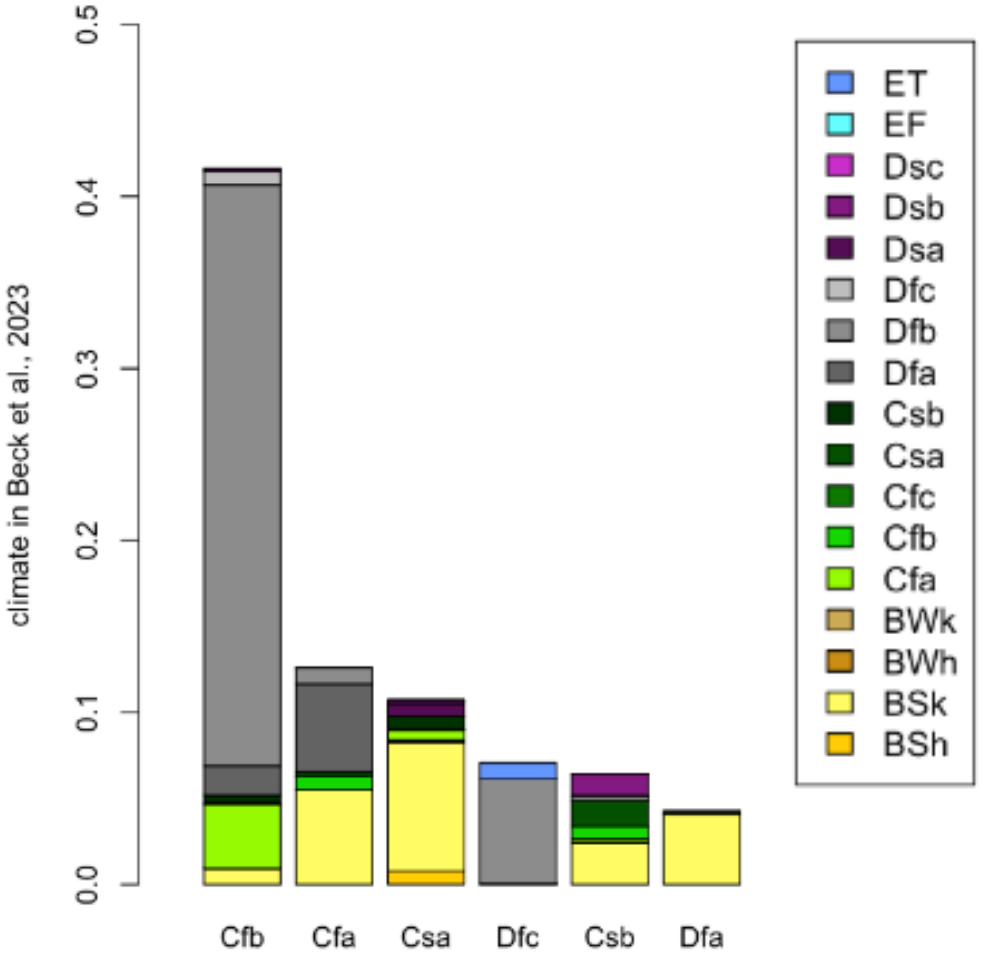


Beck



KÖPPEN-GEIGER CLASSIFICATION UPDATE IN EU

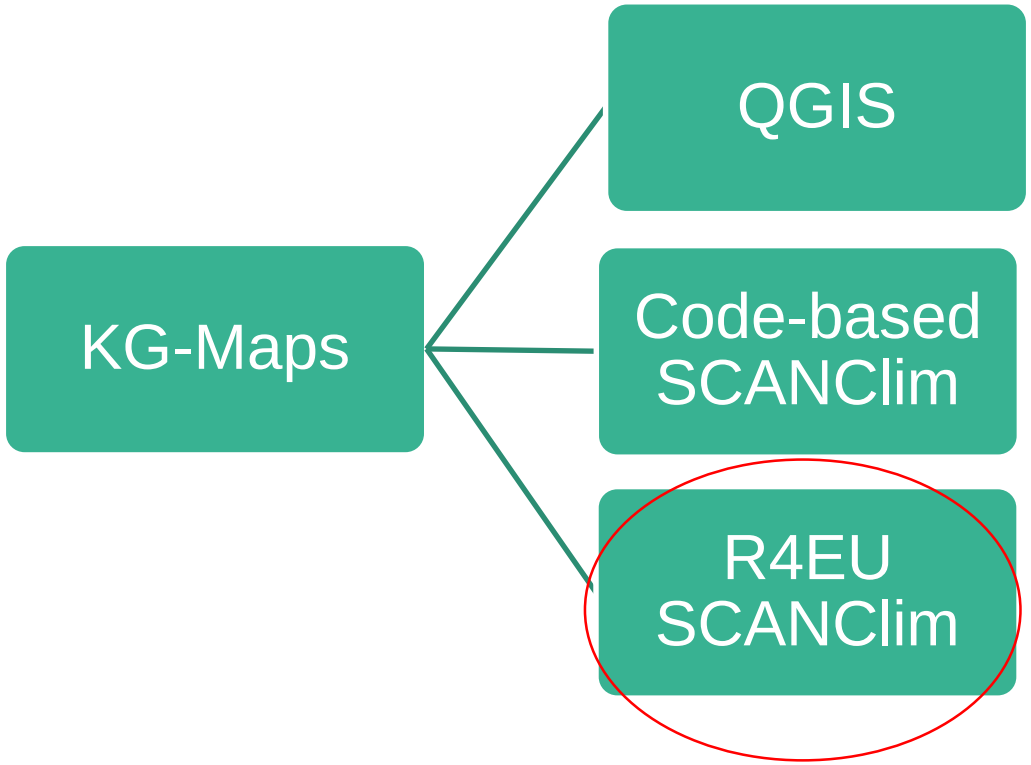


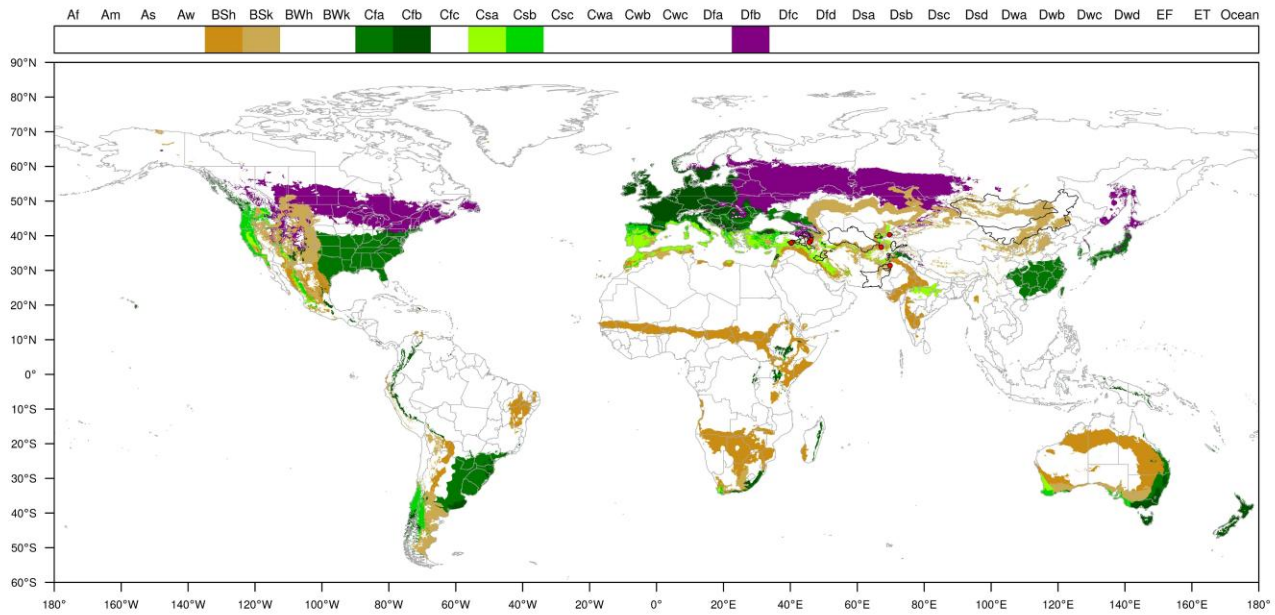


Climates in Rubel et al. 2025

BUILDING KOPPEN-GEIGER MAPS

There are 3 ways to make Koppen-Geiger maps in PLH





Currently undergoing changes and updates (software and KG reference map)

