Test of the Katam system for estimating stand data in long-term forest field trials in southwestern Sweden

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Abstract

The study tested the Katam system for estimation of stand data in long-term forest experiments in south-western Sweden. A smart phone was used to estimate individual tree diameter, stand data and tree positions in two long term forest experiments. Estimated data was compared with measured values. The results showed a good agreement between estimated and measured arithmetic mean diameter of individual trees. On stand level, there was a good agreement between estimated and measured mean diameter while stem number and basal area was underestimated for a few of the stands. For the positioning of trees, there was a good agreement between estimated and measured coordinates for most trees, while some trees had higher deviations.

Key words: basal area, mean diameter, stem number, smart phone, tree positioning

Summary

The study tested the Katam system for estimating stand data in long-term forest field trials in southwestern Sweden. An Android smart phone was used to estimate the diameter, stand data and tree coordinates of individual trees in two long-term forest field trials. Estimated data were compared with data from regular measurements in the trials. The results showed good consistency between the estimated and measured average diameter of individual trees. At the stand level, there was good consistency between estimated and measured average diameter, while the population and basal area were underestimated for a few of the trials. This will be further analyzed in the further study. For the position of the trees, there was good consistency between estimated and measured coordinates for most trees, while some trees had larger deviations.

Introduction

The katam system utilizes the camera in a smart phone for digital soil measurements of forest stand data (https://www.katam.se/sv/). The phone is carried through a forest stand while the camera records the position, shape and size of the trees on a recorded video. The soil and trees in the stand must be visible in a number of different camera angles. Data from the movie capture can be processed locally on your phone or exported to a PC for faster processing. The technology can be used to measure sample surfaces of flexible size in mainly homogeneous and thinned production stands of pine and spruce, but also enables the detection of other tree species.

The purpose of this study was to use data from SLU's long-term forest experiments to test the accuracy of the Katam system's measurements of forest stand data. The study focused on accuracy in diameter measurement of individual trees, estimation of stand data, and tree positioning.

The study was conducted by the Department of Forest and Wood Technology at Linnaeus University in collaboration with the Division of Forest Field Research and the Department of Southern Swedish Forest Sciences at SLU.

Materials and Methods

Test surfaces

The tree species trial T158 was established by planting in 1985 in Tönnersjöheden's experimental park (lat. 56° 41′, long. 13° 06′, alt. 90 m above sea level) in Halmstad Municipality, Halland County. The initial purpose of the experiment was to study stand development, volume production and timber quality in domestic and foreign tree species when growing under similar conditions. The experiment was established as a randomized block trial with 10 experimental joints and 3 repetitions. The sample spot size was 0.1 ha.

The Skogaby-trial (trial 1225) was established in 1987 in a 25-year-old planted spruce stand at Skogaby (lat. 56° 33′, long. 13° 13′, or 100 m above sea level) in Laholm Municipality, Halland County (Bergholm et al. 1995). The original purpose of the experiment was to study the effects of air pollution on tree whiteness and forest production in spruce forests in southwestern Sweden. The experiment was established as a randomized block trial with 9 trials and 4 repetitions. The sample spot size was 0.2 ha. Both trials were followed with repeated measurements according to the standard for forest long-term trials (Karlsson et al, 2013). At the time of measurement, breast height diameters (1.3 m above ground) were recorded on all permanently numbered trees on the net pair cells and tree height of the experimental surfaces on several systematically selected sample trees. At the Skogaby-trial area initiation, all trees were coordinated on the pair cells by measuring x- and y coordinates with tape measure (1 dm accuracy). In this study, data from the last regular measurement (audit 4) in T158 and an additional measurement (Nov 2018) were used by an untreated control area (Title 3) in the Skogaby trial.

Filming in the field

Filming in the field was carried out in November 2018 by dividing the experimental saving cells in 3 or 4 belts of approximately 7.5 m width. The division into belts was adapted to the numbering of the trees so that the number of the trees could be observed in the recorded images. Filming was performed through a mobile phone using the Katam system software placed in a selfie stick that was carried through the stand at about 1.3 altitude above ground surface. When starting a filming sequence, the phone was worn as shake-free as possible to get a secure identification of the position of the individual trees in the stand. After that, the camera was carried steadily and without hasty movements along a planned route along the divided individual belts, whereby the trees were recorded perpendicular to the walking direction. The filming time of a belt was 2-3 minutes. To calibrate the camera's position in the stand, 4-6 white reference signs with QR codes were placed clearly visible at the ground surface at 20-30 m apart along each filming path.

Processing of recorded films

After finishing filming in the field, the recorded films were processed in the room. The video footage was reviewed in a 3D model where the number and position of the

individual trees could be identified. The film files were exported to a personal computer and were originally processed using a software intended for this purpose provided by Katam. The primary-processed files were then analyzed by checking the numbering of the individual trees in the films against the stem count lengths from the measurement of the experimental surfaces. In cases where the tree numbers could not be identified on the film, checks were made in the field.

Calculations

In the diameter measurement study, the film files for each section of the tree species trial T158 were reviewed. For trees measured two or more times during filming, the measurement closest to the split diameter value was selected.

When comparing the coordinates of individual trees in Section 3 of the Skogaby experiment, field measured data was considered correct. In field measured data, data for trees that were not included in katam data (tree numbers: 162, 164, 194, 205, 253, 330, 338, 343). For the coordinates of individual trees in the Katam dataset, longitude and latitude were translated into coordinates in the SWEREF99 system. The origo of the Katam dataset was varied, as was the rotation of the coordinate system, whereby the best compliance with field measured data was sought. As a measure of consistency, the sum of the distances between the trees in the field measured data and the Katam dataset was used.

