

Biomass and stem volume equations for tree species in Europe

Zianis, D., Muukkonen, P., Mäkipää, R. & M. Mencuccini. *Biomass and stem volume equations for tree species in Europe*. Submitted to Silva Fennica.

A joint project with
Finnish Forest Research Institute and
University of Edinburgh
in co-operation with COST E21 Action



Objective

to compile database of tree-wise equations for

1. whole tree biomass
2. biomass of different components (e.g. foliage, branches, stump, roots)
3. stem volume

according to diameter at breast height and/or height
for common European tree species



Database

Biomass & volume equations

- $f(\text{dbh}, h)$
- Format

Additional information:

- Location
- Dependent variable
- The number of sampled trees
- Coefficient of determination
- The **min** and **max** diameter and height of the sampled trees
- Type of error estimate (e.g. RMSE, SEE)
- Contact person



Database, example

Scientific name	Location	Depende	Format of equation	a	b	c
Picea abies	Germany, Saxonia, Th	AB	$a+b*D+c*D^2$	-142,6088	13,63896	0,12593
Picea abies	Germany, Saxonia, Th	SB	$a+b*D+c*D^2$	-6,55127	0,75517	0,02156
Picea abies	Austria, Carinthia, cont	FL	$a+b*D+c*D^2$	-1.9745	0,039	0.00382
Picea abies	Austria, Carinthia, ferti	FL	$a+b*D+c*D^2$	-0.7095	0,0011	0.00142
Picea abies	Austria, Carinthia, cont	BR	$a*\exp(b*D)$	5.3727	0.00876	-
Picea abies	Austria, Carinthia, ferti	BR	$a*\exp(b*D)$	1,325	0.0135	-
Picea abies	Finland	ST	$a*D^b$	0.12269	2.3272	-
Picea abies	Finland	BR	$a*D^b$	0.0022	2.9122	-
Picea abies	Finland	FL	$a*D^b$	0.00445	2.2371	-
Picea abies	Finland	FL(1)	$a*D^b$	0.00394	2.1534	-
Picea abies	Finland	FL(2)	$a*D^b$	0.00083	2.4074	-
Picea abies	Finland	RC	$a*D^b$	0.33989	1.4728	-
Picea abies	Denmark, Klosterheden	ln(FL)	$a+b*LOG(D^2*H)$	-4.24	0.67	-
Picea abies	Denmark, Klosterheden	ln(FL)	$a+b*LOG(D^2*H)$	-4.85	0.81	-
Picea abies	Denmark, Klosterheden	ln(BR)	$a+b*LOG(D^2*H)$	-5.88	1.02	-



Scientific name	TB	AB	ABW	ST	SW	SB	FL	FL(i)	FC	FE	BR	BC	BE	TW	DB	CR	CS	CW	CO	RC	RS	RF	RT	SR	SU	Total
<i>Abies balsamea</i>																							4			4
<i>Acer pseudoplatanus</i>			2																							2
<i>Alnus glutinosa</i>		2	1	3			2				3															11
<i>Alnus incana</i>		2		2			2				2															8
<i>Arbutus unedo</i>		1	1													1										3
<i>Betula pendula</i>		1	1	2			1				2												2			9
<i>Betula pubescens</i>		1		3		2	1				1					1										9
<i>B. pubescens</i> ssp. <i>czerepanovii</i>				1			1				1				1											4
<i>Betula</i> spp.			4	1	5	4	2				2				5	3							1	1		28
<i>Eucalyptus</i> spp.		1																								1
<i>Fagus crenata</i>																							1			1
<i>Fagus moesiaca</i>		1		1			1		1	1	1	1	1				1	1							1	11
<i>Fagus sylvatica</i>		7	4	4	2	2	6				6					2					1	1	1	4		40
<i>Fraxinus excelsior</i>			2																							2
<i>Picea abies</i>	5	15	1	15	12	16	28				25			3	15	17					2	3		5	1	163
<i>Picea rubens</i>																							1			1
<i>Pinus banksiana</i>																							1			1
<i>Pinus contorta</i>																							2			2
<i>Pinus pinaster</i>		1																								1
<i>Pinus radiata</i>		1																					2			3
<i>Pinus sylvestris</i>	15	4	11	13	15	22	2				19				11	12			4	7	1	1	6	4	2	149
<i>Pinus taeda</i>																							1			1
<i>Populus tremula</i>		1		1			1				1															4
<i>Pseudotsuga menziesii</i>		3	1	1			1				1					1							5			13
<i>Pseudotsuga</i> spp.																							1			1
<i>Quercus ilex</i>		10	1	6			6				8					1				3	3		4			42
<i>Quercus petraea</i>																							1			1
<i>Quercus pyrenaica</i>					1																					1
<i>Quercus</i> spp.		1	4																							5
<i>Tilia cordata</i>			1																							1
Total	5	63	27	51	33	39	74	2	1	1	72	1	1	3	32	38	1	1	4	13	8	2	41	4	5	522

