Trimble Forestry

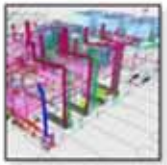
David Buddingh, Channel Account Manager, April 13, 2017

The Connected Forest - Mobile Apps for Log Management & Measurement

Transforming The Way the World Works


Agriculture


Heavy Civil Construction


Building Construction


Geospatial


Transportation & Logistics


Forestry


Rail


Environmental & Waste


Electric Utilities & Telecommunications


Mining


Water Utilities


Field Service


Oil, Gas & Chemical


OEM, Automotive & Consumer


Government

About Trimble Forestry

- 100% Owned by Trimble Navigation
- 250 employees
- Offices:

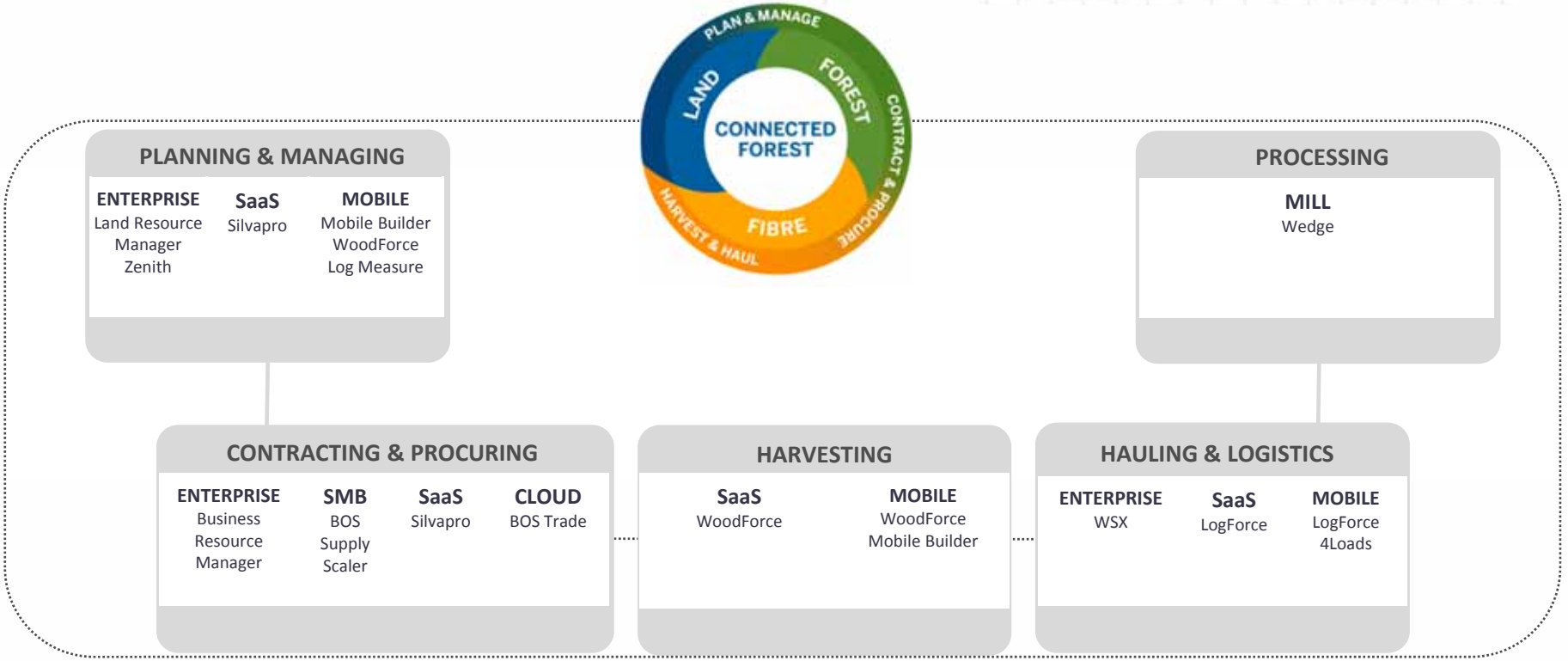
Canada	Finland	New Zealand	Brazil
USA	U.K.	Australia	Germany

- World Wide Support Services
- Enterprise, SaaS, Desktop and Mobile Solutions
- Our Customers Manage
  - Over 50 M m3 of log transactions annually
  - Millions of hectares of production forest
  - 750,000 loaded kilometers everyday

Some of Our Valued Customers

The Connected Forest

The Connected Forest



Why Trimble Forestry

- Viable Company
- Global Forestry Expertise
- The Leading Supplier of Forest Technology
- Integrated Solutions to Address the Entire Supply Chain
- Mobile Synchronization
- Manages Regulatory/Gov’t Requirements
- Configurable/Flexible
- Integration with Existing Systems
- Comprehensive Cloud & Support Services

Trimble

Trimble Forestry

4Loads

What is 4Loads

A simple yet powerful mobile application used to record, track and report load, haul and mill information.

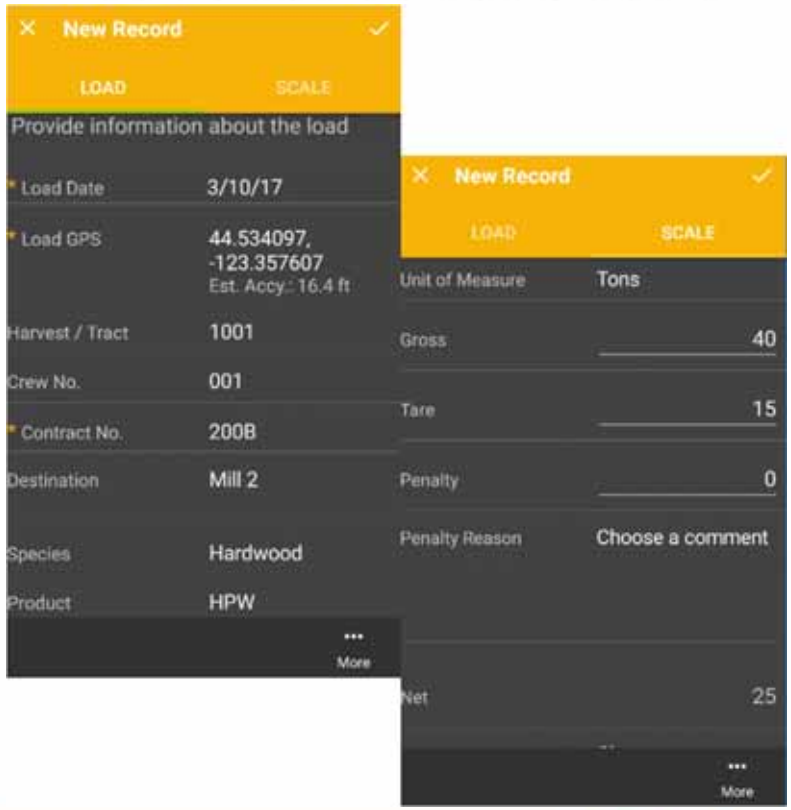
- PC Setup
- iOS or Android in the field
- Auto-Sync
- PC Reports

Logging Challenges

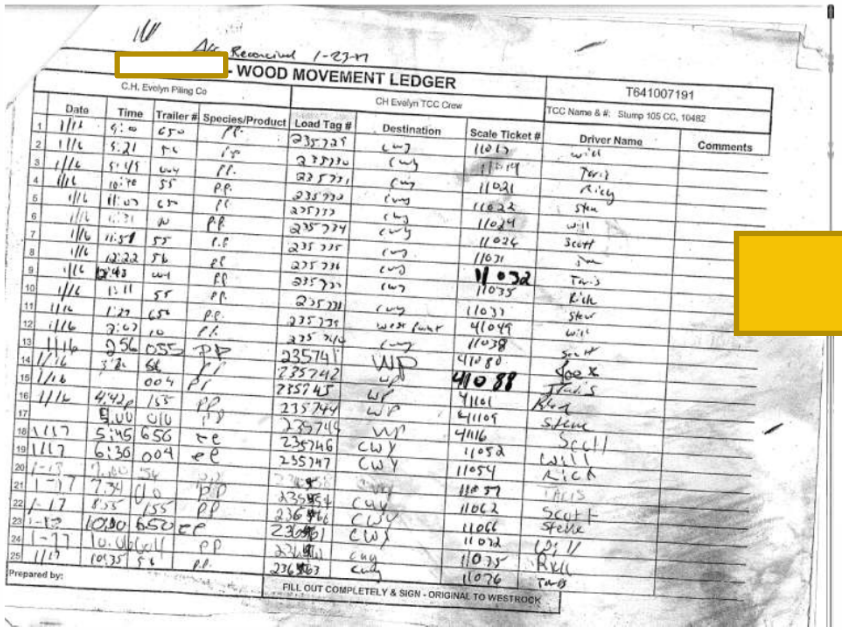
- Managing day-to-day operations is a challenge
  - Moving volume (quota), Maintenance, Weather, Trucking, Mill Turn Times
- Business challenges
  - Keeping accurate records of loads with receipts, maximize loads with legal weight, delivering to right mill.
  - Keep everyone happy (landowners, foresters, mills, trucks, secretaries, WIVES)
- Weekly Reconciliation Nightmare
  - Gathering load sheets and tickets
  - Enter everything in
  - Pay everyone

