Prediction of effect of climatic changes on forest fire risks

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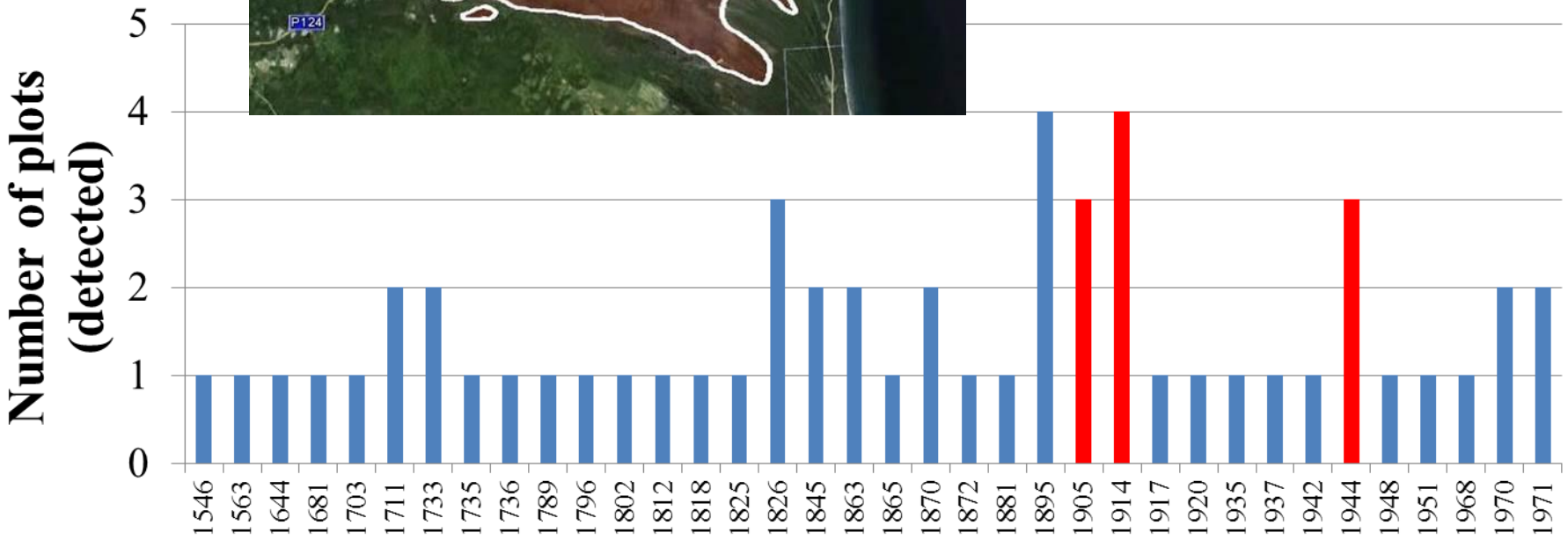
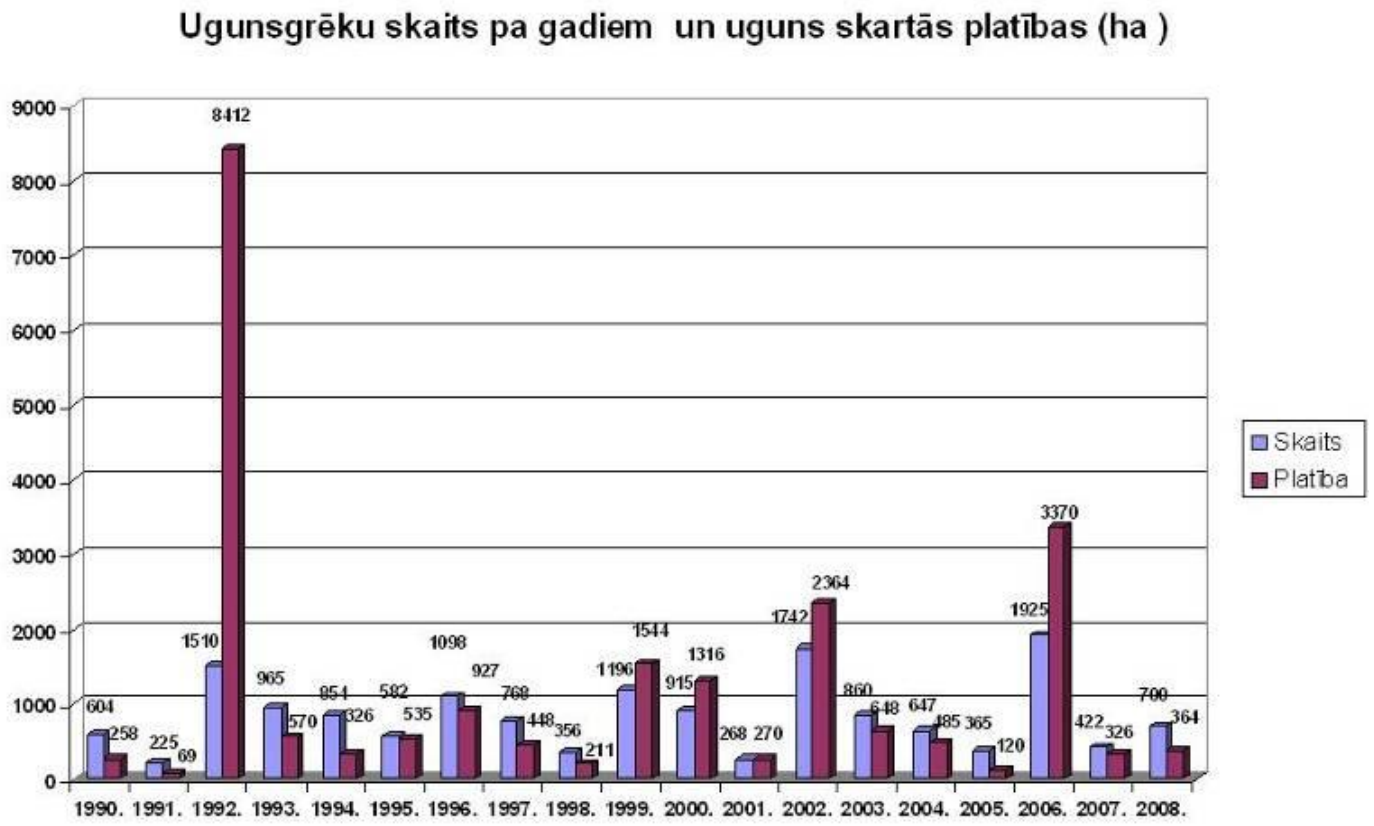
Causes of forest fires

