



# 200 years of land change in the Carpathian region

*Determinants of change and land use legacies*



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# Land change & legacies

Carpathians

Long term  
change

- Land change active for centuries

*(DeFries, 2004, Goldweijik, 2001)*

Forests

- Long term drivers of change: socio-economic, institutions, globalization, etc.

*(Meyfroid et al 2010, Geist and Lambin 2002, Geist and Lambin 2004)*

Agriculture

- Legacy effects for current ecosystems patterns

*(Foley et al 2005, Bellemare et al 2002, Thompson et al 2013)*

Outlook



# Questions

Carpathians

Long term  
change

Forests

Agriculture

Outlook

Why the Carpathians?

How do we assess long term change?

Forest and agriculture:

- Drivers of change
- Role of legacies

# Study area

Carpathians

Long term  
change

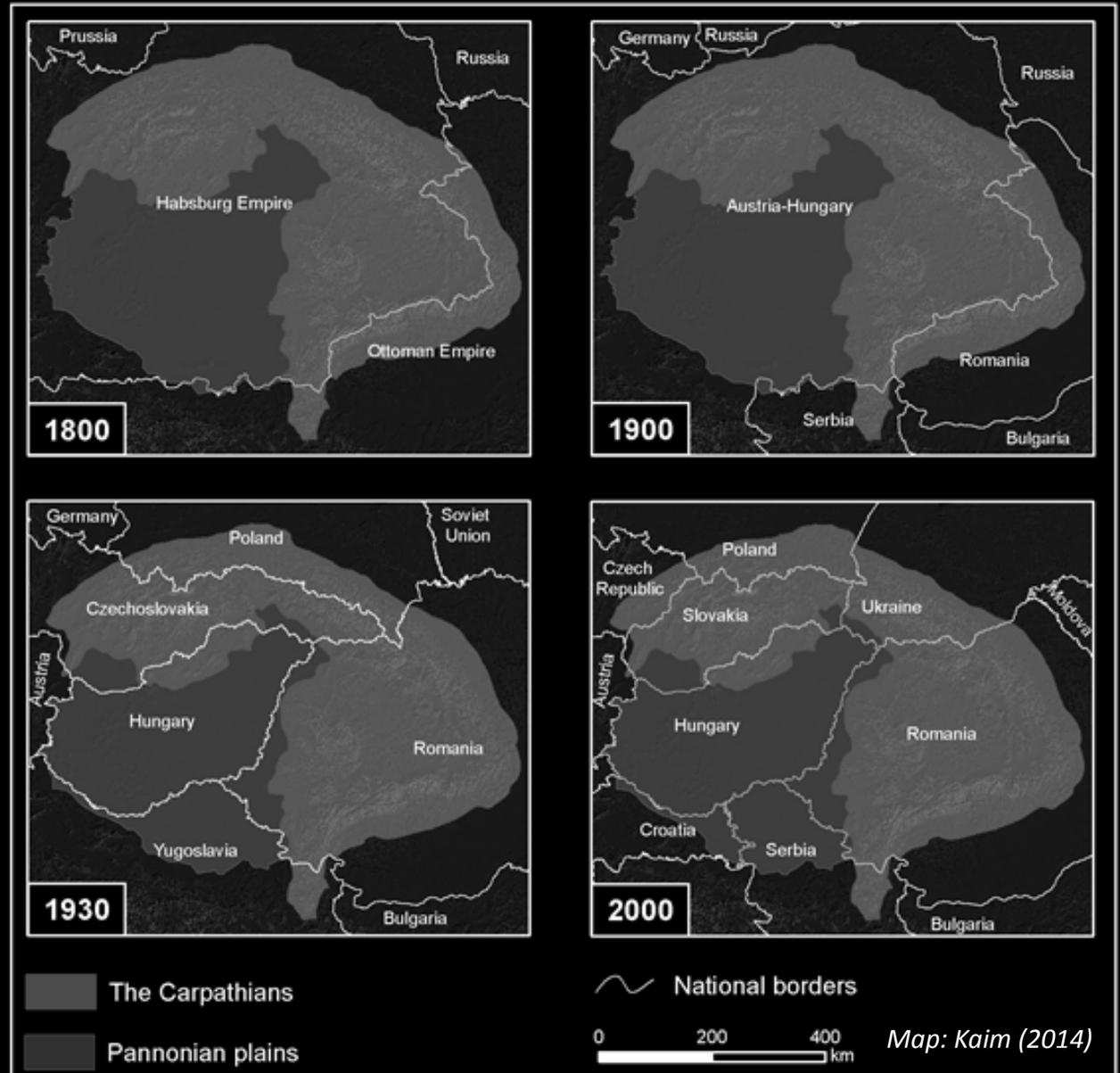
- Carpathians: 'natural experiment'

Forests

- Management regimes, land use legacies

Agriculture

Outlook



Carpathians

# Study area

Long term  
change

Forests

Agriculture

Outlook



Images: Adrian Petrisor

# The Carpathians

Carpathians

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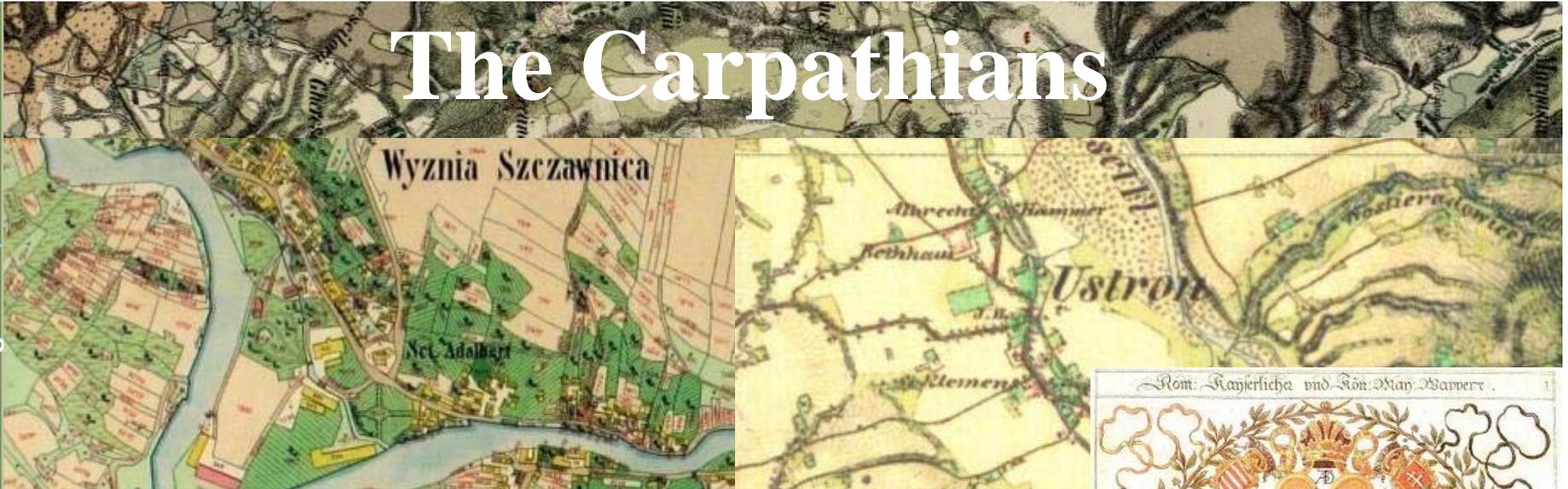
*Foto: Adrian Petrisor*



