W O R K R E P O R T

Institute for World Forestry

Evaluations of the International Cross-calibration Courses 2001 and 2002

by

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CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION
INTERNATIONAL CO-OPERATIVE PROGRAMME ON ASSESSMENT AND MONITORING OF AIR POLLUTION EFFECTS ON FORESTS

United Nations
Economic Commission
for Europe

Federal Research Centre
for Forestry and Forest Products (BFH)

BFH

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1 Introduction

Under the UNECE Convention on Long-range Transboundary Air Pollution the International Cooperative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) is operated under the Lead of Germany with a participation of 39 countries. The Programme Co-ordinating Centre (PCC) of the ICP Forests is hosted by the Federal Research Centre for Forestry and Forest Products in Germany. In order to ensure the scientific quality of the programme, experts from all countries participate in so-called Expert Panels, that are responsible for the different surveys carried out.

On its meeting held in March 2001 in Innsbruck, Austria, the Expert Panel on Crown Condition (EP Crown) discussed possibilities to improve Quality Assurance (QA) within the programme of ICP Forests and EU. Among other conclusions it was decided to submit to the Task Force a proposal for a new system of International Cross-Calibration Courses (ICCs). These ICCs should replace the International Inter-calibration Courses, which focussed on an adjustment of assessment methods between the countries before the annual survey period. The aim of the new ICCs is the quantification of differences between country specific assessments after the annual survey period in order to improve the possibility of statistical adjustments of the assessment results. A second goal is to evaluate the time-consistency in combination with the application of photo based QA methods. The Task Force of ICP Forests decided on its meeting in May 2001 in Ennis, Ireland, to develop a new system of ICCs and to test it in the years 2001/2002. Already in 2001 some details in the applied methodology could be changed in comparison with the old IICs.

This report summarizes the evaluations of the field assessments made by the participants of the ICCs in the test phase period 2001/2002. For the evaluation of the assessment results methods from earlier studies and some more simple statistics and regression models were used.

The results of the ICCs in both years are of relatively high comparability concerning the methods of the evaluation. Nevertheless there are some differences in the details of the organization, planning and implementation of the courses which are opposed to a combined evaluation of field assessment results from different courses and years. The planned revision of ICC plots will at least allow for a combined evaluation of ICC field assessments made at the same plot on the same trees. Additionally the collection of ICC field assessments for the main tree species at other locations in Europe with varying stand and site condition will allow for an integrated evaluation which should lead to a better understanding and description of methodological differences among the participants.

The presented workreport is the unmodified version of the Report “Evaluations of the International Cross-calibration Courses 2001 and 2002”.

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2 Evaluations of the International Cross-calibration Courses 2001

International cross-calibration courses (ICCs) were held 2001 in Vantaa (Finland) for northern Europe, in Luhačovice (Czech Republic) for central and eastern Europe and in Vila Real (Portugal) for the Mediterranean Countries. At the ICCs 6 to 8 localities (plots) were visited and at each plot defoliation was assessed on 15 to 30 trees independently by the participating teams from different countries according to their national methods.

Additional exercises with photographed trees were documented and their comparisons with CROCO evaluations (c.f. Mizoue 1999, Dobbertin & Mizoue 2000). The results form the electro-diagnostic method (e.g. Dimitri & Rajda 1995, Rajda, 2001) will be documented (e.g. Lindgren 2001) and evaluated elsewhere.

Methods

2.1.1 Field estimations

According to the guidelines suggested by FERRETTI & LORENZ (2001) the most common tree species of a region should be assessed under circumstances which resemble the real survey. Therefore, mainly real Level I or Level II plots were selected by the organisers (e.g. LINDGREN 2001). The tree assessment itself was performed by each team separately according to its own national assessment and reference methods in order to get unbiased estimations from each country. Demonstration of reference trees were not given before the evaluation. Also discussions of the results were avoided, until the last plot of a specific tree species has been assessed.

Due to the early timing with respect to leafing of the Nordic course and a general lack of time, only defoliation was evaluated there. During the central European course also selected optional Level II parameters associated with crown condition were performed. This concerned mainly the amount of flowers and fruits as well as stem and branch damage in spruce, further secondary shoots, stem damage, and die-back in oak. These assessments are not evaluated here. At one plot, a test assessment with additional parameters like estimated tree height or distance between observer and tree were collected in order to get a rough idea about causes of systematic differences between teams from different countries.

2.1.2 Participating countries

Six country teams participated in the cross-calibration course for northern Europe, a total of 19 country teams took part in the ICC for central and eastern Europe and a total of 7 countries participated in the ICC for the Mediterranean countries (Table 1). There were small overlaps between the participating countries at all three ICCs: Three countries took part in both ICCs for northern and central Europe and two countries were present at the central/eastern ICC and the Mediterranean course. At all three ICCs an untrained representative from the PCC (Hamburg) respectively a representative of the EU commission took part.

At the course of the Mediterranean countries there were two countries with more than one team. This offers the possibility of comparisons between the variation produced by teams from different countries and those produced by different teams of one country.

Table 1: Participating countries/teams at the International Cross-calibration Courses (ICCs) in 2001; in brackets: country code and abbreviation used during the course and number or persons per team, if known; Belgium was represented by a team from Wallonia and from Flanders. From Portugal and Spain 6 resp. 2 teams attended the course, one of them being the national reference team (NRT, see FERRETTI & LORENZ 2001).

Northern Europe (Vantaa, Finland, 4. – 6. 6. 2001)	Central and Eastern Europe (Luhačovice, Czech Republic, 18. - 22. 6. 2001)	Mediterranean Countries (Vila Real, Portugal, 4. – 6. 6. 2001)
Estonia (59, Est, 2)		
Norway (55, Nor, 2)		
Russia (62, Rus, 1)		
Finland (15, Fin, 2)	Finland (15, FIN, 2)	
Sweden (13, Swe,2)	Sweden (13, S, 1)	
Lithuania (56, Lit,1)	Lithuania (56, LT, 1)	
	Latvia (64, LV, 1)	
	Denmark (8, DK, 2)	
	Belorus (65, BY, 1)	
	Czech Rep. (58, CZ)	
	Slovak Rep. (54, SK, 1)	
	Ukraine (67, UA, 1)	
	Belgium, Fland.(21, BFL, 1)	
	Belgium, Vall. (22, BW, 1)	
	Ireland (7, IRL, 2)	
	United Kingdom (6, GB,2)	
	Germany (4, D, 1)	
	Switzerland (50, CH,2)	
	Austria (14, A, 2)	
	Hungary (51, H, 2)	
	Croatia (57, HR, 3)	Croatia (57, Cr)
	Italy (5, I, 2)	Italy (5, I)
		Portugal (10, P1 – P6)
		Spain (11, E1, E2)
		France (1, F)
		Greece (9, G)
		Cyprus (66, C)
PCC (99, PCC, 1)	PCC (99, PCC, 1)	PCC (99, ICP/EU, 2)

2.1.3 Levels of comparisons

The defoliation estimates can be compared at different levels: Most basically are comparisons at the **tree level**, since single trees are the units at which the assessments are actually done in the field. Bivariate regressions are among the adequate statistical procedures to compare the data of two teams. Kappa statistics have not been performed, since there are not enough comparable cases which fulfil its specific requirements. Instead, the "actual agreement" (see DOBBERTIN et al. 1997: 9) was calculated.

Further, estimations at **plot level** (locality) can be applied. This does not necessarily mean that only means and/or other integrating statistical parameters about the variation of defoliation are processed. With an ANOVA approach (Analysis of Variance) tree-based investigation focusing at country specific deviations at plot level are possible too, but more than one plot (locality) per tree species or species group (*Quercus robur* and *Q. petraea, Betula pendula* and *B. pubescens*) are needed in addition with further information concerning independent variables (age, site conditions) on stand level for inter-plot comparisons. Among the plots from 2001 ICC of the northern countries site conditions vary partly, whereas there was some variation of age among the plots of the ICC from central and eastern Europe. About the plots of the Mediterranean course no additional information is available. In order to get hints on possible causes for different estimations, bivariate correlation analyses have been performed.

At a third level, results from the ICCs performed in 2001 and **regular forest condition assessment** having been done so far (LORENZ et al. 2001, SEIDLING & MUES in review) are compared. This evaluation is a step towards adjustment functions.

Results

2.1.4 Coherency of field estimates at tree level between country teams

The estimates of different teams are compared plot-wise at tree level. This was done by pair-wise correlation of the estimates of all different teams.

As an example from the ICC for **central and eastern Europe** Table 1 and Table 2 show that different degrees of coherency can be observed, varying from plot to plot, probably according to different site and stand conditions (2.1.6). Whereas there is almost no consistency between the defoliation estimates of the 12 years old stand of Norway spruce at Brumov (Czech Rep.) at one side (Table 1), comparatively good relationships exist between the estimates of many teams for the 110 years old spruce stand at Brumov (Table 2). Additionally, it becomes obvious from the second example that some nations have a more deviant procedure of estimating crown condition than others. The team from the United Kingdom reveals a significant relationship only with the Latvian team for the old spruce stand at Brumov. The behaviour of some other teams is more in parallel with that of others: The estimations of the team from Hungary suits very well to those of Czech Republic, Germany, Denmark, and Finland.

Having a similar estimation behaviour as shown in Table 1 and Table 2, does not necessarily mean that the levels of defoliation are alike. This property can better be checked by another approach: After cross-tabulating tree-wise estimates of two teams, the occurrences of the diagonal cells are put into relation to the overall number of occurrences see (DOBBERTIN et al. 1997: 8 ff.):

$$t_a = \Sigma n_{ii} / n$$

n_{ii} = number of trees, beeing assessed in defoliation class i by both countries
n = total number of observations,.

Table 4 gives an example: In spite of low correlation coefficients between defoliation estimates for the 12 year old spruce stand at Brumov (Table 1), the degree of the exact agreement is with an average of 51% over all 171 valid country combinations quite high. DOBBERTIN et al. (1997) found an exact mean accuracy of 26% for 5% defoliation classes. In contrast to that and in spite of high correlation coefficients between most of the country teams (c.f. Tab. Table 2), there is much less agreement (18% over all 190 country combinations) for the old spruce stand at Brumov (Table 5). In general exact agreement or any other measure of agreement like weighted agreement is more sensitive towards different levels of defoliation estimations between national teams than correlation coefficients. The latter reflects similarities of tree ranking.

Table 2: Brumov, *Picea abies*, age = 12 years, n = 20: correlation coefficients (Pearson) r between teams from different countries including estimates of PCC, for LV no coefficients could be computed due to lack of any variance;
$p < 0.05$: yellow, $p < 0.01$: green, $p < 0.001$: blue; mean over all coefficients = 0.19.

	BFL	BW	BY	CH	CZ	D	DK	FIN	GB	H	HR	I	IRL	LT	LV	S	SK	UA	PCC
A	0.22	-0.05	-0.11	-0.05	-0.02	0.49	0.19	-0.08	0.39	0.50	-0.05	-0.03	-0.08	0.68		0.29	-0.05	-0.11	0.41
BFL		-0.25	0.23	-0.25	0.17	-0.09	-0.11	-0.02	0.33	0.06	-0.01	0.10	-0.19	0.48		-0.03	0.22	0.23	-0.13
BW			-0.11	-0.05	0.14	0.03	0.19	-0.08	-0.08	0.07	-0.05	-0.20	0.69	-0.19		-0.12	-0.05	-0.11	0.02
BY				-0.11	0.22	-0.05	0.41	0.25	0.09	0.14	-0.11	0.38	0.25	0.06		-0.04	0.46	0.69	-0.17
CH					0.45	0.03	0.19	-0.08	0.39	-0.15	-0.05	0.13	-0.08	0.10		0.70	-0.05	-0.11	0.41
CZ						-0.02	0.46	0.09	0.37	0.21	-0.17	0.47	0.32	0.20		0.39	0.29	-0.03	0.12
D							0.39	0.21	-0.02	0.75	0.49	0.34	-0.12	0.37		0.35	0.03	0.32	0.78
DK								0.52	0.28	0.76	0.19	0.76	0.52	0.30		0.44	0.53	0.22	0.31
FIN									-0.11	0.57	0.69	0.67	0.44	0.15		0.12	-0.08	0.25	0.31
GB										0.13	-0.23	0.19	0.00	0.45		0.49	0.23	-0.09	0.20
H											0.50	0.68	0.25	0.47		0.32	0.28	0.26	0.58
HR												0.46	-0.08	0.10		0.29	-0.05	0.46	0.60
I													0.19	0.15		0.50	0.46	0.38	0.35
IRL														-0.06		-0.18	-0.08	-0.17	-0.11
LT																0.35	0.10	0.06	0.39
LV																			
S																	0.29	0.18	0.58
SK																		0.46	-0.18
UA																			0.25

Table 3: Brumov, *Picea abies*, age = 110, n = 25: correlation coefficients (Pearson) r between teams from different countries including estimates of an untrained person from PCC; $p < 0.05$: yellow, $p < 0.01$: green, $p < 0.001$: blue; mean over all coefficients = 0.47:

	BFL	BW	BY	CH	CZ	D	DK	FIN	GB	H	HR	I	IRL	LT	LV	S	SK	UA	PCC
A	0.54	0.70	0.46	0.48	0.65	0.66	0.51	0.62	0.33	0.70	0.68	0.57	0.63	0.80	0.55	0.44	0.49	0.46	0.53
BFL		0.75	0.53	0.28	0.77	0.56	0.72	0.49	0.12	0.72	0.73	0.41	0.83	0.53	0.30	0.27	0.21	0.54	0.68
BW			0.52	0.22	0.57	0.45	0.55	0.54	0.13	0.67	0.52	0.39	0.70	0.65	0.24	0.34	0.20	0.55	0.68
BY				0.29	0.53	0.50	0.49	0.56	0.34	0.49	0.51	0.33	0.61	0.52	0.33	0.24	0.36	0.76	0.65
CH					0.56	0.47	0.24	0.52	0.25	0.43	0.38	0.30	0.27	0.42	0.32	0.40	0.32	0.25	0.06
CZ						0.71	0.68	0.50	0.12	0.72	0.73	0.39	0.67	0.56	0.35	0.31	0.26	0.49	0.53
D							0.56	0.38	0.39	0.61	0.60	0.56	0.47	0.69	0.47	0.60	0.48	0.59	0.50
DK								0.33	0.03	0.57	0.65	0.44	0.66	0.58	0.46	0.41	0.48	0.63	0.51
FIN									0.15	0.60	0.58	0.28	0.59	0.62	0.24	0.23	0.47	0.48	0.45
GB										0.08	0.20	0.13	0.13	0.37	0.47	0.11	0.39	0.30	0.28
H											0.79	0.55	0.69	0.83	0.26	0.41	0.28	0.44	0.60
HR												0.69	0.85	0.73	0.29	0.35	0.39	0.48	0.56
I													0.59	0.59	0.10	0.42	0.19	0.35	0.34
IRL														0.62	0.19	0.22	0.23	0.59	0.62
LT															0.47	0.45	0.52	0.63	0.62
LV																0.42	0.72	0.48	0.44
S																	0.47	0.33	0.19
SK																		0.39	0.37
UA																			0.64

Table 4: Brumov, *Picea abies*, age = 12, n = 20: agreement (%) of defoliation estimates between teams from different countries including PCC; no colour: 0 – 24%, yellow: 25-49%, green: 50-74%, blue: 75-100%.

	BFL	BW	BY	CH	CZ	D	DK	FIN	GB	H	HR	I	IRL	LT	LV	S	SK	UA	PCC
A	10	90	75	90	55	45	70	85	0	65	90	50	85	50	5	80	90	75	50
BFL		10	10	15	10	20	20	10	30	20	10	10	15	20	10	10	10	10	15
BW			75	90	55	45	65	85	0	65	90	40	90	45	0	70	90	75	50
BY				75	50	55	55	80	5	55	75	45	80	60	20	65	85	90	50
CH					50	50	70	85	0	60	90	45	85	55	5	75	90	75	50
CZ						30	45	45	5	40	45	40	50	35	25	55	50	45	40
D							50	40	5	60	45	30	45	60	40	45	50	60	60
DK								70	0	75	70	45	70	50	25	70	65	60	45
FIN									0	65	95	45	90	60	10	75	85	80	45
GB										5	0	15	0	0	5	0	0	5	10
H											65	45	70	50	10	55	65	55	60
HR												45	85	55	5	80	90	85	50
I													40	25	20	55	45	45	50
IRL														50	10	65	85	70	50
LT															40	55	55	60	50
LV																20	5	20	30
S																	80	75	40
SK																		85	45
UA																			55

Table 5: Brumov, *Picea abies*, age = 110, n = 20: agreement (%) of defoliation estimates between teams from different countries including PCC;
no colour: 0 – 24%, yellow: 25-49%, green: 50-74%, blue: 75-100%.

	BFL	BW	BY	CH	CZ	D	DK	FIN	GB	H	HR	I	IRL	LT	LV	S	SK	UA	PCC
A	*0*	*28*	*36*	*16*	*0*	*4*	*8*	*8*	*16*	*4*	*12*	*24*	*32*	*16*	*16*	*20*	*0*	*16*	*16*
BFL		*8*	*4*	*0*	*24*	*4*	*0*	*4*	*4*	*12*	*16*	*4*	*0*	*8*	*12*	*4*	*4*	*12*	*8*
BW			*20*	*8*	*12*	*8*	*20*	*8*	*0*	*16*	*16*	*28*	*20*	*12*	*0*	*24*	*0*	*8*	*12*
BY				*24*	*8*	*4*	*28*	*24*	*24*	*16*	*24*	*20*	*32*	*20*	*20*	*24*	*12*	*40*	*20*
CH					*0*	*28*	*20*	*32*	*20*	*12*	*36*	*16*	*20*	*48*	*16*	*28*	*56*	*36*	*24*
CZ						*4*	*0*	*8*	*4*	*4*	*20*	*4*	*0*	*0*	*4*	*4*	*0*	*4*	*0*
D							*28*	*28*	*4*	*24*	*24*	*8*	*28*	*28*	*24*	*12*	*20*	*32*	*28*
DK								*44*	*20*	*8*	*0*	*28*	*24*	*28*	*28*	*44*	*20*	*24*	*20*
FIN									*24*	*20*	*16*	*28*	*20*	*24*	*20*	*24*	*36*	*24*	*20*
GB										*12*	*12*	*16*	*24*	*24*	*12*	*16*	*36*	*36*	*16*
H											*16*	*16*	*16*	*12*	*12*	*4*	*24*	*16*	*12*
HR												*12*	*12*	*28*	*20*	*16*	*20*	*28*	*16*
I													*28*	*28*	*8*	*32*	*12*	*20*	*28*
IRL														*16*	*24*	*20*	*28*	*40*	*24*
LT															*28*	*32*	*36*	*32*	*36*
LV																*20*	*28*	*24*	*32*
S																	*8*	*24*	*24*
SK																		*32*	*8*
UA																			*24*

Similar country-specific results have been achieved by the ICC for **northern Europe** as shown in Table 6 to Table 21. All tables are given to see both: species-specific patterns and plot-specific patterns. Patterns of similarity become especially obvious by comparing the correlation coefficients. Estimations of the different countries for birch trees at Sipoo correlate to a distinctively lesser degree than those at Korso (Table 6 and Table 8). At Korso especially Russia shows a deviant estimation behaviour while estimations of PCC did not significantly correlate at Sipoo. At Sipoo Norway shows very high similarity with Lithuania and Finland concerning the ranking (Table 6) but low level of agreement (Table 7). Anyway, the values of total agreement are comparatively poor for both birch stands (Table 7 and Table 9). Only Finland and Estonia reach an agreement of 55% at Sipoo.

Table 6: Sipoo, *Betula pendula*, n = 20: correlation coefficients (Pearson) r between teams from different countries including PCC; yellow: $p < 0.05$, green: $p < 0.01$, blue: $p < 0.001$.

	FIN	LIT	NOR	SWE	PCC
EST	0.30	0.29	0.66	0.15	0.08
FIN		0.72	0.48	0.62	0.40
LIT			0.47	0.60	0.23
NOR				0.43	0.34
SWE					0.42

Table 7: Sipoo, *Betula pendula*: n = 20: agreement (%) of defoliation estimates between teams from different countries including PCC; no colour: 0 – 24%, yellow: 25-49%, green: 50-74%.

	FIN	LIT	NOR	SWE	PCC
EST	55	10	0	35	30
FIN		5	10	30	35
LIT			0	10	25
NOR				10	0
SWE					20

Table 8: Korso, *Betula pubescens*, n = 15: correlation coefficients (Pearson) r between teams from different countries including PCC; yellow: p < 0.05, green: p < 0.01, blue: p < 0.001.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	0.84	0.78	0.89	0.22	0.9	0.51
FIN		0.81	0.78	0.37	0.77	0.57
LIT			0.74	0.43	0.78	0.60
NOR				0.25	0.76	0.41
RUS					0.26	0.82
SWE						0.49

Table 9: Korso, *Betula pubescens*: n = 15: agreement (%) of defoliation estimates between teams from different countries including PCC; no colour: 0 – 24%, yellow: 25-49%, green: 50-74%.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	7	27	20	7	47	47
FIN		33	27	27	0	7
LIT			7	7	40	13
NOR				33	7	13
RUS					20	27
SWE						13

In spruce (Table 10 to Table 15) a ranking of the locations with respect to correlation coefficients is obvious. At Korso generally highly significant relationships between all teams can be observed, while at Tammela the correlation coefficients are much lower. At Somerniemi intermediate values are revealed. Tammela is supposed to be the best stand in terms of yield, while Someriemi is supposed to be the poorest. Therefore estimation behaviour of the teams is not simply a function of soil fertility in spruce. Again the estimates of the exact agreement (Table 11, Table 13 and Table 15) do not correspond to the patterns of the correlation coefficients.

Table 10: Korso, *Picea abies*, n = 20: correlation coefficients (Pearson) r between teams from different countries including PCC; yellow: p < 0.05, green: p < 0.01, blue: p < 0.001.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	0.92	0.90	0.78	0.82	0.92	0.74
FIN		0.83	0.82	0.81	0.96	0.77
LIT			0.69	0.80	0.84	0.70
NOR				0.69	0.79	0.64
RUS					0.80	0.72
SWE						0.74

Table 11: Korso, *Picea abies*: n = 20: agreement (%) of defoliation estimates between teams from different countries including PCC; no colour: 0 – 24%, yellow: 25-49%, green: 50-74%.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	50	35	15	25	35	0
FIN		25	15	25	25	0
LIT			15	30	25	5
NOR				10	15	5
RUS					25	5
SWE						5

Table 12: Somerniemi, *Picea abies*, n = 20: correlation coefficients (Pearson) r between teams from different countries including PCC; yellow: p < 0.05, green: p < 0.01, blue: p < 0.001.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	0.78	0.82	0.69	0.79	0.69	0.67
FIN		0.77	0.74	0.65	0.84	0.85
LIT			0.78	0.82	0.67	0.64
NOR				0.64	0.78	0.66
RUS					0.71	0.45
SWE						0.67

Table 13: Somerniemi, *Picea abies*: n = 20: agreement (%) of defoliation estimates between teams from different countries including PCC; no colour: 0 – 24%, yellow: 25-49%, green: 50-74%.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	0	45	15	25	20	30
FIN		5	15	5	15	0
LIT			20	35	35	50
NOR				5	30	15
RUS					5	50
SWE						15

Table 14: Tammela, *Picea abies*, n = 20: correlation coefficients (Pearson) r between teams from different countries including PCC; p < 0.05: yellow, p < 0.01: green, p < 0.001: blue.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	0.71	0.51	0.69	0.65	0.72	0.26
FIN		0.63	0.67	0.58	0.88	0.67
LIT			0.54	0.39	0.61	0.41
NOR				0.31	0.61	0.15
RUS					0.60	0.42
SWE						0.60

Table 15: Tammela, *Picea abies*: n = 20: agreement (%) of defoliation estimates between teams from different countries including PCC; no colour: 0 – 24%, yellow: 25-49%, green: 50-74%.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	20	20	15	50	40	25
FIN		25	30	10	15	25
LIT			30	25	20	20
NOR				30	10	25
RUS					30	35
SWE						35

In Scots pine (Table 16 to Table 21), the assessment behaviour of the country teams is generally less consistent than in the two other tree species. Especially at the pine stand at Tammela most of the teams showed a deviant behaviour. Only the teams from Finland, Russia, Lithuania and PCC gave some consistent estimates. The poorest stand in terms of soil quality was Porvo. Again, this stand did not reveal the less consistent estimates. Therefore other - probably stand related properties - may influence the estimating behaviour with concern to single tree specimen.

Table 16: Mätäkivenmäki, *Pinus sylvestris*, n = 20: correlation coefficients (Pearson) r between teams from different countries including PCC; p < 0.05: yellow, p < 0.01: green, p < 0.001: blue.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	0.83	0.7	0.59	0.73	0.81	0.41
FIN		0.78	0.62	0.81	0.83	0.47
LIT			0.36	0.78	0.81	0.56
NOR				0.45	0.49	0.38
RUS					0.87	0.38
SWE						0.55

Table 17: Mätäkivenmäki, *Pinus sylvestris*: n = 20: agreement (%) of defoliation estimates between teams from different countries including PCC; no colour: 0 – 24%, yellow: 25-49%, green: 50-74%.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	30	20	5	10	30	25
FIN		25	30	15	25	20
LIT			20	35	25	25
NOR				5	5	15
RUS					20	35
SWE						20

Table 18: Porvoo, *Pinus sylvestris*, n = 20: correlation coefficients (Pearson) r between teams from different countries including PCC; p < 0.05: yellow, p < 0.01: green, p < 0.001: blue.

	FIN	LIT	NOR	SWE	PCC
EST	0.50	0.73	0.37	0.57	0.73
FIN		0.38	0.64	0.78	0.35
LIT			0.47	0.53	0.84
NOR				0.61	0.20
SWE					0.38

Table 19: Porvoo, *Pinus sylvestris*: n = 20: agreement (%) of defoliation estimates between teams from different countries including PCC; no colour: 0 – 24%, yellow: 25-49%, green: 50-74%.

	FIN	LIT	NOR	RUS	PCC
EST	15	35	10	20	20
FIN		5	20	15	40
LIT			25	15	25
NOR				15	30
SWE					10

Table 20: Tammela, *Pinus sylvestris*, n = 20: correlation coefficients (Pearson) r between teams from different countries including PCC; $p < 0.05$: yellow, $p < 0.01$: green, $p < 0.001$: blue.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	-0.17	0.20	0.20	0.22	0.38	-0.05
FIN		0.69	0.15	0.57	0.00	0.53
LIT			0.11	0.69	0.18	0.37
NOR				-0.04	0.31	-0.15
RUS					-0.15	0.36
SWE						0.13

Table 21: Tammela, *Pinus sylvestris*: n = 20: agreement (%) of defoliation estimates between teams from different countries including PCC; no colour: 0 – 24%, yellow: 25-49%, green: 50-74%.

	FIN	LIT	NOR	RUS	SWE	PCC
EST	55	15	45	25	50	10
FIN		10	40	35	55	0
LIT			35	45	25	60
NOR				45	50	30
RUS					30	30
SWE						20

Different from the other tree species, a higher exact agreement of the defoliation estimates is observed at the Tammela plot (Table 21), the plot with the lowest average mean defoliation of the northern ICC (Table 30). This is in accordance with the result from the young spruce stand at Brumov and gives evidence to the idea that low ranges of defoliation within a tree stand give generally high values of exact agreements due to generally higher statistical occurrences per cell (number of cells is smaller). This is of course also true for the diagonal cell of a cross-table.

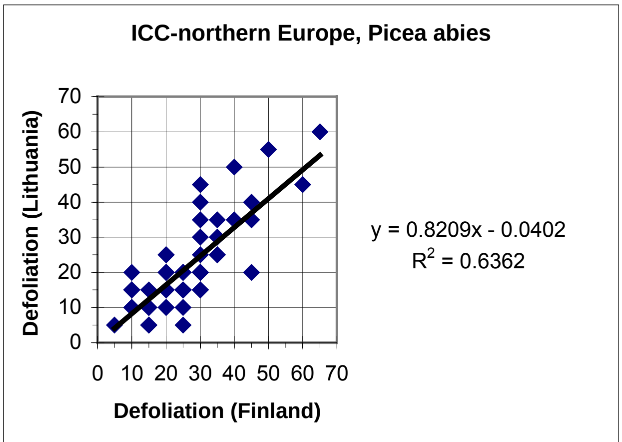

Figure 1: ICC northern Europe, defoliation estimates of spruce trees from the Lithuanian against the Finnish team, n = 60.

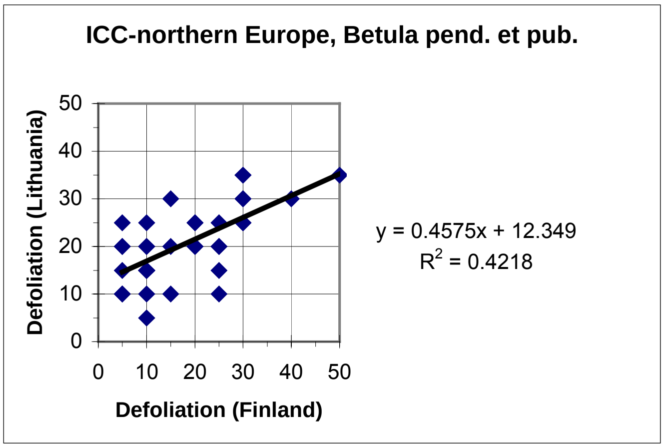

Figure 2: ICC northern Europe, defoliation estimates of birch trees from the Lithuanian against the Finnish team, n = 35.

Figure 1 and Figure 2 illustrate the differences of defoliation estimates of identical trees between teams from different countries from the ICC for northern Europe. First, the large differences between the estimations of different country teams become obvious. Second, the relationships between estimates of teams from different countries are not fully proportional as especially the example with *Betula* species (Figure 2) shows: Low estimations of the Finnish in comparison to the Lithuanian team at low defoliation level are in contrast with comparatively high estimations at high and especially at intermediate defoliation level. In more sophisticated multivariate approaches (esp. cluster analyses, not performed yet) this different estimation behaviour of country teams with respect to stand and site conditions could be used for an overall grouping of the country teams.

For the ICC of the **Mediterranean countries** in general similar results were achieved (Table 22to Table 29). For both species investigated during this course, plots with high conformity in terms of correlation coefficients could be found (Table 6-22 for *Pinus pinaster* and Table 25 for *Quercus suber*), whereas Table 23 and Table 24 give examples for plots with distinctively smaller accordance of the defoliation estimates in both species.

Most interestingly, in cases of low conformity there is no higher accordance recognisable between teams from one single country in comparison with teams from different countries. For example the team P2 from Portugal performs the most deviant estimating behaviour at plot number 4 (Table 24). Only with the estimates of team P1 a significant correlation was found. The Portuguese national reference team shows however a better conformity with other foreign teams than the other five teams from Portugal (see Table 23). This result confirms the necessity of national Cross-calibration Courses.

Table 22: Portugal Plot 1, *Pinus pinaster*, n = 30: correlation coefficients (Pearson) r between different teams;
p < 0.05: yellow, p < 0.01: green, p < 0.001: blue; mean over all coefficient = 0.87.

	P2	P3	P4	P5(NRT)	P6	E1(NRT)	E2	F	I	G	C	CR	PCC/EU
P1	0.80	0.67	0.80	0.86	0.78	0.75	0.87	0.77	0.80	0.89	0.84	0.80	0.80
P2		0.81	0.88	0.92	0.95	0.93	0.81	0.87	0.85	0.91	0.92	0.80	0.93
P3			0.80	0.84	0.83	0.77	0.82	0.77	0.80	0.81	0.84	0.80	0.80
P4				0.91	0.89	0.84	0.77	0.83	0.90	0.88	0.89	0.85	0.86
P5(NRT)					0.94	0.92	0.87	0.86	0.87	0.96	0.93	0.81	0.88
P6						0.92	0.85	0.87	0.86	0.91	0.91	0.80	0.90
E1(NRT)							0.82	0.92	0.87	0.93	0.90	0.79	0.92
E2								0.80	0.81	0.89	0.85	0.77	0.83
F									0.85	0.94	0.94	0.89	0.92
I										0.88	0.89	0.87	0.83
G											0.97	0.88	0.91
C												0.93	0.92
CR													0.86

Table 23: Portugal Plot 2, *Pinus pinaster*, n = 30: correlation coefficients (Pearson) r between different teams;
$p < 0.05$: yellow, $p < 0.01$: green, $p < 0.001$: blue; mean over all coefficient = 0.50.

