3rd Mediterranean Plant Conservation Week
"Plant Conservation Strategies: from Science to Practice"

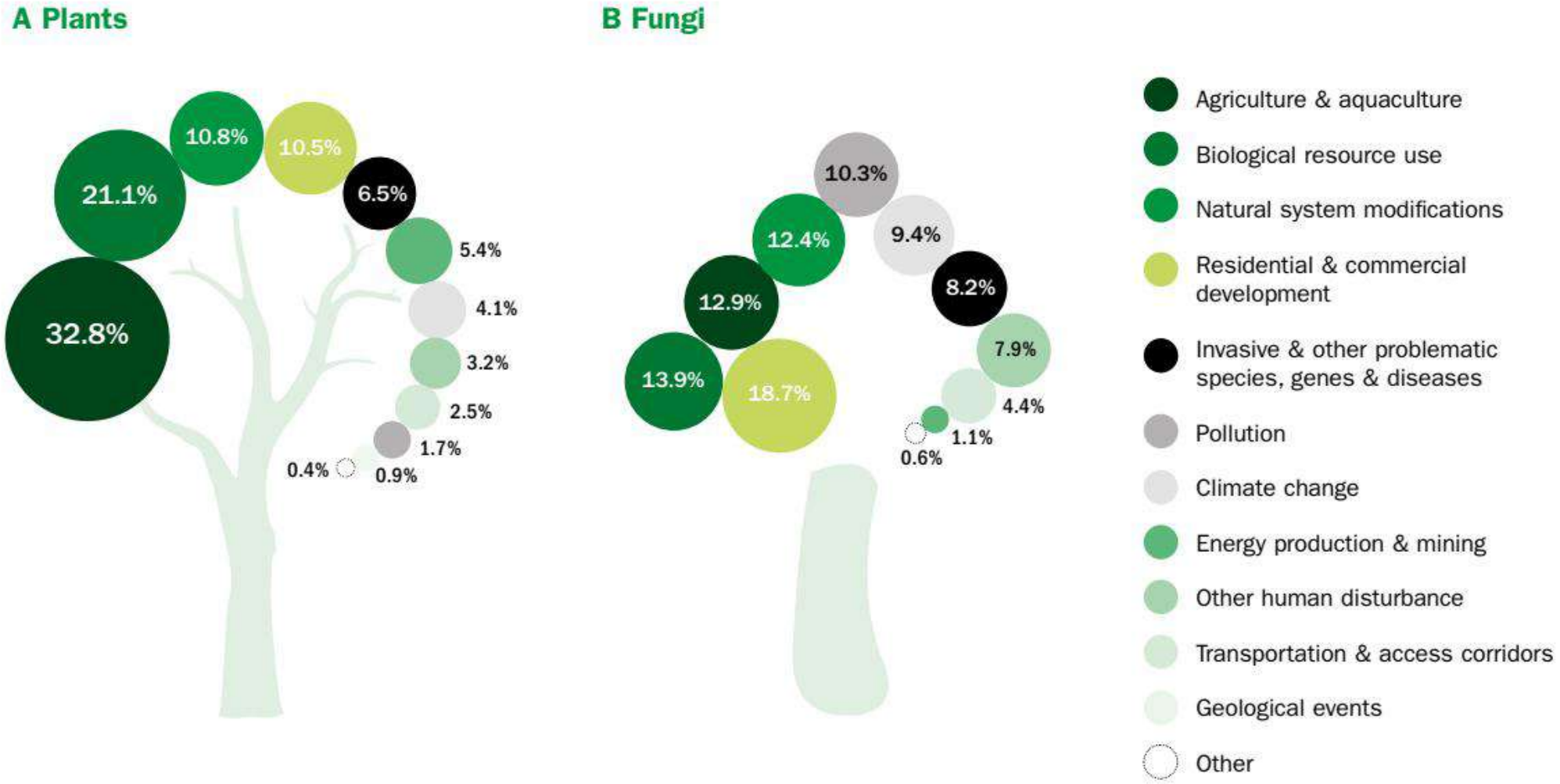
Inventories:
What are the field inventory techniques, how to assess and monitor the size of a plant population, what computer tools are available

Prof. Panayotis Dimopoulos
Department of Biology, University of Patras, Greece

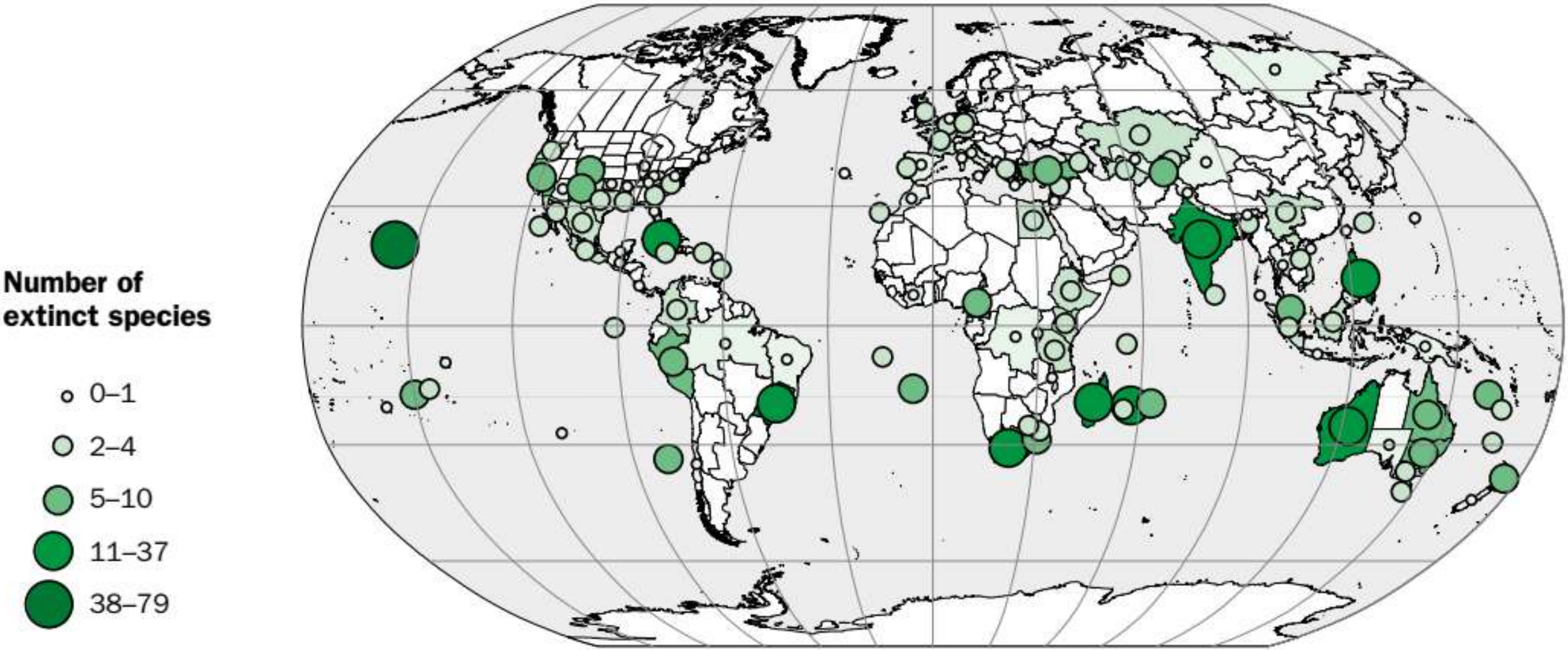
UNIVERSITY OF PATRAS
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ

Laboratory of Botany
University of Patras
Department of Biology

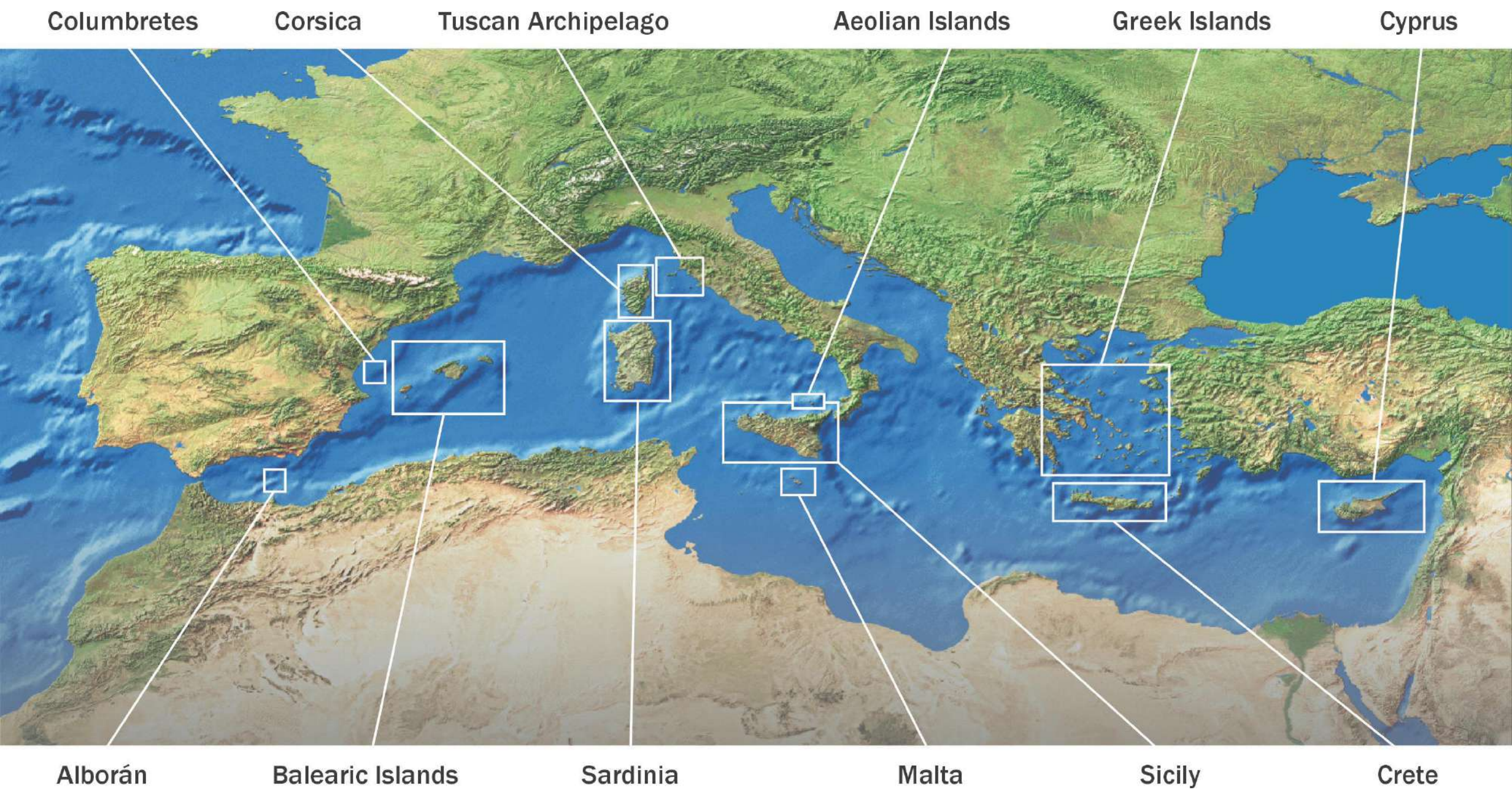
2 of 5 plants are estimated to be threatened with extinction



The major threats to plants (A) and fungi (B) that have been assessed for the IUCN Red List of Threatened Species © Royal Botanic Gardens, Kew