Introducing 4Loads

- Contracts set up on PC
- Enter Load Data on smart device 1 time
- Enter Scale Data in field or office
- Field Data is automatically synched
- Approved organizations have access to data – i.e. transparency
- Download preformatted reports



From Paper to Digital



WOOD MOVEMENT LEDGER

C.H. Evelyn Piling Co

CH Evelyn TCC Crew

T641007191

TCC Name & #: Stump 105 CC, 10482

	Date	Time	Trailer #	Species/Product	Load Tag #	Destination	Scale Ticket #	Driver Name	Comments
1	1/11	5:10	650	PP	235729	CWJ	11013	Will	
2	1/16	5:21	54	PP	235730	CWJ	11019	Terry	
3	1/16	5:49	644	PP	235731	CWJ	11021	Ricky	
4	1/16	10:10	55	PP	235732	CWJ	11022	Steve	
5	1/16	11:03	650	PP	235733	CWJ	11024	Will	
6	1/16	11:21	10	PP	235734	CWJ	11026	Scott	
7	1/16	11:58	55	PP	235735	CWJ	11031	Jim	
8	1/16	12:22	56	PP	235736	CWJ	11032	Travis	
9	1/16	12:43	644	PP	235737	CWJ	11035	Rick	
10	1/16	1:11	55	PP	235738	CWJ	11033	Steve	
11	1/16	1:29	650	PP	235739	WEST COAST	41049	Will	
12	1/16	2:07	10	PP	235740	CWJ	11038	Jim	
13	1/16	2:56	055	PP	235741	WP	41088	Scott	
14	1/16	3:26	56	PP	235742	WP	41088	Travis	
15	1/16		004	PP	235745	WP	41161	Rick	
16	1/16	4:42	155	PP	235744	WP	41109	Steve	
17		5:00	010	PP	235743	WP	41116	Scott	
18	1/17	5:45	656	PP	235746	CWJ	11052	Will	
19	1/17	6:30	004	PP	235747	CWJ	11054	Rick	
20	1-17	7:30	56	PP			11057	Travis	
21	1-17	7:34	010	PP	235748	CWJ	11062	Scott	
22	1-17	8:55	155	PP	235749	CWJ	11066	Steve	
23	1-17	10:30	650	PP	235750	CWJ	11072	Will	
24	1-17	10:46	Will	PP	235751	CWJ	11075	Rick	
25	1/17	10:35	56	PP	235752	CWJ	11076	Tim	

Prepared by:

FILL OUT COMPLETELY & SIGN - ORIGINAL TO WESTROCK

4Loads Logging Activity Report

Report Period 2017-03-01 to 2017-03-10

Contract No. All

UoM tons

Contract	4Load No.	Load Seq No.	Load Date	Scale Date	Crew	Driver	Destination	Species	Product	Scale Ticket No.	Net Volume
David Cork	852318	1	3/3/2017 4:35 PM	3/3/2017 4:35 PM	Fulgham 1	Donnie Chocran	Counce	Pine	PPW	3119964	27.120
David Cork	852320	2	3/3/2017 4:36 PM	3/3/2017 4:36 PM	Fulgham 1	Donnie Chocran	Counce	Pine	PPW	3120252	27.390
David Cork	852321	3	3/3/2017 4:36 PM	3/3/2017 4:36 PM	Fulgham 1	Allan	Counce	Pine	PPW	3120268	27.730
David Cork	852322	4	3/3/2017 4:37 PM	3/3/2017 4:37 PM	Fulgham 1	Tater	Counce	Pine	PPW	3120368	28.270
David Cork	852323	5	3/3/2017 4:37 PM	3/3/2017 4:37 PM	Fulgham 1	Marvin	Counce	Pine	PPW	3120369	31.380
David Cork	852324	6	3/3/2017 4:37 PM	3/3/2017 4:37 PM	Fulgham 1	Duck	Counce	Pine	PPW	3120393	29.150
David Cork	852325	7	3/3/2017 4:37 PM	3/3/2017 4:37 PM	Fulgham 1	Chris	Counce	Pine	PPW	3120549	28.530
David Cork	852326	8	3/3/2017 4:38 PM	3/6/2017 4:38 PM	Fulgham 1	Donnie Chocran	Counce	Pine	PPW	3120993	27.310
David Cork	852327	9	3/3/2017 4:38 PM	3/3/2017 4:38 PM	Fulgham 1	Allan	Counce	Pine	PPW	3120985	26.900
David Cork	852328	10	3/3/2017 4:38 PM	3/3/2017 4:38 PM	Fulgham 1	Tater	Counce	Pine	PPW	3120611	29.250
David Cork	852329	11	3/3/2017 4:38 PM	3/3/2017 4:38 PM	Fulgham 1	Marvin	Counce	Pine	PPW	3120616	31.130
David Cork	852330	12	3/3/2017 4:38 PM	3/6/2017 4:39 PM	Fulgham 1	Donnie Chocran	Counce	Pine	PPW	3121321	27.310
David Cork	852331	13	3/3/2017 4:39 PM	3/3/2017 4:39 PM	Fulgham 1	Duck	Counce	Pine	PPW	3120632	28.190

Eliminate Double-Entry, Faster Access to load information, Save time reconciling loads

Download Spreadsheet

4Loads Accounting Report

Report Period 2016-06-12 to 2016-07-15
Contract No. JT Contract
UoM Tons

Rate Summary

Contract No.	4Load No.	Load Seq No.	Load Date	Scale Date	Crew	Harvest / Tract	Haul Company	Driver	Destination	Scale Ticket No.	Net Volume	Rate A	Net Pay Rate A	Rate B	Net Pay Rate B	Rate C	Net Pay Rate C
JT Contract	4680012	257	6/15/2016 4:46 PM	6/15/2016 4:46 PM	Fulgham 1		JT Landers Trucking	JT	Weyco Bruce	554	26.400	12.50	330.00	7.50	198.00	7.10	187.44
JT Contract	4680013	258	6/15/2016 4:50 PM	6/15/2016 4:50 PM	Fulgham 1		JT Landers Trucking		Weyco Bruce	553	25.700	12.50	321.25	7.50	192.75	7.10	182.47
JT Contract	4680014	259	6/15/2016 4:53 PM	6/15/2016 4:53 PM	Fulgham 1				Eldridge Woodyard	56457	30.000	12.50	365.00	6.80	209.44	6.50	200.20
JT Contract	4680015	260	6/15/2016 4:54 PM	6/15/2016 4:54 PM	Fulgham 1		Brandon Anglin Trucking		GP Louisville	5758	28.400	12.50	355.00	6.25	177.50	6.00	170.40
JT Contract	4680016	261	6/16/2016 9:58 AM	6/16/2016 9:58 AM	Fulgham 1		Chris Black Trucking	Chris	GP Louisville	868648	27.350	12.50	341.88	6.25	170.94	6.00	164.10
JT Contract	4680017	262	6/16/2016 9:59 AM	6/16/2016 9:59 AM	Fulgham 1		Marvin Culpepper Trucking	James	Eldridge Woodyard	56678	28.430	12.50	355.38	7.62	216.64	7.00	199.01
JT Contract	4680018	263	##########	6/16/2016 10:00 AM	Fulgham 1		Shannon Fulgham Trucking		Eldridge Woodyard	58889	29.130	12.50	364.13	6.80	198.08	6.50	189.35
JT Contract	4680019	264	##########	6/16/2016 10:01 AM	Fulgham 1		Brandon Anglin Trucking	Brandon	Eldridge Woodyard	35738	27.630	12.50	345.38	6.80	187.88	6.50	179.60
JT Contract	4680020	265	6/16/2016 2:08 PM	6/16/2016 2:08 PM	Fulgham 1		Brandon Anglin Trucking	Lee McMullin	Counce	CN627	28.400	12.50	355.00	11.25	319.50	10.50	298.20
JT Contract	4680021	266	6/16/2016 2:09 PM	6/16/2016 2:09 PM	Fulgham 1		Marvin Culpepper Trucking	James	Counce	CN7583	28.700	12.50	358.75	11.25	322.88	10.50	301.35
JT Contract	4680022	267	6/16/2016 2:10 PM	6/16/2016 2:10 PM	Fulgham 1		Brandon Anglin Trucking	Brandon	Counce	CN73848	29.100	0.00	0.00	18.48	537.77	31.98	930.62
JT Contract	4680023	1234	##########	6/17/2016 12:04 PM	Fulgham 1		JT Landers Trucking	JT	GP Louisville	567	28.400	12.50	355.00	6.25	177.50	6.00	170.40

