IUFRO WP 3.08; 4.05 - **ADAPTATION IN FOREST MANAGEMENT UNDER CHANGING FRAMEWORK CONDITIONS**

19-23 May 2014 Sopron, Hungary

The impact of natural disturbances on the Norway spruce special cultures situated in North Eastern Romania, in relation to the management type

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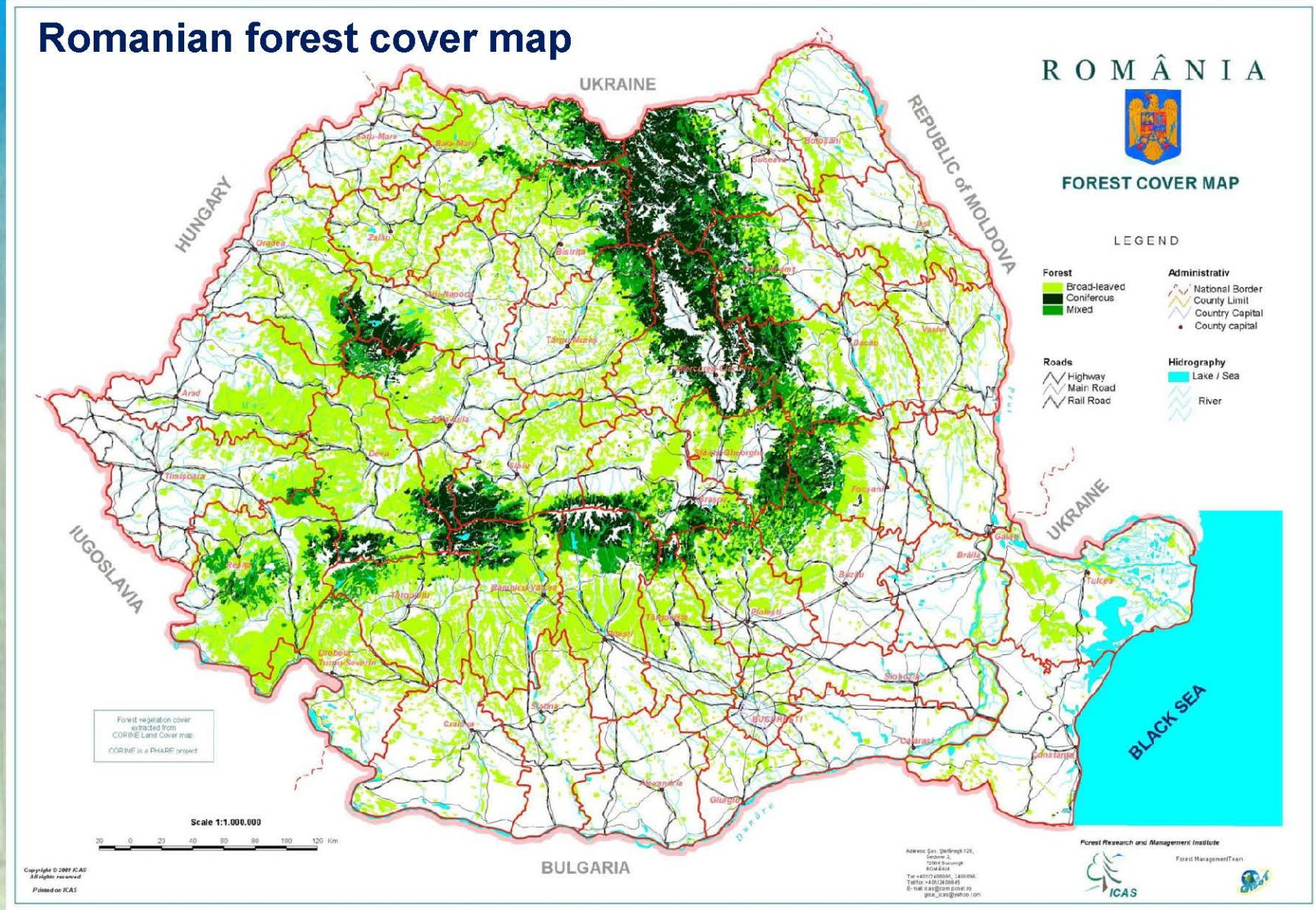
CONTEXT

Romanian forest cover map



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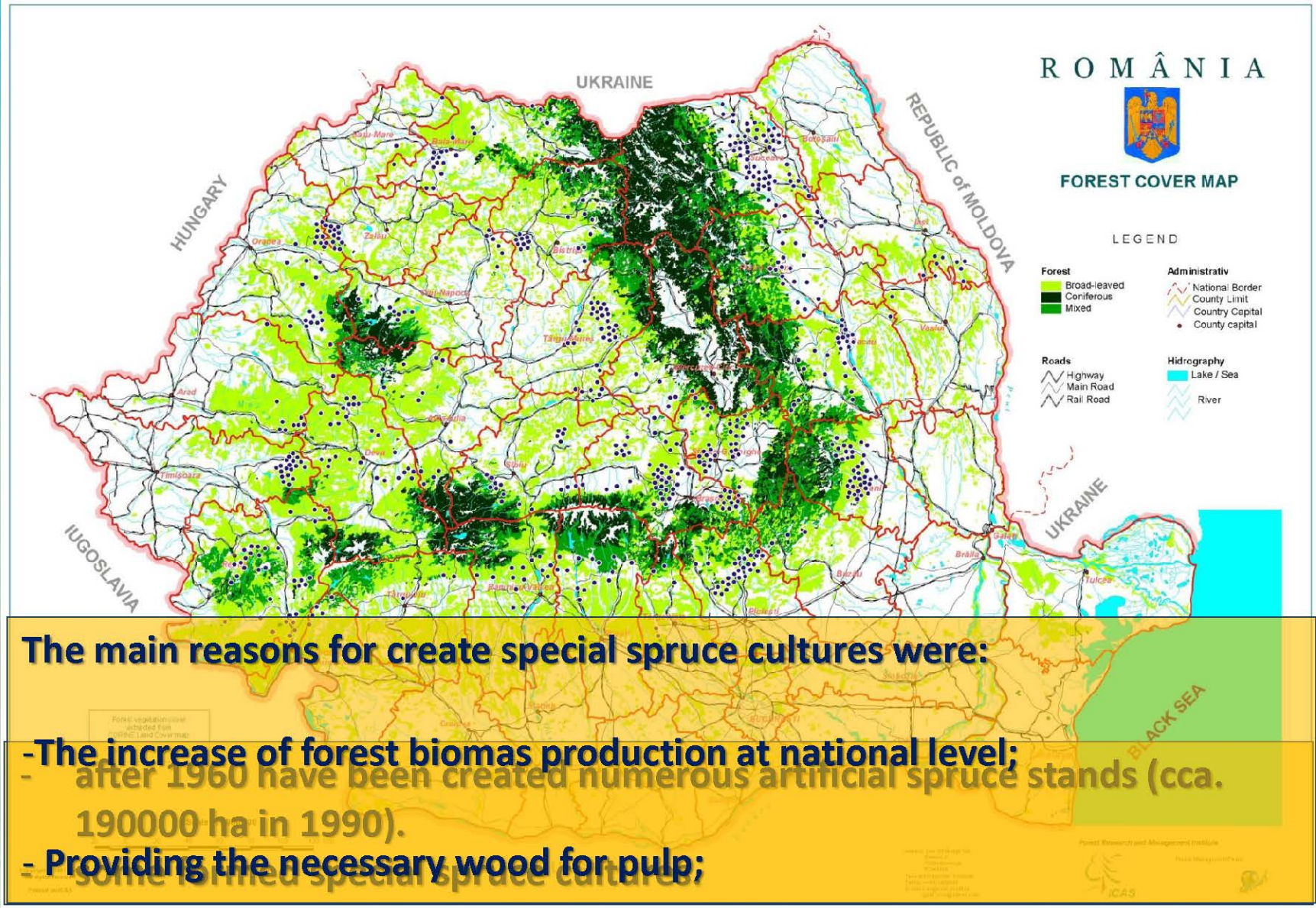
CONTEXT



The main reasons for create special spruce cultures were:

-The increase of forest biomas production at national level;

- after 1960 have been created numerous artificial spruce stands (cca. 190000 ha in 1990).
- some formed special spruce cultures.

