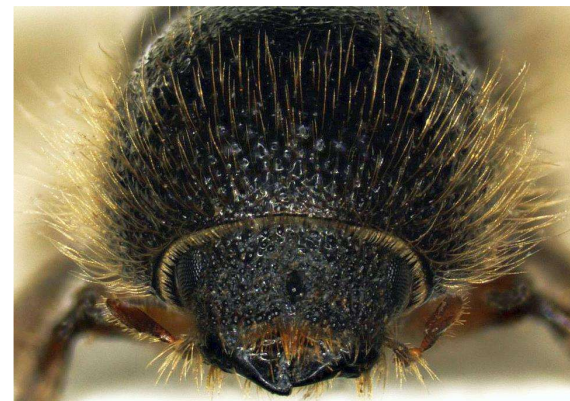


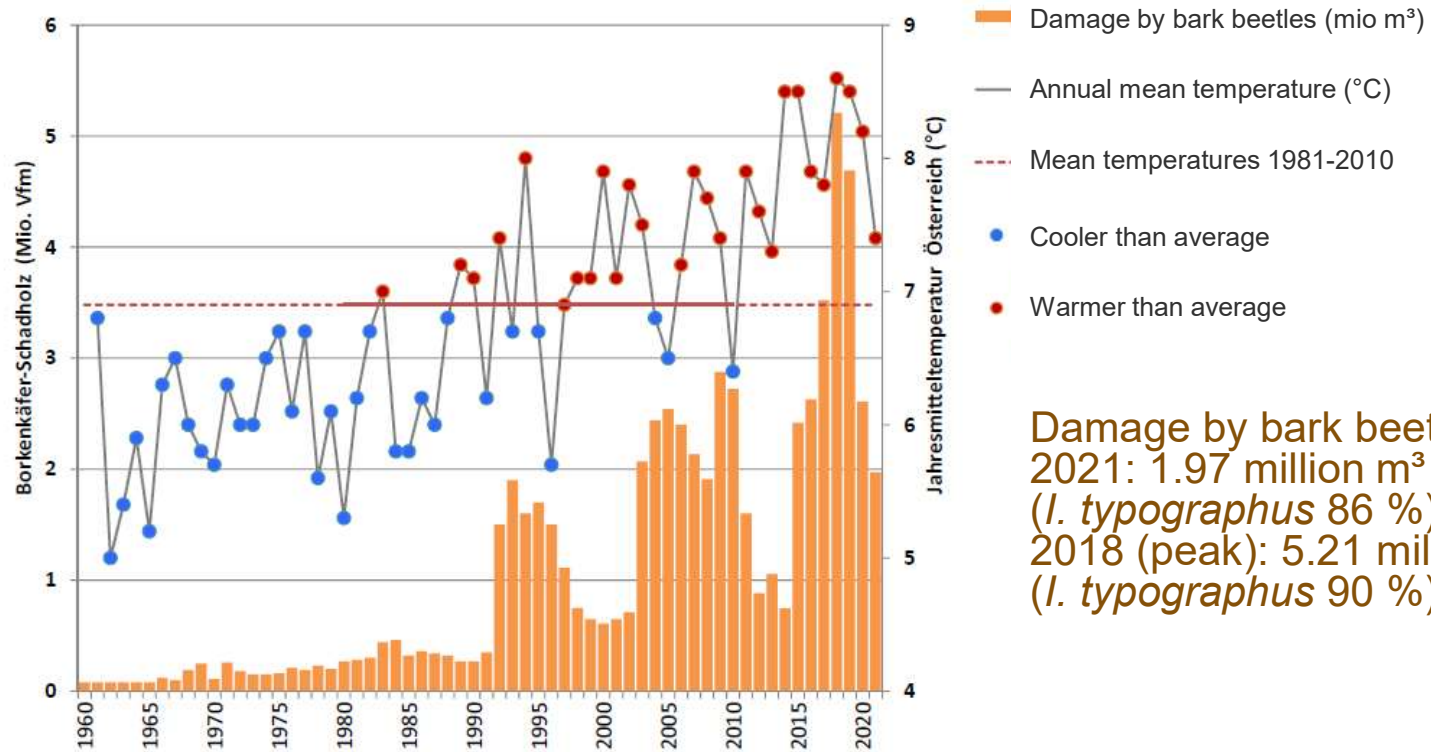
The spruce bark beetle situation in Austria

Gernot Hoch
Austrian Research Centre for Forests

PREPARE Webinar



13 May, 2022



Damage by bark beetles:
 2021: 1.97 million m³
 (*I. typographus* 86 %)
 2018 (peak): 5.21 million m³
 (*I. typographus* 90 %)

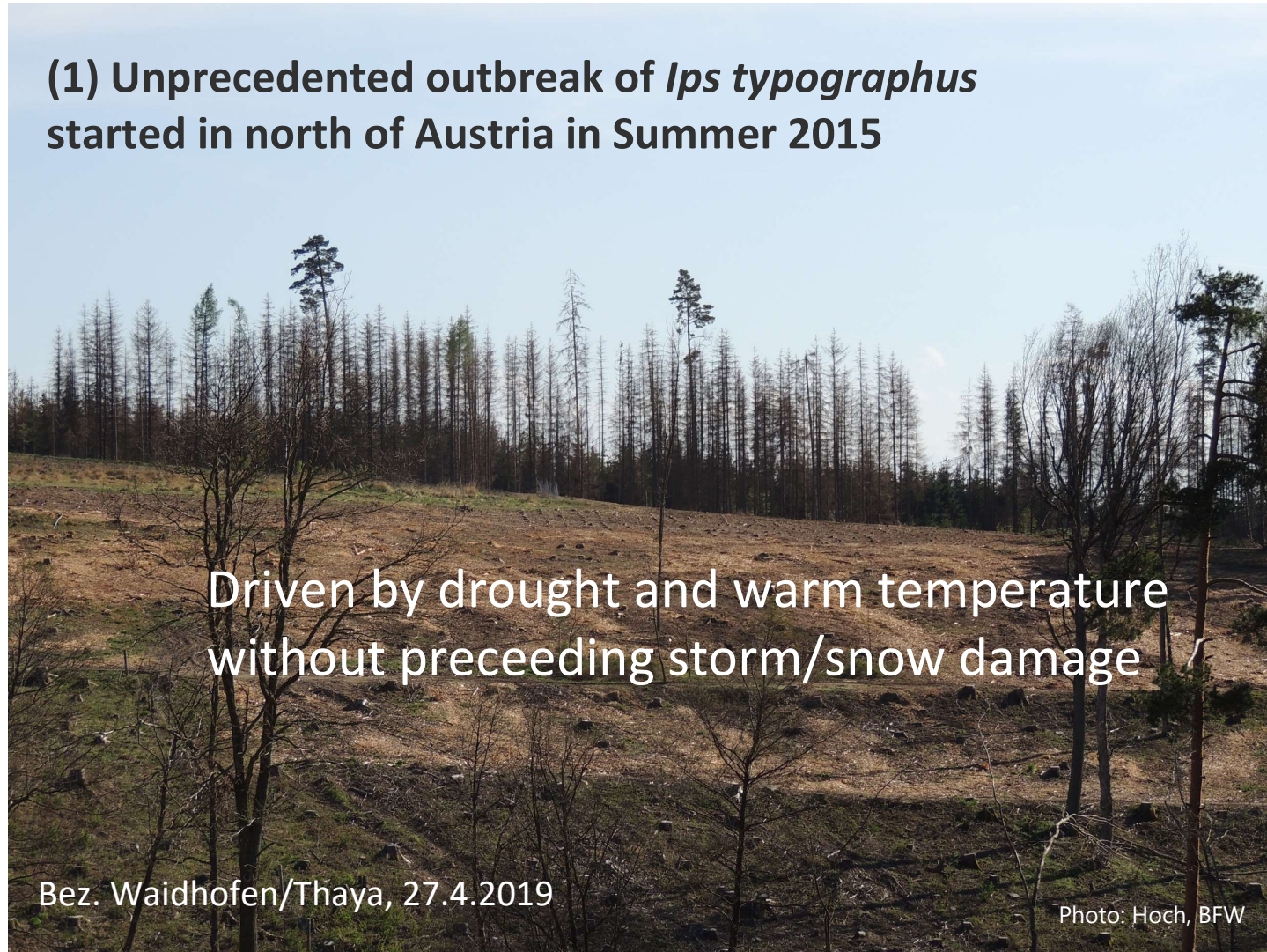
Increasing **annual damage by bark beetles in Austria** and
 increasing mean annual **temperature**
 (updated from Hoch & Steyrer 2020: CCCA Fact Sheet #31)

(1) Unprecedented outbreak of *Ips typographus* started in north of Austria in Summer 2015

