



Kick-off Meeting

Project FORRISK - Cross-border forest risk management

Zoom April 8-9, 2021

Summary

IFFF BOKU Vienna – Peter Baier
Sigrid Netherer
Thomas Kirsits

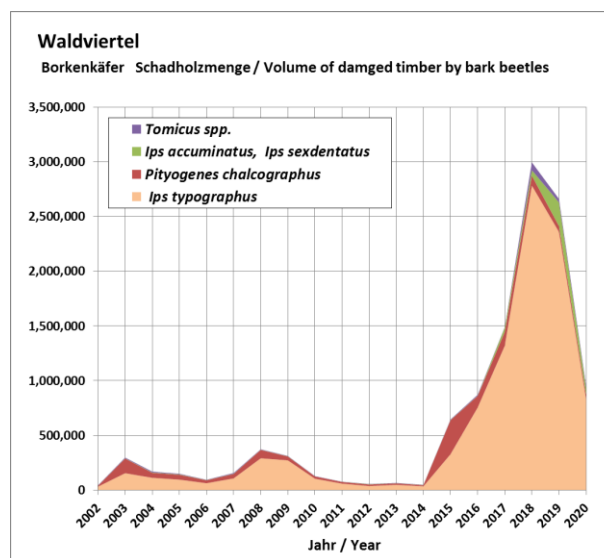
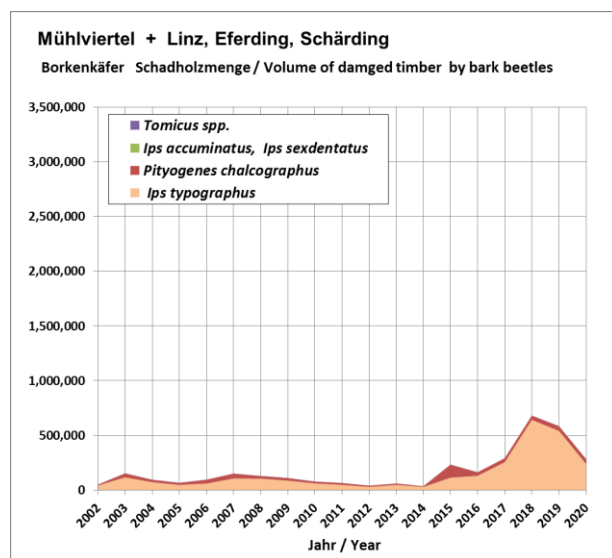
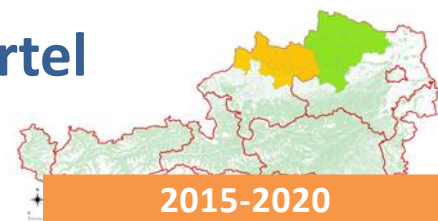


Bark beetle outbreak in Mühl- and Waldviertel

- **Outbreak history and current situation**
 - **Causes and effects**
- **Forest protection and bark beetle management**
- **Monitoring, hazard rating and early warning systems**



