Latvia University of Agriculture
Forest Faculty

ABIOTIC RISKS OF MANAGING YOUNG FOREST STANDS OF NORWAY SPRUCE
(*PICEA ABIES* (L.) KARST.)

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IEGULDĪJUMS TAVĀ NĀKOTNĒ

EIROPAS REĢIONĀLĀS ATTĪSTĪBAS FONDS

EIROPAS SAVIENĪBA

This research is financed through the European Regional Development Fund project: "Decision support system for sustainable forest management" (No. 2010/0208/2DP/2. 1.1.0/10/APIA/VIAA/146).

Research Topicality (1)

According to the forecast the number of storms in Latvia is going to increase in the future.

The wind and the snow are risk factors affecting forest damage.

Forest stability against abiotic risk factors depends on individual stands and individual trees stability.

Research Topicality (2)

Tree stability depends on:

1) height (h) and diameter (d) ratio;

2) crown percent or length of the crown;

3) structural characteristics of the root system.

When the ratio is:

1) is greater than 100 (1.0) – tree is very unstable,

2) 80 – 100 (0.8 – 1.0) – tree is unstable,

3) less than 80 (0.8) – tree is stable,

4) less than 45 (0.45) – tree is very stable.

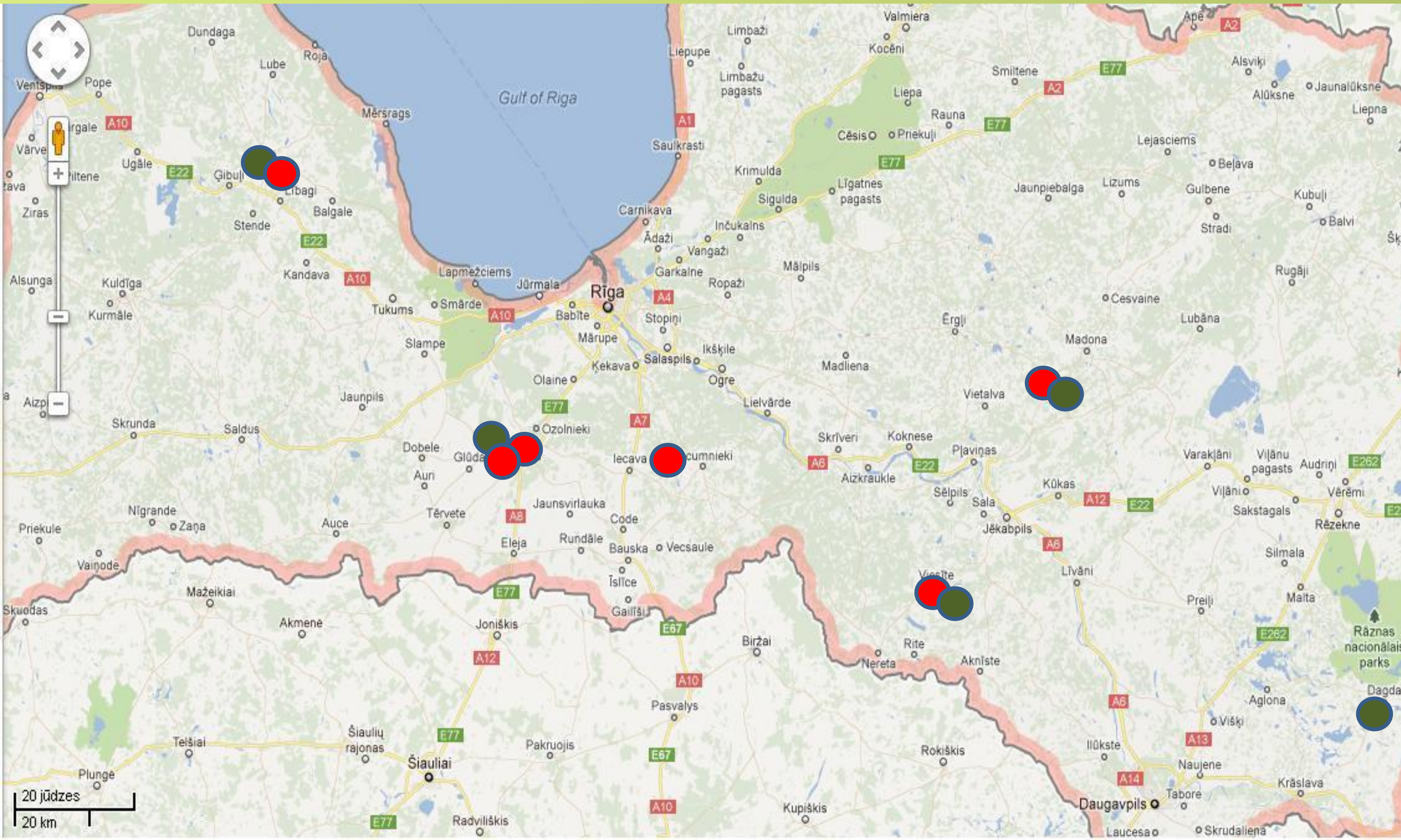
Aim of Research

The aim of research is to analyze the impact of abiotic risk factors on the management of young *Picea abies* (L.) Karst. stands.

Tasks of Research:

1) to carry out the analysis of occurrence and intensity of abiotic risk factors of young forest stands in different regions of Latvia;