Results and discussion

Diameter of individual trees

Diameter measurement of individual trees was studied on pine and spruce pair cells in the tree species trial T158 at Tönnersjöheden's experimental park (Figure 1). The arithmetic mean diameter of the trees estimated by the Katam system was close to the clustered average diameter of the corresponding tree (Table 1). The difference between the two measurements was in the range of 1-4 mm. Katam system underestimated on four sample spots and overestimated on two. There was no systematic difference in the difference between the two methods of pine and spruce pair cells. Nor did the number of saturated trees affect the difference between the methods.

Table 1. Arithmetic mean diameter (mm) for caliper and Katam measurement, difference (mm) and number of trees. Tree species attempt T158, Tönnersjöheden's trial park.

Stand / #	Tree species	Caliper	Katam measurement	Difference	Number of trees
T158:10	Pine	206,5	203,9	2,64	73
T158:11	Fir	166,6	165,4	1,18	152
T158:20	Pine	210,8	207,0	3,82	63
T158:21	Fir	172,6	168,7	3,87	139
T158:30	Pine	212,3	214,9	-2,60	67
T158:31	Fir	172,9	176,4	-3,48	140

For most of the individual trees, there was good or acceptable consistency in measuring the diameter between the methods (Figure 2). There was overestimation in Katam measurement compared to caliper. A number of trees had major deviations between the measurement methods. For pine surfaces, the deviations were in the range +/- 60 mm. On the spruce surfaces, most of the differences were in the range +/- 50 mm, however, there were a smaller number of trees with higher differences. There was no clear correlation between the difference for individual trees and the tree diameter or the location of the test surface. Possible explanations for greater difference for individual trees may be obscured visibility when filming, distance between camera and tree, variations in the terrain of the sample spot, etc. The position of breast height (1.3 m above ground) on the stem may affect the difference as this, when using caliper, considers unevenness in the ground surface while the Katam measurement is likely to have a harder time considering this. Irregularity in the diameter of the trees at breast height can also affect, since when using caliper, two diameter measurements are crossed, while katam's measurement only reports a diameter value.

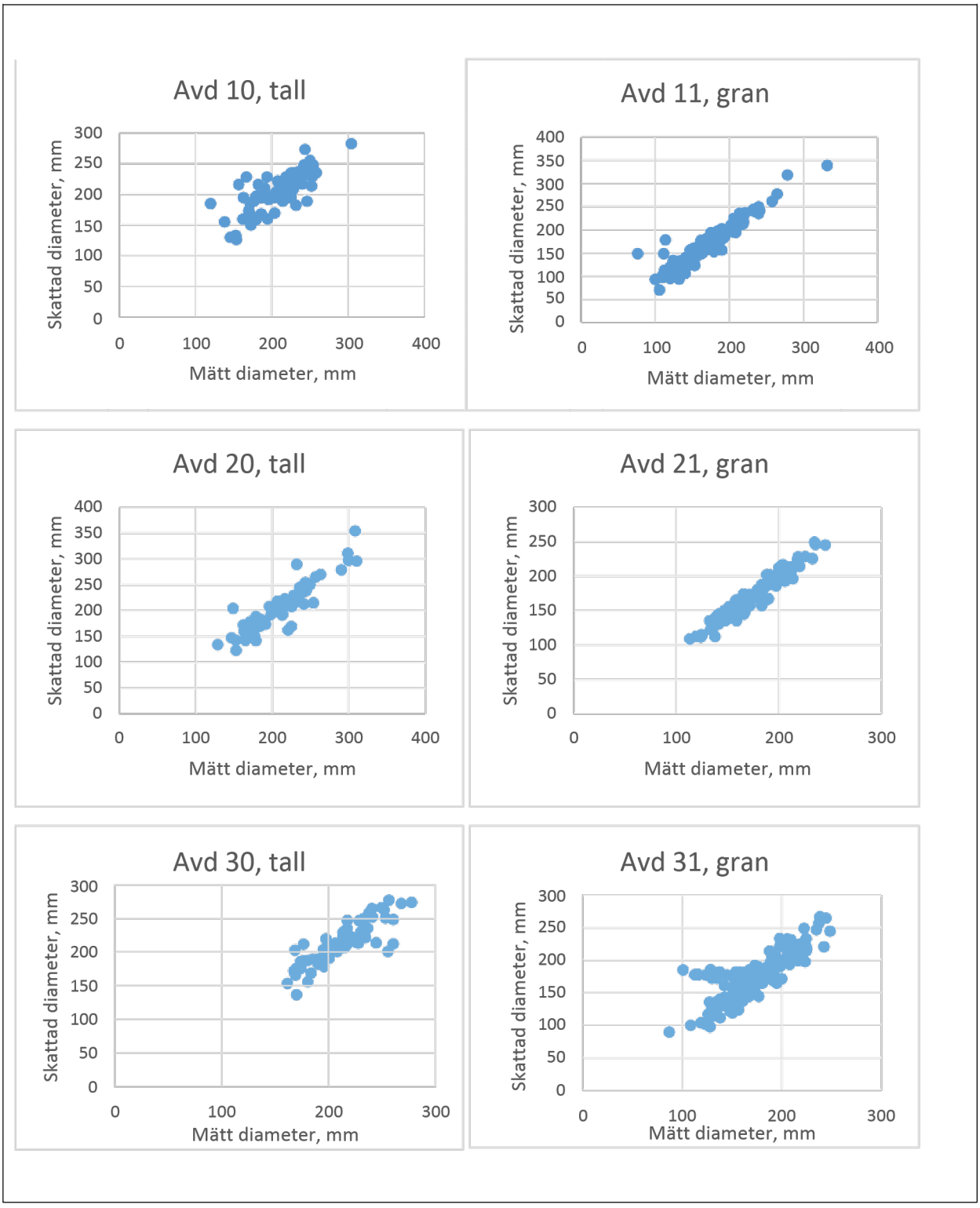

Figure 1. The diameter of individual trees is estimated by the Katam system and measured by caliper.

