Biodiversity and Landscape Diversity

Science for the Carpathians

Contributors: Ľ. Halada, M. Nijnik, J. Kozak, K. Ostapowicz, A. Bobiec, K. Mázsa, E. Ziółkowska, T. Kluvánková-Oravská, L. Bizikova, A. Nijnik

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Presentation structure

Biodiversity

- General trends
- Carpathian specificities
- Recent development
- Future projections
- COP4 reflections

Landscape diversity

- General trends
- Carpathian specificities
- Future projections
- COP4 reflections

Conclusions

Biodiversity

Biodiversity: General trends

- **Biodiversity crisis**
- **Climate changes and adaptation**
- **Invasive alien species**
- **MA, ecosystem fuctioning, ecosystem services (ES)**
- **UN Sustainable development goals**
- **Global policies:** CBD, IPBES, UNESCO MaB - Biosphere Reserves, Future Earth
- **EU policies:** Biodiversity Directives and Natura 2000, WFD, IAS Regulation, HNV Farmland and Forest Areas, MAES

futurearth
research for global sustainability

MaB
Man and the Biosphere Programme

Biodiversity: Carpathian specificities, recent development

- **High taxonomical diversity**
- **Endemism**
- **BioREGIO Carpathians**
- **Biogeography:** new methods, new knowledge
- **Large carnivores**
- **Spruce forest decline**
- **Policy:** The Convention, CC Protocol and Action Plan, CNPA, national biodiversity strategies and action plans

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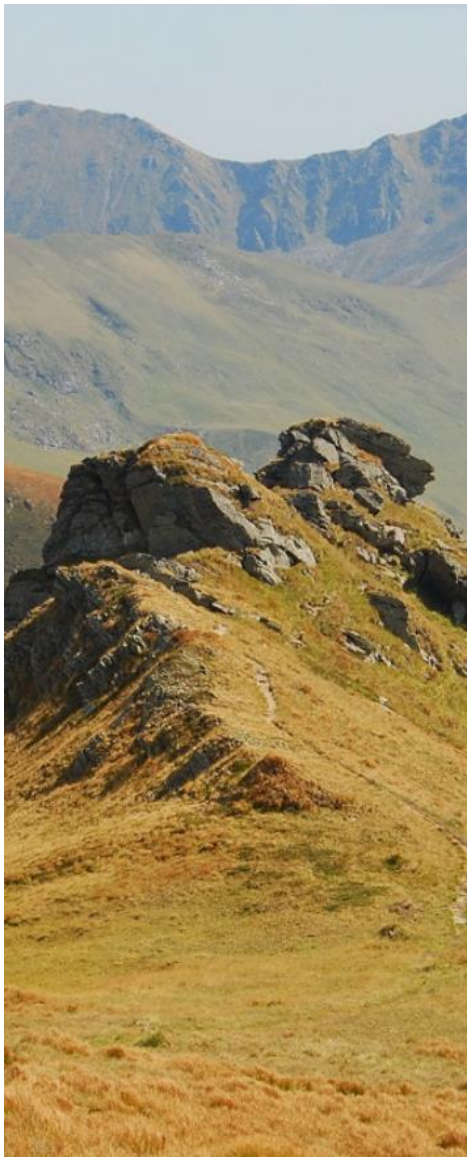
BioREGIO Carpathians

- Biodiversity knowledge gained
- Red lists of species and habitats
- List of invasive species
- Ecological connectivity
- Integrated management of protected areas
- Institutional framework and legislation



