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COUNTRYSIDE SURVEY 2000

QUALITY ASSURANCE EXERCISE

Second Draft

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SUMMARY

Introduction

It is recognized that in a field investigation on the scale of the Countryside 2000 survey the large number of recorders and surveyors involved must produce an inherent degree of variation despite the provision of a training course, a field handbook and on-site visits by supervisors (Quality Control). It is therefore important to attempt a measure of the consistency and reliability of the work done within the major components of the field programme (Quality Assurance).

How selected ?

A sample comprising 38 of the 519 squares surveyed in 1998 was selected and in each of these one quarter was resurveyed. The resurvey involved the recording of 234 species plots covering the nine plot types defined in the CS2000 methodology.

The Quality Assurance Exercise investigated:

- the efficiency of plot relocation
- species concordance i.e. the reproducibility of species records made by the original surveyors
- the reliability of percentage cover estimates of the principal species recorded
- the effect of the level of recording on the results obtained when subject to the normal techniques used to demonstrate habitat change with particular reference to the presence or absence of directional bias in the CS2000 survey
- the level of comparability between the efficiency of the CS2000 survey and that of the CS1990 survey
- the accuracy of the landuse mapping of the 1Km squares
- the efficiency of the recording of changes in landuse

210 v 234 ?

Plot relocation

Of 210 plots for which a full search was made, only 28 could not be satisfactorily relocated by the assessors; this percentage recovery (86.7%) is almost identical with that found during the 1991 QA of the 1990 survey (87.1%) and this finding demonstrated that markers and plots could be relocated equally well after eight years as after 12 months.

The CS2000 surveyors were found to have precisely relocated 60% of the 1990 plots, to have approximately (but acceptably) relocated a further 25% and to have failed to adequately find 15% of plot positions. The small, $4m^2$, Habitat Plots (Y-plots) proved the most difficult to relocate, having a failure rate of 23%.

Accuracy of species records

Of approximately 6000 species records in the 210 plots analysed and drawn from a sub-sample comprising thirty-eight 1Km squares:

- 71% were confirmed as species present in the plot by the assessors at the time of their resurvey
- non-concordances totalling a further 2% were attributable to real changes due to management or seasonal effects between original survey and assessment

This indicates an initial recording accuracy of 73%, only slightly lower than that found for the CS1990 survey (estimated at c.78%). The difference of 5% is exactly accounted for by the increase in species mis-matches due to errors in plot location by the surveyors. The circumstances of the 1990 and 1998 surveys were quite different. Plots used in Countryside Surveys prior to 1990 were not permanently marked and hence no estimate for the non-concordance due to errors of plot location could be arrived at in previous surveys. If the change in circumstances is taken into account, then the level of efficiency of species recording in 1998 is the same as that in 1990.

The report includes a detailed breakdown of the nature of species mis-matches between the 1998 field survey and the QA exercise and comparisons with similar data from the CS1990 survey. In both Countryside Surveys the greatest source of error was the overlooking of species, especially those in vegetative states, in the plots.

Estimates of vegetation cover

When a comparison was made of the 30 most frequent species forming appreciable cover, six (all grasses or grass-like species) had been recorded at significantly different levels in the plots by the surveyors and assessors; one of the disparities was certainly, and another very probably, due to seasonal effects. These results compare rather unfavourably with those of the 1990 survey but this relative failure is counterbalanced by an improved level of agreement (74.4%) in the species cover levels awarded at the regularly spaced grid of nine points in each assessed square used to assess the mapping of land cover and boundary features.

Direction of vegetation change

When data for changes in species composition and species cover within individual plots between original survey and assessment were subjected to a DECORANA correspondence analysis, the overall axis shift was insignificant. When the results were partitioned by plot type and by landclass, there were again no instances of a significant difference in axis score. The variations in species recording and in the awarding of cover levels between the survey and its quality assessment are thus shown to be unbiased or random with respect to the direction of change, i.e. the results for the two sets of records form a singe population with no overall trend distinguishing the survey from its assessment.

Landcover mapping

Landcover mapping involved the use of a series of codes (given in Annex C) which may, for the purpose of analysis, be subdivided into three groups.

- primary codes
- secondary descriptive codes
- cover codes; a further characterisation of a given parcel of land using a combination of the mapping of the most prevalent species together with a code denoting the cover of each

The levels of agreement for the different code groups were:

Code group	% agreement
Primary landcover codes	88
BAP codes	77
Primary boundary codes	85
Principal qualifying landcover codes	73
Principal qualifying boundary codes	83
Species awarded cover	63
Species cover codes	74

Where direct comparisons are possible, the levels of concordance achieved are very similar to those found between the CS1990 survey and its QA.

Recording of change

A sample of instances of alterations to the 1990 code string involving changes made either by the CS2000 surveyors or by the assessors was analysed in order to test the level of agreement in the nature of landcover and boundary changes. The sample contained 177 instances of change: of these, 29 (16.4%) were considered by the assessors to reflect errors or omissions in the 1990 survey. The results suggest that between 51 and 59% of the changes occurring were correctly recorded by the surveyors. This is a disappointingly low figure and suggests that, if the sample is representative of the survey as a whole, a substantial proportion of changes that have occurred since 1990 will have been missed.

Introduction

1. It is recognized that in a field investigation on the scale of the Countryside 2000 survey the large number of recorders and surveyors involved must produce an inherent degree of variation despite the provision of a training course, a field handbook and on-site visits by supervisors (Quality Control). It is therefore important to attempt a measure of the consistency and reliability of the work done within the major components of the field programme (Quality Assurance).

Aims

2. (a) To quantify the accuracy of field recording in CS2000 and to comment on the accuracy of change statistics.

(b) To examine the efficiency of plot relocation

(c) To seek to explain any differences in recording in terms of observer error or bias, plot location and relocation, type of plot recorded, management and seasonal effects

(d) To relate the findings with regard to overall accuracy of recording to the levels of agreement between survey and assessment found during the previous 1990 Countryside Survey.

Methods and Scope of QA Exercise

3. A sample containing 38 of the 519 squares surveyed in 1998 was selected and in each of these one quarter was resurveyed. 34 of the squares had been included in the 1990 Countryside Survey whilst the remaining four represented a sub-sample of the 61 squares introduced for the first time in 1998.

The protocol for determining the location of points to be used as the basis of the assessment of land cover mapping and boundary feature recording and for the selection of plot types to be re-recorded is given in Annex A of this report.

The full list of squares monitored, with times of original survey and assessment resurvey, is given as Annex B. Those squares also selected in 1990 for the QA exercise and repeated in 1998 are highlighted.

4. The seven main plot types used in the CS2000 survey and re-examined and analysed as part of the QA exercise may be sub-divided into quadrats and linear plots thus:

Quadrats	200m^2	X plots	
	4m^2	Y plots	repeats of a plot type introduced for targeted habitats in 1990
		U plots	a new plot type introduced for use in unenclosed (BAP) broad habitats.

