Lowland sand oak forests are extremely important and vulnerable elements of the pannonian sand forest steppe’s biodiversity

Tamás Rédei, Sándor Barabás, Anikó Csecserits, György Kröel-Dulay and Marianna Bíró

Institute of Ecology and Botany of HAS

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Kiskunság
Inland sand dune region

Transitional climate, calcareous sandy soils

Fine scale mosaic of different dry and wet habitats

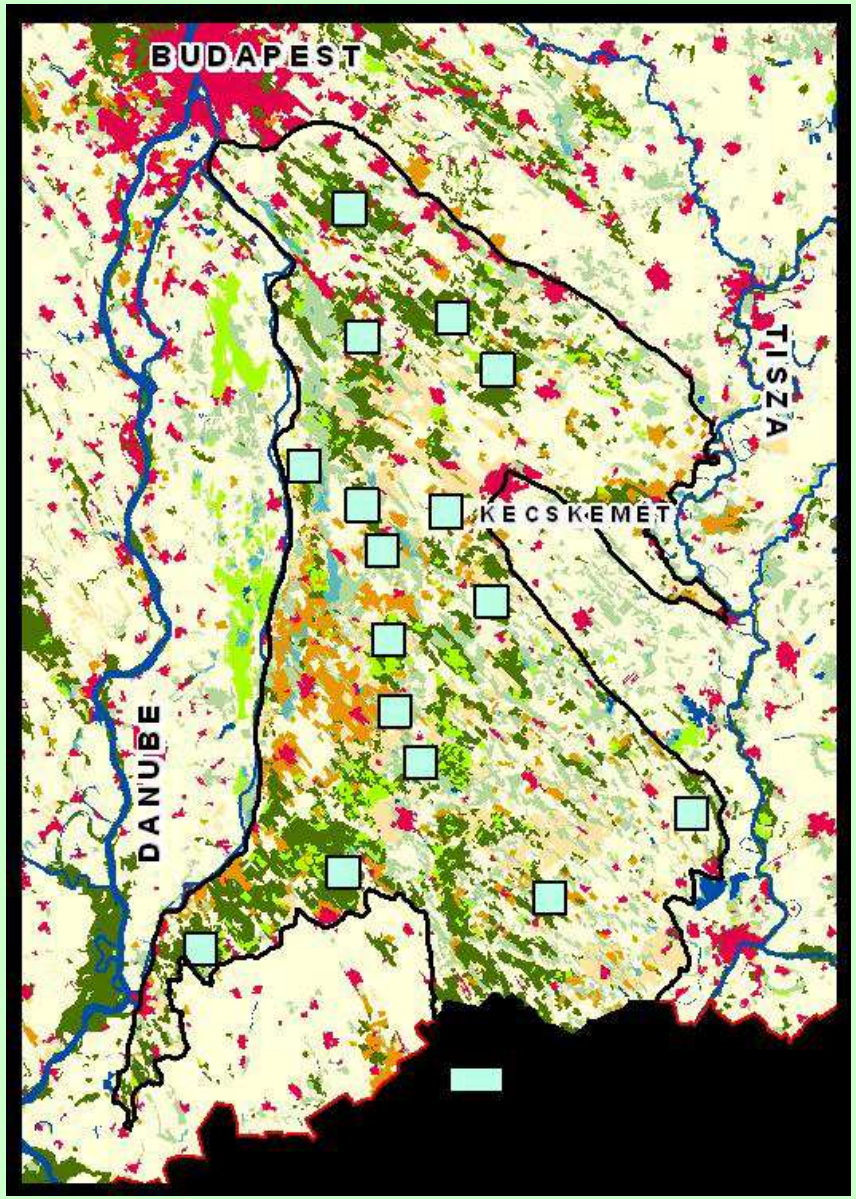
We focused the effects of the land use on the sand forest steppe vegetation

Kiskun-LTER sites (16)

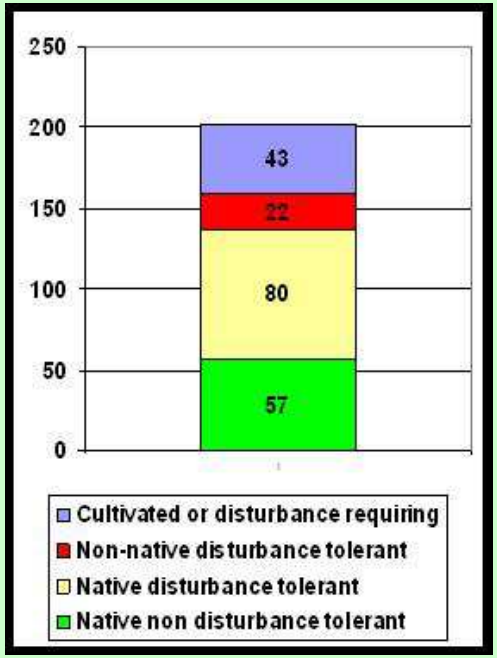
GIS database
Present and past habitat maps.
Elevation, soil, water, management data.

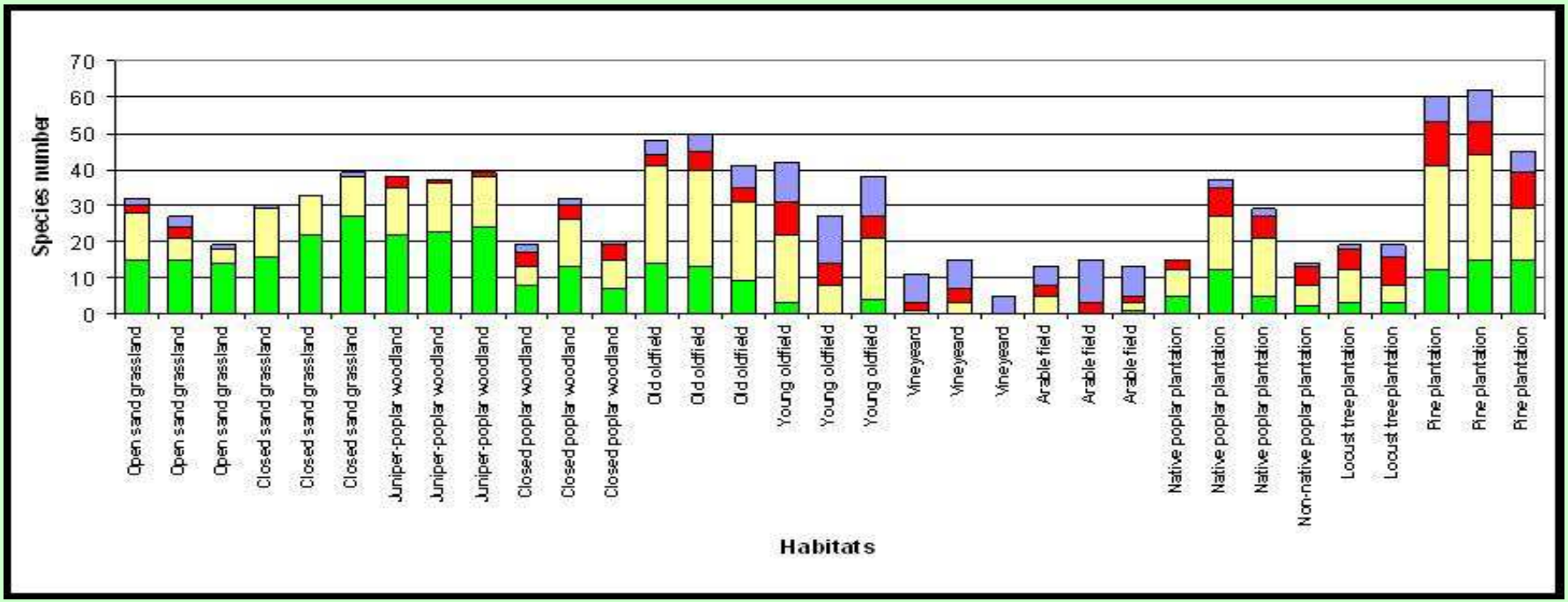
Plant biodiversity estimation:
600< relevees stratified by the sites and the habitats.