Driven by drought and warm temperature
without preceeding storm/snow damage

Bez. Waidhofen/Thaya, 27.4.2019

Photo: Hoch, BFW

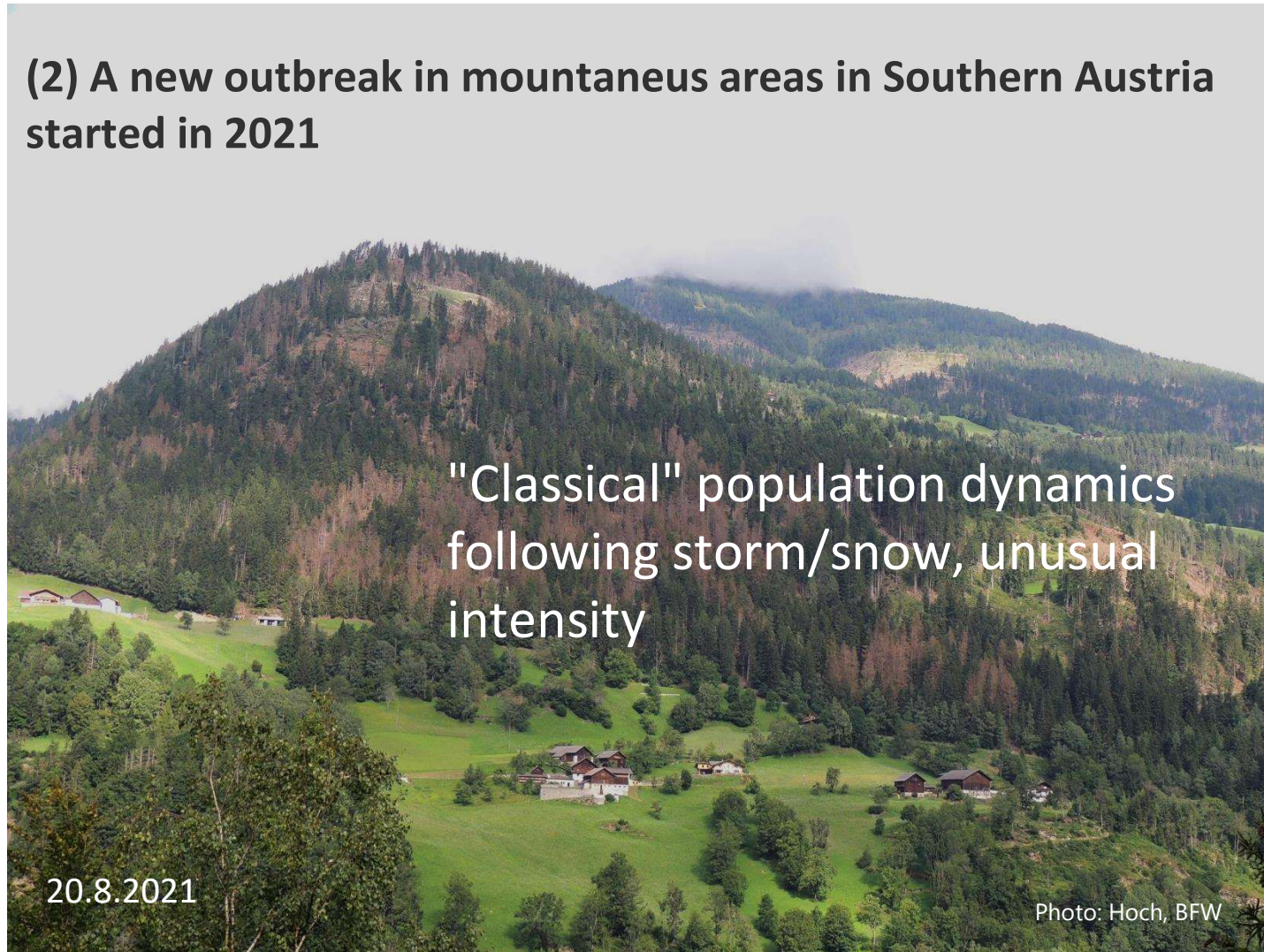


(2) A new outbreak in mountaneous areas in Southern Austria started in 2021

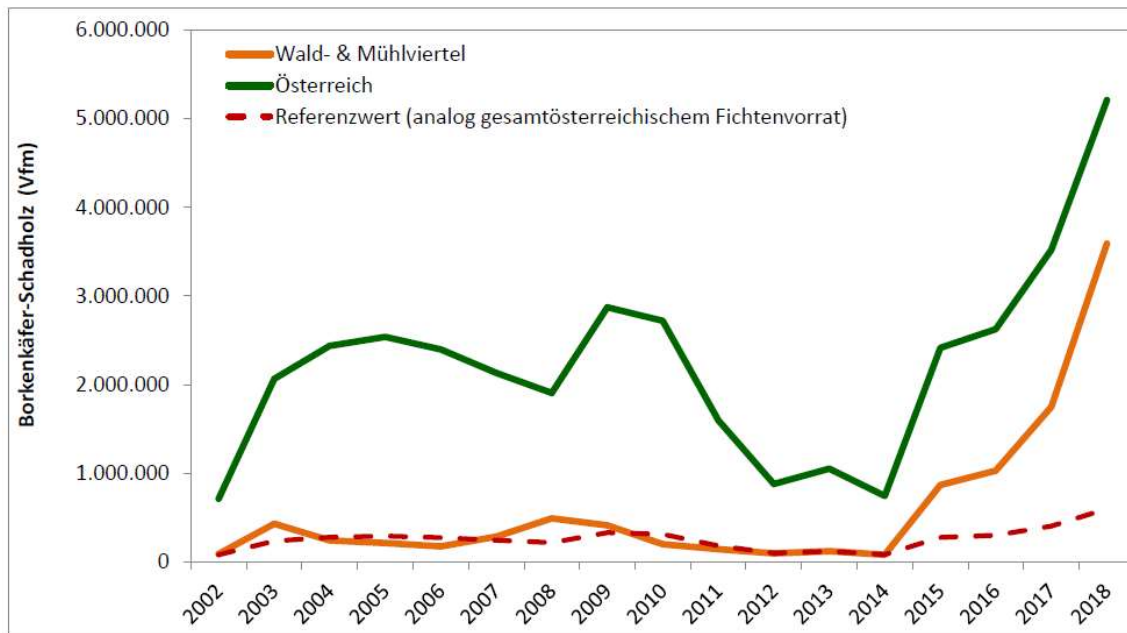
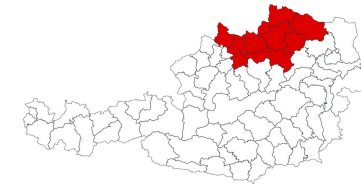
"Classical" population dynamics following storm/snow, unusual intensity

20.8.2021

Photo: Hoch, BFW

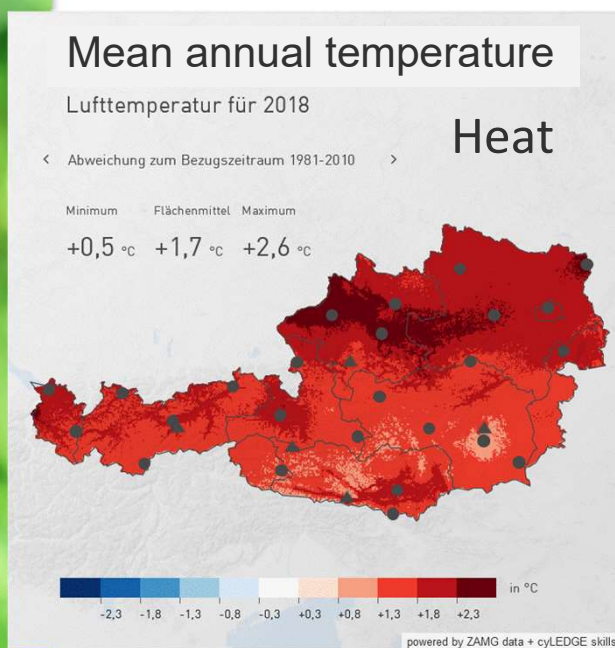


(1) Unprecedented outbreak of *Ips typographus* started in north of Austria in Summer 2015

