

Prediction of effect of climatic changes on forest fire risks

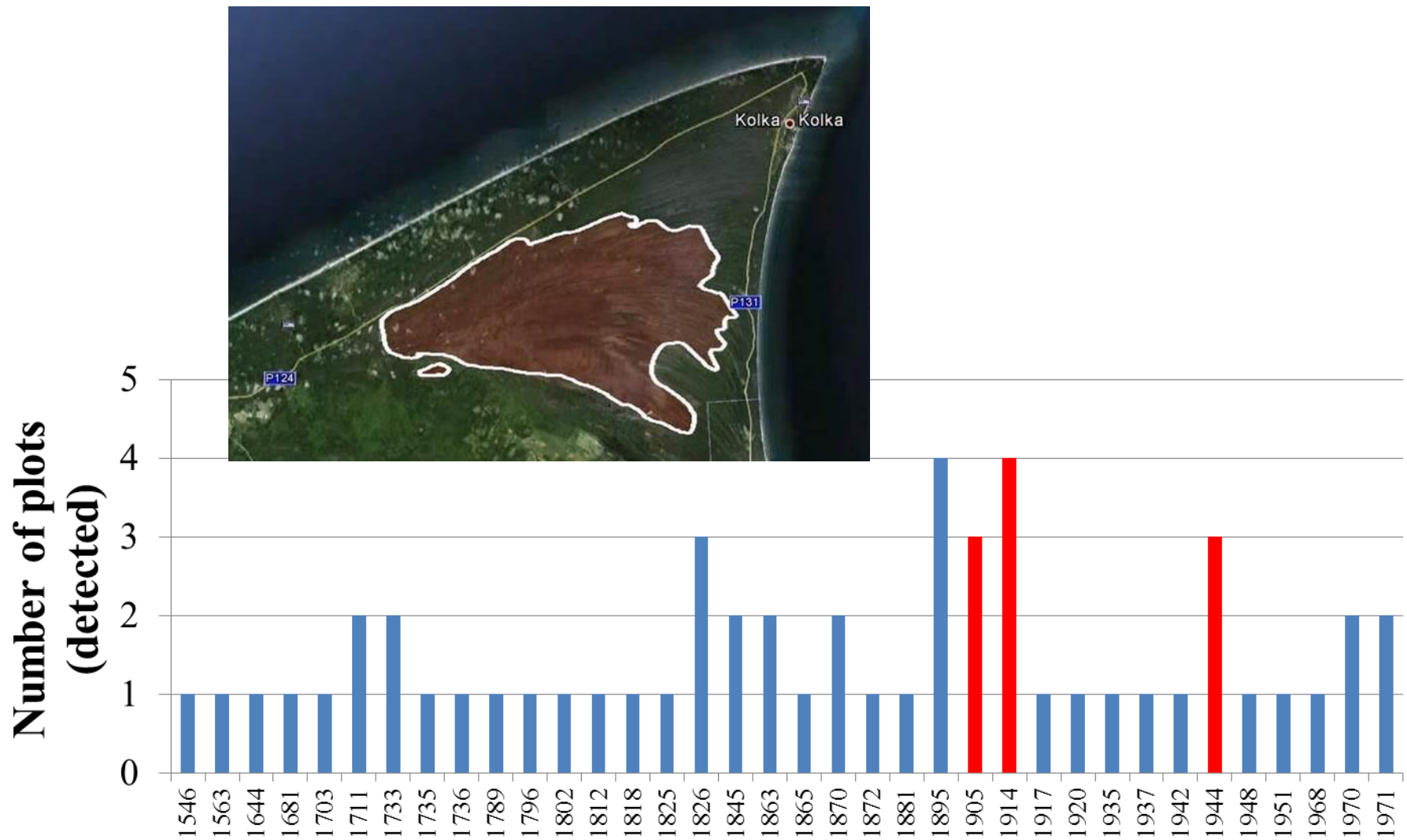
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Causes of forest fires