2) to give assessment of correlation between the sanitary conditions and the location of forest plots in forest area.

Objects


Gulf of Riga
Dundaga
Roja
Lube
Ventspils
Pope
Mērsrags
Limbaži
Valmiera
Liepupe
Kocēni
Limbažu pagasts
Smiltene
Ape
Alsviķi
Alūksne
Jaunalūksne
Liepna
Liepa
Rauna
Cēsis
Priekuļi
Saulkrasti
Krimulda
Līgatnes pagasts
Sigulda
Jaunpiebalga
Lizums
Lejasciems
Beļava
Gulbene
Kubuļi
Stradi
Balvi
Šķilbe
Vārve
Ugāle
Piltene
Gibuļi
Lībagi
Balgale
Stende
Ziras
Carnikava
Inčukalns
Ādaži
Vangaži
Garkalne
Ropaži
Mālpils
Kandava
Alsunga
Kuldīga
Kurmāle
Lapmežciems
Jūrmala
Rīga
Tukums
Smārde
Babīte
Mārupe
Stopiņi
Ērgļi
Cesvaine
Lubāna
Rugāji
Ikšķile
Salaspils
Ķekava
Madliena
Madona
Slampe
Olaine
Ogre
Lielvārde
Vietalva
Jaunpils
Aizpute
Skrunda
Saldus
Ozolnieki
Dobele
Glūda
Auri
Iecava
Skrīveri
Koknese
Pļaviņas
Aizkraukle
Varakļāni
Viļānu pagasts
Audriņi
Viļāni
Vērēmi
Sēlpils
Sala
Kūkas
Jēkabpils
Sakstagals
Rēzekne
Nīgrande
Zaņa
Priekule
Auce
Tērvete
Jaunsvirlauka
Code
Rundāle
Eleja
Bauska
Vecsaule
Īslīce
Gailīši
Vaiņode
Mažeikiai
Skuodas
Akmenė
Joniškis
Biržai
Viesīte
Līvāni
Silmala
Preiļi
Malta
Rāznas nacionālais parks
Rite
Nereta
Aknīste
Aglona
Dagda
Višķi
Pasvalys
Rokiškis
Ilūkste
Naujene
Krāslava
Telšiai
Šiaulių rajonas
Šiauliai
Pakruojis
Plungė
Radviliškis
Kupiškis
Daugavpils
Tabore
Laucesa
Skrudaliena
20 jūdzes
20 km
A1
A2
A4
A6
A7
A8
A10
A12
A13
A14
E22
E77
E67
E262

