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Direct assessment of biomass productivity in short rotation forestry (SRF) with the terrestrial laser scanner (TLS). Case of study in NE part of Romania (preliminary results).

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- The short rotation forestry (SRF) playing an important role in worldwide forest economy: obtaining higher biomass production (yield) in a short time;
- SRF are continuously developed in NE of Romania: with more that 800 Ha;
- Several studies have been done to identify difference for productivity between:
  - plant materials;
  - hybrid clones;
  - crops density/ cycle/ rotation;
  - cultivation technologies;
- For initial studies, biomass production was estimated using direct methods (destructive), comparing now, using indirect methods (scanning).

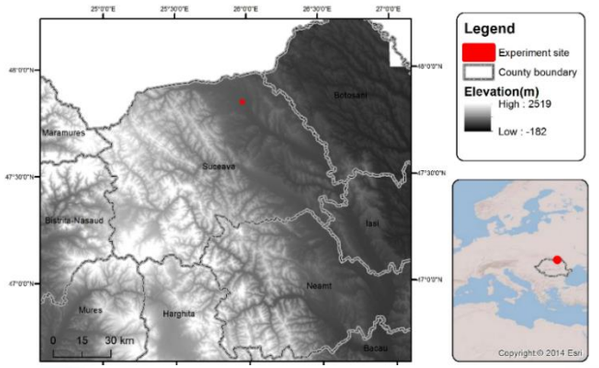
- A precise estimate of biomass is necessary for the sustainable planning of forest resources and for the exchange of energy in ecosystems;
- The use of the terrestrial laser scanner (TLS) in biomass estimation brings an important technological leap among indirect (non-destructive) methods;
- Measuring the hybrid poplars crops by TLS may have many following aspects, like:
  - ❖ higher accuracy of biomass estimation in SRF;
  - ❖ cost and time effective measurements over the biomass of tree parts;
  - ❖ new and validated allometric equations for SRF in NE Romania;
  - ❖ robust instrument for industry to estimate biomass.
- TLS technology is justified when destructive methods become difficult to carry out and allometric equations do not give accurate information.

- The research was conducted in a hybrid poplar crops in NE Romania (experimental and field crops), with:

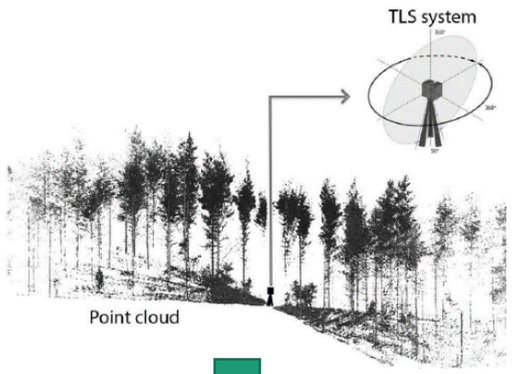
- 7 different hybrid poplar clones (AF2, AF6, AF8, Monviso, A4A, Pannonia and Max4) under intensive cultivation;

- 3 different types of planting material (cuttings, rods and seedlings) and 5 different density 3 x 1; 1,16; 1,25; 2 and 2,5 were used;

- Biomass was estimated for brunch and stem, after 4 to 7 growing seasons ($Mgha^{-1}$), for the first rotation cycle.



- In a second rotation (after 5 years) it will be compared the data obtain from direct and indirect methods:



Biomass per different parts of trees: branches and stem

Total biomass production (Mg ha^{-1})

- The validation of biomass will be done using allometric equation (from the first rotation).

Partial result from first rotation

(1) what is happening between different types of planting material?

