European classification of floodplain forests: what we can do next?

Jan Douda – Kraków – 21.5. 2018

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Funded by the Horizon 2020 Framework Programme of the European Union

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European floodplain forests (species composition, diversity) strongly vary due to environmental factors and stochastic processes

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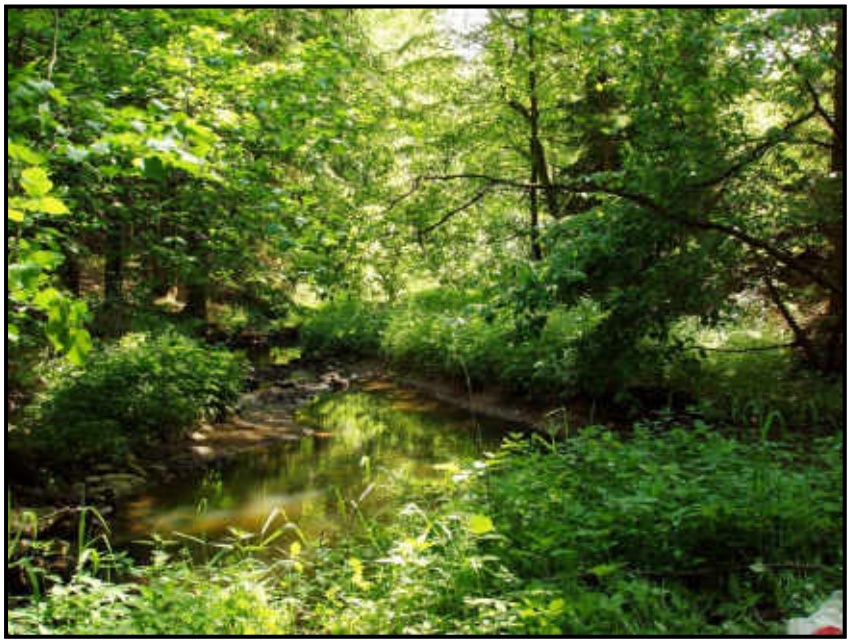
Floodplain forests and **alder carrs** include broad-leaved deciduous forest vegetation associated with flooded riparian and waterlogged (non-)riparian sites.

European phytosociological (Braun-Blanquet) approach:

Salici purpureae-Populetea nigrae **Rivas-Martínez et Cantó ex Rivas-Martínez et al. 2001**



Floodplain forests

Alnetea glutinosae **Br.-Bl. et Tüxen ex Westhoff et al. 1946**

Alder carrs

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Background

- Vegetation classifications **at the continental scale** (Douda et al. 2016, Peterka et 2017).
- A key importance for **nature conservation planning**
- Scientific basis for recent efforts to revise the EUNIS habitat (Schaminée et al. 2013).

Aims

A] To present **our project on classification** of European floodplain forests (2011-2016)

Specifically, we aimed

i) to provide a consistent classification for all of Europe and to formally redefine traditional associations reported in national vegetation surveys

ii) to show main biogeographical patterns and environmental gradients in floodplain forest vegetation.

B] To explore the **future areas in research** on floodplain forest vegetation

Applied Vegetation Science **19** (2016) 147–163

Vegetation classification and biogeography of European floodplain forests and alder carrs

