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Supplement of

The significant role of snow in shaping alpine treeline responses in modelled boreal forests

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	nodel parameter values used in LAVES	SI. References fo	r the values are	provided in the colu	mns highlighted	in grey.																								
	Scientific species name English species name	Larix gmelinii Dahurian		Larix sibirica Siberian larch	Larix cajan	x nderi ınder	Picea obovat Siberian	ta Pinu sylve	s estris s pine	Pinus sibirica		Betula Larix laric pendula Silver birch Tamarack	ina Picea glas White spr		Picea mariana Black spruce	Betula papyrifera Paper birch	Populus tremuloio Quaking	Populus balsamifer Balsam	a Pinus contort Lodge		x Iaricina sarack	Betula neoalaskana Alaska paper	Tsuga mertensian Mountain	Picea mariana Black s	a s	Picea sitchensis Sitka spruce	Picea gla White sp	trema	lus Iloides	Populus balsamifera
	Number	larch 1		2	larch 3	1	spruce 4	5	s pine	6		7 8	9	tuce	10	11	aspen 12 POTR	poplar 13	pine 14	15		hirch 16 BENE	hemlock 17	18		19	20	asper 21		poplar 22
trait abbreviation	Description Russia - 1, Canada - 2, Alaska - 3	LAGM 1		LASI 1	LAC.	:A	PIOB 1	PISY		PISI 1		BEPE LALA 1 2	PIGL 2		PIMA 2	BEPA 2	POTR 2	POBA 2	PICO 2	LAI 3	A	BENE 3	TSME 3	PIMA 3	3	PISI	PIGL 3	POTI 3	2	POBA 3
	Minimum age to begin to bear cones [years]	15	based on Abaimov (2010)	Aba	d on 15 imov 0)	Ab	sed on 15 baimov 010)	based on 15 Abaimov (2010)	based on Abaimov (2010)	15	cased on Abaimov (2010)	10 based on Roloff and Pietzarka	same as Larix 15 gmelinii	same as Picea obovata	15 same as obovata	Picea 15	based on 15 Safford et al. (1990)	based on 8 Geburek (2008)	based on 5 Weisgerber and Zsuffa	based on 15 Stephan (2008)	same as Larix gmelinii	10 based o Safford (1990)		based on 15 Means (2024)	based on 2 Schütt (2008); Fryer	20 based or Griffith (2024)		based on Nienstaedt and Zasada	based on Geburek (2008)	8
rate	Probability of seed release from	0.63931	estimated	0.63931 estin	nated 0.639	931 est	timated 0.9	estimated 0.95	estimated	0.95	estimated	(2008) 1 estimated 0.64	same as Larix 0.9	same as Picea	0.9 same as oboyata	Picea 1	same as 1 Betula	estimated 1	(2008) estimated 0.95 based on	estimated 0.64	same as Larix	1 estimate	od 1	estimated 0.9 based on	(2014) based on Fryer (2014)	0.73 estimate	ed 0.9	(2024) estimated 1	estimated	1
breeze	Conc												giiciiiii	ODO VALIA	oloviii.	P. 140	pendula		Kattge et al. (2020)		gireiiii			Kattge et al. (2020)	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					***
breeze	Horizontal seed dispersal distance at wind speed of 10 km h-1 [m] How far do the seeds usually travel?	60.1	estimated based on Matlack	base Mat		ba: Ma	timated 15 sed on atlack	estimated 30 based on Matlack	estimated based on Matlack		estimated cased on Matlack	139 estimated 60.1 based on Matlack	same as Larix 15 gmelinii	same as Picea obovata	15 same as obovata	Picea 150	based on Safford et al. (1990)	based on 200 Geburek (2008)	based on Kattge et al. (2020)	based on Stephan (2008)	same as Larix gmelinii	from se shape a	ed	from seed shape and	Fryer (2014)	based or Kattge (2020)	et al.	based on 500 Nienstaedt and Zusada	based on Geburek (2008)	200
			(1987)	(198	7)	(15	987)	(1987)	(1987)	ľ	1987)	(1987)										weight		weight				(2024); Stewart et al. (1998)		
cent	Seed descent rate [m s-1]	0.86	estimated based on Matlack		nated 0.86 d on lack	bas	timated 1.2 sed on atlack	estimated 2.4 based on Matlack	estimated based on Matlack		estimated based on Matlack	0.2 estimated 0.86 based on Matlack	same as Larix 1.2 gmelinii	same as Picea obovata	1.2 same as obovata	Picea 0.2	same as 0.1 Betula pendula	estimated 0.3	estimated 0.7 based on Zasada and	educated 0.86 literature- based	same as Larix gmelinii	0.2 estimate from se shape a	ed	from seed shape and	from seed shape and	0.8 based or Kattge of (2020)		estimated 0.1 from seed shape and	estimated	0.3
	E. a. C. F. a. J. F. a.	0.16	(1987)	(198	7)	(19	987)	(1987) estimated 0.16	(1987)	1	(1987) estimated	(1987)	estimated 0.16	estimated	0.16	1 0.16	estimated 0.16	estimated 0.16	Phipps (2024) estimated 0.16	estimate 0.16	estimated	weight	d 0.16	weight	weight estimated (ed 0.16	weight estimated 0.16	estimated	0.16
eratio odfactor	Factor of dispersal distance Factor of seed productivity	16	based on Abaimov	16 base	nated 0.16 d on 16 imov	bas	timated 0.16 sed on 16 baimov	based on 16 Abaimov	estimated based on Abaimov	16	pased on Abaimov	0.16 estimated 0.16 16 based on 16 Abaimov	based on 16 Abaimov 16	based on Abaimov	16 based on Abaimov		based on 16 Abaimov	based on 16 Abaimov	based on 16 Abaimov	based on 16 Abaimov	based on Abaimov	16 based o Abaims		based on 16 Abaimov	based on 1 Abaimov	16 based or Abaimo	n 16	based on 16 Abaimov	based on Abaimov	16