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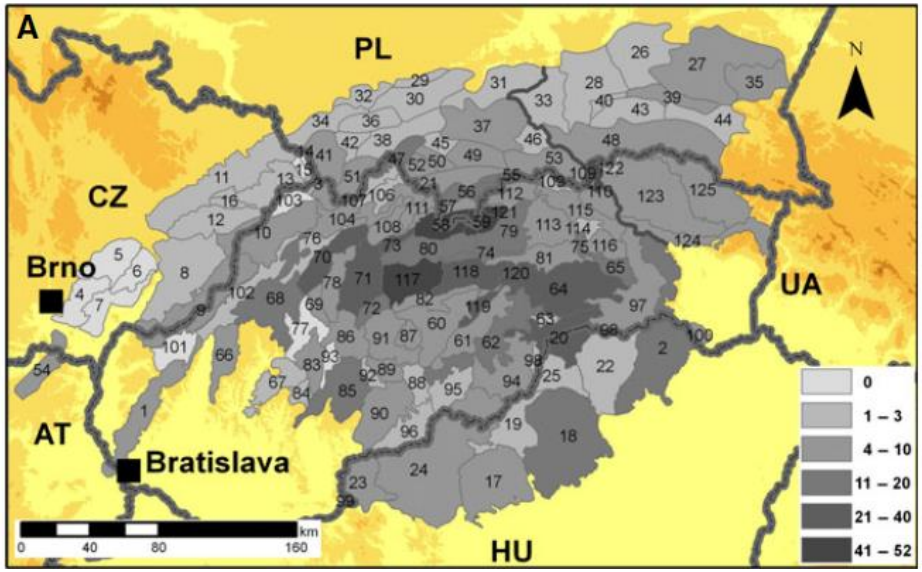
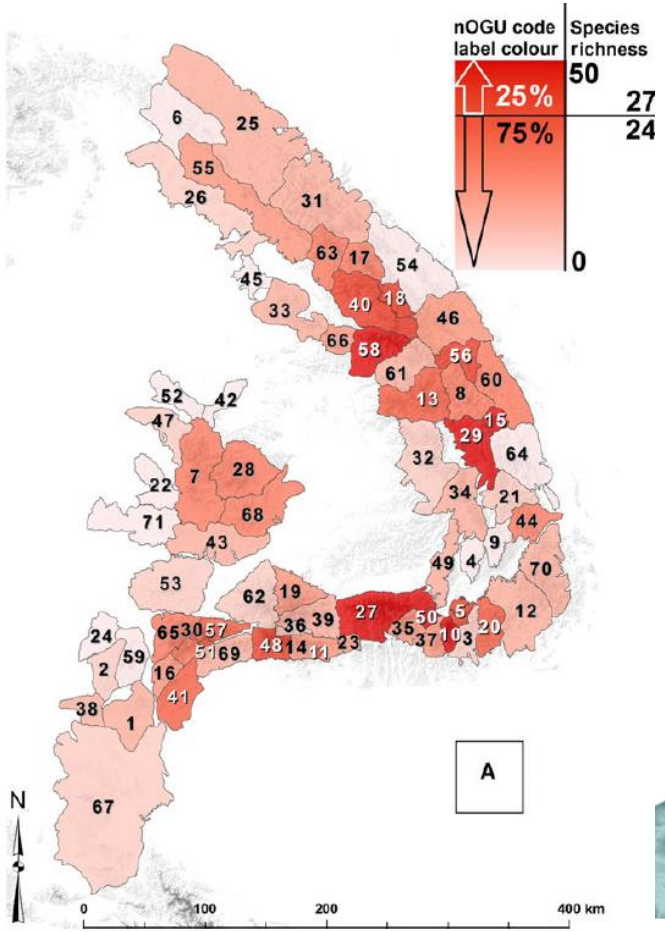
Endemism