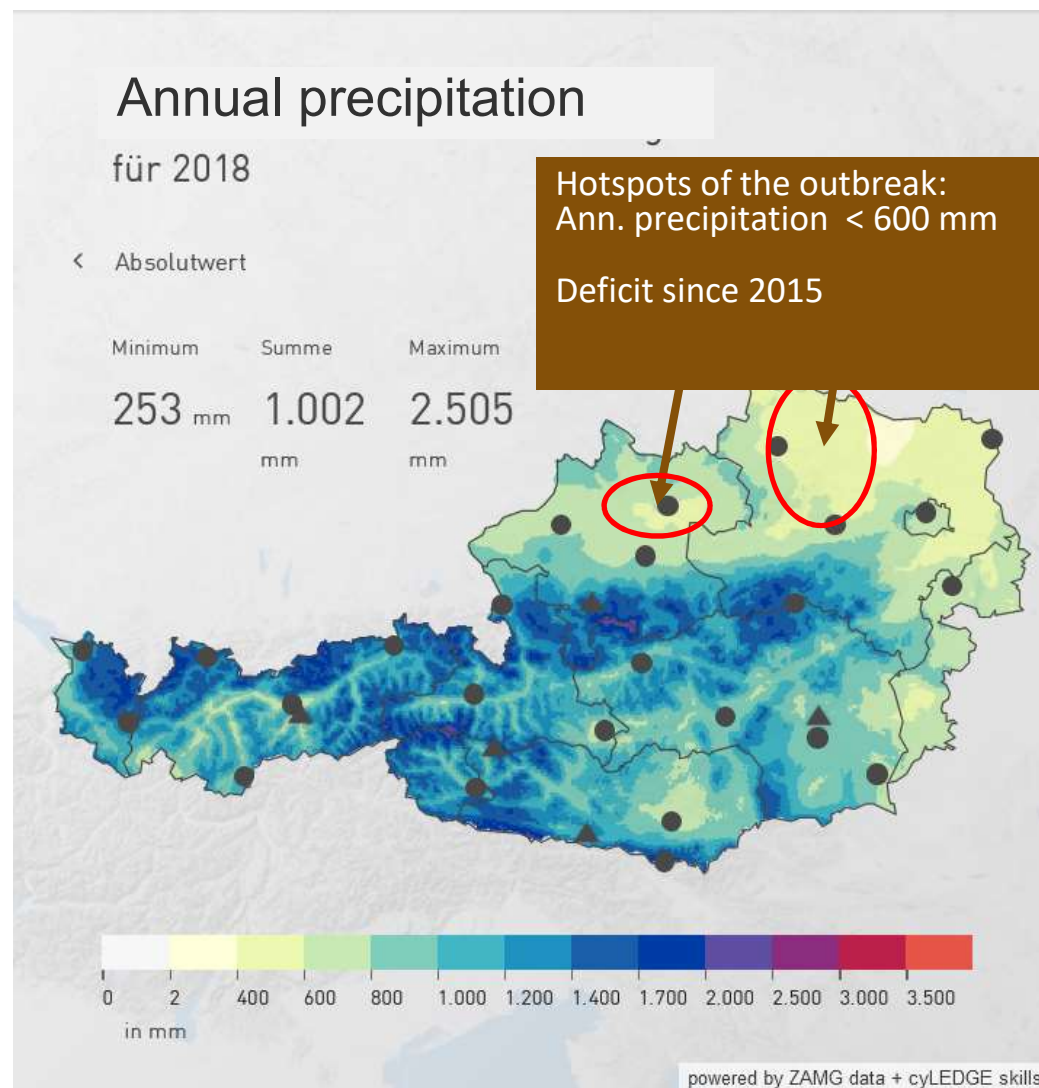


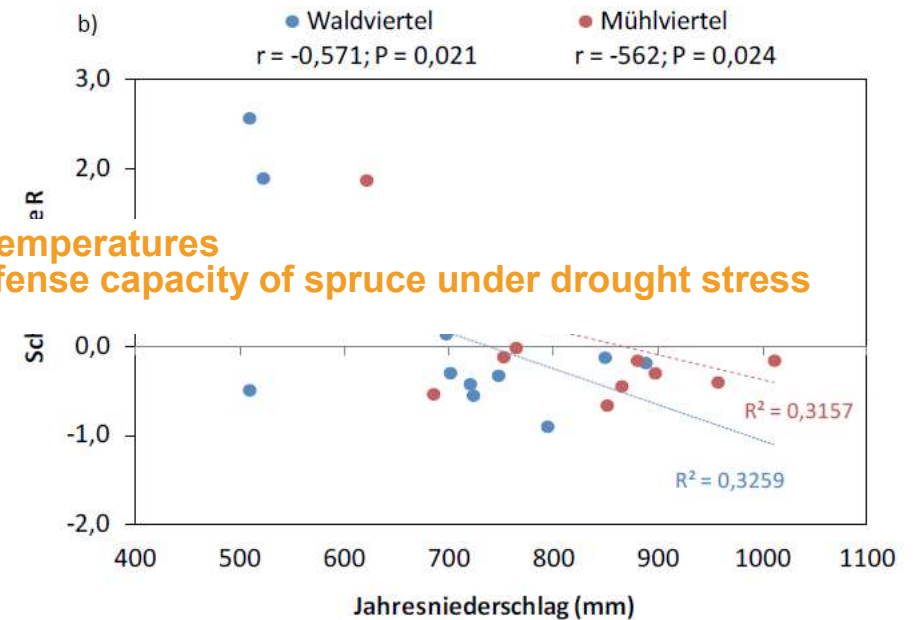
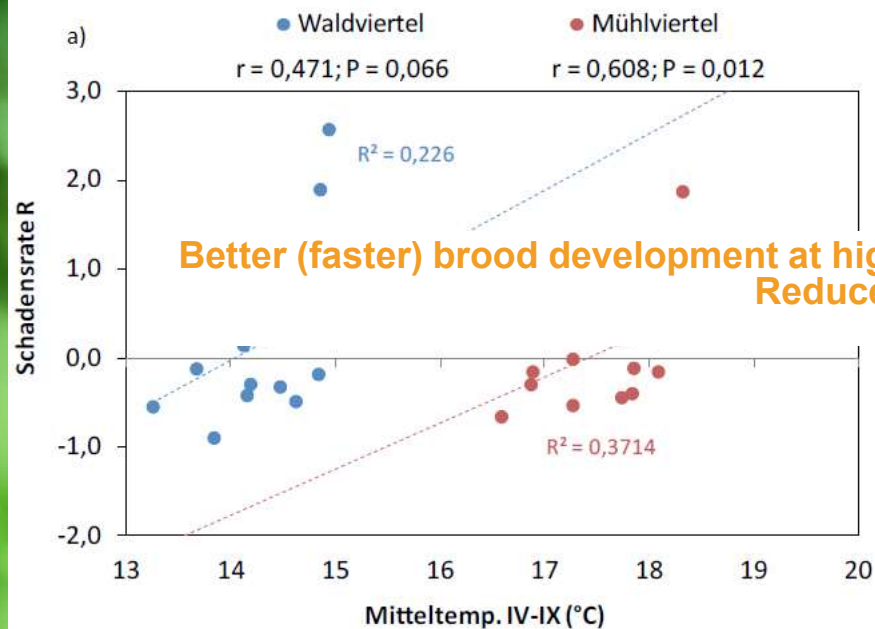
Damage by bark beetles (total) (Documentation of forest damaging factors, **DWF**): Wald- und Mühlviertel (i.e., northern Austria) in comparison to Austria total (Referenzwert = expected value based on spruce stock).

Droght



Zentralanstalt für Meteorologie und
 Geodynamik
www.zamg.ac.at





Correlation between bark beetle damage rate ($R = \ln(\text{damage}_t / \text{damage}_{t-1})$) with
 a) mean temperature April-September and b) annual precipitation for regions
 Waldviertel and Mühlviertel (r = Pearson correlation coefficient), 2002-2018.
 Hoch & Steyrer 2020: CCCA Fact Sheet #31



Bezirk Urfahr-Umgebung, 18.7.2018 (Photo: Hoch, BFW)



Freshly attacked spruce tree:
Beetles initiating the breeding
gallery – spruce shows no
response by resin flux.

Bez. Waidhofen/Thaya, 27.4.2019

Attack of young spruce stand



Photo: Hoch, BFW

Bez. Urfahr-Umgebung (near Linz, north of the Danube), 18.7.2018 (Photo: Hoch, BFW)



Also individual trees attacked in mixed forests. In the outbreak situation, species mixture did not prevent the attack. However, the photo shows the „insurance effect“ – the area is not deforested.

Bezirk Zwettl, 18.7.2019



Photo: Hoch, BFW



Logistic problems in years with extreme amount of damaged wood...
Good timber market in 2021 helped to get infested wood out of the forest

Photo: Hoch, BFW

A new outbreak in mountaneus areas in Southern Austria

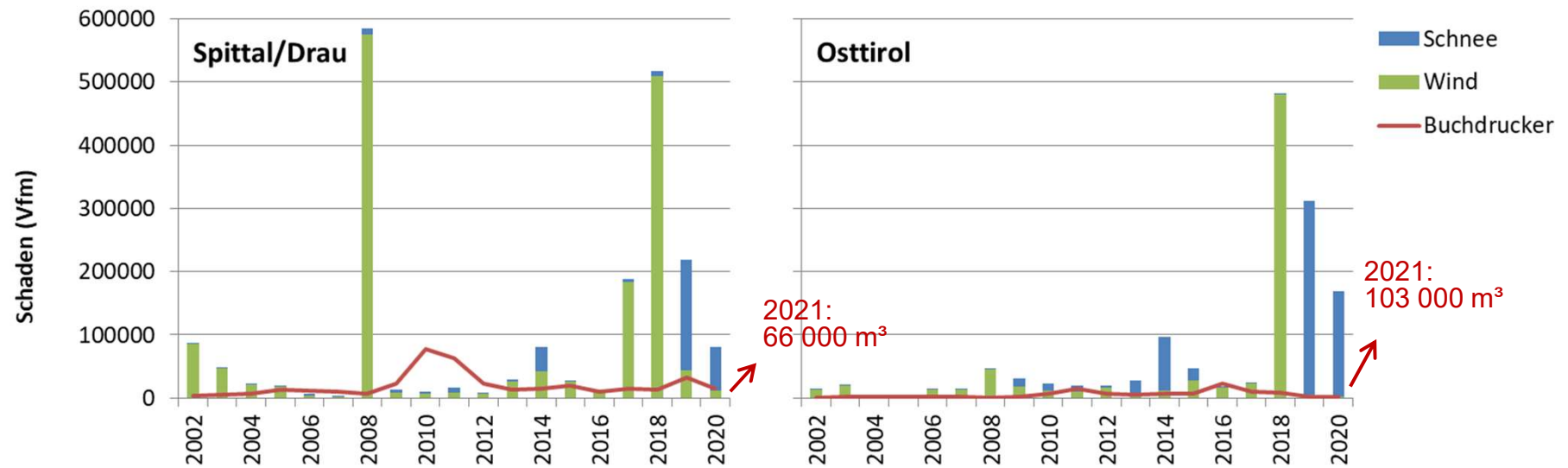
"Classical" population dynamics following storm/snow, unusual intensity