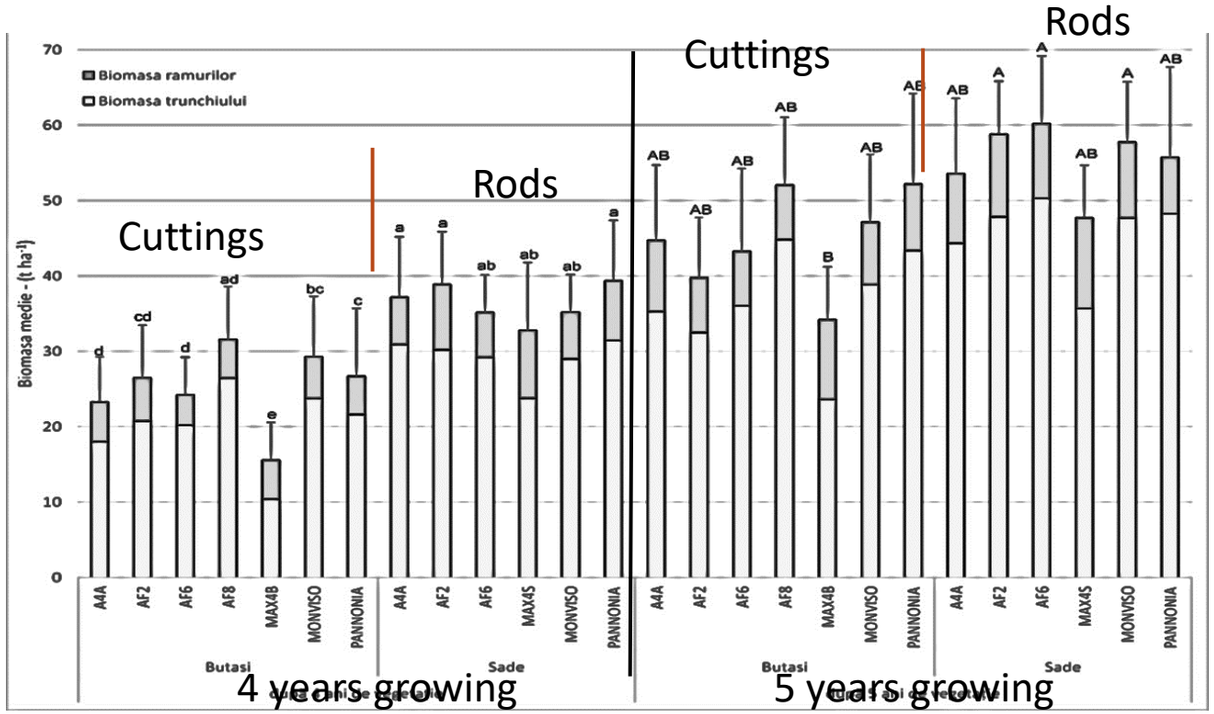


Figure 1. Biomass production per hectar, after different plant material and diferent growing seasons (after 4 and 5 years) – for 3 x 1,25 m (2667 trees ha-) planting density

Table 1. Characteristics of the planting material installed

Planting material	Length (cm)	Thickness (cm)	Weight (g)	Planting depth (cm)
Cuttings	22	1.0 – 1.5	29	18 - 20
Rods	180	2.0 – 3.0	264	60 - 70
Seedlings	60 - 70	1 - 2 (close to collar)	242	approx. 30 (close to collar)

- The biomass difference accumulated by cuttings compared to rods is due primarily to their morphological and physiological characteristics;
- Short-rotation crops offer a 30% higher yield in the last growing seasons (after 5 years);
- The expansion of the production cycle modifies the proportion between the biomass of the stem and branches for each type of planting material.

Partial result from first rotation

(2) what is happening between different density for rods?