# The Carpathians

Carpathians

Long term  
change

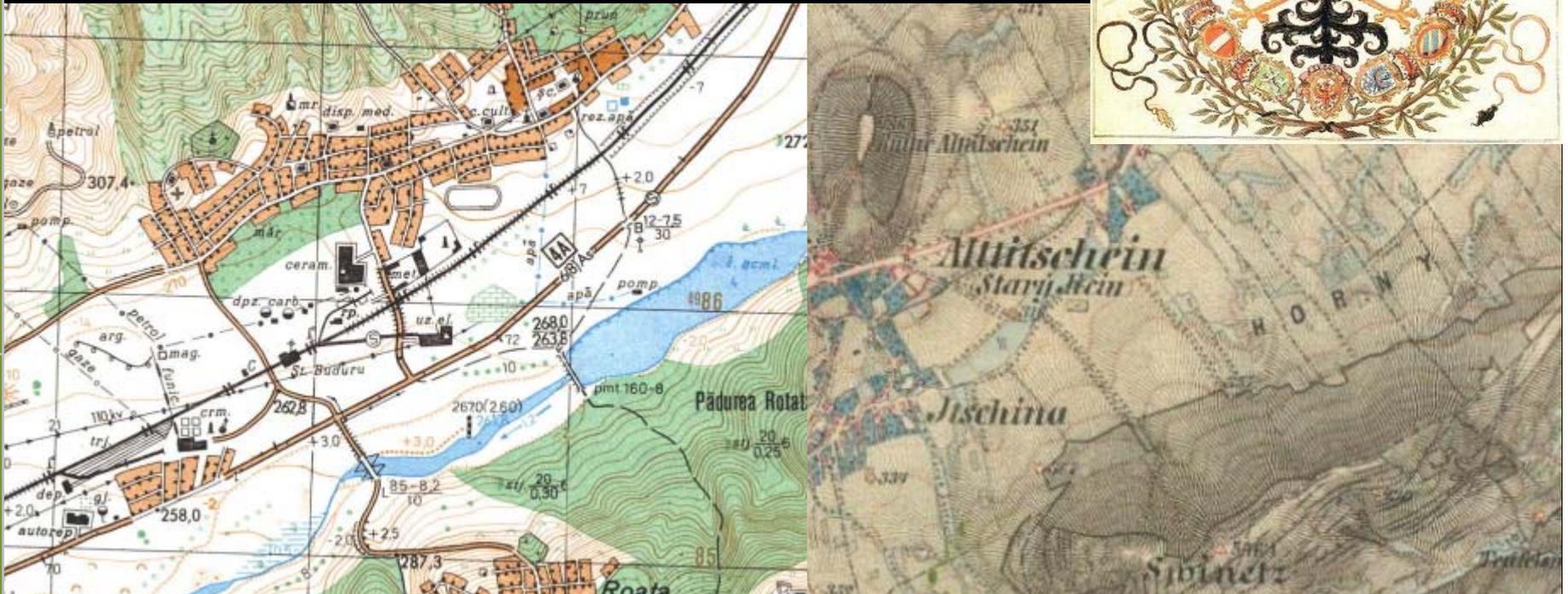


## Data sources

Forests



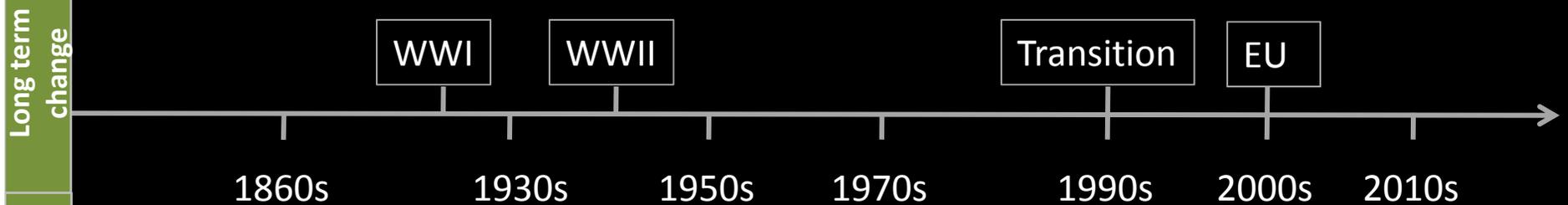
Agriculture



Outlook

# Overall change trend mapping