ationrate ationweatherinfluence	Background germination rate Influence factor of weather on	0.01	(2010) estimated estimated	0.01 estis 0.45 estis	0) nated 0.01 nated 0.45	est est	010) timated 0.01 timated 0.45	(2010) estimated 0.01 estimated 0.45	(2010) estimated estimated		2010) estimated estimated	(2010) 0.01 estimated 0.01 0.45 estimated 0.45	(2010) estimated 0.01 estimated 0.45	(2010) estimated estimated	0.01 estimate 0.45 estimate		estimated 0.01 estimated 0.45	(2010) estimated 0.01 estimated 0.45	estimated 0.01 estimated 0.45	estimated 0.01 estimated 0.45	(2010) estimated estimated	(2010) 0.01 estimate 0.45 estimate	d 0.01 d 0.45	estimated 0.01 estimated 0.45	(2010) estimated (estimated ((2010) 0.01 estimate 0.45 estimate	ed 0.01 ed 0.45	estimated 0.01 estimated 0.45	(2010) estimated estimated	0.01
netergrowth	germination rate 1st percentile (1%) of the in individual observed tree ring widths	0.005	data-based estimate	0.005 data	-based 0.005	5 dat	ta-based 0.0045552	data-based 0.00	7 data-based	d 0.01239	data-based	0.005 data-based 0.001822	data-based 0.014	data-based estimate	0.0025 data-base	od 0.005502	data-based 0.002811	data-based 0.007	data-based 0.0045	data-based 0.00	1822 data-based	0.004 data-bar	ed 0.05786	data-based 0.008	data-based (0.024 data-bas	sed 0.014	data-based 0.027	42 data-based	0.007
rwthq75p	75th percentile (75%) of the	0.132	data-based estimate	0.132 data	-based 0.099	9 dat	ta-based 0.108	data-based 0.10	8 data-basec	d 0.0595	data-based	0.105 data-based 0.023225 estimate	data-based 0.0913	data-based estimate	0.0609 data-bass	ed 0.122125	data-based 0.096225	data-based 0.142	data-based 0.0657	data-based 0.02	3225 data-based	0.129 data-bas	ed 0.28625	data-based 0.08	data-based (0.1455 data-bas estimate		data-based 0.179	5 data-based estimate	0.142
cq	individual observed tree ring width Quadratic term of the equation for basal diameter growth rate [ln(cm)	-0.01227268	data-based estimate	estin	-based -0.13 mate	est	ta-based -0.00342247 timate	data-based -0.02 estimate	2246944 data-based estimate		data-based estimate	0.002500199 data-based 0.018386 estimate 0.018386	data-based -0.003425 estimate	data-based estimate	-0.0024343 data-base estimate		data-based -0.06942 estimate	estimate	data-based -0.1247	611 data-based 0.01 estimate	83861 data-based estimate	-0.0821978 data-bas estimate		data-based 0.00253 estimate	345 data-based - estimate -	0.0377648 data-bas estimate	sed 0.001235	5 data-based -0.00 estimate	72255 data-based estimate	0.0012433
	cm-2]		similar to Fyllas et al. (2010)		lar to as et al. 0)		milar to Alas et al. 010)	similar to Fyllas et al. (2010)	similar to Fyllas et a (2010)		similar to Fyllas et al. (2010)	similar to Fyllas et al. (2010)	similar to Fyllas et al. (2010)	similar to Fyllas et al. (2010)	similar to Fyllas et (2010)		similar to Fyllas et al. (2010)	similar to Fyllas et al. (2010)	similar to Fyllas et al. (2010)	similar to Fyllas et al. (2010)	similar to Fyllas et al. (2010)	similar Fyllas e (2010)		similar to Fyllas et al. (2010)	similar to Fyllas et al. (2010)	Similar Fyllas e (2010)		similar to Fyllas et al. (2010)	similar to Fyllas et al. (2010)	
hc .	Linear term of the basal diameter growth function [ln(cm) cm-2]	0.20695933	data-based estimate similar to	estin	-based 0.107 nate lar to	est	ta-based -0.05123367 timate milar to	data-based -0.09 estimate similar to	098064 data-based estimate similar to		data-based estimate similar to	-0.34669049 data-based estimate similar to	9 data-based -0.053172 estimate similar to	data-based estimate similar to	-0.0663747 data-base estimate similar to		data-based 0.094035 estimate similar to	8 data-based -0.196889 estimate similar to	7 data-based 0.1652 estimate similar to	17 data-based -2.3. estimate similar to	293959 data-based estimate similar to	0.0369099 data-bas estimate similar		data-based -0.3487 estimate similar to	7162 data-based - estimate similar to	0.0327626 data-bas estimate similar	e	99 data-based 0.066 estimate similar to	3958 data-based estimate similar to	-0.1968897
			Fyllas et al. (2010)	Fyll (201	as et al. 0)	Fy (20	dlas et al. 010)	Fyllas et al. (2010)	Fyllas et a (2010)	al.	Fyllas et al. (2010)	Fyllas et al. (2010)	Fyllas et al. (2010)	Fyllas et al. (2010)	Fyllas et (2010)	al.	Fyllas et al. (2010)	Fyllas et al. (2010)	Fyllas et al. (2010)	Fyllas et al. (2010)	Fyllas et al. (2010)	Fyllas e (2010)	t al.	Fyllas et al. (2010)	Fyllas et al. (2010)	Fyllas e (2010)	t al.	Fyllas et al. (2010)	Fyllas et al. (2010)	