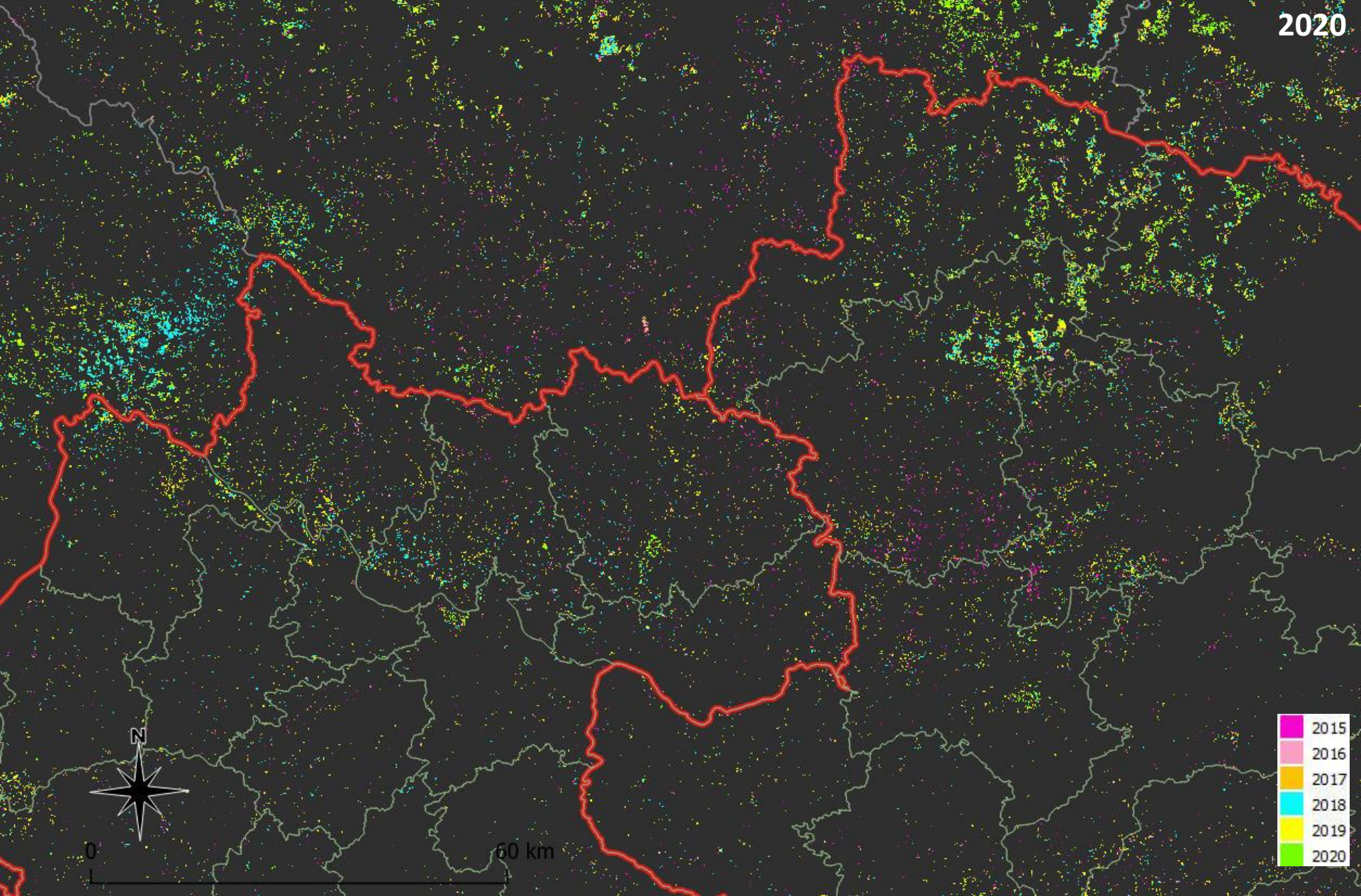
Bark beetle outbreak in Mühl- and Waldviertel



	damaged volume (Mio m ³)	damaged area (tsd ha)
bark beetle infestations		
Mühlviertel	2.2	9.7
Waldviertel	9.6	45.8
sum bark beetle infestations	11.9	55.5
wind & snow damage		
Mühlviertel	0.8	4.8
Waldviertel	0.7	8.4
sum wind & snow	1.4	13.2
Total		
Mühlviertel	3.0	14.5
Waldviertel	10.3	54.1
Total	13.3	68.7