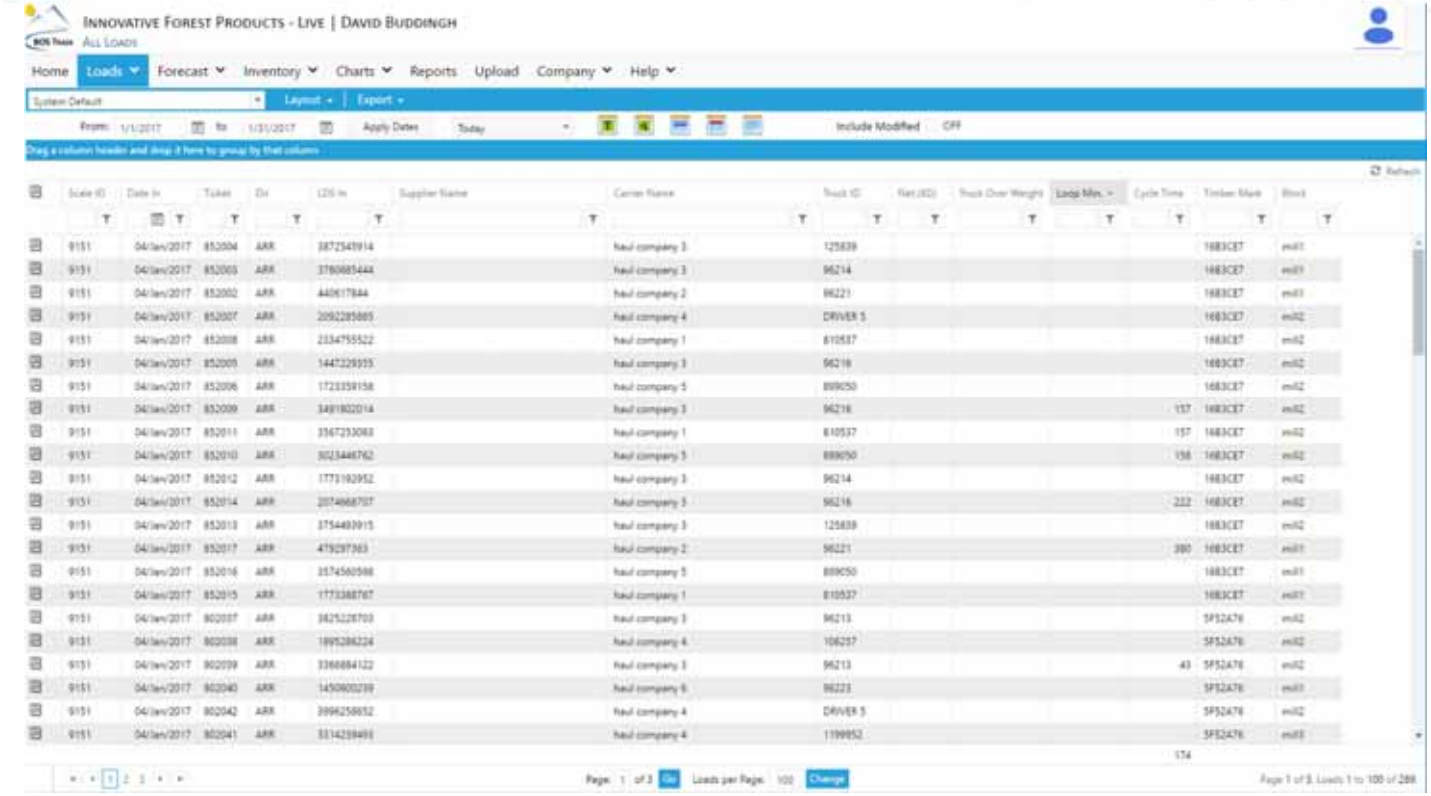
Loggers that are using the system estimate that their weekly ticket reconciliation/payment process has been shortened from 12 hours before using 4Loads to **only 20 minutes** with 4Loads!!

Export to Accounting Program

	A	B	C	D	E	F	G	H	I	J	
1	SCALE_TICKET	SCALE_DATE	CONTRACT	DESTINATION	UOM	NET_MEASUI	CREW_ID	HAULCOMPAN	PRODUCT	PIN	GR
2	189019	Apr 18 2016 1:40PM	Headley_Gladdin_200	RLC	TN	28.82	1	Thomas Trucki	PST	1	
3	189031	Apr 18 2016 1:42PM	Headley_Gladdin_200	RLC	TN	28.78	1	Jones	PST	4	
4	189029	Apr 18 2016 1:42PM	Headley_Gladdin_200	RLC	TN	29.06	1	Jones	CSL	3	
5	679638	Apr 18 2016 1:43PM	Headley_Gladdin_200	GPM	TN	25.7	1	Steen Truckin	PPW	6	
6	679636	Apr 18 2016 1:43PM	Headley_Gladdin_200	GPM	TN	25.87	1	Thomas Trucki	PPW	5	
7	189047	Apr 18 2016 2:39PM	Headley_Gladdin_200	RLC	TN	29.56	1	Thomas Trucki	PST	7	
8	47612	Apr 18 2016 3:28PM	Headley_Gladdin_200	GPT	TN	28.26	1	Jones	PLY	10	
9	679768	Apr 18 2016 4:28PM	Headley_Gladdin_200	GPM	TN	26.12	1	Steen Truckin	PPW	11	
10	679770	Apr 18 2016 4:33PM	Headley_Gladdin_200	GPM	TN	25.96	1	Thomas Trucki	PPW	12	
11	679786	Apr 18 2016 5:11PM	Headley_Gladdin_200	GPM	TN	28.34	1	Thomas Trucki	PPW	14	
12	8267	Apr 18 2016 4:52PM	Headley_Gladdin_200	GPT	TN	26.68	1	Thomas Trucki	PLY	13	
13	189023	Apr 18 2016 1:42PM	Headley_Gladdin_200	RLC	TN	28.51	1	Thomas Trucki	PST	2	
14	381231	Apr 18 2016 5:49PM	Headley_Gladdin_200	GPBY	TN	29.43	1	Thomas Trucki	HWP	15	
15	189049	Apr 18 2016 2:53PM	Headley_Gladdin_200	RLC	TN	27.38	1	Thomas Trucki	CSL	8	
16	189096	Apr 18 2016 6:53PM	Headley_Gladdin_200	RLC	TN	27.07	1	Jones	PST	17	
17	47634	Apr 18 2016 5:47PM	Headley_Gladdin_200	GPT	TN	28.5	1	Jones	PLY	16	
18	199002	Apr 18 2016 9:10PM	Headley_Gladdin_200	RLC	TN	22.99	1	Jones	PST	23	
19	199009	Apr 18 2016 9:43PM	Headley_Gladdin_200	RLC	TN	26.33	1	Jones	PST	24	
20	381255	Apr 18 2016 7:28PM	Headley_Gladdin_200	GPBY	TN	26.01	1	Thomas Trucki	HWP	19	
21	679873	Apr 18 2016 8:11PM	Headley_Gladdin_200	GPM	TN	26.35	1	Thomas Trucki	PPW	21	
22	189125	Apr 18 2016 8:36PM	Headley_Gladdin_200	RLC	TN	29.37	1	Thomas Trucki	PST	22	
23	679866	Apr 18 2016 8:11PM	Headley_Gladdin_200	GPM	TN	28.91	1	Thomas Trucki	PPW	20	
24	679853	Apr 18 2016 7:06PM	Headley_Gladdin_200	GPM	TN	25.73	1	Steen Truckin	PPW	18	

Direct integration with Forest Products Accounting's Fiber program.