onst	Constant term of the basal diameter growth function [ln(cm)]	-2.729498	data-based estimate similar to	estin	-based -1.95 nate lar to	est	ta-based -2.02861 timate milar to	data-based -1.69 estimate similar to	data-based estimate similar to		data-based estimate similar to	-1.813708 data-based -0.438993 estimate similar to	1 data-based -2.18987; estimate similar to	data-based estimate similar to	-2.6258723 data-base estimate similar to		data-based -2.11409 estimate similar to	68 data-based -1.812320 estimate similar to	9 data-based -2.3170 estimate similar to	149 data-based -0.4 estimate similar to	389931 data-based estimate similar to	-1.6877396 data-bas estimate similar		data-based -1.9308 estimate similar to	8998 data-based - estimate similar to	1.7689852 data-bas estimate similar	e to	15 data-based -2.12 estimate similar to	47331 data-based estimate similar to	-1.8123209
iscq	Quadratic term of the equation for	-0.01227268	Fyllas et al. (2010) data-based	(201	as et al. 0) based -0.13	(20	dlas et al. 010) ta-based -0.00342247	Fyllas et al. (2010) data-based -0.02	Fyllas et a (2010) 2246944 data-based		Fyllas et al. (2010) data-based	Fyllas et al. (2010) 0.002500199 data-based 0.018386	Fyllas et al. (2010) data-based -0.003425	Fyllas et al. (2010) 53 data-based	Fyllas et (2010) -0.0024343 data-base		Fyllas et al. (2010) data-based -0.06942	Fyllas et al. (2010) 29 data-based 0.0012433	Fyllas et al. (2010) data-based -0.1247	Fyllas et al. (2010) 611 data-based 0.01	Fyllas et al. (2010) 83861 data-based	Fyllas e (2010) -0.0821978 data-bar		Fyllas et al. (2010) data-based 0.00253	Fyllas et al. (2010) 345 data-based -	Fyllas e (2010) 0.0377648 data-bas		Fyllas et al. (2010) 5 data-based -0.00	Fyllas et al. (2010) 72255 data-based	0.0012433
	breast height diameter growth rate [ln(cm) cm-2]		estimate similar to Fyllas et al.	estir	nate lar to as et al.	est	timate nilar to Alas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et a		estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et	,	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar Fyllas e	p 0	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar Fyllas e	e to	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	
ac	Linear term of the breast height	0.20695933	(2010) data-based	(201 0.20695933 data	0) -based 0.107	743057 dat	010) ta-based -0.05123367	(2010) data-based -0.09	(2010) 098064 data-based	d 0.27559132 d	(2010) data-based	(2010) -0.34669049 data-based -2.329395	(2010) 9 data-based -0.053172	(2010) 22 data-based	(2010) -0.0663747 data-base	d 0.222367	(2010) data-based 0.094035	(2010) 8 data-based -0.196889	(2010) 7 data-based 0.1652	(2010) 17 data-based -2.3	(2010) 293959 data-based	(2010) 0.0369099 data-bas	ed -0.0279867	(2010) data-based -0.3487	(2010) 7162 data-based -	(2010) 0.0327626 data-bas	sed -0.19847	(2010) 99 data-based 0.066	(2010) 3958 data-based	-0.1968897
	diameter growth function [ln(cm) cm-2]		estimate similar to Fyllas et al.	simi	nate lar to as et al.	sin	timate milar to Alas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et a	.	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et)	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimat similar Fyllas e	a	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	estimate similar Fyllas e	to	estimate similar to Fyllas et al.	estimate similar to Fyllas et al.	
lconst	Constant term of the breast height diameter growth function [ln(cm)]	-2.729498	(2010) data-based estimate		0) -based -1.95 nate		010) ta-based -2.02861 timate	(2010) data-based -1.69 estimate	(2010) data-based estimate		(2010) data-based estimate	(2010) -1.813708 data-based -0.438993 estimate	(2010) 1 data-based -2.189873 estimate	(2010) data-based estimate	-2.6258723 data-base estimate		(2010) data-based -2.11409 estimate	(2010) 68 data-based -1.812320 estimate	(2010) 9 data-based -2.3170 estimate	(2010) 149 data-based -0.4 estimate	(2010) 389931 data-based estimate	(2010) -1.6877396 data-bas estimate		(2010) data-based -1.9308 estimate	(2010) 8998 data-based - estimate	(2010) 1.7689852 data-bas estimate		(2010) 15 data-based -2.12 estimate	(2010) 47331 data-based estimate	-1.8123209
	ground amenon [m(cm)]		similar to Fyllas et al.	simi	lar to as et al.	sin	milar to Alas et al.	similar to Fyllas et al.	similar to Fyllas et a		similar to Fyllas et al.	similar to Fyllas et al.	similar to Fyllas et al.	similar to Fyllas et al.	similar to Fyllas et)	similar to Fyllas et al.	similar to Fyllas et al.	similar to Fyllas et al.	similar to Fyllas et al.	similar to Fyllas et al.	similar Fyllas e	a	similar to Fyllas et al.	similar to Fyllas et al.	similar Fyllas e	to	similar to Fyllas et al.	similar to Fyllas et al.	