Focused studies on invasion and old-field succession.

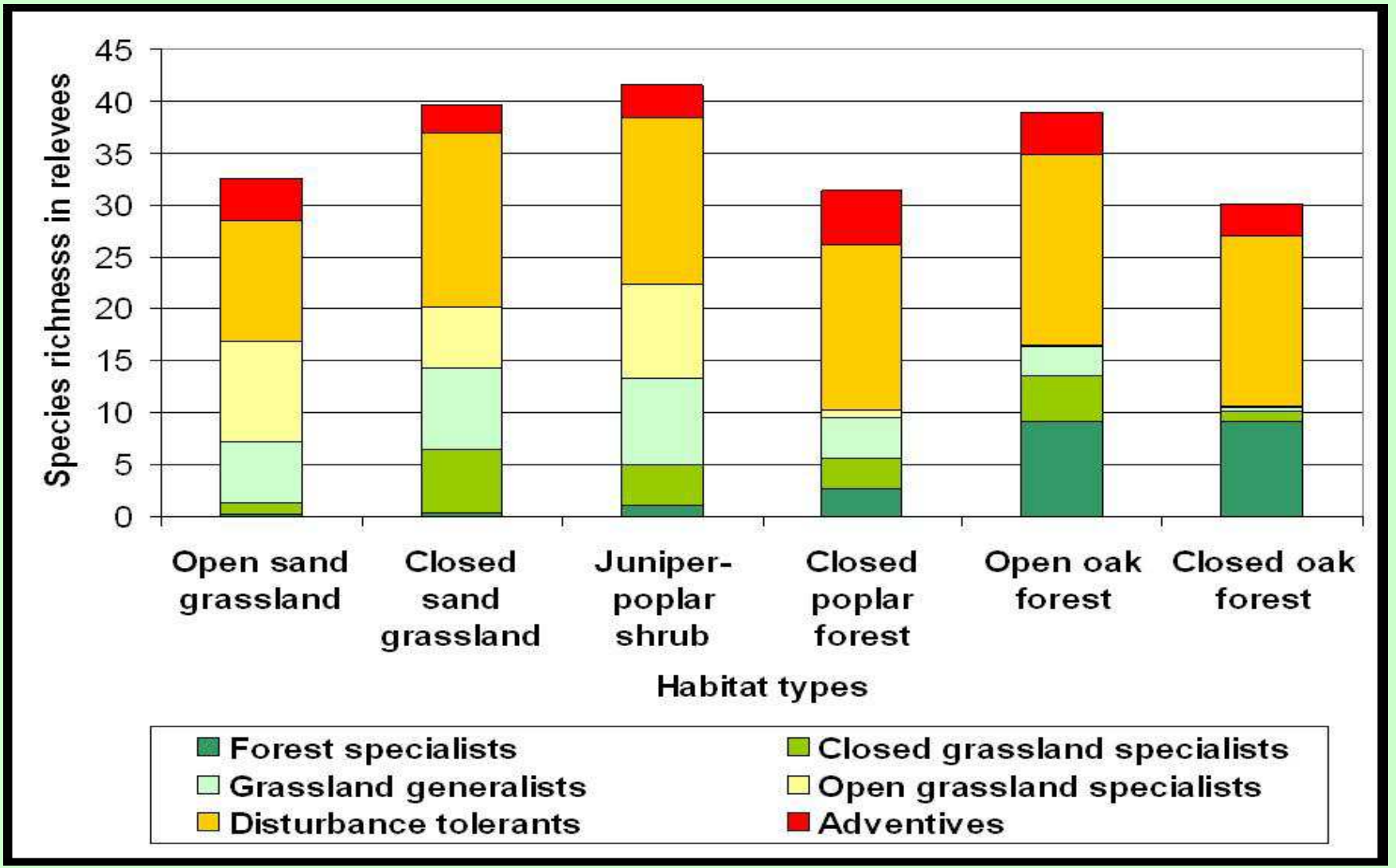


The species richness and the floristic composition of the Soltvadkert site and the habitats





Specialists, generalists and invasive plants in the species pool of the forest steppe habitats



Summary I.

Plant biodiversity and vulnerability of the sand steppe habitats in the region

	Biodiversity			Regeneration			Threats	
	Species richness +	Habitat specialists rate +		Regeneration potential (species)+	Regeneration potential (habitat)+		Invasibility -	Overall vulnerability -
Open grasslands	Medium	Very high		Very high	Very high		Medium	Very low
Closed grasslands	High	Medium		Medium	High		Very low	Low
Juniper-poplar shrubs	Very high	Very low		High	Medium		High	Medium
Steppic oak forests	Very high	High		Low	Very low		Very high	Very high
Closed poplar forests	Very low	Low		Low	Medium		Very high	High
Closed oak forests	Low	Very high		Very low	Very low		Very high	Very high

Focused studies: Oak woodlands

Motivation

Origin of the forest steppe formation:

Anthropogenic?-Zoogenic?-Climatic?-Edaphic?

Interesting phenomenons, riddles:

Poor Quercus forests-Rich Robinia plantations

Carpinus in the hearth of Kiskunság (Kunbaracs)

Floristic gradients in the region

All of endemic species are grassland specialists

Poor forest flora

Species pool of forests I.

- **Forest weeds:** Bromus sterilis, Anthriscus cerefolium, Ballota nigra, Galium aparine, Urtica dioica, Leonorus cardiaca, Cynoglossum officinale, Chenopodium album
- **Lignaeous pioneers:** Populus alba, P. canescens, P. nigra, Betula pendula, Crataegus monogyna, Prunus spinosa, Ligustrum vulgare, Rhamnus catharticus, Euonymus europaeus, Rubus caesius, Rosa canina, Berberis vulgaris, Juniperus communis, Sambucus nigra **(Zoochors!)**

- **Aliens:** Robinia pseudacacia, Pinus silvestris, Pinus nigra, Celtis occidentalis, Prunus serotinus, Juglans regia, Amorpha fruticosa, Acer negundo, Eleagnus angustifolius, Ribes aureum, Asclepias syriaca, Phytolacca americana, Erigeron annuus, Conyza canadensis, Ambrosia artemisifolia, Solidago spp.

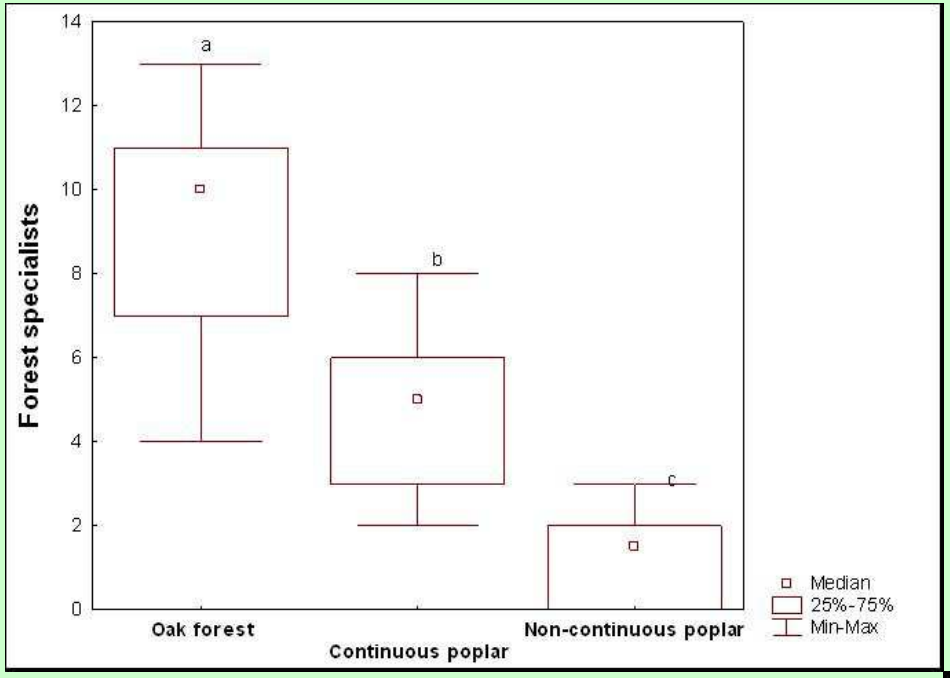
- **Dry grassland species:** Festuca spp, Stipa spp, Poa angustifolia, Potentilla arenaria, Salix rosmarinifolia, Teucrium chamaedrys, Carex liparicarpos, Vincetoxicum hirundinaria, Asparagus officinalis, Eryngium campestre, Hieracium umbellatum, Linaria genistifolia, Galium verum etc.
- **Meadow species:** Molinia spp, Carex flacca, Agrostis stolonifera, Frangula alnus etc.
- **Ruderal and segetal weeds**

Species pool of forests II.