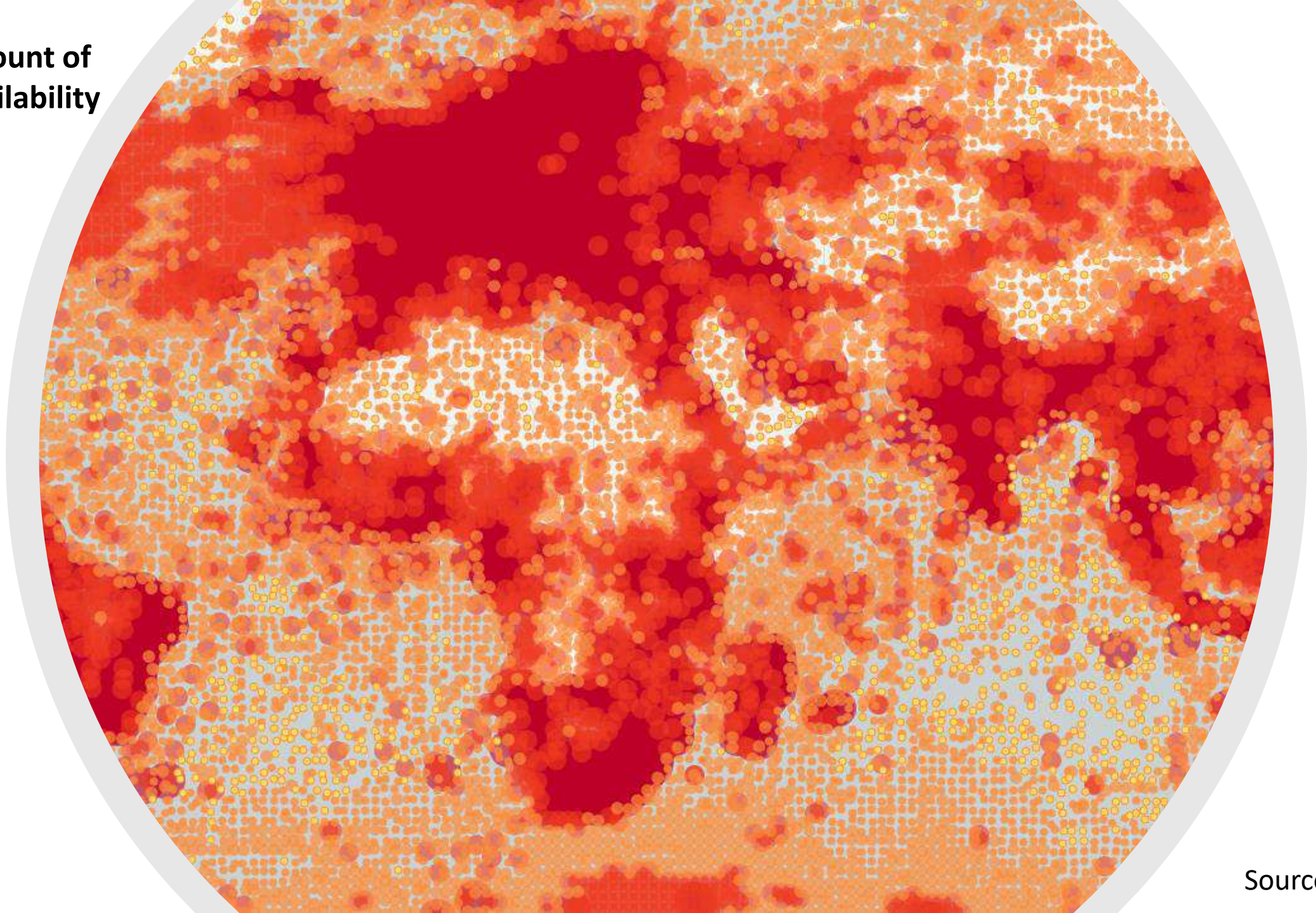


Source: State of the World's Plants and Fungi. Royal Botanic Gardens Kew, 2020.



Pasta S., Perez-Graber A., Fazan L. and Montmollin B. de (Eds). 2017. The Top 50 Mediterranean Island Plants UPDATE 2017. IUCN/SSC/Mediterranean Plant Specialist Group. Neuchâtel (Switzerland). E-book and on line. 141 pp. top50.iucn-mpsg.org

Vast amount of data availability

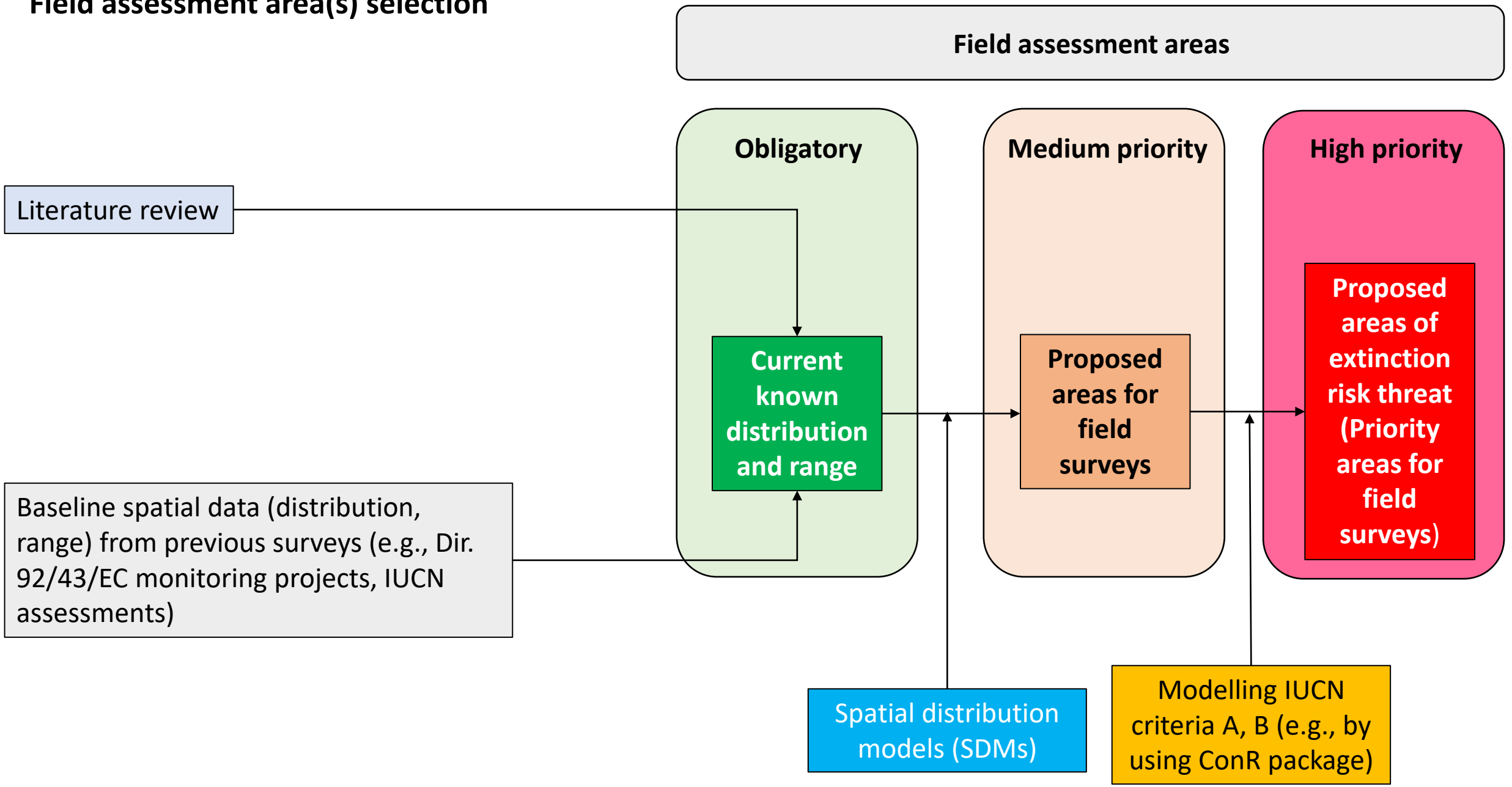


Source: gbif.org

Field inventorying methodological steps:

- **Plant species prioritization and selection**
- **Field survey area(s) delineation**
- **Filed survey methods selection**
- **Plant identification (traditional, App-based, combined)**
- **Inventorying (Databases, Web-based platforms)**

