Roundwood measurements in Latvia and ongoing research on accuracy of different methods

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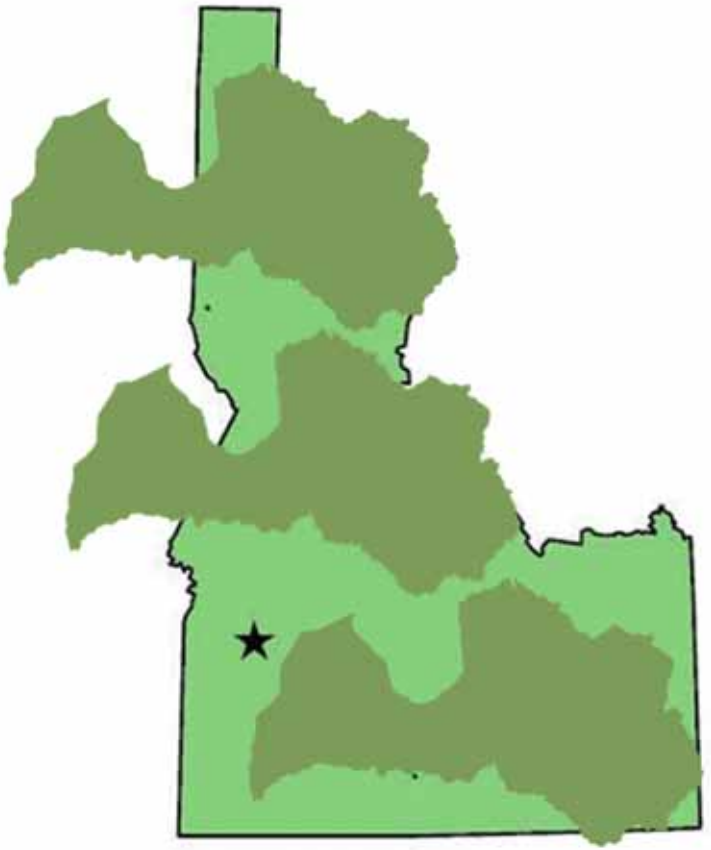
Overview

- General information about forests in Latvia
- Roundwood measurement in Latvia
  - System
  - Parameter measurements
  - Calculation methods
- Accuracy of different sawlog measurement methods
- Conclusions