Linear plots, all 10m x 1m, which include;

Road verges, commencing adjacent to and parallel with the carriageway. A second parallel strip was originally surveyed in the case of wide verges (not included in the QA exercise)

Hedges, running parallel with the hedge line and commencing at the mid-point of the hedge. Simple 50m hedgerow diversity plots, introduced in 1998, have also been included in the QA exercise.

Streamsides, from normal water level or at the lower limit of vegetation cover in the case of water courses with extensive gravel or pebble beds etc.

Boundaries, in enclosed land only; recorded at the boundary marker (plate) associated with the $200m^2$ X plot.

A small number of the newly introduced 100m x 1m arable field margin plots were resurveyed and are discussed but, since the sample size was small, are not included in the analysis of the results.

THE RECORDING OF THE PLOTS

Plate location

5. An attempt was made in each case to relocate the buried metal plate marking one corner of each quadrat using the original 1990 sketch map (and sometimes an amended version annotated by the CS2000 surveyors), the surveyors photograph of plot location and a metal detector. The plot may often in practice be accurately relocated on the basis of the sketch map measurements and a good photograph. It was, however, considered important to investigate the effectiveness with which the plates themselves could be physically relocated eight years on and to compare the 'recovery rate' with that after one year based on the results of the 1991 QA exercise. It was also thought to be essential that a comparison be made between the efficiency of the CS2000 recorders in plate and plot relocation and that achieved by the QA assessors .

6 The QA exercise involved the recording of 234 plots. These were distributed across the different plot types as follows.

X 41	Y 34	U 17*
H 23	S 31	R 30
B 34	D (Hedge diversity) 19	A (Arable margin) 5

* The targeted number of 'U' plots was 19 but two could not be even approximately located and were abandoned

7. Efforts to establish the accuracy of plate and plot location are complicated by a discrepancy in the totals for the two situations; not all plots have markers. Many X-plots, mostly those situated close to boundary features, share the boundary plate whilst the more distant X plots or those in unenclosed land have their own plate. In a few instances the 1990 surveyors did not use plates to mark the plots and in at least two cases the plate has been disturbed during farm management since 1990. In these instances the assessment of whether a plot was relocated is based on the surveyors interpretation of the sketch and photograph. The totals, both for plots and plates will be higher in the case of the QA assessment of CS2000 than for the CS2000 relocation of the CS1990 plates since the former includes both the assessment of new squares for which the search is for CS2000 plates and the relocation of 'U' plots not used in 1990.

8. Table 1 (a) and (b), summarise the findings of both exercises in plate and plot location.

Table 1. Plate and Plot relocation.

(a) CS2000 (Total number of plots = 170).

Plot	Plates expected	I. Plates found plus plots found	II. Plots found	III. Plots approx. refound	IV. Plot not found or incorrectly positioned
X (1)	11	3	6	0	2
X (2)			11	10	2
Y	30	7	6	11	7
H	20	5	10	2	4
S	29	7	12	7	3
R	23	7	10	4	4
B	30	5	12	8	5
Total	143	34	67	42	27

(b) QA Assessment (Total number of plots=210).

Plot	Plates expected	I. Plates found plus plots found	II. Plots found	III. Plots approx. refound	IV. Plot not found or incorrectly positioned
X (1)	14	9	4	1	0
X (2)			21	5	1
Y	31	20	5	6	3
H	21	14	7	1	1
S	31	22	6	3	0
R	26	25	4	1	0
B	33	20	9	4	1
U	17	12	4	1	0
Total	173	122	60	22	6

X (1) = X plot having its own plate   X (2) = X plot located *via* B-plot plate

The four categories of performance recognised with respect to the relocation of survey plots within a square were:

I. Plate and hence plot located; in the case of the CS2000 surveyors these are instances where the recorder clearly states that a plate was re-found and the species record substantiates this claim.

II. Plate not found, or no plate used, but assessor satisfied that location of CS2000 plot or QA plot closely matches original location. This includes a substantial number of cases where the CS 2000 surveyors probably found the plate **but did not indicate this on the data sheet.**

III. Plate not found; assessors concluded that plot was only approximately relocated.

IV. Plate not found; information insufficient to allow even approximate location but plot clearly in correct general area (three plots, where the directions were so woefully inadequate as to prevent even this low level of relocation were abandoned and so do not appear in the record).

9. The assessors were successful in locating 69.3% of plates; this compares with the 65.2% recovery in the 1991 QA of CS1990. It is therefore shown to be equally possible to relocate a plate eight years on as 12 months after its burial.

It is not possible to provide a precise figure for the success of the surveyors in finding essentially the same sample of plates; they definitely found 23.3 % of plates and the total recovery rate could possibly have been as high as the sum of categories (i) and (ii) i.e. 59.4 % but is thought to have been in the region of 40% to 45%. Whilst it is true that the assessors had the benefit of familiarity with many of the plot locations and **expected** to find most of the plates, it is still evident that some of the CS2000 searching must have been less than wholehearted. In one instant the assessors located the 1990 plate and, accidentally, the new 1998 plate within 65cm of each other; at least two linear plot pairs of plates were refound within 2m of each other. In conversation with one surveyor the assessors were told of the delight in finding a 1990 plate - hardly the sentiments of a team expecting to be routinely successful.

10. The results suggest that 60% of plots were accurately relocated by the surveyors, 25% were more or less relocated and c.15% of plots were inadequately relocated by the CS2000 teams. This compares with 87% adequately relocated by the QA team. There were several instances of the surveyors finding the correct location and, sometimes inexplicably, recording it incorrectly: on the wrong bank of a stream or the wrong side of a hedge. In one irritating case the 1990 surveyors clearly stated and showed on the sketch that they had erroneously recorded a roadverge plot on the wrong side of the plate yet the CS2000 team recorded the 'correct' plot and were hence the full 10m out of position. This was not the only instance of surveyors failing to read the words. One 1990 boundary plot sheet included the instructions 'plate 7 fence posts from large straining post'. It was evident from the species record that in 1998 the plot had been run from the straining post and so failed to achieve even a minimal overlap with the plot. In another instance the original plot was stated as being along a fence; the CS2000 record was for the hedge at least a metre behind the fence.

The result of the apparently rather cavalier approach to plate search was that new plates were frequently employed - this is going to make the task of the next cohort of surveyors even more difficult.

Species concordance

11. The mean species number per plot was found to have increased significantly between the original 1990 Countryside Survey and the QA assessment made in the following year. It was originally suggested that the diversity recorded during full survey might have been depressed under the drought conditions prevailing in that summer. The increase in species recorded in 1991 was however virtually the same in northern upland squares, unaffected by drought conditions, as for the country as a whole; the mean increase across all plots in the 1991 QA record was 13%. A

similar comparison has been made between the CS2000 survey and its assessment made in the same year.

The results are presented in Table 2 and are of considerable interest.

Table 2. Comparison of species numbers per plot CS2000 v. QA.