20.8.2021

Photo: Hoch, BFW

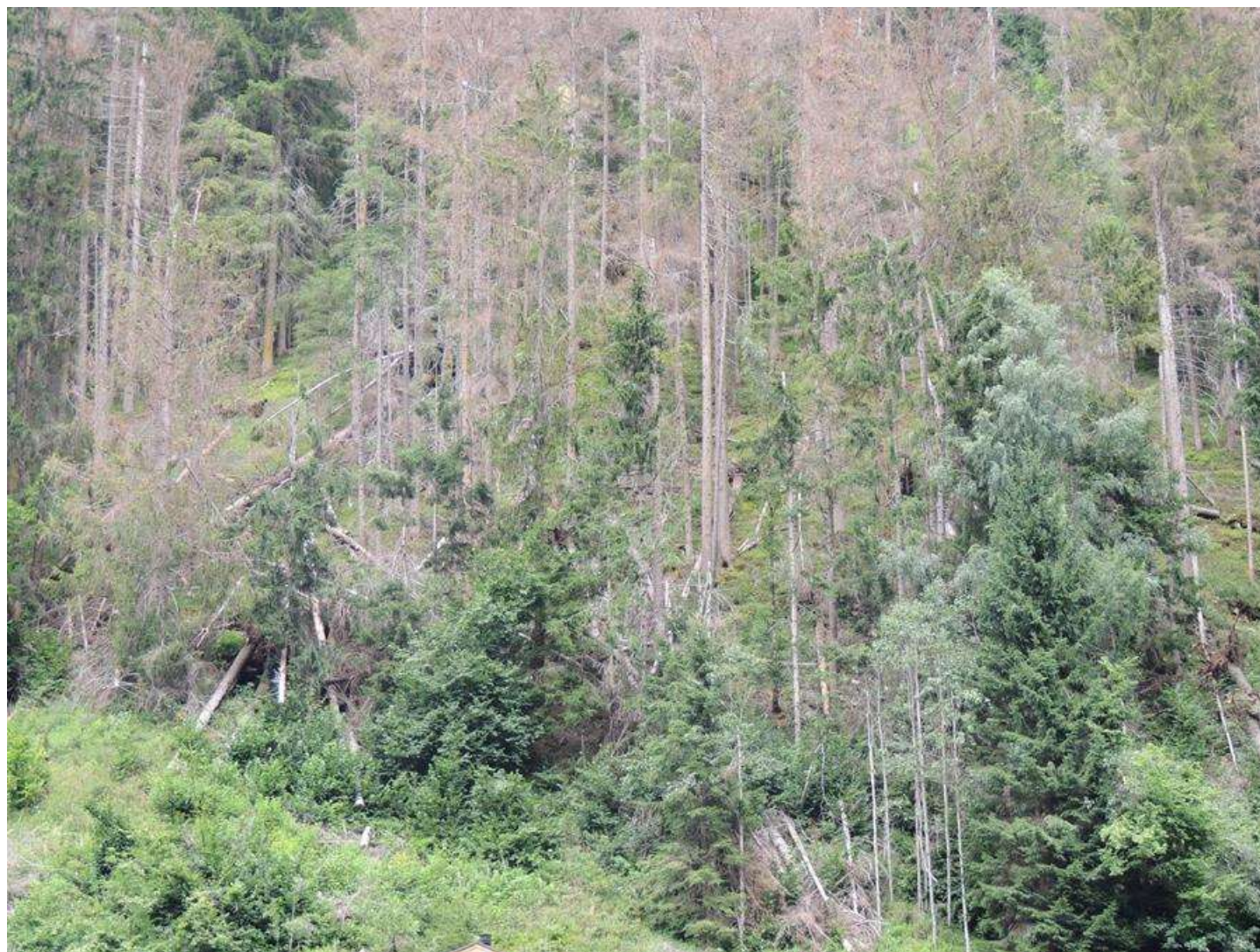


Storm Vaia in fall 2018 Extreme snowfall in winters 2019/20 and 2020/21

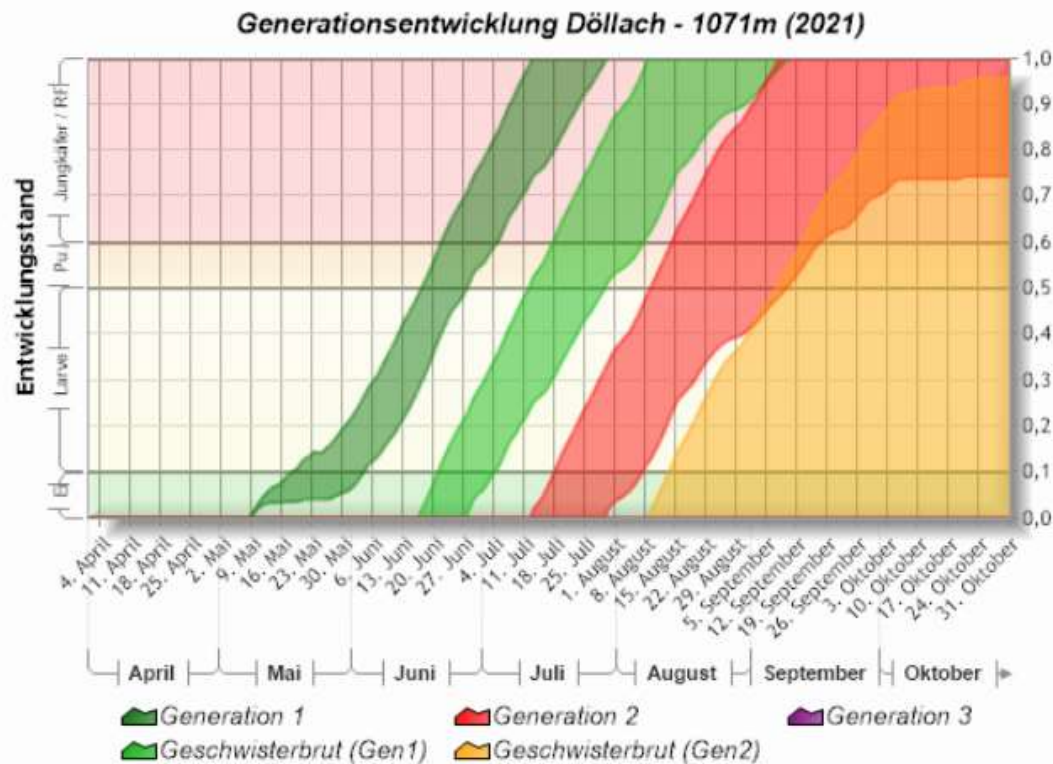


Annual damage by snow (blue), storm (green) and bark beetle (red) in two districts in southern Austria
 (Data: Documentation of Forest Damaging Factors)









Two generations developed also at high elevation
□ faster increase of population densities

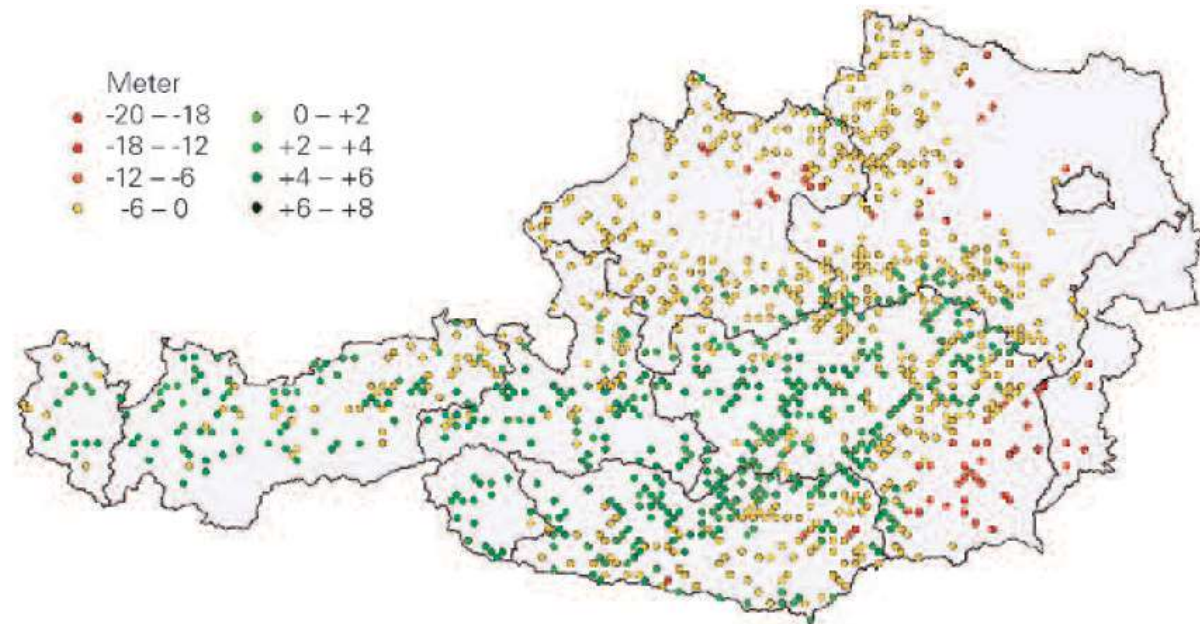
Development of *Ips typographus* (Modell PHENIPS, BOKU University) at climate station Döllach (Bez. Spittal/Drau, elevation: 1071 m)