## Novel approach to mapping long term change



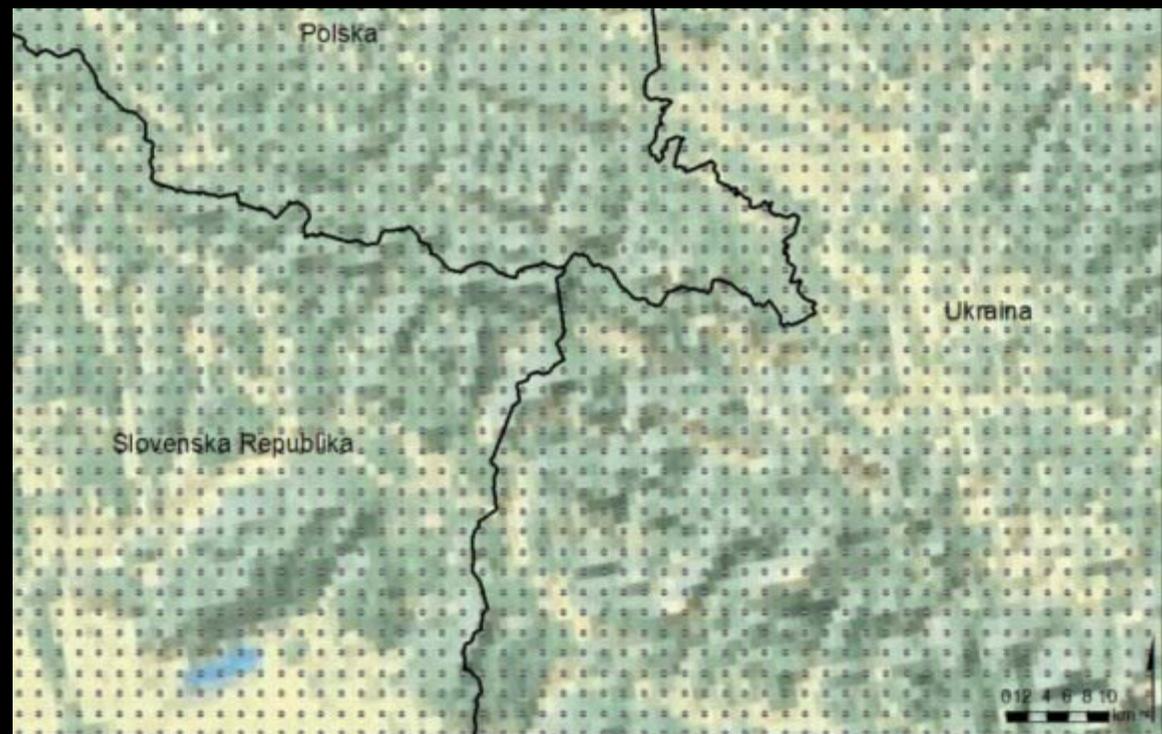
Forests

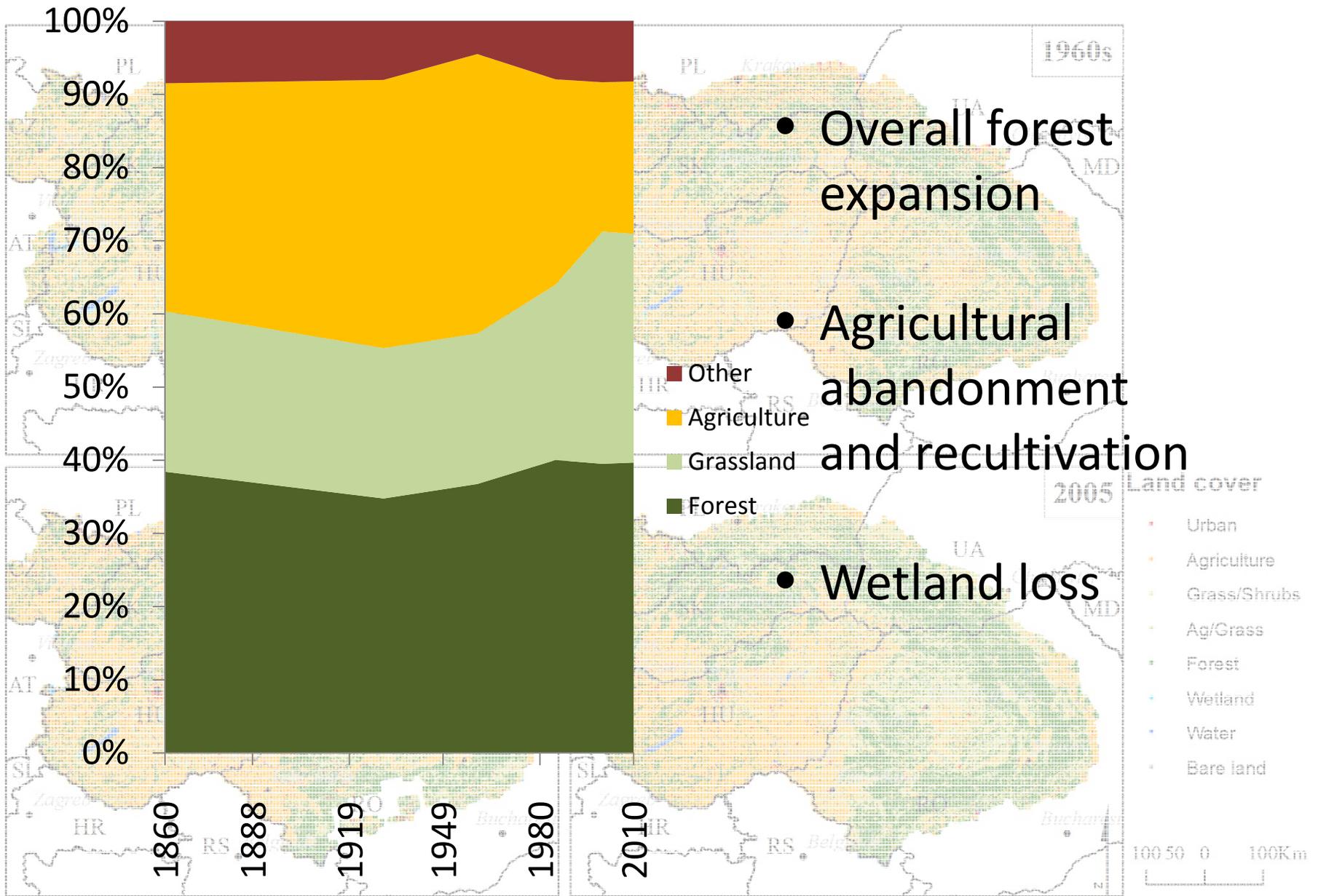
- Urban
- Agriculture
- Grasslands and shrubs
- Forest
- Wetland
- Water
- Bare land

