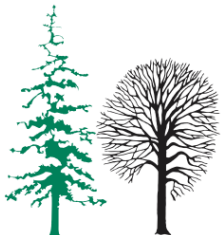


The European spruce bark beetle situation in Slovenia and how it is handled

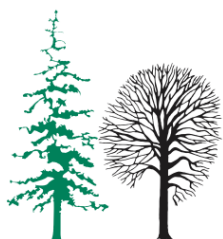
Maarten de Groot



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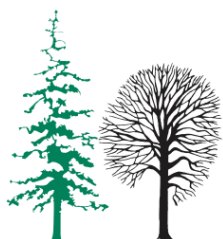
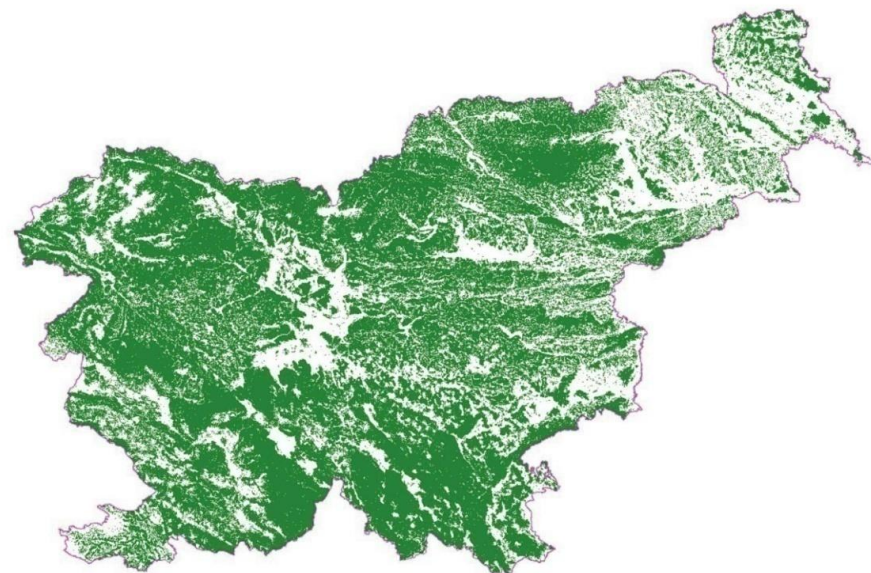
Slovenia

- Area: 20,271 km²
- Population: 2.1 million
- 5 biogeographical regions:
 - Sub Mediterranean
 - Sub alpine
 - Alpine
 - Dinaric
 - sub-Pannonian



Slovenia

- **Forest area:** 1.2 million ha (58%)
- Beech: 32.9%
- Norway spruce: 30.2%



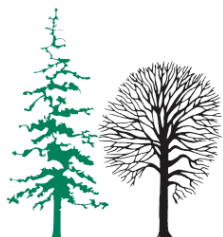
Slovenia

Forest ownership:

- private forests 75%,
- state forests 22% and
- forests of local communities 3%

Number of forest properties: 314,000

Forest owners: 461,000



Slovenia

- Forest management
 - Close to nature management
 - Small gaps of cutting
 - High tree diversity
 - Tree species in its primary habitat
 - Uneven aged forests

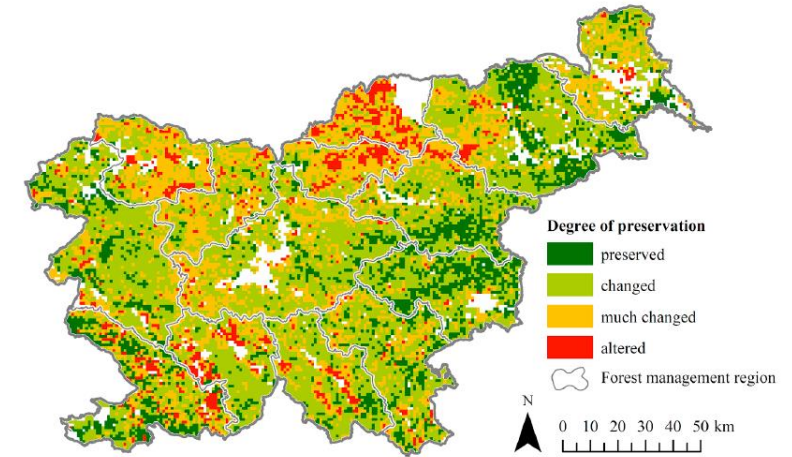
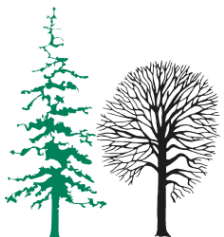


Fig. 1. Tree species composition alteration in Slovenia. Data sources: Smolej (2001), the Surveying and Mapping Authority of the Republic of Slovenia and the Slovenia Forest Service.

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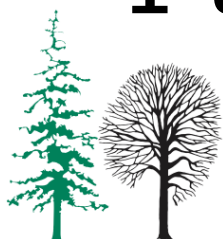


Bark beetles in Slovenia

- *Ips typographus* – European spruce bark beetle
- Flight period: Beginning of April
- 2 to 3 generations
- 1 to 2 sister generations