- Providing the necessary wood for pulp;

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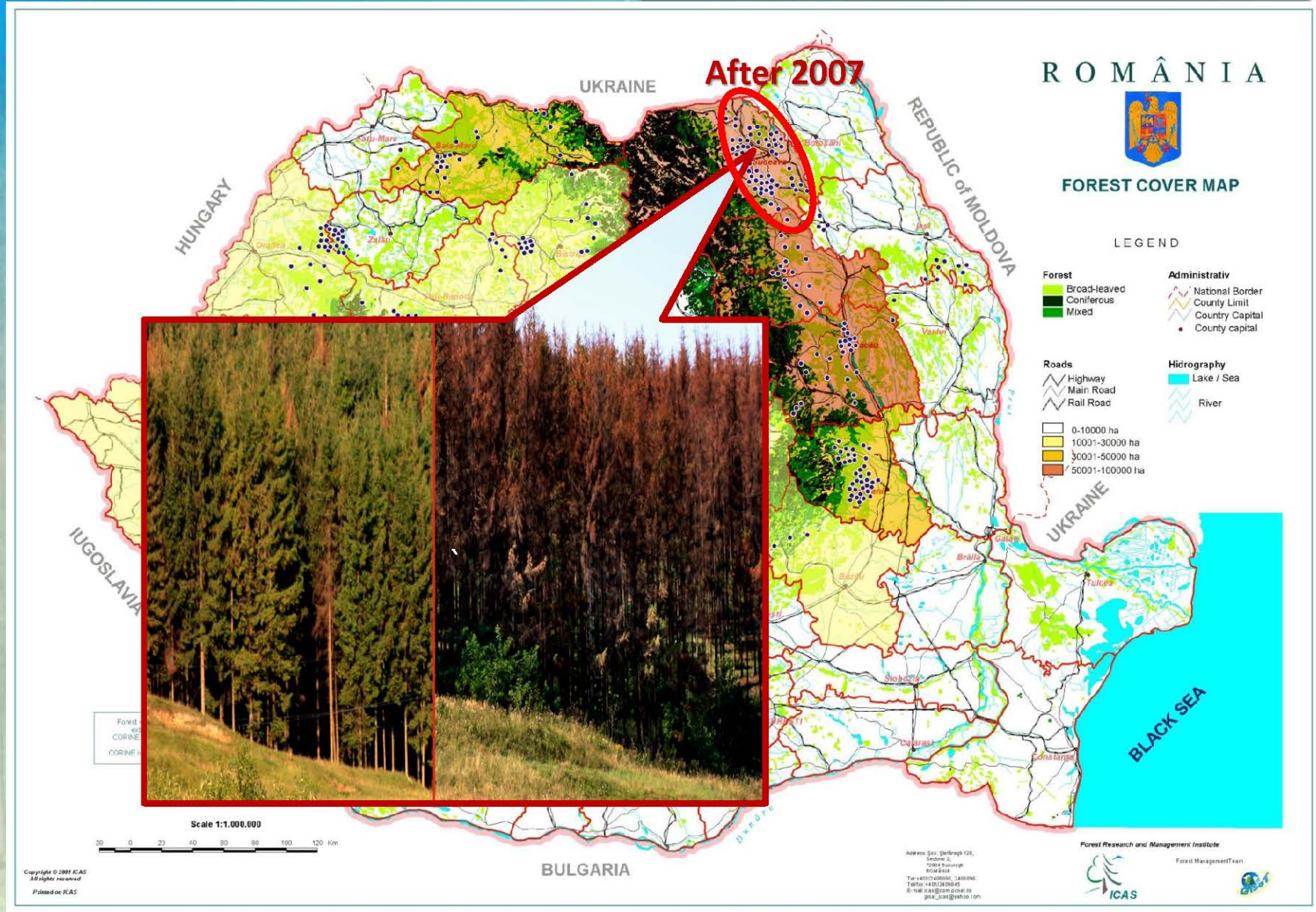
CONTEXT



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OBJECTIVE

What is the impact of natural disturbances on the spruce special cultures in relation to the management type?

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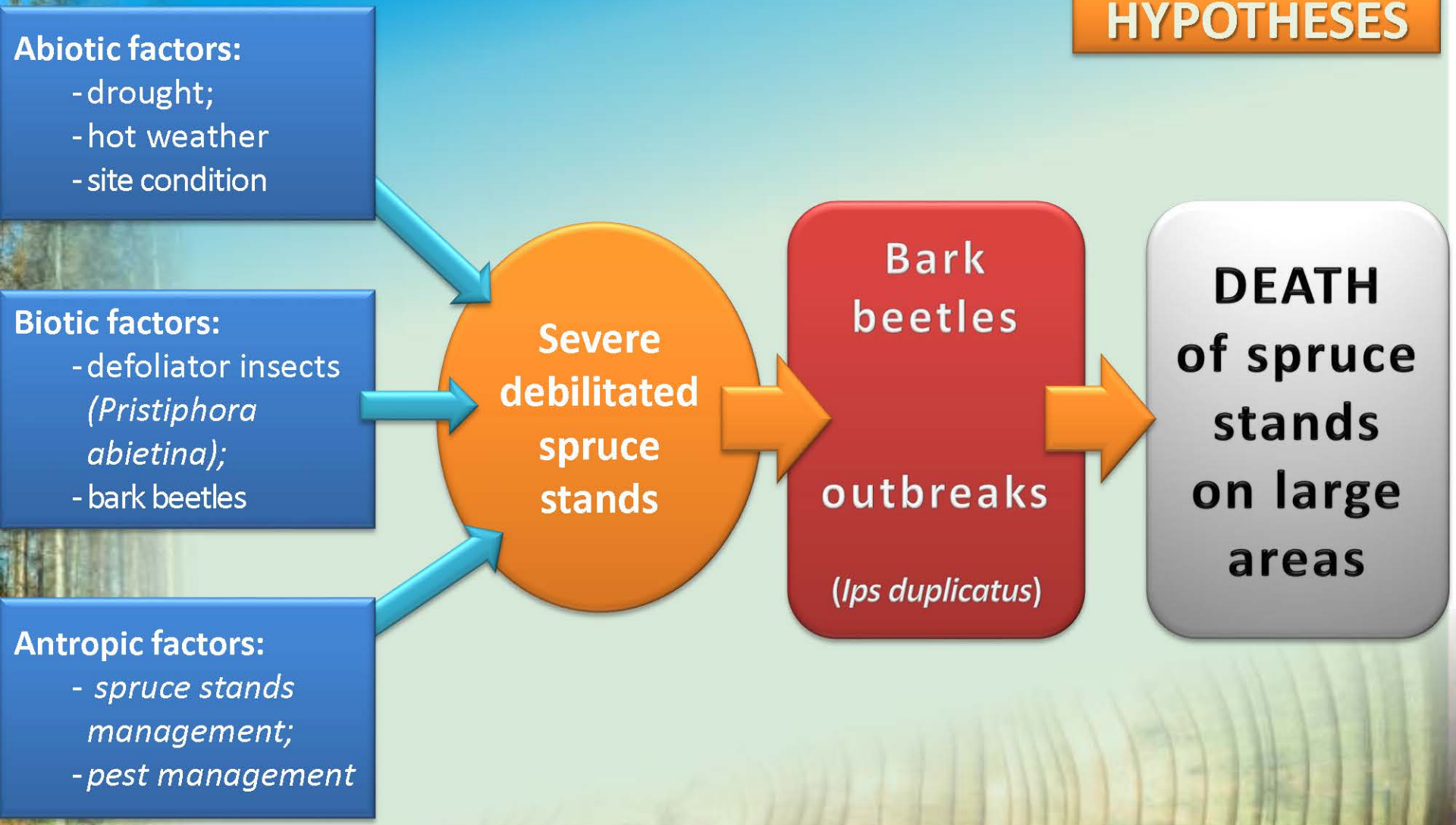
METHODS

HYPOTHESES



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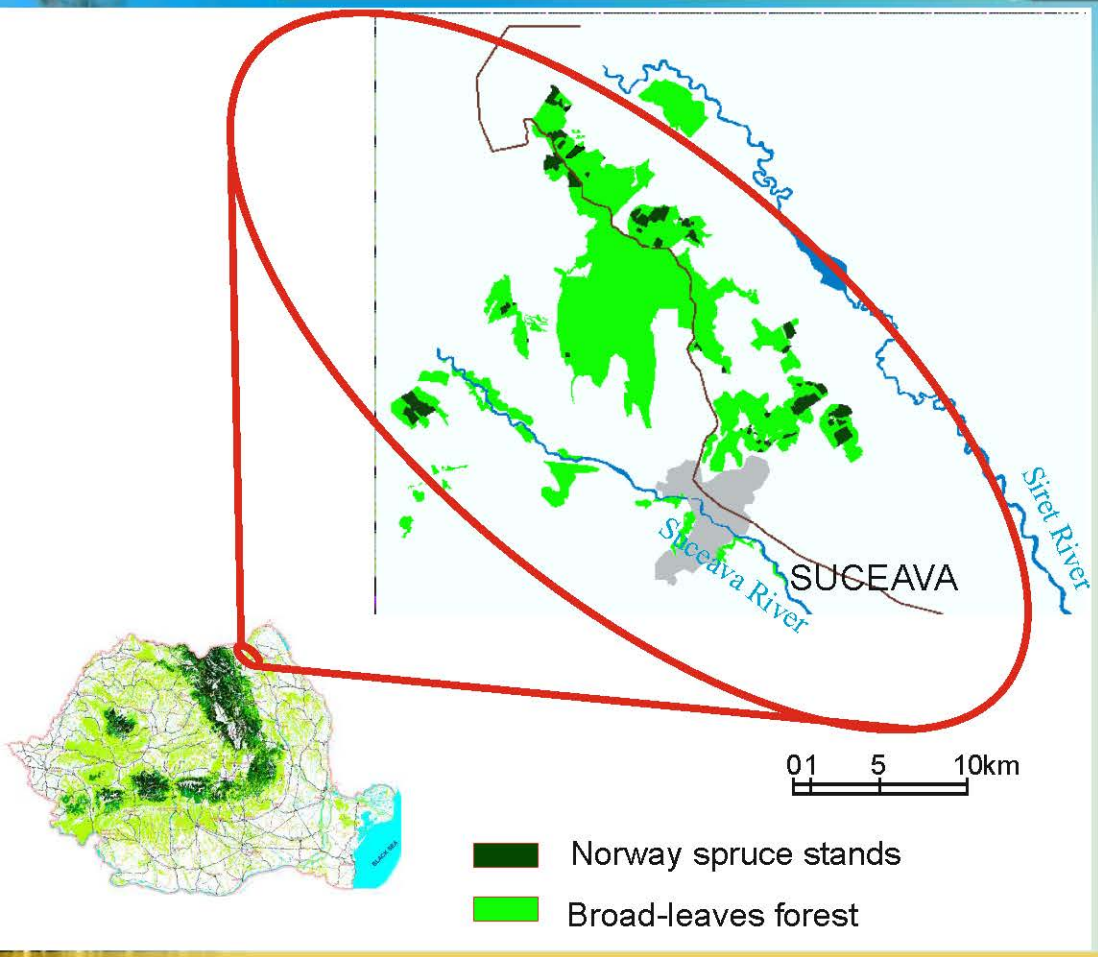
METHODS

