

Minutes from the meeting with the StanForD-group 2009-04-01

Place:	Skogforsk, Uppsala, Sweden
Present	
Manufacturing members:	Mikael Eliasson, LogMax Joonas Kaarnametsä, John Deere Jörgen Eriksson, Dasa Per Annemalm, Komatsu Forest Lars-Erik Andersson, Rottne Johan Bruun, Ponsse
Others:	Tapio Räsänen, Metsäteho Juha-Antti Sorsa, Metsäteho Timo Melkas, Metsäteho Per Knutsson, Logica Jon Rudman, StoraEnso Kim Gunnarsson, Södra Lars Henriksson, SDC Camilla Rolig-Schölin, Triona Jonas Gustafsson, Sveaskog Joakim Nygren, Haglöf
Skogforsk:	John Arlinger, Secretary Johan J. Möller, Chairman

§1 Opening of the meeting

Johan J. Möller opened the meeting. The proposed agenda was accepted.

§2 Clarifications and modifications of variables

PRIORITY OF VAR35_T2 IN OAI-FILE

Proposal from Skogforsk (2009-03-20)

Holmen skog has pointed out that it should be possible to include var35_t2 in the oai-file when sending it out together with a ghd-file. Var35_t2 is often used for registering “virkesordernummer” which is very essential information for identifying a harvesting object.

It was therefore decided that var35_t2 is given priority 2 in oai-files.

§3 New variables

QUALITY CONTROL OF FORWARDER SCALE

Background

The original proposal was based on discussions in the Finnish StanForD meeting (24th of February 2009).

Weight scaling can be used in Finland from the beginning of 2009 for commercial timber measurement of small timber quantities. It is also being implemented as a measurement method for bioenergy assortments. The regulation of Ministry of Agriculture and Forestry concerning weight scaling of timber requires that measurement accuracy of scales has to be monitored by control measurements using control weights or weight bridges of the mills. Scaling accuracy must be continuously monitored on a weekly basis and control measurement results must be registered.

Metsäliitto has announced to start using prl for the reporting of bioenergy assortments from June 2009. Forwarded quantities of prl will be based on weight scale measurements.

The present weight scale calibration variables (var60, 2002-10-28) do not cover the new Finnish requirements for controlling weight scale measurement accuracy. New variables for reporting forwarders' weight scale control measurements are therefore needed.

The Finnish StanForD-meeting has suggested that these new variables should be implemented in forwarders by the end of September 2009.

New variables

The proposal was based on reporting data of one or several control measurements in one prl file.

It was decided that the following new variables are to be implemented with priority 3 in prl-files:

Var	Name	Type	Data type	Unit	Description
61	WEIGHT-CONTROL	1	integer	no	Number of occurrences of weight scale controls.
		2	string	yyyy-mmdd-hhmmss	Time of weight scale control measurement: 1...var61_t1.
		3	integer	kg	Reference weight, weight of the control object (e.g. test object or weight bridge): 1...var61_t1.
		4	integer	no	Number of control weight scalings: 1...var61_t1.
		5	integer	kg	Registered mass of control scaling in forwarder per scaling occasion: 1...var61_t4/ 1...var61_t1. Weight values of the forwarder's scale.
		6	integer	code	Calibration of the weight scale has been done (or not) based on the weight control results and suggestions of the scale manufacturer: 1...var61_t1. Codes: 0 = no, 1 = yes

		7	string	text	Optional free text about control measurements, calibration reasons, weight scale faults and repairs etc.
		8	string	Free text	Name and identity of certificate of type examination for scale
		9	string	Free text	Scale model and manufacturer
		10	integer	Code	Scale type: grapple vs bunks Codes: 0=grapple scale, 1= bunk (load bearers) scale

Each individual scaling is registered in the new variables as described above. This makes it possible to calculate not only the average deviation but also for example standard deviation, minimum and maximum. It will also be possible to filter out extreme values (outliers) if needed. It also means that we register data in way similar to the ktr-file.

The existing old var60 (WEIGHTCAL, type 1-5) could still be used when weight scale calibration is done on some other basis than control measurements. It could also be possible to always use the old var60_t1 and t2 for expressing that a calibration has been done and the time of the calibration. Var61_t7 could then be left out from the variables. Clear definitions about how and using which variables the scale calibrations should be registered must be made

It was suggested that var60_t3 and t4 are given priority 4 since the information is possible to register in the new var61. However this was not acceptable to the meeting since the variables have been implemented by some manufacturers.