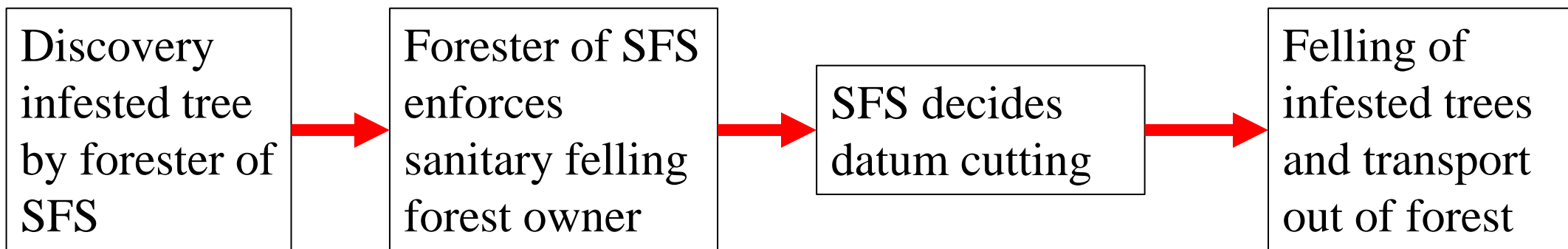


Foto: Daniel Adam, Office National des Forêts, Bugwood.org

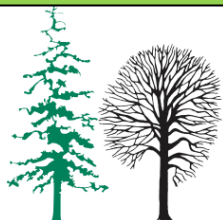


Bark beetles in Slovenia

- Process of sanitary felling

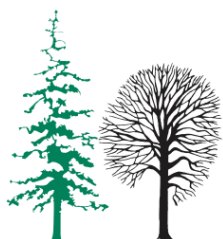
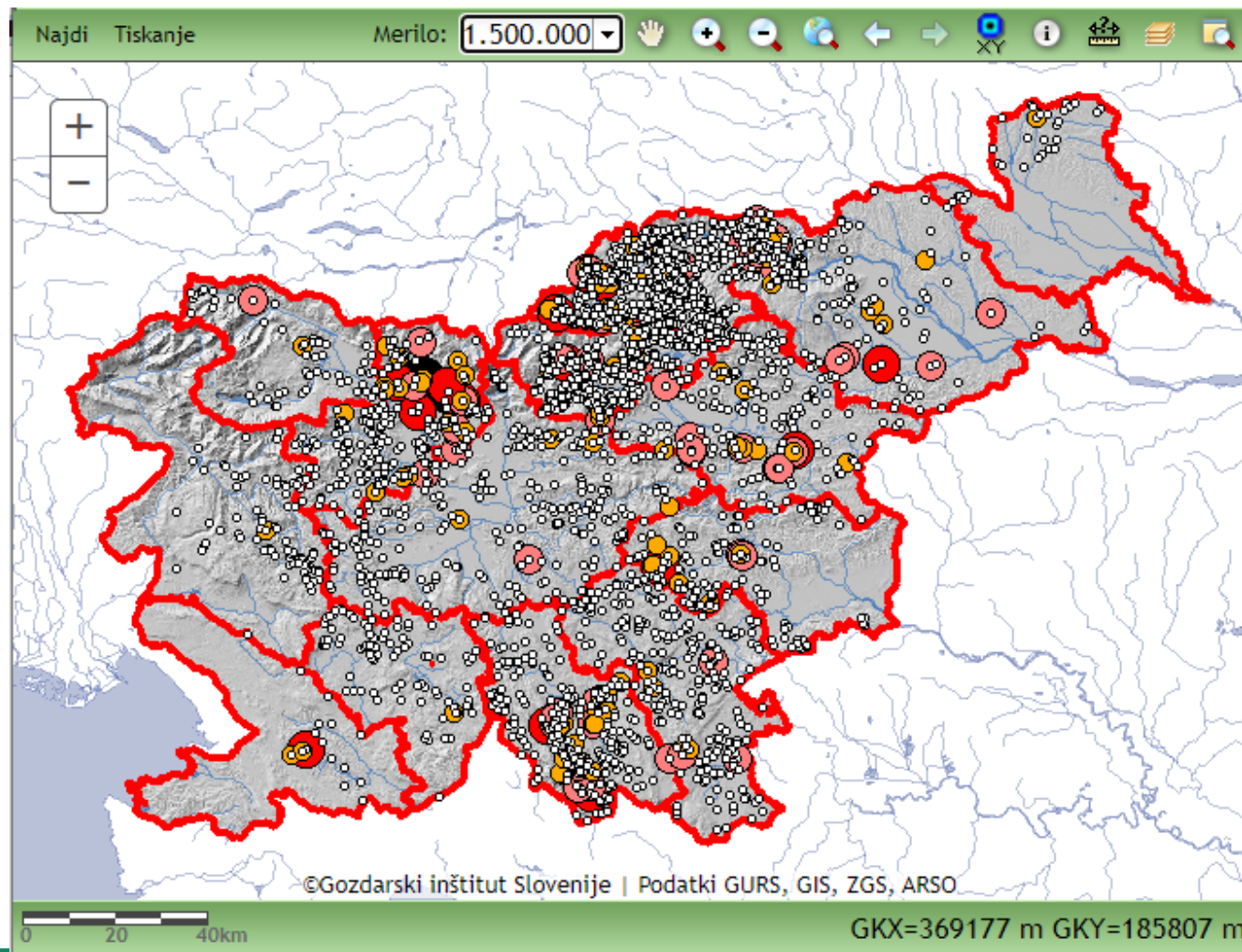