Agriculture

Outlook

Total: 92 000 points  
Area: 350 000 km<sup>2</sup>





# Forests – long term change

Carpathians

Long term  
change

Forests

Agriculture

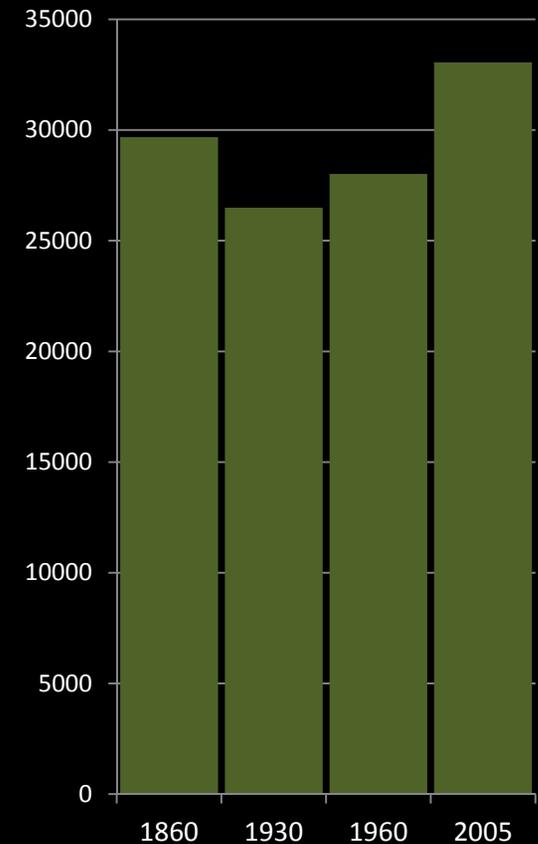
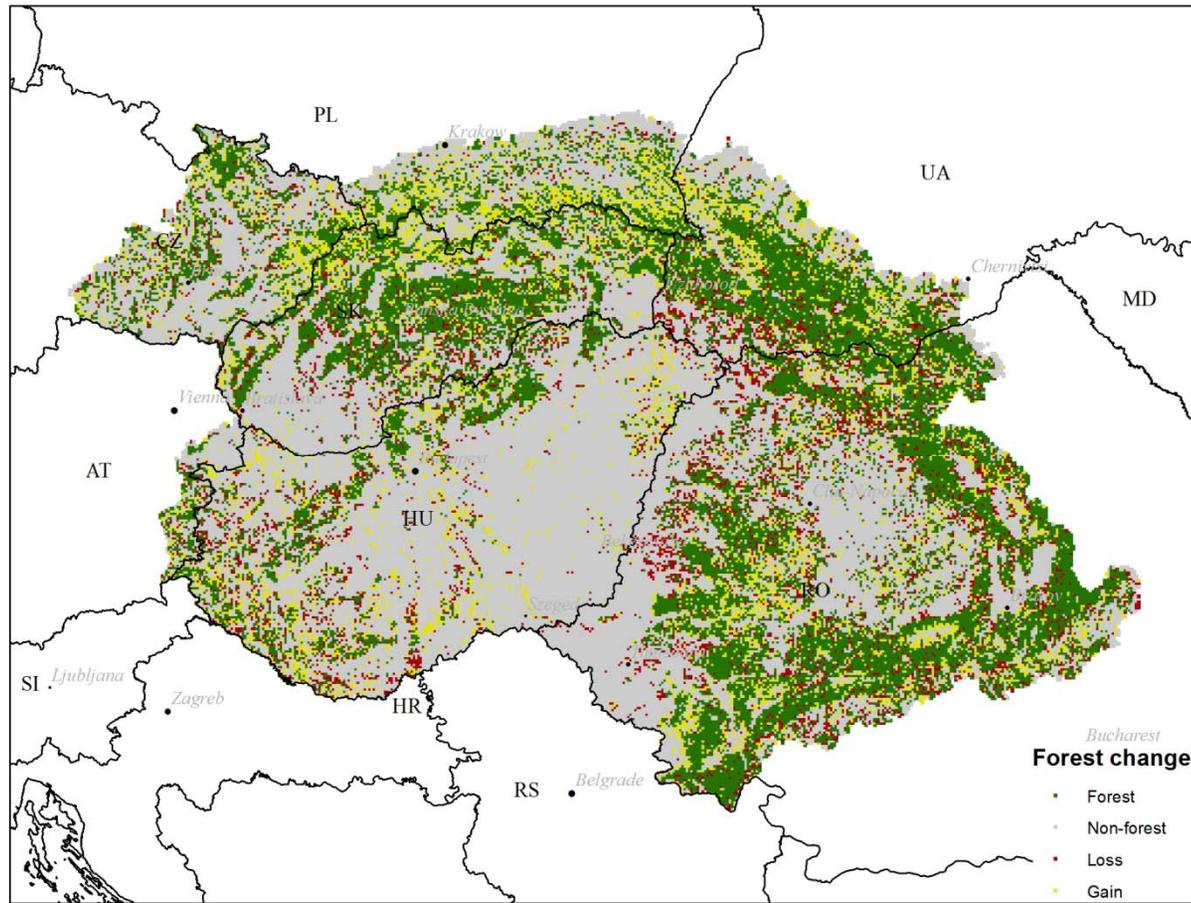
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<http://adypetrisor.blogspot.com>

*Foto: Adrian Petrisor*



# Forests – 1860 to 2005



## Forest transition in the 1930s

- Habsburg management and War, agricultural expansion
- Abandonment of marginal areas, reforestation plans