ightalloslope	Height-diameter nonlinear function slopes (H < 1.3 m & ≥ 1.3 m) [cm	42.88	(2010) data-based estimate		0) -based 42.88 nate		010) ta-based 42.88 timate	(2010) data-based 42.8 estimate	(2010) 8 data-based estimate		(2010) data-based estimate	(2010) 42.88 data-based 42.88 estimate	(2010) data-based 42.88 estimate	(2010) data-based estimate	42.88 data-base estimate	d 42.88	(2010) data-based 42.88 estimate	(2010) data-based 42.88 estimate	(2010) data-based 42.88 estimate	(2010) data-based 42.8 estimate	(2010) 8 data-based estimate	42.88 data-bae estimate		data-based 42.88 estimate	(2010) data-based 4 estimate	(2010) 42.88 data-bas estimate		(2010) data-based 42.88 estimate	(2010) data-based estimate	42.88
ghtalloexp	cm−1] Height-diameter nonlinear function exponent (H < 1.3 m & ≥ 1.3 m)	1	data-based estimate		-based 1	dat	ta-based 1 timate	data-based 1 estimate	data-basec estimate		data-based	data-based 1 estimate	data-based 1 estimate	data-based estimate	1 data-base estimate		data-based 1 estimate	data-based 1 estimate	data-based 1 estimate	data-based 1 estimate	data-based estimate	1 data-bas	ed 1	data-based 1 estimate	data-based l	data-bas		data-based 1 estimate	data-based estimate	1
rightalloslope	Height-diameter nonlinear function slopes (H < 1.3 m & ≥ 1.3 m) [cm	42.88	data-based estimate		-based 42.88 nate	8 dat	ta-based 42.88 timate	data-based 42.8 estimate		d 42.88	data-based estimate		data-based 42.88 estimate	data-based estimate	42.88 data-base estimate	ed 42.88	data-based 42.88 estimate	data-based 42.88 estimate	data-based 42.88 estimate	data-based 42.8 estimate	8 data-based estimate	42.88 data-bas estimate	ed 42.88	data-based 42.88 estimate	data-based 4 estimate	12.88 data-bas estimate	sed 42.88	data-based 42.88 estimate	data-based estimate	42.88
ightalloexp	Height-diameter nonlinear function exponent (H ≤ 1.3 m & ≥ 1.3 m)	1	data-based estimate	1 data	-based 1 nate	dat	ta-based 1 timate	data-based 1 estimate	data-based estimate	d 1	data-based estimate	data-based 1 estimate	data-based 1 estimate	data-based estimate	1 data-base estimate	d 1	data-based 1 estimate	data-based 1 estimate	data-based 1 estimate	data-based 1 estimate	data-based estimate	data-basestimate	ed 1	data-based 1 estimate	data-based 1 estimate	data-bas estimate	sed 1	data-based 1 estimate	data-based estimate	1
htslopenonlin	Height-diameter nonlinear function slopes (H < 1.3 m) [cm cm-1] Height-diameter nonlinear function	7.02	data-based estimate data-based		-based 44.43 nate -based 7.02		ta-based 44.43163 timate 7.02	data-based 44.4 estimate data-based 7.02	3163 data-based estimate data-based	d 44.43163 d 7.02	data-based estimate data-based	44.43163 data-based 44.43 estimate 7.02 data-based 7.02	data-based 44.43 estimate data-based 7.02	data-based estimate data-based	44.43 data-base estimate 7.02 data-base	d 44.43	data-based 44.43 estimate 44.43 data-based 7.02	data-based 44.43163 estimate data-based 7.02	data-based 44.43 estimate data-based 7.02	data-based 44.4 estimate data-based 7.02	3 data-based estimate data-based	44.43163 data-bas estimato 7.02 data-bas		data-based 44.4316 estimate data-based 7.02	63 data-based 4 estimate data-based 7	14.43163 data-bas estimate 7.02 data-bas	sed 44.43163 e 7.02	data-based 44.43 estimate data-based 7.02	163 data-based estimate data-based	7.02
	slopes (≥ 1.3 m) [cm0.5 cm-0.5] Asymmetry of height estimation model	9.415	data-based estimate		hate 9.415	5 dat	timate ta-based 10.827 timate	estimate data-based 28.7 estimate	estimate 19 data-based estimate	d 11.590869	stimate data-based	7.822067 data-based 8.9637	data-based 8.21802	data-based estimate	estimate 14.779175 data-base estimate	rd 7.238483	estimate data-based 6.904783 estimate	estimate data-based 8.009746	data-based 12.173	estimate data-based 8.96 estimate	estimate 37 data-based estimate	7.18017 data-bar estimate	ed 12.878784	data-based 8.14016 estimate	estimate 61 data-based 7	7.4374 data-bas	e sed 7.267284	estimate data-based 7.679	estimate 233 data-based estimate	8.009746
b	Centre of height estimation model	2.83	data-based estimate	2.83 data estin	-based 2.83 nate	dat	ta-based 3.543 timate	data-based 10.9 estimate	data-based estimate		data-based estimate	1.548396 data-based 3.9904 estimate	data-based 2.66653 estimate 1.670120	data-based estimate	5.967531 data-base estimate	d 0.9904787	data-based 5.162 estimate	data-based 3.599828 estimate	data-based 3.88 estimate 3.600	data-based 3.99 estimate	04 data-based estimate	3.16288 data-bar estimate	ed 5.889165	data-based 4.12278 estimate	estimate	3.1562 data-bas estimate	sed 3.676405	data-based 3.663 estimate	742 data-based estimate	3.599828
yc	Scaling factor of height estimation model Background mortality rate [yr-1]	0.0001	data-based estimate fixed		-based 2.214 nate 0.000	est 01 fix	timate 2.381 timate 0.0001	data-based 4.91 estimate 0.00	6 data-based estimate 01 fixed	d 3.057776 0	data-based estimate fixed	1.663913 data-based 2.585987 estimate 0.0001 fixed 0.0001	data-based 1.679129 estimate 0.0001	data-based estimate fixed	3.676815 data-base estimate 0.0001 fixed	0.0001	data-based 0.0272 estimate 0.0001	data-based 1.238247 estimate 0.0001	data-based 3.6068 estimate 0.0001	data-based 2.58 estimate 0.00	5987 data-based estimate 01 fixed	0.82948 data-bas estimate 0.0001 fixed	ed 7.490937 0.0001	data-based 1.24090 estimate 0.0001	02 data-based 1 estimate fixed (1.636 data-bas estimate 0.0001 fixed	sed 1.04931 e 0.0001	data-based 0.891 estimate 0.000	484 data-based estimate 1 fixed	0.0001