STUDY AREA



GENERAL CARACTERISTICS OF STUDIED SPRUCE SPECIAL CULTURES:

- **area: 975,9 ha;**
- **age: 30 – 50 years old;**
- **initial density of plantations: 3300 trees/ha;**

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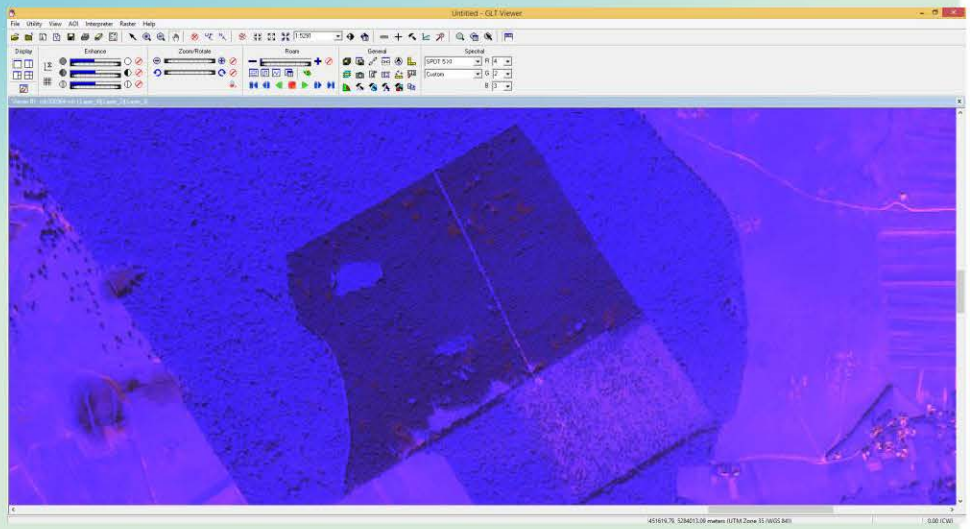
METHODS

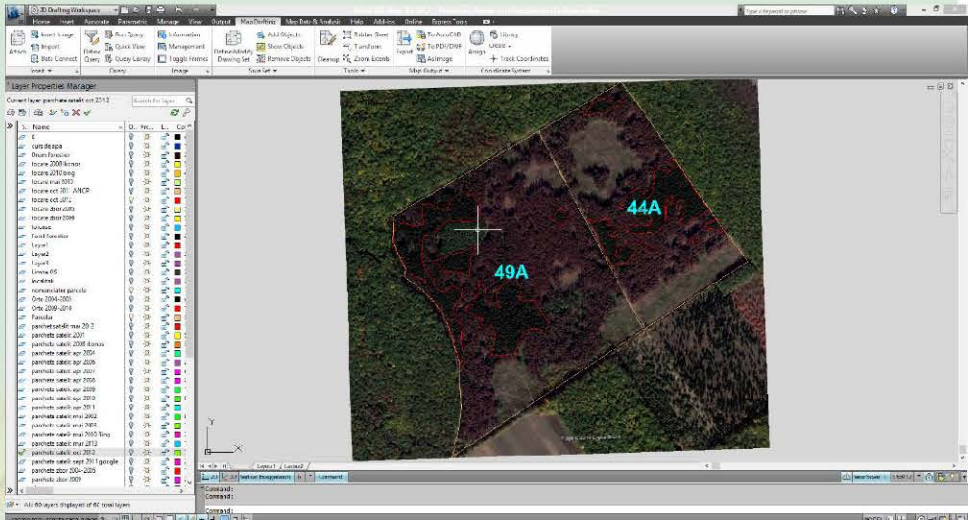
Satelite and aerial images processing

Software used:

- **Erdas Image:** satellite multispectral images processing;

- **Autocad Map:** georeferencing images; area measurements (green spruce, dead spruce, surfaces and clear cut areas).





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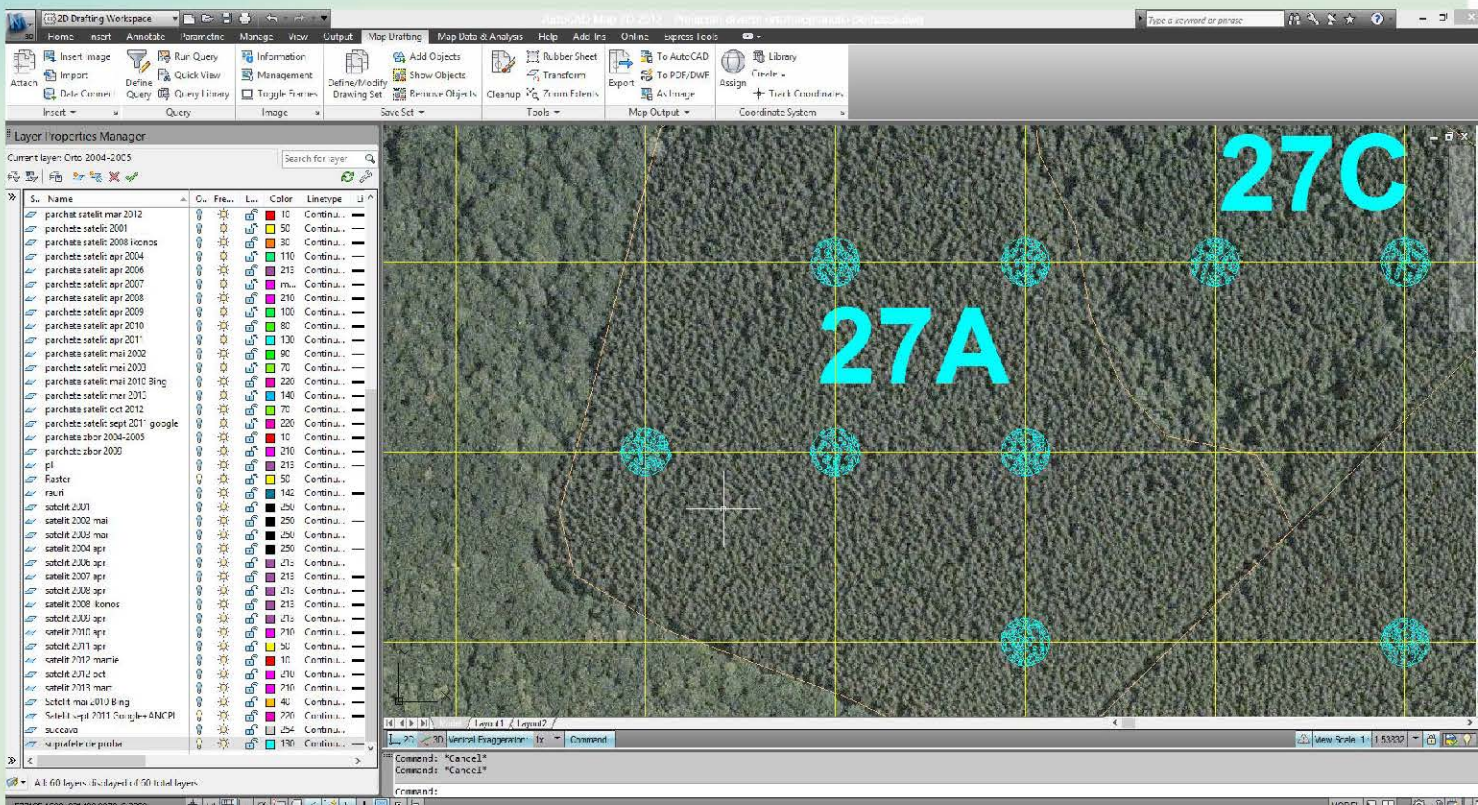
METHODS

Real spruce stands density

- Was quantified on aerial images (taken in 2004) using AutoCAD Map;
- In each management unit at least 3 circular areas (500 m^2) were delimited;
- In every circle all spruce trees where counted.



