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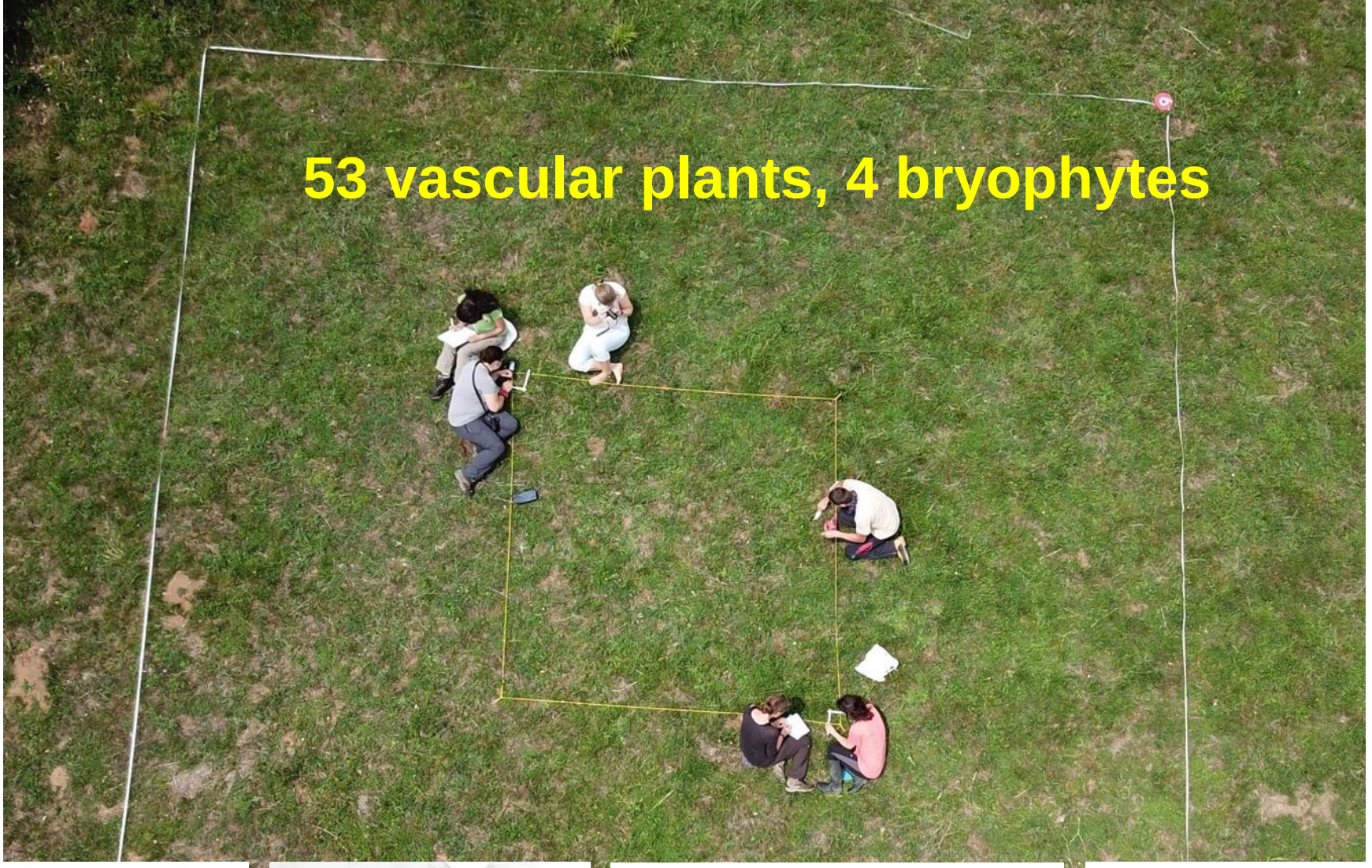

53 vascular plants, 4 bryophytes

Grasslands in Europe

Zonal steppes

Arctic-alpine grasslands

Azonal and extrazonal grasslands

Secondary grasslands

Natural and semi-natural grasslands

Primary origin

Without human impact, affected by wild herbivores and occasional fires

Secondary origin

Mowing

Tree and shrub removal

Controlled burning

Manuring and fertilisation

Grazing

Mulching

Hurdling

Land recultivation and reclamation

Origin and development of European grasslands

- Steppe-like grasslands in the Palearctic – around 5 million years old
- Continuous existence in Europe since the Pleistocene (the last 2.4 million years)
- Spatial expansion and retreat during the Pleistocene ice cycles
- Emergence of semi-natural grasslands in Holocene 5000-7000 years ago

Festucion valesiacae
(Subcontinental steppic grasslands):
several million years old