- **Dry oak forest species (Quercetea p.-p.):** Quercus pubescens, Q. cerris, Viburnum lantana, Cornus mas, Colutea arborescens. Festuca heterophylla, Genista tinctoria, Ajuga genevensis, Astragalus glycyphyllos, Carex michelii, C. montana, C. spicata, Clinopodium vulgare, Inula conyza, Polygonatum odoratum, Dictamnus albus, Geranium sanguineum, Iris variegata, I. graminea, Sedum maximum, Silene nutans, Trifolium montanum, T. medium, Veronica chamaedrys, Verbascum austriacum, Primula veris, Lithospermum purpureo-coerulem, Lychnis coronaria, Melampyrum cristatum, Origanum vulgare.

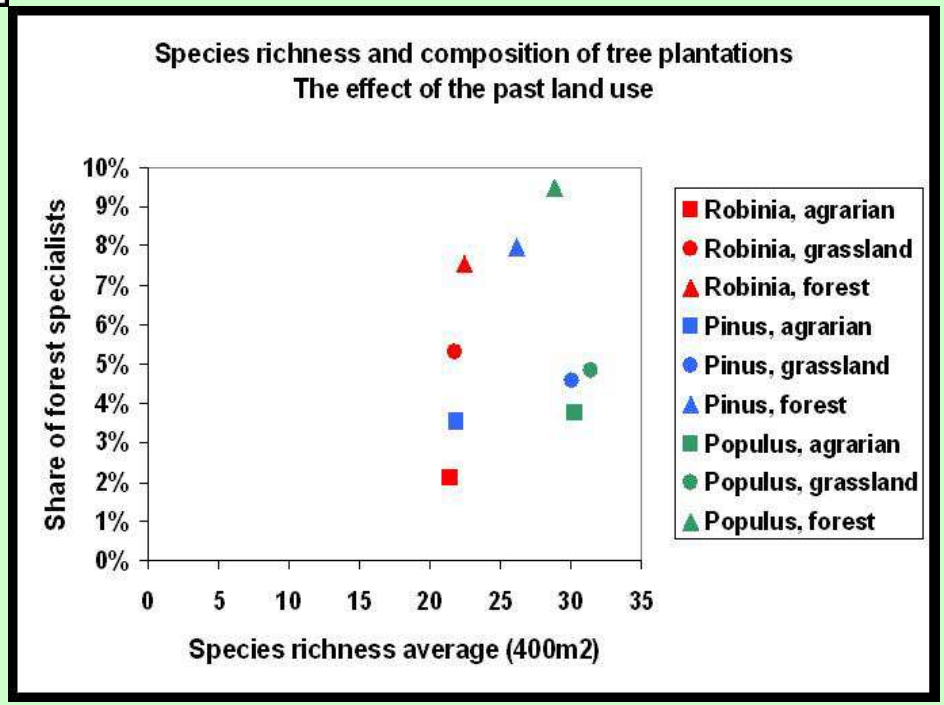
- **Forest generalists (Querco-Fagea):** Quercus robur, Acer tataricum, Acer campestre, Tilia platyphyllos, Ulmus laevis, Ulmus minor, Geum urbanum, Elymus caninus, Brachypodium sylvaticum, Viola hirta, V. cyanea, Lithospermum officinale, Lapsana communis, Melica altissima, Fragaria vesca, Botrichyum virginianum, Anthryscus silvestris, Poa nemoralis, Epipactis atrorubens, Cephalanthera rubra, Allium vineale, Atropa belladonna, Muscari botryoides.

- **Mesic forest species (Querco-Fagetea):** Carpinus betulus, Corylus avellana, Polygonatum latifolium, Convallaria majalis, Circaea lutetiana, Mycelis muralis, Parietaria officinalis, Carex silvatica, C. pilosa, Ficaria verna, Scrophularia nodosa, Salvia glutinosa, Stachys silvatica, Viola silvestris, Moehringia trinervia, Campanula trachelium, Cucubalus baccifer.



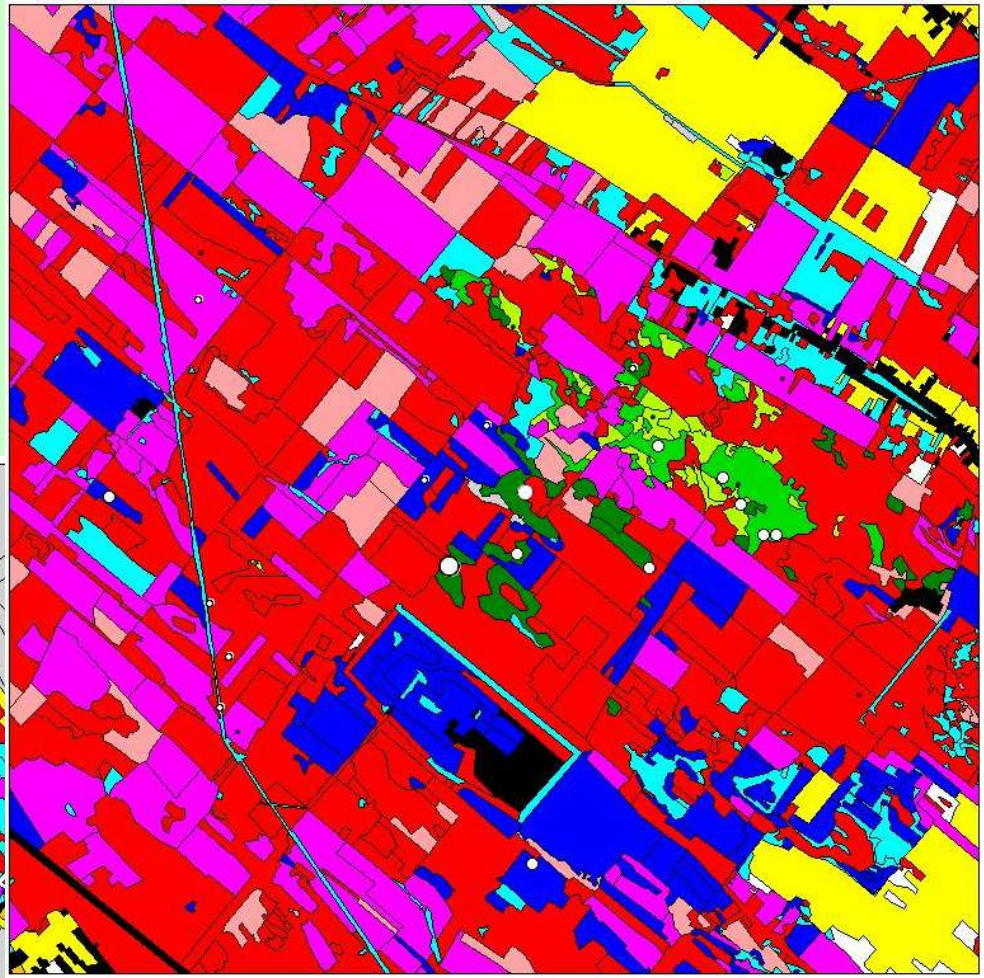
Number of the forest species in the continuous and secundary forests. Spontaneus secondary poplar forests are very poor in forest specialists.

