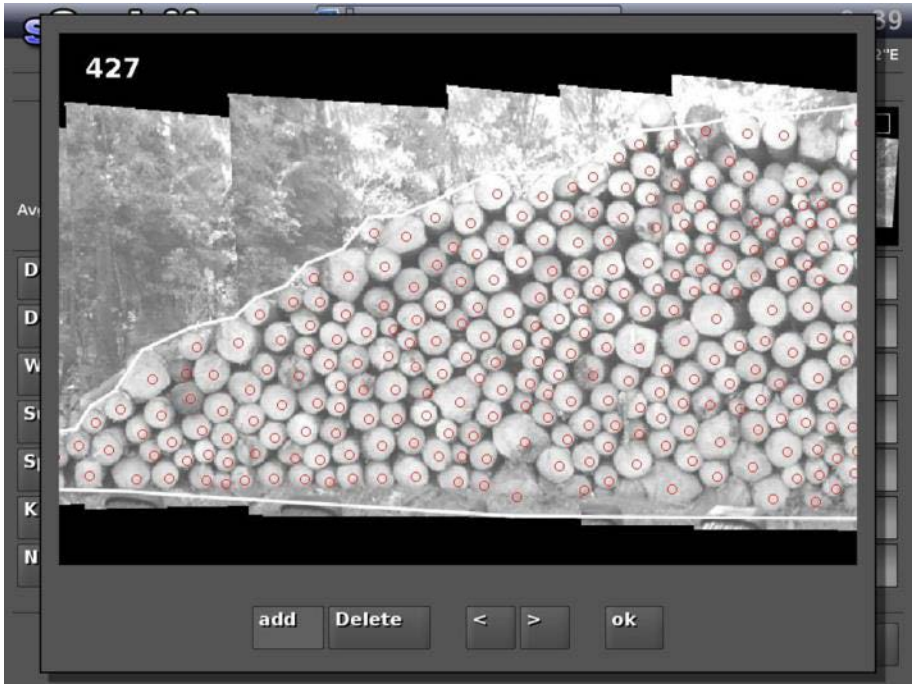
Państwowe Gospodarstwo Leśne
Lasy Państwowe

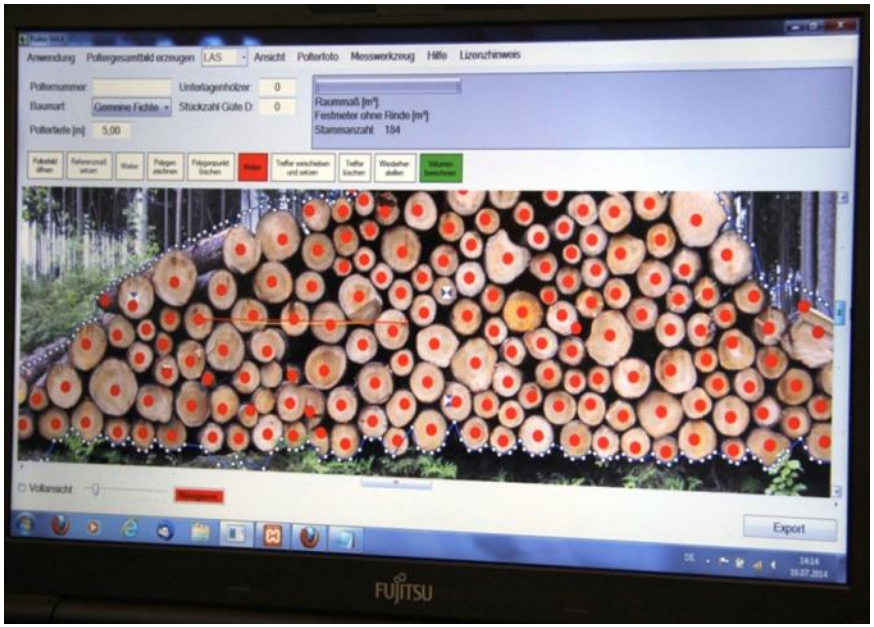
The use of photo-optical systems for measurement of stacked wood

Wojciech Sarzyński
Tadeusz Moskalik
Krzysztof Jodłowski
Robert Tomusiak

FORMEC, Warsaw, 7 September 2016 r.

There is no escape from progress and innovative, modern modern technology. Standing in the same place in practice means regression.





Electronic wood measuring systems are expanding and will lead to the optimization of the registration process of wood by field forester

Companies are seeking for legalization of their systems

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
Nationales Metrologieinstitut

Konformitätsbescheinigung
Certificate of conformity

Die Übereinstimmung des Messgerätes
The conformity of the measuring instrument:

Hersteller: *Issued to:*	Dralle A/S Cognitive systems Venlighedsvej 4 2970 Hoersholm DÄNEMARK
Geräteart: *Type of instrument:*	Foto-optisches Messgerät zur Holzvermessung *Photo-optical measuring instrument for log measurements*
Identitätskennung: *Identification:*	sScale 3.4 SN 63033

mit den Anforderungen der Mess- und Eichverordnung wurde im Rahmen eines Konformitätsbewertungsverfahrens nach Anlage 4, Teil B Modul G festgestellt.
with the requirements of the Measures and Verification Ordinance was established in a conformity assessment procedure according to appendix 4, Part B Module G.

Ort und Datum der Überprüfung: *Place and date of verification.:*	Braunschweig, 09.12.2015
Nr. der Bescheinigung: *Certificate No.:*	KB-15-M-PTB0003
Zertifizierungsdokumentensatz: *Set of Certication Documents.:*	ZDS-KB-15-M-PTB0003
Geschäftszeichen: *Reference No.:*	PTB-5.45-4077044
Nr. der Stelle: *Body No.:*	0102

Zertifizierung: *Certification:* Braunschweig, 15.12.2015
Im Auftrag *On behalf of PTB*
Ingo Lohse

Siegel *Seal*

Bewertung: *Evaluation:*
Im Auftrag *On behalf of PTB*
Heike Wippich

Physikalisch-Technische Bundesanstalt
Konformitätsbewertungsstelle *(Conformity Assessment Body)*
Bundesallee 100
38116 Braunschweig
DEUTSCHLAND / GERMANY