Data source: Documentation of forest damaging factors, BFW

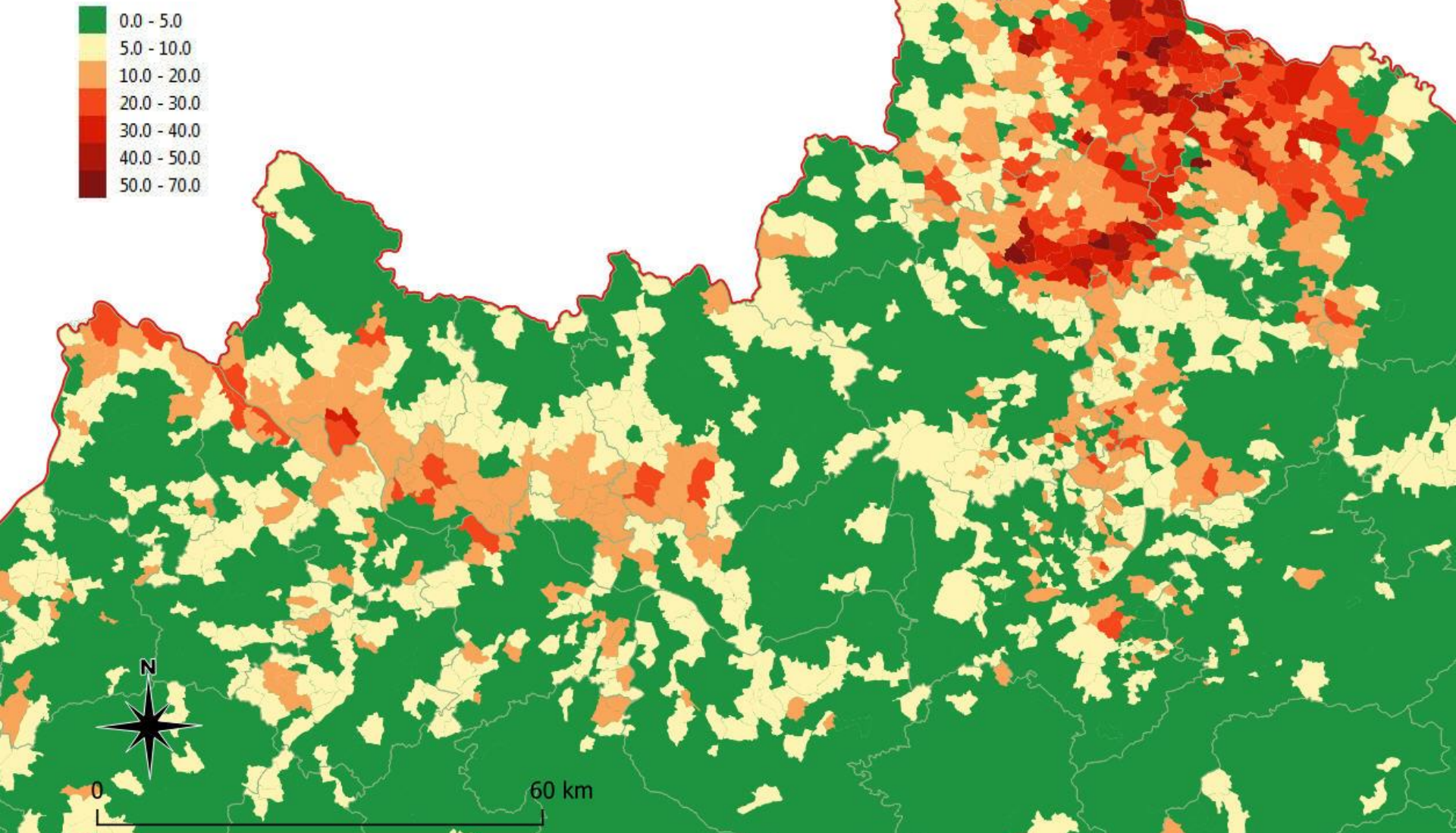
2020



Data source: Senf, C. and Seidl, R. (2021) Mapping the forest disturbance regimes of Europe. *Nature Sustainability*.
<https://corneliussenf.users.earthengine.app/view/european-disturbance-map>