Finnish comments after meeting

In the original proposal from the Finnish StanForD group there was a separate variable for registering the difference between the sum of control weight scaling and real weight in per mille. The meeting decided to exclude this variable since this information can be calculated based on var61_t3, t4 and t5. It was decided to ask for comments from Finnish users regarding this decision and make a final decision with the minutes of the meeting based on the comments.

Metsäteho requested comments concerning the updated list of variables as described above from the Finnish StanForD group and from the weight scale manufacturers by 24th of April 2009. Responses from three companies were received and they were all positive to the updated list of variable including the exclusion of the difference. However, it was remarked that it would be good to have the difference showed in the forwarder's weight scale management application even if it is not saved in the prl-file.

Example

An example of data registered in new var61:

<i>Date</i>	<i>Reference mass</i>	<i>No of control scalings</i>	<i>Total mass according to forwarder scale</i>	<i>Calibration done</i>
090227	500 kg	6 st	496, 512, 509, 520, 497, 499 kg	No
090307	500 kg	6 st	519, 515, 542, 507, 499, 504 kg	Yes

Results:

<i>Date</i>	<i>Average</i>	<i>Standard dev</i>	<i>Max</i>	<i>Min</i>
090227	505.5	9.7	520	496
090307	514.3	15.4	542	499

Calibration log (var60):

<i>Date</i>	<i>Adjustment</i>
090307	97.2% (500/514.3)

Other considerations

A preliminary idea in StanForD 2010 has been to reserve a specific message for forwarder quality control data. Control measurements of weight scales will be reported in that message. It will also be discussed within StanForD 2010 whether some kind of instruction for the control measurements is needed.

There are also some other possible variables that could be used together with the proposed ones. These were discussed in the Finnish meeting, but they were left out from the proposal for time being:

1. difference of control weight and real weight as per mille
 - a. additional information, but can be calculated from the difference in kilograms
2. calibration reason
 - a. list of different reasons? is there any other than control measure-ment result
 - b. what about automatic calibrations of some weight scales?
 - c. calibration reason could be given in var61_t7
3. type of the control weight
 - a. different types should be listed and codes be defined for those
 - b. there might be at least two types of control weight objects: official or pre-defined and non-official
4. inspection of the control weight
 - a. time when the control weight was last inspected
 - b. weight of control weight should be inspected annually with another calibrated scale

§4 Multi tree harvesting

The issue of updating and clarifying multi tree harvesting variables was intensively discussed at the meeting. This was partly due to the fact that it was discovered during the meeting that these variables had been recently implemented by one manufacturer. No final decisions were taken at the meeting.

The basic conclusion drawn by the secretary was that the net volume definitions should be more flexibly defined with several optional calculation methods described in the StanForD appendix. The suggestions below are

based on this conclusion. No meeting participants disagreed with the suggestions thus meaning that the all suggestions were accepted.

It was decided with the minutes that the following terms for different types of harvesting systems are to be used in StanForD documents (for ex var230:

- Single tree harvesting is divided up into two separate types: *single tree processing* and *single tree felling*.
 - Single tree processing is defined as one stem being felled, delimbed and cross cut into logs individually.
Only one individual stem is processed at a time.
 - Single tree felling is defined as one stem being felled. The stem is not processed but placed on the ground including branches and top. Observe that this information is to be registered in the same way as *Multi tree felling* (see below).
- Multi tree harvesting is divided up into two separate types: *multi tree processing* and *multi tree felling*.
 - Multi tree processing is defined as several stems being felled, accumulated, delimbed and cross cut into log bunches simultaneously.
At least two stems are always processed simultaneously.
 - Multi tree felling is defined as several stems being felled and accumulated, the stems are not processed but placed in one stem bunch on the ground including branches and tops.

NET VOLUME CALCULATION IN MULTI TREE PROCESSING

A number of the variables are defined in the standard for registering an estimated "net" volume of multi tree processed stems. There are two categories of variables for registering the net volume in the standard. The first category (variable 246 in prd- and pri-file) is a total volume with no information about individual log bunches. The second category is only registered in pri-files (var256_t3 log code 408, 409, 428, 429). In this case the volume per log bunch is registered.