	P2	P3	P4	P5(NRT)	P6	E1(NRT)	E2	F	I	G	C	CR	PCC/EU
P1	0.19	0.55	0.55	0.52	0.48	0.50	0.40	0.63	0.39	0.50	0.54	0.47	0.51
P2		0.29	0.40	0.43	0.36	0.33	0.51	0.34	0.38	0.35	0.45	-0.01	0.43
P3			0.62	0.71	0.75	0.28	0.65	0.61	0.58	0.58	0.57	0.56	0.67
P4				0.54	0.45	0.44	0.57	0.51	0.50	0.44	0.51	0.39	0.49
P5(NRT)					0.62	0.40	0.77	0.56	0.60	0.55	0.66	0.44	0.58
P6						0.41	0.70	0.46	0.41	0.62	0.57	0.57	0.45
E1(NRT)							0.45	0.49	0.43	0.59	0.57	0.23	0.45
E2								0.63	0.64	0.56	0.54	0.34	0.48
F									0.69	0.48	0.53	0.39	0.68
I										0.35	0.41	0.49	0.62
G											0.79	0.35	0.54
C												0.43	0.60
CR													0.35

Table 24: Portugal Plot 4, *Quercus suber*: n = 28 (PCC/EU: n = 24): correlation coefficients (Pearson) r between different teams;
$p < 0.05$: yellow, $p < 0.01$: green, $p < 0.001$: blue; mean over all coefficient = 0.48.

	P2	P3	P4	P5(NRT)	P6	E1(NRT)	E2	F	I	G	C	CR	PCC/EU
P1	0.40	0.56	0.41	0.69	0.43	0.49	0.63	0.60	0.50	0.34	0.56	0.66	0.59
P2		0.10	0.16	0.31	0.23	0.34	0.16	0.21	0.21	0.17	0.29	0.36	0.25
P3			0.29	0.39	-0.09	0.22	0.49	0.59	0.50	0.14	0.38	0.27	0.47
P4				0.73	0.45	0.30	0.41	0.44	0.36	0.56	0.58	0.41	0.61
P5(NRT)					0.60	0.58	0.72	0.61	0.65	0.60	0.72	0.79	0.73
P6						0.53	0.48	0.12	0.37	0.58	0.64	0.56	0.38
E1(NRT)							0.47	0.46	0.34	0.33	0.57	0.67	0.43
E2								0.59	0.54	0.47	0.64	0.58	0.59
F									0.64	0.58	0.63	0.55	0.64
I										0.54	0.59	0.61	0.63
G											0.84	0.51	0.50
C												0.70	0.68
CR													0.59

Table 25: Portugal, Plot 5, *Quercus suber*, n = 30: correlation coefficients (Pearson) r between different teams;
p < 0.05: yellow, p < 0.01: green, p < 0.001: blue; mean over all coefficient = 0.75.

	P2	P3	P4	P5(NRT)	P6	E1(NRT)	E2	F	I	G	C	CR	PCC/EU
P1	0.83	0.85	0.84	0.82	0.78	0.70	0.78	0.83	0.75	0.80	0.81	0.75	0.63
P2		0.79	0.62	0.89	0.78	0.84	0.84	0.81	0.77	0.77	0.86	0.75	0.58
P3			0.77	0.83	0.83	0.70	0.65	0.75	0.82	0.76	0.80	0.81	0.52
P4				0.66	0.64	0.37	0.48	0.67	0.63	0.63	0.65	0.55	0.44
P5(NRT)					0.91	0.79	0.79	0.84	0.86	0.77	0.87	0.81	0.54
P6						0.75	0.71	0.78	0.83	0.75	0.84	0.82	0.54
E1(NRT)							0.88	0.81	0.79	0.74	0.81	0.85	0.60
E2								0.86	0.70	0.79	0.82	0.86	0.66
F									0.84	0.91	0.93	0.87	0.70
I										0.77	0.82	0.83	0.64
G											0.92	0.83	0.67
C												0.87	0.64
CR													0.65

The calculation of the total agreement according to DOBBERTIN et al. (1997) confirms the findings from the other two ICCs: High correlation at plot number 1 on one side is accompanied by low agreement values between the teams, while a lower correlation between the estimates of the teams at plot number 2 (Tab. 26) results in higher agreement values (Tab. 27). For the two oak plots given as examples (Tab. 28 and 29), this difference is however less distinct.

Table 26: Plot 1, *Pinus pinaster*, n = 30: agreement (%) of defoliation estimates between teams from different countries including PCC;
no colour: 0 – 24%, yellow: 25-49%, green: 50-74%, blue: 75-100%.

	P2	P3	P4	P5(NRT)	P6	E1(NRT)	E2	F	I	G	C	CR	PCC/EU
P1	13	13	17	27	13	13	37	7	17	20	17	13	37
P2		23	37	17	33	27	33	27	20	23	20	23	27
P3			17	13	43	23	10	27	7	27	17	13	20
P4				20	23	20	10	17	13	30	20	27	20
P5(NRT)					20	27	37	17	37	40	40	27	30
P6						33	3	20	10	17	7	13	17
E1(NRT)							20	37	17	47	30	13	27
E2								17	20	30	27	23	13
F									3	23	3	17	17
I										33	43	23	23
G											60	30	20
C												30	30
CR													27

Table 27: Plot 2, *Pinus pinaster*, n = 30: agreement (%) of defoliation estimates between teams from different countries including PCC;
no colour: 0 – 24%, yellow: 25-49%, green: 50-74%, blue: 75-100%.

	P2	P3	P4	P5(NRT)	P6	E1(NRT)	E2	F	I	G	C	CR	PCC/EU
P1	27	37	47	27	33	17	33	50	10	30	33	20	27
P2		23	33	53	10	27	10	33	40	43	30	30	47
P3			53	30	57	20	40	47	33	50	47	23	37
P4				27	37	27	43	47	20	53	57	20	33
P5(NRT)					13	40	70	30	50	27	17	33	50
P6						20	30	40	23	47	53	10	23
E1(NRT)							33	27	47	23	17	33	27
E2								33	40	37	30	43	43
F									37	40	33	20	23
I										33	27	37	27
G											83	20	40
C												13	37
CR													27

Table 28: Plot 4, *Quercus suber*, n = 30: agreement (%) of defoliation estimates between teams from different countries including PCC;
no colour: 0 – 24%, yellow: 25-49%, green: 50-74%, blue: 75-100%.

	P2	P3	P4	P5(NRT)	P6	E1(NRT)	E2	F	I	G	C	CR	PCC/EU
P1	21	32	36	50	32	14	21	25	36	25	39	43	25
P2		18	29	21	36	25	36	25	29	11	25	25	14
P3			11	29	21	7	0	25	25	14	25	18	18
P4				32	25	36	46	21	18	25	25	29	14
P5(NRT)					46	21	36	32	43	25	39	43	32
P6						25	32	29	29	14	25	29	18
E1(NRT)							39	21	29	14	21	25	4
E2								21	32	14	18	32	18
F									36	4	18	25	32
I										11	25	39	36
G											43	21	18
C												32	21
CR													21

Table 29: Plot 5, *Quercus suber*, n = 30: agreement (%) of defoliation estimates between teams from different countries including PCC;
no colour: 0 – 24%, yellow: 25-49%, green: 50-74%, blue: 75-100%.

	P2	P3	P4	P5(NRT)	P6	E1(NRT)	E2	F	I	G	C	CR	PCC/EU
P1	57	13	57	47	47	13	27	23	30	33	40	20	20
P2		23	53	63	50	23	50	37	47	40	60	27	33
P3			17	27	17	23	23	23	20	17	30	40	33
P4				47	37	20	40	27	27	30	40	20	27
P5(NRT)					43	23	53	40	57	43	70	23	40
P6						23	40	33	40	43	37	30	43
E1(NRT)							23	10	27	20	17	33	20
E2								47	37	40	47	43	53
F									40	50	40	37	43
I										43	53	30	33
G											53	33	50
C												20	47
CR													40

2.1.5 Comparisons of defoliation estimates between country teams at plot level

Confessing the estimates of defoliation of each team as an independent "group", an analysis of variance (ANOVA) is an adequate method to evaluate i) whether there is a significant overall differentiation of the pseudo-continuous response variable defoliation and ii) whether significant groups of countries exist (Ryan-Einot-Gabriel-Welsch multiple range test, SAS 1990).

Table 30: ICC northern Europe: Species-specific results of the ANOVA for each plot and for all trees (plots), R squared: amount of variance explained by the country teams, mean defol: mean defoliation; levels of significance: p < 0.05: *, p < 0.01: **, p < 0.001: ***.

Pinus sylvestris	*locality*	*Mätäkivenmäki*	*Tammela*	*Porvoo*	*all localities*
	R squared	*0.12 ***	*0.44 ****	*0.16 ***	*0.03 n.s.*
	mean defol	*21.5*	*7.5*	*19.1*	*15.9*
	n of cases	*140*	*140*	*120*	*400*
Picea abies	*locality*	*Korso*	*Tammela*	*Somerniemi*	*all localities*
	R squared	*0.20 ****	*0.16 ****	*0.27 ****	*0.09 ****
	mean defol	*29.3*	*13.3*	*19.5*	*20.7*
	n of cases	*140*	*140*	*140*	*420*
Betula pendula + B. pubescens	*locality*	*Sipoo*	*Korso*		*all localities*
	R squared	*0.32 ****	*0.15 **		*0.15 ****
	mean defol	*14.0*	*20.8*		*17.2*
	n of cases	*140*	*105*		*245*

Table 30 to Table 32 give the results of the species-specific ANOVA runs for each locality on the one hand and for all specimen of a tree species without regard of locality on the other. At the ICC for northern Europe (Table 30) the amount of variance explained by "between group (country teams) effects" varies considerably between the three localities and between the tree species. In *Pinus sylvestris* R^2 values low as 0.12 and high as 0.44 can be observed, while for pine taken from all localities together no significant team/country effects appear. This indicates a plot-specific estimation behaviour of the teams in this species. For *Picea abies* and for *Betula pendula* and *B. pubescens* at the Finnish localities as well as for all species at the Czech plots the same effect can be observed (Table 31), however with lower intensity. This gives further support that stand- and/or site-specific peculiarities may influence the assessment behaviour of the teams.

Table 31: ICC central and eastern Europe: Species-specific results of the ANOVA for each plot and for all trees (plots), R squared: amount of variance explained by the country teams, mean defol: mean defoliation; levels of significance: p < 0.05: *, p < 0.01: **, p < 0.001: ***.

Picea abies	*locality*	*Liptál*	*Brumov 110 y*	*Brumov 12 y*	*all localities*
	R squared	*0.28 ******	*0.31 ******	*0.51******	*0.13 ******
	mean defol	*16.9*	*21.2*	*3.4*	*14.6*
	n of cases	*485*	*500*	*400*	*1385*
Quercus robur and Q. petraea	*locality*	*Haluzice*	*Sidonie*		*all localities*
	R squared	*0.48 ******	*0.10 ******		*0.14 ******
	mean defol	*21.7*	*26.8*		*24.2*
	n of cases	*500*	*499*		*999*
Fagus sylvatica	*locality*	*Haluzice*	*Sidonie*		*all localities*
	R squared	*0.33 ******	*0.40 ******		*0.28 ******
	mean defol	*19.2*	*14.7*		*16.9*
	n of cases	*480*	*500*		*980*

At the Mediterranean ICC even for all localities significant differences between the teams have been found (Table 32). In maritime pine between 6 and 24% can be explained by team effects, while in cork oak the respective range is slightly higher (9 – 28%). Again results differ plot-wise, but team specific peculiarities have also considerable effect on the species level without regard of location (all localities).

Table 32: ICC Mediterranean countries: Species-specific results of the ANOVA for each plot and for all trees (plots), R squared: amount of variance explained by the different teams, mean defol: mean defoliation; levels of significance: p < 0.05: *, p < 0.01: **, p < 0.001: ***.

Pinus pinaster	*Locality*	*Plot 1*	*Plot 2*	*Plot 3*	*all localities*
	R squared	*0.06 **	*0.20 ******	*0.24 ******	*0.21 ******
	mean defol	*17.8*	*12.5*	*21.6*	*17.3*
	n of cases	*420*	*420*	*420*	*1260*
Quercus suber	*Locality*	*Plot 4*	*Plot 5*	*Plot 6*	*all localities*
	R squared	*0.16 ******	*0.09 ******	*0.28 ******	*0.20 ******
	mean defol	*21.6*	*17.6*	*17.0*	*18.7*
	n of cases	*392*	*420*	*420*	*1228*

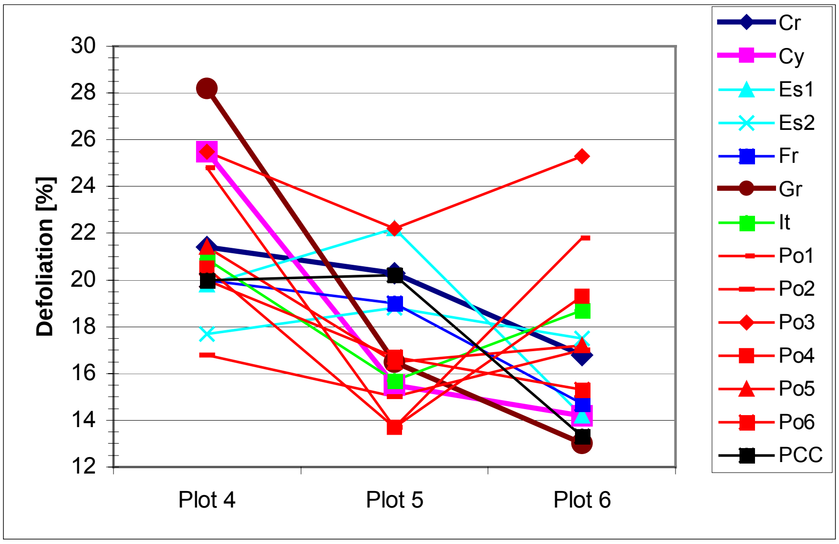

Figure 3: ICC Mediterranean countries: mean defoliation of *Quercus suber* plots stratified by team.

Figure 3 visualises this inconsistent situation at hand of the cork oak plots. Both Spanish teams and the PCC team consider plot 5 as the most defoliated, while most of the other teams consider plot 4 as the most defoliated. Some Portuguese teams evaluate however plot 6 as the most damaged, or at least as much damaged as plot 4.

The detailed results of the ANOVA runs show that for Scots pine at Porvo two groups of countries can be distinguished (Table 33): Norway and Finland with low values of plot mean defoliation and Sweden, Lithuania and Estonia with high values. PCC belongs with intermediate values to both groups. The means vary between 12.5% and 25%, which is considerable.

Table 33: ICC northern Europe: Results of the Ryan-Einot-Gabriel-Welsch (REGWQ) test for two plots with Scots pine (*Pinus sylvestris*), REGWQ grouping: the same letter denotes a significant group of countries, mean defol: plot mean defoliation.

Porvo; n of trees = 20			
REGWQ grouping		*mean defol*	*country*
	A	*25.00*	*Swe*
	A	*21.75*	*Lit*
	A	*21.75*	*Est*
B	*A*	*17.25*	*PCC*
B		*16.50*	*Nor*
B		*12.50*	*Fin*

Tammela; n of trees = 20			
REGWQ grouping		*mean defol*	*Country*
	A	*12.50*	*PCC*
B	*A*	*11.00*	*Lit*
B	*C*	*8.50*	*Rus*
D	*C*	*7.25*	*Nor*
D	*E*	*5.00*	*Fin*
D	*E*	*4.75*	*Swe*
	E	*3.75*	*Est*

Defoliation estimates for Scots pine at Tammela (Table 33) vary even more in relative terms (3.75 – 12.5%), however the grouping is much less clear. Five groups show considerable overlap; the defoliation estimates form more or less a continuum. An interesting fact is that the ranking order of the countries is different: for example Estonia produced the lowest defoliation value at Tammela, however at Porvo, Estonia is in the group with the highest defoliation estimates. Similar is true for Sweden. This underlines, that the ranking order of countries may vary between different sites.

Table 34: ICC northern Europe: Results of the Ryan-Einot-Gabriel-Welsch (REGWQ) test for plots with common and silver birch trees (*Betula pendula* and *B. pubescens*), REGWQ grouping: the same letter denotes a significant group of countries, mean defol: plot mean defoliation.

Korso, n of trees = 15			
REGWQ grouping		*mean defol*	*country*
A		*26.33*	*Fin*
A		*24.67*	*Nor*
A	*B*	*21.67*	*Lit*
A	*B*	*20.33*	*Est*
A	*B*	*19.67*	*Rus*
A	*B*	*18.33*	*Swe*
	B	*14.67*	*PCC*

Sipoo, n of trees = 20		
REGWQ grouping	*mean defol*	*country*
A	*21.25*	*Nor*
A	*20.00*	*Lit*
B	*12.25*	*Fin*
B	*11.25*	*PCC*
B	*10.25*	*Swe*
B	*9.25*	*Est*

For the deciduous birch (Table 34) also a considerable range of means can be observed. At Korso, the untrained person from PCC produced the lower extreme, while the other countries are comparatively close together (18 to 26%) forming only two broadly overlapping groups. The results at Sipoo are quite different: two distinct groups were found with Norway and Lithuania with high values and the rest of the countries with distinctively lower values. In birch no fundamental differences between the estimation behaviour of the country teams were obvious.

Table 35: ICC central and eastern Europe: Results of the Ryan-Einot-Gabriel-Welsch (REGWQ) test for two plots with Norway spruce (*Picea abies*), REGWQ grouping: the same letter denotes a significant group of countries, mean defol: plot mean defoliation.

Brumov, 110 y, n of trees = 25					
REGWQ grouping				*mean defol*	*country*
		A		*36.20*	*BFL*
		A		*34.80*	*CZ*
		B		*26.80*	*H*
C		*B*		*25.00*	*HR*
C		*B*	*D*	*22.80*	*D*
C		*B*	*D*	*21.60*	*LV*
C		*B*	*D*	*21.40*	*SK*
C		*B*	*D*	*21.00*	*UA*
C	*E*	*B*	*D*	*20.40*	*FIN*
C	*E*	*B*	*D*	*20.00*	*PCC*
C	*E*	*B*	*D*	*20.00*	*GB*
C	*E*	*B*	*D*	*19.20*	*BW*
C	*E*	*B*	*D*	*19.00*	*IRL*
C	*E*		*D*	*18.40*	*LT*
C	*E*		*D*	*18.40*	*BY*
C	*E*		*D*	*18.00*	*CH*
C	*E*		*D*	*17.40*	*DK*
	E		*D*	*16.20*	*I*
	E		*D*	*15.40*	*S*
	E			*12.20*	*A*

Liptál, n of trees = 25								
REGWQ grouping							*mean defol*	*country*
			A				*27.40*	*CZ*
	B		*A*				*24.40*	*BFL*
	B		*A*		*C*		*23.20*	*BY*
	B	*D*	*A*		*C*		*22.00*	*HR*
E	*B*	*D*	*A*		*C*		*20.80*	*LT*
E	*B*	*D*	*A*		*C*		*20.60*	*D*
E	*B*	*D*	*F*		*C*		*18.60*	*UA*
E	*B*	*D*	*F*		*C*	*G*	*17.60*	*CH*
E	*B*	*D*	*F*		*C*	*G*	*17.40*	*SK*
E	*B*	*D*	*F*	*H*	*C*	*G*	*17.20*	*GB*
E	*B*	*D*	*F*	*H*	*C*	*G*	*16.60*	*DK*
E	*B*	*D*	*F*	*H*	*C*	*G*	*16.00*	*LV*
E		*D*	*F*	*H*	*C*	*G*	*15.40*	*FIN*
E		*D*	*F*	*H*	*C*	*G*	*15.20*	*IRL*
E	*I*	*D*	*F*	*H*		*G*	*14.00*	*I*
E	*I*		*F*	*H*		*G*	*13.25*	*H*
	I		*F*	*H*		*G*	*11.00*	*PCC*
	I			*H*		*G*	*9.25*	*BW*
	I			*H*			*8.75*	*S*
	I						*6.20*	*A*

Examples from the ICC of central and eastern Europe are given in the Table 35 to Table 36. For both shown spruce stands broadly overlapping groupings of the 20 participating teams were found, especially for Liptál. The plot means reflect huge differences between the assessments ranging from mean defoliation values of 12 to 36% for the 110 years old spruce stand at Brumov (Table 35) and from 6 to 27% for the 87 year old stand at Liptál (Table 35). This more or less continuous estimating behaviour of the participating countries does indicate that countries have not adopted or joined certain "schools" to estimate defoliation of forest trees, but practice a wide variety of methods. The comparison of the two spruce stands reveals a certain consistency of many countries. The teams from the Flemish part of Belgium and Czech team reveal in both examples the highest defoliation means, while the Austrian and the Swedish team produced the lowest. Other teams, like those from Switzerland, Belarus or Lithuania got lower estimates at the Brumov plot and higher at the Liptál plot, which is quite opposite to their general trend with higher estimates for the older Brumov stand and lower ones for the younger Liptál stand. Other teams, especially the team from Hungary got a much lower estimates at the Liptál stand. These differences underline again that there is no simple country-specific estimation behaviour and that site-specific properties may influence the results of the different teams.

The mean estimates for the two oak plots are given in Table 36. The results differ even more than for spruce, especially at the Haluzice stand with a range from 6% to 36% mean defoliation. Leaving the estimates from PCC aside, the defoliation at Sidonie embraces means from 21% and 38%. At this 139 years old stand almost no distinct groups can be differentiated. At Sidonie an effect of the phytogeographical range of a tree species becomes obvious: oak does not belong to the standard trees assessed by e.g. the Finnish team. Those teams can therefore be confessed as untrained (see PCC) for this tree species and their estimates might be seen as outliers.

Table 36: ICC central and eastern Europe: Results of the Ryan-Einot-Gabriel-Welsch (REGWQ) test for plots with penduculate and sessile oak (*Quercus robur* and *Q. petraea*), REGWQ grouping: the same letter denotes a significant group of countries, mean defol: plot mean defoliation.

Haluzice, n of trees = 25						
REGWQ grouping					*mean defol*	*country*
			A		*35.80*	*CZ*
	B		*A*		*32.20*	*LV*
	B		*A*		*31.80*	*HR*
	B		*A*		*30.40*	*FIN*
	B		*A*	*C*	*28.00*	*SK*
	B		*D*	*C*	*27.20*	*UA*
	B		*D*	*C*	*26.00*	*IRL*
	B		*D*	*C*	*25.80*	*LT*
	B		*D*	*C*	*25.00*	*BY*
	B		*D*	*C*	*24.40*	*BW*
	E		*D*	*C*	*21.60*	*GB*
	E	*F*	*D*	*C*	*20.60*	*BFL*
G	*E*	*F*	*D*	*C*	*20.40*	*CH*
G	*E*	*F*	*D*		*19.20*	*I*
G	*E*	*F*	*H*		*15.20*	*A*
G	*I*	*F*	*H*		*13.00*	*PCC*
G	*I*		*H*		*12.40*	*DK*
	I		*H*		*10.00*	*S*
	I		*H*		*8.80*	*D*
	I				*5.60*	*H*

Sidonie, n of trees = 25			
REGWQ grouping		*mean defol*	*country*
A		*38.20*	*FIN*
A		*34.00*	*GB*
A		*34.00*	*HR*
A		*33.80*	*BFL*
A		*32.20*	*CZ*
A	*B*	*29.60*	*SK*
A	*B*	*28.60*	*D*
A	*B*	*27.60*	*H*
A	*B*	*27.00*	*BW*
A	*B*	*26.60*	*I*
A	*B*	*25.00*	*IRL*
A	*B*	*24.80*	*LV*
A	*B*	*24.80*	*BY*
A	*B*	*24.60*	*DK*
A	*B*	*23.80*	*CH*
A	*B*	*23.60*	*A*
A	*B*	*22.40*	*UA*
A	*B*	*22.20*	*LT*
A	*B*	*20.63*	*S*
	B	*12.60*	*PCC*

For beech (not figured) somewhat smaller ranges of the country specific means were produced: The extremes are for the 84 year old stand at Haluzice the Czech Republic with 28% and Denmark with 10% (PCC 9%) and for the 75 year old stand at Sidonie again the Czech Republic with 23% and Sweden with 6%.

Table 37: ICC Mediterranean countries: Results of the Ryan-Einot-Gabriel-Welsch (REGWQ) test for plots with Maritime pine (*Pinus pinaster*), REGWQ grouping: the same letter denotes a significant group of teams, mean defol: plot mean defoliation.

Plot 1, n of trees = 30		
REGWQ grouping	*mean defol*	*country*
A	*22.83*	*Po1*
A	*22.67*	*Es2*
A	*22.33*	*It*
A	*20.67*	*PCC*
A	*19.83*	*Cr*
A	*19.50*	*Cy*
A	*18.50*	*Po5 (NRT)*
A	*17.33*	*Gr*
A	*16.50*	*Es1 (NRT)*
A	*15.83*	*Po4*
A	*14.50*	*Po2*
A	*13.33*	*Fr*
A	*12.83*	*Po3*
A	*12.00*	*Po6*

Plot 2, n of trees = 30					
REGWQ grouping				*Mean defol*	*country*
A				*17.33*	*Cr*
A				*15.33*	*It*
A				*15.17*	*Es1 (NRT)*
A	*B*			*14.33*	*Po5 (NRT)*
A	*B*	*C*		*13.67*	*Po2*
A	*B*	*C*		*13.50*	*PCC*
A	*B*	*C*		*13.50*	*Es2*
	B	*C*	*D*	*11.00*	*Po4*
	B	*C*	*D*	*10.83*	*Fr*
	B	*C*	*D*	*10.50*	*Po1*
	B	*C*	*D*	*10.33*	*Po3*
		C	*D*	*10.17*	*Gr*
		C	*D*	*9.67*	*Cy*
			D	*9.17*	*Po6*

Table 37 to Table 40 demonstrate that at the Mediterranean course also a wide variety of inconsistent results for both evaluated tree species at different plots were found. As in central and northern Europe not only the ranking of teams varies, but also the grouping is different from plot to plot. This situation suggests the consideration of "team" or even "plot" as a variable in further statistical evaluations to cover methodological differences produced by different assessment teams (c.f. LORENZ et al. 2001a and LORENZ et al. 2001b).

Table 38: ICC Mediterranean countries: Results of the Ryan-Einot-Gabriel-Welsch (REGWQ) test for plots with Maritime pine (*Pinus pinaster*), REGWQ grouping: the same letter denotes a significant group of teams, mean defol: plot mean defoliation.

Plot 3, n of trees = 30						
REGWQ grouping					*mean defol*	*Country*
A					*32.00*	*It*
	B				*26.17*	*Po1*
	B	*C*			*25.67*	*PCC*
	B	*C*			*24.17*	*Po4*
	B	*C*	*D*		*23.17*	*Po2*
	B	*C*	*D*	*E*	*22.67*	*Fr*
	B	*C*	*D*	*E*	*22.00*	*Po3*
	B	*C*	*D*	*E*	*21.50*	*Po5 (NRT)*
	B	*C*	*D*	*E*	*20.00*	*Es1 (NRT)*
		C	*D*	*E*	*19.00*	*Cr*
		C	*D*	*E*	*16.87*	*Es2*
			D	*E*	*16.83*	*Cy*
				E	*16.00*	*Po6*
				E	*16.00*	*Gr*

Table 39: ICC Mediterranean countries: Results of the Ryan-Einot-Gabriel-Welsch (REGWQ) test for plots with cork Oak (*Quercus suber*), REGWQ grouping: the same letter denotes a significant group of teams, mean defol: plot mean defoliation.

Plot 4, n of trees = 28				
REGWQ grouping			*mean defol*	*Country*
A			*28.21*	*Gr*
A	*B*		*25.54*	*Cy*
A	*B*		*25.54*	*Po3*
A	*B*		*24.82*	*Po1*
	B	*C*	*21.43*	*Cr*
	B	*C*	*21.43*	*Po5 (NRT)*
	B	*C*	*20.89*	*It*
	B	*C*	*20.54*	*Po4*
	B	*C*	*20.00*	*Fr*
	B	*C*	*20.00*	*Po6*
	B	*C*	*20.00*	*PCC*
	B	*C*	*19.82*	*Es1 (NRT)*
		C	*17.68*	*Es2*
		C	*16.79*	*Po2*

Plot 5, n of trees = 30			
REGWQ grouping		*mean defol*	*country*
A		*22.17*	*Es1 (NRT)*
A		*22.17*	*Po3*
A	*B*	*20.33*	*Cr*
A	*B*	*20.17*	*PCC*
A	*B*	*19.00*	*Fr*
A	*B*	*18.83*	*Es2*
A	*B*	*16.67*	*Po6*
A	*B*	*16.50*	*Po5 (NRT)*
A	*B*	*16.50*	*Gr*
A	*B*	*15.67*	*It*
A	*B*	*15.50*	*Cy*
A	*B*	*15.00*	*Po2*
	B	*13.67*	*Po4*
	B	*13.67*	*Po1*

Table 40: ICC Mediterranean countries: Results of the Ryan-Einot-Gabriel-Welsch (REGWQ) test for plots with cork oak (*Quercus suber*), REGWQ grouping: the same letter denotes a significant group of teams, mean defol: plot mean defoliation.

Plot 6, n of trees = 30						
REGWQ grouping					*mean defol*	*Country*
A					*25.33*	*Po3*
A	*B*				*21.83*	*Po1*
	B	*C*			*19.33*	*Po4*
	B	*C*	*D*		*18.67*	*It*
		C	*D*	*E*	*17.50*	*Es2*
		C	*D*	*E*	*17.17*	*Po5 (NRT)*
		C	*D*	*E*	*17.00*	*Po2*
		C	*D*	*E*	*16.83*	*Cr*
		C	*D*	*E*	*15.33*	*Po6*
			D	*E*	*14.67*	*Fr*
			D	*E*	*14.17*	*Cy*
			D	*E*	*14.17*	*Es1 (NRT)*
				E	*13.33*	*PCC*
				E	*13.00*	*Gr*

The results of this chapter clearly show that i) significant country specific differences exist and ii) the ranking of the countries may include species-specific, site-specific and stand-specific peculiarities.

2.1.6 Possible causes for differences of mean plot defoliation between teams

In the last chapter, it was shown that significant differences of the estimating behaviour of teams from different European countries and even from teams from one country exist. In the following chapter some limited evaluations are performed, which may give some additional information concerning the stand or site qualities. Due to the lack of extensive data sets not necessarily the most efficient predictors might be at hand. Also the ranges covered by the additional data are not wide, neither are the data equally distributed. This evaluations are therefore rather preliminary.

For the plots from the course at Luhačovice the age of the tree stands is known exactly in years and for the plots of the Nordic course in 10 year's intervals. It has often been shown that age is a significant predictor of defoliation (SEIDLING 2000 for an overview). In Figure 4 and Figure 5 mean plot defoliation averaged over all countries is plotted against age and a respective linear regression is calculated. These graphs clearly demonstrate the strong dependency of defoliation estimates averaged over all participating teams from age (R^2 = 0.92 rsp. 0.85) in spite of the low number of cases (7 resp. 8 plots).

Since all plots of the ICC in the Czech Republic belong to the yield class 1 or 2 (on a scale from 1 to 9) only minor additional influences from soil related qualities can be supposed. However, altitude varies between 380 (Brumov) and 630 (Liptál) m a.s.l. which may have an additional influence, but is not investigated here. Also "species" itself may have an additional effect.

At the Finnish plots age also explains statistically significant a vast part of the variance of the plot defoliation averaged over all teams (R^2 = 85%). Further known variables like species or the roughly estimated yield additionally introduced into a generalised linear model rise the R^2 as high as 0.95, however both variables additionally introduced do not achieve significance.