nage	Maximum tree age [years]	609	background variable based on	vari	ground able d on 609	var	ckground riable sed on 250	background variable based on 250	backgrour variable based on		oackground variable oased on	background variable 100 based on 609	variable same as Larix 250	background variable same as Picea	backgrot variable 250 same as	nd Picea 140	background variable based on 200	background variable based on 140	background variable based on 200	background variable based on 609	background variable same as Larix	backgro variable 100 based o	1 500	background variable based on 250	background variable based on	backgro variable 700 based or		background variable based on 200	background variable based on	140
-			Vaganov et al. (1999), cited in	Vag al. (anov et 1999),	Va al.	aganov et (1999),	Vaganov et al. (1999), cited in	Vaganov e al. (1999)	et i,	Vaganov et al. (1999),	Vakkari (2009)	gmelinii	obovata	obovata		Safford et al. (1990)	Geburek (2008)	Weisgerber and Zsuffa	Stephan (2008)	gmelinii	Safford (1990)	et al.	Schütt and Lang	Schütt (2008); Fryer (2014)	Kattge (2020)	et al.	Mackenthun (2008)	Geburek (2008)	
			Abaimov (2010)	Aba (201	imov 0)	Al: (20	baimov 010)	Abaimov (2010)	Abaimov (2010)		Abaimov (2010)								(2008)					(2020), Kattge et al. (2020)	(2014)					
th	Influence factor for trees older than the age limit on tree mortality Tree youth influence factor on tree	0.4	estimated		nated 8.187	est est	timated 8.18785 timated 0.4	estimated 8.18 estimated 0.4	785 estimated		estimated estimated	8.18785 estimated 8.19 0.4 estimated 0.4	estimated 8.19 estimated 0.4	estimated estimated	8.19 estimate 0.4 estimate		estimated 8.19 estimated 0.4	estimated 8.18785 estimated 0.4	estimated 8.19 estimated 0.4	estimated 8.19 estimated 0.4	estimated estimated	8.18785 estimate 0.4 estimate		estimated 8.18785 estimated 0.4	stimated 6	3.18785 estimate 0.4 estimate	ed 8.18785 ed 0.4	estimated 8.187 estimated 0.4	85 estimated estimated	0.4
thinfluenceexp	mortality Span of tree youth mortality Influence exponent on current tree	0.79295	estimated estimated		nated 0.792 nated 0.01		timated 0.79295 timated 0.01	estimated 0.79 estimated 0.01	295 estimated estimated		estimated estimated	0.79295 estimated 0.79 0.01 estimated 0.01	estimated 0.79 estimated 0.01	estimated estimated	0.79 estimate 0.01 estimate		estimated 0.79 estimated 0.01	estimated 0.79295 estimated 0.01	estimated 0.79 estimated 0.01	estimated 0.79	estimated estimated	0.79295 estimate 0.01 estimate		estimated 0.79295 estimated 0.01	5 estimated C	0.79295 estimate 0.01 estimate		estimated 0.792	95 estimated estimated	0.79295
у	prowth mortality Density influence factor on tree	0.2	estimated		nated 0.2	est	timated 0.2	estimated 0.2	estimated		estimated	0.2 estimated 0.2	estimated 0.2	estimated	0.2 estimate		estimated 0.2	estimated 0.2	estimated 0.2	estimated 0.2	estimated	0.2 estimate		estimated 0.2	estimated (0.2 estimate		estimated 0.2	estimated	0.2
valuemaximumatheight ser	not used anymore Weather influence factor on tree	0.1	estimated estimated		nated 0 nated 0.1	est	timated 0 timated 0.1	estimated 0 estimated 0.1	estimated estimated		estimated estimated	0 estimated 0 0.1 estimated 0.1	estimated 0 estimated 0.1	estimated estimated	0 estimate 0.1 estimate		estimated 0 estimated 0.1	estimated 0 estimated 0.1	estimated 0 estimated 0.1	estimated 0 estimated 0.1	estimated estimated	0 estimate 0.1 estimate		estimated 0 estimated 0.1	estimated () estimate 0.1 estimate	ed 0 ed 0.1	estimated 0 estimated 0.1	estimated estimated	0.1
eathermorteinflussexp	Exponent scaling the height influence	e 0.2	estimated	0.2 estin	nated 0.2		timated 0.2	estimated 0.2	estimated	0.2	estimated	0.2 estimated 0.2	estimated 0.2	estimated	0.2 estimate	i 0.2	estimated 0.2	estimated 0.2	estimated 0.2	estimated 0.2	estimated	0.2 estimate	d 0.2	estimated 0.2	estimated (0.2 estimate	ed 0.2	estimated 0.2	estimated	0.2
row f	Mortality rate of windthrow Drought influence factor on tree mortality (0 is not sensitive to	0.01	estimated tuned value		nated 0.01 d value 0.237	7805 tur	timated 0.01 ned value 0.5	estimated 0.01 tuned value 0.5	estimated tuned valu		estimated uned value	0.01 estimated 0.01 0.15 based on 0.24	estimated 0.01 same as Larix 0.5 emelinii	estimated same as Picea oboyata	0.01 estimate 0.5 same as obovata	Picea 0.15	estimated 0.01 same as 0.2 Betula	estimated 0.01 based on 0.7 Geburek	estimated 0.01 based on 0.5	estimated 0.01 educated 0.24 literature-	estimated same as Larix gmelinii	0.01 estimate 0.15 based o	1 0.7	estimated 0.01 based on 0.5	based on Fryer (2014)	0.01 estimate 0.7 based or	n 0.5	based on 0.2 Sullivan et	estimated based on Boyd et al.	0.01
	drought, 1 is max)											Peng et al. (2022)					pendula	(2008)	Kattge et al. (2020)	based estimate		Peng et (2022)		Kattge et al. (2020)		(2020)		al. (2021)	(2021)	
mort		0.44724	tuned value		d value 0.447		ned value 0.44724 ned value 0.999	tuned value 0.44 tuned value 0.99	724 tuned value	ue 0.44724 I	tuned value	1 tuned value 0.45 0.1 tuned value 0.56	tuned value 0.45	tuned value	0.45 tuned va		tuned value 0.45	tuned value 0.44724 tuned value 0.999	tuned value 0.45	tuned value 0.45	tuned value	tuned v tuned v tuned v	due 0.44724	tuned value 0.44724 tuned value 0.999	tuned value C).44724 tuned vi).999 tuned vi		tuned value 0.447	tuned value tuned value	0.44724