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METHODS

Surface measurements (green trees, trees, clear cut)

Years of observations	Image source	Image type	Resolution	Surface type
2001-2004; 2006-2009; 2011-2013	Landsat	Satellite	30 m	Green trees, clear cut
2008	Ikonos	Satellite	3 m	Green trees, clear cut, dead trees,
2011-2013	Google Earth	Satellite	1-2 m	Green trees, clear cut, dead trees
2005; 2009; 2011	ANCPI Romania	Aerian photos	<1 m	Green trees, clear cut, dead trees

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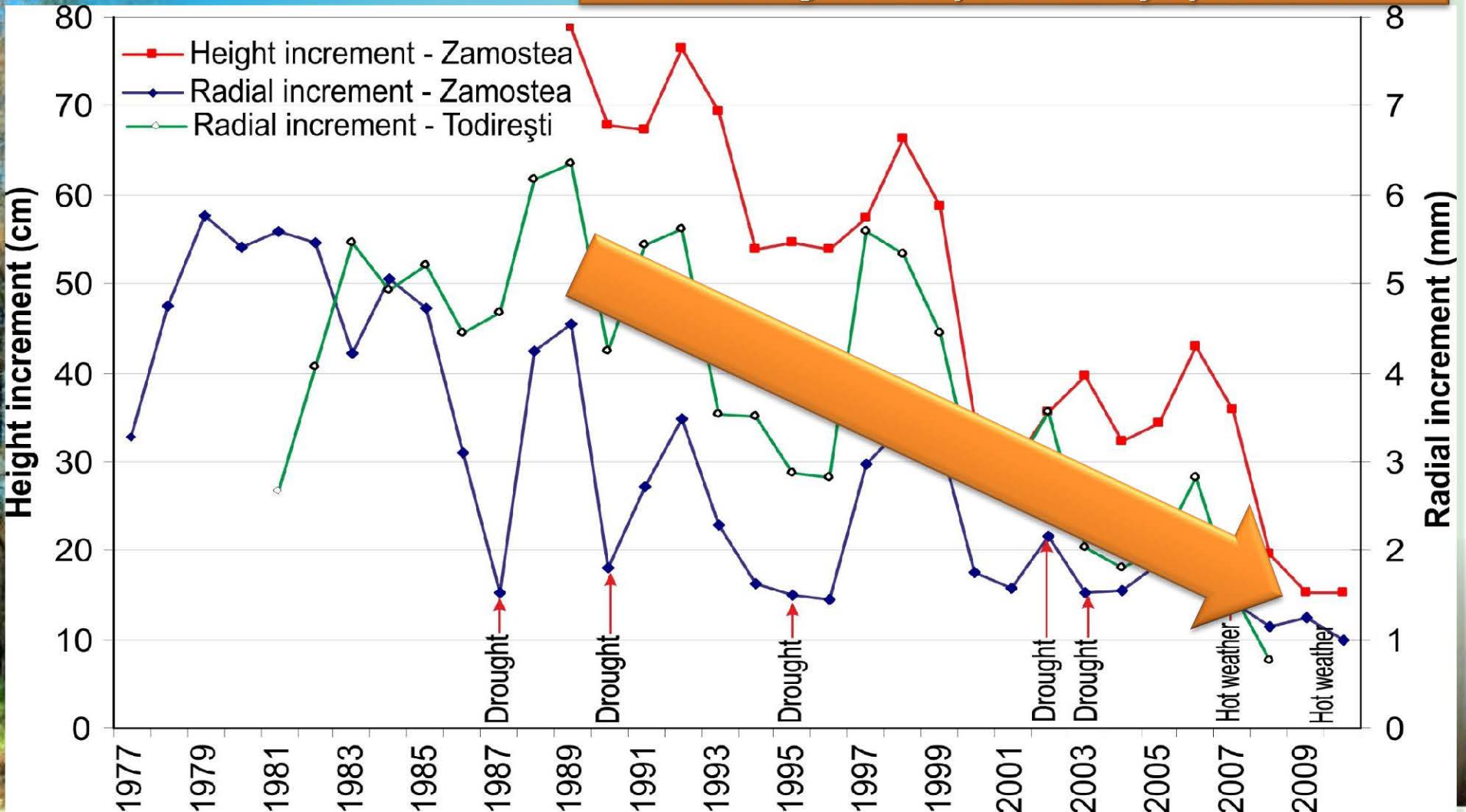
RESULTS

INDICATORS OF SPRUCE STANDS DEBILITATION

Reduced growth process of spruce trees



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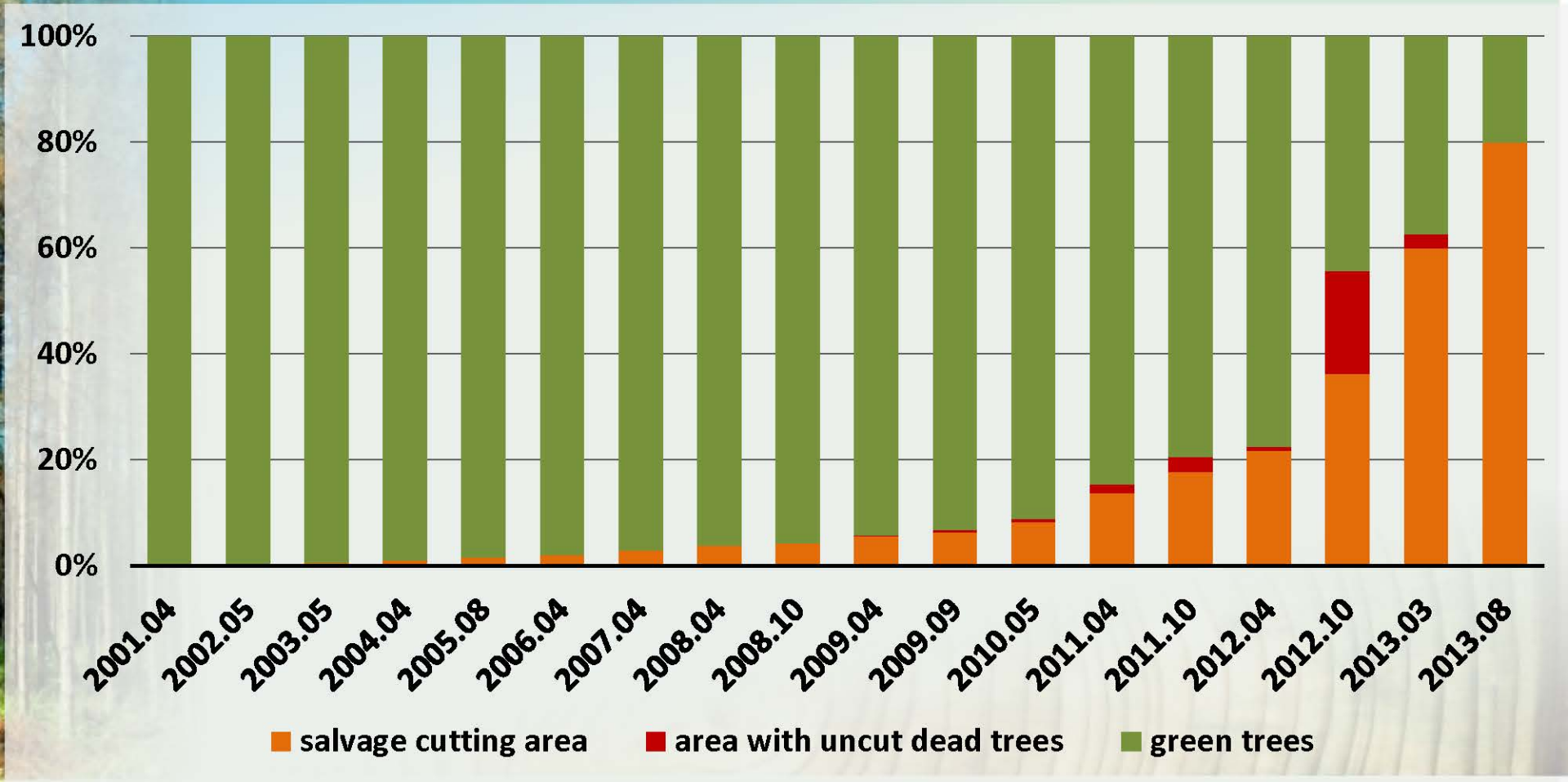
RESULTS