BFW Website
Bark beetle monitoring
www.borkenkaefer.at

Effects of climate change

Spruce in lowland areas under pressure (drought and heat)

And: More generation of spruce bark beetle
 also at higher elevation
 ☐ increasing risk of outbreak after abiotic damage (snow, storm)



Model: Change of spruce growth (site index) under **+2,5°C** temperature scenario (Schadauer et al. 2019: BFW-Praxisinformation)

Integrated Bark Beetle Management

Silviculture: Diversity, increase stability of stands, protect and enhance natural enemies

Forest road infrastructure

Removal of susceptible material (e.g. after storm)

Early detection of infestation

visual control, monitoring tools

Timely removal of infested material

treatment if necessary (debarking, insecticides, insecticide nets, wet storage, chipping, burning)

Trapping of beetles

Trap trees, traps, insecticide treated tap logs,

Documentation

Legal background

Austrian Forest Law (Forstgesetz) 1975

§ 44. (1) The **forest owner must** in appropriate and reasonable manner

a) take care to **prevent a threatening damage** of the forest by forest pests and

b) to **effectively control forest pests** that occur in dangerous outbreak condition.

Forest Protection Directive (Forstschutzverordnung) 2003

§ 2. Infested trees or wood have to be treated

§ 3. Treatment: Debarking, wet storage, chipping, burning, technical drying, registered insecticides, fumigation

§ 4. Storage of untreated wood is not allowed

Forest Ownership

Austria

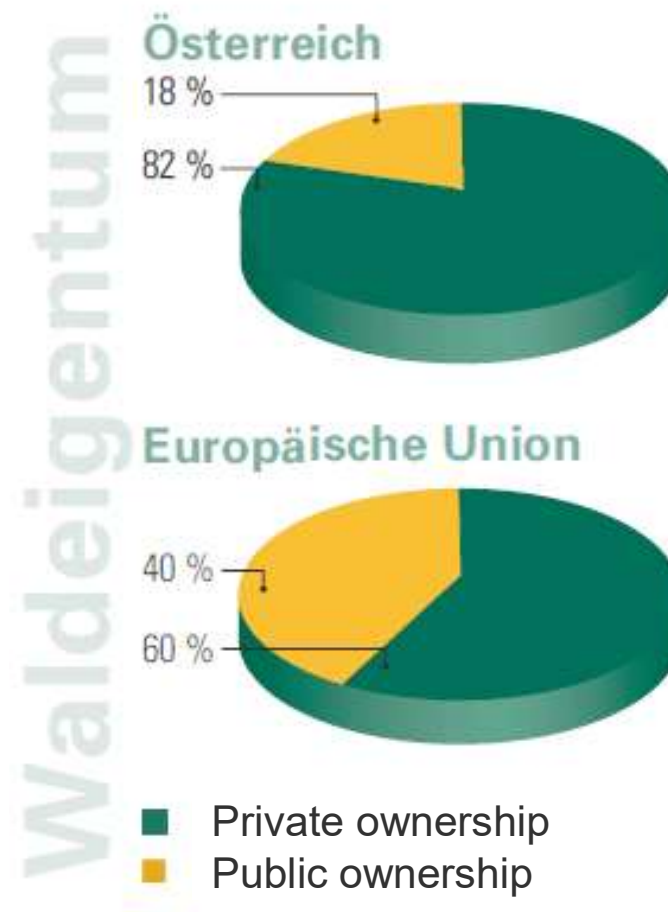
170 000 forest owners
53 % of forest are units < 200 ha
(average area of these small forest units:
9.2 ha)

EU

60% private, about 16 million private
forest owners.
Average size of private forest 13 ha,
majority < 5 ha

Ownership












affects forest management
affects pest management



BFW (2013)

Spruce bark beetle 2021

Reported in form of maps and tables; used as basis for reports on forest damage in AT

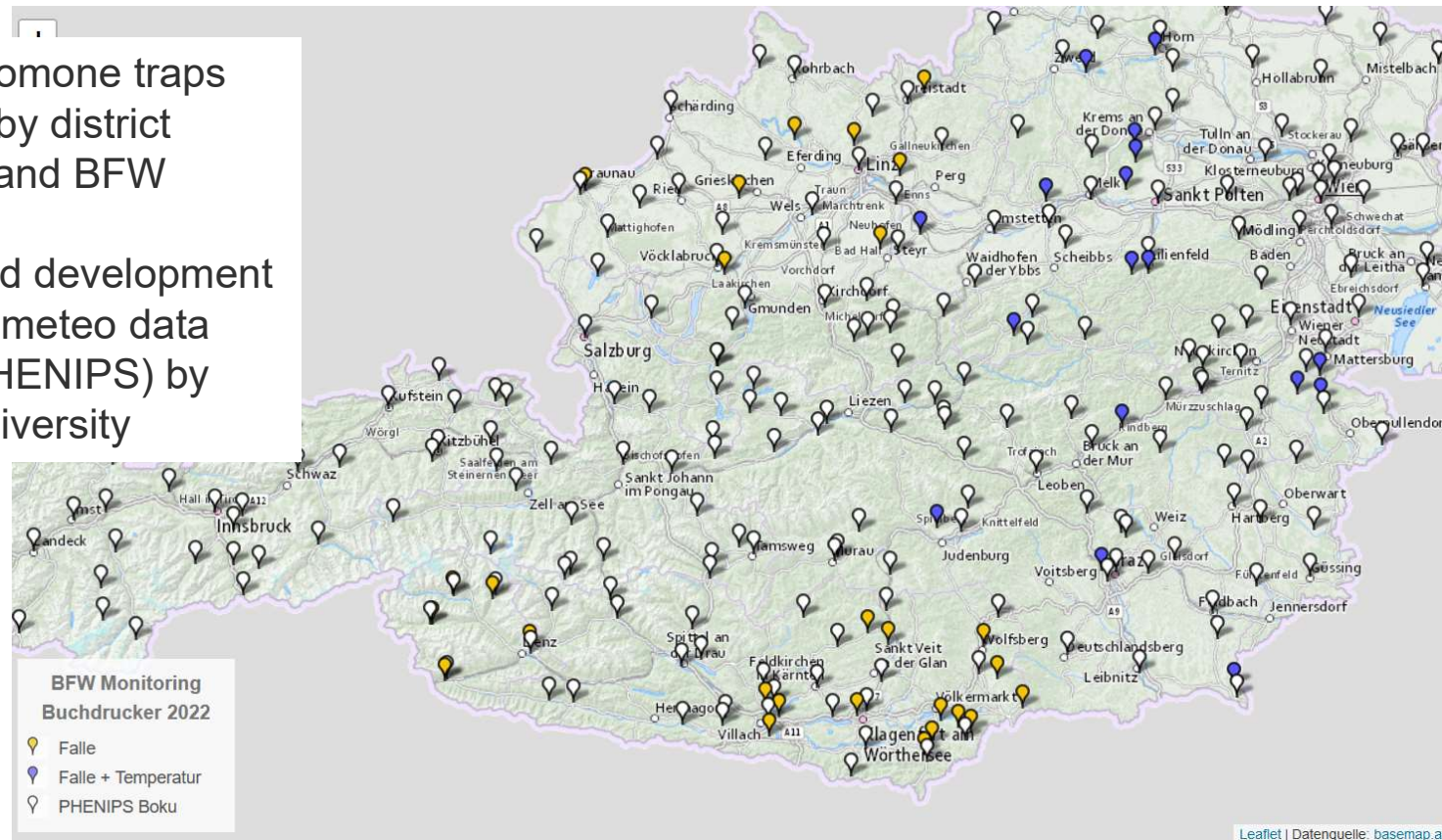
	> 10000 m ³		flächig extensive
	1000 - 10000 m ³		in Nestern scattered
	< 1000 m ³		einzel individual
	Zunahme increase		keine Schädigung no damage
	gleichbleibend constant		keine Angabe no data
	Abnahme decrease		



Bark beetle monitoring in Austria

Spruce bark beetle 2022

- ○ Pheromone traps operated by district foresters and BFW
- Modeled development based on meteo data (Model PHENIPS) by BOKU University



