Changes in the Carpathian ecosystems as the result of natural and anthropogenic factors

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What shall we protect in the Carpathians?

Key factors – anthropogenic and climatic

Sources of knowledge –
monitoring systems, is it enough?

Threats? - shall we be afraid?

Shall we do anything or just leave it as it is?

What shall we protect in the Carpathians?

e.g. valuable non-forest natural habitat types according to annex I of EU Habitats Directive

(list for Polish Carpathians)

3150 Natural eutrophic lakes with *Magnopotamion* or *Hydroharition* – type vegetation
3160 Natural dystrophic lakes and ponds
3220 Alpine rivers and the herbacaous vegetation along their banks
3230 Alpine rivers and their ligneous vegetation with *Myricaria germanica*
3240 Alpine rivers and their ligneous vegetation with *Salix elaeagnos*
4060 Alpine and Boreal heaths
4070 Bushes with *Pinus mugo* and *Rhododendron hirsutum* (*Mugo-Rhododendretum hirsutum*)
4080 Sub-Arctic *Salix* spp. scrub
5130 *Juniperus communis* formation on heaths or calcareous grasslands
6150 Siliceous alpine and boreal grasslands
6170 Alpine ad subalpine calcareous grasslands

-Non-forest natural habitat types in the Polish Carpathians

6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates *(Festuco-Brometalia)*
6230 Species-rich *Nardus* grasslands, on silicaous substrates in mountain areas (and submountain areas in Continental Europe)
6410 Molinia meadows on calcaraous, peaty or clayey-silt-laden soils *(Molinion caeruleae*)
6430 Hydrophilous tall herb fringe communities of plains and montane to alpine levels
6510 Lowland hay meadows (*Alopecurus pratensis, Sanquisorba officinalis*)
6520 Mountain hay madows
7110 Active raised bogs
7120 Degraded raised bogs still capable of natural regeneratio
7140 Transition mires and quaking bogs
7220 Petrifying springs with tufa formations *(Cratoneurion)*
7230 Alkaline fens
8110 Siliceous scree of the montane to snow levels
8120 Calcareous and calchist screes of the montane to alpine levels
8150 Medio-European upland siliceous screes
8160 Medio-European calcareous scree of hill and montane levels
8210 Calcareous rocky slopes with chasmophytic vegetation
8220 Siliceous rocky slopes with chasmophytic vegetation
8310 Caves not open to the public

6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates *(Festuco-Brometalia)*

Easy identification in mountains

In lowlands some troubles with transitional facies 6210/6510 And 6210/6120

6230 Górskie i niżowe murawy bliźniczkowe
Species-rich Nardus grasslands,
on siliceous substrates in mountain areas

Troublesome definition of „species rich” grasslands

In mountains it used to be a last stadium of degeneration of mountain hay meadows as the result of overgrazing

Highly diverse unstable regeneration stadia 6230 toward 6520 meadows

In Natura 2000 SDF broader definition on Nardion grassland was used (together with poorer stadia with domination of Nardus)

This habitats type is often claimed to be a proof of important role of pastoralism for maintenance of Natura 2000 sites

Link between pastoralism and natural habitats favourable state in not that clear and direct

6520 – Mountain hay meadows

Identification:

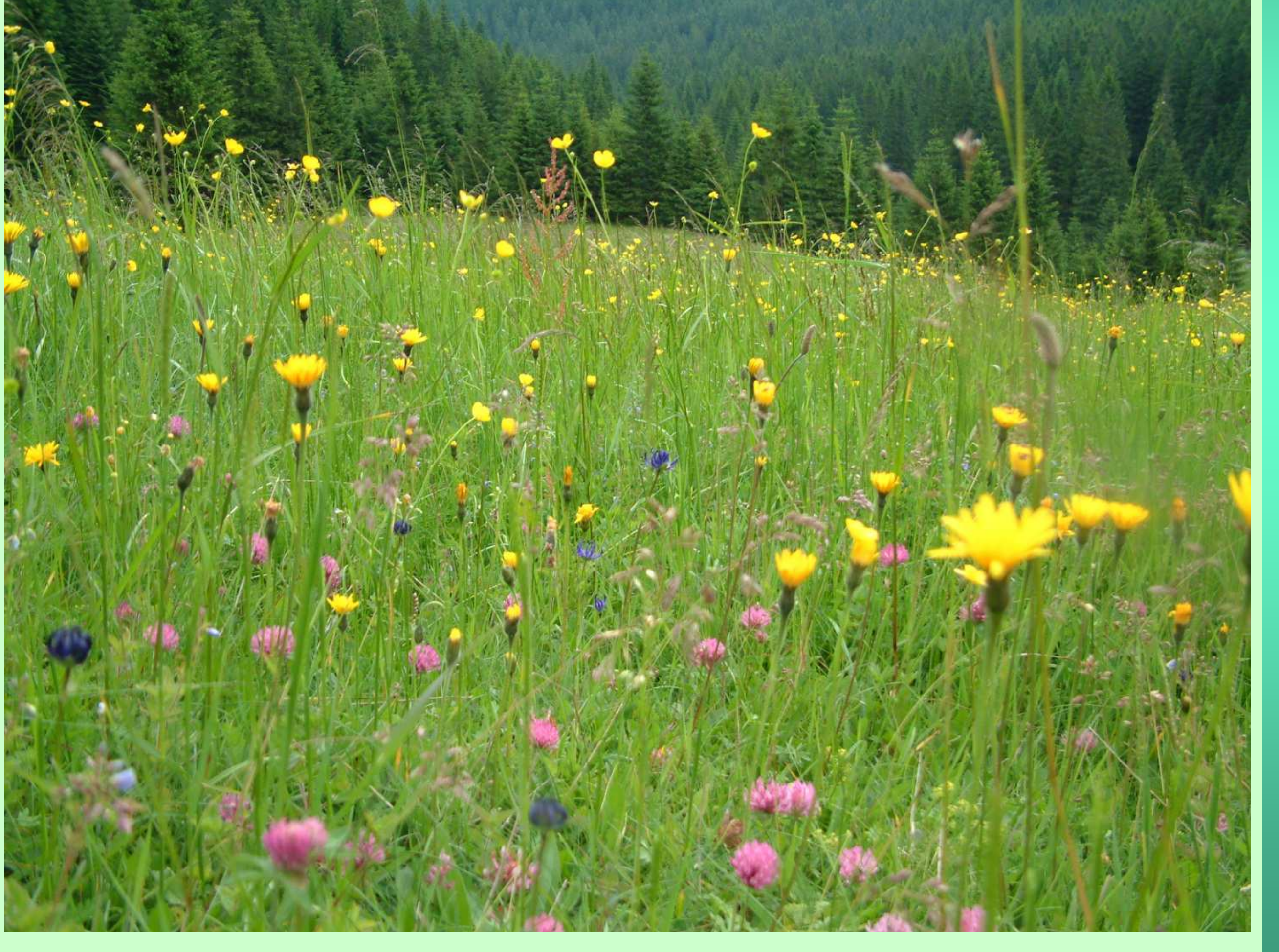
Trouble with distinction between 6510/6520

Practical approach:

6520 are most often over Altittude of 500-550 m

Rather on higher situated clearings not in valleys

Mowed just once not twice as 6510, it used to be grazed by cattle after mowing



4070 Zarośla kosodrzewiny- Bushes with Pinus mugo and Rhododendron hirsutum

7110 Torfowiska wysokie z roślinnością torfotwórczą – active raised bogs

Complex of high mountain communities –
screes, snowbeds, rock vegetation, alpine grasslands, subalpine scrub

Tall herb communities on screes in Tatra mts (fot. Katarzyna Kozłowska -Kozak).

Snowbed community (Luzuletum alpino-pilosae) on screes in Tatra mts
(fot. Katarzyna Kozłowska-Kozak).

