Progress in classification of riparian forests in southeastern Europe

Jan Douda, Maria Šibíková, Jozef Šibík, Dejan Mandzukovski, Svetlana Aćić, Andraž Čarni, János Csiky, Panayotis Dimopoulos, Richard Hrivnák, Victor Adrian Indreica, Balázs Kevey, Renata Kjusterevska Michal Slezák, Vladimir Stupar, Željko Škvorc, Kiril Vasilev

Mária Šibíková – Thessaloniki – 12th February 2020

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

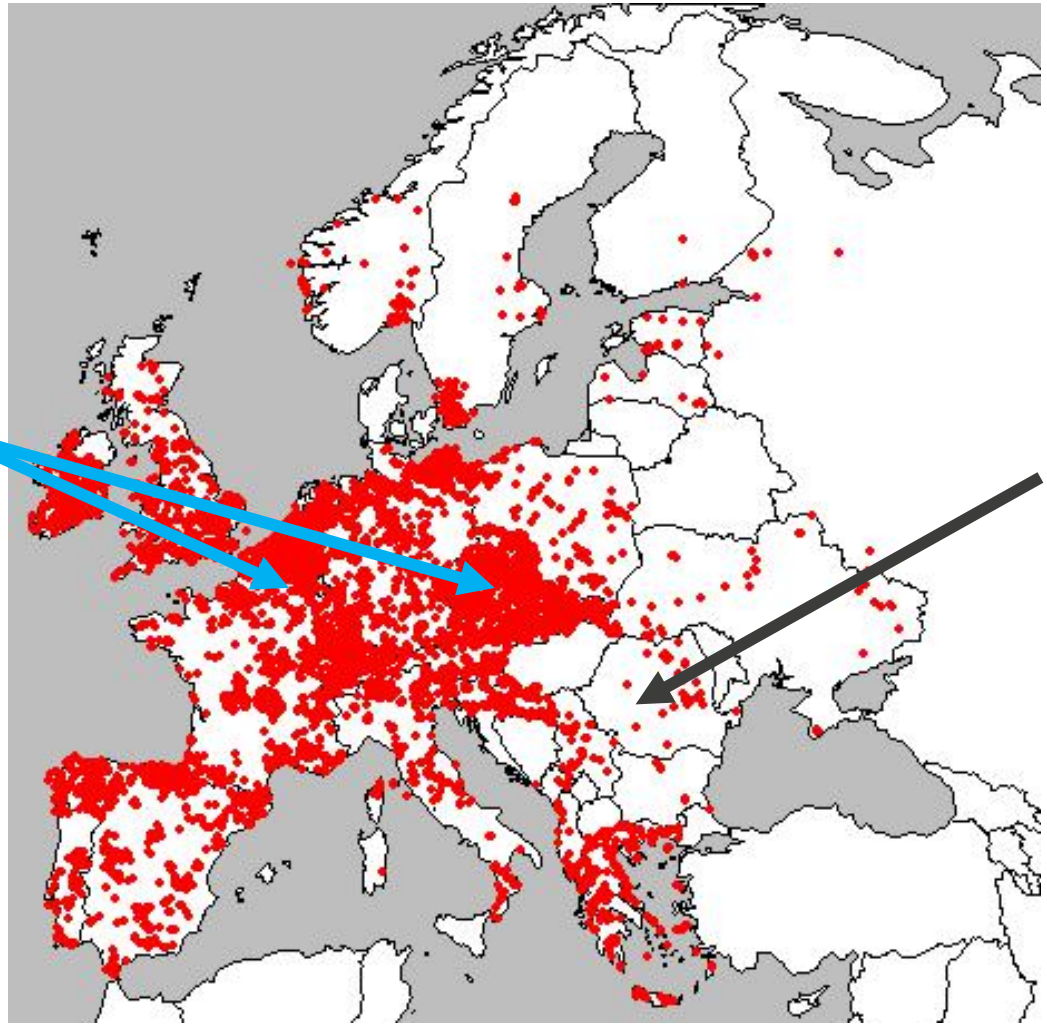
Funded by the Horizon 2020 Framework Programme
of the European Union