Abbestraße 2-12
10587 Berlin
DEUTSCHLAND / GERMANY

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
Nationales Metrologieinstitut

Zertifizierungsdokumentensatz
Set of Certification Documents (ZDS)

Nr.: *No.:*	ZDS-KB-15-M-PTB0003
Ausgestellt für: *Issued to:*	Dralle A/S Cognitive systems Venlighedsvej 4 2970 Hoersholm DÄNEMARK
Geräteart: *Type of instrument:*	Foto-optisches Messgerät zur Holzvermessung *Photo-optical measuring instrument for log measurements*
Typbezeichnung: *Type designation:*	sScale 3.4 SN 63033
Anzahl der Seiten: *Number of pages:*	3
Bewerter: *Evaluator:*	Braunschweig, 15.12.2015

Im Auftrag *On behalf of PTB*
Heike Wippich

Siegel *Seal*

Physikalisch-Technische Bundesanstalt
Konformitätsbewertungsstelle *(Conformity Assessment Body)*
Bundesallee 100
38116 Braunschweig
DEUTSCHLAND

Abbestraße 2-12
10587 Berlin
DEUTSCHLAND

In Europe the amount of wood measured with those systems doubles year by year

Three optical systems were tested in Poland from the beginning of April to the end of June 2015.

FOVEA

Log stack No.: 17715 2

Measure date	20.04.2015	Coordinates	53° 6' 54.002" N, 16° 51' 8.076" E
Gager	test25		53.148334, 16.852244
	test25@fovea.eu	Forest side	Kaczory, -, -
Tree Species	PI	Note	-
Fineness	C		

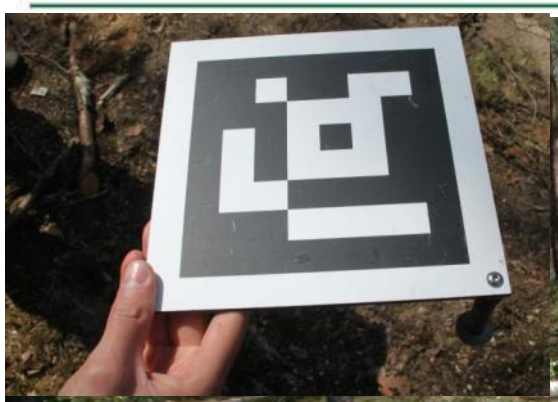
CBM gross	29.92 m³
CBM net	28.78 m³ (Fac. 0.962)
Solid CBM FOVEA	20.94 m³ incl. underl. (Fac. 0.700)
Solid CBM HKS	17.95 m³ excl. underl. (Fac. 0.600)
Count (+Underlay)	119 (+8)
Trunk length	3.60 m
Log stack width	6.47 m
Solid CBM underlays	1.29 m³
Average height front	-
Front surface area	-
Average height back	-
Back surface area	-

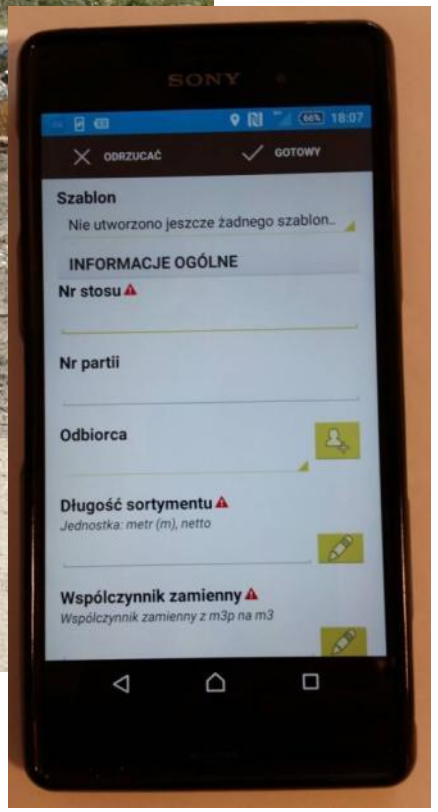
Number per strength classes		Solid m³ per strength classes
2	1a	0.11
18	1b	1.74
60	2a	8.57
51	2b	6.57
8	3a	2.26
0	3b	0.00
0	4a	0.00
0	4b	0.00
0	5	0.00
0	6	0.00

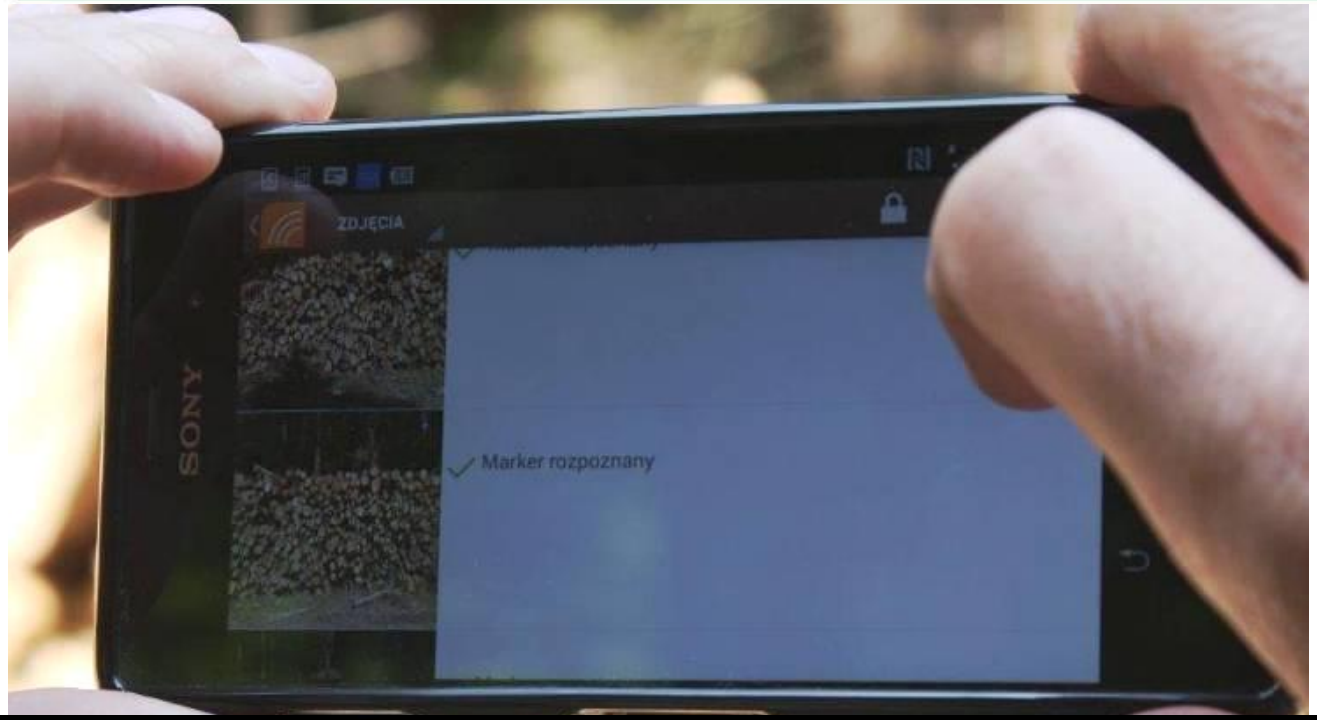
Medium diameter	0.24 cm
Volume per piece	0.16 m³