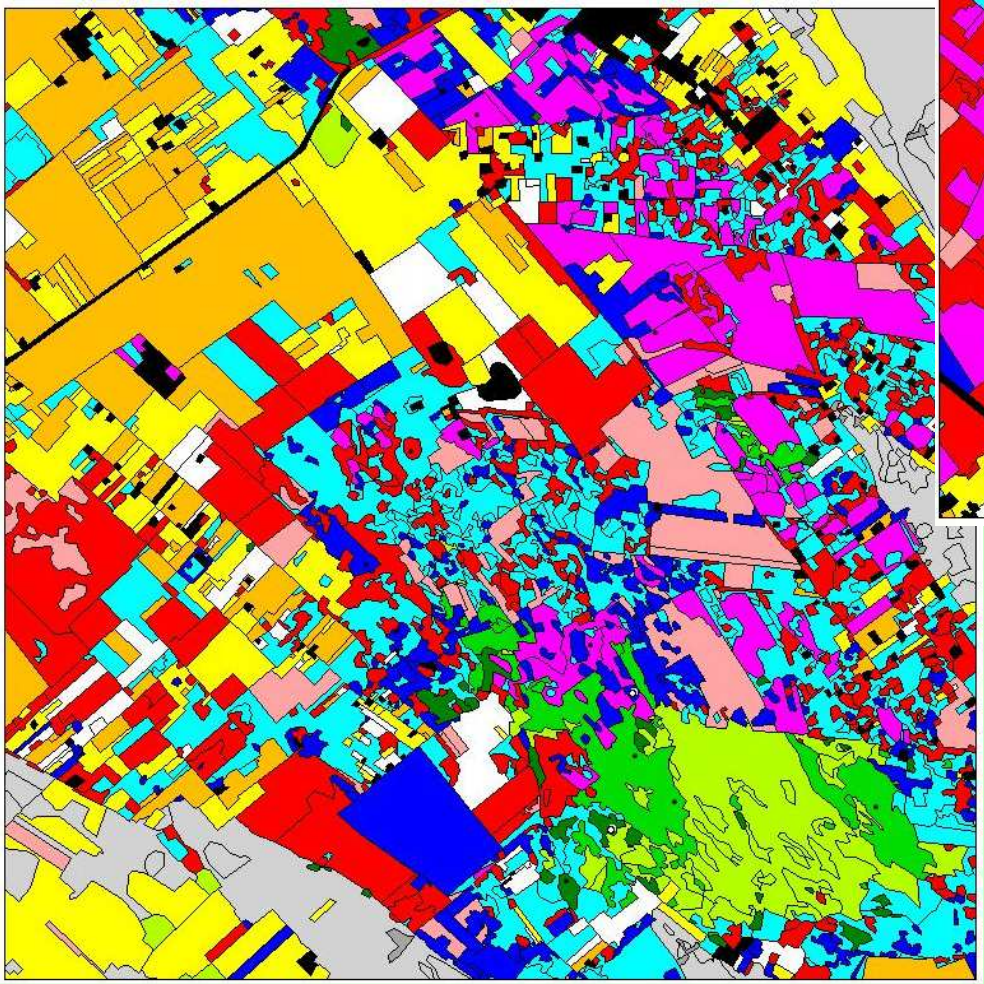
The number of forest specialists in the native and non-native plantations depends on the past land use.



Richness of the forest flora on the sites

Orgovány – poor
(just black dots and small circles)

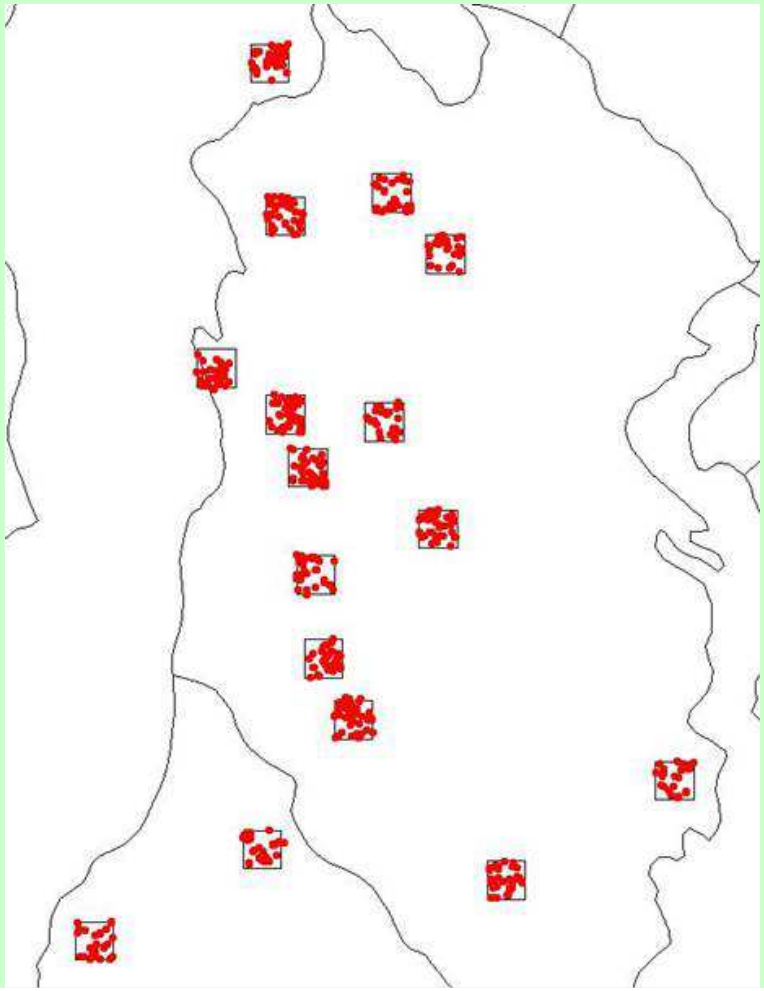




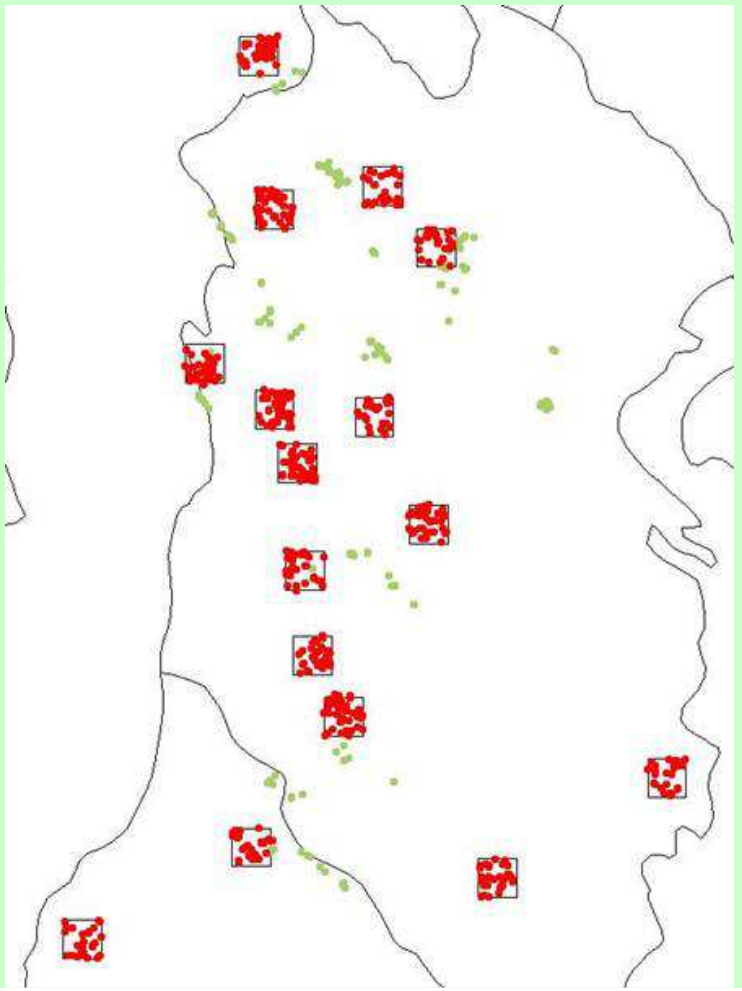
Csévharaszt- relative rich
(large white circles)

