WAFO
Institut für Waldwachstum
Universität für Bodenkultur Wien

Forest Inventory as a “problem solver” Fairytale and trap

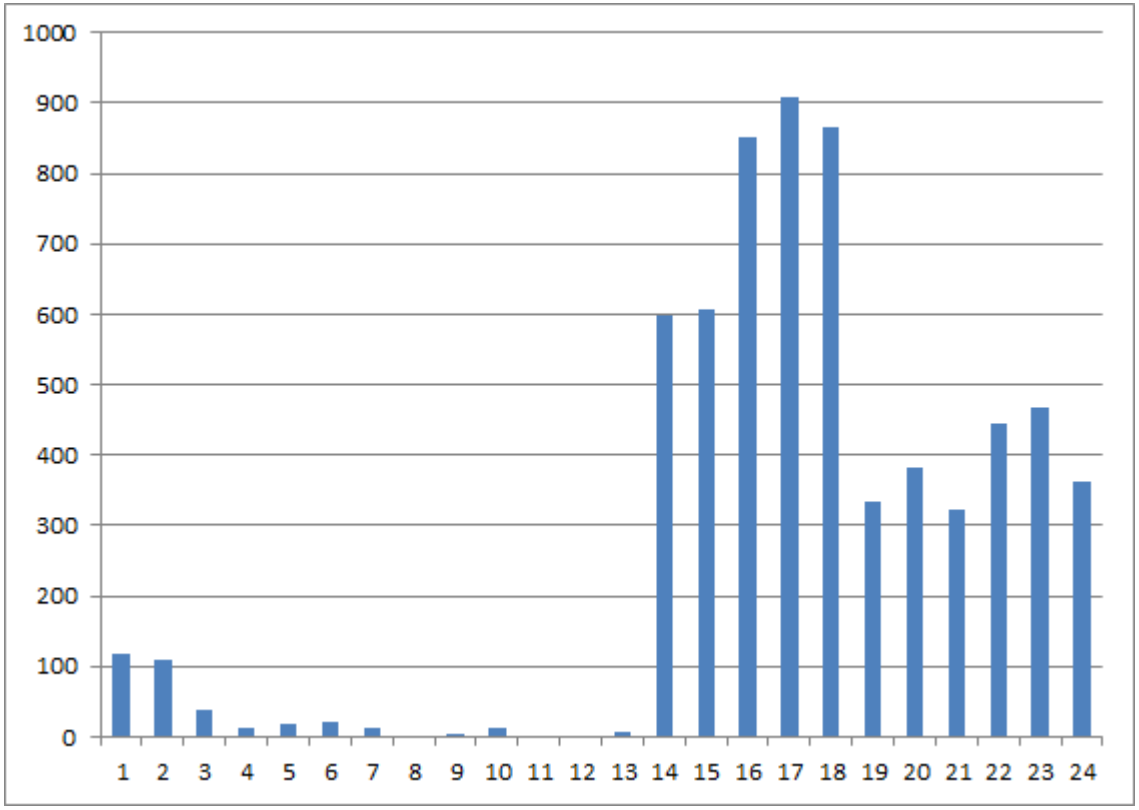
Dr Otto Eckmüllner 2015

Institut für Waldwachstum
Universität für Bodenkultur Wien

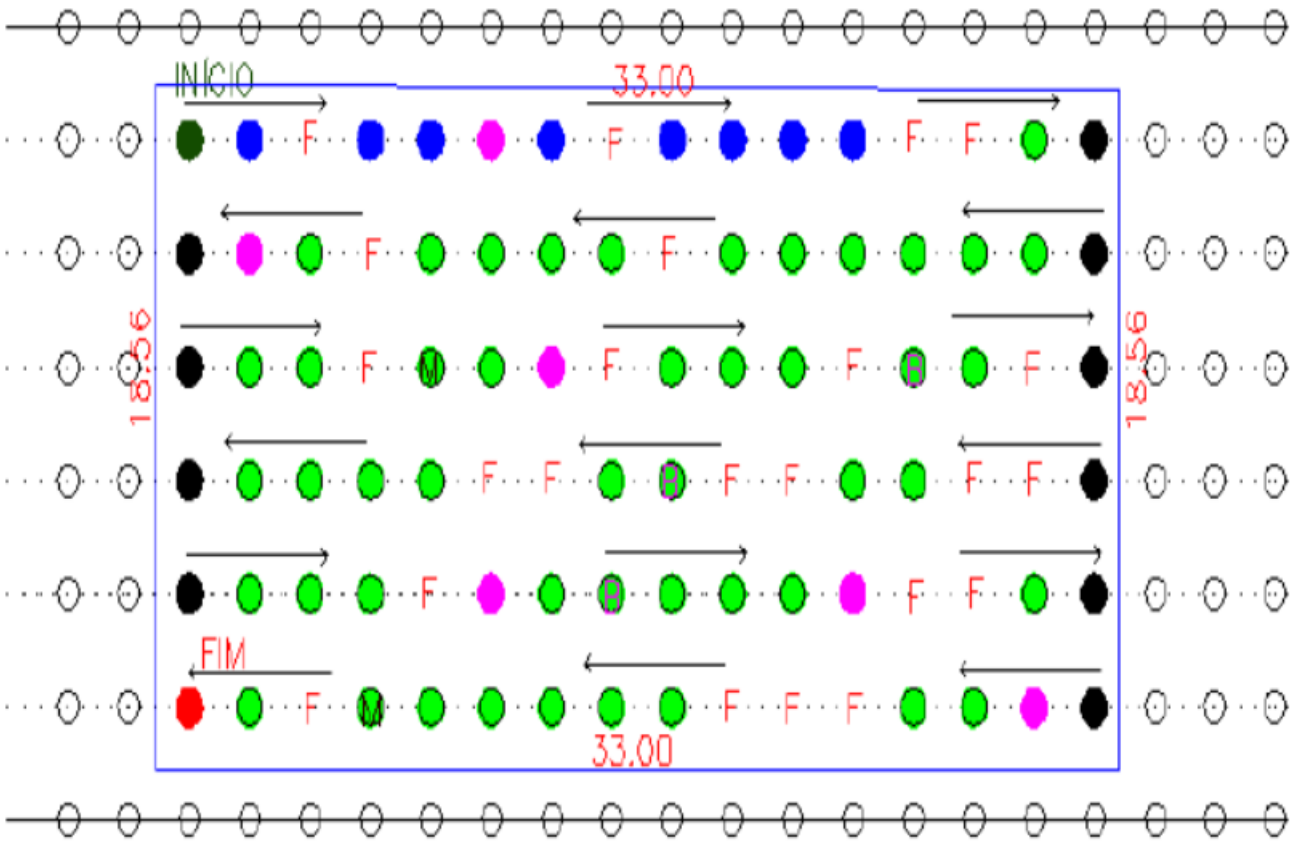
What do we want to know: the stocking volume and a growth rate and an estimation of the yield?

