



**FORRISK**  
Cross-border forest risk management





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*Folgende NUTS III-Regionen gehören zum Programmgebiet:*

**Österreich:**

Mostviertel-Eisenwurzen, Sankt Pölten, Waldviertel, Weinviertel, Wiener Umland-Nordteil, Wien, Innviertel, Linz-Wels, Mühlviertel, Steyr-Kirchdorf

**Tschechische Republik:**

Jihočeský kraj, Kraj Vysočina, Jihomoravský kraj

The damage situation in the forests of the border region, which has persisted for years poses major problems and challenges for forest owners, authorities and stakeholders at the cross-border region Austria and Czech Republic.

In the FORRISK project, operational and administrative procedures for dealing with the bark beetle crisis situation are identified.



Region	total [ha]
<b>Jihocesky Kraj [SB]</b>	<b>368.800</b>
<b>Jihomoravsky Kraj [SM]</b>	<b>189.700</b>
<b>Vysocina Region</b>	<b>201.100</b>
<b>Mühlviertel</b>	<b>127.000</b>
<b>Waldviertel</b>	<b>127.000</b>
	<b>1.013.600</b>



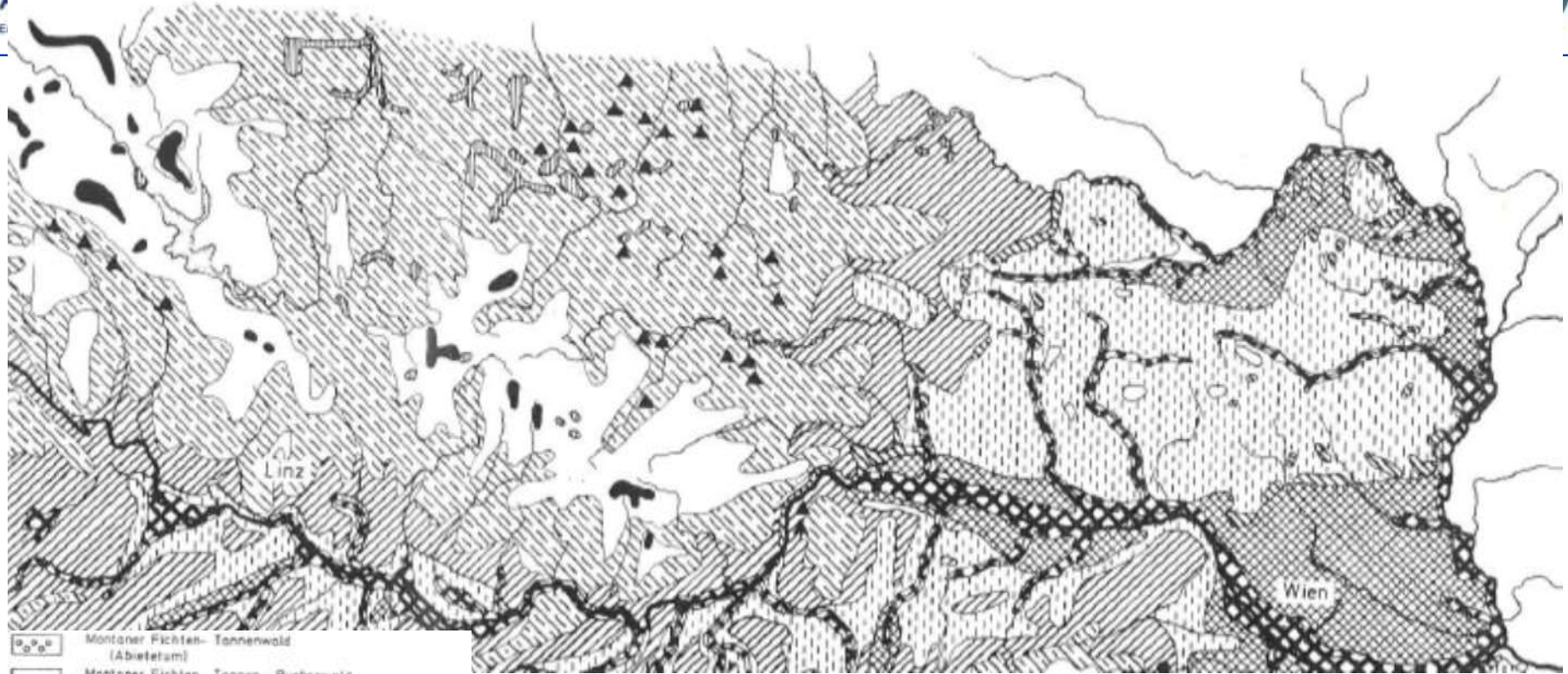




Region	mean annual temperature [°]	mean annual precipitation [mm]
Jihocesky Kraj [SB]	7,1 - 8,1	650 - 710
Vysocina Region	7,2 - 8,2	650 - 680
Jihomoravsky Kraj [SM]	8,3 - 9,6	540 - 560
Mühlviertel	6,2 - 7,3	700 - 1000 (1100)
Waldviertel	6,6 - 8,9	500 - 700 (1000)









-  Montaner Fichten- Tannenwald (Abietetum)
-  Montaner Fichten- Tannen- Buchenwald (Abieti- Fagetum)
-  Montaner Buchenwald z.T. mit Tanne (Fagetum montanum)
-  Tief- bis- submontaner Eichen- Buchenwald (Fagetum s.l.)
-  Eichen- Hainbuchenwald (Querc- et Robur- Carpinetum)
-  Bodensaure Eichen- und Kiefern- Eichenwald (Luzula- et Pino-Quercetum)
-  Flaumeichenwald (Lithospermo-Quercetum)
-  Subkontinentaler Eichenmischwald z.T. mit Zerreiche (Potentillo albae- Quercetum)
-  Submediterraner Laubmischwald (Orno- Ostryetum)
-  Padanischer Stieleichen- Hainbuchenwald (Robur- Quercetum)
-  Waldkiefernwald (Erica- et Vaccino- Pinetum sylvestris)
-  Waldkiefernwald (Pinetum sylvestris) Schwarzkiefernwald (Pinetum nigrae, Osten)
-  Außeripine Auwälder
-  Flach- und Hochmoore

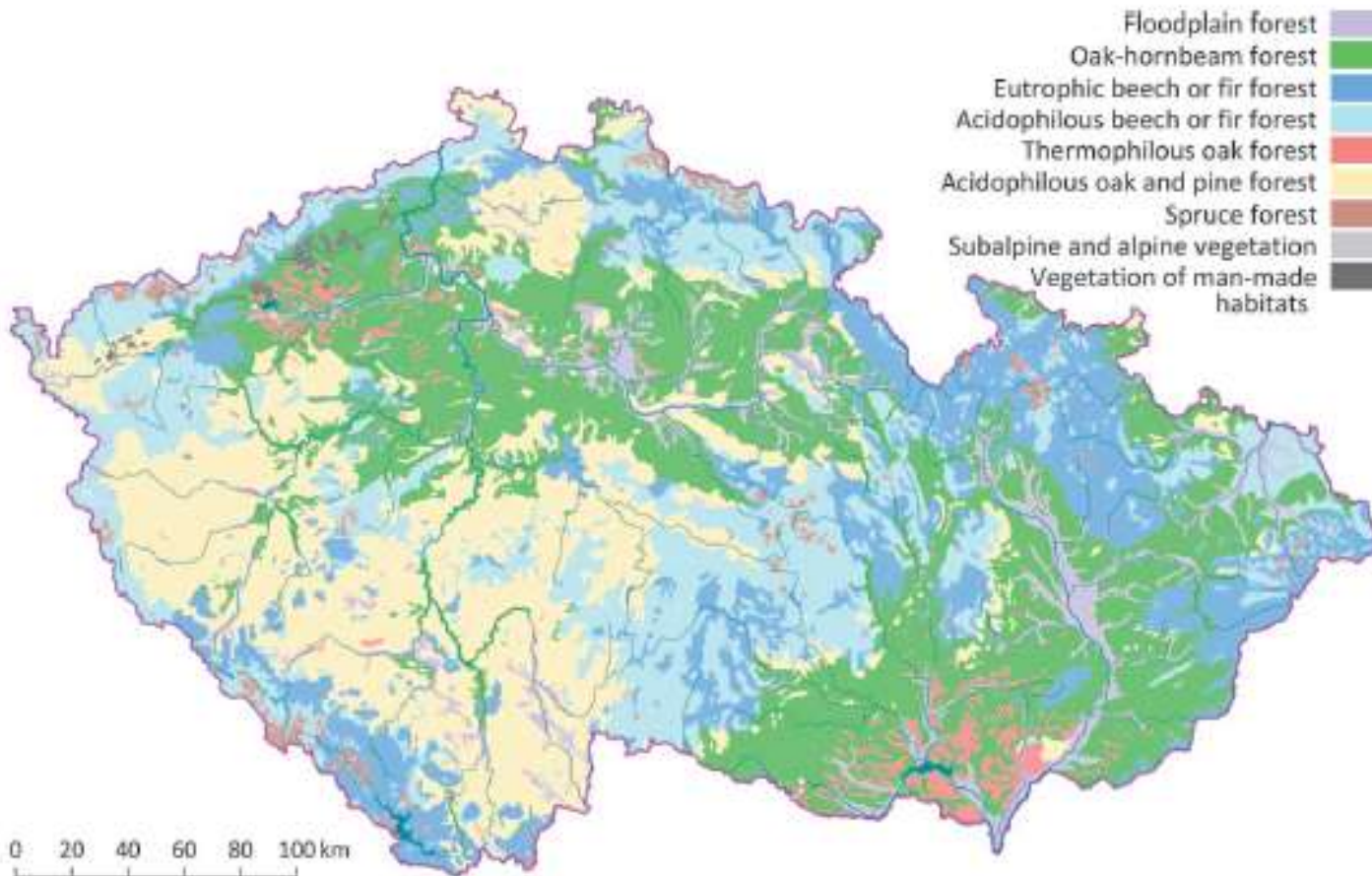


Fig. 12. – Potential natural vegetation according to Neuhäuslová et al. (1997).