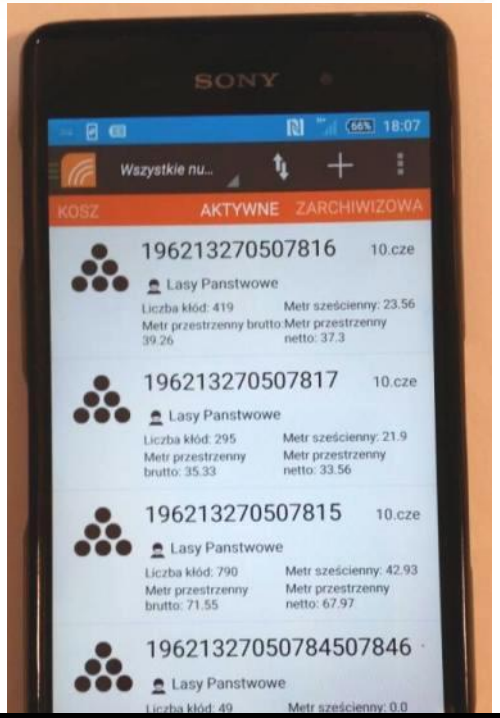
Information: The volume of the underlays is calculated through the number and average diameter and distributed according to the actual strength class distribution.

Felling number	813001771S	Begin	20.04.2015
Forestry office/ district	Kaczory/ Piła	End	20.04.2015
Lumberjack	Skubi	Note	-
Skidder	Skubi		
Plot number	813001771S	Date	20.04.2015
Fineness	C	Note	-
Wood buyer	store	Street	
		City	-

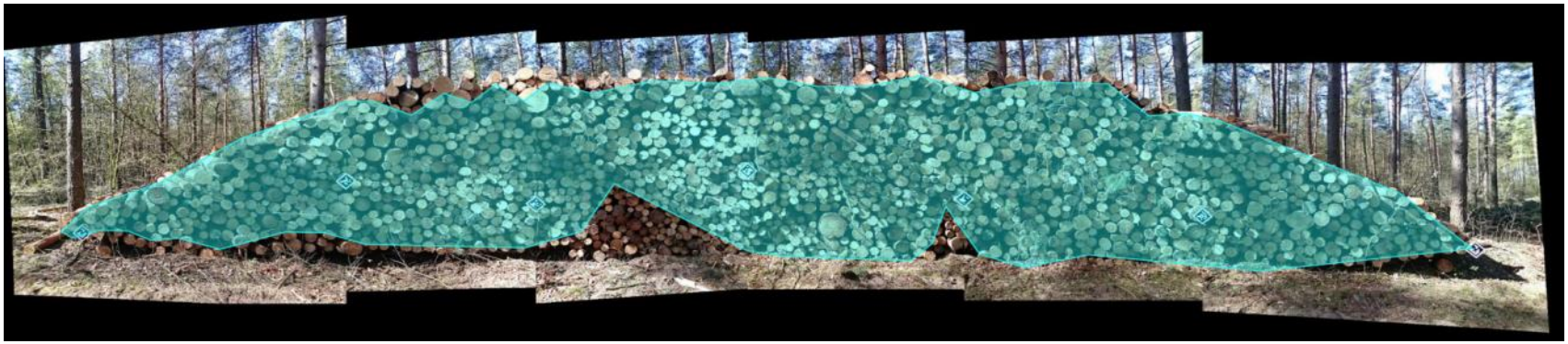



SONY
18:07
ODRZUCAĆ
GOTOWY
Szablon
Nie utworzono jeszcze żadnego szablon..
INFORMACJE OGÓLNE
Nr stosu
Nr partii
Odbiorca
Długość sortymentu
Jednostka: metr (m), netto
Współczynnik zamienny
Współczynnik zamienny z m3p na m3