Material and Methods (1)

- **Norway spruce young forest stands (40 years old) were surveyed in the years 2011 and 2012.**
- **125 temporary sample plots were established in 14 pure stands and 20 mixed stands.**
- **Abiotic damages were detected in 11 Norway spruce stands that have been injured by various factors – frost, snow and wind.**
- **Stands for the research were selected randomly.**
- **Round sample plots were used, only in stands with high density square sample plots were used.**
- **The ruling indicator for choosing the kind of sample plots was the average tree height of the stand.**
- **In each of the temporary sample plots trees were counted, diameter at breast height (DBH) was measured.**

Material and Methods (2)

Sample plot radius, area and coefficient (k) for estimation of number of trees

Average tree height, m	Sample plot radius, m	Square sample plot size, m	Sample plot area, m^2	Coefficient (k) to estimate number of trees	Min number of sample plots per ha	Measured sample area, m^2 ha^{-1}
≤ 12.0	3.99	10.0 × 5.0	50	200	4	0.02
12.0 ≤	7.98	-	200	50	2	0.04

Material and Methods (3)

Degrees of damage of abiotic factors

Damage evaluation	Degree of damage
Trees without indications of weakening or growth disturbances	0
Economically insignificant damage or faults (few broken branches, small stem damage)	1
Economically significant damage (trees with one or more small stem damages that does not exceed half of the stem diameter, etc.)	2
Highly damaged (damage of the central shoot, its premature die-back; withered, broken top; stem of a tree is bent and is not able to take a vertical position; tree with one or more stem damages where scars exceed half of stem diameter)	3
Trees have died in the current year (needles and leafs are yellow and brown)	4
Dead trees	5

