


Fire history and tree population dynamics in Białowieża Forest, Poland and Belarus

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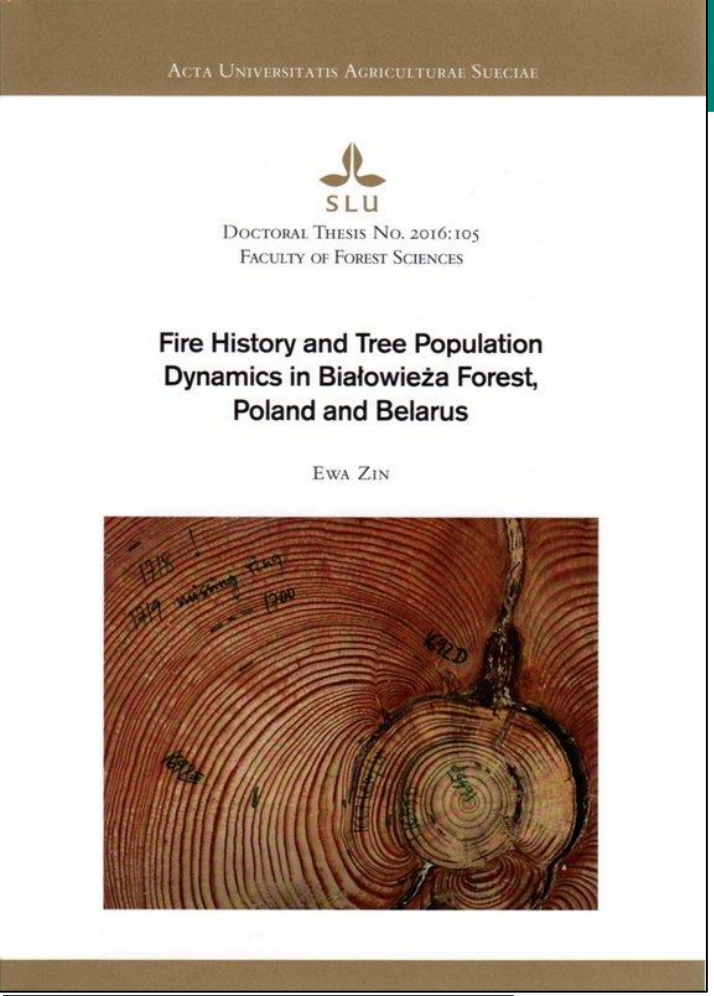

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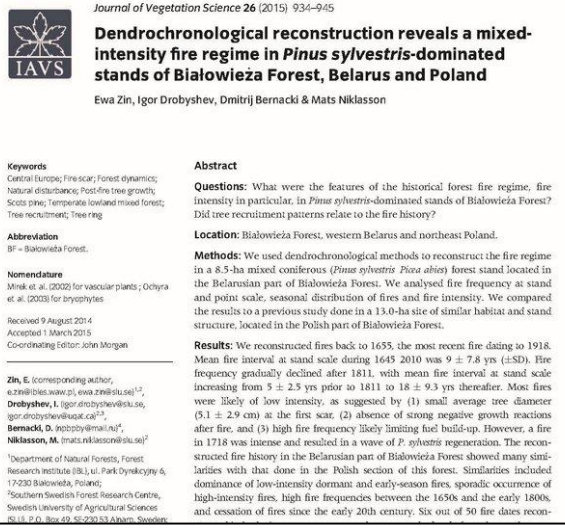

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Dendrochronological reconstruction reveals a mixed-intensity fire regime in *Pinus sylvestris*-dominated stands of Białowieża Forest, Belarus and Poland

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Keywords
Central Europe; Fire scar; Forest dynamics; Natural disturbance; Post-fire tree growth; Scots pine; Temperate lowland mixed forest; Tree recruitment; Tree ring

Abbreviation
BF = Białowieża Forest.

Nomenclature
Mirek et al. (2002) for vascular plants ; Ochyra et al. (2003) for bryophytes

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Abstract

Questions: What were the features of the historical forest fire regime, fire intensity in particular, in *Pinus sylvestris*-dominated stands of Białowieża Forest? Did tree recruitment patterns relate to the fire history?