Mean species number

Plot type	N	CS2000	QA	CS2000 %	*p*
All Plots	210	17.9	20.4	87.7	<0.001
X	41	19.8	22.6	87.6	0.001
Y	34	14.3	15.9	89.9	0.025
H	23	16.5	18.4	89.7	0.019
S	31	20.1	23.0	87.4	0.002
R	30	21.1	23.4	90.2	0.003
B	34	16.8	20.0	84.0	<0.001
U	17	15.0	18.2	82.4	0.004

p = results of paired t-test comparison of CS2000 and QA

12 The QA exercise again frequently produced a longer species list per plot and, interestingly, the magnitude of the increase was almost identical with that reported previously:

1991 QA as % increase in number of species found over the 1990 Survey for all plots recorded = 13.04%

1998 QA as % increase in number of species found over the 1998 Survey for all plots recorded = 13.97%

Since the same pair of assessors were used in both QA exercises, there is a strong implication that the efficiency of search of the 1990 and 1998 survey teams has been remarkably similar.

13. The mean number of species per plot has declined significantly since the time of the 1990 survey. In 1990 and 1991 the order of plots, in terms of their richness, was the same in both survey and QA; in order of decreasing mean species number per plot:

S —— R —— X —— H —— B —— Y

In 1998, the results of both surveyors and assessors again ranked the plots in an identical order but the road verge plots now exceed the streamside plots in richness; the streamside plots showing the greatest decrease in mean number of species per sample since 1990.

14. A variety of measures may be used to compare aggregate records made for the same plot at different times; the 1991 QA report examined four such indices. Two of these have been retained in the present draft.

a) Species common to both samples divided by the aggregate of species at time one (T1) and at time two (T2) and expressed as a percentage: this may be termed **Percentage Agreement** and produces the simplest, crudest, but most objective value.

b) Species common to both samples divided by the total number of species recorded at T1 plus T2 minus the T2 mismatches and expressed as a percentage. This may be referred to as **Surveyor Accuracy (% Efficiency)** and is intended to remove variations due to e.g. season, management and errors attributable to the assessors rather than the surveyors.

The results, summarised by Landscape type were:

Landscape type	Squares assessed	Mean % agreement (with range)	Mean % efficiency (with range)
Arable (LC)	10	54.0 (36.4 – 73.5)	59.1 (39.5 – 81.1)
Pastural (LG)	11	55.2 (45.3 – 70.2)	62.4 (46.7 – 77.8)
Marginal upland (MA)	11	57.0 (45.2 – 67.2)	65.4 (55.0 – 71.9)
Upland (UP)	6	59.1 (47.4 – 64.6)	65.7 (52.2 – 72.1)

Annex B presents values for these two measures for each of the 38 squares assessed in the 1998 QA exercise. The values presented are averages derived from the individual plot records within each square.

Allocation of T1 and T2 variation as a percentage of total mis-matches

15. Species recorded by CS2000 surveyors but not confirmed for the plot by the assessors (T1 variations).

Types 1 -9

1) *Mis-identified in CS2000* and forming a couplet with the, hopefully, correctly identified species recorded at QA

2) *Mis-identified in CS2000*, not apparently forming a couplet with any species recorded during the QA exercise e.g. where both *Convolvulus arvensis* and *Calystegia sepium* appear in the T1 record but only one of these species was found at T2.

3) *Wrong box ticked at CS2000,* e.g. pairs of species adjacent on the data sheet. *Primula vulgaris-Prunella vulgaris* and *Ranunculus flammula-Ranunculus ficaria* are the most frequently encountered examples. Categories 1-3, if combined, are equivalent to the variations of Type A, "mis-identified", in the 1991 QA report.

4) *Species considered to have been overlooked during the CS2000 recording.* The allocation of species to this category was relatively straightforward, especially for linear plots, when the QA assessors were confident that the CS2000 surveyors had accurately relocated the plot. However, in situations where it was apparent that the CS2000 plot and the assessors

plots did not exactly overlap, or where the CS2000 surveyors were clearly in the wrong place, the assessment was extended to include a search of that area of the CS2000 plot which was not part of the 'real' plot in order to distinguish between species not recorded by the CS2000 surveyors because of their incorrect plot location (errors 7 and 9), species which were present in their plot but not recorded (error 4) and extra species recorded due to their plot location (error type 8).

5) *Over-zealous recording.* During the QA exercise particular care was taken to restrict recording to the exact plot size stipulated. The surveyors had, in some instances, not adequately measured the plot or had included species adjacent to but not strictly within the defined area.

6) *Mysteries.* Species records, apparently incorrect, for which no reasonable explanation could be advanced.

7) *Species mis-matches due to the incorrect orientation of the plot by CS2000 surveyors* These errors relate to species mis-matches due to the CS2000 plot being recorded in only approximately the correct location, i.e. adjacent to or overlapping the original location or where the plot must have been markedly skewed in relation to the cardinal bearing.

8) *Species recorded due to wrong location of CS2000 plot.* Species which were recorded by the CS2000 surveyors (which were not in the QA plot) because the CS2000 surveyors were in the wrong place. Examples: S plot recorded on the wrong side of a stream; B plot started from the wrong straining post; R plot recorded in the wrong direction from the start point; H plot of the road side when it was originally on the field side.

9) *Species not recorded by the CS2000 surveyors due to wrong plot location.* The converse of 8, species which were in the QA plot but not recorded by the CS2000 surveyors due to their incorrect plot location.

16. T2 Variations

Types 20 -24.

20) *Species mis-matches due to management changes in plots between CS2000 survey and QA assessment.* These involve changes in crop type, changes in species recorded due to crop management, verge mowing etc. They represent species which were very probably present when the CS2000 surveyors recorded the plot but which were no longer evident at the time of the QA exercise (e.g. *Cynosurus* and *Anthoxanthum* in mown hay meadows). Conversely, regrowth of species by the time of the QA assessment in plots which had been recently mown at time of the CS2000 survey, especially on road verges.

21) *Species mis-matches due to seasonal changes between CS2000 and QA assessment.* The execution of the QA exercise within the same season as the CS2000 survey was expected to reduce the magnitude of this error term and this is born out by the results: seasonal effects have declined from 8% of the record in 1991 to just over 1% in 1998. Some species however, especially annuals, still appeared in the mis-matches between the two surveys.

22) *Species mis-matches due to the incorrect positioning of the QA assessors plot.* Equivalent to the type 8+9 errors at time 1.

23) *Species mis-matches due to doubtful orientation of the QA plot* . Equivalent to type 7 errors at time 1.

24) *Species missed by the QA assessors.* Species which were in the plot but only recorded when the plot was searched a second time during the comparison of the initial QA record with the CS2000 surveyors record.

17 The total combined species record for CS2000 and its assessment = 5841 records: of these, records common to T1 and T2 = 3585. The 225 mis-matches can be partitioned, as a percentage of the total non-concurrences, as shown in Table 3 in which equivalent values for the 1990 –91 QA exercise are also included.

Table 3. Allocation of T1 and T2 variation as a percentage of total mismatches.