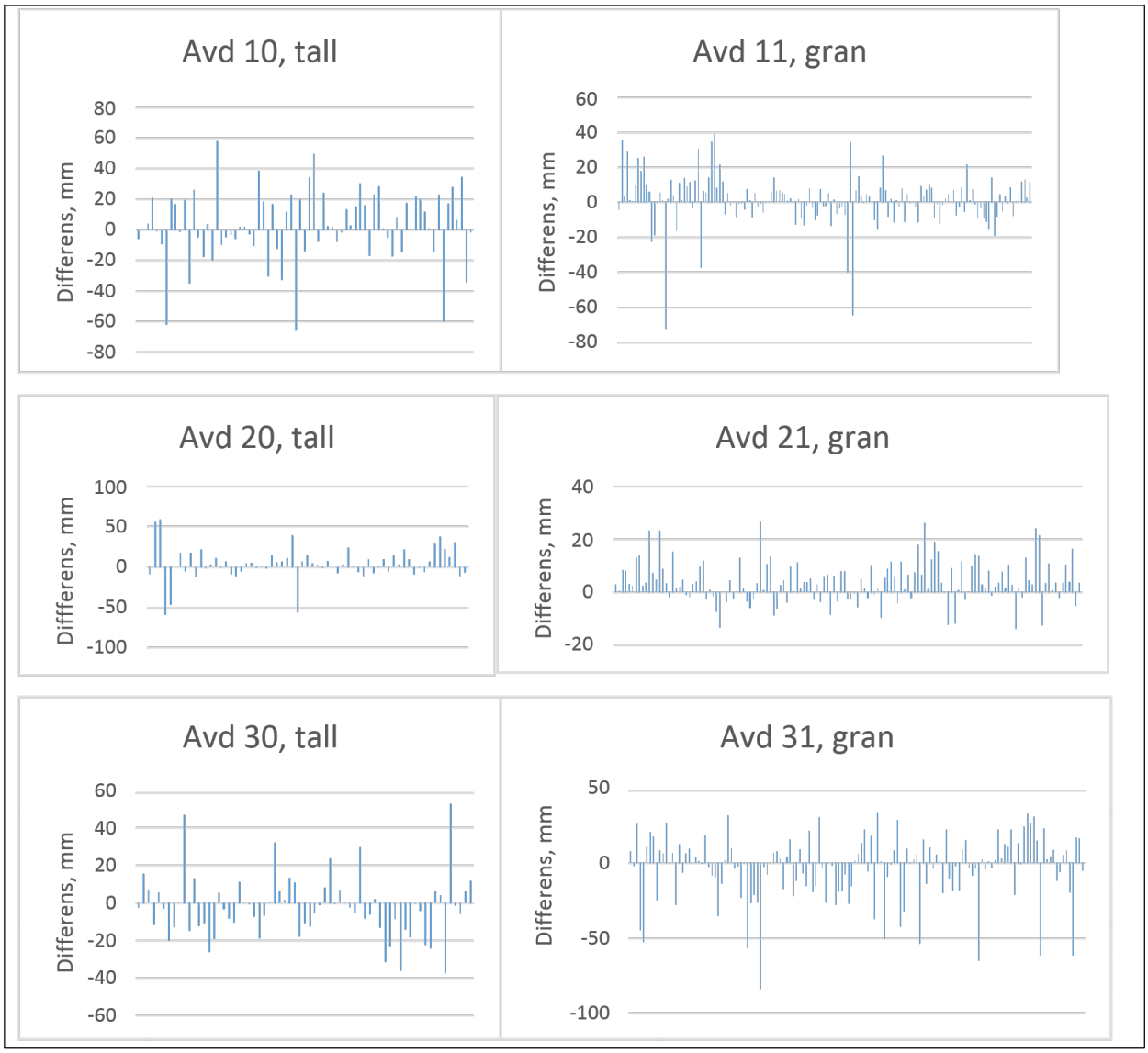

Figure 2. Difference between the diameter of individual trees as measured by caliper and the Katam system.

Stand data

The accuracy of the estimation of the average diameter of the stand was acceptable for both the pine and spruce pair cells in the tree species trial T158 (Table 2). In Katam measurement, there was both over- and underestimation of the average diameter.

The katam measurement underestimated the stand's population compared to the regular audit. For three (one pine and two spruce pair cells) of the saturated departments, the underestimation was of marginal importance while for the other three it was in the order of 10-20%. The reason for the underestimates was that a number of trees were not identified at the Katam measurement. There was no obvious common detail for the unidentified trees such as tree size or the location of the trees. Possible reasons for not identifying trees during filming may be the laying of the belts, the camera positioning

during filming, uneven terrain along the walkways, hidden camera angles, area mount, etc. Katam has identified a number of software bugs after the trial results and claims that the system has now become more reliable to detect all trees. In the app there is also the possibility to visually determine in the AR view whether a tree has not been detected. The user can then manually add a new tree in a missing position. However, this function has not been used in the evaluation.