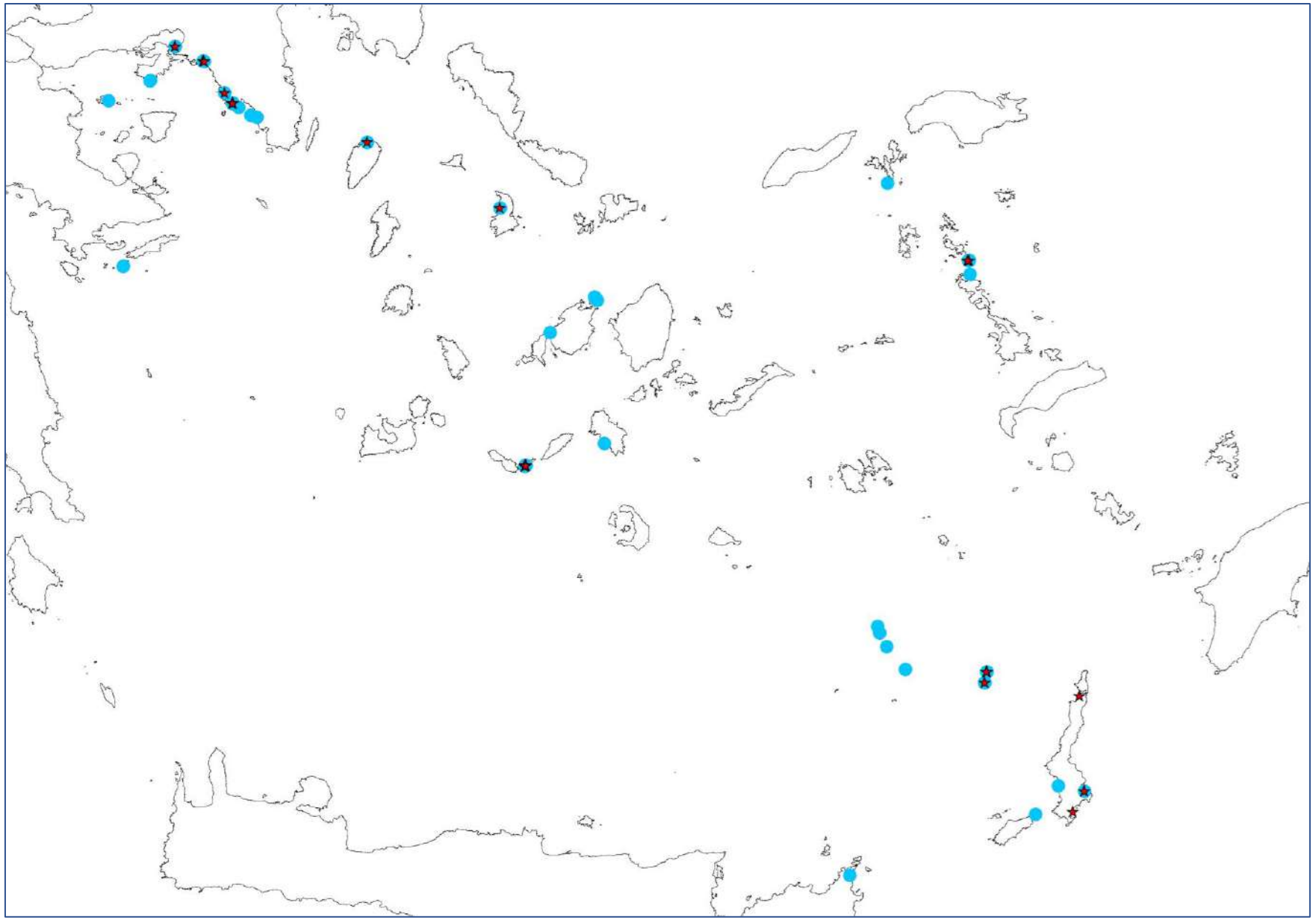
Field assessment area(s) selection



Field assessment area(s) selection

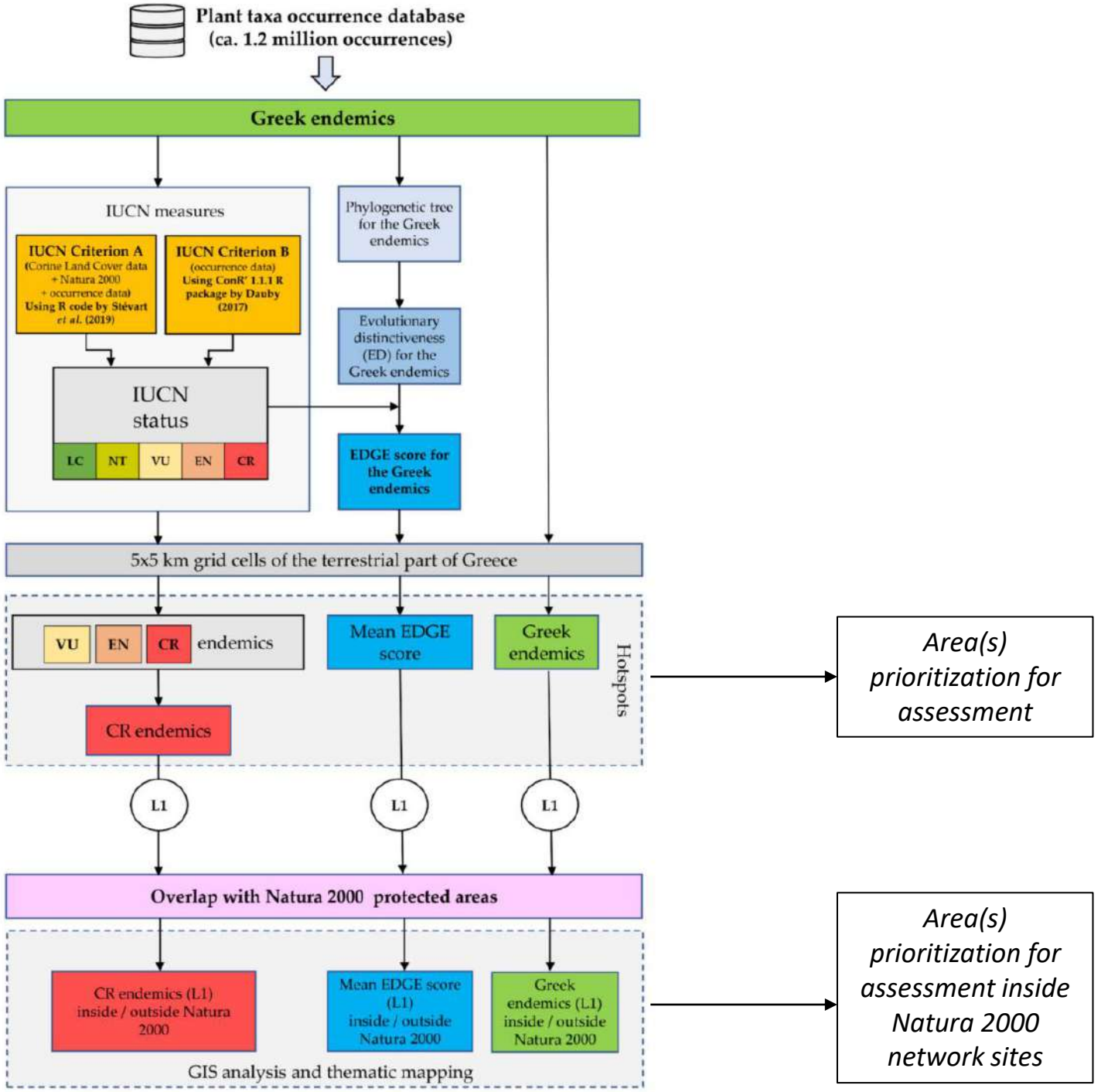
Known and potential sites
for field assessment

Stars: known population
Blue dots: sites with suitable habitat



Field assessment area(s) prioritization and selection

IUCN criteria A and B example



Flowchart of our methodological workflow. EDGE: Evolutionary Distinct and Globally Endangered.

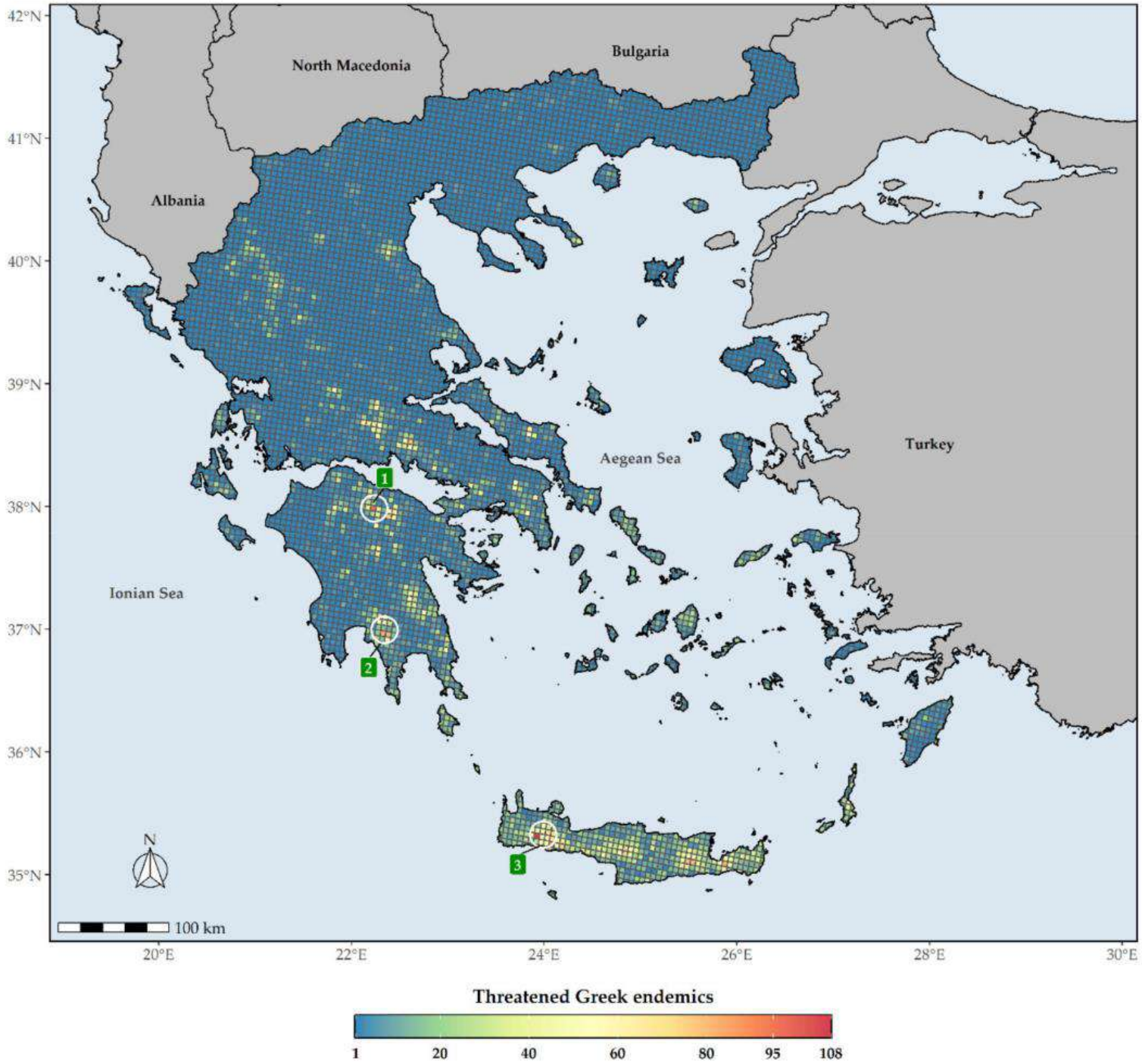
L1 hotspots: the 1% of cells (i.e., the 1% quantile) that had the highest score for each metric.

CR: Critically Endangered. EN: Endangered. VU: Vulnerable. LC: Least Concern. NT: Near Threatened

Field assessment area(s) prioritization and selection

Species richness in Greece regarding threatened Greek endemic taxa (GR) for every grid cell in Greece.

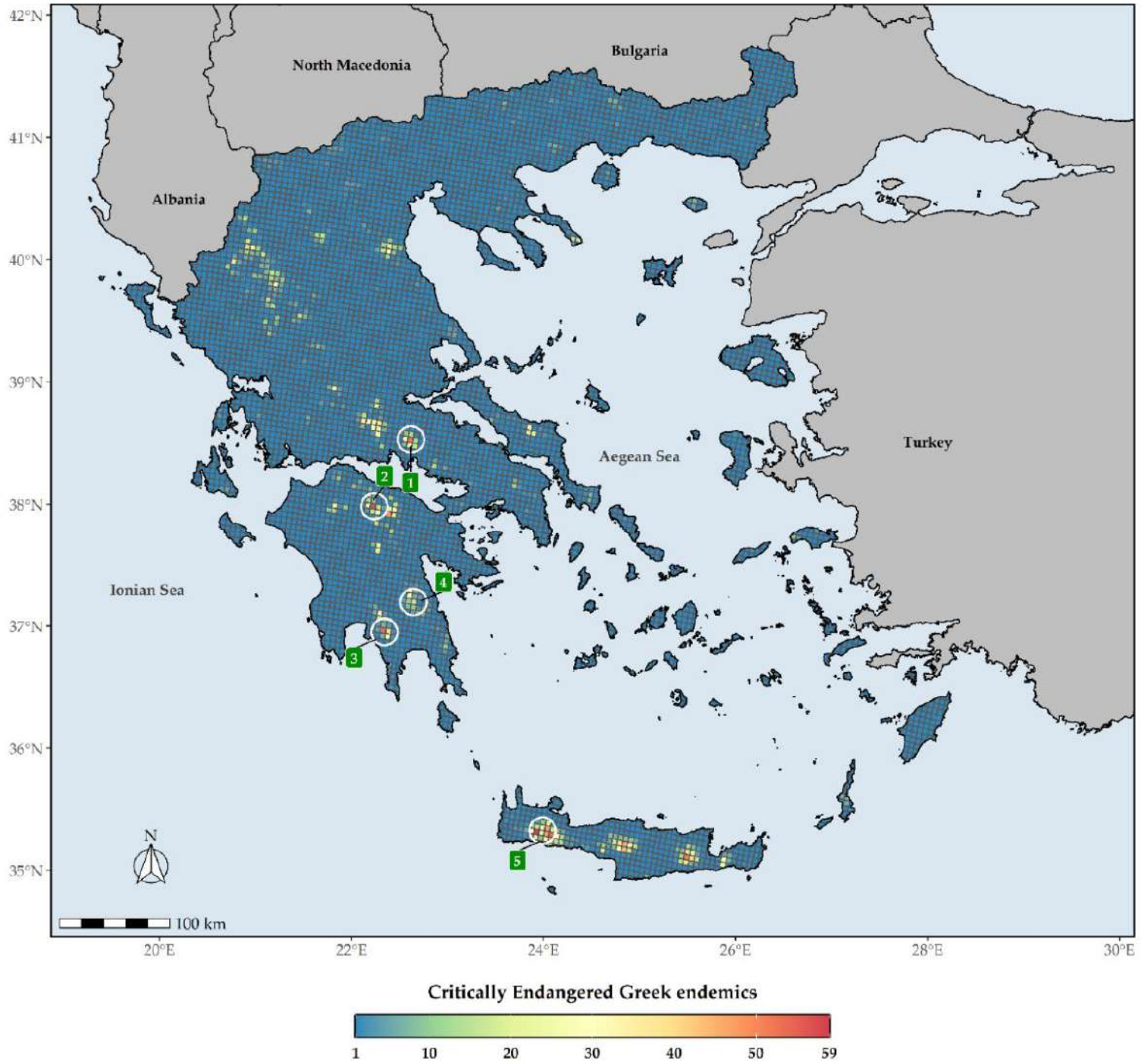
Grid cell resolution equals to ca. 5 km. 1: Mt. Chelmos, 2: Mt. Taygetos, 3: Lefka Ori mountain range.