CONVERGES
European Riparian Ecosystems

Introduction

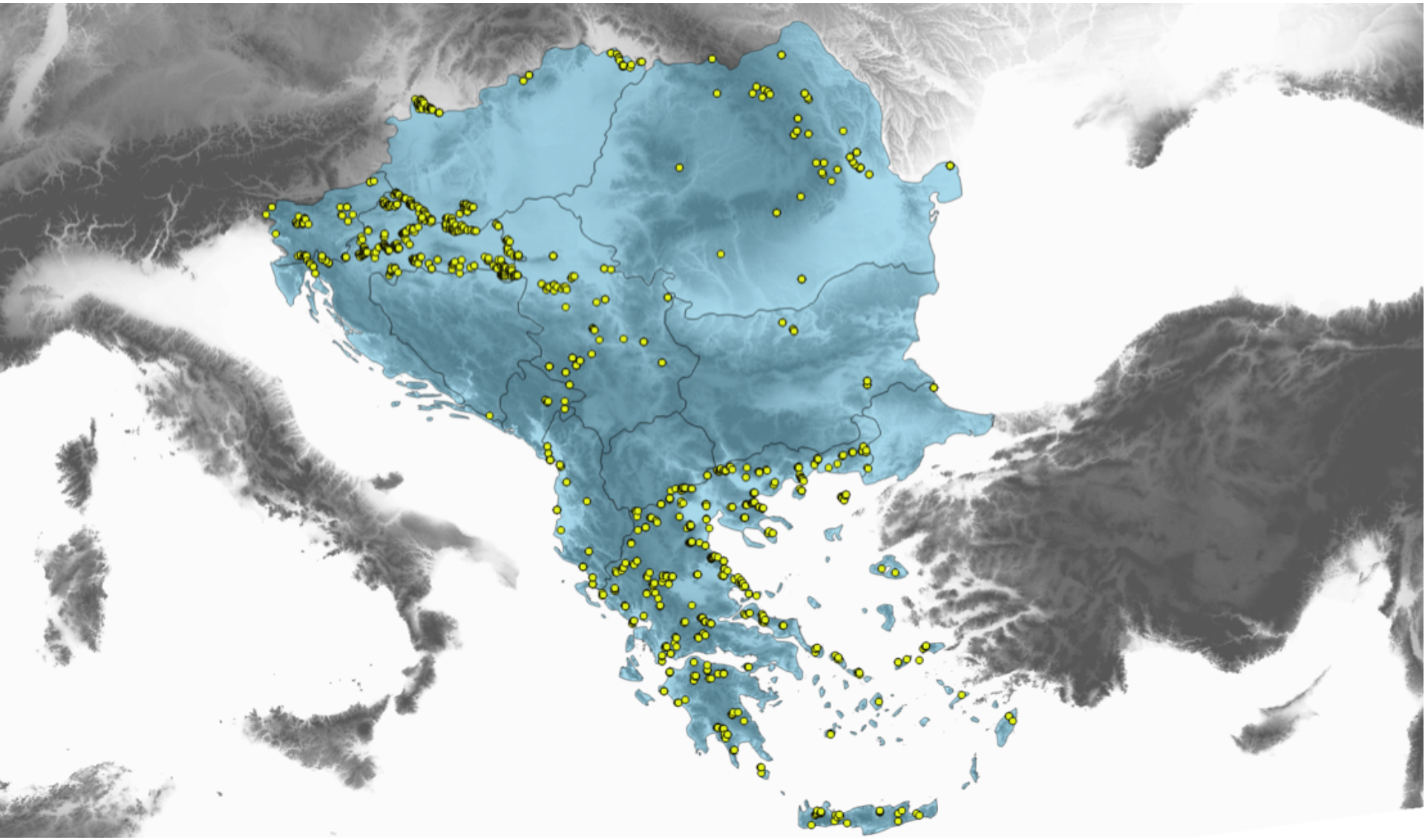
CONVERGES
European Riparian Ecosystems

over-sampled areas



under-sampled areas

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

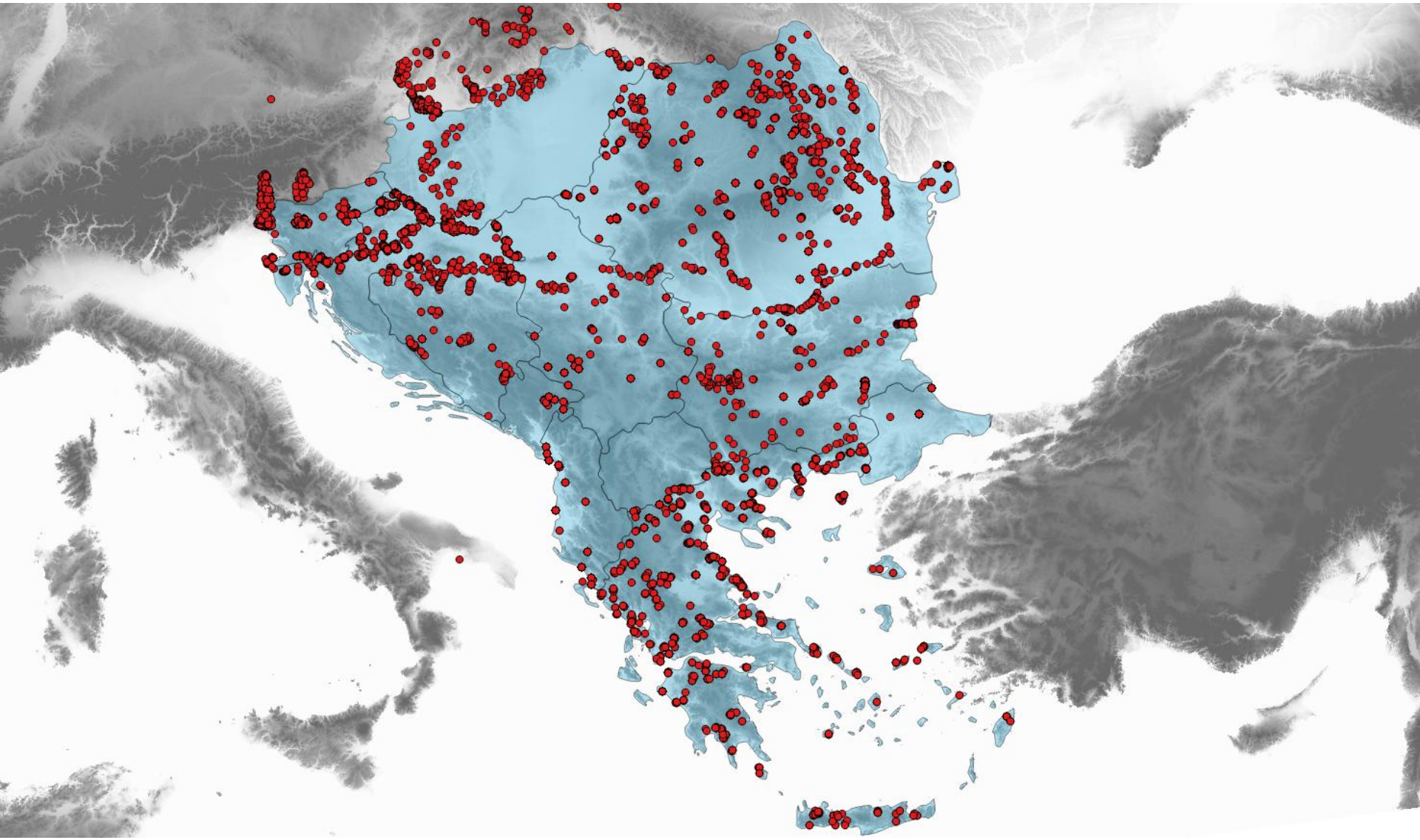


cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Methods

- The datasets of phytosociological relevés from SE Europe
- Bosnia and Hercegovina, Bulgaria, Croatia, Greece, Macedonia, Romania, Serbia, Slovenia
- Together more than 6000 relevés



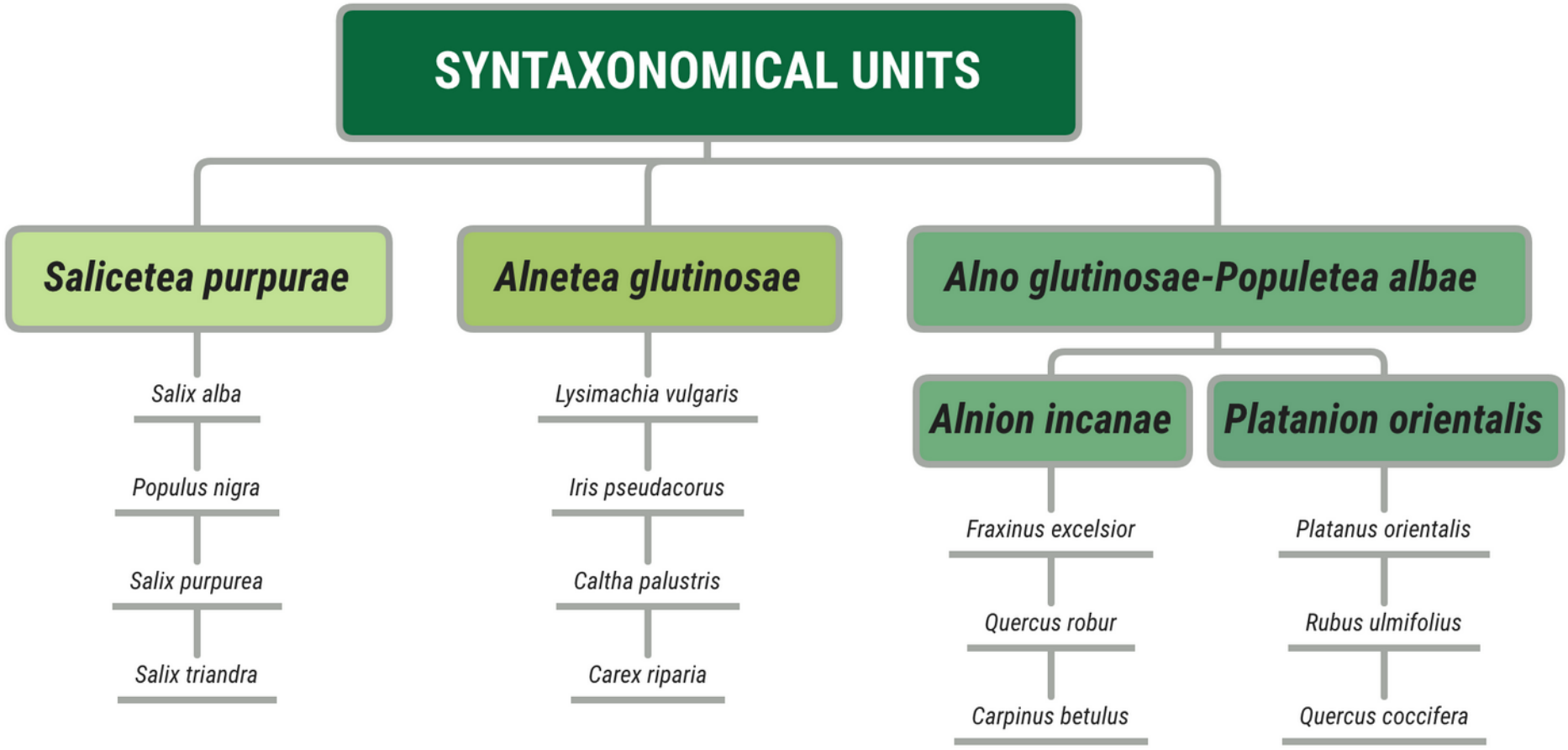
cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Methods

- Partial datasets were checked (plot area, coordinates)
- Species lists were harmonized and merged
- Header data were harmonized
- Final dataset was processed
- Nomenclature was unified according Euromed database

- This dataset present the largest database of relevés from SE riparian forests that was ever analysed together - 5727 releves, 2361 species
- Divisive and agglomerative clustering methods (Twinspan, PcOrd)

Results - classes

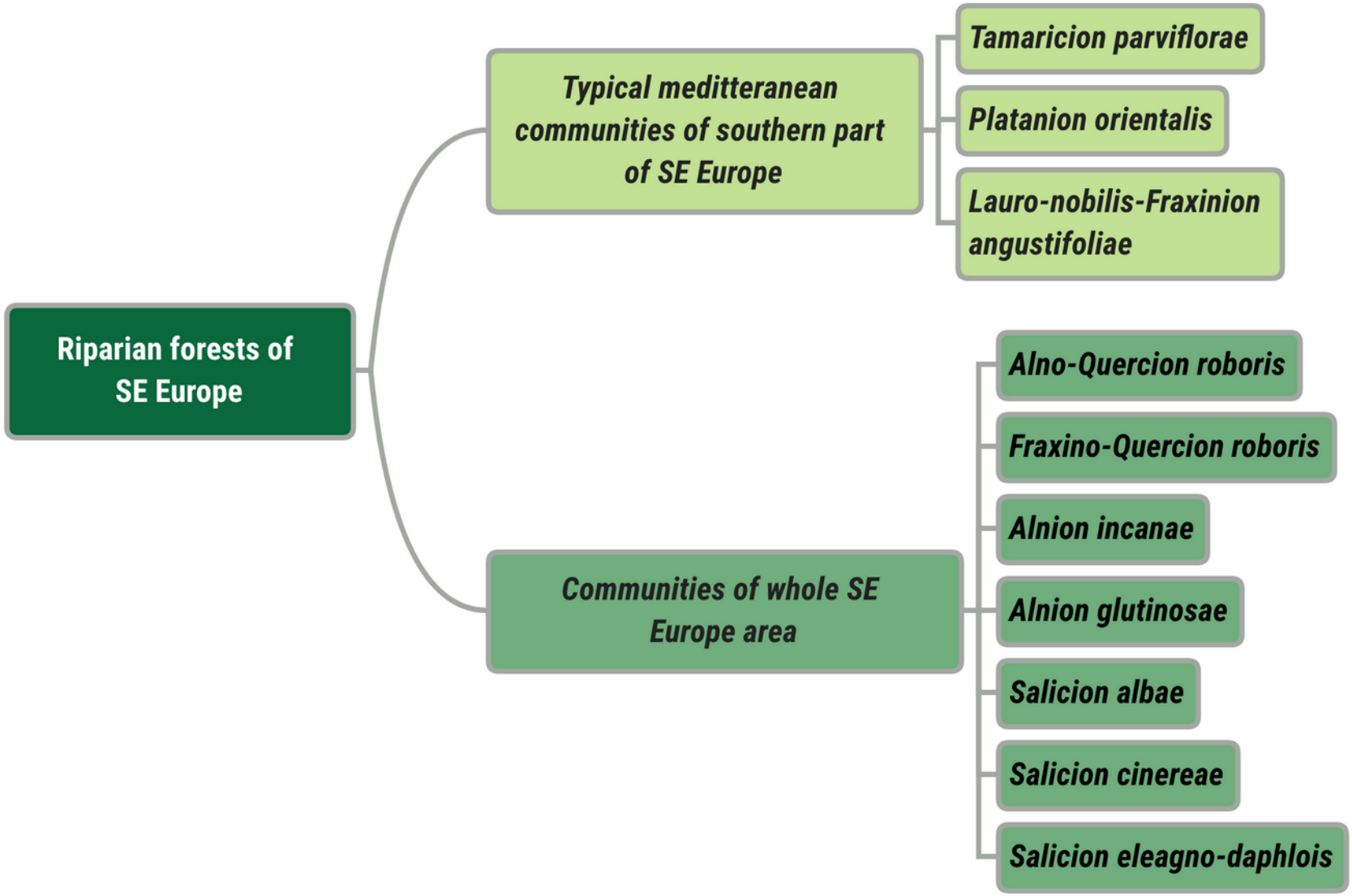


Results

- Heterogeneous dataset
- Some areas and vegetation units oversampled
- Rare communities were neglected

- Geographical stratification
  - grid cell of latitude 0.75 and longitude 1.25 minutes,
  - five relevés remain in each grid.