Causes of forest fire: history

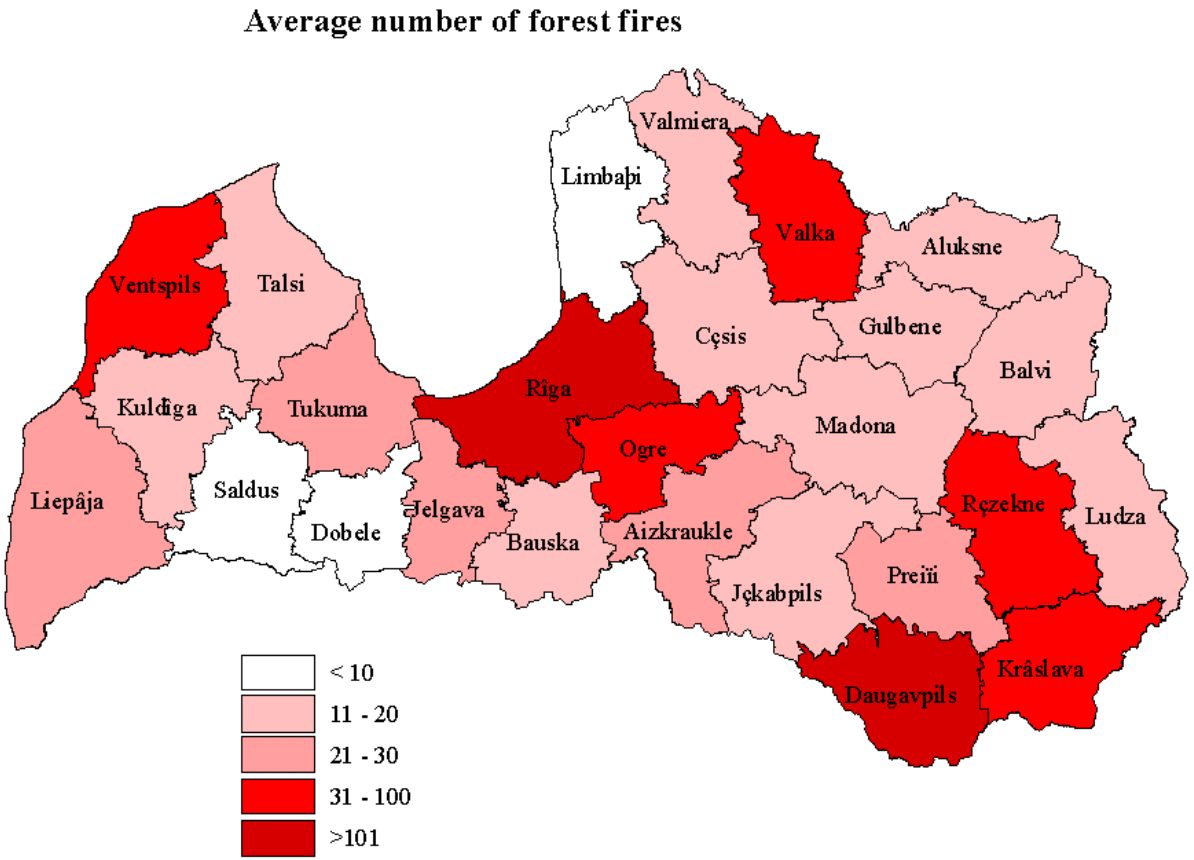


Forest fire distribution



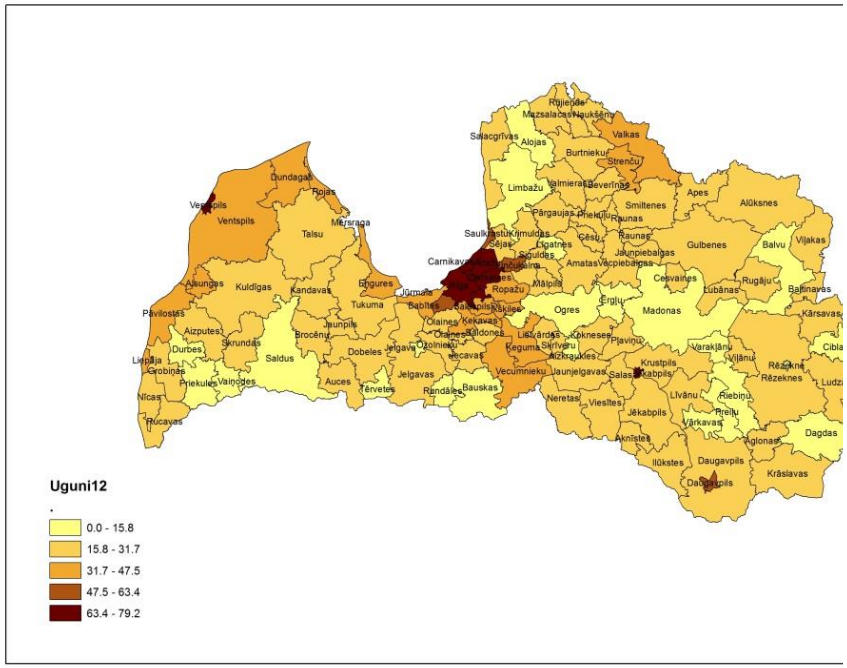
http://www.vmd.gov.lv/doc_upl/uguns_pa_gadiem.JPG

Forest fire distribution

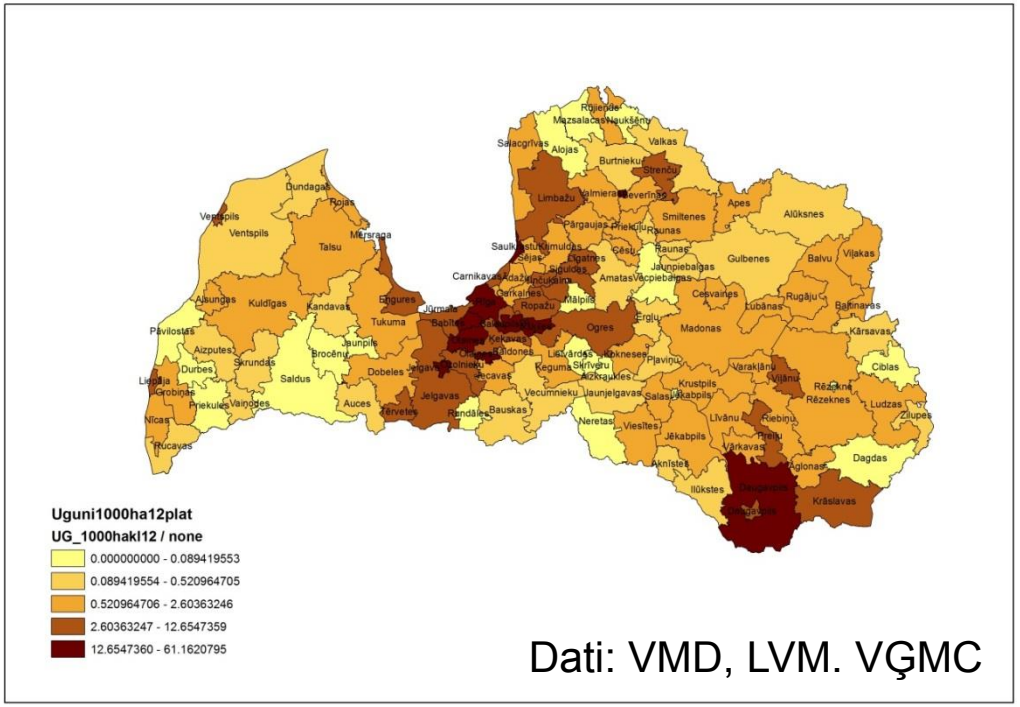


(IFFN No. 24 - April 2001, p. 31-34)