BOS Trade



Currently integrating data with BOS Trade load data portal

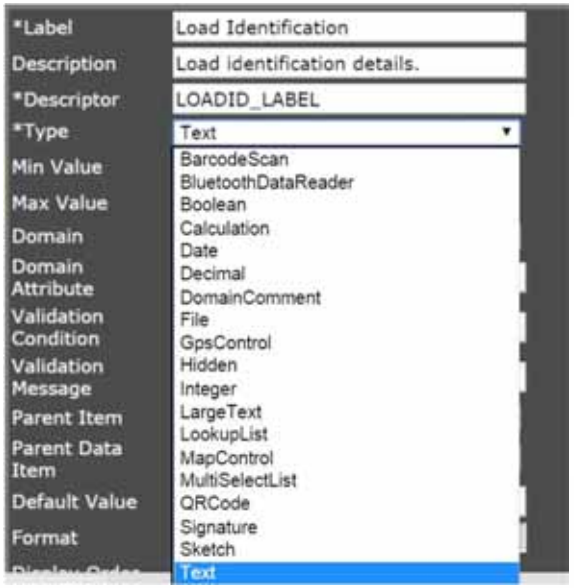
Who is using 4Loads?

- Companies like Good Hope Land & Timber Management – Mississippi, Louisiana, Arkansas – 23 Logging crews currently using 4Loads

Shannon Fulgham Logging – Maben, Mississippi
"4Loads is an easy app to learn and use," stated Shannon. "We've entered thousands of loads into the app and rely on it now as part of our operation. It saves us time, minimizes data errors and eliminates paper tracking."

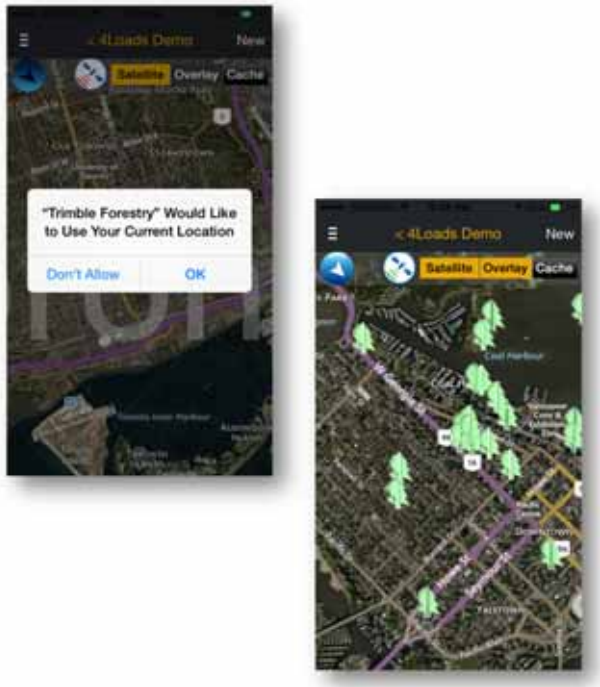
Mobile Builder; Key Features – Configuration

- Subscribe to Existing Forms
  - Field Kit, 4Loads, etc.
- Design once
  - Native iOS or Android app
  - One layout for either platform
- Build your own Forms
  - One to many relationships
  - Calculations while offline
  - Conditional logic
  - Read QR Code / Barcode
  - Create QR Codes
  - Print tickets
- Feature Collection
  - Point, line, or polygon features
  - Use sketch, weigh points or automatic



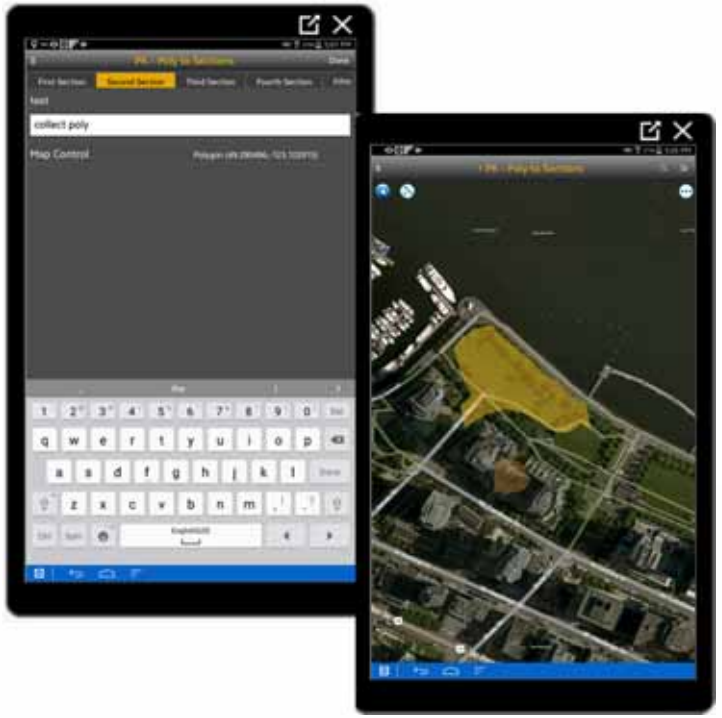
Key Features – Spatial Maps

- Out of the box base map
  - Satellite
  - Street map
- Connect to other Web Map Services
- Collect location data using the device or via Bluetooth connected devices



Key Features – Map Collection

- Each section can have 1 point, line, or polygon feature
- Manual and automatic GPS collection
- Example shows 2 digitized polygons – 1 in each section



Trimble Forestry

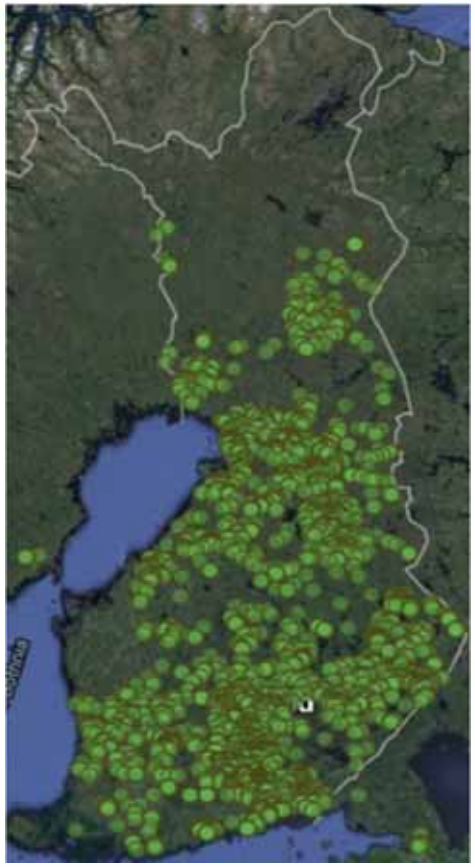
Forest Inventory Measurement

Forest Inventory System

- Forest Inventory is a tool for measuring forest attributes
  - Basal area
  - DBH and height
  - Area
  - Species Distribution
  - Breast height diameter distribution
- Download app to smartphone or tablet from Play Store

Who is Trestima?

- Software house established in 2012, specialised in forest industry
- Located in Tampere, Finland
- High-level expertise in location based services and software, machine vision and web-and mobile programming
- Two main products:
  - TRESTIMA™ Forest Inventory System
    - Innovation award, Finnish Society of Forest Sciences, 2013
    - The first and only image recognition based inventory system in the world. Patented technology.
  - TRESTIMA™ Stack
    - Based on the same robust software stack as TRESTIMA™ Forest Inventory System
- Customers in five continents.
- Trimble Forestry is licensed distributor of applications.