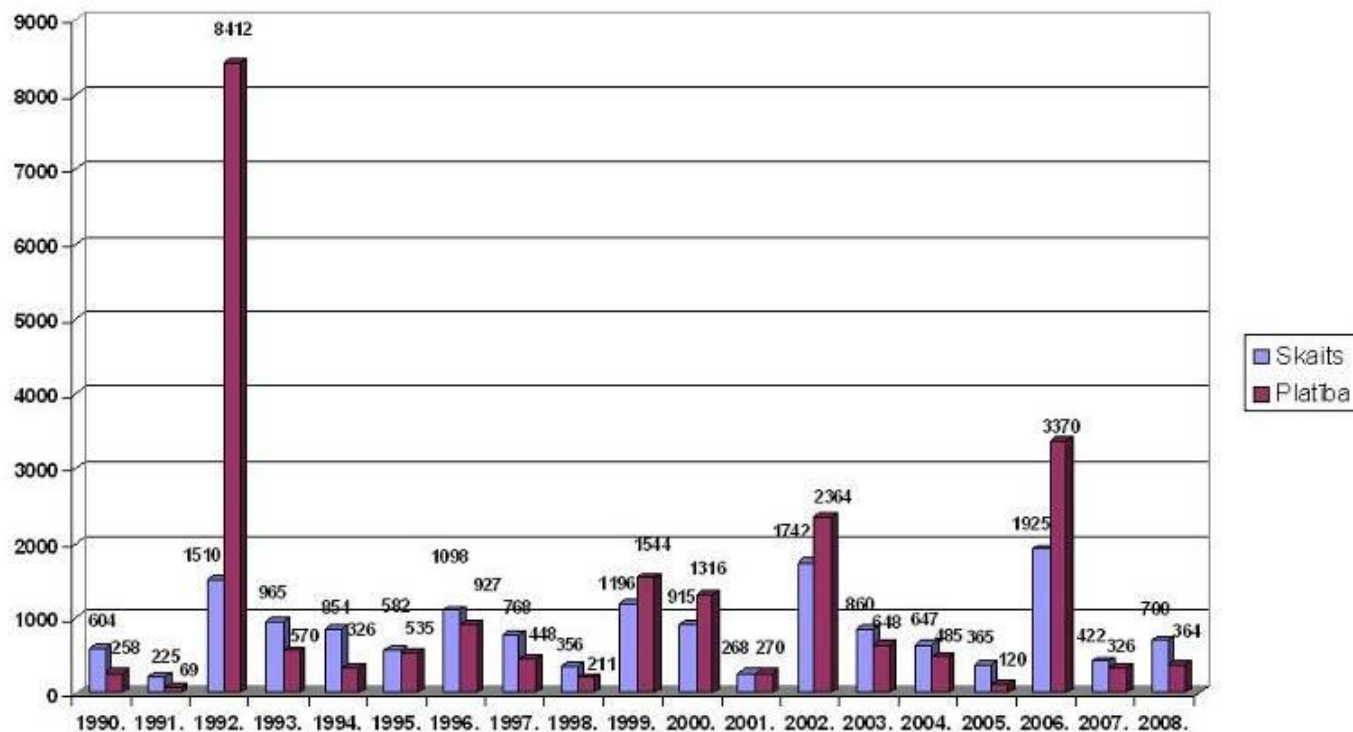


Causes of forest fire: history



Forest fire distribution

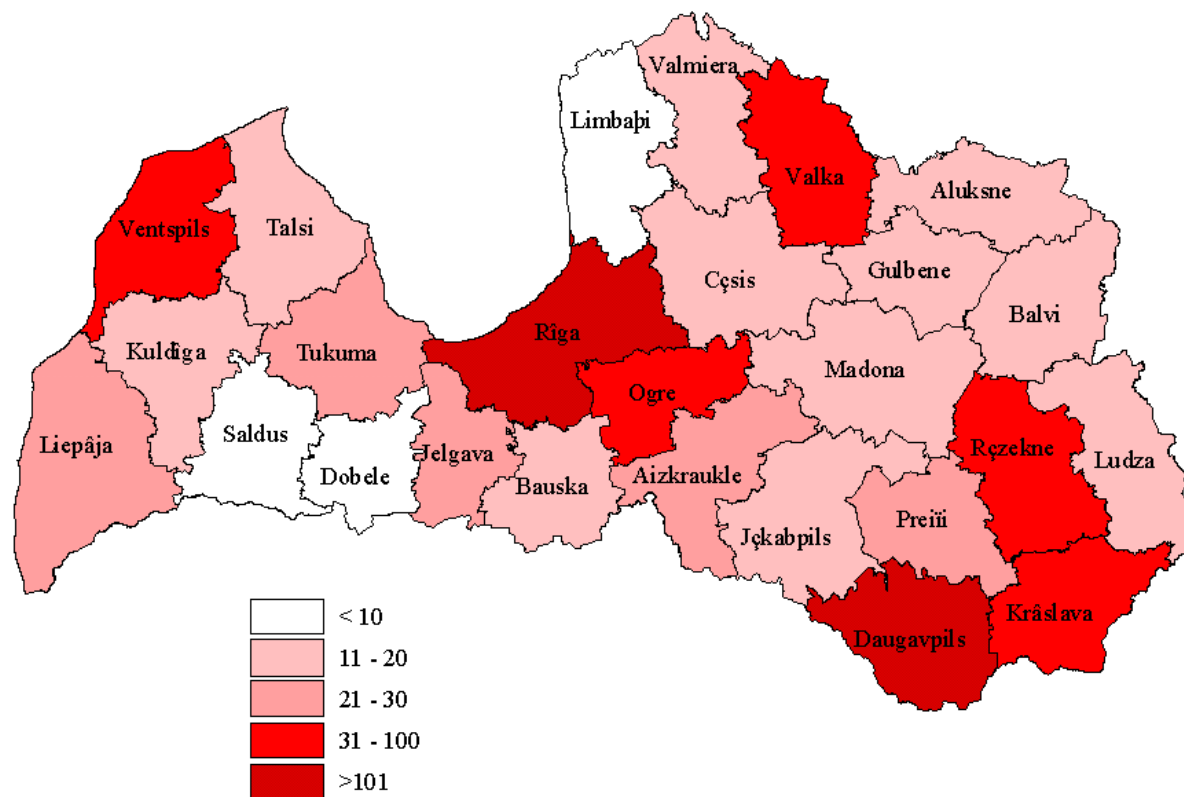
Ugunsgrēku skaits pa gadiem un uguns skartās platības (ha)