Causes of forest fire: spatial distribution



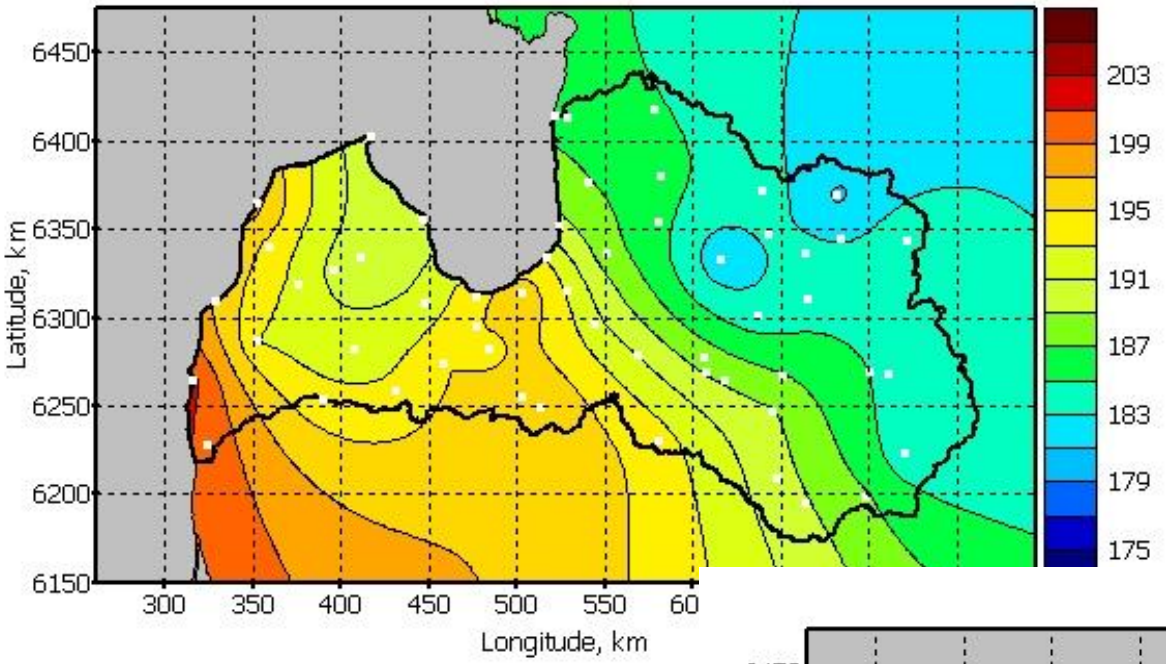
Proportion of 1. and 2. fire risk class forests

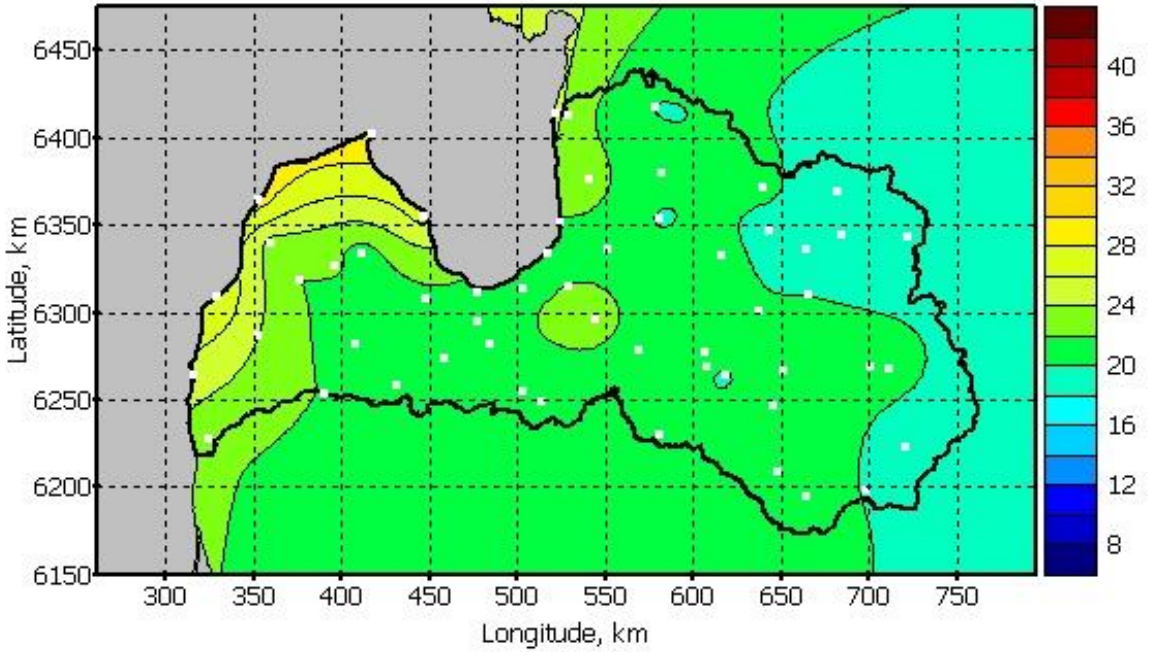


Number of fires per 1000ha of forests

- 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%)