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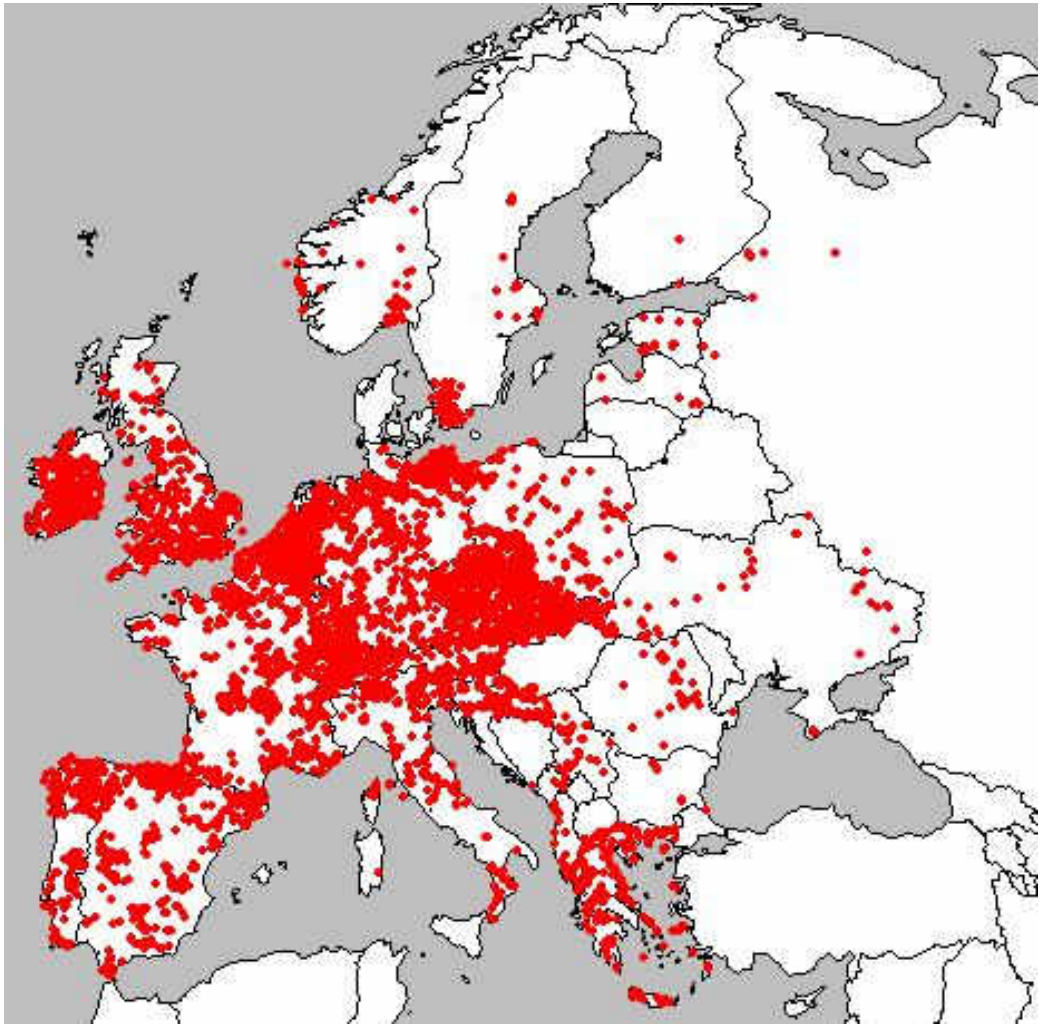
Keywords
Alnion glutinosae; *Alnion incanae*; Biogeographic patterns; Climatic limitations; Cocktail method; Formalized classification; *Osmundo-Alnion*; *Platanion orientalis*; *Populion albae*; Riparian forests; Swamp forests; Vegetation survey

Abstract

Aim: Formalized classifications synthesizing vegetation data at the continental scale are being attempted only now, although they are of key importance for nature conservation planning. Therefore, we aim to provide a vegetation classification and to describe the main biogeographical patterns of floodplain forests and alder carrs in Europe.

The initial database contained **45,774 vegetation plots** (1,693 from literature)



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A. Databases listed in the Global Index of Vegetation-Plot Databases (GIVD) with IDs (www.givd.info) and references.

Austrian Vegetation Database	EU-AT-001	Willner et al. (2012)
AuVeg	EU-DE-028	Horchler et al. (2012)
CoenoDat Hungarian Phytosociological Database	EU-HU-003	Csiky et al. (2012)
Croatian Vegetation Database	EU-HR-002	Željko Škvorc
Czech National Phytosociological Database	EU-CZ-001	Chytrý & Rafajová (2003)
Estonian Vegetation Database	EU-EE-011	Paal (2012)
German Vegetation Reference Database (GVRD)	EU-DE-014	Jandt & Bruelheide (2012)
Hellenic Natura 2000 Vegetation Database (HelNatVeg)	EU-GR-005	Dimopoulos & Tsiripidis (2012)
Iberian and Macaronesian Vegetation Information System (SIVIM)	EU-00-004	Font Castell et al. (2012)
Irish Vegetation Database	EU-IE-001	FitzPatrick & Kingston (2012)
Slovak Vegetation Database	EU-SK-001	Šibík (2012)
Polish Vegetation Database	EU-PL-001	Kacki & Sliwinski (2012)
SOPHY: basis of plant socio-ecology and phytoclimatology in France	EU-FR-003	Garbolino et al. (2012)
The Alps Vegetation Database	EU-00-014	Lenoir et al. (2012)
The Dutch National Vegetation Database	EU-NL-001	Schaminée et al. (2012)
UK National Vegetation Classification Database	EU-GB-001	Rodwell (2012)
Vegetation database of Slovenia	EU-SI-001	Šilc (2012)
Vegetation-Plot Database of the University of the Basque Country (BIOVEG)	EU-00-011	Biurrun et al. (2012)
VegItaly	EU-IT-001	Landucci et al. (2012)
VegMV	EU-DE-001	Jansen et al. (2012)

B. List of personal databases; names of databases and their providers are shown.

Bulgaria	Rossen Tzonev
Direction des Ressources Forestières	Hugues Lecomte
Floodplain forests Upper Rhine Valley	Hans-Gerhard Michiels
Het Agentschap voor Natuur en Bos	Bart Roelandt (Cornelis et al. 2009)
Austria	David Paternoster
Poland	Remigiusz Pielech
Serbia	Svetlana Aćić
Slovakia	Michal Slezák, Richard Hrivnák
Sweden	Jörg Brunet
Ukraine	Yakiv Didukh
Belgium	Hugues Claessens