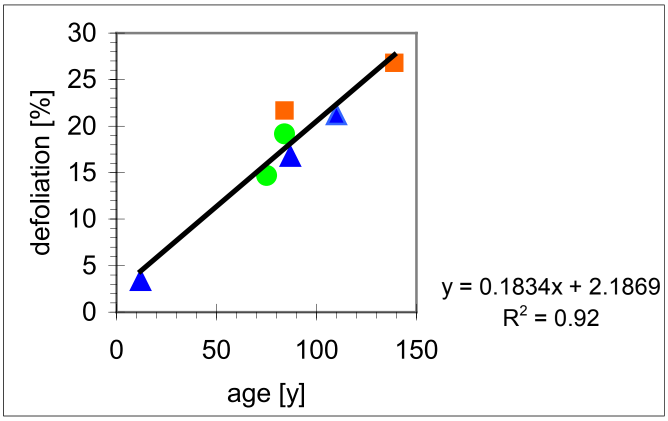

Figure 4: Plot related mean defoliation (as mean over all country means) plotted against stand age for the plots of the ICC for central and eastern Europe (Luhačovice); blue triangles: spruce stands, green dots: beech stands, orange quadrats: oak stands; correlation coefficient r is calculated without regard of tree species.

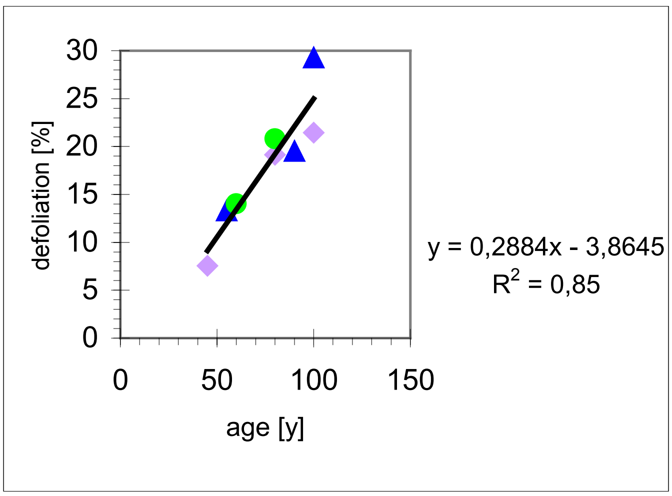

Figure 5: Plot related mean defoliation (as mean over all country means) plotted against stand age for the plots of the ICC for northern Europe (Vantaa); blue triangles: spruce stands, violet squares: pine stands, green dots: birch stands; correlation coefficient r is calculated without regard of tree species.

According to this result, an increase of defoliation of 1.8% per 10 years can be supposed for the plots surveyed at the ICC within central Europe and even 2.9% per 10 years for the plots at the northern Europe ICC.

If country-specific plot means without regard of tree species (n = 7) are regressed against age (Figure 6), regression lines result, of which the majority is almost parallel. The flattest progress of defoliation along the age x-axis has the regression line of the United Kingdom, followed by PCC and Austria. These teams obviously take more into account during the survey that older trees may have less dense crowns than younger ones. Table 41 summarises the regression coefficients of these country-specific models and compares them with the respective outcomes of the generalised linear models from the Technical Report 2001 (LORENZ et al. 2001). In spite of all the weaknesses of such comparisons, for some countries similar slopes can be observed. For instance, Germany achieved a regression coefficient of 0.166 within the ICC. According to the generalised linear models applied in LORENZ et al. (2001) respective coefficients between 0.230 (spruce), 0.169 (beech) and 0.110 (oaks) were found. For the United Kingdom with its low regression coefficient of 0.049 within the ICC respective values between 0.087 and 0.012 were found. Thus, ICCs as well as the statistical approach of Lorenz et al. (2001) produce at least partially consistent results, which allow for a first quantification of methodologically caused differences in the level of defoliation. Especially improvements of the ICCs seem to be a promising task for future.

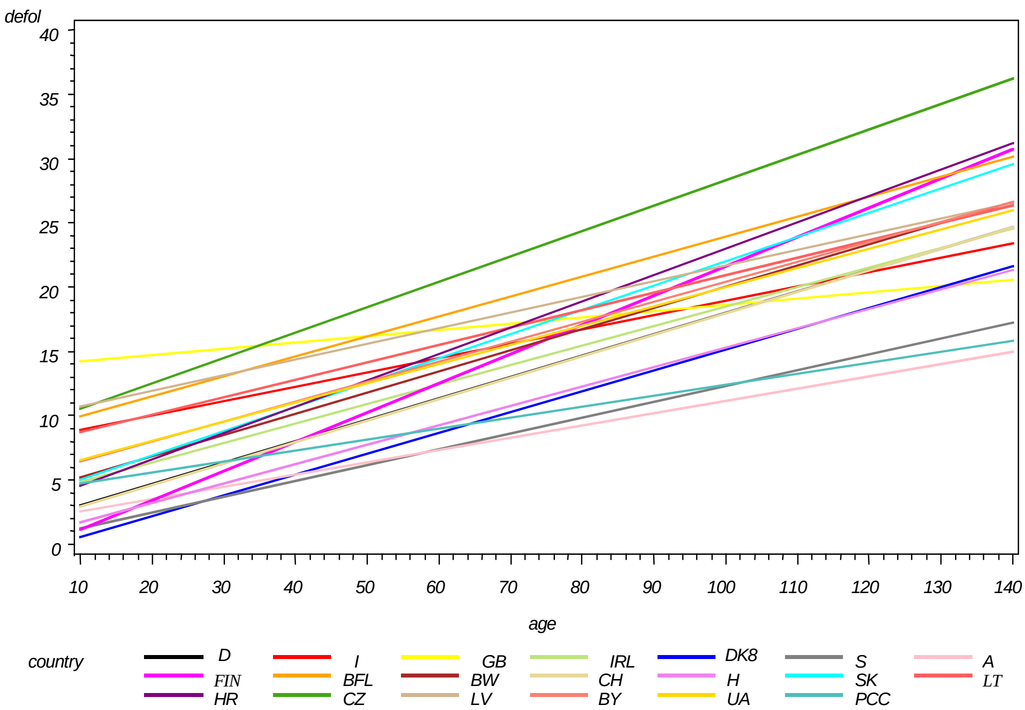

Figure 6: Country-specific regressions lines of plot related mean defoliation against age for the plots of the ICC for central and eastern Europe (Luhačovice).

Table 41: Regression models defoliation estimates against age with country-specific estimates in comparison to the model results with medium-term means of the pan-European evaluation of crown condition data (LORENZ et al. 2001) if at least 5 plots were situated within a country; *: only data for Belgium as a whole are available.

Country [code]	*regression coefficient*	*Norway spruce **	*common beech**	*oaks**
4 Germany	*0.166*	*0.230*	*0.169*	*0.110*
5 Italy	*0.111*	*0.009*	*0.033*	*0.092*
6 UK	*0.049*	*0.087*	*0.026*	*0.012*
7 Ireland	*0.152*			
8 Denmark	*0.162*	*0.030*	*0.145*	
13 Sweden	*0.123*	*0.179*	*0.168*	*-0.070*
14 Austria	*0.096*	*0.059*	*0.085*	
15 Finland	*0.227*	*0.291*		
21 Belgium/Fl	*0.156*	*-0.036**	*0.573**	*0.084**
22 Belgium/W	*0.165*	*-0.036**	*0.573**	*0.084**
50 Switzerland	*0.167*	*0.082*	*0.060*	
51 Hungary	*0.151*		*-0.020*	*0.312*
54 Slovak Rep.	*0.189*	*0.079*	*-0.003*	*0.159*
56 Lithuania	*0.136*	*0.168*		
57 Croatia	*0.205*		*0.083*	*0.114*
58 Czech Rep.	*0.198*	*0.032*		
64 Latvia	*0.122*	*0.053*		
65 Belarus	*0.155*			
67 Ukraine	*0.150*			
99 PCC	*0.086*			
All participants	*0.183*			

Interestingly other statistical properties of the defoliation estimates do also systematically vary with age. In Figure 7 the amount of variance explained by the ANOVA model for each plot from the ICC at Luhačovice is regressed against age. The older a stand is, the lower is the amount which can be explained be country differences. Since complex mutual dependencies between different physical properties of the tree stands and respective statistical parameters exist, more in-depth investigations are necessary in this respect.

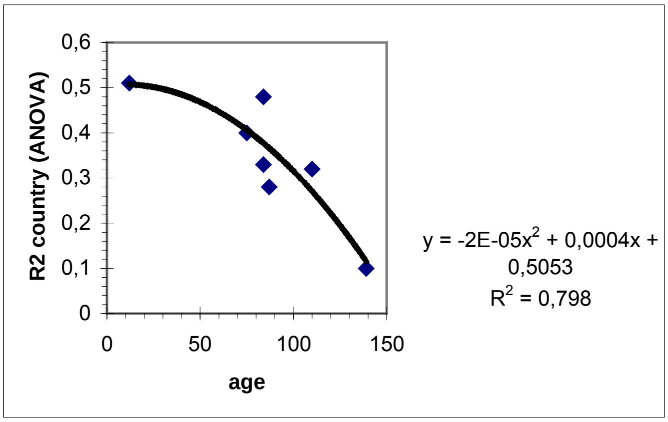

Figure 7: Amount of variance explained by country for the plots of the ICC for central and eastern Europe (Luhačovice).

2.1.7 Results from ICCs and regular crown condition assessment

The results of the ICCs at the plot level can also be put into relationship to the respective results of the regular forest monitoring. These comparisons are of course limited by different circumstances and conditions: i) the number of plots on which a country-specific mean is estimated within the ICCs is much smaller than in the regular forest monitoring, ii) the average site conditions among the ICC plots are more or less deviant from the average site qualities of the specific country, iii) the age structure of the ICC stands can not be expected to be in agreement with the age structure of a specific country, iv) the estimating behaviour of the team participating at the ICC must not necessarily be that of the average team of the respective country (c.f. FERRETTI & LORENZ 2001).

In spite of these limitations, country-specific means from the ICC were regressed against the outcomes of the country-specific means calculated as medium-term averages over the years 1994 to 2000 (LORENZ et al. 2001). Figure 8 shows the resulting graph for *Pinus sylvestris* from the ICC for northern Europe. At least for the countries at the extremes a consistent estimating behaviour between both evaluations can be observed: Finland reveals in both surveys the lowest and Lithuania the highest defoliation averages. For plots with *Picea abies* a similar relationship was found (Figure 9), however the correlation coefficient was lower than in *Pinus sylvestris*.

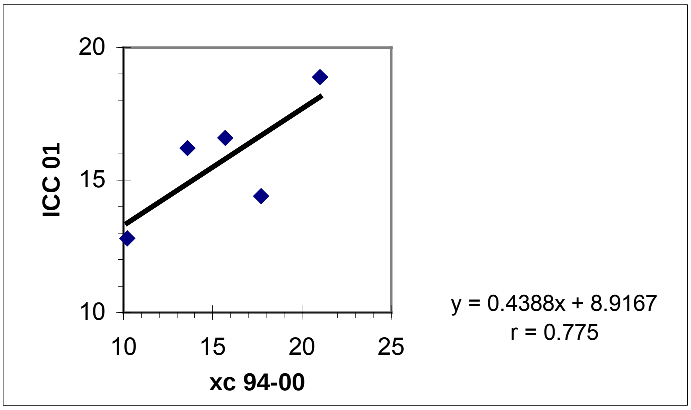

Figure 8: Mean defoliation of *Pinus sylvestris* of the ICC for northern Europe (ICC 01) against mean defoliation of the regular monitoring (xc 94-00; taken from LORENZ et al. 2001); n = 5, Russia is omitted since no medium-term averages are available.

The results of the ICC for central and eastern Europe reveal similar results, however the relationship is generally weaker. One reason might be the higher differences between the environmental conditions at the ICC plots and the average condition of each participating country. The different teams represent countries from Ukraine and Belarus in the east to Ireland in the west and from Norway, Finland, and Sweden in the north to Italy and Croatia in the south. Quite a large range of meteorological and ecological conditions is covered by this ICC. The new system should avoid too hard differences by the installation of two courses for each tree species.

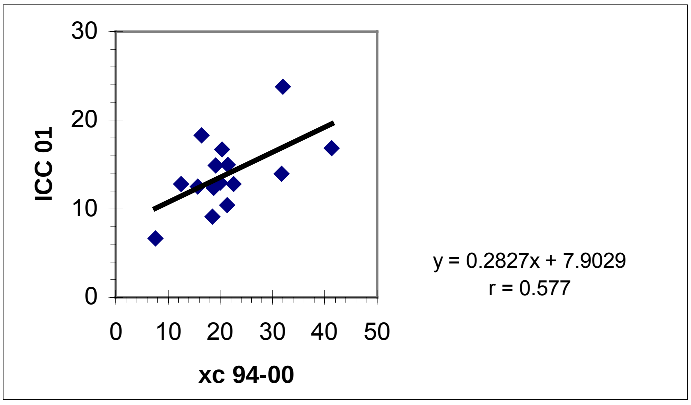

Figure 9: Mean defoliation of *Picea abies* of the ICC for central and eastern Europe (ICC 01) against mean defoliation of the regular monitoring (xc 94-00, from LORENZ et al. 2001.

When model defoliation values at the age of 90 (LORENZ at al. 2001) were used instead of the country-specific mean values almost similar results were achieved. However, when defoliation estimates from single plots are compared with country-specific means of model-90 values, the relationship can vary considerably, as was already shown in chapter 2.1.6.

The results of these comparisons encourage strongly further efforts to consider country-specific peculiarities of estimating defoliation of tree crowns in future maps and statistical models. However, the influence of age and other important predictors of defoliation onto the country-specific estimating behaviour must be investigated in more detail. The results from future ICCs and probably those of earlier International Inter-calibration Courses (IICs) should be included for that purpose.

Discussion of the Results 2001

The data of the three cross-calibration courses (ICCs) in the year 2001 were collected according to the guidelines suggested by FERRETTI & LORENZ (2001). Due to the application of national reference trees and assessment methods, a high degree of independence of each assessment team has been achieved. Therefore the results of these cross-calibration courses can be used for the establishment of further statistical and methodological measurements to describe and consider methodological deviations within crown condition assessment data.

On the European level the empirical study of KLAP et al. (1997) stated already a distinct statistical influence of the categorical variable “country” onto plot means of defoliation. SEIDLING (2001) confirmed this finding on a smaller geographic scale. LORENZ et al. (2001a) corroborated this relationship with medium-term means of defoliation estimates for five of six investigated main tree species in Europe.

With the results from this year’s cross-calibration courses, the attempt was made to gain independent defoliation estimates from different countries for identical trees. This procedure should allow straight forward comparisons of the estimation behaviour of teams from different countries. Similar investigations were already performed by INNES et al. (1993), however teams from much less countries took part in their study. DOBBERTIN et al. (1997) evaluated results of ‘cross-calibration exercises’ showing that differences for individual trees of 30 and 40 percent defoliation are not uncommon and systematic differences between countries exist. The resulting “adjustment coefficients” are country specific transition probabilities between classical damage classes, which cannot simply be applied to the 5% classes of defoliation commonly used at present. Other authors were confessed with the accuracy of the visual estimation of defoliation itself (e.g. INNES 1988, HORNVEDT 1997, KÖHL 1991, 1993, SCHADAUER 1990). DOBBERTIN et al. (1997) compared estimations from regular and control teams collected at the same plot within the same assessment period from five European countries by means of actual agreement and kappa statistics. They got a kappa value of only 12% for exact agreement of both estimates and 31%, if a tolerance of ± 5% of the defoliation estimate is accepted. The probability for exact agreement was almost random (c.f. CZAPLEWSKI 1994) and only likely for a allowed tolerance of ±5% leaf or needle loss. Other authors undertook comparisons with related parameters like crown density, leaf area index (LAI) or measurements of leaf or needle litter (e.g. DUFRÊNE & BRÉDA 1995) or needle spur analyses (JALKANEN et al. 1994).

First results of the now presented evaluation show that the relative order of countries differs according to species, age and site conditions.

The results of the three cross-calibration courses have shown that the estimation behaviour varies at different levels. At the level of single trees, estimations of different teams cannot only vary considerably in a stochastic manner (e.g. Figure 1), but systematic differences are also apparent. E.g. the regression coefficient of 0.46 in Figure 2 denotes clearly this different behaviour of two teams: While the Finnish team reveals an averaged increase of defoliation from circa 10% to 40% for all estimated birch trees, the team from Lithuania produced a respective increase for the same trees from circa 15% to 30%. In this case the averaged values over all birches for both teams do not differ much (18.3 for Finnish team, 20.7 for Lithuanian team), however at plot level, such deviant estimation behaviour may produce considerable differences (12.3% at Sipoo by the Finnish and 20% by the Lithuanian team).

The statistical parameters used at tree level in this evaluation of the ICCs emphasise two different aspects: The correlation coefficient is sensitive towards a similar estimation behaviour of different teams without regard of the estimation level. This means practically that at least the ranking of tree crown conditions are similar with high correlation coefficients. The actual agreement between teams responds mainly towards the mean level of the estimations. Even if single trees are assessed quite differently, the agreement can be around 50% only if the level is similar. The latter statistical parameter is closely related with kappa statistics and with the index of concordance according to KENDAL. High measures of agreement alone seem not sufficiently to describe accordance between teams entirely. The use of both types of similarity measurements or probably its combination in a two-dimensional approach, are more advisable. Similarity indices from both statistics can be used as a basis for more advanced evaluations like cluster or factor analyses. The latter may promote the establishment of correction functions for country specific defoliation estimates in future approaches.

Since all teams did their estimations under almost identical weather conditions, influences from this side can be excluded. Most probably, different references for different site and stand conditions are the causes for differences at tree and plot level. Since the reference for each individual tree is always an imagination, it cannot be simply recorded. The list of factors considered by each team during the assessment may give hints for different estimation behaviours; however a certain amount of subjectivity may always be left.

Former inter-calibration courses as well as other control assessments of tree crown condition with instructions and examples of reference trees given immediately before the field survey (HOLLAND-MORITZ et al. 2001) showed that those immediate instructions led in most cases to comparable estimations of defoliation (index of concordance after KENDALL (W) mostly > 0.81 = almost complete concordance). Only bad weather condition or acute predation by insects may under these circumstances reduce the concordance of the defoliation estimates (W = {0.56 – 0.74}); also recent natural or anthropogenic thinnings may reduce the agreement between different teams (HOLLAND-MORITZ et al. 2001). Instructions given immediately before the field estimations can distinctively harmonise the estimation behaviour of different teams. Similar conclusions were already stated by INNES (1988). However, those calibrations of the teams immediately before each assessment might neither lead to harmonised assessments during the survey period (LORENZ et al., 2001), nor lead to useful adjustment functions.

The within country variation of the assessment behaviour of different teams is not necessarily smaller than that between teams from different countries. Therefore it cannot be excluded that fine grained patterns within countries (see LORENZ et al. 2001: Fig. 4.2.6.2-2) may to a certain degree be based on such team-specific effects. The importance of National Cross-calibration Courses, thus, is underlined.

Like in other empirical studies, age is also a significant predictor of defoliation (see SEIDLING 2000 for an overview) even for the few plots evaluated during the Nordic and central European cross-calibration courses. However, there is an indication that in some countries like UK, age is already considered to a certain degree by the imagined reference tree. This may produce a certain bias, if defoliation values of different countries are compared. The inconsistent rankings of countries at different plots do however indicate, that other conditions - most probably site conditions - may additionally influence the estimations. In future cross-calibration courses those differences should be investigated in more detail. Since the available time is limited at such courses, the selected plots should cover both: a representative range of ages and examples from distinctively different, growth-related site conditions. The partial accordance between the estimations of defoliation attained within the ICCs of central-eastern and northern Europe and the results of empirical generalised linear models used to evaluate regular mean term means from the regular crown condition survey (LORENZ et al. 2001) promise valuable results of future ICCs.

3 Evaluations of the International Cross-calibration Courses 2002

Main objectives of the test-phase for a new concept of International Cross-calibration Courses (ICCs) in 2002

In 2002, the host countries of the International Cross-calibration Courses of EU / ICP Forests, Germany, Norway, and Spain, were asked to apply guidelines for a “New Design of International Cross-Calibration Courses” (FERRETTI et al. 2002). The aim was to test whether an increase in plot and tree number would enable an improved evaluation of statistical relations between assessed values parameters of the EU / ICP Forests crown condition monitoring. Accordingly, the number of tree species per course was reduced to two tree species and the number of plots per species was increased to 3. An additional aim was to test the feasibility of assessing an even higher number of plots closely located together

Following the draft guidelines all plots of a specific International Cross-Calibration Course in a certain country constitute a so-called test range, which is foreseen to be re-assessed every 4 years in order to check the temporal consistency of the assessments. This cyclic re-visiting of the test ranges and the close location of the plots might help to save costs on the long run. Additionally, it was aimed to reduce the variability of the plots within the test ranges with respect to site and most stand characteristics. Only stand age as a main influencing factor should vary between the plots.

Description of the ICCs 2002

3.1.1 International Cross-Calibration Course for Crown Condition Assessment - Oak and Beech – August 26-29, Bad Gottleuba, Saxony, Germany

The ICC in Bad Gottleuba was cancelled a week before its beginning due to heavy floodings in the Ore Mountains and the region of Dresden/Saxony which made the realization of the course impossible.

3.1.2 International Cross-Calibration Course for Crown Condition Assessment – Norway spruce and Scots pine – September 1-4, Oslo, Norway

The International Cross-calibration Course in Sørmarka, Oslo/Norway, was conducted from 1 to 4 September 2002. With the exception of one plot located close to the Norwegian Forest Research Institute in Ås, 20km south of Oslo, all plots of the Norwegian test range are located close to the training and conference centre in Sørmarka and could be reached by short walks. Thus, one of the most important preconditions for a higher number of assessed plots and stand/site conditions was fulfilled.

Table 42: Plots of the test range in Norway for the assessment of Norway spruce and Scots pine.

ID codes	tree species	age	site quality compared to average	date
99_5501	Scots pine	150	Below	3 Sep02
99_5502	Scots pine	130	Below	2 Sep02
99_5503	Norway spruce	77	Above	2 Sep02
99_5504	Norway spruce	45	Above	2 Sep02
99_5505	Scots pine	35	*average*	4 Sep02
99_5506	Norway spruce	75	Above	3 Sep02

The test range stands for the assessment of Norway spruce are of different age (Table 42) and all of above average site quality. A possible influence of site quality on the assessments could thus not be evaluated. On the other hand, it can be assumed that the assessed values are not biased due to different site qualities. Deviating from the proposal of FERRETTI *et al*. (2002), for each tree a position was marked in the stand which was to use for the assessment of defoliation.

The Scots pine stands were of different age (Table 42), the young stand was of average site quality the older ones of below average site quality. Thus, a good comparability at least between the data of the older stands was to be expected.

According to the procedure proposed by FERRETTI *et al*. (2002) discussions among the participating teams concerning single tree assessments were avoided before the final discussion at the last day. This procedure aimed to minimize adaptation effects. Furthermore, before the field assessments, photos of trees from 4 test range stands were assessed.

All trees were of good visibility. This was partly due to a low stand density following harvesting procedures in recent years (e.g. plot 99_5506), or due to the selection of trees at the stand edges (plots 99_5504 and 99_5503).

14 teams from 12 countries participated in the ICC 2002 in Oslo/Norway (Annex 1). 15 defoliation assessments were conducted as the Estonian participants assessed two values following the national method. The first value was assessed for the upper third of the crown and the second for the entire crown. The assessments of the participants from Belgium and Ireland are not included in the interpretations as both participants indicated that they were not so much experienced in assessing *Picea abies* and *Pinus sylvestris* under the given site and stand conditions.

3.1.3 International Cross-Calibration Course for Crown Condition Assessment – Holm oak and Maritime pine – September 10-13, Spain

The International Cross-Calibration Course in Spain was held from 10 to 13 September on original Level I plots spread over a large area in the west and south west of Madrid. The selected plots had a low variation with respect to tree age particularly concerning Maritime pine (21-60 years; Table 43). On the other hand, the variation with respect to height above sea level, exposure, slope, and stand density was very high. Especially the Holm oak plots assessed during the course were located at varying altitudes (301-950m above sea level).

Table 43: Plots of the test range in Spain for the assessment of Holm oak and Maritime pine.

PLOT NUMBER (Level I)	ID codes	tree species density	age	site quality	date
1069 Qi Montesclaros (TOLEDO)	1069_1101	Holm oak normal	irregular	Moder, 15% N, 501-550m	10 Sep02
1025 Ppr Arenas de San Pedro (AVILA)	1025_1102	Maritime pine normal to high	21-40	Mor, 30% W, 901-950m	11 Sep02
1065 Ppr Talayuela (CÁCERES)	1065_1103	Maritime pine normal	41-60	Moder, 0% SW, 201-250m	11 Sep02
979 Qi Guijo de Granadilla (CÁCERES)	979_1104	Holm oak dehesa, 30-35% coverage	>120	Moder, 10% NW, 301-350m	11 Sep02
935 Ppr El Payo (SALAMANCA)	935_1105	Maritime pine normal	21-40	Mor, 10% NW, 951-1000m	12 Sep02
896 Qi Guijuelo (SALAMANCA)	896_1106	Holm oak dehesa, 15-20% coverage	81-100	Moder, 10% SW, 901-950m	12 Sep02

During the Spanish course different national methodologies were discussed during the assessments. A final discussion at the last day was not possible due to a lack of time. Thus, general conclusions can only be based on the impressions and observations of the PCC participant and by the written experience report of the host country (Annex 12).

Photo assessments were made before the field assessments on 6 trees per test range plot and on the photos from the last year's ICC in Portugal.

The selected plots were of normal visibility. The locations from where to do the assessments were not marked according to the proposal of Ferretti *et al.* (2002). Due to the necessity of views from various directions, fixed locations would mostly have been misleading. In some of the stands harvesting operations had taken place in recent years.

Evaluation of assessed defoliation

Following to the evaluation of the 2001 courses the evaluations of the 2002 field estimates at tree level focus on two main statistics: the correlation coefficient between the estimates of different teams/participants and the 'actual agreement' between them.

Firstly, plot specific distributions of the assessments of each participant are described. Secondly evaluations of the coherency of field estimates at plot level are conducted (ANOVA models), which explain the variation of defoliation by the variable team/participant and aim to test whether there is a significant overall differentiation. Thirdly, the Ryan-Einot-Gabriel-Welsch multiple range test (SAS, 1990) was applied to check whether significant groups of teams/participant can be differentiated.

3.1.4 ICC Norway

There were 15 defoliation assessments available for each tree of the *Picea abies* and *Pinus sylvestris* plots in Oslo, Norway (Annex 1). Due to the fact that all plots are located very closely together, large scale influences can be neglected which might influence any comparison among the plots. Due to the good visibility, fixed positions, and very good weather conditions during the entire course, it was assumed that variations between the assessments on different plots can mainly be attributed to the factors tree age and site quality, the last one being of low variation. Furthermore differences between the parts of the living crown which are assessed by the teams are a possible source of variation (s. below).

3.1.4.1 Coherency of Field Estimates at Tree Level between Country Teams

Picea abies was assessed on three plots of the ICC in Norway 2002 (Table 42). The assessment values for these plots (99_5503, 99_5504, 99_5506) are presented in Annex 2, in the following annexes up to Annex 6 related statistics are presented. The main results are presented below.

The *Picea abies* trees on plot 99_5503 (tree age: 77 years, Table 42) showed by far the largest range of defoliation values (10% to 95% assessed defoliation). The high standard deviation values on this plot (Annex 2 and error indicators in Annex 3) are a direct result of this wide and regular distribution. Mean and median of the assessments of the teams are nearly at the middle of the respective ranges. The opposite can be observed for the younger stand 99_5504 (tree age: 45 years). A low range with values from 0% to 40% is observed and values of 30% or more were assessed only for tree 22 and tree 23. Due to the low range of values a high share of 'actual agreement' and relatively poor correlations are expected. The range of defoliation on the third *Picea abies* plot 99_5506 (tree age 75 years) is only a little higher with values from 0% to 45%. However, within this range extreme values were more frequent.

The deviations of the defoliation assessments from the tree specific median are presented in Annex 4. Whereas e.g. the assessments of the German participant, and less clear of the Italian team, were almost either equal to or higher than the median values the assessments of the participants from Latvia, Estonia (upper third of the crown), and from the Norwegian Forest Officers tend to be rather lower than the respective median values. Also very important with respect to the detection of possible differring methodologies are those teams which showed changing deviations. The assessments from the Swiss team as well as the assessments from the Estonian team for the entire crown in general are rather lower on plot 99_5503 and rather higher on the other two plots (99_5504 and 99_5506). The opposite was detected for the participant from Denmark and the Norwegian Level II team. These deviations can not be explained by different methods related to tree age (Table 42).

The correlations (Annex 5) and the percentages of absolute agreement (Annex 6) between the teams in general are in line with expectations due to the ranges of the assessed values. Whereas the correlations are high for the older trees (plots 99_5503 and 99_5506) and lower for the young trees with a low range (plot 99_5504) the agreement for the younger trees at plot 99_5504 is higher than for the older trees with values of a higher range. Nevertheless, there are some deviations from this general outcome. Thus, especially for plot 99_5506 the assessments of the Estonian team for the entire crown are not as strongly correlated with the assessments of the other teams as the assessments for the upper third of the crown are. This perhaps indicates that most of the teams tended to assess an upper part of the crown. In a stand of low density with low competition between the trees this assessment behavior, perhaps, was realized due to recent thinning which was observed by the participants. This observation fits well with the low agreement of the assessments of the Estonian team for the entire crown with other teams and with the assessments for the upper third of the crown on this plot. Also the Swiss team and the Danish participant made assessments which differ from the assessments of many other teams on absolute level on this plot. For the two other plots (99_5503 and 99_5506) the absolute agreement often is higher for the assessment values on the entire crown than for the upper third. This could indicate that the selection of assessed crown parts is influencing the tree specific results more than other possibly existing methodological differences.

Pinus sylvestris was assessed on three plots (Table 42). The assessment values for these plots (99_5501, 99_5502, 99_5505) are presented in Annex 7, Annex 8 to Annex 11 are presenting related statistics. The main results are presented below.

The range of assessed values is nearly the same for all three assessed plots The results from the teams (excluding Belgium and Ireland) vary between 0 and 55% for all trees with the lowest values on plot 99_5505. On this plot three trees were assessed with maximum values of 30% or more. Also on the other two plots (99_5501 and 99_5502) at least three trees were assessed with values of the upper third of the range. Nevertheless most distributions are right skewed which is e.g. indicated by the means being higher than the median values. For most trees, highest defoliation values were assessed by the teams from Switzerland, the Czech Republic, Germany, and Italy. All the other assessments from the Scandinavian and Baltic teams – with exception of the assessments of the Estonian team for the entire crown – were very close together and of lower level (Annex 8).

The deviations of the assessments from the tree specific median values are relatively consistent over all three plots (Annex 9). Whereas the assessments of the teams from Switzerland, the Czech Republic, Estonia (entire crown), Germany, and Italy are rather higher than the median values, the assessments of the teams from Denmark, Estonia (upper third of the crown), Finland, and Latvia are rather lower than the median values. Only the assessments of the participant from Lithuania and of the Norwegian Forest Officers are of varying level compared to the tree specific median values. For the plots 99_5501 and 99_5502 their assessments are rather lower, for plot 99_5505, the youngest stand of best site quality of the three *Pinus sylvestris* plots, they are equal or higher than the tree specific median values.

The correlations (Annex 10) among the teams do not lead to a consistent result for all 3 plots. Assessments on plot 99_5501 show high correlations between the teams.

Only the correlation coefficients related to the assessments of the teams from the Czech Republic, Estonia, and Latvia are lower than 0.7 or even 0.5. On the other two plots there are only some groups of teams with higher correlation values: In case of plot 99_5502 the teams from Denmark, Estonia (upper third of the crown), Germany, Italy, and Norway are correlated on a relatively high level. On plot 99_5505 the assessments of the Finnish team are highly correlated to those of the Norwegian teams and less high to those of the Baltic teams and Germany (second group). The assessments of the Norwegian Level II team and the Norwegian Forest Officers are also correlated with the assessments of the teams from Switzerland, the Czech Republic, and Denmark.