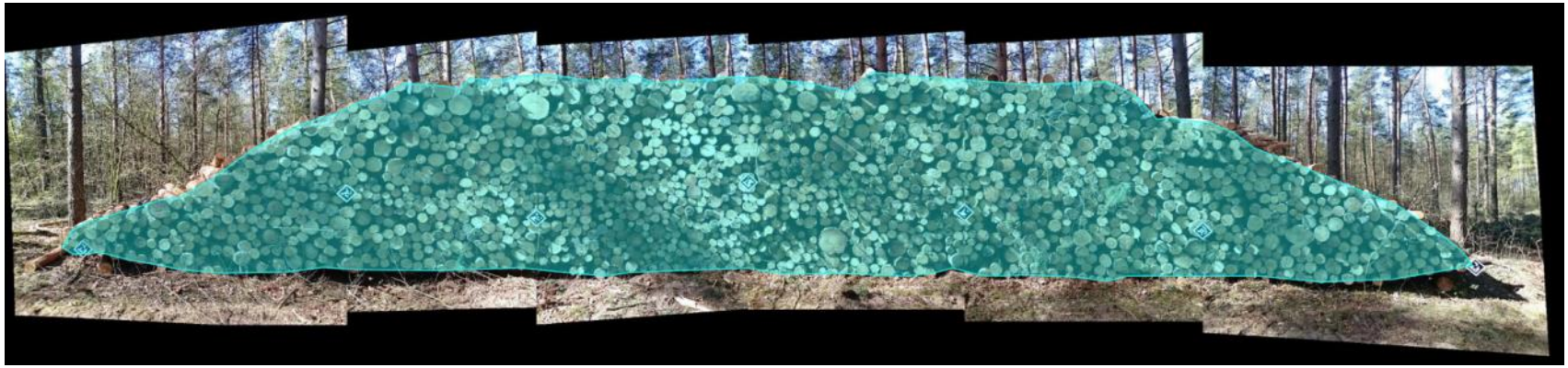

ZDJĘCIA
Marker rozpoznany
SONY


SONY
18:07
Wszystkie nu...
KOSZ
AKTYWNE
ZARCHIWIZOWA
196213270507816
10.cze
Lasy Panstwowe
Liczba kłód: 419
Metr sześcienny: 23.56
Metr przestrzenny brutto: 39.26
Metr przestrzenny netto: 37.3
196213270507817
10.cze
Lasy Panstwowe
Liczba kłód: 295
Metr sześcienny: 21.9
Metr przestrzenny brutto: 35.33
Metr przestrzenny netto: 33.56
196213270507815
10.cze
Lasy Panstwowe
Liczba kłód: 790
Metr sześcienny: 42.93
Metr przestrzenny brutto: 71.55
Metr przestrzenny netto: 67.97
19621327050784507846
Lasy Panstwowe

Antoniewo forest sub-district, pile nr 124



Before correction



After correction

Measurement report

AFoRS
Automatisierter Fotogrammetrischer
Rohholz-Vermessungs-Service

AFORS Report 08020900124

utworzono: 26.4.2015 20:49

Nr k?odowiska:	08020900124		
Data przyjcia:	23.04.15 10:02	Ilo pieni:	1075
Los:		Objto pieni:	
Koordynacje GPS Lat.:	52.6904106140137		
Koordynacje GPS	17.2439937591553		
		Klasy mocy:	
Typ drzewa:	So	L0 Ø 00,00 - 9,00	0 (00,00%)
Asortyment:	SO	L1a Ø 10,00 - 14,00	500 (52,58%)
Dugo asortymentu:	2,4 m	L1b Ø 15,00 - 19,00	326 (34,28%)
Jako:	N	L2a Ø 20,00 - 24,00	84 (08,83%)
Uszkodzenia drewna:	OSB	L2b Ø 25,00 - 29,00	26 (02,73%)
		L3a Ø 30,00 - 34,00	9 (00,95%)
Objto brutto:	112,97 m³	L3b Ø 35,00 - 39,00	4 (00,42%)
Objto netto:	107,32 m³	L4 Ø 40,00 - 49,00	2 (00,21%)
Objto:	70,04 m³	L5 Ø 50,00 - 59,00	0 (00,00%)
		L6 Ø > 60,00	0 (00,00%)
Metr przestrzenny >	0,620		
Odbitka:	5 %	Podkadki:	
Adnotacje:		Podkadki (m³):	

Bazie

Miejsce

Scheller Systemtechnik GmbH
ul. Grójecka 127, 02-124 Warszawa

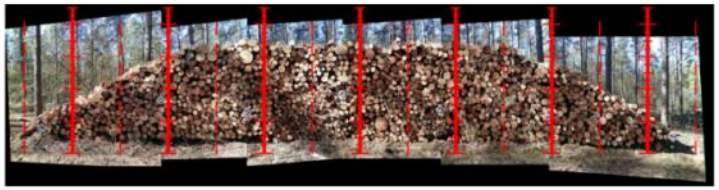
Seite 1 of 2

AFoRS
Automatisierter Fotogrammetrischer
Rohholz-Vermessungs-Service

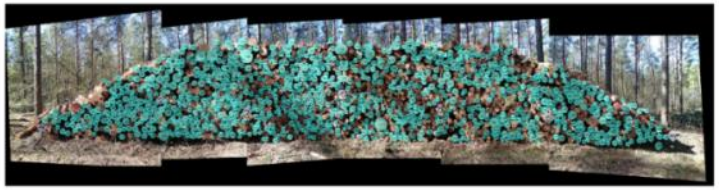
AFORS Report 08020900124

utworzono: 26.4.2015 20:49

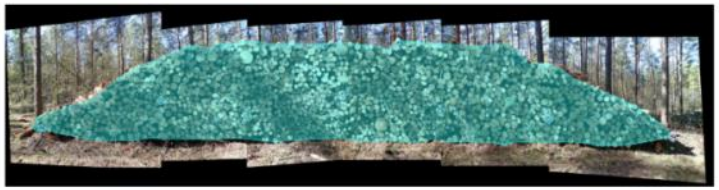
Sekcje:



Rozpoznanie pojedyczego pienia

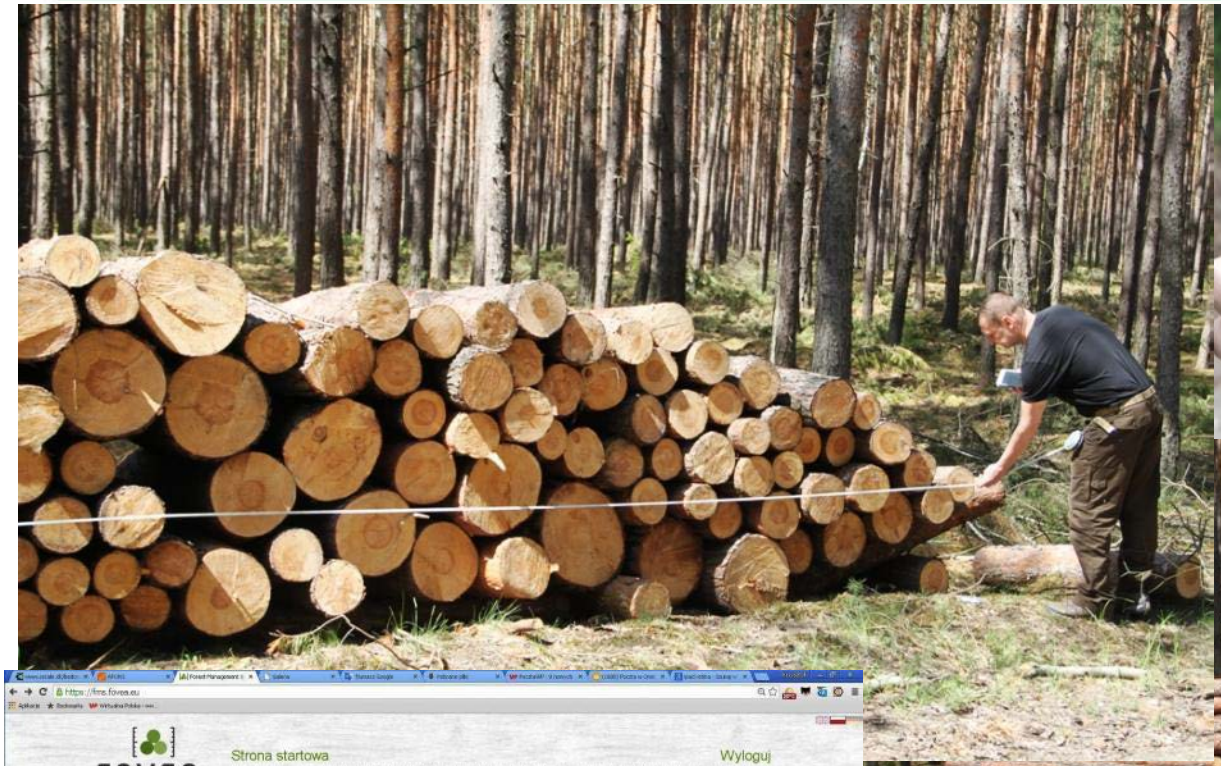


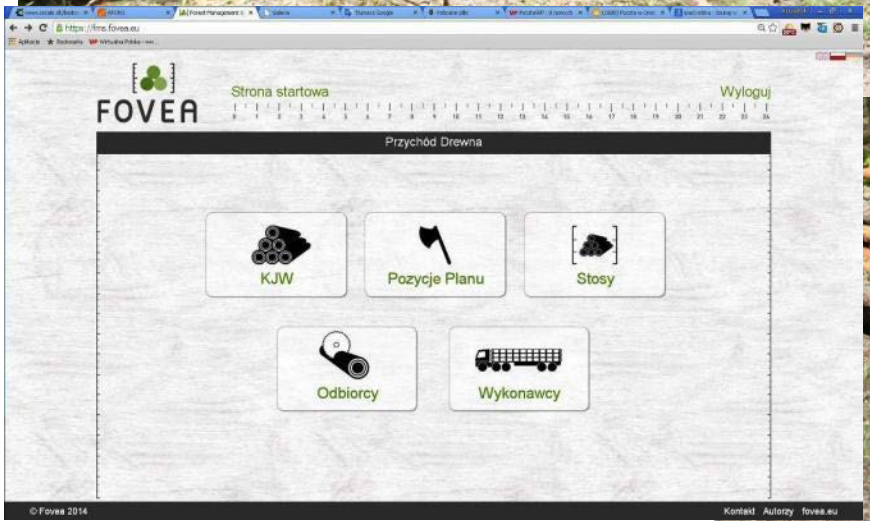
Obwiedni

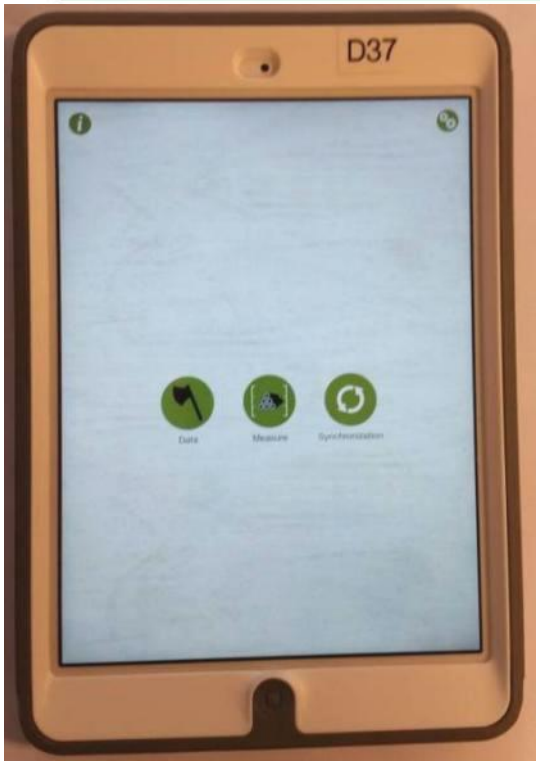


Scheller Systemtechnik GmbH
ul. Grójecka 127, 02-124 Warszawa

Seite 2 of 2

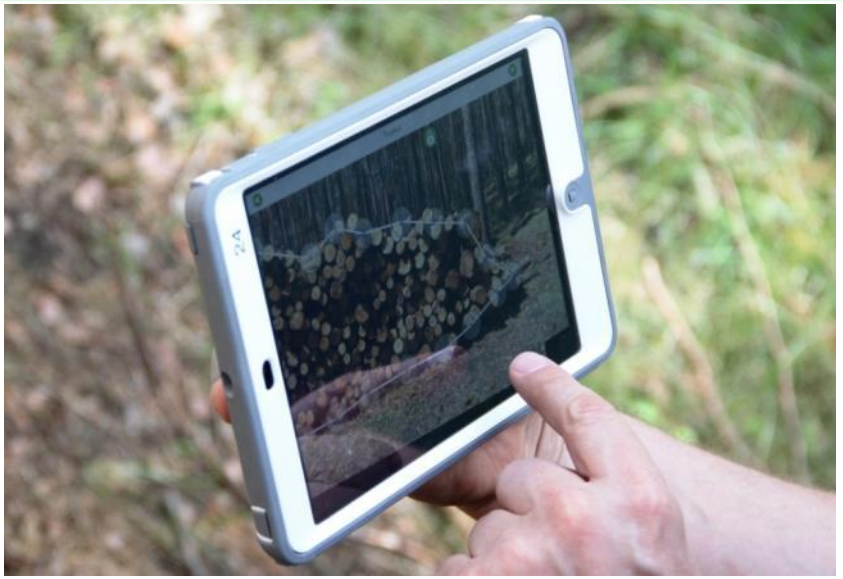



FOVEA
Strona startowa
Wyloguj
Przychód Drewna
KJW
Pozycje Planu
Stosy
Odbiorcy
Wykonawcy
© Fovea 2014
Kontakt Autorzy fovea.eu