age	Maximum age of seeds [years]	4	based on	1 base	d on 2	bas	sed on 1	based on 1	based on		pased on	15 based on 4	same as Larix 1	same as Picea	1 same as	Picea 13	same as 0.08	based on Kim 0.1	based on 80	educated 4	same as Larix	13 based o		based on 1	based on 1	based or	n 1	based on 0.08	based on	0.1
			Abaimov (2010)		imov 0)		baimov 010)	Abaimov (2010)	Abaimov (2010)		Abaimov (2010)	Tiebel et al. (2021)	gmelinii	obovata	obovata		Betula pendula	(2018)	Harris (1990)	literature- based estimate	gmelinii	Tiebel (2021)		Tumer (1985)	Fryer (2014)	(2020)	et al.	Mackenthun (2008)	Kim (2018)	
noldtemp	Mean temperature of the coldest month (January) at the border of the species' geographical range [°C]	-45	based on Abaimov (2010)	-33 base Aba (201	d on -60 imov	Ab	sed on -33 baimov 010)	based on -33 Abaimov (2010)	based on Abaimov (2010)		based on Abaimov (2010)	40 based on 45 Roloff and Pietzarka	same as Larix -33 gmelinii	same as Picea obovata	-33 same as obovata	Picea -40	based on -30 Gilman and Watson	based on -30 Geburek (2008)	Zasada and Phipps (2024) -22.9	based on Strong (2013)	same as Larix gmelinii	-40 based o Safford (1990)		based on -33 Means (2024)	based on Schütt (2008); Fryer	3 based or Schütt a Lang (2	and	based on -30 Mackenthun (2008);	based on Geburek (2008)	-30
	species geographica image [c.]		(2010)	(20)	,	(2.		(2010)	(2010)	ĺ	2010)	(2008)					(1993)	(2000)				(1550)		(2021)	(2014)	Long (2		Nienstaedt and Zasada	(2000)	
noldtempcalcvalue		9	data-based value in first	valu	based 9 e in first	val	ta-based 6.6 lue in first	data-based value in first	data-based value in fi	irst	data-based value in first	value in first	data-based 6.6 value in first	data-based value in first	value in	first	data-based 6.6 value in first	data-based 6.6 value in first	data-based value in first	data-based value in first	data-based value in first	value ir		data-based 6.6 value in first	data-based value in first	5.6 data-bas value in	n first	(2024) data-based value in first	data-based value in first	6.6
ariablea	Function parameters a-d determining	g 1	version, then reused fixed value	reus	ion, then ed I value 1	ret	rsion, then used ted value 1	version, then reused fixed value 1	version, the reused fixed value		version, then reused fixed value	version, then reused 1 fixed value 1	version, then reused fixed value 1	version, then reused fixed value	version, reused 1 fixed val		version, then reused fixed value 1	version, then reused fixed value 1	version, then reused fixed value 1	version, then reused fixed value 1	version, then reused fixed value	version reused 1 fixed ve		version, then reused fixed value 1	reused fixed value 1	version, reused fixed va		version, then reused fixed value 1	version, then reused fixed value	1
ariableb	curvature of the July index calculation Function parameters a-d determining	g 13.49967	data-based	14.01075 data	-based 13.49	9967 dat	ta-based 18.39039	data-based 13.6	1796 data-bases	d 17.31612	lata-based	10.37459 data-based 15.1	data-based 14.22	data-based	14.6 data-bass	ed 13.86	data-based 15.17	data-based 13.82667	data-based 12.32	data-based 15.1	data-based	15.87896 data-bar	ed 13.32363	data-based 14.5995	99 data-based 1	3.42066 data-bas	sed 14.21738	data-based 15.16	684 data-based	13.82667
	curvature of the July index calculation; Maximum July temperature within distribution range		estimate using BIEN database	estir	nate g BIEN	est	timate ing BIEN	estimate using BIEN database	estimate using BIE database	EN I	estimate using BIEN	estimate using BIEN database	estimate using BIEN database	estimate using BIEN database	estimate using BI		estimate using BIEN	estimate using BIEN	estimate using BIEN	estimate using BIEN database	estimate using BIEN database	estimat using B databas	EN	estimate using BIEN database	estimate using BIEN database	estimate using B database	e IEN	estimate using BIEN database	estimate using BIEN database	
	without the 1st extreme value	e	based on Fick and Hijmanns	base	base d on Fick Hijmanns	bas	tabase sed on Fick d Hijmanns	based on Fick and Hijmanns	based on l and Hijms	Fick	database based on Fick and Hijmanns	based on Fick and Hijmanns	based on Fick and Hijmanns	based on Fick and Hijmanns	database based on and Hijn	anns	database based on Fick and Hijmanns	database based on Fick and Hijmanns	database based on Fick and Hijmanns	based on Fick and Hijmanns	based on Fick and Hijmanns	based o Fick an		based on Fick and	based on Fick and	based or Fick and	n d	based on Fick and	based on Fick and	
			(2017); Maitner et al. (2018)		7); iner et al. 8)		017); aitner et al. 018)	(2017); Maitner et al. (2018)	(2017); Maitner e (2018)	et al.	(2017); Maitner et al. (2018)	(2017); Maitner et al. (2018)	(2017); Maitner et al. (2018)	(2017); Maitner et al. (2018)	(2017); Maitner (2018)		(2017); Maitner et al. (2018)	(2017); Maitner et al. (2018)	(2017); Maitner et al. (2018)	(2017); Maitner et al. (2018)	(2017); Maitner et al. (2018)	Hijman (2017); Maitne		Hijmanns (2017); Maitner et al.	Hijmanns (2017); Maitner et al.	Hijmani (2017); Maitner		Hijmanns (2017); Maitner et al.	Hijmanns (2017); Maitner et al.	