T1 variations

Type		% of total error 1998	% of total error 1990
1	Mis-identified - couplet	6.4	}
2	Mis-identified - no couplet	1.8	} 6.3
3	Wrong box	0.3	}
4	Overlooked	39.8	34.5
5	Over-zealous	1.9	5.8
6	Mysteries	4.6	2.8
7	Orientation errors	10.7	}
8	Recorded due to incorrect location	3.8	} 3.7
9	Not recorded due to incorrect location	5.4	}

T2 variations

Type		% of total error 1998	% of total error 1990
20	Management	2.0	3.4
21	Season	3.7	20.8
22	Incorrect location	2.1	4.7
23	Incorrect orientation	7.1	13.0
24	Overlooked	10.4	5.0

The high figure for type 24 mis-matches, species initially overlooked by the assessors during their "blind" recording of the quadrat, reflects the advanced stage of the growing season when the assessments were made. In 1991, when the equivalent error was 5%, only five squares were recorded in September and none as late as October. During the 1998 QA, eleven squares were examined in September and ten in October. A high proportion of the overlooked species were grasses and sedges reduced to late season vegetative condition and only confirmed in the second recording conducted with the assistance of the surveyors record.

18. In order to effect a direct comparison with CS1990, the figures are also presented as percentages of the total species record in Table 4 where the values in brackets are those for the 1991 QA.

Table 4. Summary of allocation of variation in species records (as percentage of the total species record)
Figures in [ ] indicate values from the 1991 QA exercise

CS2000 [T1] variation				QA [T2] variation			
Type		%		Type		%	
1	Mis-ID couplet	2.6	}	20	Management	0.7	[1.3]
2	Mis ID no couplet	0.7	}[2.5]	21	Season	1.3	[8.2]
3	Wrong box	0.1	}	22	Wrong location	0.7	[1.8]
4	Overlooked	14.1	[13.5]	23	Wrong orientation	2.5	[5.1]
5	Over-zealous	0.7	[2.3]	24	Overlooked	3.7	[1.9]
6	Mysteries	1.6	[1.1]				
7	Orientation	3.8	[1.4]				
8+9	Wrong location	3.1	-				
	Total	26.9	[20.7]			8.9	[18.4]

19. Non-concurrences associated with plot mis-orientation and mis-location on the part of the surveyors have increased from 1.4% of total records to 6.9%. This should not, however, be a cause for alarm. The circumstances of the 1990 and 1998 surveys were quite different. Plots used in Countryside Surveys prior to 1990 were not permanently marked and hence plot orientation and location errors were confined to inadmissible records arising through a combination of the positioning of the plot in a way which did not correspond with the standard protocol and failure to note this on the sketch which accompanied the species record. The plots were not precisely relocatable. The exercise in true plot location is a new venture and since it is estimated that only approximately 45% of the plots exactly duplicated the exact position, the increased species non-concordance due to mis-location of a little over 5% could be regarded as highly satisfactory under the more rigorous requirements of the CS2000 protocol.

Comparison of other mis-matches

20. *Mis-identification:* increased from 2.5% to 3.4% of the total record. Much of this is due to confusion within *Poa* and *Agrostis* species. *Rumex, Ranunculus* and *Stellaria* were also generally producing a fair number of mis-ID couplets. The assessors were lenient with respect to the identification of *Rosa* spp - many recorders confining themselves to using the *Rosa spp* code. This was wise since where species identification was attempted most surveyors produced clearly incorrect records.

Overlooked species: the proportion of species apparently overlooked within the plot was remarkably similar to that estimated for the CS1990 survey and continued to provide the greatest number of non-common records. Although considerable effort was devoted to partitioning mis-matches between 'overlooked species' and those missed due to mis-orientation it is not possible to exactly segregate these non-concurrences (see Paragraph 21).

Over-zealous: much improved since 1990. The error term has been reduced from over 2% to less than 1%.

21. In easily relocatable linear plots such as road verges and hedgerows it is a relatively simple matter to partition T1 errors between species present but overlooked and those due to mis-location or mis-orientation. In the X plots and, to an even greater degree, the small Y and U plots, such distinctions are less clearly arrived at. However, since recorders have a very consistent search image, it is to be expected that the proportion of species overlooked will be roughly proportional to the number of species present in a sample irrespective of the plot type involved.

If the mean number of mis-matches attributed to Type 4 (overlooked) for each plot type is calculated, the following results are obtained;

S plots	R	B	U	X	H	Y
5.6	4.5	4.3	4.2	3.8	3.3	2.1

This pattern closely resembles that of the gradient of mean species richness found (Para. 13) and it is thus felt that the mis-matches categorised as species overlooked at T1 are likely to be reasonably accurate.

The recording of vegetation cover

22 As an integral part of the original recording schedule, surveyors were required to give visual estimates of cover for any species perceived to exceed 5% cover in the plot. These estimates were repeated during the QA. The comparison of cover values presented in Table 5 matches estimates made by surveyors and assessors across all plot types.

Table 5. Comparison of cover values for the principal species recorded in plots, CS2000 surveyors v. QA assessors.

		Mean % cover		
Species	Number of couplets *	CS2000	QA	Wilcoxon 'p'
Holcus lanatus	78	10.2	7.2	**0.029**
Lolium perenne	68	28.2	26.4	0.378
Poa trivialis	53	9.4	4.6	**0.001**
Poa annua	37	6.9	4.6	0.103
Agrostis stolonifera	56	9.9	9.4	0.560
Agrostis capillaris	43	16.2	20.2	0.165
Dactylis glomerata	63	9.3	5.9	**0.005**
Festuca rubra	46	8.8	5.6	0.125
Arrhenatherum elatius	51	18.1	12.8	**0.009**
Anthoxanthum odoratum	35	6.7	3.6	**0.040**
Elymus repens	25	12.2	12.7	0.391
Cynosurus cristatus	28	6.8	4.8	0.113
Urtica dioica	69	9.5	8.8	0.394
Ranunculus repens	55	3.2	4.0	0.167
Trifolium repens	56	6.3	8.5	0.064
Cirsium arvense	36	3.0	2.8	0.629
Galium aparine	45	5.8	3.4	0.278
Taraxacum officinale	42	1.8	1.6	0.545
Juncus effusus	33	17.8	17.9	0.518
Plantago lanceolata	33	3.2	3.4	0.898
Plantago major	21	3.5	2.9	0.288
Heracleum sphondylium	30	2.9	1.6	0.066
Anthriscus sylvestris	28	2.2	3.9	0.259
Hedera helix	26	10.1	16.3	0.342
Rubus fruticosus	37	8.9	9.7	0.505
Calluna vulgaris	39	15.7	16.8	0.267
Scirpus cespitosus	21	18.0	20.8	0.462
Eriophorum angustifolium	21	4.0	2.8	0.854
Eriophorum vaginatum	16	23.3	11.8	**0.018**
Molinia caerulea	32	16.3	14.5	0.286
Crataegus monogyna	30	28.5	28.8	0.825

* Couplets for all species occurring in >15% of samples at either CS2000 or QA.

(Species which only ever occurred at the 1 or 5% cover band were excluded from these analyses.)