D37
Data
Measure
Synchronization

D37
Log Stack 19621408052671
Solid CBM FOVEA w/o bark 27,55 m³ (Ratio 0,687)
Solid CBM HKS w/o bark 24,05 m³ (Fac. 0,600)
Number of trunks 138 (+4)
CBM gross 40,09 m³
CBM net 38,57 m³ (Fac. 0,962)
Department Nowa Sol
Log stack width 7,43 m
Altitude 67,71 m
Latitude 51,812069°
Longitude 15,683955°
Orientation 215,077621°
Date 13.05.2015
Note

D37
Log Stack 19621408052671
Altitude 67,71 m
Latitude 51,812069°
Longitude 15,683955°
Orientation 215,077621°
Date 13.05.2015
Note



24
10130103701
1
Kanwin
Ustronie
9.40 m
27.99 m³
26.93 m³ (Fac. 0.962)

Measurement report – industrial wood

FOVEA

Log stack No.: 08020900124 2

Measure date	23.04.2015	Coordinates	52° 41' 25.001" N, 17° 14' 38.400" E
Gager	test25		52.690278, 17.244000
	test25@fovea.eu	Forest side	Durowo, Antoniewo, -
Tree Species	PI	Note	-
Fineness	IN		
CBM gross	98.32 m³	Average height front	-
CBM net	94.58 m³ (Fac. 0.962)	Front surface area	-
Trunk length	2.40 m	Average height back	-
Log stack width	18.70 m	Back surface area	-
Felling number	8020900124	Begin	23.04.2015
Forestry office/ district	Antoniewo/ Durowo	End	
Lumberjack	Skubi	Note	-
Skidder	Skubi		
Plot number	8020900124	Date	23.04.2015
Fineness	IN	Note	-
Wood buyer	steico	Street	
		City	-

Measurement report – logs

FOVEA

Log stack No.: 17715 2

Measure date	20.04.2015	Coordinates	53° 8' 54.002" N, 16° 51' 8.078" E
Gager	test25		53.148334, 16.852244
	test25@fovea.eu	Forest side	Kaczory, -, -
Tree Species	PI	Note	-
Fineness	C		

CBM gross	29.92 m³
CBM net	28.78 m³ (Fac. 0.962)
Solid CBM FOVEA	20.94 m³ incl. underl. (Fac. 0.700)
Solid CBM HKS	17.95 m³ excl. underl. (Fac. 0.600)
Count (+Underlay)	119 (+8)
Trunk length	3.60 m
Log stack width	8.47 m
Solid CBM underlays	1.29 m³
Average height front	-
Front surface area	-
Average height back	-
Back surface area	-

Number per strength classes		Solid m³ per strength classes
2	1a	0.11
18	1b	1.74
60	2a	8.97
31	2b	6.57
8	3a	2.26
0	3b	0.00
0	4a	0.00
0	4b	0.00
0	5	0.00
0	6	0.00

Medium diameter	0.24 cm
Volume per piece	0.16 m³

Information: The volume of the underlays is calculated through the number and average diameter and distributed according to the actual strength class distribution.

Felling number	8130617715	Begin	20.04.2015
Forestry office/ district	Kaczory/ Piła	End	20.04.2015
Lumberjack	Skubi	Note	-
Skidder	Skubi		
Plot number	8130617715	Date	20.04.2015
Fineness	C	Note	-
Wood buyer	stora	Street	
		City	-

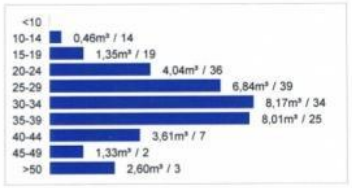
sScale™
53°10'18"N, 16°50'48"E
14:23
Nr stosu/mygły: 08130711445
53°10'17"N, 16°50'48"E
Operator: test driver
Miąższość : 10.86 m³
Powierzchnia-przód : 7.00 m²
Powierzchnia-tył : ___.__ m²
Długość : 3.22 m
Wysokość : 2.18 m
Śred. średnica : 0.16 m
Szacun. liczba : 91
Nr stosu
Ręczny
Tył stosu
Naciśnij zdjęcie aby edytować!
Długość 2.50m
Wsp. zamienny 62%
Wadliwe
Legary
Gatunek SO
Rodzaj S2A
Uwagi
Źródło Nadl. Kaczory
Przeznaczenie KRO
liczba sztuk
m³p 100% 17.51m³
Prześlij
Odrzuć
sScale™

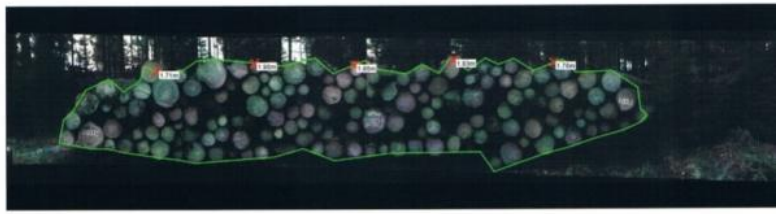
Miljøministeriet
Naturstyrelsen

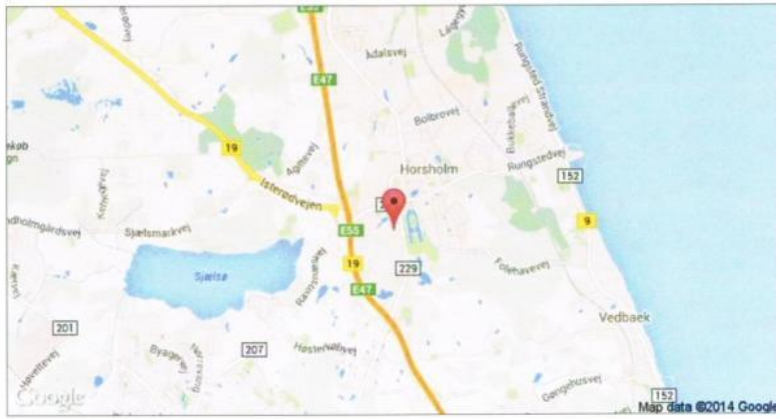
110654 37,46m³

55°52'26"N, 12°29'42"E (UTM32: 718638, 6197555)