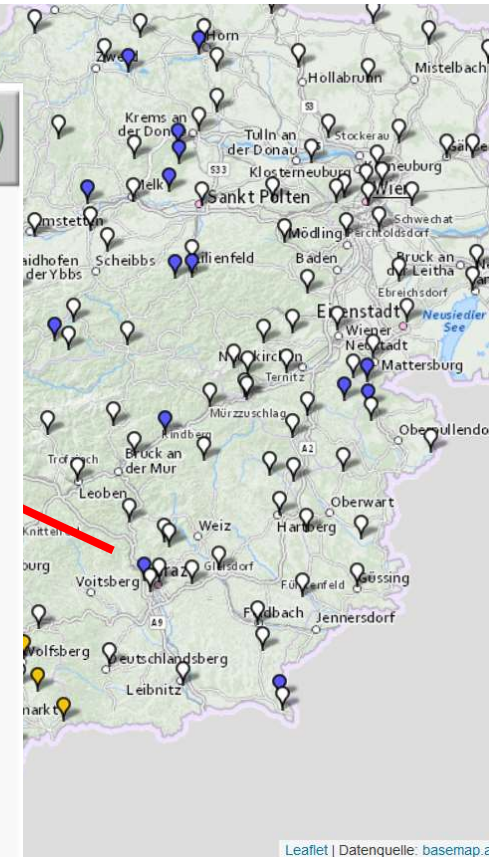
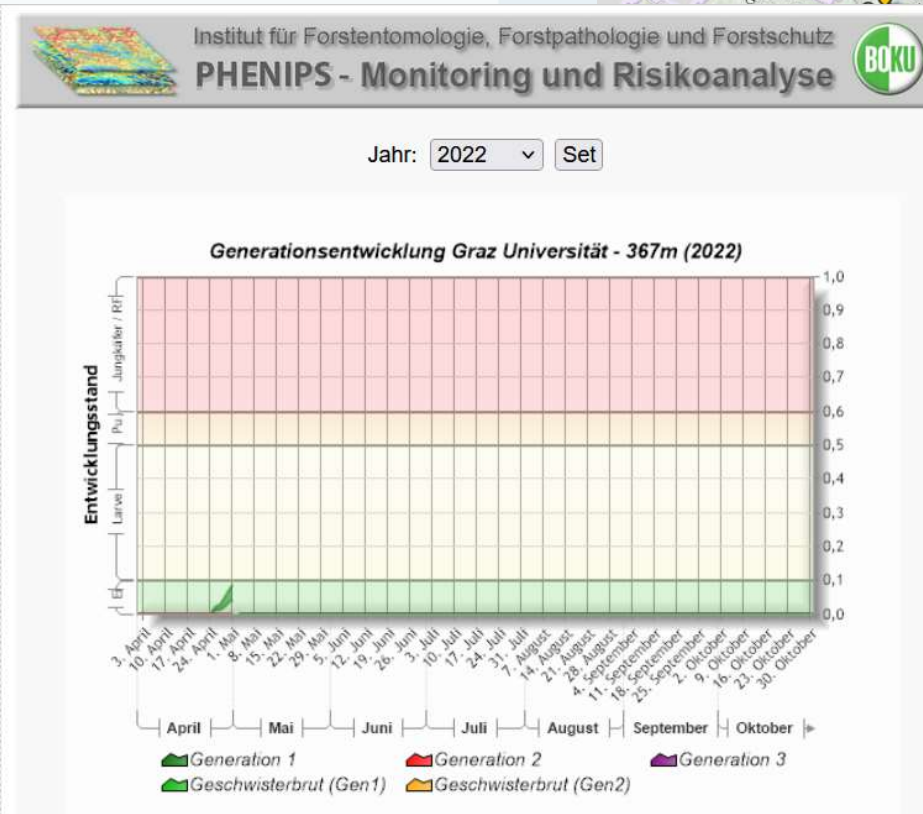
<https://bfw.ac.at/rz/bfwcms2.web?dok=5323>

Bark beetle monitoring in Austria

Spruce bark beetle 2022
(May 2, 2022)

<https://bfw.ac.at/rz/bfwcms2.web?dok=5323>

BFW Falle: Plabutsch BD < 2022
Fallenstern auf 754m Käferart Buchdrucker 150



Bark beetle monitoring in Austria

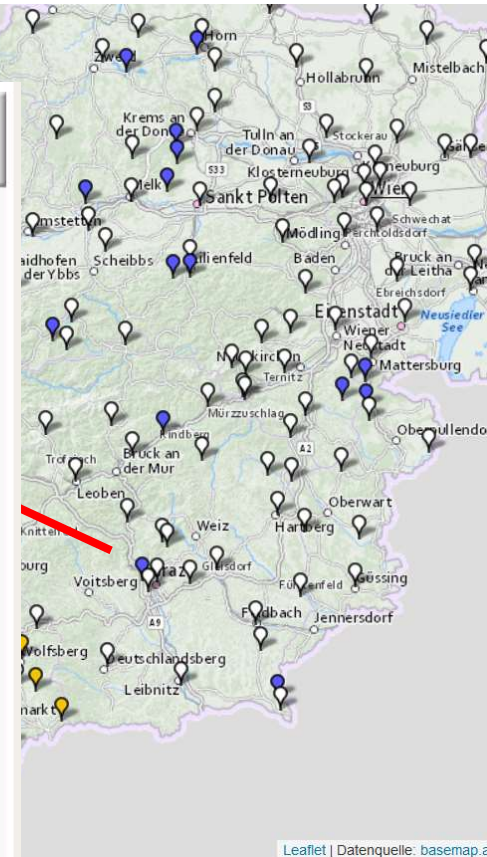
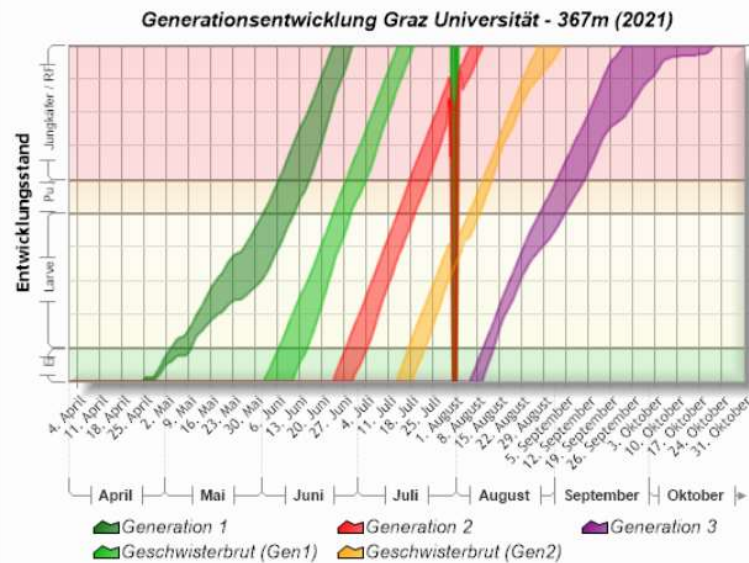
Spruce bark beetle 2021 (end of season)

<https://bfw.ac.at/rz/bfwcms2.web?dok=5323>

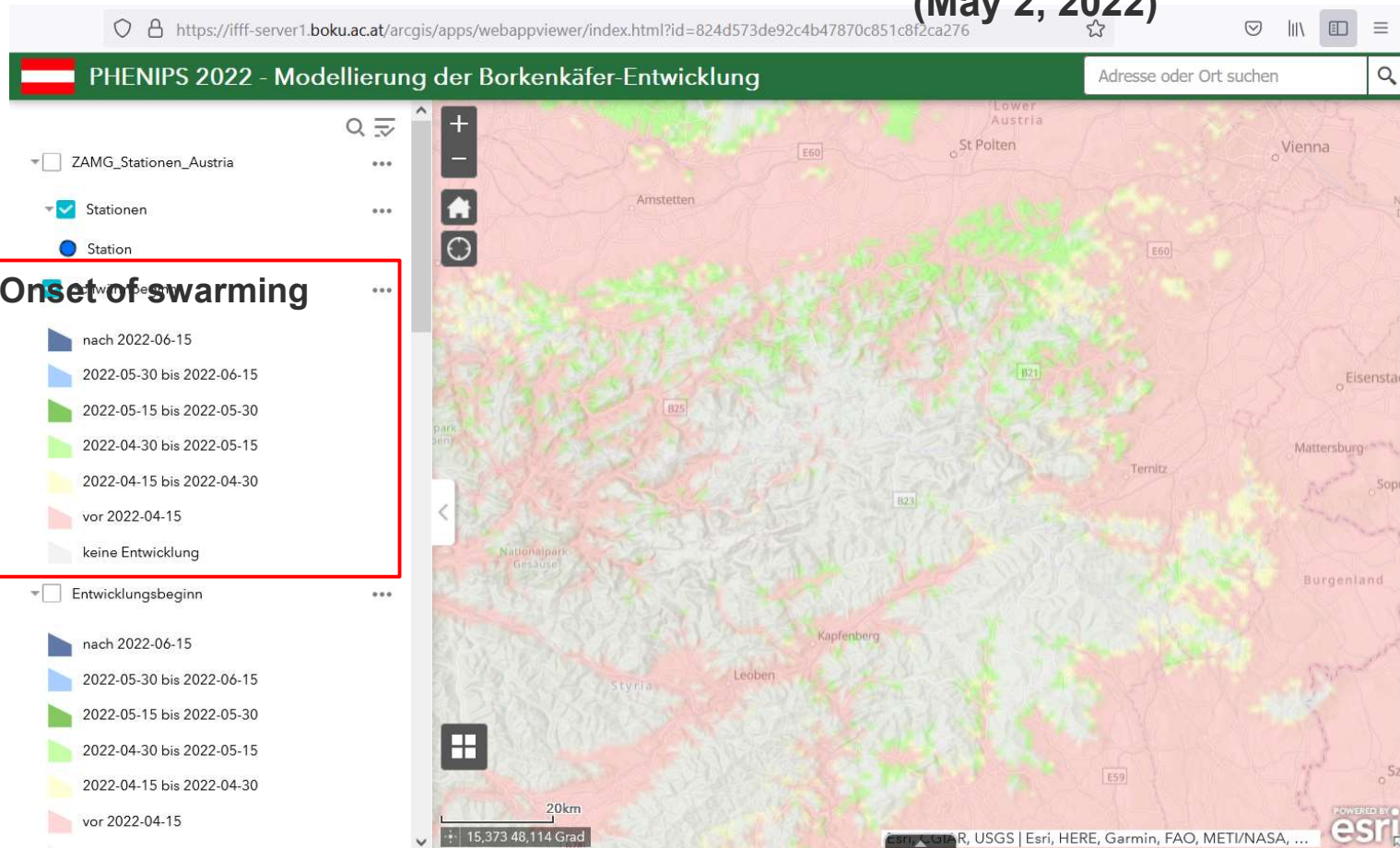
BFW Falle: Plabutsch BD < 2021 >
 Fallenstern auf 754m Käferart Buchdrucker 25000