	Function parameters a-d determining	g 0	fixed value	0 fixe	i value 0	fix	ted value 0	fixed value 0	fixed valu	ie 0	fixed value	0 fixed value 0	fixed value 0	fixed value	0 fixed val	ue 0	fixed value 0	fixed value 0	fixed value 0	fixed value 0	fixed value	(2018) 0 fixed va		(2018) fixed value 0	(2018) fixed value	(2018) fixed va		(2018) fixed value 0	(2018) fixed value	0
niablec		1	fixed value	1 fixe	i value 1	fix	sed value 1	fixed value 1	fixed valu	ie 1	fixed value	1 fixed value 1	fixed value 1	fixed value	1 fixed val	ue 1	fixed value 1	fixed value 1	fixed value 1	fixed value 1	fixed value	1 fixed va	lue 1	fixed value 1	fixed value 1	fixed va	alue 1	fixed value 1	fixed value	1
	curvature of the July index calculation Function parameters a-d determining	g 1					sed on 200	based on 100	based on	200	based on	40 based on 20	same as Larix 200	same as Picea	200 same as	Picea 60	based on 50	based on 50	based on 100	same as Pinus 20	same as Larix	40 based o	1 100	value from 200	based on 1	10 based or		based on 50	based on	50
iabled	curvature of the July index calculation	g 1	based on	200 base	d on 20		baimov	Abaimov (2010)	Abaimov (2010)	(Abaimov (2010)	Hoffmann (1966); Starikov	gmelinii	obovata	obovata		Safford et al. (1990)	Perala (2024)	Kattge et al. (2020)	sylvestris	gmelinii	Stariko (1969)		rooting depth	Fryer (2014)	(2020)		Mackenthun (2008)	Geburek (2008)	
riabled	curvature of the July index calculation Function parameters a-d determining curvature of the July index calculation	g 1 : 20	based on Abaimov (2010)	200 base Aba (201	d on 20 imov 0)	(20	010)					(1969) 9 based on 21.1	same as Larix 25	same as Picea	25 same as oboyata	Picea 9	same as 10	based on 4	estimated 15	same as Pinus 21.1	same as Larix	9 based o Possen		estimated 25	based on 2 Fryer (2014)	25 estimate accordir		estimated 10	based on	4
ariabled	curvature of the July index calculation Function parameters a -d determining curvature of the July index calculation Minimum depth of active layer table [cm] Minimum available soil water	g 1 20 21.1	Abaimov (2010) based on Sato	Aba (201 21.1 base	imov 0) d on Sato 21.1	(20 bar	sed on Sato 25	based on Sato 15	based on S		based on Sato		gmeinii	opovata	obovata		Betula pendula	University of Minnesota (2024)	according to preferred soil type	syrvestris	gmetinii	Possen (2011)	es all.	according to preferred soil	rryer (2014)	accordin	ing to	according to		
riabled	curvature of the July index calculation Function parameters a-d determining curvature of the July index calculation Minimum depth of active layer table [cm]	g 1 20 21.1	Abaimov (2010)	Aba (201 21.1 base	imov 0)	(20 bar	sed on Sato 25 al. (2016)	based on Sato 15 et al. (2016)	based on 9 et al. (201		et al. (2016)	Possen et al. (2011)												type		preferre type	ed soil	preferred soil type	University of Minnesota (2024)	
ariabled clayer	curvature of the July index calculation Function parameters a-d determining curvature of the July index calculation Minimum depth of active layer table [cm] Minimum available soil water content [%]:	21.1	Abaimov (2010) based on Sato	Aba (201 21.1 base et al 40 base	imov 0) d on Sato 21.1	baset s				Sato 40		(2011)	same as Larix 40 gmelinii	same as Picea obovata	40 same as obovata	Picea 85	same as 85 Betula	same as 47 Betula	estimated 30 according to	same as Pinus 40 sylvestris	same as Larix gmelinii	85 based o Possen		type estimated 40 according to	based on 7 Fryer (2014)	rstimate rstimate rstimate rstimate	ed 40	preferred soil type estimated according to	Minnesota	47
variabled clayer valer	curvature of the July index calculation Function parameters a-d determining curvature of the July index calculation Minimum depth of active layer table [cm] Minimum available sed water content [%] wiking point Maximum soil moisture as soil water content [%]	21.1	Abaimov (2010) based on Sato et al. (2016) based on Sato et al. (2016)	Aba (201 21.1 base et al 40 base et al	d on Sato 21.1 d on Sato 40 . (2016)	baset :	al. (2016) seed on Sato al. (2016)	et al. (2016) based on Sato et al. (2016)	et al. (201 based on t et al. (201	Sato 40 166)	et al. (2016) eased on Sato et al. (2016)	(2011) 85 based on Possen et al. (2011)	gmelinii	obovata	obovata		Betula pendula	Betula pendula		sylvestris	gmelinii	Possen (2011)	et al.	estimated according to preferred soil type	Fryer (2014)	type rs estimate accordin preferre type	ed 40 ng to ed soil	estimated 85 according to preferred soil type	Minnesota (2024) estimated according to preferred soil type	47
onriabled clayer	curvature of the July index calculation Function parameters a- d determining curvature of the July index calculation Minimum depth of active layer table [cm] Minimum available soil water content [%]: wilting point Maximum soil moisture as soil water	21.1	Abaimov (2010) based on Sato et al. (2016)	Aba (201 21.1 base et al 40 base et al	d on Sato 21.1 (2016)	baset :	al. (2016) sed on Sato 40	et al. (2016) based on Sato 30	et al. (201 based on 1	Sato 40 166)	et al. (2016)	(2011) 85 based on 40	same as Larix 40 gmelinii same as Larix 200 gmelinii	same as Picea obovata same as Picea obovata	obovata		Betula		according to	same as Pinus 40 sylvestris same as Pinus 50 sylvestris	same as Larix gmelinii same as Larix gmelinii	Possen (2011)	et al.	estimated according to 40		type 75 estimate accordir	ed 40 ng to ed soil	estimated according to 85	Minnesota (2024) estimated according to	47 800