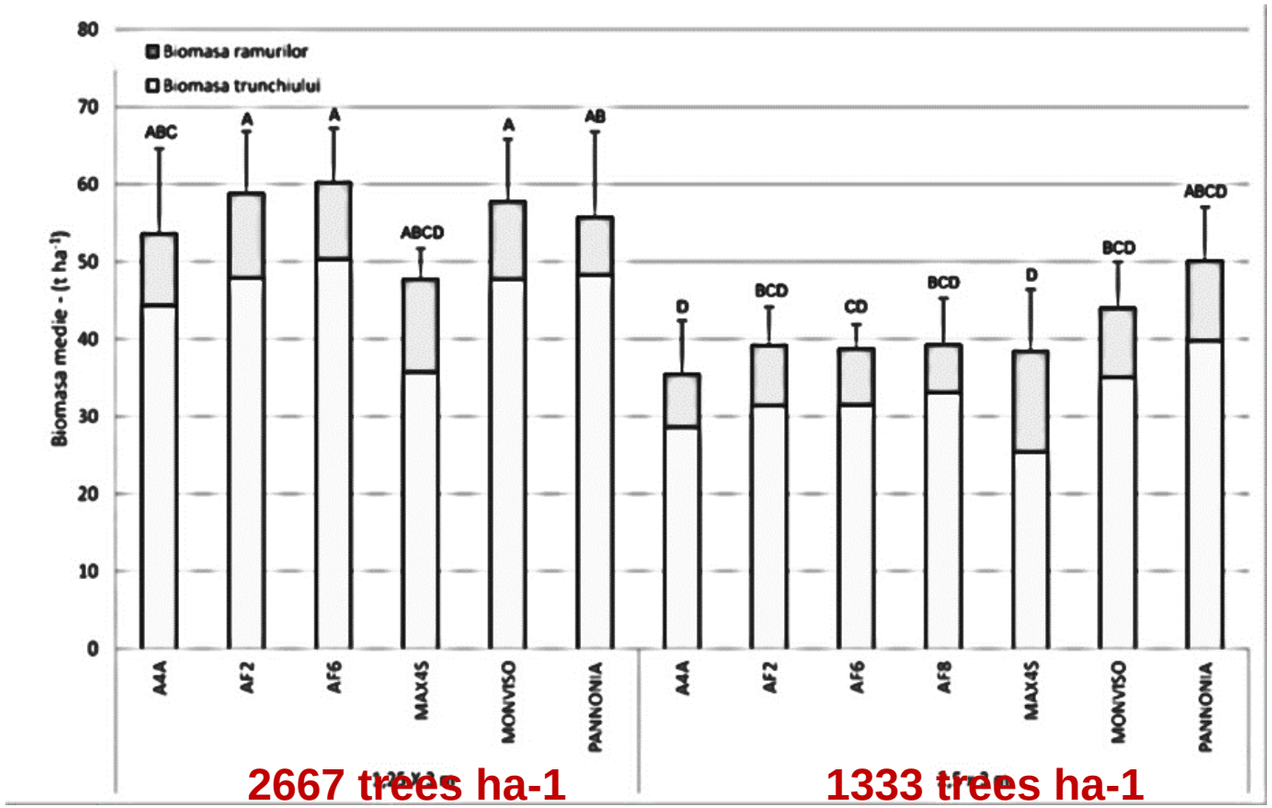


Figure 2. Biomass production for two different density – 3 x 1,25 m (2667 trees ha-1) and 3 x 2,5 m (1333 trees ha-1)

- Doubling the planting scheme brings an individual biomass addition of over 60%, but records a reduced yield when it is proportioned per area unit.
- Doubling the planting distance has also significantly influenced the proportion between the biomass of the stem and branches and produces a biomass increase at branch level.

Partial result from first rotation

(3) what is happen after 6 years growing season??