Extension of the forest studies

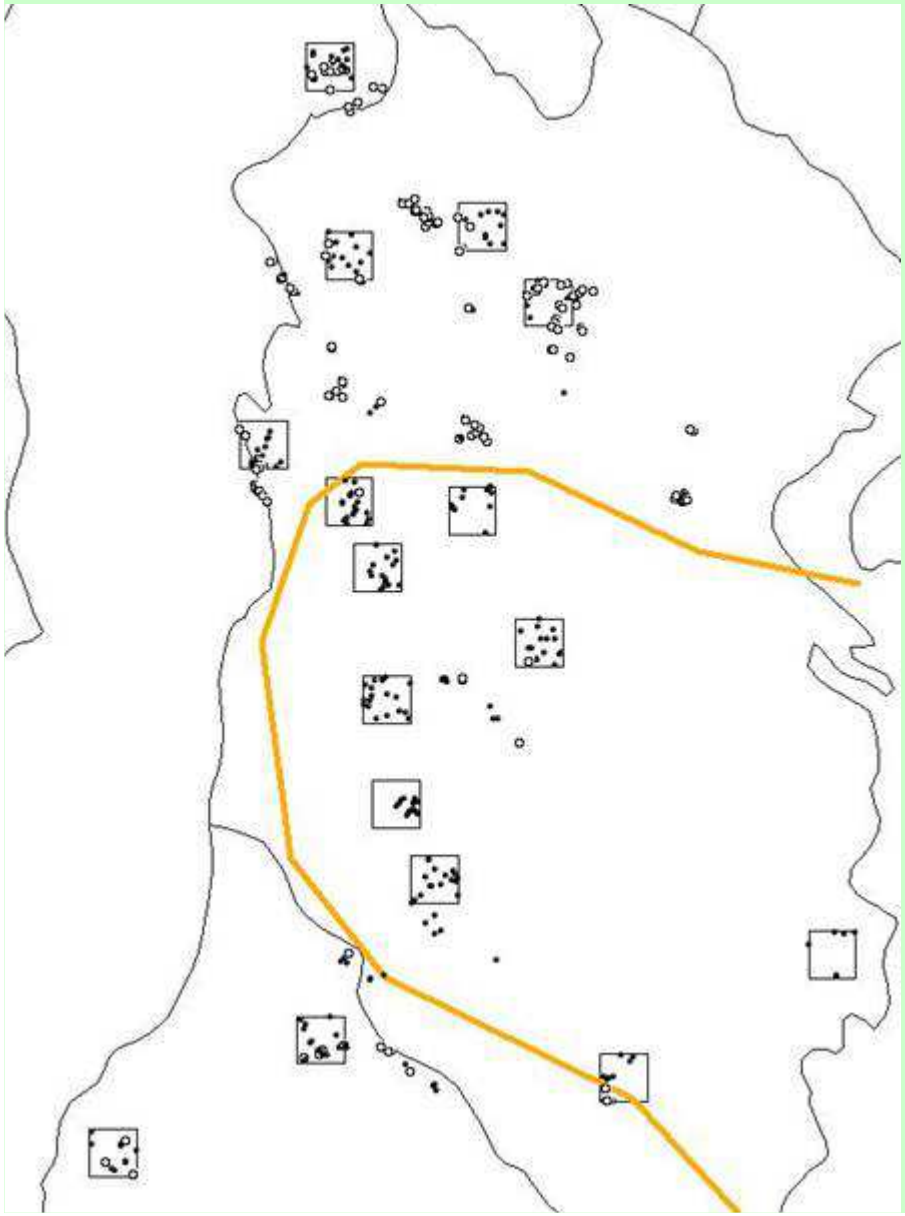
KISKUN-LTER 260 forest releves



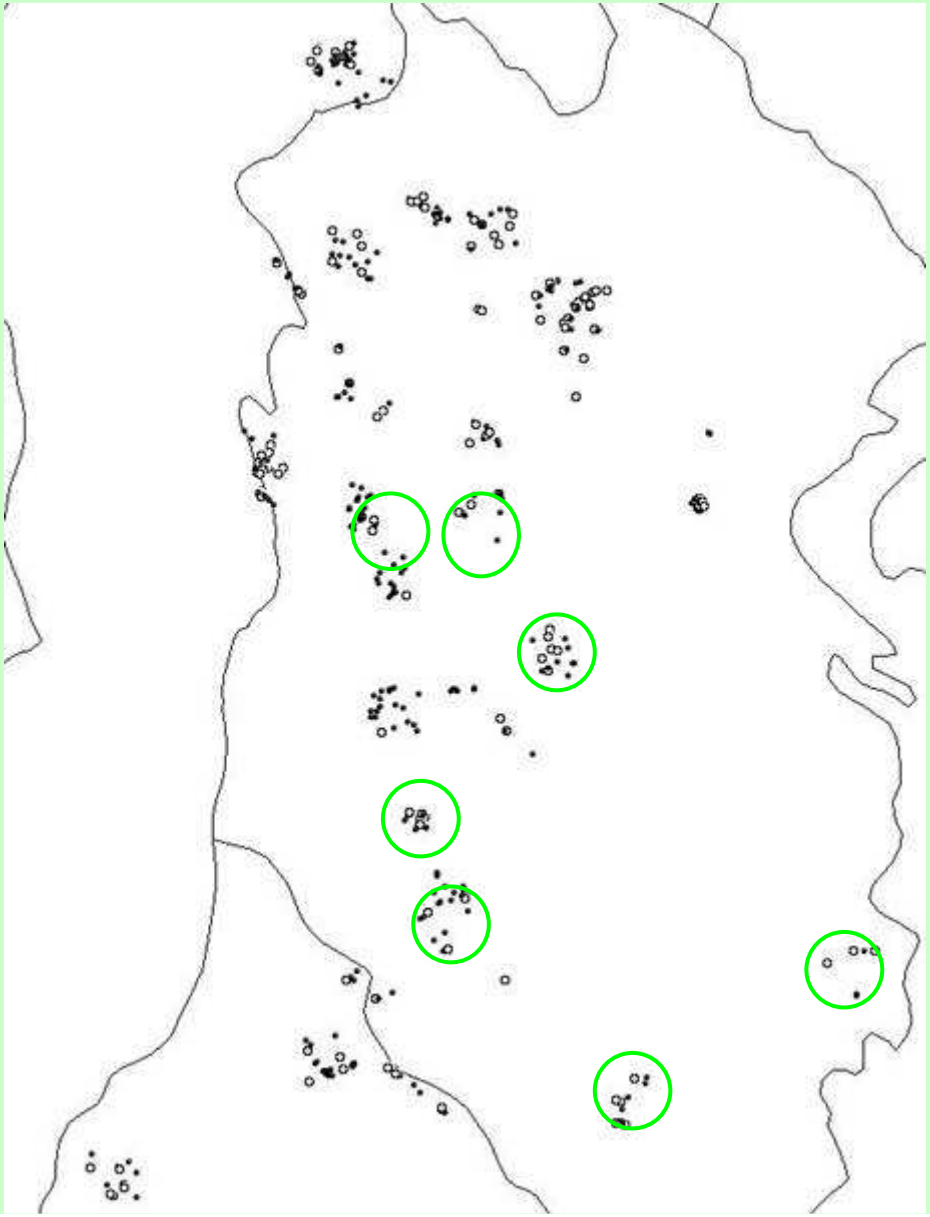
140 additional releves in continous forests (Based on the first military survay)