Location: Białowieża Forest, western Belarus and northeast Poland.

Methods: We used dendrochronological methods to reconstruct the fire regime in a 8.5-ha mixed coniferous (*Pinus sylvestris Picea abies*) forest stand located in the Belarusian part of Białowieża Forest. We analysed fire frequency at stand and point scale, seasonal distribution of fires and fire intensity. We compared the results to a previous study done in a 13.0-ha site of similar habitat and stand structure, located in the Polish part of Białowieża Forest.

Results: We reconstructed fires back to 1655, the most recent fire dating to 1918. Mean fire interval at stand scale during 1645 2010 was 9 ± 7.8 yrs (±SD). Fire frequency gradually declined after 1811, with mean fire interval at stand scale increasing from 5 ± 2.5 yrs prior to 1811 to 18 ± 9.3 yrs thereafter. Most fires were likely of low intensity, as suggested by (1) small average tree diameter (5.1 ± 2.9 cm) at the first scar, (2) absence of strong negative growth reactions after fire, and (3) high fire frequency likely limiting fuel build-up. However, a fire in 1718 was intense and resulted in a wave of *P. sylvestris* regeneration. The reconstructed fire history in the Belarusian part of Białowieża Forest showed many similarities with that done in the Polish section of this forest. Similarities included dominance of low-intensity dormant and early-season fires, sporadic occurrence of high-intensity fires, high fire frequencies between the 1650s and the early 1800s, and cessation of fires since the early 20th century. Six out of 50 fire dates recon-

Zin et al. 2015
Journal of Vegetation Science, 26: 934–945.

Journal of Ecology

Journal of Ecology 2010, **98**, 1319–1329 doi: 10.1111/j.1365-2745.2010.01710.x

A 350-year tree-ring fire record from Białowieża Primeval Forest, Poland: implications for Central European lowland fire history

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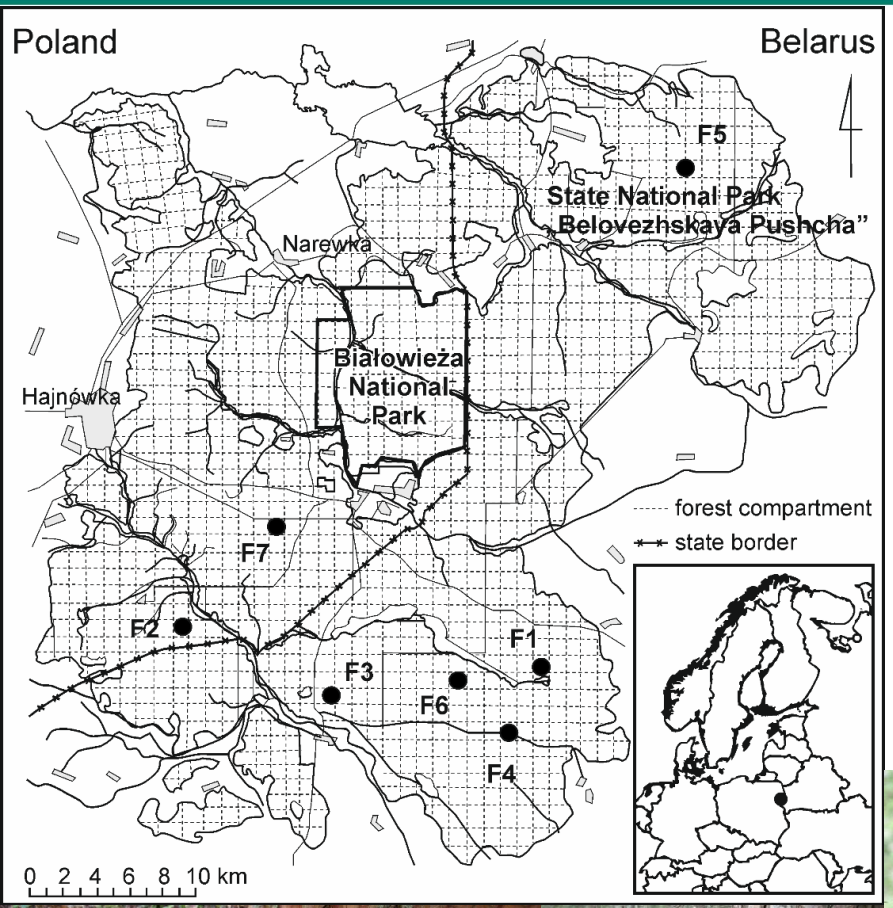
Summary