23. The results of the 1991 QA demonstrated that only two of the principal species, *Holcus lanatus* and *Poa trivialis* had mean covers awarded which differed significantly between surveyors and assessors; the same pair of species are again prominent in the list of species with differing mean cover but are joined in 1998 by *Dactylis glomerata, Anthoxanthum odoratum, Arrhenatherum elatius* and *Eriophorum vaginatum.*

All the discrepancies involve grasses or grass-like species; the covers of no commonly encountered herb species differed significantly between the two sets of records. The similarities in the covers awarded to *Lolium perenne, Agrostis stolonifera* and *Agrostis capillaris* are encouraging and go some way to counterbalance the rather poor agreement for these species seen in the land cover mapping codes (Paragraph 42). The variation noted for *Anthoxanthum* is almost certainly an effect of season, the species being much more prominent in early season before the QA exercise commenced.

Changes in frequency of the most prevalent species

24. Although there are approximately 35% of mis-matches between species records when direct comparisons are made between individual pairs of plots, it might be expected that these differences would, for many of the commoner species, average out over a large number of plots. To test this assumption the frequencies of all species recorded in the CS2000 sample and its QA have been compared. The results for the principal species are presented as Table 6.

25. The ranking order of records from surveyors and assessors is broadly similar though rather less so than in the CS1990 survey. It is not possible to apportion reasons for the individual discrepancies with any confidence but the following points may be made:

a) The recording of mosses was generally poor and the frequent omissions from the CS2000 records have been a factor in depressing the overall percentage agreement between survey and QA and hence the percentage efficiency of the recording.

b) The over-recording of *Poa trivialis* often stems from a tendency to record this species when any *Poa* species was encountered in a quadrat.

c) In contrast, the under-recording of other grasses, notably *Agrostis capillaris, Elymus repens, Arrhenatherum* and *Cynosurus* seems to arise from a general level of unfamiliarity with these species in a vegetative state whilst *Festuca rubra* is often simply overlooked. A quirk of the recording in 1998 has been the tendency to award very high levels of cover to the coarser grasses such as *Arrhenatherum, Elymus* and *Dactylis* when they are recorded. There is little concordance between the frequency of a species and the mean cover it attains; this quite normal situation is, however, exaggerated in the CS2000 sample.

d) *Ranunculus repens* is frequently recorded as *R. acris* whereas the figures for *Cirsium arvense* include records for *Cirsium vulgare*, occasionally *Cirsium palustre* and once *Cirsium acaule*.

e) *Taraxacum* and *Galium aparine* were under-recorded in CS1990 and this has been repeated in CS2000. The former is sometimes recorded as a *Crepis* whilst it seems that *Galium aparine* is often missed if in a seedling stage; this may also account for the overlooking of *Hedera* and *Rubus fruticosus* in some plots.

Table 6. Variation in the frequency of occurrence of the principal species recorded in plots, CS2000 surveyors v. QA assessors. (The relationship, as a percentage of the CS2000 records, between the survey results and those of the QA exercise is given in the third column for those cases where the disparity is greater than 15%).

Number of records

Species	CS2000	QA	CS *versus* QA (%)
Holcus lanatus	92	91	
Lolium perenne	78	77	
Poa trivialis	78	66	84.6
Urtica dioica	75	77	
Agrostis stolonifera	72	81	
Dactylis glomerara	71	73	
Ranunculus repens	64	78	121.9
Trifolium repens	63	68	
Festuca rubra	58	68	117.2
Arrhenatherum elatius	56	62	
Cirsium arvense	53	48	
Anthoxanthum odoratum	52	38	73.1
Cerastium fontanum	52	52	
Galium aparine	52	62	119.2
Poa annua	51	51	
Taraxacum officinalis	50	68	117.2
Agrostis capillaris	49	67	136.7
Rumex acetosa	47	47	
Rubus fruticosus	42	50	119.0
Rumex obtusifolius	40	44	
Calluna vulgaris	40	43	
Potentilla erecta	39	43	
Juncus effusus	37	36	
Molinia caerulea	35	34	
Plantago lanceolata	38	40	
Heracleum sphondylium	37	33	
Anthriscus sylvestris	36	34	
Brachythecium spp.	32	42	131.3
Crataegus monogyna	32	36	
Cynosurus cristatus	30	41	136.6
Elymus repens	29	43	148.3
Hedera helix	29	35	120.6
Eurhynchium praelongum	26	49	188.5
Plantago major	25	32	128.0
Scirpus cespitosus	23	25	
Eriophorum angustifolium	21	27	128.5
Eriphorum vaginatum	18	17	

Hedge diversity

26. A synopsis of the results of the nineteen samples which comprise the QA of these plots forms Table 7.

The total species record made by the assessors exceeded that of the CS2000 surveyors by 14.1%, a very similar value to that obtained for the QA as a whole. This is rather disappointing since the plots were simple to search and a higher recording rate was to be expected. The hedge diversity plots seem to have been treated somewhat as an afterthought; on a substantial number of occasions a woody species correctly recorded in the 'H' plot was omitted from the diversity plot of which it is part, hence the high total for 'overlooked' species.

Table 7. Synopsis of data from 19 hedge diversity plots.

		Variation types T1				T2
Species	Concurrences	1	4	5	6	
Corylus avellana	5	-	2	-	-	-
Crataegus monogyna	17	-	-	-	1	-
Hedere helix	10	-	4	-	-	-
Rosa canina	8	-	3	-	-	1
Prunus spinosa	8	-	1	-	-	-
Fraxinux excelsior	8	-	1	-	-	-
Sambucus niger	8	-	-	-	-	2
Acer pseudoplatanus	4	-	-	-	-	-
Ulmus glabra	2	-	-	1	-	-
Quercus spp.	4	-	-	-	-	-
Rosa arvensis	1	2	1	-	-	-
Salix caprea	1	-	2	-	-	-
Ilex aquifolium	1	-	1	-	-	-
Cornus sanguinea	1	-	-	-	-	1
Ligustrum vulgare	1	-	1	-	-	-
Prunus domestica	1	-	1	-	-	-
Prunus pardus	1	-	-	-	-	-
Ulmus procera	1	-	-	-	-	-
Laburnum anagyroides	1	-	1	-	-	-
Malus sylvestris	1	-	-	-	-	-
Acer campestre	1	-	-	-	-	-
Sorbus aucuparia	1	-	1	-	-	-
Rubus idaeus	1	-	-	-	-	-
Salix fragilis	1	-	-	-	-	-
Rhamnus catharticus	1	-	-	-	-	-
Clematis vitalba	1	-	-	1	-	-
Salix cinerea	1	-	-	-	-	-
Leycesteria formosa	1	-	1	-	-	-
Tamux communis	-	-	-	1	-	-
Rosa rubiginosa	-	1	-	-	-	-
Crataegus laevigata	-	-	-	-	1	-
Total	92	3	20	3	2	4

Total species record: 124

Common species: 92

% Agreement: 74.2

% Surveyor Efficiency: 77.4

Mean number of species recorded/ plot : CS2000= 5.16 QA= 5.89

Arable plots

27. Only five arable plots were assessed and so any conclusions must be very tentative. The level of concordance in these samples was, however, extremely poor.