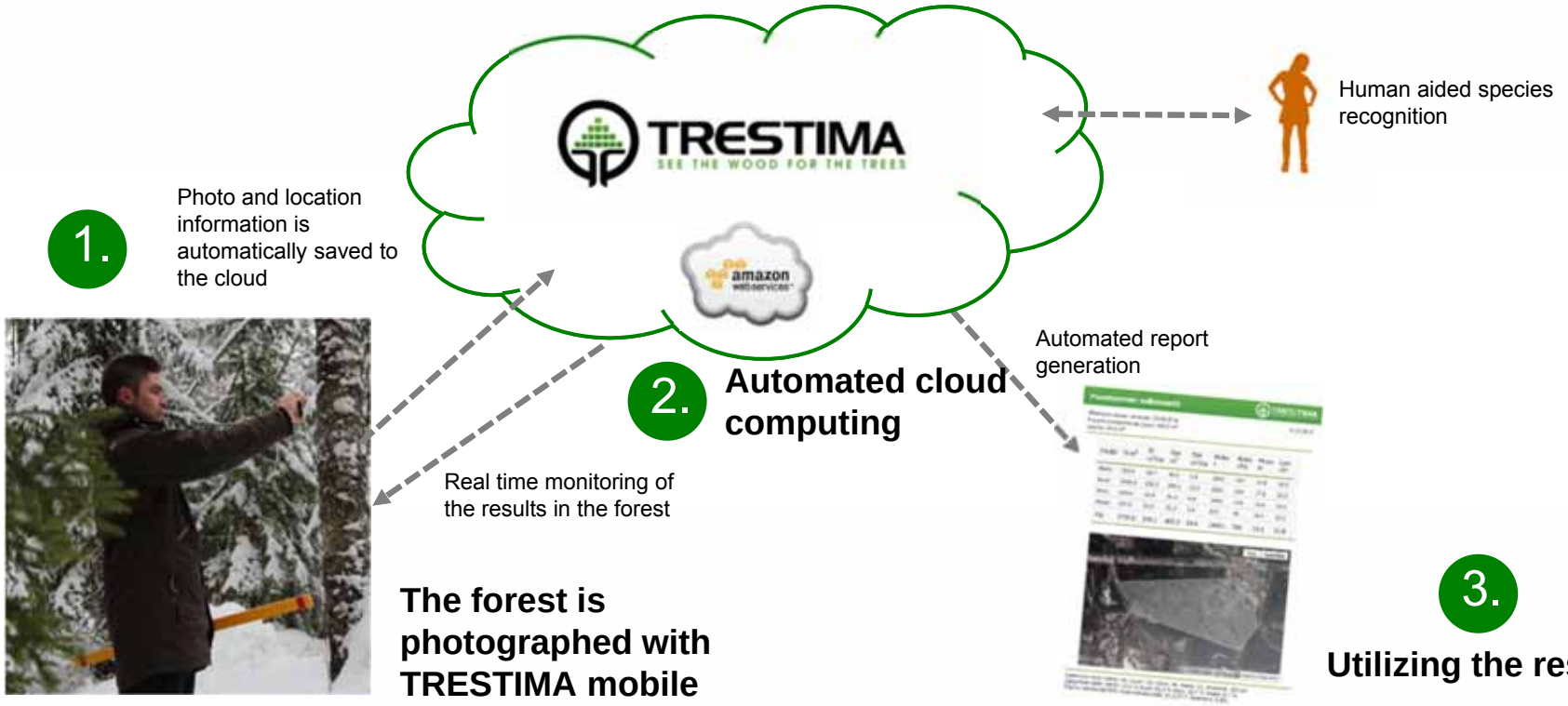


TRESTIMA™ in Finland

Usage in 2014:

- 75 000 hectares of forest stands processed
- 150 000 basal area pictures taken
- Over 1.3 million measured trees

System overview



TRESTIMA™ Application

1) Active stand
2) Parcel selection
3) Username
4) Realtime result and error
5) Input heights and widths
6) Input for notes, images, etc.
7) Stand Map
8) Own location
9) Map type toggle
10) Photo capture

Forest Inventory System

Application measures basal area with a dynamic basal area factor at 1.3m height from the root. Each image represent a accurate sample of a forest stand.

Tree Height and DBH

Application provides easy and tamper proof method for measuring widths and heights (site trees).
Functionality requires usage of TRESTIMA –yardstick.
Alternatively height and width observations can be inputted manually with clever UI.

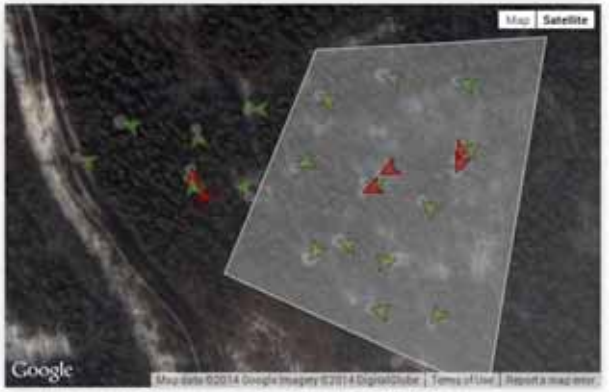
Inspecting Results

Forest inventory report: solkivuori

TRESTIMA

Measurement performed 04.06.2013 — 23.01.2014
Measured area 2.17 ha
BA sample amount 12 pcs

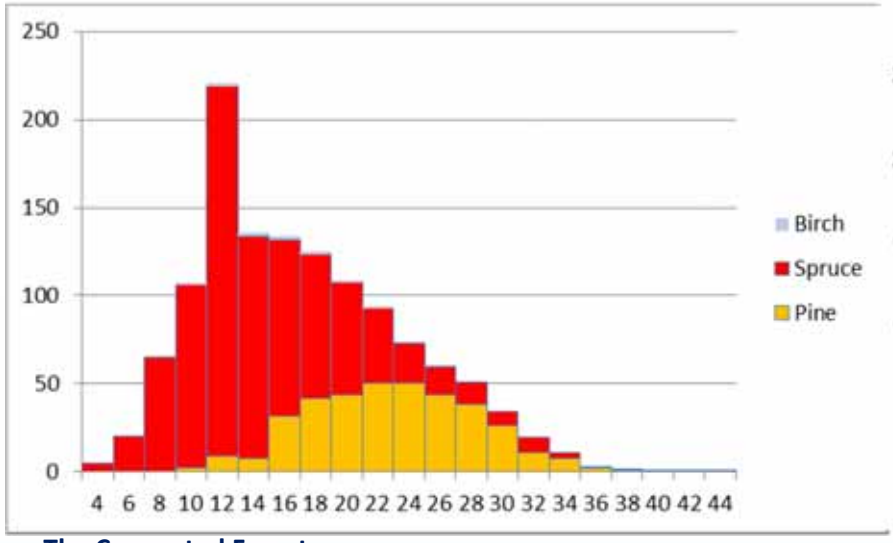
Specie	BA m^2/ha	Stems pcs/ha	Stems pcs	DBH cm	Height m	Vol m^3/ha	Vol m^3	Log %
spruce	16.8	527	1142	20.8	20.4	157.5	341.0	53
aspen	6.7	160	346	24	20	60.4	130.7	38
pine	2.0	54	117	22.5	20.2	19.5	42.3	60
birch	4.6	92	199	26.5	24.2	49.3	106.8	46
Tot.	30.1	833	1804	22.5	20.9	286.7	620.8	49

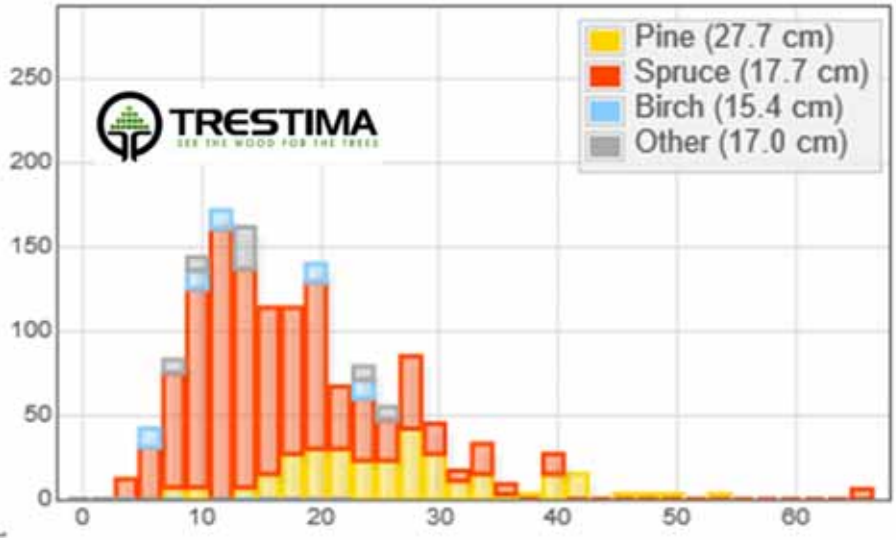


Sample size: spruce: 246, aspen: 99, pine: 30, birch: 68, total: 441 pcs
Specie ratios: spruce: 55.7 %, aspen: 22.4 %, pine: 6.7 %, birch: 15.3 %
BA range with 95% probability 26.2-34.0. Std. error: 6.6%

DBH distribution charts

Forest Inventory application measures width of every recognized trunk at breast height and automatically forms a DBH distribution chart of the results.