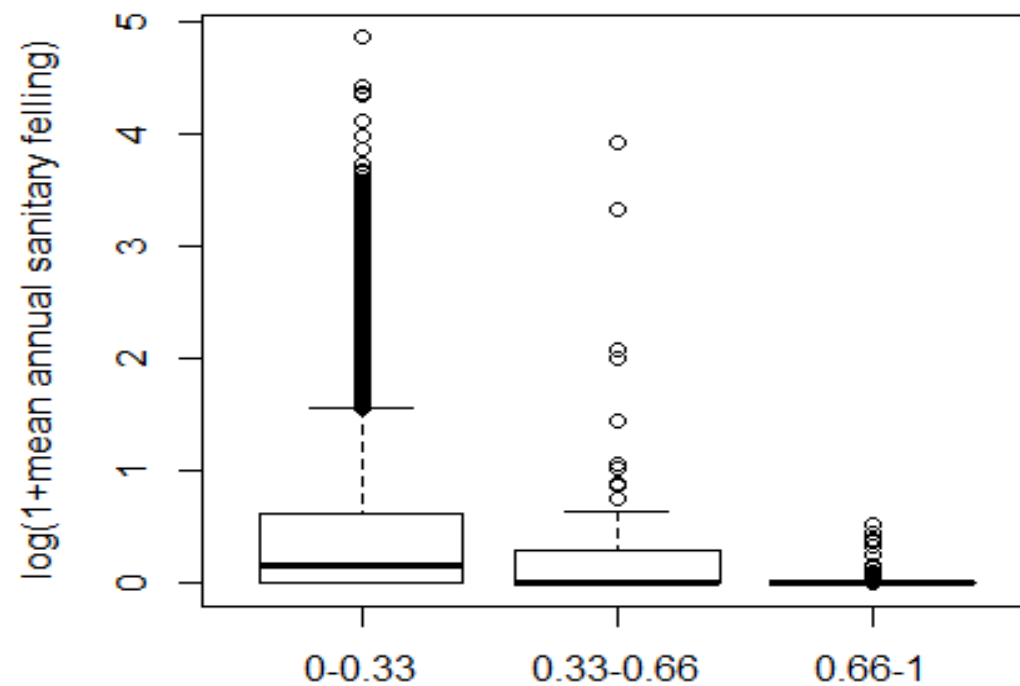
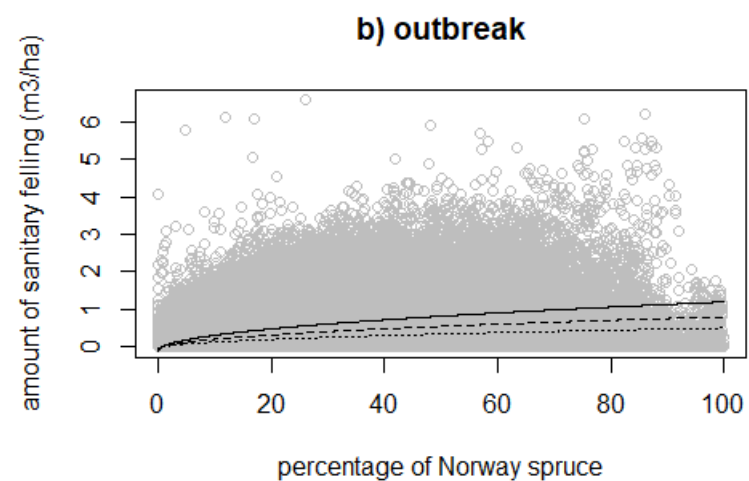
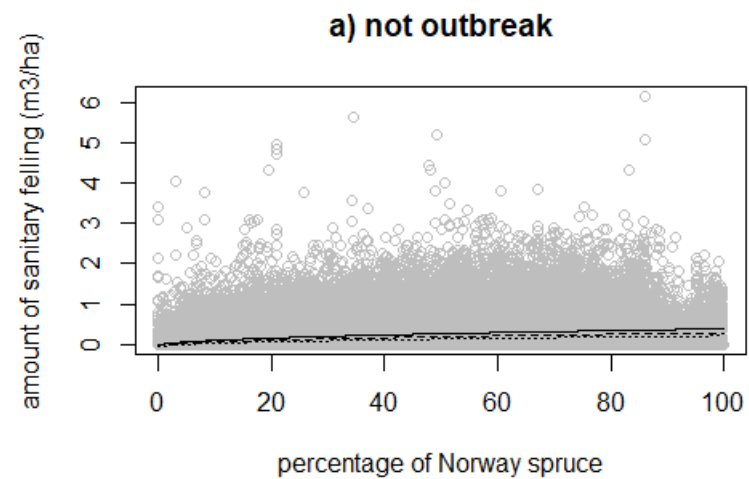
Inspector oversees whole process of sanitary felling (forest owners and forest workers)



Bark beetles in Slovenia

- Monitoring
- Pheromone traps
- >3000 traps
- Every 2 weeks emptying minimally till end of first generation
- Outbreak threshold 7,000 *I. typographus* beetles and 20,000 *P. chalcographus* beetles

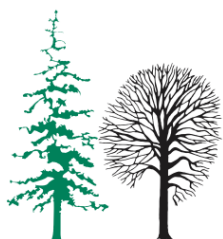
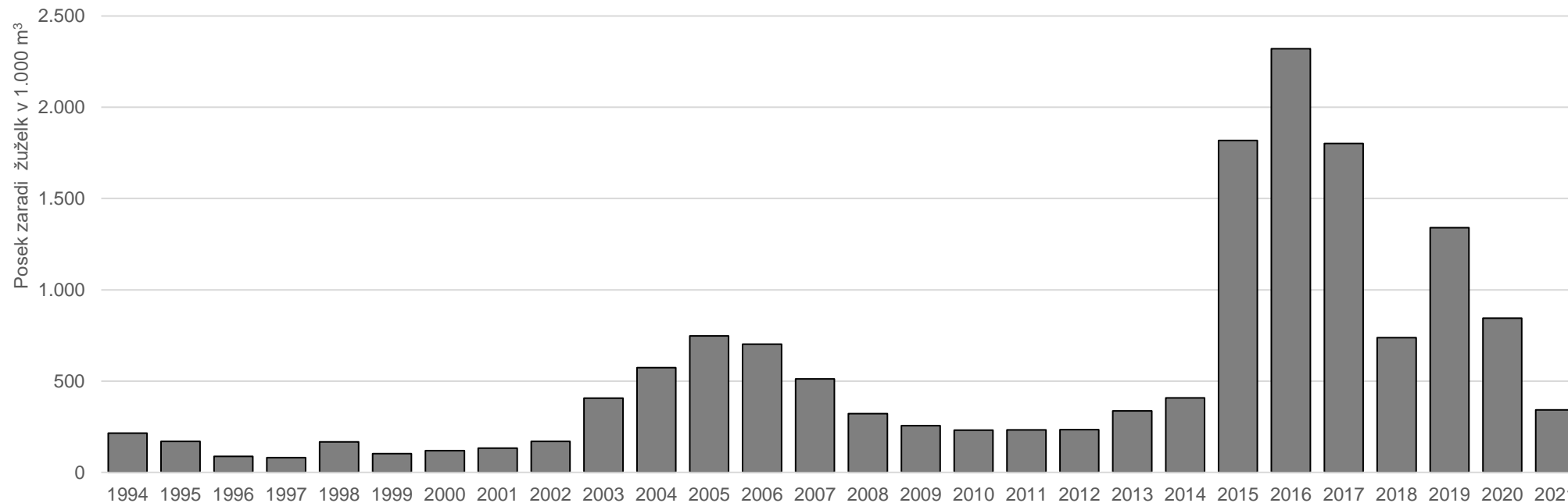