Results - alliances



Tamaricion parviflorae

CONVERGES
European Riparian Ecosystems

CHARACTERISTIC

- moderately species rich communities (average number of species 23)
- semi-closed horizontal structure – strongly dominated by *Tamarix parviflora*.
- *Tamarix parviflora* formed low-tree or high shrub layer with cover between 50 and 90%.
- The cover of herb layer – very high (e.g. between 60 and 90%) species such as *Anisanta sterillis*, *Brachipodium sylvaticum*, *Hordeum murinum*, *Galium aparine*.
- Subdominant species are *Ulmus minor* and *Clematis vitalba*. The herb layer was composed by

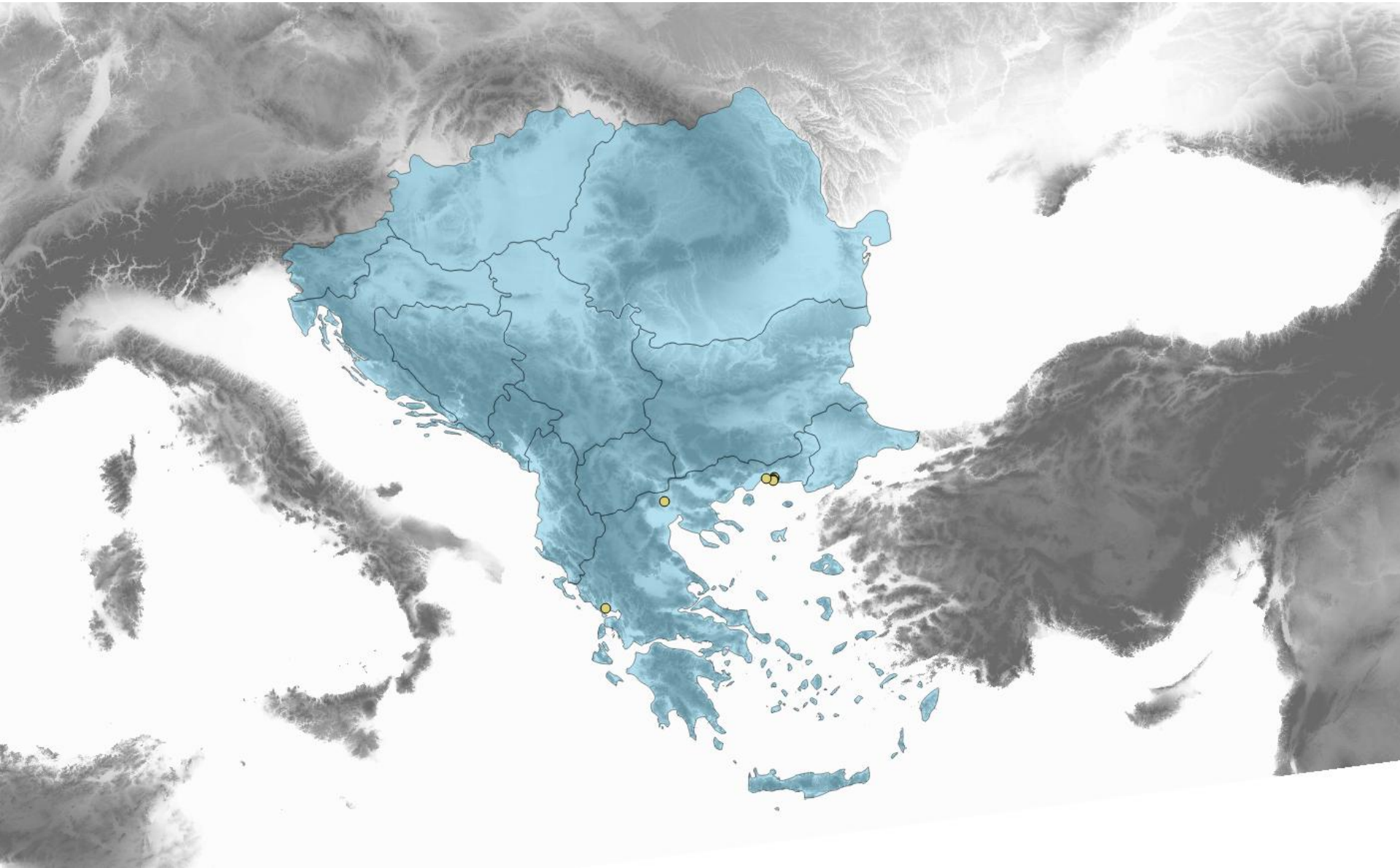
ECOLOGY

- The distribution is limited along lower rivers banks of rivers in western Balkan peninsula.
- The data from analysed data set present Tamarix parvfilora communities of Albania.
- According to new collected and unpublished data from southern Bulgaria we also expect its distribution will be expanded to central part of the peninsula.

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Tamaricion parviflorae

CONVERGES
European Riparian Ecosystems



Tamaricion parviflorae

CONVERGES
European Riparian Ecosystems

Platanion orientalis

CONVERGES
European Riparian Ecosystems

CHARACTERISTIC

- Very or moderately species-rich communities closed horizontal structure.
- well-formed tree, shrubs, herb and cryptogam layers.
- Dominant species is *Platanus orientalis*. Some mesophytic (such as *Fagus sylvatica*, *Ostrya carpinifolia*, *Alnus glutinosa*) and xerophytic tree species (such as *Quercus coccifera*, *Q. ilex*) are also frequently found in *Platanion orientalis* stands.

ECOLOGY

- Along river valleys and gorges more frquently in montane and semi-montane regions and rearer in plain regions or in the coastal zone of southern Balkan peninsula.
- This vegetation is colonizing poorly stabilised alluvial zone of rivers, which is rich of gravel or stone deposits.

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Platanion orientalis

CONVERGES
European Riparian Ecosystems

THREATS

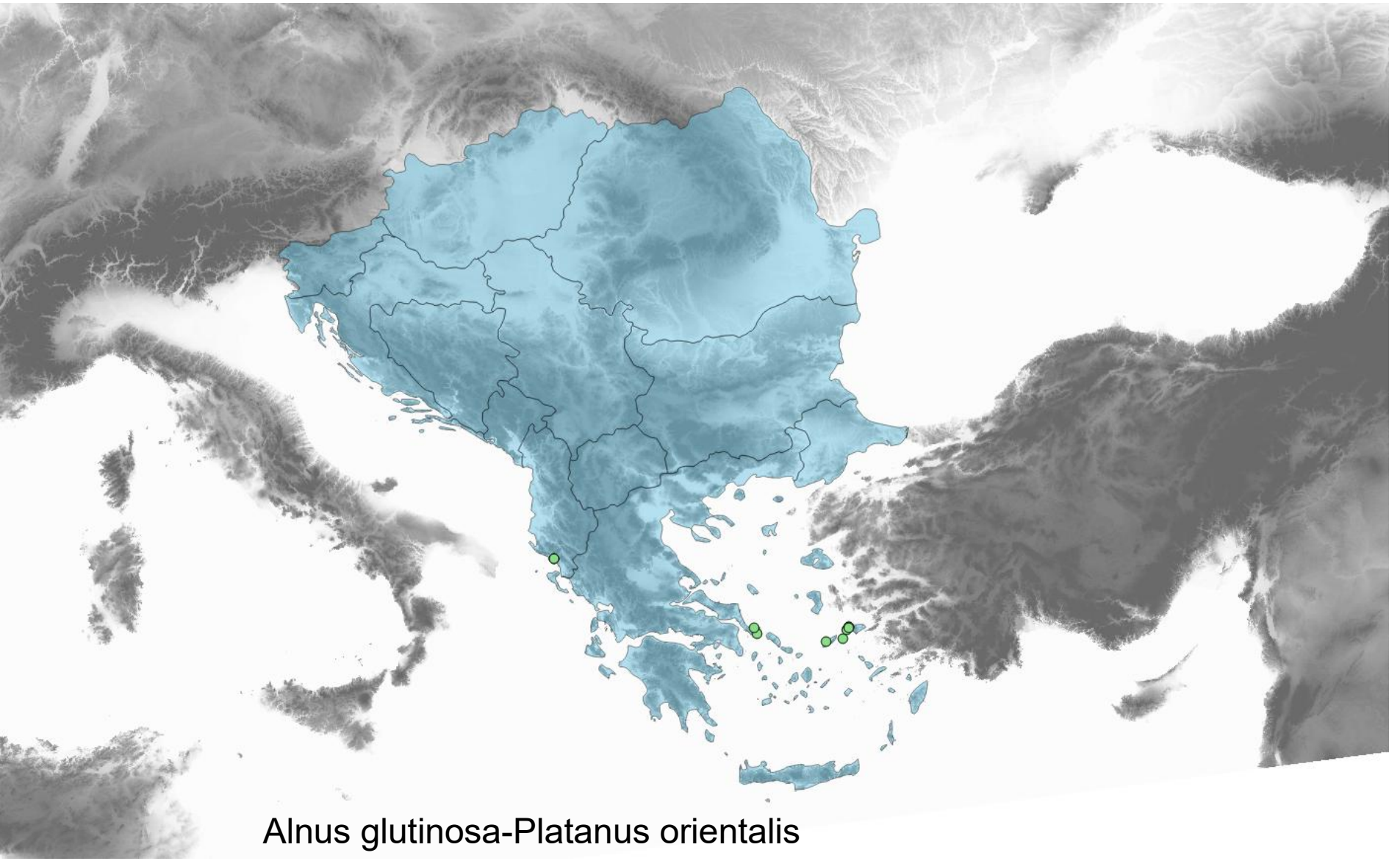
- Strong anthropogenic pressure.
- Phytocoenosis at higher altitude and more difficult accessible terrains are well preserved.
- Those situated closely to settlements, roads and tracks are contaminated with wastes and frequently tree species have been cutted during centuries.
- High abundance of alien species such as *Bidens tripartita*, *B. cernua*, *Conyza canadensis*, *Impatiens glandulifera*, *Amorpha fruticosa*, *Robinia pseudoacacia*, etc.