So we need at least a **sound sampling design** and a **valid volume or form factor function** and in addition to get information's on different assortments **a taper curve**. The other information's we can relative easily get from **stem analysis**, like the height development and the diameter increments under certain conditions. Increment cores in forest inventory give good information of the growing rate in the last years. To determine the reactivity on thinning operation or on fertilization we need controlled experiments or permanent sample plots.

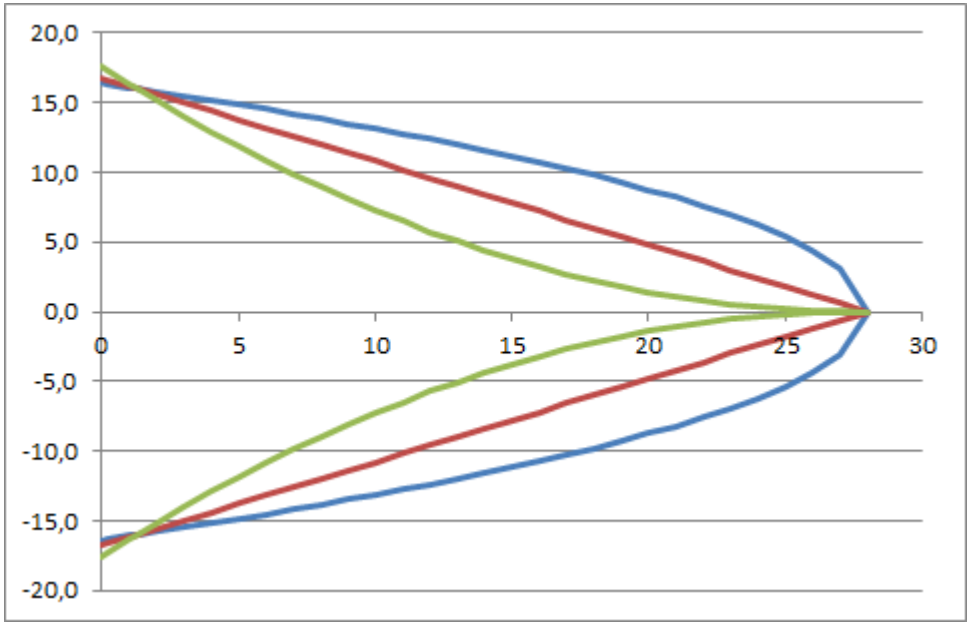
Rotation ???


1000
900
800
700
600
500
400
300
200
100
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

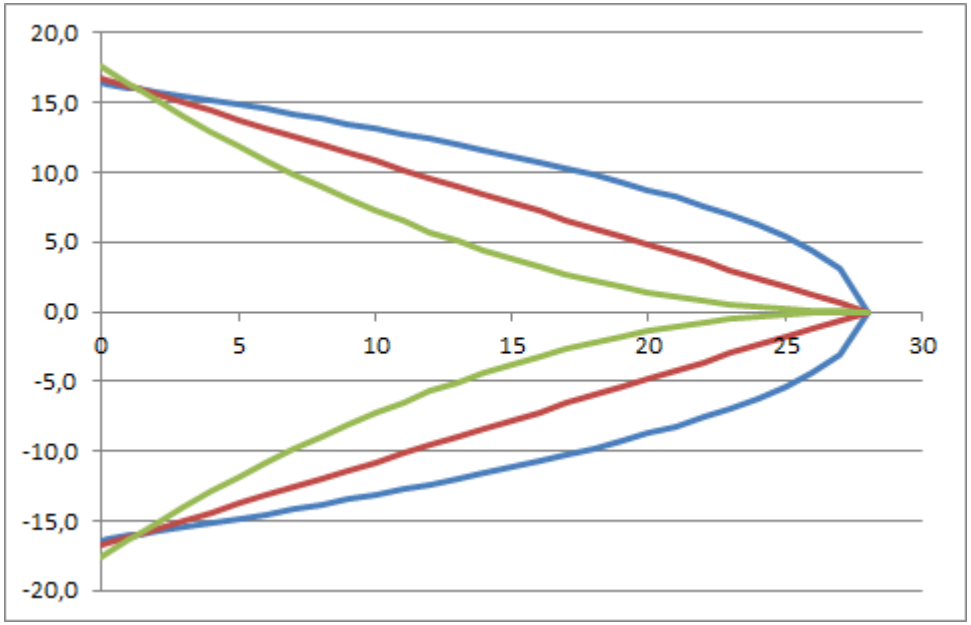
This design make-believes to be sound but the variance is biased