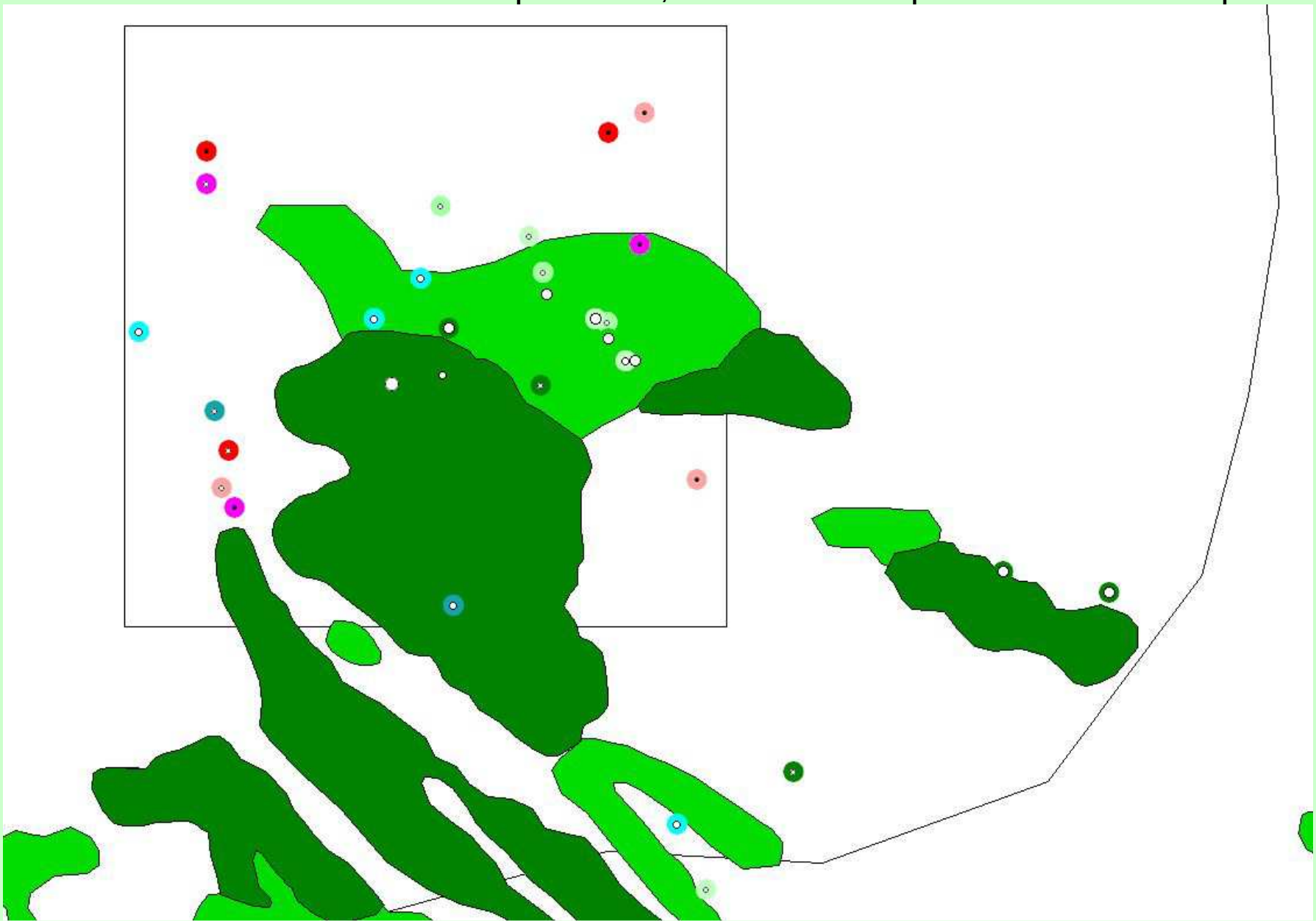
Adult Quercus robur



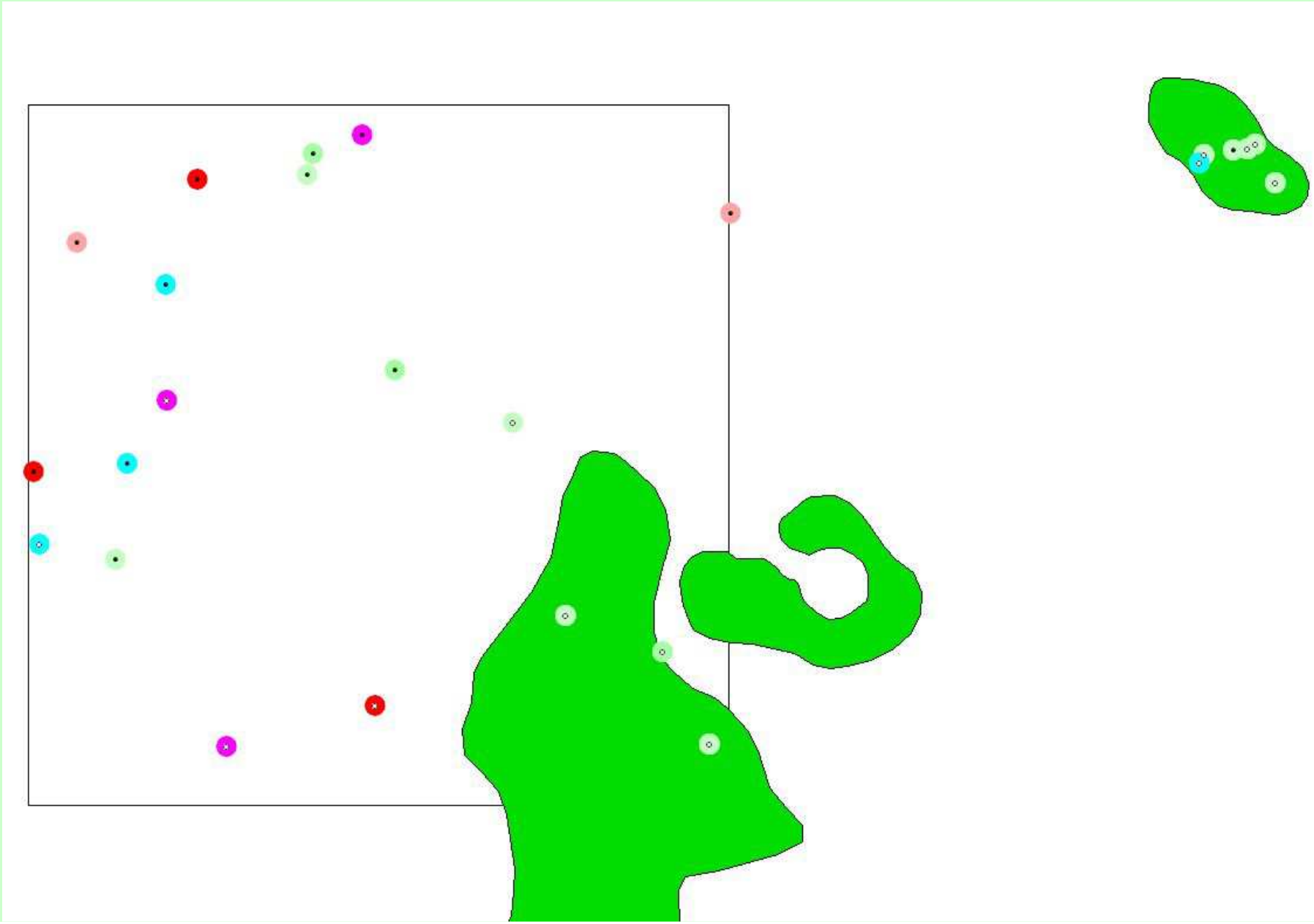
Juvenile Quercus robur



Number of forest specialist in releves and the forest cover at the end of the 18th century near Csévharaszt.
Black dots – absence of forest specialists, White circles - presence of forest specialists



Number of forest specialist in releves and the forest cover at the end of the 18th century near Bócsa.
Black dots – absence of forest specialists, White circles - presence of forest specialists



The total number of forest species in the releves and the forest cover at the end of 18th century