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Bark beetles in Slovenia



Ice storm and the aftermath

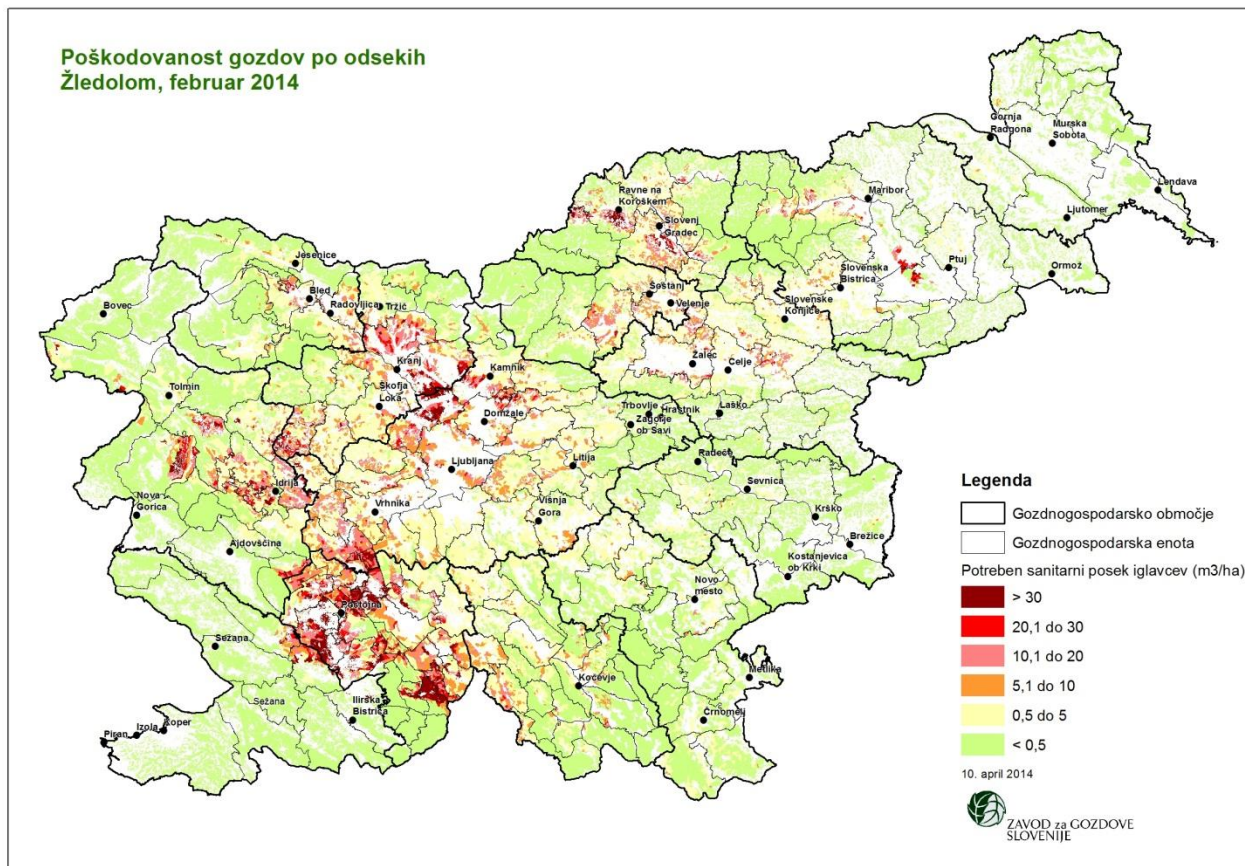


Photo: Andrej Kobler



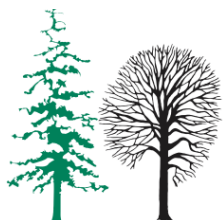
Photo: Andrej Kobler



Photo: Andrej Kobler



Photo: Marija Kolšek



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Ice storm and the aftermath

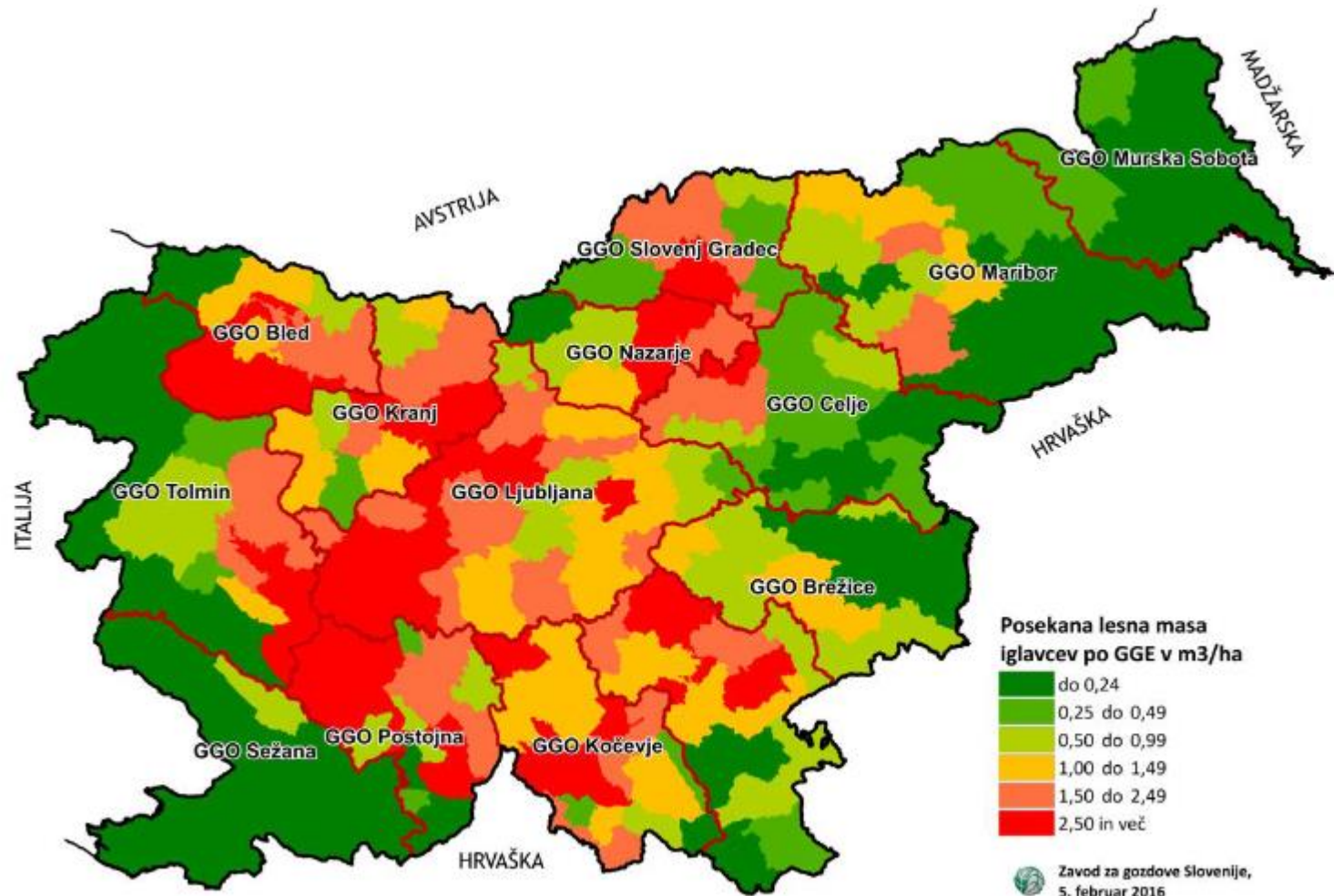
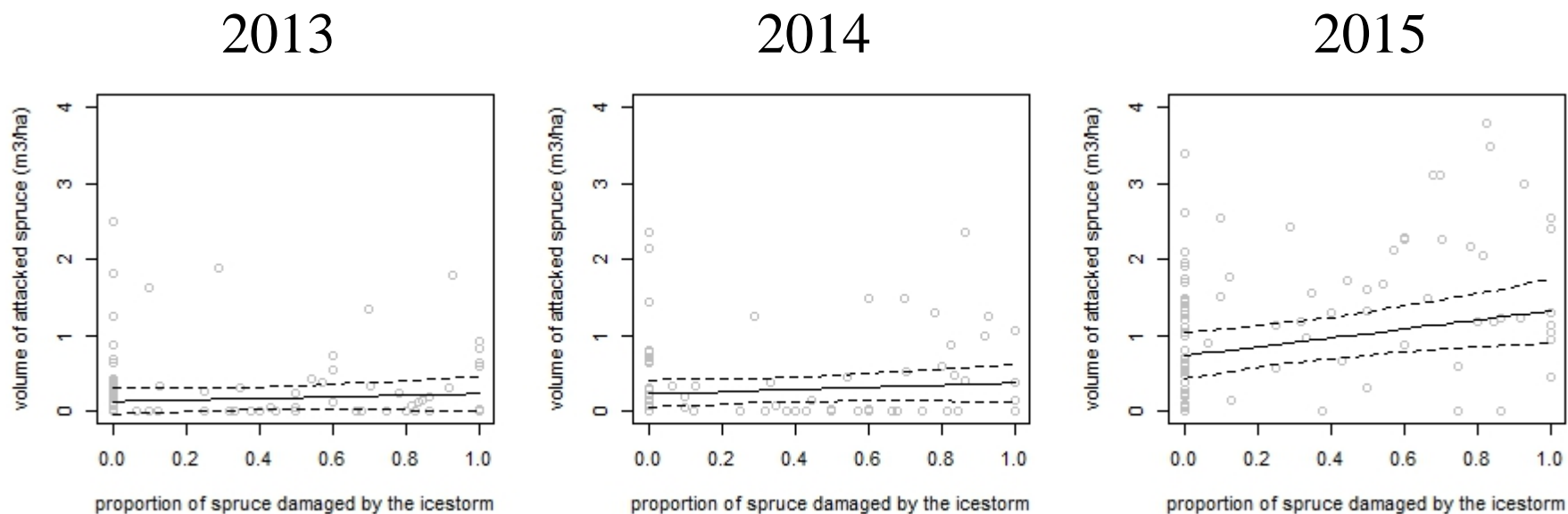