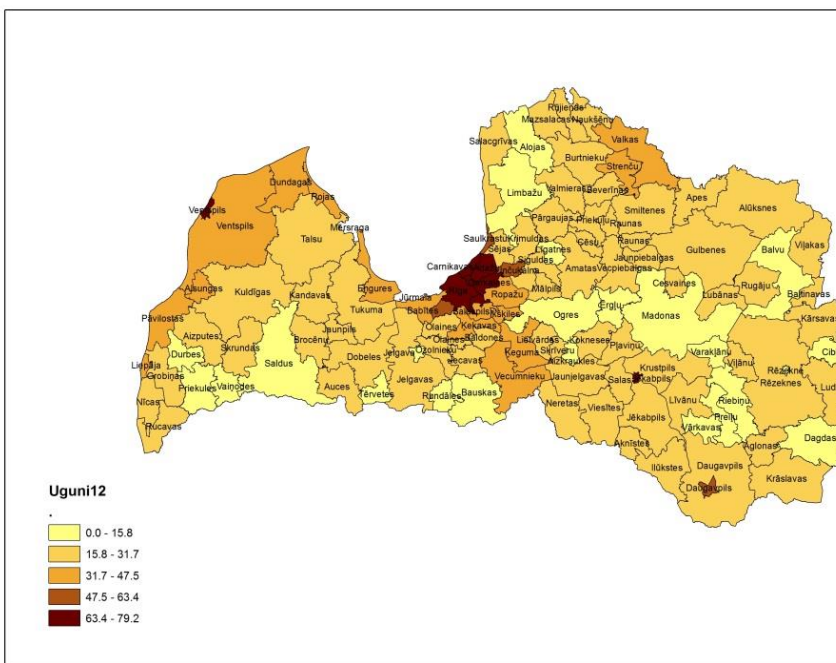
http://www.vmd.gov.lv/doc_upl/uguns_pa_gadiem.JPG