# Forests – 1985 - 2010

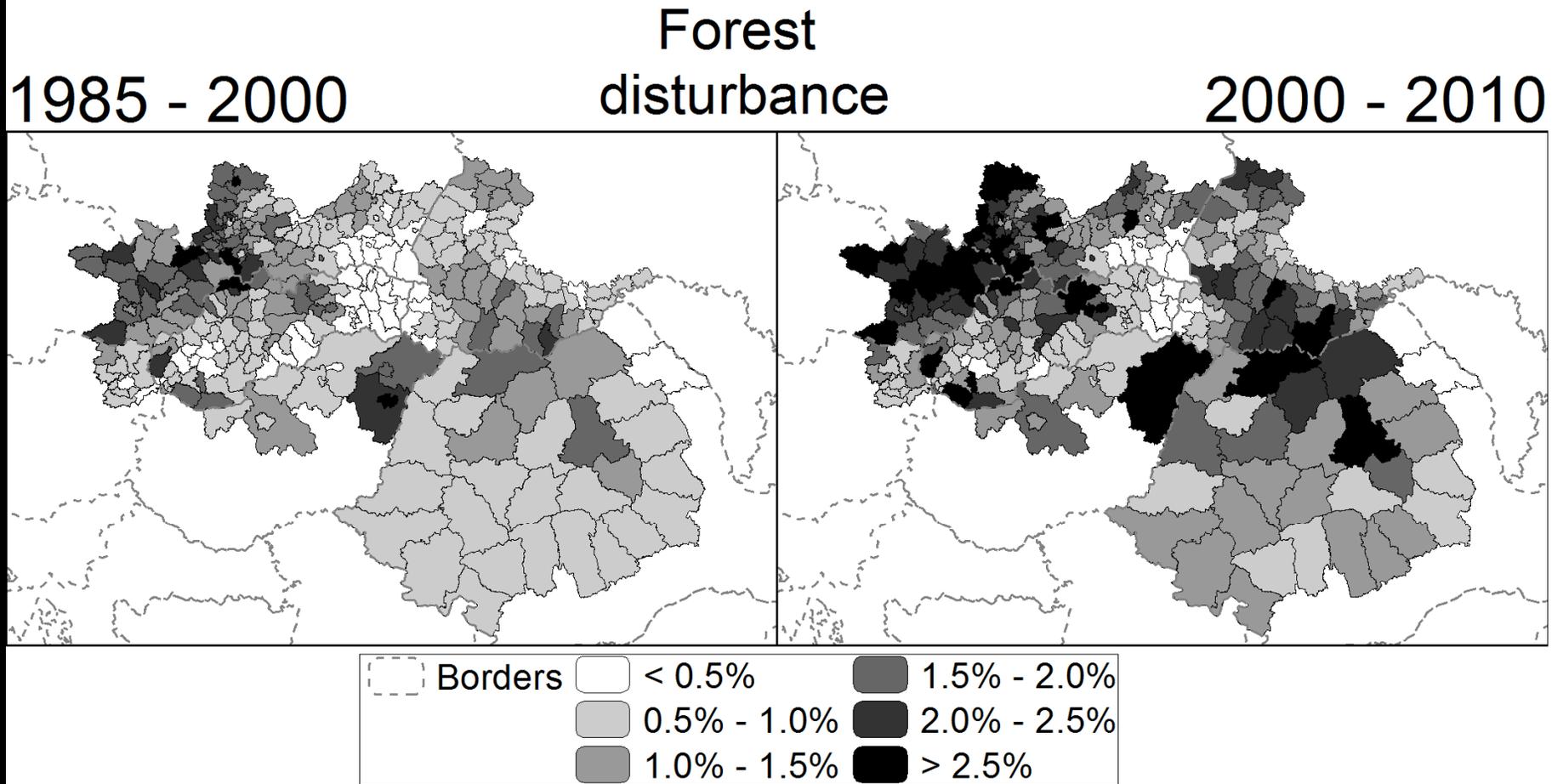
Carpathians

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Outlook



# Forests – drivers of change

## Spatial determinants of change and legacies

Long term change

WWI

WWII

Transition

EU

1860s

1960s

1985

2000

2010

Forests

**disturbance**  $_{1985-2010} \sim \text{forest}_{1860} +$

elevation + slope + temperature +  
precipitation + soil + dist. city + dist. road  
+ dist. river + dist. settlement + travel  
time + dist. border + population