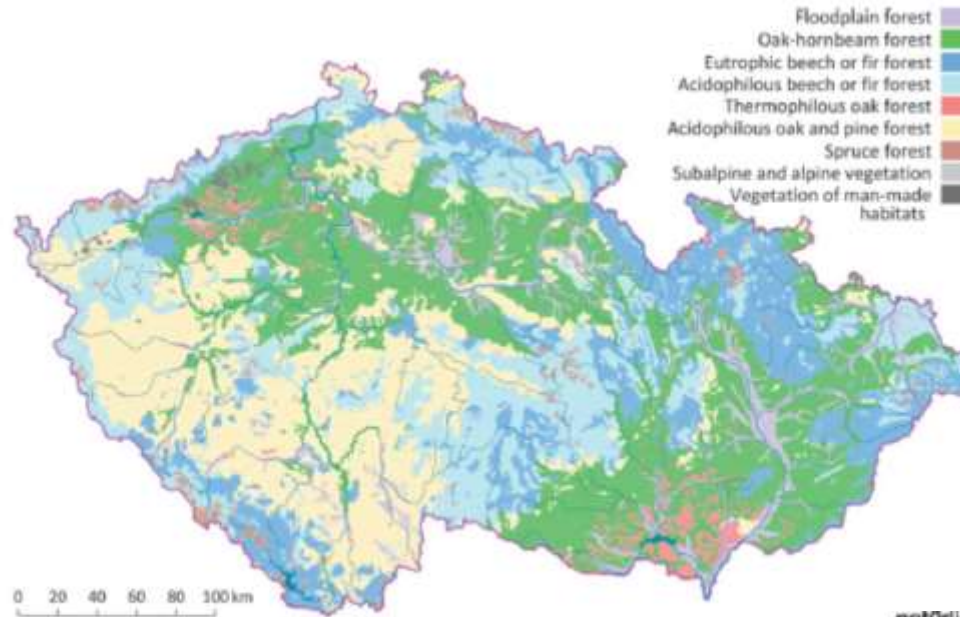
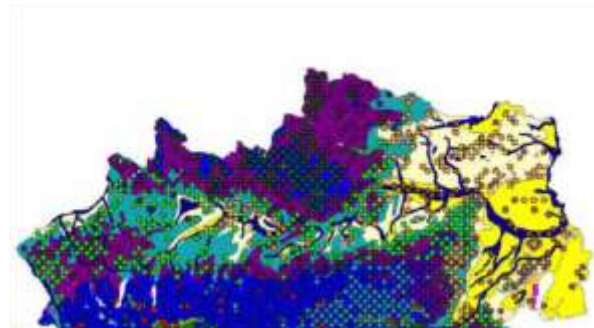


Fig. 12. – Potential natural vegetation according to Neuhäuslová et al. (1997).

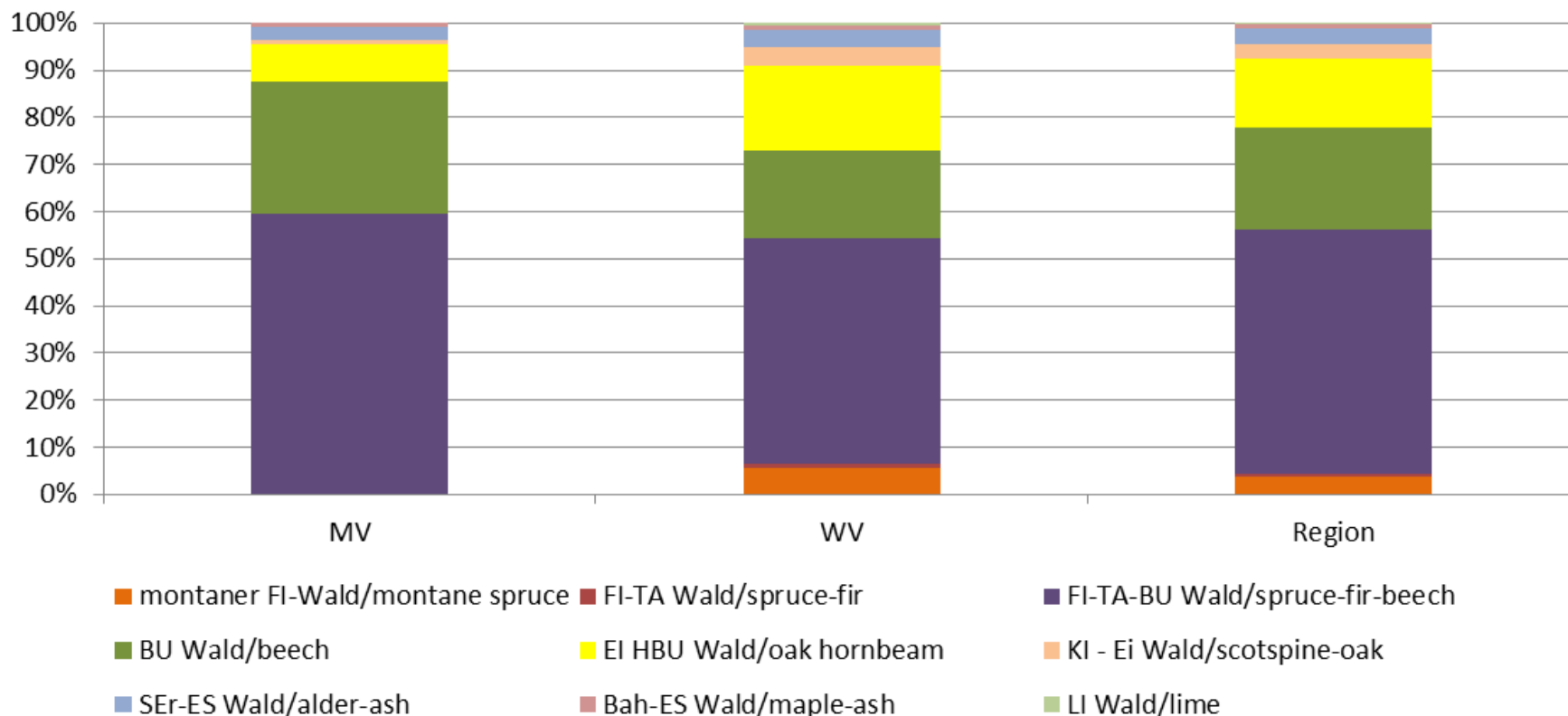


**natürliche Waldgesellschaften**

- No Data
- Nivale Stufe
- Alpine Schuttfleuren und Grashaiden
- Hochsubalpiner Lärchen-Zirbenwald
- Subalpiner Legföhrengbüsch-Lärchenwald
- Tiefsubalpiner Fichtenwald
- Montaner Fichtenwald
- Montaner Fichten-Tannewald
- Montaner Fichten-Tannen-Buchenwald
- Montaner Buchenwald
- Tief- bis Submontaner Eichen-Buchenwald
- Eichen-Hainbuchenwald
- Bodensaurer Eichen- und Kieferneichenwald
- Flaumeichenwald
- Subkontinentaler Eichenmischwald
- Waldkiefernwald
- Außeralpiner Auenwald
- Flach- und Hochmoore
- Seen



**potentiell natürliche Waldgesellschaften/  
 potential natural forest community**



Data source: ÖWI 07/09



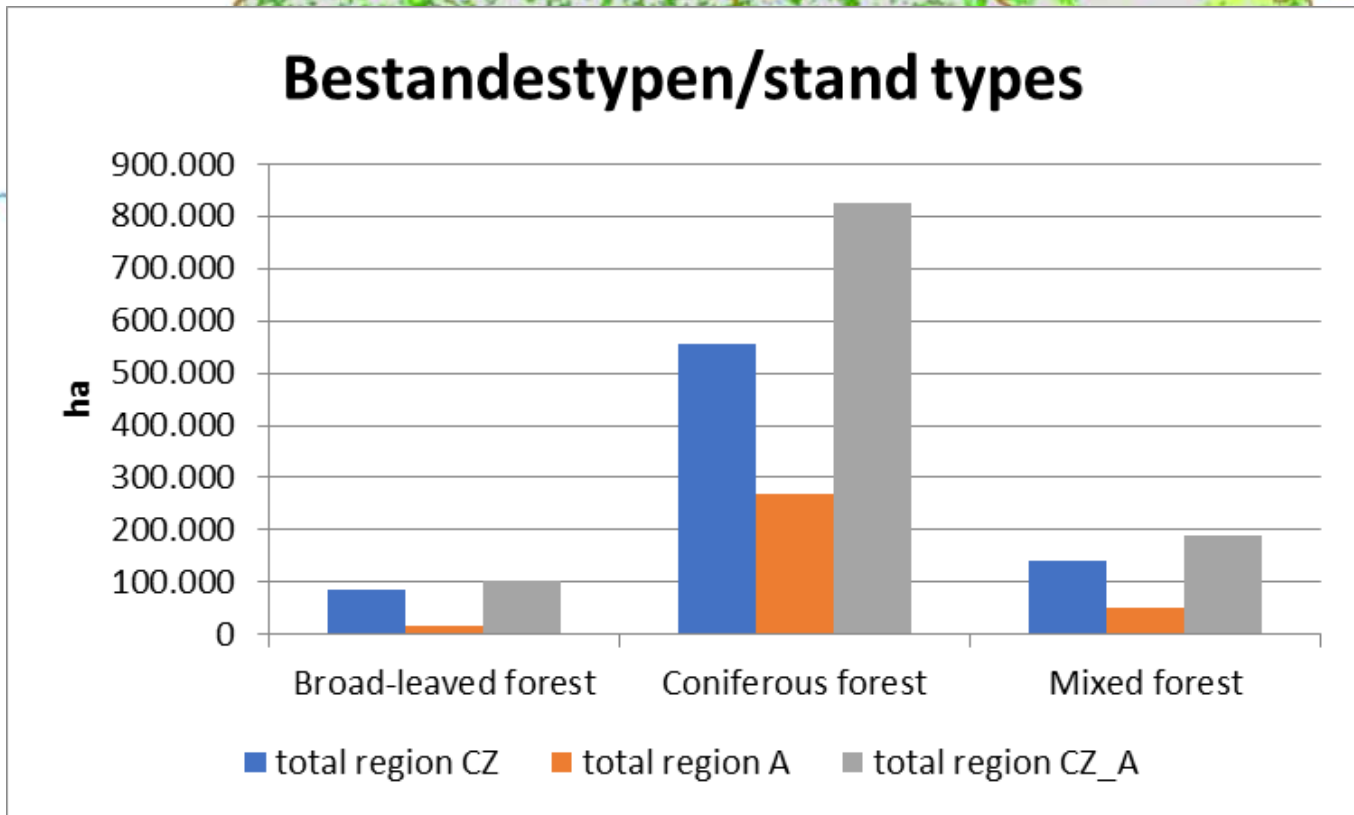
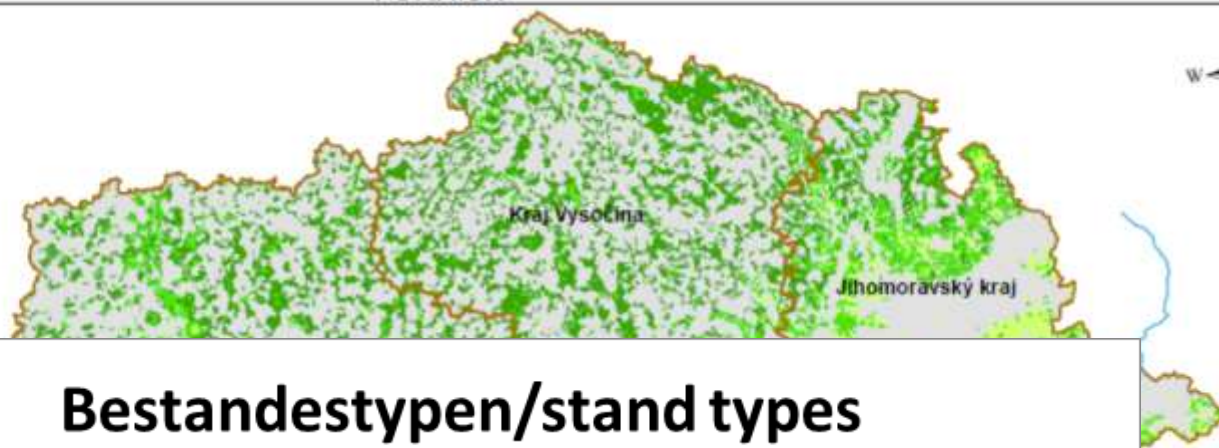