Institut für Forstentomologie, Forstpathologie und Forstschutz
PHENIPS - Monitoring und Risikoanalyse

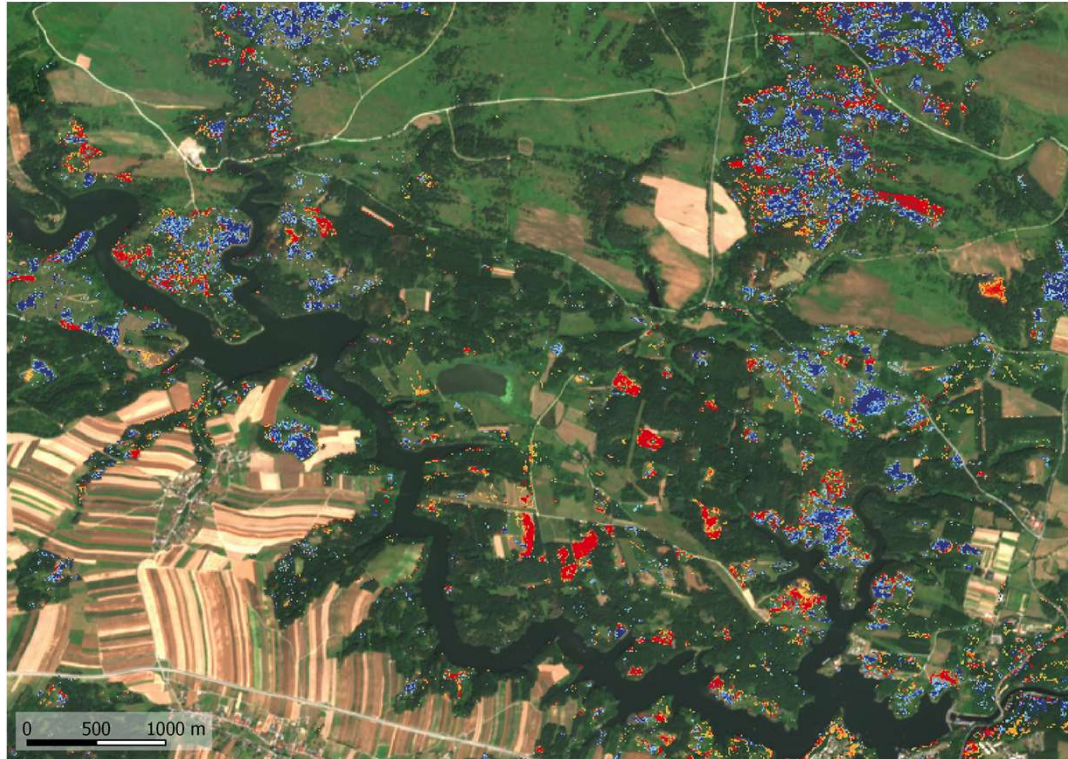

Jahr: 2021 Set



Spruce bark beetle 2022 (May 2, 2022)



Remote sensing



Analysis of Sentinel-2 data (BFW – Forest Inventory)

Useful tool for documentation, strategic planning, forest policy, etc.

Bark beetle damaged area: blue = damaged Oct 2017 to Sept 2018, red = damaged Oct 2018 to July 2019 (Schadauer et al. 2019: ÖFZ)

Early detection remains ground work



Problem: Storage of infested timber

Even when new infestations were detected early, felling and removing trees, or transportation/sale of wood often turned out to be a major problem

- Machine capacity and manpower
- Transport capacity
- Oversupply of industry

Temporary storage without treatment on registered sites authorized by forest authorities (considering distance to susceptible forests, establishment of monitoring system)

More methods for treating infested wood for temporary storage are necessary (both, at large and small scale)

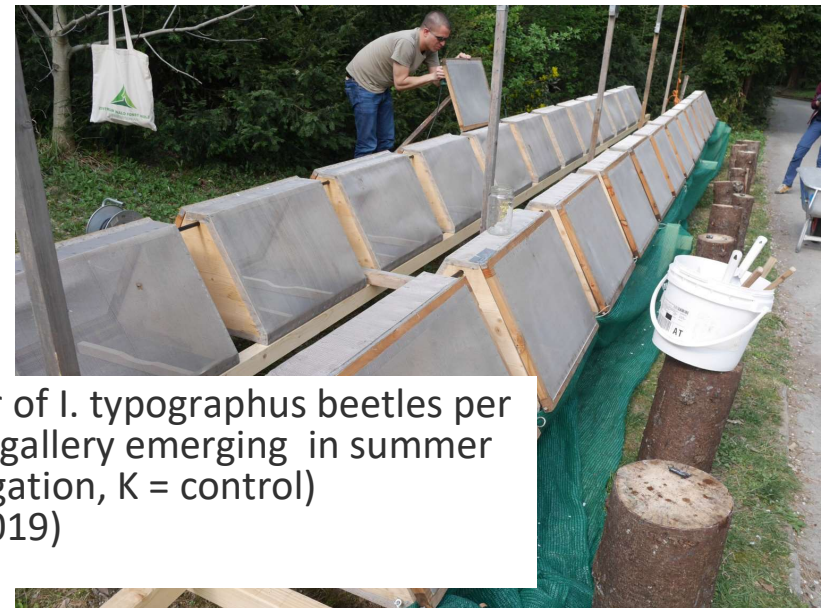
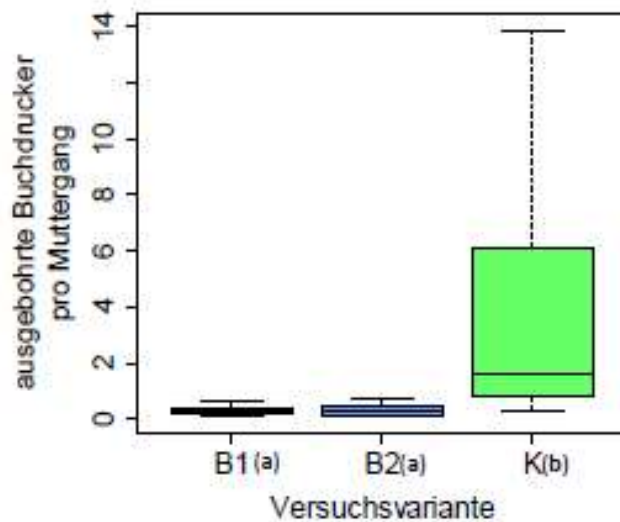
Treatment of stored wood

- **Reduce suitability for breeding:**
cutting, chipping, enhance drying
- **Debark**
- Storage in foil (oxygen depletion)
- Cover with **insecticide net** (Storanet®)
Testing alternative methods
- **Insecticides** (registered for this
purpose, authorised users)
- Wet storage for large amounts



Wet storage

An established method to conserve
 uninfested timber
 ...can temporarily prevent
 emergence of bark beetles from
 infested logs



Number of *I. typographus* beetles per
 mother gallery emerging in summer
 (B = irrigation, K = control)
 (Thür 2019)

Experiment at BFW: Effect of irrigation
 on the emergence of *Ips typographus*

Debarking by harvester

DEBARK: Project of BOKU Univ. (Franz Holzleitner) & BFW (Bernhard Perny)