Photo: Maarten de Groot

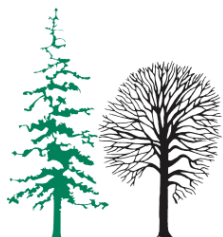


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Ice storm and the aftermath

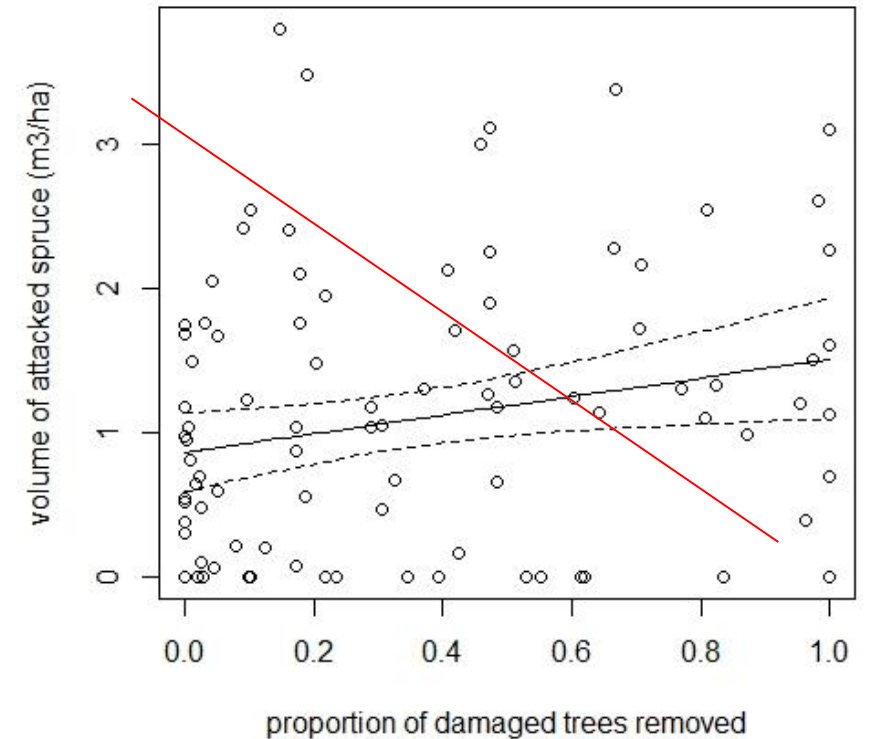


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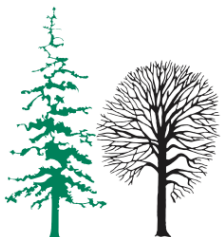


Ice storm and the aftermath

- 50% of fallen conifer trees were salvaged in 2014
- Less damaged standing trees were left
- A lot of felling residuals
- Broken tree tops.

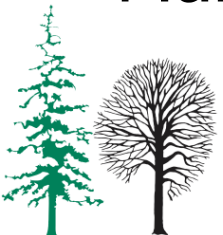


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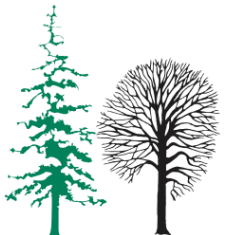
Ice storm and the aftermath

- Forests were secondary problem -> problems in other sectors after ice storm
- No entrance to the forest due fallen trees
- Market was flooded with wood. Wood couldn't get out of the forest.
- Slovenia doesn't have a large wood/cellulose industry -> export of wood
- Too less forest workers in SFS
- Many new public workers were temporally employed at SFS



Ice storm and the aftermath

- Preparation of additional wood storage places outside the forest
- Not enough optimal locations for wood storage -> a lot of forest

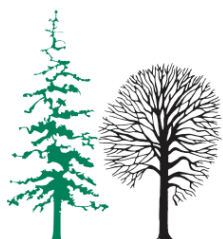


Influence of forest owner structure

Table 4. Confirmation (+), partial confirmation (+/-), or rejection (–) of the hypotheses on the influence of forest owner characteristics on bark beetle management according to the results.

