

Historical range of variability in temperate mountain spruce forests in Central Europe

M. Svoboda

(svobodam@fld.czu.cz)

***Czech University of Life
Sciences, Faculty of Forestry,
Czech Republic***

***M. Theodosius, I. Biris, ICAS
Romania***

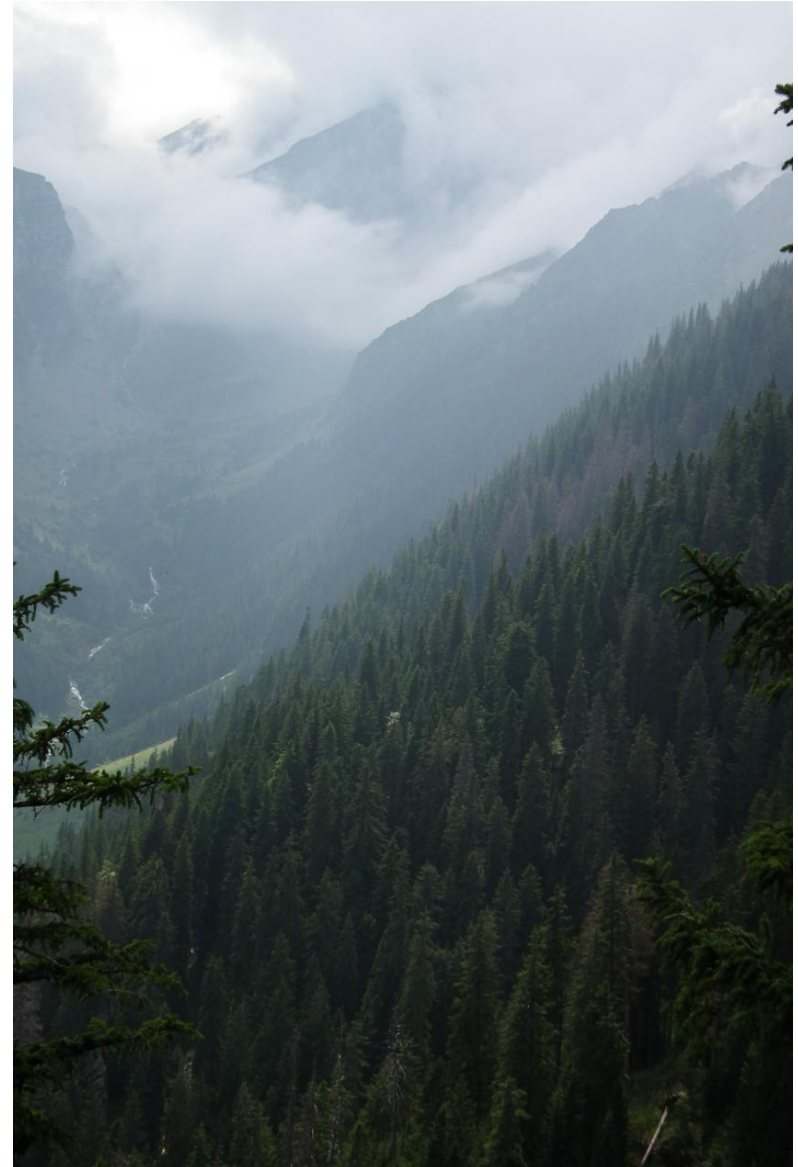
***P. Janda, R. Bace, K. Boublik, J.
Douda, CLUS CZ***