Methods: dataset resampling

We selected vegetation samples:

i) plot area (50-1600 m^2)
ii) contained geographical coordinates
iii) tree cover exceeding 25%
iv) geographical stratification (10 × 6 minutes; 5-15 plots in each cell)
v) Heterogeneity-constrained random resampling (Lengyel et al. 2011; Bray-Curtis dissimilarity index as a measure of heterogeneity among vegetation plots)

Resulting dataset contained 16,392 vegetation plots and 3,971 species

Cocktail classification (Bruelheide 1997; Chytrý 2007–2013)

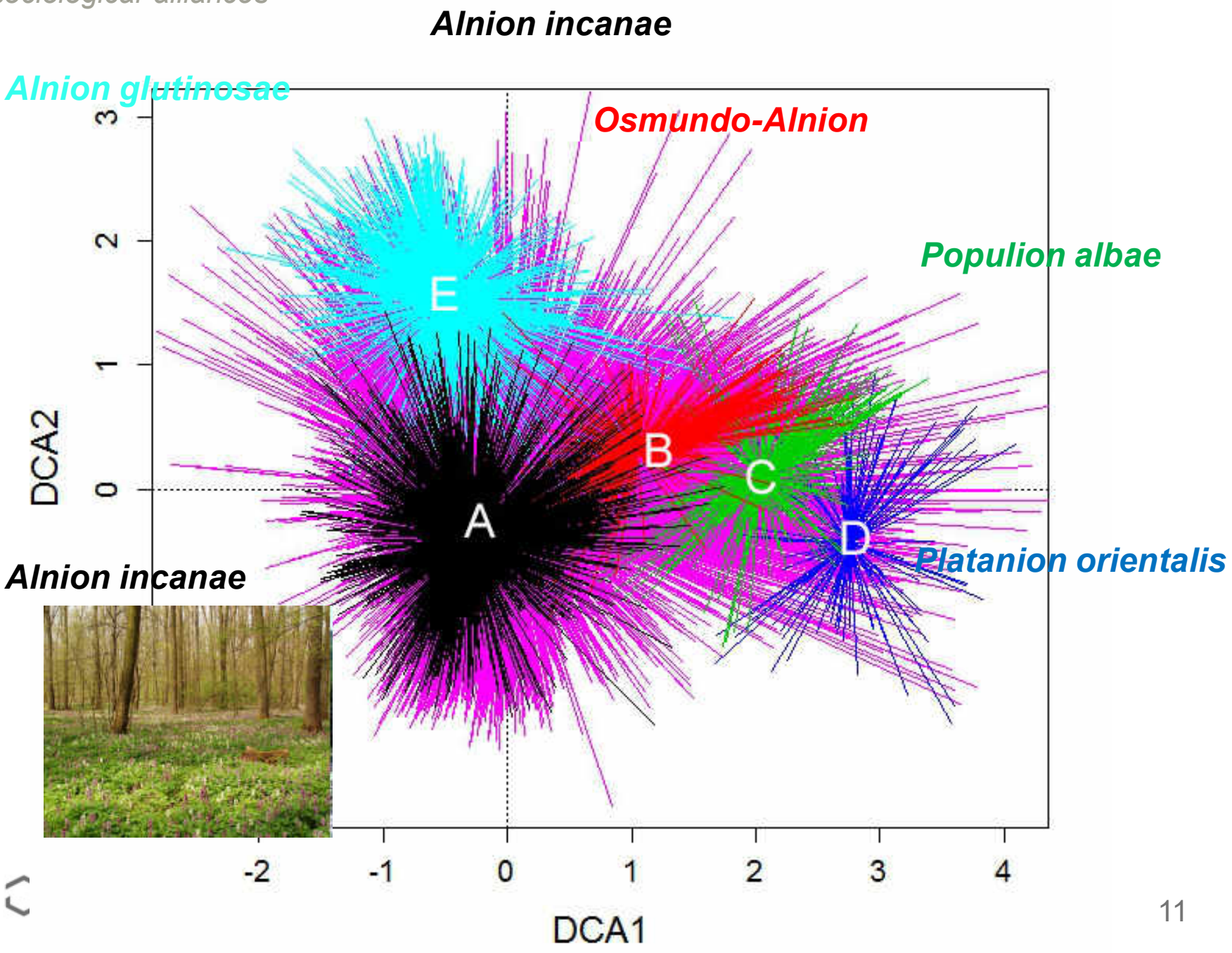
- we compiled a list of **148 associations** of floodplain forests and alder carrs mentioned in European national vegetation surveys and other phytosociological studies
- the **Cocktail definitions** were created by combinations of sociological species groups (SSGs) and high cover of certain plant species, which were linked together by logical operators AND, OR and NOT.
- we tried to prepare a Cocktail definition for each association
- we identified **diagnostic species** for each association using the phi (fidelity) coeficient
- **associations lacking specific diagnostic species were not retained**