According to the percentages of absolute agreement (Annex 11) among the teams it is obvious that on plot 99_5501 a group of very high agreement consists for the teams from Switzerland, the Czech Republic, and Italy. The assessments of the team from Italy also largely agree with those of Denmark, Estonia (upper third of the crown), Finland and Germany. With exception of the Italian delegation, all these countries also show a good agreement with assessments of the teams from Lithuania, Latvia, and Norway. Important results on plot 99_5502 are the differences between the assessments from the Estonian team on the upper third and on the entire crown. Whilst the assessments of the teams from Switzerland, the Czech Republic, and Germany and to a lower extent those from Latvia and the Norwegian Level II team agree very much with the assessments of the Estonian team on the entire crown, the assessments of the Danish participant and the Norwegian Forest Officers agree more with the Estonian assessments on the upper third of the crown. This may lead to the conclusion which part of the crown was assessed by the teams but an agreement of such a high level can also be reached by chance if the assessments are roughly at the same level and the range of the defoliation is low. Thus, e.g. the assessments of the Danish participant show higher correlations with the Estonian assessments of the upper third of the crown than with those of the entire crown (Annex 10). However, the higher absolute agreement is observed with the Estonian assessments of the entire crown. Thus, the Danish participant seems to assess rather the upper third than the entire crown but on a higher level than the Estonian participants do.

On plot 99_5505, which shows the lowest range of defoliation values among the *Pinus sylvestris* plots, in general the percentages of absolute agreement are very high. Only for the assessments of the Swiss and Italian teams and from the Estonian team on the entire crown lower agreement is observed.

3.1.4.2 Comparisons of defoliation assessments between country teams at plot level

The comparison of defoliation assessments at plot level was made using a descriptive way by comparison of distributions (e.g. Table 44) and by calculating an analysis of variances (ANOVA). This statistical method is used to look if there is a significant overall differentiation of the pseudo-continuous response variable defoliation and if significant groups of countries exist (Ryan-Einot-Gabriel-Welsch multiple range test, SAS 1990).

The distributions of team assessments for *Picea abies* in Norway 2002 (Table 44) show no clear distinction between the team assessments. Teams which made relatively high (low) assessments on one plot made lower (higher) ones on other plots. These differences seem to be not correlated with the age of the stands and the site quality is similar on all these three plots (Table 42, page 30).

Table 44: Distributions of team assessments of *Picea abies* in Norway 2002

	BEL	CH	CZH	DEN	EST 1/3	EST 1/1	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N FO
99_5503		N=25													
Median	45	35	45	45	40	35	35	50	45	45	35	45	45	45	30
Mean	**48,2**	**41,4**	**49,8**	**48,4**	**44,2**	**43,4**	**43,8**	**55,0**	**48,6**	**47,6**	**40,4**	**51,4**	**46,4**	**49,6**	**36,8**
Std	17,3	19,3	19,5	25,6	23,8	21,8	21,4	21,4	18,0	18,9	19,8	21,6	22,3	,9	21,9
Min	25	15	15	15	15	20	15	20	25	20	15	20	15	10	10
Max	85	85	85	95	90	95	90	95	85	90	90	90	90	95	85
99_5504		N=25													
Median	10	20	10	5	5	15	5	10	15	10	5	15	5	5	5
Mean	**9,8**	**16,4**	**10,4**	**3,6**	**6,8**	**18,0**	**8,6**	**13,8**	**12,8**	**14,2**	**8,6**	**13,8**	**7,4**	**7,8**	**8,0**
Std	4,8	9,0	6,6	3,6	4,4	7,7	9,0	8,7	5,3	8,0	5,2	5,5	5,3	8,1	5,1
Min	5	0	0	0	0	5	0	0	5	5	0	5	0	0	5
Max	20	40	30	15	20	40	40	35	20	35	20	25	25	40	25
99_5506		N=26													
Median	22,5	17,5	25	12,5	10	20	15	17,5	20	15	17,5	15	20	10	15
Mean	**24,6**	**17,5**	**23,7**	**14,6**	**9,6**	**20,4**	**14,8**	**21,5**	**24,0**	**16,5**	**17,3**	**13,8**	**19,4**	**11,3**	**15,4**
Std	10,1	9,2	9,9	11,6	6,8	6,8	8,0	13,4	9,6	9,4	6,5	6,5	8,5	6,9	7,8
Min	10	5	5	0	0	10	5	5	10	5	5	5	5	0	5
Max	40	35	45	40	25	40	35	45	45	35	30	25	35	25	35

The ANOVA detected no significant differences between the participants of the Norwegian ICC 2002 calculated over all plots for ***Picea abies*** (not depicted). Accordingly the Ryan-Einot-Gabriel-Welsch multiple range test (Table 45) does not lead to a distinction of groups of teams with more similar assessments.

Table 45: *Picea abies*; significant groups of countries (Ryan-Einot-Gabriel-Welsch multiple range test, SAS 1990), 76 trees on 3 plots

group	**Mean def**	**team/country**
A	30,0	GER
A	28,4	IRL
A	27,9	CZH
A	27,5	BEL
A	27,2	EST 1/1
A	26,2	LIT
A	26,0	ITA
A	25,0	CH
A	24,3	N LevI
A	22,8	N LevII
A	22,3	FIN
A	22,1	DEN
A	22,0	LAT
A	20,1	EST 1/3
A	20,0	NFO

Similar results were found for the plot specific evaluation (Table 46). There exist several groups of teams but always with a lot of overlapping between the groups. A consistent ranking of the teams according to the mean defoliation assessed at each plot is not obvious. Some differences in the ranking (e.g. of the Italian team) could be due to the tree age (plot 99_5504 with younger trees compared to the other two plots) but this could not be confirmed satisfactorily because of the relatively low number of plots with varying age.

Table 46: *Picea abies*: Significant groups of countries (Ryan-Einot-Gabriel-Welsch multiple range test, SAS 1990)

99_5503; N = 25			**99_5504; N=25**			**99_5506; N=26**		
grp	**mean def**	**Team**	**grp**	**Mean def**	**team**	**grp**	**mean def**	**team**
A	55.0	GER	A	18.0	EST 1/1	A	24.6	BEL
A	51.4	LIT	AB	16.4	CH	A	24.0	IRL
A	49.8	CZH	ABC	14.2	ITA	A	23.7	CZH
A	49.6	N LevII	ABCD	13.8	LIT	AB	21.5	GER
A	48.6	IRL	ABCD	13.8	GER	AB	20.4	EST 1/1
A	48.4	DEN	ABCDE	12.8	IRL	ABC	19.4	N LevI
A	48.2	BEL	BCDE	10.4	CZH	ABCD	17.5	CH
A	47.6	ITA	CDEF	9.8	BEL	ABCD	17.3	LAT
A	46.4	N LevI	CDEF	8.6	FIN	ABCD	16.5	ITA
A	44.2	EST 1/3	CDEF	8.6	LAT	BCD	15.4	NFO
A	43.8	FIN	CDEF	8.0	NFO	BCD	14.8	FIN
A	43.4	EST 1/1	DEF	7.8	N LevII	BCD	14.6	DEN
A	41.4	CH	EF	7.4	N LevI	BCD	13.8	LIT
A	40.4	LAT	EF	6.8	EST 1/3	CD	11.3	N LevII
A	36.8	NFO	F	3.6	DEN	D	9.6	EST 1/3

For ***Pinus sylvestris*** the distributions of the assessments show a very consistent figure (Table 47). Whereas the assessments of the teams from Switzerland, the Czech Republic, Italy, and the assessments of the Estonian team for the entire crown are on all plots on average the highest ones the assessments of the teams from Denmark, Norway, Latvia, and Finland and the assessments of the Estonian team for the upper third of the crown are on low level on all plots. This observation could be made also for the presentation in Annex 8.

Table 47: Distributions of team assessments of *Pinus sylvestris* in Norway 2002

	BEL	CH	CZH	DEN	EST 1/3	EST ent.	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N ForO
99_5501		N=24													
Median	35	25	30	15	20	25	15	22,5	45	25	20	20	15	15	12,5
Mean	**38,1**	**26,0**	**26,5**	**19,8**	**19,0**	**25,8**	**18,8**	**23,5**	**45,6**	**24,8**	**17,7**	**19,8**	**18,8**	**20,2**	**13,5**
Std	13,9	9,1	7,0	10,2	8,3	6,1	10,1	11,9	12,5	9,9	6,9	10,9	8,1	11,0	7,1
Min	15	10	10	0	5	10	5	5	20	10	5	5	5	5	5
Max	65	45	40	40	45	40	50	50	70	45	30	50	45	45	30
99_5502		N=26													
Median	35	25	25	10	10	25	15	20	35	22,5	15	15	20	20	10
Mean	**34,0**	**24,8**	**27,7**	**12,5**	**12,9**	**24,2**	**16,2**	**22,5**	**34,6**	**25,4**	**17,9**	**17,7**	**19,4**	**19,8**	**13,5**
Std	12,2	6,9	7,0	9,9	5,6	7,3	5,8	8,9	12,6	10,1	5,9	8,8	6,3	8,7	6,3
Min	15	15	20	0	5	10	5	5	15	10	10	5	10	5	5
Max	60	40	50	35	25	40	30	40	60	55	30	45	30	40	30
99_5505		N=24		N=23											
Median	5	15	15	0	5	15	5	10	30	15	5	10	5	10	7,5
Mean	**10,0**	**17,9**	**13,5**	**4,3**	**7,3**	**16,5**	**8,1**	**10,0**	**29,4**	**17,1**	**6,0**	**11,5**	**7,1**	**9,0**	**10,0**
Std	8,0	6,4	5,9	5,8	6,5	5,1	4,5	7,5	10,2	6,3	4,8	6,4	3,5	4,3	6,0
Min	5	10	5	0	0	5	0	0	15	5	0	0	0	5	5
Max	40	40	25	20	30	30	20	30	60	30	20	30	15	20	25

Over all plots, the Ryan-Einot-Gabriel-Welsch multiple range test shows a similar situation (Table 48). The ANOVA reveals significant differences between the assessments of the teams (not depicted, R^2 value: 0.29).

Table 48: *Pinus sylvestris*: Significant groups of countries (Ryan-Einot-Gabriel-Welsch multiple range test, SAS 1990), 74 trees on 3 plots (Denmark assessed only 73 trees)

grp	mean def	team
A	36.5	IRL
B	27.6	BEL
BC	23.0	CH
BC	22.7	CZH
C	22.5	ITA
C	22.2	EST 1/1
CD	18.8	GER
DE	16.4	N LevII
DE	16.4	LIT
DE	15.2	N LevI
DE	14.4	FIN
DE	14.0	LAT
E	13.0	EST 1/3
E	12.4	NFO
E	12.3	DEN

Corresponding results were found by the plot specific Ryan-Einot-Gabriel-Welsch multiple range test (Table 49). In general, a relation of the results to the age of the plots (Table 42) was not detected. The only change concerning the ranking between the teams could be observed between Germany and Lithuania/the Norwegian Forest Officers if their position on the youngest plot 99_5505 is compared with their position on the other plots.

Table 49: *Pinus sylvestris*: Significant groups of countries (Ryan-Einot-Gabriel-Welsch multiple range test, SAS 1990)

99_5501; N = 24			99_5502; N=26			99_5505; N=24 (DEN: 23)		
grp	**mean def**	**team**	**grp**	**mean def**	**team**	**grp**	**mean def**	**team**
A	45.6	IRL	A	34.6	IRL	A	29.4	IRL
A	38.1	BEL	A	34.0	BEL	B	17.9	CH
B	26.5	CZH	AB	27.7	CZH	BC	17.1	ITA
B	26.0	CH	BC	25.4	ITA	BC	16.5	EST 1/1
B	25.8	EST 1/1	BC	24.8	CH	BCD	13.5	CZH
B	24.8	ITA	BC	24.2	EST 1/1	CDE	11.5	LIT
B	23.5	GER	BCD	22.5	GER	F DE	10.0	NFO
BC	20.2	N LevII	CDE	19.8	N LevII	F DE	10.0	BEL
BC	19.8	DEN	CDE	19.4	N LevI	F DE	10.0	GER
BC	19.8	LIT	CDE	17.9	LAT	F DE	9.0	N LevII
BC	19.0	EST 1/3	CDE	17.7	LIT	F DE	8.1	FIN
BC	18.8	FIN	DE	16.2	FIN	F E	7.3	EST 1/3
BC	18.8	N LevI	E	13.5	NFO	F E	7.1	N LevI
BC	17.7	LAT	E	12.9	EST	F E	6.0	LAT
C	13.5	NFO	E	12.5	DEN	F	4.3	DEN

3.1.5 ICC Spain

The fact that the plots of the Spanish test range for *Quercus ilex* and *Pinus pinaster* were allocated over a wide region implies that differences of the assessments at plot level can be strongly affected by differences in site characteristics, and other large-scale factors.

The participants of the Spanish course in 2002 came from 7 countries (Annex 13). The values of the PCC representative are included in the calculation of the median value for each tree but are not interpreted in detail, as PCC does not regularly assess defoliation.

The assessment values and descriptive statistics for the assessments of each participant are presented in Annex 14 for *Quercus ilex* and in Annex 19 for *Pinus pinaster*.

3.1.5.1 Coherency of Field Estimates at Tree Level between Country Teams

Quercus ilex was assessed on three plots of the ICC in Spain 2002. The assessment values for these plots (1069_1101, 979_1104, 896_1106) are presented in Annex 14, Annex 15 to Annex 18 include related statistics. The main results are presented below.

Plot number 979_1104 is the plot with the largest range of defoliation values (5% to 100%). This is not only due to tree number 23 which was assessed to have 100% defoliation by all participants, also 3 additional trees (numbers 4, 13, and 15) were assessed to have high defoliation values. The trees 6, 7, 8, 9, 14, and 18 were in general assessed to be of low defoliation. With an age of over 120 years, this plot was the oldest of the *Quercus ilex* plots (Table 43). Even of lower density is plot 896_1106 with coverage of only 15-20%. The trees at this plot are 81-100 years old and defoliation varies between 5 and 75%. The density of the third *Quercus ilex* plot

1069-1101 is normal and the stand age is irregular. This might be a reason for the relatively high deviations between the defoliation assessments on this plot.

The graphical presentation of the distribution of the assessment values (Annex 15) of the participants reveals some interesting points: The three Spanish participants (number 6, 7, and 8) delivered relatively low assessments on plot 1069_1101. On the other two plots the participants from Portugal assessed on a relatively low level. Participant 3 from Croatia had the highest level on plot 979_1104 whereas his defoliation values were relatively low on the two other plots. Nevertheless, on plot 896_1106 he assessed the absolute highest value with 75% defoliation. The next highest value was 65%, assessed by the participants 2 (Portugal), 13 (Greece), 16, and 17 (both Italy) for the same tree number 9 (Annex 14).

The evaluation of the differences to the tree specific median enables the detection of significant deviations from the mean level of defoliation assessments (Annex 16). If those deviations are in all cases in the same direction one could expect that they are due to systematic causes. Defoliation values of at least 10% below the median were observed for the Spanish participants on plot 1069_1101 especially for trees which were assessed to show high defoliation in terms of the median (trees 3,4,5, and 13). The other participants show varying deviations from the median or – in case of the participants from France and Cyprus – positive deviations from the median. On the two other plots (979_1104 and 896_1106) it is obvious that the participants from Croatia assessed above the median – participant number 3 from Croatia with 6 estimations under the median on plot 896_1106 – whereas the participants from Portugal made some assessments significantly below the respective median values. Only tree number 13 is assessed higher than the median by the Portuguese participants.

The correlations between the participants (Annex 17) and the share of trees with the same defoliation value (Annex 18) show that participants from the same country make similar assessments in general what should be expected. Nevertheless, this is obviously not the case for participant three from Croatia. The defoliation values of this participant and of participant 6 from Spain, in general, also show lower values of correlation and agreement with the values of other participants. In case of plot 1069_1101 in addition the participants 4 and 5 from Portugal, the participant 8 from Spain, and the participants 13 and 14 from Greece reach only low correlations with the other teams. The generally low correlation coefficients for plot 1069_1101 suggest that some distinctive features of this plot have reduced the comparability of the assessments. In general, the assessments of the participants from Portugal, Spain, Cyprus, France, Greece, Italy, and with exception of participant 3 those of Croatia seem to be of high comparability.

Pinus pinaster was assessed on 3 plots during the ICC 2002 in Spain (Table 43, page 31). The assessment values for these plots (1025_1102, 1065_1103, and 935_1105) are presented in Annex 19, the following annexes up to Annex 23 include related statistics. The main results are presented below.

Concerning the range of the defoliation values of the assessed trees plot 935_1105 is by far the plot with the lowest range (5% to 40% defoliation) (Annex 19). The other two plots (1025_1102 and 1065_1003) show higher ranges with values from 5% to 100% defoliation. These ranges are due to a few trees with high values. In case of plot 1065_1103 only tree 12 was assessed with values above 50% defoliation and the French participants indicated that it was not assessable according to the French manual. The Spanish participants assessed this tree with only 25% to 30% defoliation.

Also tree 4 at plot 1025_1102 was not assessable according to the French manual. This tree was not assessed by the Italian participants too ("dominated tree"). Besides tree 24 which was assessed with 100% defoliation by nearly all participants tree 4 was the only tree on plot 1025_1102 with values above 40% defoliation. Furthermore, tree 19 on plot 1025_1102 was not assessed by participant 12 from France due to a "very small crown".

Annex 20 shows that, in general, assessments of all participants were very similar to those of their national colleagues. Little deviation especially on plot 935_1105 could be due to deviating assessments on a few trees.

Homogeneous ranking is depicted by the differences of the defoliation assessments to the tree specific median (Annex 21) with only a few exceptions which show positive deviations as well as negative deviations on the same plot. The Croatian participants and the participants from Portugal and Greece assessed higher defoliation values in general. The Spanish participants (exception: tree 28 on plot 1065_1103) and the French participants (exception: 13/1065_1103) assessed lower defoliation values. Varying deviations resulted for the Italian participants as well as – on a lower level – for the participants from Cyprus: Whereas the participants from Italy (Cyprus) assessed lower (higher) defoliation values on plot 1025_1102 and on plot 935_1105 they assessed higher (lower) defoliation values on plot 1065_1103. It can not be identified if this is due to effects of elevation, tree age or any other factor which was probably not documented at all (Table 43).

In general, the correlations among the participants (Annex 22) as well as the shares of agreeing assessments (Annex 23) underline the homogenous assessments of the participants with their national colleagues. Only for participant 3 from Croatia and for the participants from Spain deviating assessment behaviours and assessment levels were observed among participants from one nation. All participants showed the same ranking of the trees. Nevertheless, the percentage of agreement (Annex 23) indicates different assessment levels for Croatia-France, Croatia-Italy, Portugal-Spain, Portugal-France, Portugal-Italy, Spain-Greece, Cyprus-Italy, France-Greece, and Greece-Italy.

On plot 1065_1103 in addition to the participants 3 and 6 for the participants 8 (Spain), 11, and 12 (both France) lower correlation was found for their assessments with those of the other participants. The agreement seems to be reduced only for some combinations with Croatia, Portugal, the participants 6 and 7 from Spain, France, and Italy.

On plot 935_1105 correlation and agreement analyses lead to different outcomes: Whereas the correlations of the Croatian and Portuguese participants and participant 13 from Greece with others are relatively low, the share of agreeing assessments is bigger. In contrast, the French participants and especially the Greece participant 14 reached very poor agreement values with some other participants while having good correlations with them (e.g. participants 14-7 and 14-8). Especially in case of a plot with comparably low ranges (e.g. plot 935_1105) it seems possible that relatively high values of agreement are reached even where the general ranking or assessment behaviour is differing.

3.1.5.2 Comparisons of defoliation estimates between country teams at plot level

The distributions of the team assessments on the ***Quercus ilex*** plots are described in Table 50. Two participants from Croatia are on all three plots among the participants with the highest defoliation assessments. The third one varies between highest and lowest assessments. Also the ranking of other participants is changing between the plots without a clear relation to the stand and site conditions documented in Table 43. No groups but similarities from participants of the same country can be detected from the distributions of the assessments.

Table 50: Distributions of team assessments of *Quercus ilex* in Spain 2002

	57 POTOC	57 SELET	57 ROSAJ	10 BARRO	10 RAMAL	11 SANCH	11 TORRE	11 GARCI	99 ARIST	99 CHRIS	01 REBOU	01 AUMON	09 SKOUT	09 BOURL	05 POMPE	05 BETTI	05 CENNI
1069_1101		N=24															
Median	25.0	25.0	20.0	25.0	25.0	17.5	17.5	20.0	25.0	20.0	25.0	25.0	25.0	25.0	20.0	25.0	22.5
Mean	**25.6**	**24.2**	**21.3**	**23.8**	**23.8**	**18.8**	**17.3**	**19.6**	**26.7**	**25.8**	**27.7**	**25.4**	**22.9**	**25.0**	**20.8**	**23.8**	**23.1**
Std	10.5	9.3	10.1	7.4	7.4	6.5	4.6	3.2	10.1	10.0	12.2	9.6	7.5	8.0	8.5	10.0	9.9
Min	5	10	5	15	15	10	10	15	10	10	5	10	10	10	5	5	5
Max	50	45	35	45	45	30	25	25	45	45	50	45	35	35	40	45	45
979_1104		N=24															
Median	30.0	35.0	35.0	25.0	20.0	30.0	25.0	25.0	22.5	20.0	22.5	20.0	22.5	25.0	27.5	27.5	27.5
Mean	**34.6**	**34.6**	**42.3**	**27.1**	**24.4**	**33.1**	**30.0**	**30.4**	**28.3**	**27.7**	**27.3**	**25.6**	**28.5**	**30.6**	**32.1**	**32.3**	**32.5**
Std	19.7	18.9	20.3	17.1	17.7	18.5	18.4	18.3	20.3	20.5	19.3	19.3	18.8	19.9	19.5	20.2	19.8
Min	10	5	15	10	10	10	15	15	5	5	5	5	15	10	5	5	5
Max	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
896_1106		N=24															
Median	27.5	27.5	15.0	20.0	15.0	15.0	20.0	20.0	15.0	20.0	20.0	20.0	17.5	20.0	15.0	17.5	15.0
Mean	**27.3**	**26.5**	**17.3**	**18.8**	**16.3**	**19.6**	**20.6**	**18.5**	**18.5**	**19.8**	**20.0**	**20.2**	**19.6**	**20.8**	**18.3**	**20.2**	**19.8**
Std	12.7	12.6	15.6	8.4	8.2	10.4	10.3	8.4	9.6	11.0	9.8	8.7	11.4	10.7	11.0	12.2	12.6
Min	10	10	5	5	5	5	10	5	5	5	10	10	5	5	5	5	5
Max	60	65	75	40	45	50	60	50	50	60	60	55	65	60	60	65	65

Accordingly the grouping following the Ryan-Einot-Gabriel-Welsch multiple range test calculated for the tree *Quercus ilex* plots (Table 51) shows no differentiation between the teams and the mean defoliation values show a low range.

Table 51: *Quercus ilex*: Significant groups of countries (Ryan-Einot-Gabriel-Welsch multiple range test, SAS 1990), 72 trees on 3 plots

grp	mean def	team
A	29.2	57_potoc
A	28.4	57_selet
A	26.9	57_rosaj
A	25.5	09_bourl
A	25.4	05_betti
A	25.1	05_cenni
A	25.0	01_rebou
A	24.5	99_arist
A	24.4	99_chris
A	23.8	11_sanch
A	23.8	01_aumon
A	23.8	05_pompe
A	23.7	09_skout
A	23.2	10_barro
A	22.8	11_garci
A	22.6	11_torre
A	21.5	10_ramal

At least on two plots relatively high ranges were observed but no significant distinction between the participants according to the Ryan-Einot-Gabriel-Welsch multiple range test (Table 52). On plot 1069_1101 three groups were found but with very large overlapping. Only the participants with the highest or lowest, respectively, mean defoliation are not in the intermediate group B.

Table 52: *Quercus ilex*: Significant groups of countries (Ryan-Einot-Gabriel-Welsch multiple range test, SAS 1990)

1069_1101; N = 24			979_1104; N=24			896_1106; N=24		
grp	mean def	team	grp	mean def	team	grp	mean def	team
A	27.7	01_rebou	A	42.3	57_rosaj	A	27.3	57_potoc
AB	26.7	99_arist	A	34.6	57_potoc	A	26.5	57_selet
ABC	25.8	99_chris	A	34.6	57_selet	A	20.8	09_bourl
ABC	25.6	57_potoc	A	33.1	11_sanch	A	20.6	11_torre
ABC	25.4	01_aumon	A	32.5	05_cenni	A	20.2	01_aumon
ABC	25.0	09_bourl	A	32.3	05_betti	A	20.2	05_betti
ABC	24.2	57_selet	A	32.1	05_pompe	A	20.0	01_rebou
ABC	23.8	10_barro	A	30.6	09_bourl	A	19.8	05_cenni
ABC	23.8	05_betti	A	30.4	11_garci	A	19.8	99_chris
ABC	23.8	10_ramal	A	30.0	11_torre	A	19.6	11_sanch
ABC	23.1	05_cenni	A	28.5	09_skout	A	19.6	09_skout
ABC	22.9	09_skout	A	28.3	99_arist	A	18.8	10_barro
ABC	21.3	57_rosaj	A	27.7	99_chris	A	18.5	11_garci
ABC	20.8	05_pompe	A	27.3	01_rebou	A	18.5	99_arist
ABC	19.6	11_garci	A	27.1	10_barro	A	18.3	05_pompe
BC	18.8	11_sanch	A	25.6	01_aumon	A	17.3	57_rosaj
C	17.3	11_torre	A	24.4	10_ramal	A	16.3	10_ramal

The distributions of the assessments of the three plots for ***Pinus pinaster*** are described in Table 53. On the plots 1025_1102 and 1065_1103 the assessment results are influenced by two (in case of one French participant three) trees which were not assessed by all participants due to deviations to their national methodology. E.g. on plot 1025_1102 all participants but those from Spain who assessed the respective tree had relatively high mean values. A comparison with the pure assessment values (Annex 19) indicates that this is due to the different assessment behavior according to tree 4. According results are found for plot 1052_1103 and there for tree 12. For plot 935_1105 another observation was made: Two participants from Croatia and the participants from Portugal assessed on average higher defoliation values than the other participants.

Table 53: Distributions of team assessments of *Pinus pinaster* in Spain 2002

	57 POTOC	57 SELET	57 ROSAJ	10 BARRO	10 RAMAL	11 SANCH	11 TORRE	11 GARCI	99 ARIST	99 CHRIS	01 REBOU	01 AUMON	09 SKOUT	09 BOURL	05 POMPE	05 BETTI	05 CENNI
1025_1102		N=24															
											N=23	N=22			N=23	N=23	N=23
Median	20.0	17.5	15.0	20.0	22.5	10.0	10.0	10.0	15.0	17.5	10.0	10.0	20.0	20.0	10.0	10.0	10.0
Mean	**24.8**	**24.6**	**20.8**	**27.1**	**28.1**	**15.4**	**16.3**	**15.0**	**22.7**	**24.0**	**14.8**	**15.2**	**26.0**	**26.7**	**13.3**	**13.5**	**13.7**
Std	23.1	22.4	19.3	19.5	19.7	18.0	18.7	18.6	21.0	21.9	19.1	19.6	20.5	21.1	19.0	19.1	19.2
Min	5	10	10	15	15	5	5	5	10	10	5	5	10	10	5	5	5
Max	100	100	95	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1065_1103		N=24															
	N=23	N=23									N=23	N=23					
Median	20.0	20.0	15.0	20.0	20.0	15.0	15.0	15.0	15.0	20.0	10.0	10.0	17.5	15.0	20.0	20.0	20.0
Mean	**26.3**	**25.4**	**19.8**	**23.1**	**21.7**	**15.4**	**16.0**	**16.7**	**19.8**	**21.5**	**13.7**	**14.1**	**20.6**	**20.8**	**23.8**	**24.0**	**24.8**
Std	18.3	17.9	19.0	13.9	13.0	6.6	5.4	4.2	12.6	14.1	8.1	10.4	15.0	15.5	15.6	15.0	14.9
Min	5	5	5	5	10	5	10	10	5	5	5	5	5	5	10	10	10
Max	100	100	100	80	80	**30**	**30**	**25**	70	80	35	50	80	85	90	85	85
935_1105		N=24															
Median	25.0	25.0	15.0	25.0	20.0	15.0	15.0	15.0	20.0	15.0	10.0	15.0	20.0	20.0	15.0	15.0	15.0
Mean	**24.2**	**24.0**	**15.2**	**24.6**	**23.5**	**17.9**	**15.8**	**15.8**	**19.8**	**18.8**	**12.3**	**14.8**	**20.8**	**23.1**	**15.6**	**16.7**	**16.3**
Std	7.2	6.6	5.3	6.4	4.7	6.4	4.9	4.2	5.5	6.0	6.1	5.1	5.5	6.1	7.0	7.3	7.5
Min	15	15	10	15	15	10	10	10	10	10	5	10	15	15	5	5	5
Max	40	40	25	40	30	30	25	25	30	35	25	25	35	40	30	35	35

The same observation was made by the Ryan-Einot-Gabriel-Welsch multiple range test for the tree plots (Table 54). Interestingly this result is mainly influenced by the differentiation which could be found based on the distributions on plot 935_1105 (Table 53 and Table 55). For both other plots no distinction was made among the participants (Table 55).

Table 54: *Pinus pinaster*: Significant groups of countries (Ryan-Einot-Gabriel-Welsch multiple range test, SAS 1990), 72 trees on 3 plots, some participants did not assess all trees (Annex 19)

grp	mean def	team
A	25.1	57_potoc
A	24.9	10_barro
A	24.6	57_selet
AB	24.4	10_ramal
ABC	23.5	09_bourl
ABCD	22.5	09_skout
ABCDE	21.4	99_chris
ABCDE	20.8	99_arist
ABCDE	18.6	57_rosaj
ABCDE	18.3	05_cenni
ABCDE	18.1	05_betti
ABCDE	17.6	05_pompe
BCDE	16.3	11_sanch
CDE	16.0	11_torre
CDE	15.8	11_garci
DE	14.7	01_aumon
E	13.6	01_rebou

For the three plots together the respective ANOVA model explains 6.2% of the variation of defoliation assessments by the participants. For plot 935_1105 the R^2 value is as high as 28.2% whereas the models for the other plots show lower values of 6.8% (plot 1025_1102) and 7.4% (plot 1065_1103), respectively.

Table 55: *Pinus pinaster*: Significant groups of countries (Ryan-Einot-Gabriel-Welsch multiple range test, SAS 1990), 72 trees on 3 plots, some participants did not assess all trees (Annex 19)

1025_1102; N = 24			1065_1103; N=24			935_1105; N=24		
grp	mean def	team	grp	mean def	team	grp	mean def	team
A	28.1	10_ramal	A	26.3	57_potoc	A	24.6	10_barro
A	27.1	10_barro	A	25.4	57_selet	A	24.2	57_potoc
A	26.7	09_bourl	A	24.8	05_cenni	A	24.0	57_selet
A	26.0	09_skout	A	24.0	05_betti	AB	23.5	10_ramal
A	24.8	57_potoc	A	23.8	05_pompe	AB	23.1	09_bourl
A	24.6	57_selet	A	23.1	10_barro	ABC	20.8	09_skout
A	24.0	99_chris	A	21.7	10_ramal	ABC	19.8	99_arist
A	22.7	99_arist	A	21.5	99_chris	ABC	18.8	99_chris
A	20.8	57_rosaj	A	20.8	09_bourl	BCD	17.9	11_sanch
A	16.3	11_torre	A	20.6	09_skout	CD	16.7	05_betti
A	15.4	11_sanch	A	19.8	57_rosaj	CD	16.3	05_cenni
A	15.2	01_aumon	A	19.8	99_arist	CD	15.8	11_garci
A	15.0	11_garci	A	16.7	11_garci	CD	15.8	11_torre
A	14.8	01_rebou	A	16.0	11_torre	CD	15.6	05_pompe
A	13.7	05_cenni	A	15.4	11_sanch	CD	15.2	57_rosaj
A	13.5	05_betti	A	14.1	01_aumon	CD	14.8	01_aumon
A	13.3	05_pompe	A	13.7	01_rebou	D	12.3	01_rebou

Whereas the range of mean values on plot 1025_1102 and plot 1065_1103 are higher than the range of mean values on plot 935_1105 only for this plot groups are distinguished by the Ryan-Einot-Gabriel-Welsch multiple range test (SAS, 1990). On all plots the values of the two Croatian participants and the participants from Portugal are relatively high. If differences of the ranking of the participants among the plots (e.g. Italian teams) can be observed due to or although the varying stand and site conditions on the plots can not be clarified because of the high number of changing variables. Perhaps e.g. the relatively high ranking of the Italian participants on plot 1065_1103 could be explained because their reference tree is less influenced by the high elevation on the other two *Pinus pinaster* plots (Table 43).