Arrhenatherion elatioris
(Lowland hay meadows):
several hundred years old











SPECIES POOL

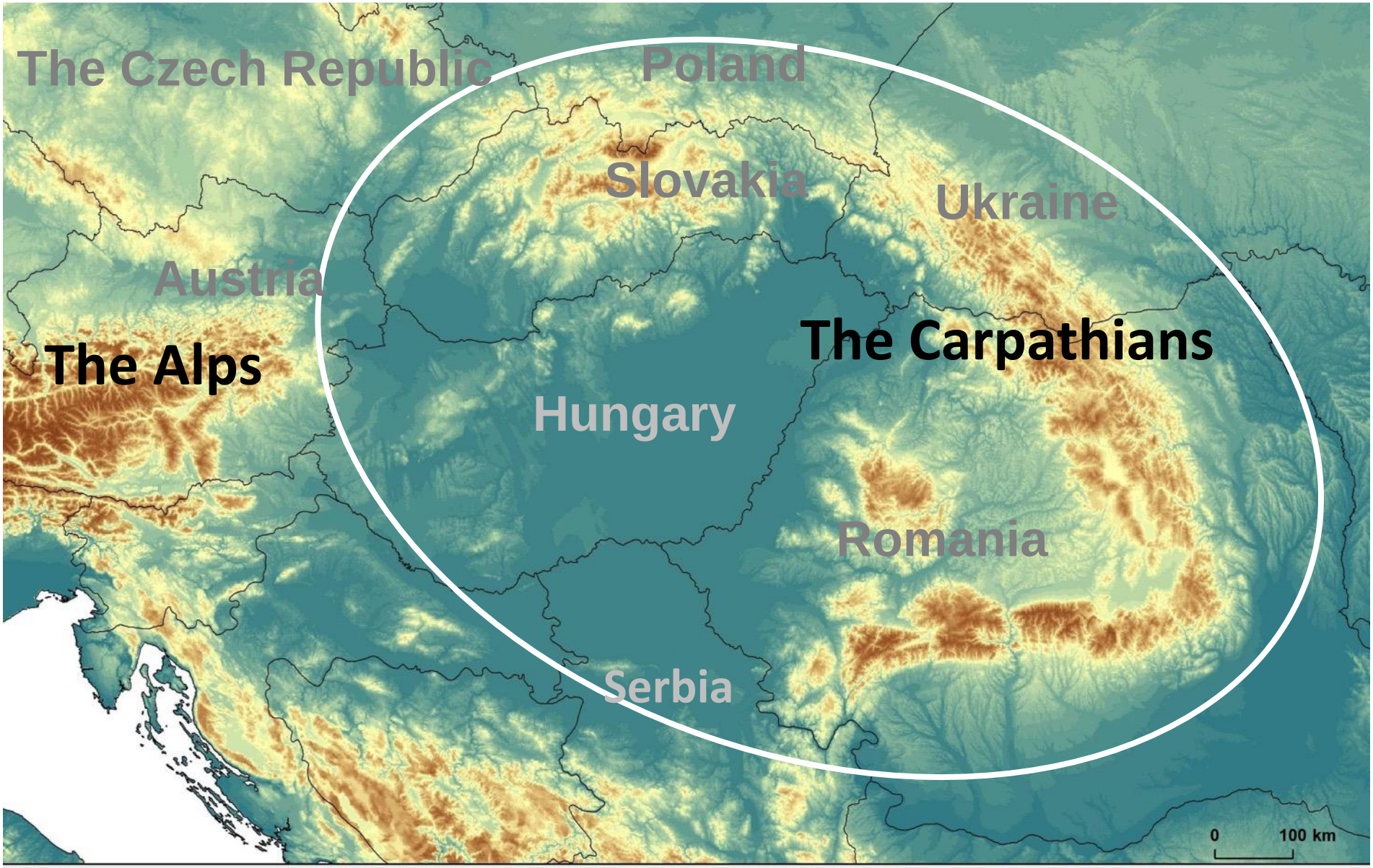
SPECIES POOL

European grasslands have large species pool also due to :

- long duration human management (since the Neolithic period)
- low-intensity utilization
- long-distance species dispersal by grazing and transhumance

- Recently, semi-natural grassland is the most widespread grassland type in Europe covering 10-15% of the total surface and about one third of the utilized agricultural area
- HNV (high nature value) grasslands – only a very small fraction of this area!