Disturbance intensity 2015-2020

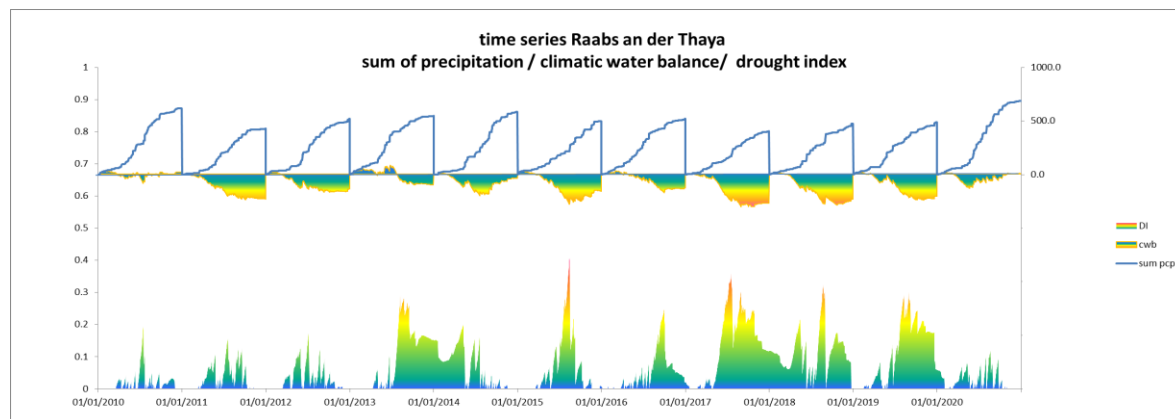
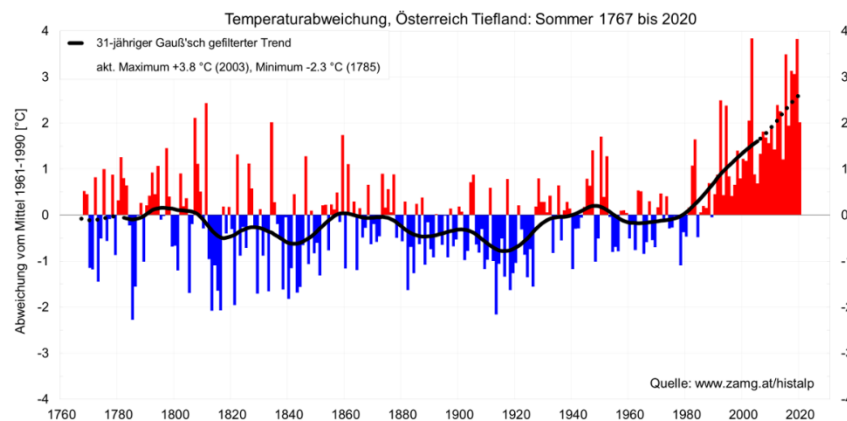
Sum of disturbed area/ area of forest cover (%)





Bark beetle outbreak since 2015 caused by climate change

Temperature deviations from climate normal 1961-1990
 Austrian lowlands, summer temperatures 1767-2020





Elements of integrated bark beetle management recommended / practiced in

Conservation biological control

→ promotion of natural
enemies

Salvage & timber logistics

→ timely removal or treatment (e.g. de-
barking, chopping, wet storage) of
suitable breeding material

Silviculture, forest management

→ stable stands, tree species
composition, accessibility

Documentation of infested areas



Early detection of infested trees

→ mainly ground surveys

Sanitation

→ removal and treatment
(e.g. debarking, insecticides,
Storanet®, wet storage) of
infested material

Monitoring

→ pheromone traps, trap trees,
PHENIPS plus, ...

Catching of beetles

→ trap trees (timing of
measures!), pheromone
traps, Trinet®, ...