T. Nagel , UL Slovenia

S. Fraver , FS USDA USA

P. Samonil , VUKOZ CZ

many others













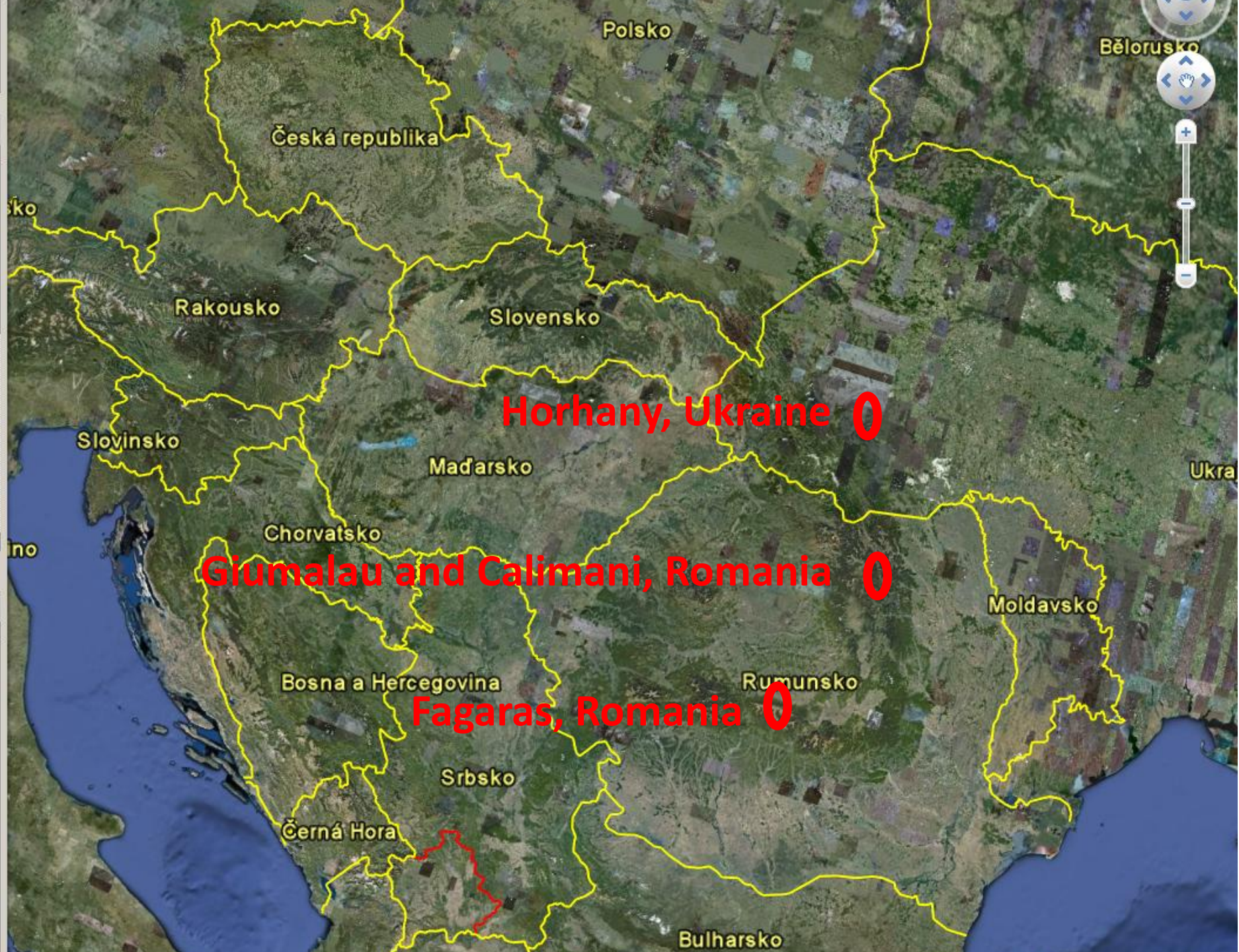
Questions?

Are these severe events part of the historical range of variability?

Sustainable management of the spruce forests in managed forest and in protected areas.

Aim of the study

- studying of the disturbance regime in the spruce temperate forests



Methods

- selecting primary spruce stand
- focus on the landscape scale dynamics
- grid of circular plots (0.1 ha) over the landscape
- basic tree layer parameters (dhb, height, position, etc.)
- 25 cores per plots
- dead wood, regeneration, light conditions

Disturbance history analysis

- standard dendrochronological procedures
- dating of canopy accession (date when the tree accessed canopy) through gap recruitment or release
- in total about 130 plots for the first region with over 3500 trees cores