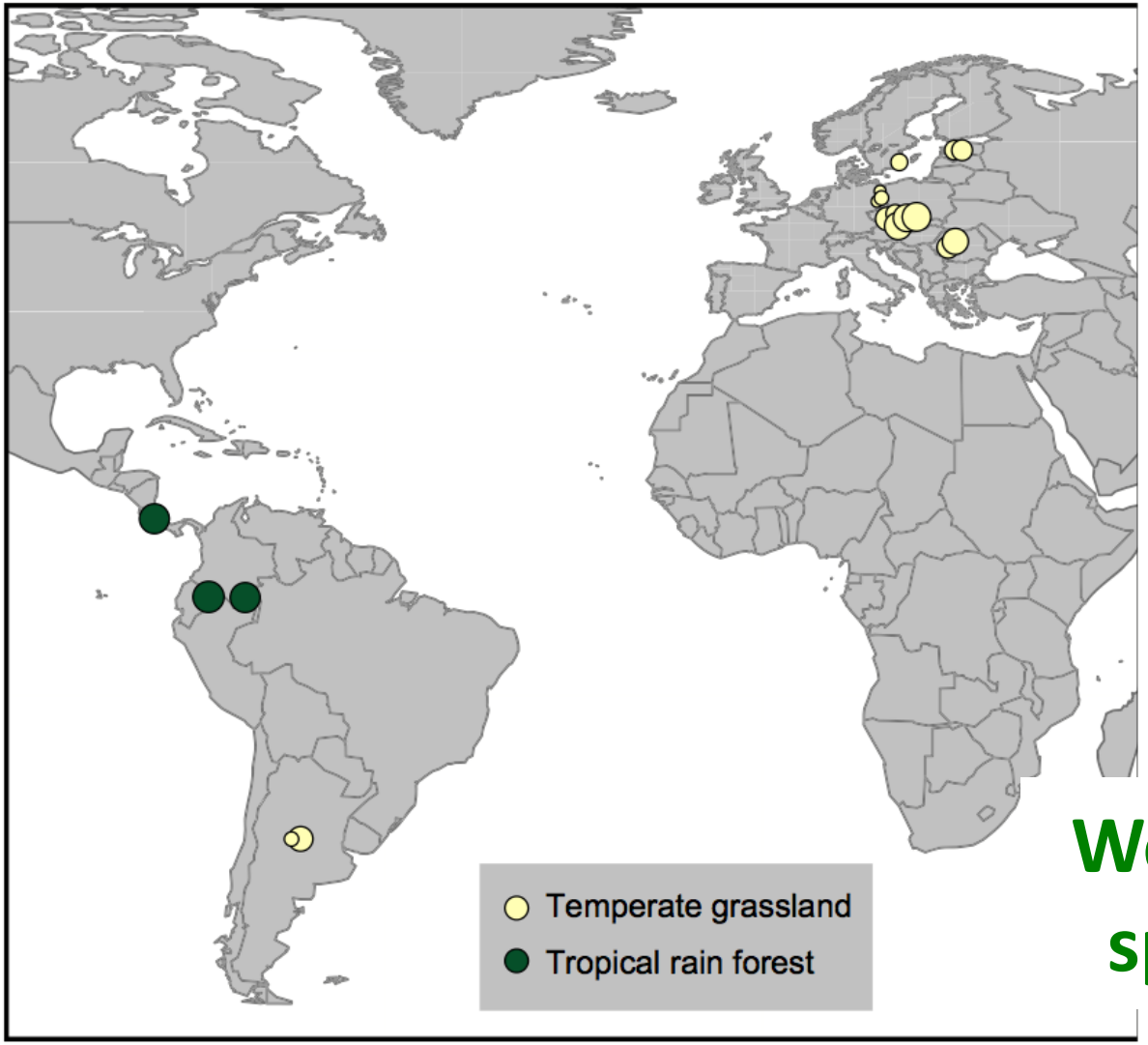
The Carpathians



Diversity of vascular plants in grasslands

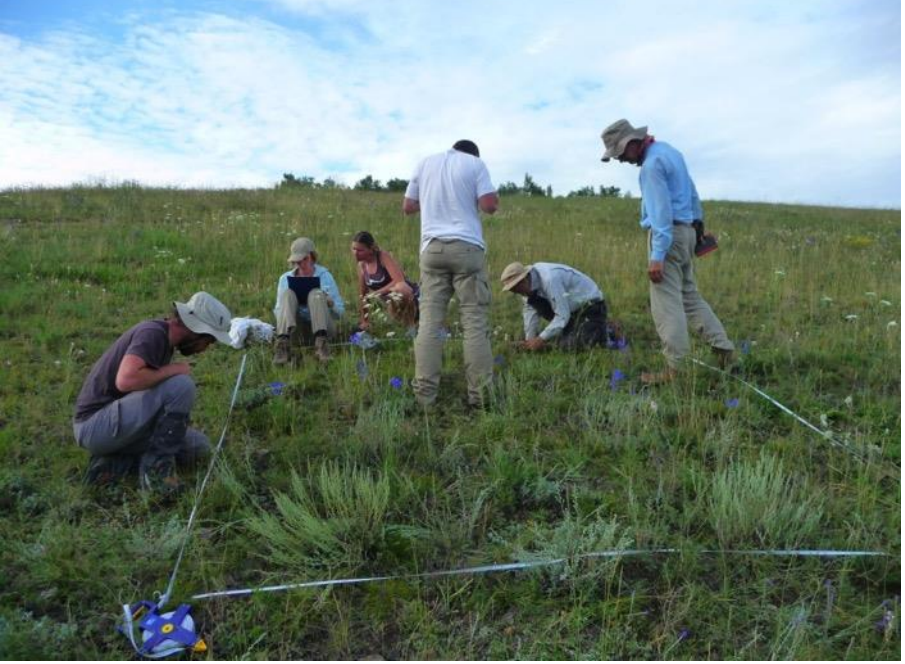
Grasslands make a very substantial contribution to European biodiversity of vascular plants and other taxonomic groups

Wilson et al. 2012
J. Veg. Sci.