Risk Factors of Young Forest Stand Management

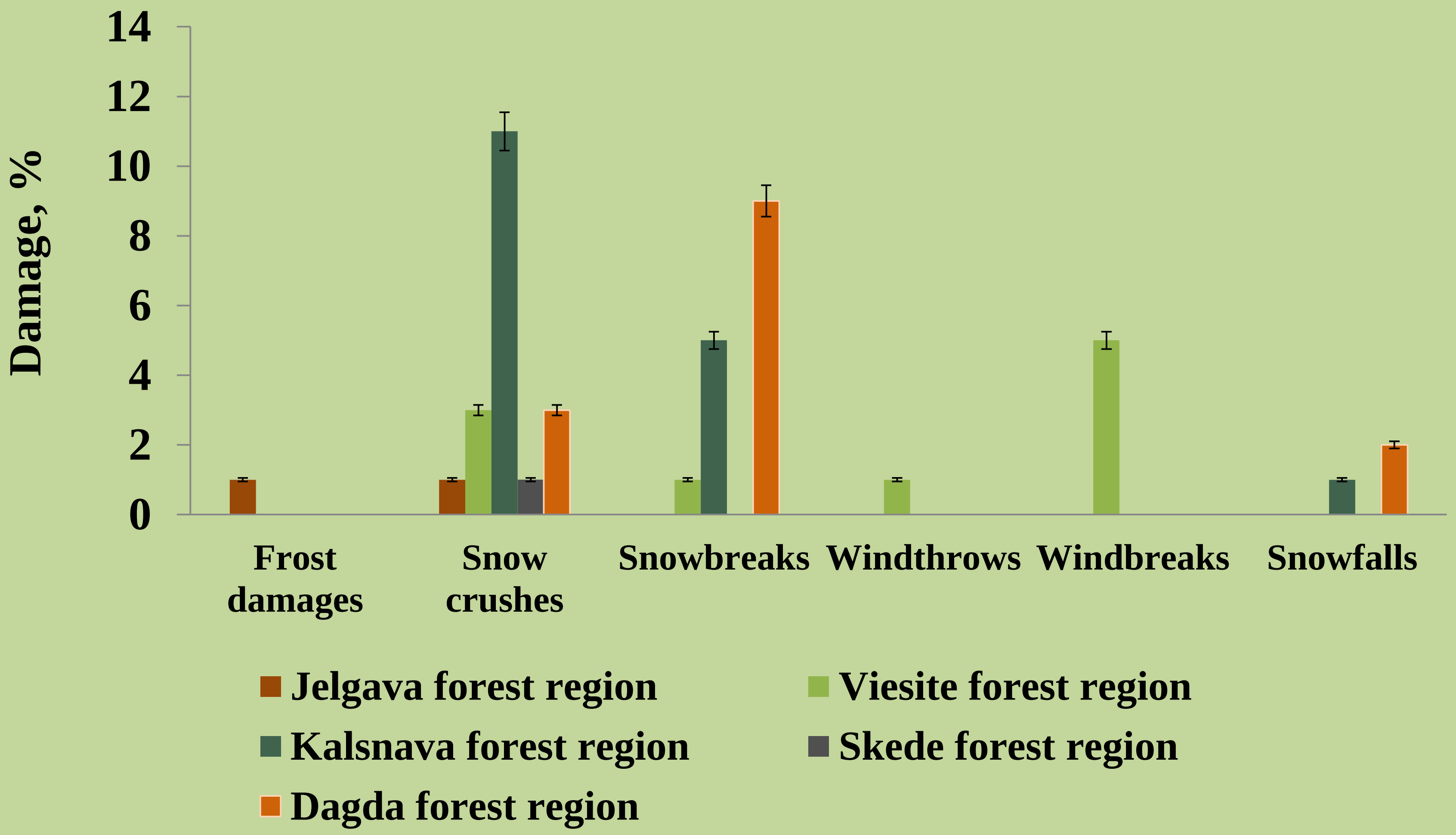
$$P = \frac{n \cdot 100}{N}$$

where P - damage occurrence proportion, %;
n - number of damaged trees, pieces ha^{-1};
N - total number of measured trees, pieces ha^{-1}.