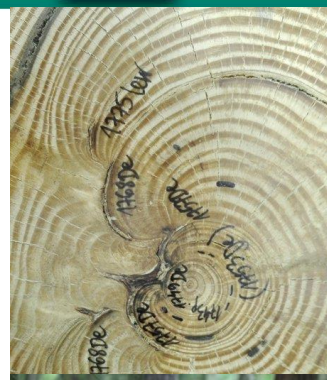
1. Fires are nowadays small, yet frequent, in temperate Central European conifer forests, but little is known about the fire history in this region. This is likely due to the lack of intact forests that contain old trees and dead wood from which fire history may be reconstructed. An exception is the Białowieża Primeval Forest (BPF) in Poland for which we were able to reconstruct the fire history in detail.

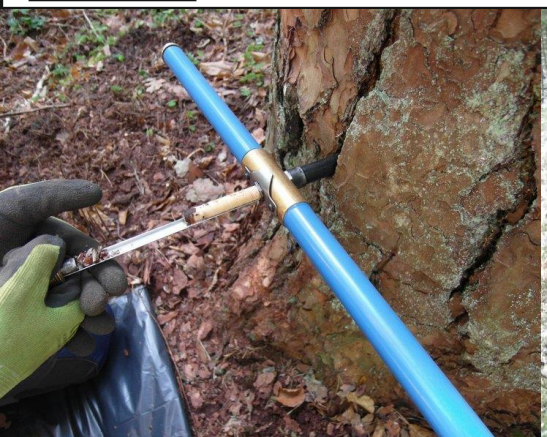
Niklasson et al. 2010
Journal of Ecology, 98: 1319–1329.

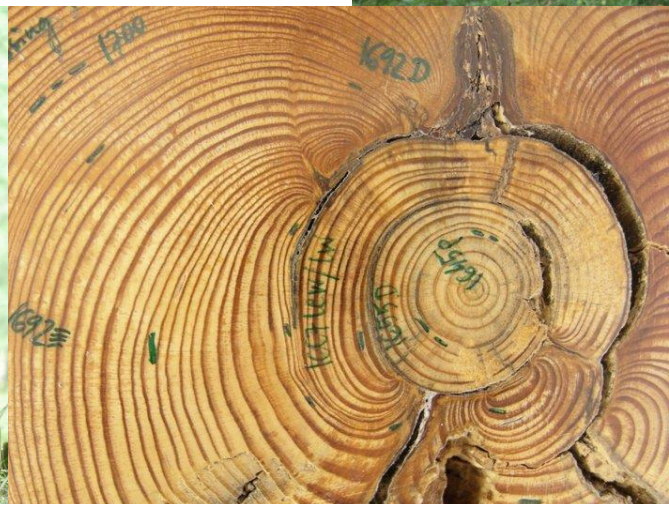
Methods



- **tree ring** data:
  Pinus sylvestris, *Picea abies*
  cross sections, increment cores
  (n=1356, 955 trees)
- **fire regime** parameters:
  frequency, intensity, seasonality
- **spatial** aspect
- **other data** sources:
  stand & flora inventories
  historical literature & maps