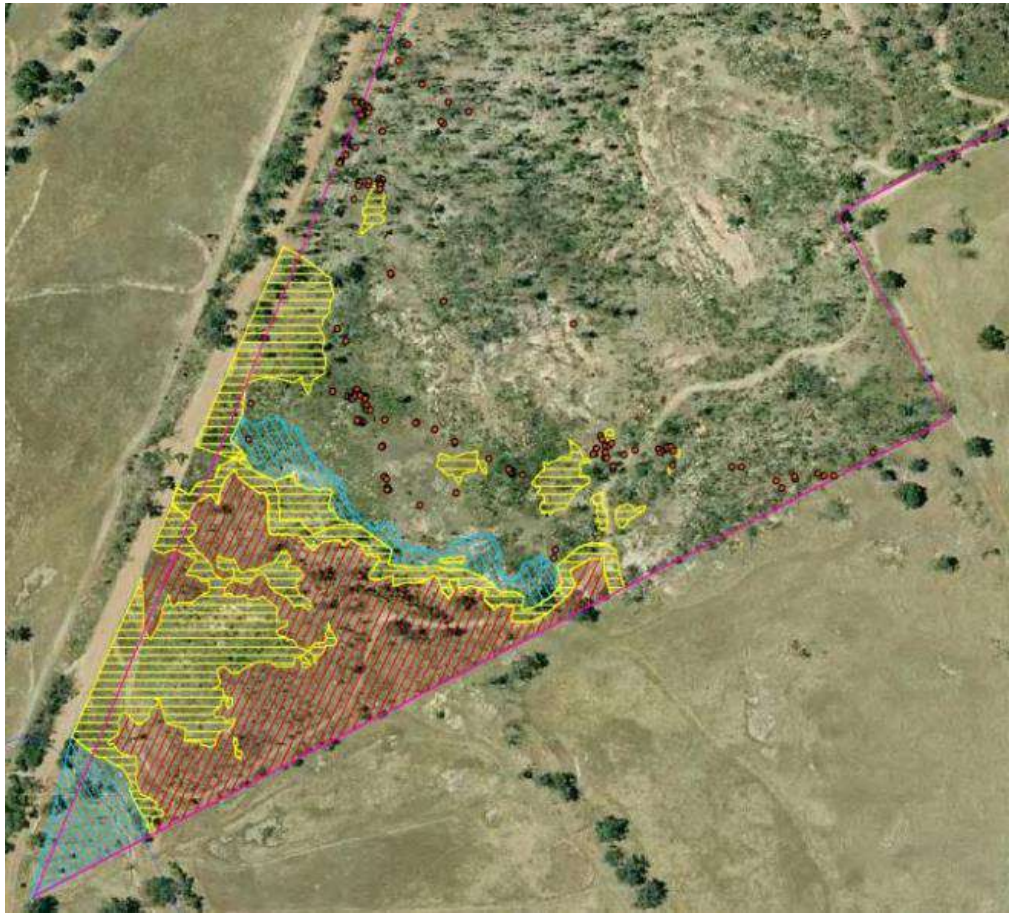
Field assessment area(s) prioritization and selection

Species richness in Greece regarding Critically Endangered Greek endemic taxa (CR_{END}) for every grid cell in Greece.

Grid cell resolution equals to ca. 5 km. 1: Mt. Parnassos, 2: Mt. Chelmos, 3: Mt. Taygetos, 4: Mt. Parnonas, 5: Lefka Ori mountain range



Filed survey methods selection (general)



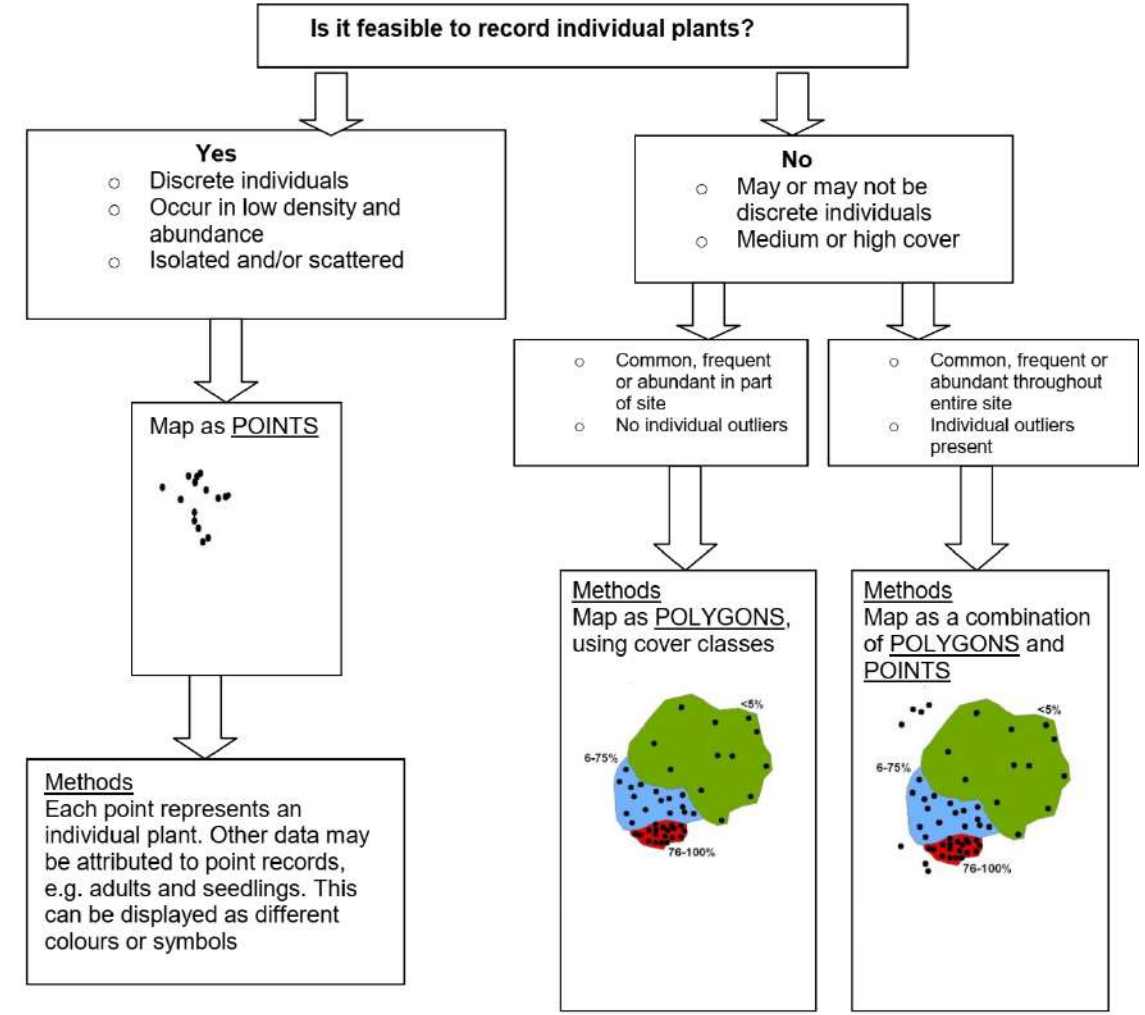
Plant cover < 5%

Plant cover 5-75 %

Plant cover > 75%

Individual plants

Source: Brown et al. 2011



POINT DATA

Advantages

- Data can be used to directly monitor changes in numbers of individuals over time
- Can record and display different life stages

Disadvantages

- Not suitable for many species where it is difficult to record or differentiate individuals (e.g. certain geophytes, vines)
- Areas of mass seedlings may not be effectively be captured

POLYGON DATA

Advantages

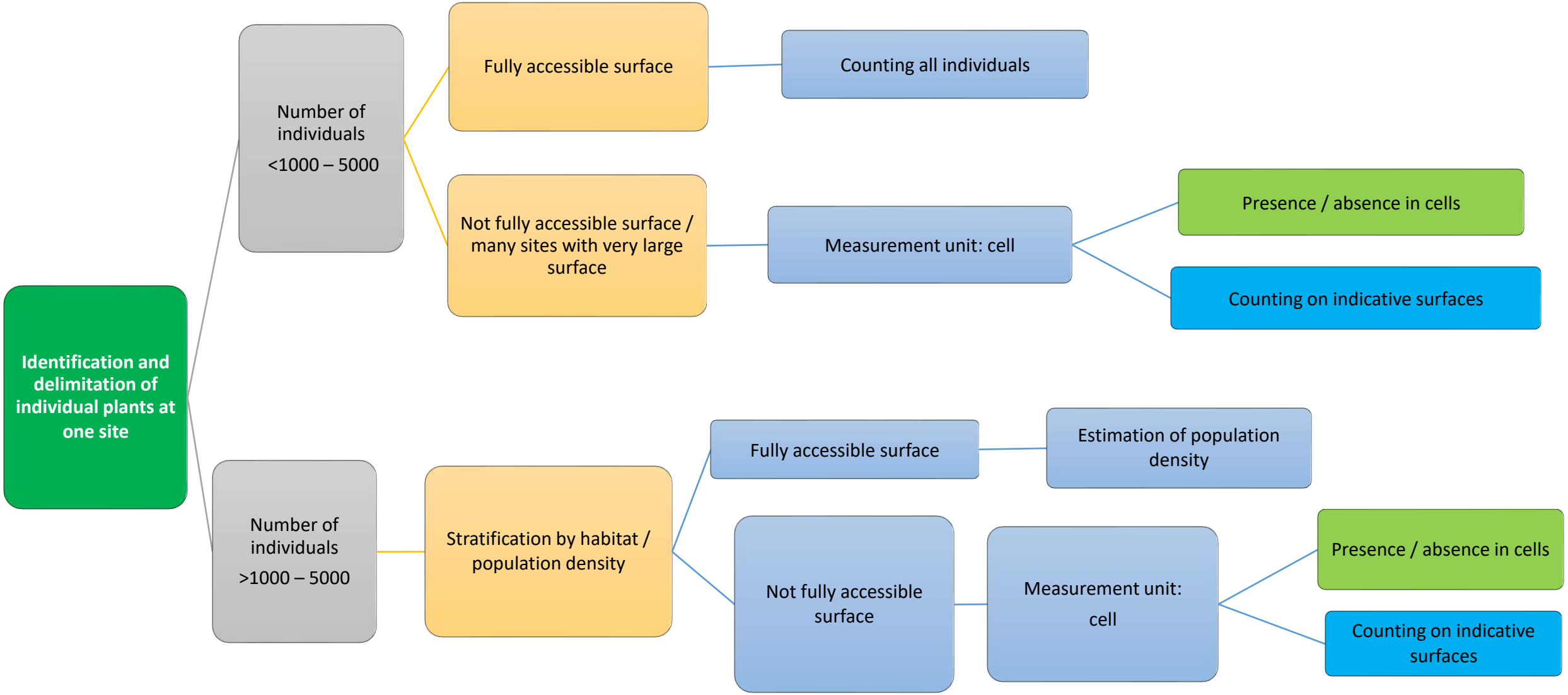
- Data can be used to monitor changes in cover (if cover classes are quantified) over time