National Environment Monitoring:
MONITORING OF NATURAL HABITATS IN POLAND 2006-2014

2006: basic monitoring: 944 localities

2007: basic and detailed monitoring: 689 localities

2008: detailed and integrated monitoring : 262 localities

2009: integrated monitoring : 800 localities

2010: integrated monitoring : 800 localities

2011: integrated monitoring : 800 localities

2013: integrated monitoring : 1600 localities
(new localities and first repeating of survey)

2014: integrated monitoring : 1300 localities
(new localities and first repeating of survey)




National Environment Monitoring:
MONITORING OF NATURA HABITATS 2006-2014

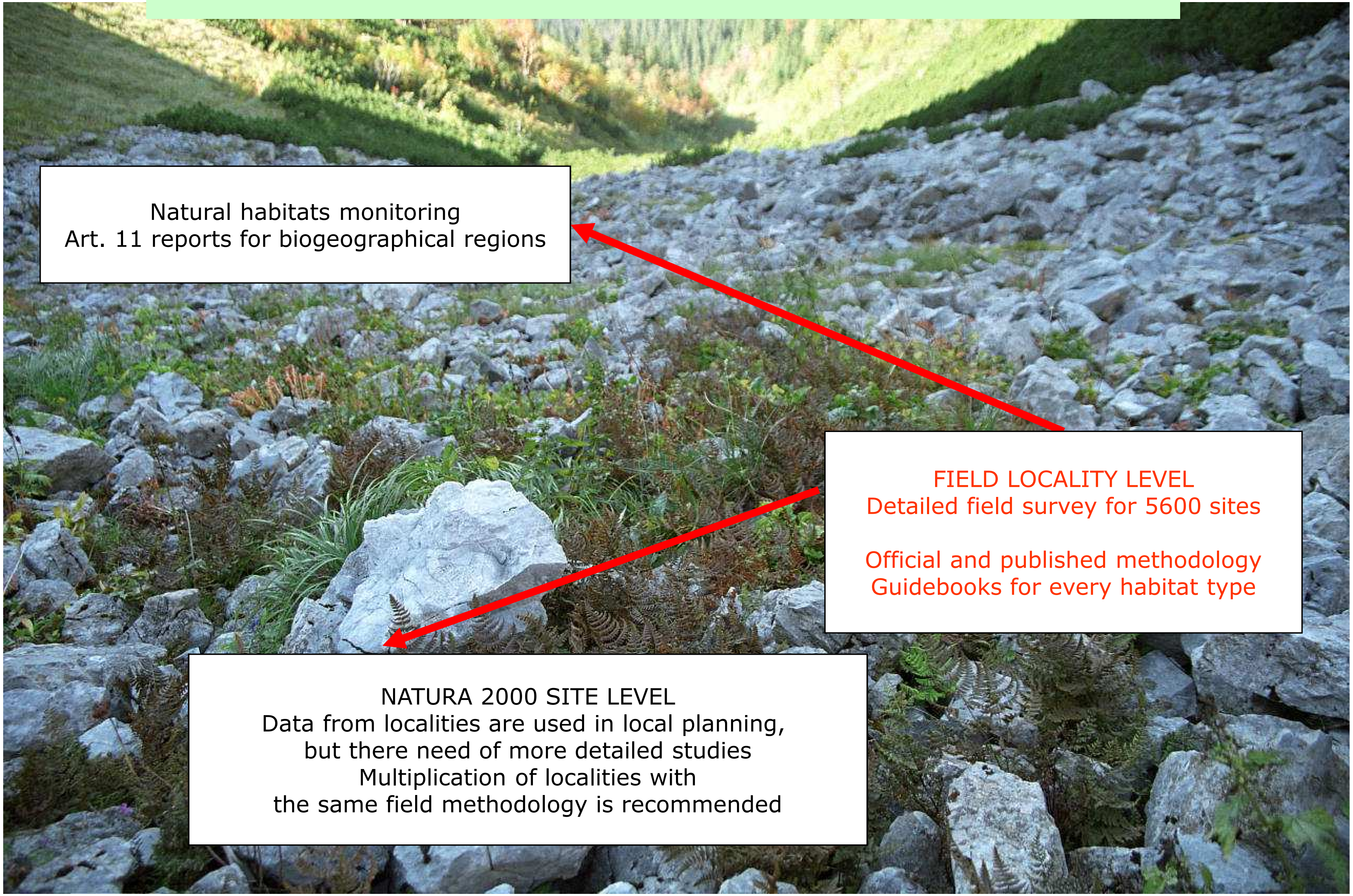
Together

In 2006-2014

79 types on natural habitats

Final number of localities repeated each 6 ys – 5600 field sites!

METHODOLOGY



ASSESSEMENT

BIOGEO. REGION = NATURA 2000 SITE = FIELD LOCALITITY

THE SAME PARAMETERS AND ASSESSEMENT APPROACH

1. Area
2. Specific structure and functions
3. Future prospects
4. General assessement

FV – favourable

U1 – unfavorable – inadequate

U2 - unfavorauble – bad

XX – unknown

Parameter	Conservation status			
	FV Favourable ('green')	**U1 Unfavourable – Inadequate ('amber')**	**U2 Unfavourable - Bad ('red')**	***XX Unknown (insufficient information to mak an assessment)***
Range				
Area				
Specific structure and functions				
Future prospects				
Overall assesement	All FV or 3 green and 1 XX	One or moreU1 lack of U2	One or more U2	2 or more XX in combination with FV or all XX

Indicators of Favourable CS – natural habitats

1.Parameter: Area - no additional indicators, best expert judgement

2.Parameter: Specific structure and functions

- Set of indicators specific for each of habitats type (6-13 indicators for a type)
- Selected main/crucial indicators or each of habitats, for any of them – automatic degradation of parameter assessement, regardless other indicators assessement
- Evaluation table for each indicator-habitat is used by local experts to assess the values of indicators – FV/U1/U2 system for each assessement

3.Parameter: Future prospects - no additional indicators, best expert judgement

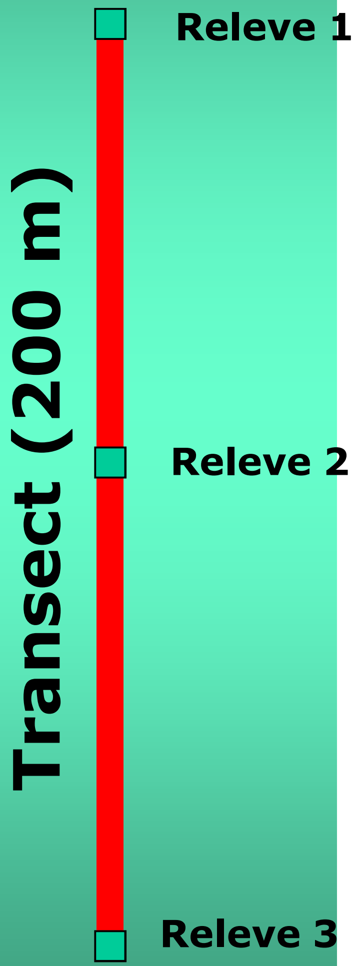
4.General assessement – lowest assessement of 3 parameters

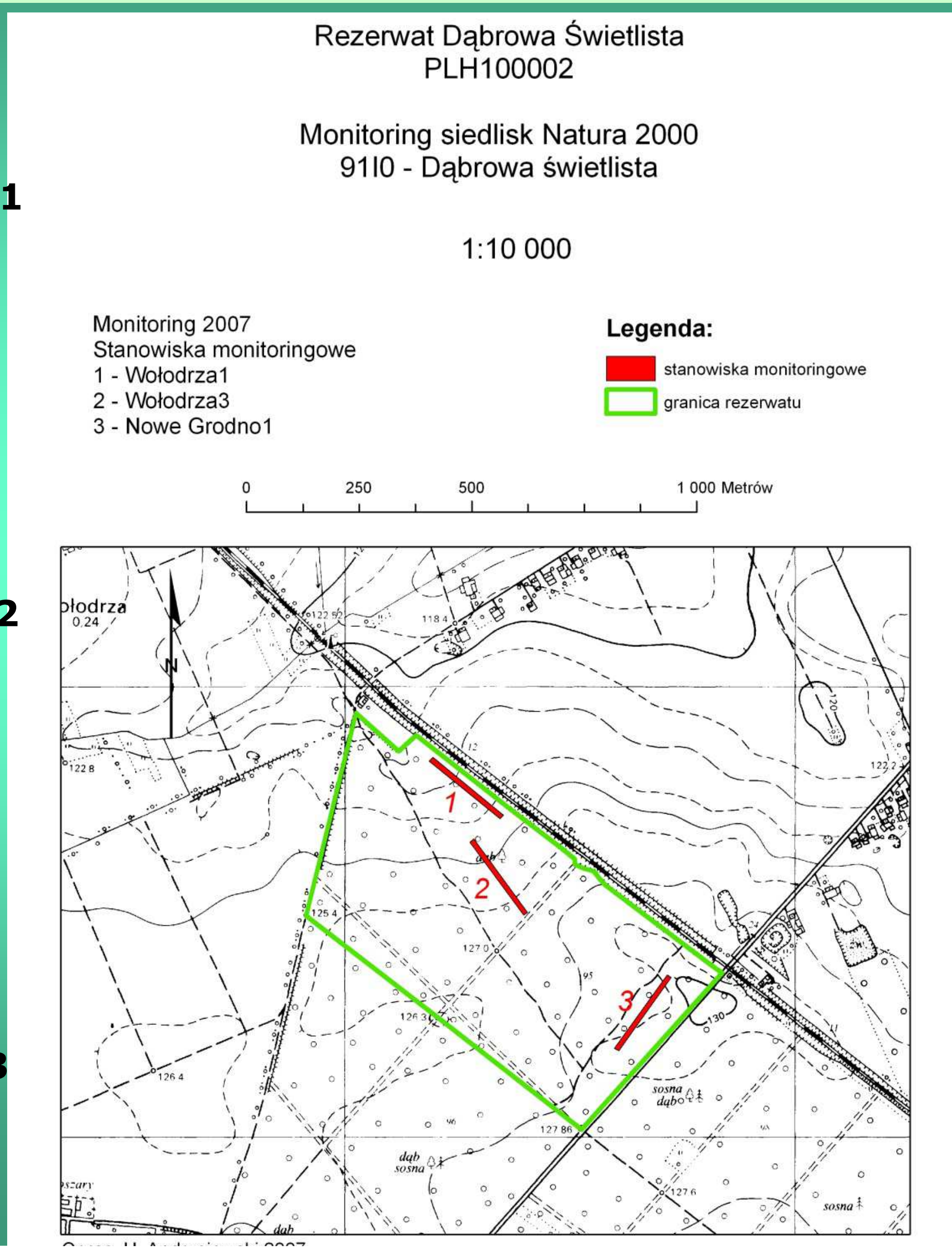
Indicator of specific structure and functions on natural habitats