	Hypotheses	Amount of Sanitary Felling	Timing of Summer Sanitary Felling	Timing of Winter Sanitary Felling
1.	A large distance between the forest parcel and the forest owner's residence is more likely to be expressed in less active forest management and consequently in later cutting and more outbreaks.	+	–	+/-
2.	Co-ownership of forest parcels can have a negative influence on forest management and therefore result in delays in the cutting of attacked trees.	–	+	+
3.	Large parcels have more spruce and therefore a higher potential of sanitary felling and later timing of cutting.	+	+/-	+/-
4.	Larger forest owners have more outbreaks but are more active in forest management, more experienced, better equipped for forest operations, and have better connections to forest contractors and therefore cut earlier.	+/-	+	+
5.	Forest owners living in urban areas are less active in forest management, resulting in more outbreaks and later cutting.	–	+	–
6.	Older forest owners with more experience in forest management are more careful and notice attacks sooner and therefore cut earlier.	–	–	–
7.	Gender of forest owners has no specific influence on forest management activities and therefore also on the timing of sanitary felling.	+	+	+

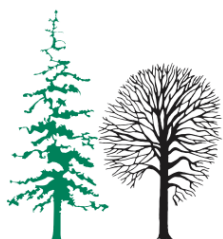
De Groot et al. 2021 Forests



Ice storm and the aftermath

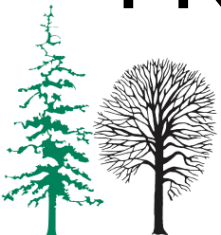
- Use of pesticides of wood laying along forest roads
- Not used a lot.
- FSC doesn't allow pesticides
- Slovenian foresters are ecological minded
- In unusual situations allowed in forests
- Special permit and knowledge necessary for the use of pesticides

	Fastac Forst (l)	Storanet (kos)
2014	55	12
2015	145	116
2016	55	112
2017	20	31
2018	40	14
2019	5	16
2020	20	6
2021	0	0

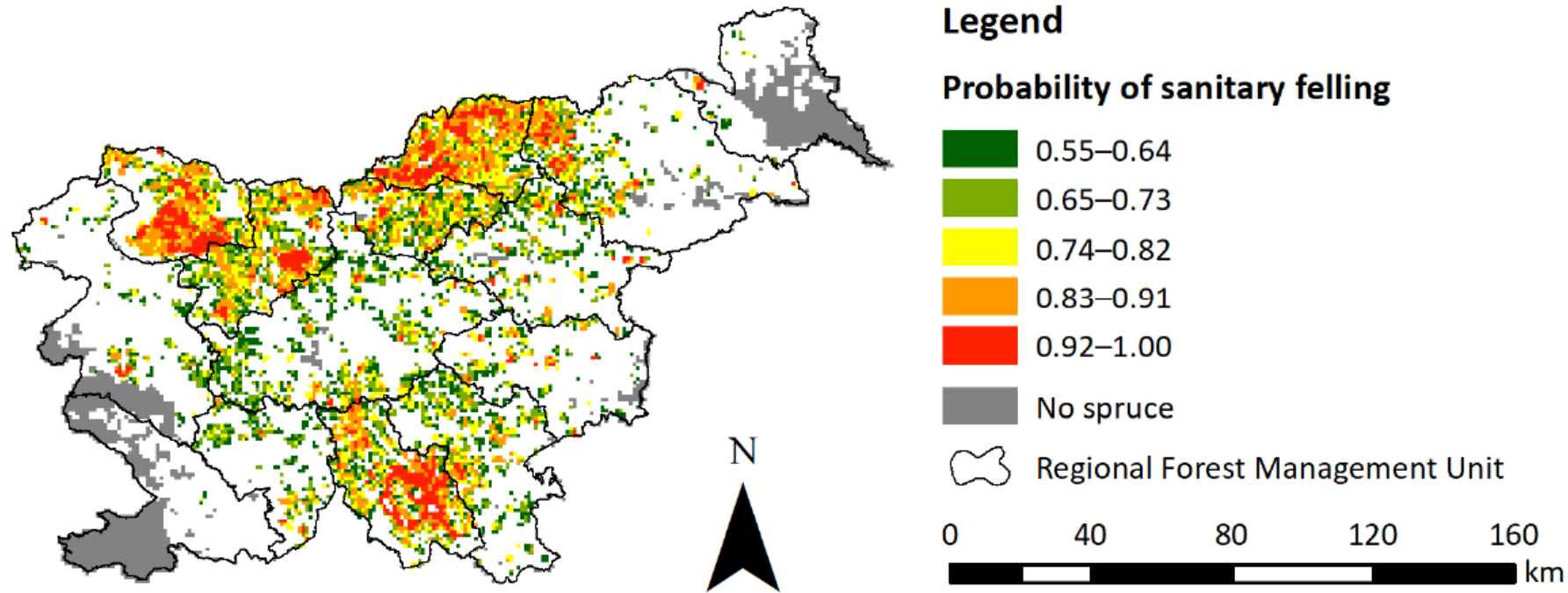


Ice storm and the aftermath

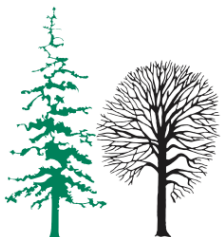
- Terrain conditions were harsh
- 2013 already slowly increasing because of drought
- Reorganisation of management of state forests by law in 2016 -> didn't work efficiently in the first few months
- PRP funding for renewing forests, forest roads