INDICATORS OF SPRUCE STANDS DEBILITATION

Increase mortality of spruce trees



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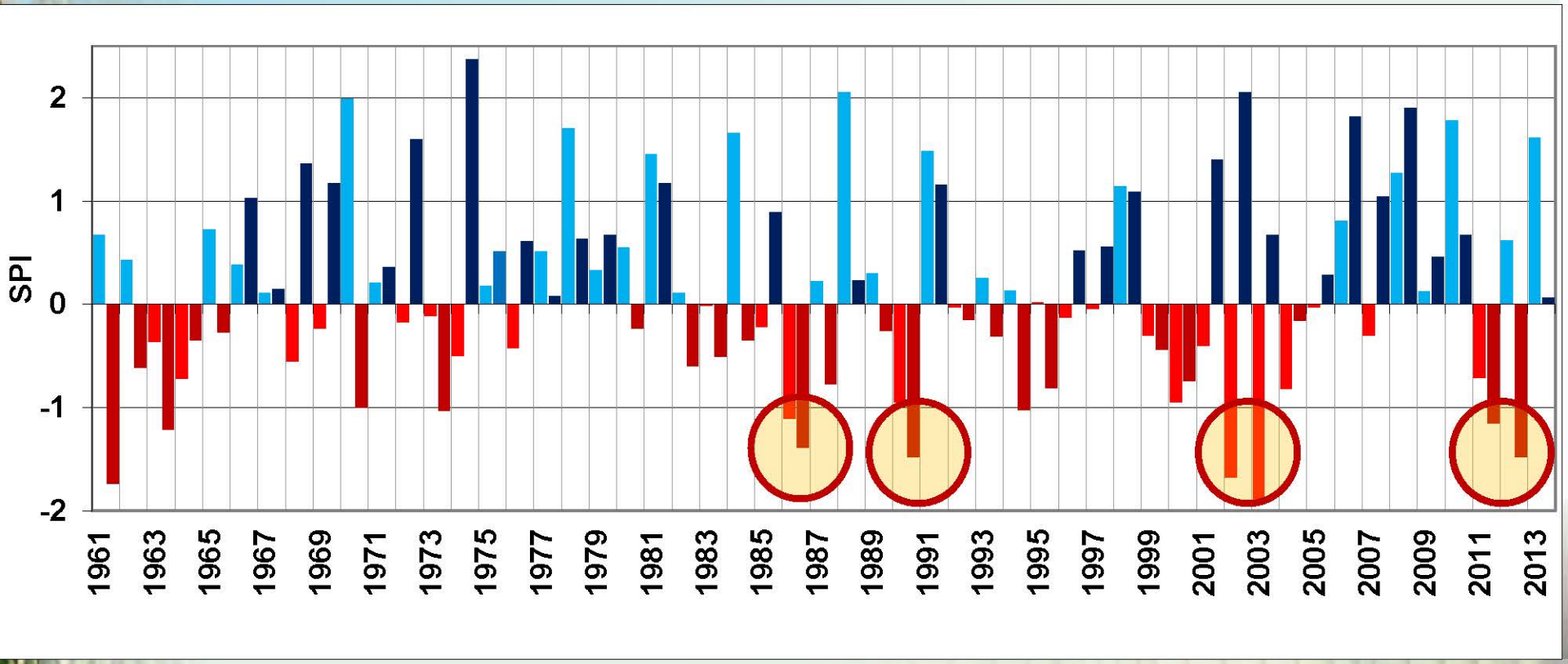
RESULTS

CLIMATIC FACTORS

DROUGHT periods for study area were characterized through precipitation deficit, using SPI (standardized precipitation index).



SPI was computed for the six months of the growing season using monthly precipitation amounts registered between 1922 and 2013.

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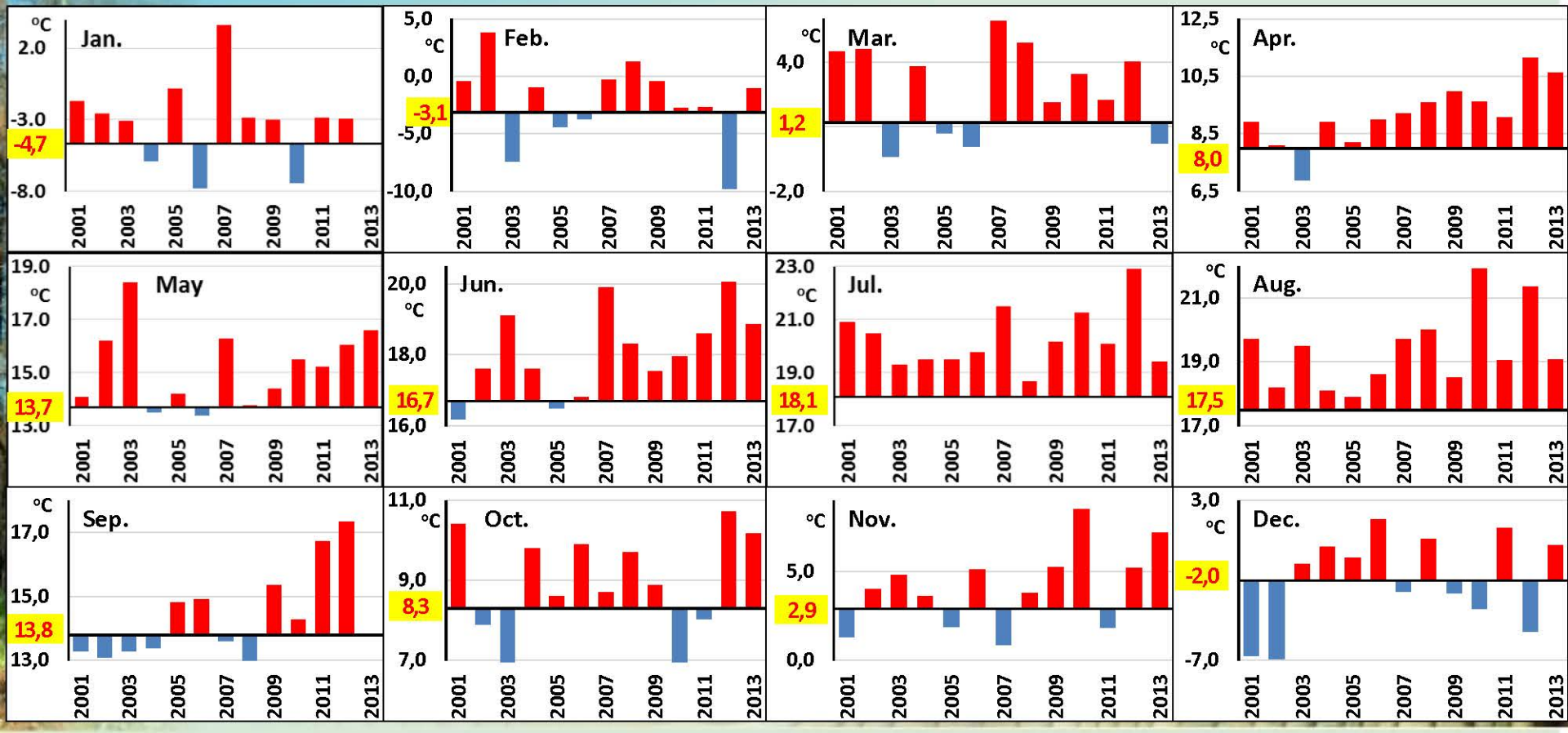
RESULTS

CLIMATIC FACTORS

HOT WEATHER periods characterized by mean monthly temperatures higher than the normal monthly temperatures (1961-1990)



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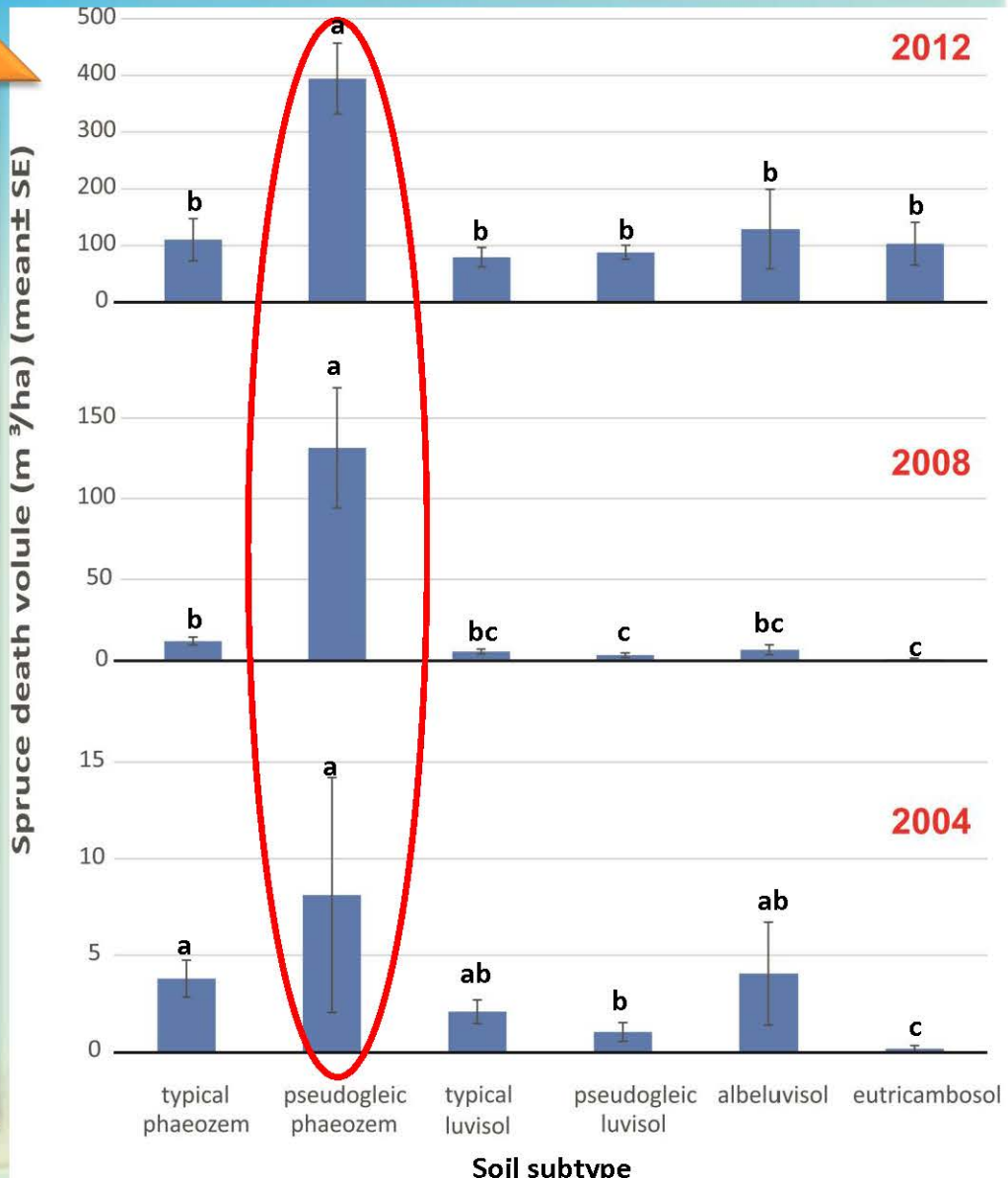
RESULTS