Timber storage

→ wet and dry storage; usually
only treated uninfested and
infested timber (but exceptions)



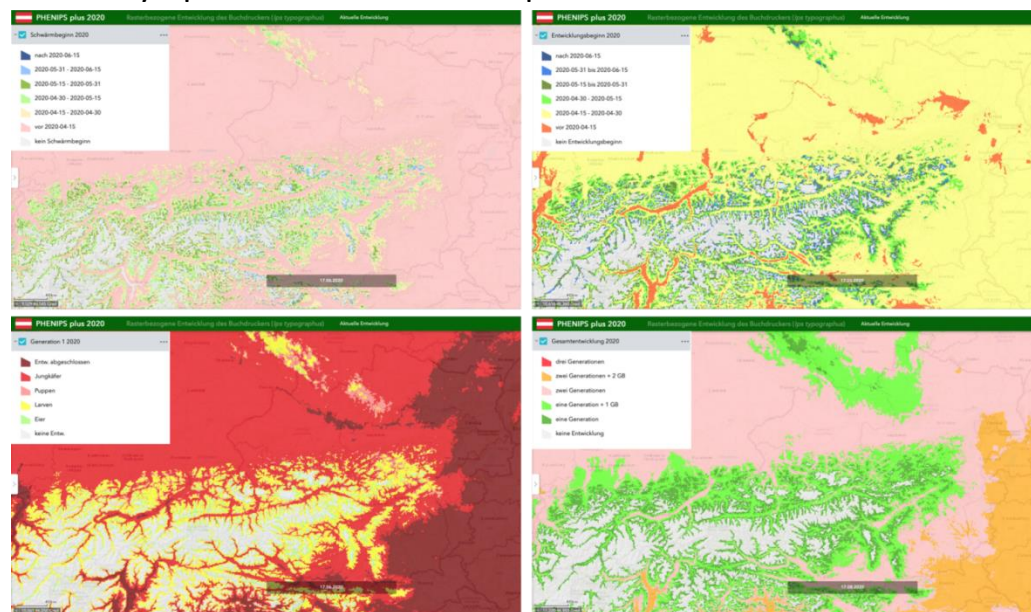
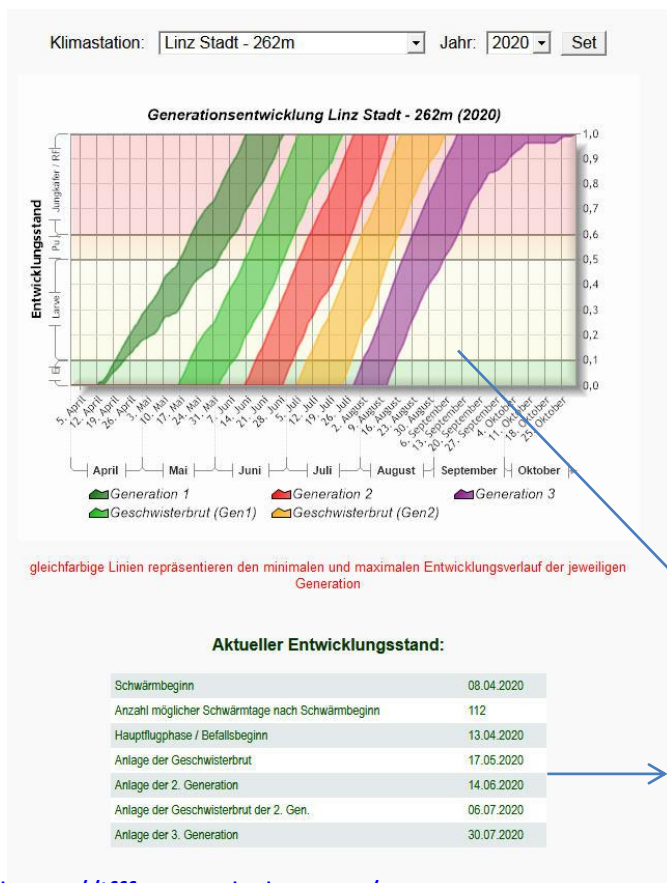
Monitoring, hazard rating and early warning systems for bark beetle management