Forest fire distribution

Average number of forest fires

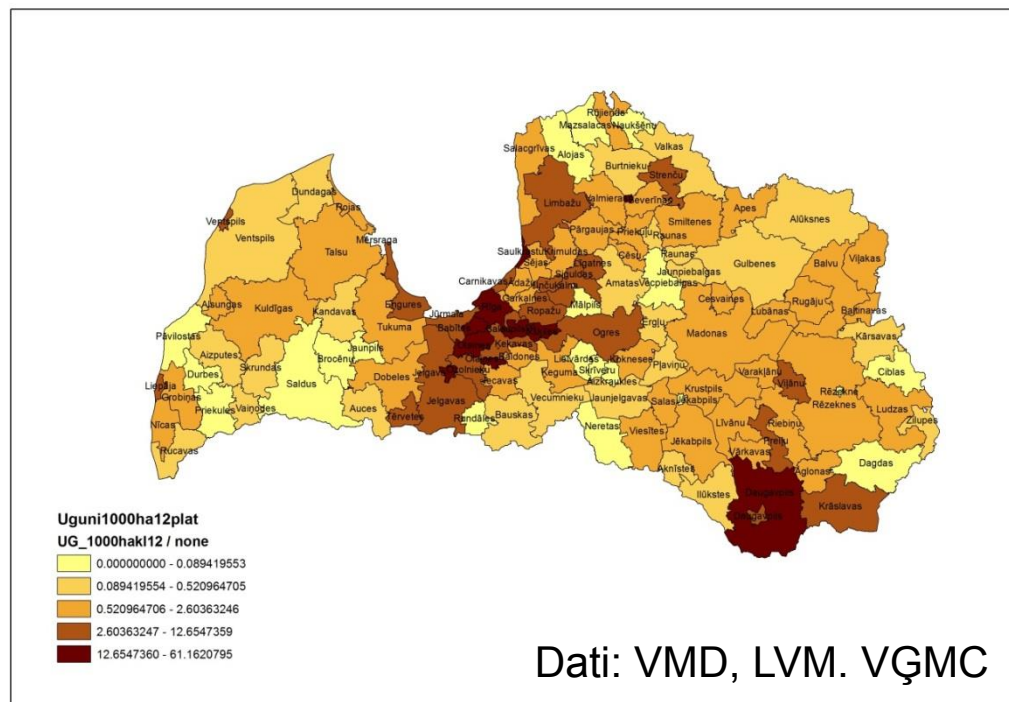


Causes of forest fire: spatial distribution



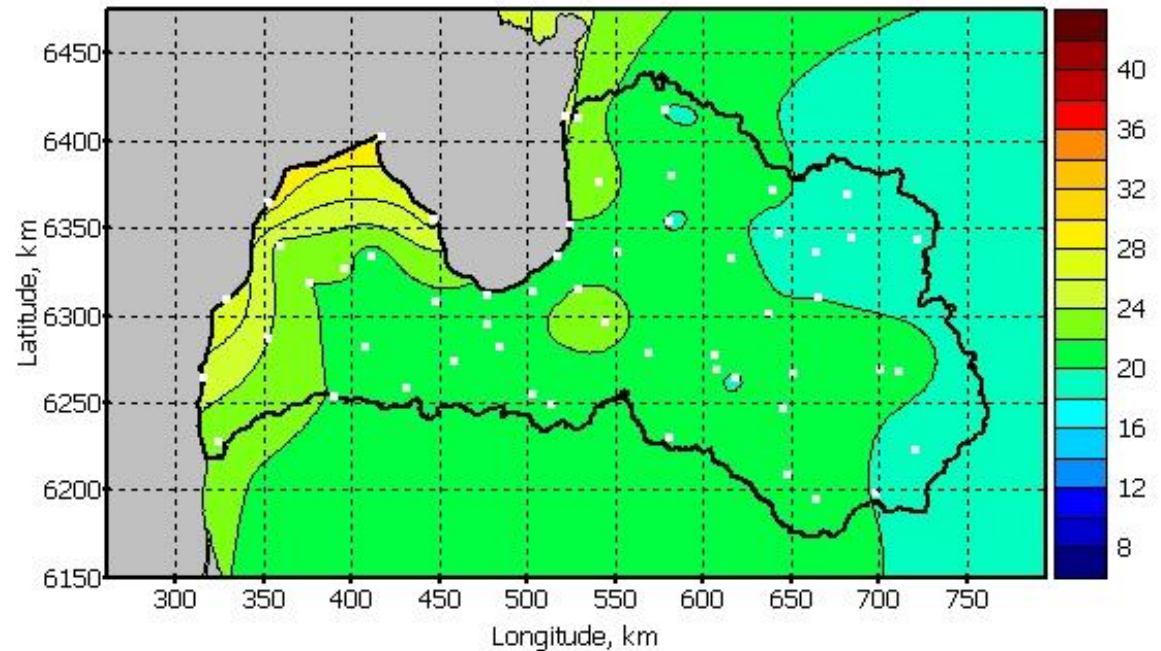
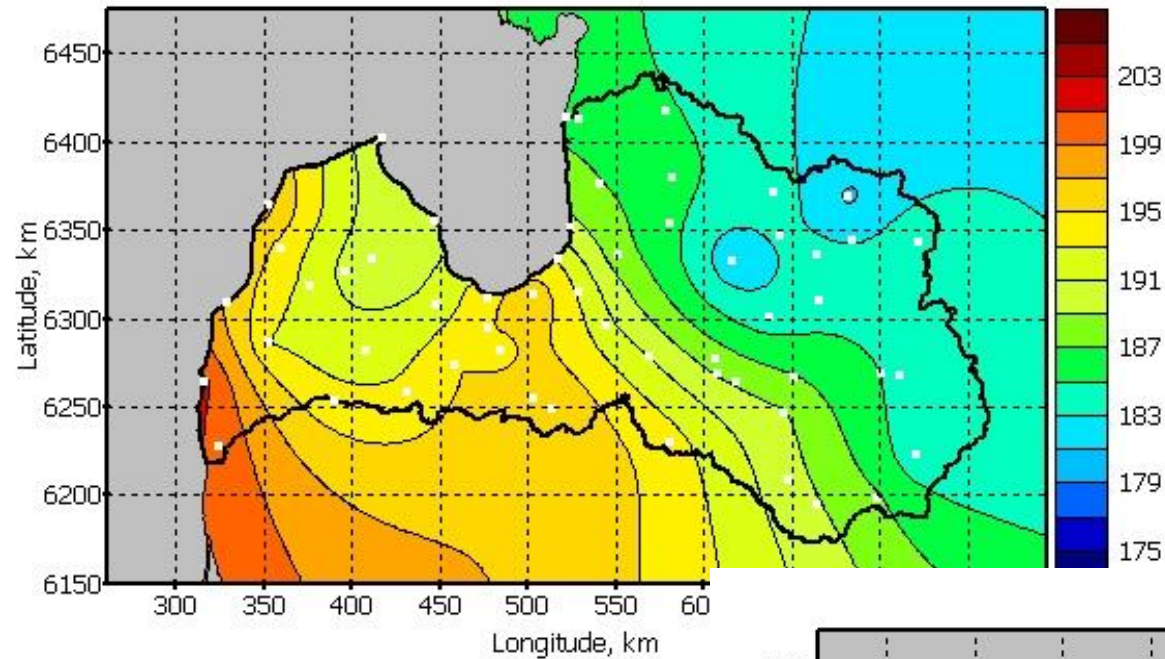
Proportion of 1. and 2. fire risk class forests

- Disproportionally high number of forest fires on Riga and Daugavpils regions
- In days with high fire risk (20-24% from the number of days in summer) highest number of fires are starting (65-75%)