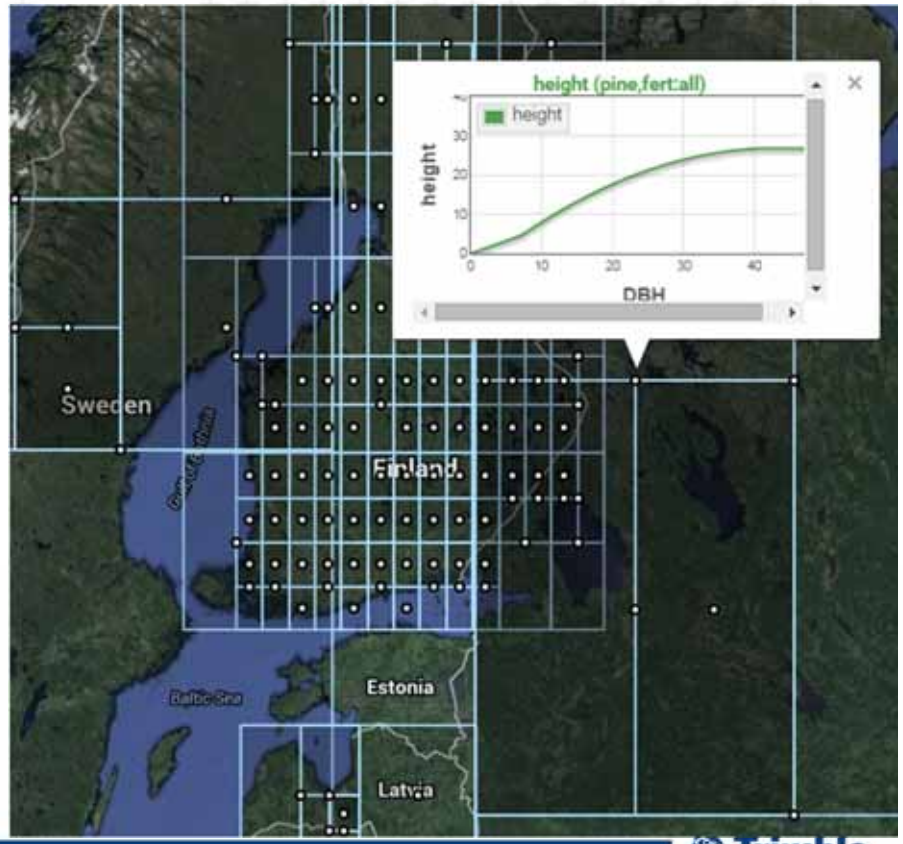


Clever usage of Big Data

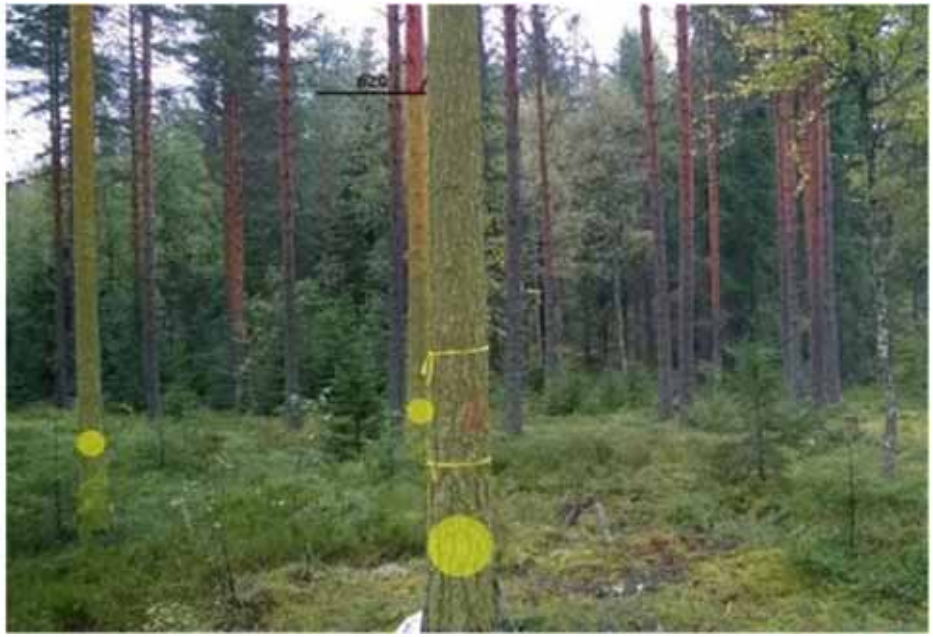
TRESTIMA utilizes its Big Data to fill out the gaps in reporting.

For example tree's height and age can be automatically determined based on GPS location in many parts of the world.

As more data is accumulated into Trestima's DB, utilization of this Big Data becomes more and more accurate and local.



Automatic Quality Assessment



- Dead branch level
- Branchiness
- Trunk form
- Trunk straightness
- Statistical analysis for the non-visible parts

Forest data migration

TRESTIMA supports the most commonly used formats for forest data and related geometries. This makes integration into other systems easy.

IMPORT:
- Mapinfo Mif/Tab
- Esri Shapefile
- KML/KMZ
- XML
- PMT

EXPORT:
- Excel
- XML
- PMT
- JSON

For system level integrations TRESTIMA provides a lightweight web –interface as well as full blown SOAP API.
TRESTIMA can also push customer's data (JSON) automatically into customer's database.

Species of the World

Species profile can be defined and limited for each customer and user individually.

In addition to native Finnish species (scotch pine, spruce, birch and aspen) TRESTIMA can recognize the following species: larch, ash, oak, swiss pine, fir, sitka spruce, eucalyptus, teak and monterey pine.

Models for volume (Taper functions) can be defined for each specie and for each customer separately. New species can be added based on business need.

Business Benefits

Forest Inventory measuring system has several benefits compared to conventional methods:

- ***Efficiency:*** 100-1000% more efficient than traditional methods.
- ***Quality* of data collection increases**. results are objective & human errors are eliminated.
- ***Quality Assessment of Trees***: objectively measures different quality aspects of trees from the pictures.
- ***Better visibility*** in data collection. Everything is GPS tagged and time stamped.
- ***Standardized results:*** gives same results for every user.
- ***Improved decision making.*** When the forest reserve is known in detail operations can be planned better.

Trimble

Trimble Forestry

Log Stack

What is Log Stack?

- Log Stack is a tool for measuring the volume of a log stack from images taken using a smartphone or a tablet device.
- Download app to smartphone or tablet from Play Store