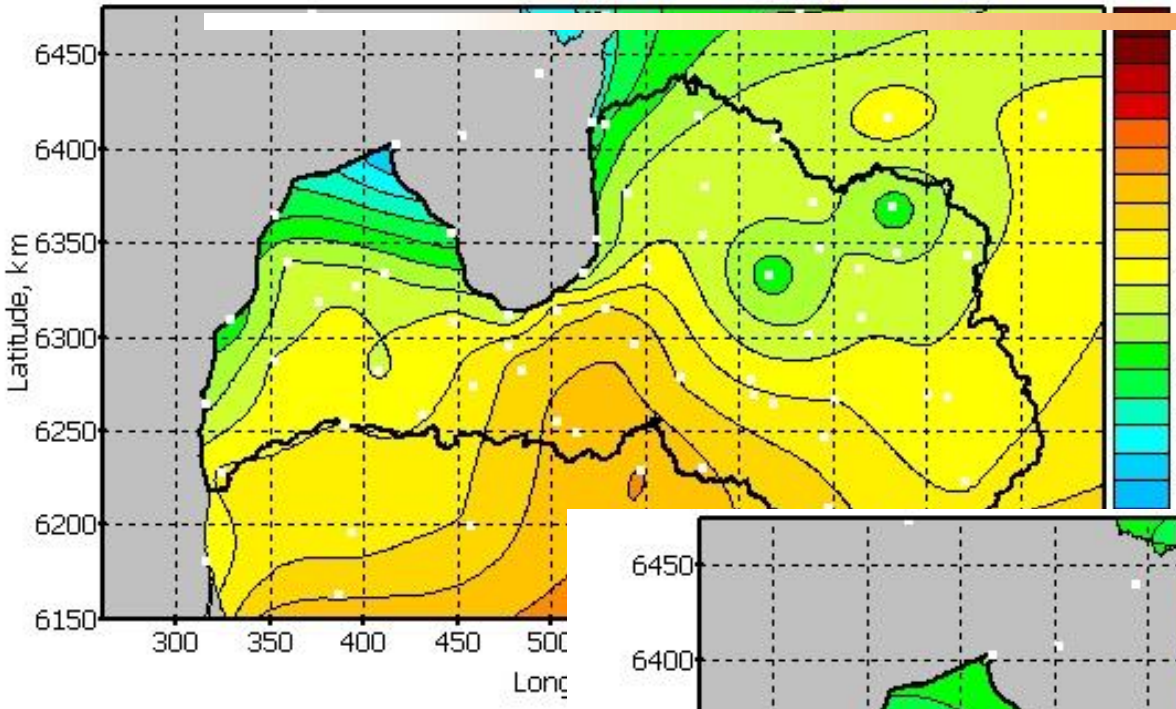
Predicted climate changes: longer vegetation period