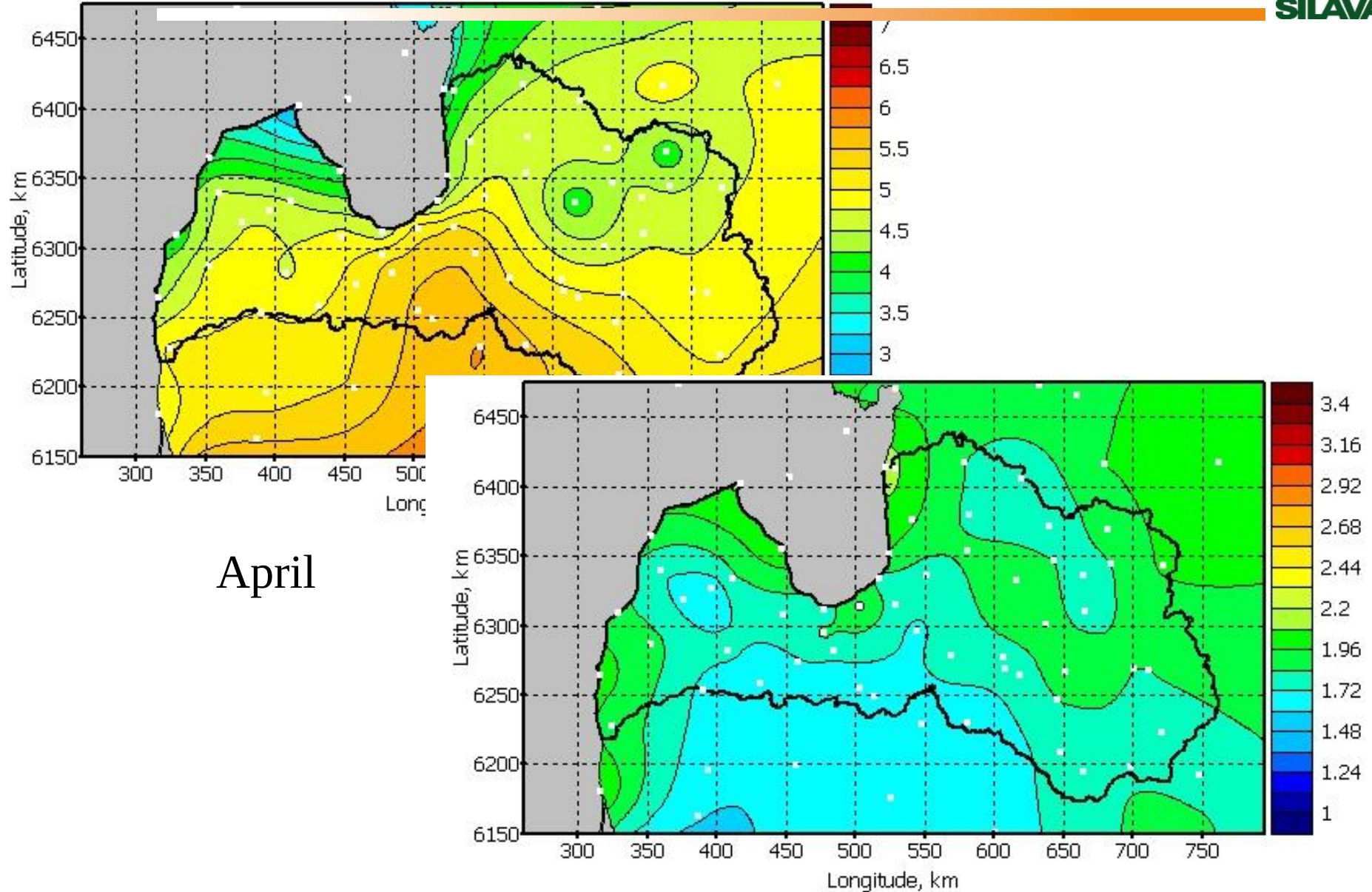


Number of fires per 1000ha of forests

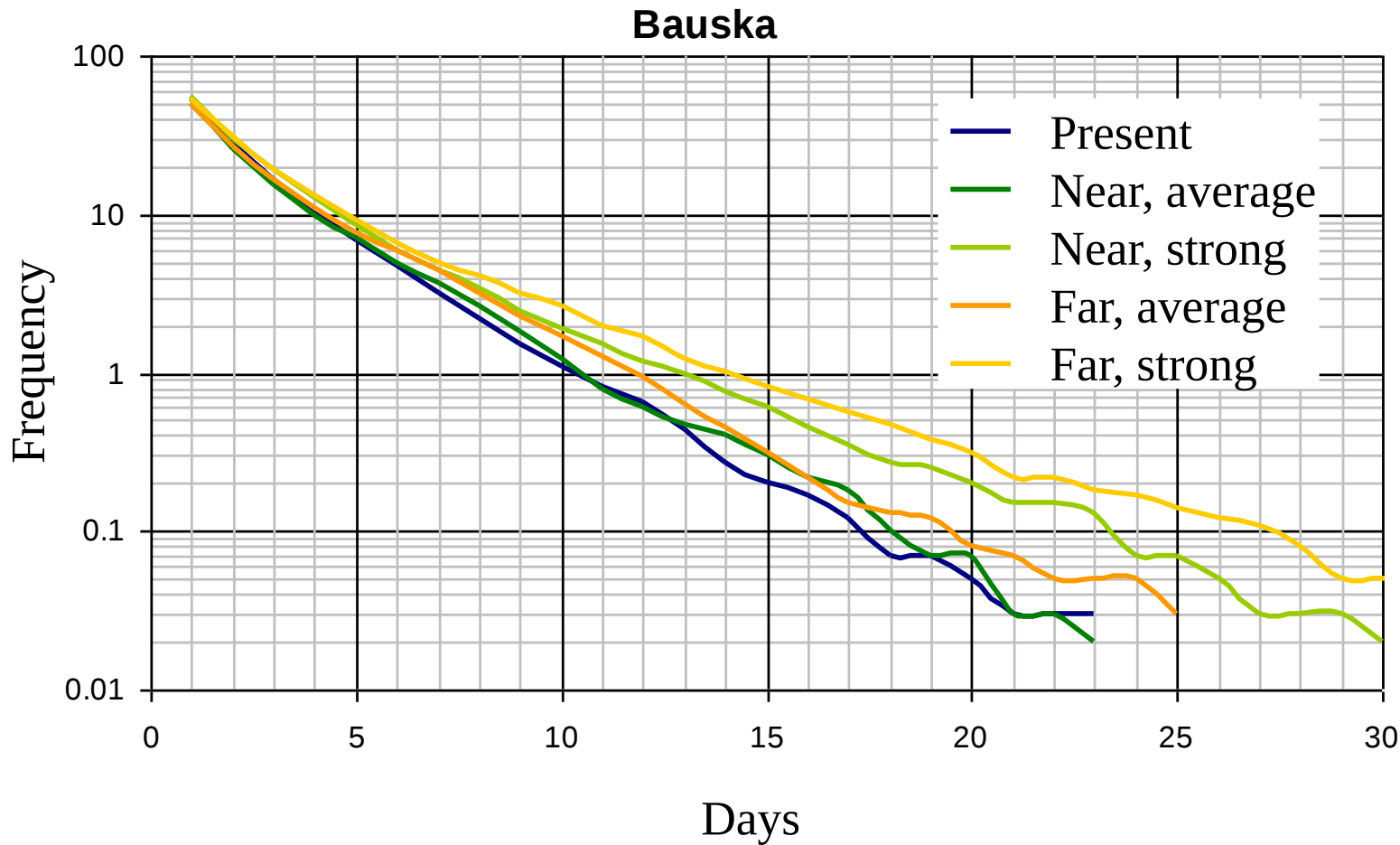
Predicted climate changes: longer vegetation period