SYNTAXONOMY

- 8 associations - *Juglando-Platanetum*, ***Nerio-Platanetum orientalis***, *Petasiti-Platanetum orientalis*, *Platanetllm orientalis balcanicum*, *Euphorbio characiae-Platanetum orientalis, Hyperico hircini-Platanetum orientalis, Equiseto telmateiae-Platanetum orientalis*, *Castaneto-Platanetum* n.n, and 2 communities - ***Platanus orientalis-Quercus coccifera***, ***Alnus glutinosa-Platanus orientalis***

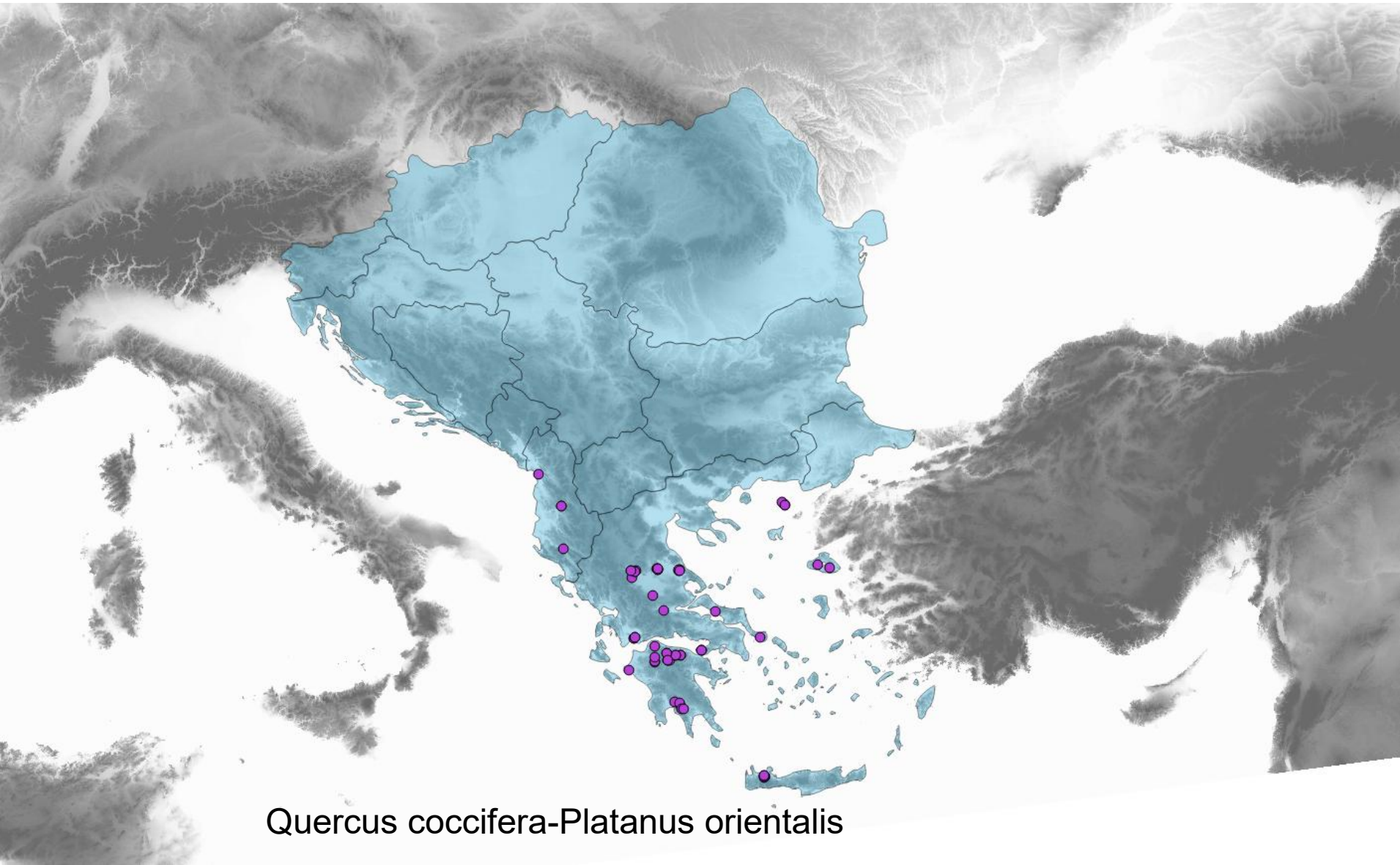
cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Platanion orientalis