PHENIPS „Phenology of *Ips typographus*“

PHENIPS plus

PHENIPS online

daily updated interactive 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

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



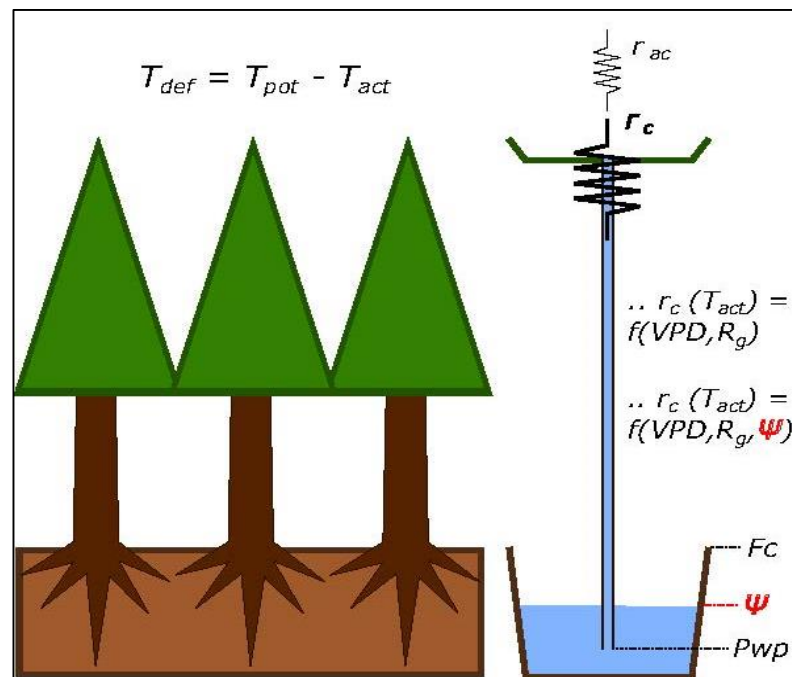
Simulation of Transpiration deficits by TDEF

Agricultural and Forest Meteorology 263 (2018) 69–89



Transpiration deficits increase host susceptibility to bark beetle attack:
Experimental observations and practical outcomes for *Ips typographus* hazard
assessment

Bradley Matthews^{a,c,1}, Sigrid Netherer^{b,1}, Klaus Katzensteiner^a, Josef Pennerstorfer^b,
Emma Blackwell^b, Patrick Henschke^c, Peter Hietz^c, Sabine Rosner^c, Per-Erik Jansson^d,
Helmut Schume^a, Axel Schopf^d



Water Balance Model TDEF

Two Bucket Model:

Water supply of rooted soil layers
Crown Interception

Simulation of Soil water potential

⇒ Potential Transpiration

⇒ Simulation of Transpiration Deficits



TDEF: Parameters

Forest Stand Parameters

Parameter	Value (variable/fixed)	Unit	Description
ELEV_WS	variable	m a.s.l.	Elevation Weather station
H_WS	variable	m	Height Wind sensor
ELEV	variable	m a.s.l.	Elevation Forest stand
SL	variable	°	Slope Forest stand
SLAA	variable	°	Aspect Forest stand
LAT	variable	°	Latitude
LONG	variable	°	Longitude
SM	variable	°	Standard Meridian Zeitzone
CH	variable	m	Bestandeshöhe (Hc)
LAI	variable	m ² /m ²	Leaf Area Index Bestand
LAIT	6	m ² /m ²	Threshold LAI
imax	0,8	mm/LAI	Maximum interception capacity per unit LAI
sf	100		LAI reduction factor for aerodynamic conductance
gmax	0,002	m/s per LAI	Canopy conductance of water vapour per unit LAI
REDvpd	1		Coefficient reducing gmax for vapour pressure deficit
Alb	0,05		Solar albedo of the forest stand (canopy and soil)
k	0,3		Canopy light extinction coefficient per unit LAI
RD	variable	mm	Rooting depth
ALPHA	variable	cm	Air entry pressure of the soil
LAMDA	variable		Parameter describing unimodal soil pore size distribution
THETA_R	variable	m ³ /m ³	Residual water content of the soil
THETA_S	variable	m ³ /m ³	Saturated water content of the soil
STONE	variable	m ³ /m ³	Stone content soil
Ht	100		Root uptake parameter (Van Genuchten function)
H50	2000	cm	Soil water potential at which root water uptake is reduced by 50%
EXP	1,15		Root uptake parameter - exponent