Discussions during the assessments 2002

3.1.6 ICC Norway

Following the proposal for the organization of ICCs (FERRETTI *et al*. 2002), preliminary results, the ICC structure and its possible improvements were discussed at the end of the course. Preliminary evaluations of the values assessed on the first four plots were presented and were basis for the discussion of problems of single teams with the given conditions. Furthermore, general points were discussed which are summarized below.

- The dating of the ICC after the survey period is possible and should be done by the host countries in cooperation with PCC.
- Birch should be included in a future system of ICCs.
- Plots of higher stand density should be included to enable analyses according to this factor.
- Especially in stands of higher stand density the concept of fixed positions can not be followed. The respective decision must be taken by the host country depending on the stand density.
- For photo assessments more stand information is needed. It was proposed to conduct them after the field assessments. It was suggested to mirror the photographs in order to ensure that the participants can not remember their field assessments.
- The participants from Finland and Ireland are not used to assess photographs and missed information about competition of the assessed trees with other trees.
- Some of the participants (Germany, the Czech Republic) indicated that the environmental and stand conditions differ from the conditions they are used in their countries.
- Discussions of the results or assessment methods in the field were not missed.
- Reference trees should be presented by the host country only in case that participants required them.
- Permanent ICC test ranges were seen as an advantage.

3.1.7 ICC Spain

In Spain the results of all participants were discussed directly in the forest at the end of the assessment on each plot. A possible advantage of error detection was out-weighted by the risk of adaptations between the participating teams and, thus, the impossibility to quantify methodological differences between the participating countries. The discussions did not focus on problems with assessments of single trees but on more general differences in the methodology of the participating countries (s. attached report of host country).

Furthermore, it was indicated by the participants from Greece and Cyprus that *Pinus nigra* should be included in a future system of ICCs.

4 Concluding Remarks and Recommendations

In general, the **similarity of the assessment behaviour of the teams was very high**. This means that most participants assessed the same trees with higher defoliation and consistently rated other trees as less defoliated. For some species it was even impossible to group participants by the Ryan-Einot-Gabriel-Welsch multiple range test.

For *Pinus sylvestris* in Norway there were also very **consistent relations between all teams,** indicating constant levels of the assessments. This was at least partly due to the high comparability of the site conditions of the plots and was observed even at varying tree ages. For this tree species, thus, no age specific deviations are expected at comparable site conditions. The forthcoming ICCs will allow checking this relation at other stand and site conditions.

The **comparability of assessments from experts from the same country** was mostly high in both courses, but there were also outliers detected. This shows that even though there are different methods, they seem at least to be consistently applied in the different countries.

The **documentation of stand and site parameters** for the assessed plots was excellent. Nevertheless, some differences between the assessments of different participants could not be related to the stand and site parameters. This shows that there remain influences which can not be explained. Other differences, however, were related to more than one of the documented parameters (e.g. *Pinus pinaster* in Spain). The statistical influence of single parameters could in these cases however not be differentiated due to a too low number of replicates. Thus, it is recommended for future courses to either reduce the variation of plot and site characteristics or to increase the number of replicates / plots. Both recommendations support the guidelines which foresee test plots located on comparable sites closely together (Ferretti et al. 2002). The Norwegian course showed that within the given time it would even have been possible to slightly increase the number of plots assessed.

The comparability of assessments in Spain was reduced due to the high **spatial extent of the test range**. Generalizations are mostly valid for 2 plots; the third plot mostly contradicts the derived results. Due to the high number of varying factors among the plots the identification of the main influencing factors is not possible from this course alone. The relatively high range of defoliation assessments on the Spanish plots (with the only exception of plot 935_1105) generally is a good basis to detect methodological differences between the participating teams.

The Norwegian ICC revealed that **recent thinning** seems to be very important. Furthermore, the two assessments of the Estonian team at the ICC in Norway 2002 enabled valuable insights. For some plots these analyses showed that differences of the assessments might be due to differences in the **proportion of the crown assessed** by the teams. This is only one possible interpretation which should be verified during future ICCs by a documentation of the assessed part of the crown (e.g. percentage of crown from top). At the ICCs the participants should also be given the chance to document special points of interest for each tree.

A major advantage of the new concept is the possibility for a re-assessment of the test ranges and thus the possibility to check the temporal consistency. In this respect, a combined assessment with results from the photo assessments and CROCO values will be beneficial.

It must be kept in mind that in principal the assessment of each participant is correct. Not a correction of the assessment behavior is needed but a statistical linkage. The most important precondition for related evaluations is to increase the number of plots and to enlarge the number of combinations of environmental parameters step by step at the future ICCs.

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Annexes

Annex 1: Norway 2002: List of participants/teams

COUNTRY	NAME	ID. CODE
Belgium	Pierre Giot-Wirgot	BEL
Czech Republic	Monika Kroupova	CZH
Switzerland	Freddy Protzinger	CH
	Raphäel Siegrist	
	Matthias Dobbertin	
Denmark	Mogens Egebjerg Pedersen	DK
Estonia	Enn Pilt	EST1/3 and ESTentire
	Heino Õunap	
Finland	Martti Lindgren	FIN
	Kimmo Siuruainen	
Germany	Mario Helbig	GER
Ireland	John Madden	IRL
Italy	Jacopo Ristori	ITA
	Alberto Cozzi	
Latvia	Leva Zadeika	LAT
Lithuania	Vidas Stakenas	LIT
Norway	Anette Ludahl	N LevI
	Rune Eriksen	
	Svein Solberg	N LevII
	Robert Andersen	
	Dagfinn Haget	N ForOfficer
	Oddbjørn Aardalen	
Norway	Gro Hylen	Organization
PCC of ICP Forests		

Annex 2: Norway 2002, *Picea abies*: Assessment values and simple statistics

99_5503	field assessments														
	BEL	CH	CZH	DEN	EST 1/3	Est entir	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	or. Offic
1	35	25	40	15	30	30	35	40	35	30	20	25	25	30	20
2	40	50	45	50	30	30	30	45	40	50	35	55	40	55	30
3	45	35	35	45	40	35	30	45	40	40	35	45	35	30	30
4	30	15	15	15	15	20	15	30	30	30	20	20	15	15	15
5	25	20	25	20	20	20	25	30	25	25	15	25	20	30	15
6	45	40	60	50	40	40	55	65	45	50	40	60	55	50	35
7	30	25	35	15	15	20	25	35	35	25	25	25	25	15	15
8	75	85	85	90	90	95	90	90	80	85	90	85	90	95	80
9	65	45	55	55	55	55	50	55	65	45	55	65	50	70	40
10	85	80	85	90	90	85	90	95	85	90	75	90	85	95	85
11	55	45	50	75	65	60	60	75	55	55	50	70	75	70	55
12	50	45	55	55	50	50	50	60	50	55	45	50	65	60	35
13	45	25	35	35	30	35	30	35	45	45	25	45	45	25	25
14	40	30	45	35	35	35	35	50	40	40	30	40	40	45	25
15	80	75	85	95	90	80	85	90	85	85	75	90	80	85	80
16	35	20	20	15	15	20	20	20	35	20	20	20	20	10	10
17	40	30	40	45	20	20	30	35	45	35	20	40	30	35	25
18	75	55	75	85	75	75	70	80	75	65	65	75	75	85	60
19	60	45	65	70	45	40	45	70	60	55	50	65	45	50	35
20	40	35	55	35	45	40	35	65	40	40	40	40	45	40	25
21	55	60	60	60	50	50	45	70	55	50	40	65	55	70	65
22	65	65	70	75	75	65	60	80	65	70	60	80	70	75	55
23	30	35	40	40	35	35	40	40	30	40	30	35	30	35	25
24	30	35	40	25	30	30	25	45	25	40	30	40	25	45	20
25	30	15	30	20	20	20	20	30	30	25	20	35	20	25	15
	BEL	CH	CZH	DEN	EST 1/3	Est entir	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	or. Offic
n	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
median	45	35	45	45	40	35	35	50	45	45	35	45	45	45	30
mean	**48.2**	**41.4**	**49.8**	**48.4**	**44.2**	**43.4**	**43.8**	**55.0**	**48.6**	**47.6**	**40.4**	**51.4**	**46.4**	**49.6**	**36.8**
std	17.3	19.3	19.5	25.6	23.8	21.8	21.4	21.4	18.0	18.9	19.8	21.6	22.3	24.9	21.9
min	25	15	15	15	15	20	15	20	25	20	15	20	15	10	10
max	85	85	85	95	90	95	90	95	85	90	90	90	90	95	85

99_5504	field assessments														
	BEL	CH	CZH	DEN	EST 1/3	Est entir	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	or. Offic
1	5	0	0	5	5	10	10	5	15	10	5	15	5	0	5
2	5	20	10	5	5	15	15	10	15	10	10	15	5	10	5
3	10	20	15	5	5	15	5	10	20	20	15	15	0	0	10
4	10	15	10	5	5	15	10	10	5	5	5	10	5	5	5
5	10	20	10	0	5	15	5	5	5	15	10	10	5	5	5
6	20	20	10	0	5	15	10	5	20	15	10	5	5	10	5
7	15	10	5	0	5	15	5	0	15	10	10	10	5	0	5
8	20	20	5	0	5	15	5	20	20	25	15	15	5	5	15
9	5	10	5	0	5	15	5	10	5	5	5	5	5	5	5
10	15	15	10	0	5	15	5	5	20	5	0	10	10	5	5
11	10	0	5	5	0	5	0	10	10	5	0	10	5	0	5
12	10	20	15	5	10	20	10	25	20	20	5	10	10	10	10
13	5	5	10	0	5	10	0	10	15	20	5	15	5	0	5
14	15	25	10	5	5	20	5	25	15	10	15	20	5	5	10
15	15	20	15	0	5	25	5	20	15	10	5	15	10	10	5
16	10	15	15	0	5	20	5	5	15	5	5	5	5	10	5
17	5	10	10	5	5	10	0	5	10	10	5	15	5	5	10
18	5	10	5	0	5	15	0	10	5	10	5	10	5	5	5
19	5	10	10	5	5	15	5	15	5	10	5	20	5	10	5
20	5	20	10	5	10	20	15	20	10	15	15	20	10	20	10
21	5	20	15	5	10	25	15	20	5	25	15	20	15	15	10
22	10	35	25	5	20	35	30	30	15	30	15	25	20	10	20
23	15	40	30	15	20	40	40	35	10	35	20	25	25	40	25
24	5	20	5	5	10	30	5	15	15	15	5	10	5	5	5
25	10	10	0	10	5	15	5	20	15	15	10	15	5	5	5
	BEL	CH	CZH	DEN	EST 1/3	Est entir	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	or. Offic
n	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
median	10	20	10	5	5	15	5	10	15	10	5	15	5	5	5
mean	**9.8**	**16.4**	**10.4**	**3.6**	**6.8**	**18.0**	**8.6**	**13.8**	**12.8**	**14.2**	**8.6**	**13.8**	**7.4**	**7.8**	**8.0**
std	4.8	9.0	6.6	3.6	4.4	7.7	9.0	8.7	5.3	8.0	5.2	5.5	5.3	8.1	5.1
min	5	0	0	0	0	5	0	0	5	5	0	5	0	0	5
max	20	40	30	15	20	40	40	35	20	35	20	25	25	40	25

99_5506	field assessments														
	BEL	CH	CZ	DEN	EST 1/3	Est entir	FIN	GER	IRL	ITA	LAT	LIT	N Levl	N Levll	or. Offic
1	40	35	35	35	15	20	30	45	40	35	30	25	35	25	20
2	15	5	15	5	5	15	10	10	15	10	15	10	15	5	15
3	35	20	30	25	20	25	25	40	35	25	20	15	30	15	20
4	20	20	20	15	5	20	15	15	15	20	15	15	25	10	10
5	35	15	25	20	10	20	10	25	25	15	20	15	20	10	20
6	20	20	15	5	5	25	20	15	35	15	20	15	25	10	30
7	15	20	25	10	5	20	15	20	25	10	15	10	15	5	15
8	35	25	35	20	10	30	25	35	35	20	25	20	30	15	25
9	30	20	25	15	10	25	15	20	20	20	20	15	20	10	10
10	40	35	45	35	25	30	35	45	40	35	30	25	30	25	25
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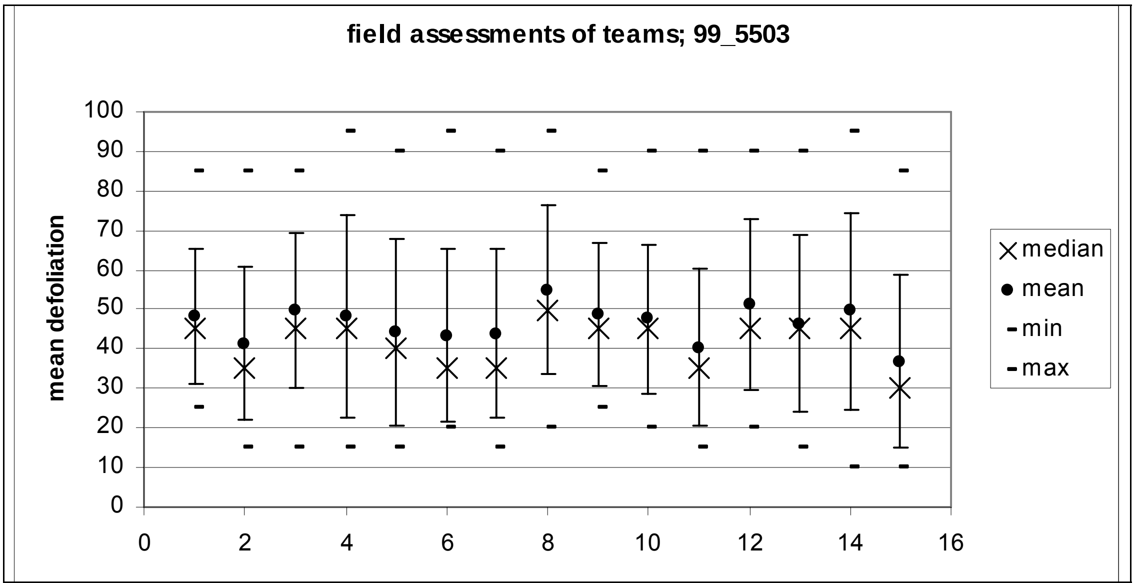
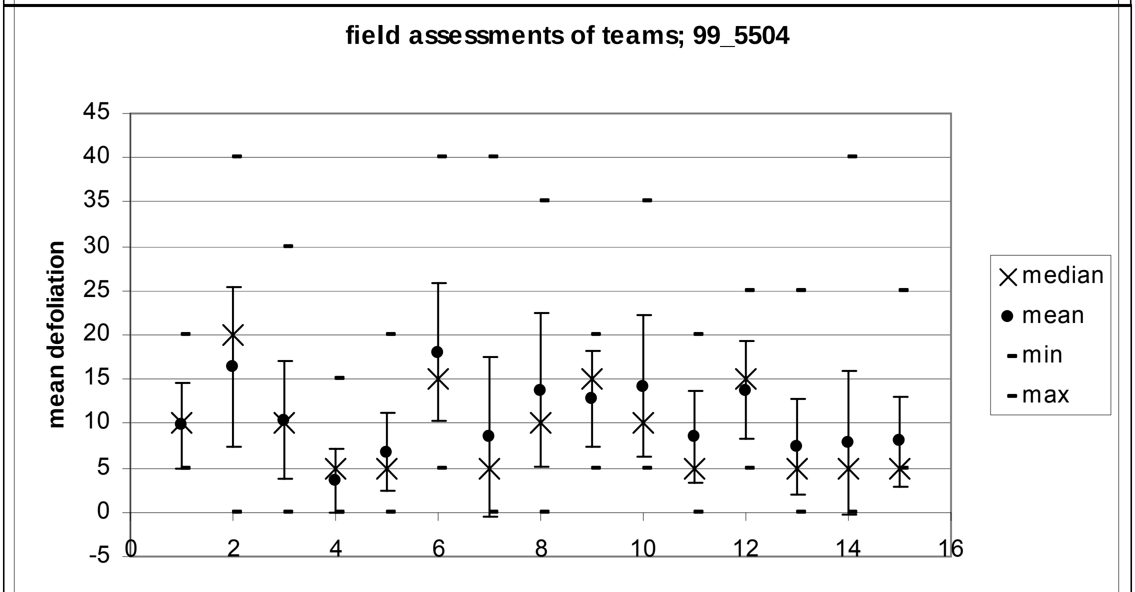
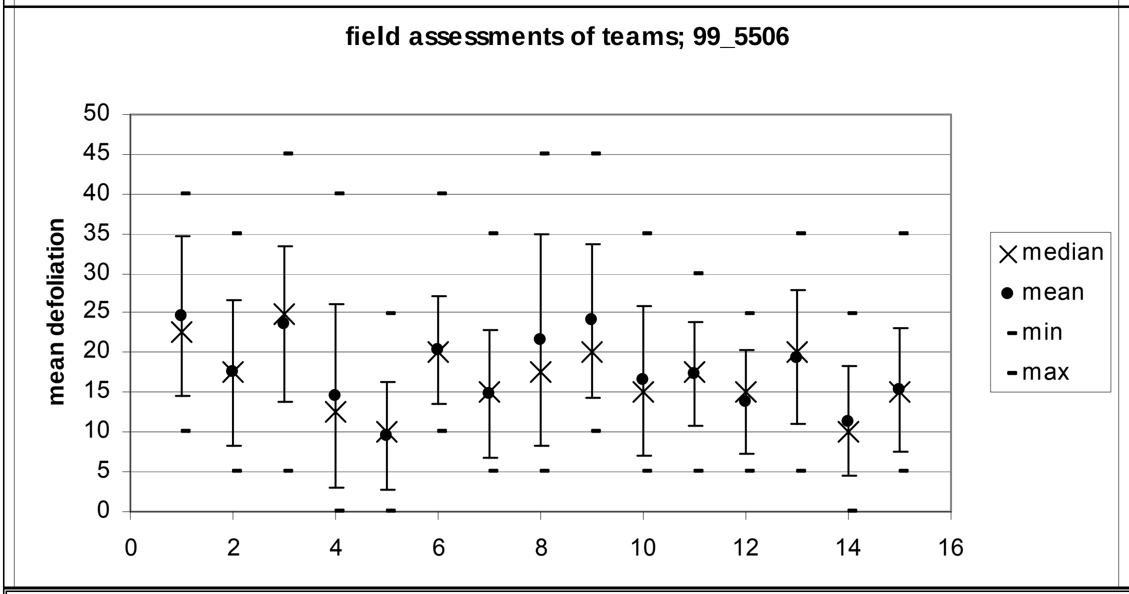
12	35	25	25	5	5	25	15	15	20	10	10	10	20	15	10
13	20	10	20	5	5	15	5	10	15	10	10	10	10	5	15
14	10	5	15	0	0	15	5	5	10	5	10	5	10	5	10
15	20	20	25	10	10	20	10	15	25	10	20	5	15	10	10
16	35	35	40	30	15	40	20	35	45	20	15	15	30	25	35
17	15	5	5	5	5	15	5	5	15	5	10	5	5	5	5
18	40	30	35	40	20	30	25	40	30	25	30	25	35	20	25
19	10	15	10	5	5	20	5	5	20	5	15	5	10	5	5
20	10	5	15	5	0	10	10	5	25	10	20	10	10	5	5
21	15	10	15	0	5	15	10	10	15	5	10	5	10	5	10
22	30	20	25	10	10	10	10	25	20	20	15	20	15	10	20
23	30	15	30	20	20	20	20	30	35	30	20	20	20	20	15
24	30	15	25	15	10	15	15	30	20	25	20	15	20	10	15
25	25	15	35	30	20	15	15	40	15	30	20	25	25	15	15
26	15	5	10	0	0	15	5	5	15	5	5	10	10	0	5
	BEL	CH	CZ	DEN	EST 1/3	Est entir	FIN	GER	IRL	ITA	LAT	LIT	N Levl	N Levll	or. Offic
n	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
median	22.5	17.5	25	12.5	10	20	15	17.5	20	15	17.5	15	20	10	15
mean	**24.6**	**17.5**	**23.7**	**14.6**	**9.6**	**20.4**	**14.8**	**21.5**	**24.0**	**16.5**	**17.3**	**13.8**	**19.4**	**11.3**	**15.4**
std	10.1	9.2	9.9	11.6	6.8	6.8	8.0	13.4	9.6	9.4	6.5	6.5	8.5	6.9	7.8
min	10	5	5	0	0	10	5	5	10	5	5	5	5	0	5
max	40	35	45	40	25	40	35	45	45	35	30	25	35	25	35

Annex 3: Norway 2002, *Picea abies*: Distribution of team assessments







BEL	CH	CZH	DEN	EST 1/3	EST entire	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. Officers
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Annex 4: Norway 2002, *Picea abies*: Differences to median

	99_5503						difference to median more than									
						value	-10	-5	other	5	10					
		field - median				symbol	<<	<		>	>>					
Median		BEL	CH	CZH	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. C
30	1			>	<<				>			<				<
40	2		>		>	<	<	<			>		>>		>>	<
35	3	>			>				>				>			
15	4	>>							>>	>>	>>					
25	5											<				<
50	6		<	>		<	<		>>			<	>			<<
25	7			>	<	<			>	>					<	<
90	8	<<								<						<
55	9	>	<							>	<		>		>>	<<
85	10								>			<			>	
60	11		<<	<	>>				>>			<	>	>>	>	
50	12								>					>>	>	<<
35	13	>	<							>	>	<	>	>	<	<
40	14		<						>			<				<<
85	15		<		>							<				
20	16	>>								>>					<	<
35	17				>	<<	<<			>		<<				<
75	18		<<		>						<	<			>	<<
50	19	>		>>	>>		<		>>	>			>>			<<
40	20			>>					>>							<<
55	21							<	>>			<<	>		>>	>
70	22							<	>			<	>			<<
35	23															<
30	24			>					>>		>		>		>>	<
20	25	>		>					>	>			>>			

	99_5504						difference to median more than									
						value	-10	-5	other	5	10					
		field - median				symbol	<<	<		>	>>					
Median		BEL	CH	CZH	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. C
5	1									>			>			
10	2		>													
10	3		>							>	>			<	<	
5	4		>				>									
5	5		>>				>				>					
10	6	>	>		<					>						
5	7	>					>			>						
15	8			<	<<	<		<			>			<	<	
5	9						>									
5	10	>	>				>			>>						
5	11															
10	12		>				>		>>	>	>					
5	13									>	>>		>			
10	14		>>				>		>>				>			
10	15		>		<		>>		>							
5	16		>	>			>>			>						
5	17												>			
5	18						>									
5	19						>		>				>>			
15	20	<			<											
15	21	<			<		>			<	>					
20	22	<	>>		<<		>>	>	>		>				<	
25	23	<	>>		<		>>	>>	>	<<	>				>>	
5	24		>>				>>		>	>	>					
10	25			<					>							

	99_5506						difference to median more than									
						value	-10	-5	other	5	10					
		field - median				symbol	<<	<		>	>>					
Median		BEL	CH	CZ	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. C
35	1					<<	<<		>				<		<	<<
10	2															
25	3	>							>>	>			<		<	
15	4					<								>		
20	5	>>				<		<							<	
20	6				<<	<<				>>					<	>
15	7			>		<				>					<	
25	8	>		>		<<			>	>					<	
20	9	>				<									<	<
35	10			>		<			>				<		<	<
10	11						>									
15	12	>>	>	>	<	<	>									
10	13	>		>												
5	14			>			>									
15	15			>						>			<			
30	16			>		<<	>	<		>>	<	<<	<<			
5	17	>					>			>						
30	18	>			>	<			>						<	
5	19		>				>>			>>		>				
10	20					<				>>		>				
10	21				<											
20	22	>			<	<	<	<							<	
20	23	>		>					>	>>	>					
15	24	>>		>					>>		>					
20	25			>>	>				>>		>					
5	26	>					>			>						

Annex 5: Norway 2002, *Picea abies*: Simple correlation coefficient (Pearson)

99_5503

>=	0.5	+
>=	0.7	++
>=	0.9	+++

correlation comparison

	BEL	CH	CZH	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. O
BEL	1	++	+++	+++	+++	+++	+++	++	+++	+++	+++	+++	+++	++	+++
CH	++	1	+++	+++	+++	+++	+++	+++	++	+++	+++	+++	+++	+++	+++
CZH	+++	+++	1	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
DEN	+++	+++	+++	1	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
EST 1/3	+++	+++	+++	+++	1	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Est entire	+++	+++	+++	+++	+++	1	+++	+++	+++	+++	+++	+++	+++	+++	+++
FIN	+++	+++	+++	+++	+++	+++	1	+++	+++	+++	+++	+++	+++	+++	+++
GER	++	+++	+++	+++	+++	+++	+++	1	++	+++	+++	+++	+++	+++	+++
IRL	+++	++	+++	+++	+++	+++	+++	++	1	+++	+++	+++	+++	++	+++
ITA	+++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++	+++	+++	+++	+++
LAT	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++	+++	+++	+++
LIT	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++	+++	+++
N LevI	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++	+++
N LevII	++	+++	+++	+++	+++	+++	+++	+++	++	+++	+++	+++	+++	1	+++
N For. Office	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1

99_5504

>=	0.5	+
>=	0.7	++
>=	0.9	+++

correlation comparison

	BEL	CH	CZH	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. O
BEL	1								+						
CH		1	++		++	++	++	+		+	++		+	+	++
CZH		++	1		++	++	++	+		+		+	++	++	++
DEN				1	+		+	+				+		+	+
EST 1/3		++	++	+	1	++	++	++		++	+	+	++	++	++
Est entire		++	++		++	1	++	++		+	+	+	++	++	+
FIN		++	++	+	++	++	1	+		+	+	+	++	++	++
GER		+	+	+	++	++	+	1		+	+	++	++	+	++
IRL	+								1						
ITA		+	+		++	+	+	+		1	++	+	+	+	++
LAT		++			+	+	+	+		++	1	+		+	++
LIT			+	+	+	+	+	++		+	+	1	+		+
N LevI		+	++		++	++	++	++		+		+	1	++	++
N LevII		+	++	+	++	++	++	+		+	+		++	1	+
N For. Office		++	++	+	++	+	++	++		++	++	+	++	+	1

99_5506

>=	0.5	+
>=	0.7	++
>=	0.9	+++

correlation comparison

	BEL	CH	CZ	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. O
BEL	1	++	++	++	++	+	++	++	+	++	+	++	++	++	+
CH	++	1	++	++	+	++	++	++	++	+	+	+	++	++	++
CZ	++	++	1	++	++	+	++	+++	++	++	++	++	++	++	++
DEN	++	++	++	1	++	+	++	+++	+	++	++	++	++	++	+
EST 1/3	++	+	++	++	1	+	++	++	+	++	+	++	++	++	+
Est entire	+	++	+	+	+	1	+	+	++				++	+	+
FIN	++	++	++	++	++	+	1	++	++	++	++	++	+++	++	+
GER	++	++	+++	+++	++	+	++	1	++	+++	++	++	++	++	++
IRL	+	++	++	+	+	++	++	++	1	+	+	+	++	++	++
ITA	++	+	++	++	++		++	+++	+	1	++	+++	++	++	+
LAT	+	+	++	++	+		++	++	+	++	1	++	++	++	+
LIT	++	+	++	++	++		++	++	+	+++	++	1	++	++	+
N LevI	++	++	++	++	++	++	+++	++	++	++	++	++	1	++	++
N LevII	++	++	++	++	++	+	++	++	++	++	++	++	++	1	+
N For. Office	+	++	++	+	+	+	+	++	++	+	+	+	++	+	1

Annex 6: Norway 2002, *Picea abies*: Percent of trees with agreeing assessment values

99_5503				>=	30	+++									
				>=	20	++									
				>=	10	+									
	agreement comparison				other										
	BEL	CH	CZH	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. O
BEL			++		+	++	+	+	+++	++	+	+++	+++		+
CH			++	++	++	++	++			++	+++	++	+++	+	+
CZH	++	++		++	+	++	++	+++	++	+++	+	+++	++	+	
DEN		++	++		+++	++	+++	++		++	+		++	++	
EST 1/3	+	++	+	+++		+++	+++	+	+	+	++	++	++	++	+
Est entire	++	++	++	++	+++		++	+	++	+	+++	++	++	+	+
FIN	+	++	++	+++	+++	++		+	++	++	++	++	+++	+	+
GER	+		+++	++	+	+	+		+	+	+	+	+	++	
IRL	+++		++		+	++	++	+		+++		++	+++		+
ITA	++	++	+++	++	+	+	++	+	+++		+	+++	++	++	
LAT	+	+++	+	+	++	+++	++	+		+		+	++	+	+
LIT	+++	++	+++		++	++	++	+	++	+++	+		++	+	
N LevI	+++	+++	++	++	++	++	+++	+	+++	++	++	++			+
N LevII		+	+	++	++	+	+	++		++	+	+			++
N For. Office	+	+			+	+	+		+		+		+	++	

99_5504				>=	30	+++									
				>=	20	++									
				>=	10	+									
	agreement comparison				other										
	BEL	CH	CZH	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. O
BEL		++	++	+++	+++		++	++	+++		+++	++	+++	++	+++
CH	++		+			++		++	++	++	+	+		++	
CZH	++	+			++	+	++	+	++	++	+++	++	+++	+++	+++
DEN	+++				++		++	+	+		+++		+++	++	++
EST 1/3	+++		++	++			+++	++	++	+	+++	++	+++	+++	+++
Est entire		++	+				+	+	++	+++		++			+
FIN	++		++	++	+++	+		++	+	++	+++	++	+++	+++	+++
GER	++	++	+	+	++	+	++		+	++	+	++	++	++	++
IRL	+++	++	++	+	++	++	+	+		++	++	++	++	+	++
ITA		++	++		+	+++	++	++	++		++	++	++	++	++
LAT	+++	+	+++	+++	+++		+++	+	++	++		++	+++	+++	+++
LIT	++	+	++		++	++	++	++	++	++	++		++	+	++
N LevI	+++		+++	+++	+++		+++	++	++	++	+++	++		+++	+++
N LevII	++	++	+++	++	+++		+++	++	+	++	+++	+	+++		+++
N For. Office	+++		+++	++	+++	+	+++	++	++	++	+++	++	+++	+++	

99_5506				>=	30	+++									
				>=	20	++									
				>=	10	+									
	agreement comparison				other										
	BEL	CH	CZ	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. O
BEL		+	+++			++	+	++	+++	+	+		++		+
CH	+		+	++	+	++	+++	+++	+	+++	+++	++	+	++	+++
CZ	+++	+		+		++		+++	++	++		+	+++		
DEN		++	+		+++	+	+++	++		+++	+	+++	++	+++	++
EST 1/3		+		+++			+++			+	+	++		+++	++
Est entire	++	++	++	+			++		+++	+	++	+	++	+	++
FIN	+	+++		+++	+++	++		+++		+++	+++	+++	+	+++	+++
GER	++	+++	+++	++			+++		+	+++	+	++	++	+	++
IRL	+++	+	++			+++		+			++		++		+
ITA	+	+++	++	+++	+	+	+++	+++			+	+++	+	++	+++
LAT	+	+++		+	+	++	+++	+	++	+		++	+++		+++
LIT		++	+	+++	++	+	+++	++		+++	++		++	+++	+++
N LevI	++	+	+++	++		++	+	++	++	+	+++	++			++
N LevII		++		+++	+++	+	+++	+		++		+++			+++
N For. Office	+	+++		++	++	++	+++	++	+	+++	+++	+++	++	+++	