Alnus glutinosa-Platanus orientalis

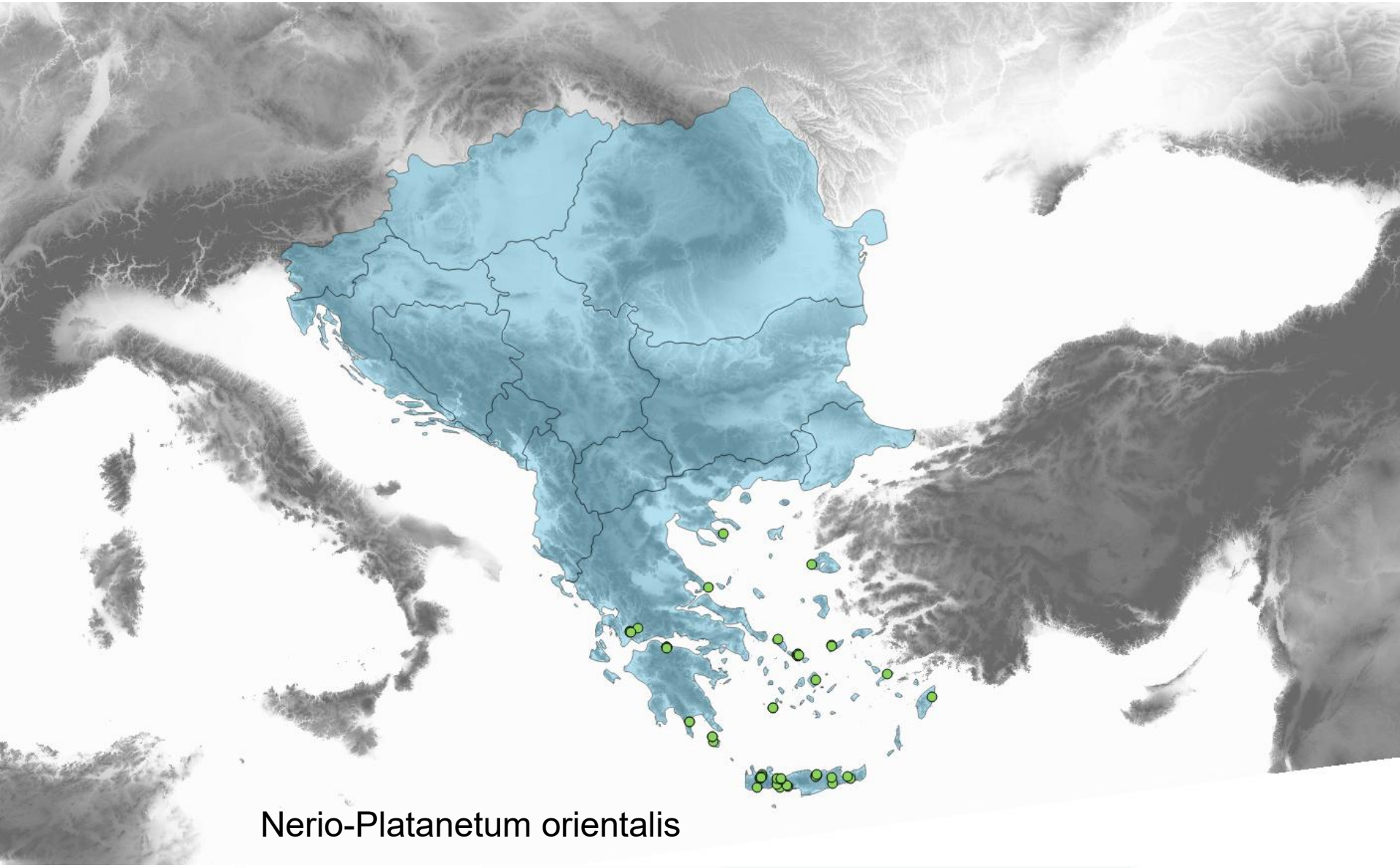
Platanion orientalis



Quercus coccifera-Platanus orientalis

Platanion orientalis

CONVERGES
European Riparian Ecosystems



Nerio-Platanetum orientalis

Lauro nobilis-Fraxinion angustifoliae

CONVERGES
European Riparian Ecosystems

CHARACTERISTIC

- In tree layer – *Fraxinus angustifolia, Quercus robur, Populus alba, Plantanus orientalis, Alnus glutinosa, Ulmus minor*, but *Ulmus laevis* is more sporadic (in comparison with alliance *Alno-Quercion*).
- High presence of **liana species**, such as *Periploca graeca, Vitis sylvestis, Smilax excelsa, Tamus communis*.
- In the **shrub layer** we can find a mixture of **evergreen** and deciduous species, such as *Ruscus aculeatus, Myrtus communis, Quercus coccifera* and also *Rosa canina, Paliurus spina-christi, Prunus spinosa*.
- In the **herb layer**
  - less **mesophyilous deciduous forests**
  - many species with **Mediterranean distribution pattern**, such as *Ruscus aculeatus, Asparagus acutifolius* and *Rubia tinctorium*.
  - There appear many plant species that show **degradation** of these stands like *Prunella vularis, Lysimachia nummularia, Plantago major*. In more humid places we can find hygrophytes like *Juncus acutus, Cyperus longus* and *Lycopus europaeus*.

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Lauro nobilis-Fraxinion angustifoliae

CONVERGES
European Riparian Ecosystems

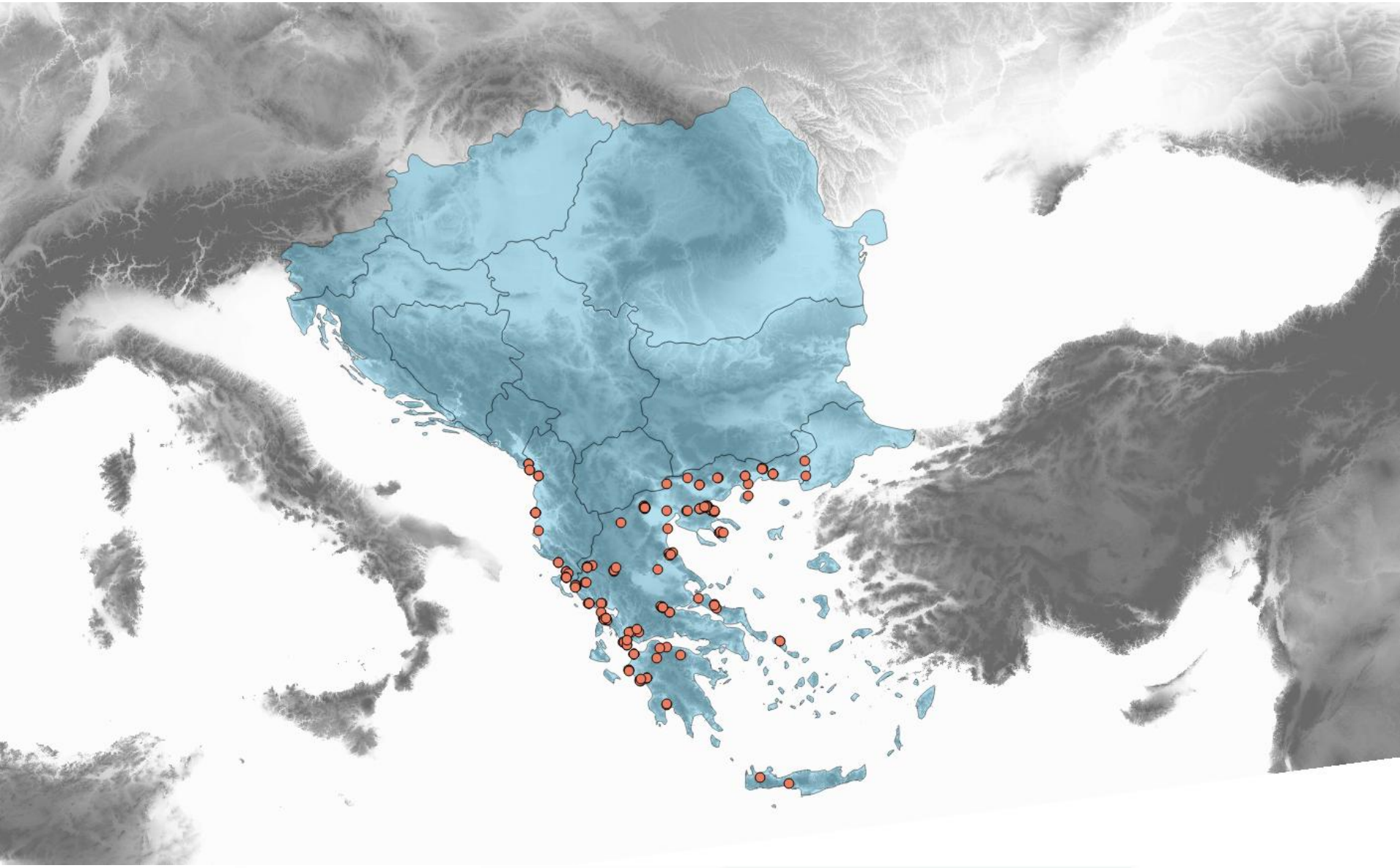
ECOLOGY

- Transition from Mediterranean to continental climate.
- The vegetation of the broader area belongs to the evergreen vegetation of the class *Quercetea ilicis*.
- Therefor also evergreen and thermophilic species occur in these stands and distinguish them from other riverside forest of the Balkan Peninsula.
- These stands can be found close to the sea, where sea makes climate more Mediterranean.
- They are flooded in spring for a short time and then water flows in the river bed, but humidity during summer is provided by high undergrown water.
- These forests are remnants of extensive alluvial forests that used to be distributed along Mediterranean rivers and around water bodies.

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Lauro nobilis-Fraxinion angustifoliae

CONVERGES
European Riparian Ecosystems



Lauro nobilis-Fraxinion angustifoliae

CONVERGES
European Riparian Ecosystems

Lauro nobilis-Fraxinion angustifoliae

CONVERGES
European Riparian Ecosystems

THREATS

- Deforestation and change of areas to agricultural land (in combination with drainage).
- Replacement of natural floodplain forests by poplar plantation and introduction of other alliance species.
- Invasive species.
- These productive forests are source of wood and logging is also practiced.
- One of threats is also grazing pressure causing lack of forest floor vegetation (incl. seedling of tree species).
- The severest treat is change of water regime, especially protection from flooding and drawdown of water level, due to river arrangements, barrage construction, alluvial plain drainage.

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Alno-Quercion roboris

CONVERGES
European Riparian Ecosystems

CHARACTERISTIC

- The mixed floodplain forests dominated by hardwood species (*Quercus robur*, *Fraxinus angustifolia*, *F. pallisae*).
- *Ulmus laevis* and *U. minor* are also very important species but because of Dutch Elm Disease gradually disappeared from the tree layer and remains in the shrub layer.
- Herb layer is well developed, with diverse species composition depends of micro topography and water regime.

