

Measuring Timber Piles with TRESTIMA Stack

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NOFOBE and NB-NORD Conference "Industrial Scale Bioeconomy and its Requirements"
16 June 2017, Lappeenranta, Finland



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TRESTIMA Stack



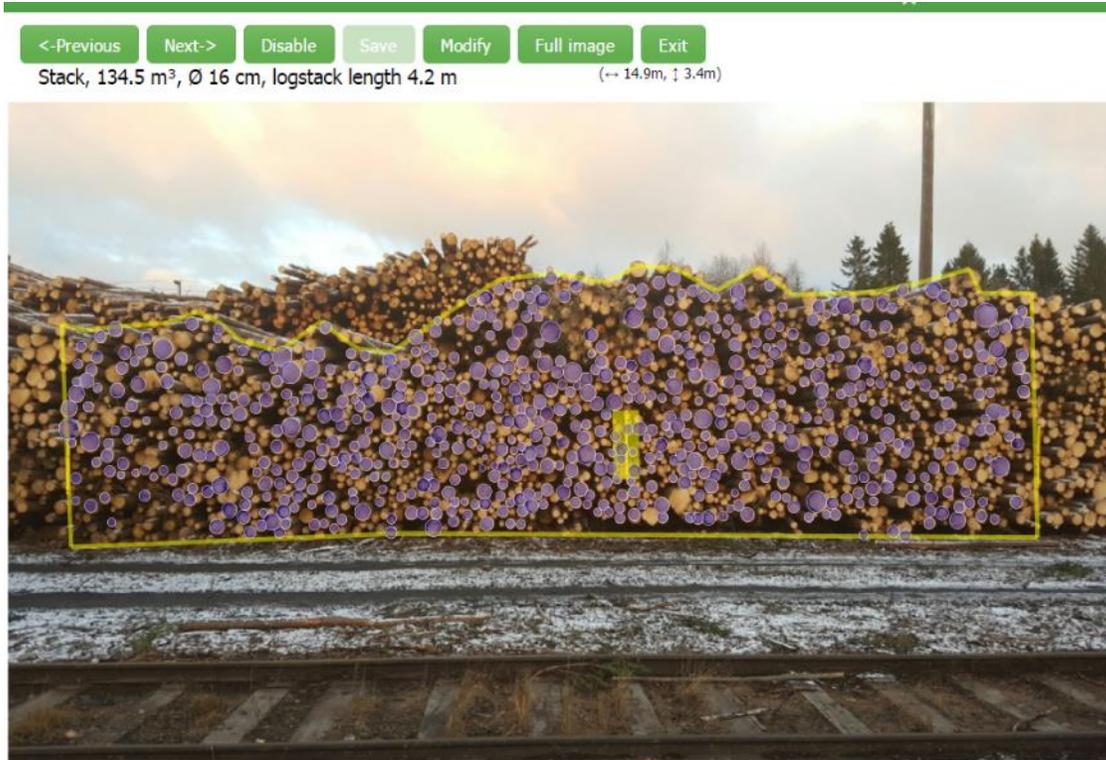
- Founded by Finnish company Trestima Ltd.
- Mobile application for measuring volume of a timber pile from images taken by a smartphone or a tablet device.
- Machine vision recognizes the ends of logs and determines their diameters using one meter long TRESTIMA Yardsticks as a reference.



Process of using TRESTIMA Stack:

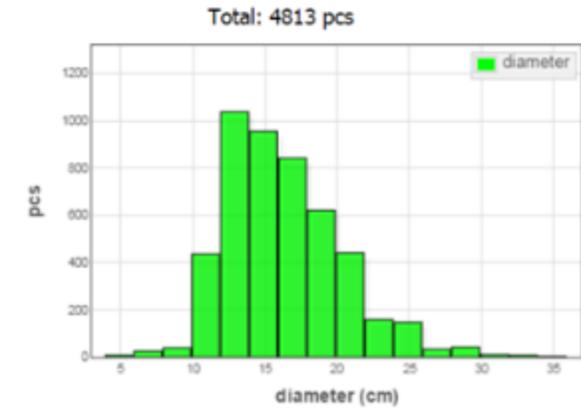
1. Name the time of measurement.
2. Attach TRESTIMA Yardsticks to pile side and make a picture.
3. Input the outer boundary of the pile to the screen.
4. Add an average length of logs (need to measure manually).
5. Add tree species (coniferous/deciduous).