Outlook

# Forests – area change legacies

Carpathians

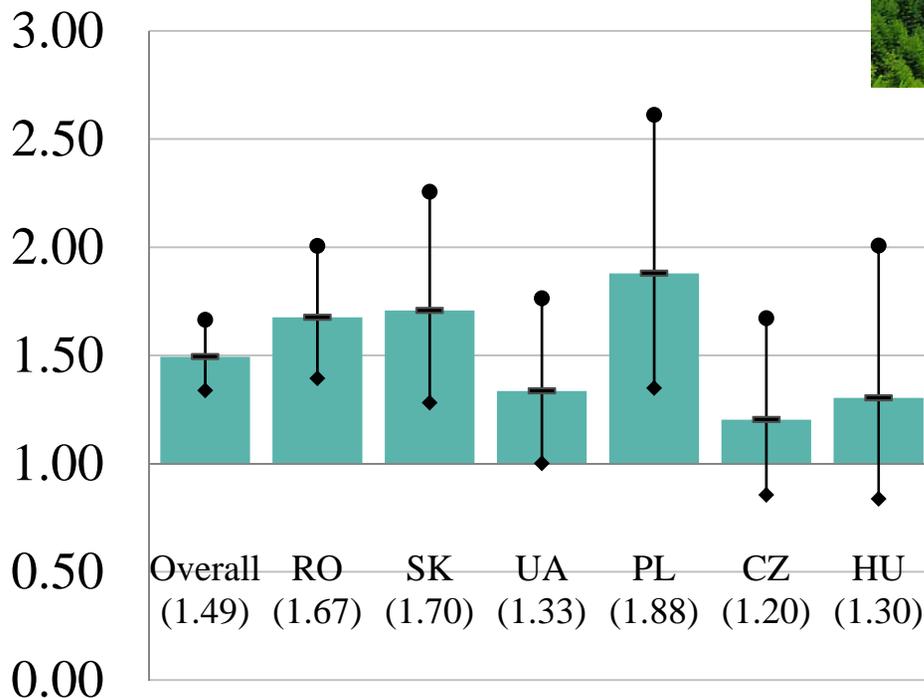
Long term  
change

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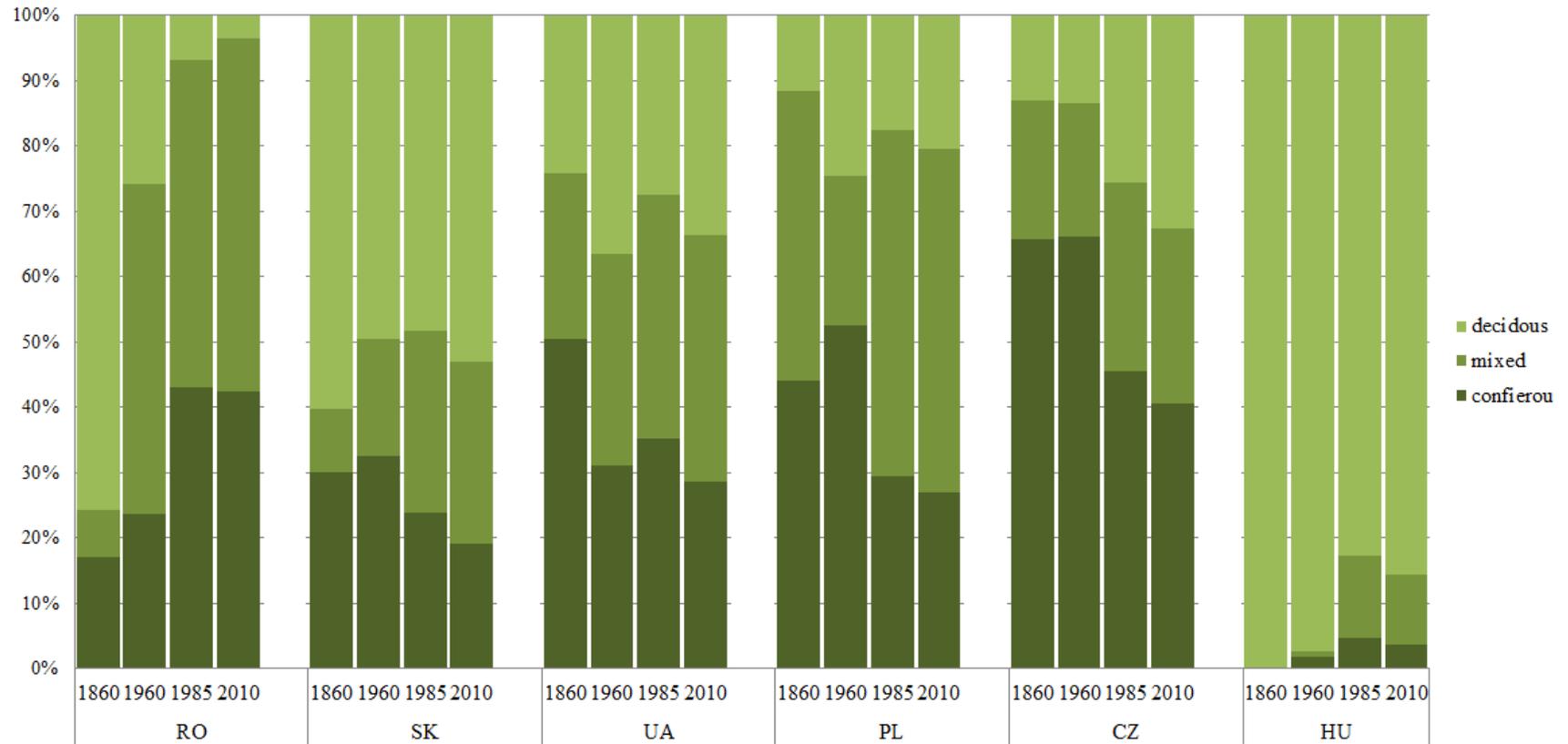
More disturbance in  
new forests than in  
old forests



Plantations of  
monocultures outside  
forest ranges – prone to  
disturbance

Land abandonment –  
forest expansion

# Forests – management legacies



Decrease of coniferous: harvest -> natural regeneration (mixed species), management for mixed (PL, CZ)  
 Increase of coniferous: harvest -> restocking with spruce plantations (RO)

# Spatial determinants

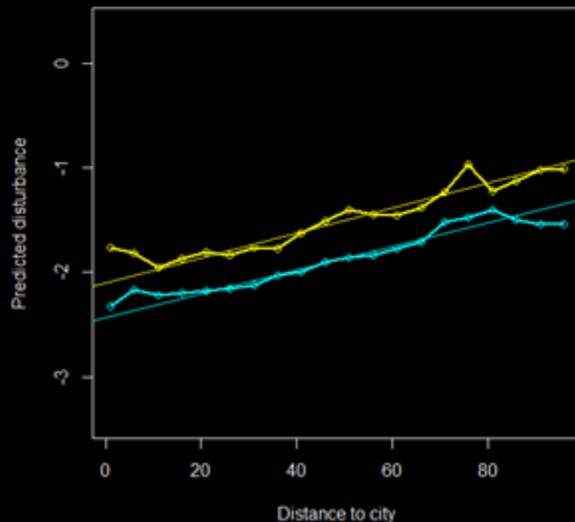
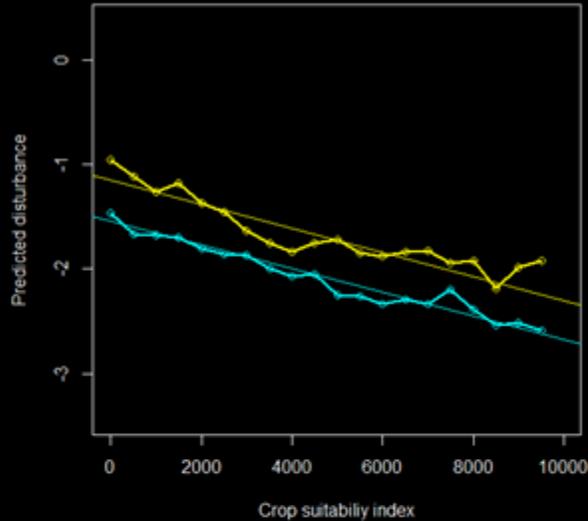
Carpathians

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Outlook



- Country: institutional and socio-demographic context
- Remoteness (distance to city, less road access)
- Poor soils (acidification of spruce plantation soils)



# Forest summary

Carpathians

Long term  
change

Forests

Agriculture

Outlook

- Forest area increase overall, forest transition 1930s
- Forest disturbance after 1990
- Legacies alongside other spatial determinants

# Agriculture

Carpathians

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Agriculture

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# Agricultural change 1860-2005