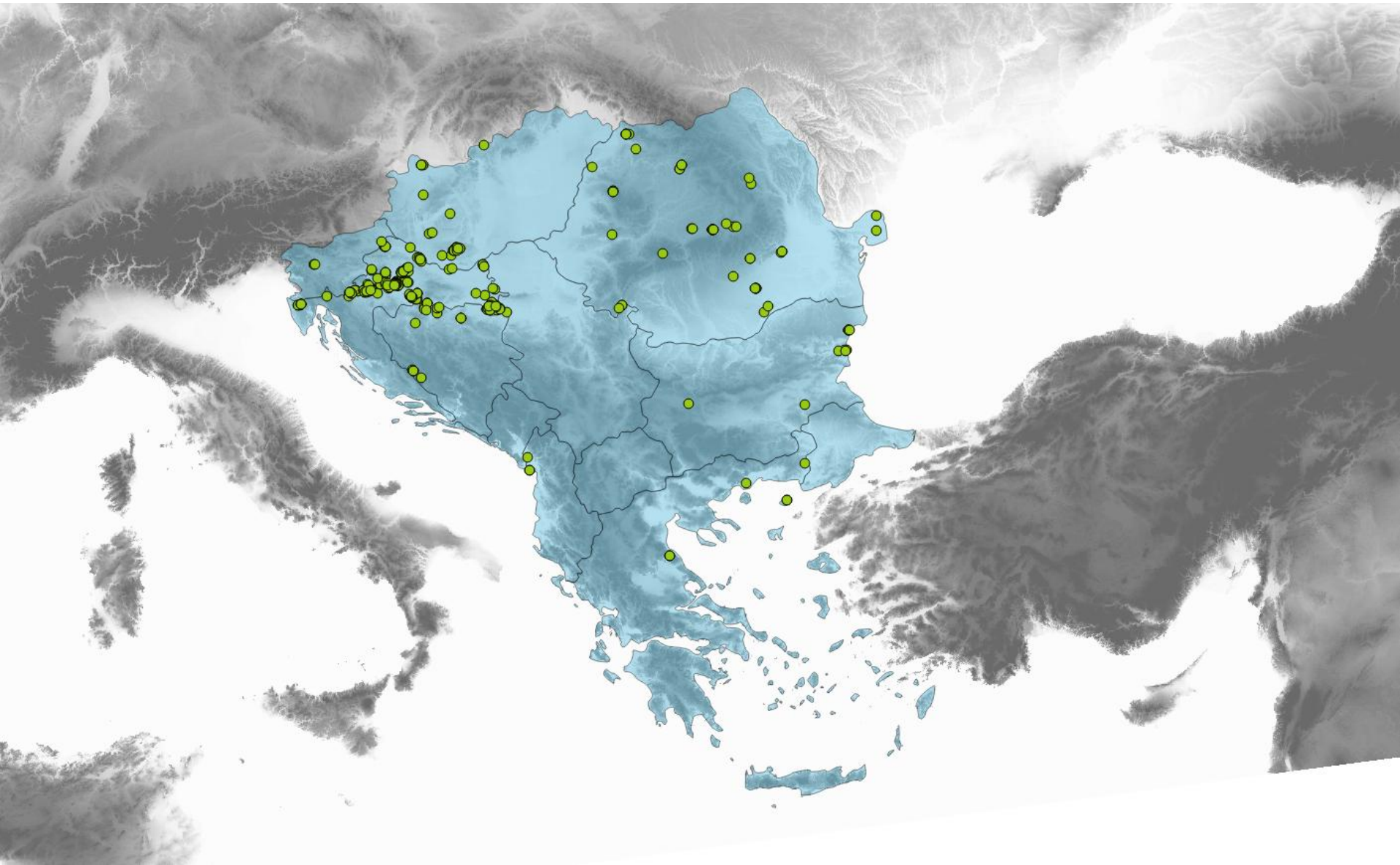
ECOLOGY

- Mainly developed along the large lowland rivers in a transitional zone between highest river terraces (beyond the reach of floods) and depressions with stagnant water.
- Periodically flooded, mostly in spring and autumn
- These stands are highly productive and often serve as important source of valuable timber.

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

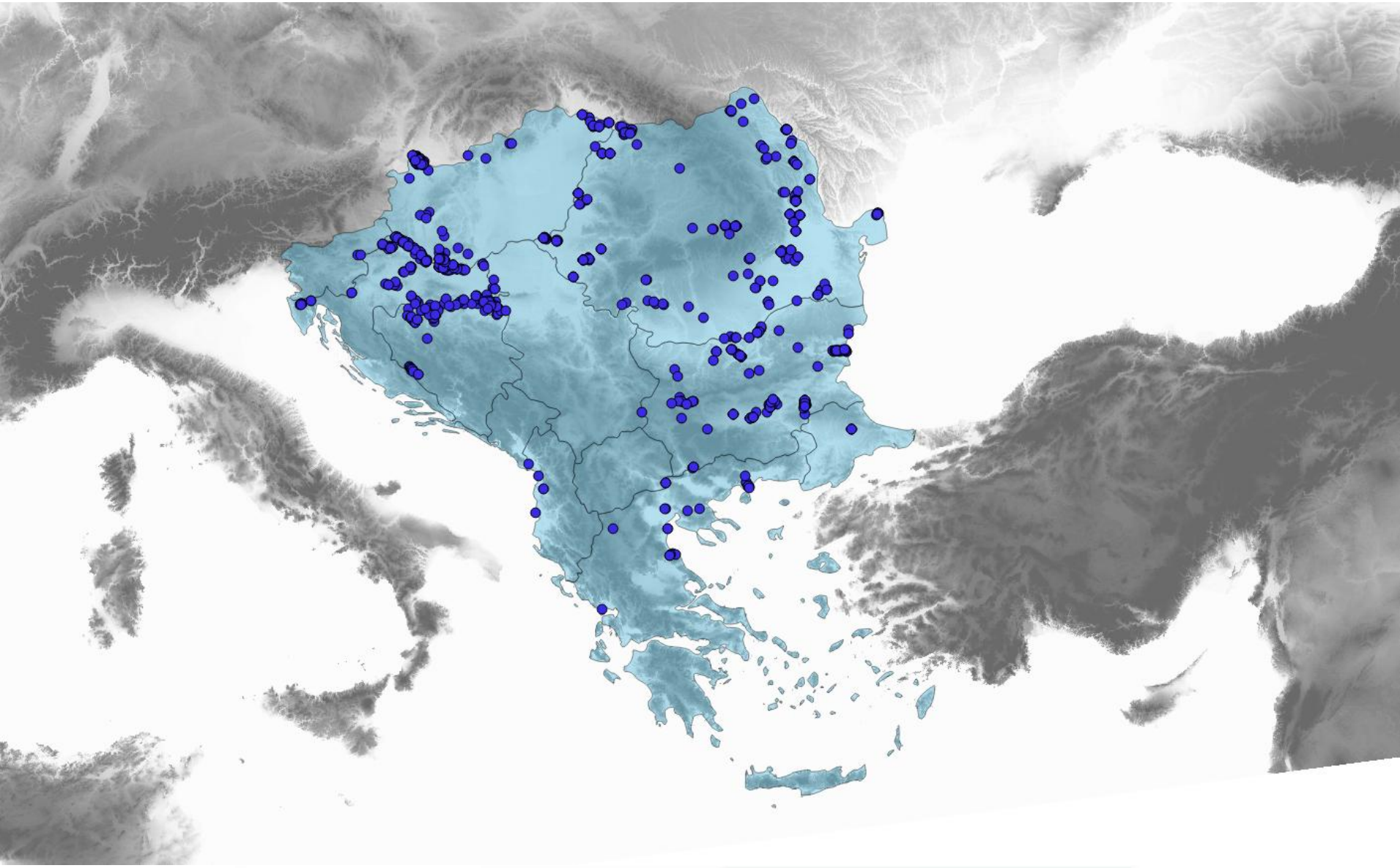
Alno-Quercion roboris

CONVERGES
European Riparian Ecosystems



Fraxino-Quercion roboris ?

CONVERGES
European Riparian Ecosystems



Alno-Quercion roboris

CONVERGES
European Riparian Ecosystems

THREATS

- Affected by human activities from ancient times.
- Their habitats are fragmented od destroyed for agricultural land or intensive plantations of hybrid poplars.
- Hydromelioration activities: construction of dikes, draining and redirection of river beds.
- Homogenisation, loosing complex pattern of different plant communities and decreasing of biodiversity.
- Less endangered by invasive alien species compared to habitats of softwood species, but in the case of high disturbance it can be significant threats (especially *Amorpha fruticosa*).

SYNTAXONOMY

- The alliance of *Alno-Quercion roboris* is vicariant to alliance *Fraxino-Quercion roboris* Passarge 1968 appearing in the N and C Europe.
- In our dataset – nextstanding cluster could be assigned to *Fraxino-Quercion roboris*

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Alno-Quercion roboris

Alnion incanae

CONVERGES
European Riparian Ecosystems

CHARACTERISTIC

- Ash-alder riparian and seepage forests and ash-oak hardwood floodplain forests of large rivers.
- Dominated by *Alnus incana* in the mountain areas, *Alnus glutinosa* and *Fraxinus excelsior* at mid-elevation and *Fraxinus angustifolia*, *Quercus robur* and *Ulmus minor* in lowlands along broad rivers.
- Presence of *Acer pseudoplatanus*, *Fraxinus excelsior* and *Tilia cordata* positively differentiates this alliance from other floodplain forests and alder carrs.

ECOLOGY

- Dynamic ecological conditions that control composition and diversity of species pool.