World maxima for species richness

Fig. 2. The location of sites with world maxima for species richness, at a range of spatial grains, with the diameter of the symbol proportional to the log of grain size. Some locations have been moved slightly to make them visible.



Diversity of vascular plants

World record plant species richness J. Bastow Wilson et al.

Table 1. The communities used as the richest in vascular plant species at a range of spatial grains.

Area (m^2)	Richness	Method	Community	Region	References
0.000001	3	Shoot	Dry, sandy grassland	Germany	J. Dengler et al. (unpubl.; see Dengler et al. 2004)
0.000009	3	Shoot	Dry, sandy grassland	Germany	J. Dengler et al. (unpubl.; see Dengler et al. 2004)
0.0001	5	Shoot	Dry, sandy grassland	Germany	J. Dengler et al. (unpubl.; see Dengler et al. 2004)
0.0009	8	Rooted	Mountain grassland	Argentina	J.J. Cantero (unpubl.)
0.001	12	Shoot	Limestone grassland	Sweden	van der Maarel & Sykes (1993)[1]
0.004	13	Rooted	Semi-dry basiphilous grassland	Czech Republic	Klimeš et al. (2001)
0.01	25	Rooted	Wooded meadow	Estonia	Kull & Zobel (1991)
0.04	42	Rooted	Wooded meadow	Estonia	Kull & Zobel (1991)
0.1	43	Shoot	Semi-dry basiphilous grassland	Romania	Dengler et al. (2009)
0.25	44	Rooted	Semi-dry basiphilous grassland	Czech Republic	Klimeš et al. (2001)
1	89	Rooted	Mountain grassland	Argentina	Cantero et al. (1999)
10	98	Shoot	Semi-dry basiphilous grassland	Romania	Dengler et al. (unpubl.; see Dengler et al. 2009)
16	105	Shoot	Semi-dry basiphilous grassland	Czech Republic	Z. Otýpková (unpubl.)
25	116	Shoot	Semi-dry basiphilous grassland	Czech Republic	Z. Otýpková (unpubl.)
49	131	Shoot	Semi-dry basiphilous grassland	Czech Republic	Z. Otýpková (unpubl.)
100	233	Rooted	Tropical lowland rain forest	Costa Rica	Whitmore et al. (1985)
1000	313	Rooted	Tropical lowland rain forest	Colombia	Duivenvoorden (1994)
10 000	942	Rooted	Tropical rain forest	Ecuador	Balslev et al. (1998)

[1]Correction of a higher, incorrect value in the original publication.