It was decided 2008-05-06 to implement a calculation methods for net volumes. It has however been noted by some manufacturers that these definitions are not ideal. New additional definitions of these estimated volumes are therefore described below. These methods were discussed at the meeting. At least one company has already implemented the previously described methods.

The following was decided with the minutes (valid for both multi tree processing and multi tree felling):

- To update the definition of “net volumes” in order to make it clear that *“these net volumes are to represent estimated merchantable volumes based on previously single processed stems”*.
- Several different methods, including the older as well as the new one (see below), will be described in the appendix.
- The exact calculation method for net volumes can be decided by the manufacturers. It is in other words possible to use either the older or the newer calculation methods.

Methods

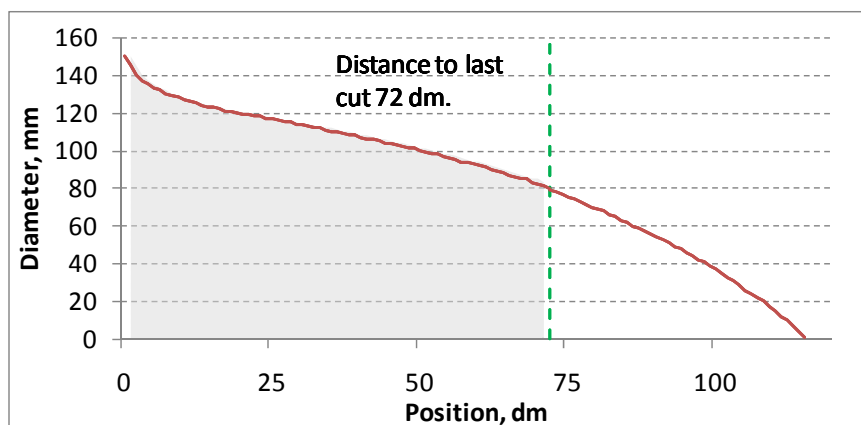
Below are the new methods for calculating net volumes of total multi tree processed logs. The volumes are to be an estimation of the log volumes. It is based on an assumption that it is possible to estimate the dbh of the first multi tree processed stem in one bunch. It was decided to add this text to the appendix.

Estimation method for total net solid stem volume of stem bunches (prd-file)

1. *Set species and estimate DBH of first cut stem (in multi tree processing).*
2. *Find the most suitable stem taper prediction curve based on DBH and species. This is to be the same prediction curve that is used for single tree processed stems.*
3. *The volume of the stem is calculated based on the taper prediction curve and the distance of feeding to the last cut.*
4. *Estimate the total net solid volume for the tree bunch by multiplying the number of stems with the volume of the first stem.*
5. *The net volume calculated by the harvester is registered in var246 (type 3-4 and 6-7). The net volume will be an estimation of the total log volume including unclassified logs.*

Example

The estimated DBH of the first multi tree processed stem is 125 mm. A total of three stems are processed simultaneously. The distance from the stump to the last cut is 7,2 m. A taper prediction curve is selected based on DBH and species. The volume is calculated based on the taper curve up to 7,2 m (illustrated in figure below, gray area represents calculated volume).



The estimated volume of the first stem is 0.057 m³sub. The total net solid volume u.b. for a tree bunch is thus 0,171 m³sub (0,057 m³sub*3 trees) in this example.

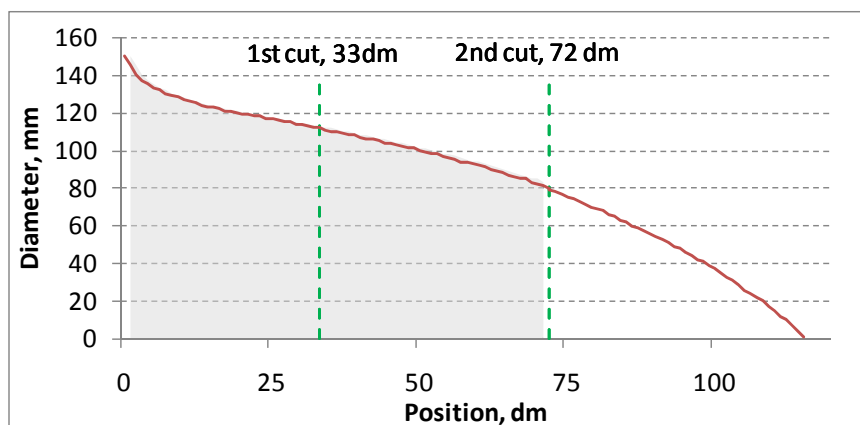
Estimation method for net volumes of log bunches in pri-file

The net volume of log bunches in pri-files are stored in var256_t3 log code 408, 409, 428, 429.