the zone of rapid
early growth

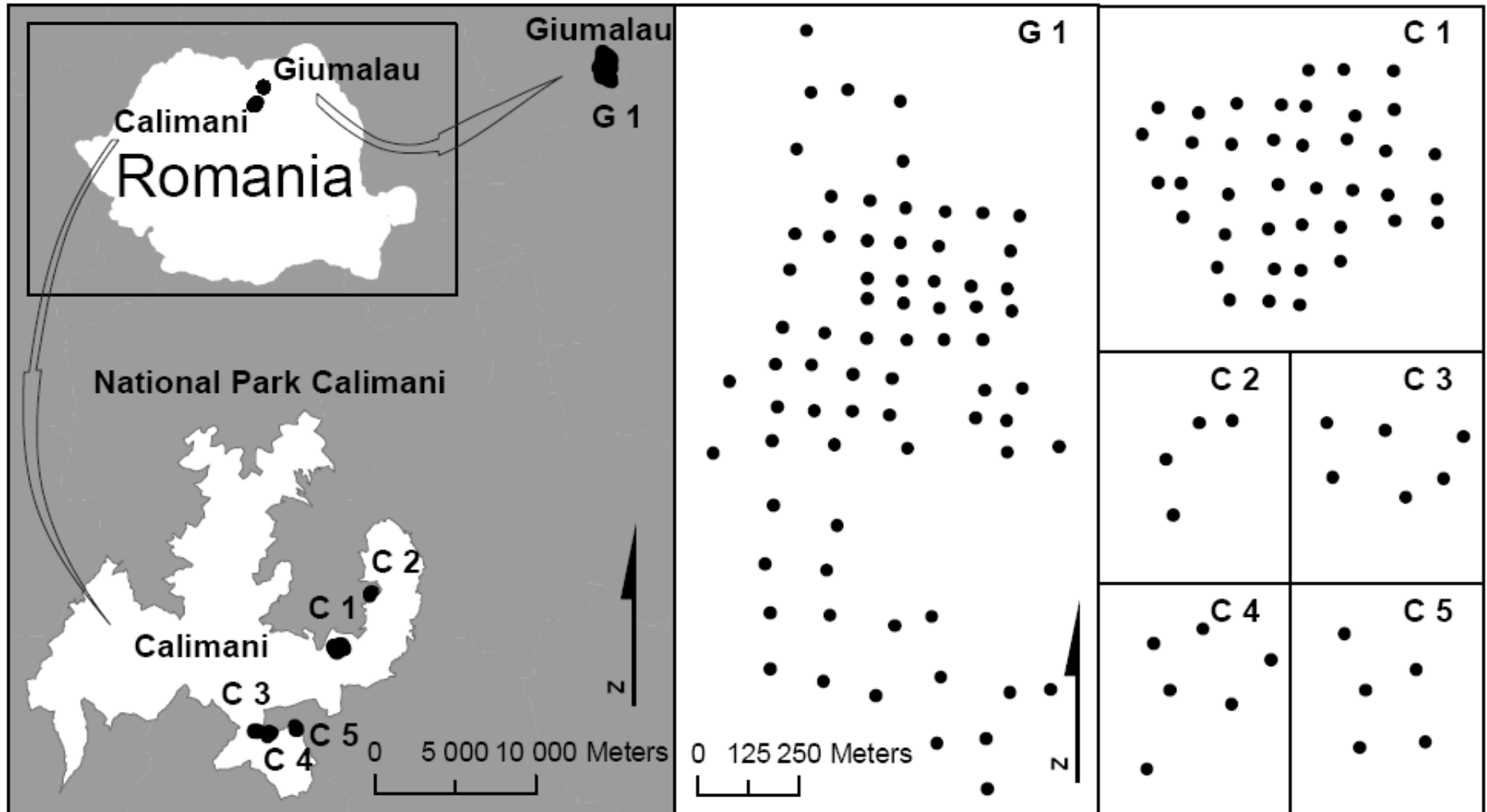
gap origin



the zone of slow
early growth with
abrupt growth
change

release from
suppression

Map of the study area showing location of the stands and plots in Giumalau (G1) and Calimani (C1, C2, C3, C4 and C5)