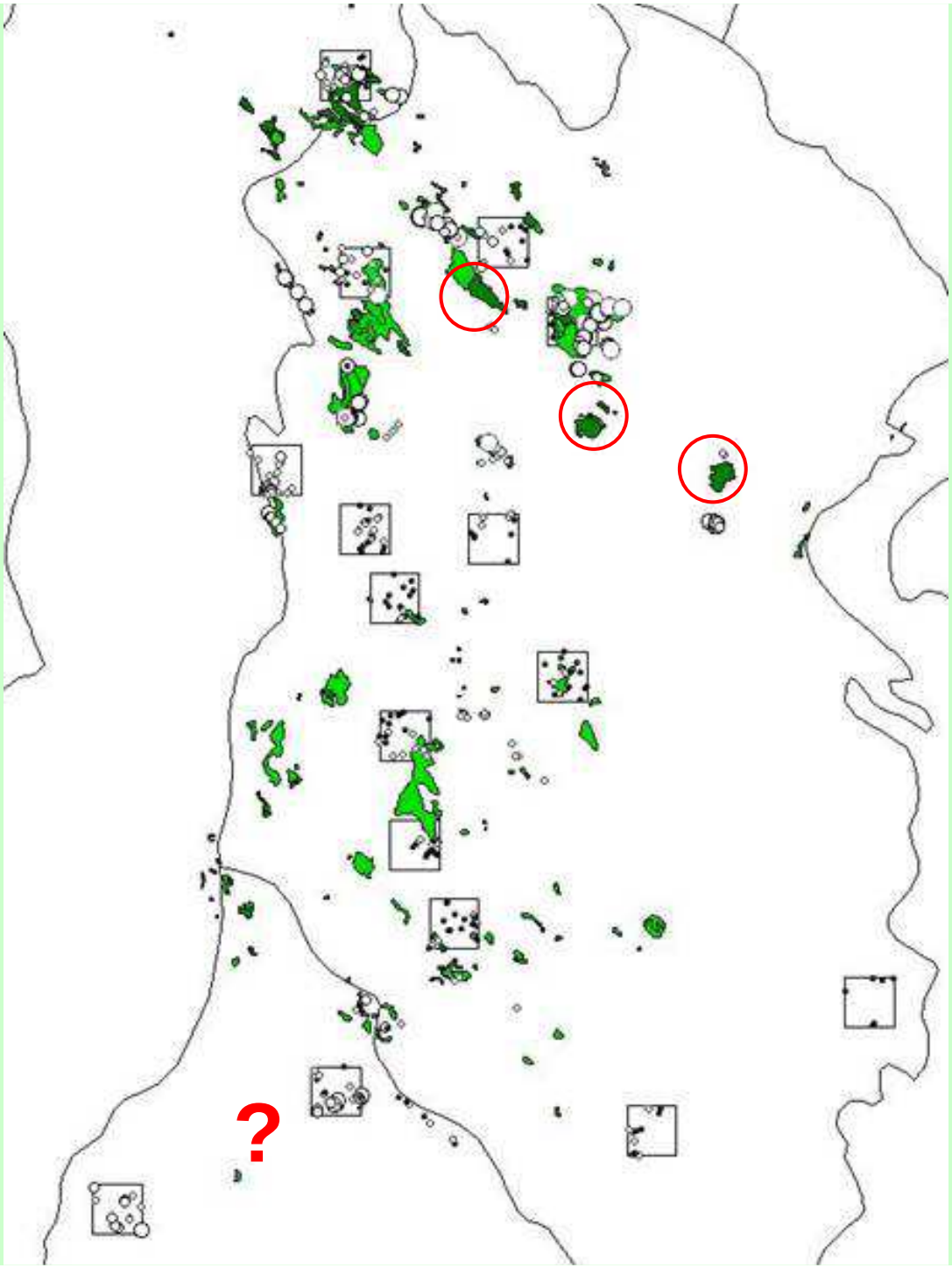
Black dots – Absence

White circles - Presence

Light green fields – Shrublands

Dark green fields – Closed forests

Red circles – Destroyed oak forests

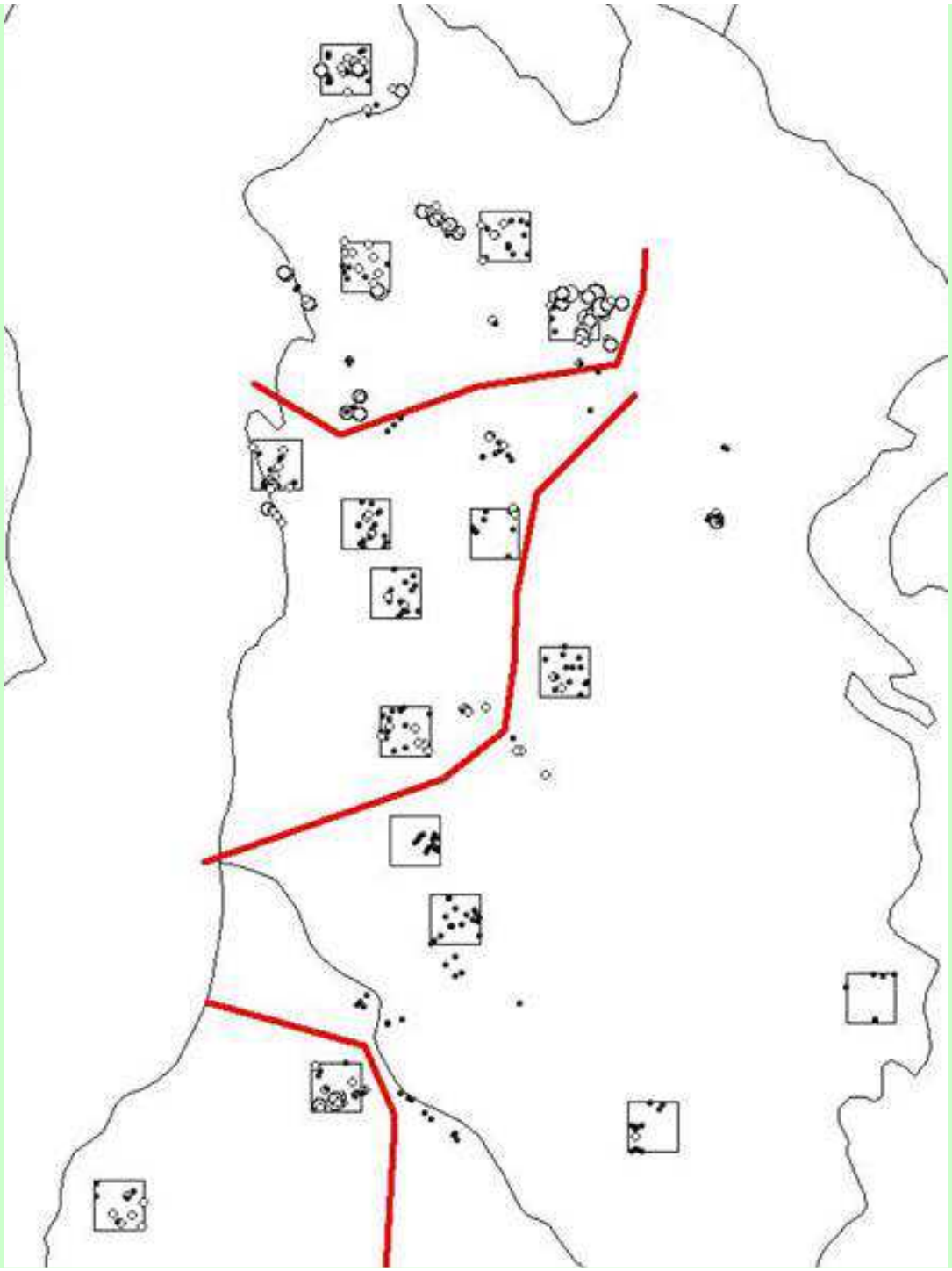


Number of the dry oak forest (Quercetea p.-p.) species
Max: 8

Black dots – Absence

White circles - Presence

Red line – Floristic border



The number of the mesic forest (Querco-Fagea and Querco-Fagetea) species
Max: 14

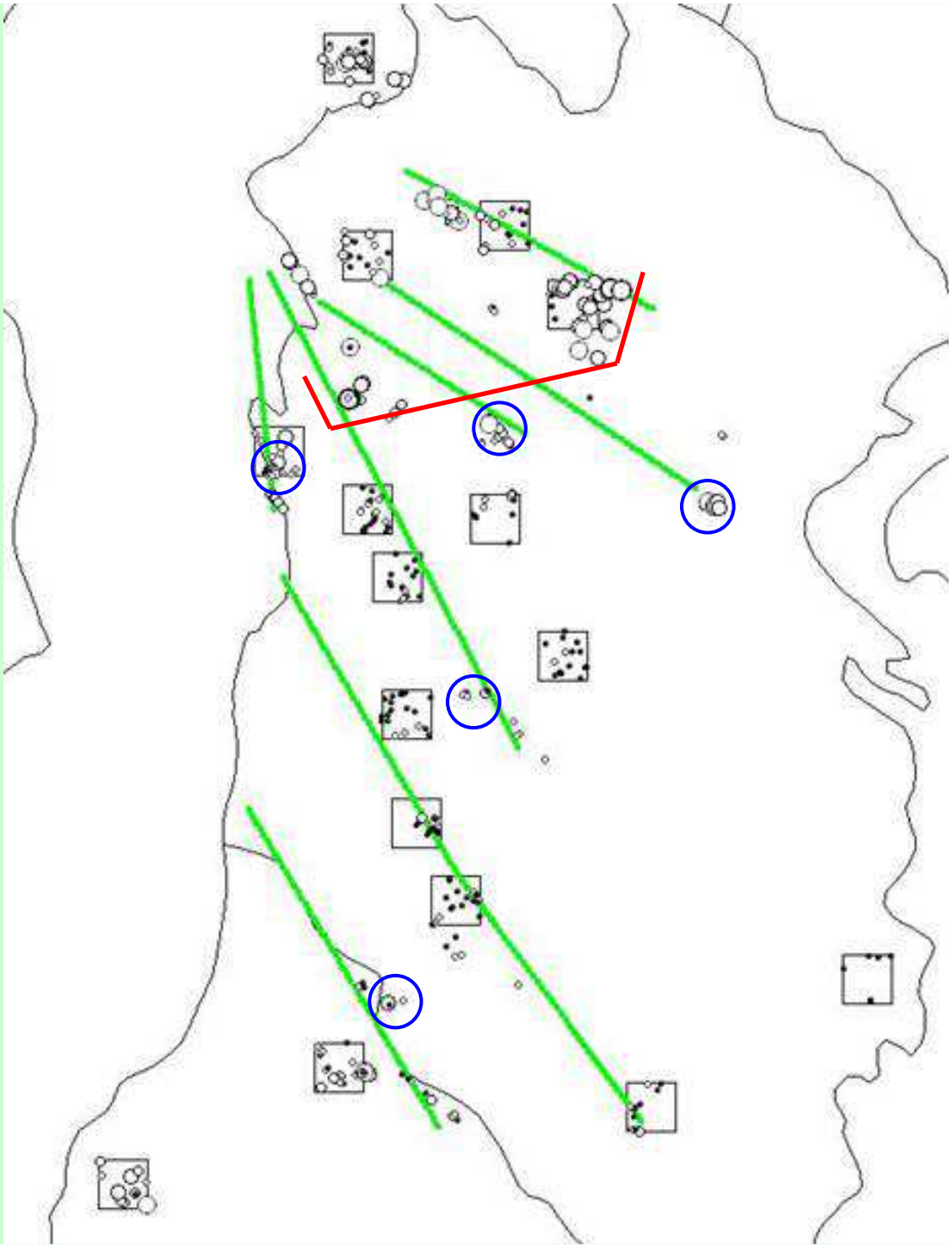
Black dots – Absence

White circles - Presence

Red line – Floristic border of the dry oak forest species

Green line – Possible connection (long-ago river beds?).

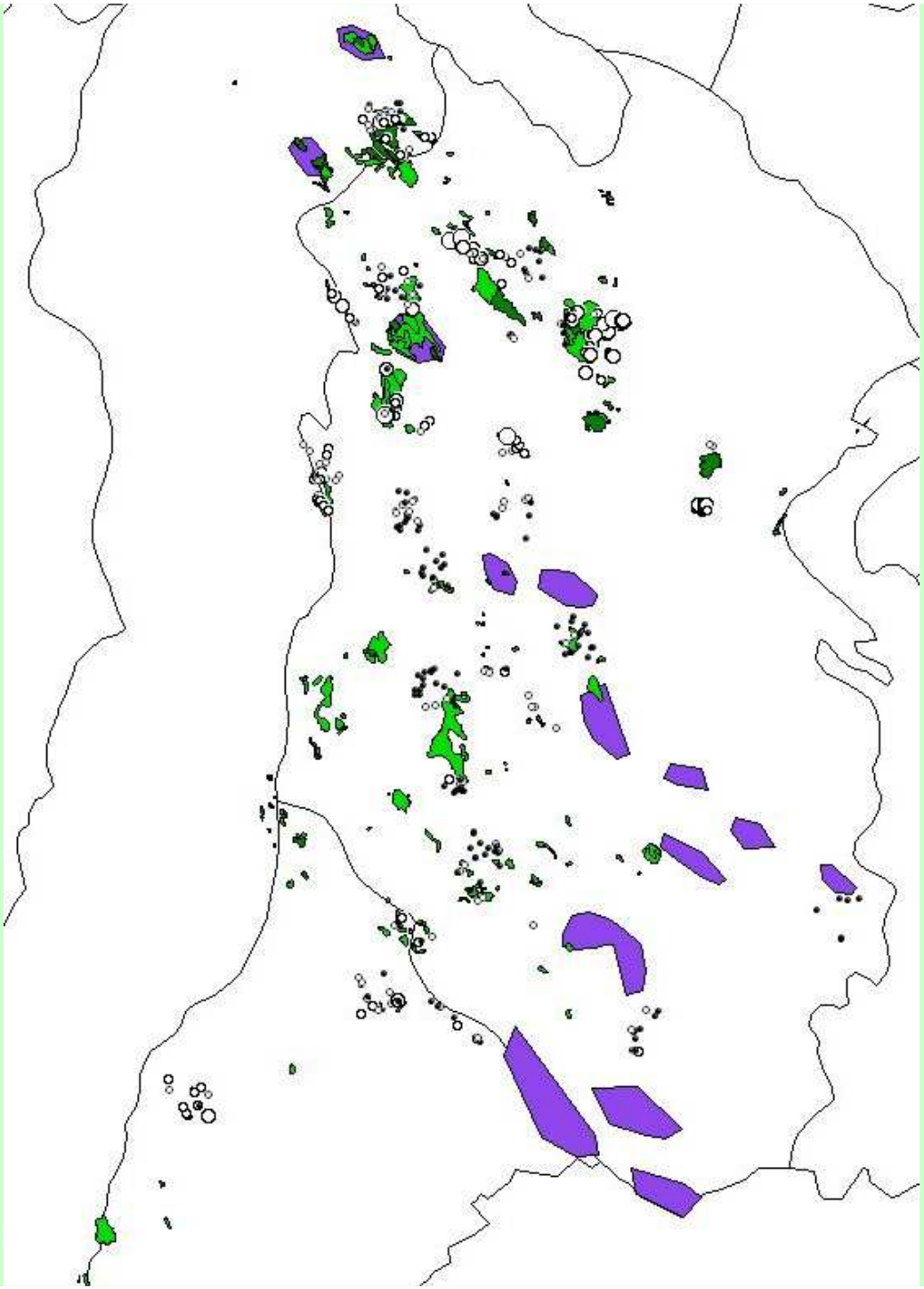
Blue circle – Missing dry oak forest elements



Missing data

Green fields – Forest at the end of 18th century

Purple fields – Present forests (mainly foreign plantations) not sampled based on CORINE Land Cover.



Summary II.

Biogeography

The key factor of the forest plant biodiversity in the region is the continuity.

„Oakless” region

The number dry oak forest elements decreases along the climatic gradient.

The mesic forest flora survived in the refugees of the former gallery forests and/or swamp woodlands.

Conservation

The remainig lowland oak forest are unique and key elements of the biodiversity.

All of continuous stads should be protected (without compromises)!

Plantations with surviving herb layer should be important targets of the restoration.