variabled valuer valuer valuer valuer	curvature of the July index calculation Function parameters a-d determining curvature of the July index calculation Minimum depth of active layer table [cm] Minimum available sed water content [%] wiking point Maximum soil moisture as soil water content [%]	21.1	Abaimov (2010) based on Sato et al. (2016) based on Sato et al. (2016) based on Abaimov	Aba (201 21.1 basses et al 40 basses et al 100 basses Aba (201 2 own	d on Sato 21.1 d on Sato 40 . (2016)	baset :	al. (2016) seed on Sato al. (2016) 40 seed on 200	et al. (2016) based on Sato et al. (2016)	et al. (201 based on et al. (201 based on Abaimov	Sato 40 1 100 1	et al. (2016) eased on Sato et al. (2016)	(2011) 85 hased on Possen et al. (2011) 100 hased on Roloff and Pictrarka (2008) 1 hased on 2 Viheria	gmelinii	obovata	200 same as obovata	Picea 60	Betula pendula based on 75	Betula pendula based on Geburek (2008) based on Geburek	according to preferred soil type 100 based on 1 Weisgerber	sylvestris	gmelinii	Possen (2011) 100 based o	2t al. 100 et al. 1	estimated according to preferred soil type based on 200	estimated based on other spruces based on Schütt	type estimate accordir preferre type 200 based or Kattge (2020) based or Schütt a	ed 40 and 40 and 50 and	estimated according to preferred soil type based on 75	Minnesota (2024) estimated according to preferred soil type based on Geburek	800
variabled valuer valuer valuer valuer	curvature of the July index calculation Function parameters and determining curvature of the July index calculation Minimum depth of active layer table [cm] Minimum available soil water content [%]: withing point Maximum soil moisture as soil water content [%] Rooting depth [cm]	21.1	Abaimov (2010) based on Sato et al. (2016) based on Sato et al. (2016) based on Abaimov (2010) own	Aba (201 21.1 basses et al 40 basses et al 100 basses Aba (201 2 own	d on Sato 21.1 d on Sato 40 (2016) d on Sato 40 (2016) d on mov 20 20	baset :	al. (2016) sed on Sato 40 al. (2016) sed on Sato 40 al. (2016) 200 baimov 010)	et al. (2016) based on Sato et al. (2016) based on Abaimov (2010) own 3	et al. (201 based on et al. (201 based on Abaimov	Sato 40 1 100 1	et al. (2016) coased on Sato et al. (2016) coased on Abaimov (2010)	(2011)	gmelinii same as Larix 200 gmelinii	obovata same as Picea obovata	200 same as obovata	Picea 60	Betula pendula based on 75 Safford et al. (1990) based on 1	Betula pendula based on Geburek (2008) based on 1.5	based on Weisgerber and Zauffa (2008);	sylvestris same as Pinus 50 sylvestris based on 2	gmelinii same as Larix gmelinii	Possen (2011) 100 based o Safford (1990) I based o	2t al. 100 et al. 1	estimated according to preferred soil type based on County (200) based on 1.5	estimated based on other spruces	type estimate according preferre type 200 based or Kattge 6 (2020) based or	ed 40 and 40 and 50 and	estimated according to preferred soil type based on Mackenthun (2008)	Minnesota (2024) estimated according to preferred soil type based on Geburek (2008)	800
variabled variabled variabled variabled variabled variabled variabled variabled variabled	curvature of the July index calculation Function parameters as determining curvature of the July index calculation Minimum depth of active layer table [cm] Minimum available soil water content [%]: withing point Maximum soil moisture as soil water content [%]: Resting the Minimum soil moisture as soil water content [%] Resting the Minimum soil moisture as soil water content [%] Resting the Minimum soil moisture as soil water content [%] Chance of resprouting following	21.1	Abaimov (2010) based on Sato et al. (2016) based on Sato et al. (2016) based on Abaimov (2010) own observation	Aba C201	mov (1) (2016) (2) (2016) (2) (2016) (2) (2016) (2) (2) (2) (2) (2) (2) (2) (2) (2) (2	base et : base et : base et : capacitation de : base et : base et : capacitation de : base et : base e	al. (2016) ased on Sato 40 al. (2016) sed on 1010 200 200 1.5	et al. (2016) based on Sato of al. (2016) based on Abaimov (2010) own 3 observation 3 educated 0	et al. (201 based on et al. (201 based on Abaimov (2010) own observation	Sato 40 100 100 100 100 100 100 100 100 100	et al. (2016) sassed on Sato et al. (2016) sassed on Abaimov (2010) sown observation	(2011) 85 based on Possern et al. (2011) 100 based en Roloff and Pictzarka (2005) 1 based on Vibertin Vetling (2017) 2010 on 1 educated 0.01	gmelinii same as Larix 200 gmelinii	obovata same as Picea obovata	200 same as obovata 1.5 same as obovata	Picea 60	Betula pendula based on 75 Safford et al. (1990) based on 1 Safford et al. (1990) educated 0	Betula pendula based on Geburek (2008) based on Geburek	according to preferred soil type 100 based on Weisgerber and Zsuffs (2008); Kattge et al. (2020) educated 0	sylvestris same as Pinus 50 sylvestris based on National Park Service (2024) same as Pinus 0.01	gmelinii same as Larix gmelinii	Possen (2011)	et al. 100 et al. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	estimated 40 according to preferred soil type based on Kattge et al. (2020) based on 1.5 Kattge et al. (2020) ceducated 0	estimated 2 based on other spruces based on 1 Schütt (2008); Fryer	sype estimate according preferency type. 200 based of Schitt Lang (2	ed 40 mg to d soil et al. 200 et al. 1.5	estimated according to preferred soil type hased on Asckenthun (2008) assed on 1 dakethal (2008) assed on 1 dakethal (2008) assed on 1 dakethal (2008)	Minnesota (2024) estimated according to preferred soil type based on Geburek (2008) based on Geburek (2008)	800
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