Cocktail definition. *Alnus incana* cover > 15% AND (SSG *Lactuca alpina* OR SSG *Petasites albus*) NOT SSG *Vaccinium myrtillus* NOT SSG *Viola epipsila* NOT SSG *Viola palustris* NOT *Alnus glutinosa* cover > 15%

SSG *Lactuca alpina*: *Athyrium alpestre, Lactuca alpina, Ranunculus platanifolius, Rumex alpestris, Salix silesiaca*

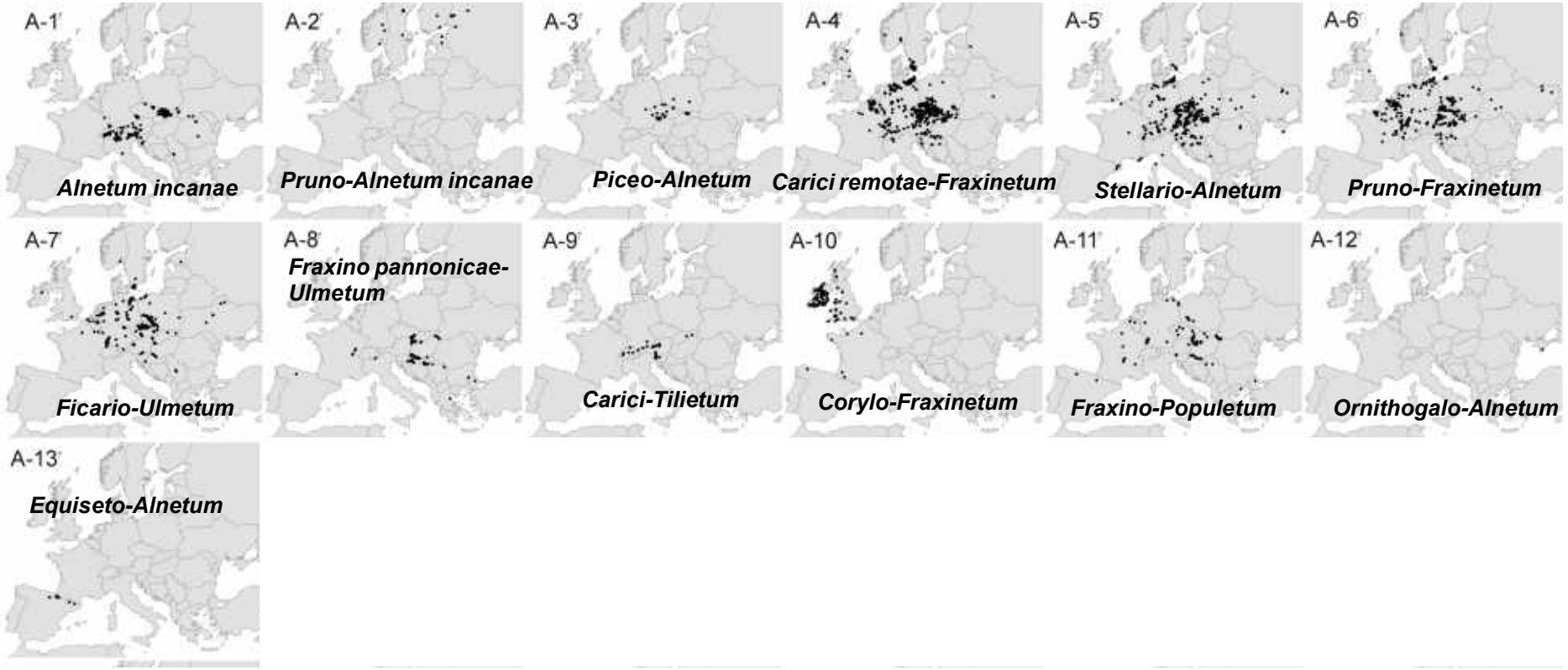
Results

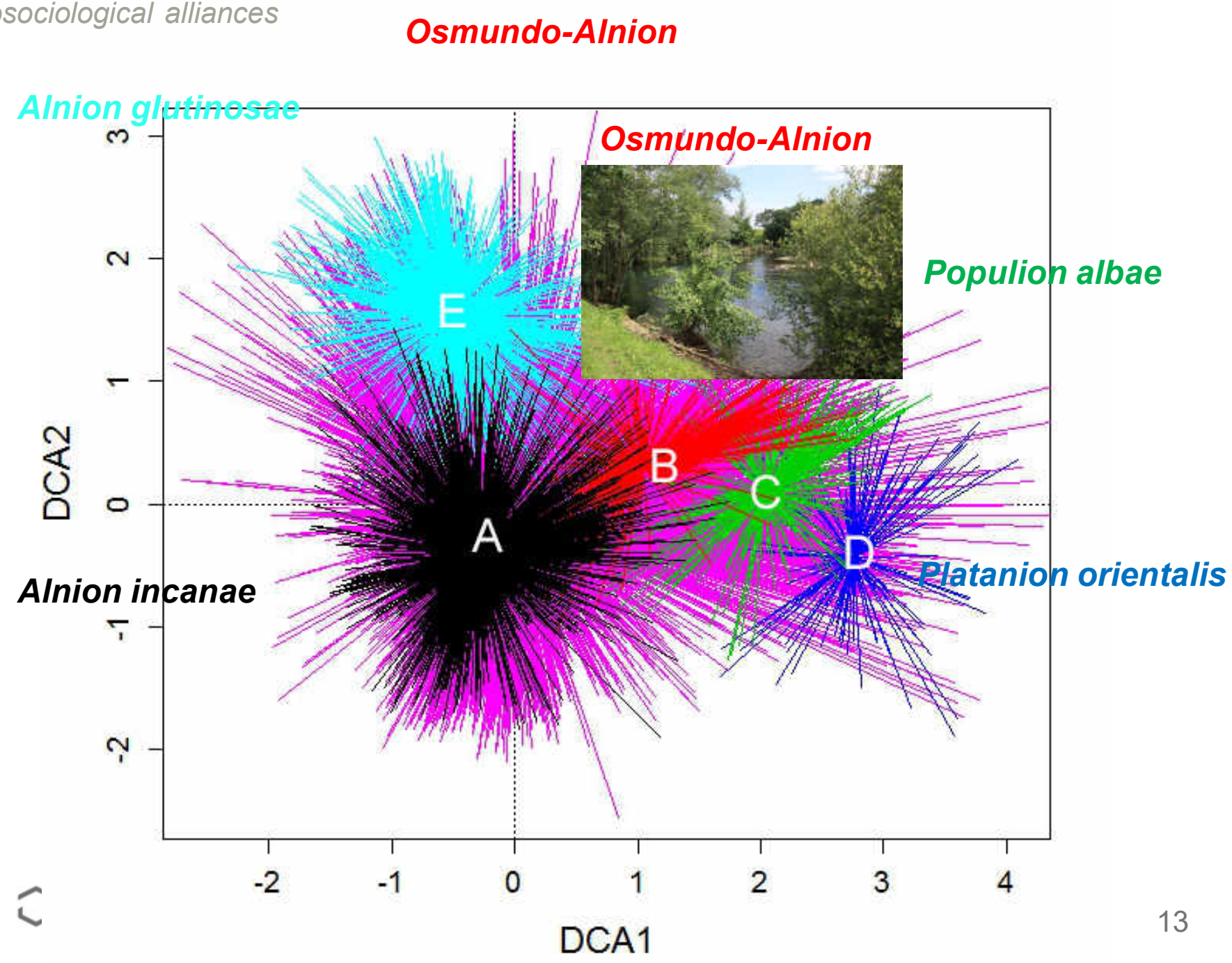
- **30 associations** (i.e. 20%) from 148 were reproduced using the Cocktail classification method
- **5 alliances** were confirmed using cluster analysis and ordination method


Alnion incanae
Alnion glutinosae
Osmundo-Alnion
Populion albae
Platanion orientalis
Alnion incanae
E
B
C