Region [ha]	Broad-leaved forest	Coniferous forest	Mixed forest	Moors and heathland	Transitional woodland-shrub	Total
Jihočeský kraj	7.639	321.473	53.048	0	15.490	397.649
Jihomoravský kraj	74.256	58.263	65.090	0	11.912	209.521
Kraj Vysočina	2.766	177.063	20.839	0	6.586	207.255
<b>total region CZ</b>	<b>84.661</b>	<b>556.799</b>	<b>138.977</b>	<b>0</b>	<b>33.988</b>	<b>814.425</b>
Waldviertel	10.476	171.953	27.381	0	2.159	211.969
Mühlviertel	6.199	97.297	23.248	0	1.174	127.918
<b>total region A</b>	<b>16.675</b>	<b>269.250</b>	<b>50.629</b>	<b>0</b>	<b>3.333</b>	<b>339.887</b>
<b>total region CZ_A</b>	<b>101.336</b>	<b>826.048</b>	<b>189.607</b>	<b>0</b>	<b>37.321</b>	<b>1.154.311</b>

Region [ha]	Broad-leaved forest	Coniferous forest	Mixed forest
Weinviertel	55.545	2.457	13.077
Mostviertel	48.969	94.715	115.083
Innviertel	2.292	49.150	10.470
Hausruckviertel	5.821	23.089	33.325
<b>total [ha]</b>	<b>112.628</b>	<b>169.411</b>	<b>171.955</b>
<b>in %</b>	<b>24,8</b>	<b>37,3</b>	<b>37,9</b>



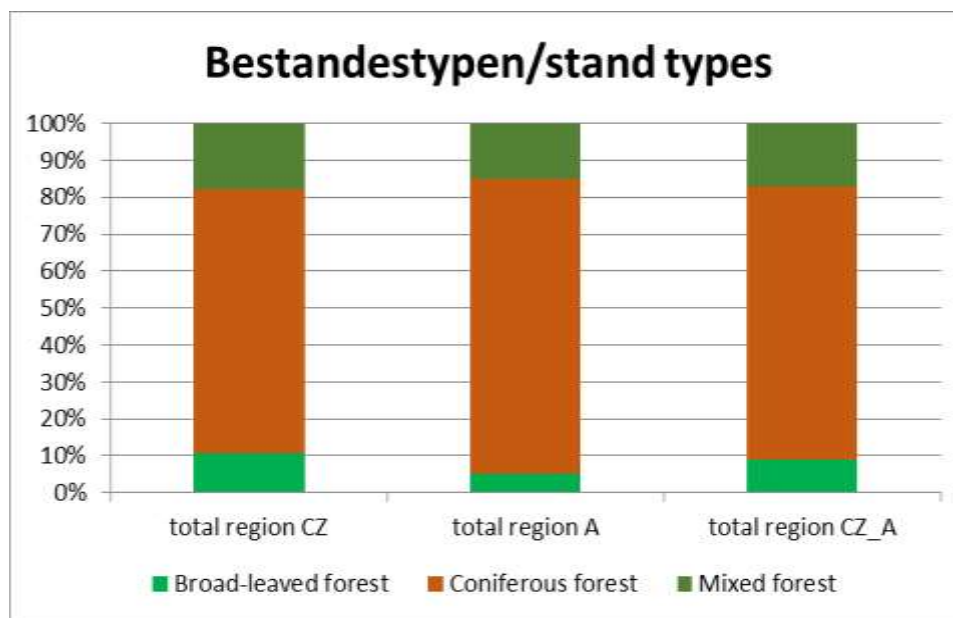
## FORRISK







Region [%]	Broad-leaved forest	Coniferous forest	Mixed forest
Jihočesky kraj	2,0	84,1	13,9
Jihomoravsky kraj	37,6	29,5	32,9
Kraj Vysočina	1,4	88,2	10,4
total region CZ	10,8	71,3	17,8
Waldviertel	5,0	82,0	13,1
Mühlviertel	4,9	76,8	18,3
total region A	5,0	80,0	15,0
total region CZ_A	9,1	74,0	17,0





## FORRISK

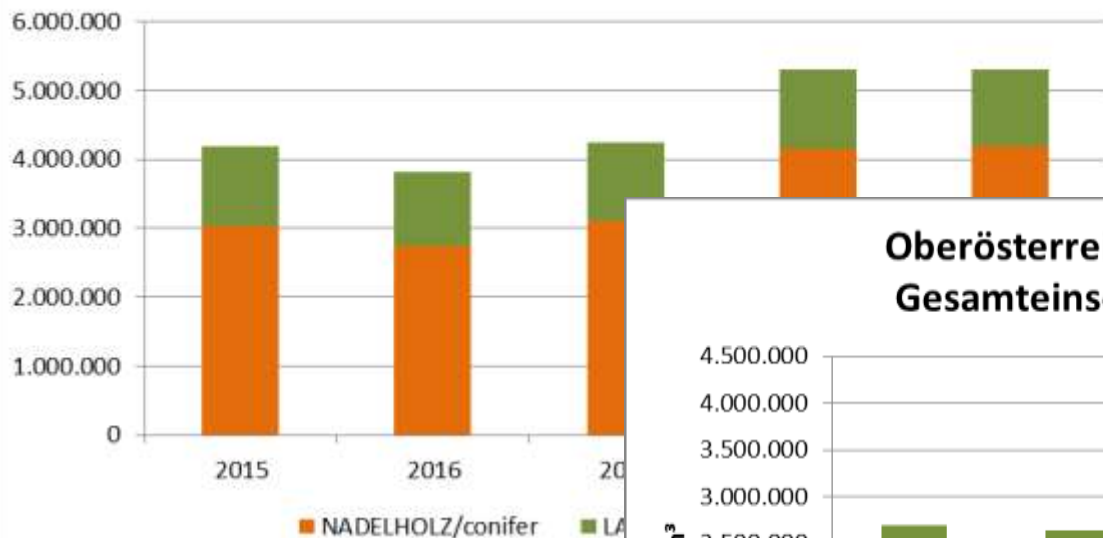


Region	period	damaged volume (Mio m <sup>3</sup> )	damaged area (ha)	forest area	damaged area [% of forst area]
Jihočeský Kraj [SB]	2015 - 2019	4,0			
Vysocina Region	2015 - 2019	5,0			
Jihomoravský Kraj [SM]	2015 - 2019	3,0			
Mühlviertel	2015 - 2020	3,0	14.500	127.000	11,4
Waldviertel	2015 - 2020	10,3	54.100	232.000	23,3
		<b>25,3</b>			

