



# **Marteloscope as part of training for forest engineers in Serbia**

Nenad Petrović  
Branko Kanjevac  
University of Belgrade Faculty of Forestry

# Marteloscopes and I+ software in Serbia

- Practical implementation started during 2017 within the project financed by BMEL:

*Promotion of Vocational and Practical Postgraduate Training in the Serbian Forestry Sector*

- Within the project, 9 demonstration plots were set up, where several trainings were conducted
- In second part of the project 5 more demonstration plots were set up for the same purpose
- Currently, the demonstration plots are used for training of engineers within the Chamber of Forestry Engineers of Serbia

# Implementation of marteloscopes and I+ software

- $\Sigma = 14$  demonstration plots
- Demo plots are located in following tree species:
  - *Quercus robur*
  - *Quercus frainetto*
  - *Quercus cerris*
  - *Fagus sylvatica*
  - *Pinus nigra*
  - *Abies alba*
- Demo plots cover different structural forms and development stages

# Demo field in young stand of pedunculate oak



# Demo field in maturing stand of pedunculate oak



# Demo field in middle-aged stand of beech



# Demo field in maturing stand of beech



# Demo field in uneven-aged stand of beech and fir



# Practical use of marteloscopes and I+ software in Serbia

- **Chamber of Forestry Engineers of Serbia**



КОМОРА ИНЖЕЊЕРА ШУМАРСТВА СРБИЈЕ

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- Institution in the development phase
- Founded in 2011
- Main objective is coordination and implementation of continuous education in forest sector
- About 800 active members
- About 600 licenses issued to forestry engineers based on field training

# Practical use of marteloscopes and I+ software in Serbia

- **Chamber of Forestry Engineers of Serbia**



- Future activities:
  - admission of new members of the Chamber,
  - organization of professional exams for obtaining licenses,
  - licensing,
  - continuous education of existing staff,
  - project activities.

# Use of Marteloscopes and I+ software in practical trainings.

- Since 2018, practical training of forestry engineers has been conducted in Serbia.
- Forestry engineers maintain the acquired license using Marteloscopes demo plots.
- The primary focus is on forest management planning and silviculture.

# Implementation of marteloscopes and I+ software

The **key topics** covered in the practical training of forestry engineers, in which marteloscopes and I+ software have found application are:

- Implementation of forest management types in forest management planning system;
- Testing of new biodiversity methodology
- Training in different management strategies in oak and beech forests;
- Training on regeneration in beech forests;
- Training on regeneration in oak forests.

# Practical work of engineers in training



# Practical work of engineers in training



# Example of using marteloscopes and I+ software in training

- **Training activities:**

1. defining forest management types at demo plot
2. Practical training on different management strategies
3. Introduction on application of marteloscopes and I + software
4. simulation of tree marking (by tapes)
5. data entry into software (tablet computers are used)
6. creating report in software
7. evaluation of completed works

All participants in the training (usually there are about 10-12) are divided into 3-4 teams

# Example of using marteloscopes and I+ software in training

Presentation of basic information on the application of marteloscopes and I+ software