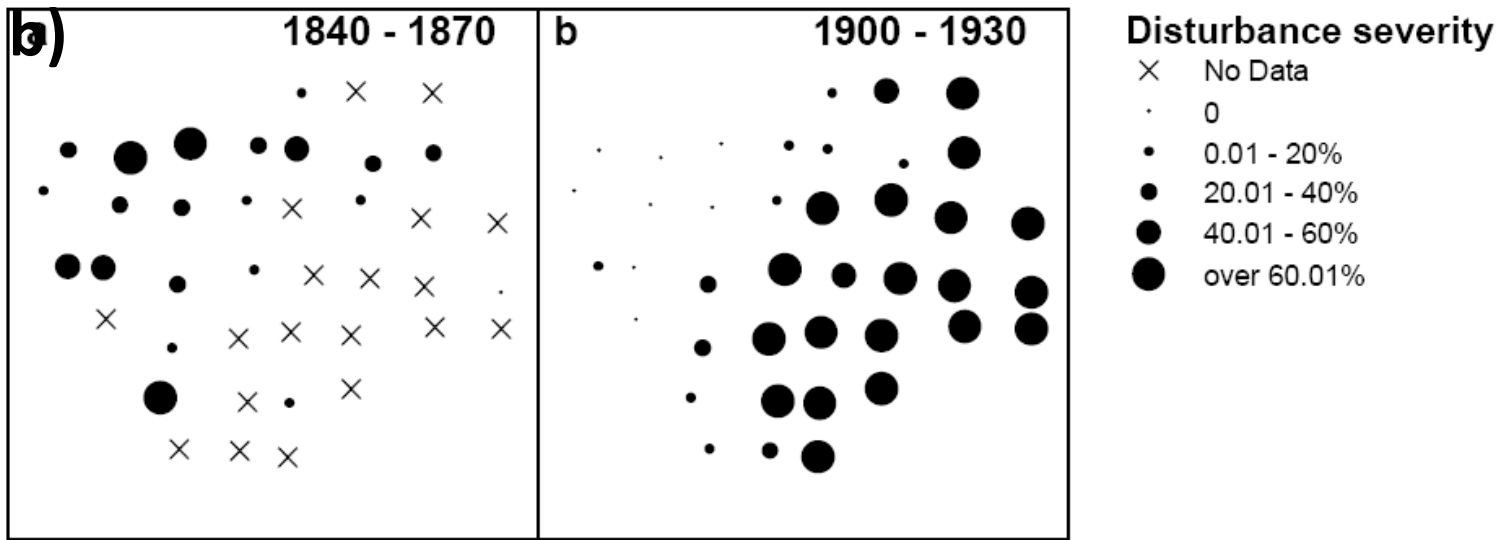
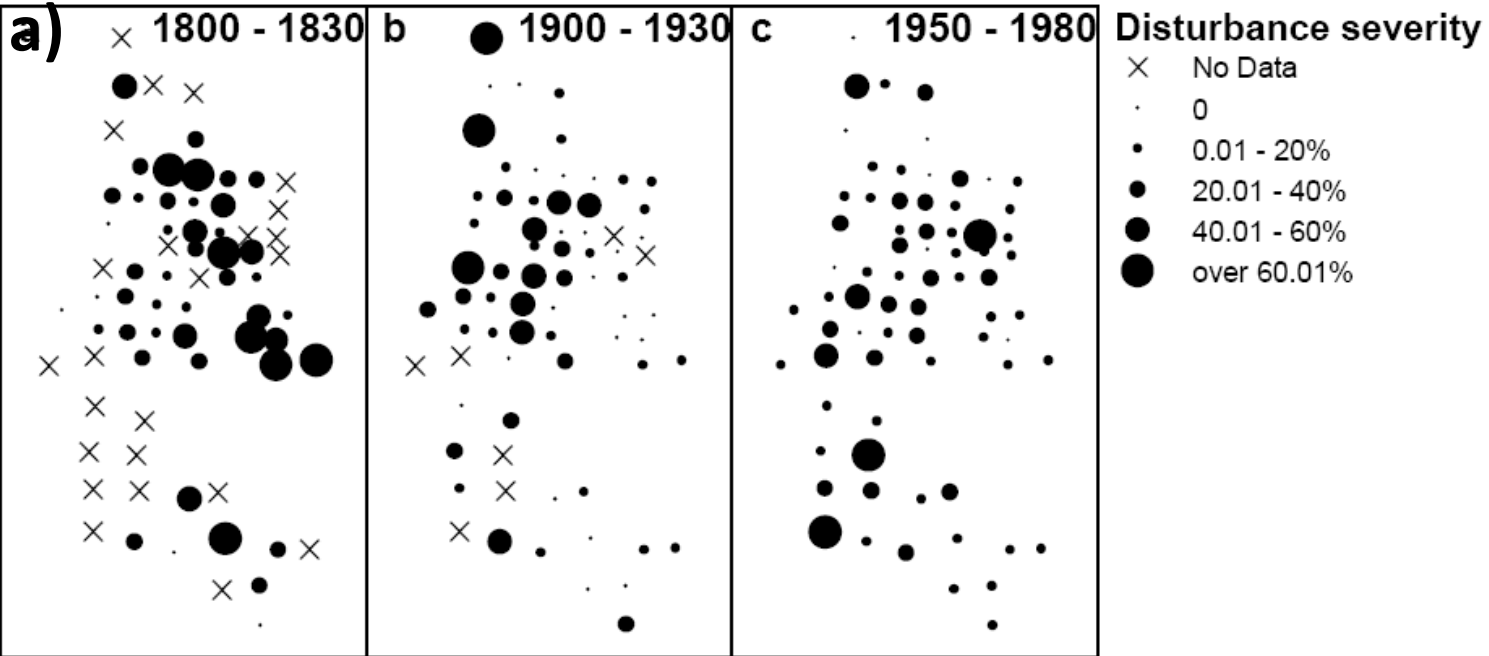


Disturbance history severity

Proportion of plots with disturbance severity classes over 60 and 80 %. The periods with highest number of plots fulfilling the 60 and 80 % criteria are shown of each stand in column

Disturbance severity	over 80 %		60.1 – 80 %	
Study sites	Percentage of plots	Important decades	Percentage of plots	Important decades
Giumalau G1	11 %	1800-1830	25 %	1800-1830
		1900-1930		1900-1930
		1950-1980		1950-1980
Calimani C1	50 %	1900-1930	30 %	1900-1930
		1840-1870		1840-1870
Calimani C2	0 %		0 %	
Calimani C3	100 %	1930-1960	0 %	
Calimani C4	0 %		50 %	1800-1830
				1900-1930
Calimani C5	0 %		60 %	1800-1830

Maps of disturbance severity classes for Giumalau (a) and stand Calimani C1 (b) for periods with the most severe disturbance