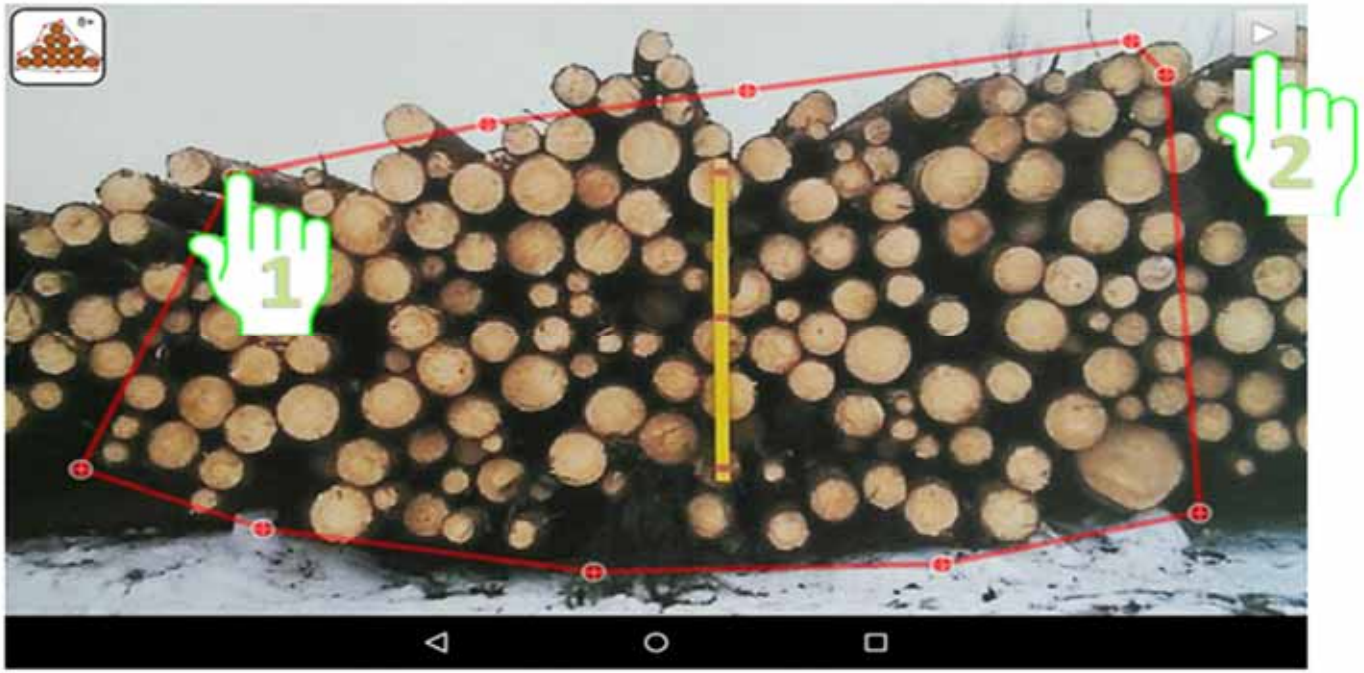
Four Step Process

1. Capture image
2. Mark stack boundaries
3. Mark yardstick
4. Mark log length and send

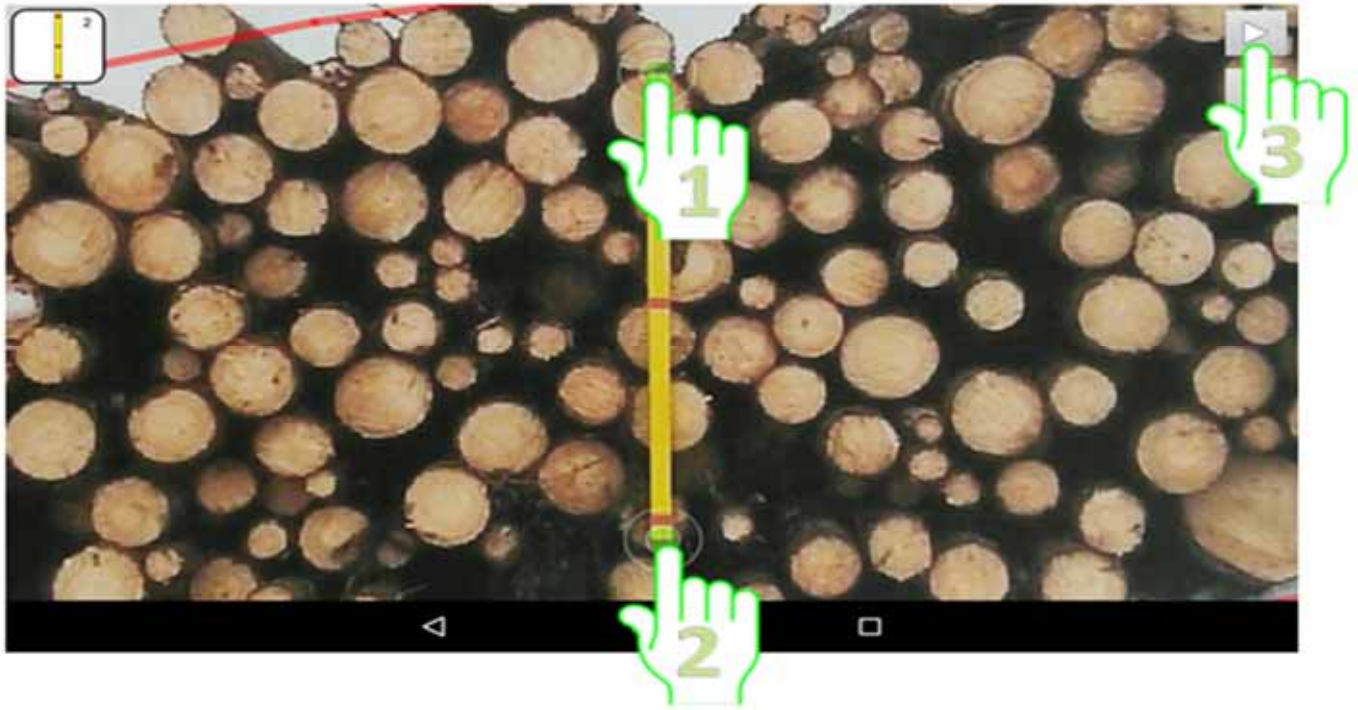
For long piles repeat until whole pile is measured.