$$R = \frac{\sum n_i b_i}{N \cdot k} \cdot 100$$

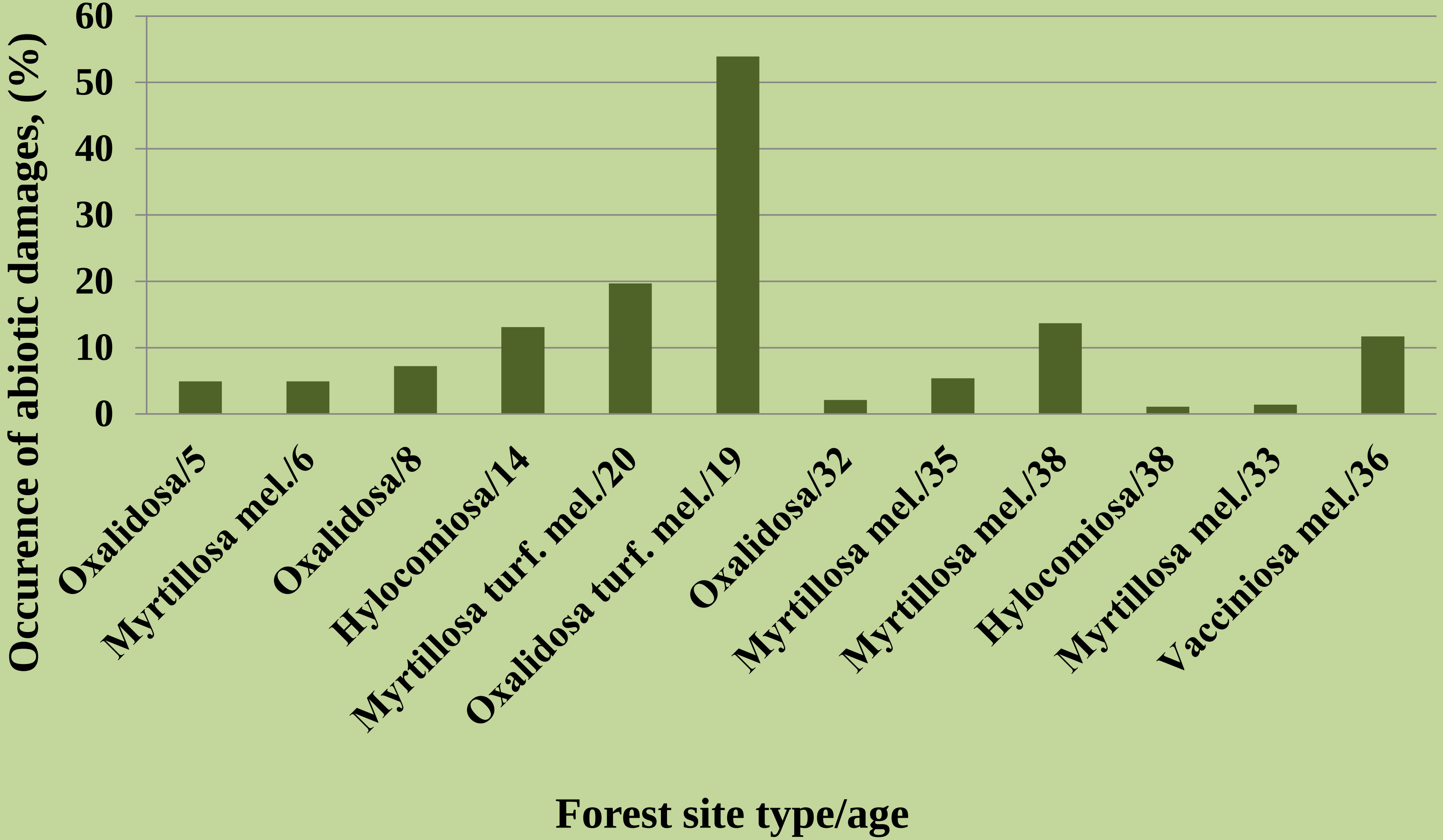
where R - damage intensity, %;
n_i – number of damaged trees, pieces ha^{-1};
b_i - degree of damage;
N - total number of measured trees, pieces ha^{-1};
k - highest degree of damage (points).

Results (1)