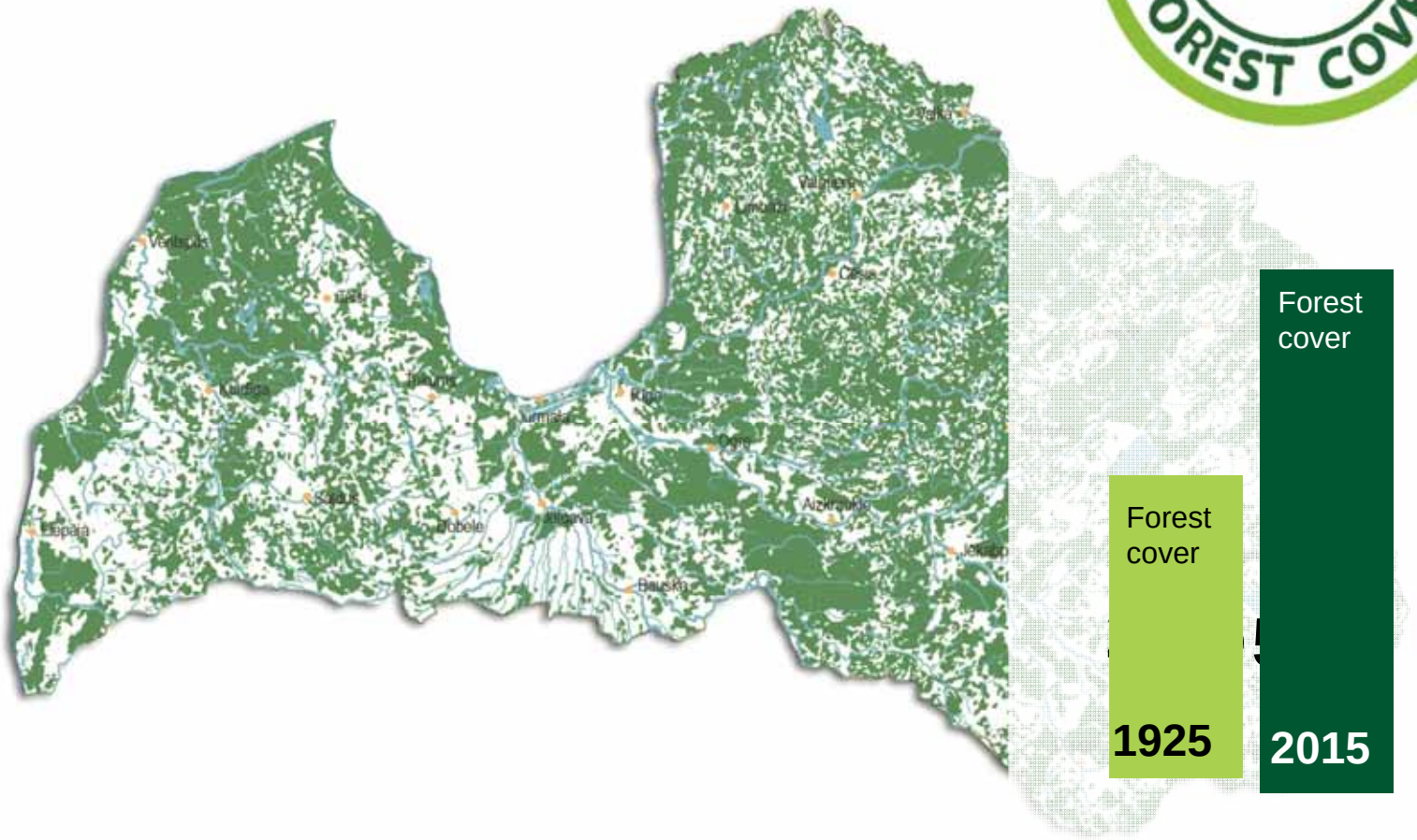
Idaho = 3.3 Latvia's

Area: **64 589 km²**
(152x less than US)
Population: **2 million**


Forests in Latvia

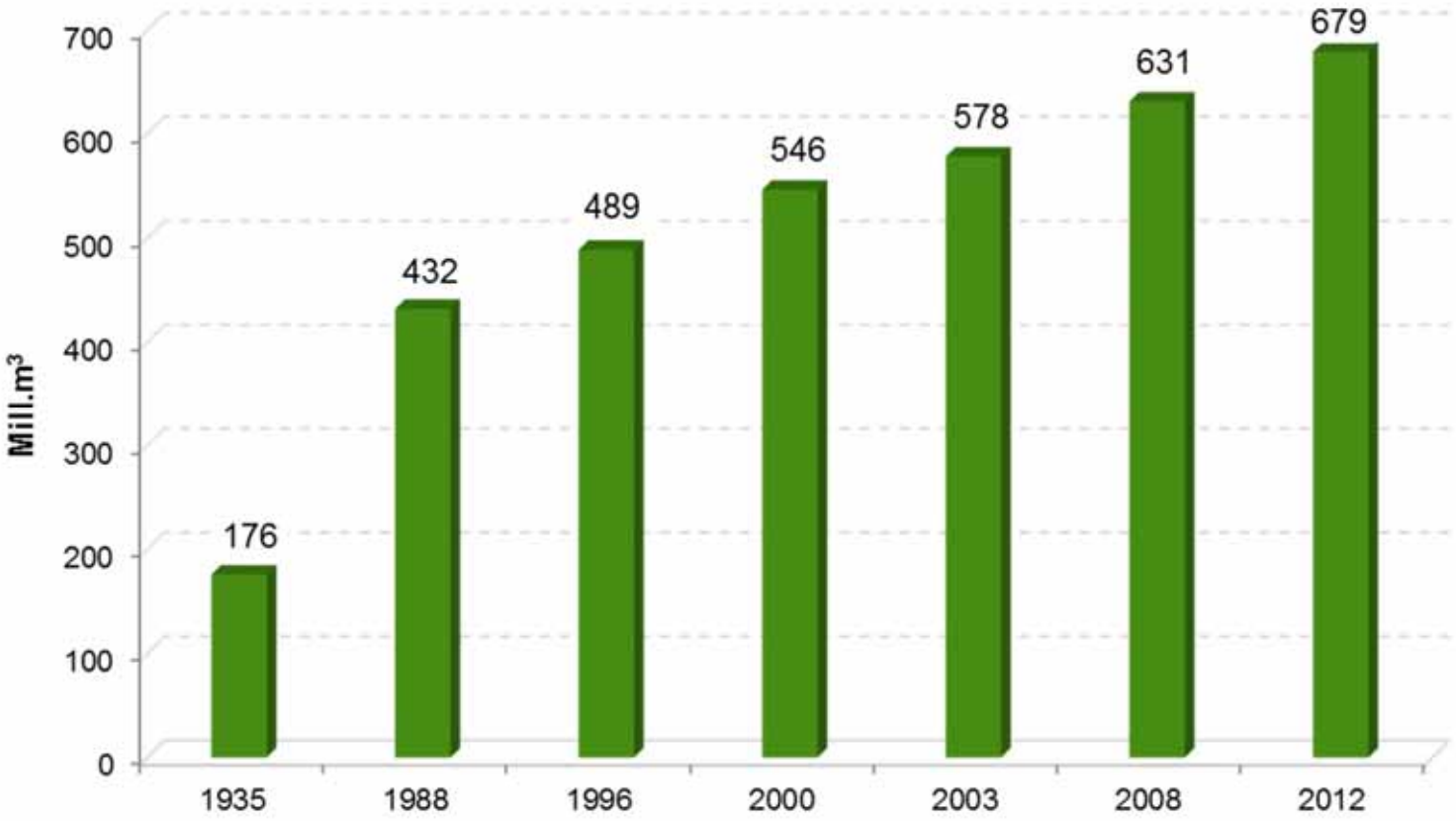
Forests in Latvia 2015

With 3.8 million ha of forests
Latvia is among the most forested countries in Europe



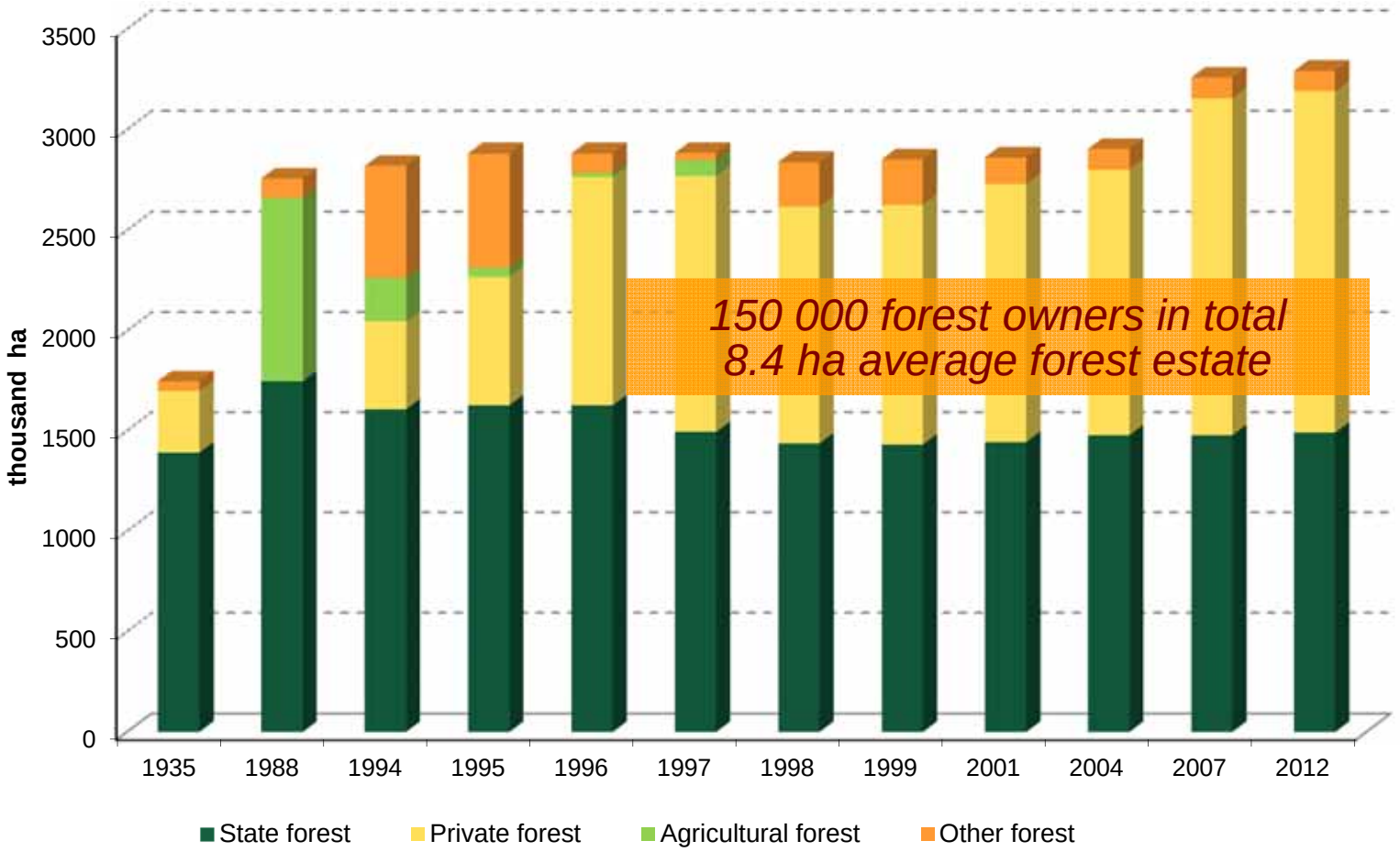
Source: Latvian State Forest Research Institute "Silava", Forest Statistical Inventory