marking trees with tapes

# Example of using marteloscopes and I+ software in training

data entry into software



creating report in software



# Example of marking trees in training in I + software

Menu

East Boranja I, Serbia

100 % 60 x 80 m

## Removed trees (14)

Volume: 27.9 m<sup>3</sup>

Basal area: 1.8 m<sup>2</sup>

Economic value: 1494 €

Habitat value: 163

## Remaining stand

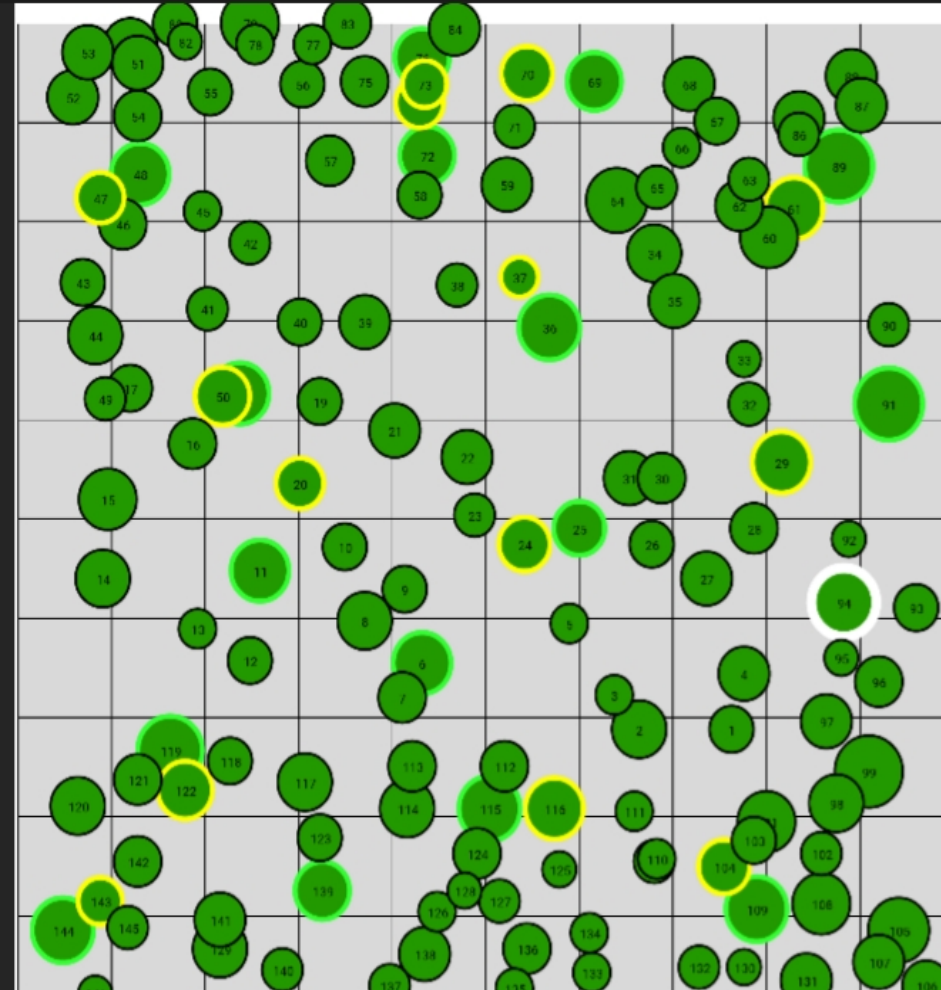
Volume: 221.9 m<sup>3</sup>

Basal area: 14.7 m<sup>2</sup>

Economic value: 12329 €

Habitat value: 1655

## Retention trees (17)



# Report – stand characteristics

Stand data (before intervention): East Boranja I

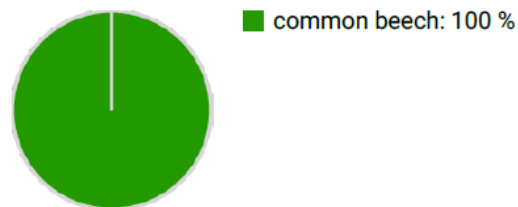


22/06/2022 branko za prezentaciju

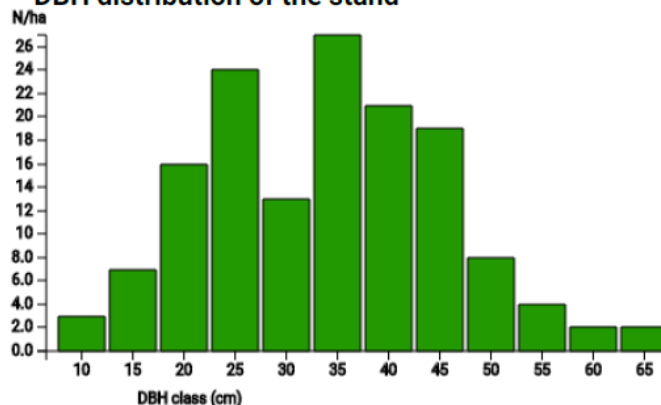
## Site conditions

Altitude: 730 m.a.s.l.  
 Forest ecological region: Mačva  
 Geology / Bedrock: Granodiorite  
 Soil type: Dystric cambisol  
 Natural forest community:  
 Fagetum moesiacaе montanum  
 Mean annual temperature: 11.6  
 degrees C; Mean annual  
 precipitation: 868 mm;  
 Ownership: State; Establishment:  
 2016

## Tree species distribution by volume (in %)



## DBH distribution of the stand



## Initial stand (details by tree species)

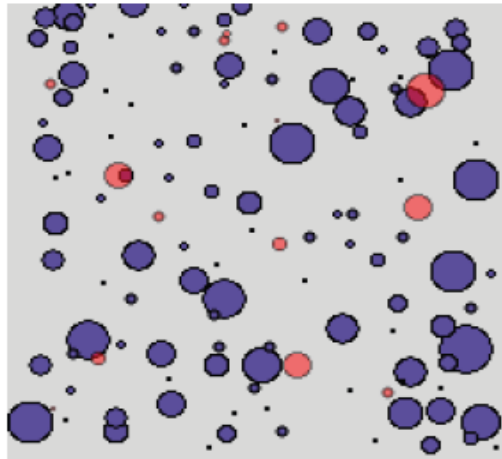
| Tree species | N/ha | Basal area (m <sup>2</sup> ) | Volume (m <sup>3</sup> ) | Economic value (€) | Habitat value (pts.) | Microhabitats (N) |
|--------------|------|------------------------------|--------------------------|--------------------|----------------------|-------------------|
| common beech | 146  | 16.5                         | 249.8                    | 13823              | 1818                 | 177               |
| Total        | 146  | 16.5                         | 249.8                    | 13823              | 1818                 | 177               |