1. Set species and estimate DBH of first cut stem (in multi tree processing).
2. Find the most suitable stem taper prediction curve based on DBH and species. This is to be the same prediction curve that is used for single tree processed stems.
3. The volume of the logs is calculated based on the taper prediction curve and the distance of feeding to the positions of cutting.
4. Estimate the total net solid volume for each log bunch by multiplying the number of stems with the log volume of the first stem.
5. The net volume calculated by the harvester is registered in var256_t3 (log code 408, 409, 428, 429). The net volume will be an estimation of the total log volume including unclassified logs.

Example

The estimated DBH of the first multi tree processed stem is 125 mm. A total of three stems are processed simultaneously. The distance from the stump to the last cut is 7.2 m. A taper prediction curve is selected based on DBH and species. The volume is calculated based on the taper curve between 0 and 3.3 m for the first log and between 3.3 and 7.2 m for the second log (illustrated in figure below, gray area represents calculated volume).



Two log bunches were thus cut when processing this stem bunch with three stems. The resulting net volumes will be:

Log bunch	Estimated log volume of first stem, m3sub	Log bunch volume (log code 409 or 429), m3sub
1	0.031	0.093 (0.031 * 3)
2	0.026	0.078 (0.026 * 3)
Total	0.057	0.171

STEM DEFINITIONS

It was also decided with the minutes that it should be clearly pointed out that the definition of a stem as used in single tree processing (for example var221) must not be used in multi tree processing. All stems should thus be registered (var231) independently of size when carrying out multi tree processing.

ASSORTMENTS

The question concerning the need for registering assortment identities per log bunch has been raised a couple of times at different StanForD meetings.

It was decided with the minutes to introduce a new log bunch code 1 or 20 in var256_t3 for assortment code (comparable with log code 1 or 20 in var256_t1). This means that the volume per assortment is only registered in pri-files. This will also be the case in the future StanForD 2010.

NEW VARIABLES FOR MULTI TREE FELLING (FELLER BUNCHER)

It is not known exactly how the old var230_t1, var231_t1 and var246_t1 were to be used when proposed 1992-03-09. The idea might have been to use them for registering the production of a feller-buncher which was used in combination with a forwarder with a grapple saw. That means that several stems were felled and accumulated in bunches by the strip road and then bucked but not delimbed by a forwarder and finally transported to an industry for debarking and delimbing.

These are the present variable definitions (updated 2006-04-04, 2008-10-22):

Var	Name	Type	Data type	Unit	Description
230	NUMBNCH	1	Integer	No	Number of bunches/tree species: 1...var111_t1 Some type of feller-buncher system used
231	STMSINBNCH	1	Integer	No	Number of stems processed in bunches/tree species: 1...var111_t1 Some type of feller-buncher system used
246	BUNCHEDVOL	1	Integer	m3 (stacked)	Total volume (stacked) of bunched wood/tree species: 1...var111_t1 Some type of feller-buncher system used

Var246_t1 is to be used for registering multi tree felling volumes. However the definition of this volume is very poor. Since the stems are not processed in this case no measurements exists along the stems. It was therefore decided with the minutes that the volume definition is updated in order to make it clear that *“this volume is to represent estimated merchantable volumes based on previously single processed stems”*.

Var	Name	Type	Data type	Unit	Description
230	NUMBNCH	1	Integer	No	Number of <u>stem bunches</u> in multi tree felling/tree species: 1...var111_t1 Some type of feller-buncher system used. <u>Species is dependant on first stem in stem bunch.</u>
231	STMSINBNCH	1	Integer	No	Number of stems in <u>stem bunches</u> in multi tree felling /tree species: 1...var111_t1 Some type of feller-buncher system used. <u>Species is dependant on first stem in stem bunch.</u>
246	BUNCHEDVOL	1	Integer	<u>m3sob</u>	Total volume <u>over bark</u> (stacked) of bunched wood <u>stems</u> in multi tree felling as calculated by harvester/tree species: 1...var111_t1 Some type of feller-buncher system used. <u>Species is dependant on first stem in stem bunch.</u> <u>This volume is to represent estimated merchantable log volumes based on previously single processed stems.</u> <u>Possible calculation methods described in appendix.</u>