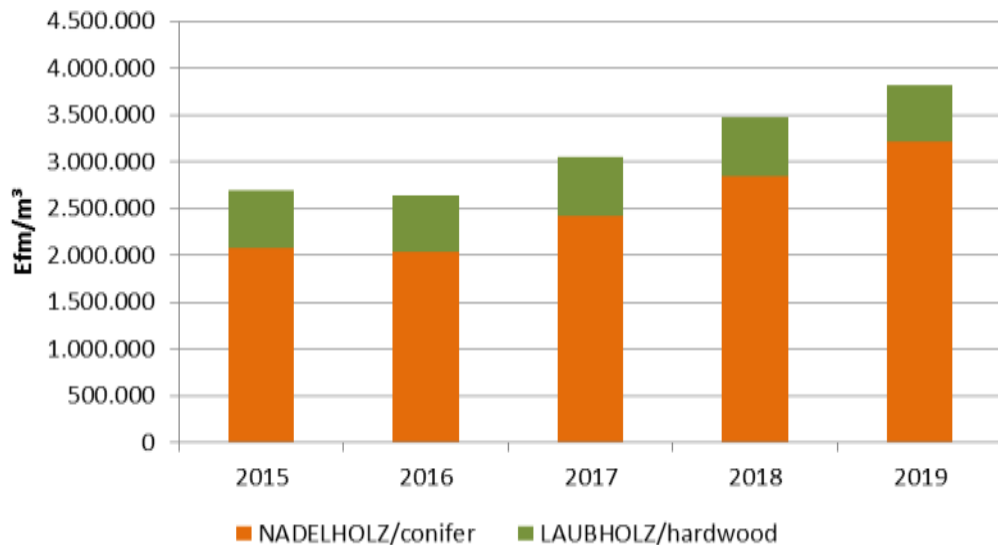




**Niederösterreich/Lower Austria:  
 Gesamteinschlag/total felling**



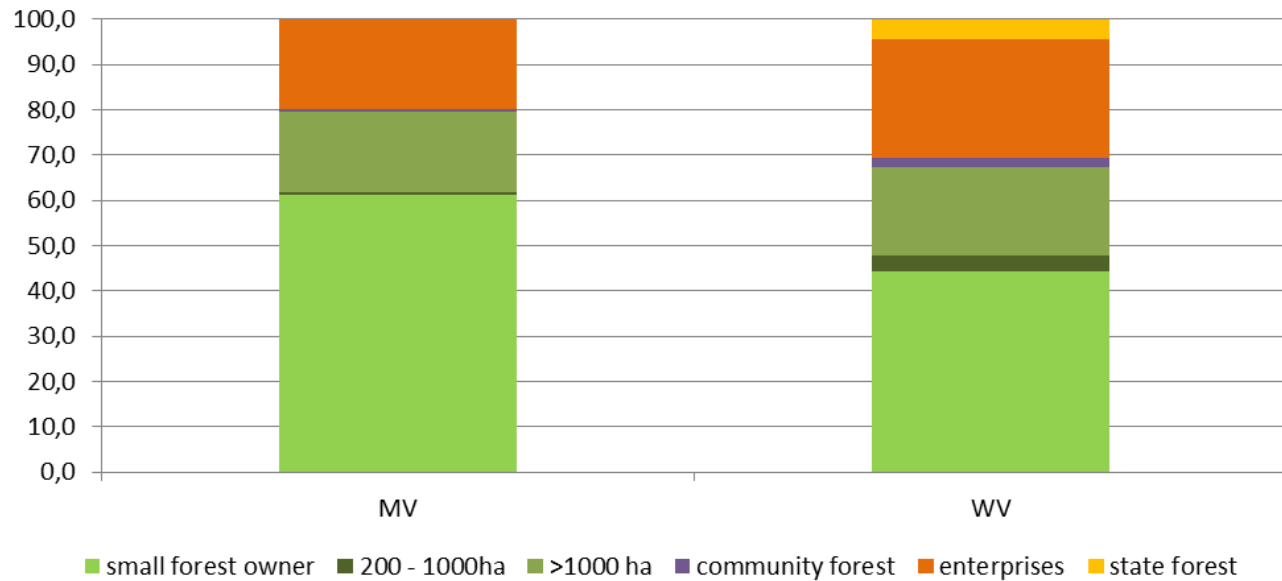
**Oberösterreich/Upper Austria:  
 Gesamteinschlag/total felling**