Disadvantages

- Cover estimates are subjective and can vary between recorders

Methodology for estimating monitoring parameters

The example of Dir.92/43/EC monitoring scheme



Methodology for evaluating the monitoring parameters

1. • Pattern of distribution
   - Range, Area
2. • Population
   - Size and structure, dynamics, viability analysis
3. • Habitat
   - Extent and quality
4. • Pressures and Threats
   - current (6-years) and future (12-years)


Centaurea attica subsp. megarensis

Filed survey protocol

Taxon		Date		Habitat type code	
Researcher		Altitude (m)		Relief	
Locality		Soil type		A_0 (cm)	
Habitat		Aspect (°)		Slope (°)	
Photographs		Geol. Substr.			
Comments					
Pressures / Threats					

	Yes	No	Hist	Intensity	Cover %	Effect		Yes	No	Hist	Intensity	Cover%	Effect
Overgrazing							Intensive agriculture						
Roads / paths							Traditional agriculture						
Trampling							Proximity to cropland						
Logging							Fire						
Alien taxa							Raw material deposition						
Other							Waste disposal						

Special structure / function	Excellent	Favorable	Not favorable
1			
2			
3			
4			

GPS points	1	2	3	4	Plot area (m^2)	
	Cover %	Height (max)		Cover %	Height (max)		Cover %
Layer T			Layer H1			Total cover	
Layer S1			Layer H2			Moss layer	
Layer S2			Total H			Lichens layer	
Total T + S			Other			Bare rocks	

Floristic catalogue (taxa)	Cover	Layer	Floristic catalogue (taxa)	Cover	Layer

D – Dominant >75%
A – Abundant 51-75%
F – Frequent 26-50%
O – Occasional 11-25%
R – Rare 1-10%

Filed survey protocol – Population size

Taxon		Unit	Individuals		Stands		Stems		Cell __X__km	

Measurement method	All individuals		Sampling plots (area m^2)		Indicative		Random		Systematic		Custom	
	Stratification		Habitat		Density							

Polygon	GPS point	Mature units			Young units		Vegetative unit		Stand size	Height	Vitality	Sex	Special structure	Phytogeography	Comments
		A	K1	K2	A	K2	A	K2							

Population size assessment

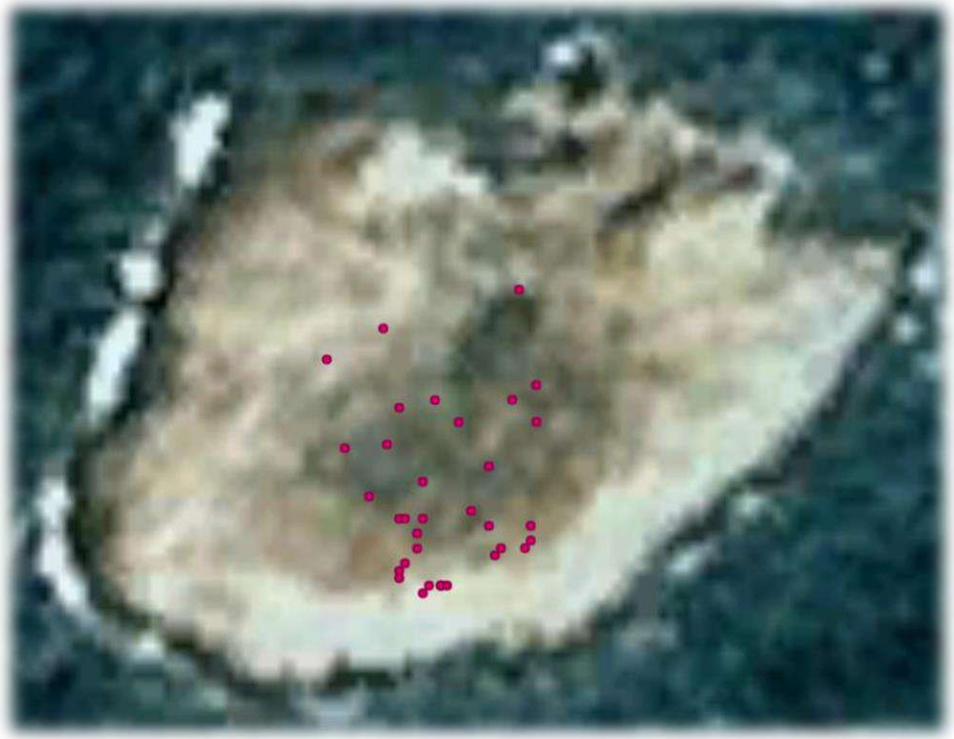
Counting all individuals

Silene holzmannii

Fokionisi

2008

2013



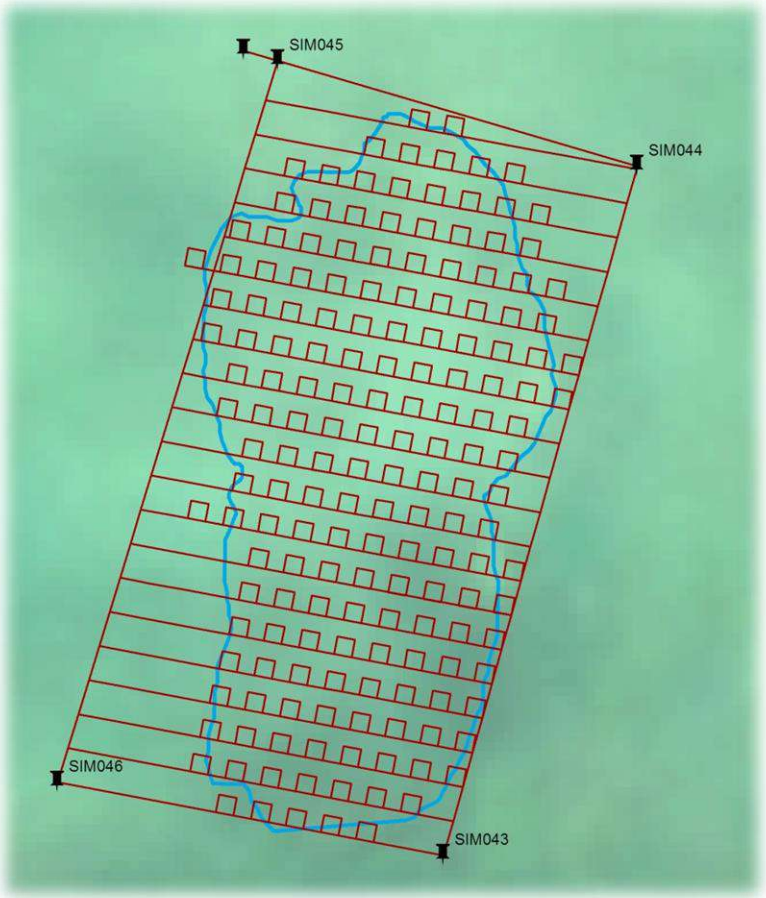
•Counting individuals in points or in polygons with GPS.

Population size assessment

Density assessment using systematic sampling

Veronica oetaea

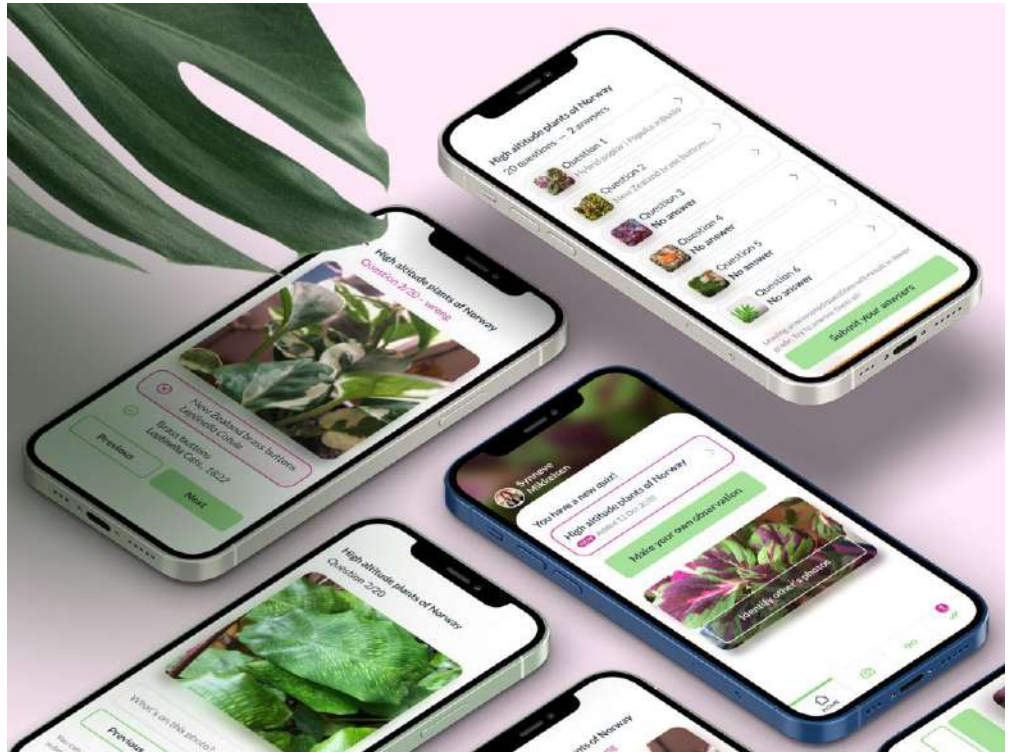
Mount Iti: ponds in Livadies, Greveno, Alykaina



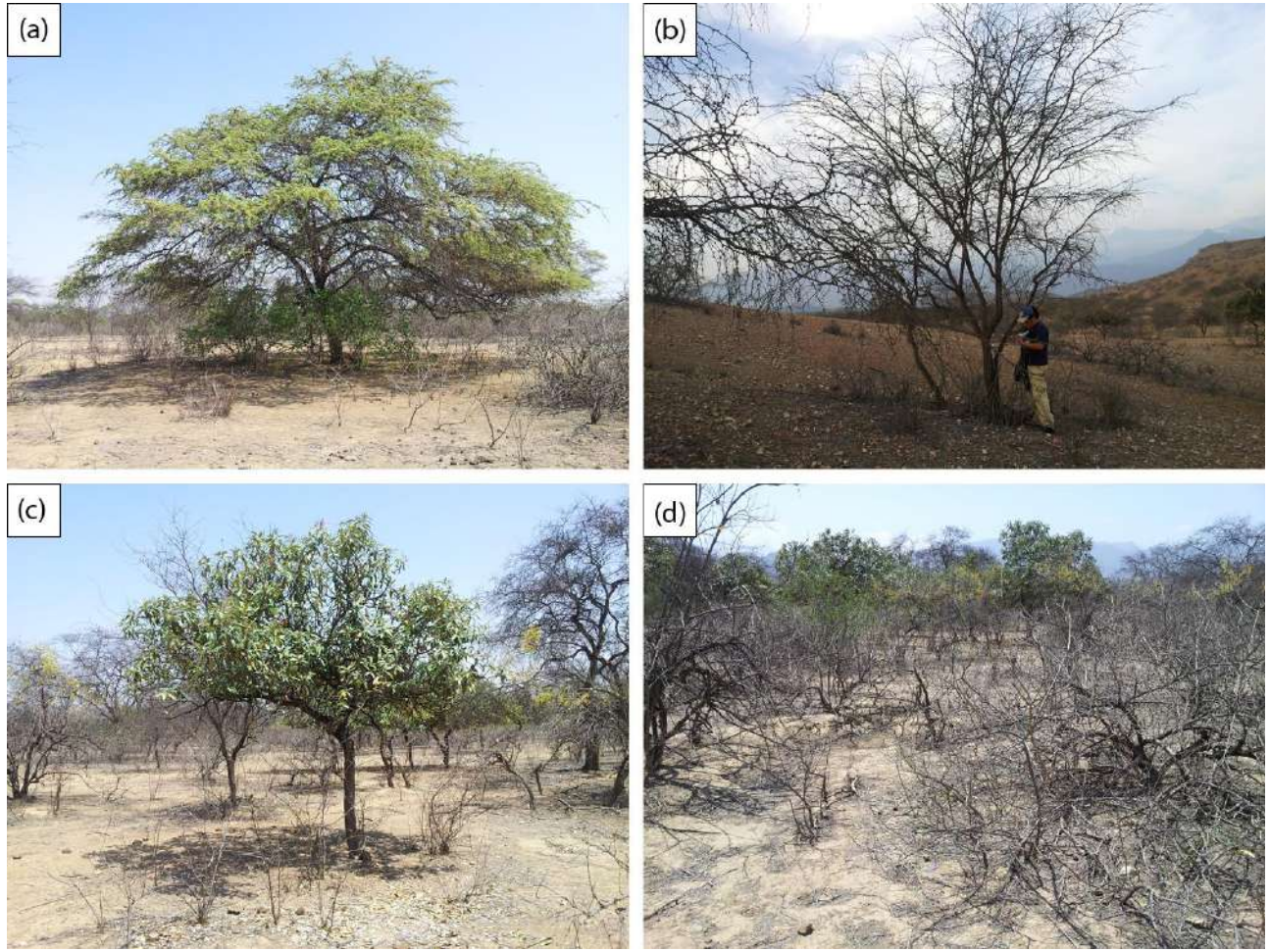
Plant identification apps

Popular Apps:

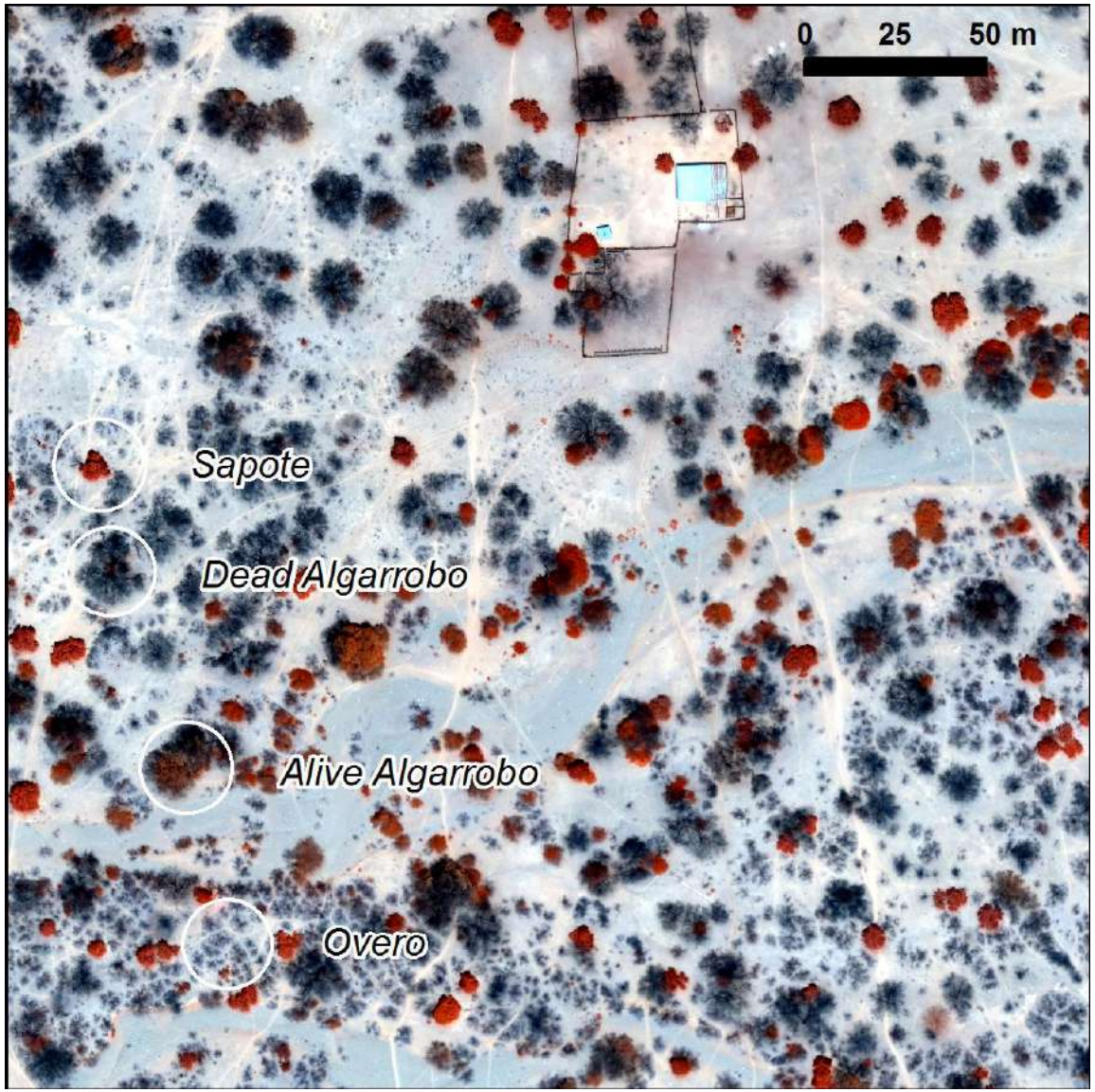
- PlantNet
- iNaturalist
- PlantSnap
- PictureThis
- FlowerChecker
- Garden Compass
- Agrobase
- Plantix



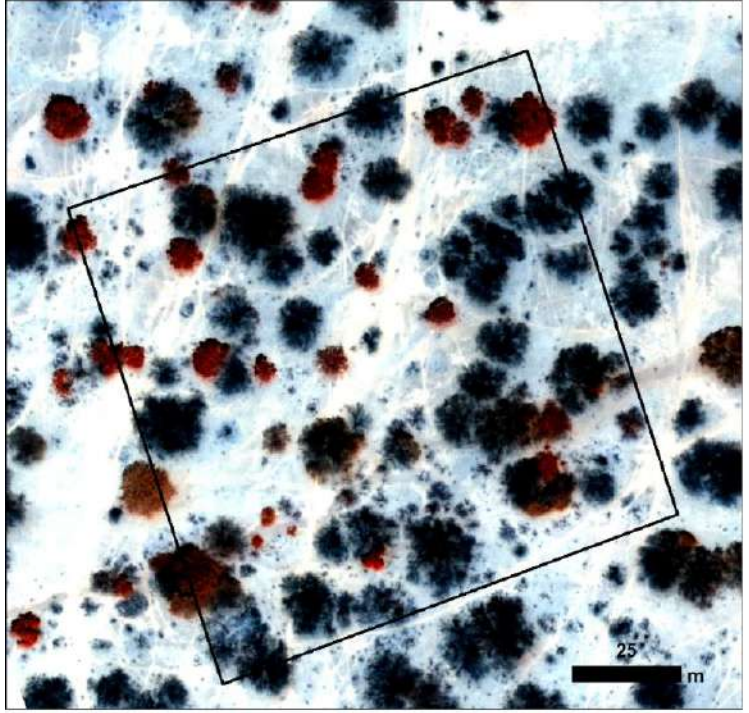
Tree species identification using UAVs

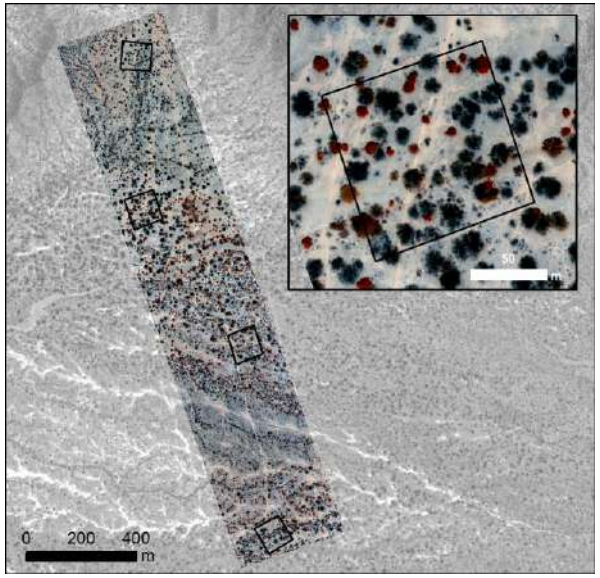


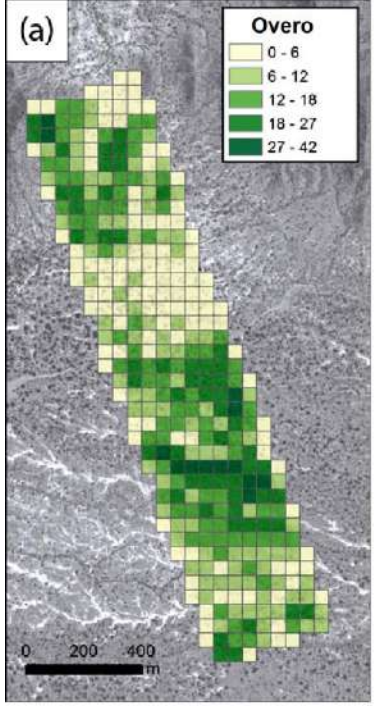
Target species: (a) Alive Algarrobo (b) Dead Algarrobo (c) Sapote (d) Overo.

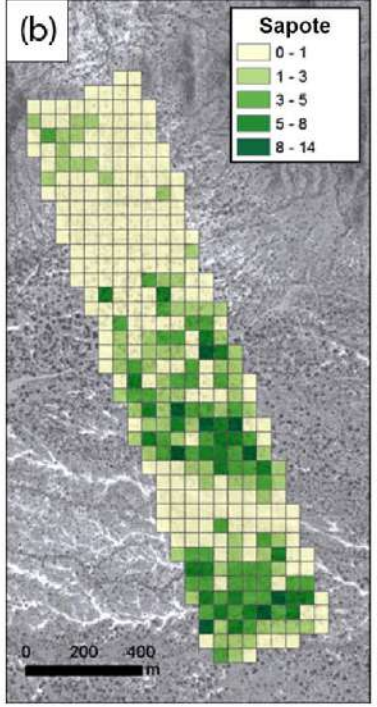


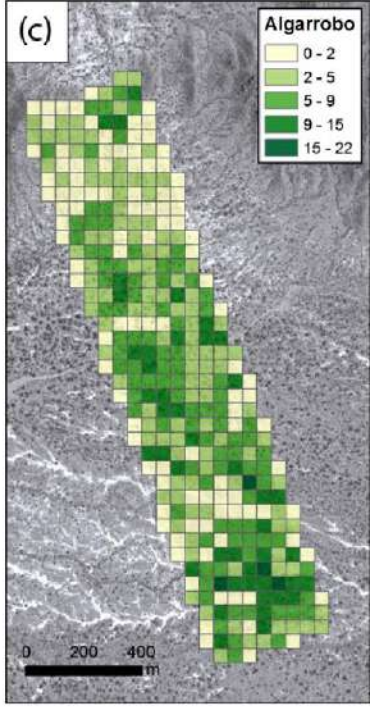
Baena, S., Moat, J., Whaley, O., & Boyd, D. S. (2017). Identifying species from the air: UAVs and the very high resolution challenge for plant conservation. *PloS one*, *12*(11), e0188714.