Total Growing Stock in Latvia



Source: Ministry of Agriculture. 2012 year from Latvian State Forest Research Institute "Silava"

Forest Ownership Structure



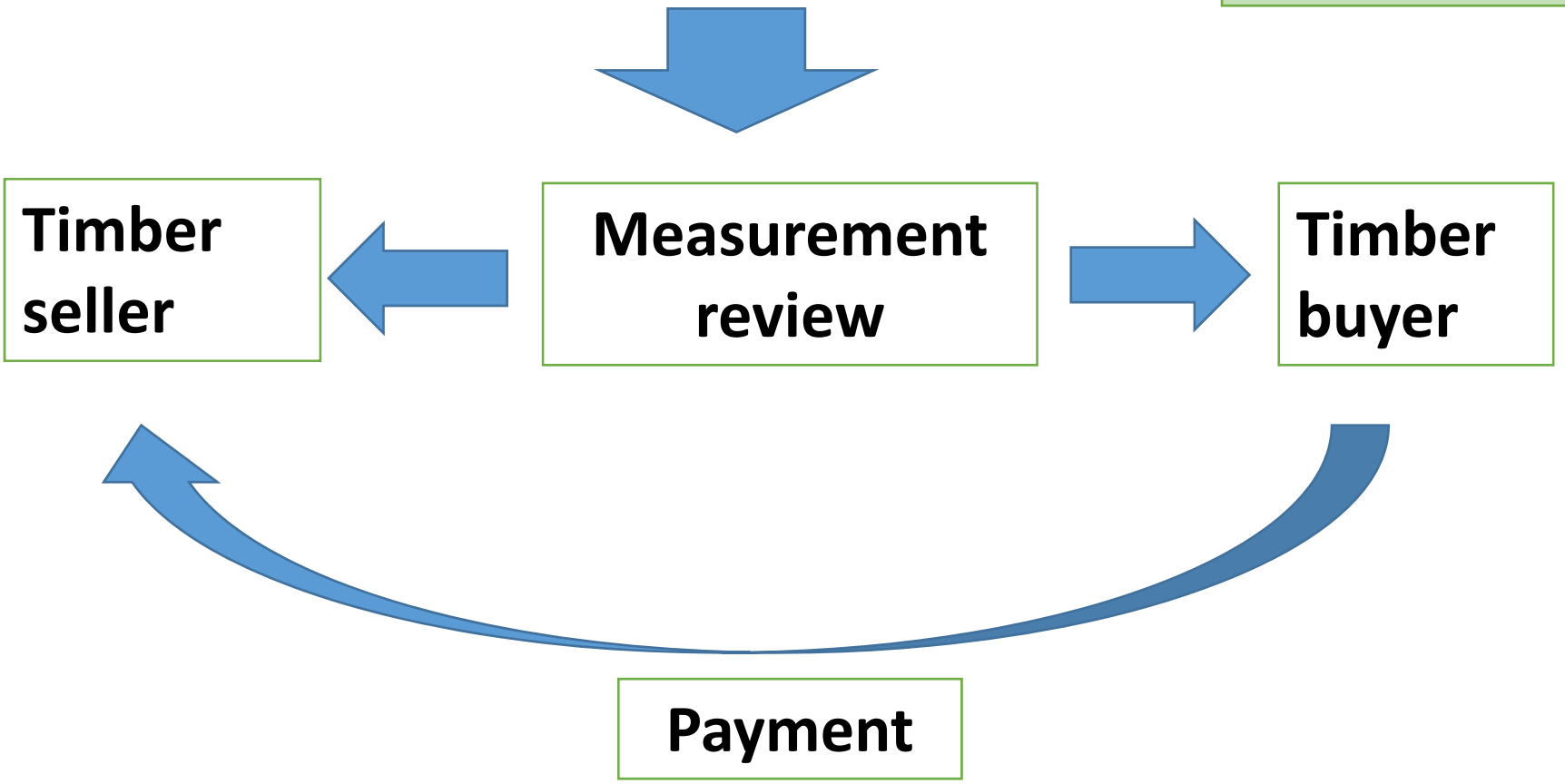
Source: Ministry of Agriculture

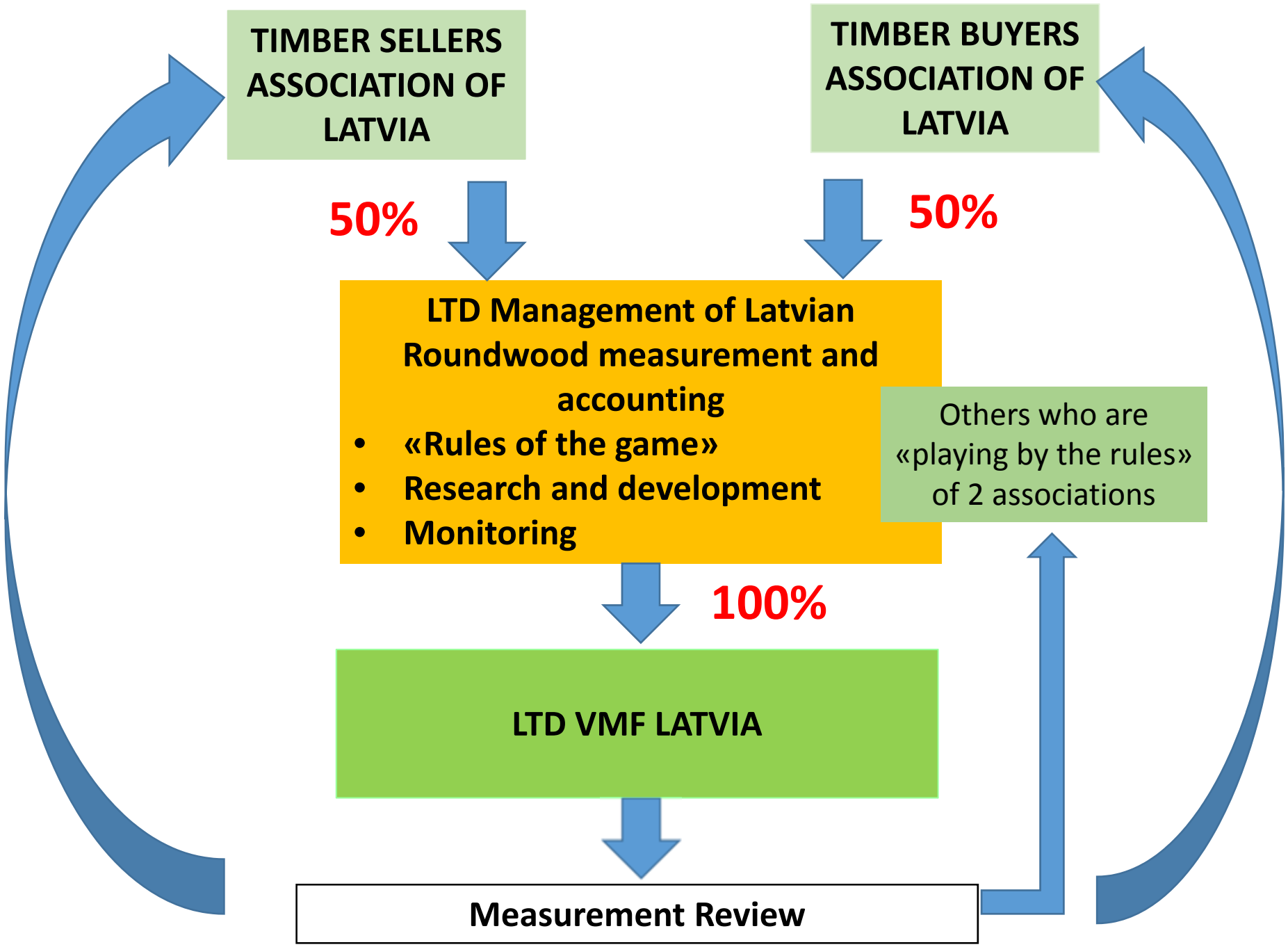
Market situation

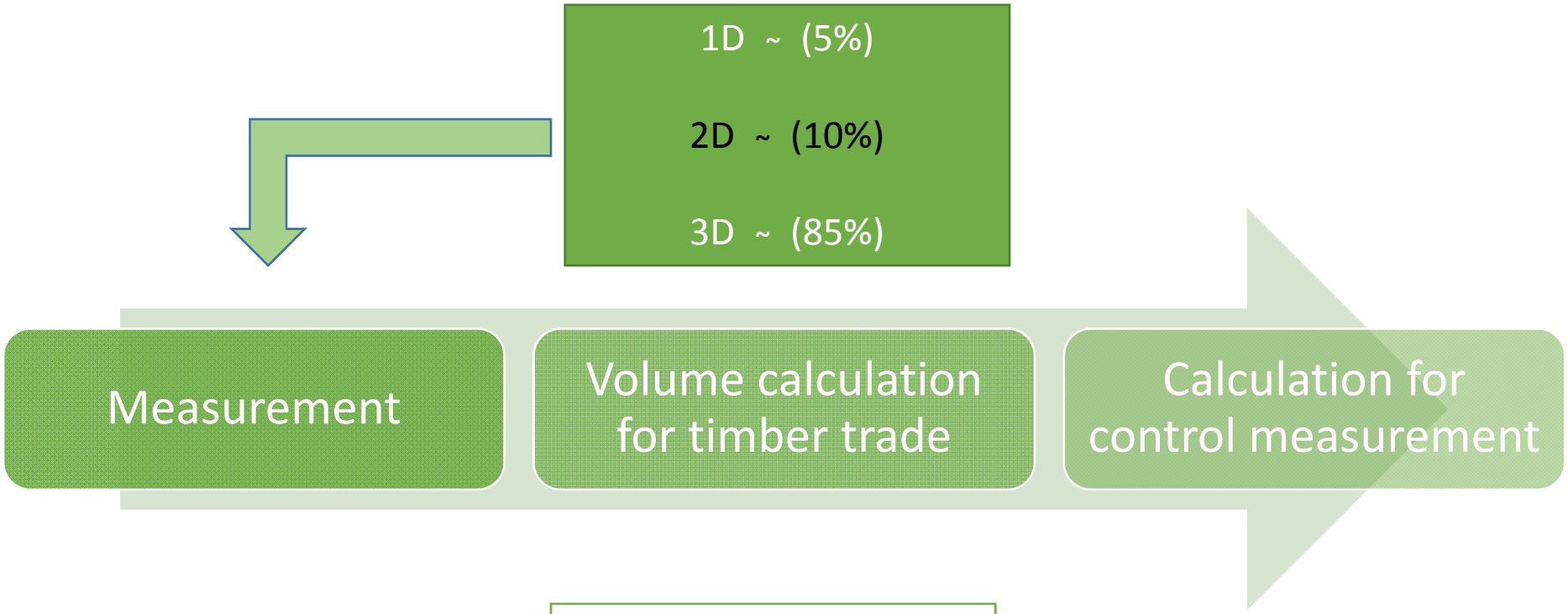
- Market orientation
- Legislation
  - Law
  - Regulations of Cabinet of Ministers
  - Measurement standards

- Total cut in 2015 11,8 milj m3
- VMF LATVIA measured 9,2 milj. m3
  - Sawlogs 5,4
  - Pulpwood 2,2
  - Firewood 1,6

Approximately 70% of all measurements are controlled by VMF LATVIA




TIMBER SELLERS ASSOCIATION OF LATVIA
TIMBER BUYERS ASSOCIATION OF LATVIA
50%
50%
LTD Management of Latvian Roundwood measurement and accounting
• «Rules of the game»
• Research and development
• Monitoring
Others who are «playing by the rules» of 2 associations
100%
LTD VMF LATVIA
Measurement Review


1D ~ (5%)
2D ~ (10%)
3D ~ (85%)
Measurement
Volume calculation for timber trade
Calculation for control measurement
• Dimameter
• Lenghts
• Rounding
• By mid diameter Huber's formula
• By top diameter + taper
• Step by step measurement
• Small end + large end at 5-15 cm from end plane - Smalian's formula
Regulated by measurement standard
Allowed by measurement standard
Regulated by measurement standard

EIROPAS REĢIONĀLĀS ATTĪSTĪBAS FONDS
MNKC Meža nozares kompetences centrs
VMF LATVIA
EIROPAS SAVIENĪBA
Timber sellers association of Latvia and timber buyers association of Latvia

Research on accuracy of individual roundwood measurements by calliper

The aim of the project:

1. To get science-based roundwood volume determination influencing factors for Latvian conditions, when conducting measurements with individual method;
2. Based on the results of the study, put forward proposals that potentially would increase the accuracy of roundwood volume determination;
3. Identify techniques that can be used to carry out the control measurements.