The katam measurement underestimated the basal area of the stand compared to the regular audit. For three (one pine and two spruce pair cells) of the measured departments, the underestimation was of marginal importance, while for the other three it was in the order of 5-15%. The reason for the underestimations was the same as for the number of stems, namely that several trees were not identified during filming.

Table 2. Estimation of the diameter of the basal area strain (Dg), the number of stems and the basal area during the regular audit autumn 2018 (Rev 4) and Katam measurement in November 2018. Tree species attempt T158, Tönnersjöheden's trial park.

Stand / #	Tree species	Dg, cm			Stem count, pcs/ha			Basal area, m^2/ha		
		Ref 4	Katam	Diff	Ref 4	Katam	Diff	Ref 4	Katam	Diff
10	Pine	21,0	20,7	0,3	736	716	20	25,4	24,0	0,4
11	Fir	17,1	17,1	0	1549	1519	30	35,5	34,9	0,6
20	Pine	20,9	21,2	-0,3	750	614	136	25,8	21,7	4,1
21	Fir	17,4	17,1	0,3	1359	1339	20	32,4	30,9	1,5
30	Pine	21,0	21,7	-0,7	788	636	152	27,2	23,5	3,7
31	Fir	17,3	18,0	-0,7	1379	1254	125	32,4	31,9	0,5

Positioning of individual trees

Positioning of individual trees was studied in Ward 3 of the Skogaby-trial. For most of the individual trees, the consistency was good between the coordinates of the Katam system and the field-measured coordinates (Figure 3). For practical use, the precision of the Katam system's tree positioning should be sufficient for most applications. The deviation between the two coordinates was on average 0.66 m (s-dev 0.30) and the variation between 0.01 – 1.51 m (Figure 4). There was no clear pattern in the variation for the deviations that could be attributed to the location of the trees on the sample surface, tree size or other obvious explanations. Possible causes of deviations may be inaccuracies in field-measured coordinates, coordinate transformations performed, terrain conditions, etc.

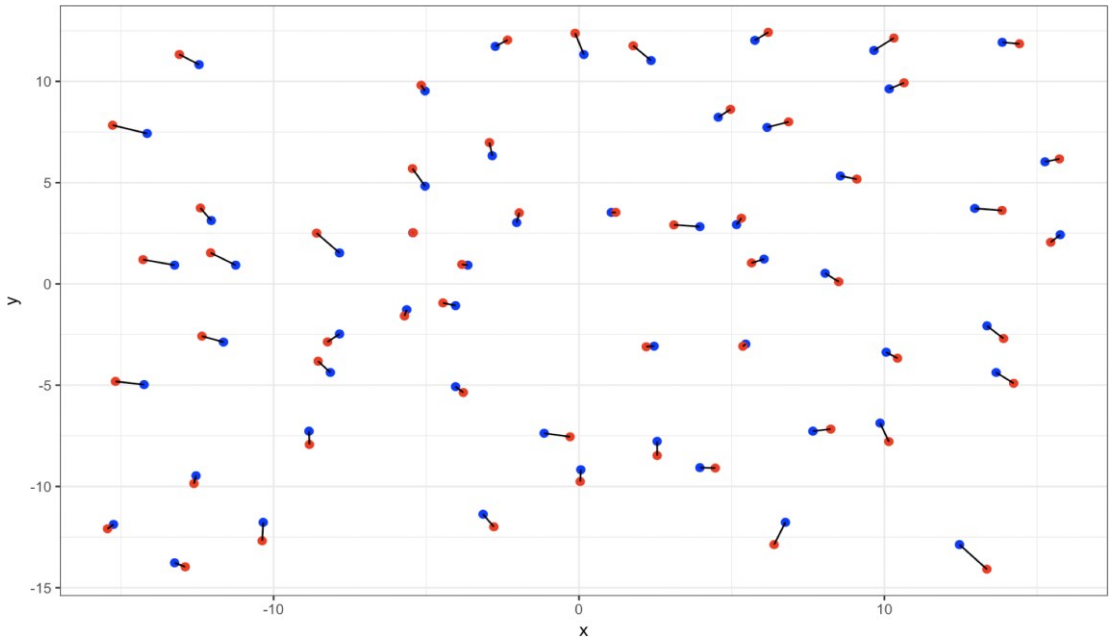

Figure 3. Coordinates of individual trees measured in fields (blue) and with the Katam system (Red). The lines bind the trees together. Section 3 of the Forest Village Trial.