Date	3-6-2014
Species	Beech
Kind	Timber
Length	11,83m
Height	1,63m
Depth	3,00m
Face area	19,26m²
Supports	1,70m³
Wrecks	3,00m³
Density	63,00%
Seller	Forest
Buyer	Saw mill
Heights	1,71m/ 1,90m/ 1,85m/ 1,83m/ 1,76m
Note	Truck driver: entry from south gate







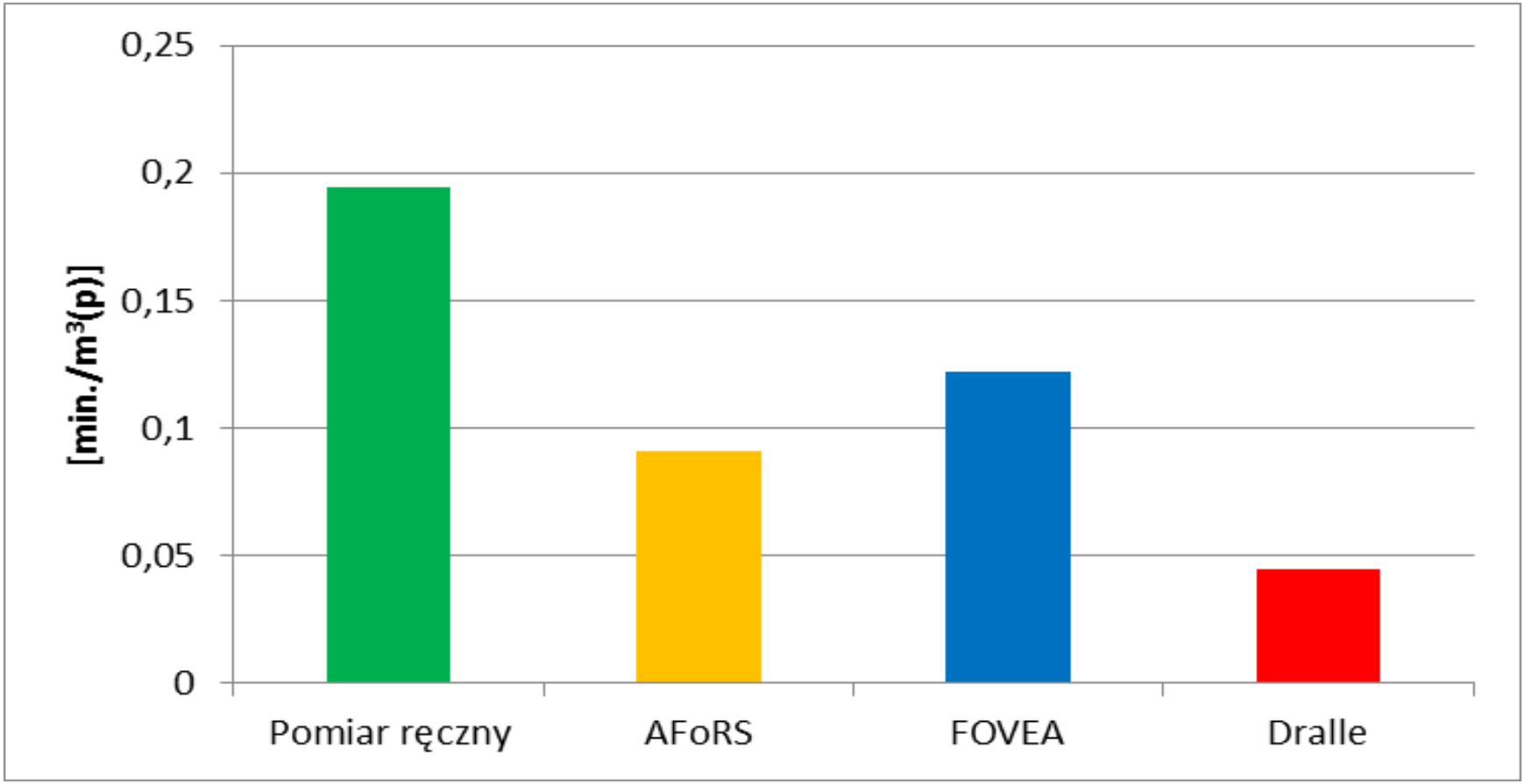
Volume of industrial wood stacks measured during tests

Location	m^3(p)
Karwin 1	7 112,90
Karwin 2	7 312,67
Nowa Sól 1	4 337,64
Nowa Sól 2	3 129,60
Piła	12 355,33
FOVEA	10 651,40
AFoRS	7 532,06
sScale	5 073,08
Świeradów 1	3 961,50
Świeradów 2	1 162,85
Total	**39 372,49**