Vascular plants endemism

Western Carpathians



Eastern Carpathians



Sources: Mráz et al., 2016,
Hurdu et al., 2016

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Biogeography of Carpathians

Pan-Carpathian exchange of knowledge - conferences

2013: Evolution of Biodiversity in a Spatiotemporal Context

Biogeography of the Carpathians
Kraków 2013

2017: Ecological and evolutionary facets of biodiversity

Biogeography of the Carpathians
Cluj-Napoca 2017

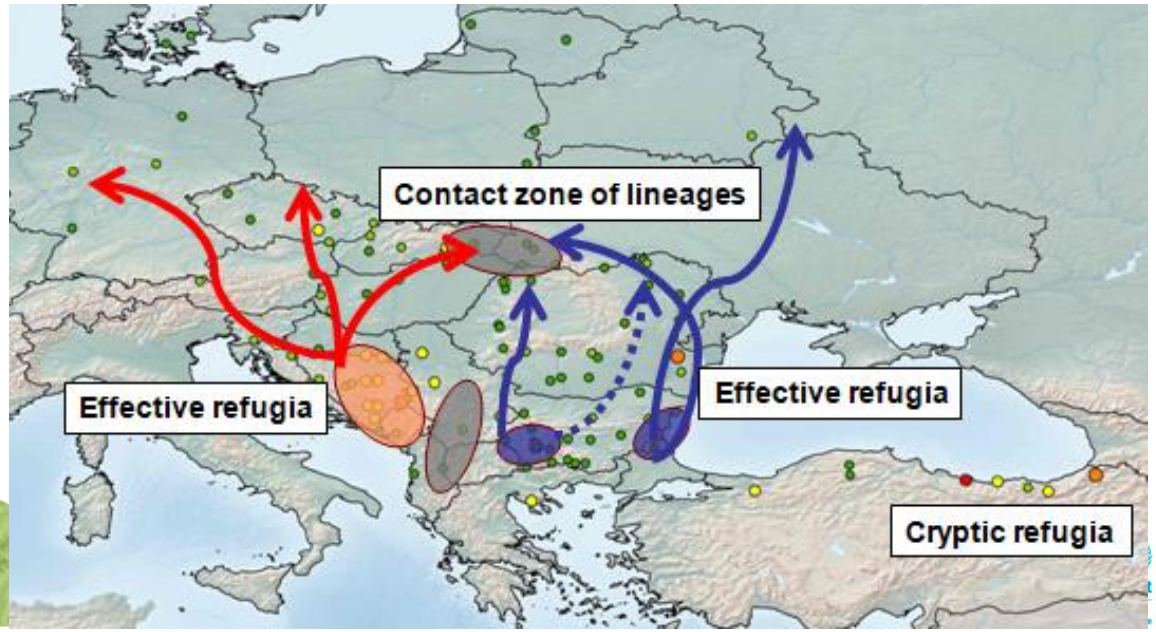
- Historical biogeography and drivers of evolution
- Ecological biogeography and drivers of assemblages
- The Carpathians in a larger biogeographical context
- Diversity patterns in genes and species
- Conservation of biodiversity in the Carpathians: consequences of global environmental changes on regional biodiversity

New genetic methods in biogeography: new knowledge

Centres of genetic diversity – links to adaptation abilities

Example – hornbeam (Carpinus betulus)

- Contact zones between Western and Eastern lineages in Eastern Carpathians may conduct to higher genetic diversity at mid-latitude where migration routes meets.
- Effective refugia and cryptic refugia represent hot spots of diversity and conservation priorities should target these populations



Source:
Postolache et al., 2016

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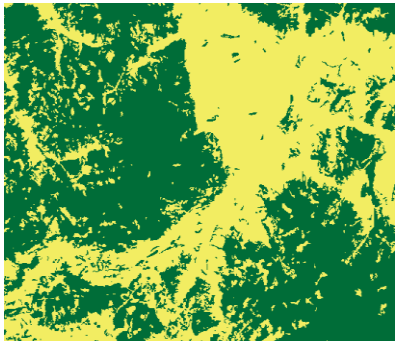
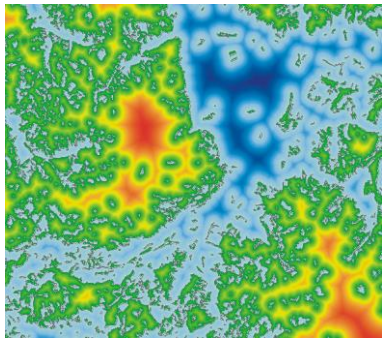
Biodiversity: fragmentation and connectivity assessment