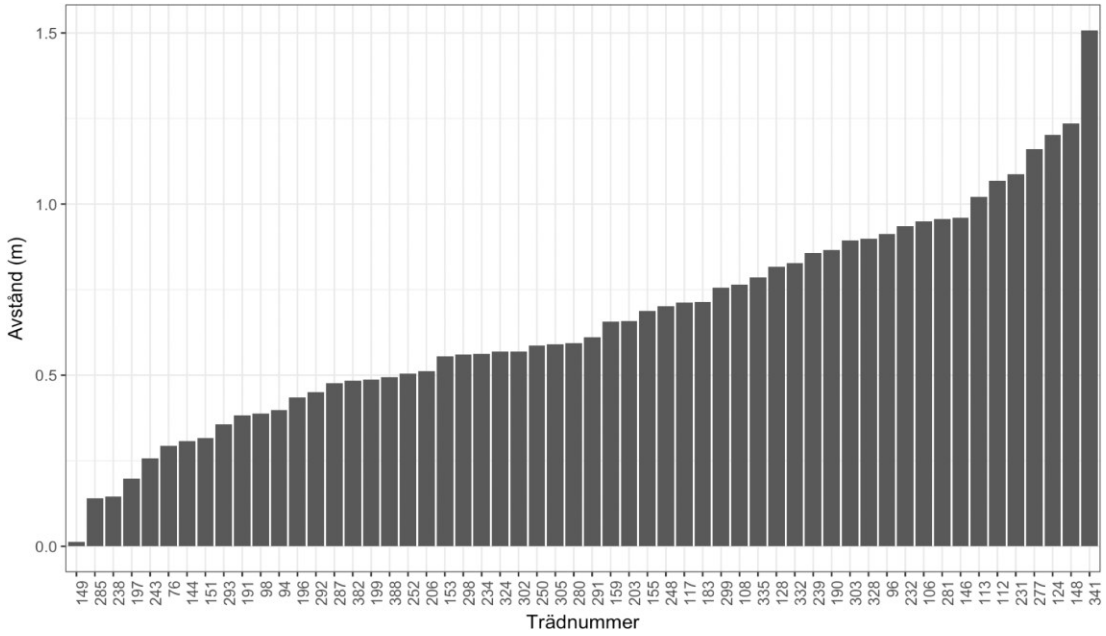

Figure 4. Distance (m) between trees in field measured data and Katam data.

Conclusions

- The katam system has on average high accuracy in measurements of diameter for individual trees, however, there are under- and overestimations.
- At the stand level, the Katam system has acceptable accuracy in estimating average diameter while in some cases the population and basal area are underestimated.
- The katam system has improvement potential for the identification and positioning of individual trees, which according to Katam has improved since the experiment was carried out.

Recognition

This study was funded through grants from the Seydlitz MP Foundation.

References

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Appendix 1. Statistical cards for the experimental surfaces used in the study

SLU

Försöksyta 8158 Avdelning 10

STATISTIKKORT

Ägare eller förvaltning: TÖNNERSJÖHEDENS FÖRSÖKSPARK, BOX 17, 313 25 SIMLÅNGSDALEN

Fastighet: SKÄLLÅS 1:12 | Socken: BREARED | Höjd över havet: 90 m

Topografisk karta: 04CNO | Latitud: 56° 41' 30" | Longitud: 13° 06' 40"

Huvudträdslag: TALL | Ståndortsindex: 32 (vid 36 år) | Beståndets födelseår: 1983

Uppkomstsätt: Plantering | Behandlingar vid revision nr: 1 Fri gallring. 2 Fri gallring. 3 Fri gallring. 4 Fri gallring.

		Kvarvarande beståndet						Utgallrat virke					Total produktion		Årlig löpande tillväxt				
	Trädslag	Diam	Medel-höjd	Övre-höjd	Stam-antal	Grund-yta	Volym	Diam	Stam-antal	Grund-yta	Volym	% antal	% volym	Grund-yta	Volym	Diam	Grundyta m²	%	Volym m³	%
Revision 1	Ålder 18		Datum 2000-09-01			Areal 0,10190														
	Tall	9,8	8,2	9,1	2444	18,3	84,5	9,1	1021	6,6	30,3	29	26							
TORR	Tall							6,5	20	0,1	0,3									
SA	Tall	9,8	8,2		2444	18,3	84,5	9,0	1040	6,7	30,6	30	27	25,0	115,1					
	Gran	0,0	0,0	0,0	0	0,0	0,0	6,5	108	0,4	1,5	100	100	0,4	1,5					
	Glasbjörk	0,0	0,0	0,0	0	0,0	0,0	6,4	137	0,4	2,0	100	100	0,4	2,0					
SA	Tot	9,8			2444	18,3	84,5	8,6	1286	7,5	34,1	34	29	25,8	118,6					
Revision 2	Ålder 25		Datum 2007-10-04			Areal 0,10190														
	Tall	14,3	12,5	13,7	1295	20,7	135,3	10,6	854	7,6	45,9	40	25							
TORR	Tall							7,0	294	1,1	6,4									
SA	Tall	14,3	12,5		1295	20,7	135,3	9,8	1148	8,7	52,3	47	28	36,1	218,2	3,7	1,59	7,0	14,7	12,1
SA	Tot													36,9	221,7					
Revision 3	Ålder 30		Datum 2012-08-10			Areal 0,10190														
	Tall	18,1	15,5	16,1	746	19,1	143,5	14,2	540	8,5	63,7	42	31							
TORR	Tall							10,5	10	0,1	0,6									
SA	Tall	18,1	15,5		746	19,1	143,5	14,1	550	8,6	64,3	42	31	43,1	290,7	4,4	1,39	6,0	14,5	9,0
SA	Tot													43,9	294,2					
Revision 4	Ålder 36		Datum 2018-08-27			Areal 0,10190														
	Tall	21,7	18,2	18,7	579	21,5	183,3	17,7	157	3,9	32,4	21	15							
TORR	Tall							10,4	10	0,1	0,7									
SA	Tall	21,7	18,2		579	21,5	183,3	17,4	167	4,0	33,1	22	15	49,4	363,5	4,7	1,06	4,9	12,1	7,1
SA	Tot													50,2	367,0					

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STATISTIKKORT

Ägare eller förvaltning: TÖNNERSJÖHEDENS FÖRSÖKSPARK, BOX 17, 313 25 SIMLÅNGSDALEN

Fastighet: SKÄLLÅS 1:12 | Socken: BREARED | Höjd över havet: 90 m

Topografisk karta: 04CNO | Latitud: 56° 41' 30" | Longitud: 13° 06' 40"

Huvudträdslag: GRAN | Ståndortsindex: 37 (vid 37 år) | Beståndets födelseår: 1982

Uppkomstsätt: Plantering | Behandlingar vid revision nr: 1 Fri gallring. 2 Fri gallring. 3 Fri gallring.