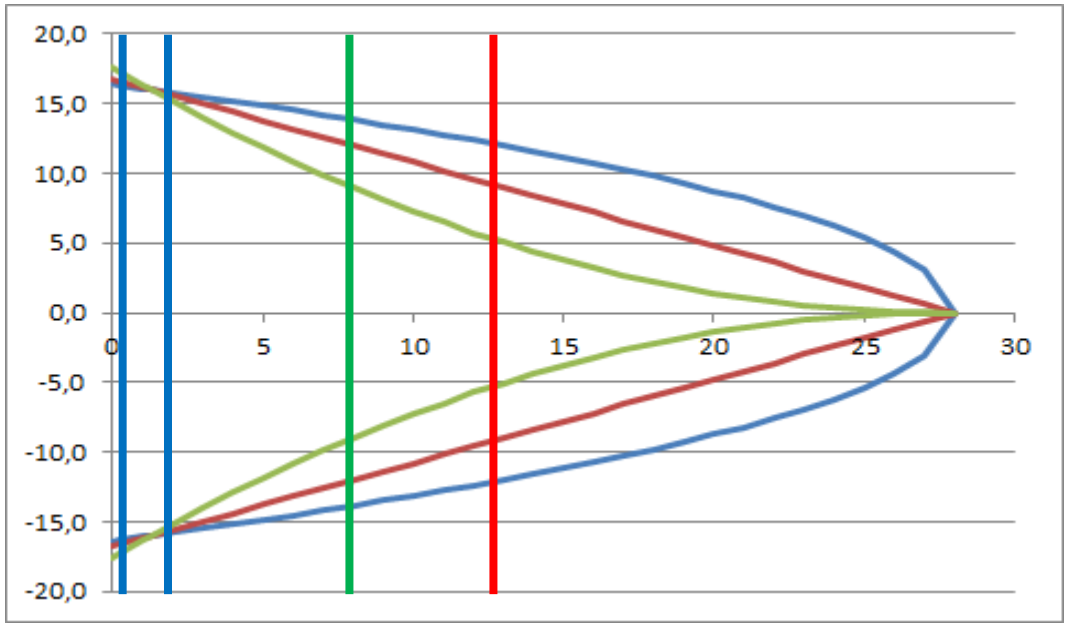
A misconception: volume- and form factor function are only dependent on the tree species
Far from it: a strongly dependency on site and density regime influence the form of trees



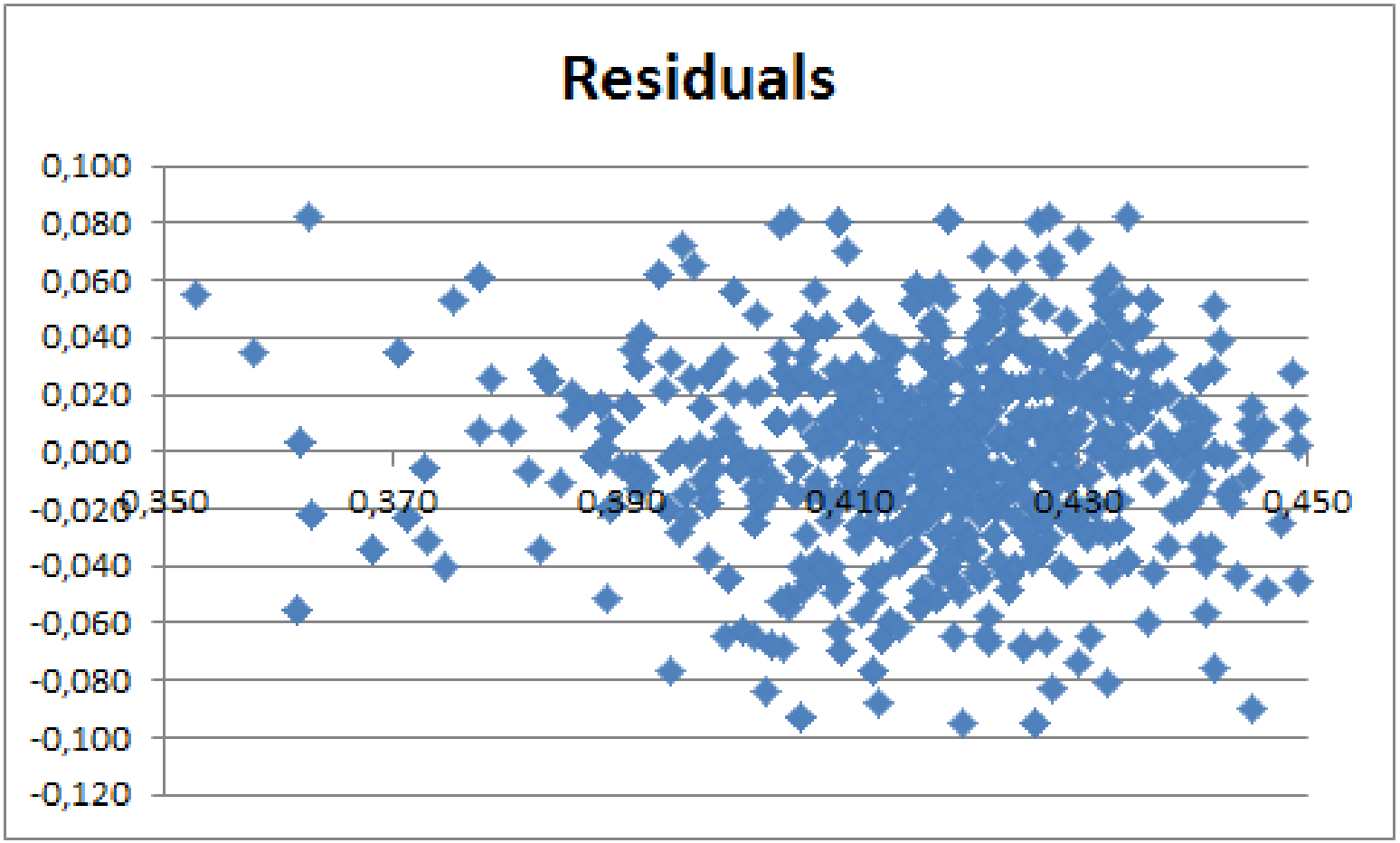
Attention: on the same DBH and height totally different forms are possible ➔ so we need at least 3 parameters