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Alnion incanae

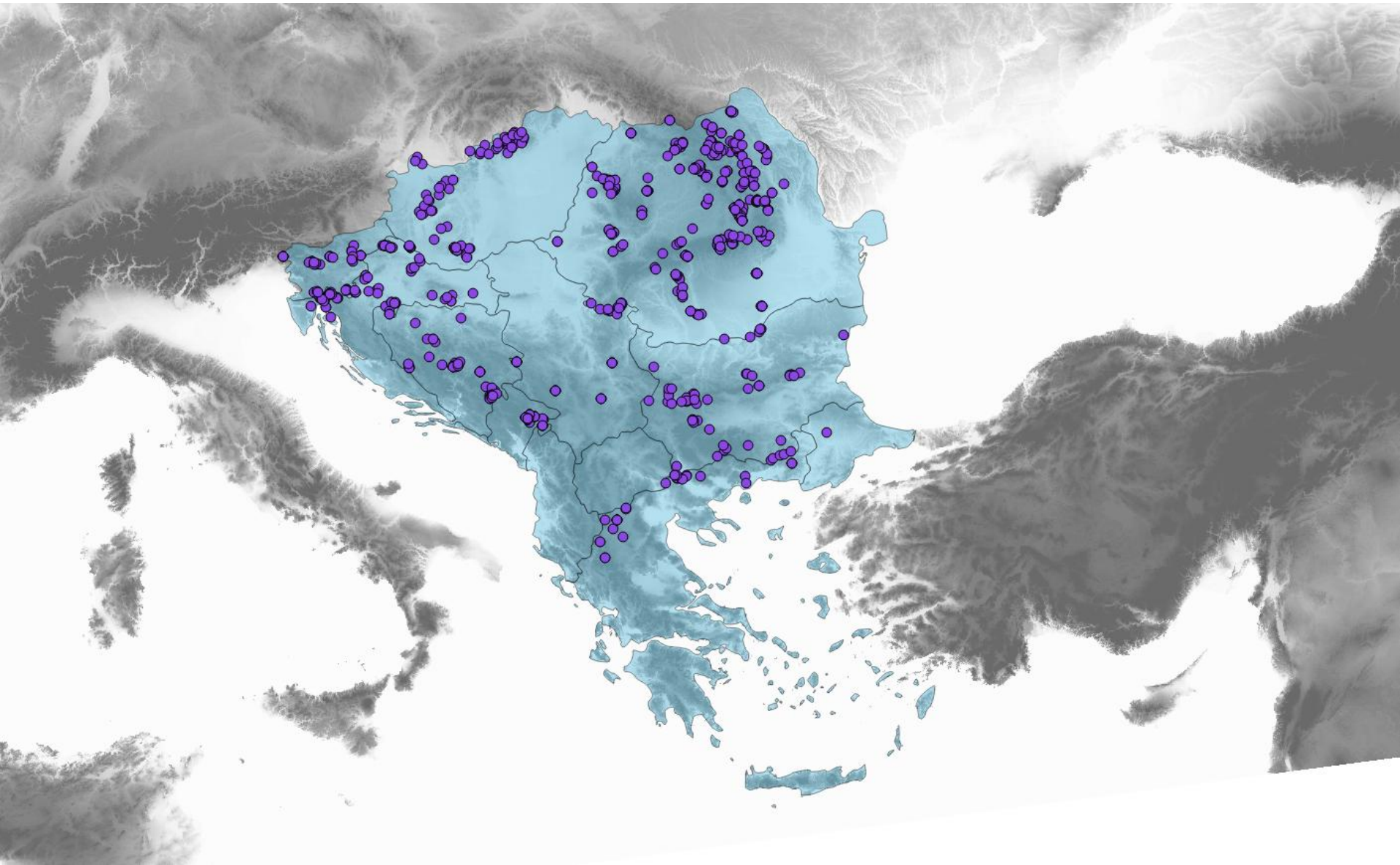
© R. Hrivnák

CONVERGES
European Riparian Ecosystems

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Alnion incanae

CONVERGES
European Riparian Ecosystems



Alnion incanae

CONVERGES
European Riparian Ecosystems

THREATS

- Biodiversity in floodplain forests is vulnerable to river regulations (i.e., lower frequency of flooding) which facilitate successional processes leading to mesophilous forests.
- Abandoning of traditional forest practices (i.e., coppicing with standards, wood pasture, litter raking and grass cutting) due to their effect on various site-specific properties, for example nutrient regime, light conditions, etc.
- The eutrophication, fragmentation and high dispersal potential increase their susceptibility to plant invasions

SYNTAXONOMY

- Montane riparian forests dominated by *Alnus incana* (ass. ***Alnetum incanae* Lüdi 1921)**.
- Seepage forests that are characterized by dominance of *Carex remota* (ass. ***Carici remotae-Fraxinetum excelsioris* Koch ex Faber 1936)**.
- Forests that are distributed along small streams in uplands and highlands (ass. ***Stellario nemorum-Alnetum glutinosae* Lohmeyer 1957)**.
- Forests of river sites that occur in river alluvia (ass. ***Pruno padi-Fraxinetum excelsioris* Oberdorfer 1953**).

Alnion glutinosae

CONVERGES
European Riparian Ecosystems

CHARACTERISTIC

- The alliance includes vegetation of swamps mostly dominated by *Alnus glutinosa*,
- Herb layer composed of tall sedges (e.g. *C. acutiformis*, *Carex elongata* and *C. riparia*,) and wetland herbs.
- In the southeastern Europe, some type of swam forests are also dominated by *Fraxinus angustifolia*, which is widespread along oxbows of large rivers predominantly in lowlands.
- Other characteristic species are *Galium palustre*, *Lycopus europaeus*, *Lysimachia vulgaris*, *Scutellaria galericulata* and *Solanum dulcamara*.

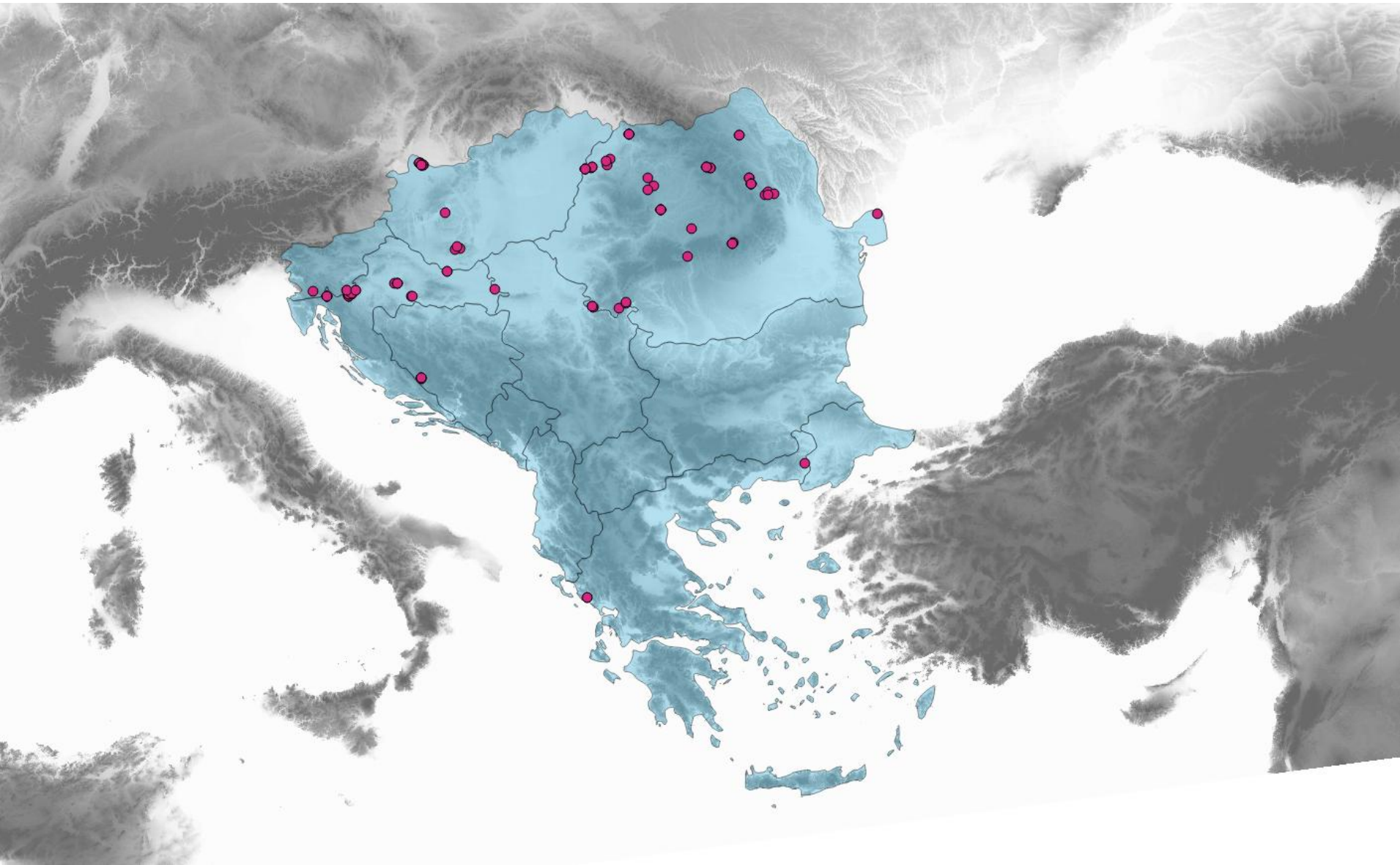
ECOLOGY

- Developed in shallow waterlogged depression, mainly near lakes and in broad river floodplains.
- Inundated by groundwater for considerable parts of the vegetation season;
- The species composition of alder carrs depends primarily on soil acidity gradient), but other factors such as microtopography, successional status of site and regional specificity

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Alnion glutinosae

CONVERGES
European Riparian Ecosystems



Alnion glutinosae

© R. Hrivnák

Alnion glutinosae

THREATS

- They were proposed to add into threatened ecosystems listed in Habitat Directive of the European Union (Evans 2010), but there is still no consensus on their conservation strategy.
- They significantly contribute to regional species pool, provide suitable habitats for many important regional flora and fauna species.
- Many areas of swamp forests have already been destroyed or at least degraded because these ecosystems are sensitive to synergistic impacts of anthropogenic disturbances.