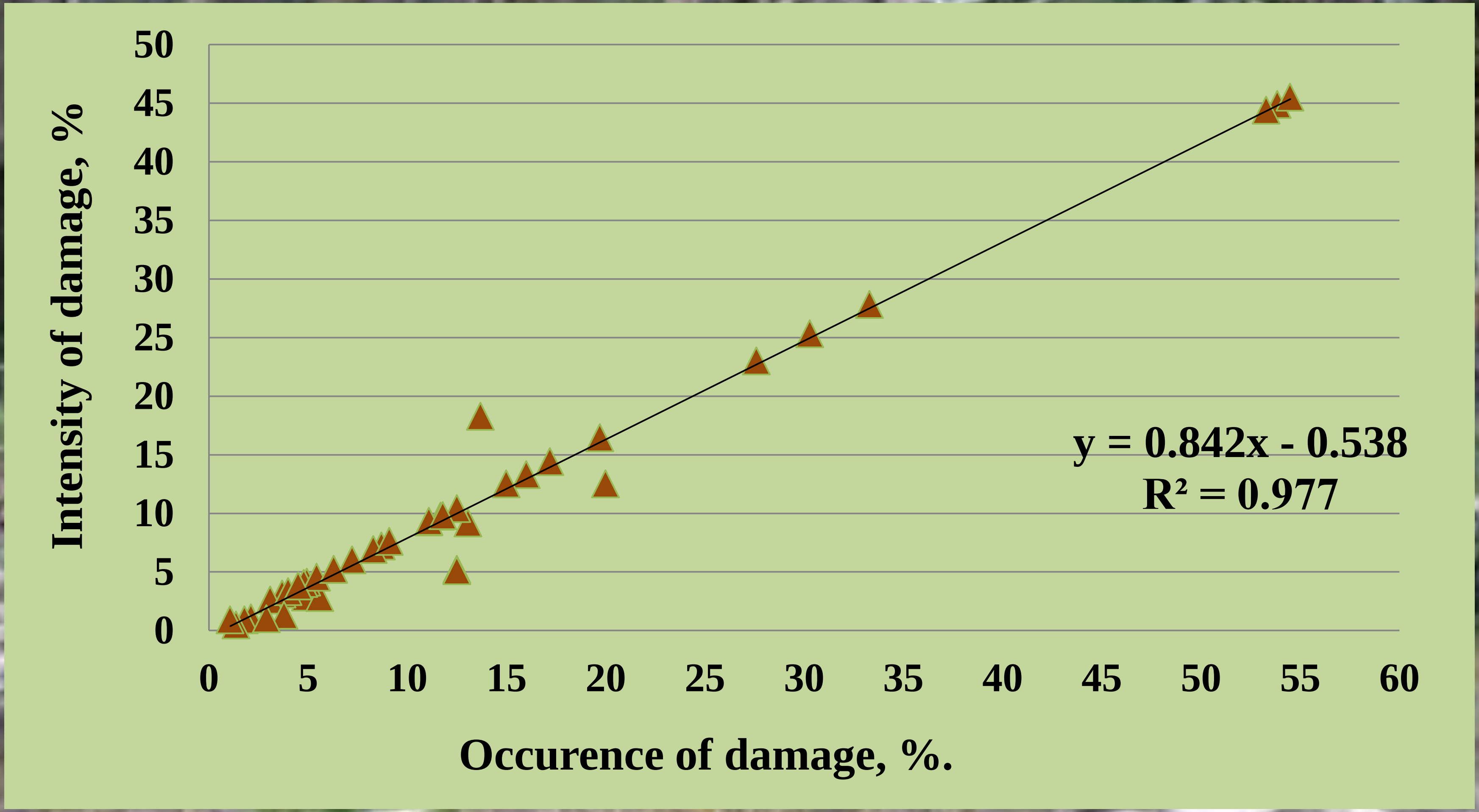
14
12
10
8
6
4
2
0
Damage, %
Frost damages
Snow crushes
Snowbreaks
Windthrows
Windbreaks
Snowfalls
Jelgava forest region
Viesite forest region
Kalsnava forest region
Skede forest region
Dagda forest region

Results (2)



60
50
40
30
20
10
0
Occurence of abiotic damages, (%)
Oxalidosa/5
Myrtillosa mel./6
Oxalidosa/8
Hylocomiosa/14
Myrtillosa turf. mel./20
Oxalidosa turf. mel./19
Oxalidosa/32
Myrtillosa mel./35
Myrtillosa mel./38
Hylocomiosa/38
Myrtillosa mel./33
Vacciniosa mel./36
Forest site type/age

Results (3)



50
45
40
35
30
25
20
15
10
5
0
0
5
10
15
20
25
30
35
40
45
50
55
60
Intensity of damage, %
Occurence of damage, %.
y = 0.842x - 0.538
R² = 0.977

Conclusions (1)

1) One of the most important abiotic factors which is found in all forest districts represented in this research and causes significant impact on Norway spruce young forest stands is snow crush.

2) Block rides, roads, amelioration system ditches, water bodies, clear-cutted areas and location of the stand in woodland play significant role as factors of the intensity of abiotic damage risk.

Conclusions (2)

3) The most significant damage is observed in those young forest stands of Norway spruce which are located aside the block rides and are surrounded by at least two seasoning stands or middle-forest. In these stands level of damage occurrence reach 53.9% and intensity of damage – 44.9%.

4) Shape (regular or irregular) of the forest plot is not a significant abiotic risk factor ($p = 0.686 > \alpha = 0.05$).

Acknowledgments

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Thank you for attention!