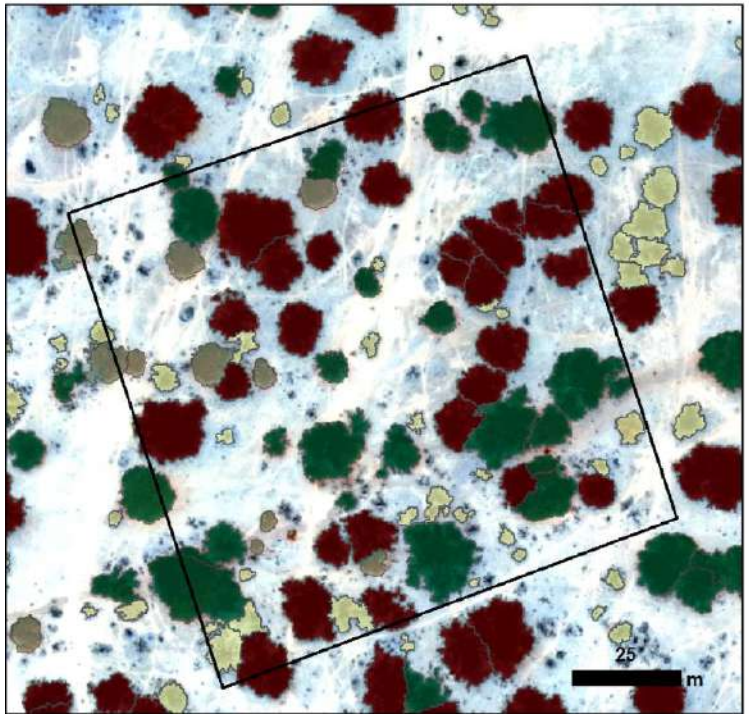


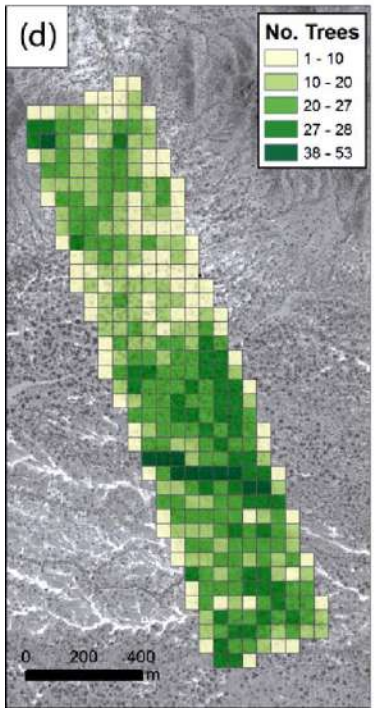


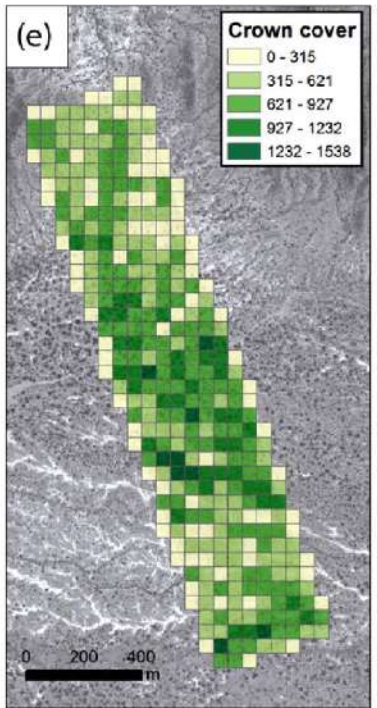


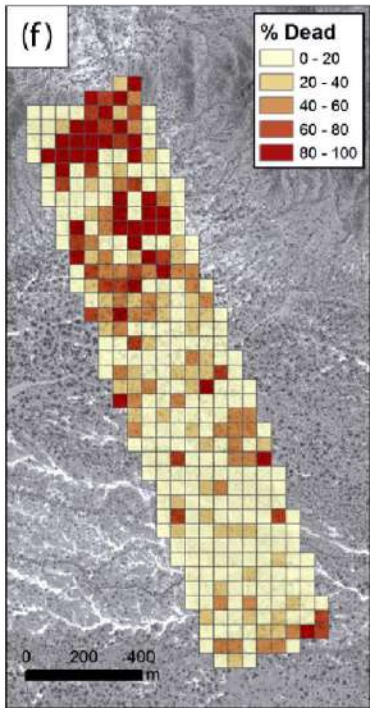












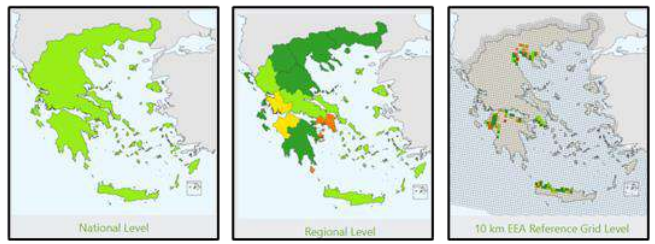
Baena, S., Moat, J., Whaley, O., & Boyd, D. S. (2017). Identifying species from the air: UAVs and the very high resolution challenge for plant conservation. *PloS one*, *12*(11), e0188714.

Inventorying (Databases, Web-based platforms)

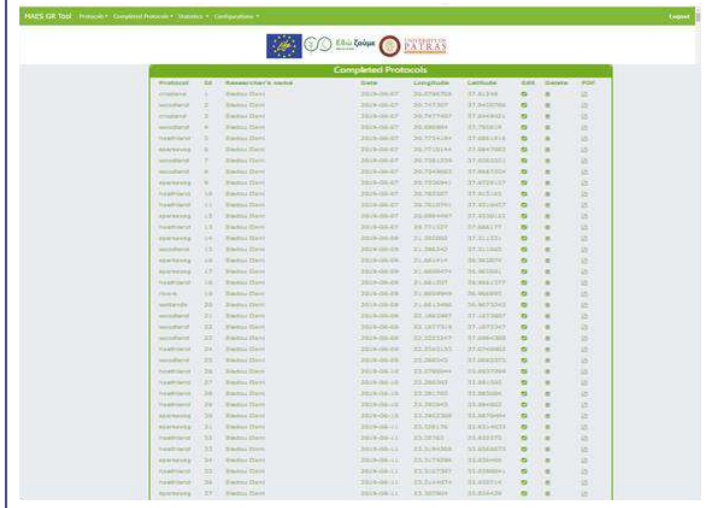
Web-based, mobile survey approach to recording, registering and presenting field data and relevant results in order to cope with a **cost-effective**, **efficiently functioning** method for **large-scale ecological field assessments**.

- More specifically, a web-based platform aims to:
  - provide pre-defined responses for ecological parameters' registration
  - calculate relevant information based on location and the registered data
  - minimize post-processing effort
  - be user-friendly
  - be compatible with a variety of devices and operating systems
  - support a variety of field-based assessments (e.g., IUCN, Dir. 92/43/EC monitoring)

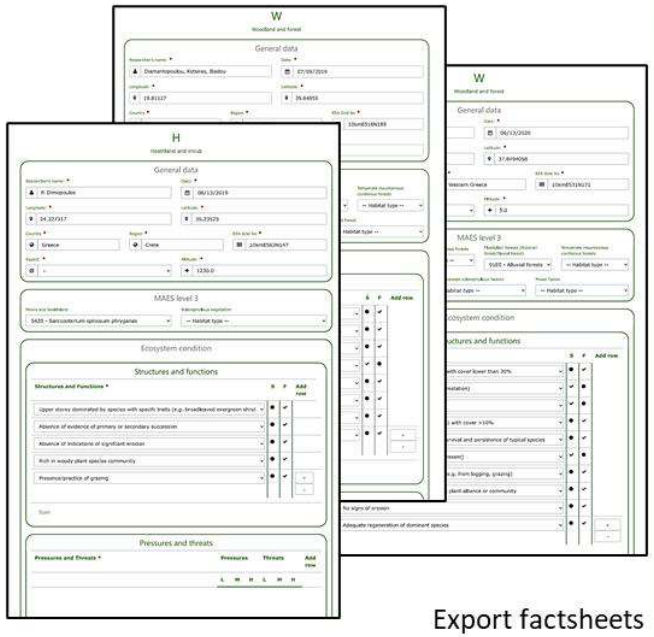
The example of MAES_GR platform



Export georeferenced data: ecosystem types, ecosystem condition, ecosystem services

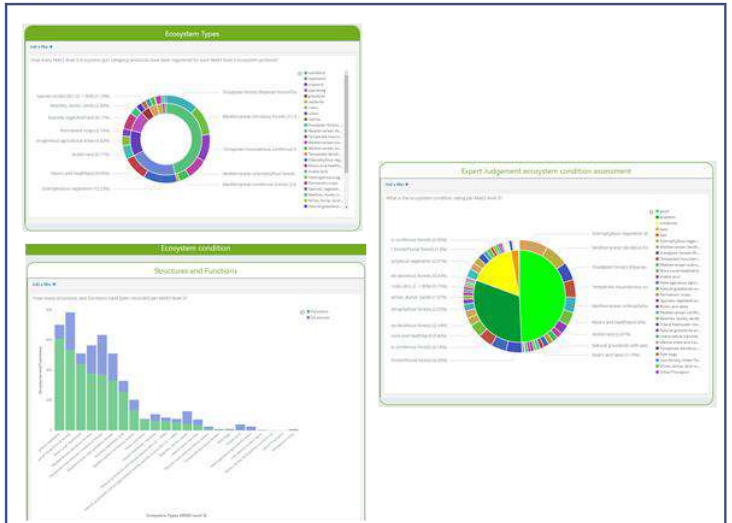


Search the database



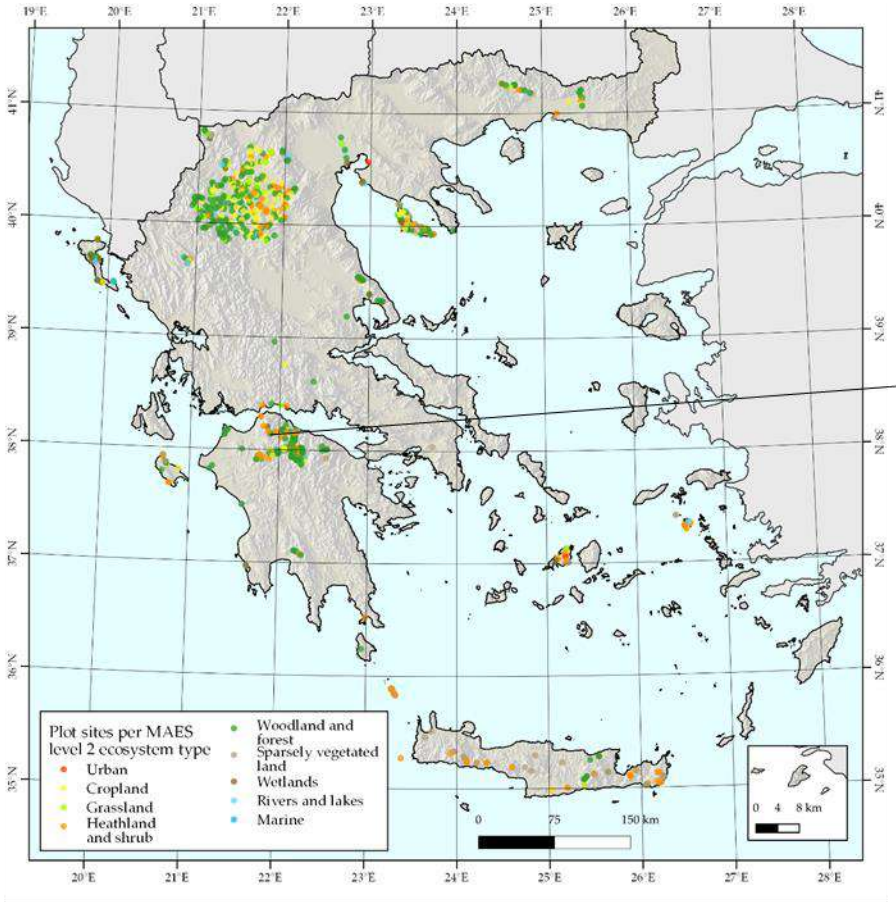
Export factsheets

Database
(dynamic update)