HEM: <https://www.bmlrt.gv.at/forst.html>

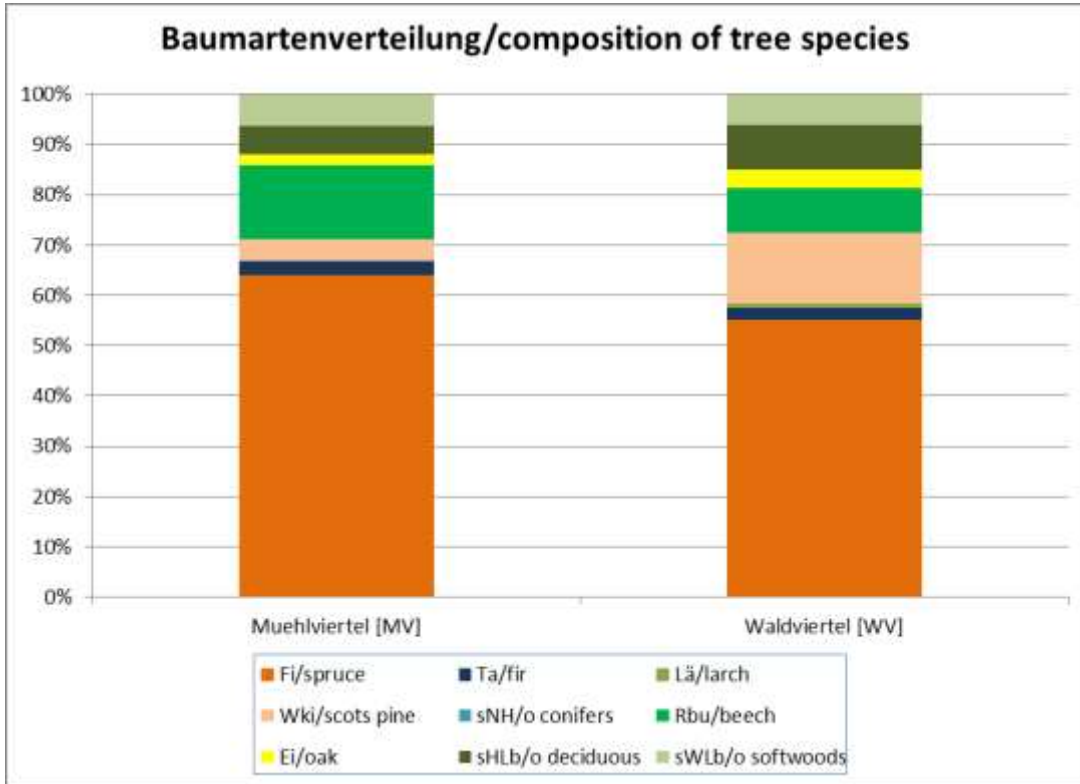


### Eigentumsarten/type of properties



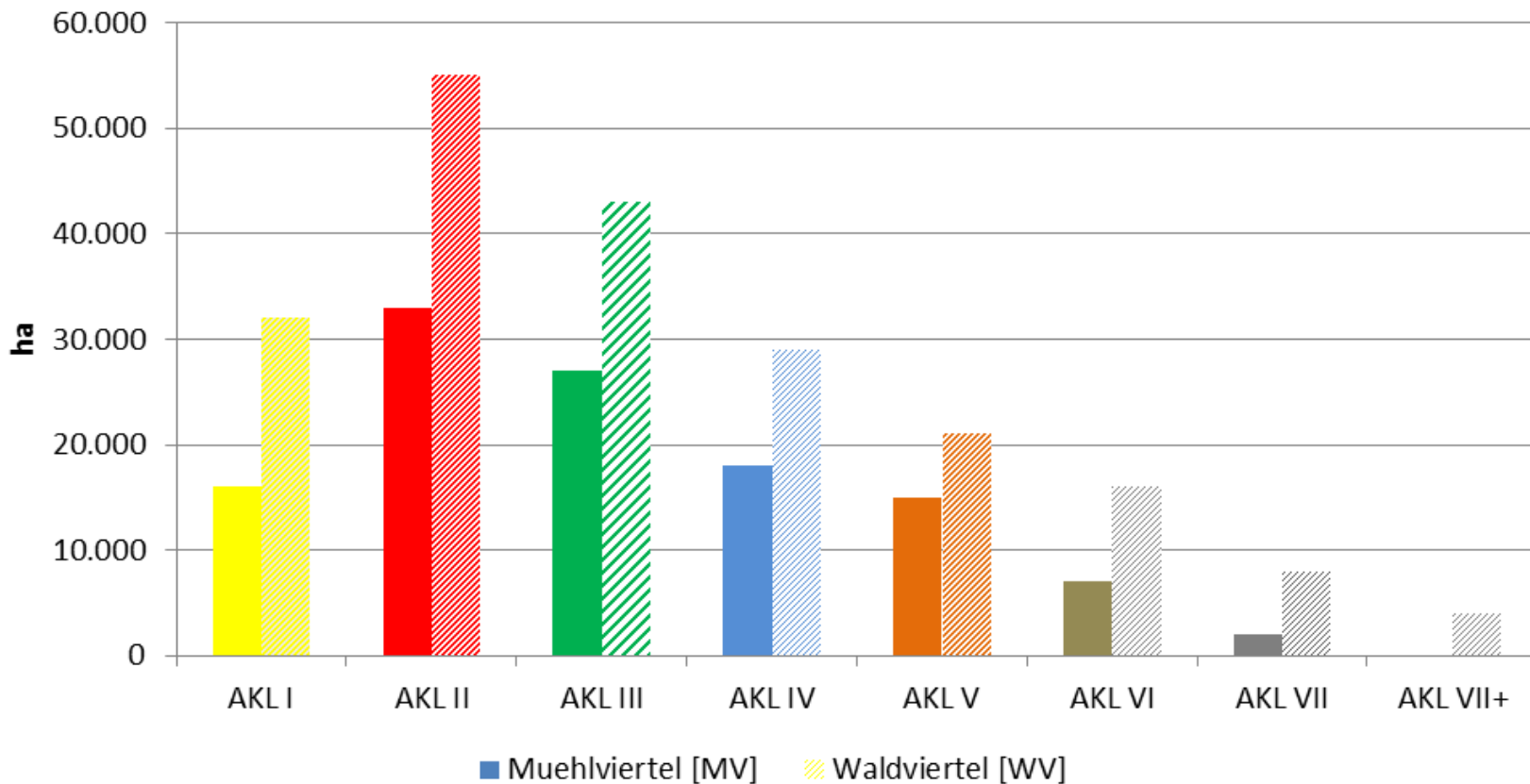
Data source: ÖWI 07/09







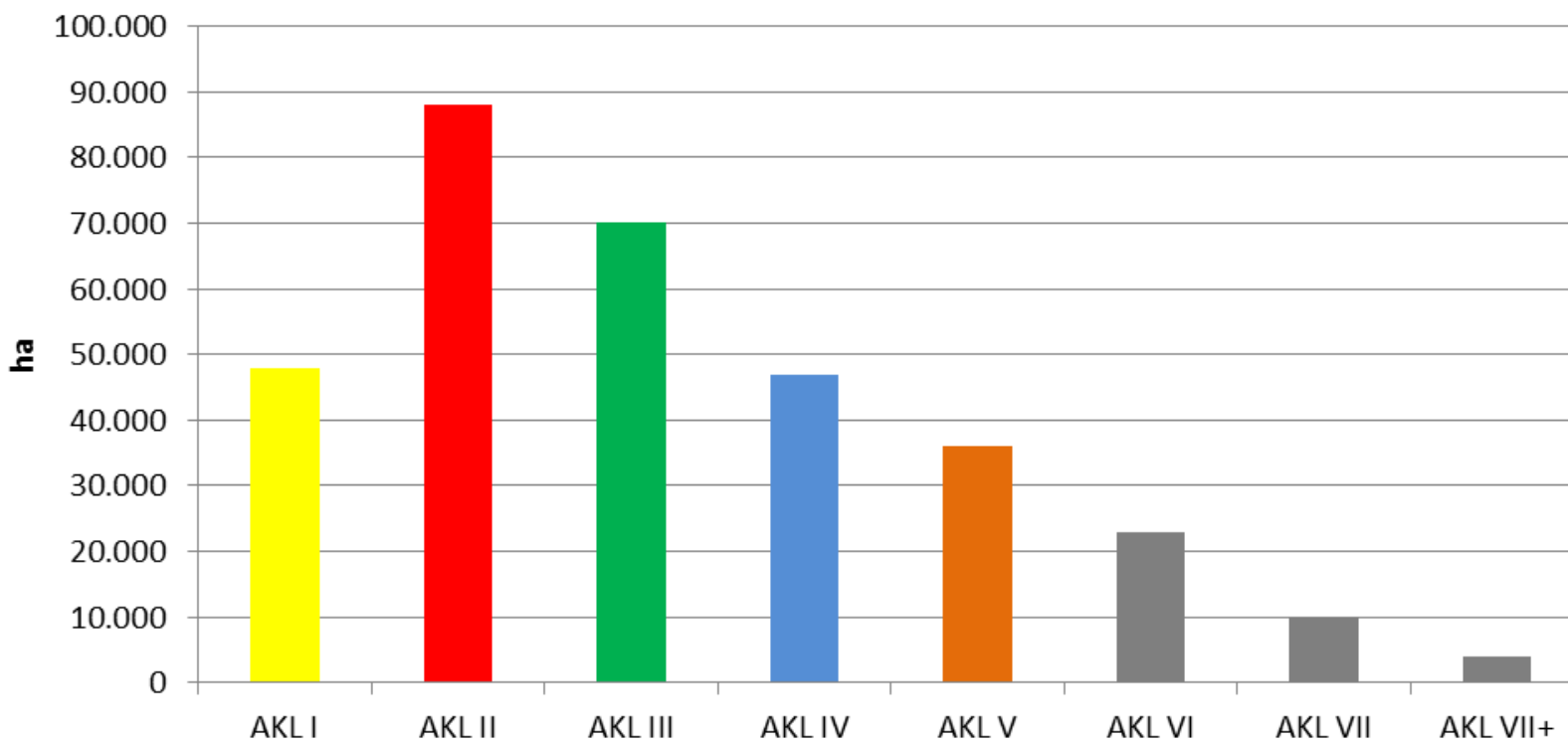
## Altersklassenverteilung/age class distribution