To what compare the volume?

$1m^3 \neq 1m^3$

«Reference»

Terastrial laser scaner-Trimble FX 3D

1. All methods compared to laser scaner

With bark
Without rounding length and diameter

- Section type with step 0,5m;
- Section type with step 1m;
- Large end + midlle + small end;
- Large end + small end Smalian's (measurements done 5-15 cm from end plane in smalest place)
- Large end + small end Swedish algorithm (measurements done 5-15 cm from end plane in smalest place)

$$V_{tr}=\frac{1}{100000}\times\frac{\pi}{4}\times l[\alpha\, d_r^2+(1-\alpha)d_t^2]$$

Methods which could be used in control measurements

- Mid diameter (Huber's formula);
- Top diameter + taper (Values from JSC LVM);
- Top diameter + taper (Values from LUA FF);

Methods used in timber trade

2. All methods compared to section type with step 0,5 m

Without bark
Diameter rounded down to full cm + compensation of 0,5 cm
Length rounded down to full decimeters

- Section type with step 1m;
- Large end + midlle + small end;
- Large end + small end Smalian's (measurements done 5-15 cm from end plane in smalest place)
- Large end + small end Swedish algorithm (measurements done 5-15 cm from end plane in smalest place)

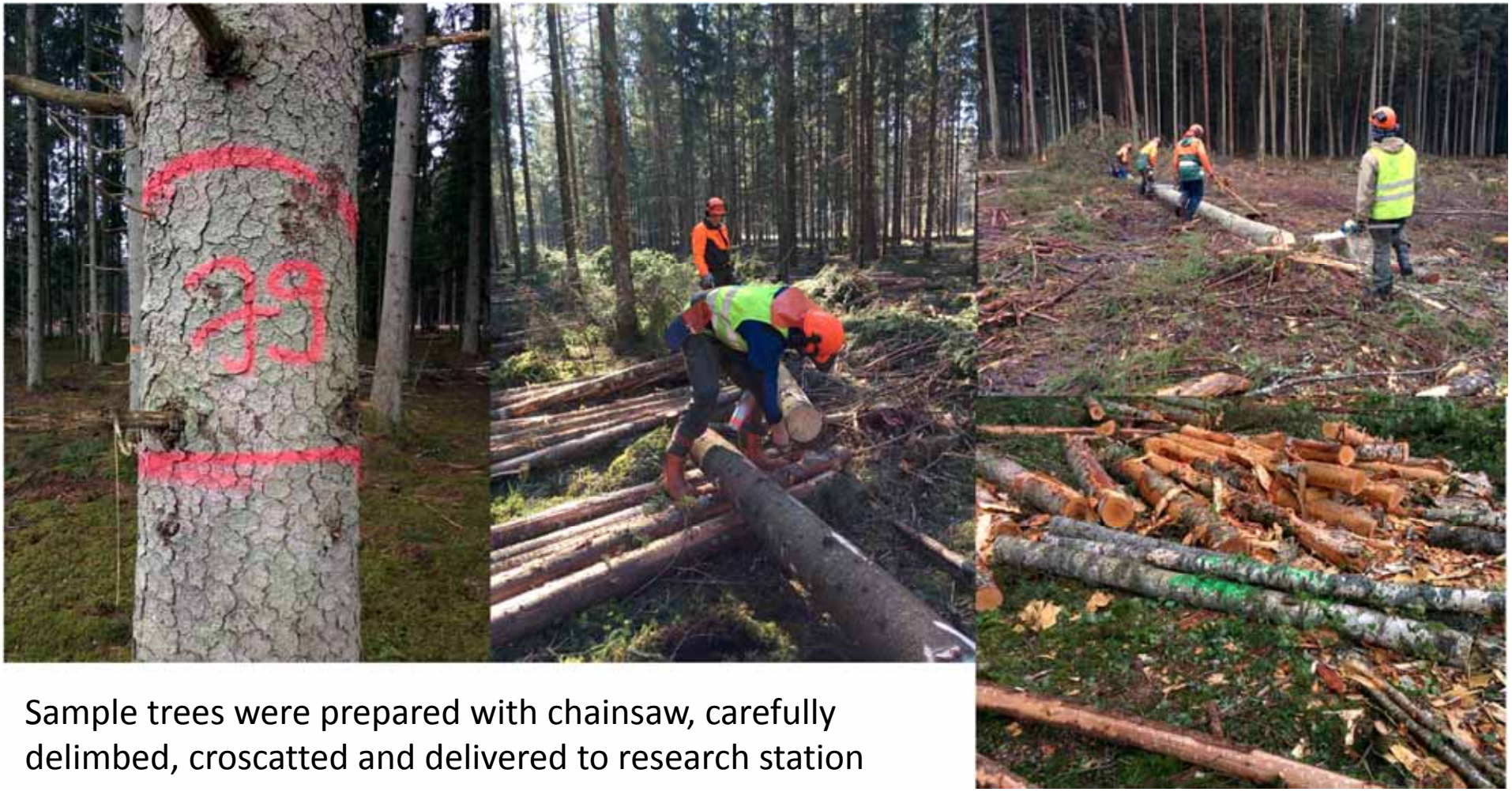
$$V_{tr}=\frac{1}{100000}\times\frac{\pi}{4}\times l[\alpha\, d_r^2+(1-\alpha)d_t^2]$$

Methods which could be used in control measurements

- Mid diameter (Huber's formula);
- Top diameter + taper (Values from JSC LVM);
- Top diameter + taper (Values from LUA FF);
- Top diameter + taper (Lithuanian volume tables)

Methods used in timber trade

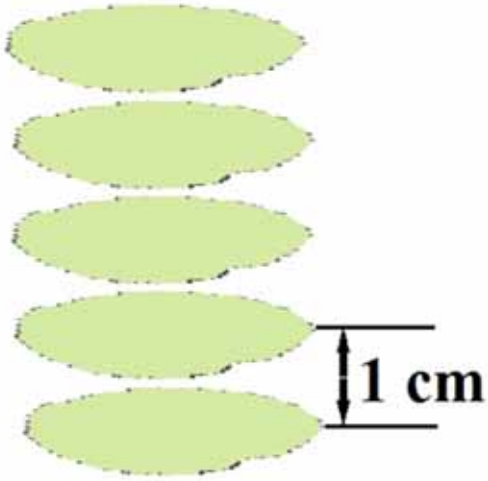
Methodology (1)