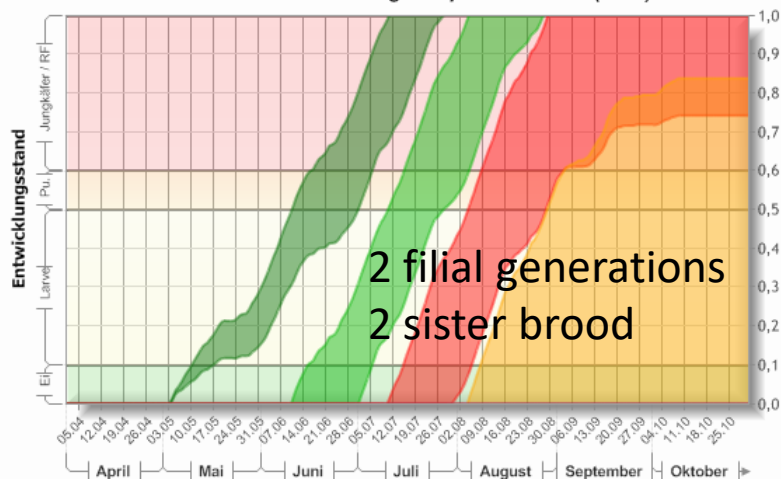
Soil Parameters



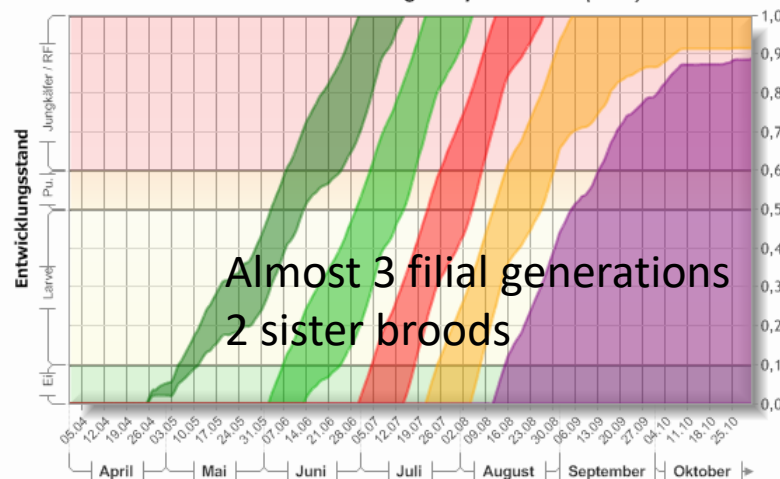
High infestation risk!

PHENIPS-TDEF

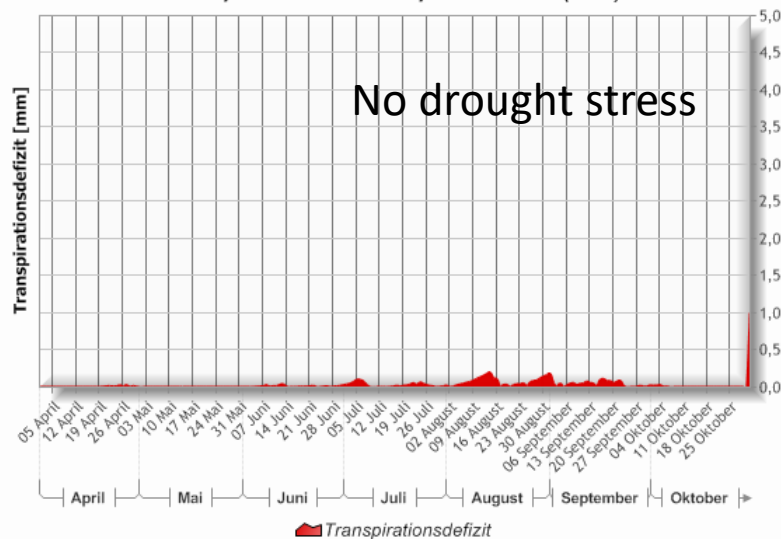
Generationsentwicklung Sample Plot STMK (2015)