		Kvarvarande beståndet						Utgallrat virke					Total produktion		Årlig löpande tillväxt				
	Trädslag	Diam	Medel-höjd	Övre-höjd	Stam-antal	Grund-yta	Volym	Diam	Stam-antal	Grund-yta	Volym	% antal	% volym	Grund-yta	Volym	Diam	Grundyta m²	%	Volym m³	%
Revision 1	Ålder 26		Datum 2007-09-11			Areal 0,10006														
	Tall	0,0	0,0	0,0	0	0,0	0,0	10,4	220	1,9	10,7	100	100							
TORR	Tall							5,4	10	0,0	0,1									
SA	Tall	0,0	0,0		0	0,0	0,0	10,2	230	1,9	10,8	100	100	1,9	10,8					
	Gran	11,8	12,4	14,3	1889	20,7	138,1	9,1	1279	8,4	46,8	40	25	29,1	184,9					
	Vårtbjörk	0,0	0,0	0,0	0	0,0	0,0	5,9	60	0,2	0,7	100	100	0,2	0,7					
SA	Tot	11,8			1889	20,7	138,1	9,2	1569	10,4	58,3	45	30	31,1	196,4					
Revision 2	Ålder 31		Datum 2012-09-06			Areal 0,10006														
	Gran	14,4	14,9	17,6	1549	25,3	197,7	10,8	330	3,0	21,3	18	10							
TORR	Gran							13,1	10	0,1	1,1									
SA	Gran	14,4	14,9		1549	25,3	197,7	10,8	340	3,1	22,4	18	10	36,9	266,9	4,1	1,56	6,6	16,4	9,8
SA	Tot													38,9	278,5					
Revision 3	Ålder 37		Datum 2018-08-31			Areal 0,10006														
	Gran	18,3	17,4	20,4	1129	29,6	260,5	13,4	420	5,9	47,1	27	15	47,0	376,9	4,4	1,69	5,8	18,3	7,6
SA	Tot													49,0	388,4					

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STATISTIKKORT

Ägare eller förvaltning: TÖNNERSJÖHEDENS FÖRSÖKSPARK, BOX 17, 313 25 SIMLÅNGSDALEN

Fastighet: SKÄLLÅS 1:12 | Socken: BREARED | Höjd över havet: 90 m

Topografisk karta: 04CNO | Latitud: 56° 41' 30" | Longitud: 13° 06' 40"

Huvudträdslag: TALL | Ståndortsindex: 33 (vid 36 år) | Beståndets födelseår: 1983

Uppkomstsätt: Plantering | Behandlingar vid revision nr: 1 Fri gallring. 2 Fri gallring. 3 Fri gallring. 4 Fri gallring.

		Kvarvarande beståndet						Utgallrat virke					Total produktion		Årlig löpande tillväxt				
	Trädslag	Diam	Medel-höjd	Övre-höjd	Stam-antal	Grund-yta	Volym	Diam	Stam-antal	Grund-yta	Volym	% antal	% volym	Grund-yta	Volym	Diam	Grundyta m²	%	Volym m³	%
Revision 1	Ålder 18	Datum 2000-09-13				Areal 0,10260														
	Tall	10,1	8,1	9,3	2203	17,7	81,9	9,7	780	5,7	27,5	26	25							
TORR	Tall								7,2	195	0,8	3,5								
SA	Tall	10,1	8,1		2203	17,7	81,9	9,2	975	6,5	30,9	31	27	24,2	112,9					
	Gran	0,0	0,0	0,0	0	0,0	0,0	6,0	29	0,1	0,3	100	100	0,1	0,3					
	Glasbjörk	6,5	8,7	0,0	29	0,1	0,4	7,6	146	0,7	3,1	83	89	0,8	3,5					
SA	Tot	10,1			2232	17,8	82,3	9,0	1150	7,2	34,3	34	29	25,0	116,7					
Revision 2	Ålder 25	Datum 2007-10-03				Areal 0,10260														
	Tall	14,6	12,7	13,6	1160	19,5	127,1	10,9	624	5,9	35,4	35	22							
TORR	Tall							7,6	419	1,9	11,0									
SA	Tall	14,6	12,7		1160	19,5	127,1	9,7	1043	7,8	46,4	47	27	33,7	204,4	3,5	1,37	6,4	13,1	11,3
	Glasbjörk	0,0	0,0	0,0	0	0,0	0,0	10,6	19	0,2	1,0	100	100							
TORR	Glasbjörk							6,1	10	0,0	0,2									
SA	Glasbjörk	0,0	0,0		0	0,0	0,0	9,3	29	0,2	1,1	100	100	0,9	4,2	4,0	0,01	10,6	0,1	16,3
SA	Tot	14,6			1160	19,5	127,1	9,7	1072	8,0	47,5	48	27	34,7	209,0		1,38	6,4	13,2	11,3
Revision 3	Ålder 30	Datum 2012-08-23				Areal 0,10260														
	Tall	18,4	15,8	16,8	750	19,9	150,9	13,9	380	5,8	42,8	34	22							
TORR	Tall							9,1	29	0,2	1,4									
SA	Tall	18,4	15,8		750	19,9	150,9	13,6	409	6,0	44,2	35	23	40,1	272,5	4,5	1,28	5,9	13,6	9,0
SA	Tot													41,1	277,0					
Revision 4	Ålder 36	Datum 2018-08-28				Areal 0,10260														
	Tall	22,1	19,1	19,7	526	20,2	177,6	17,8	224	5,6	46,9	30	21	46,0	346,0	4,2	0,98	4,4	12,3	6,8
SA	Tot													47,0	350,6					

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STATISTIKKORT

Ägare eller förvaltning: TÖNNERSJÖHEDENS FÖRSÖKSPARK, BOX 17, 313 25 SIMLÅNGSDALEN

Fastighet: SKÄLLÅS 1:12 | Socken: BREARED | Höjd över havet: 90 m

Topografisk karta: 04CNO | Latitud: 56° 41' 30" | Longitud: 13° 06' 40"

Huvudträdslag: GRAN | Ståndortsindex: 35 (vid 37 år) | Beståndets födelseår: 1982

Uppkomstsätt: Plantering | Behandlingar vid revision nr: 1 Fri gallring. 2 Fri gallring. 3 Fri gallring.