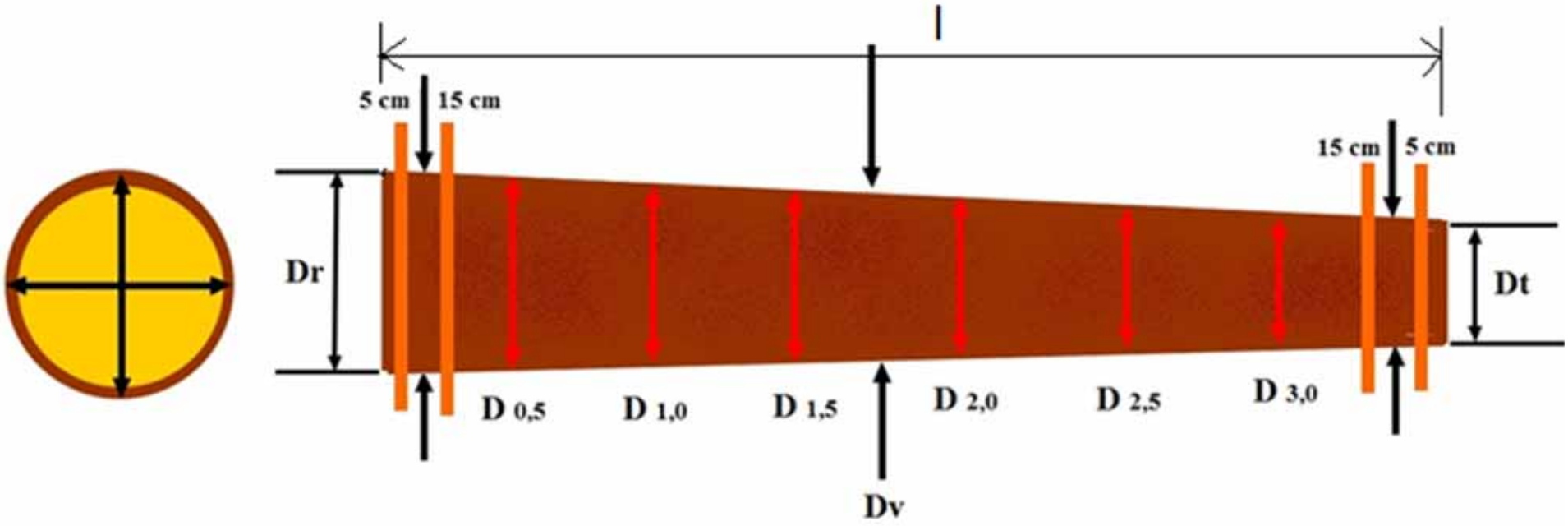
Sample trees were prepared with chainsaw, carefully delimbed, croscatted and delivered to research station

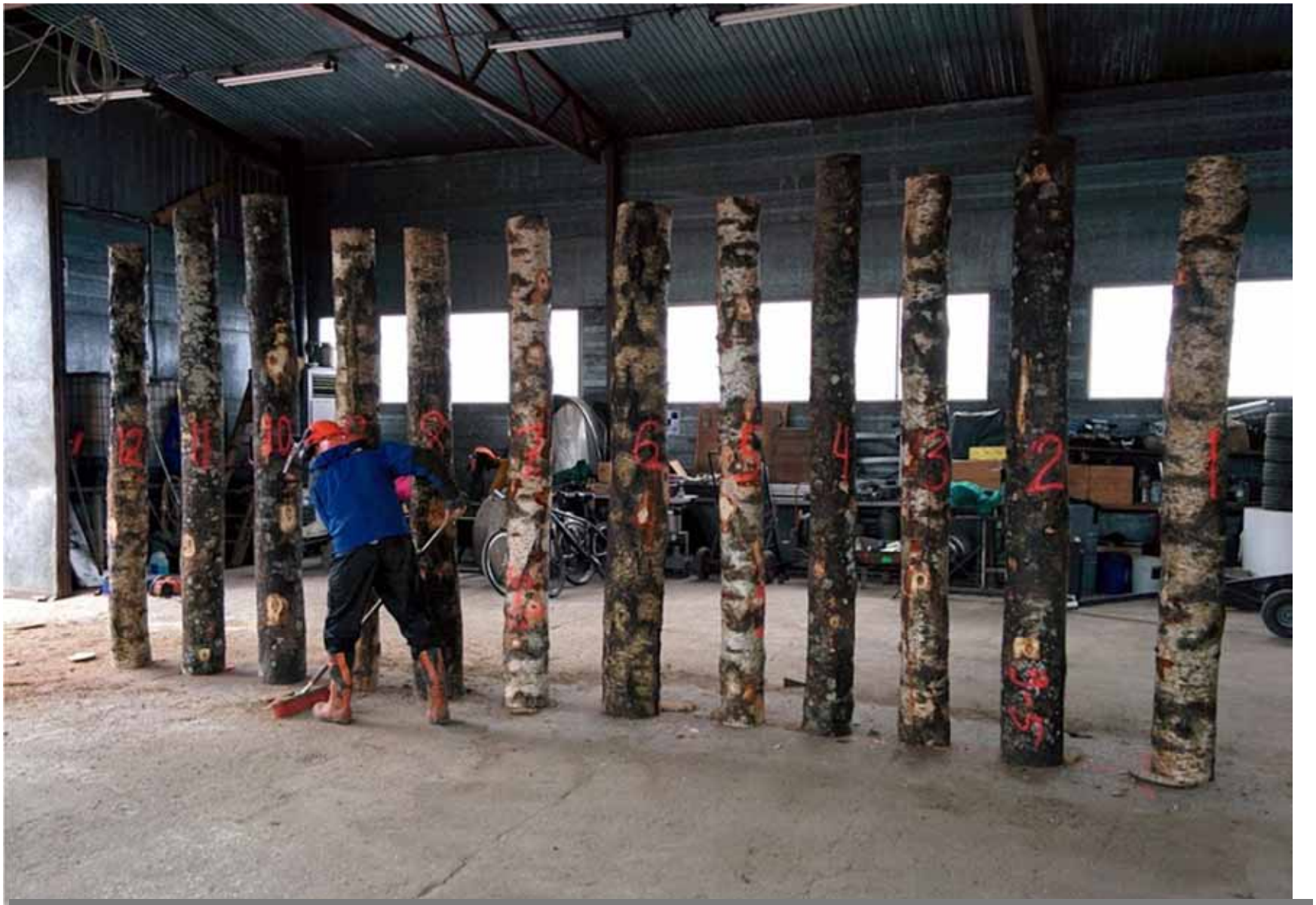
Methodology (2)