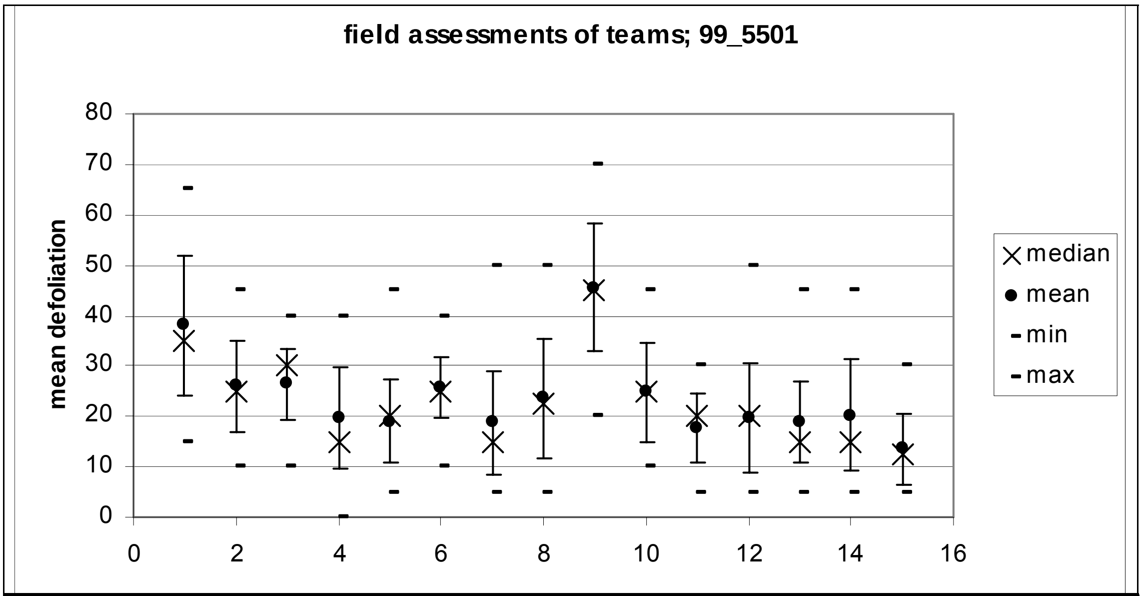
Annex 7: Norway 2002, *Pinus sylvestris*: Assessment values and simple statistics

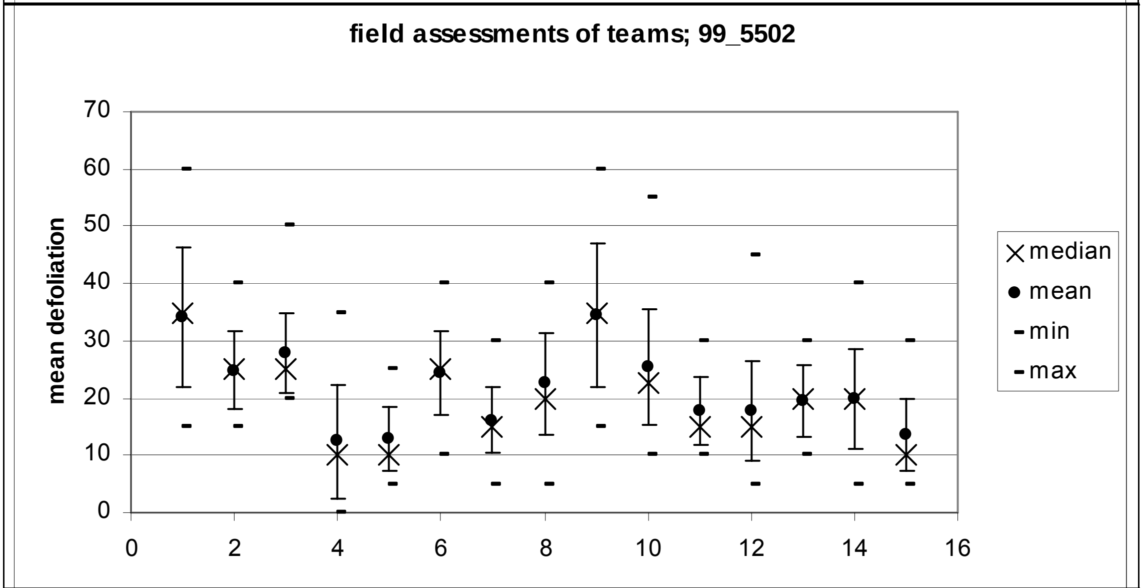
99_5501		field assessments													
	BEL	CH	CZH	DEN	EST 1/3	Est entir	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. C
1	15	15	10	15	10	20	5	15	20	15	10	10	10	5	5
2	30	20	20	10	10	20	10	15	30	20	10	15	15	15	5
3	40	25	30	15	20	30	25	30	40	25	15	20	15	25	20
4	35	25	25	10	20	30	20	15	45	20	15	15	15	15	10
5	35	25	35	15	25	30	25	20	35	25	20	10	20	25	15
6	30	15	20	10	10	20	15	5	30	15	15	5	15	10	10
7	35	35	30	20	15	25	15	30	55	30	25	25	20	30	15
8	35	30	30	20	20	25	15	25	45	20	20	20	15	15	15
9	25	20	15	20	10	20	15	15	35	15	10	20	20	10	5
10	40	35	30	25	15	25	20	25	45	35	20	25	25	30	20
11	35	30	30	15	20	25	15	15	40	25	25	10	15	30	20
12	30	20	25	15	15	25	10	15	55	10	20	15	15	15	15
13	65	45	40	40	30	40	35	45	65	40	25	35	30	45	25
14	50	35	30	35	20	25	25	35	50	35	25	30	25	25	25
15	20	10	20	0	5	10	5	5	25	10	5	5	5	5	5
16	60	30	30	35	15	25	25	40	60	30	20	30	25	25	20
17	60	40	35	40	20	25	35	50	60	45	30	40	30	40	30
18	65	35	30	30	45	35	50	35	70	45	15	50	45	40	15
19	40	15	20	20	25	30	15	20	50	20	15	20	15	10	10
20	40	15	20	10	20	25	10	5	45	10	5	5	10	10	5
21	40	30	35	15	15	25	20	30	50	25	30	20	15	15	10
22	50	35	30	30	30	35	15	30	55	30	20	20	20	20	10
23	20	25	25	15	25	30	15	25	55	25	20	15	15	10	5
24	20	15	20	15	15	20	10	20	35	25	10	15	15	15	10
	BEL	CH	CZH	DEN	EST 1/3	Est entir	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. C
n	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
median	35	25	30	15	20	25	15	22.5	45	25	20	20	15	15	12.5
mean	**38.1**	**26.0**	**26.5**	**19.8**	**19.0**	**25.8**	**18.8**	**23.5**	**45.6**	**24.8**	**17.7**	**19.8**	**18.8**	**20.2**	**13.5**
std	13.9	9.1	7.0	10.2	8.3	6.1	10.1	11.9	12.5	9.9	6.9	10.9	8.1	11.0	7.1
min	15	10	10	0	5	10	5	5	20	10	5	5	5	5	5
max	65	45	40	40	45	40	50	50	70	45	30	50	45	45	30

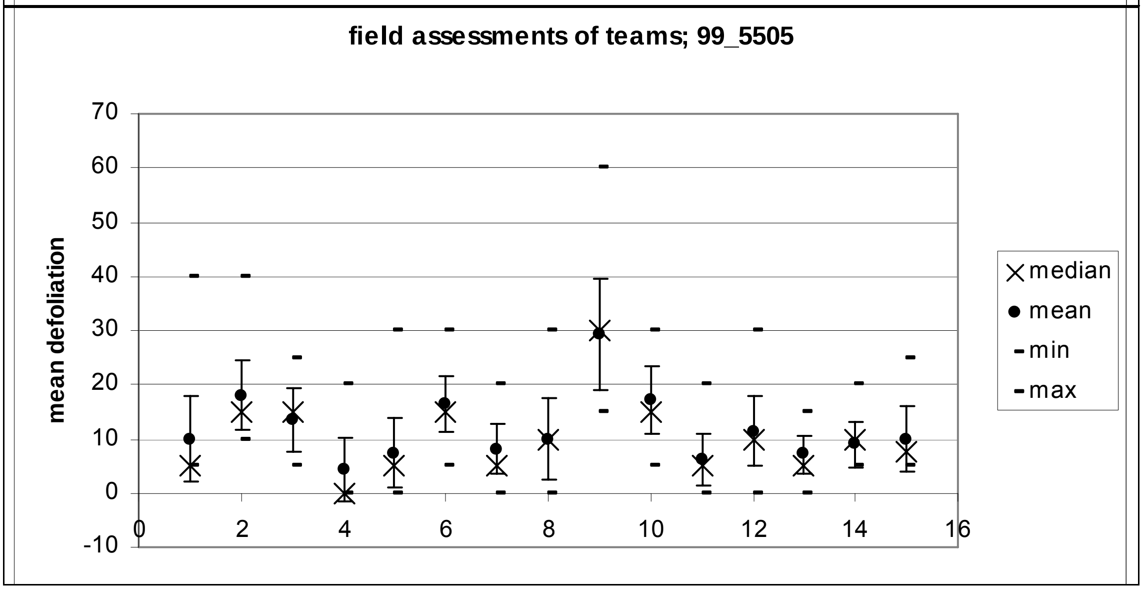
99_5502		field assessments													
	BEL	CH	CZH	DEN	EST 1/3	ST entir	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	or. Offic
1	50	20	25	10	15	25	25	30	50	25	10	20	25	20	10
2	20	30	30	5	10	20	10	20	25	15	20	10	15	15	10
3	25	20	20	5	10	15	15	15	20	10	15	10	10	10	5
4	40	15	20	25	5	15	15	25	40	20	10	15	20	15	15
5	35	30	35	15	15	30	15	30	35	20	20	5	25	20	20
6	15	35	30	10	10	25	15	20	20	15	15	5	15	10	10
7	50	25	35	10	10	40	15	20	50	30	10	15	25	10	10
8	40	35	50	30	15	20	20	40	40	55	30	35	25	20	30
9	40	25	30	20	20	30	25	35	40	35	25	25	20	40	20
10	30	20	25	5	10	20	15	25	30	20	15	20	15	20	15
11	35	30	30	15	10	25	20	25	35	30	15	15	15	30	15
12	25	25	25	0	10	20	15	10	25	20	15	10	15	15	10
13	20	15	30	5	5	15	10	20	20	20	15	15	10	10	10
14	35	15	25	5	5	15	10	15	35	15	15	15	10	5	5
15	15	15	20	5	10	20	10	20	15	15	20	10	15	15	10
16	30	20	25	15	15	30	20	30	30	30	30	25	25	35	20
17	25	20	20	5	10	20	10	15	25	25	15	20	15	20	15
18	30	20	20	0	15	30	20	15	25	25	10	15	25	25	10
19	15	25	25	5	5	10	5	15	15	20	15	20	10	10	5
20	30	25	25	0	20	25	10	5	30	15	15	10	15	15	5
21	55	30	40	35	25	35	25	40	55	40	30	45	25	25	20
22	60	40	30	25	15	35	20	25	60	40	20	25	30	30	25
23	50	25	25	20	15	25	15	25	55	35	20	20	25	20	15
24	35	20	20	5	10	25	15	10	35	20	15	10	20	20	10
25	35	35	35	25	25	35	30	35	45	30	25	20	30	35	10
26	45	30	25	25	20	25	15	20	45	35	20	25	25	25	20
	BEL	CH	CZH	DEN	EST 1/3	ST entir	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	or. Offic
n	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
median	35	25	25	10	10	25	15	20	35	22.5	15	15	20	20	10
mean	**34.0**	**24.8**	**27.7**	**12.5**	**12.9**	**24.2**	**16.2**	**22.5**	**34.6**	**25.4**	**17.9**	**17.7**	**19.4**	**19.8**	**13.5**
std	12.2	6.9	7.0	9.9	5.6	7.3	5.8	8.9	12.6	10.1	5.9	8.8	6.3	8.7	6.3
min	15	15	20	0	5	10	5	5	15	10	10	5	10	5	5
max	60	40	50	35	25	40	30	40	60	55	30	45	30	40	30

99_5505		field assessments													
	BEL	CH	CZ	DEN	EST 1/3	Est entir	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	or. Offic
1	5	20	5	0	10	15	5	10	35	15	5	15	5	5	15
2	5	10	10	0	5	10	5	0	25	15	5	15	5	5	5
3	5	15	15	5	0	5	5	15	35	25	5	15	5	5	5
4	15	15	15	0	5	10	10	15	30	15	10	10	10	10	10
5	5	15	15	0	10	15	10	10	35	25	10	15	5	10	5
6	10	20	20	5	5	15	5	10	40	15	10	10	5	5	10
7	10	20	15	15	10	20	10	20	35	15	5	10	10	10	5
8	5	15	5	5	5	10	5	10	15	15	5	5	5	5	5
9	5	20	10	5	20	20	5	15	20	20	5	15	0	5	5
10	5	15	10	0	5	20	10	5	20	10	5	5	5	15	15
11	5	10	5	0	5	15	5	0	25	15	0	5	5	5	5
12	5	10	10	0	5	15	5	5	15	5	0	5	5	5	5
13	5	20	20	5	10	20	10	0	25	15	5	10	5	10	20
14	5	40	25	10	5	30	15	10	35	20	5	10	10	20	15
15	5	10	10	0	0	20	5	0	20	15	0	5	5	10	5
16	10	25	20	15	5	20	5	15	35	20	10	15	5	15	15
17	20	25	15	0	0	15	10	5	30	20	5	10	10	10	10
18	5	15	5	0	0	10	0	5	20	10	0	0	5	5	5
19	5	15	10	0	10	15	5	10	15	15	0	10	10	5	5
20	15	25	25	5	10	20	10	15	30	30	10	20	5	10	15
21	40	20	20	20	30	20	15	30	60	30	20	30	15	15	25
22	15	15	15		10	20	5	0	30	10	5	5	10	5	5
23	20	20	15	10	5	15	20	20	45	25	15	20	15	15	20
24	15	15	10	0	5	20	15	15	30	10	5	15	10	10	10
	BEL	CH	CZ	DEN	EST 1/3	Est entir	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	or. Offic
n	24	24	24	23	24	24	24	24	24	24	24	24	24	24	24
median	5	15	15	0	5	15	5	10	30	15	5	10	5	10	7.5
mean	**10.0**	**17.9**	**13.5**	**4.3**	**7.3**	**16.5**	**8.1**	**10.0**	**29.4**	**17.1**	**6.0**	**11.5**	**7.1**	**9.0**	**10.0**
std	8.0	6.4	5.9	5.8	6.5	5.1	4.5	7.5	10.2	6.3	4.8	6.4	3.5	4.3	6.0
min	5	10	5	0	0	5	0	0	15	5	0	0	0	5	5
max	40	40	25	20	30	30	20	30	60	30	20	30	15	20	25

Annex 8: Norway 2002, *Pinus sylvestris*: Distribution of team assessments







BEL	CH	CZH	DEN	EST 1/3	EST entire	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. Officers
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Annex 9: Norway 2002, *Pinus sylvestris*: Differences to median

99_5501					difference to median more than										
					value	-10	-5	other	5	10					
	field - median				symbol	<<	<		>	>>					
	BEL	CH	CZH	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. C
1						>			>						
2	>>								>>						<
3	>>			<					>>		<		<		
4	>>	>	>			>>			>>						
5	>		>	<					>			<<			<
6	>>							<	>>			<			
7	>	>			<		<		>>						<
8	>>	>	>						>>						
9	>								>>						<
10	>>	>			<				>>	>					
11	>>	>	>						>>			<		>	
12	>>		>			>			>>						
13	>>				<				>>		<<		<		<<
14	>>	>		>				>	>>	>					
15	>>		>>						>>						
16	>>			>	<			>>	>>						
17	>>				<<	<		>>	>>	>					
18	>>				>		>>		>>	>	<<	>>	>		<<
19	>>					>			>>					<	<
20	>>		>		>	>>			>>						
21	>>	>	>>					>	>>		>				<
22	>>						<<		>>		<	<	<	<	<<
23						>			>>					<	<<
24									>>	>					

99_5502					difference to median more than										
					value	-10	-5	other	5	10					
	field - median				symbol	<<	<		>	>>					
	BEL	CH	CZH	DEN	EST 1/3	EST enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. C
1	>			<<	<				>		<<				<<
2		>	>	<					>						
3	>			<											<
4	>			>	<			>	>						
5	>	>	>			>		>	>			<<			
6		>	>			>						<			
7	>		>	<	<	>			>	>	<			<	<
8	>		>		<<	<	<	>	>	>				<	
9	>							>	>	>				>	
10	>			<<	<				>						
11	>			<	<<				>		<	<	<		<
12	>	>	>	<<					>						
13			>	<	<										
14	>		>	<	<				>					<	<
15				<											
16				<	<									>	
17				<<	<		<								
18	>			<<		>					<				<
19		>	>	<	<		<								<
20	>	>	>	<<		>		<	>						<
21	>				<		<		>			>	<	<	<<
22	>	>			<<		<		>	>	<				
23	>				<		<		>	>					<
24	>			<<	<			<	>			<			<
25									>			<			<<
26	>						<		>	>					

99_5505					difference to median more than										
					value	-10	-5	other	5	10					
	field - median				symbol	<<	<		>	>>					
	BEL	CH	CZ	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. C
1		>		<					>>						
2									>>	>		>			
3		>	>					>	>>	>>		>			
4				<					>>						
5				<					>>	>>					
6		>	>						>>						
7		>				>		>	>>						
8		>							>	>					
9		>			>	>			>	>			<		
10				<		>			>						
11						>			>>	>					
12						>			>						
13		>	>			>		<	>>						>
14	<	>>	>		<	>>			>>		<				
15						>>			>>	>					
16		>			<		<		>>				<		
17	>	>>		<	<				>>	>					
18		>							>>						
19				<							<				
20		>	>	<					>>	>>			<		
21	>>				>			>	>>	>		>			
22				<		>		<	>>						
23				<	<<				>>						
24				<		>			>>						

Annex 10: Norway 2002, *Pinus sylvestris*: Simple correlation coefficient (Pearson)

99_5501

>=	0.5	+
>=	0.7	++
>=	0.9	+++

correlation comparison

	BEL	CH	CZH	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. O
BEL	1	++	++	++	+	+	++	++	++	++	+	++	++	++	++
CH	++	1	++	++	+	+	++	++	++	++	++	++	++	++	++
CZH	++	++	1	+	+	+	+	++	+	++	++	+	+	++	++
DEN	++	++	+	1	+	+	+	++	++	++	+	++	++	++	++
EST 1/3	+	+	+	+	1	++	++		++	+		+	+	+	
Est entire	+	+	+	+	++	1	+	+	++	+		+	+	+	
FIN	++	++	+	+	++	+	1	++	+	++		++	+++	++	+
GER	++	++	++	++		+	++	1	++	++	++	++	++	++	++
IRL	++	++	+	++	++	++	+	++	1	+	+	++	++	+	+
ITA	++	++	++	++	+	+	++	++	+	1	+	++	++	++	++
LAT	+	++	++	+				++	+	+	1			+	++
LIT	++	++	+	++	+	+	++	++	++	++		1	+++	++	+
N LevI	++	++	+	++	+	+	+++	++	++	++		+++	1	++	+
N LevII	++	++	++	++	+	+	++	++	+	++	+	++	++	1	++
N For. Office	++	++	++	++			+	++	+	++	++	+	+	++	1

99_5502

>=	0.5	+
>=	0.7	++
>=	0.9	+++

correlation comparison

	BEL	CH	CZH	DEN	EST 1/3	EST enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. O
BEL	1			+		+	+		+++	+		+	++		+
CH		1	+	+	+					+					
CZH		+	1	+				+		+	+				+
DEN	+	+	+	1	+		+	++	++	++	+	++	+	+	++
EST 1/3		+		+	1	+	++		+	+	+	+	+	+	
EST entire	+				+	1	+		+				++	+	
FIN	+			+	++	+	1	++	+	+			++	++	
GER			+	++			++	1	+	+	+	+	+	+	++
IRL	+++			++	+	+	+	+	1	+		+	++		+
ITA	+	+	+	++	+		+	+	+	1	+	++	+	+	++
LAT			+	+	+			+		+	1	+		+	+
LIT	+			++	+			+	+	++	+	1			+
N LevI	++			+	+	++	++	+	++	+			1	+	+
N LevII				+	+	+	++	+		+	+		+	1	+
N For. Office	+		+	++				++	+	++	+	+	+	+	1

99_5505

>=	0.5	+
>=	0.7	++
>=	0.9	+++

correlation comparison

	BEL	CH	CZ	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N LevI	N LevII	N For. O
BEL	1			+	+		+	+	++		++	+	++		+
CH		1	+	+		+								+	+
CZ		+	1	+					+	+	+			+	+
DEN	+	+	+	1	+			++	+	+	+	+		+	+
EST 1/3	+			+	1			+			+	+			
Est entire		+				1								+	
FIN	+						1	+	+		+	+	++	++	+
GER	+			++	+		+	1	+	+	++	++			
IRL	++		+	+			+	+	1	+	++	++	+		+
ITA			+	+				+	+	1	+	++			
LAT	++		+	+	+		+	++	++	+	1	++		+	+
LIT	+			+	+		+	++	++	++	++	1			+
N LevI	++						++		+				1		
N LevII		+	+	+		+	++				+			1	+
N For. Office	+	+	+	+			+		+		+	+		+	1

Annex 11: Norway 2002, *Pinus sylvestris*: Percent of trees with agreeing assessment values

99_5501				>=	30	+++									
				>=	20	++									
				>=	10	+									
	agreement comparison				other	-									
	BEL	CH	CZH	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N Levl	N LevlI	N For. O
BEL		+							+++						
CH			++	++	+	++	+	++		+++	+	+	+	++	
CZH	+	++		+	+	++		++		+++		+		+	
DEN		++	+		++	+	+	++		++	+	+++	+++	++	+
EST 1/3		+	+	++			++	+		++	++	++	++	++	++
Est entire		++	++	+				++		++	+	+	+		
FIN		+		+	++			+		++	++	++	+++	+++	++
GER		++	++	++	+	++	+			++	++	+++	++	++	+
IRL	+++														
ITA		+++	+++	++	++	++	++	++			+	+	+	+	
LAT		+		+	++	+	++	++		+		++	+++	++	+++
LIT		+	+	+++	++	+	++	+++		+	++		+++	++	+
N Levl		+		+++	++	+	+++	++		+	+++	+++		+++	++
N LevlI		++	+	++	++		+++	++		+	++	++	+++		++
N For. Office				+	++		++	+			+++	+	++	++	

99_5502				>=	30	+++									
				>=	20	++									
				>=	10	+									
	agreement comparison				other										
	BEL	CH	CZH	DEN	EST 1/3	EST enti	FIN	GER	IRL	ITA	LAT	LIT	N Levl	N LevlI	N For. O
BEL		+	+			+		++	+++	+	+			+	-
CH	+		+++			+++	+	+	+	++	+	+++	+	+++	-
CZH	+	+++				+++		+	+	+		+	++	++	-
DEN					+++						++	+	+	+	+++
EST 1/3				+++			++	+			+	++	+	+	+++
EST entire	+	+++	+++				+	+++		+	++	++	+	++	-
FIN		+			++	+				+	++	++	+++	+	+++
GER	++	+	+		+	+++			+	+	+++	+			++
IRL	+++	+	+					+		+				+	-
ITA	+	++	+			+	+	+	+		+	+	+++	+++	-
LAT	+	+		++	+	++	++	+++		+		+	++	+	+++
LIT		+++	+	+	++	++	++	+		+	+		+	++	++
N Levl		+	++	+	+	+	+++			+++	++	+		+++	+
N LevlI	+	+++	++	+	+	++	+		+	+++	+	++	+++		++
N For. Office				+++	+++		+++	++			+++	++	+	++	

99_5505				>=	30	+++									
				>=	20	++									
				>=	10	+									
	agreement comparison				other										
	BEL	CH	CZ	DEN	EST 1/3	Est enti	FIN	GER	IRL	ITA	LAT	LIT	N Levl	N LevlI	N For. O
BEL		+	++	+	++		+++	+++		+	+++	+++	+++	+++	+++
CH	+		+++			++		++	+	+		+			+
CZ	++	+++		+	+	++	+	+		++	+	++	++	++	++
DEN	+		+		++		++	++			+++	+	++	++	+
EST 1/3	++		+	++			+++	++		+	+++	+++	+++	+++	+
Est entire		++	++						++	++	+	+	+	+	+
FIN	+++		+	++	+++			+			+++	+++	+++	+++	+++
GER	+++	++	+	++	++		+			+	++	+++	++	+	++
IRL		+				++				+					
ITA	+	+	++		+	++		+	+			+	+	+	+
LAT	+++		+	+++	+++	+	+++	++				++	+++	+++	+++
LIT	+++	+	++	+	+++	+	+++	+++		+	++		+++	+++	+++
N Levl	+++		++	++	+++	+	+++	++		+	+++	+++		+++	+++
N LevlI	+++		++	++	+++	+	+++	+		+	+++	+++	+++		+++
N For. Office	+++	+	++	+	+	+	+++	++		+	+++	+++	+++	+++	

Annex 12: Experience report of hosting country on ICC 2002 on *Quercus ilex* and *Pinus pinaster* (Spain)

INTERNATIONAL CROSS – CALIBRATION COURSE ON CROWN CONDITION ASSESSMENT
Quercus ilex* & *Pinus pinaster
Spain 10th to 13th September 2002

PREVIOUS LIMITATIONS

Although we tried to adapt as much as possible to the draft guidelines of new concept of ICC Courses we found some limitations when trying to adapt theory to practice:

- In the case of Spain the National Calibration (CC) previous to summer field works did not take place in the same plots as the ICC did. Therefore, both results can not be compared. In this sense we just can provide the scores given by the National Field Teams (not NRT) during their assessment of the 6 real level plots assessed during ICC.
- It was really difficult to find suitable plots easily accessible, near one from each other, etc in order to minimise time (just 2,5 - 3 days, for 6 plots) and transportation costs. Even more difficult was to achieve that these plots represented different site qualities and stand conditions, different ages classes, defoliation levels or whatever other factors influencing defoliation assessments (given that the geographical area covered by the route can not be too large).
- Participants are given a personal individual code, and they are supposed to be the national reference team leaders (NRTs), but will they be the same each time?.
- The date was also an important limitation, as in Spain the summer field works last until 15th of September so it was a bit difficult that NRTs are willing to stop the works for a week time to attend the course.

DESIGN AND PREPARATION OF THE COURSE

- In total 6 real Level I plots were selected, 3 per species (3 for *Quercus ilex* and 3 for *Pinus pinaster*)
- Each Level I plot in Spain has 24 trees
- We tried to cover different defoliation levels, site qualities, etc.
- Just 2 – 3 participants per country (National Reference Team Leaders) were asked to be selected by NFCs, in order to accelerate the working process and make transportation easier.
- The course was designed as a route, travelling from plot to plot. That was the only way to make it possible to assess 6 plots in maximum 3 days.
- Transportation from plot to plot was made by means of a small bus, but with the help of several all terrain vehicles in some cases.
- Scoring of the trees was intended to be individual and according to the different national methods.
- General material given to participants:

The programme of the course, a document containing information about Level I design in Spain, a model of EC form (blank), list with the codes of T – damages, a document about *Pinus pinaster*, a document about *Quercus ilex*, a document about “seca”, 1 sheet with pictures from the Mediterranean photo guide for *Quercus ilex* and for *Pinus pinaster* crown assessment and route maps.

• Material given to participants per plot:
A document containing information about the stand where plot is located, a map with the access to the plot, map with tree location within the plot, blank form to be completed, 2 blank EC forms, and the form for the reference tree (including a colour picture). This form for reference was not intended to be used as a help in the assessments.
• 2 to 3 plots assessed per day: the same routine and working plan as the field teams.
• There was no time planned for discussing and or analysing the results in the field.

SOME EXPERIENCES DURING THE COURSE

• Our general impression about the development of the cross calibration was quite satisfactory.
• Suitable real Level I plots were found, relatively easy accessible (bus + land cruisers). It is also possible to repeat the assessments in the future in the same plots, where sample trees are permanently documented and marked.
• Stand conditions were documented.
• The planned schedule was satisfactorily accomplished.
Unavoidably, much time was spent in transportation.
• Participation: there were participants from 7 countries: France, Italy, Greece, Portugal, Cyprus, Croatia and Spain.
• At last there were some discussions in the field (although they were not foreseen) but they were all about the different concepts of assessable crown, trees to be selected or not to be part of the sample, and not about results. Important differences among countries were detected.
• Participants expressed their liking the possibility of discussing forest health items in the field.
• Photo exercises: all participants scored the photos of some of the trees of each plot previously to the arrival at the plot. However, several participants expressed their disagreement with these kind of exercises.