- **Indicators detect the crucial environmental changes that might affect the miantanance of specific structure and functions of habitats**
- **Indicators reflect changes that are possible in next 6 or 12 years**
- **Easy and quick measurement or simple expert judgement**
- **No expensive equipement**
- **Enable to differentiate the state of habitat – more or less Gauss distribution**
- **repeatibility**
- **We avoid measerement of phenemona with high variation (sesonal or daily) –**
- **the feature shall be evaluable during one day field visit**

Field survey –

1 transect = 1 locality = 3 releves + observations on transect





Monitoring systems

OK – we've establish monitoring scheme for all crucial mountain habitats, but…

- it is focused on human impact – anthropogenic factors
- it analyses the natural factors as well, particularly natural succession, changes in species composition etc.
- it is a kind of early warning system showing just the very visible changes
- It gives the proper answers for management and local planning
- It describes the situation of habitats types on the level of biogeographical region and Natura 200 sites

- It does not give the answer on slight but cumulative changes – processes connected with microclimatic variation, changes in snow coverage, corellation between plant physiology and temperature, humidity etc.

For that analysis we need

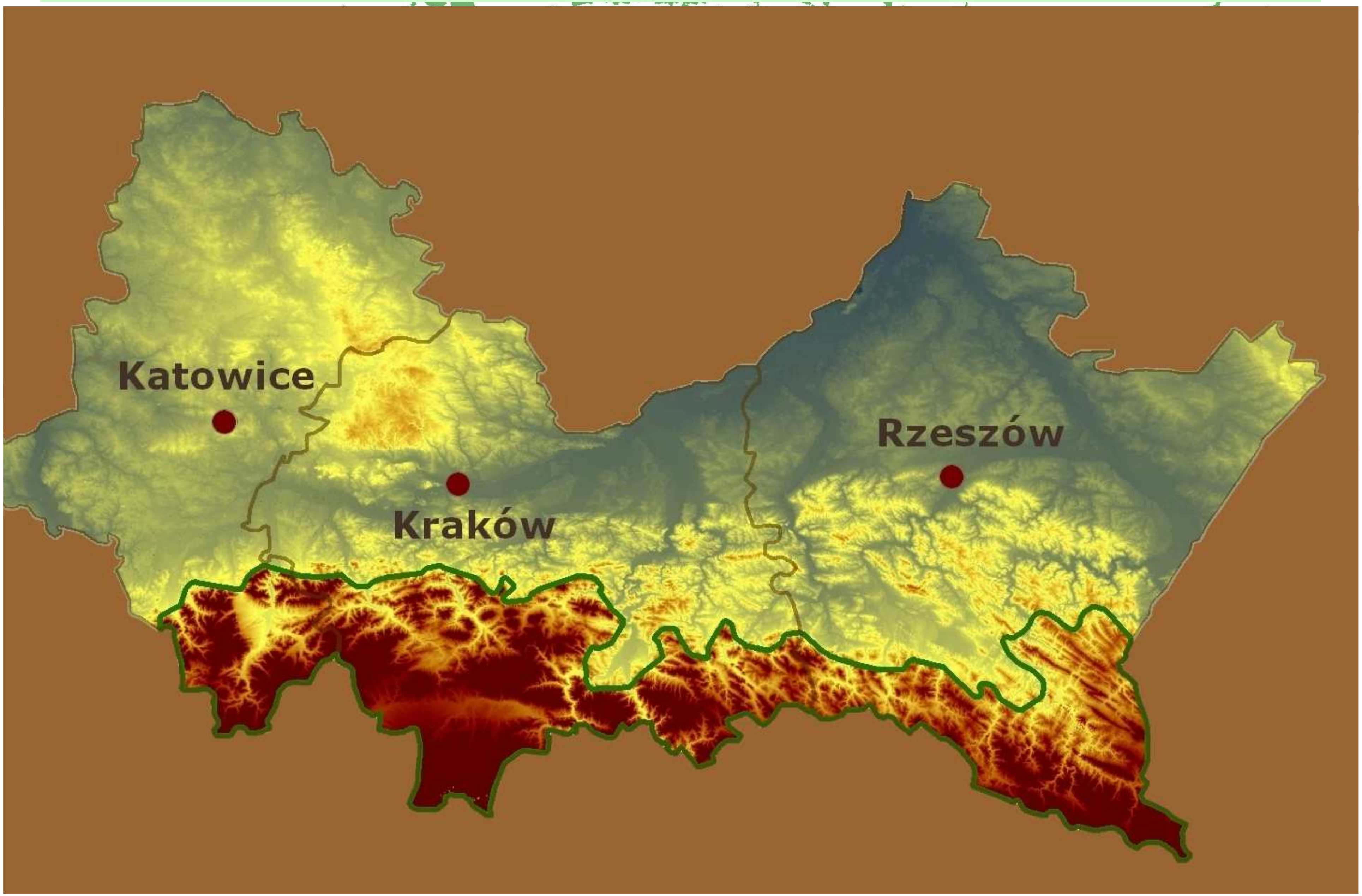
- a number of long-term research plots focused on detailed climatic analysis in correlation with plant response

together with:

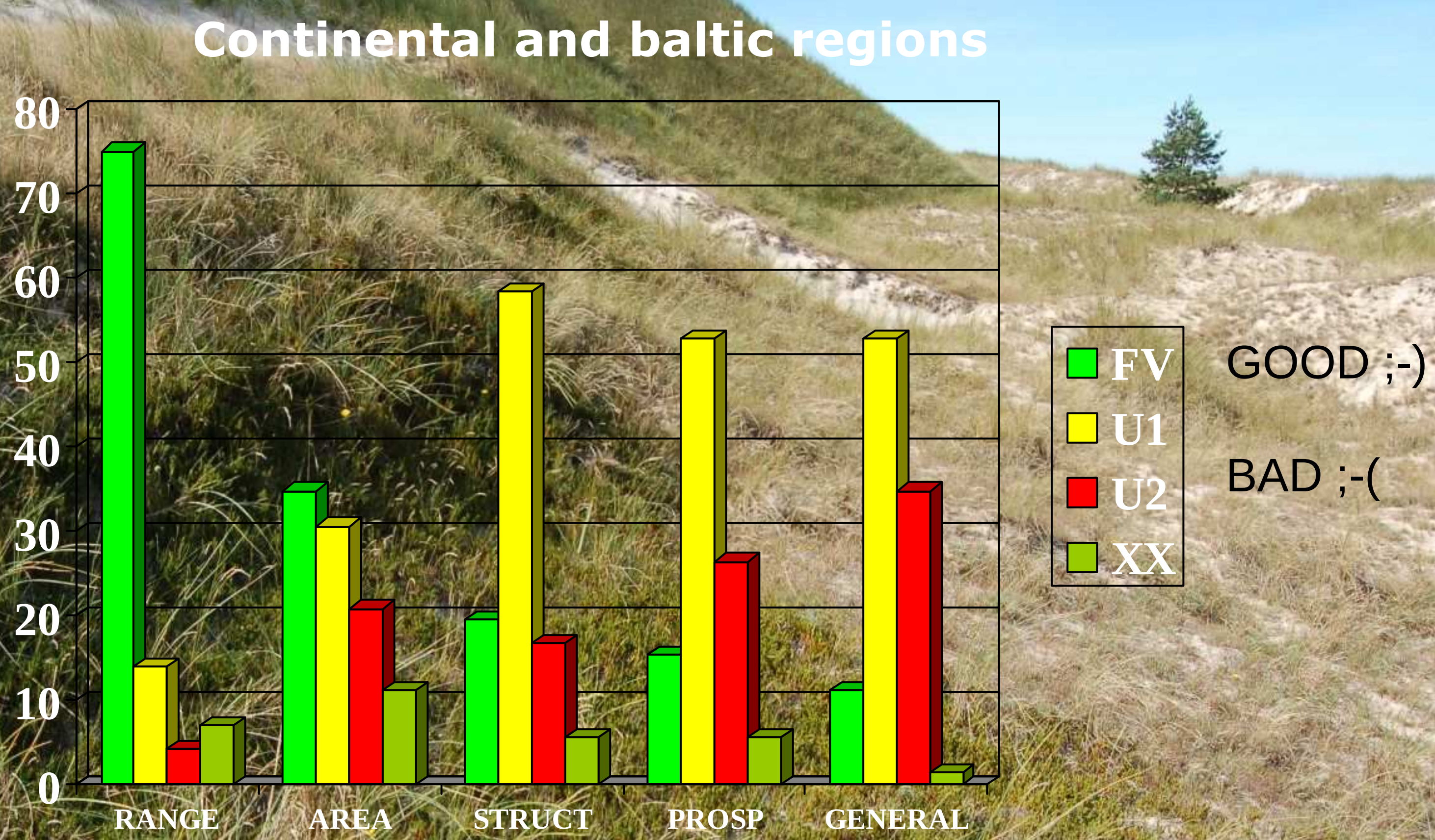
- GIS analysis in macroscale

Natura 2000 sites in Poland („habitat" sites + „bird" sites)