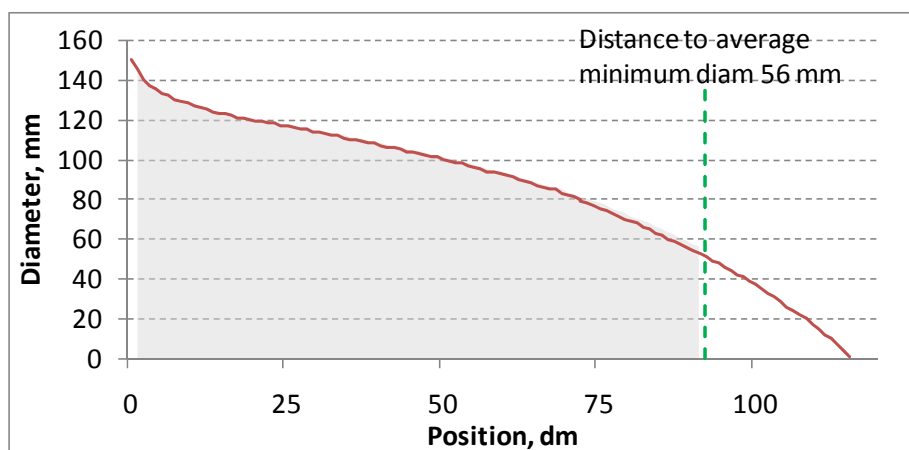
Var246_t1 is a predicted total stem volume over bark. This volume is calculated in a way similar to the net volumes for multi tree processing (for example var246, type 3-4 and 6-7).

Estimation method for total net solid volume of multi tree felled stems

1. *Set species and estimate DBH of first cut stem (in multi tree felling).*
2. *Find the most suitable stem taper prediction curve based on DBH and species. This is to be the same prediction curve that is used for single tree processed stems.*
3. *The volume of the stem is calculated based on the taper prediction curve and the distance from stump to the average minimum diameter of previously harvested stems (last cut).*
4. *Estimate the total net solid volume for the tree bunch by multiplying the number of stems with the volume of the first stem.*
5. *The net volume calculated by the harvester is registered in var246 (type 1). The net volume will be an estimation of the potential total log volume including unclassified logs.*

Example

The estimated DBH of the first multi tree processed stem is 125 mm. A total of three stems are felled simultaneously. The distance from the stump to the minimum diameter 56 mm is 9.2 m. A taper prediction curve is selected based on DBH and species. The volume is calculated based on the taper curve up to 9.2 m (illustrated in figure below, gray surface represents calculated volume).



The estimated volume of the first stem is 0.063 m³_{sub}. The total net solid volume u.b. for a tree bunch is thus 0,189 m³_{sub} (0,063 m³_{sub}*3 trees) in this example.

Multi tree felling in pri-files

It was also decided with the minutes to implement new separate variables in order to register data from multi tree felling in pri-files. The new stem bunch variables will be var265_t3, var266_t3 and var267_t3. No variables for log bunches will be included since no log bunch information is available.

The following variables are to be used in pri-files (priority 2):

Var no	Name	Type	Data type	Description
<u>230</u>	<u>NUMBNCH</u>	<u>5</u>	<u>Integer</u>	Number of stem bunches in multi tree felling. Some type of feller-buncher system used. All occasions registered in the current file are to be included.
<u>265</u>	<u>NUMTRECOD</u>	<u>3</u>	<u>Integer</u>	Number of tree (tree bunch) codes for multi-tree-felling in var266 t3. No log bunch data for these stems since no logs are cut.
<u>266</u>	<u>TREECODE</u>	<u>3</u>	<u>Integer</u>	Codes set for measurement data in var267 t3, all multi tree felled trees follows the definition in this variable:1..var265 t3. See appendix. No log bunch data for these stems since no logs are cut.
<u>267</u>	<u>TREEDATA</u>	<u>3</u>	<u>integer</u>	Measurement data in the pri-file for multi-tree-felled trees (tree bunches) /1...var265 t3/1...var230 t5. No log bunch data for these stems since no logs are cut.