In summary:

Total species record for the five plots	111
Common species records	34
Species recorded at T1, not at T2	24
Species recorded at T2, not at T1	53
% Agreement	30.6

28. There will be very considerable differences in the arable weed population between May and October and so many of the mis-matches will be due to season. The impression gained however was of samples less scrupulously recorded than the standard repeat plot types. The surveyors may have been less familiar with ruderal species than with those of other habitats. Many of the concordances were of common grasses or herbs growing in an arable situation with recognition of true ruderals seeming much less certain; identification of *Veronica* and *Euphorbia* species in particular left much to be desired, the suspicion being that for the former genus at least a quick glance at the illustrations in Rose was used rather than anything more rigorous.

It is probably sensible, though hardly cost effective, to plan the remaining field work so as to allow at least two visits, well spaced in time, to any future arable margin plots.

Overall effects of species change

29 The assumption to be tested is that, though the axis scores for individual pairs may shift markedly due to e.g. a gross mis-match in recording or in the assignment of cover or through failure to accurately relocate a particular plot, the results for the two total records should form a single population with little or no overall shift in mean axis score. Changes in apparent species composition have been demonstrated for individual plots of all types. In order to assess the effects of this variation on the plots as a whole, the quadrats have been arranged in a continuum using the first axis of a DECORANA analysis as the gradient. All pairs of quadrats of a single plot type have, with a small number of exceptions, been pooled. Each quadrat pair consists of that from the original CS2000 survey and that from the QA reassessment. Six X-plots which took the form of a narrow strip at the crop edge have been omitted, as have two Y-plots, one containing a single species and one placed in saltmarsh vegetation; the inclusion of these eight plots would have unduly distorted the ordination plot. For each allowed pair the change in axis score has been plotted against the percentage agreement in the species compliment between the two times of survey.

30 The resulting graphs for individual plot types form Figure 1(a-g)..

Figure 1. Changes in Axis I score of DECORANA ordination against recorder percentage agreement.

Principal causes of axis score shifts:

a = location/orientation, **b** = cover mis-matches, **c** = Species mis-identified/overlooked

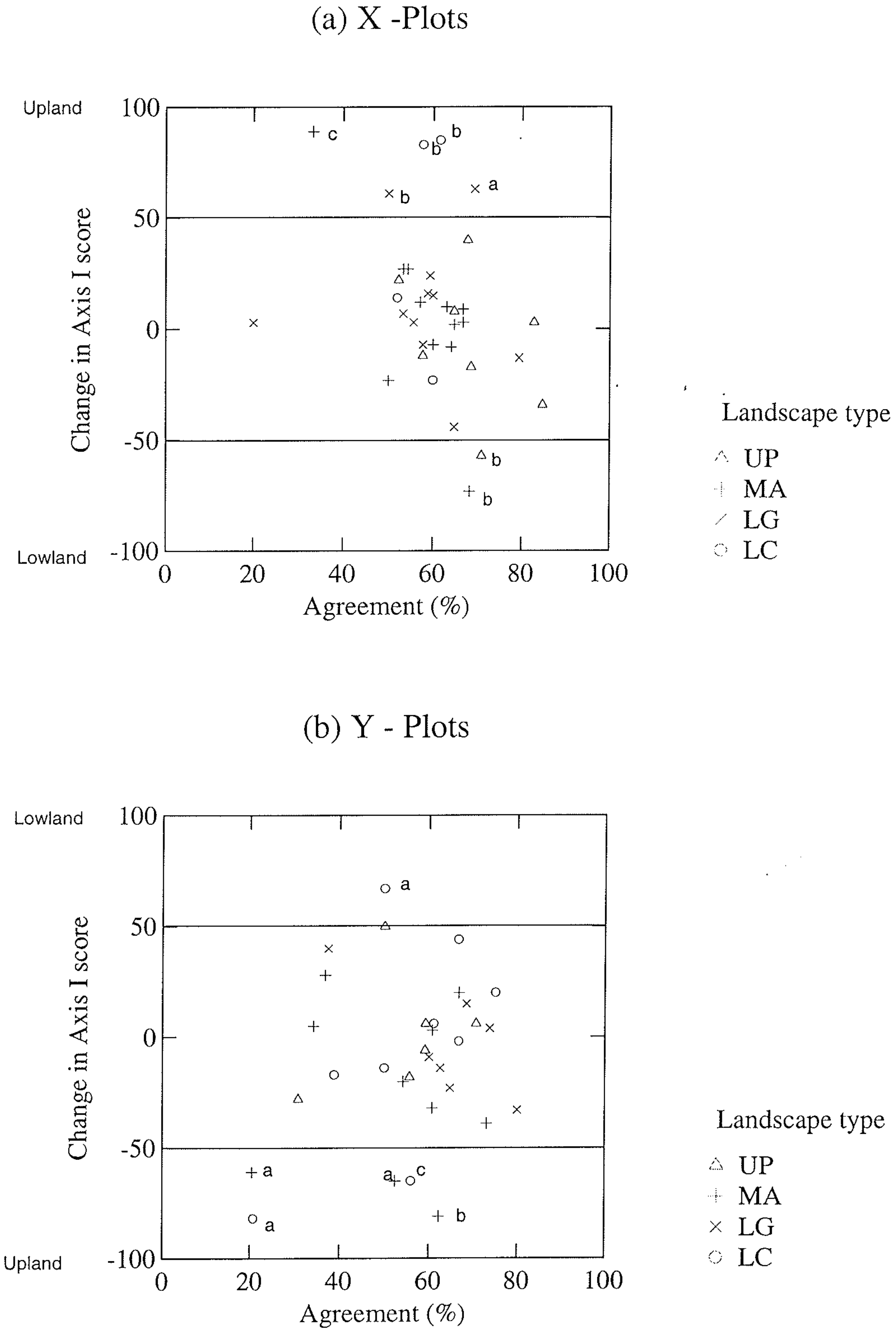
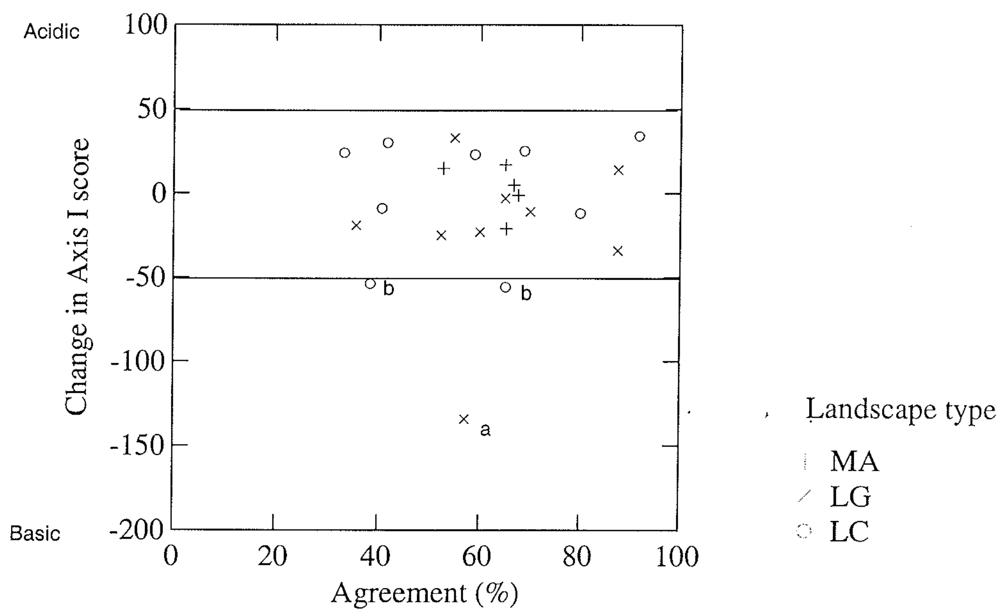


Figure 1. Changes in Axis I score of DECORANA ordination against recorder percentage agreement.