Different biogeographic regions showed (Baltic, continental and ALPINE)

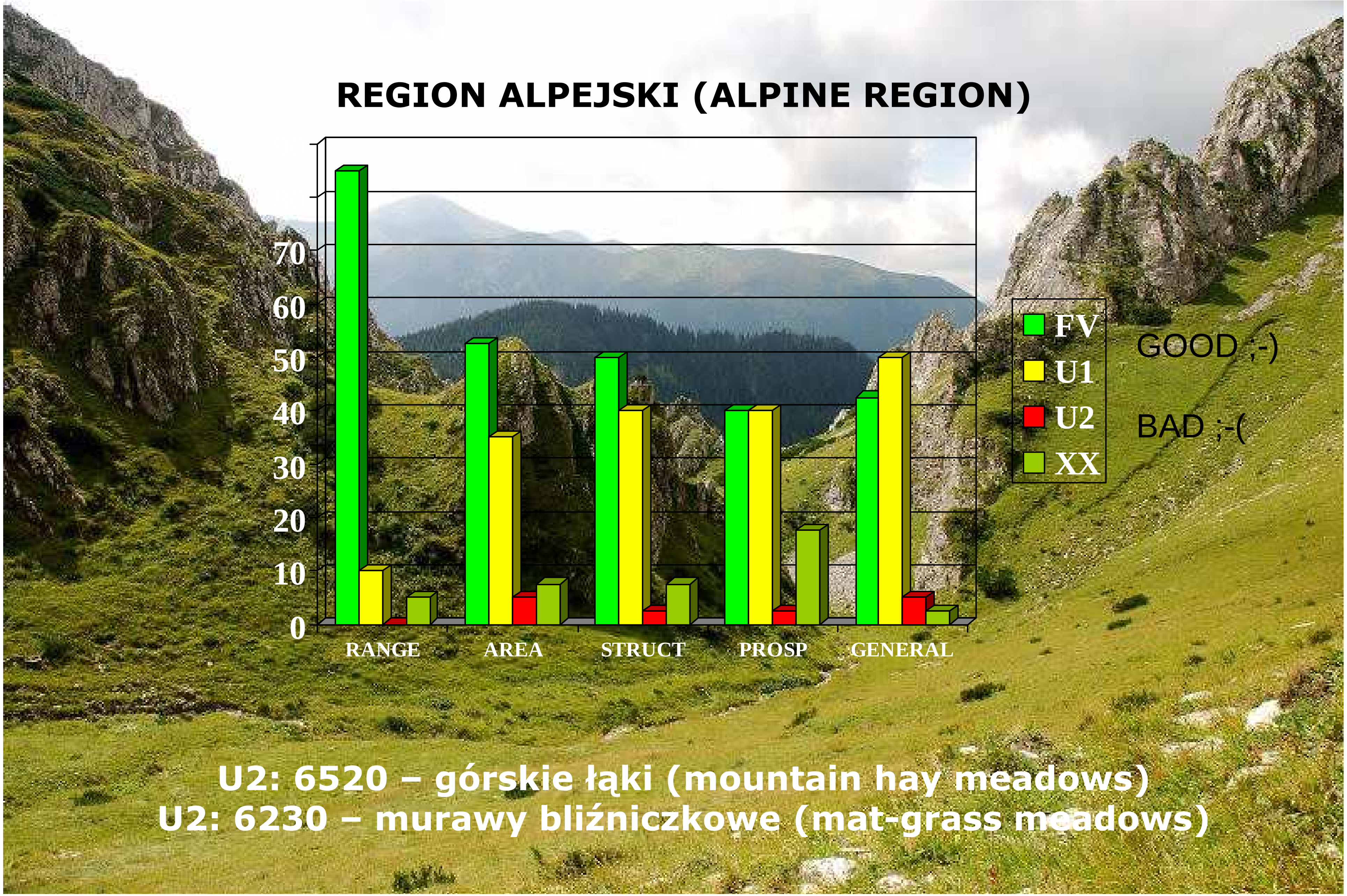


The state of natural habitats conservation in Poland (2007)

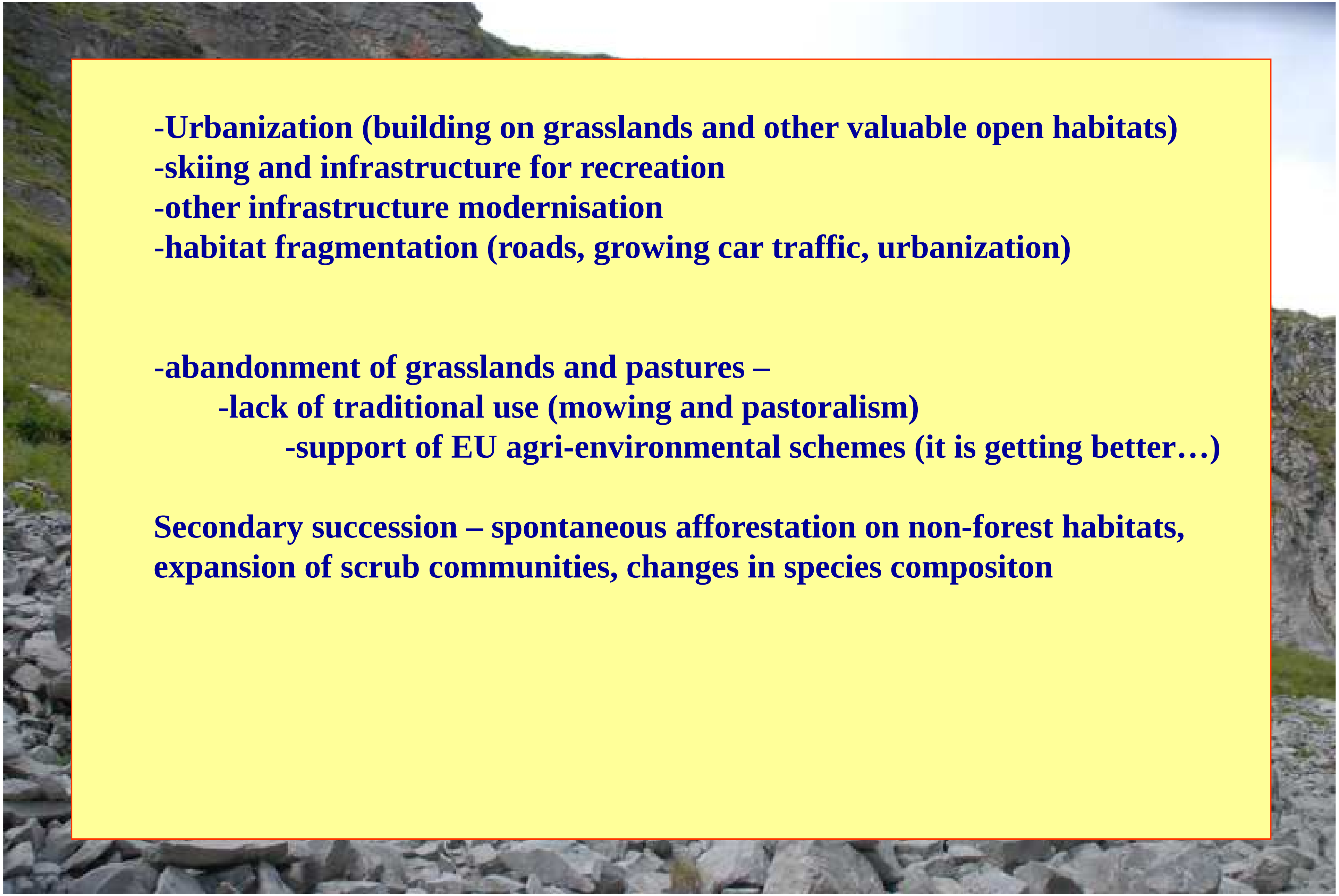


U2: słonorośla (salt grasslands); wydmy szare (grey dunes), wydmy śródlądowe (inland dunes), suche wrzosowiska (dry heathland), murawy napiaskowe i kserotermiczne (dry grasslands), łąki trzęślicowe (Molinia grasslands), torfowiska wysokie i przejściowe (raised bogs and transition mires), bory bagienne (bog woodland), łęgi (alluvial forests), górskie bory świerkowe (mountain spruce forest)

Stan siedlisk przyrodniczych w Polsce (2007)



MAIN THREATS FOR MOUNTAIN BIODIVERSITY IN POLAND



-Urbanization (building on grasslands and other valuable open habitats)
-skiing and infrastructure for recreation
-other infrastructure modernisation
-habitat fragmentation (roads, growing car traffic, urbanization)