The Western Carpathians – one of species-richness hotspots

Chytrý et al. 2015
Preslia

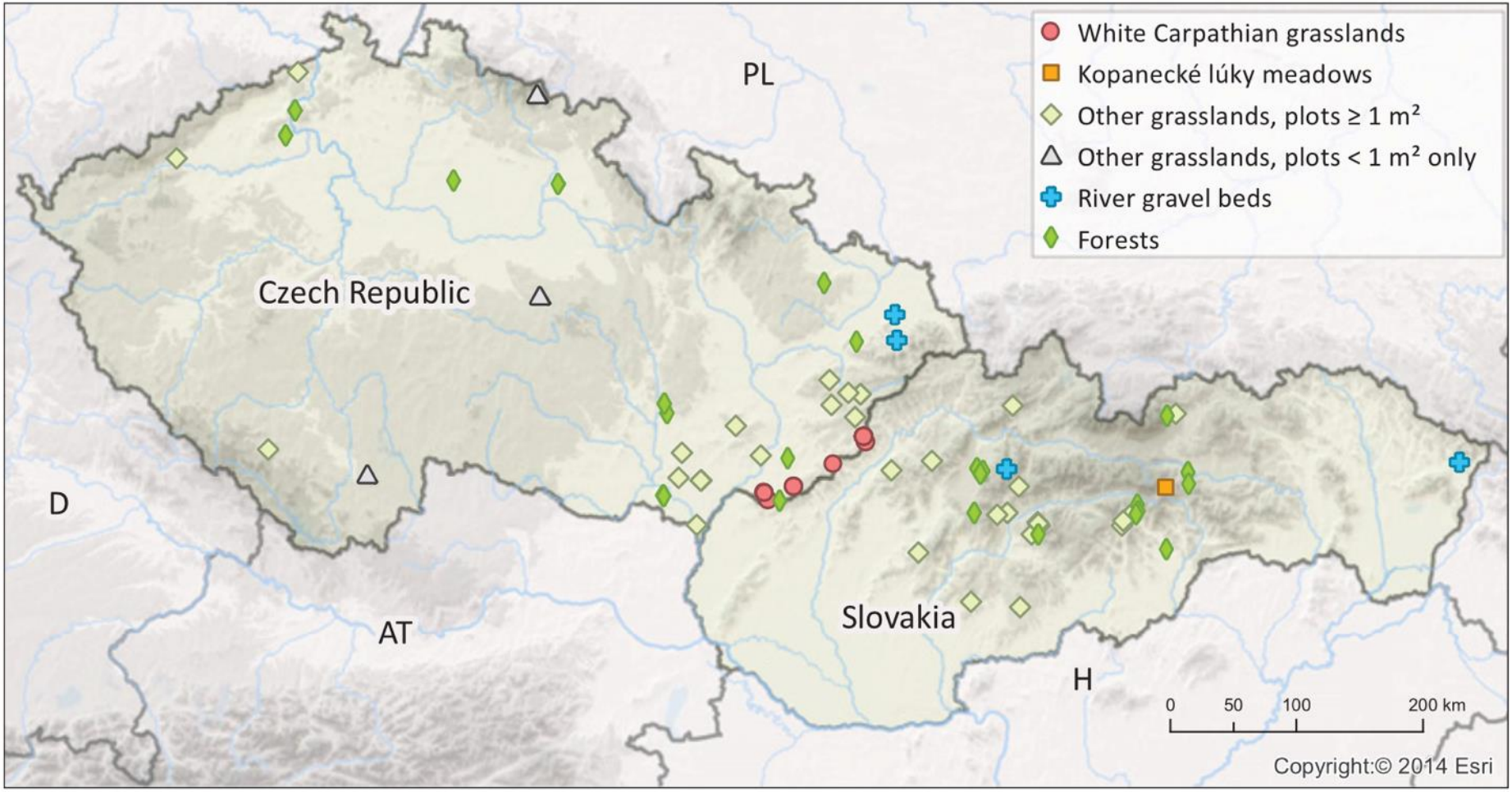


Fig. 7. – Distribution of the richest and next-to-richest vegetation plots in the Czech Republic and Slovakia (see Tables 1 and 3 and Appendix 1).

The most species-rich grasslands in the Czech Republic and Slovakia are concentrated in regions with base-rich soils in the Western Carpathians, especially on flysch and limestone and volcanic areas in central Slovakia. The richest types of non-forest vegetation include semi-dry base-rich meadows (*Bromion erecti* and *Cirsio-Brachypodion pinnati*), base-rich pastures and mesic meadows (*Cynosurion cristati* and *Arrhenatherion elatioris*), *Nardus stricta* grasslands (*Violion caninae* and *Nardo strictae-Agrostion tenuis*) and some wet meadows and natural subalpine grasslands.

Possible preconditions for extraordinarily high species richness at a plot:

- Base-rich soils
- Intermediate values of environmental factors
- Low intensity management or natural disturbance
- Landscape with large areas od (semi)natural vegetation
- Long historical continuity

Non of the single measured factors can explain this extraordinary species richness.

It is probably a result of co-incidence of several factors.