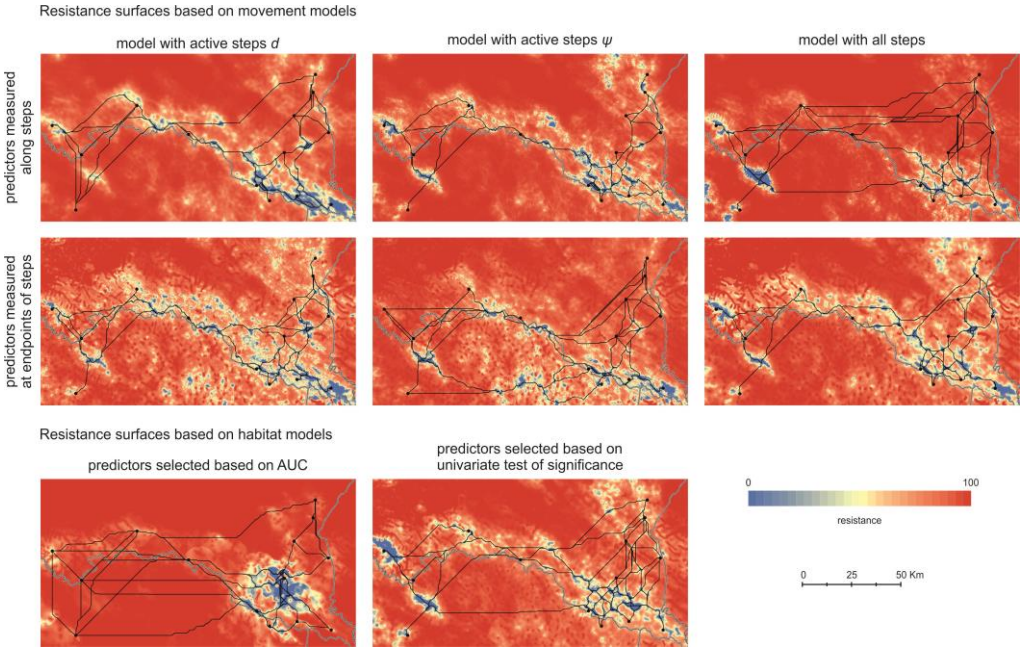
- New metrics e.g. Landscape hypsometic curve *(Ostapowicz et al. 2014, 2017)*
- Landscape and habitat level (*Ziółkowska et al. 2014, 2016a&b*)

New landscape metric LHC
(Ostapowicz et al. 2014&2017)





Connectivity assessment for brown bear - the Polish Carpathians *(Ziółkowska et al. 2016)*



Project examples: LIM project (http://www.gis.geo.uj.edu.pl/LIMProject/index.html)
CON@SK.PL project (http://www.geography.sav.sk/conskpl/index.php/)

Biodiversity: Future

- Climate change adaptation
- Need of better biodiversity knowledge especially on endemic and rare species and habitats
- Centres of biodiversity – including genetical diversity
- Large carnivores and connectivity
- Invasive alien species – research, eradication
- Nature protection: besides conservation to focus on proper management regimes
- Integration of HNV approach to RDP and national forestry policies

COP4 reflections

- **Continue the work done in BioregioCarpathians**
  - ❖produce a complete set of red lists for Carpathians, list of endemic species and list of invasive species
- **Develop strategy for the invasive species elimination**
- **Study and model expected effects of climate change to sensitive species, especially endemic ones**
- **Improve habitat connectivity for the umbrella species** by removal of barriers and decrease of habitat fragmentation
- **Adopt necessary management measures to improve conservation status of wetland, grassland and freshwater habitats, esp. those of European importance**
- **Use new bioinformatics modelling tool sets and indicators** for ecosystem-scale simulations and ES studies for the Carpathians.