-abandonment of grasslands and pastures –
    -lack of traditional use (mowing and pastoralism)
        -support of EU agri-environmental schemes (it is getting better…)

Secondary succession – spontaneous afforestation on non-forest habitats, expansion of scrub communities, changes in species compositon

Changes in subalpine vegetation the Eastern Carpathians (Poland and Ukraine)

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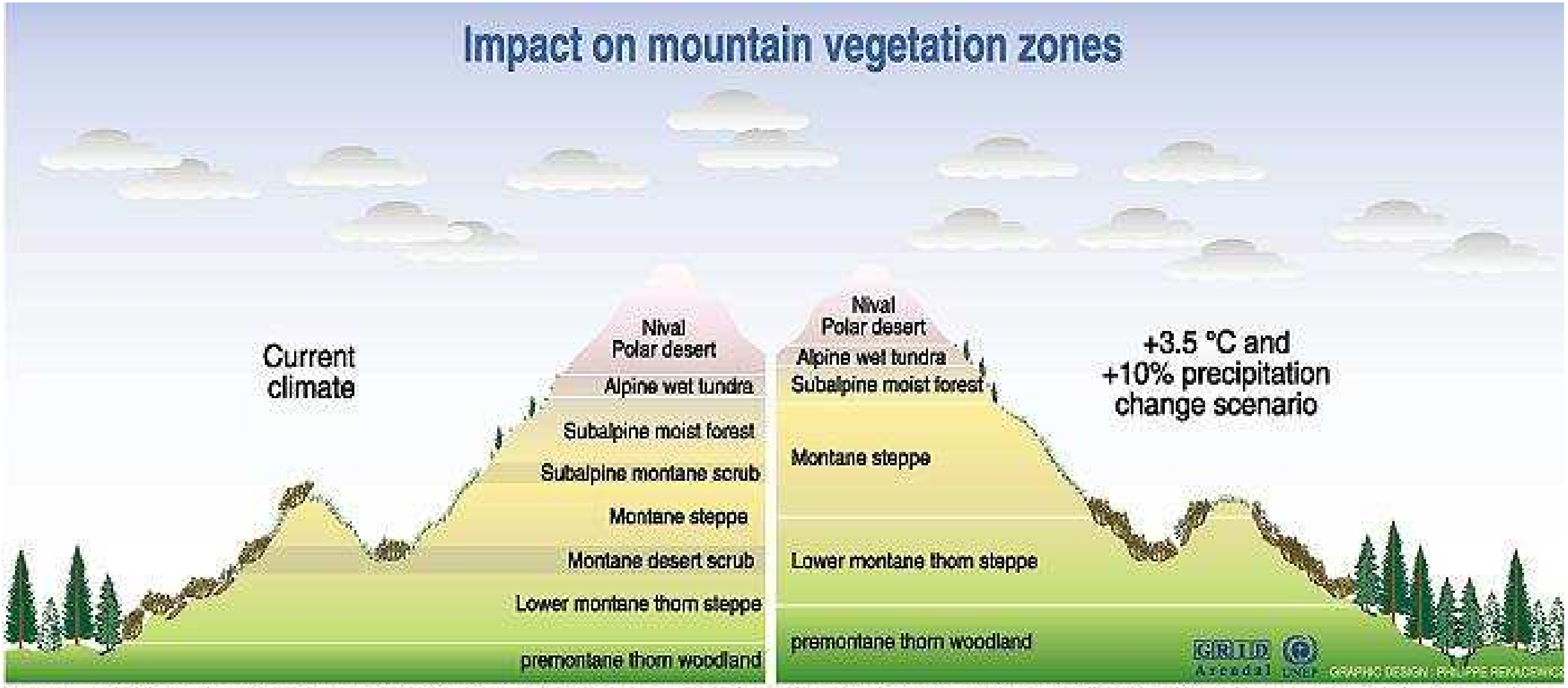
Habitat fragmentation (roads, growing car traffic, urbanization)

And climate changes???



Sources: Martin Beniston, Mountain environments in changing climates, Routledge, London, 1994; Climate change 1995, Impacts, adaptations and migration of climate change, contribution of working group 2 to the second assessment report of the intergovernmental panel on climate change (IPCC), UNEP and WMO, Cambridge press university, 1996.

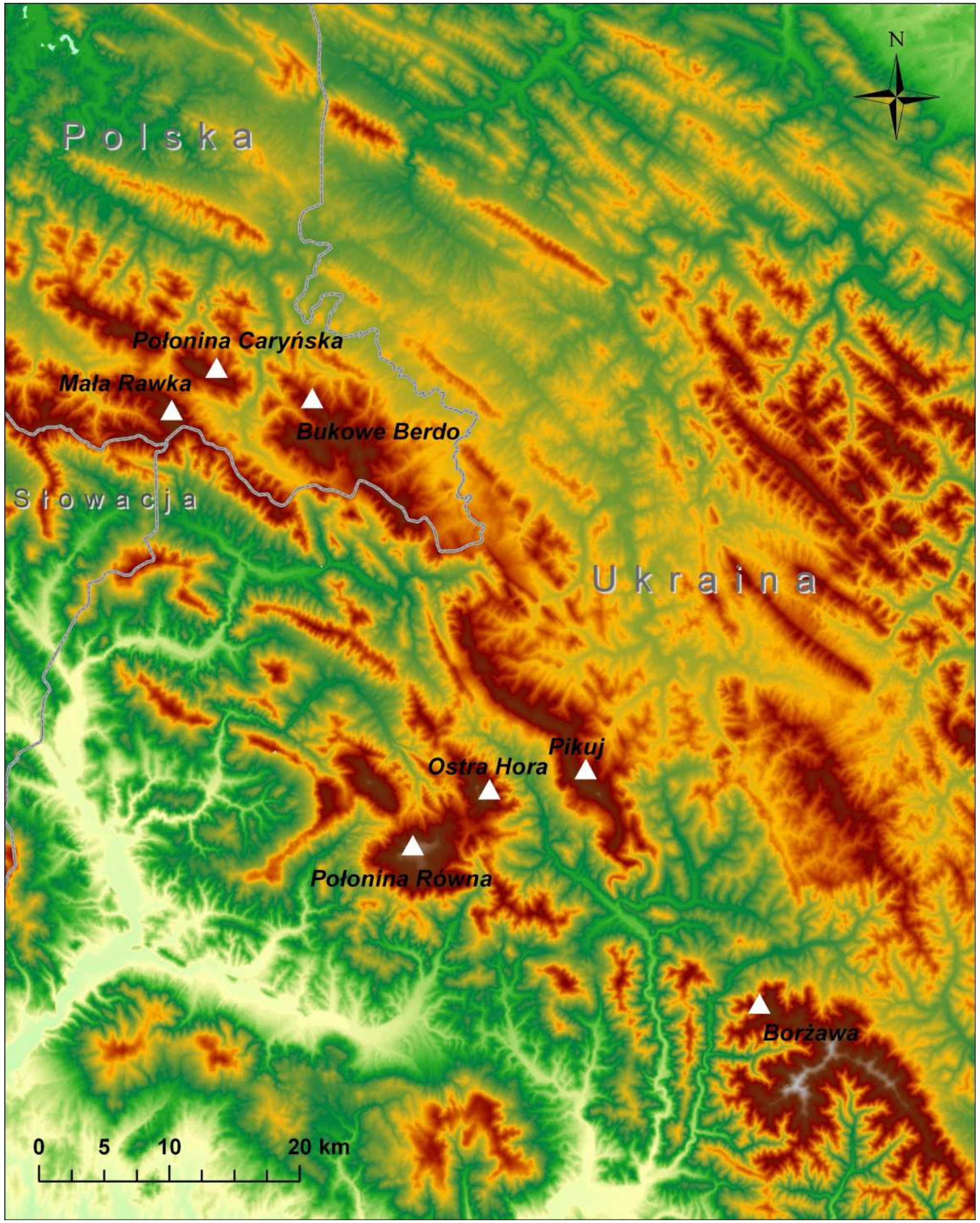
Źródło: www.maps.grida.no

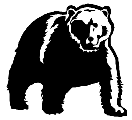
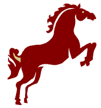
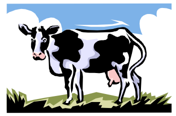
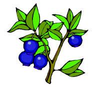
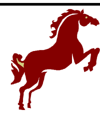
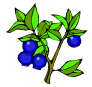
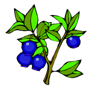
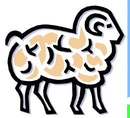
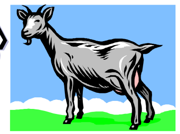
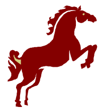
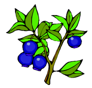
THEURILLAT J-P., GUISAN A. Potential impact of climate change on vegetation in the European Alps: A review. Climatic change, 2001, Vol. 50, p. 77-109.