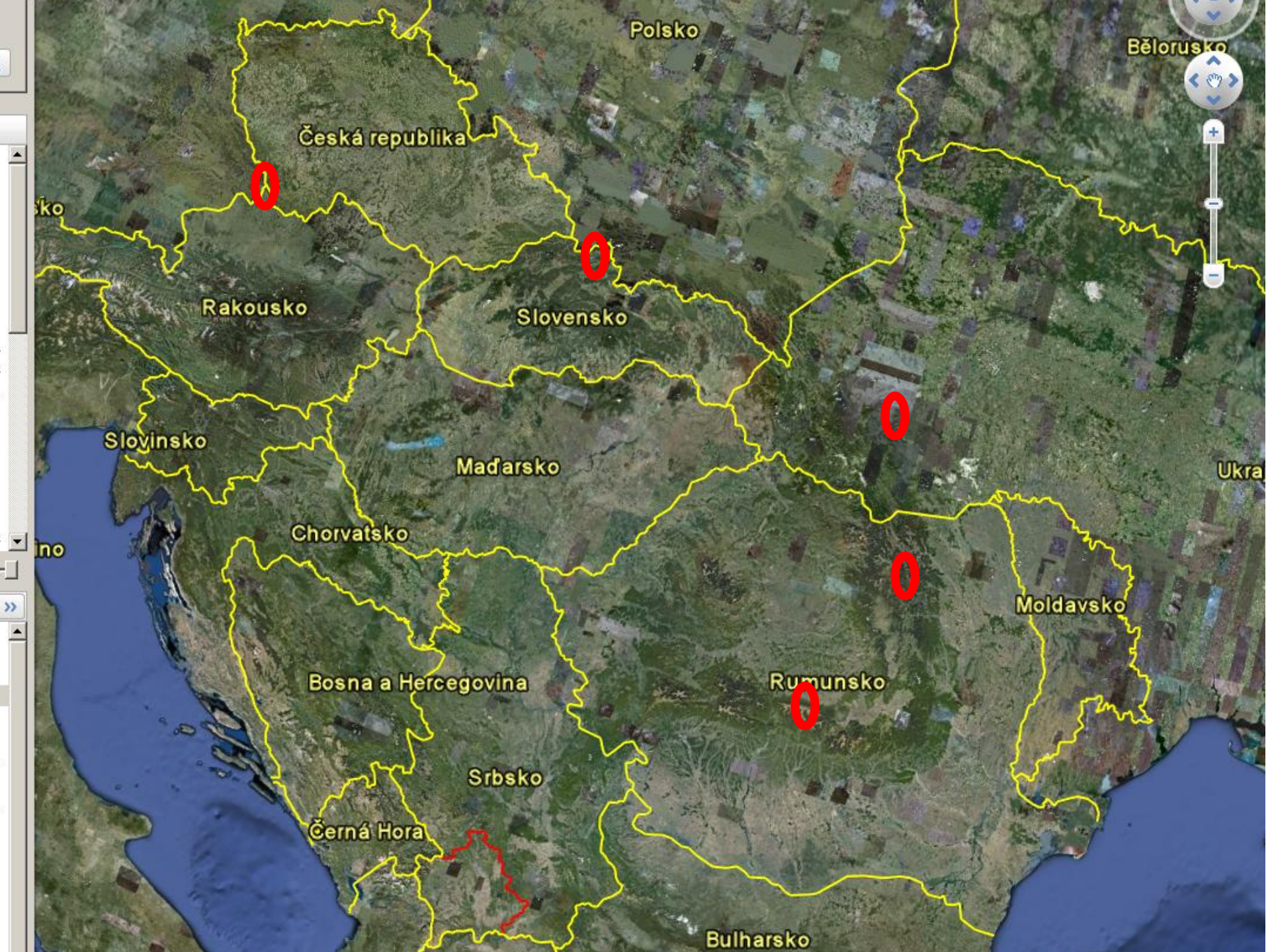


Results

- more than half of the plots (total of 132 plots) showed high severity disturbance
- Calimani landscape showed higher proportion of plots with severe disturbance compared to Giumalau
- stand replacing disturbance on the scale of 20 ha in Calimani
- clustering of the high severity disturbance on the plot level
- in Giumalau more than half of the plots did not experience high severity disturbance
- considerable spatial and temporal variation in disturbance pattern across landscape in disturbance severity







Study area: Bohemian Forest NP – Czech. R and Germany, Tatra Mts. NP – Slovakia and Poland





Disturbance history of an old-growth sub-alpine *Picea abies* stand in the Bohemian Forest, Czech Republic

Miroslav Svoboda, Pavel Janda, Thomas A. Nagel, Shawn Fraver, Jan Rejzek & Radek Bače