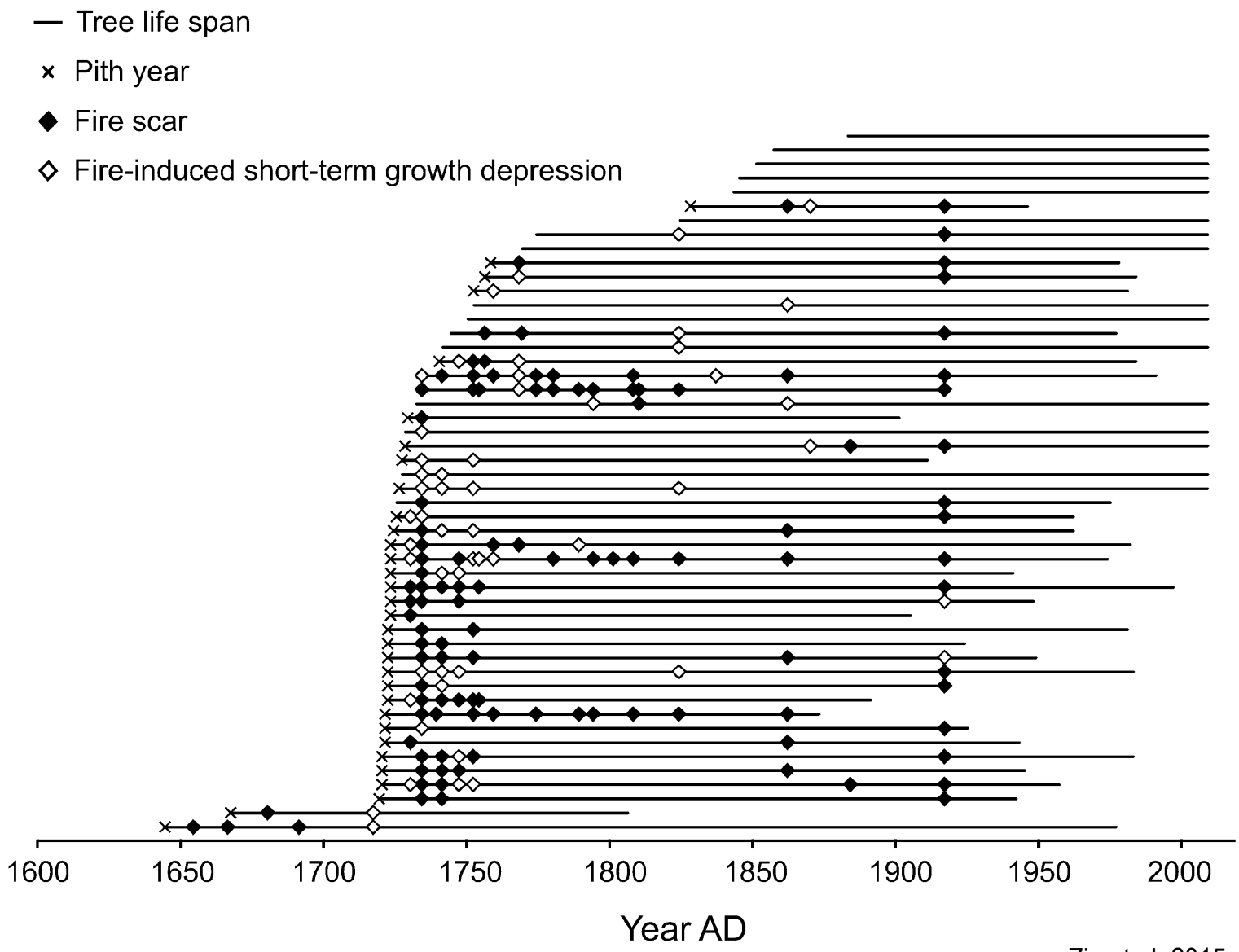






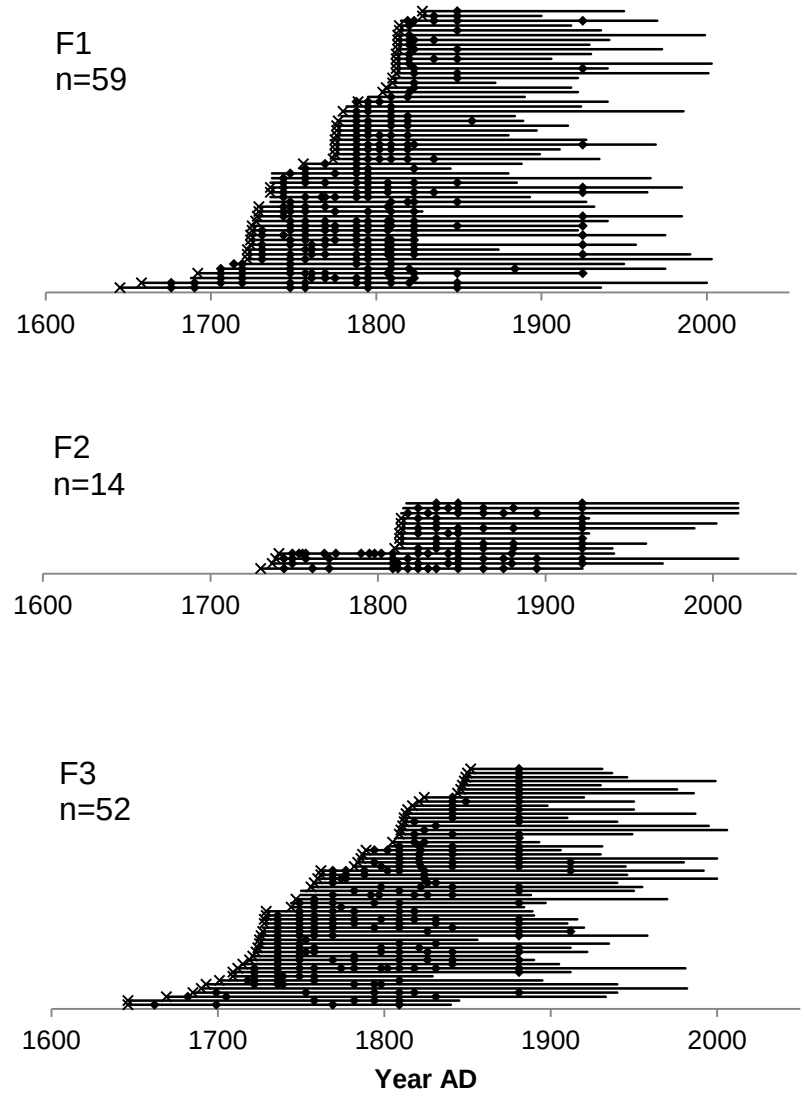
Fot. M. Dworakowski, D. Graszka-Petrykowski, I. Sondej, E. Zin.