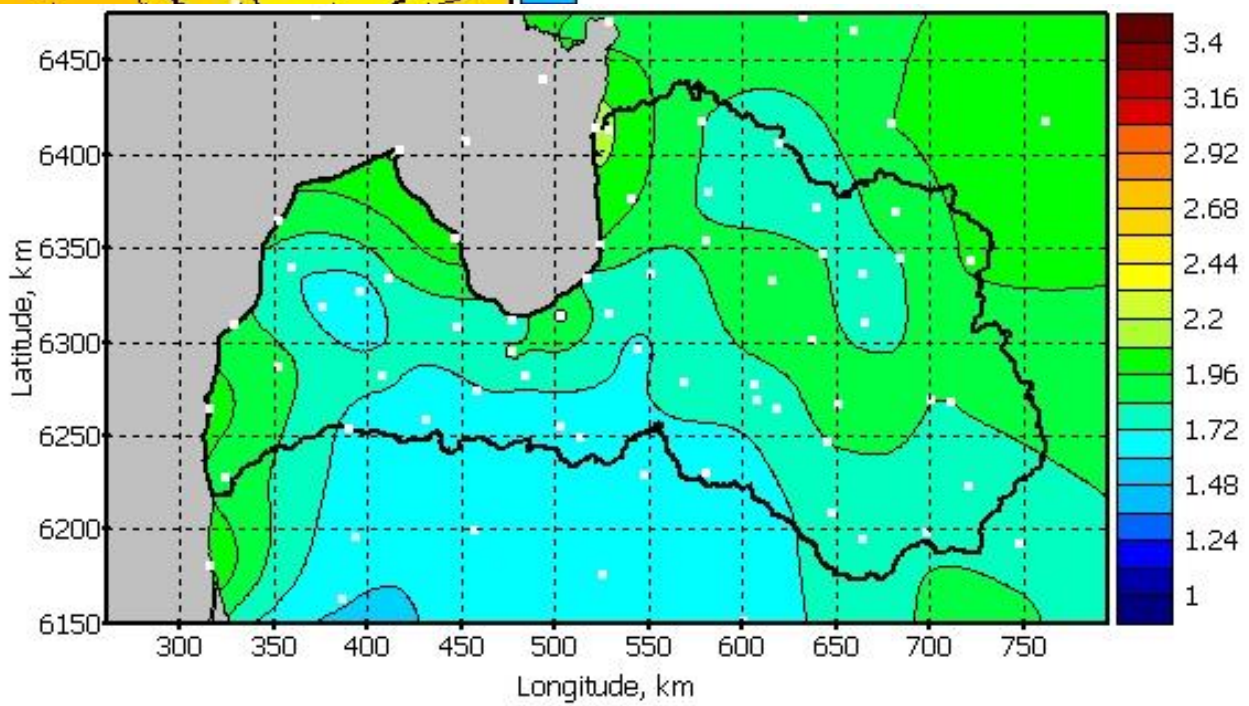


Bether et al., 2010

Predicted climate changes temperature: higher temperature

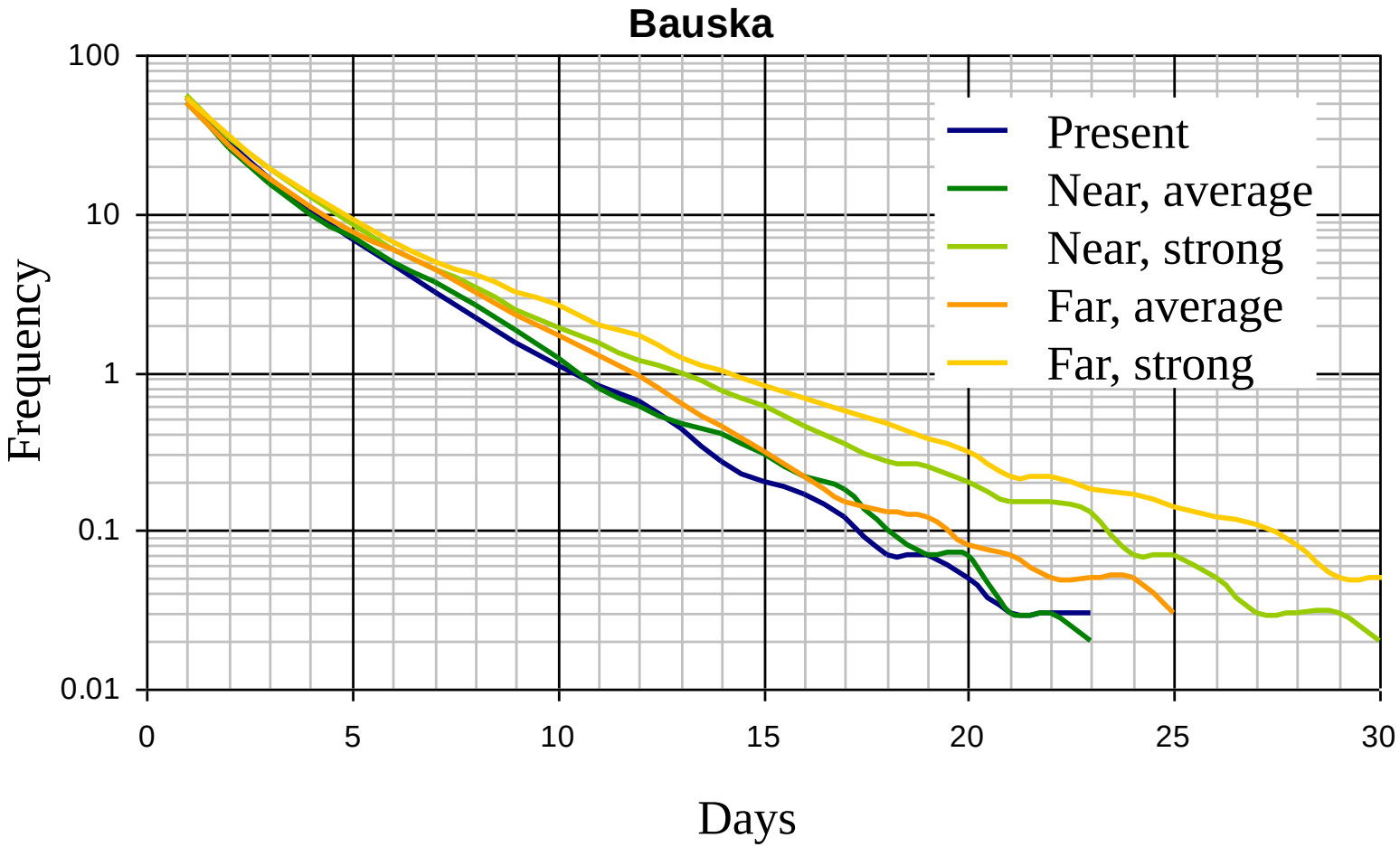


April



Bether et al., 2010

Predicted climate changes: pattern of precipitation



Bether et al., 2010

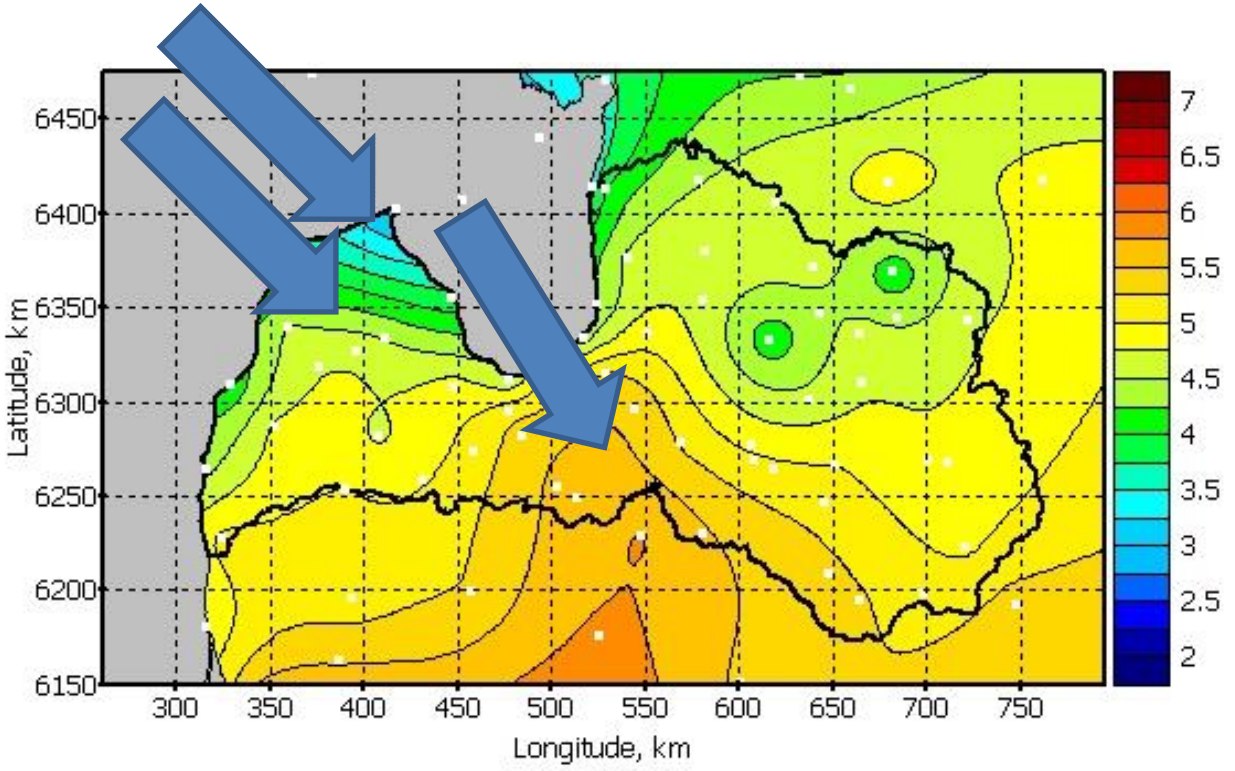