Predicted climate changes temperature: higher temperature



Predicted climate changes: pattern of precipitation

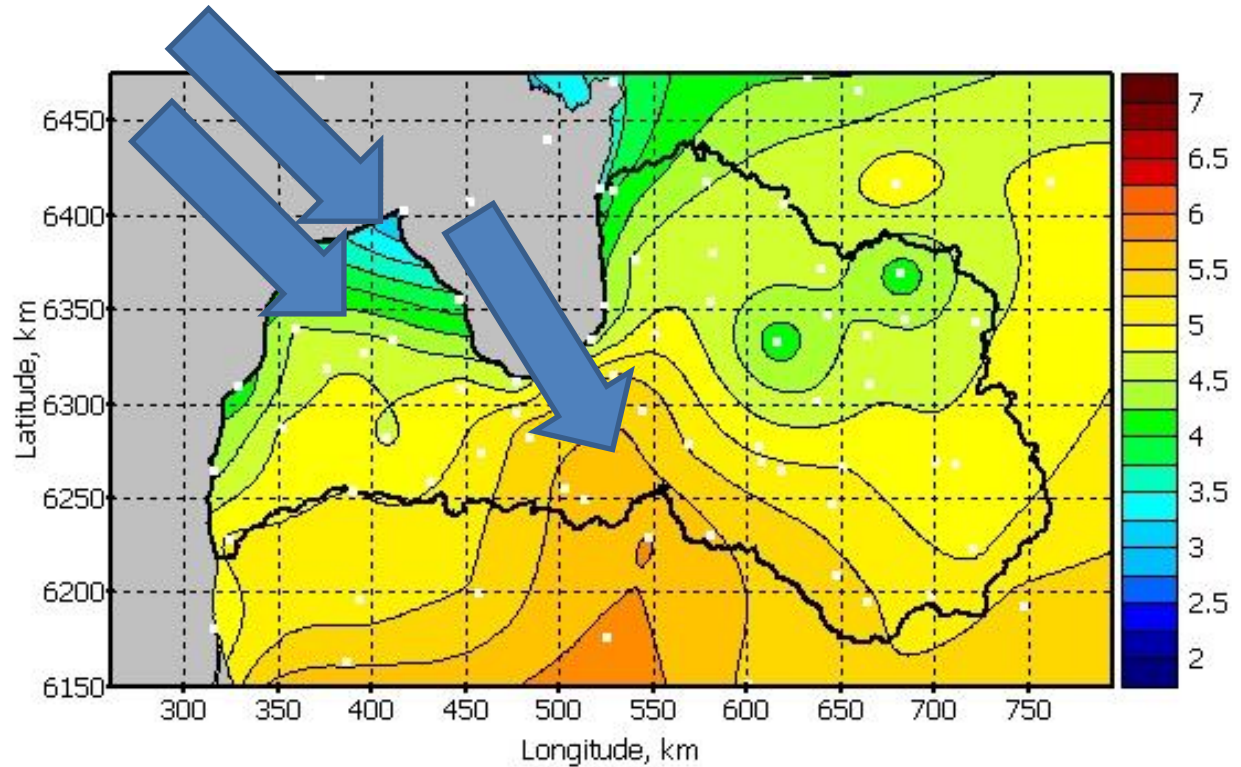


Increase in values of fire risk indexes
(Angstrom index, Nesterov index)

Moisture of:

- litter
- humus / duff
- top soil layer
- small dimension deadwood

3 tree species
3 sites
69 sample plots

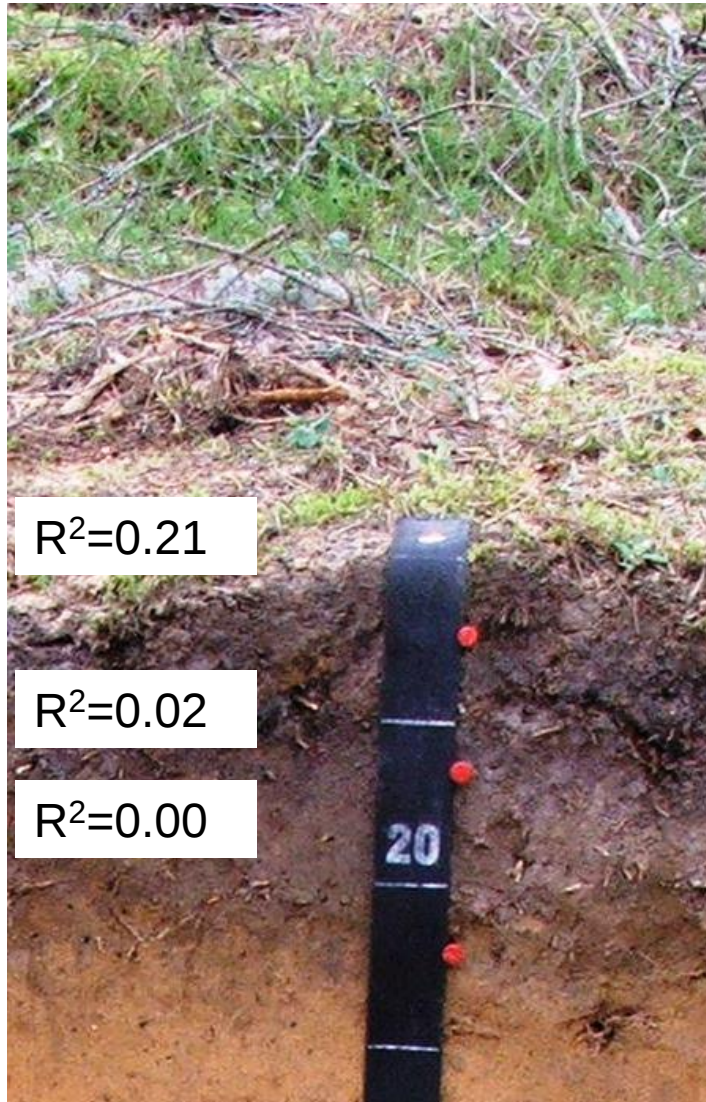


Temperature, April

Modified Nesterov index is used for classification of fire risk in Latvia

Fire risk class	Description of forest
1.	✓ Coniferous forest younger than 40 years in all forest types and on abandoned agricultural lands. Broadleaved forests younger than 10 years on former agricultural lands. ✓ Sl, Gs (<i>Cladinoso- callunosa</i>, <i>Callunoso- sphagnosa</i>)
2.	Mr, Ln, Av, Kv (<i>Vacciniosa</i> , <i>Myrtillosa</i> , <i>Cladinosa mel.</i> , <i>Cladinosa turf. Mel</i>)
3.	Dm, Am, As, Km, Ks (<i>Hylocomiosa</i> , <i>Vacciniosa mel.</i> , <i>Vacciniosa turf. mel</i> , <i>Myrtillosa mel.</i> , <i>Myrtillosa turf. mel</i>)
4.	Vr, Gr, Mrs, Dms, Vrs, Grs, Ap, Kp [wet mineral soils]
5.	Pv, Nd, Db, Lk [wet peat soils]

Results: fire risk



- Changes in moisture of litter and soil are linked to forest type and not to age of the stand
- Nesterov index represents changes in moisture in litter and humus layer in 1. and 2. fire risk class stands, but modified Nesterov index – in duff and deeper soil layers
- Fire weather index (FWI) correlates better with changes of moisture in analysed materials (from litter to layer of soil)

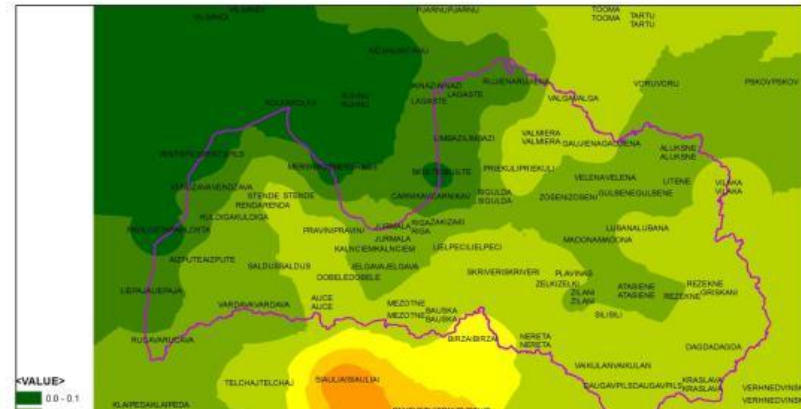
Fire risk class	N	Group					
		1	2	3	4	5	6
I	184	11,4					
I/II	237	17,2					
II	222		29,1				
III	1200			37,7			
I/III	576			43,5	43,6		
I/IV	299				48,2	48,12	
IV	363					51,4	51,4
V	76						56,6
Sig.		0,07	1,00	0,07	0,28	0,73	0,16