Data source: ÖWI 07/09



## Region/region: Altersklassenverteilung/age class distribution

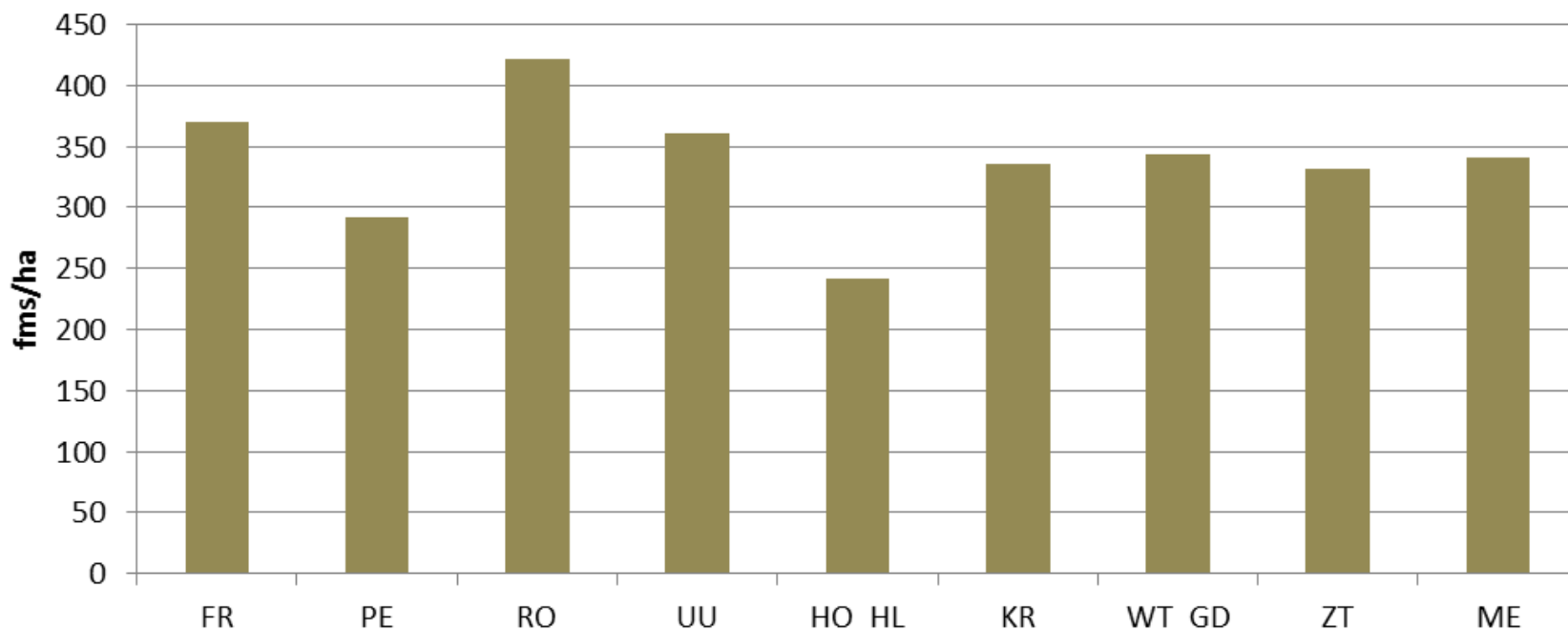


Data source: ÖWI 07/09

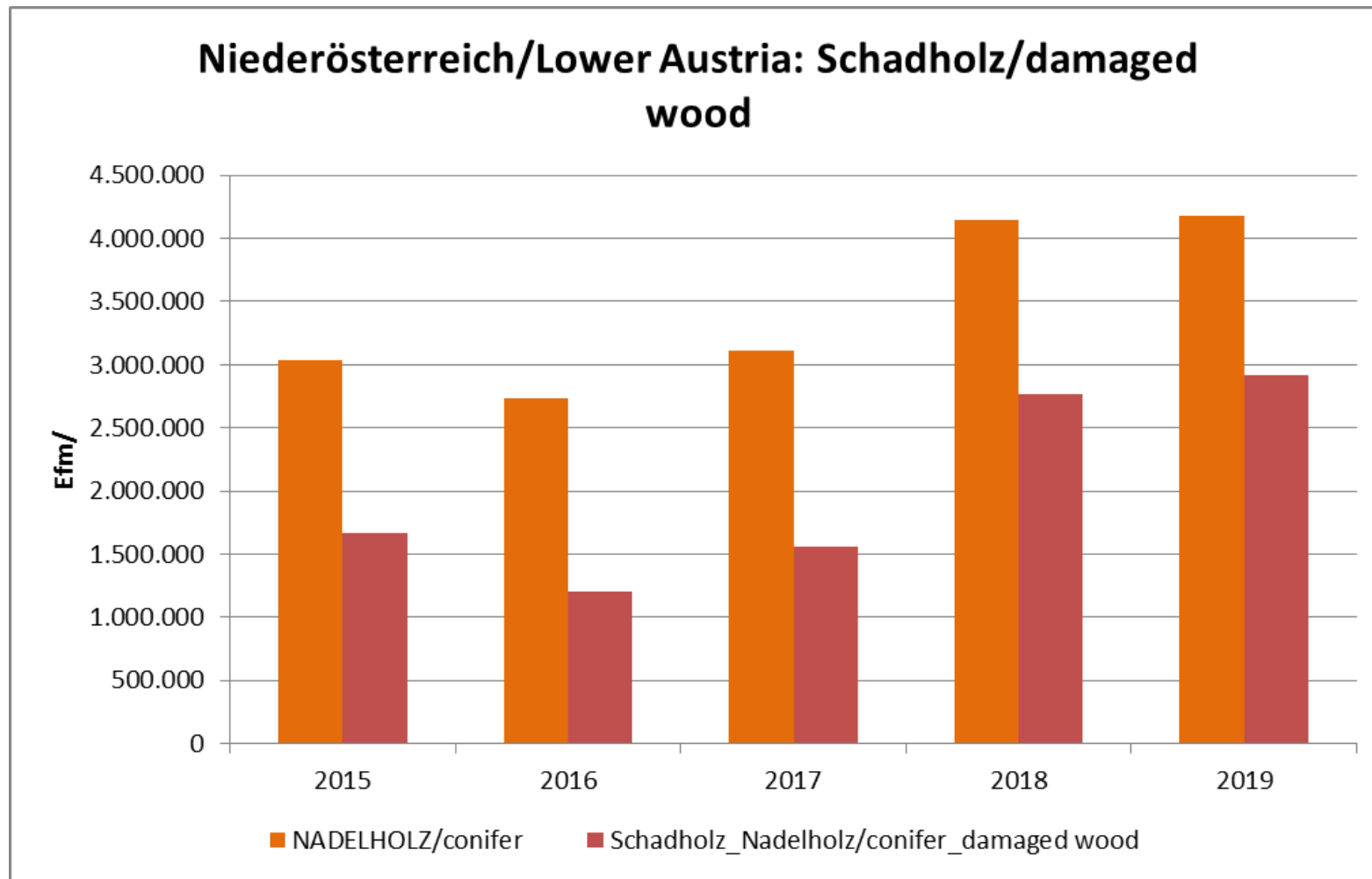




## Bezirke/districts: mittlerer Vorrat/average standing volume (fms/ha)



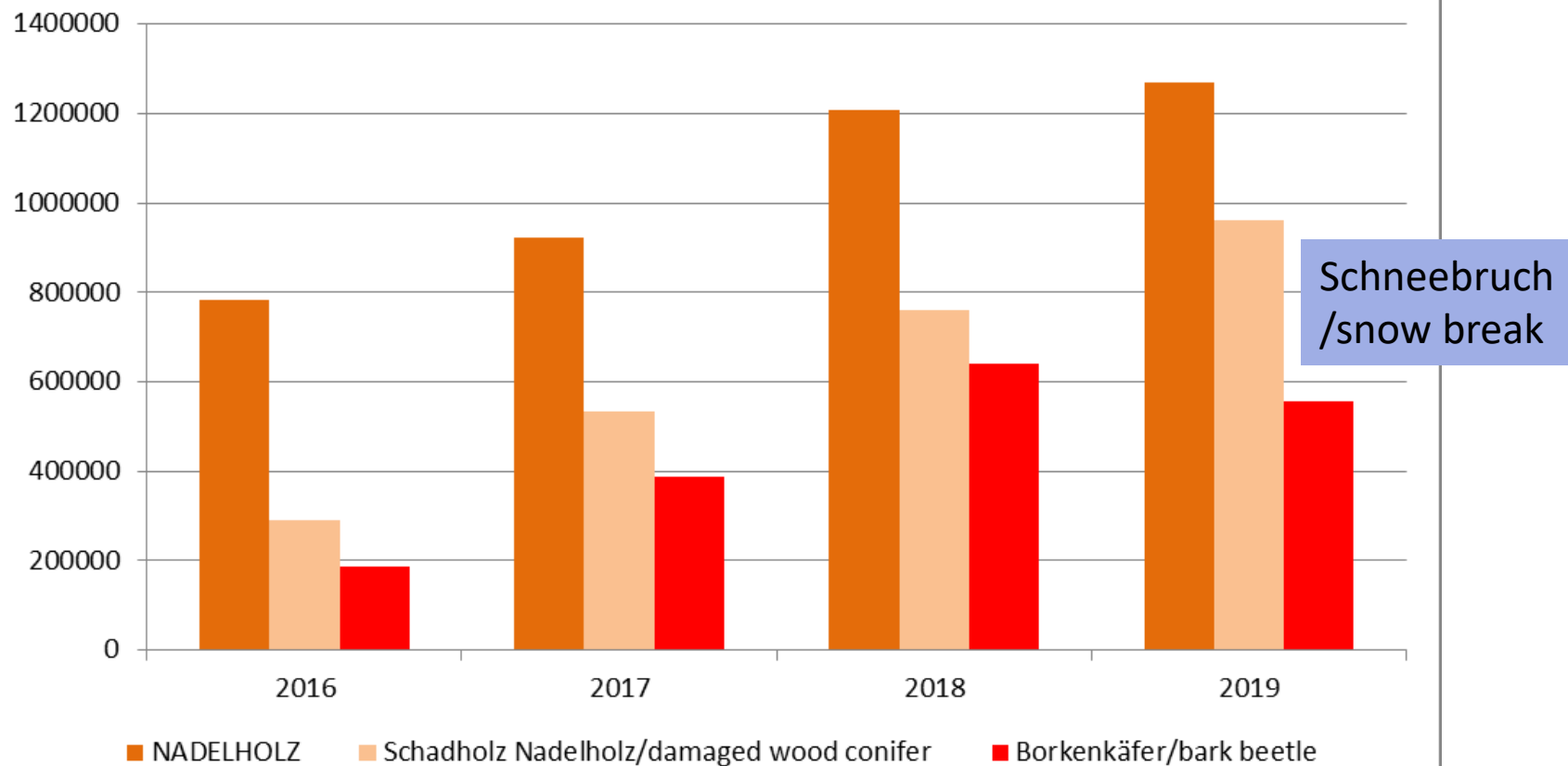
Data source: ÖWI 07/09



HEM: <https://www.bmlrt.gv.at/forst.html>



**MV: NH/conifer: Einschlag/total felling [Efm]/, davon Schadholz und/oder Borkenkäfer/from that damaged wood and/or damaged by bark beetle**



<https://www.land-oberoesterreich.gv.at/38123.htm>





## Climate prediction

- **Climate prediction (frameadapt.cz)**
- **Drought risk monitoring system**



# Legislative framework – Forest act – Forest subsidies

- Czech - administration
- Austria - administration
  - Forest act
  - Subsidies (Waldfonds)
- Austria - Chamber of Agriculture



# Forest protection and bark beetle management

- IFF – Baier, Netherer, Kirisits
  - Monitoring: PHENIPS + PHENIPS plus
  - TDEF (Simulations of Transpiration deficits)
  
- Cermak, Martinek, Zid
  - KUROVCOVE INFO: Monitoring and sharing information about bark beetle swarming





## Monitoring, hazard rating and early warning systems for bark beetle management in Austria

### PHENIPS „Phenology of *Ips typographus*“

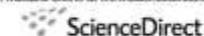
#### Spatio-temporal simulation of the development and phenology

#### different thresholds and thermal sums for

- temperature dependend brood development
- onset of swarming and infestation in spring
- development of sisterbroods and filial generations
- reproductive diapause (depending on photoperiod)
- hibernation and winter mortality



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)



Forest Ecology and Management 249 (2007) 175–186

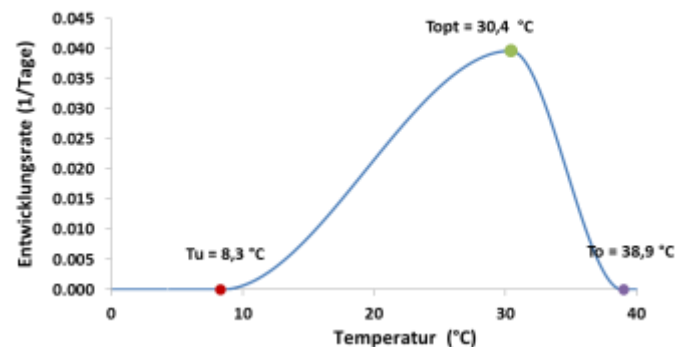


PHENIPS—A comprehensive phenology model of *Ips typographus* (L.) (Col., Scolytinae) as a tool for hazard rating of bark beetle infestation

Peter Baier<sup>a</sup>, Josef Pemmerstorfer, Axel Schopf<sup>b</sup>

<sup>a</sup>Institute of Forest Entomology, Forest Pathology and Forest Protection, Department of Forest and Soil Sciences, University of Natural Resources and Applied Life Sciences, Muthgasse 35, A-1130 Vienna, Austria  
<sup>b</sup>Received 1 June 2006; revised in final form 24 January 2007; accepted 5 May 2007

#### nonlinear relation between temperature and development

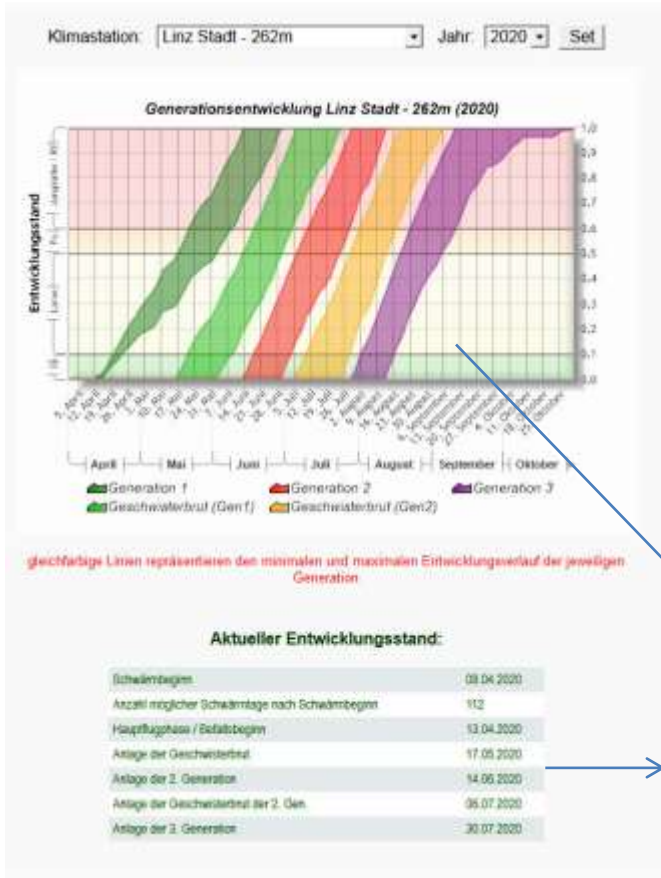




## PHENIPS „Phenology of Ips typographus“

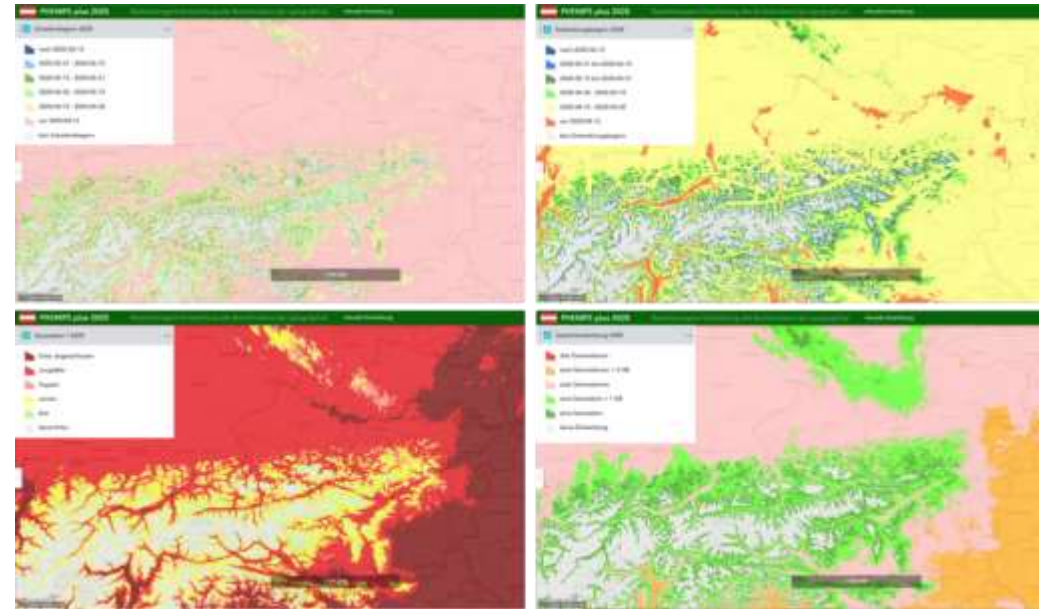
<https://iff-server.boku.ac.at/>

### PHENIPS online



### PHENIPS plus

daily updated interactiv map service



#### daily updated thermal sums

for **maximal** development (sun exposed openings and stand edges )  
 and **minimal** development (shadowed sites within stands)