SYNTAXONOMY

- Oligotrophic peatland carrs dominated by *Alnus glutinosa* and *Sphagnum* species (ass. ***Sphagno palustris-Alnetum glutinosae* Lemée 1937**).
- Mesotrophic carrs (ass. ***Carici elongatae-Alnetum glutinosae* Tüxen 1931**).
- The eutrophic carrs dominated by *Alnus glutinosa* and by nutrient-demanding species (ass. ***Carici ripariae-Alnetum glutinosae* Weisser 1970**).
- The swamp forests dominated by *Fraxinus angustifolia* (ass. ***Leucojo aestivi-Fraxinetum angustifoliae* Glavač 1959)**.

Salicion albae

CONVERGES
European Riparian Ecosystems

CHARACTERISTIC

- Periodically flooded riparian forests along the large rivers, dominated by *Salix alba, Salix fragilis, Populus nigra* and *Populus alba*.
- One of the most invaded communities (*Acer negundo*, *Fraxinus americana* and *Amorpha fruticose*).
- Herb layer depends on developmental stage of these forests, it is very poor in young (2-3 years) and thick grows, while in older, relatively open stands it can be relatively rich, comprised mainly by hygrophyllous and nitrophyllous species

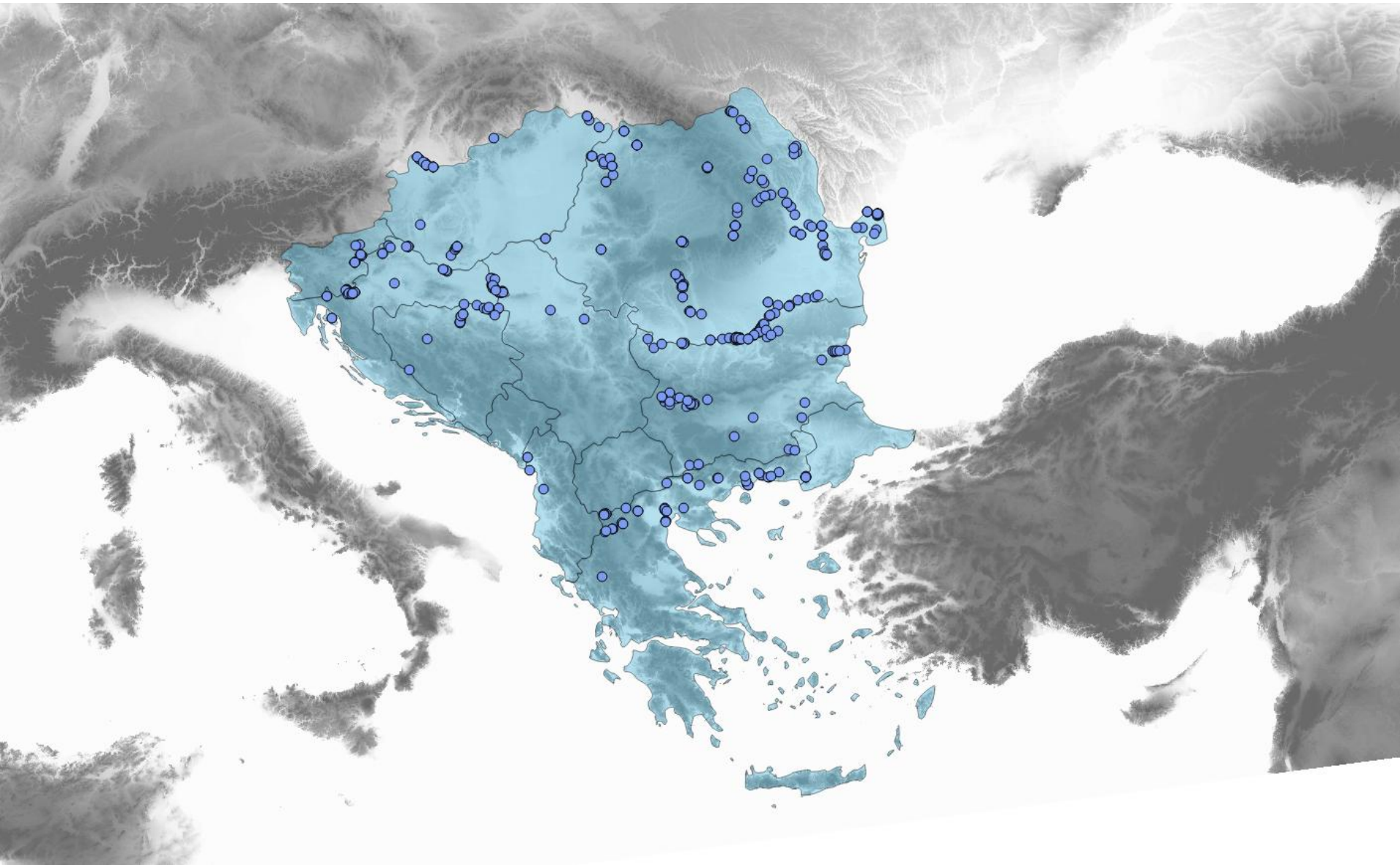
ECOLOGY

- Along the large lowland rivers
- Depending on groundwater level these communities there is a gradient from more hygrophyllous *Salix* communities and more meso-hygrophylous *Populus* communities.
- Management of these forests depends on the region where they are developed,
  - regularly cut in Danube river basin of Serbia,
  - Bosnia and Herzegovina – they ae considered “protective” forests.

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Salicion albae

CONVERGES
European Riparian Ecosystems



Salicion albae

CONVERGES
European Riparian Ecosystems

THREATS

- Human impact in the past – destroyed mainly due to agriculture development.
- Their habitats are fragmented, often found as narrow strips along the river.
- Hydromeliorative systems, gravel quarries etc.
- Invasive alien species, which are well adopted to disturbed and nutrient rich habitats, and at certain sites can completely replace natural vegetation.

SYNTAXONOMY

- *Salicetum albae* – the most hygrophyllous association of the *Salicion albae*, occur in lowest parts of alluvial plane
- *Salici albae-Populetum nigrae* – transitional between *Salicetum albae* and *Populetum nigro-albae*.
- Populetum nigro-albae Slavnić 1952 – the driest association of *Salicion albae*, occurs on higher parts of alluvial plane with shorter period of flooding and lower groundwater level.

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Salicion albae

Salicion cinereae

CONVERGES
European Riparian Ecosystems

CHARACTERISTIC

- Vegetation of willow carrs mostly dominated by *Salix aurita, S. cinerea* and *Frangula alnus*.
- The coverage of herb layer depends on intensive shading by shrubs.
- Herbaceous species of swamps (e.g., *Galium palustre*, *Lycopus europaeus*, *Myosotis palustris* and *Solanum dulcamara*) and wet meadows (e.g., *Cirsium palustre*, *Deschampsia cespitosa* and *Filipendula ulmaria*)

ECOLOGY

- The willow carrs occur in river alluviums and wet meadows and edges of lakes and fens.
- Their soils are waterlogged, which creates an anaerobic soil environment through year.
- They represent successional stage in natural succession of lakes and secondary succession after abandonment of wet meadows.

Salicion cinereae

CONVERGES
European Riparian Ecosystems

Salicion cinereae

THREATS

- The willow swamps provide suitable habitats for many endangered species of regional flora and fauna.
- Habitat destruction caused by city development and road construction
- Human-induced decline of water level.

SYNTAXONOMY_

- Oligotrophic to mesotrophic carrs dominated by *Salix aurita*, *Salix cinerea* and *Frangula alnus* (ass. ***Salicetum auritae* Jonas 1935**).
- The eutrophic communities are most frequently dominated by *Salix cinerea* (ass. ***Salicetum pentandro-auritae* Passarge 1957**).

Salicion eleagno-daphnoidis

CONVERGES
European Riparian Ecosystems

CHARACTERISTIC

- Scrub semi-open to closed formations on gravel and/or sandy deposits of **montane and altimontane in upper water courses**
- Dominated by low- to medium tall shrubs: *Salix eleagnos, Salix amplexicaulis, Salix daphnoides, Salix purpurea* and/or *Myricaria germanica*.
- Downriver it is replaced by *Salicion triandrae* in lowlands

ECOLOGY

- Occurs on gravel and/or sandy alluvial deposits on terraces of small rivers and streams predominantly in montane and altimontane belts,
- **Fast and turbulent flows**,
- Growing on shallow terraces of wider river valleys These habitats are mobile, periodically inundated and well-drained,
- Indicating very wet conditions in one spring and autumn and very dry in the summer

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Salicion eleagno-daphnoidis

Salicion eleagno-daphnoidis

THREATS

- Very strong human impact in last few decades in SE Europe,
- Construction (or their planning) of numerous small hydropower plants on montane river courses.

SYNTAXONOMY

- 7 associations
- *Salici purpureae-Myricarietum germanicae, Salici amplexicaule-Myricarietum, Petterio-Salicetum incanae, Hippophaë-Salicetum elaeagni, Salicetum eleagno-daphnoidis, Seslerio autumnalis-Salicetum eleagni, Salicetum incanae, Salicetum incano-purpureae, Salicetum purpureae*

Gaps? Nerio-Tamaricetea

- Includes dwarf woodlands, scrubs and tall grass communities developing on initial soils of river beds,
- Creeks and temporary pools of fresh, brackish or saline water,
- Without running water during long periods of the year.
- Lack of relevés in recent dataset

Next steps

CONVERGES
European Riparian Ecosystems

- Finalization of classification
- Preparation of synoptic tables
- Manuscript submission (Preslia) – spring/summer 2020

- Preparation of printed book – autumn 2020

- Cooperation with other WG's

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Thank you for your attention

CONVERGES
European Riparian Ecosystems