- *Majority of alpine (high-mountain) plant species adapt to direct and indirect effects of smaller temperature increase (1-2 C) but not for change of 3-4 C (Theurillat, 1995).*
On the other hand with change of 1-2 C some species might loose some localities as the effect of secondary succession (Gottfried et al. (1999)

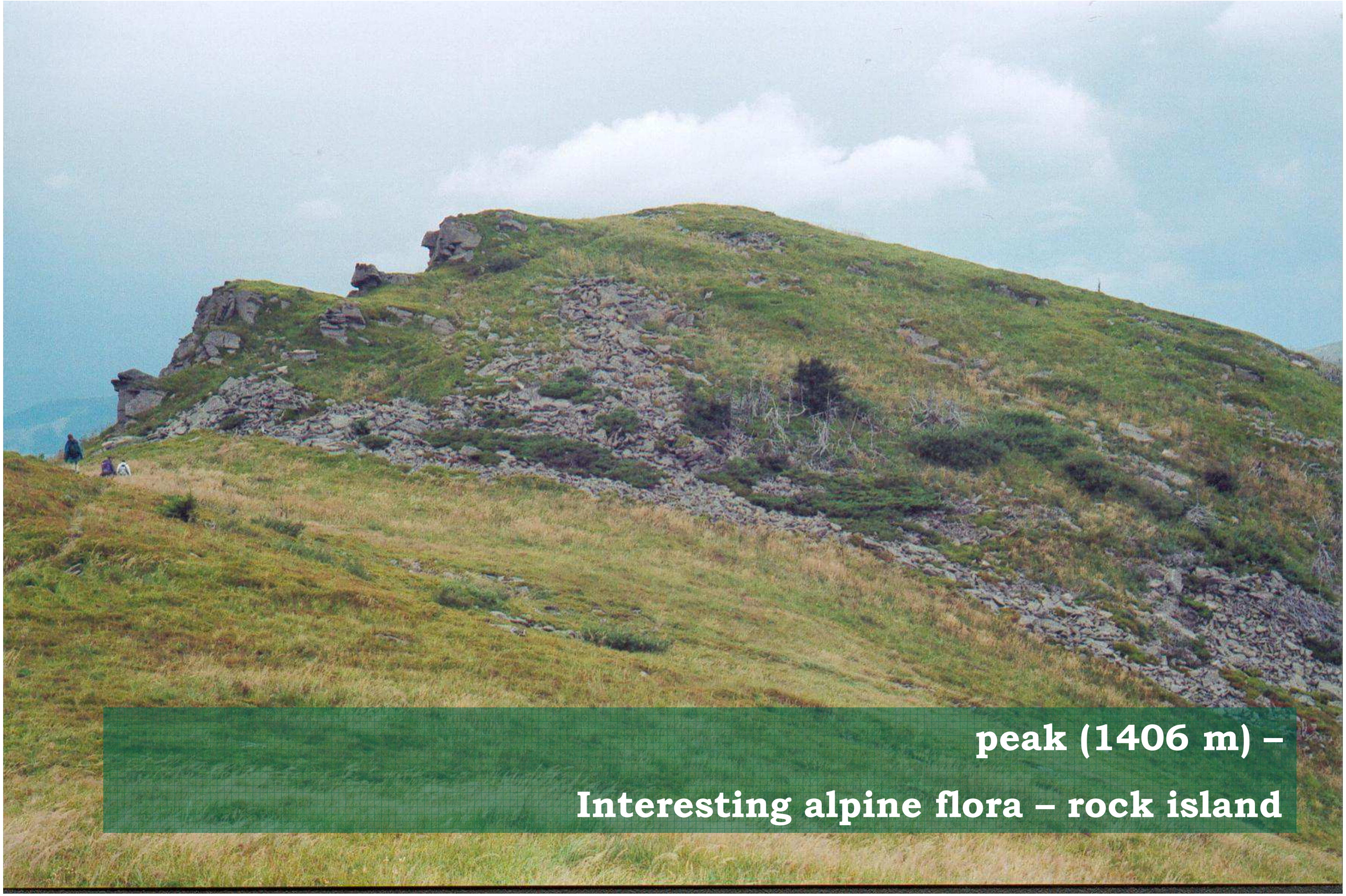
- *Threat to the refugia of alpine plants in lower alltitudes (limited area of an „island", no place to escape,(Grabherr et al., 1994, 1995; Gottfried et al., 1994)*

EASTERN CARPATHIANS



LOCALITY	MOUNTAIN RIDGE	TREELINE	PEAK	USE
Mała Rawka, Bukowe Berdo Połonina Caryńska	**Bieszczady Zachodnie**	**1061-1196**	**1296**	 
Pikuj	**Bieszczady Wschodnie**	**1140-1153**	**1406**	   
Ostra Hora	**Bieszczady Wschodnie**	**1231-1256**	**1405**	 
Połonina Równa	**P. Równa**	**1161-1225**	**1479**	 
Płaj Temnatyk	**Borżawa**	**1099-1127**	**1334**	   