Tree bunch codes in var266_t3

Code	Description
3	Species no of first felled stem
510	Processing order (tree bunch number) for multi tree felled stems (same as var270_t4). Incremented with each multi tree felling of stems. Reset when starting at a new harvesting object. Not to be modified by operator.

512	No of stems processed simultaneously
513	Stem number for previously normally harvested stem (single processed stem), identical with tree code 500 for single processed stems
721	Estimated DBH of first felled stem
730	<u>Predicted merchantable stem volume over bark up to minimum diameter according to available assortments</u>
750	Operator number. The number refers to the order of the drivers in variable 212, type 1. Number = 1...var211_t2. Operator no. 1 is the operator that comes directly after the type number in Var 212.
760	Latitude, integer as 0.00001 degrees, stored according to var521_t1, var521_t2 and var520_t1.
761	1=North, 2=South The code in var522_t2 is valid for all trees if this code is excluded.
762	Longitude, integer as 0.00001 degrees, stored according to var521_t1, var521_t2 and var520_t1.
763	1=East, 2=West The code in var522_t4 is valid for all trees if this code is excluded
764	Altitude, meters above sea level, stored according to var521_t1, ar521_t2 and var520_t1.

Tree data 760, 762 and 764 must be "-1" when no signal (invalid) is received from the gps.

2000-series - User defined codes, not standardized

The following tree data must be included in a pri-file: 510, 512

§5 StanForD 2010,

DATA STRUCTURES AND DATA CONTENT

John Arlinger gave a brief presentation of the latest development in the StanForD 2010 project regarding the structures and data content. Juha-Antti Sorsa thereafter went through his work on the first versions of xml-schemas for harvested production.

It was discussed whether the complete product instructions (definitions) shall be sent with the production message or not. Another issue that it is very important is that it is possible to convert new StanForD production message to old prd-/ pri-files when we start with tests in machines. It will then not be any problem to test machines in practical operations for the forest companies. Joonas Kaarnametsä think that it will be rather easy to do this conversion.

Time table

Johan Möller presented the preliminary time table decided at the meeting in December 2008. The group decided to just do small changes in the time table now. The group will make a better plan for the practical test at the next meeting in Helsinki. It is important to involve Logica in Sweden (production message) and the forest companies in Finland when writing a test plan.

Suggested up-dated timetable for development of a new standard:

Activity (type)	Activity	Time	Responsibility
Structure and format	Preliminary structure document	15 Jan 2009	Skogforsk
	Format document "StanForD 2010 – Naming and design rules"	31 Dec 2008	Metsäteho
	Meeting to agree on final structures and format for each message, Uppsala	28-29 Jan 2009	Skogforsk
	Document describing XML technologies	October	Metsäteho

	and tools with StanForD 2010	2009	
New message for bucking and production	Preliminary xml-product instruction message	June 2009	Skogforsk/ Metsäteho
	Preliminary xml-harvester production including messages for stem data. And message for control data	June 2009	Skogforsk/ Metsäteho
	Preliminary xml-forwarder production message	June 2009	Skogforsk/ Metsäteho
	Meeting to agree on product instruction (bucking) and production messages	June 2009	
	Simulations test with new product instruction and production message	July-Oct 2009	Skogforsk
	Practical test in machines	Nov 2009- feb 2010	Manufactures
	Meeting for decision of final bucking and production message	Mar 2010	Manufactures
	Schema/ Validation tools for bucking and production ready	Apr 2010	Skogforsk/ Metsäteho
New message geographical and operational monitoring	Preliminary structure for operational monitoring	May 2009	Skogforsk
	Preliminary xml-operational monitoring message	Oct 2009	Metsäteho
	Preliminary structure for geographical message	Oct 2009	Skogforsk
	Preliminary xml- geographical message	Jan 2010	Metsäteho
	Meeting to agree on geographical and operational monitoring message	March 2010	
	Simulation test with new geographical and operational monitoring message	Oct- Feb2010	Skogforsk
	Practical test in machines	March-May 2010	Manufactures
	Schema / Validation tools for geographical and operational monitoring message ready	March 2010	Skogforsk/ Metsäteho
Final decision	Decision of StanForD xml-version	June 2010	Manufactures/ Skogforsk/ Metsäteho
	Finish for implementation	Dec2010	Manufacturer

Next meeting for StanForD 2010 is in June in Helsinki. After some e-mail discussion the date is decided to the 9th of June at Metsäteho in Helsinki. The aim with the meeting is to go through the xml-schemas for the product instruction and the production message.