John Deere Forestry Oy:
Harvester 1270G
Aggregat H415

Larvae/Pupae



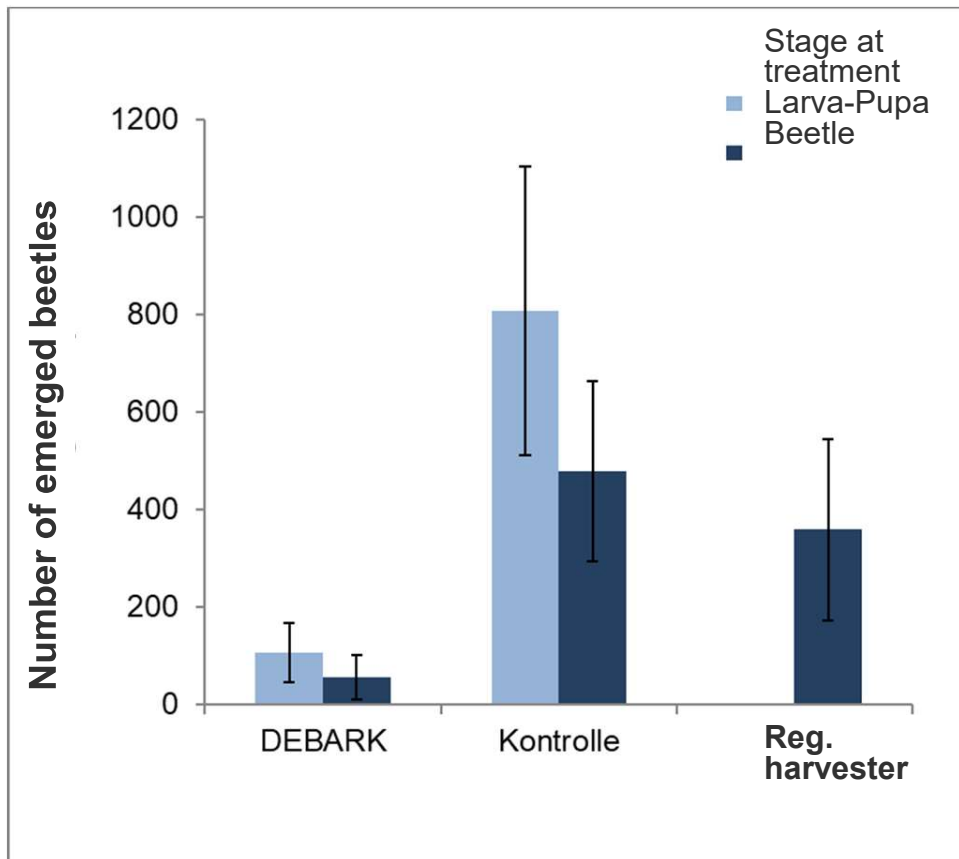
Beetles



Uninfested wood, prophylactic



Debarking by harvester



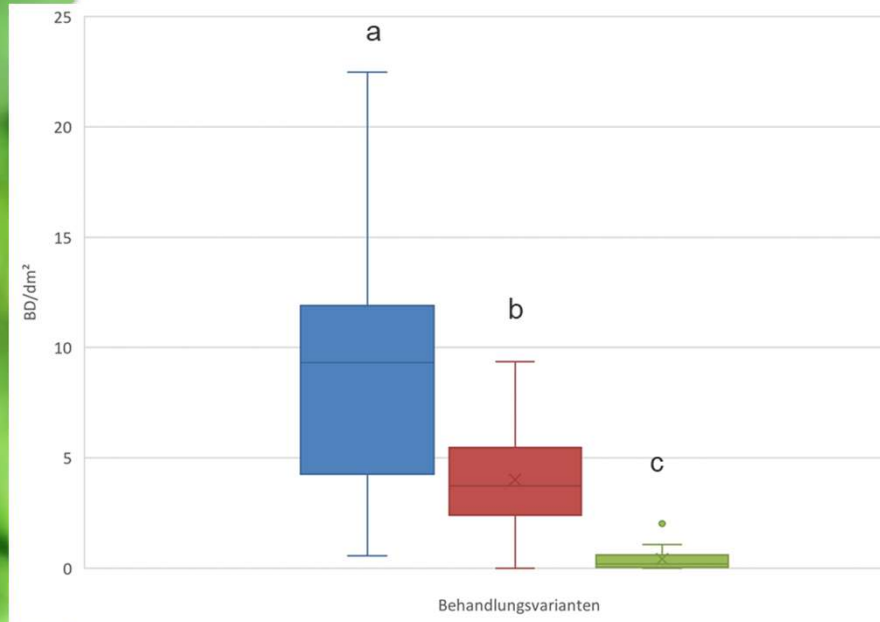
Development in removed bark:

- Immature – no development
- Many beetles killed



Holzleitner et al. (2021)
DEBARK, project report,
BMLRT Austria

Manual debarking and bark scratching

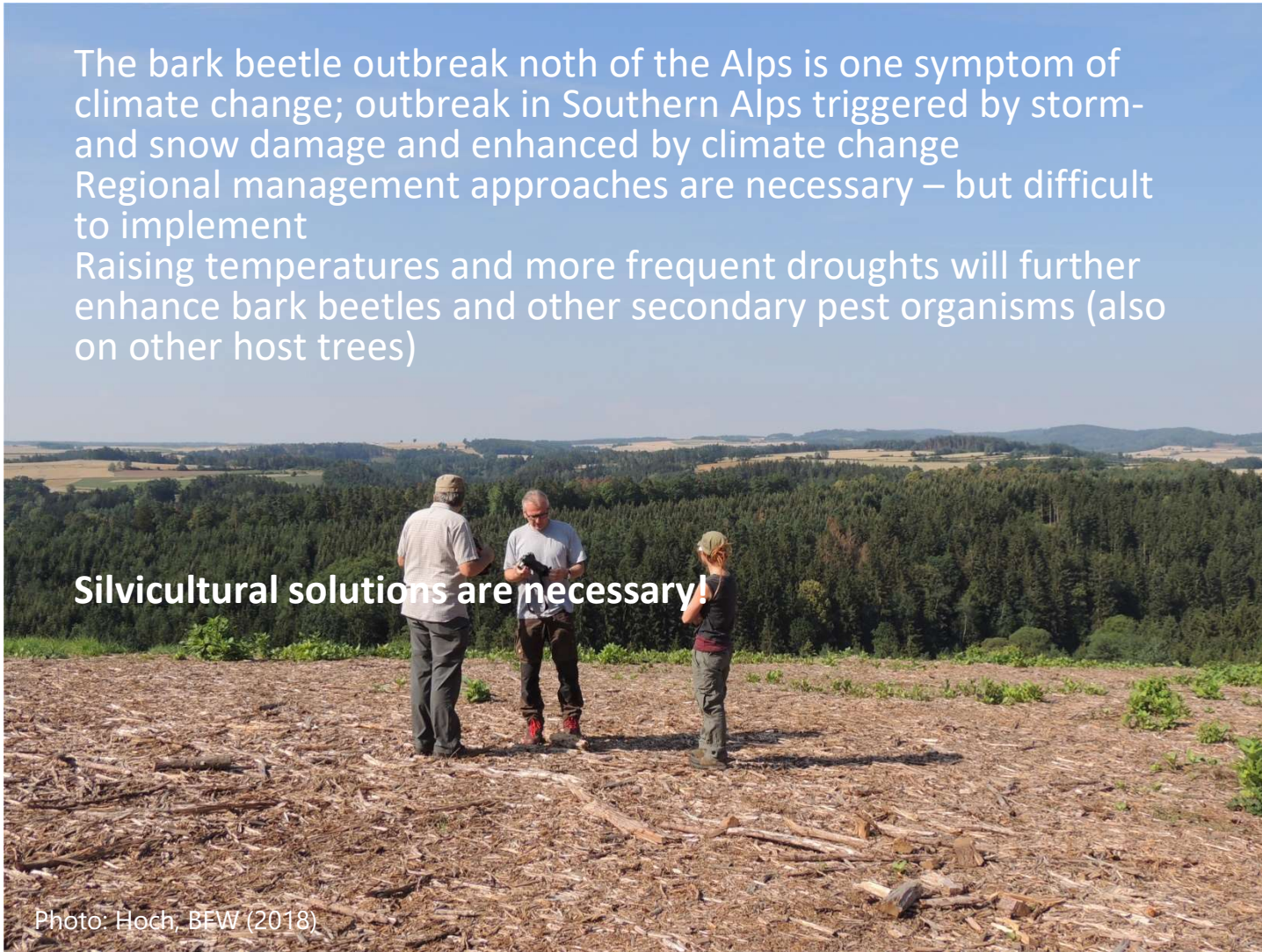


Ips typographus beetles emerging per dm² surface from logs scratched before (green) or after (red) infestation, and from untreated controls (blue) (Puschacher et al., unpublished)

The bark beetle outbreak north of the Alps is one symptom of climate change; outbreak in Southern Alps triggered by storm- and snow damage and enhanced by climate change
Regional management approaches are necessary – but difficult to implement
Raising temperatures and more frequent droughts will further enhance bark beetles and other secondary pest organisms (also on other host trees)

Silvicultural solutions are necessary!

Photo: Hoch, BEW (2018)





Thank you!

Gernot Hoch
Department for Forest Protection
BFW - Austrian Research Centre for Forests
Seckendorff-Gudent-Weg 8, 1131 Wien
www.bfw.gv.at
01/87838-1155, gernot.hoch@bfw.gv.at