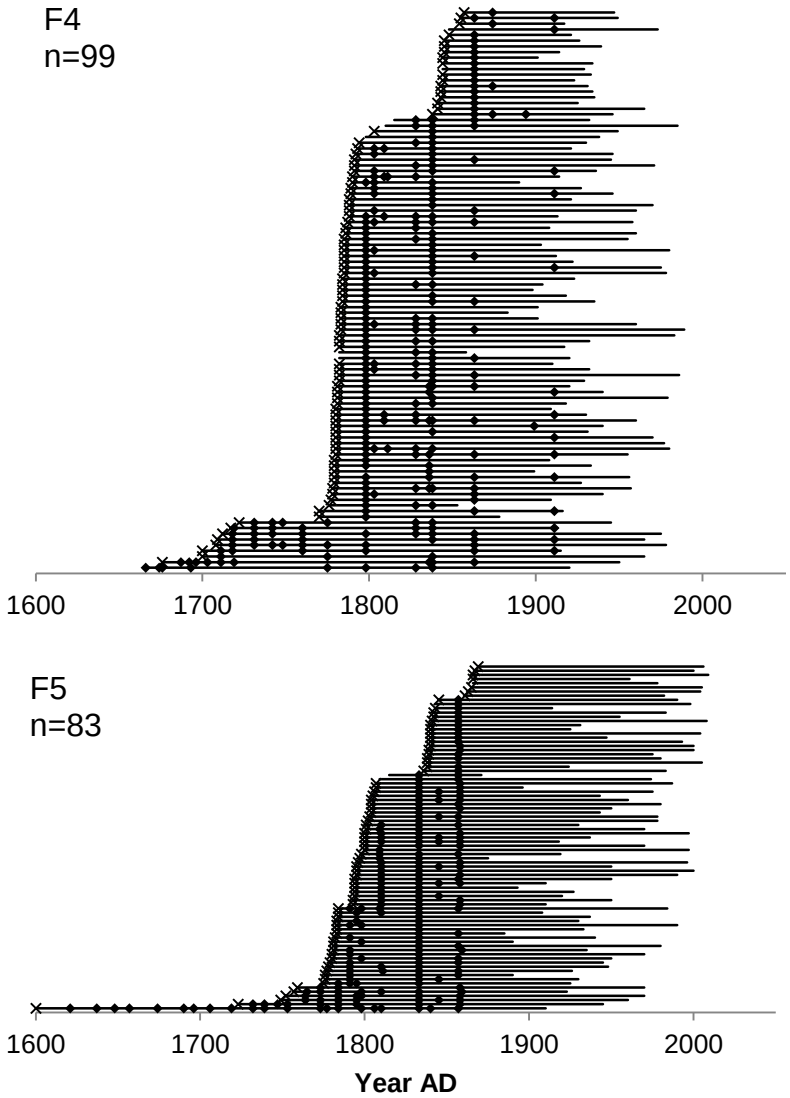
Results