Landscape diversity

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Landscape diversity: General trends

- Land use changes driven by global and regional drivers
- Urban sprawl, development, transport infrastructure
- Depopulation of rural areas, land abandonment
- Landscape fragmentation, landscape homogenisation
- Loss of landscape naturalness and diversity
- Policies: European Landscape Convention (CoE), Green Infrastructure Strategy

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CONVENTION EUROPÉENNE DU PAYSAGE
COUNCIL OF EUROPE/CONSEIL DE L'EUROPE

Landscape diversity: Carpathian specifities, recent development

- Higher degree of naturalness, high forest coverage
- Lower intensity of land use
- High-heterogeneity areas - traditional agricultural landscapes
- Long-term trends, drivers of changes, legacies
- Transition from socialism to democracy – large and quick changes in society reflected in landscape changes
- Recent urbanisation, transportation infrastructure boom

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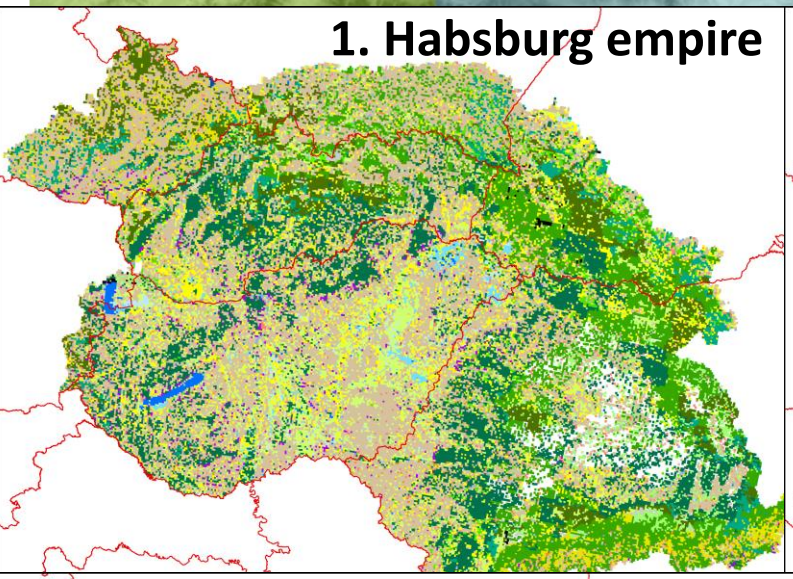
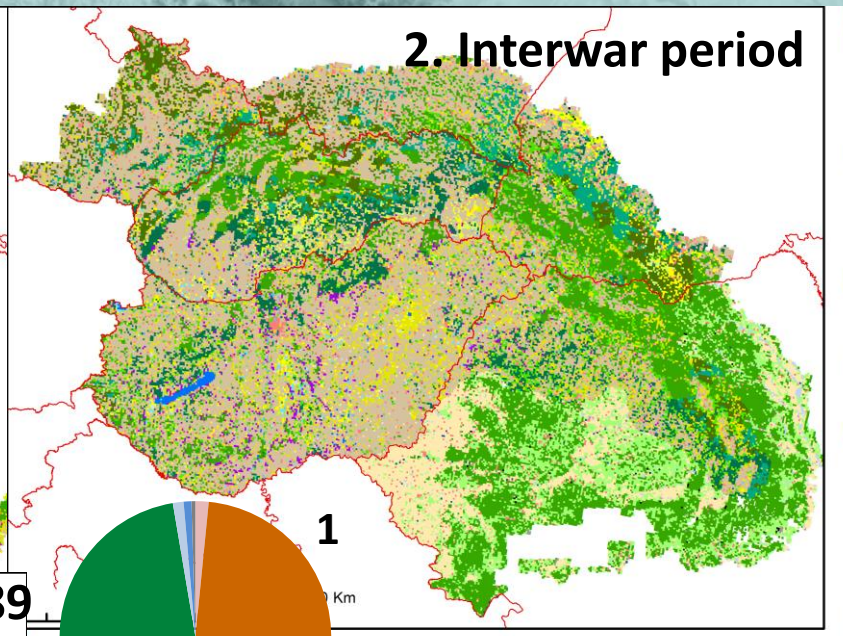
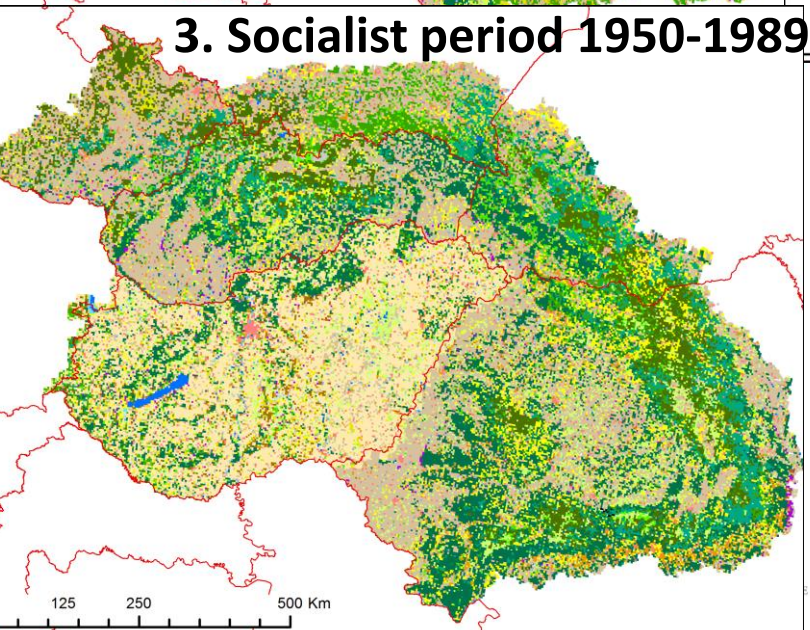
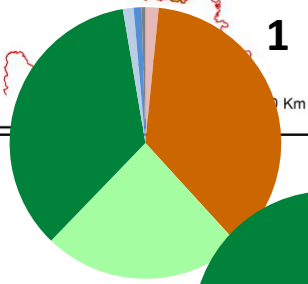
Long-term changes – NASA project