Improvement bark beetle management

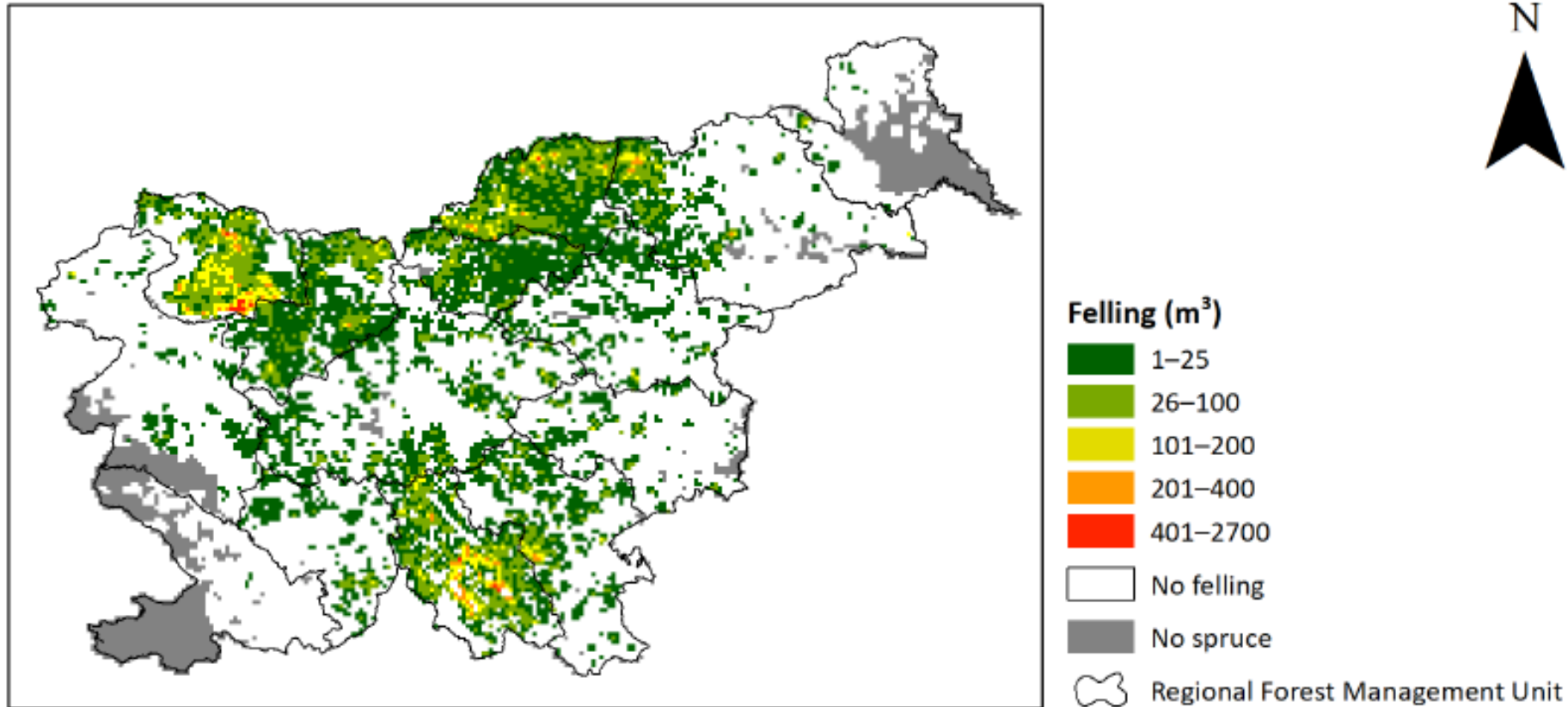


De Groot & Ogris 2019. Forest Ecology and Management

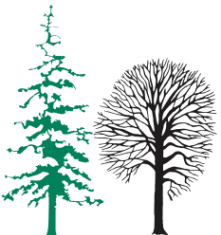


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Improvement bark beetle management



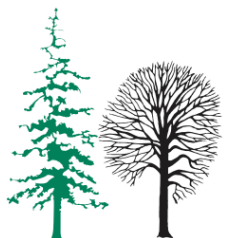
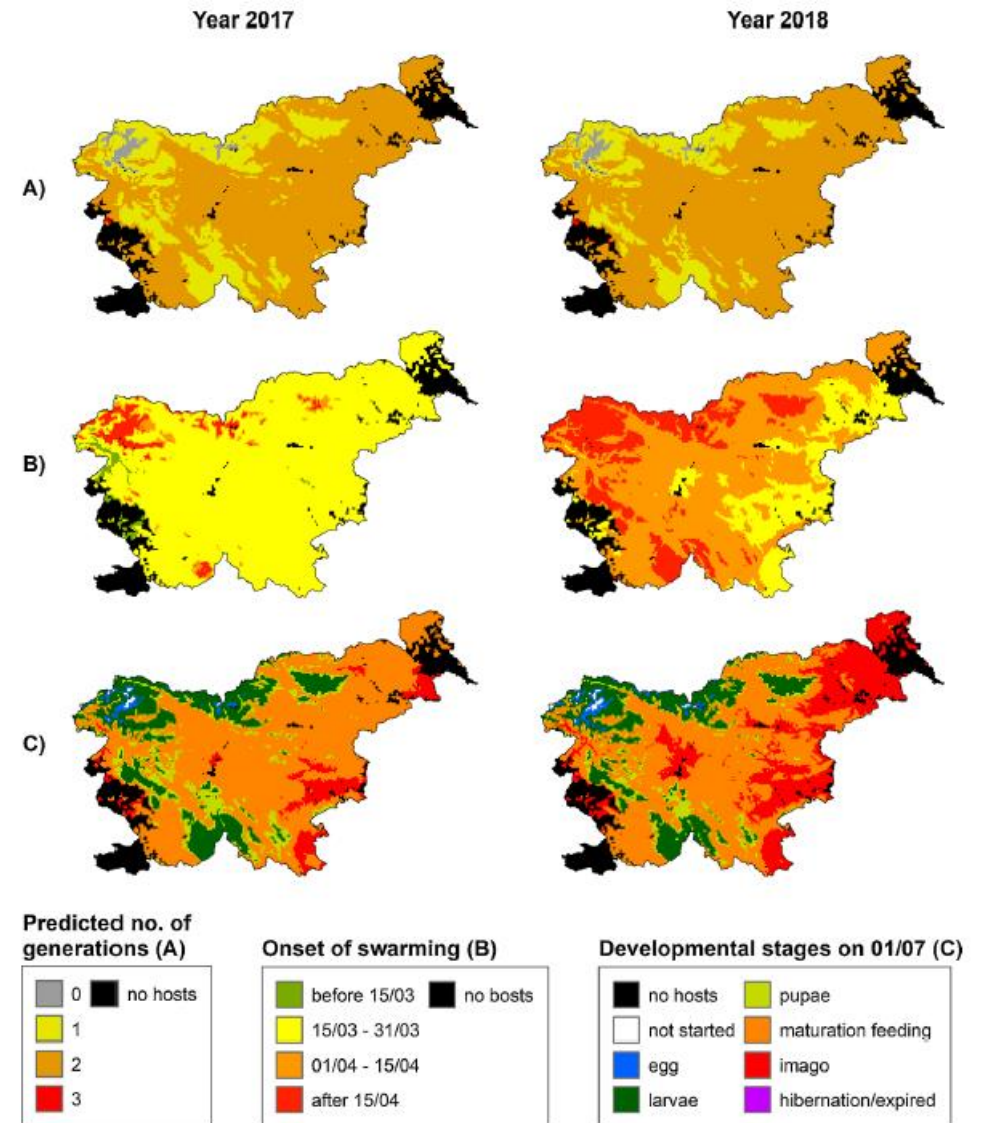
De Groot & Ogris 2022 Forests