Principal causes of axis score shifts:
a = location/orientation, **b** = cover mis-matches, **c** = Species mis-identified/overlooked

(c) Hedge - Plots



(d) Stream - Plots

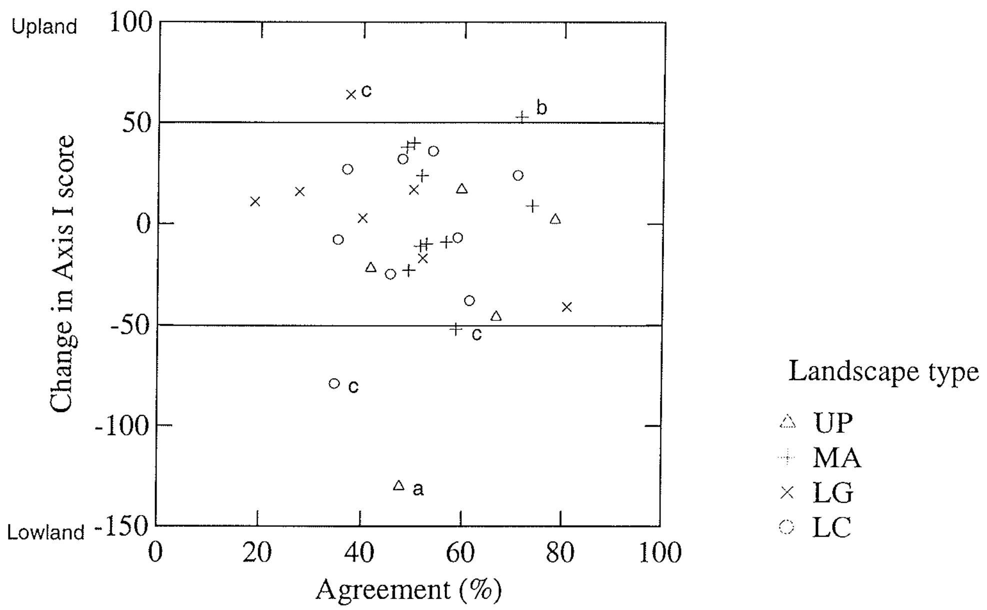
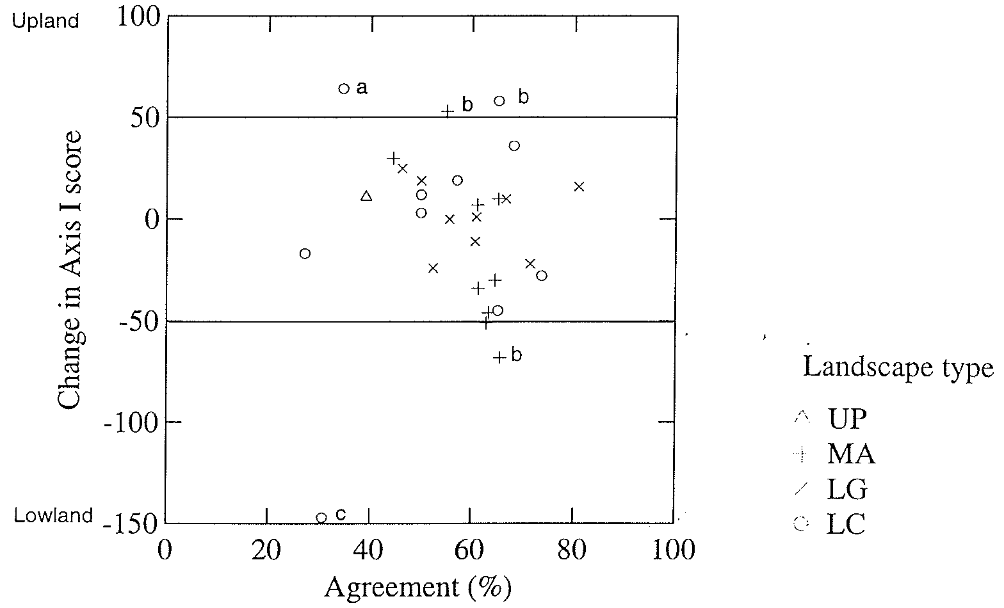


Figure 1. Changes in Axis I score of DECORANA ordination against recorder percentage agreement.
Principal causes of axis score shifts:
a = location/orientation, **b** = cover mis-matches, **c** = Species mis-identified/overlooked