The effect is huge: the volume of the blue form is 2.5 greater than this of the green one



Obviously the best way is to measure a upper diameter the best is in the middle of the tree, but there is often a sighting problem (living crown), the ANFI measures in 30% of the tree height and we use the difference between the diameters in 0.2 m and 2 m on the bole, because this diameters can be measured precisely with a caliper



%see=7.9%

	coeffizient	*Standarderror*	*t-statistic*	*P-Wert*
Intercept	0,13760	0,04	3,12	0,19%
0.2m- 2m	-0,09676	0,01	-11,75	0,00%
DBH	-0,00063	0,00	-2,30	2,19%
H	0,00938	0,00	7,94	0,00%
1/H	2,40611	0,40	5,97	0,00%

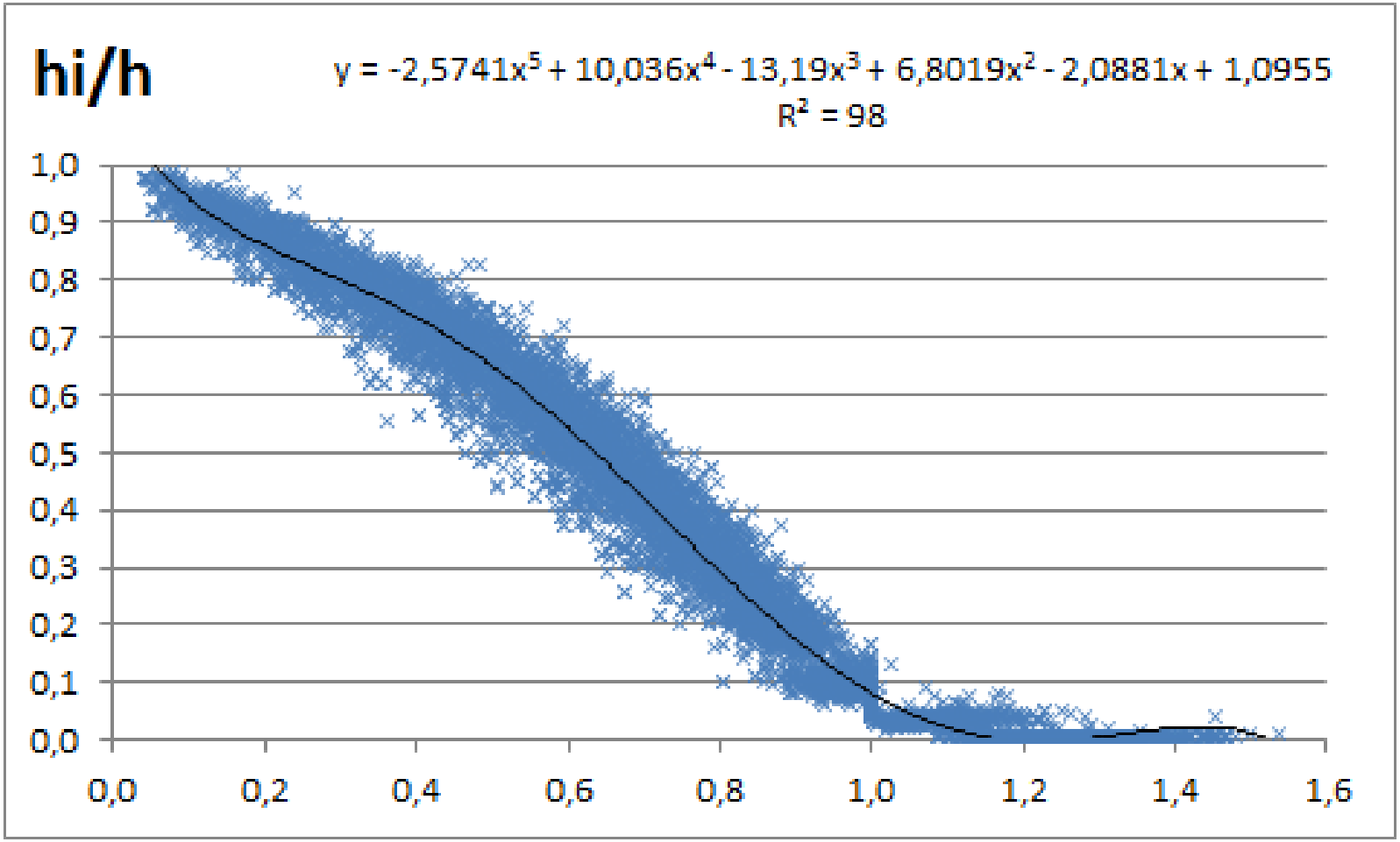
The taper curve

district	b0	b1	b2	b3	b4	b5	R^2	see	n
A	1,22	-4,80	20,76	-43,86	40,96	-14,29	0,98	0,049	399