PIKUJ



peak (1406 m) –

Interesting alpine flora – rock island

OSTRA HORA

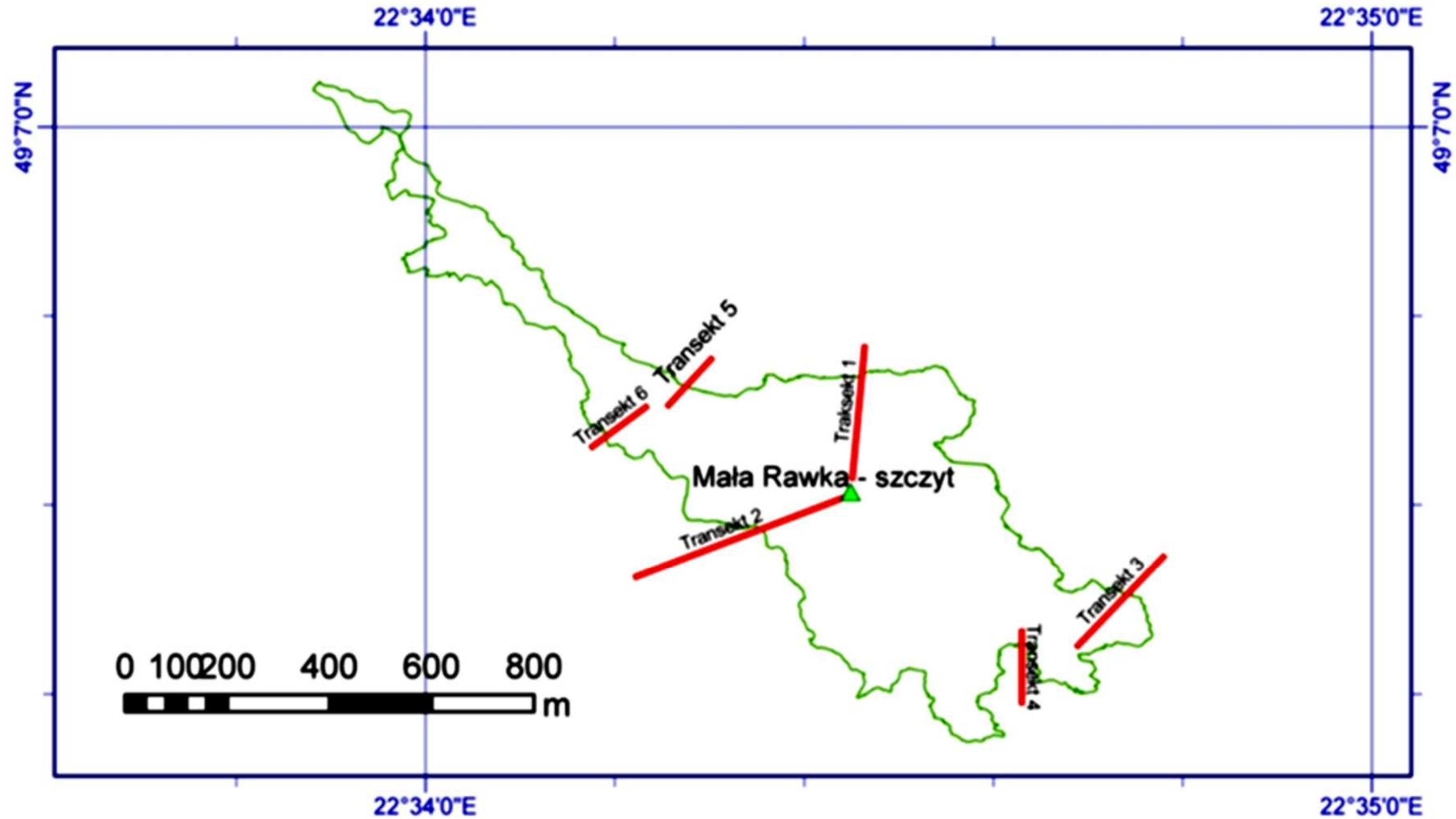
POŁONINA RÓWNA

WIELKA I MAŁA RAWKA

POŁONINA CARYŃSKA

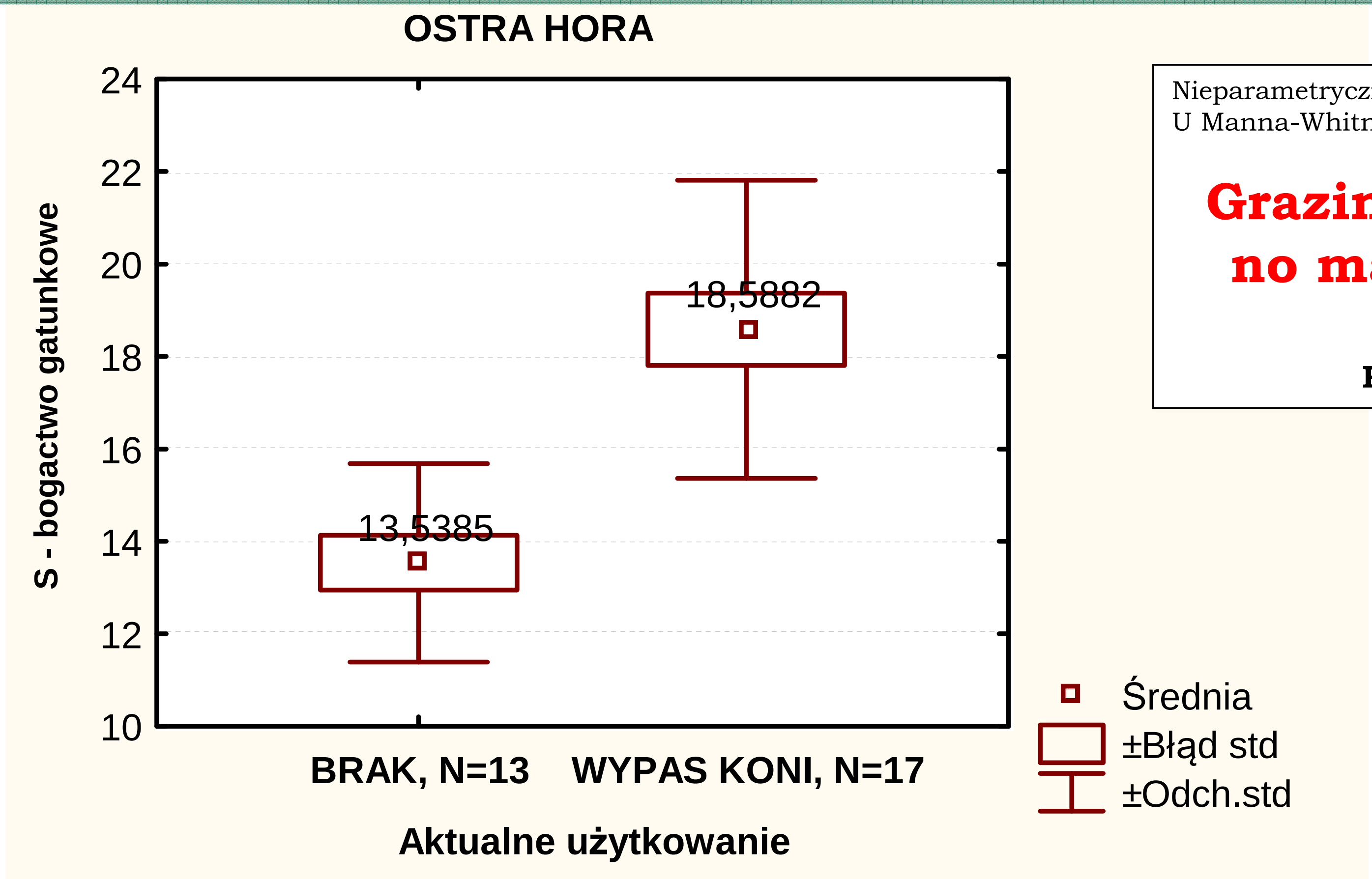

BUKOWE BERDO

transekty pionowe na Małej Rawce



Species diversity on non-forest habitats vs grazing

(plots in the Eastern Carpathians)



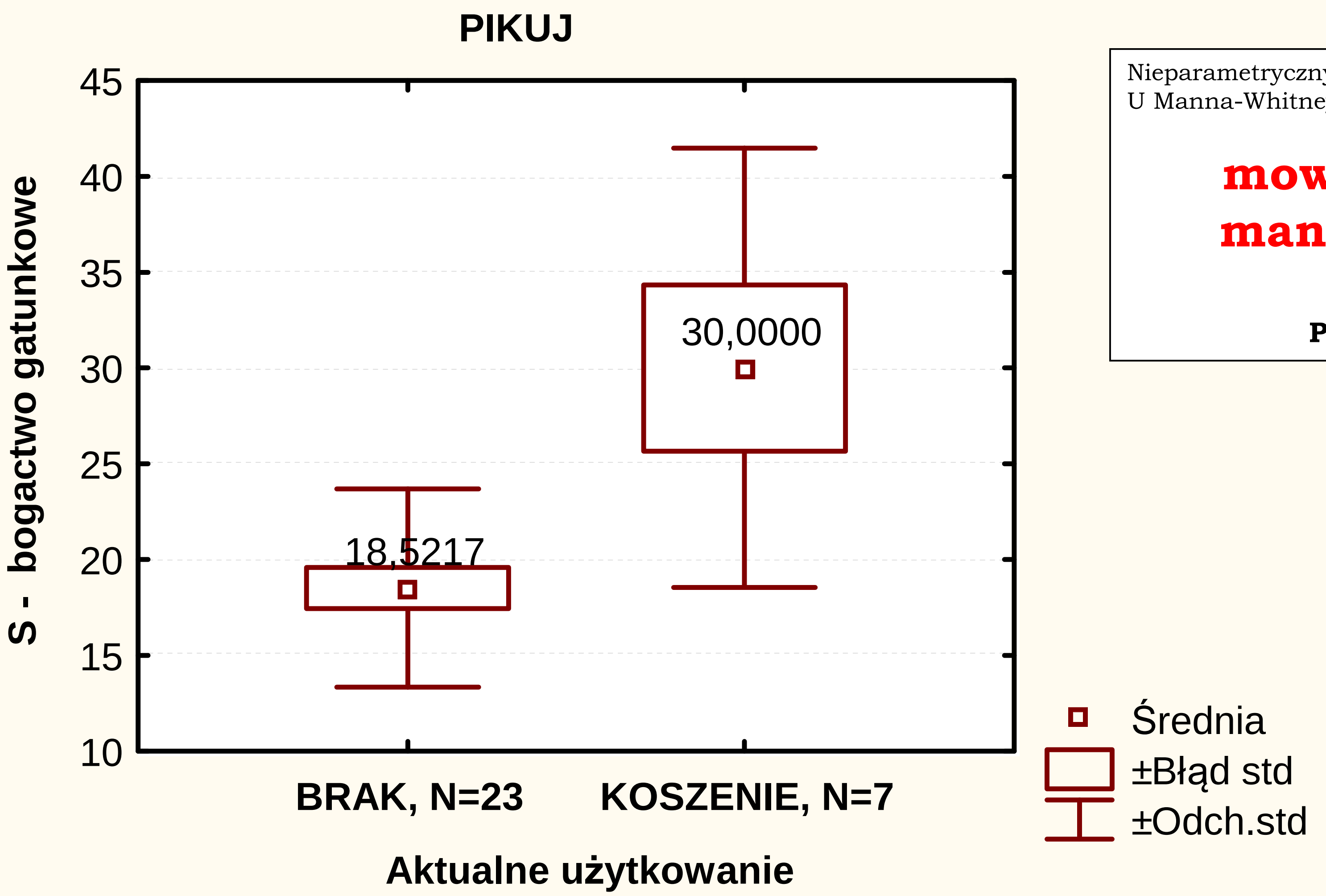
Nieparametryczny test
U Manna-Whitneya

Grazing (horses) > no management

P = 0,0002

Species diversity on non-forest habitats vs mowing

(plots in the Eastern Carpathians)