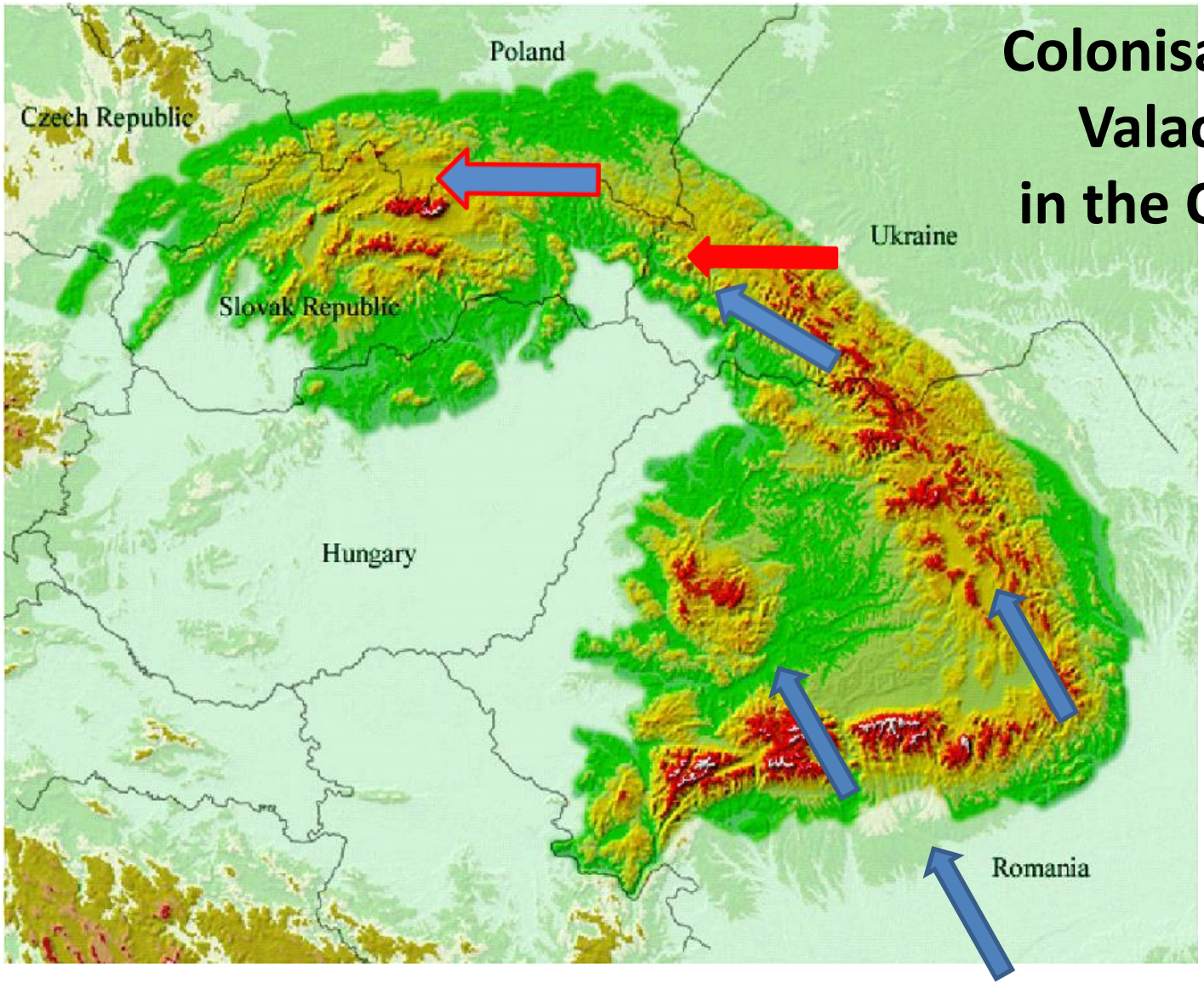
The White Carpathian Mountains

***Brachypodio pinnati-Molinietum arundinaceae* (*Bromion erecti*)**

Brachypodio pinnati-Molinietum arundinaceae

World record grassland in Transylvania with 98 vascular plant species on 10 m²

Colonisation on the Valachian law in the Carpathians



14th century – movement of the Valachians from the Balkan peninsula to the teritorry of Romania. Asimilation of these people with members of other cultures. Gradual movement to the north and west of the Carpathians. Deforestation and pastoralism mainly in the mountains.

The colonisation on the Valachian law (14-17th century)

System of legal rules and habits of Valachian culture related mainly to livestock farming in the mountains. The Valachians were invited to come and settle. They were discharged of the lieges obligations, such as taxes, etc.


eftelya





Traditional grassland management in Romania and Ukraine


Betonica officinalis

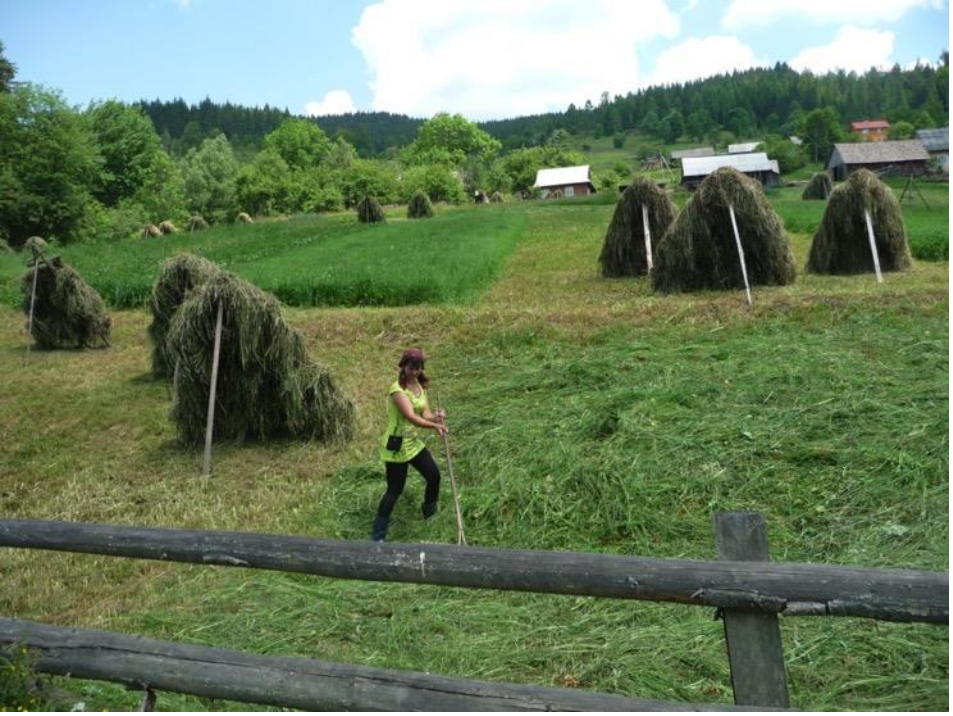

Arnica montana


Solidago virgaurea

Aconitum moldavicum subsp. *hosteanum*

Delphinium elatum subsp. *nacladense*




Pasture
Meadow

Gyimes, the Eastern Carpathians, Romania

MEADOWS

- Mowing
- Mowing-date rotation of tracts
- Cleaning from woody species
- Amelioration with hayseed and *Onybrychis viciifolia* seeds
- Manuring
- Manual thinning of unwanted plants
- Supression of mosses
- Small-scale drainage