# Report – effects of conducted tree marking

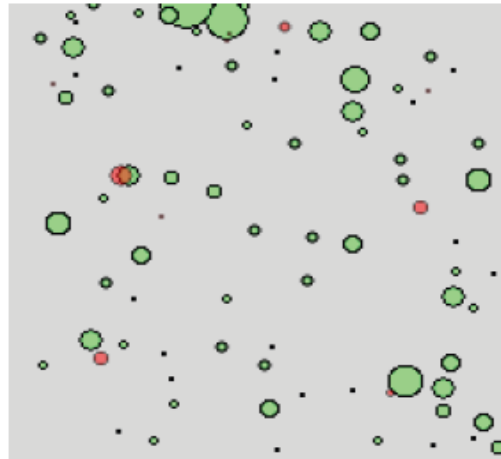
Removed trees



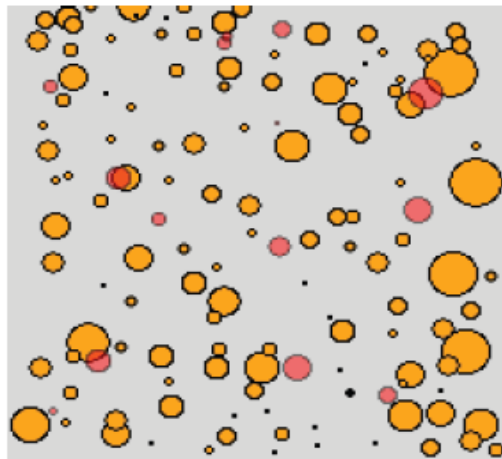
Economic value [EUR]



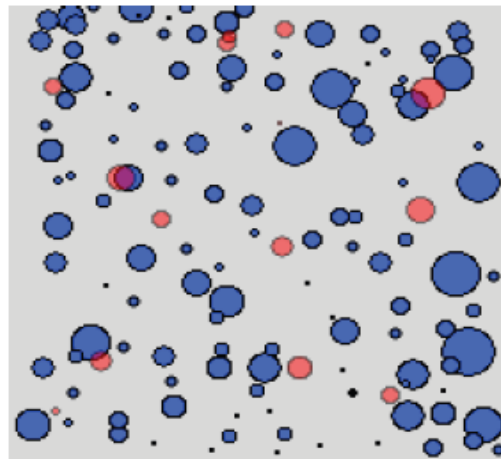
Habitat value



Basal area [m<sup>2</sup>]



Volume [m<sup>3</sup>]



**Description:**

Red circles (removed trees); circle size according to numerical values (e.g. large circles mean high values); trees with very low values (e.g. habitat value "0") are not visible.