DATA PREPARATION AND SUBMISSION

• Each participant and each plot received an individual identification code following the guidelines in the draft
• Data were introduced in Excel files following the instructions of the draft (1 book per country with different sheets for each of the 6 plots)
• All data and documents of the course, as well as the photos and their scores, were submitted to participants in a CD – ROM, where the information is structured in 6 different folders
• We like the proposed structure and format of data files (very graphic and user friendly)

PHOTO EXERCISES

• There was a repetition of the photo exercise carried out last year during the ICC for Mediterranean countries in Vila Real (Portugal)

- There was a photo exercise for each plot: participants were given some photos of some of the trees, which had to score before getting to the plot. There is a folder in the CD with the data obtained about these photos
- As said before, some of the participants, specially the French delegation, expressed their disagreement with these photo exercises and with the new method in general: some of them wrote it in the forms and some others expressed it just orally. In general people think that with a picture:

- it is very difficult just to have an idea of the actual stand conditions even if they are documented
- it is not possible to see the whole assessable crown
- in some stand conditions and with some species (very dense stand, etc), it is not possible to take good quality photos

Annex 13: Spain 2002: List of participants

COUNTRY	NAME	ID. CODE
CROATIA	Nenad Potocic	57 POTOC
	Ivan Seletcovic	57 SELET
	Jadranka Rosa	57 ROSAJ
PORTUGAL	Maria Barros	10 BARRO
	José Manuel Ramalho	10 RAMAL
SPAIN	Gerardo Sánchez	11 SANCH
	Belén Torres	11 TORRE
	Paloma García	11 GARCI
CYPRUS	Aristarchou Aristarchos	99 ARIST
	Andreas Christou	99 CHRIS
FRANCE	Daniel Reboul	01 REBOU
	Thierry Aumonier	01 AUMON
GREECE	Mina Skouteri	09 SKOUT
	Athanasios Bourletsikas	09 BOURL
ITALY	Enrico Pompei	05 POMPE
	Davide Bettini	05 BETTI
	Enrico Cenni	05 CENNI
PCC-ICP FOREST	Martin Lorenz	PC LOREN

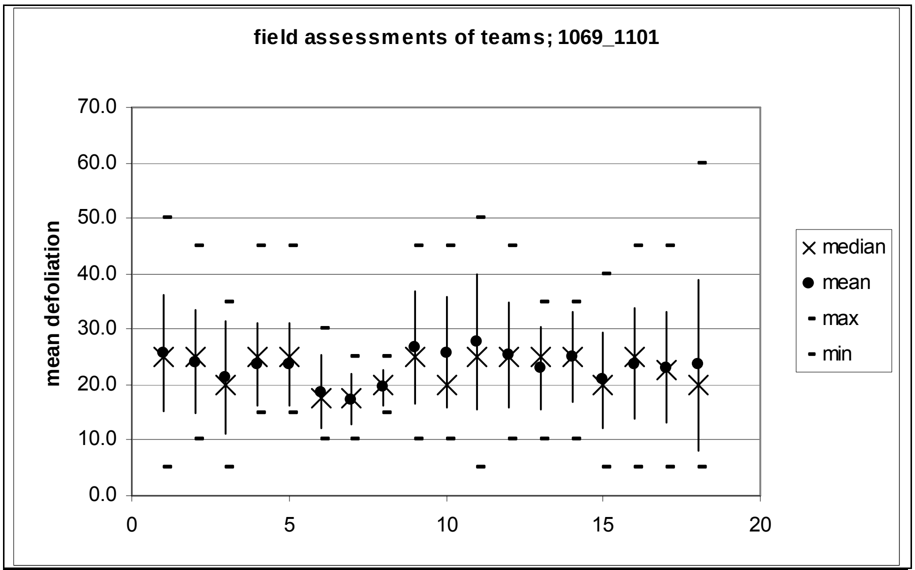
Annex 14: Spain 2002, *Quercus ilex*: Assessment values and simple statistics

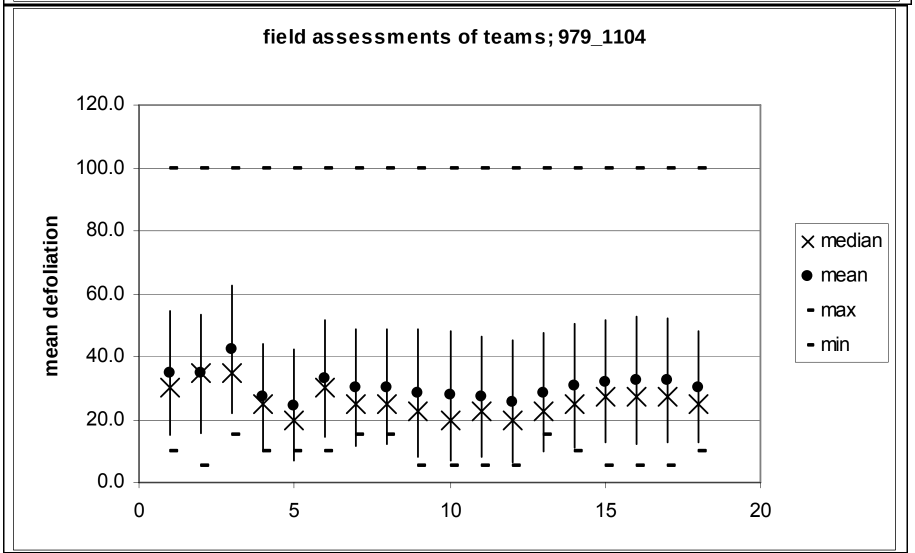
1069_1101_defoliation																		
Tree No	57_P	57_S	57_R	10_B	10_R	11_S	11_T	11_G	99_	99_	01_R	01_A	09_S	09_B	05_P	05_B	05_C	PCC_
1	25	25	15	15	15	25	15	20	25	20	20	25	20	20	25	25	25	20
2	20	20	15	20	20	15	15	20	25	20	20	15	15	15	25	30	30	20
3	35	35	35	25	25	20	20	25	35	35	40	30	30	30	30	35	35	35
4	40	35	30	25	25	20	20	20	35	35	45	40	20	25	30	35	35	50
5	40	40	35	30	30	20	20	20	35	35	45	40	25	25	30	35	35	40
6	30	25	35	25	25	25	15	20	40	40	35	25	30	30	25	25	25	25
7	15	15	10	15	15	10	10	20	15	15	15	15	15	15	10	10	10	15
8	10	10	5	15	15	10	10	15	10	15	5	10	10	10	5	5	5	5
9	20	15	15	25	25	15	15	20	20	20	20	15	30	30	15	20	20	10
10	35	30	35	25	25	15	25	25	40	40	30	25	25	25	15	20	20	25
11	35	30	25	20	20	30	20	20	20	20	30	30	25	35	25	30	25	20
12	5	10	5	15	15	15	10	15	15	10	15	15	10	15	10	5	5	5
13	50	45	15	30	30	30	25	25	45	45	50	40	30	35	40	40	40	60
14	35	30	25	45	45	30	25	25	35	35	50	45	35	30	35	45	45	50
15	25	25	20	30	30	20	20	20	25	20	20	20	30	35	20	20	20	40
16	25	25	25	20	20	15	20	20	40	35	25	25	30	35	15	20	20	30
17	15	15	15	30	30	15	15	20	15	15	15	15	10	10	10	15	15	10
18	30	30	35	20	20	20	20	15	35	35	30	30	30	25	25	25	25	15
19	30	30	25	25	25	20	20	20	35	30	45	40	25	30	25	25	25	35
20	20	20	15	15	15	15	15	15	20	20	15	20	25	25	20	20	20	5
21	15	15	35	30	30	10	15	20	15	15	25	25	15	15	15	15	15	10
22	25	25	20	35	35	30	20	20	25	30	25	20	30	35	20	30	25	15
23	20	20	15	20	20	15	15	15	20	20	25	25	20	30	15	25	20	15
24	15	10	5	15	15	10	10	15	15	15	20	20	15	20	15	15	15	10
n	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
median	25.0	25.0	20.0	25.0	25.0	17.5	17.5	20.0	25.0	20.0	25.0	25.0	25.0	25.0	20.0	25.0	22.5	20.0
mean	**25.6**	**24.2**	**21.3**	**23.8**	**23.8**	**18.8**	**17.3**	**19.6**	**26.7**	**25.8**	**27.7**	**25.4**	**22.9**	**25.0**	**20.8**	**23.8**	**23.1**	**23.5**
std	10.5	9.3	10.1	7.4	7.4	6.5	4.6	3.2	10.1	10.0	12.2	9.6	7.5	8.0	8.5	10.0	9.9	15.4
min	5.0	10.0	5.0	15.0	15.0	10.0	10.0	15.0	10.0	10.0	5.0	10.0	10.0	10.0	5.0	5.0	5.0	5.0
max	50.0	45.0	35.0	45.0	45.0	30.0	25.0	25.0	45.0	45.0	50.0	45.0	35.0	35.0	40.0	45.0	45.0	60.0

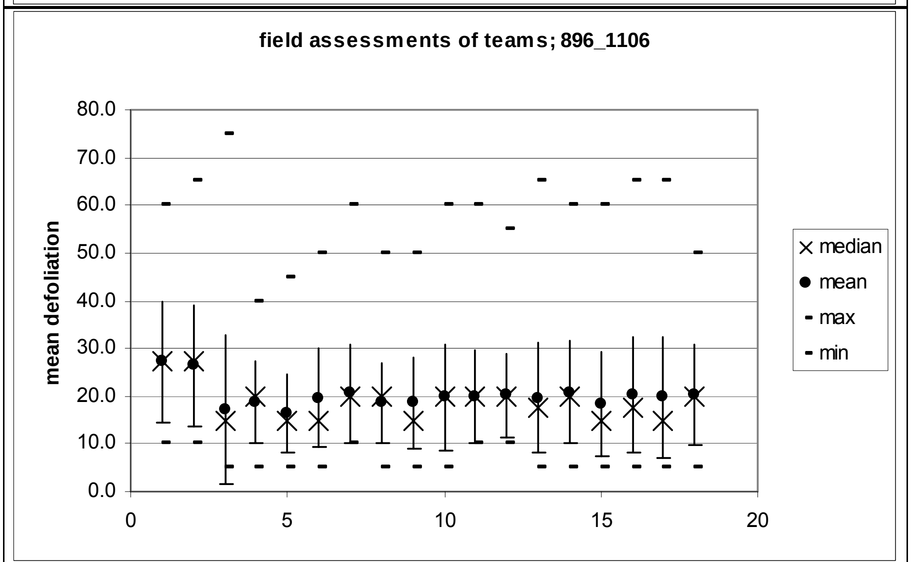
979_1104_defoliation																		
Tree No	57_P	57_S	57_R	10_B	10_R	11_S	11_T	11_G	99__	99__	01_R	01_A	09_S	09_B	05_P	05_B	05_C	PCC_
1	35	30	35	30	30	25	25	25	20	15	25	20	25	30	35	30	35	20
2	55	45	50	35	35	40	40	40	45	40	35	35	35	45	50	55	50	45
3	30	30	25	15	20	35	25	25	25	20	20	15	20	20	25	25	25	20
4	60	60	70	45	40	55	60	60	60	65	65	60	60	60	60	65	65	50
5	25	25	35	20	15	30	25	25	25	20	25	20	20	25	30	35	35	25
6	15	40	25	10	10	10	15	15	5	5	5	5	15	15	10	10	10	10
7	20	20	15	15	15	15	15	15	5	10	15	15	15	10	5	5	5	15
8	25	25	35	20	15	30	20	20	20	20	20	20	15	20	20	20	20	25
9	15	15	35	20	15	15	15	15	10	10	15	15	15	15	15	15	15	25
10	50	40	50	30	25	40	45	40	40	45	35	40	40	55	50	50	50	35
11	20	20	35	20	20	25	20	20	15	15	20	20	15	20	20	20	20	20
12	40	35	40	25	20	30	25	25	20	20	15	15	25	25	30	30	30	30
13	60	60	80	35	35	40	45	50	45	40	40	40	30	30	45	45	45	45
14	10	5	15	15	10	15	15	15	15	15	10	10	15	10	15	15	15	15
15	30	35	75	25	25	25	35	30	40	35	30	25	45	50	40	40	40	35
16	35	35	45	20	20	30	20	20	25	20	20	20	25	30	20	20	25	25
17	25	20	50	20	20	25	20	20	20	20	25	25	25	25	25	25	25	25
18	15	20	45	15	10	20	15	20	5	10	10	10	15	15	15	15	15	15
19	30	35	35	25	25	30	30	30	25	20	25	25	20	25	35	30	35	40
20	15	15	25	25	15	35	20	20	20	20	20	15	20	20	25	20	20	25
21	45	45	35	35	30	65	30	35	35	35	30	25	45	45	35	35	35	30
22	40	40	35	25	20	25	35	35	40	45	30	25	25	30	40	45	40	30
23	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
24	35	35	25	25	15	35	25	30	20	20	20	15	20	15	25	25	25	20
n	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
median	30.0	35.0	35.0	25.0	20.0	30.0	25.0	25.0	22.5	20.0	22.5	20.0	22.5	25.0	27.5	27.5	27.5	25.0
mean	**34.6**	**34.6**	**42.3**	**27.1**	**24.4**	**33.1**	**30.0**	**30.4**	**28.3**	**27.7**	**27.3**	**25.6**	**28.5**	**30.6**	**32.1**	**32.3**	**32.5**	**30.2**
std	19.7	18.9	20.3	17.1	17.7	18.5	18.4	18.3	20.3	20.5	19.3	19.3	18.8	19.9	19.5	20.2	19.8	17.7
min	10.0	5.0	15.0	10.0	10.0	10.0	15.0	15.0	5.0	5.0	5.0	5.0	15.0	10.0	5.0	5.0	5.0	10.0
max	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

896_1106_defoliation																		
Tree No	57_P	57_S	57_R	10_B	10_R	11_S	11_T	11_G	99__	99__	01_R	01_A	09_S	09_B	05_P	05_B	05_C	PCC_
1	25	25	15	15	15	15	20	15	15	15	20	15	15	15	15	20	15	20
2	30	30	10	20	15	15	20	15	25	25	25	20	15	20	25	25	25	25
3	15	15	15	5	5	15	15	15	10	10	10	10	15	20	10	10	10	15
4	35	35	15	20	20	30	30	20	25	30	20	20	30	30	25	30	30	20
5	30	30	15	20	15	30	30	20	15	20	15	15	25	25	20	25	25	25
6	45	35	10	10	10	10	20	20	10	15	15	15	25	20	15	15	15	20
7	15	15	5	10	10	15	15	10	10	10	10	10	10	15	10	10	10	10
8	10	10	5	5	5	5	10	10	10	10	15	15	10	10	15	10	5	15
9	60	65	75	40	45	50	60	50	50	60	60	55	65	60	60	65	65	50
10	15	15	10	20	15	25	20	15	15	15	15	20	20	20	10	15	15	15
11	50	45	35	20	20	35	30	20	20	25	20	25	20	20	20	20	25	25
12	25	25	5	20	20	30	20	15	15	20	20	20	20	25	15	15	15	20
13	30	30	5	20	20	10	10	15	10	10	20	20	15	15	10	10	10	5
14	35	35	15	25	15	20	20	20	20	20	20	20	20	25	20	25	25	20
15	15	10	15	20	15	15	15	20	15	15	15	15	15	15	15	15	15	10
16	20	20	15	25	15	20	20	20	25	20	25	25	15	15	20	20	20	15
17	35	30	15	25	20	10	15	20	20	20	25	25	20	25	15	15	15	30
18	25	25	35	25	20	15	15	20	20	20	20	20	15	20	20	25	25	25
19	30	35	35	30	25	25	30	25	35	35	25	25	30	35	30	30	30	30
20	10	10	5	5	5	5	10	5	5	5	10	15	5	5	5	5	5	5
21	10	10	5	5	5	10	10	10	10	10	10	10	5	5	5	5	5	10
22	20	20	5	20	15	15	15	15	15	15	15	20	15	15	10	15	10	10
23	35	30	35	25	20	30	25	30	30	30	25	25	25	25	30	35	35	40
24	35	35	15	20	20	20	20	20	20	20	25	25	20	20	20	25	25	30
n	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
median	27.5	27.5	15.0	20.0	15.0	15.0	20.0	20.0	15.0	20.0	20.0	20.0	17.5	20.0	15.0	17.5	15.0	20.0
mean	**27.3**	**26.5**	**17.3**	**18.8**	**16.3**	**19.6**	**20.6**	**18.5**	**18.5**	**19.8**	**20.0**	**20.2**	**19.6**	**20.8**	**18.3**	**20.2**	**19.8**	**20.4**
std	12.7	12.6	15.6	8.4	8.2	10.4	10.3	8.4	9.6	11.0	9.8	8.7	11.4	10.7	11.0	12.2	12.6	10.5
min	10.0	10.0	5.0	5.0	5.0	5.0	10.0	5.0	5.0	5.0	10.0	10.0	5.0	5.0	5.0	5.0	5.0	5.0
max	60.0	65.0	75.0	40.0	45.0	50.0	60.0	50.0	50.0	60.0	60.0	55.0	65.0	60.0	60.0	65.0	65.0	50.0

Annex 15: Spain 2002, *Quercus ilex*: Distribution of team assessments







57 POTOC	57 SELET	57 ROSAJ	10 BARRO	10 RAMAL	11 SANCH	11 TORRE	11 GARCI	99 ARIST
1	2	3	4	5	6	7	8	9

99 CHRIS	01 REBOU	01 AUMON	09 SKOUT	09 BOURL	05 POMPE	05 BETTI	05 CENNI	PC LOREN
10	11	12	13	14	15	16	17	18

Annex 16: Spain 2002: *Quercus ilex*: Differences to median

	1069_1101				difference to median more than														
						value	-10	-5	other	5	10								
		field - median				symbo	<<	<		>	>>								
Median		57_PO	57_SE	57_RO	10_BA	10_RA	11_SA	11_TO	11_GA	99__AF	99__CI	01_RE	01_AU	09_SK	09_BO	05_PO	05_BE	05_CE	PCC_L
20	1																		
20	2																>	>	
32.5	3				<	<	<<	<<	<			>							
32.5	4	>			<	<	<<	<<	<<			>>	>	<<	<				>>
35	5						<<	<<	<<			>		<	<				
25	6			>				<		>>	>>	>							
15	7																		
10	8																		
20	9													>	>				<
25	10	>		>			<			>>	>>					<			
25	11	>													>				
10	12																		
40	13	>		<<	<	<	<	<<	<<			>		<					>>
35	14			<	>	>		<	<			>>	>				>	>	>>
20	15				>	>								>	>>				>>
25	16						<			>>	>				>	<			
15	17				>>	>>													
25	18			>					<	>	>								<
25	19									>		>>	>>						>
20	20																		<<
15	21			>>	>>	>>						>	>						
25	22				>	>									>				<
20	23														>				
15	24			<															

	979_1104				difference to median more than														
						value	-10	-5	other	5	10								
		field - median				symbo	<<	<		>	>>								
Median		57_PO	57_SE	57_RO	10_BA	10_RA	11_SA	11_TO	11_GA	99__AF	99__CI	01_RE	01_AU	09_SK	09_BO	05_PO	05_BE	05_CE	PCC_L
27.5	1	>		>						<	<<		<			>		>	<
42.5	2	>>		>	<	<						<	<	<		>	>>	>	
25	3				<		>						<						
60	4			>	<<	<<													<
25	5			>		<											>	>	
10	6		>>	>>															
15	7									<						<	<	<	
20	8			>>			>												
15	9			>>															>
40	10	>		>	<	<<									>>	>	>	>	
20	11			>>															
25	12	>>	>	>>								<	<						
45	13	>>	>>	>>	<	<								<<	<<				
15	14		<																
35	15			>>	<	<	<						<	>	>>				
22.5	16	>>	>>	>>			>								>				
25	17			>>															
15	18			>>						<									
30	19										<			<					>
20	20						>>												
35	21	>	>				>>						<	>	>				
35	22				<	<<	<				>		<	<			>		
100	23																		
25	24	>	>			<	>						<		<				

	896_1106				difference to median more than														
						value	-10	-5	other	5	10								
		field - median				symbo	<<	<		>	>>								
Median		57_PO	57_SE	57_RO	10_BA	10_RA	11_SA	11_TO	11_GA	99__AF	99__CI	01_RE	01_AU	09_SK	09_BO	05_PO	05_BE	05_CE	PCC_L
15	1	>	>																
22.5	2	>	>	<<		<	<		<					<					
12.5	3				<	<									>				
27.5	4	>	>	<<	<	<			<			<	<						<
22.5	5	>	>	<		<	>	>		<		<	<						
15	6	>>	>>											>					
10	7																		
10	8																		
60	9			>>	<<	<<	<		<	<									<
15	10						>												
22.5	11	>>	>>	>>			>>	>											
20	12			<<			>												
12.5	13	>>	>>	<	>	>						>	>						<
20	14	>>	>>																
15	15																		
20	16																		
20	17	>>	>				<												>
20	18			>>															
30	19																		
5	20												>						
10	21																		
15	22			<															
30	23					<													>
20	24	>>	>>																>

Annex 17: Spain 2002, *Quercus ilex*: Simple correlation coefficient (Pearson)

1069_1101					>=	0.5	+											
					>=	0.7	++											
correlation comparison					>=	0.9	+++											
	57_PO	57_SEL	57_RO	10_BA	10_RA	11_SA	11_TO	11_GA	99__AF	99__CH	01_RE	01_AU	09_SK	09_BO	05_PO	05_BE	05_CE	PCC_L
57_POTO	1	+++	+			+	++	+	++	++	++	++	+	+	++	++	++	++
57_SELET	+++	1	+			+	++	+	++	++	++	++	+	+	++	++	++	++
57_ROSA	+	+	1				+		+	+	+	+	+				+	
10_BARR				1	1	+	+	+			+	+	+			+	+	+
10_RAMA				1	1	+	+	+			+	+	+			+	+	+
11_SANC	+	+		+	+	1	+		+	+	+	+	+	+	++	++	++	+
11_TORR	++	++	+	+	+	+	1	++	++	++	++	++	++	+	++	++	++	++
11_GARC	+	+		+	+		++	1	+	+	+				+	+	+	+
99__ARIS	++	++	+			+	++	+	1	+++	++	++	++	+	++	+	++	++
99__CHRI	++	++	+			+	++	+	+++	1	++	++	++	+	++	++	++	++
01_REBO	++	++	+	+	+	+	++	+	++	++	1	+++	+	+	++	++	++	++
01_AUMO	++	++	+	+	+	+	++		++	++	+++	1	+	+	++	++	++	++
09_SKOU	+	+	+	+	+	+	++		++	++	+	+	1	++	+	+	+	+
09_BOUR	+	+				+	+		+	+	+	+	++	1	+	+	+	+
05_POMP	++	++				++	++	+	++	++	++	++	+	+	1	+++	+++	++
05_BETTI	++	++		+	+	++	++	+	+	++	++	++	+	+	+++	1	+++	++
05_CENNI	++	++	+	+	+	++	++	+	++	++	++	++	+	+	+++	+++	1	++
PCC_LOR	++	++		+	+	+	++	+	++	++	++	++	+	+	++	++	++	1

979_1104					>=	0.5	+											
					>=	0.7	++											
correlation comparison					>=	0.9	+++											
	57_PO	57_SEL	57_RO	10_BA	10_RA	11_SA	11_TO	11_GA	99__AF	99__CH	01_RE	01_AU	09_SK	09_BO	05_PO	05_BE	05_CE	PCC_L
57_POTO	1	+++	++	+++	+++	++	+++	+++	+++	+++	+++	+++	++	++	+++	+++	+++	+++
57_SELET	+++	1	++	++	++	++	+++	+++	++	++	++	++	++	++	++	++	++	++
57_ROSA	++	++	1	++	++	+	++	++	++	++	++	++	++	++	++	++	++	++
10_BARR	+++	++	++	1	+++	+++	+++	+++	+++	+++	+++	+++	+++	++	+++	+++	+++	+++
10_RAMA	+++	++	++	+++	1	++	+++	+++	+++	++	+++	+++	+++	++	+++	++	+++	+++
11_SANC	++	++	+	+++	++	1	++	++	++	++	++	++	++	++	++	++	++	++
11_TORR	+++	+++	++	+++	+++	++	1	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
11_GARC	+++	+++	++	+++	+++	++	+++	1	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
99__ARIS	+++	++	++	+++	+++	++	+++	+++	1	+++	+++	+++	+++	+++	+++	+++	+++	+++
99__CHRI	+++	++	++	+++	++	++	+++	+++	+++	1	+++	+++	+++	+++	+++	+++	+++	+++
01_REBO	+++	++	++	+++	+++	++	+++	+++	+++	+++	1	+++	+++	+++	+++	+++	+++	+++
01_AUMO	+++	++	++	+++	+++	++	+++	+++	+++	+++	+++	1	+++	+++	+++	+++	+++	+++
09_SKOU	++	++	++	+++	+++	++	+++	+++	+++	+++	+++	+++	1	+++	+++	+++	+++	+++
09_BOUR	++	++	++	++	++	++	+++	+++	+++	+++	+++	+++	+++	1	+++	+++	+++	+++
05_POMP	+++	++	++	+++	+++	++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++	+++	+++
05_BETTI	+++	++	++	+++	++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++	+++
05_CENNI	+++	++	++	+++	+++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++
PCC_LOR	+++	++	++	+++	+++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1

896_1106					>=	0.5	+											
					>=	0.7	++											
correlation comparison					>=	0.9	+++											
	57_PO	57_SEL	57_RO	10_BA	10_RA	11_SA	11_TO	11_GA	99__AF	99__CH	01_RE	01_AU	09_SK	09_BO	05_PO	05_BE	05_CE	PCC_L
57_POTO	1	+++	+	+	++	+	++	++	+	++	++	++	++	++	++	++	++	++
57_SELET	+++	1	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
57_ROSA	+	++	1	++	++	++	++	+++	++	++	++	++	++	++	++	++	++	++
10_BARR	+	++	++	1	+++	+	++	++	++	++	++	++	++	++	++	++	++	+
10_RAMA	++	++	++	+++	1	++	++	++	++	+++	+++	+++	++	++	++	++	++	++
11_SANC	+	++	++	+	++	1	+++	++	++	++	+	++	++	++	++	++	++	+
11_TORR	++	++	++	++	++	+++	1	++	++	+++	++	++	+++	+++	+++	+++	+++	++
11_GARC	++	++	+++	++	++	++	++	1	++	+++	++	++	+++	+++	+++	+++	+++	++
99__ARIS	+	++	++	++	++	++	++	++	1	+++	++	++	++	++	+++	+++	+++	++
99__CHRI	++	++	++	++	+++	++	+++	+++	+++	1	+++	++	+++	+++	+++	+++	+++	++
01_REBO	++	++	++	++	+++	+	++	++	++	+++	1	+++	++	++	+++	++	++	++
01_AUMO	++	++	++	++	+++	++	++	++	++	++	+++	1	++	++	++	++	++	++
09_SKOU	++	++	++	++	++	++	+++	+++	++	+++	++	++	1	+++	+++	+++	+++	++
09_BOUR	++	++	++	++	++	++	+++	+++	++	+++	++	++	+++	1	+++	+++	+++	++
05_POMP	++	++	++	++	++	++	+++	+++	+++	+++	+++	++	+++	+++	1	+++	+++	++
05_BETTI	++	++	++	++	++	++	+++	+++	+++	+++	++	++	+++	+++	+++	1	+++	++
05_CENNI	++	++	++	++	++	++	+++	+++	+++	+++	++	++	+++	+++	+++	+++	1	++
PCC_LOR	++	++	++	+	++	+	++	++	++	++	++	++	++	++	++	++	++	1

Annex 18: Spain 2002, *Quercus ilex*: Percent of trees with agreeing assessment values

1069_1101					>=	30	+++											
					>=	20	++											
					>=	10	+											
agreement comparison						other	-											
	57_PO	57_SEL	57_RO	10_BA	10_RA	11_SA	11_TO	11_GA	99__AF	99__CH	01_RE	01_AU	09_SK	09_BO	05_PO	05_BE	05_CE	PCC_L
57_POTO	-	+++	++	+	+	+	+	+	+++	+++	+++	+++	+++	++	++	+++	+++	++
57_SELET	+++	-	+	+	+	+++	++	-	+++	+++	+++	+++	++	++	++	+++	+++	++
57_ROSA	++	+	-	+	+	++	+++	++	+	++	++	++	+	-	+++	+++	+++	+
10_BARR	+	+	+	-	-	++	++	+++	++	++	+	++	++	++	+	++	++	++
10_RAMA	+	+	+	-	-	++	++	+++	++	++	+	++	++	++	+	++	++	++
11_SANC	+	+++	++	++	++	-	+++	++	+	+	++	+++	++	+	+++	++	++	+
11_TORR	+	++	+++	++	++	+++	-	+++	+	++	+	++	++	+	++	++	++	+
11_GARC	+	-	++	+++	+++	++	+++	-	+	++	++	+	+	+	+	+	+	++
99__ARIS	+++	+++	+	++	++	+	+	+	-	+++	++	++	++	+	++	+++	+++	+
99__CHRI	+++	+++	++	++	++	+	++	++	+++	-	++	+	+++	++	++	+++	+++	++
01_REBO	+++	+++	++	+	+	++	+	++	++	++	-	+++	+	+	-	++	++	++
01_AUMO	+++	+++	++	++	++	+++	++	+	++	+	+++	-	++	++	+++	+++	++	+
09_SKOU	+++	++	+	++	++	++	++	+	++	+++	+	++	-	+++	+++	+	++	++
09_BOUR	++	++	-	++	++	+	+	+	+	++	+	++	+++	-	+	-	-	+
05_POMP	++	++	+++	+	+	+++	++	+	++	++	-	+++	+++	+	-	+++	+++	+
05_BETT	+++	+++	+++	++	++	++	++	+	+++	+++	++	+++	+	-	+++	-	+++	+
05_CENN	+++	+++	+++	++	++	++	++	+	+++	+++	++	++	++	-	+++	+++	-	+
PCC_LOR	++	++	+	++	++	+	+	++	+	++	++	+	++	+	+	+	+	-

979_1104					>=	30	+++											
					>=	20	++											
					>=	10	+											
agreement comparison						other	-											
	57_PO	57_SE	57_RO	10_BA	10_RA	11_SA	11_TO	11_GA	99__AF	99__CH	01_RE	01_AU	09_SK	09_BO	05_PO	05_BE	05_CE	PCC_L
57_POTO	-	+++	+	+	++	++	+++	+++	+	-	++	++	++	+++	+++	+++	+++	++
57_SELET	+++	-	-	+	++	++	++	+++	++	+	+	++	++	+++	++	+	++	++
57_ROSA	+	-	-	++	-	+	++	++	+	+	-	-	+	-	+++	++	+++	+
10_BARR	+	+	++	-	+++	++	+++	+++	++	++	++	+++	+++	++	+++	+++	+++	++
10_RAMA	++	++	-	+++	-	++	++	++	+	++	+++	+++	++	+++	++	++	+	++
11_SANC	++	++	+	++	++	-	++	+++	+	+	++	+++	+++	+	++	++	++	++
11_TORR	+++	++	++	+++	++	++	-	+++	+++	+++	+++	++	+++	+++	+++	+++	+++	+++
11_GARC	+++	+++	++	+++	++	+++	+++	-	+++	+++	+++	+++	+++	+++	+++	+++	+++	++
99__ARIS	+	++	+	++	+	+	+++	+++	-	+++	++	++	+++	++	+++	+++	+++	+++
99__CHRI	-	+	+	++	++	+	+++	+++	+++	-	+++	++	+++	++	++	+++	++	++
01_REBO	++	+	-	++	+++	++	+++	+++	++	+++	-	+++	+++	+++	++	+++	++	+++
01_AUMO	++	++	-	+++	+++	+++	++	+++	++	++	+++	-	+++	+++	++	++	++	++
09_SKOU	++	++	+	+++	++	+++	+++	+++	+++	+++	+++	+++	-	+++	++	++	++	+++
09_BOUR	+++	+++	-	++	+++	+	+++	+++	++	++	+++	+++	+++	-	++	+++	++	+++
05_POMP	+++	++	+++	+++	++	++	+++	+++	+++	++	++	++	++	++	-	+++	+++	+++
05_BETT	+++	+	++	+++	++	++	+++	+++	+++	+++	+++	++	++	+++	+++	-	+++	+++
05_CENN	+++	++	+++	+++	+	++	+++	+++	+++	++	++	++	++	++	+++	+++	-	+++
PCC_LOR	++	++	+	++	++	++	+++	++	+++	++	+++	++	+++	+++	+++	+++	+++	-

896_1106					>=	30	+++											
					>=	20	++											
					>=	10	+											
agreement comparison						other	-											
	57_PO	57_SEL	57_RO	10_BA	10_RA	11_SA	11_TO	11_GA	99__AF	99__CH	01_RE	01_AU	09_SK	09_BO	05_PO	05_BE	05_CE	PCC_L
57_POTO	-	+++	+	+	-	++	+++	++	+	++	++	+	+	++	+	++	++	++
57_SELET	+++	-	-	-	-	++	++	++	++	++	+	-	+	+	-	++	+	++
57_ROSA	+	-	-	++	+++	++	+	+	++	+	-	+	++	++	++	++	++	+
10_BARR	+	-	++	-	+++	++	++	+++	++	++	+++	+++	+++	+++	+++	++	+++	++
10_RAMA	-	-	+++	+++	-	+++	+	+++	+++	+++	+++	+++	+++	+++	+++	++	++	++
11_SANC	++	++	++	++	+++	-	+++	+++	+++	+++	++	++	+++	++	+++	++	++	++
11_TORR	+++	++	+	++	+	+++	-	+++	++	+++	+++	++	+++	+++	+++	+++	++	++
11_GARC	++	++	+	+++	+++	+++	+++	-	+++	+++	+++	++	+++	+++	+++	+++	++	+++
99__ARIS	+	++	++	++	+++	+++	++	+++	-	+++	+++	+++	+++	+++	+++	+++	+++	++
99__CHRI	++	++	+	++	+++	+++	+++	+++	+++	-	+++	+++	+++	+++	+++	+++	+++	+++
01_REBO	++	+	-	+++	+++	++	+++	+++	+++	+++	-	+++	++	++	+++	+++	++	+++
01_AUMO	+	-	+	+++	+++	++	++	++	+++	+++	+++	-	++	++	+++	++	++	++
09_SKOU	+	+	++	+++	+++	+++	+++	+++	+++	+++	++	++	-	+++	+++	+++	+++	+++
09_BOUR	++	+	++	+++	+++	++	+++	+++	+++	+++	++	++	+++	-	+++	+++	++	+
05_POMP	+	-	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	-	+++	+++	++
05_BETT	++	++	++	++	++	++	+++	+++	+++	+++	+++	++	+++	+++	+++	-	+++	+++
05_CENN	++	+	++	+++	++	++	++	++	+++	+++	++	++	+++	++	+++	+++	-	+++
PCC_LOR	++	++	+	++	++	++	++	+++	++	+++	+++	++	+++	+	++	+++	+++	-