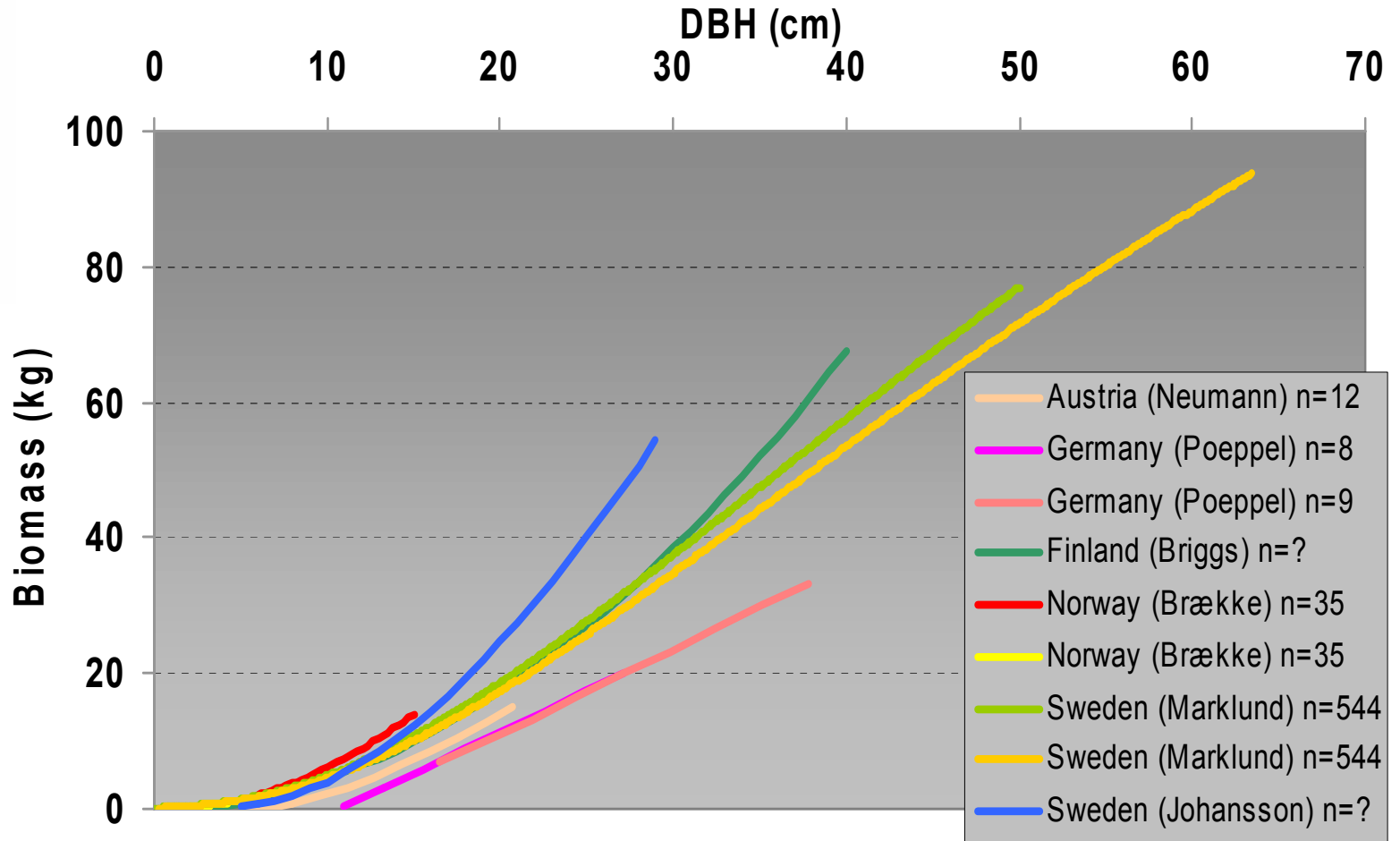
Biomass

	Austria	Belgium	Czech republic	Denmark	Finland	France	Germany	Greece	Italy	Netherlands	Norway	Poland	Portugal	Scotland	Spain	Sweden	UK	Central Europe	Northern Europe	Southern Europe	Europe	n/a	Total	
Scientific name																								
<i>Abies balsamea</i>																							4	4
<i>Acer pseudoplatanus</i>																	2							2
<i>Alnus glutinosa</i>																8	3							11
<i>Alnus incana</i>																8								8
<i>Arbutus unedo</i>									3															3
<i>Betula pendula</i>																4	3						2	9
<i>Betula pubescens</i>					4											5								9
<i>B. pubescens ssp. czerepanovii</i>					4																			4
<i>Betula spp.</i>					1											14	4							28
<i>Eucalyptus spp.</i>									1															1
<i>Fagus crenata</i>																							1	1
<i>Fagus moesiaca</i>								11																11
<i>Fagus sylvatica</i>	1	3				9	2		6	1					4	5								40
<i>Fraxinus excelsior</i>																	2							2
<i>Picea abies</i>	4	5	16	8	19		61				12					38								163
<i>Picea rubens</i>																							1	1
<i>Pinus banksiana</i>																							1	1
<i>Pinus contorta</i>																							2	2
<i>Pinus pinaster</i>									1															1
<i>Pinus radiata</i>									1														2	3
<i>Pinus sylvestris</i>		6	8		43						28	1		7		3	4	4	4	4	4	7	3	149
<i>Pinus taeda</i>																							1	1