PASTURES

- Sectional cleaning of shrubs and trees
- Burning and coralling against matgrass *Nardus stricta*

Babai & Molnar, *Agriculture, Ecosystems and Environment* 2014

The village Gyimes in Transylvania (Babai & Molnar, *Agriculture, Ecosystems and Environment* 2014)

http://ngm.nationalgeographic.com/2013/07/transylvania-hay/nicolson-text

„*Traditional rural culture is expanding to every aspect of rural life. It has got not only 8-10 subjects like in school, but hundreds and hundreds ... The peasant knows his animals, soil types, weather to the tiniest details, can make tools, build houses, fish, hunt, breed domestic animals, cultivate soil, and heal man and animal. He knows grasses, trees, birds and bugs, their nature, benefits and disad-vantages. He can tell the time by the position of the sun and the route of stars. He can tell tales, sing, dance, play, plate, spin, sew, cook etc.*“

I. Györffy (1942)

Grassland conservation

Hay packages are delived directly to the cow keepers

Carpathian nature-conservation assotiation of altruists (KOZA)
Biele Karpaty, Slovakia

Pogány-havas Association, Csik Mts, Transylvánia

Situation in individual Carpathian countries

Ukraine

- No agricultural subsidies and agro-environmental schemes are provided as UA is not an EU member. Since the last few years farmers have small financial support for keeping calves (no other cattle) but only for the first year, which approximately covers the feeding costs and anything else.
- The economical situation of farmers in the Ukrainian Carpathians is bad, high proportion of people work abroad and only women, old people and children stay at home and keep the farm. They produce products for their own consumption. The proportion of people working abroad in some regions reaches more than 70%. Some people return home and invest in tourism.
- Traditional ecological knowledge is well preserved. In general people would like to keep their farms and traditional forms of grassland management, also young people and children are not afraid of the hard work, but sometimes they really have hard conditions, because of poor infrastructure and especially poor quality of roads (in some regions roads are literally missing).
- Heritage from collective farming – spread of *Heracleum sphondylium* as this species was used as crop.
- Some villages live from mushrooms or medicinal plants
- Grassland abandonment visible mainly at lower altitudes

Situation in individual Carpathian countries

Romania

- Mountainous regions with unproductive land without collectivization have well maintained patchy landscape structure, traditional rural cultures and TEK
- Subsidies for the management of high nature value grasslands aim to combat the effects of land abandonment and to support traditional agricultural practices, despite the questionable suitability of the preservation approach of the currently available subsidy systems of the CAP. Some measures have negative effect on biodiversity because they do not take into consideration the positive ecological impact of the local practices.
- The main problem is that local ecological system, governed by local ecological knowledge is replaced with abstract rules and distant conservation objectives that ignore the value of the landowners' perspective.
- The bureaucratization of semi-subsistence agriculture, technical problems, and corruption. Grabbing phenomenon on more productive soils.
- Steppe grasslands were reduced significantly to expand arable land in lowlands
- Transhumant sheep grazing is still practiced today as a traditional use of mountain pastures
- Grasslands still have high cultural value – this is not more true in most of the W Europe

Situation in individual Carpathian countries

Poland

- In mountainous areas land was not consolidated, so the landscape structure is patchy and private farms predominate. However, too intensive grassland management resulted in strong decline of grassland diversity, mainly in oligotrophic habitats.

Hungary

- Abandonment of grassland management, recultivation and afforestation caused the main decrease in grassland cover.
- Well developed administration of protected areas and strong support by the NGOs

Situation in individual Carpathian countries

Austria:

- The only country, which was not developing under influence of communism among the Carpathian countries.
- Traditional agriculture died out in Lower Austria in the 60ies. Sheep breeding and grazing were reintroduced in 1983 in the Nature Reserve Hundsheime Berge (sheep), Spitzenberg (sheep) and Braunsberg (sheep, later Konik horses). Special type of grazing developed by biologists helped to maintain valuable dry grassland habitats. Farmers (only one family) struggle with lack of subsidies, hay and problematic administration.
- Outside the Carpathians – very intensive farming and strong decline in grassland diversity. An attempt to improve the situation: Abgestufte Nutzung (graduated intensity of grassland management), when each farmers has very intensive grasslands (up to 6 cuts/year supported by the subsidies) and also low-intensity grasslands to support the biodiversity.
- Similarly to Slovenia, agri-environmental schemes do not importantly support biodiversity, most of them are applied on intensive grasslands (in Slovenia only 3% of HNV grasslands are included)

Situation in individual Carpathian countries

Slovakia

- Most agricultural area was consolidated in the Soviet Era, only very steep mountainous regions have maintained patchy landscape structure
- In most regions traditional grassland management practices and TEK died out during 1950-1980, recently hand mowing is very rare.
- More than 50% of extensively used semi-natural grasslands were lost to arable land or to intensive meadows during the communism.
- In the post-communist period, abandonment of grassland management prevails and gradual shrub and tree encroachment goes on. Agri-environmental schemes have helped to slow down this process, but usually the management regime has changed – former meadows were transformed to pastures or mulched grasslands.