A
D
DCA2
DCA1
3
2
1
0
-2
-1
0
1
2
3
4

Alnion incanae Pawłowski et al. 1928

- ash-alder riparian and seepage forests and ash-oak hardwood floodplain forests of large rivers dominated by ***Alnus glutinosa*** and ***Fraxinus excelsior*** in the nemoral and hemiboreal zones and ***A. incana*** in the boreal zone.

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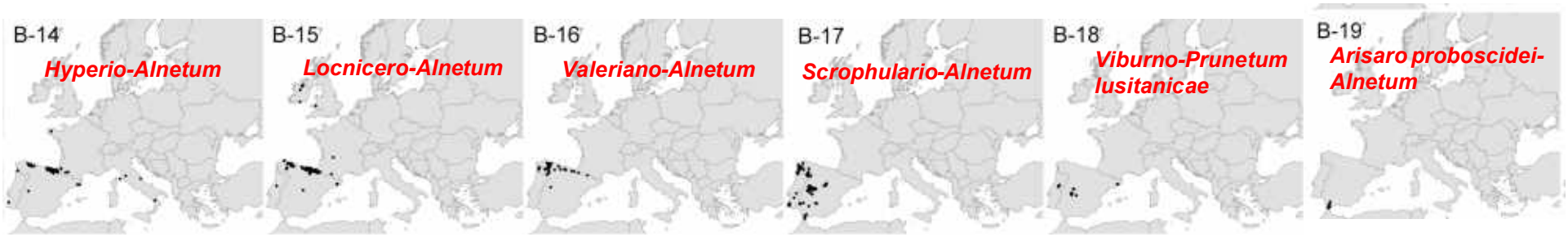
Osmundo regalis-Alnion glutinosae (Braun-Blanquet et al. 1956) Dierschke et Rivas-Martínez in Rivas-Martínez 1975

- Ash-alder riparian forests dominated by ***Alnus glutinosa*** and ***Fraxinus excelsior*** that occur in the uplands of western Europe, mostly in the north of the Iberian Peninsula.