Increase in values of fire risk indexes (Angstrom index, Nesterov index)

Material & Methods

Moisture of:

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

3 tree species
3 sites
69 sample plots



Temperature, April

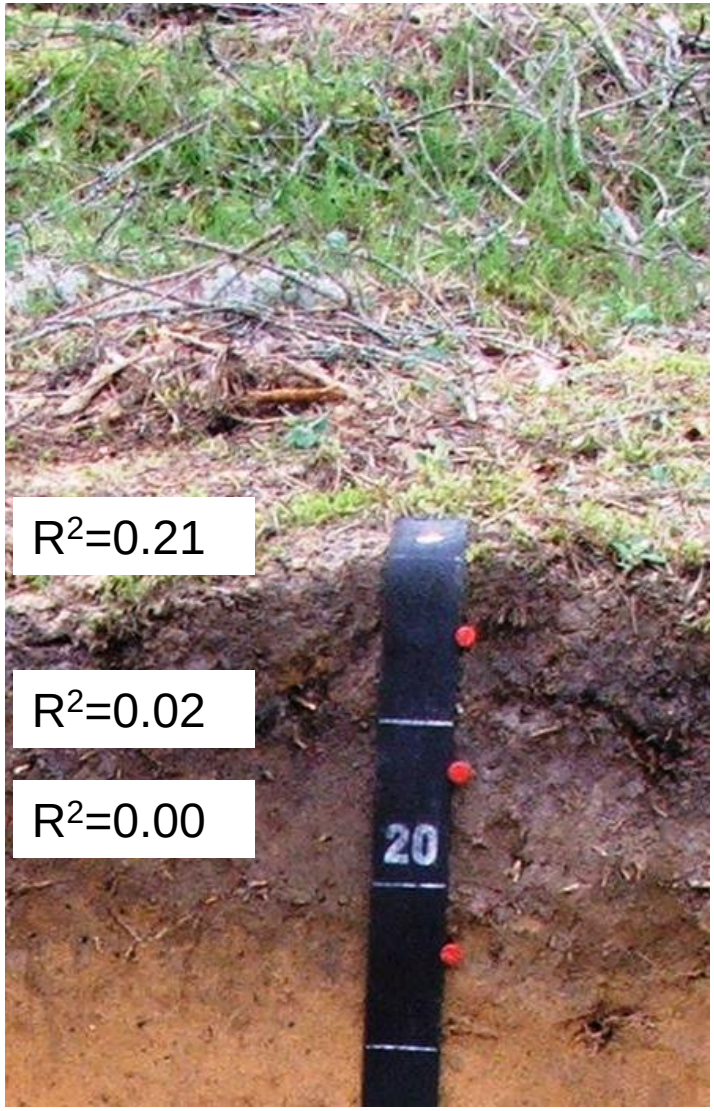
Material & Methods

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 (*Cladinoso- callunosa*, *Callunoso- sphagnosa*)
2.	Mr, Ln, Av, Kv (*Vacciniosa, Myrtillosa, Cladinosa mel., Cladinosa turf. Mel)*
3.	Dm, Am, As, Km, Ks (*Hylocomiosa, Vacciniosa mel., Vacciniosa turf. mel, Myrtillosa mel., Myrtillosa turf. mel)*
4.	Vr, Gr, Mrs, Dms, Vrs, Grs, Ap, Kp [wet mineral soils]
5.	Pv, Nd, Db, Lk [wet peat soils]

Regulation No.82 from 17.02.2004.