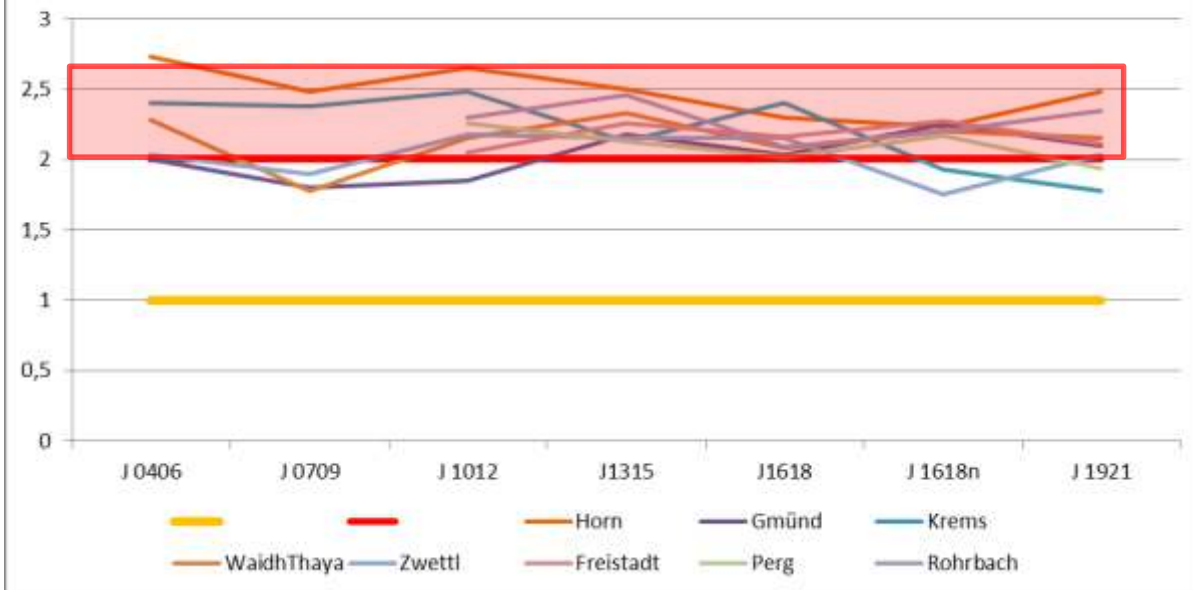
#### essential dates for timely bark beetle management

onset of swarming and infestation in spring  
 start of sister broods and filial generations



# Forest protection and game management

**Durchschnittlicher Wildeinfluss nach Bezirken/  
 average game influence by districts (WEM; BFW 1921)**



**Oberhöhenbäume/top height trees**

Bezirk/ N [n/ha]	Ei - unverb (oak not browsed)	Ei- verb (oak browsed)	<b>Ei - Verbiss % (oak browsing percentage)</b>	Ta - unverb (fir not browsed)	Ta- verb (fir browsed)	<b>Ta - Verbiss % /fir browsing percentage)</b>
Rohrbach	11	100	<b>90,1</b>	137	67	<b>32,8</b>
Perg	51	110	<b>68,3</b>	191	94	<b>33,0</b>
Freistadt	17	124	<b>87,9</b>	93	87	<b>48,3</b>
Gmünd	85	147	<b>63,4</b>	32	22	<b>40,7</b>
Horn	100	183	<b>64,7</b>	48	30	<b>38,5</b>
Krems	56	110	<b>66,3</b>	57	27	<b>32,1</b>
WaidThaya	65	170	<b>72,3</b>	33	55	<b>62,5</b>
Zwettl	8	90	<b>91,8</b>	102	80	<b>44,0</b>





# Remote sensing techniques

- Mendel University
  - Remote sensing based monitoring of bark beetle infestation in CZ
- BOKU
  - Early detection based on remote sensing (Immitzer)



# Risk management and statistics (Agricultural census)

- **BAB**
  - Statistics on Waldviertel
  - small forest owner
- **CM** – calculations for various goal management types

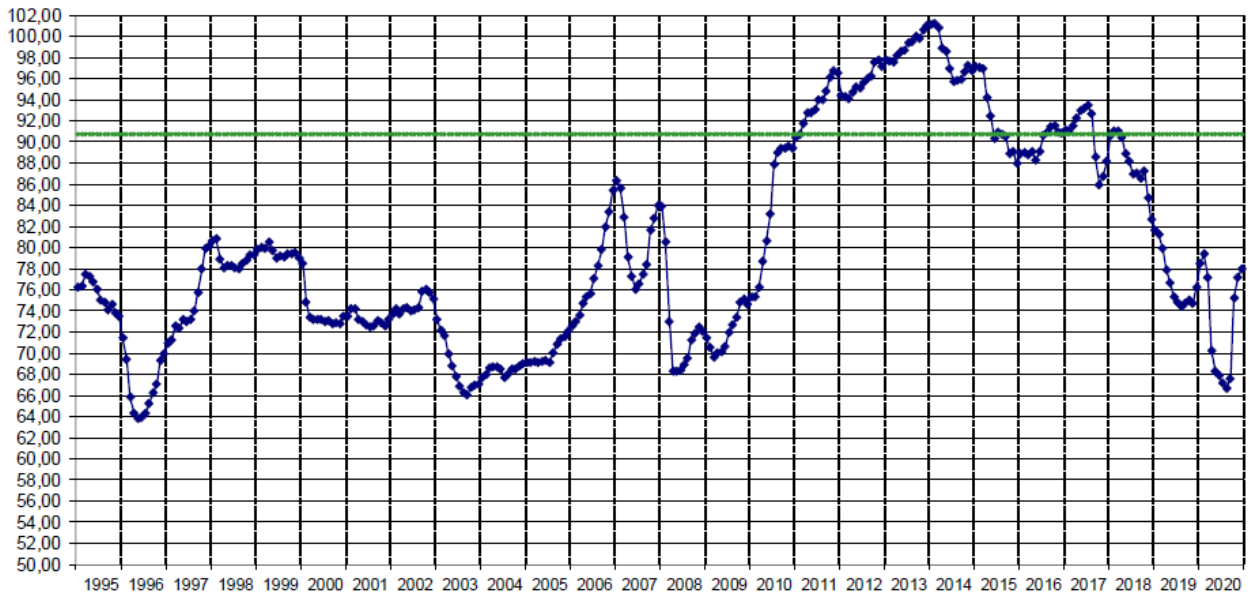


## Holzpreisentwicklung/timber price development Sägeholz 2 b/sawlog 2b



### Sägerundholz, Fi/Ta, B, Stärkeklasse 2b

Euro/FMO ab LKW-fahrbarer

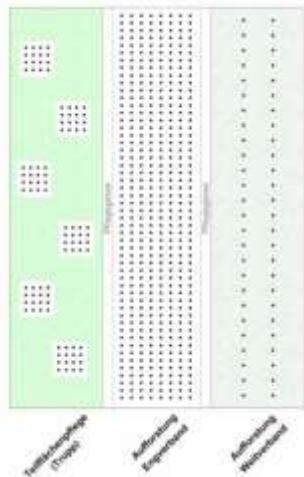
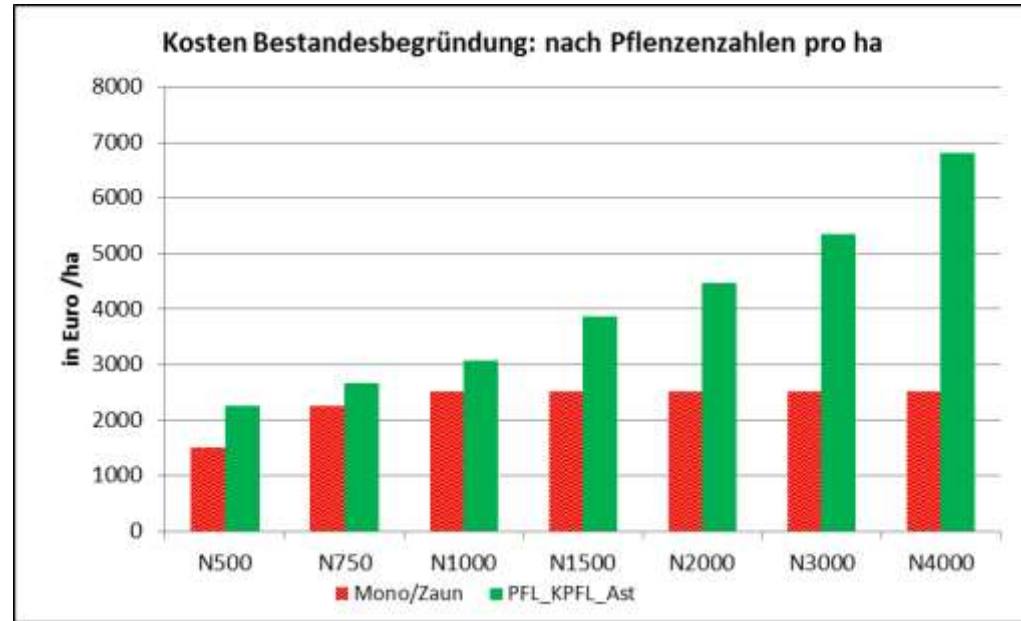


Quelle: ÖSTAT





## Reforestation concepts vs. natural regeneration



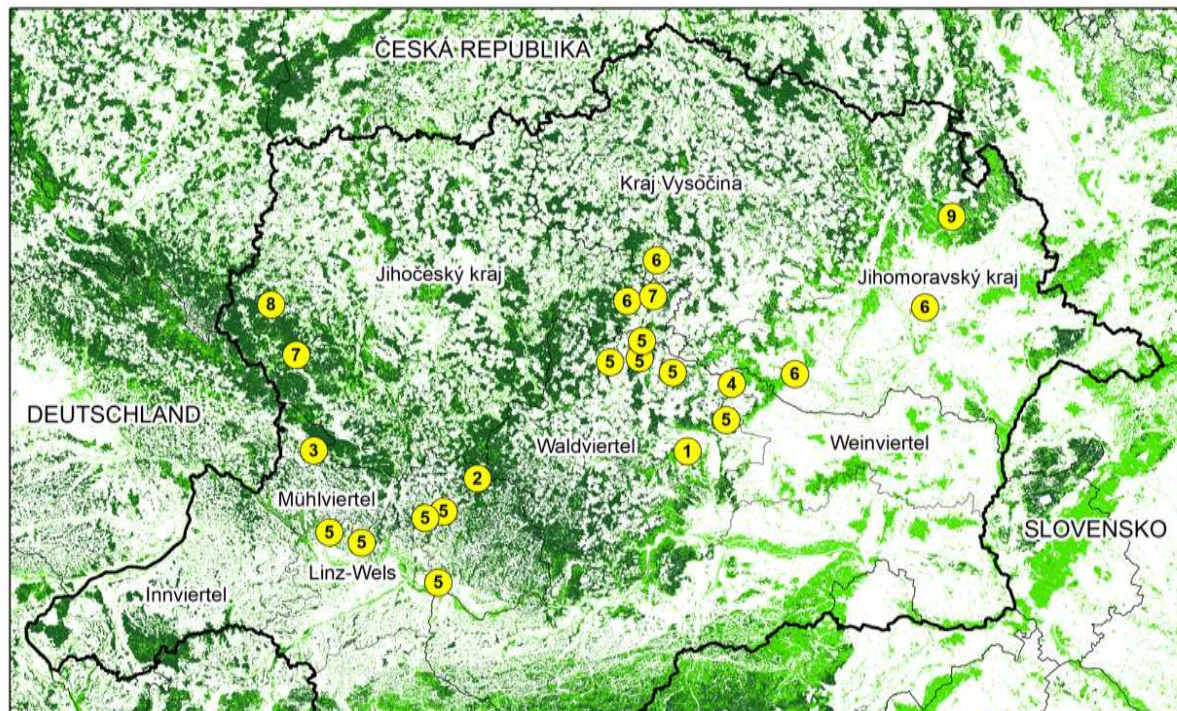
Small group/cluster planting [1\*1m;  
 normal (narrow) spacing [ 2\*1m]

wide spacing [3\*1m]