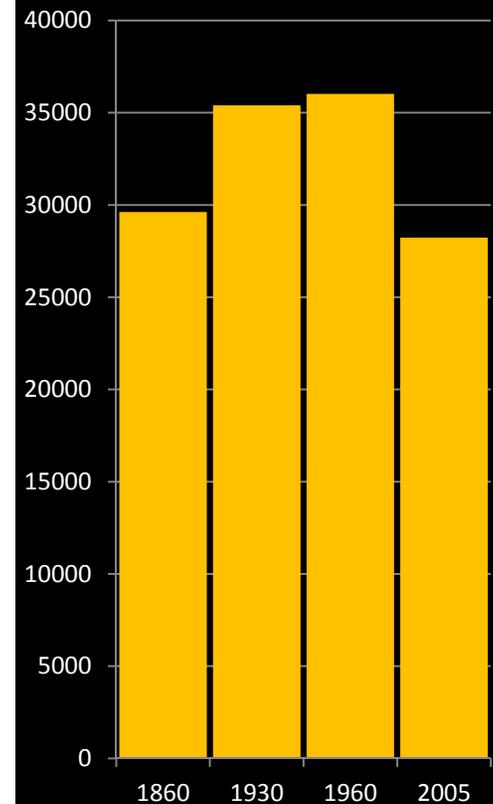
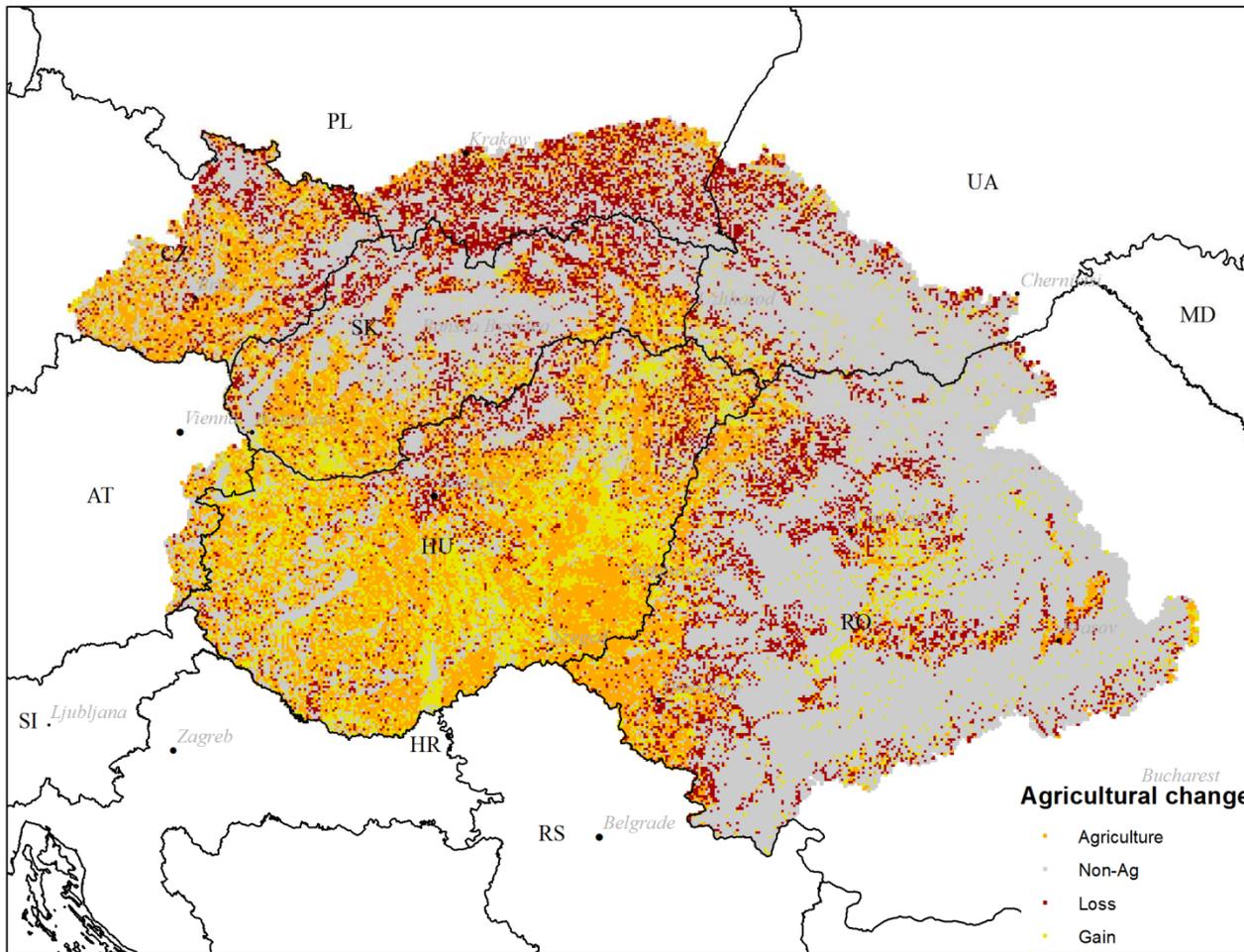
Carpathians

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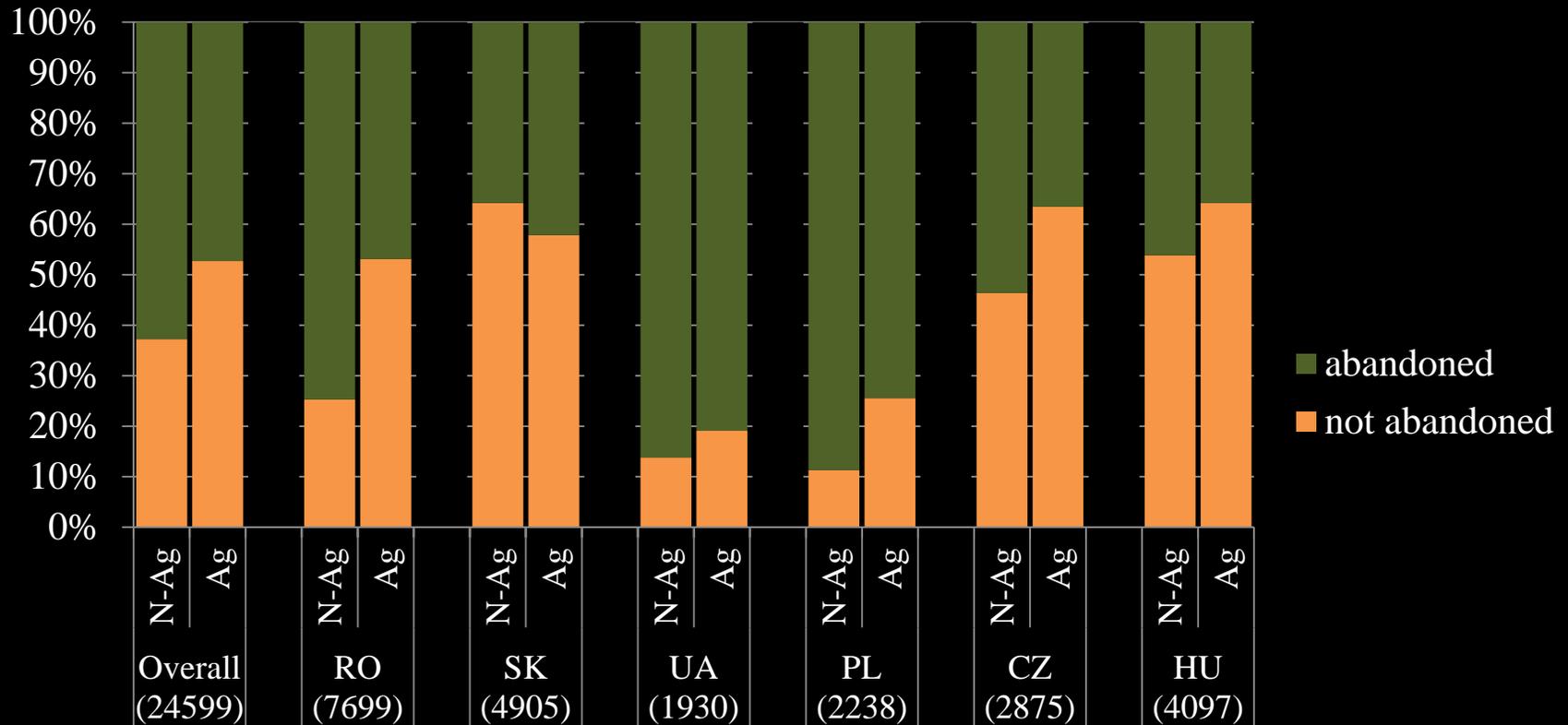
Agriculture