Results: changes of fire risk

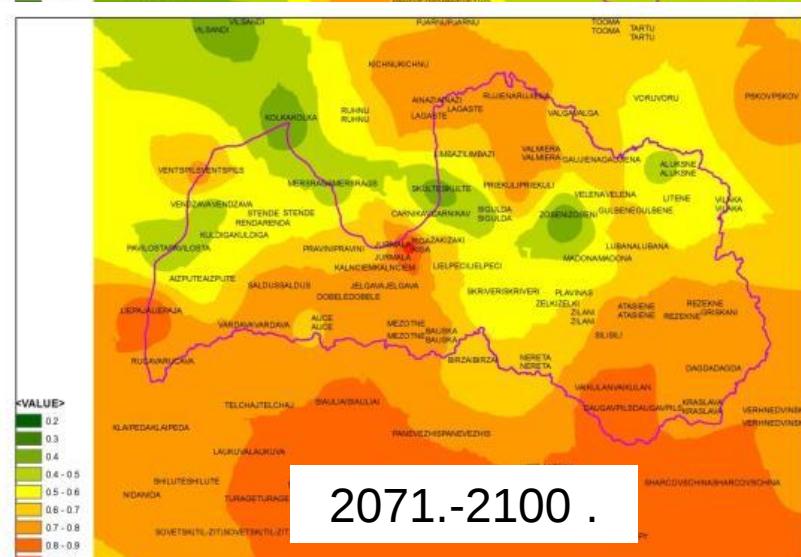
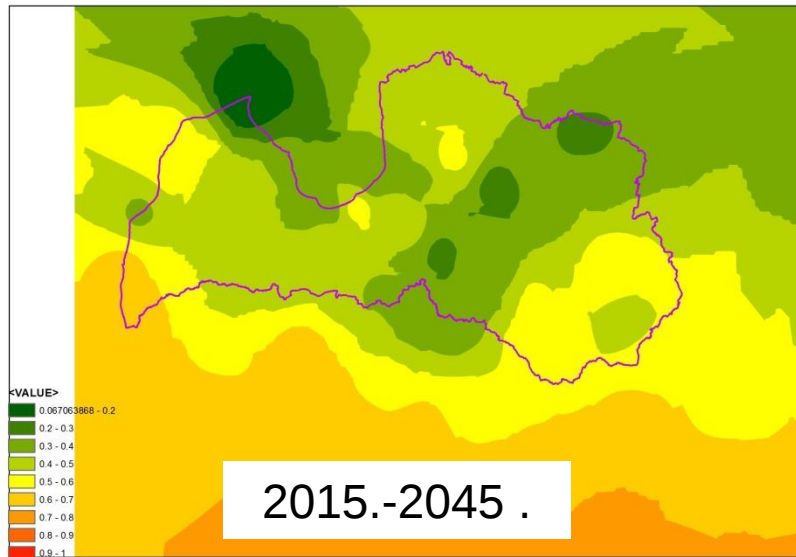
Both number frequency of years with extremely high fire risk ($NI > 4000$, $FWI > 17$) and number of days per year with extremely high fire risk are predicted to increase in future



2015.-2045 .



2071.-2100 .



Climatic changes might influence not only the probability of forest fire, but also its impact

Impact of forest fire depends on:

- Meteorological conditions (before/during/after fire)
- Fire intensity (linked to fuel quantity and quality)
- Type of fire (crown, ground; linked also to soil type)
- Tree species, dimensions and parameters (bark thickness, crown height, root allocation)



Direct impact of forest fire

Stem
Crown
Roots



Indirect impact of forest fire

Increasing probability of uprooting in wind, windbreaks



Insect damages of weakened trees



Probability of survival after forest fire



Vienkāršotā izdzīvošanas varbūtības matrica. Priede 39 mēneši pēc ugunsgrēka

PRIEDE						
D1,3, cm	Max apdeguma augstums, m	Atsegtas saknes, %				
		0	25	50	75	100
0,1 - 6,0	< 0,2					
	0,2 - 1,0					
	1,1 - 2,0					
	2,1 - 3,0					
	3,0 <					
D1,3, cm	Max apdeguma H, m	Atsegtas saknes, %				
		0	25	50	75	100
6,1 - 14,0	< 0,2					
	0,2 - 1,0					
	1,1 - 2,0					
	2,1 - 3,0					
	3,0 <					
D1,3, cm	Max apdeguma H, m	Atsegtas saknes, %				
		0	25	50	75	100
14,1 - 22,0	< 0,2					
	0,2 - 1,0					
	1,1 - 2,0					
	2,1 - 3,0					
	3,0 <					
D1,3, cm	Max apdeguma H, m	Atsegtas saknes, %				
		0	25	50	75	100
22,1 - 30,0	< 0,2					
	0,2 - 1,0					
	1,1 - 2,0					
	2,1 - 3,0					
	3,0 <					
D1,3, cm	Max apdeguma H, m	Atsegtas saknes, %				
		0	25	50	75	100
> 30,0	< 0,2					
	0,2 - 1,0					
	1,1 - 2,0					
	2,1 - 3,0					
	3,0 <					

Izdziļošana
80 - 100 %
21 - 79 %
0 - 20 %

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Zaļš – vesels, dzeltens – vidēji bojāts, sarkans - iznīcis

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Egļe						
D1,3, cm	Max apdeguma augstums, m	Atsegtas saknes, %				
		0	25	50	75	100
0,1 - 6,0	< 0,2					
	0,2 - 1,0					
	1,1 - 2,0					
	2,1 - 3,0					
	3,0 <					
D1,3, cm	Max apdeguma H, m	Atsegtas saknes, %				
		0	25	50	75	100
6,1 - 14,0	< 0,2					
	0,2 - 1,0					
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D1,3, cm	Max apdeguma H, m	Atsegtas saknes, %				
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Izdzīvošana

80 - 100 %

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Zaļš – vesels, dzeltens – vidēji bojāts, sarkans - iznīcis

Dbh, max height of fire scare, proportion of uncovered roots

Donis, 2010



Thank You!

Research was carried out in Forest Competence Centre (ERAF) project
„Methods and technologies for increasing forest capital value”
(No. L-KC-11-0004)

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