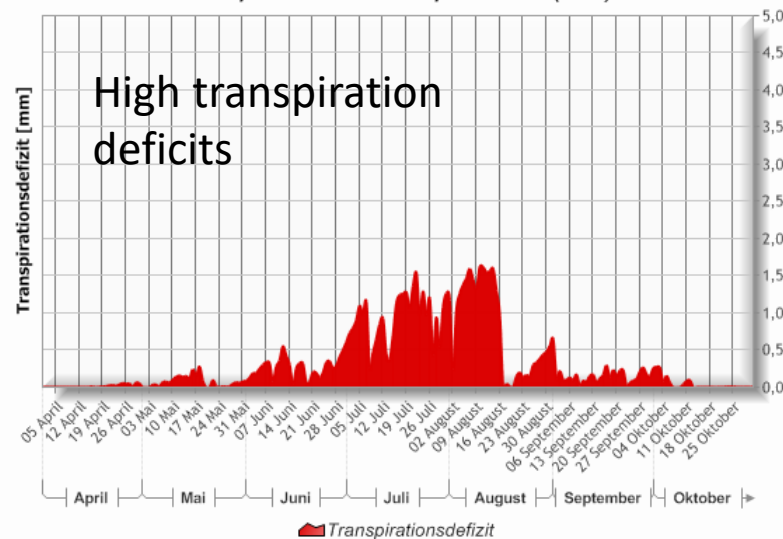
Generationsentwicklung Sample Plot WV (2015)



Transpirationsdefizit Sample Plot STMK (2015)



Transpirationsdefizit Sample Plot WV (2015)





Assessment of stand and site related predisposition to *Ips typographus*

PAS

Site / Stand level

Criteria (weighting)

Potential number of bark beetle generations

(Effective temperature sums)

Water supply

Predisposition to wind

Proportion of Norway spruce

Stand age,

Indicators (relative scores):

Examples: Topology, Proportion of Norway spruce

Topology	Score	Relative Score	Relative Weighting
Plateau, ridge, hilltop	10	1,00	0,40
Upper and middle slopes	7	0,70	0,28
Lower slopes, valleys, ditches	1	0,10	0,04



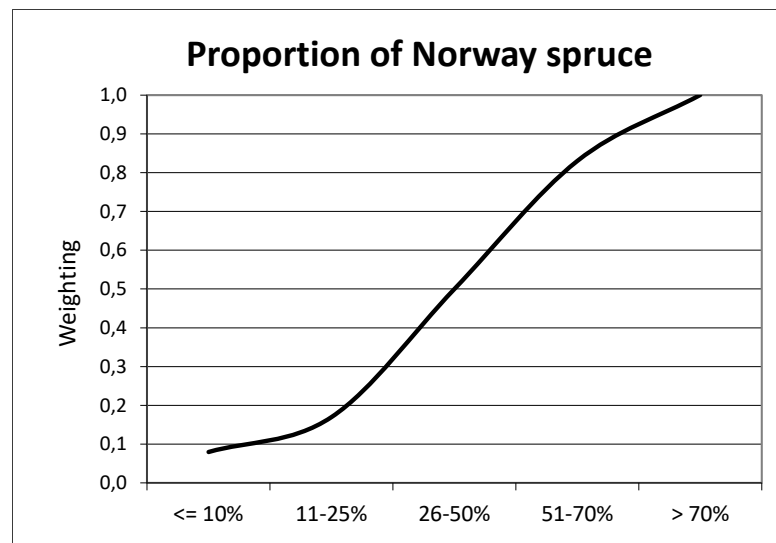
Predisposition assessment systems (PAS) as supportive tools in forest management—rating of site and stand-related hazards of bark beetle infestation in the High Tatra Mountains as an example for system application and verification

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Assessment of stand and site related predisposition to *Ips typographus* PAS