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Populion albae

Alnion glutinosae

Osmundo-Alnion

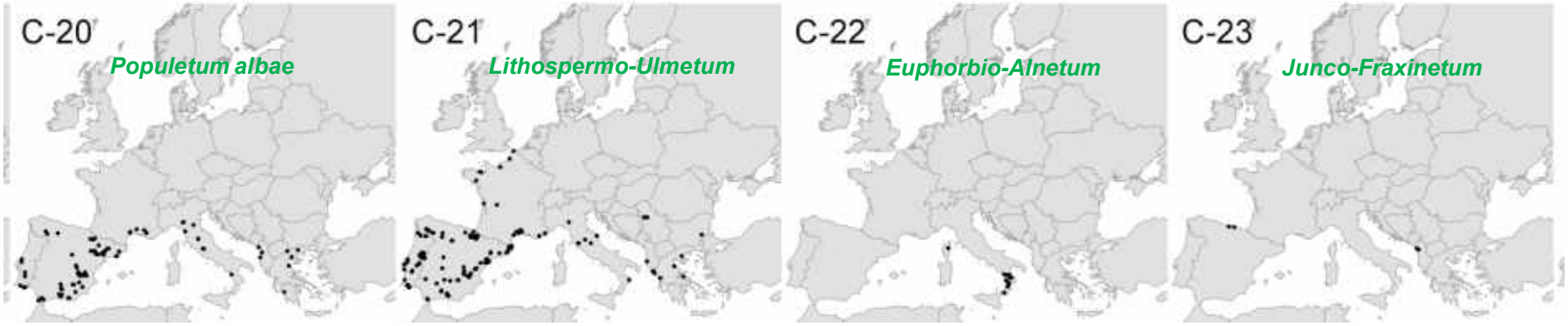
Populion albae

Platanion orientalis

Alnion incanae

Populion albae Braun-Blanquet ex Tchou 1948

- Floodplain forests frequently dominated by ***Fraxinus angustifolia***, ***Populus alba*** and ***P. nigra*** that are widespread in alluvia of large rivers in the dry climate of the Mediterranean Basin including Iberian, Italian and Balkan Peninsulas.