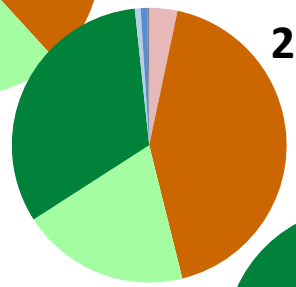


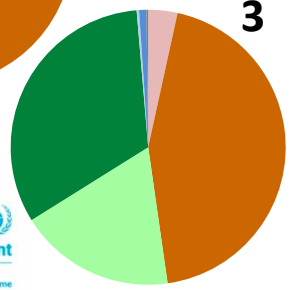




1.Urban/Built-up
2.Agriculture
2.1.Seasonal agriculture
2.2.Perennial agriculture
2.2.1.Orchards
2.2.2.Vineyards
3.Grassland and shrubs
3.1.Meadows and pastures
3.1.1.Meadows
3.1.2.Pastures
3.2.Wooded pastures and sh
3.3.Dwarf pine
4.Forest
4.1.Deciduous forest
4.2.Mixed forest
4.3.Evergreen forest
5.Wetlands
5.1.Reed
5.2.Peat bogs & mires
6.Water
6.1.Standing waters
6.2.Water courses
7.Bare land
7.1.Natural rocks
7.1.1.Solid rocks
7.1.2.Sand
7.2.Quarries
Unidetified