Ke
De
Dis
No
Na

Re
Ac
Co

nd
e,
t-
o-
in

Dating of canopy accession

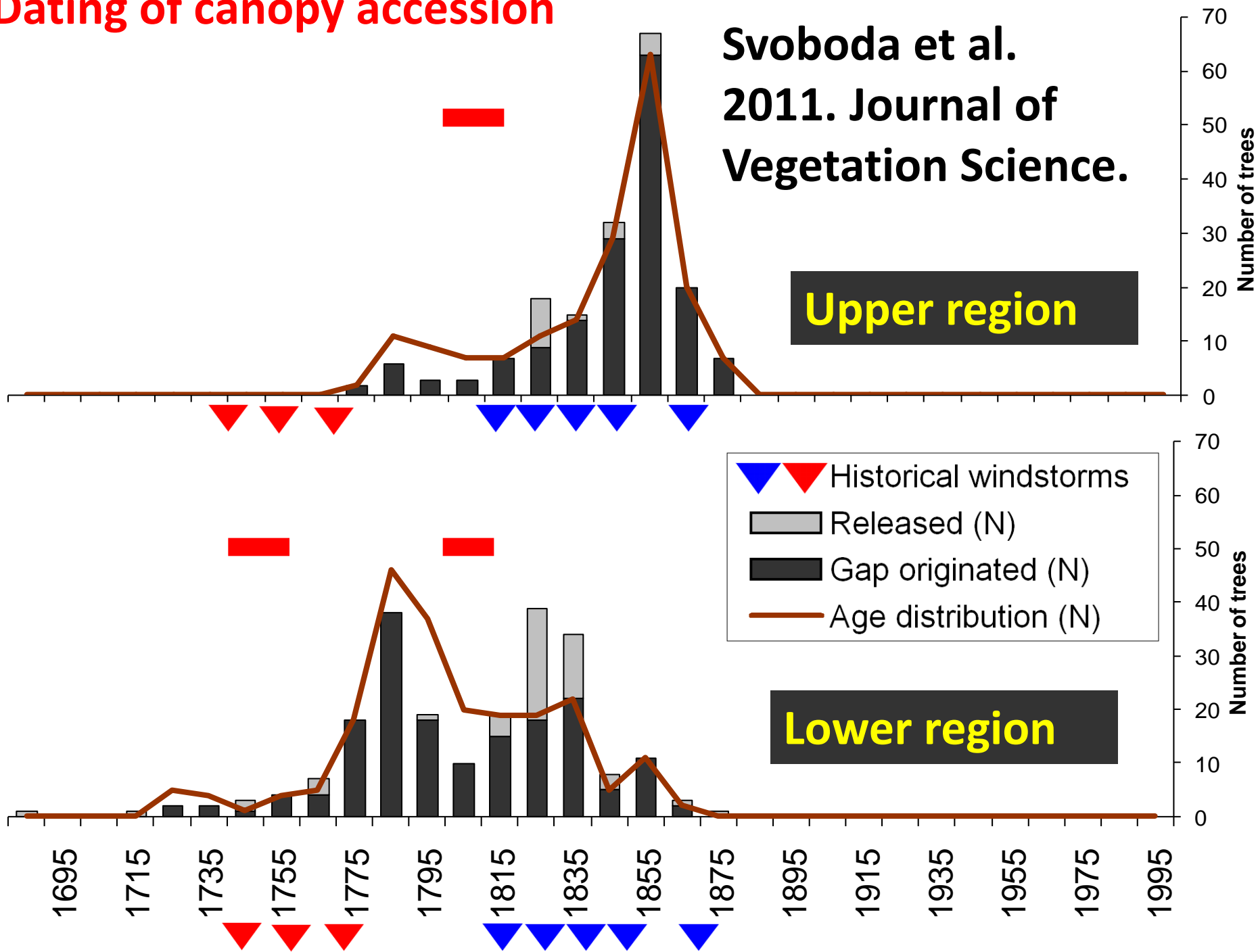
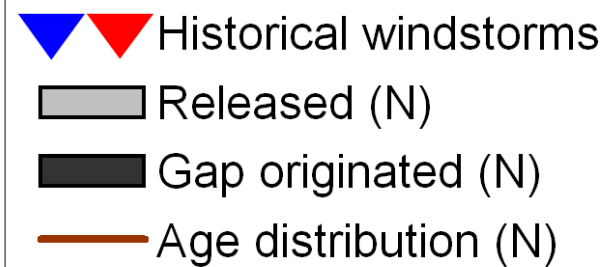
Svoboda et al.
2011. Journal of
Vegetation Science.

Number of trees

Upper region

Number of trees

Lower region



Bohemian Forest – Czech. R and Germany

Historical disturbances (windstorms and bark beetle outbreaks) in the Bohemian Forest in the 18th and 19th century

Date	Disturbance agent	Description
1710	Windstorm	Heavy damage by windstorm. Exact extent unknown.
1718 - 1728	Windstorms and bark beetle outbreak	Damage by windstorm followed by bark beetle outbreak.
1740	Windstorm	Heavy damage by windstorm. Exact extent unknown.
1778	Windstorm	Unknown damage by windstorm
1801	Windstorm	Unknown damage by windstorm
1812 - 1813	Windstorms	Unknown damage by windstorm
1821 - 1822	Windstorms	Unknown damage by windstorm
1833 - 1840	Windstorms and bark beetle outbreak	Heavy damage by windstorm followed by bark beetle outbreak. Estimated volume of the disturbed wood is about one-half million m ³ .
1853	Windstorm	Unknown damage by windstorm
1859 - 1861	Windstorms	Unknown damage by windstorm
1868 - 1880	Windstorms and bark beetle outbreak	Heavy damage by windstorm followed by bark beetle outbreak. Estimated volume of the disturbed wood is about three million m ³ .