<i>Populus tremula</i>																4								4
<i>Pseudotsuga menziesii</i>									1	7													5	13
<i>Pseudotsuga spp.</i>										1														1
<i>Quercus ilex</i>									5						37									42
<i>Quercus petraea</i>						1																		1
<i>Quercus pyrenaica</i>													1											1
<i>Quercus spp.</i>	1																4							5
<i>Tilia cordata</i>																	1							1
Total	6	14	24	8	80	10	63	11	18	18	40	1	1	7	41	116	23	4	4	4	7	22	522	

Volume

	Scientific name	Abies spp.	Acacia spp.	Acer pseudoplatanus	Alnus spp.	Arbutus unedo	Betula spp.	Carpinus spp.	Chamaecyparis lawsoniana	Corylus avellana	Fagus spp.	Fraxinus exelsior	Fraxinus spp.	Larix spp.	Picea spp.	Pinus spp.	Populus spp.	Prunus avium	Pseudotsuga spp.	Quercus spp.	Salix spp.	Sorbus aucuparia	Thuja pilicata	Tilia cordata	Tsuga heterophylla	Ulmus spp.		
Austria		2			1						2			2	2	1	1			2								13
Belgium				1			1					1		1	1	1		1	1	2						1	11	
Czech republic															2												2	
Finland							4							2	7	8											21	
Germany		1									2				2	3											8	
Iceland														2													2	
Italy						1										1				1							3	
Netherlands		1		1	1		1	3	1		2	1		5	6	10	3		4	5			1		1	1	47	
Norway		2			3		2			1			1	4	15	8	2		1		1	1	1		1		43	
Poland															2												2	
Romania		1	1	1	2		1			1		1	1	1	1	2	3		1	4	3			1		1	25	
Sweden							4								6	6											16	
Total		7	1	3	7	1	13	3	1	1	7	2	2	17	44	40	9	1	7	14	4	1	2	1	2	3	193	