§6 Items for discussion and information

FILE ORDER (VAR22) IN PRL-FILES (SDC)

Lars Henriksson pointed out that there is a tendency towards increasing sizes of prl-files. It would therefore be wise from an SDC perspective to make it possible for the operators to use var22 in order to make the files smaller.

FINNISH REPORT OF MEASUREMENT ACCURACY (METSÄTEHO)

Tapio Räsänen informed the meeting about the work on developing standardized ktr-reports for use in Finland.

BIO-ENERGY CALCULATIONS (SKOGFORSK)

Johan J Möller shortly informed about the ongoing project where the pri-file is used for calculating potential bio energy volumes after harvesting.

BARK FUNCTIONS IN SWEDEN AND AUSTRALIA (RADIATA PINE)

Based on questions from an Australian researcher Skogforsk has realized that the new bark function for Scots pine should be slightly modified. It is recommended that the DBH restrictions currently in use are modified so that the limit for DBH is 480 mm. This means that an estimated bark thickness corresponding to trees with a DBH of 480 mm are used for all trees with a DBH above 480 mm.

The detailed description of var113_t7 in the appendix will be changed to (only Scots pine):

```
Function developed by Skogforsk (2004) for Scots pine (Pinus Sylvestris)
dbh_b=min(dbh, 480 590) /* DBH maximum 480 590 mm. */
htg=-ln(0.12/(72.1814+0.0789*dbh_b-0.9868*lat))/(0.0078557-0.0000132*dbh_b) /* Break point in cm */
db=3.5808+0.0109*dbh_b+(72.1814+0.0789*dbh_b-0.9868*lat)* exp(-(0.0078557-0.0000132*dbh_b)*h)
/*Double bark thickness below break point calculated, mm */
if h>htg then db=3.5808+0.0109*dbh_b+0.12-0.005*(h-htg) /* Double barkthickness above break point
calculated, mm */
db=max(db, 2) /* Bark thickness minimum 2 mm */
```

The possibilities of using the Scots pine function for Pinus radiata in Australia will be further analyzed. Changing the DBH restriction is not an urgent issue from a Scandinavian perspective since very few stems have a DBH above 48 cm (see also appendix 1 below).

§11 Other issues

No other issues were discussed.

§12 Next meeting

Next meeting will take place on Wednesday the **11th of November 2009**, at Skogforsk in Uppsala, starting at 10.00 a.m. Observe that the date has been changed due to the fact that the secretary expects his second child to arrive in mid October.

Proposals for the meeting shall be the secretary by hand preferably not later than October 25th 2009.

§13 End of meeting

Johan J Möller (chairman) closed the meeting.

Secretary

John Arlinger



John Arlinger
Björn Hannrup
Johan J Möller

2008-09-23

Amendment to Work report nr 575 "Funktioner för skattning av barkens tjocklek hos tall och gran vid avverkning med skördare" (in Swedish)

INTRODUCTION

Bark functions are used in harvesters and sawmills in order to estimate the diameter under bark on the basis of measurements on the bark. Skogforsk developed, in cooperation with SP Trätek, new bark functions directly adapted for use in a harvester (Hannrup 2004). In tests on an independent data material, the new pine function proved to provide significantly better estimates than the function previously used. The basic data material for the new Scots pine function (SF_tall) consists mainly of Swedish pine stem bank. The maximum DBH in this data set is 420 mm. The function has been found to work well also for larger trees (450 mm) in some validations tests.

This amendment to the previous work report where the new bark functions were described, aims to highlight how SF_tall works for trees with a DBH larger than 450 mm

LIMITATIONS FOR SF_TALL

SF_tall is defined up to a DBH of 590 mm. DBH above this value changes the exponential part of the function, giving unreasonable values for bark thickness. In practical use a limitation has therefore been imposed where tree with a DBH over 590 mm are given an estimated bark thickness corresponding to trees with a DBH of 590 mm. As described above, the function was developed using data from trees with a maximum DBH of 420 mm and has been validated using trees with a DBH up to and including 450 mm. No test with DBH exceeding 450 mm has been performed. To illustrate how SF_tall works for trees with DBH between 450 and 590 mm we have to use simulated data.