Urban
Agriculture
Grasslands and shrubs
Forest
Wetlands
Water
Bare land

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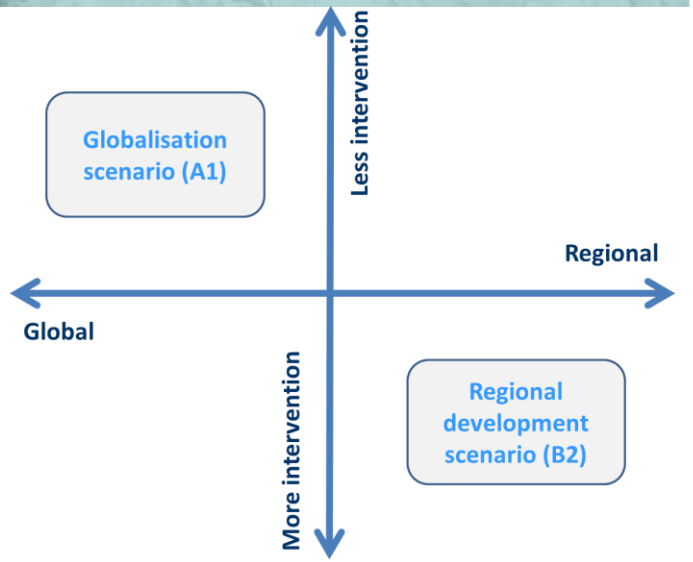
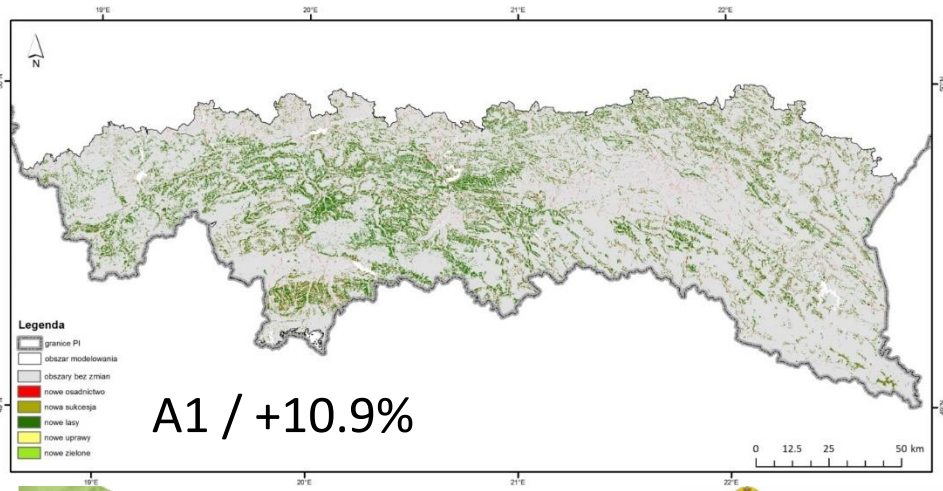
Future projections – forests

Example: Polish Carpathians

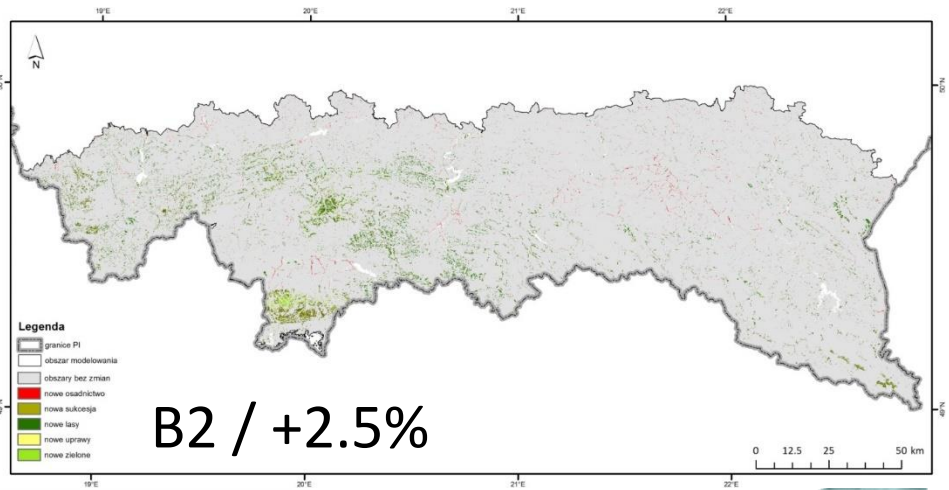
Future projections (till 2060) show forest cover increase, with rates depending on scenario