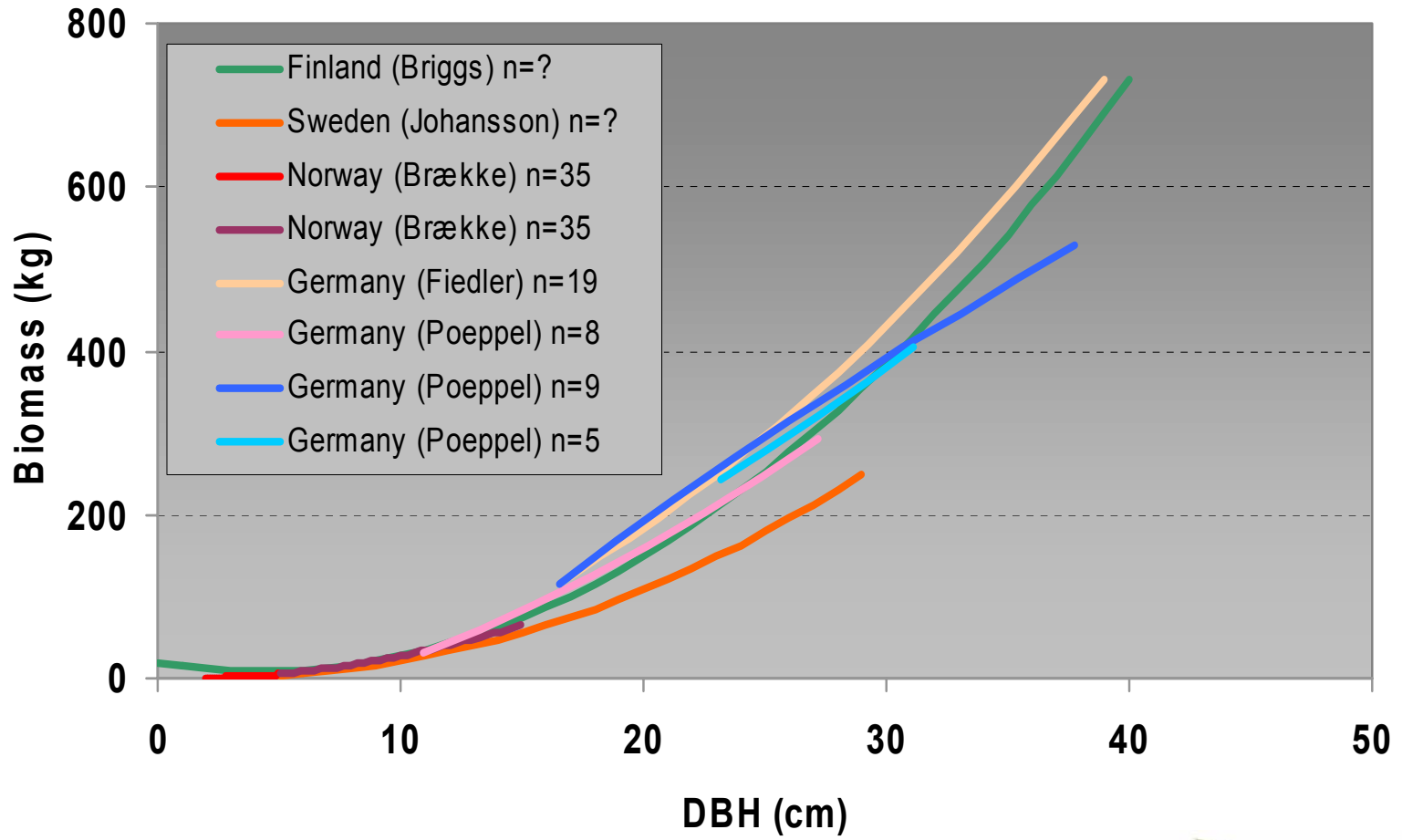
Foliage biomass of Norway spruce (*Picea abies*)