Situation in individual Carpathian countries

Czech Republic

- Similar development to Slovakia during pre-communism and communism period but much stronger nature conservation in post-communism period
- Several projects were implemented in collaboration with conservation authorities to restore meadows from arable land, using regional seed mixtures. White Carpathians, Ivana Jongepierova et al.
- Agro-environmental schemes integrated some of the conservation initiatives (e.g. use of regional seed mixtures). However, farmers perceive the conservation oriented grassland management as unusual, complicated despite of higher compensation.

Restoration of Grasslands

Sowing with commercial mixtures was carried out also on abandoned fields in Bílé Karpaty (White Carpathians). In order to maintain the character of the landscape and the phenomenon of flowering meadows, regional mixtures consisting of indigenous species of grasses and herbs have been developed.

Ivana Jongepierová came up with the idea of renewal of White Carpathians' meadows and put it into practice. Currently, **Karel Prach** and **Klára Řehounková** in collaboration with Ivana Jongepierová are engaged in renewal of these meadows (see **Scientific Publications**: Prach et al. 2013).

http://www.restoration-ecology.eu/renewal-of-flower-meadows

Comparison on the most important features in protected areas with direct influence on the grassland habitats' management and conservation according to Balázsi (2018)

Analyzed aspects	Czech Republic	Slovakia	Hungary	Romania
governance and management of protected areas	Delegated to state nature conservation at regional level and national park administrations; NGOs have an important participative role.	Delegated to state nature conservation authority; some NGOs have meaningful contribution in conservation initiatives.	Centralized; covered and coordinated by the national parks directorates, based on their operational area; NGOs have limited participation, because of the centralized system.	Delegated to administrators – large scale protected areas (10 year contract) or custodians – small scale protected areas (5 year contract); NGO participation is remarkable.
management plans and conservation measures	Good overall situation of the management plans at national level; every category of protected area has its own management plan, in case if different categories overlap, the objectives are harmonized together; buffer zones are outside of the limits of the national park.	Weak overall situation of the management plans; slow process because of the complexity of the management categories which has to integrate the regulation for Natura 2000 network; buffer zones are outside of the limits of the national park.	Medium overall situation of the management plans for national interest protected areas – compulsory measures; distinct, nature conservation guidelines for Natura 2000 sites - recommended conservation measures; buffer zones are within the limits of the national parks.	Medium overall situation, debatable quality in some of the cases (fist plans); integrated management plans for Natura 2000 and national protected area categories; compulsory conservation measures; buffer zones are within the limits of the national parks.
restitution of property rights for land ownership after the collectivization in protected areas	Difficult property right restitution, excluding those who left the territory of Czechoslovakia during the communism; the agricultural activities are mostly abandoned in mountain areas which are under protection.	Restitution of property rights, but re-establishment of cooperatives in some areas; properties were very fragmented; disinterest of land owners for agriculture; abandonment of less productive areas.	Land aquisition by protected area directorates/ remained state property; Partially collective property was privatized, establishment of large farming companies or former landowners had no interest for agriculture.	Restitution of property rights to former landowners; viable small-scale farms, producing mostly for self-consumption; after EU accession considerable changes in farming structure; small-scale farms are not eligible for rural development programs.
actual nature conservation priorities for grassland habitats	Restoration of species-richness in former arable land; continuity of (traditional) farming practices.	Establishment of active management; involvement of stakeholders in conservation	Raising interest for farmers to rent land and keep animals in national parks property.	Survival of traditional farming practices and small-scale farms; to maintain connection of people with their land.

Takeaways:

Problems with grassland conservation are similar throughout Europe, with some regional particularities. Species-rich grasslands in areas with existing rural cultures are extremely valuable cultural heritage. All existing subsidy schemes fail in sustaining rural farming systems.

Subsidy schemes should be different for areas with maintained rural cultures and TEK, where maintanance of grassland biodiversity should be priority. On the other hand, in W Europe, where the traditional management has already died out, enrichment of grassland biodiversity should be priority. Here the TEK can be replaced by scientific expert knowledge, if TEK is missing.

Takeaways:

Fully functional farming system should be supported as a whole, not only certain elements of them. These systems can collapse already when only one part is slightly modified.

To keep the biological diversity there must be also diversity in farming. We should avoid unification and restrictive approaches. Tools should be understandable, culture-based and innovative. Farmers should be included in the management plans development.

Result or product-orientated approaches are more efficient than measure-oriented approach.