SITE CONDITIONS

Distribution of the volume per hectare of dead trees in the studied area, according to **soil subtypes**

DEAD TREES VOLUME



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RESULTS

SITE CONDITIONS

Elevation
(300-400m; 400-500 m)

Exposition

Slope
(0-5; 6-10; 11-15 %)

Did not significantly influence the distribution of the volume per hectare of dead trees in the studied area

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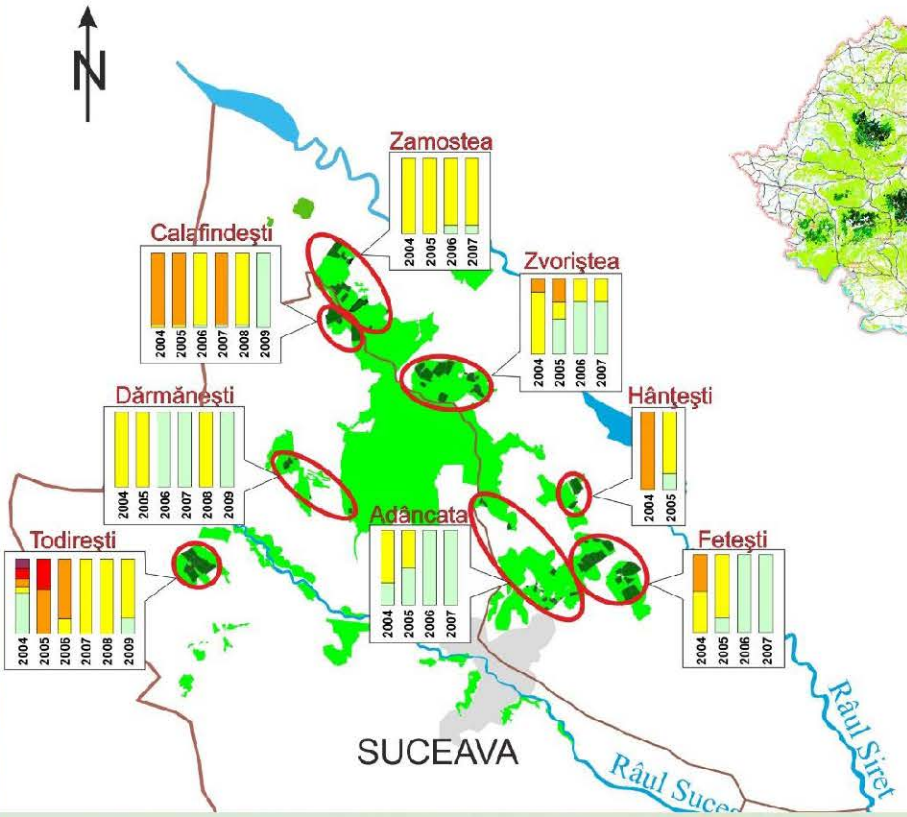
RESULTS

BIOTIC FACTORS — *Pristiphora abietina*

- Affected the spruce stands from 1996, with maximum intensity in the period 2003-2009
- Was present in all spruce stands taken into account for this study
- The attack of this wasp contributed to spruce tree debilitation, but not conducted to death of trees



Legend

- Spruce stands
- Broadleaves forests

Defoliation intensity:

- Very low
- Low
- Medium
- Strong
- Very strong

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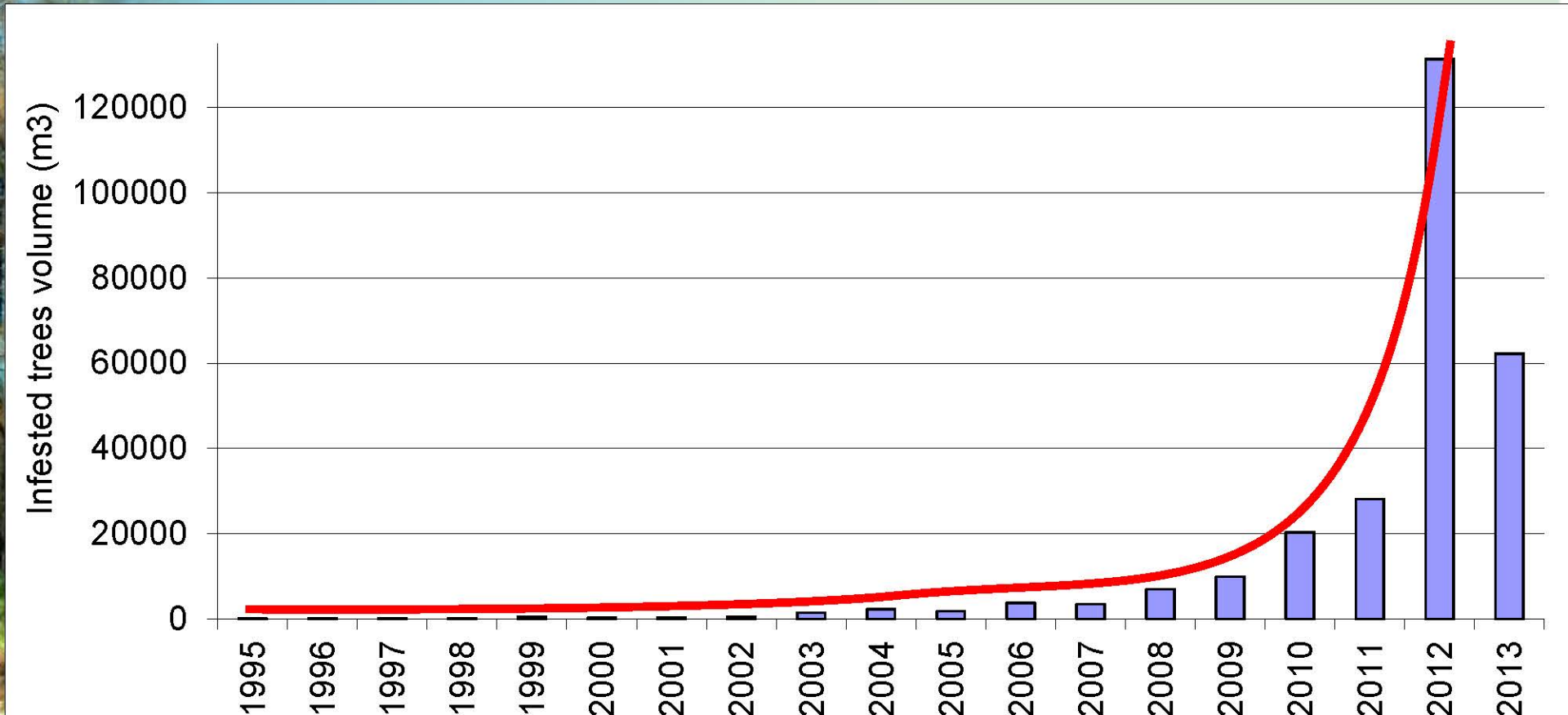
RESULTS

BIOTIC FACTORS

Bark beetles

-Bark beetle outbreak was strongly connected with spruce trees debilitation

-Spruce stands were attacked by *Ips duplicatus* (invasive species), *Ips typographus*, *Pityogenes chalcograpus* etc."