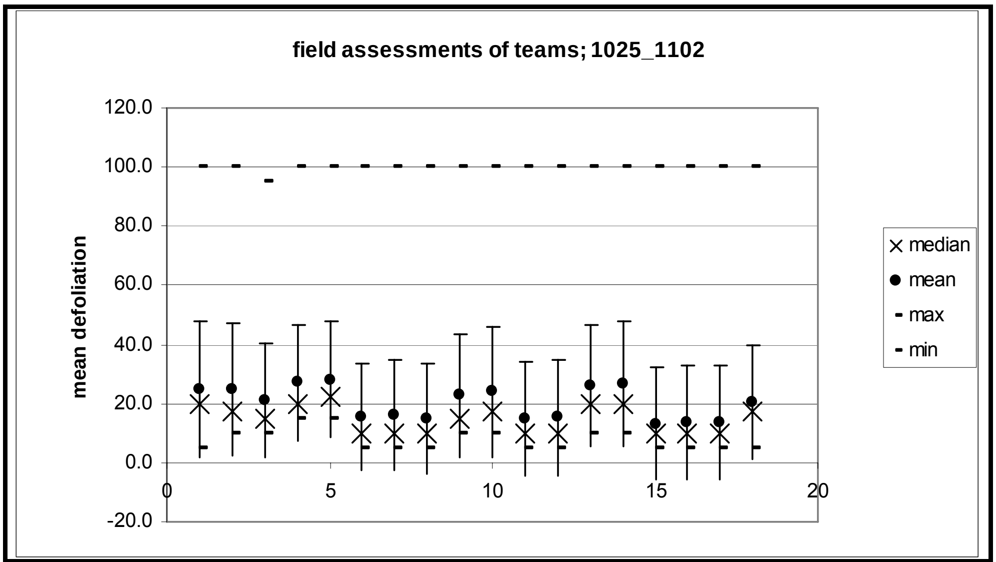
Annex 19: Spain 2002, *Pinus pinaster*: Assessment values and simple statistics

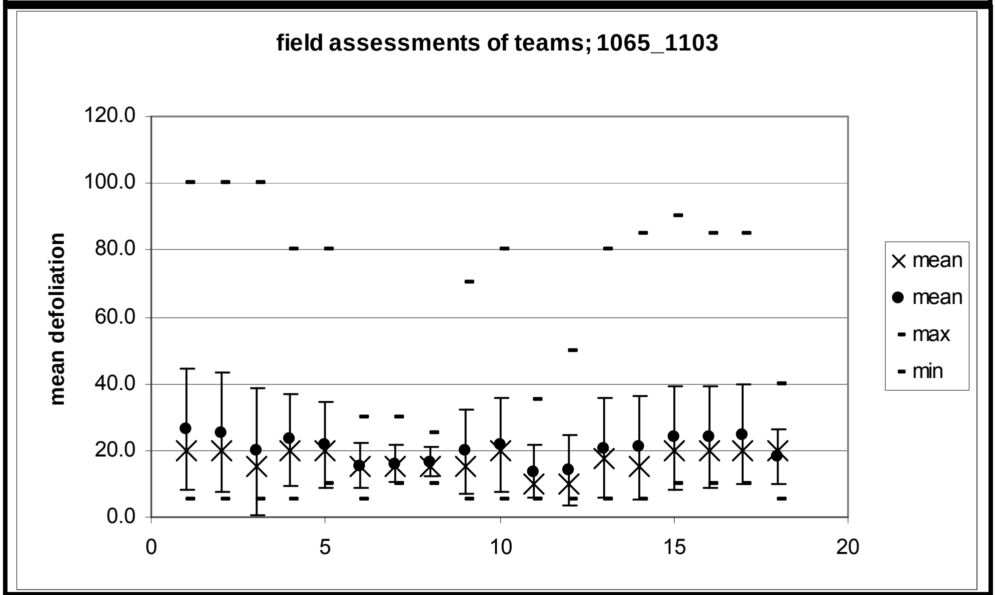
1025_1102_defoliation																		
Tree I	57 PC	57 SE	57 RC	10 BA	10 RA	11 SA	11 TC	11 GA	99 AF	99 CI	01 RE	01 AU	09 SK	09 BC	05 PC	05 BE	05 CE	PC LC
1	15	10	10	15	15	10	10	10	15	15	5	5	15	15	5	5	5	5
2	15	15	15	15	15	10	10	10	15	15	10	10	20	20	5	10	10	10
3	10	10	15	15	20	15	10	15	10	15	5	5	25	25	10	5	5	10
4	95	90	65	75	80	20	40	35	80	90	a	b	75	85	c	d	e	50
5	15	15	10	25	20	5	10	15	10	10	5	5	10	10	10	10	10	10
6	25	25	15	30	30	15	10	10	15	15	10	10	15	20	10	10	10	10
7	20	15	20	20	30	15	10	5	15	20	15	10	15	15	10	10	10	10
8	15	15	10	15	15	10	5	5	15	15	5	5	15	10	5	5	5	5
9	25	25	15	25	25	10	15	10	20	20	10	10	20	25	10	5	5	20
10	15	15	10	15	20	10	10	5	15	15	5	10	15	15	5	5	5	20
11	30	30	25	35	30	15	15	10	25	25	20	25	35	25	10	10	10	30
12	10	10	10	20	15	5	5	10	15	10	5	10	10	15	5	5	5	20
13	10	10	10	20	20	10	10	10	10	15	5	5	15	15	5	5	5	20
14	25	25	10	20	20	10	10	10	15	20	10	15	20	15	10	15	15	5
15	30	35	15	30	35	15	15	10	25	25	20	25	30	35	20	20	25	30
16	20	20	25	15	25	10	10	10	20	25	5	5	15	25	5	5	5	15
17	5	10	10	15	15	15	10	10	10	10	5	5	15	20	5	5	5	5
18	15	15	10	15	20	15	15	10	15	20	20	20	20	20	15	20	20	25
19	5	10	15	20	25	10	10	10	15	15	10	f	15	15	10	5	5	15
20	20	20	25	25	25	10	10	10	15	15	15	15	20	20	10	10	10	15
21	20	20	25	30	30	10	15	15	25	20	15	5	40	30	10	10	10	20
22	30	25	30	25	20	15	20	15	25	25	25	20	35	35	20	20	20	20
23	25	25	10	30	25	10	15	10	20	20	15	15	30	30	10	15	15	20
24	100	100	95	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
n	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	23.0	22.0	24.0	24.0	23.0	23.0	23.0	24.0
mediai	20.0	17.5	15.0	20.0	22.5	10.0	10.0	10.0	15.0	17.5	10.0	10.0	20.0	20.0	10.0	10.0	10.0	17.5
mean	**24.8**	**24.6**	**20.8**	**27.1**	**28.1**	**15.4**	**16.3**	**15.0**	**22.7**	**24.0**	**14.8**	**15.2**	**26.0**	**26.7**	**13.3**	**13.5**	**13.7**	**20.4**
std	23.1	22.4	19.3	19.5	19.7	18.0	18.7	18.6	21.0	21.9	19.1	19.6	20.5	21.1	19.0	19.1	19.2	19.4
min	5.0	10.0	10.0	15.0	15.0	5.0	5.0	5.0	10.0	10.0	5.0	5.0	10.0	10.0	5.0	5.0	5.0	5.0
max	100.0	100.0	95.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

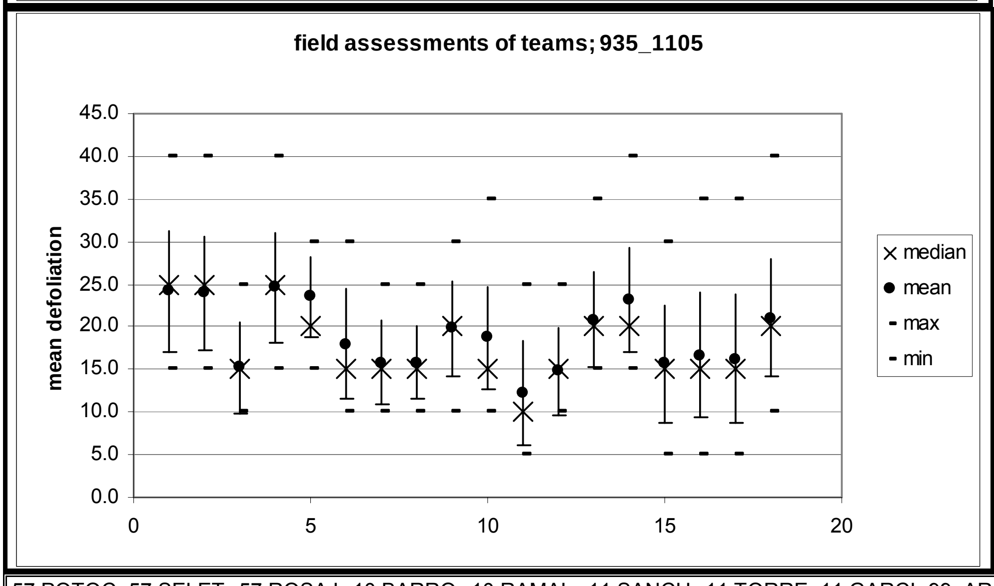
1065_1103_defoliation																		
Tree N	57 P(	57 SE	57 R(	10 B/	10 R/	11 S/	11 T(	11 G/	99 A	99 C	01 RE	01 A	09 SI	09 B(	05 P(	05 BE	05 CE	PC L
1	30	30	15	20	20	20	15	20	25	25	25	30	20	25	30	30	35	30
2	20	20	10	20	15	20	15	20	15	20	10	10	20	20	20	20	20	20
3	a	b	25	20	25	10	20	20	30	30	10	5	40	35	25	25	30	25
4	15	15	15	15	15	5	10	15	10	10	5	5	10	10	10	15	15	10
5	10	10	10	10	15	15	10	15	15	15	10	5	15	15	15	15	15	10
6	15	15	5	10	10	15	10	15	10	10	5	10	5	5	10	10	10	10
7	40	35	15	25	20	10	20	20	25	25	20	20	15	15	30	30	30	25
8	20	20	15	25	25	15	15	20	10	10	10	10	10	10	15	10	15	20
9	20	20	10	30	25	15	25	25	25	30	10	10	20	25	25	25	25	20
10	20	15	15	20	25	10	15	15	15	15	15	15	15	15	30	30	30	30
11	35	30	50	20	20	15	20	20	15	15	10	5	20	15	15	15	15	10
12	100	100	100	80	80	30	30	15	70	80	c	d	80	85	90	85	85	25
13	35	35	25	25	15	20	20	20	30	25	35	50	20	25	30	35	35	20
14	15	20	15	20	15	5	10	10	10	10	5	10	10	10	10	10	10	10
15	35	30	10	20	15	10	10	15	10	15	15	15	15	15	20	20	20	20
16	35	35	25	45	30	30	25	25	30	35	30	30	45	40	30	30	30	40
17	30	25	15	25	20	5	20	20	25	20	25	20	20	20	30	35	35	20
18	5	5	5	5	20	15	15	10	5	5	5	5	10	10	10	10	10	5
19	25	25	15	20	20	15	15	15	15	20	15	15	15	15	30	30	30	20
20	20	20	15	20	20	25	15	15	20	20	10	10	20	20	20	20	20	15
21	30	30	15	20	15	20	15	15	20	20	15	15	20	20	25	25	25	20
22	10	10	15	20	15	15	10	10	15	20	5	5	15	15	15	15	20	10
23	25	25	25	20	20	15	15	15	15	20	15	15	15	20	20	20	20	15
24	15	15	10	20	20	15	10	10	15	20	10	10	20	15	15	15	15	10
n	23.0	23.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	23.0	23.0	24.0	24.0	24.0	24.0	24.0	24.0
median	20.0	20.0	15.0	20.0	20.0	15.0	15.0	15.0	15.0	20.0	10.0	10.0	17.5	15.0	20.0	20.0	20.0	20.0
mean	26	25	19.8	23.1	21.7	15.4	16.0	16.7	19.8	21.5	13.7	14.1	21	21	24	24	25	18.3
std	18.3	17.9	19.0	13.9	13.0	6.6	5.4	4.2	12.6	14.1	8.1	10.4	15.0	15.5	15.6	15.0	14.9	8.1
min	5.0	5.0	5.0	5.0	10.0	5.0	10.0	10.0	5.0	5.0	5.0	5.0	5.0	5.0	10.0	10.0	10.0	5.0
max	100.0	100.0	100.0	80.0	80.0	30.0	30.0	25.0	70.0	80.0	35.0	50.0	80.0	85.0	90.0	85.0	85.0	40.0

935_1105_defoliation																		
Tree No	57 PC	57 SE	57 RC	10 BA	10 RA	11 SA	11 TC	11 GA	99 AI	99 CI	01 RE	01 AL	09 SK	09 BC	05 PC	05 BE	05 CE	PCC L
1	20	20	25	25	25	20	15	15	15	15	15	10	20	20	15	15	15	25
2	15	15	10	25	20	10	10	10	10	10	5	10	25	15	10	10	10	15
3	25	25	15	30	30	30	25	25	30	30	25	25	15	30	30	35	35	40
4	15	15	10	20	20	10	10	15	15	15	5	10	15	20	10	10	10	15
5	15	15	10	20	20	10	10	10	20	20	5	10	25	20	5	10	10	15
6	15	15	15	20	20	15	15	10	25	20	10	10	20	20	5	5	5	15
7	25	30	10	30	30	15	15	15	20	15	15	20	20	25	10	15	15	20
8	40	40	25	40	30	15	20	20	30	35	20	25	35	40	30	30	30	30
9	25	25	15	30	30	25	20	20	25	30	15	20	30	30	25	25	25	30
10	25	25	20	25	30	30	25	25	25	25	20	20	25	30	25	25	25	30
11	20	20	15	15	20	10	10	15	15	15	5	15	20	20	10	10	10	15
12	20	20	10	20	20	15	15	10	15	15	10	10	25	20	10	10	10	20
13	40	35	25	35	30	30	25	20	25	20	20	20	20	25	25	25	25	30
14	20	20	10	15	15	15	10	10	10	15	5	10	15	15	10	10	5	15
15	35	30	20	20	20	15	15	15	20	15	10	20	15	20	15	15	15	20
16	25	25	15	35	25	20	15	20	25	25	20	15	25	25	20	20	20	25
17	20	20	15	25	25	15	10	15	15	20	10	10	15	20	10	10	10	15
18	30	30	15	30	30	15	15	15	20	15	10	15	20	25	15	20	15	20
19	15	15	10	20	20	15	15	15	20	15	5	10	15	15	15	15	15	20
20	25	25	15	15	20	20	15	15	20	15	15	10	15	20	15	15	15	20
21	25	30	10	25	20	15	15	15	15	15	5	10	15	20	15	15	15	15
22	30	25	10	25	25	15	15	15	15	15	15	15	20	20	15	15	15	20
23	25	25	25	20	20	20	15	15	20	15	10	15	20	25	15	15	15	10
24	30	30	15	25	20	30	25	20	25	20	20	20	30	35	20	25	25	25
n	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
median	25.0	25.0	15.0	25.0	20.0	15.0	15.0	15.0	20.0	15.0	10.0	15.0	20.0	20.0	15.0	15.0	15.0	20.0
mean	**24.2**	**24.0**	**15.2**	**24.6**	**23.5**	**17.9**	**15.8**	**15.8**	**19.8**	**18.8**	**12.3**	**14.8**	**20.8**	**23.1**	**15.6**	**16.7**	**16.3**	**21.0**
std	7.2	6.6	5.3	6.4	4.7	6.4	4.9	4.2	5.5	6.0	6.1	5.1	5.5	6.1	7.0	7.3	7.5	6.9
min	15.0	15.0	10.0	15.0	15.0	10.0	10.0	10.0	10.0	10.0	5.0	10.0	15.0	15.0	5.0	5.0	5.0	10.0
max	40.0	40.0	25.0	40.0	30.0	30.0	25.0	25.0	30.0	35.0	25.0	25.0	35.0	40.0	30.0	35.0	35.0	40.0

Annex 20: Spain 2002, *Pinus pinaster*: Distribution of team assessments







57 POTOC	57 SELET	57 ROSAJ	10 BARRO	10 RAMAL	11 SANCH	11 TORRE	11 GARCI	99 ARIST
1	2	3	4	5	6	7	8	9

99 CHRIS	01 REBOU	01 AUMON	09 SKOUT	09 BOURL	05 POMPE	05 BETTI	05 CENNI	PC LOREN
10	11	12	13	14	15	16	17	18

Annex 21: Spain 2002, *Pinus pinaster*: Differences to median

	1025_1102				difference to median more than														
						value	-10	-5	other	5	10								
		field - median				symbo	<<	<		>	>>								
Median		57 PO	57 SEL	57 RO	10 BAF	10 RA	11 SA	11 TO	11 GA	99 ARI	99 CHI	01 REB	01 AU	09 SK	09 BOL	05 PO	05 BET	05 CEN	PC LO
10	1																		
12.5	2													>	>	<			
10	3					>								>>	>>				
75	4	>>	>>	<			<<	<<	<<		>>	a	b		>	c	d	e	<<
10	5				>>	>													
15	6	>	>		>>	>>													
15	7					>>			<										
10	8																		
17.5	9	>	>		>	>	<		<			<	<		>	<	<<	<<	
12.5	10					>			<			<				<	<	<	>
25	11				>		<	<	<<					>		<<	<<	<<	
10	12				>														>
10	13				>	>													>
15	14	>	>																<
25	15		>	<		>	<	<	<<						>				
15	16			>		>					>	<	<		>	<	<	<	
10	17														>				
17.5	18			<					<										>
10	19				>	>>							f						
15	20			>	>	>													
20	21				>	>	<						<<	>>	>	<	<	<	
22.5	22	>		>			<		<					>>	>>				
17.5	23	>	>	<	>>	>	<		<					>>	>>	<			
100	24																		

	1065_1103				difference to median more than														
						value	-10	-5	other	5	10								
		field - median				symbo	<<	<		>	>>								
Median		57 PO	57 SEL	57 RO	10 BAF	10 RA	11 SA	11 TO	11 GA	99 ARI	99 CHI	01 REB	01 AU	09 SK	09 BOL	05 PO	05 BET	05 CEN	PC LO
25	1			<				<										>	
20	2			<								<	<						
25	3	a	b				<<					<<	<<	>>	>				
10	4																		
15	5												<						
10	6																		
22.5	7	>>	>>	<			<<							<	<	>	>	>	
15	8				>	>													
25	9			<<			<					<<	<<						
15	10					>										>>	>>	>>	>>
15	11	>>	>>	>>									<						
80	12	>>	>>	>>			<<	<<	<<	<		c	d			>			<<
25	13	>	>			<						>	>>				>	>	
10	14		>		>														
15	15	>>	>>																
30	16				>>									>>	>				>
20	17	>					<<									>	>>	>>	
7.5	18					>>	>	>											
17.5	19	>	>													>>	>>	>>	
20	20											<	<						
20	21	>	>																
15	22											<	<						
20	23																		
15	24																		

	935_1105				difference to median more than														
						value	-10	-5	other	5	10								
		field - median				symbo	<<	<		>	>>								
Median		57 PO	57 SEL	57 RO	10 BAF	10 RA	11 SA	11 TO	11 GA	99 ARI	99 CHI	01 REB	01 AU	09 SK	09 BOL	05 PO	05 BET	05 CEN	PCC L
17.5	1			>	>	>							<						>
10	2				>>	>								>>					
30	3			<<										<<					>
15	4											<							
12.5	5				>	>				>	>	<		>>	>	<			
15	6									>						<	<	<	
17.5	7	>	>>	<	>>	>>									>	<			
30	8	>	>		>		<<	<	<			<			>				
25	9			<								<							
25	10																		
15	11											<							
15	12													>					
25	13	>>	>		>														
12.5	14	>	>									<						<	
17.5	15	>>	>>									<							
22.5	16			<	>>			<					<						
15	17				>	>													
17.5	18	>>	>>		>>	>>						<			>				
15	19											<							
15	20	>	>																
15	21	>	>>		>							<							
15	22	>>	>		>	>													
17.5	23	>	>	>								<			>				<
25	24			<											>				

Annex 22: Spain 2002, *Pinus pinaster*: Simple correlation coefficient (Pearson)

					>=	0.5	+											
1025_1102					>=	0.7	++											
correlation comparison					>=	0.9	+++											
	57 POT	57 SEL	57 ROS	10 BAF	10 RAM	11 SAN	11 TOF	11 GAF	99 ARI	99 CHI	01 REB	01 AUN	09 SKO	09 BOU	05 PON	05 BET	05 CEN	PC LOI
57 POT	1	+++	+++	+++	+++	++	++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	++
57 SEL	+++	1	+++	+++	+++	++	++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	++
57 ROS	+++	+++	1	+++	+++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
10 BAF	+++	+++	+++	1	+++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
10 RAN	+++	+++	+++	+++	1	++	+++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
11 SAN	++	++	++	++	++	1	+++	+++	++	++	+++	+++	++	++	+++	+++	+++	++
11 TOF	++	++	+++	+++	+++	+++	1	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
11 GAF	++	++	+++	+++	++	+++	+++	1	++	++	+++	+++	++	++	+++	+++	+++	+++
99 ARI	+++	+++	+++	+++	+++	++	+++	++	1	+++	+++	+++	+++	+++	+++	+++	+++	+++
99 CHI	+++	+++	+++	+++	+++	++	+++	++	+++	1	+++	+++	+++	+++	+++	+++	+++	++
01 REB	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++	+++	+++	+++	+++	+++	+++
01 AUN	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++	+++	+++	+++	+++	+++
09 SKO	+++	+++	+++	+++	+++	++	+++	++	+++	+++	+++	+++	1	+++	+++	+++	+++	+++
09 BOU	+++	+++	+++	+++	+++	++	+++	++	+++	+++	+++	+++	+++	1	+++	+++	+++	+++
05 PON	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++	+++	+++
05 BET	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++	+++
05 CEN	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	1	+++
PC LOI	++	++	+++	+++	+++	++	+++	+++	+++	++	+++	+++	+++	+++	+++	+++	+++	1

					>=	0.5	+											
1065_1103					>=	0.7	++											
correlation comparison					>=	0.9	+++											
	57 POT	57 SEL	57 ROS	10 BAF	10 RAN	11 SAN	11 TOF	11 GAF	99 ARI	99 CHI	01 REB	01 AUN	09 SKO	09 BOU	05 PON	05 BET	05 CEN	PC LOI
57 POTO	1	+++	++	++	++		++		+++	++	++	+	++	++	+++	+++	+++	
57 SELE	+++	1	++	+++	++	+	++		+++	+++	++	++	++	+++	+++	+++	+++	
57 ROSA	++	++	1	++	++		+		++	++			++	++	++	++	++	
10 BARR	++	+++	++	1	+++	+	++		++	+++	+	+	++	+++	++	++	++	+
10 RAMA	++	++	++	+++	1	+	++		++	++			++	+++	+++	++	++	
11 SANC		+		+	+	1			+	+			+	+	+			
11 TORR	++	++	+	++	++		1	+	++	++	+		++	++	++	++	++	+
11 GARC							+	1			+							+
99 ARIS	+++	+++	++	++	++	+	++		1	+++	++	+	+++	+++	+++	+++	+++	+
99 CHRI	++	+++	++	+++	++	+	++		+++	1	+		+++	+++	+++	+++	+++	
01 REBO	++	++		+			+	+	++	+	1	+++		+	++	++	++	+
01 AUMO	+	++		+					+		+++	1			+	++	+	+
09 SKOU	++	++	++	++	++	+	++		+++	+++			1	+++	++	++	++	+
09 BOUR	++	+++	++	+++	+++	+	++		+++	+++	+		+++	1	+++	+++	+++	+
05 POMP	+++	+++	++	++	+++	+	++		+++	+++	++	+	++	+++	1	+++	+++	+
05 BETTI	+++	+++	++	++	++		++		+++	+++	++	++	++	+++	+++	1	+++	+
05 CENN	+++	+++	++	++	++		++		+++	+++	++	+	++	+++	+++	+++	1	+
PC LORE				+			+	+	+		+	+	+	+	+	+	+	1

					>=	0.5	+											
935_1105					>=	0.7	++											
correlation comparison					>=	0.9	+++											
	57 POT	57 SEL	57 ROS	10 BAF	10 RAN	11 SAN	11 TOF	11 GAF	99 ARI	99 CHI	01 REB	01 AUN	09 SKO	09 BOU	05 PON	05 BET	05 CEN	PCC LO
57 POTO	1	+++	+	+	+		+	+			+	++		+	+	+	+	+
57 SELET	+++	1	+	+	+		+	+	+		+	++		++	+	+	+	
57 ROSA	+	+	1												+			
10 BARR	+	+		1	++		+	+	+	+	+	+	+	+	+	++	+	+
10 RAMA	+	+		++	1		+	+	+	+	+	+		+	+	++	++	++
11 SANCI						1	+++	++	+		++	+		+	++	++	++	++
11 TORRI	+	+		+	+	+++	1	++	++	+	++	++		++	++	++	++	++
11 GARCI	+	+		+	+	++	++	1	++	+	++	++		++	++	++	+++	++
99 ARIST		+		+	+	+	++	++	1	++	++	++		++	++	++	++	++
99 CHRIS				+	+		+	+	++	1	+	+	+	++	++	++	++	++
01 REBOI	+	+		+	+	++	++	++	++	+	1	++		++	++	++	++	++
01 AUMO	++	++		+	+	+	++	++	++	+	++	1		++	++	++	++	++
09 SKOUT				+						+			1	+				
09 BOURI	+	++		+	+	+	++	++	++	++	++	++	+	1	++	++	++	+
05 POMP	+	+	+	+	+	++	++	++	++	++	++	++		++	1	+++	+++	++
05 BETTI	+	+		++	++	++	++	++	++	++	++	++		++	+++	1	+++	++
05 CENNI	+	+		+	++	++	++	+++	++	++	++	++		++	+++	+++	1	++
PCC LOR	+			+	++	++	++	++	++	++	++	++		+	++	++	++	1

Annex 23: Spain 2002, *Pinus pinaster*: Percent of trees with agreeing assessment values

>=	30	+++
>=	20	++
>=	10	+
	other	

1025_1102

agreement comparison

	57 POT	57 SEL	57 ROS	10 BAR	10 RAM	11 SAN	11 TOR	11 GAR	99 ARI	99 CHI	01 REB	01 AUM	09 SKO	09 BOU	05 POM	05 BET	05 CEN	PC LOR
57 POT		+++	++	+++	++	+	+	+	+++	+++		+	++	++	+	+	+	++
57 SEL	+++		++	++	++	++	++	++	+++	+++	+		++	++	+			+
57 ROS	++	++		+	+	+++	+++	+++	+++	+++		+	+	++	+			
10 BAR	+++	++	+		+++	+			++	+++			+++	++				++
10 RAM	++	++	+	+++					++	++		+	++	+++		+	+	++
11 SAN	+	++	+++	+			+++	+++	++	+	+++	++	+	+	+++	++	++	
11 TOR	+	++	+++			+++		+++	++	+	+++	+++			+++	+++	+++	+++
11 GAR	+	++	+++			+++	+++		+	+	+++	++			+++	++	++	+
99 ARI	+++	+++	+++	++	++	++	++	+		+++	+	++	+++	+++	+	+	+	++
99 CHI	+++	+++	+++	+++	++	+	+	+	+++		+	++	+++	+++		+	+	++
01 REB		+				+++	+++	+++	+	+		+++	+	+	+++	+++	+++	++
01 AUM	+		+		+	++	+++	++	++	++	+++		+	+	+++	+++	+++	+++
09 SKO	++	++	+	+++	++	+			+++	+++	+	+		+++		+	+	++
09 BOU	++	++	++	++	+++	+			+++	+++	+	+	+++			+	+	+
05 POM	+	+	+			+++	+++	+++	+		+++	+++				+++	+++	+++
05 BET	+				+	++	+++	++	+	+	+++	+++	+	+	+++		+++	+++
05 CEN	+				+	++	+++	++	+	+	+++	+++	+	+	+++	+++		+++
PC LOI	++	+		++	++		+++	+	++	++	++	+++	++	+	+++	+++	+++	

>=	30	+++
>=	20	++
>=	10	+
	other	-

1065_1103

agreement comparison

	57 POT	57 SEL	57 ROS	10 BAR	10 RAM	11 SAN	11 TOR	11 GAR	99 ARI	99 CHI	01 REB	01 AUM	09 SKO	09 BOU	05 POM	05 BET	05 CEN	PC LOR
57 POTO	-	+++	++	++	+	+	-	++	+	+	+	-	+	+	++	++	++	++
57 SELE	+++	-	++	++	-	+	+	++	++	++	++	+	+	+	+	++	++	++
57 ROSA	++	++	-	+	++	+	+++	++	++	+	+++	++	++	++	+	+	-	++
10 BARR	++	++	+	-	+++	+	+	++	++	+++	+	-	+++	++	++	++	++	+++
10 RAMA	+	-	++	+++	-	+	++	+++	++	+++	+	++	+++	++	+++	+++	++	+
11 SANC	+	+	+	+	+	-	++	++	+++	+	++	+	+++	++	++	++	++	+
11 TORR	-	+	+++	+	++	++	-	+++	+++	++	++	+++	+++	++	++	+	+	+++
11 GARC	++	++	++	++	+++	++	+++	-	++	++	++	+++	+++	+++	++	++	++	+++
99 ARIS	+	++	++	++	++	+++	+++	++	-	+++	+++	+++	+++	+++	+++	+++	+++	++
99 CHRI	+	++	+	+++	+++	+	++	++	+++	-	++	++	+++	+++	+++	+++	+++	+++
01 REBO	+	++	+++	+	+	++	++	++	+++	++	-	+++	++	++	-	+	-	++
01 AUMO	-	+	++	-	++	+	+++	+++	+++	++	+++	-	++	++	+	++	+	++
09 SKOU	+	+	++	+++	+++	+++	+++	+++	+++	+++	++	++	-	+++	++	++	++	+++
09 BOUR	+	+	++	++	++	++	++	+++	+++	+++	++	++	+++	-	+++	+++	+++	++
05 POMP	++	+	+	++	+++	++	++	++	+++	+++	-	+	++	+++	-	+++	+++	+++
05 BETTI	++	++	+	++	+++	++	+	++	+++	+++	+	++	++	+++	+++	-	+++	++
05 CENN	++	++	-	++	++	++	+	++	+++	+++	-	+	++	+++	+++	+++	-	++
PC LORE	++	++	++	+++	+	+	+++	+++	++	+++	++	++	+++	++	+++	++	++	-

>=	30	+++
>=	20	++
>=	10	+
	other	-

935_1105

agreement comparison

	57 POT	57 SEL	57 ROS	10 BAR	10 RAM	11 SAN	11 TOR	11 GAR	99 ARI	99 CHI	01 REB	01 AUM	09 SKO	09 BOU	05 POM	05 BET	05 CEN	PCC LO
57 POTO	-	+++	-	++	+	++	+	+	+	++	-	-	++	+++	+	+	+	++
57 SELET	+++	-	-	++	++	++	+	+	+	++	-	-	++	+++	+	+	+	++
57 ROSA	-	-	-	+	-	++	+++	+++	++	+	+	+++	+	+	+++	++	++	++
10 BARR	++	++	+	-	+++	+	+	+	+++	+++	-	-	++	+++	+	+	+	+++
10 RAMA	+	++	-	+++	-	++	-	-	+++	++	-	-	++	+++	+	-	-	+++
11 SANC	++	++	++	+	++	-	+++	+++	+++	+++	+	++	+++	++	+++	+++	+++	++
11 TORRE	+	+	+++	+	-	+++	-	+++	+++	+++	++	+++	++	-	+++	+++	+++	+
11 GARCI	+	+	+++	+	-	+++	+++	-	+++	+++	+++	+++	+++	-	+++	+++	+++	+
99 ARIST	+	+	++	+++	+++	+++	+++	+++	-	+++	-	++	+++	++	+++	+++	+++	+++
99 CHRIS	++	++	+	+++	++	+++	+++	+++	+++	-	++	++	+++	+++	+++	+++	+++	++
01 REBOU	-	-	+	-	-	+	++	+++	-	++	-	+++	-	-	+++	++	+++	-
01 AUMO	-	-	+++	-	-	++	+++	+++	++	++	+++	-	-	-	+++	+++	+++	+
09 SKOUT	++	++	+	++	++	+++	++	+++	+++	+++	-	-	-	+++	++	++	++	+++
09 BOURI	+++	+++	+	+++	+++	++	-	-	++	+++	-	-	+++	-	+	-	-	+++
05 POMP	+	+	+++	+	+	+++	+++	+++	+++	+++	+++	+++	++	+	-	+++	+++	-
05 BETTI	+	+	++	+	-	+++	+++	+++	+++	+++	++	+++	++	-	+++	-	+++	+
05 CENNI	+	+	++	+	-	+++	+++	+++	+++	+++	+++	+++	++	-	+++	+++	-	+
PCC LOR	++	++	++	+++	+++	++	+	+	+++	++	-	+	+++	+++	-	+	+	-