Actual volume is counted based on surface area of pile, log length, and an automatically generated coefficient factor.



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stack volume:431.8 m³(Σ)
 avg. diameter:16.0 cm
 logstack length:4.2 m
 stems:4813 pcs
 gross volume:673.9 m³(Σ)
 CF:0.6407 (coniferous)
 stack volume:107.9 m³(x̄)
 v:0.090 m³
 samples:4 pcs (0 invalid)
 verified:100 %



*Total volume of the stack
 Diameter distribution
 Total amount of logs
 Coefficient factor
 Pile dimensions
 GEO-tagged pictures.*

Our Study



- The aim was to determine the **accuracy and time consumption** of TRESTIMA Stack tool compared to the conventional measuring method of piled timber stacks.
- The usage of the TRESTIMA Stack was clarified both with smaller **roadside timber piles** and larger **wood terminal and intermediate yards**.
- The control volumes of all piles studied were measured in October 2016 – February 2017 in Stora Enso Anjala, Imatra and Varkaus mills by **weight scale sampling with immersion**.



Timber pile at roadside landing



Timber stacks in terminal of mill

Data and Results of Accuracy



N		Trestima Stack	Conventional measuring	M³	Avg pile	Min	Max
28	Intermediate/Terminal	0.7 %	-4.8 %	9650	345	29	1037
19	Coniferous pulpwood	0.8 %	-6.0 %	7621		89	1037
9	Deciduous pulpwood	0.6 %	-2.4 %	2029		29	821

32	Roadside	4.5 %	-4.9 %	2307	72	15	298
21	Coniferous pulpwood	4.3 %	-3.6 %	1706		15	298
11	Deciduous pulpwood	4.9 %	-7.5 %	600		29	97

Total	60	2.7 %	-4.9 %	11957			
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Results: Time Consumption



Avg Effective Time Consumption	Trestima Stack (N=49)	Conventional Measuring (N=36)
Measurement method/pile	0:18:16	0:28:07
Time/m³	0:00:10	0:00:16
Measurement/pile	0:08:48	0:24:52
Time/m ³	0:00:05	0:00:14
Volume counting	0:09:28	0:03:16

Employees of TRESTIMA verify images before the final result of stack volume which caused occasionally remarkable delays to measurements.

By omitting the time loss caused by the delays, the effective time consumption of TRESTIMA Stack decreased to 5 s/m³.

Diameter



- Correlation analysis showed that **average pile diameter** correlate statistically significantly with the accuracy of TRESTIMA Stack.
- Average diameter of timber pile differed from 27.9% (3.6 cm) with TRESTIMA Stack and
- 21.3% (2.7 cm) with conventional measurement method.