B	1,22	-4,76	20,38	-43,20	40,52	-14,18	0,98	0,046	415
C	1,18	-4,05	17,00	-36,90	35,25	-12,49	0,98	0,045	646
D	1,17	-3,64	14,68	-31,68	30,18	-10,71	0,99	0,040	1.009
E	1,23	-4,92	21,99	-48,58	47,59	-17,30	0,98	0,052	769
F	1,23	-4,70	20,01	-42,02	38,86	-13,39	0,98	0,048	403
G	1,18	-3,90	16,24	-34,98	33,01	-11,56	0,99	0,040	457
H	1,19	-4,00	16,92	-37,05	35,88	-12,94	0,98	0,042	1.178

$di/DBH=b0+b1*hi/H+b2*(hi/H)^2+b3*(hi/H)^3+b4*(hi/H)^4+b5*(hi/H)^5$

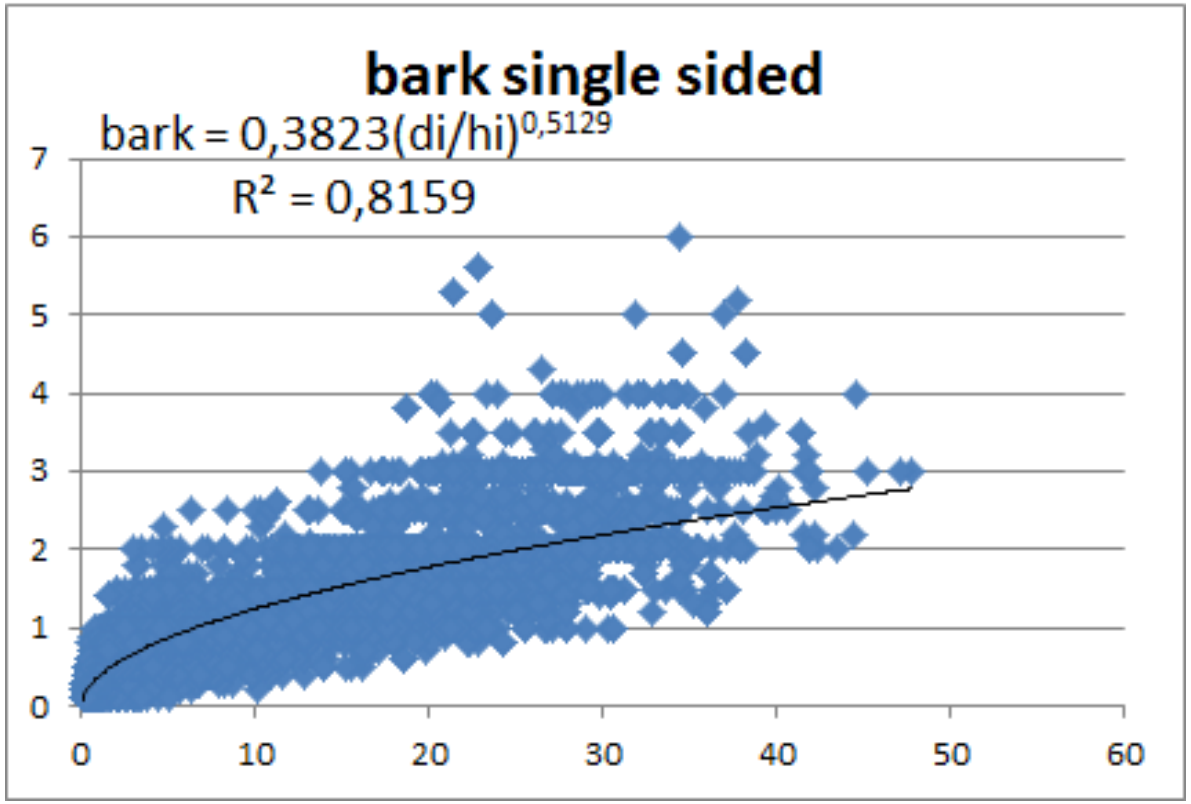
1. The separation in 8 different districts is superfluous , because the differences are not significant
2. the independent variable is inappropriate, nobody is interested to know the relative diameter in a certain height on the bole rather we search the height of a given diameter