		Kvarvarande beståndet						Utgallrat virke					Total produktion		Årlig löpande tillväxt				
	Trädslag	Diam	Medel-höjd	Övre-höjd	Stam-antal	Grund-yta	Volym	Diam	Stam-antal	Grund-yta	Volym	% antal	% volym	Grund-yta	Volym	Diam	Grundyta m²	%	Volym m³	%
Revision 1	Ålder 26	Datum 2007-09-12				Areal 0,10380														
	Tall	0,0	0,0	0,0	0	0,0	0,0	9,2	106	0,7	4,0	100	100	0,7	4,0					
	Gran	11,9	12,5	13,7	1965	21,8	145,1	9,4	1146	8,0	49,4	37	25	29,8	194,5					
	Vårbjörk	0,0	0,0	0,0	0	0,0	0,0	7,3	96	0,4	1,8	100	100	0,4	1,8					
SA	Tot	11,9			1965	21,8	145,1	9,3	1349	9,1	55,2	41	28	30,9	200,3					
Revision 2	Ålder 31	Datum 2012-08-30				Areal 0,10380														
	Gran	14,9	15,4	15,7	1349	23,4	189,3	11,9	617	6,9	48,5	31	20	38,2	287,3	4,2	1,68	6,7	18,6	10,4
SA	Tot													39,3	293,1					
Revision 3	Ålder 37	Datum 2018-08-29				Areal 0,10380														
	Gran	17,9	17,6	18,8	1137	28,6	257,3	14,8	222	3,8	32,1	16	11	47,2	387,3	4,3	1,50	5,6	16,7	7,3
SA	Tot													48,3	393,1					

Försöksyta 8158 Avdelning 30

STATISTIKKORT

Ägare eller förvaltning: TÖNNERSJÖHEDENS FÖRSÖKSPARK, BOX 17, 313 25 SIMLÅNGSDALEN

Fastighet: SKÄLLÅS 1:12 | Socken: BREARED | Höjd över havet: 90 m

Topografisk karta: 04CNO | Latitud: 56° 41' 30" | Longitud: 13° 06' 40"

Huvudträdslag: TALL | Ståndortsindex: 32 (vid 36 år) | Beståndets födelseår: 1983

Uppkomstsätt: Plantering | Behandlingar vid revision nr: 1 Fri gallring. 2 Fri gallring. 3 Fri gallring. 4 Fri gallring.

		Kvarvarande beståndet							Utgallrat virke					Total produktion		Årlig löpande tillväxt				
	Trädslag	Diam	Medel-höjd	Övre-höjd	Stam-antal	Grund-yta	Volym	Diam	Stam-antal	Grund-yta	Volym	% antal	% volym	Grund-yta	Volym	Diam	Grundyta m^2	%	Volym m^3	%
Revision 1	Ålder 18	Datum 2001-04-20				Areal 0,10530														
	Tall	9,8	8,2	9,1	2355	17,9	83,9	6,5	9	0,0	0,1	0	0	18,0	84,0					
	Gran	9,1	8,4	0,0	28	0,2	0,8	8,7	1073	6,4	27,9	97	97							
TORR	Gran							5,1	19	0,0	0,2									
SA	Gran	9,1	8,4		28	0,2	0,8	8,6	1092	6,4	28,1	98	97	6,6	28,8					
	Vårtbjörk	0,0	0,0	0,0	0	0,0	0,0	7,3	19	0,1	0,3	100	100	0,1	0,3					
	Ek	0,0	0,0	0,0	0	0,0	0,0	10,8	9	0,1	0,3	100	100	0,1	0,3					
SA	Tot	9,8			2384	18,1	84,6	8,6	1130	6,6	28,9	32	25	24,7	113,5					
Revision 2	Ålder 25	Datum 2007-10-04				Areal 0,10530														
	Tall	14,5	12,5	13,3	1178	19,4	122,5	10,7	1016	9,2	53,2	46	30							
TORR	Tall							8,0	161	0,8	4,5									
SA	Tall	14,5	12,5		1178	19,4	122,5	10,4	1178	10,0	57,7	50	32	29,4	180,4	3,9	1,63	7,3	13,8	11,5
SA	Tot	14,5			1178	19,4	122,5	10,4	1206	10,2	58,8	51	32	36,2	210,2		1,63	7,2	13,8	11,5
Revision 3	Ålder 30	Datum 2012-08-30				Areal 0,10530														
	Tall	18,1	15,3	15,8	788	20,3	151,4	14,7	370	6,3	46,0	32	23							
TORR	Tall							9,7	19	0,1	1,0									
SA	Tall	18,1	15,3		788	20,3	151,4	14,5	389	6,5	47,0	33	24	36,7	256,3	5,1	1,47	6,6	15,2	10,1
SA	Tot													43,5	286,1					
Revision 4	Ålder 36	Datum 2018-08-30				Areal 0,10530														
	Tall	21,8	18,2	18,6	570	21,3	179,6	18,6	218	5,9	50,3	28	22	43,7	334,8	4,8	1,16	5,0	13,1	7,2
SA	Tot													50,4	364,6					