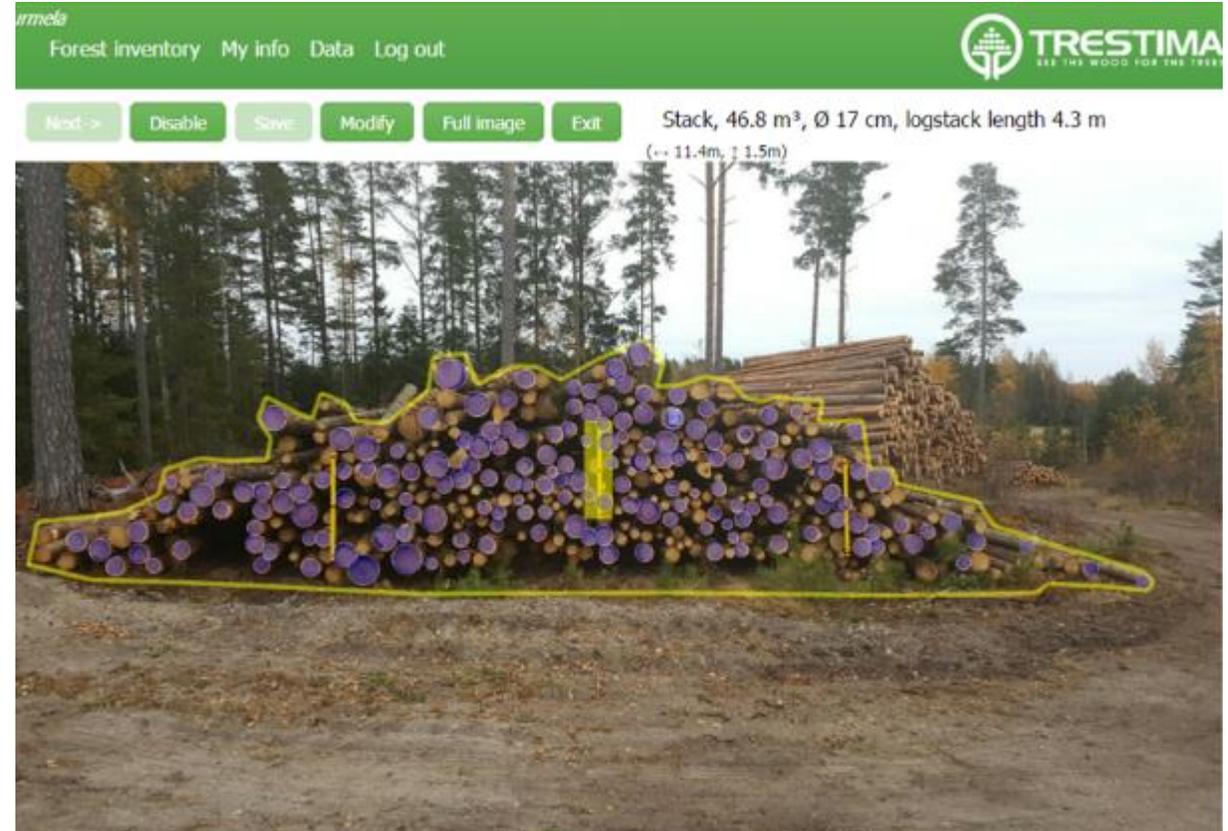
Studied attributes that might affect the accuracy:

Average pile diameter
Coefficient factor
Density of timber
Gross volume
Number of images
Number of piles
Pile size
Snow
Shooting distance
Tree species
Storage
Temperature
Time between measurement and immersion

Gross Volume



- The most common reason for the inaccuracy by the TRESTIMA Stack was **empty space** in the final image framing around the pile.
- Consequently, the TRESTIMA Stack application assessed the **gross volume of pile too high**.



Discussion & Conclusions (1/2)



- **TRESTIMA Stack:**
 - Compared to conventional measurement method, it is **more accurate and faster** system.
 - Measurements in wood terminals and intermediate yards are more accurate than measurements at roadside landings.
 - Determination of average diameter of timber pile is inaccurate.
 - Average diameter of timber pile has statistically significant impact to accuracy.
- **Conventional pile measurement method:**
 - Almost equally accurate in both storage types.
 - Determination of average diameter of timber pile is inaccurate.



Discussion & Conclusions (2/2)



- Although the TRESTIMA Stack is very accurate especially when measuring large quantities in terminal and intermediate yards, the usage of the TRESTIMA Stack between narrow timber yards is not easy.
 - In terminals namely timber stacks are stored normally side by side because of the lack of space.
 - Those timber yards are currently measured by multiplying the first stack with the number of stacks behind it because measuring the middle stacks is impossible.
 - TRESTIMA Stack will not remove challenges of volume evaluation in that kind of timber yards.
- Therefore, the TRESTIMA Stack is recommendable for **inventorying timber piles at roadside landings.**





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Thank you!

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