The taper curve



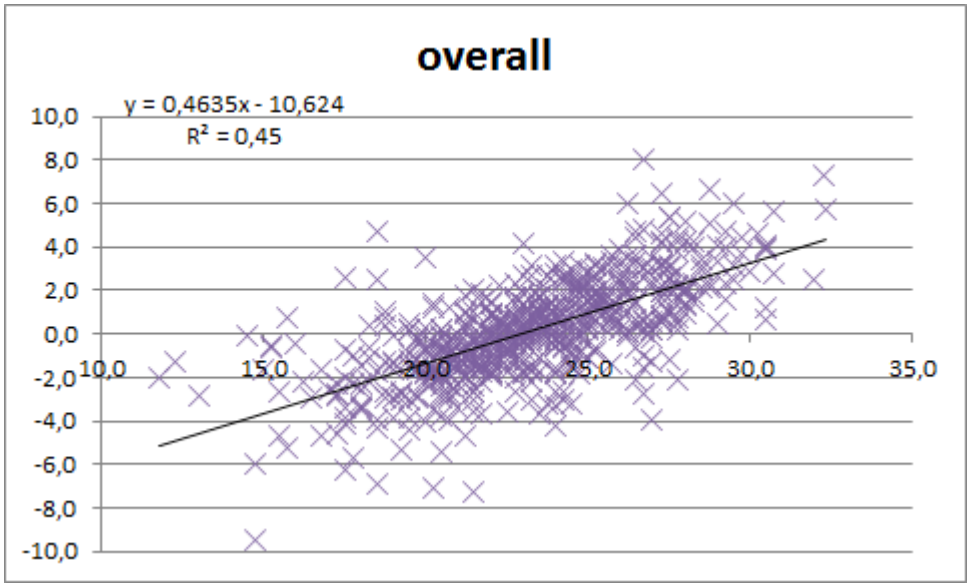
the relative height of a given diameter

The bark function is better than a table



CLASS	Form factor	n	V% bark
10-15	0,4065	20	23,8
15-20	0,4112	74	23,0
20-25	0,4173	125	19,8
25-30	0,4156	72	18,0
30-35	0,4012	18	18,0

For the measurement of heights we currently have available various equipment which are widely used in the forest activity,
Blume Leis (accuracy ± 50 cm) theoretically, in reality ± 150-200 cm
Electronic vertex (accuracy ± 10 cm)) theoretically , in reality ± 50-100 cm
Electronic Haglof (accuracy ± 10 cm)) theoretically , in reality ± 50-100 cm
mechanical Suunto (accuracy ± 25 cm)) theoretically , in reality ± 150-200 cm

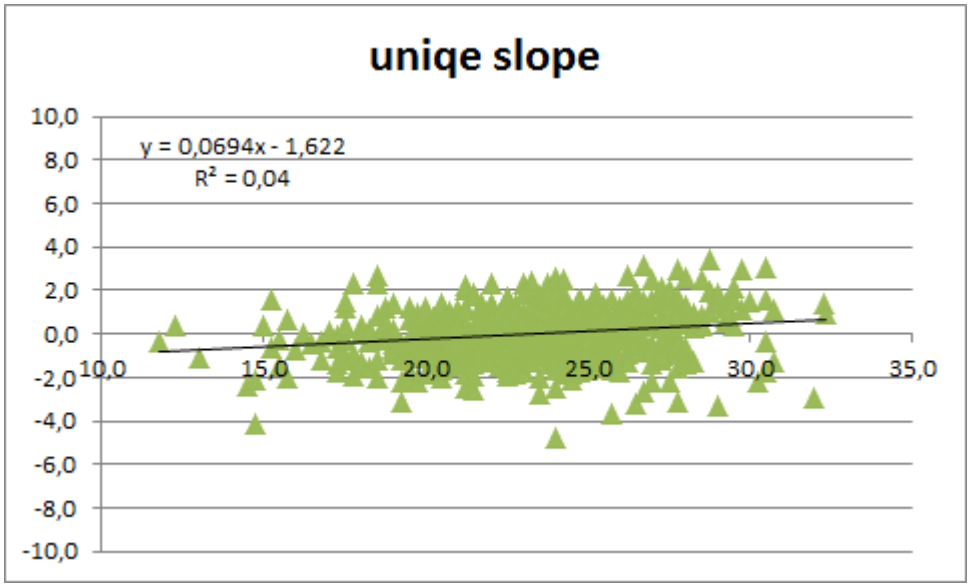


A strongly underestimation of smaller height as well as a strongly overestimation of big heights, the trend is highly significant – bias = - 17 cm