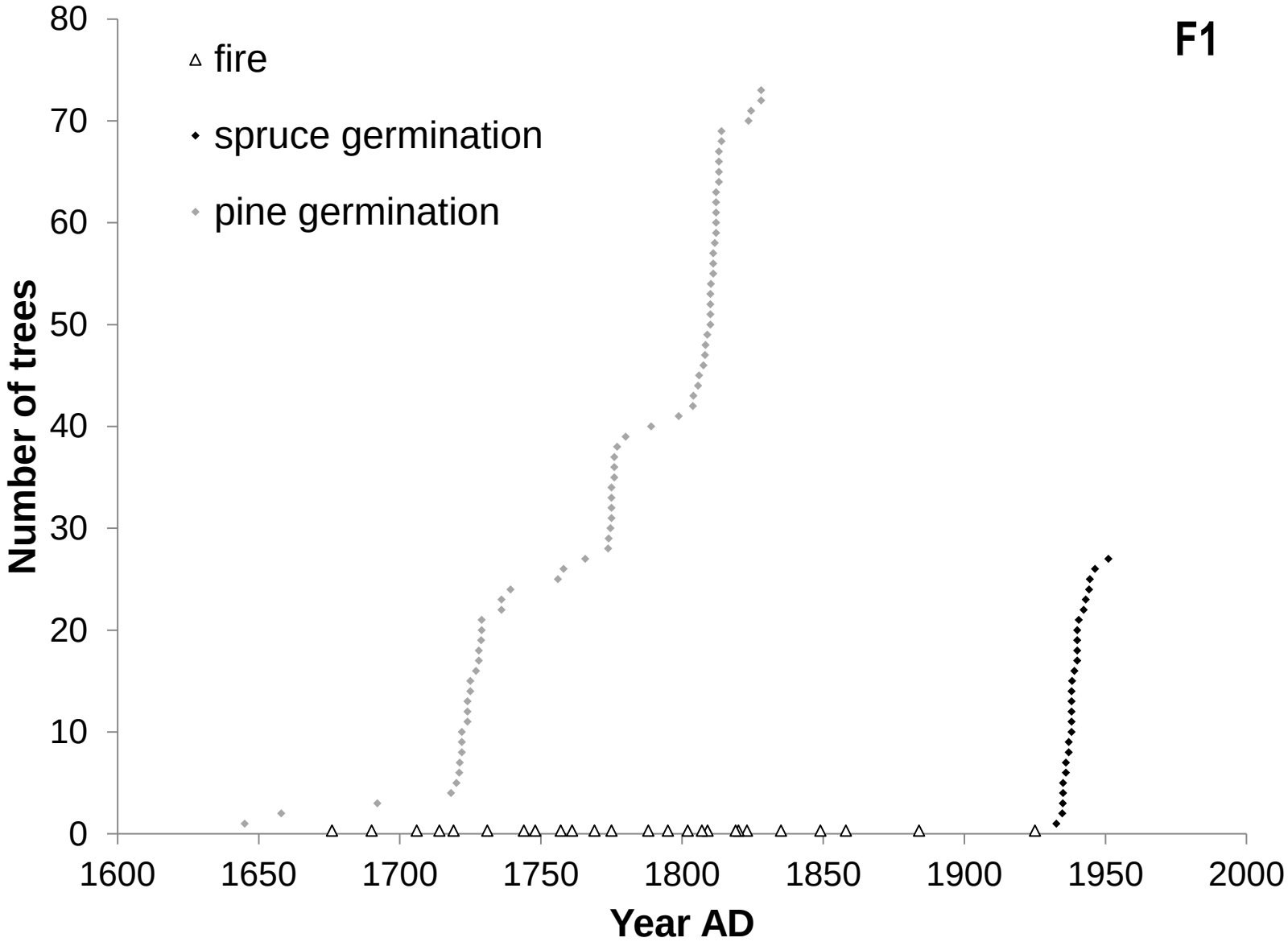
Zin et al. 2015, J Veg Sci.