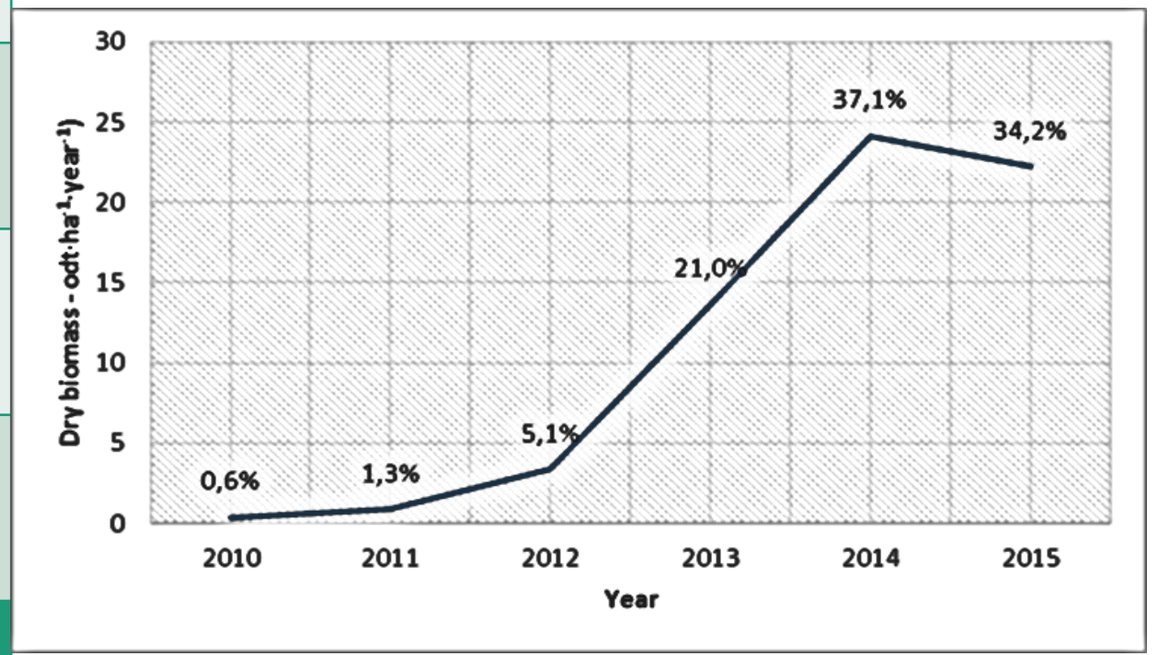


Figure 4. Annual dry biomass accumulation in 6 vegetation years

- In NE of Romania, 3 x 1,25 m (2667 trees ha^{-1}) is recommended to obtain a biomass productivity of 10 $odt \cdot ha^{-1} \cdot yr^{-1}$ after 5 growing seasons.

- After six growing seasons (in 2015), because of very reduced precipitation in the maximum vegetative accumulation period (May - June), this crop has accumulated a biomass of approx. 22,3 $odt \cdot ha^{-1}$, that represents approx. 34,2% of the total production.

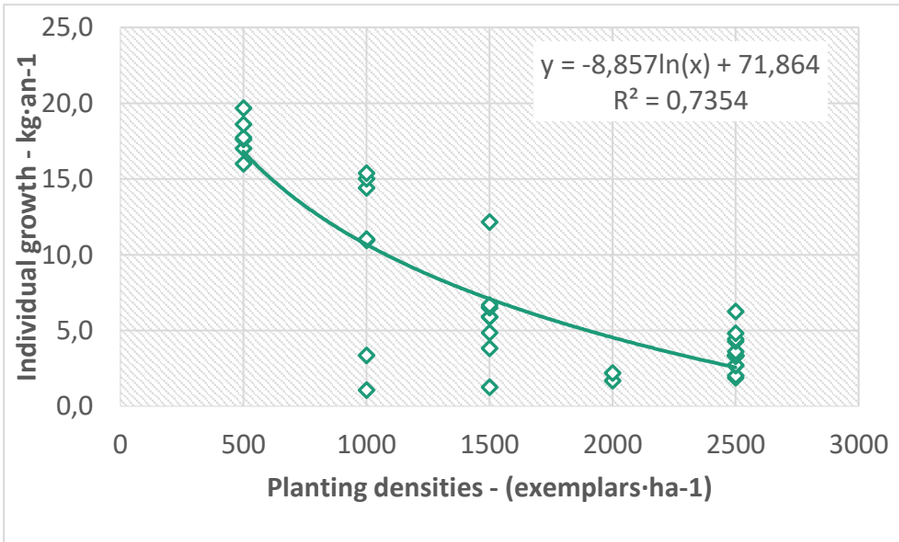


Figure 5. Average individual growt an^{-1} for different planting densities

Background
Hypothesis
Material
Procedure
Results
Conclusion

What we expect.... (?)

1) Evaluation of above ground wood biomass using TLS;
2) Accurate biomass estimation for different tree parts (stem and branches);
3) New and validated allometric equations for SRF in NE Romania;
4) AGWB calculated under the terrestrial laser scanner method could improve the company strategies for short periods of time;
5) The research will contribute to the development of knowledge in the field of hybrid crops.

Thank you for your attention!





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