(*Price et al. 2016, Reg Environ Change)*





A1 / +10.9%



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Future projections – grasslands

Reality - 2003

Modeling - Business as usuall 2030

Reality - 2015

Modeling - Agriculture liberalisation 2030

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BioScene
Scenarios for reconciling biodiversity conservation with declining agricultural use in the mountains of Europe

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Social & institutional factors affecting landscape changes & biodiversity

- Top-down management principles
- Implementation: many stakeholders to be involved → gap between planned & implemented measures
- LU practices often developed for large public holdings - to be redesigned
- Numerous & diverse policies not always enhancing sustainability
- Aging of rural population, depopulation, rural poverty, unemployment etc. often leading to land abandonment
- Weak "owners - their land" connection and a lack of knowledge & managerial experience in sustainable land use management
- Weak cooperation between various land users & stakeholders, lack of trust & co-operation, and inadequate level of stakeholder engagement
- Difficulties in dissemination of best-practices (bottom-up & top-down) and knowledge sharing

Adapted from Nijnik M, Bizikova L, Nijnik A, 2009. Analysing the Development of Small-Scale Forestry in Central and Eastern Europe. *Small Scale Forestry* 8(2): 159-174 and Bizikova L, Nijnik M, Kluvanková-Oravská T, 2012. Sustaining multifunctional forestry through the developing of social capital and promoting participation: a case of multiethnic mountain communities (a case of the Carpathians), *Small Scale Forestry* 11 (3): 301-319

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Conference„Wooded rural landscape rural landscape in Central and Eastern Europe”

20-25 September 2017, Rzesów – Bükk Mts.

- Recent conversion of intimate mixtures of scattered trees, open woods, and grasslands grazed in an extensive way to large blocks of arable, rough meadows and forest ;
- Wood pasture, with its harmonious use of wood products, fruit, pasture land, grazing animals and high biodiversity - true “cultural landscape” and high value natural heritage of the Carpathian region;
- However, the exceptional significance of wood pastures not really recognized, these habitats are continuously damaged or lost, due to the fast and dramatic landscape changes in the larger Carpathian region;
- We therefore propose the establishment new projects and landscape-scale demonstration areas, where local communities would be helped to restore and sustain the traditional way of farming (including silvopastoralism), or experiment different models such as agroforestry.

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Landscape diversity: future

- Identification of high-heterogeneity areas, traditional agricultural landscapes - policies for their maintenance and protection
- Use of GI process/projects for improvement of landscape connectivity and stability
- HNV areas and their management
- Measures to regulate urban sprawl, building outside cities and villages

COP4 reflections

- **Improving the understanding of current drivers of LULCC in the region**
  in particular those related to the accession to EU and impact of EU policies
- **Better understanding the expansion/sprawl of housing (vacation homes) and infrastructure (roads, skiing facilities)**
- **Assessing changes within broad land cover categories**
  (e.g., changes among forest types, different types of grasslands)
- **Mapping agricultural intensity:**
  both inputs (fertilizer, pesticide, field size) and outputs (yields) - combination of satellite and cenuss data
- **Better understanding ownership maps (and changes therein)**

Conclusions

- Global changes – drivers of changes and pressures: need of adaptation and mitigation
- Biodiversity: still need to improve knowledge
- Landscape connectivity studies for big mammals
- Recent quick development in Carpathians and lifestyle changes versus biodiversity and landscape values maintenance
- High Nature Value approach to management of agricultural and forest land – one possible solution
- Role of spatial planning and (supra) national policies in mitigation and regulation of urban sprawl and landscape fragmentation
- Further development of workflows for land cover and land use change detection, delivery message to policy makers
- More transboundary and interdisciplinary projects
- Promotion of social innovation & innovative actions (see e.g. EU H2020 funded SIMRA project www.simra-h2020.eu)


Thank you for attention
http://carpathianscience.org/