Bohemian Forest – Czech. R and Germany

Conclusion: severe windstorms and bark beetle outbreaks could play in the past important role in the forest dynamics



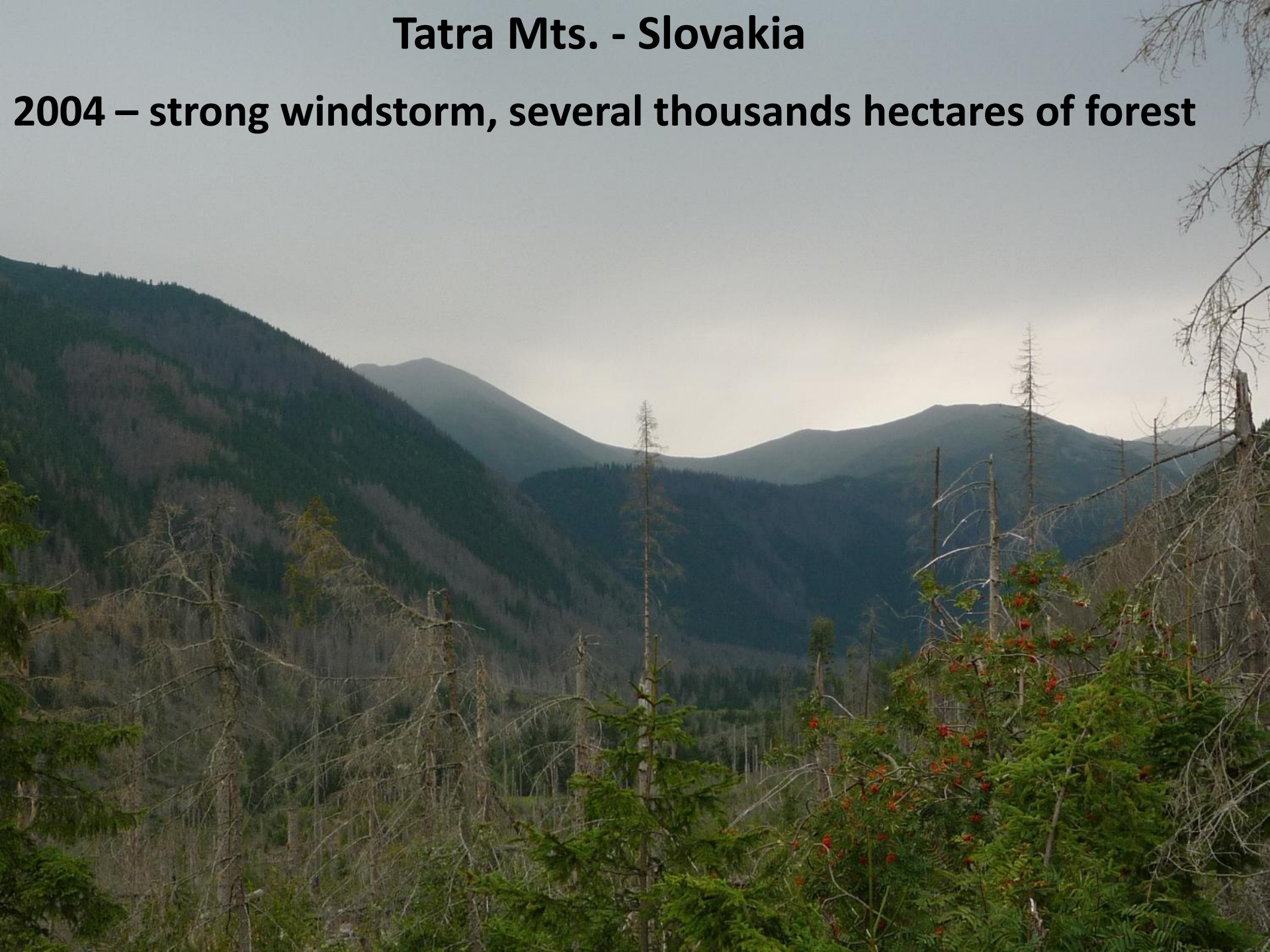
A tree-ring reconstruction of wind disturbances in a forest of the Slovakian Tatra Mountains, Western Carpathians