CALCULATION OF BARKTHICKNESS FOR SIMULATED STEMS

Stems with a DBH between 200 and 600 mm were simulated. Bark thickness was calculated with SF_tall along stems up to a height of 40 m. Such a large heights are unrealistic for most of the stems in the diameter

range, but this simplification does not affect what will be highlighted in the report. The figure below shows the bark thickness along the stem when DBH increases. The curve becomes more linear with increasing DBH as indicated in the graph. This is an effect of the fact that the exponential part of the function goes towards zero. The exponential part of the function controls how quickly the bark thickness goes from the maximum value at the butt end of the tree to the asymptotic value of the thin/gloss bark. The development of the curvature is smoother for stems with DBH up to 500 mm while the linear tendency is accelerating for larger stems. This is especially evident for stems with DBH over 540 mm.

It should be emphasized that there are no available measured bark thicknesses, which can demonstrate that the accelerating development is not correct. However it seems unlikely that the larger trees in the tested diameter range would have such a thick bark near the top of the stems since that would mean that the thick bark extends right up to the top of the trees. There do seem to be a reason to limit how SF_{tall} is used in harvesters until measurement data for the bark thickness of the really larger pines is available.

We therefore recommend that the restrictions currently in use are modified so that the limit for DBH is 480 mm. This means that an estimated bark thickness corresponding to trees with a DBH of 480 mm are used for all trees with a DBH above 480 mm.

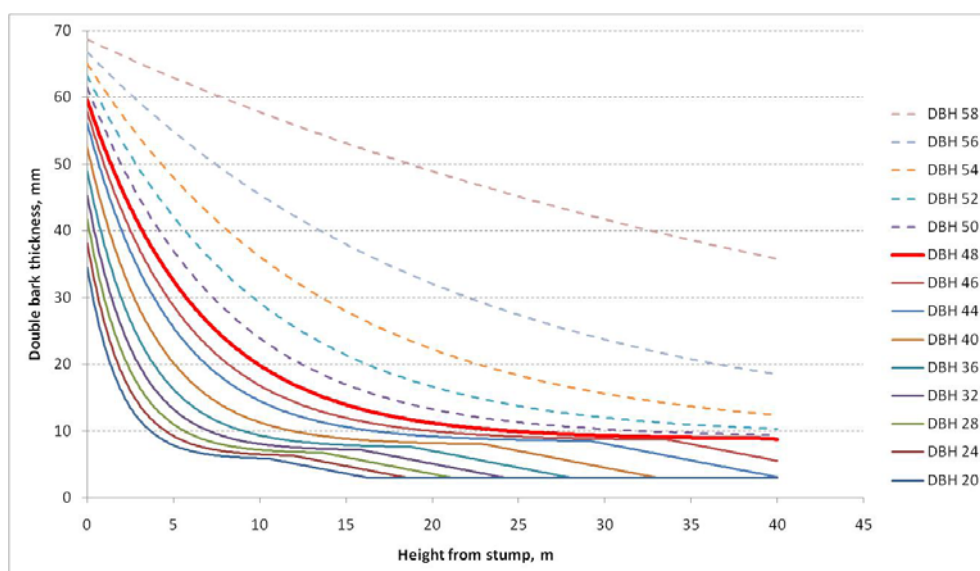
In order to facilitate the introduction of this restriction see paragraph "Practical application of the new function for pine bark."

CONSEQUENCES IN SWEDEN OF NEW DBH LIMITATION

Table 1 displays summary statistics on the distribution of trees in various DBH classes. The table shows that 0.5% and 0.7% of the trees growing in southern and central Sweden have a DBH larger than 480 mm. The proportion of these large trees are probably smaller in practical forestry since they are often felled manually or left for environmental reasons..

Table 1. DBH- distribution of Scots pine according to Swedish national forest survey (no of stems in final fellings).

DBH, cm	<30	30	40	44	48	52	56	60	64
Middle of Sweden	68,5%	76,4%	96,5%	98,5%	99,5%	99,8%	99,9%	100,0%	100,0%
South of Sweden	51,1%	61,3%	92,0%	97,0%	99,2%	99,6%	99,8%	99,9%	100,0%



LITTERATURE

Hannrup, B. 2004. Funktioner för skattning av barkens tjocklek hos tall och gran vid avverkning med skördare. Arbetsrapport från Skogforsk, nr. 575.