Försöksyta 8158 Avdelning 31

STATISTIKKORT

Ägare eller förvaltning: TÖNNERSJÖHEDENS FÖRSÖKSPARK, BOX 17, 313 25 SIMLÅNGSDALEN

Fastighet: SKÄLLÅS 1:12 | Socken: BREARED | Höjd över havet: 90 m

Topografisk karta: 04CNO | Latitud: 56° 41' 30" | Longitud: 13° 06' 40"

Huvudträdslag: GRAN | Ståndortsindex: 37 (vid 37 år) | Beståndets födelseår: 1982

Uppkomstsätt: Plantering | Behandlingar vid revision nr: 1 Fri gallring. 2 Fri gallring. 3 Fri gallring.

		Kvarvarande beståndet							Utgallrat virke					Total produktion		Årlig löpande tillväxt				
	Trädslag	Diam	Medel-höjd	Övre-höjd	Stam-antal	Grund-yta	Volym	Diam	Stam-antal	Grund-yta	Volym	% antal	% volym	Grund-yta	Volym	Diam	Grundyta m^2	%	Volym m^3	%
Revision 1	Ålder 26	Datum 2007-09-14				Areal 0,11166														
	Tall	0,0	0,0	0,0	0	0,0	0,0	8,7	143	0,9	4,7	100	100	0,9	4,7					
	Gran	12,2	13,3	15,1	1764	20,8	149,2	9,6	1048	7,5	49,1	37	25	28,3	198,4					
	Vårtbjörk	0,0	0,0	0,0	0	0,0	0,0	7,0	36	0,1	0,6	100	100	0,1	0,6					
SA	Tot	12,2			1764	20,8	149,2	9,4	1227	8,5	54,5	41	27	29,3	203,7					
Revision 2	Ålder 31	Datum 2012-09-07				Areal 0,11166														
	Gran	15,0	15,7	17,7	1397	24,6	201,8	11,8	367	4,0	32,0	21	14	36,2	283,0	4,3	1,58	6,7	16,9	9,4
SA	Tot													37,2	288,4					
Revision 3	Ålder 37	Datum 2018-08-31				Areal 0,11166														
	Gran	18,4	18,9	20,5	1057	28,0	271,3	13,2	322	4,4	38,8	23	13							
TORR	Gran							21,2	18	0,6	6,1									
SA	Gran	18,4	18,9		1057	28,0	271,3	13,8	340	5,1	45,0	24	14	44,6	397,4	3,9	1,40	5,0	19,1	7,8
SA	Tot													45,6	402,8					

Försöksyta 1225 Avdelning 3

STATISTIKKORT

Ägare eller förvaltning: Region Halland, Box 517, 301 80 Halmstad.

Fastighet: SKOGABY Socken: LAHOLM Höjd över havet: 100 m

Topografisk karta: 04CSO Latitud: 56° 33' 15" Longitud: 13° 12' 52"

Huvudträdslag: GRAN Ståndortsindex: 32 (vid 49 år) Beståndets födelseår: 1962

Uppkomstsätt: Plantering Behandlingar vid revision nr: 1 Uppskattning. 2 Fri gallring. 3 Fri gallring. 4 Uppskattning. 5 Uppskattning.

Utgallrat virke 2007 utgörs av stormfällt 8 januari 2005

		Kvarvarande beståndet						Utgallrat virke					Total produktion		Årlig löpande tillväxt				
	Trädslag	Diam	Medel-höjd	Övre-höjd	Stam-antal	Grund-yta	Volym	Diam	Stam-antal	Grund-yta	Volym	% antal	% volym	Grund-yta	Volym	Diam	Grundyta m^2	%	Volym m^3	%
Revision 1	Ålder 26		Datum 1987-09-18				Areal 0,09000												
	Gran	11,3	9,5	10,9	2089	21,1	101,0	0,0	0	0,0	0,0	0	0	21,1	101,0				
.																			
Revision 2	Ålder 32		Datum 1993-10-19				Areal 0,09000												
	Gran	14,8	12,3	13,6	1300	22,3	138,5	10,2	800	6,5	37,8	38	21	28,8	176,3	3,1	1,28	5,3	12,5	9,7
.																			
Revision 3	Ålder 40		Datum 2001-10-23				Areal 0,09000												
	Gran	18,1	16,9	17,8	933	24,1	203,7	14,7	356	6,0	46,2	28	18						
TORR	Gran							14,8	11	0,2	1,4								
SA	Gran	18,1	16,9		933	24,1	203,7	14,7	367	6,2	47,6	28	19	36,8	289,1	3,1	1,00	3,9	14,1	7,7
.																			
Revision 4	Ålder 46		Datum 2007-09-18				Areal 0,09000												
	Gran	20,2	18,5	20,1	756	24,2	221,9	19,0	178	5,1	44,4	19	17	41,9	351,8	3,1	0,86	3,3	10,4	4,6
.																			
Revision 5	Ålder 49		Datum 2010-09-20				Areal 0,09000												
	Gran	21,3	19,6	21,5	711	25,4	243,9	20,3	22	0,7	6,7	3	3						
TORR	Gran							12,3	22	0,3	2,2								
SA	Gran	21,3	19,6		711	25,4	243,9	16,8	44	1,0	8,9	6	4	44,2	382,6	3,1	0,75	3,0	10,3	4,4