TOOLS: SCANCLIM

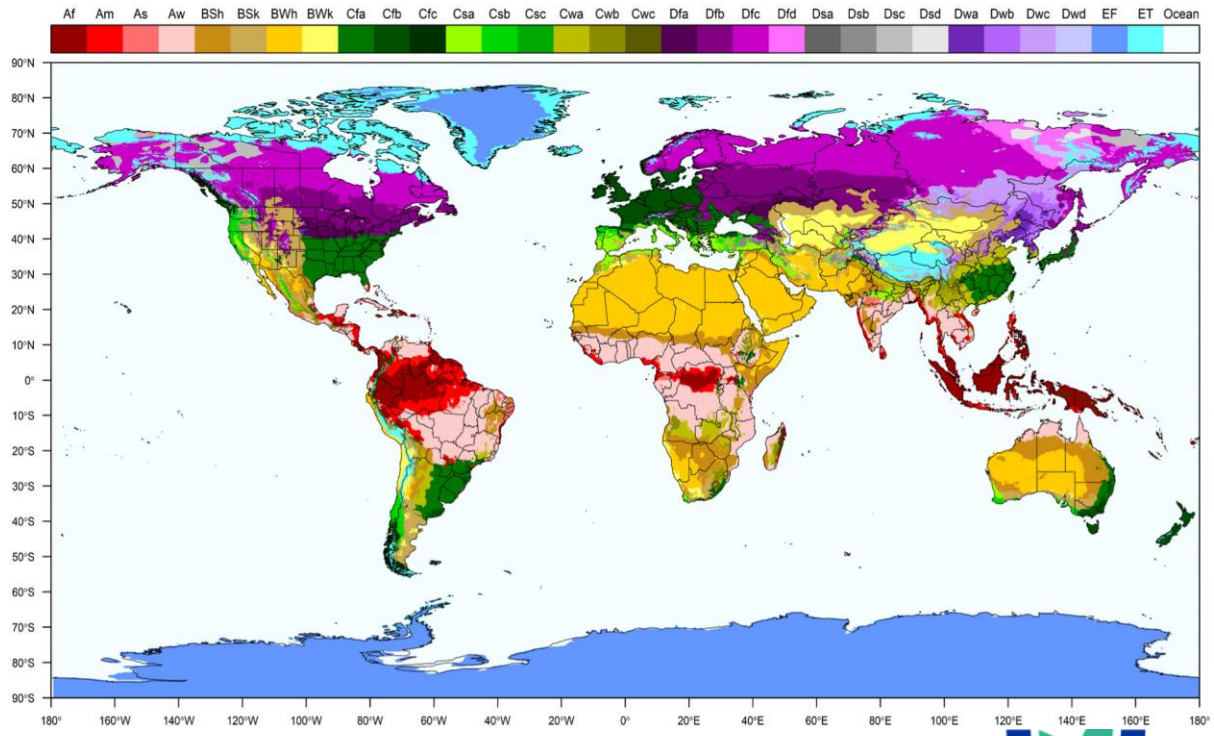
Köppen-Geiger Climate Classification starting from EPPO Distribution at country level (using EPPO API) or customized distribution dataset (points and/or admin units)

Links:

Report

Source code

Web based tool: R4EU (ClimMAP tool, select SCAN-Clim tab)

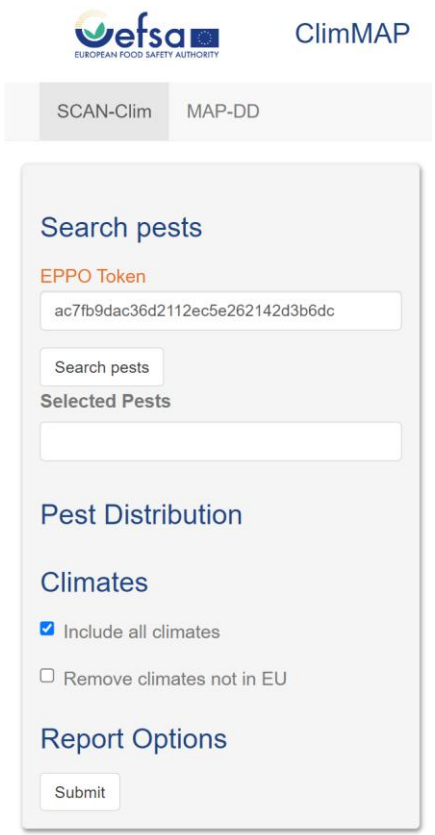


Currently undergoing changes and updates (software and KG reference map)

R4EU SCRIPT: SCANCLIM

Connect to:
https://r4eu.efsa.europa.eu/app/climmap and
Login with EFSA Credentials

Test with *Coleosporium asterum*



- Search Pest in the Database and Confirm
- (Optional) If EPPO-Data are available you can use it and Submit. Then Download the Map
- Upload Observation File
- Submit
- Download the Maps and eventually Additional information

PRACTICAL DEMONSTRATION

Alex Gobbi

crea
Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

efsa
EUROPEAN FOOD SAFETY AUTHORITY