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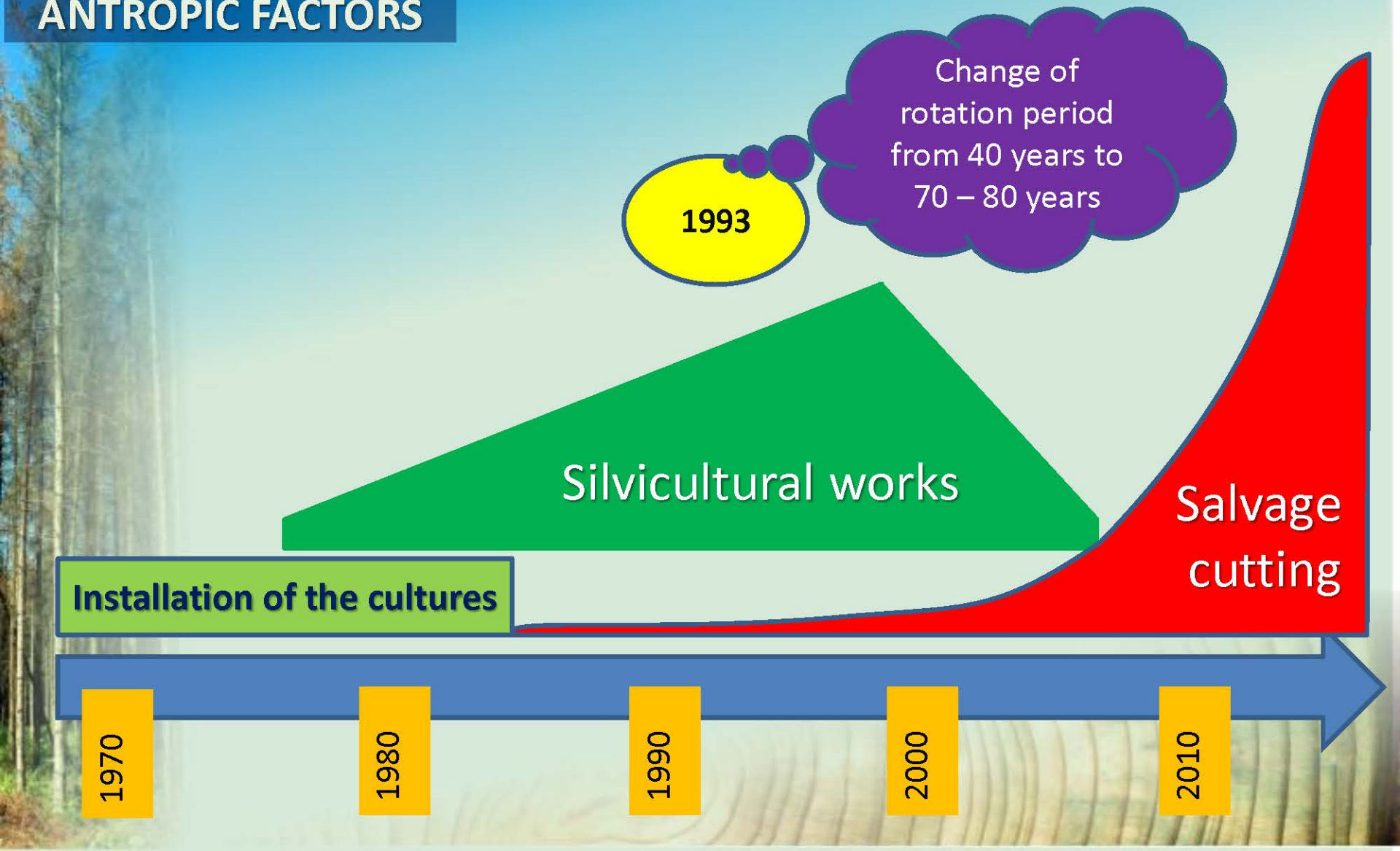
RESULTS

ANTROPIC FACTORS



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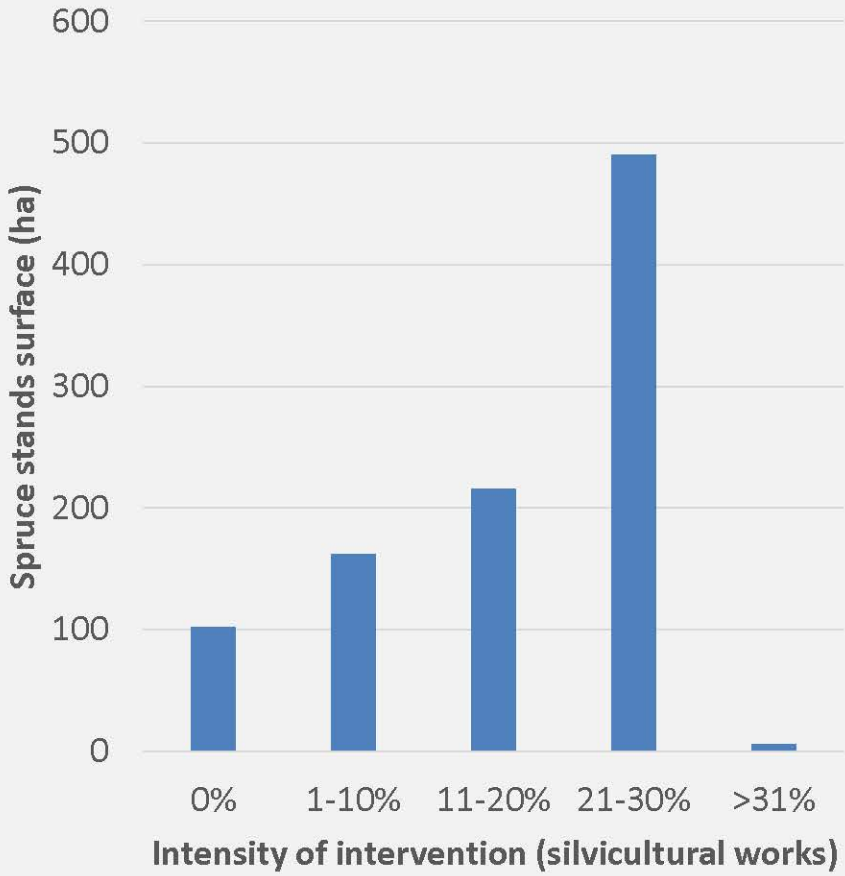
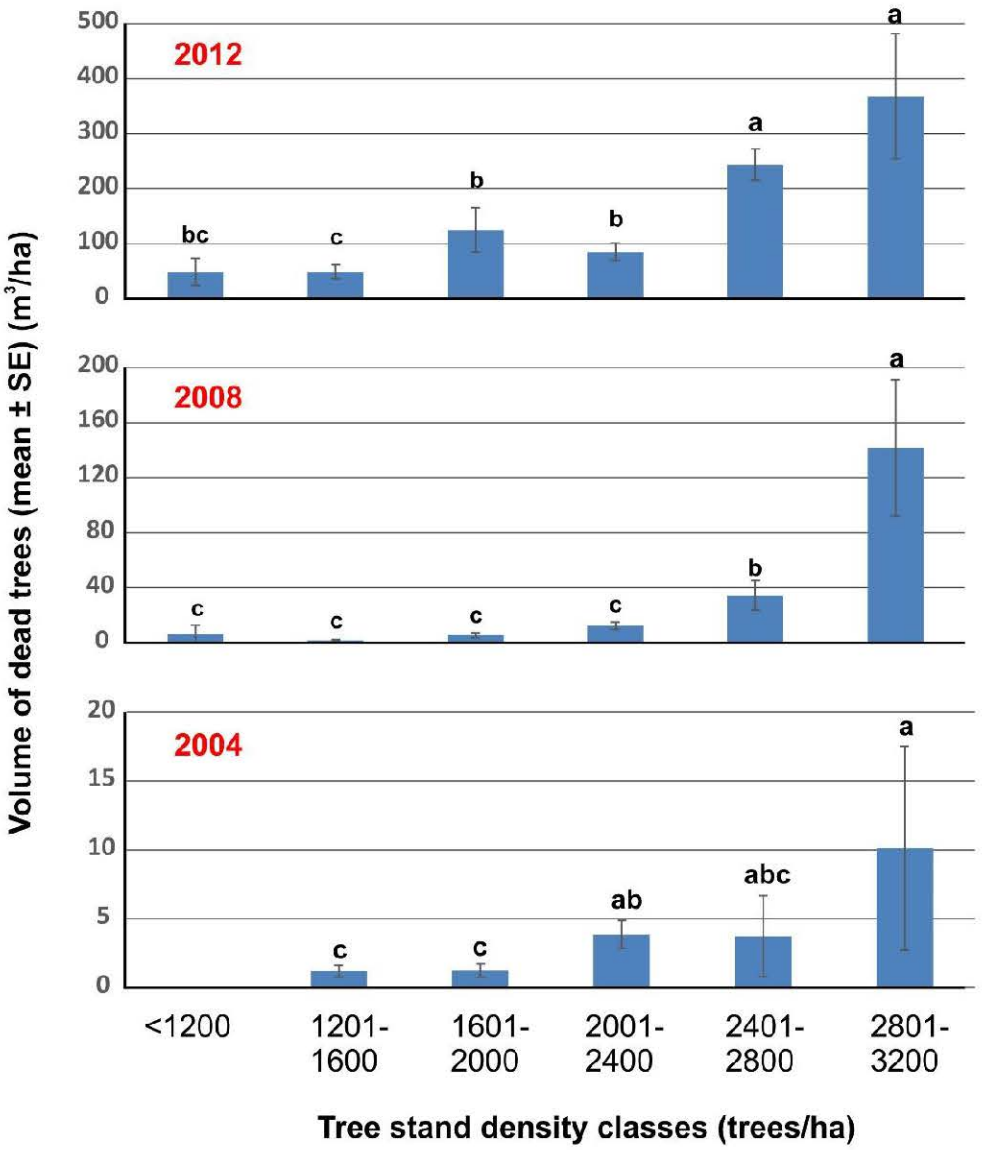
RESULTS