Results





(Zin & Niklasson, in prep.).



(Zin & Niklasson, in prep; Zin et al., in prep.), modified.

Conclusions

- **fire** & **tree** population **dynamics** in coniferous habitats of Białowieża:

  century-long interplay

- **landscape-scale fire influence** on European **temperate** forest ecosystem

(1) **fire**: shaping Białowieża Forest (BF) **until ~100–150 yrs ago**

(2) prevalence of **low-intensity fires** (stand-replacing: occasionally)

(3) **fire**: assuring landscape-scale **pine dominance** (*vs.* competitors)

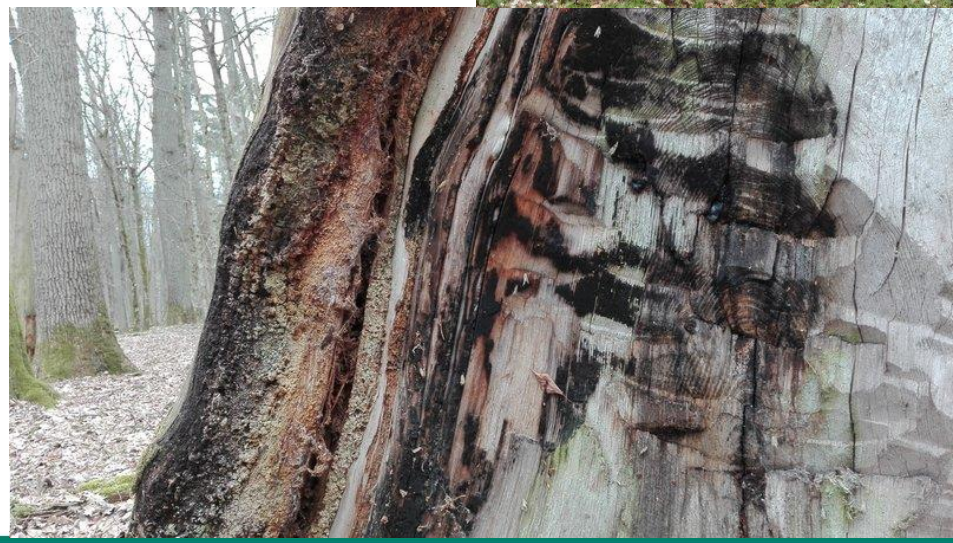
also in **temperate** Europe (as in the boreal)

(4) **spruce** dominance in BF: **short-term & recent** phenomenon

(5) **spatial dimension** of past fire in BF: **possible** to reconstruct

Perspectives

- fire in **other habitat types** of Białowieża Forest (decidous-dominated)
- fire vs. **oak** (*Quercus robur*)
- role of potential **fire breaks**
- **spatial** aspects of **severity**
- **fire-climate-humans** relationships



Fot. J. M. Gutowski, E. Zin.