Platanion orientalis

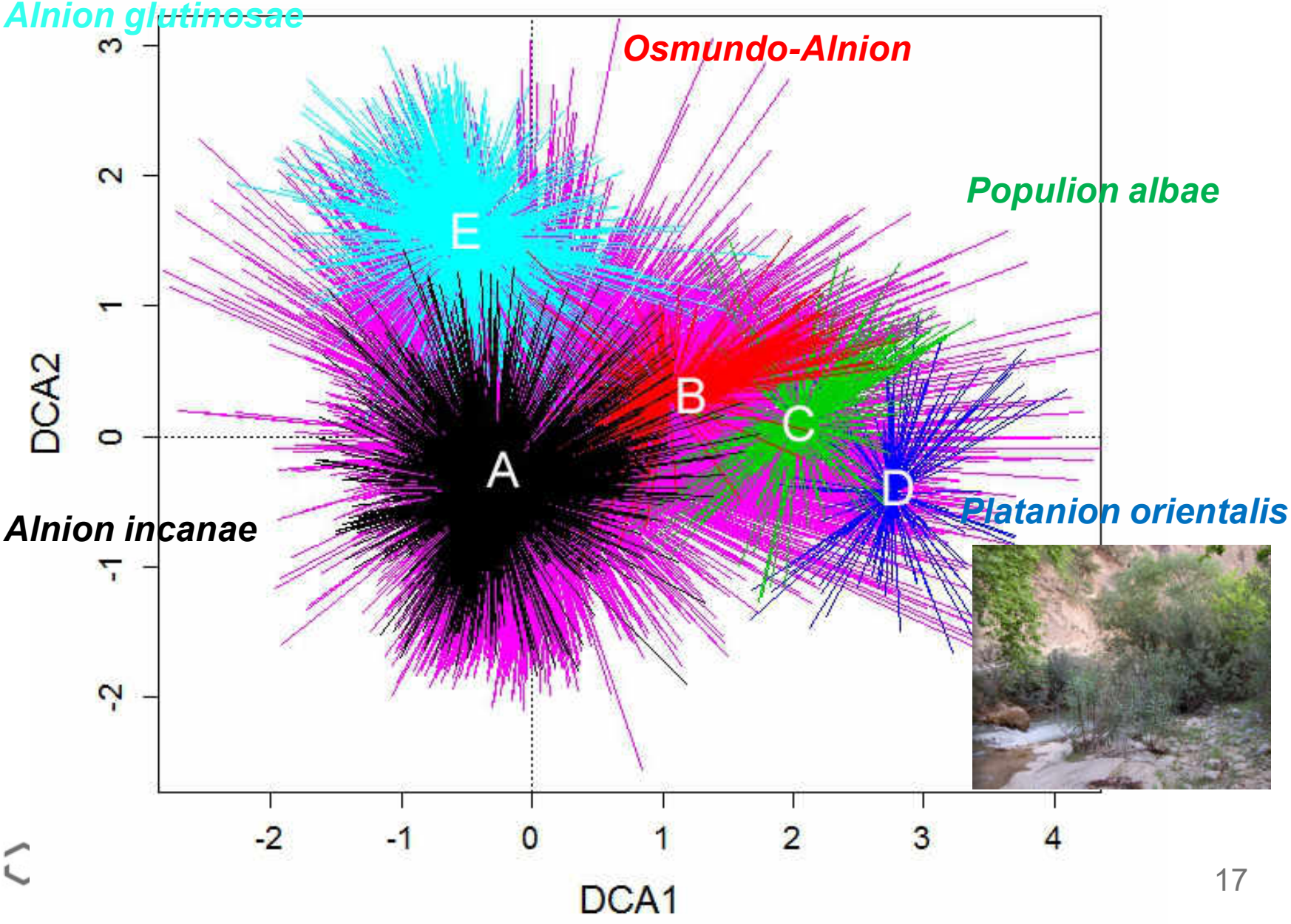
Alnion glutinosae

Osmundo-Alnion

Populion albae

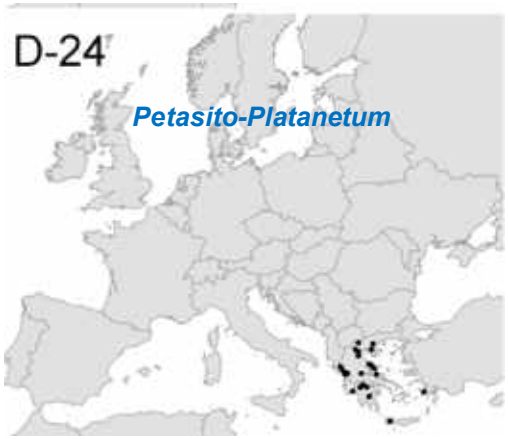
Alnion incanae

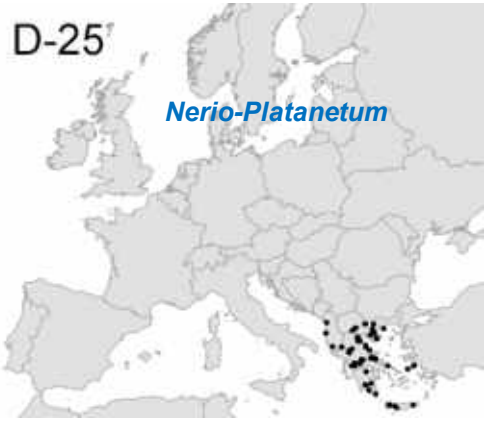
Platanion orientalis



***Platanion orientalis* Karpati et Karpati 1961**

- Floodplain forests dominated by ***Platanus orientalis*** are distributed in dry areas of the eastern Mediterranean Basin.