ANTROPIC FACTORS

Silvicultural works





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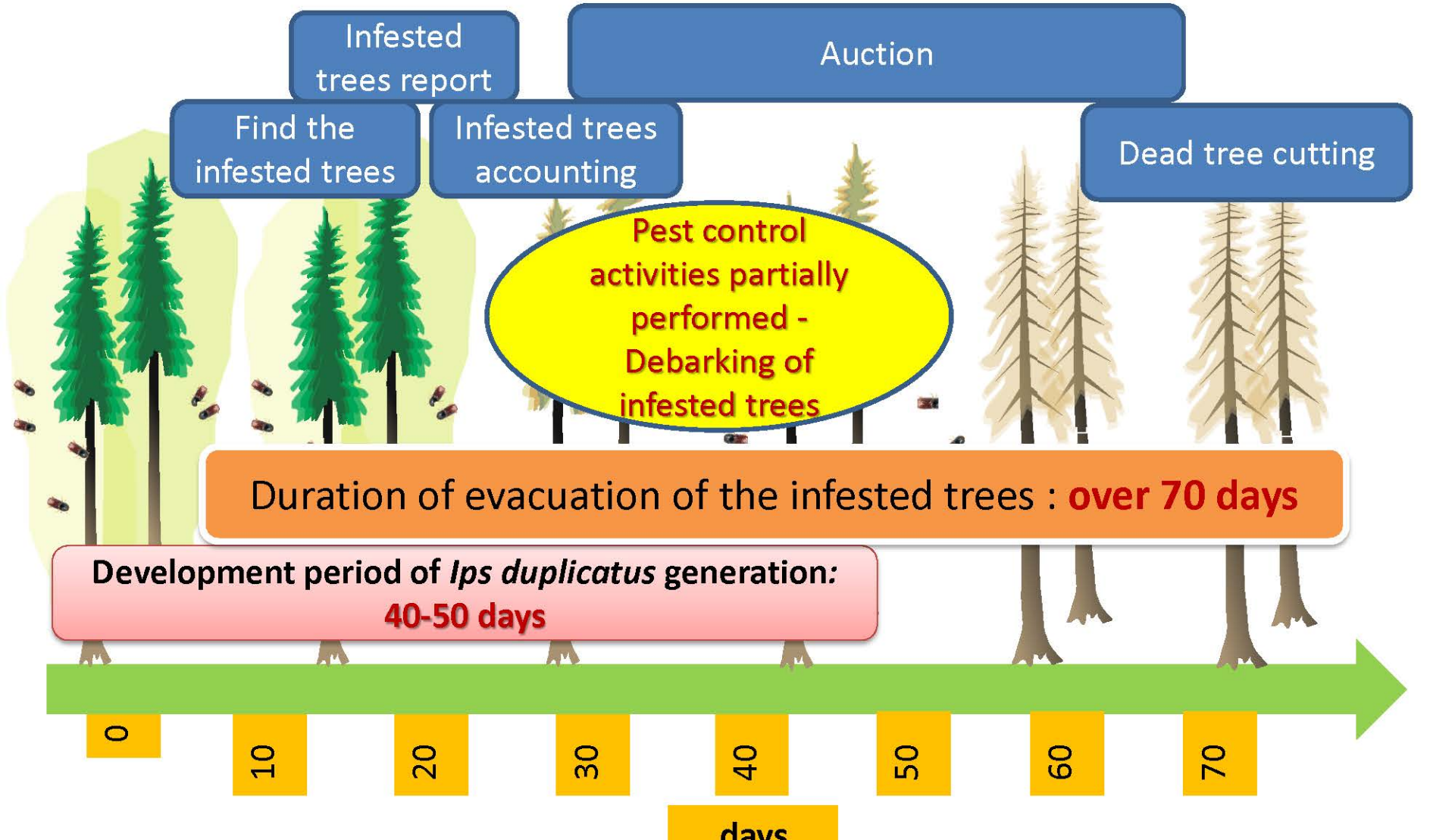
RESULTS

ANTROPIC FACTORS

Pest management: Bark beetles



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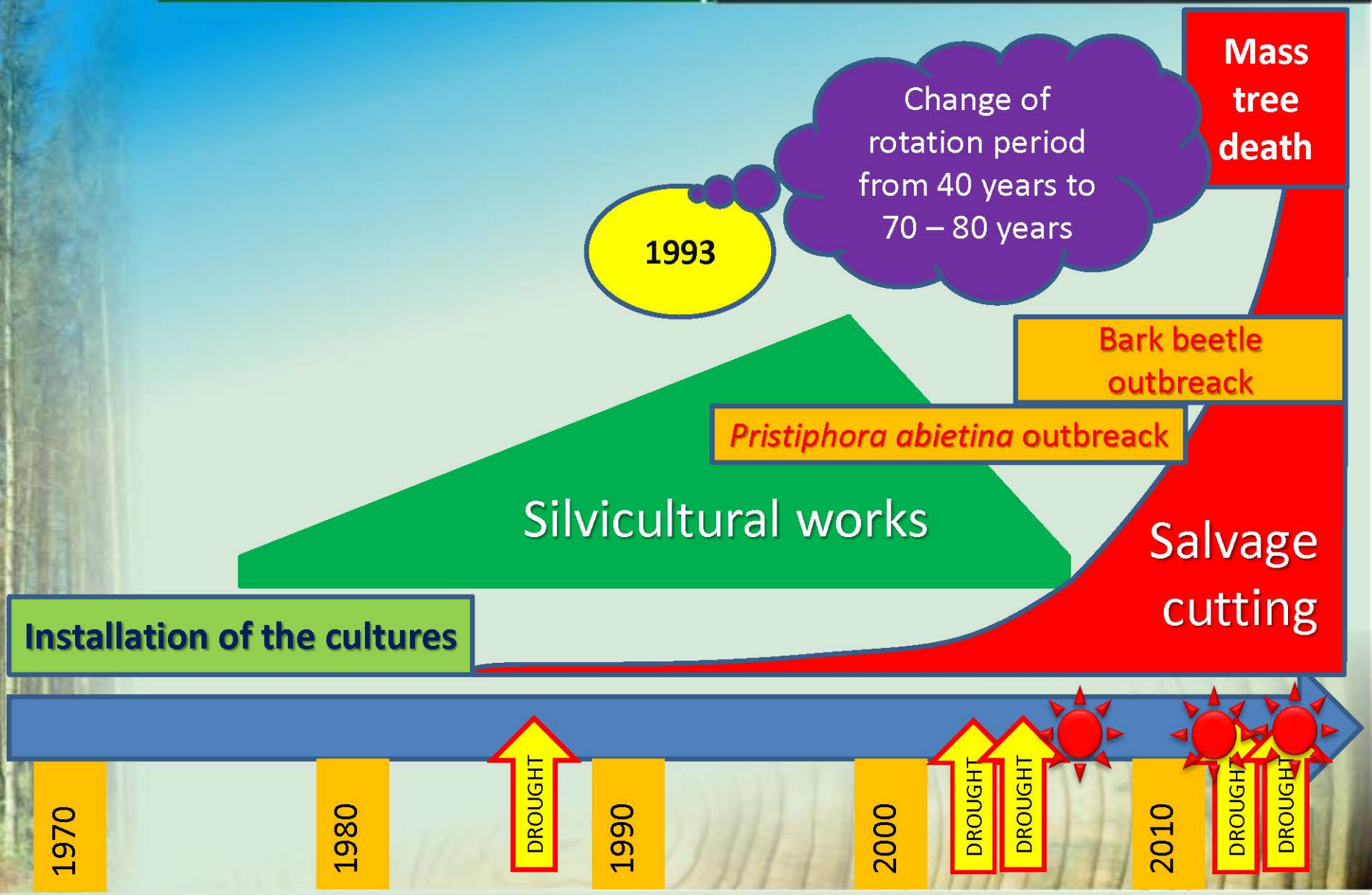
DISCUSSION



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CONCLUSIONS

Due to low intensity and delayed tending works, the competition between the trees was exacerbated and caused the debilitation of trees. This facilitated the increased manifestation of pests, especially after intense drought episodes.

The lack of adequate silvicultural and protective works resulted in the degradation of these cultures on increasing areas each year, especially in the stands with high tree density.

DUPLIFEN

ACKNOWLEDGMENT

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