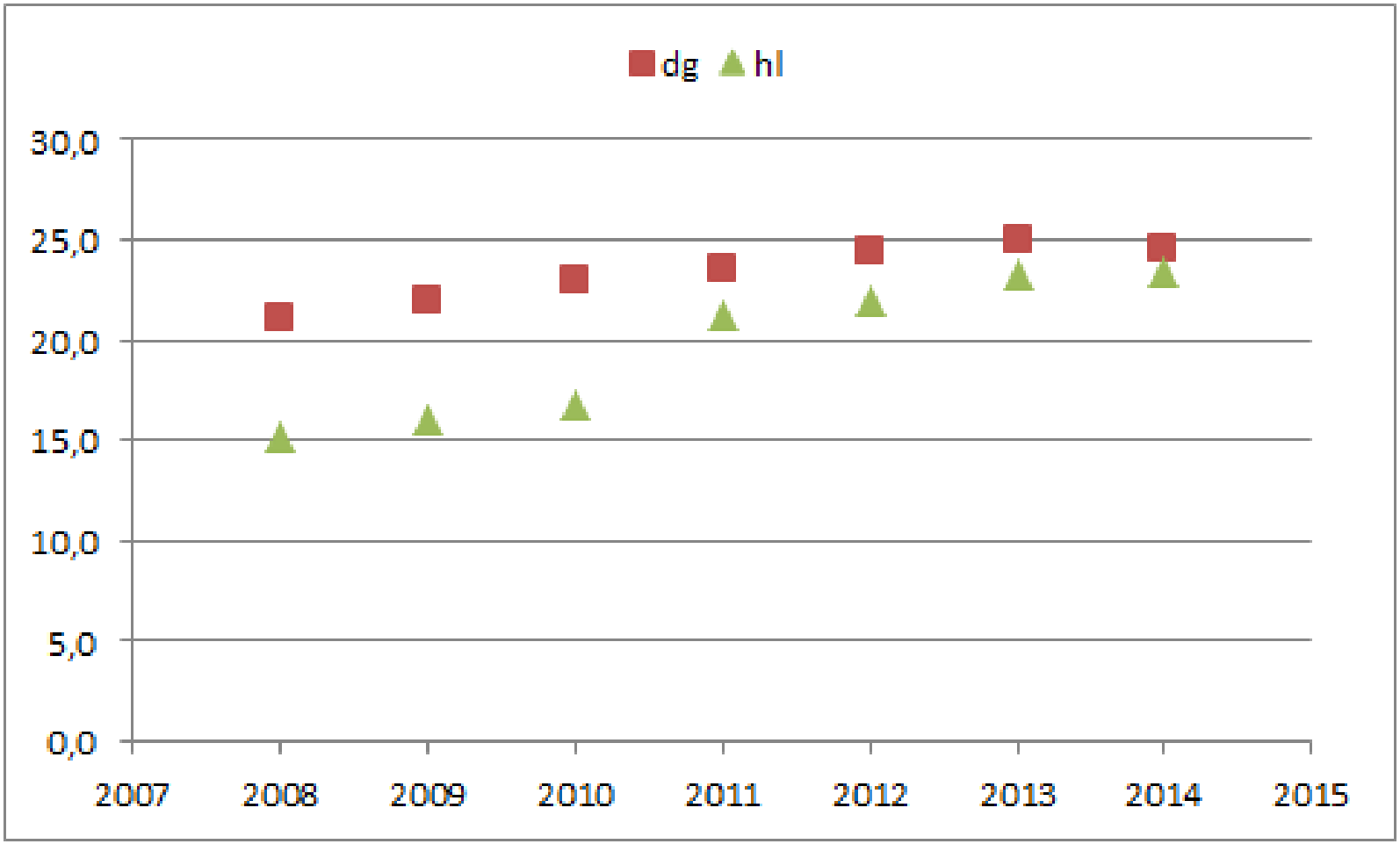
The height functions with unique slopes

$$h = \frac{1}{\left(a + \frac{b}{dbh}\right)^2} + 1.3$$

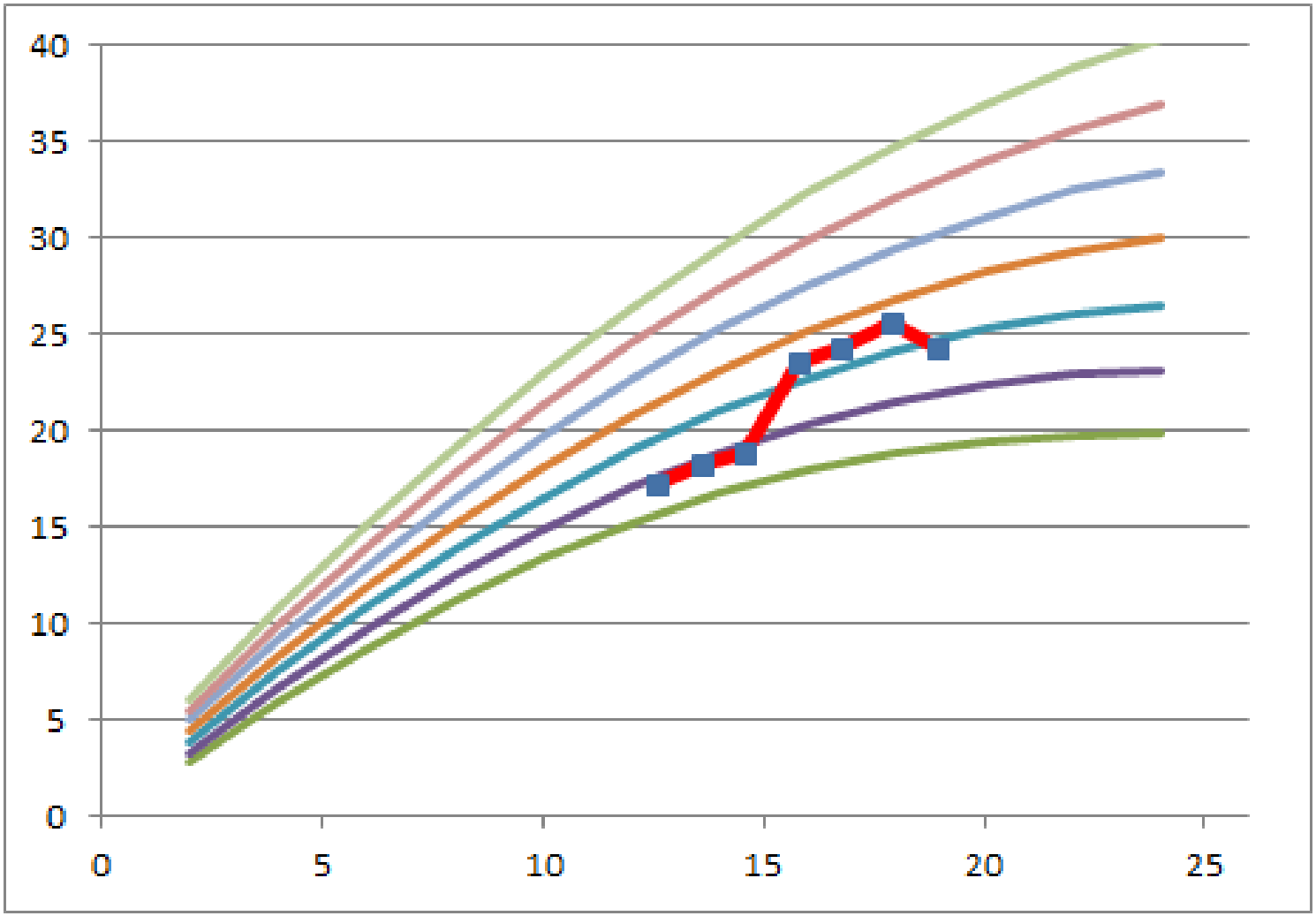
district	b
A	0.9032
B	1.0316
C	1.1621
D	0.5699
E	1.6175
F	1.4806
G	1.5972
H	2.5053
I	2.3892
J	1.6856