Every log was scanned from 4 sides and 3D image was created



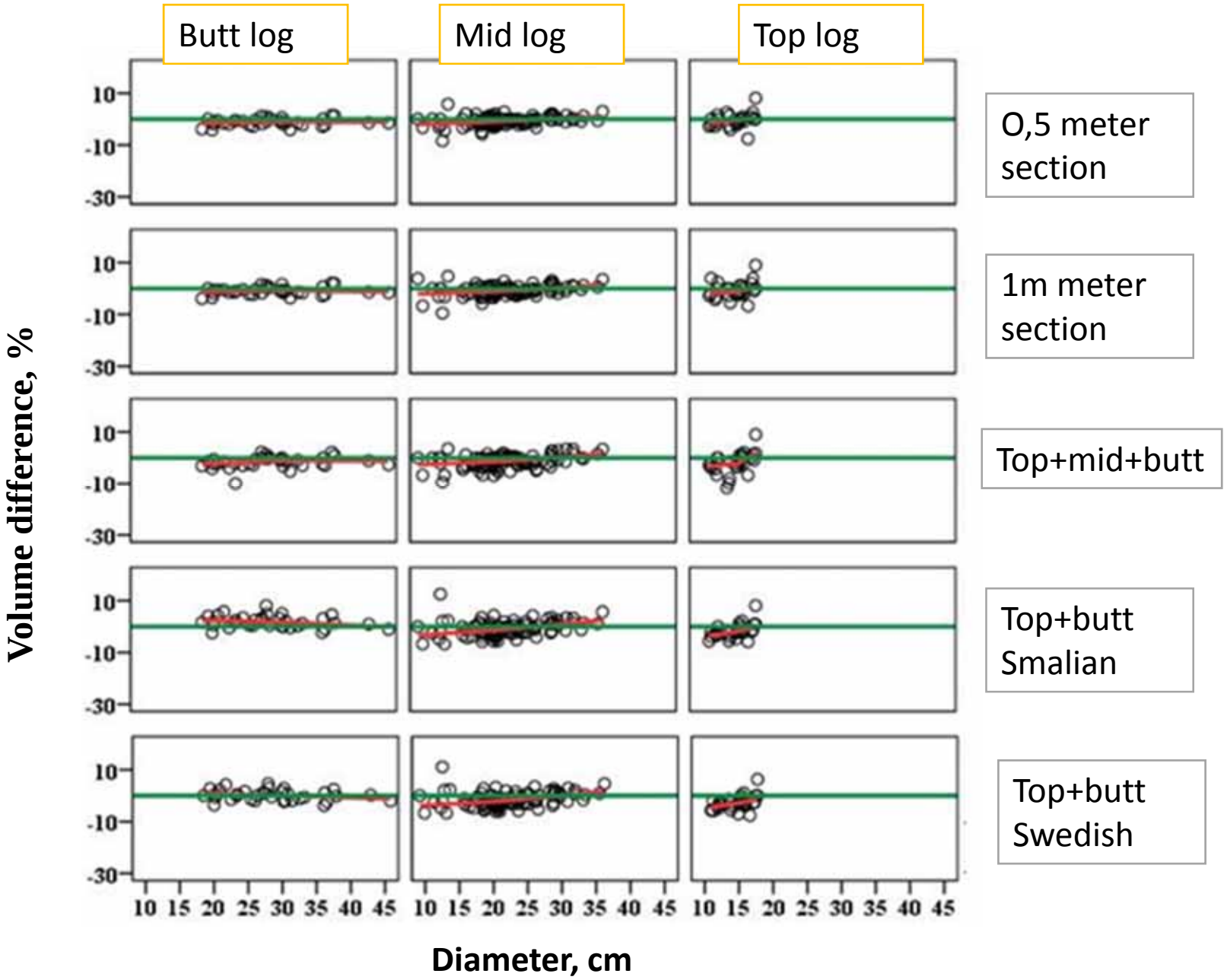
1300 Logs were measured on bark and under bark