Statistics and visualizations

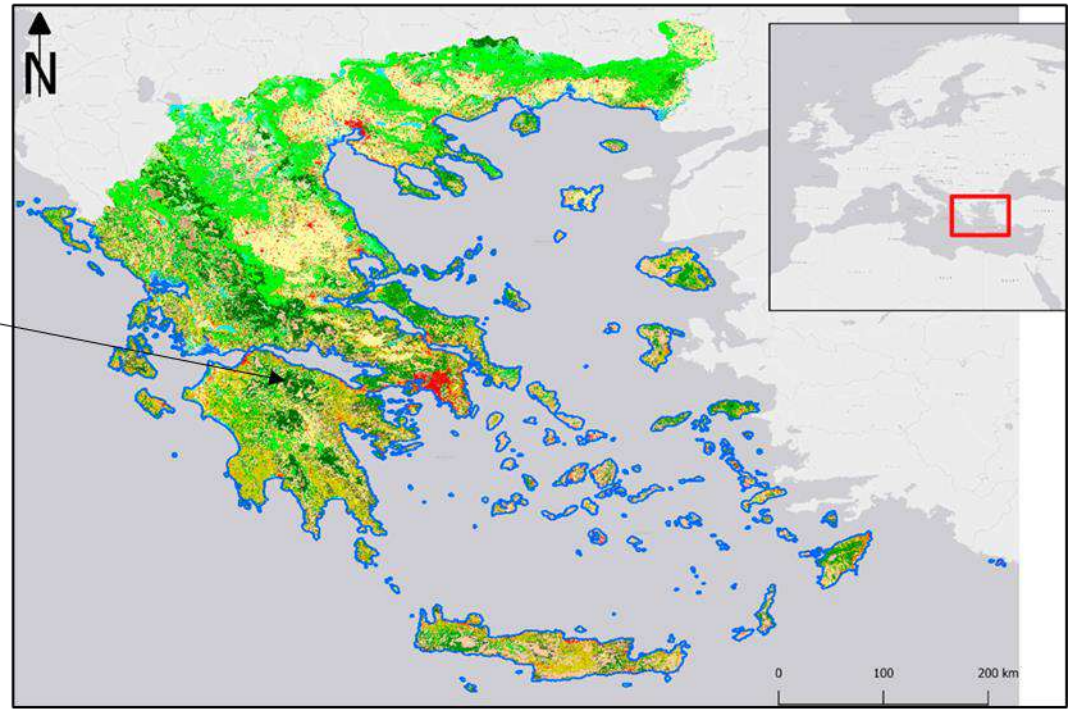
The example of MAES_GR platform



Field-survey plots per MAES level 2 ecosystem type (includes info for MAES level 3)

Ground control points for the mapping model

Ecosystem services identification at plot



The example of MAES_GR platform

Efficiency of the platform

Ecosystem Types (MAES Level 2)	Mean Time Needed for Completing the Protocol	
	MAES Platform Assessment (Total Number of Survey Protocol Forms)	Natura 2000 Monitoring with Paper survey Protocol Forms (% Difference from the Platforms' Performance)
Urban	8 min (4 protocols)	n/a
Cropland	7 min (134 protocols)	n/a
Woodland and forest	15 min (431 protocols)	25 min (+40%)
Grassland	10 min (36 protocols)	10 min (=)
Heathland and shrub	11 min (182 protocols)	15 min (+27%)
Sparsely vegetated land	7 min (82 protocols)	15 min (+43%)
Wetlands	14 min (36 protocols)	20 min (+30%)
Rivers and lakes	10 min (23 protocols)	15 min (+33%)
Marine inlets and transitional waters	10 min (6 protocols)	10 min (=)

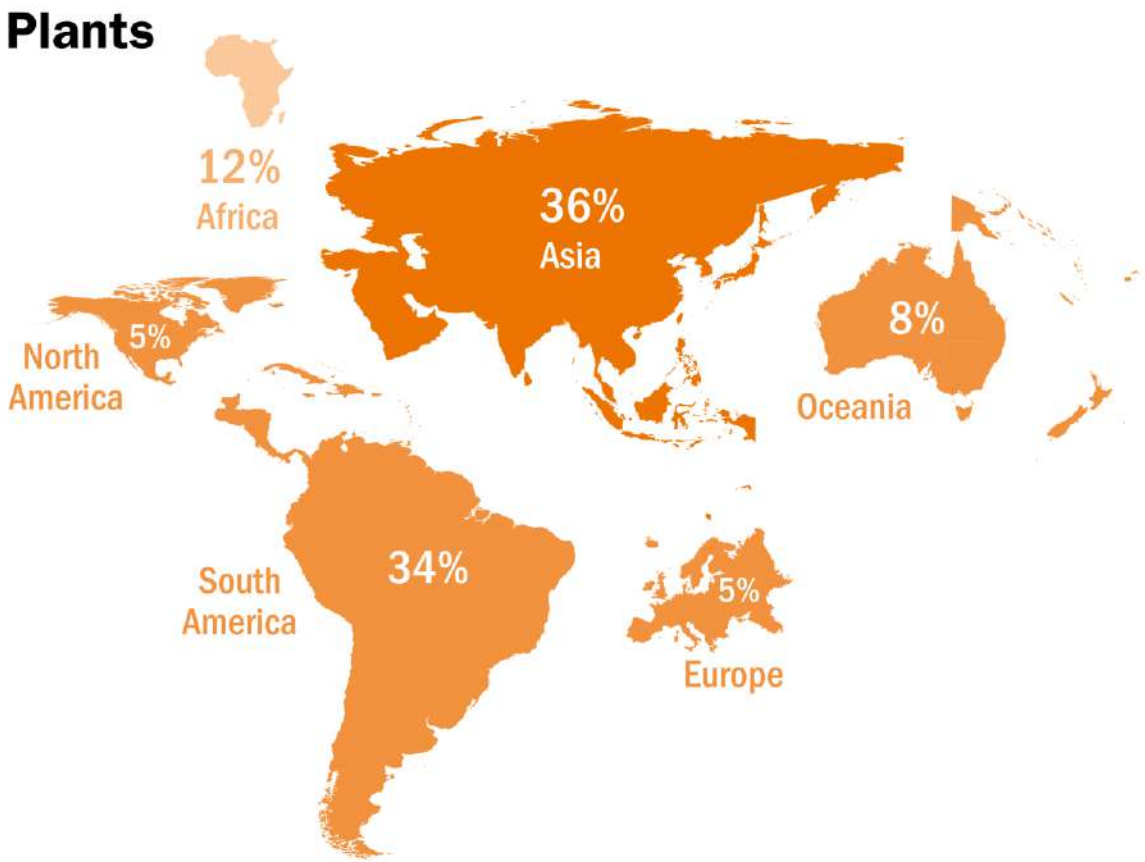
Concluding remarks

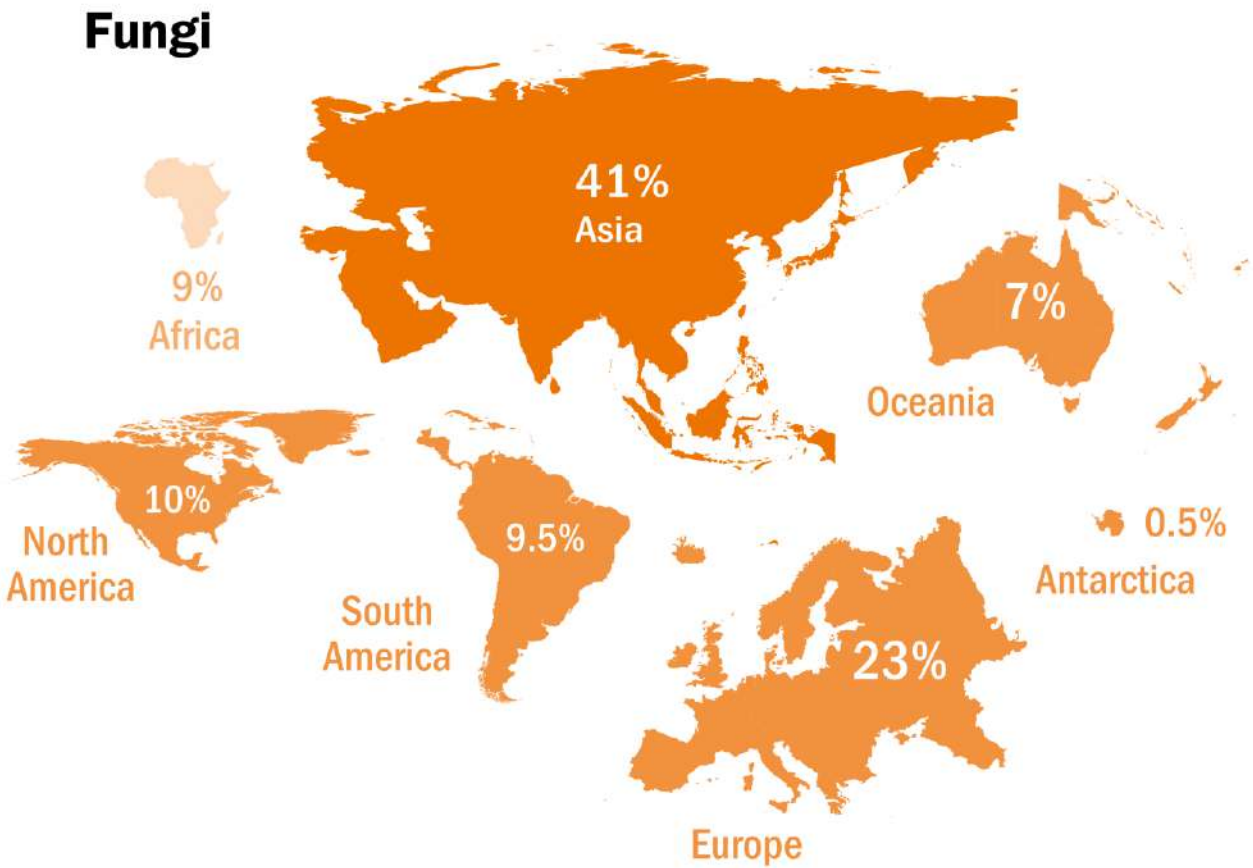
- Classic “old-school” field explorations and surveys are essential and irreplaceable methods for detailed flora inventorying.
- International and national conservation strategies provide the basic guidance for the methodological approach at field-based assessments.
- Modern computational techniques, including big-data analyses, machine learning, remote sensing and Artificial Intelligence provide guidance for targeted field surveys and data collection.
- Online geo-databases minimise laboratory effort for registering filed data parameters and simultaneously disseminate the inventory to the authorised users or the general public.
- IT scientists are welcome to the field of systematic inventorying, while botanists should be trained at least on relevant basic skills.
- The data in most cases is already here; validation and interpretation is the role that botanists and flora experts should serve!
- Inventorying is a never-ending, beautiful and challenging story that supports current needs and the prosperity of future generations.

Proportion of species from each continent named as new to science in 2019!

This is quite a lot to inventory!

So, let the inventorying begin!





Source: State of the World's Plants and Fungi. Royal Botanic Gardens Kew, 2020.

Thank you for your attention!

Prof. Panayotis Dimopoulos
Laboratory of Botany
Department of Biology
University of Patras
pdimopoulos@upatras.gr

http://portal.cybertaxonomy.org/flora-greece/

https://www.alienplants.gr/