Alnion glutinosae

Alnion glutinosae

Osmundo-Alnion

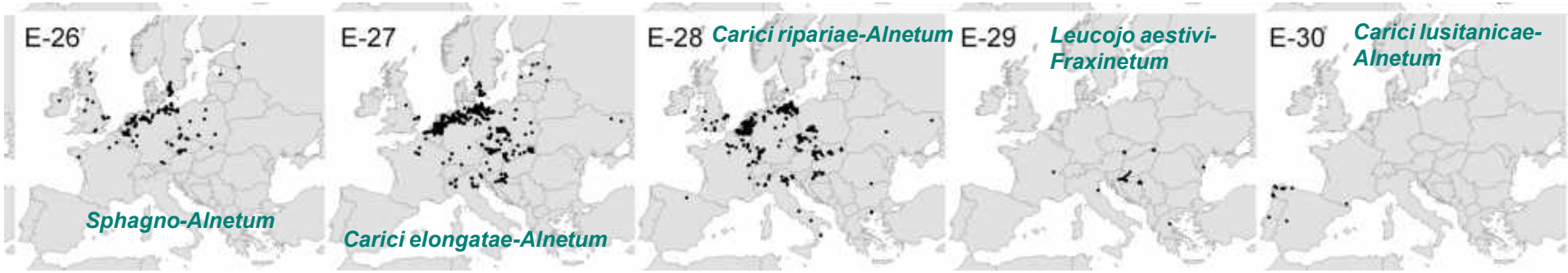
Populion albae

Alnion incanae

Platanion orientalis

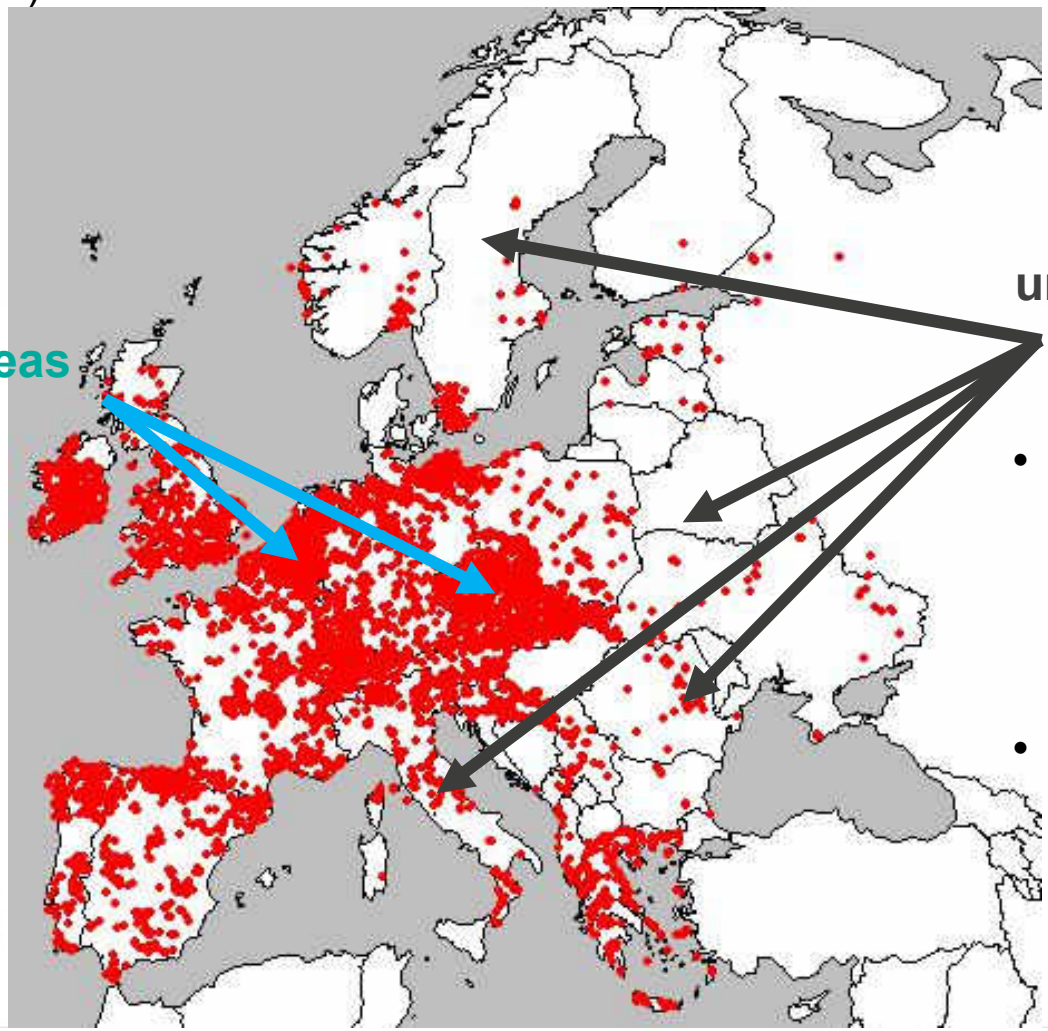
***Alnion glutinosae* Malcuit 1929**

- Forest swamps, mostly dominated by ***Alnus glutinosa***, are distributed in the nemoral and hemiboreal zones of Europe but rarely occur in the Mediterranean region.



What we can do next?

a) Regional classifications (e.g., Italy, Romania, Balkan peninsula = data collection + excerption literature)



over-sampled areas

under-sampled areas

- plots exist (in manuscripts, grey literature) but not in databases
- plots do not exist

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What we can do next?

b) Biogeographical analyses *(Douda et al. 2016, 2018)*

RESEARCH PAPER

WILEY Journal of Biogeography

Legacy of post-glacial colonization affects β-diversity: Insights into local community assembly processes

Jan Douda[1] | Alena Havrdová[1] | Jana Doudová[1] | Bohumil Mandák[1,2]

Thank you for your attention