## Case studies – pilot areas



- Private enterprises
- State forest
- Mendel University Forest enterprise
- Community forest
- Small forest owners

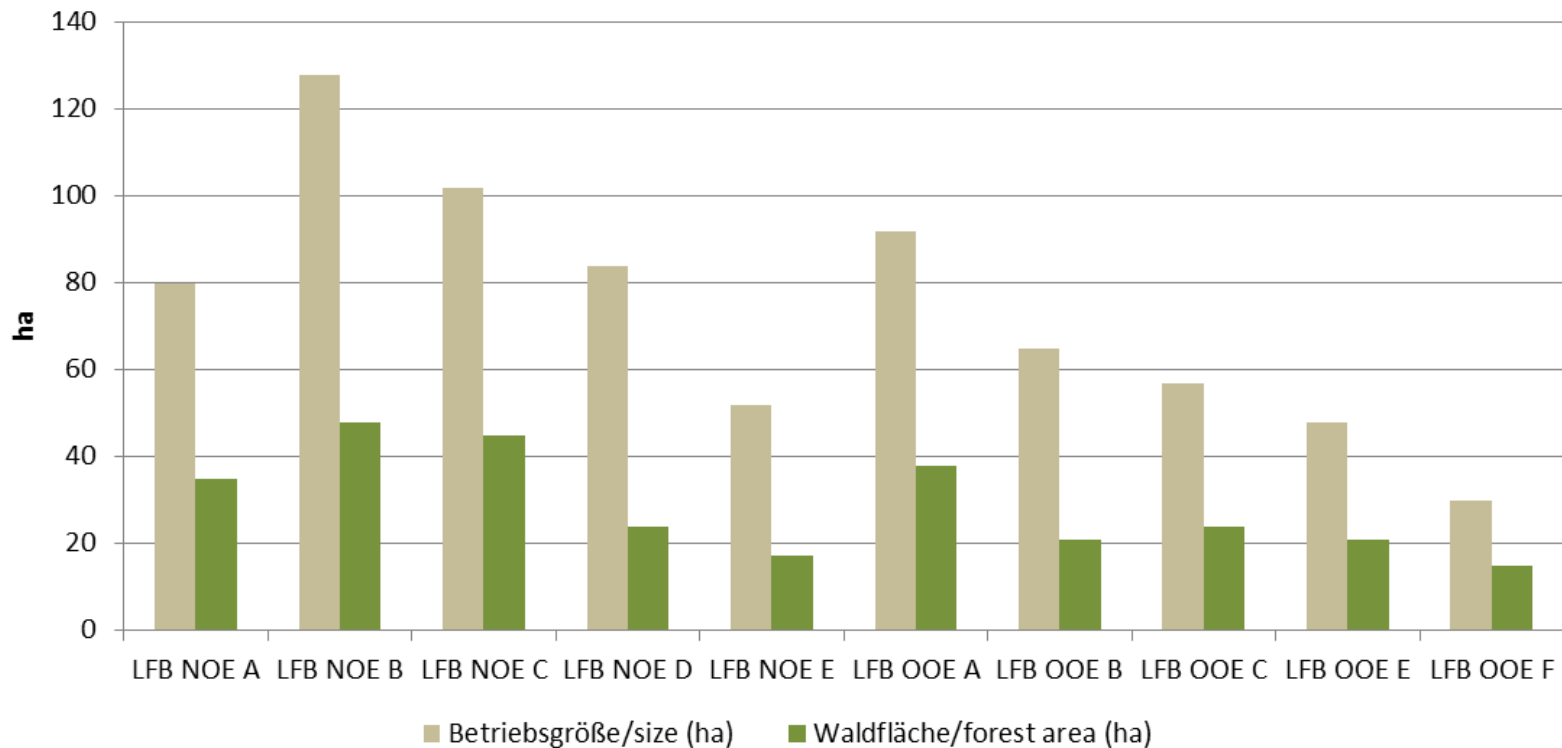


FD Ing. Herbert Schmid: FA Stift Altenburg  
 DI Christian Gartlehner: FG Rosenhof  
 DI Mag Johannes Wohlmacher: FV Stift Schlägl  
 DI Bernhard Funke, Dr DI Norbert Putzgruber: ÖBf

	ÖBf - Revierteil Riegesburg (FB Waldviertel-Voralpen)	Forstamt Stift Altenburg	Czernin-Kinsky Forstgut Rosenhof	FV Prämonstratenser- Chorherrenstift Schlägl
Waldfläche/forest area	1100	2800	5.900	5.800
Schadflächen/-mengen durch Borkenkäfer seit 2015 in Hektar/damaged area - bark beetle (ha) since 2015	140 ha	180 ha		
Schadholzmengen durch Schneebruch/volume of damaged timber due to snow breakage			~ 30.000 Efm	2.000 -> 5.000 -> 7.000 Efm

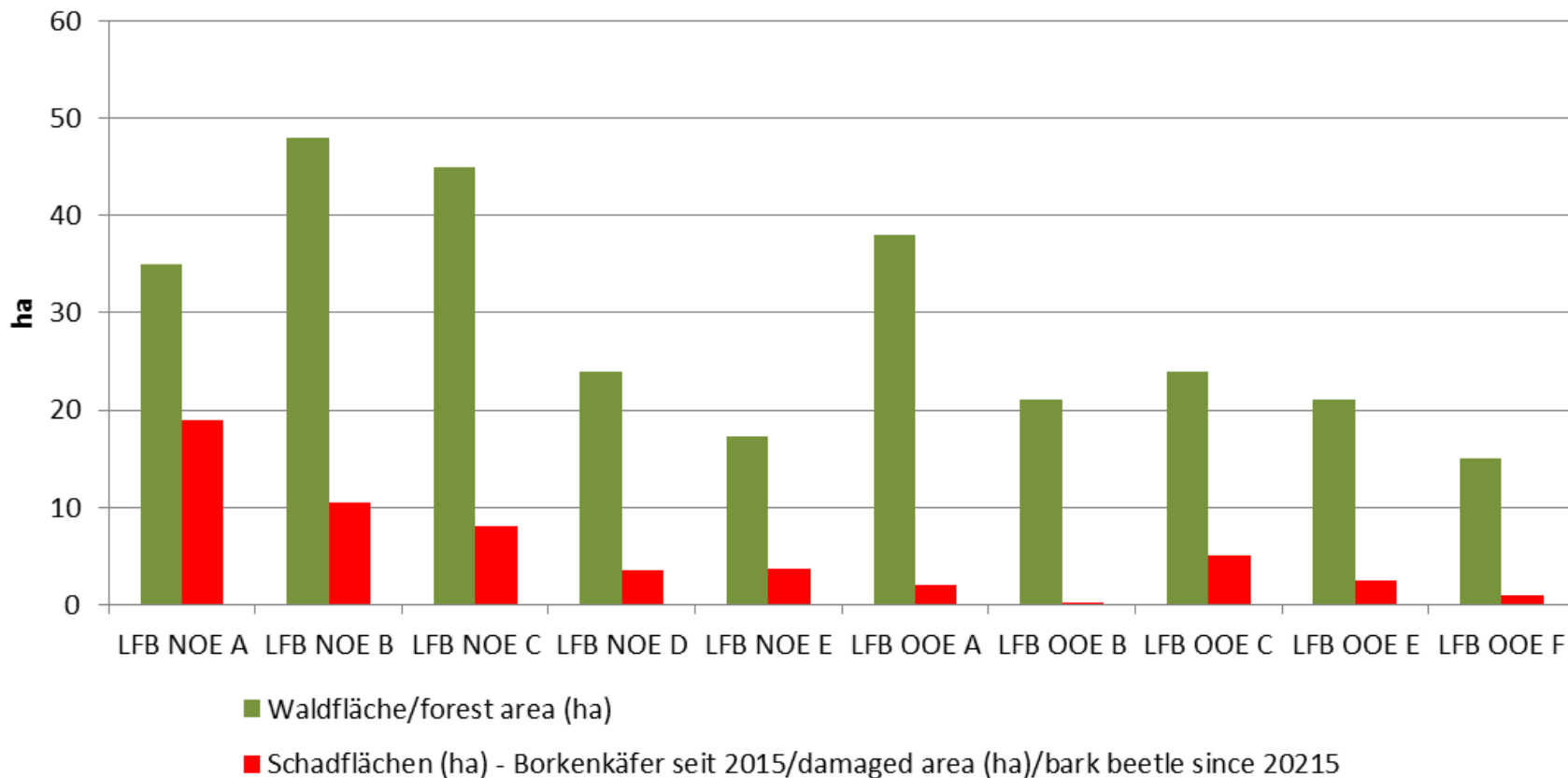


### Kleinwald/small forest owner





## Kleinwald/small forest owner







<b>farm business</b>	LFB NOE A	LFB NOE B
size (ha)	80	128
forest area (ha)	35	48
damaged area since 2016	19	10,5
spruce in ha	18	6,5
pine in ha	1	3,5
fir in ha		0,5
damaged volume since 2016	6000	1600
<b>reforestation (ha) - total</b>	<b>4</b>	<b>3,7</b>
subsidised by state	2	2
tree species for reforestation	douglas, oak, maple, red oak, fir	oak, douglas, spruce
non subsidised	2	1,7
tree species for reforestation	spruce, larch, pine	douglas, maple, spruce
mortality (n/ha)	3000	0
mixed forest - less damages		35
remarks	The long-term economic situation of the company was negatively influenced by the bark beetle calamity	
		% - 2015 -> 2025 spruce 30 20 pine 30 20 fir 25 30 deciduous tree species 10 20 larch, douglas 5 10