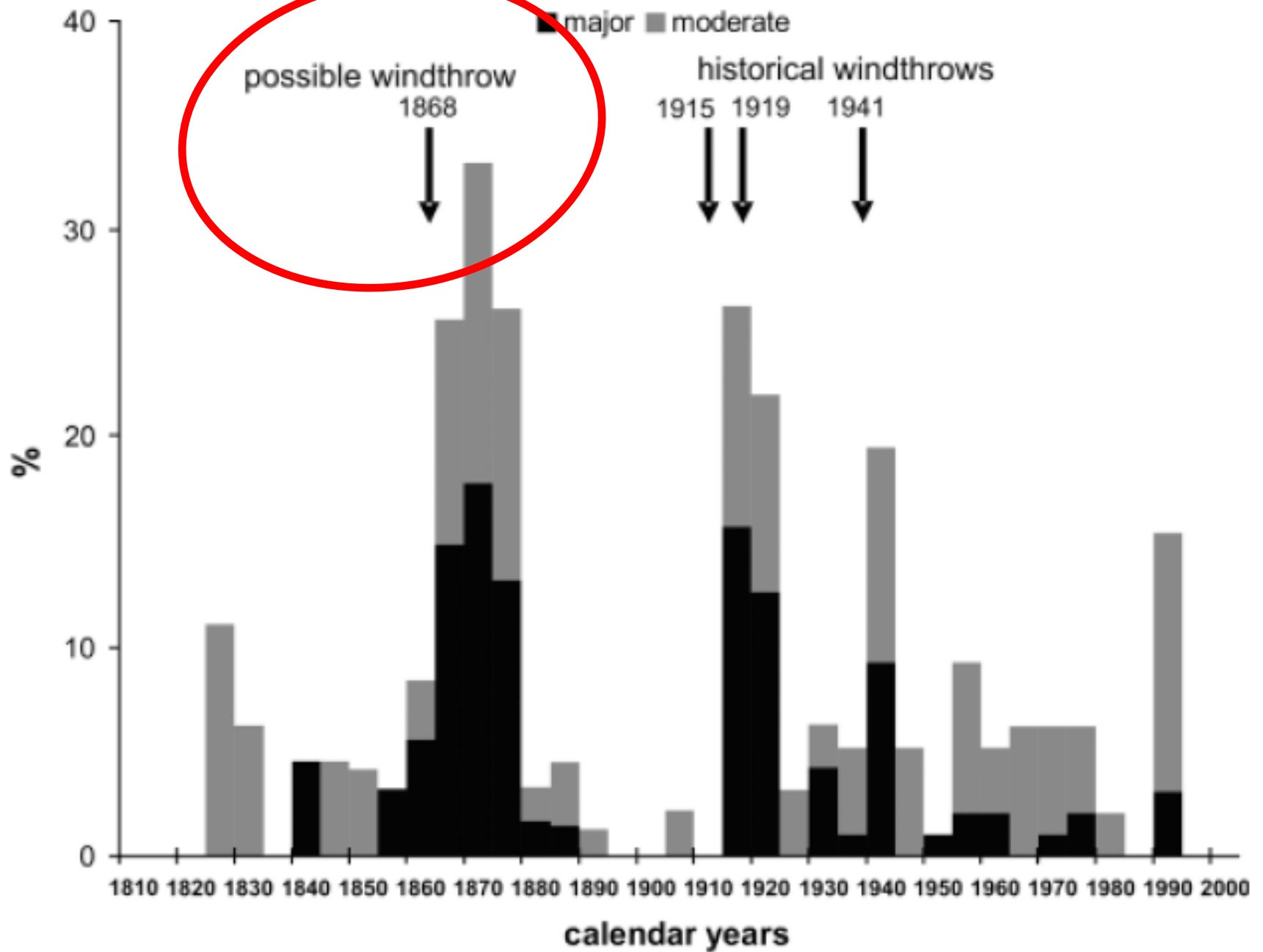
Tomasz Zielonka^{1*}; Jan Holeksa¹; Peter Fleischer² & Paweł Kapusta¹



Tatra Mts. - Slovakia

2004 – strong windstorm, several thousands hectares of forest





Tatry Mts. - Slovakia

Historical windstorms since 1915.

Date	Disturbance agent	Description
1915	Windstorm	Heavy damage by windstorm – 0.5 mil. m3
1919	Windstorms	Heavy damage by windstorm – 0.2 mil. m3
1971	Windstorm	Heavy damage by windstorm – 0.5 mil. m3
1981	Windstorm	Heavy damage by windstorm – 0.2 mil. m3
2004	Windstorm	Heavy damage by windstorm – 3 mil. m3

Tatra Mts. - Slovakia

**Conclusion: severe windstorms (bark beetle outbreaks)
could play in the past important role in the forest dynamics**



Discussion

Romania (preliminary results) evidence of high severity disturbance. However no evidence of large bark beetle outbreaks.

Czech R. and Slovakia preliminary results: evidence of high severity disturbance and recent large bark beetle outbreaks.



Discussion

Is there a gradient in disturbance severity from west to east Europe (windstorms and bark beetle)?

Which factors controls and trigger bark beetle outbreaks?

Study limitations

- fragments representing whole landscape
- historical disturbance regime and recent disturbance regime

Mařák, Bohemian Forest, 1850

Thank you for your attention



Questions? Collaboration?