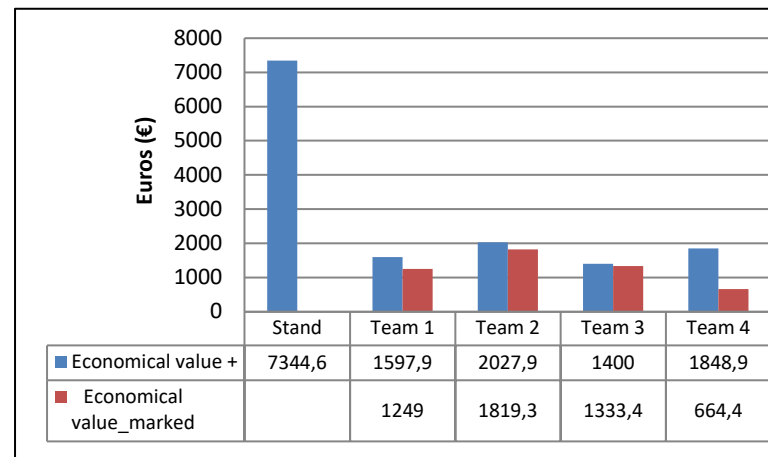
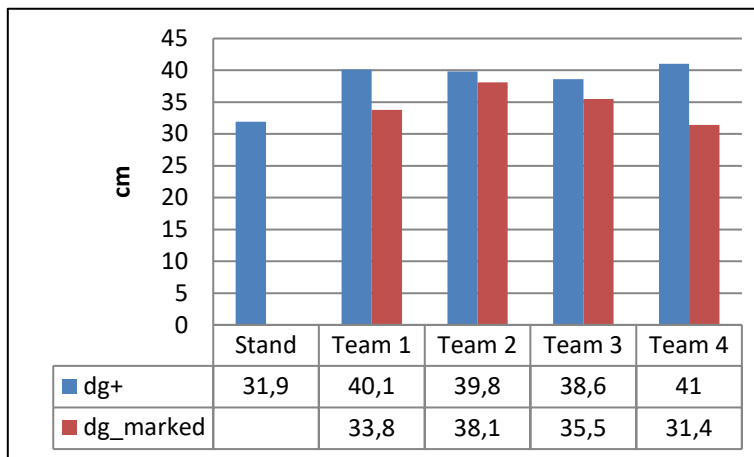
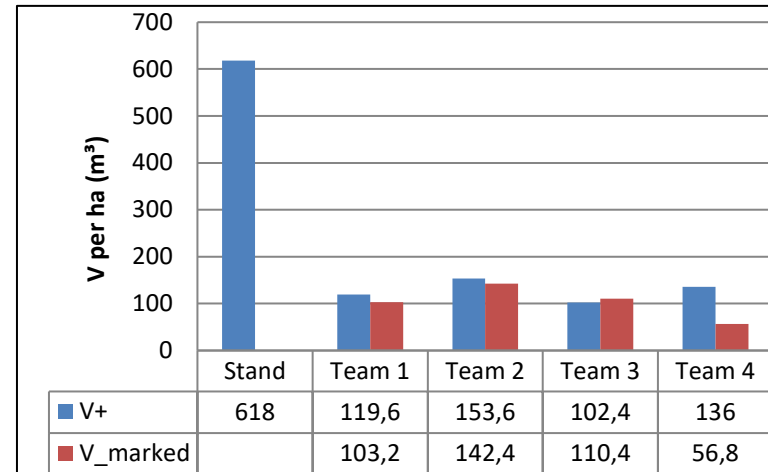
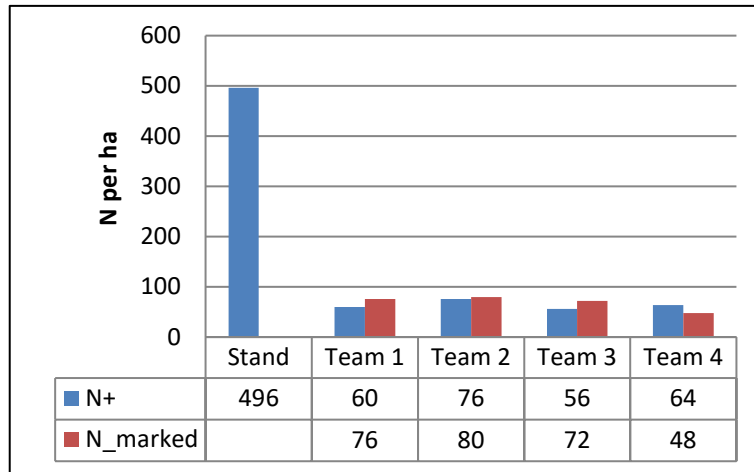
# Example of using marteloscopes and I+ software in training

## Evaluation of completed works:

- After the simulation of the silvicultural treatment by each team and data entry into the software, the evaluation of the performed works follows.
- The summary results obtained in I+ software report are used.
- In our case we use the number of trees, the basal area, the volume, the economic value of the trees, the habitat value
- In addition, we calculate elements such as the average diameter of marked and remaining trees, the average height of dominant trees, etc.

# Example of using marteloscopes and I+ software in training

- Evaluation of completed works:



**N+** - Crop trees; **N\_marked** – Marked trees

# Presentation of results and discussion



## Some experiences with the implementation of marteloscopes and I+ software

- Solid tool for better understanding biodiversity component in forest management planning.
- Practical understanding close-to-nature silviculture/forest management (CNS).
- Positive evaluation by forest engineers after training campaign.
- Some of demo plots is about to become part of long-term research plots taking in consideration climate change aspects.

# Some experiences with the implementation of marteloscopes and I+ software

- Potential for solid communication instrument between forest sector and wider community (Nature protection- Environmental NGO and Forest sector).
- It is desirable to make a version for windows operating system.
- Financial resources need to be provided for the exchange of experiences and the expansion of the network at national level.
- European Marteloscope Network could be used as international exchange platform.
- We plan to start using it (2022/23) as part of practical teaching with students at Faculty of Forestry.

# Thank you!