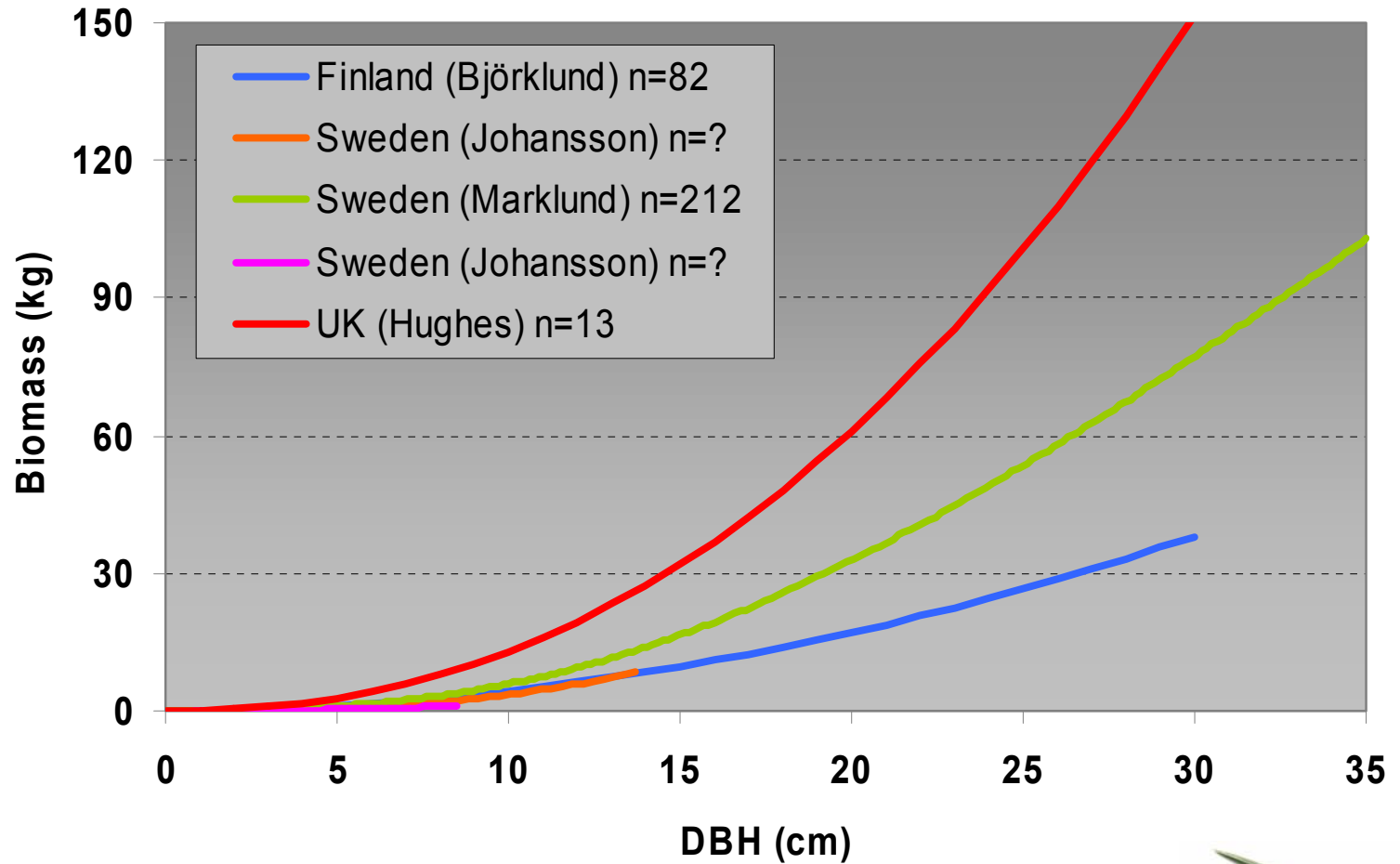
27.5.2004



Aboveground biomass of Norway spruce (*Picea abies*)



Branch biomass of birch (*Betula* spp.)



Applications

- Formulation of stand level biomass expansion (BEF) factors for major tree species of Europe
- Studies on allometry of trees
- Examination of nutrient and carbon cycling in forest ecosystem
- Ecophysiological studies



Download information

You can download the database (excel-file) for your own use from the web page:

<http://www.metla.fi/hanke/3306/tietokanta.htm>