Capture image

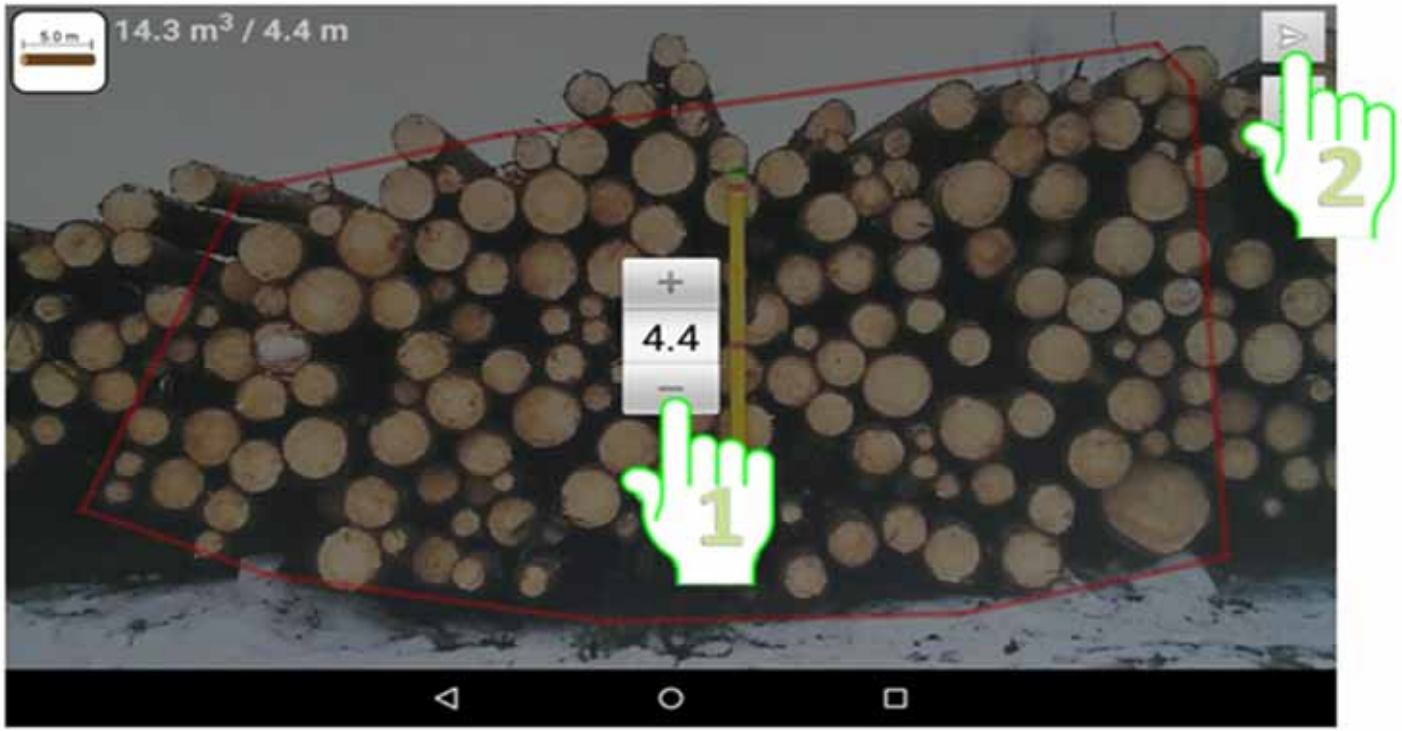
Mark boundaries



Mark the Yardstick



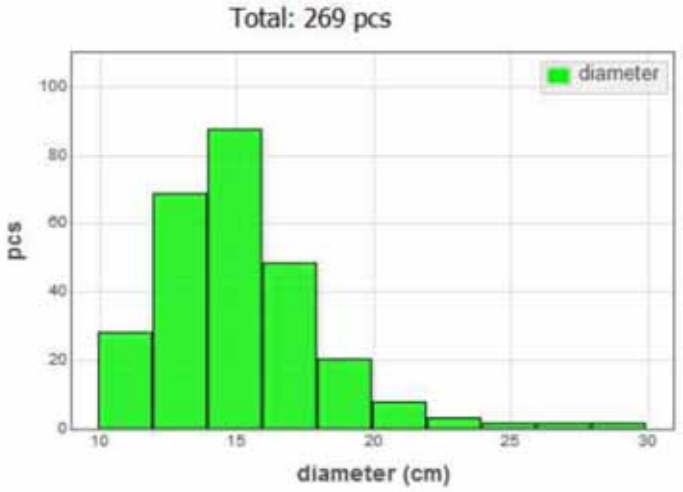
Input log length



Results

example_stack

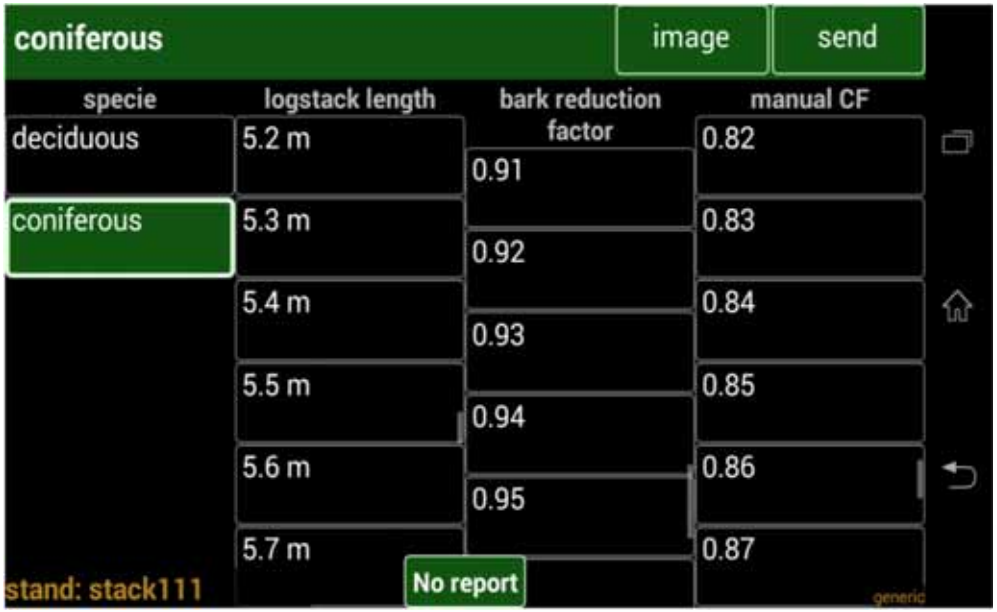
stack volume:23.8 $m^3(\Sigma)$
avg. diameter:14.7 cm
logstack length:5 m
stems:269 pcs
gross volume:41.9 $m^3(\Sigma)$
CF:0.5692
stack volume:11.9 $m^3(\bar{x})$
v:0.088 m^3
samples:2 pcs
verified:100 %



Can Enter Custom Specs

From the stack options view the following items can be inputted:

- **Specie**, or rather ‘specie group’. Setting the stack to either to coniferous or deciduous
- **Stack length,** Note that all length inputs are averaged.
- **Bark reduction factor,** if you need to report the volume without bark, you can input the bark reduction factor which will be used to reduce CF.
- **Manual CF,** this can be used to override all the automatic CF calculations.



Interested?

Contact us for more information or to set up a trial.

http://www.trimble.com/forestry/index.aspx

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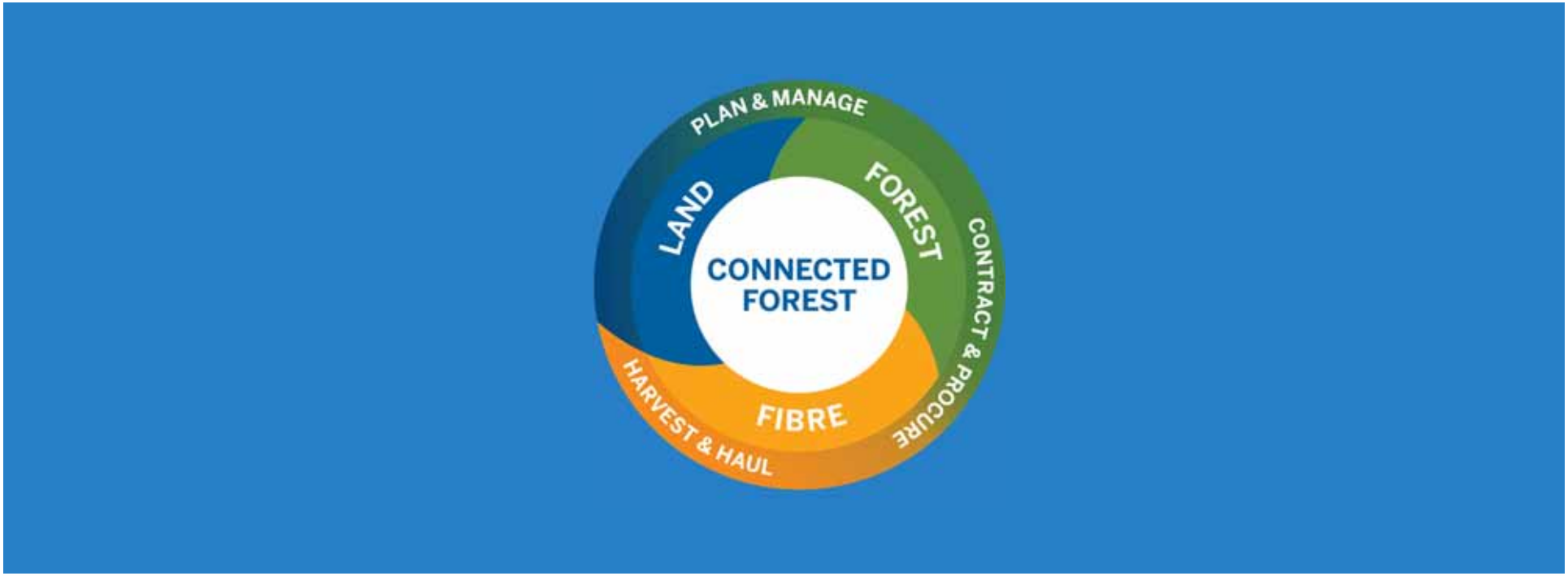
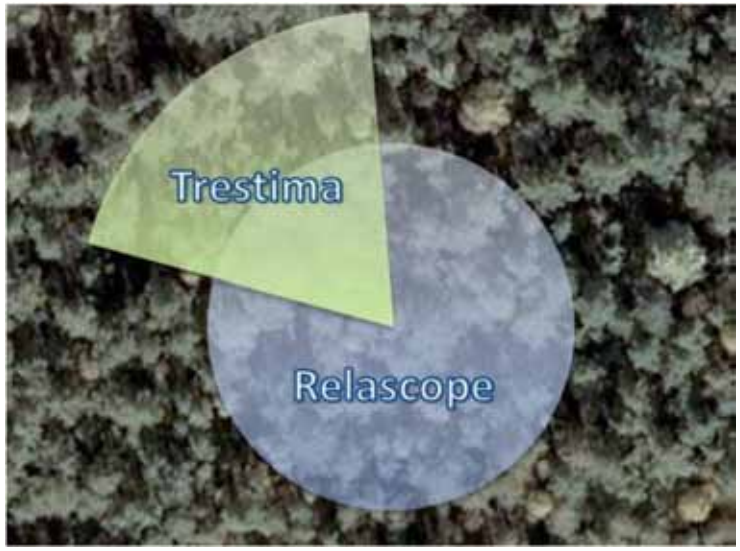
Thank You


PLAN & MANAGE
LAND
FOREST
CONTRACT & PROCURE
HARVEST & HAUL
FIBRE
CONNECTED FOREST

How Forest Inventory calculates basal area

- The app's basal area calculation is fundamentally based on the principles of a Bitterlich relascope but instead of physical gauge and a rod Trestima uses a mobile device's camera for measuring basal area.
- Relascope's rod and slot have been replaced with information given by camera's focal length and amount of pixels of the sensor.
- While with a relascope you turn around a full circle counting stems you simply take just one picture with Trestima. Depending on the mobile device's camera, the picture can represent about 60 – 70 degrees of full circle (i.e. Sony Xperia Z1's angular field of view is ~64 degrees)



Measurements done by the Log Stack tool

- **Diameters**. The tool tries to always get at least 20% area coverage of log heads compared to the facial area of the stack.
- In practice the coverage varies between 15-80% depending on the sample image (distance to stack, stack quality, wood quality, lighting conditions, etc.)
- The aim is to get good enough diameter sampling to form a reliable diameter distribution chart.
- **Stack limits – the boundary of the measured area**. This together with inputted stack length makes it possible to calculate the gross volume of the stack.
- The stack volume calculation is based on the gross volume of the stack. The automatic CF calculation uses formulas that are based on a pile measuring document by Metsäteho (http://www.metsateho.fi/wpcontent/uploads/2015/02/Kuitupuun_pinomittaus_ohje_uusi.pdf).
- **Automatic CF -** The stack tool provides automatic CF which uses the stack length and each measured diameter as an input for the formulas to calculate the final CF.