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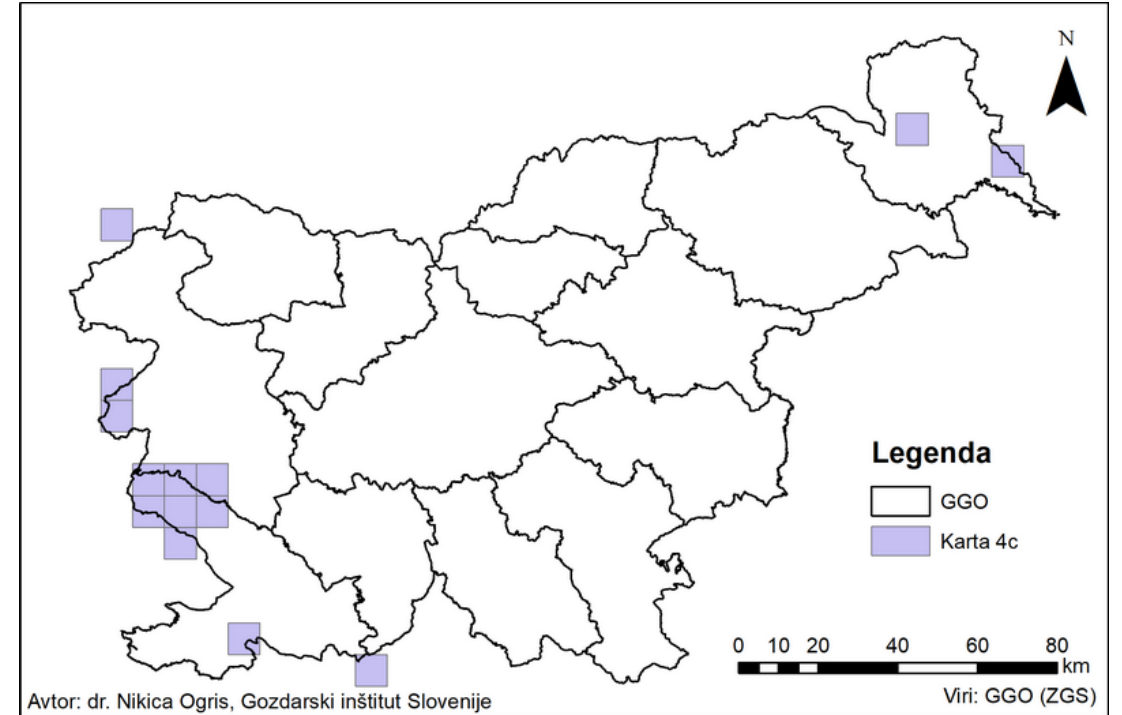
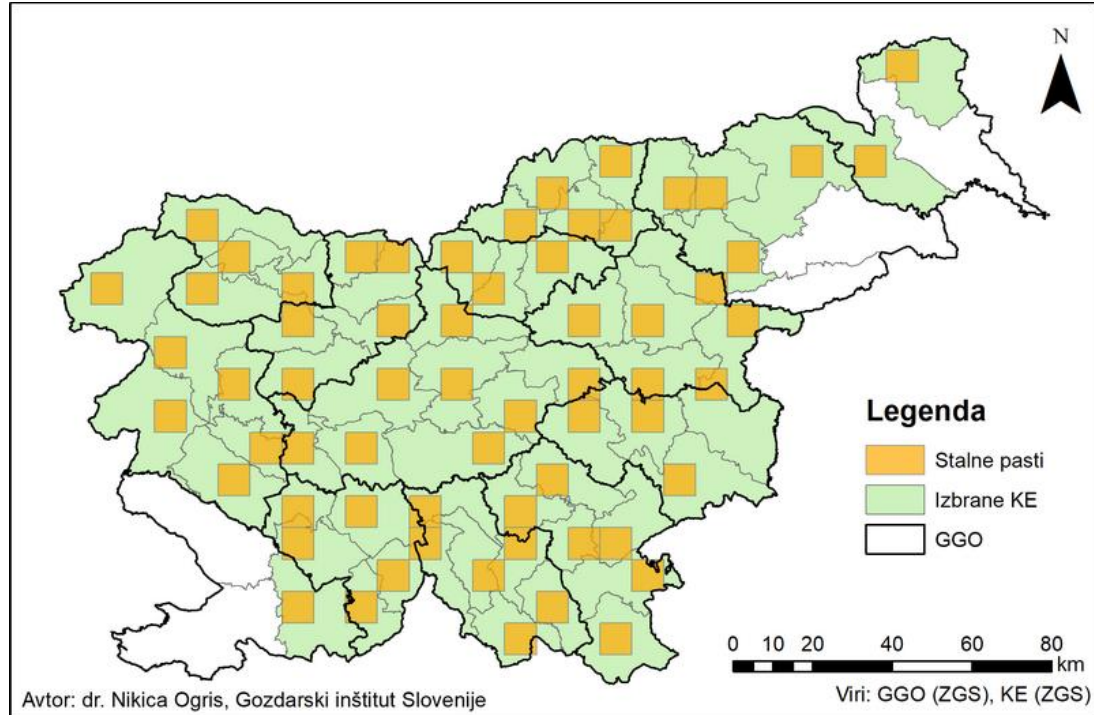
Improvement bark beetle management

- Phenological models
 - *I. typographus* (RITY)
 - *P. chalcographus* (CHAPY)



Improvement bark beetle management

- Location and number of traps

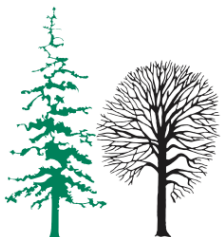


Improvement bark beetle management

- Cutting residuals



Photo: M. de Groot



Thank you for your attention

- Acknowledgment:
 - Marija Kolšek (SFS)