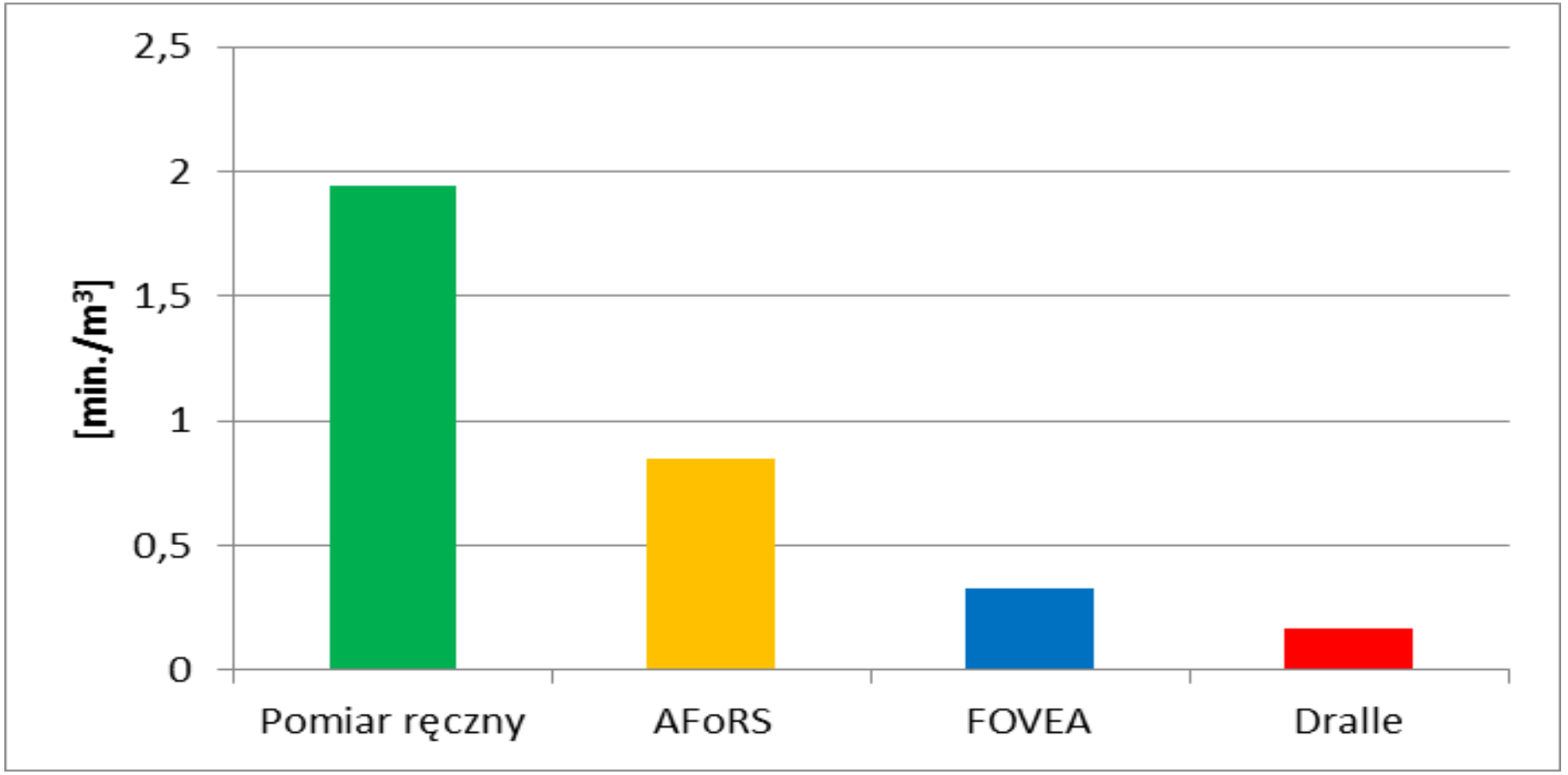
Volume of logs measured during tests

Location	m^3
Karwin 1	853,18
Karwin 2	633,18
Nowa Sól 1	518,61
Nowa Sól 2	1 281,90
Piła	982,62
w tym FOVEA	526,23
AFoRS	680,27
sScale	311,05
Świeradów 1	190,11
Świeradów 2	1 134,29
Razem	**5 593,89**

Average measurement time of 1 cubic meter – industrial wood



Average measurement time of 1 solid cubic meter - logs



Recommendations for practice

1. Field tests have demonstrated the practical usefulness of the systems used in Polish conditions, both for logs and industrial wood.
AFoRS and iFOVEA are mobile applications (tablet, smartphon), to be used at the level of sub-districts, sScalle is a solution large volumes of wood, at the level of forest district or even higher.

2. Among mobile applications a slightly better opinion among the field users obtained iFOVEA than AFORS. This application should be recommended for use. However one can also consider solution which would combine the functionality of both applications.

3. User rating suggests one set sScale for regional directorate (large stacks, sent to one recipient or in the event of natural disasters). It could be done even by an independent organization. Intensively used system should reduce costs of wood measurements.

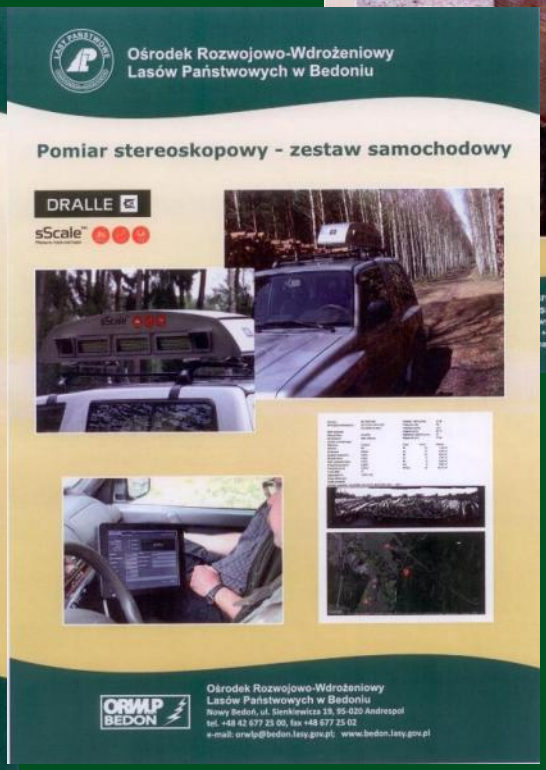
4. Statistical analyzes revealed a significant difference between the results obtained in different locations, which indicates that significant impact on the accuracy of volume measurement has experience and diligence of users.

5. Of key importance is the quality stacking. Logs inserted into the pile more than 10 cm may not be recognized and not included in the measurement results. Manual indication is associated with additional time spent on measurement. Similarly, the outline of the stack - more varied, more time is needed to adjust it.

6. Image processing at stake is much better solution than later in the office - it is possible to make necessary corrections in the case of stacks localized in difficult terrain conditions (vegetation, depressions, etc.). It should also possible to check the measurement results and make necessary corrections in the office.

7. Device for optical wood measurement should not be an additional equipment only for wood registering. It should be integrated with applications which are alredy used.

Państwowe Gospodarstwo Leśne
Lasy Państwowe



Dziękuję za uwagę.

www.lasy.gov.pl