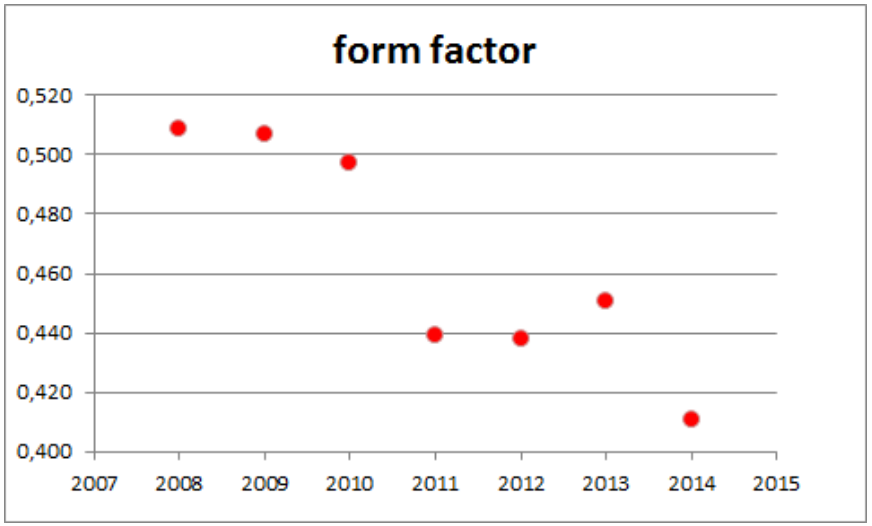
Neither an underestimation of smaller height nor an overestimation of big heights, the trend is not significant, no bias = 0,1 cm n.s.

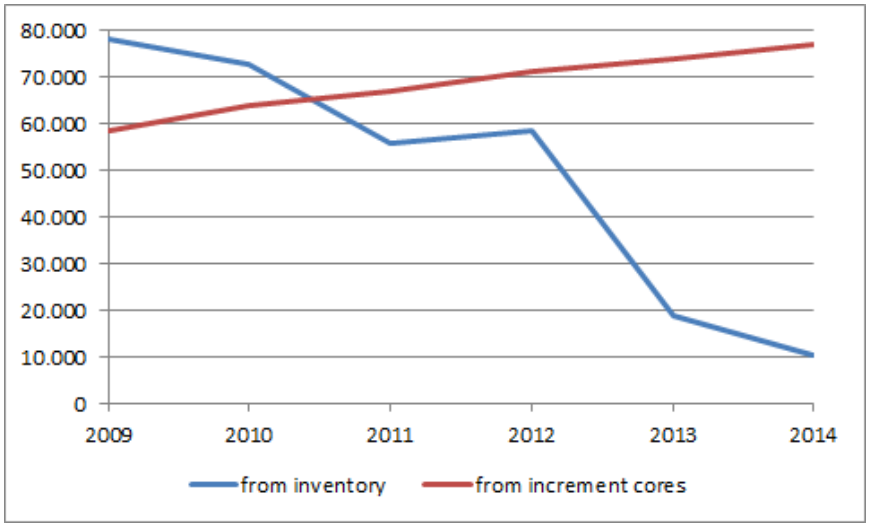


Development of the quadratic mean diameter and the height of Lorey from temporary forest inventories



Dominant height development based on stem analyses and based on temporary inventories





Volume increment per year and ha blue on temporary inventory, red on increment cores

With temporary inventories and periodic changing evaluation criteria no sound results can derived.

Obrigado

Dr Otto ECKMÜLLNER 2015