Nieparametryczny test
U Manna-Whitneya

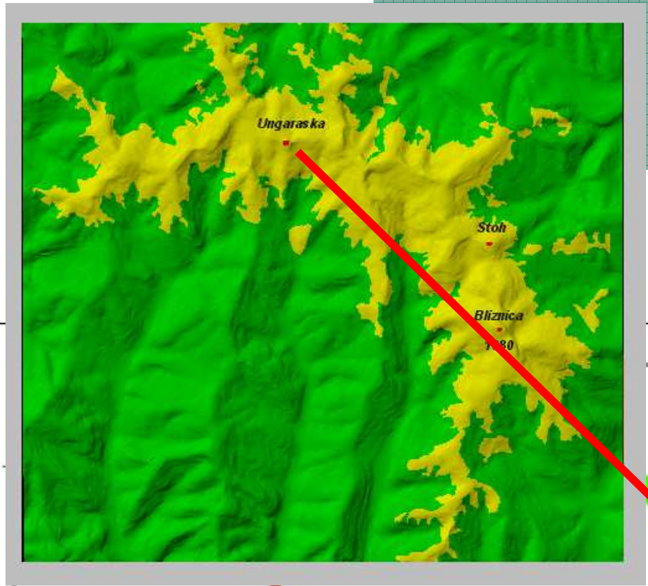
mowing > no management

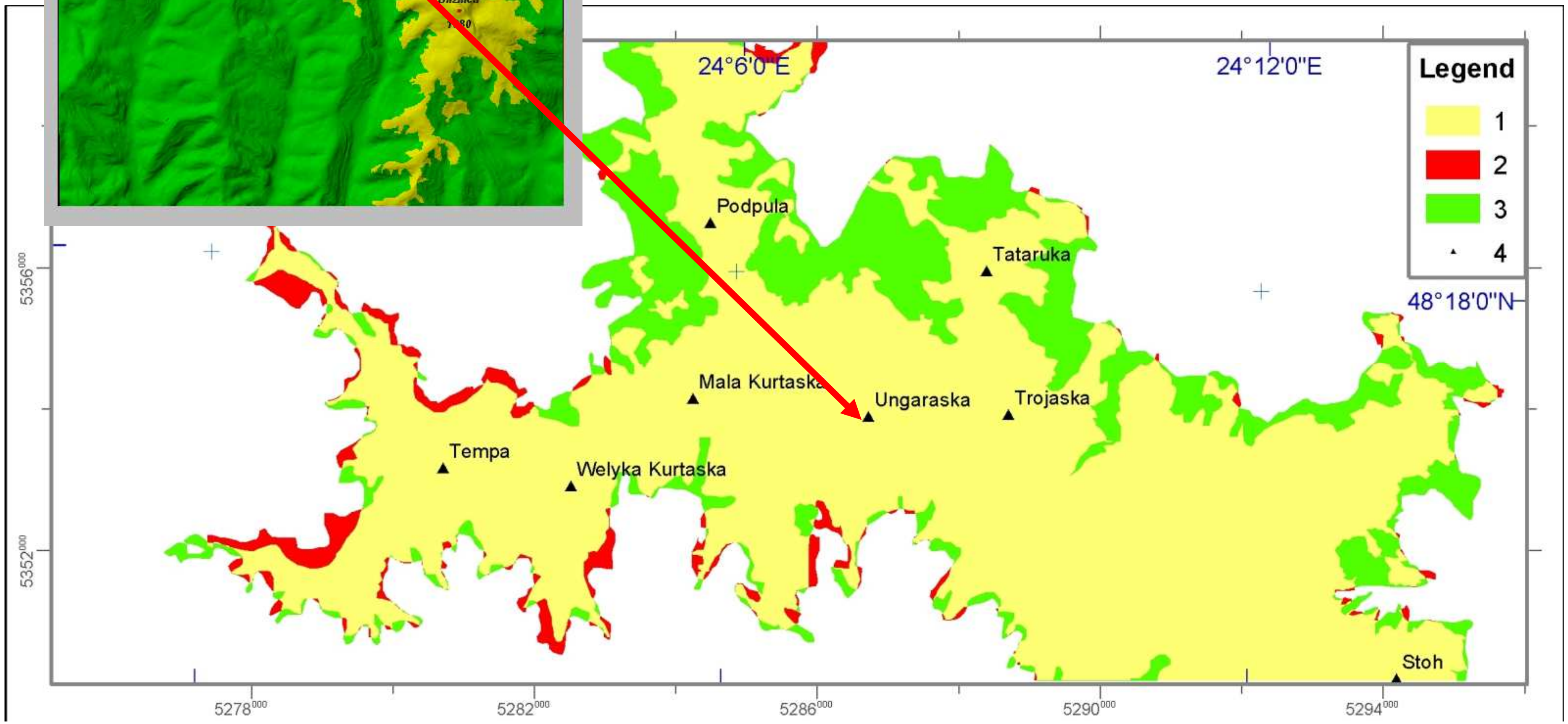
P = 0,018

Changes in upper tree line in the Eastern Carpathians

Changes in the upper treeline in the Eastern Carpathians (Świdowiec-Ukraine)

1935-2000





SUMMARY

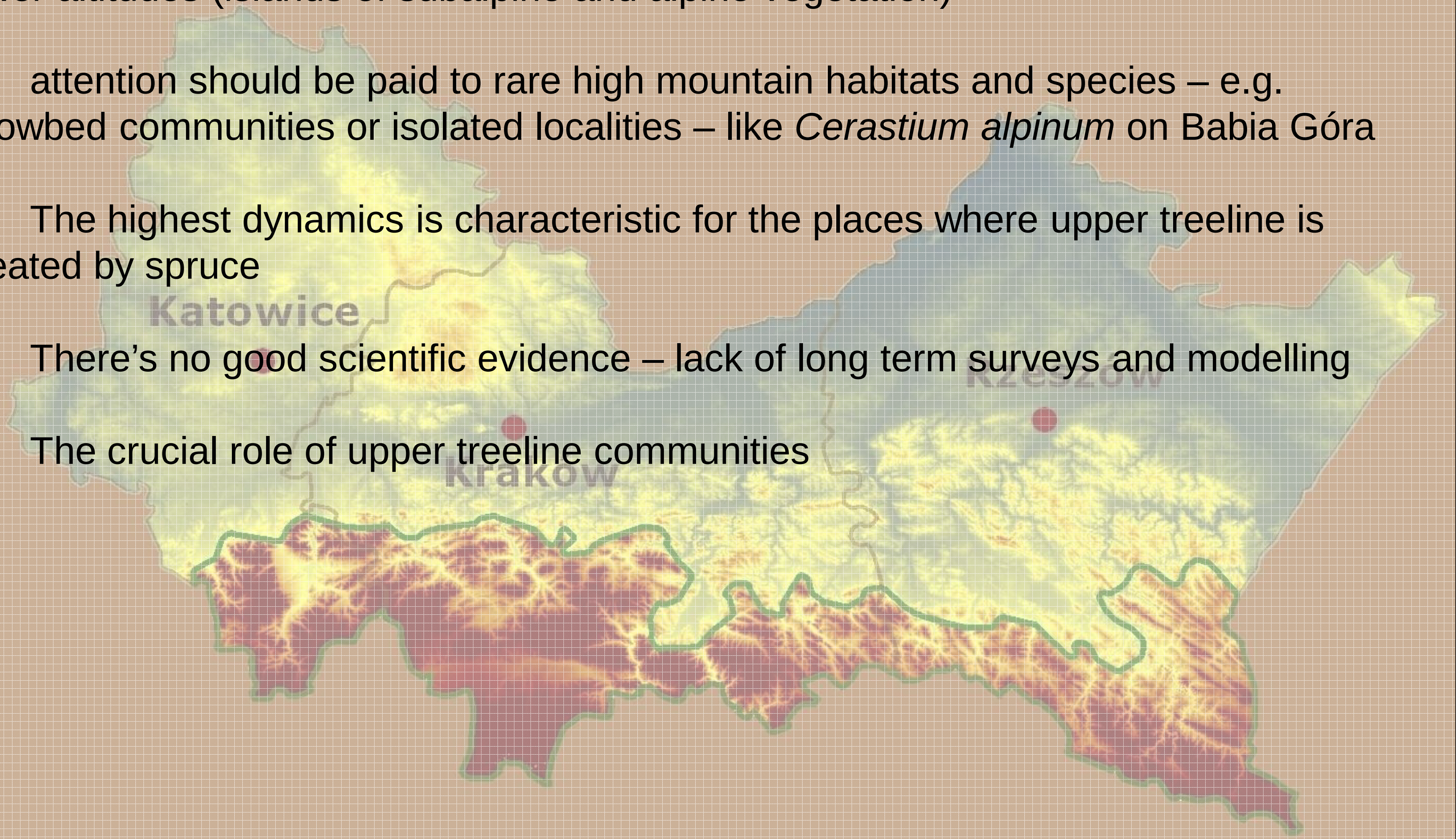
- The most endangered – vegetation of subalpine and alpine zones, particularly in lower altitudes (islands of subalpine and alpine vegetation)

- attention should be paid to rare high mountain habitats and species – e.g. snowbed communities or isolated localities – like *Cerastium alpinum* on Babia Góra

- The highest dynamics is characteristic for the places where upper treeline is created by spruce

- There's no good scientific evidence – lack of long term surveys and modelling

- The crucial role of upper treeline communities



Implications for climate change adaptation policy

Potential changes are rather slow, but it is very important to identify local threats – endangered rare species and habitats

Probably the direct impact of climatic conditions is not significant taking into account high adaptability of mountain plants and their resilience to environmental changes, more important is indirect impact, in particular secondary succession

The attention should be paid to conservation of subalpine and alpine habitats, especially in lower locations

The detailed analysis of upper tree line dynamics should be done

Implications for climate change adaptation policy

Crucial role of the monitoring system – focus on indicators of climate change

The existing monitoring scheme can be very useful in preditcion and modelling, but it is not enough

Permanent monitoring of changes, focused on field survey of whole ecosystem reponse, should be established

The data from different mountains shall be gathered, and international cooperation should be improved

Implications for climate change adaptation policy

The impact of climatic condition is generally intensified by a number of anthropogenic factors

So:

We shall minimalize potential negative effects of climate change through elimination of anthopogenic factors having similar impact and through providing support to any activities that might lead to improvement of the conservation status of natural habitats and species, especially those that are exceptionally sensitive to climate change.

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