Outlook



Widespread abandonment, much earlier than expected – 1960s

# Agricultural legacies



- Agricultural legacies: more abandonment in area not used for agriculture in 1860

# Agriculture summary

Carpathians

Long term  
change

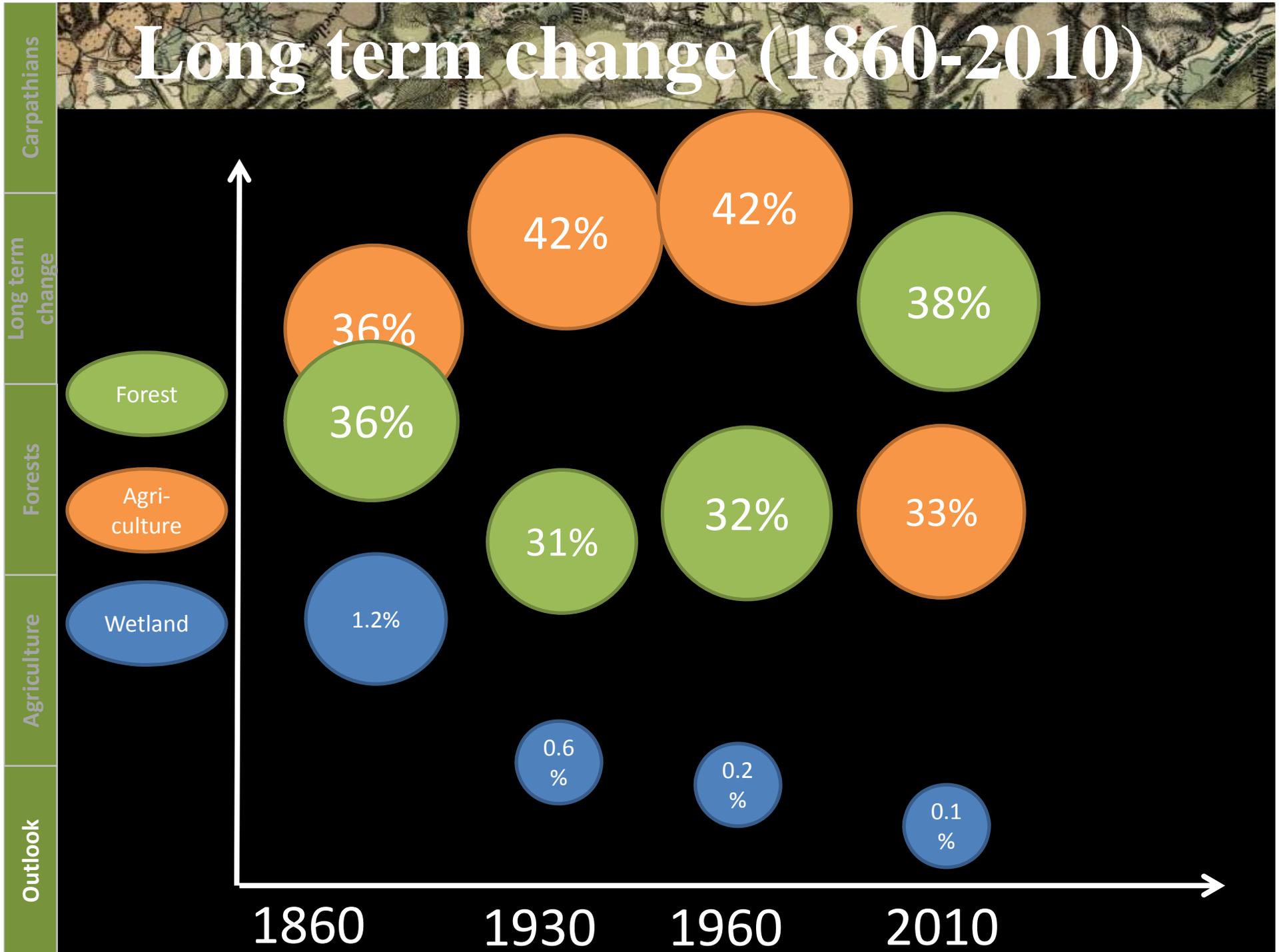
Forests

Agriculture

Outlook

- Abandonment: marginal areas during socialist time
- Abandonment: large farms 1985-2000, institutional
- More abandonment in 'new agriculture areas'

# Long term change (1860-2010)



# Summary

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Agriculture

Outlook

- Land change science:
  - long term land system change
  - drivers of change
  - role of legacies
- Longitudinal studies for management planning



Thank you!



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