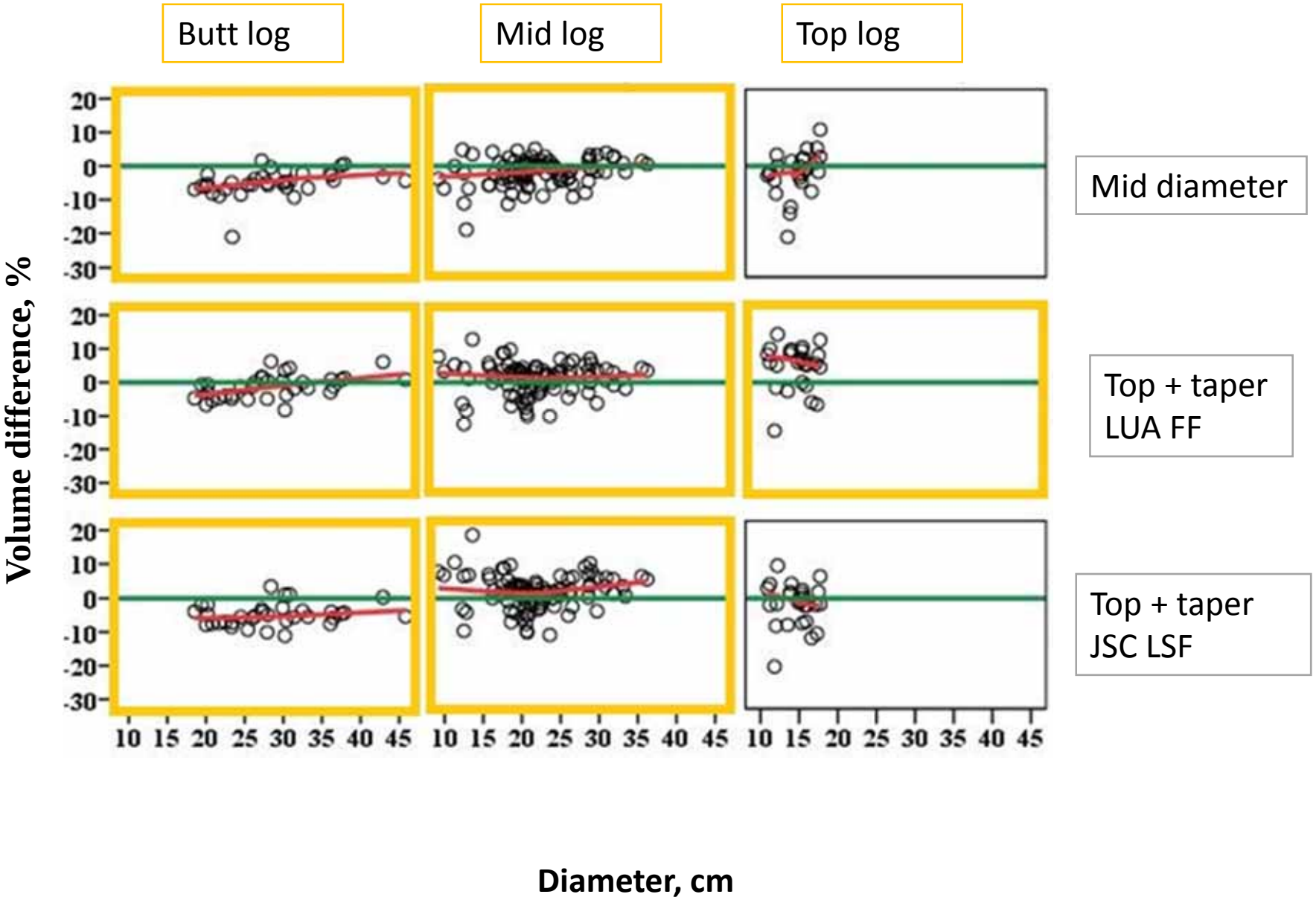


What we actually found?!

1. Control measurement methods for pine comparing to laser scaner



2. Methods used in timber trade for pine comparing to laser scaner



3. Values that fit in particular deviation

Measurement purpose	Measurement method	Pine					
		Interval	Līdz 1 %	1,1 - 2 %	2,1 - 3 %	3,1 - 4 %	Virs 4 %
Control measurement methods	0,5 m section	Butt log	26	28	15	11	20
		Mid log	42	32	13	8	6
		Top log	41	26	22	0	11
	1 m section	Butt log	27	27	14	17	15
		Mid log	37	30	18	9	6
		Top log	22	19	33	11	15
	Butt+mid+top	Butt log	25	10	30	7	28
		Mid log	34	23	16	14	13
		Top log	19	33	11	11	26
	Butt+top Smalians	Butt log	28	20	14	10	28
		Mid log	28	22	18	14	17
		Top log	15	30	22	11	22
	But+top Swedish	Butt log	28	26	25	6	15
		Mid log	20	20	25	14	21
		Top log	11	15	22	19	33
Methods used for timber trade	Mid Huberts	Butt log	4	4	6	6	80
		Mid log	20	27	15	14	24
		Top log	15	19	22	7	37
	Top + taper LUA FF	Butt log	21	14	6	9	51
		Mid log	14	17	16	15	39
		Top log	7	4	4	0	85
	Top + taper JSC LSF	Butt log	10	9	11	12	58
		Mid log	11	12	17	13	46
		Top log	7	37	15	4	37
					Highest amount		

4. Statistical comparison for pine - scanner vs section 0,5m as reference

Measurement method	Average volume relation,%	Anount of logs	Standard Deviation	Random error, %
Pine volume compared to laser scanner				
Section type 0,5 m	99	289	2,4	0,3
Section type 1 m	99	289	2,5	0,3
Butt+mid+top	98,8	289	3,4	0,4
Butt+top (Smalians)	100,9	289	5	0,6
Butt+top (Swedish)	99,3	289	4,4	0,5
Mid (Huberts)	96,9	289	5,3	0,6
Top + taper LUA FF	100	289	6,3	0,7
Top + taper JSC LST	99,9	289	6,1	0,7
Pine volume compared to section of 0,5 meters				
Section type 1 m	100,1	289	1,4	0,2
Butt+mid+top	99,8	289	3,1	0,4
Butt+top (Smalians)	101,2	289	4,4	0,5
Butt+top (Swedish)	99,9	289	4,1	0,5
Mid (Huberts)	98,7	289	5,2	0,6
Top + taper LUA FF	103,7	289	6,3	0,7
Top + taper JSC LST	103,9	289	6,1	0,7
Top + taper Lithuanian vol. t.	107,1	289	7,1	0,8

Highest precision for control methods are 0,5 and 1m section in timber trade mid diameter

5. Statistical comparison for spruce - scanner vs section 0,5m as reference

Measurement method	Average volume relation,%	Anount of logs	Std	Random error, %
Spruce volume compared to laser scaner				
Section type 0,5 m	99,1	125	2,5	0,4
Section type 1 m	98,9	125	2,4	0,4
Butt+mid+top	98,7	125	2,5	0,4
Butt+top (Smalians)	100,7	125	3,3	0,6
Butt+top (Swedish)	99,1	125	2,9	0,5
Mid (Huberts)	97	125	4,5	0,8
Top + taper LUA FF	99,9	125	6,5	1,1
Top + taper JSC LST	99,7	125	7,3	1,3
Spruce volume compared to section of 0,5 meters				
Section type 1 m	99,8	125	1,3	0,2
Butt+mid+top	99,7	125	2,1	0,4
Butt+top (Smalians)	101,9	125	3,9	0,7
Butt+top (Swedish)	100,3	125	3,7	0,6
Mid (Huberts)	97,7	125	4,3	0,8
Top + taper LUA FF	101,2	125	7,1	1,2
Top + taper JSC LST	101,5	125	7,8	1,4
Top + taper Lithuanian vol. t.	103,4	125	7	1,2

Rounding influence on actual volume, m3

Volume without rounding, m3	Volume after length and diameter rounding (diameter compensation 0,5cm) by comparison of different measurement methods, m3							
	Top + taper JSC LST	Top + taper LUA FF	Mid (Huberts)	Butt+top Swedish	Butt+top Smalians	Butt+mid+top	Section type 1m	Section type 0,5m
0,100	0,100	0,100	0,099	0,100	0,100	0,099	0,099	0,099
0,200	0,198	0,198	0,199	0,199	0,199	0,199	0,199	0,199
0,300	0,297	0,297	0,299	0,298	0,298	0,298	0,299	0,299
0,400	0,395	0,395	0,398	0,397	0,397	0,398	0,398	0,399
0,500	0,494	0,494	0,498	0,496	0,496	0,497	0,498	0,499
0,600	0,592	0,592	0,598	0,595	0,595	0,597	0,598	0,599
0,700	0,691	0,691	0,698	0,694	0,694	0,696	0,698	0,699
0,800	0,789	0,789	0,798	0,793	0,793	0,796	0,797	0,799

Volume reduction 0% until -1,4%, but average reduction 1,2%

Volume reduction -0,2% until -1 %, but average reduction 0,4%

Most precise average reduction 0,2%

Conclusions

1. If comparing individual measurement methods for conifer tree species as a reference method - section type method with step – 1m can be used(precision close to 0,5 section, but less money and time consumed).

2. If comparing methods used in timber trade, volume calculated by middle diamaters and Hubert's formula is the most precises, but it gives sistematic negative average error, which should be considered if this method is used.

Thank You for attention!
Questions? Suggestions? Comments?