Results: fire risk

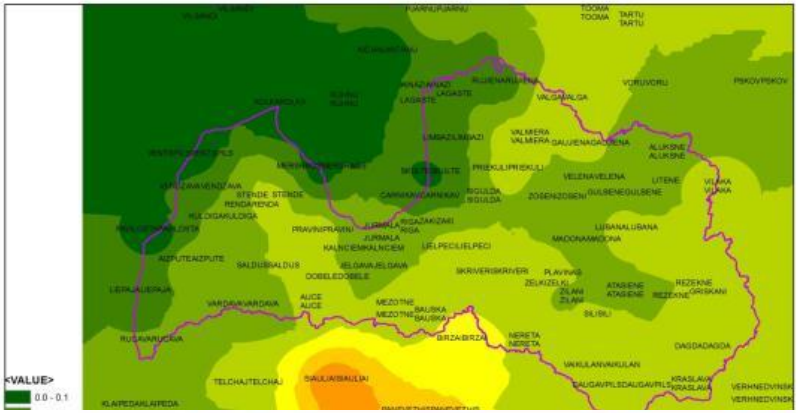


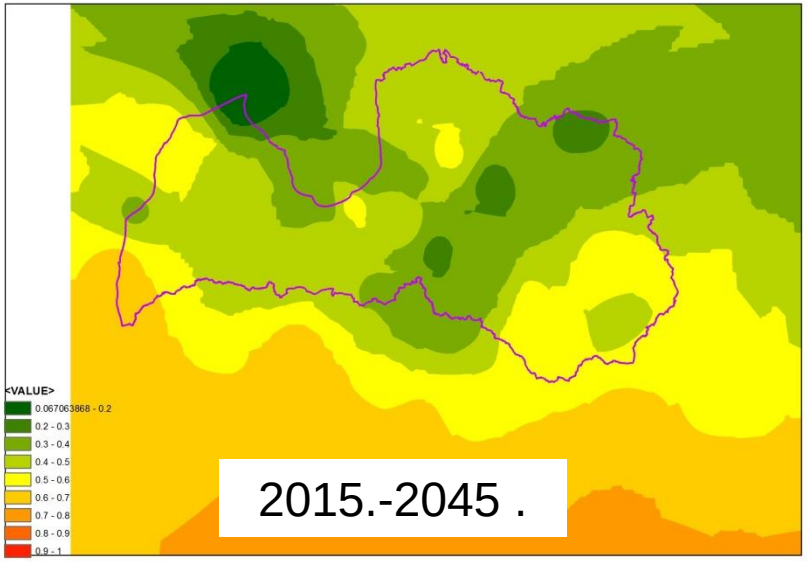
- Changes in moisture of litter and soil are linked to forest type and not to age of the stand
- Nesterov index represents changes in moisture in litter and humus layer in 1. and 2. fire risk class stands, but modified Nesterov index – in duff and deeper soil layers
- Fire weather index (FWI) correlates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

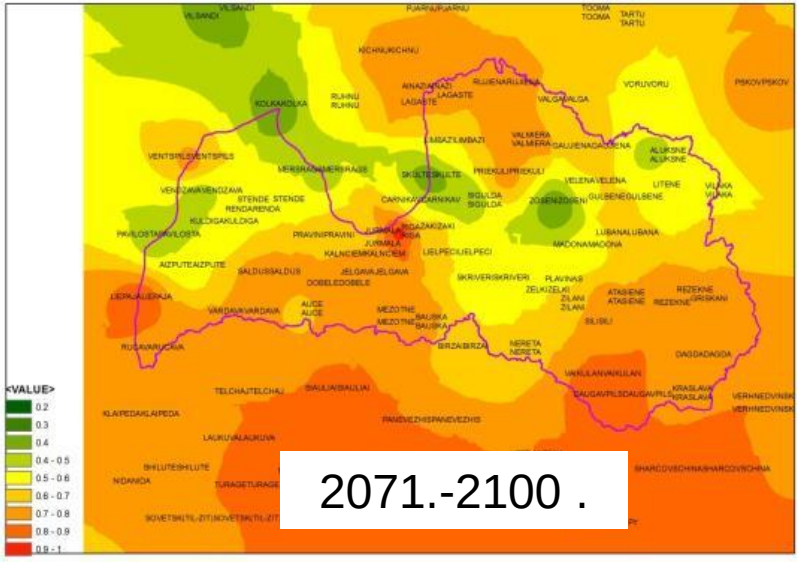
Results: changes of fire risk

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 <					

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

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

Vienkāršotā izdzīvošanas varbūtības matrica. Egle 36 mēneši pēc ugunsgrēka

Egle						
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					
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	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					
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D1.3, cm	Max apdeguma H, m	Atsegtas saknes, %				
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> 30,0	< 0,2					
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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

ERAF
EIROPAS REĢIONĀLĀS ATTĪSTĪBAS FONDS
EIROPAS SAVIENĪBA
IEGULDĪJUMS TAVĀ NĀKOTNĒ
MNKC Meža nozares kompetences centrs
SILAVA

Thank You!

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