(e) Road - Plots



(f) Boundary - Plots

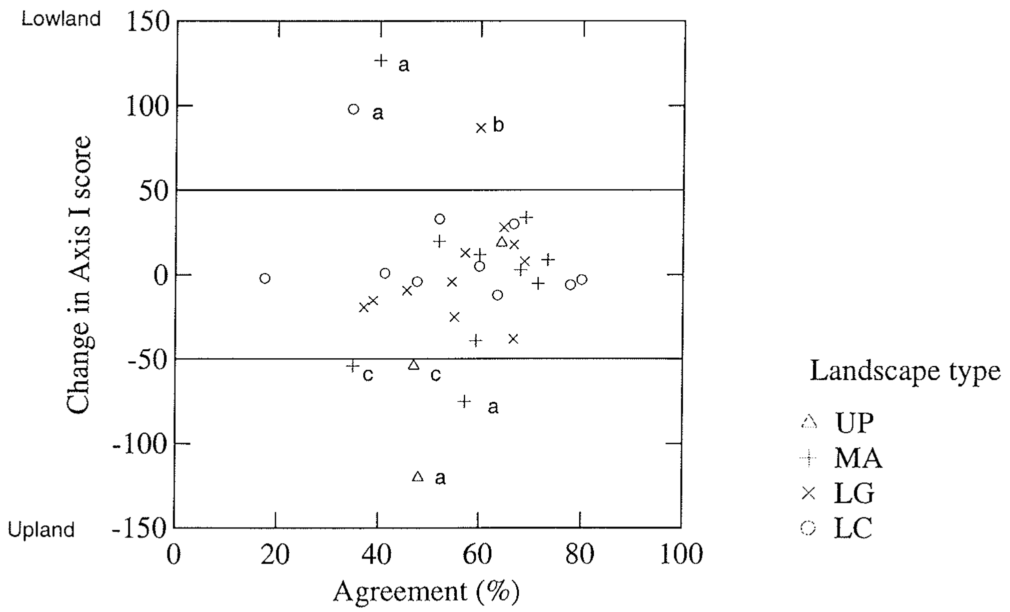
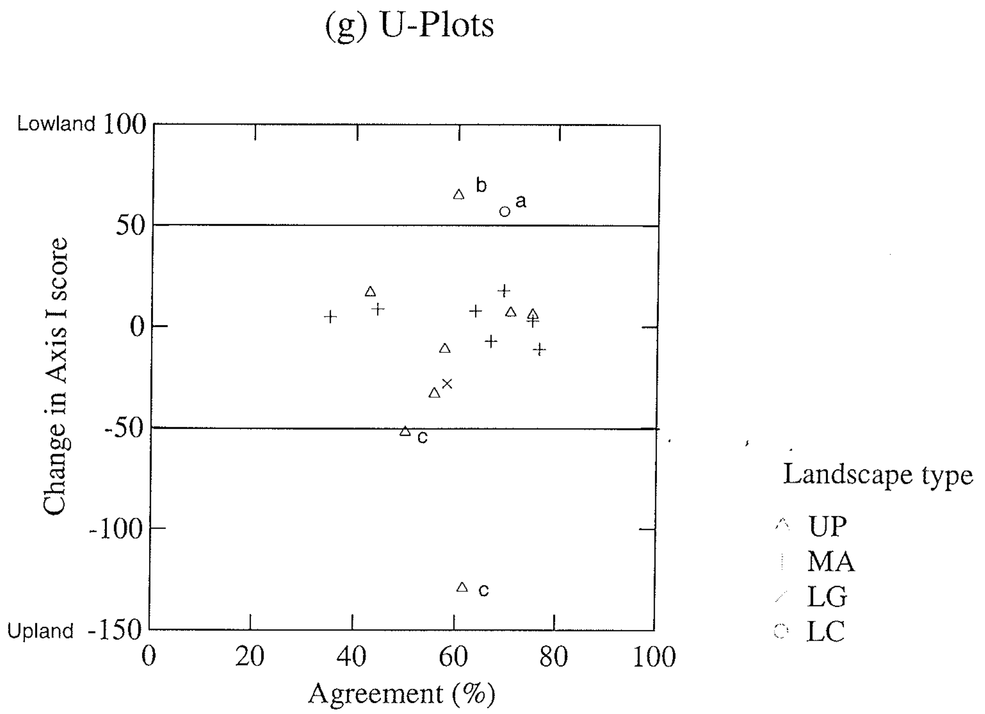


Figure 1. Changes in Axis I score of DECORANA ordination against recorder percentage agreement.
Principal causes of axis score shifts:
a = location/orientation, **b** = cover mis-matches, **c** = Species mis-identified/overlooked



A 50 unit change in first axis score has been taken as the arbitrary level above which reasons are sought for the discrepancies between time one and time two pairs of records. No single cause for large discrepancies is evident; most can be attributed either to problems of plot location, inefficient species recording (including significant mis-identifications and the overlooking of species present), and marked disparities in the awarding of cover values for species recorded.

31 No correlation exists between the shifts in axis score and the percentage agreement in species concordance between plot pairs; large discrepancies in axis score coupled with a poor percentage agreement usually result from failures in the location or orientation of plots whilst similar shifts in quadrat pairs with reasonably high levels of concordance usually stem from gross mis-matches in the cover awarded to diagnostic species.

Example: the X-plot pair marked with an * in Figure 1a had very good general concurrence of species but in CS2000 *Lolium multiflorum* (not recorded at T2) was awarded very high cover whilst *Agrostis stolonifera* (not noted at T1) was awarded similarly high cover by the assessors.

Changes in mean axis score

32 When the ordination is conducted using an amalgamation of sample pairs from all plot types, the mean axis one scores for CS2000 and for the QA exercise are 387.8 and 392.0 respectively. An Analysis of Variance shows no significant difference between the two times and the probability value, using the Bartlett Test, is 0.847. There is thus no evidence of any directional bias in the variations between the original survey and the QA.

33 The changes in mean axis score for the individual plot types between CS2000 and the QA are displayed in Table 8.

Table 8. Changes in mean Axis score and variance between CS2000 and QA for all plot types

		Mean score	Bartlett *p*	C.V. (%)
X-plots	CS2000	286.7		83.3
	QA	295.9	0.75	76.5
Boundaries	CS2000	548.7		33.5
	QA	550.5	0.76	35.2
Stream plots	CS2000	367.9		66.9
	QA	364.5	0.74	63.6
Hedge plots	CS2000	183.9		60.6
	QA	175.9	0.90	65.0
Roadside plots	CS2000	210.5		52.2
	QA	204.8	0.86	52.1
Y-plots	CS2000	587.4		55.5
	QA	578.1	0.94	57.1
U-plots	CS2000	313.8		73.2
	QA	309.4	0.98	74.6

The results parallel those shown for the entire data set; no plot type shows a significant difference in the principal axis score between the two sets of records.

34. The plot data from the ordination may be partitioned into four landclass aggregates rather than analysed by plot type. The aggregates, with their identifiers are:

LC: landclasses dominated by arable-growing areas of the lowlands

LG: landclasses dominated by lowland grasslands

MA: landclasses in marginal upland areas

UP: landclasses in the uplands

The results of such a grouping are summarised in Table 9.

Table 9. Changes in mean Axis score by landclass; CS2000 v QA exercise

(Figures in brackets are the number of quadrat pairs in each class)

		CS2000	QA
LC	(52)	234	238
LG	(56)	266	268
MA	(63)	441	447
UP	(31)	757	763

ANOVA:

Variable	*p*
Time	0.741
Landclass	0.000
Time*Landclass	1.000

The results demonstrate that though the plots in one landclass occupy a very different position on the gradient, represented by axis one of the ordination, from those of other landclasses, there is no significant different in the position of the CS2000 plots from those of the QA in any landclass; there is again no evidence of a directional bias.

The coding of landcover and boundary features.

General

35 Though the results derived from the assessment of concordance in the recording of plot types provide the more rigorous estimates of the reliability of the CS2000 field work, the mapping element forms a major part of the survey and an attempt has been made to provide an objective assessment of this work.

36 The efficiency of mapping can be tested in three ways. The frequency of primary codes can provide a population estimate which will indicate any overall discrepancy in the units mapped. The accuracy of mapping at a particular point can be gauged by matching the primary code awarded by the assessors at the point location with the code given by the CS2000 surveyors for the parcel of land in which the point is located. These first two approaches are combined in the tables presented for primary and qualifying code types. The third test is that of change since 1990 and the extent to which this has been recorded and apportioned between real change and the correction of original (1990) mis-coding. The accuracy of change in Countryside Survey codes is considered in paragraphs 39 *et.seq*.

37 CS 2000 survey involves the reporting of change

1. by broad habitat categories
2. by more detailed coding of land cover using the established Countryside Survey reporting categories and
3. through a comprehensive examination of boundary features using a combination of previously existing codes and additional categories introduced to assess hedge and wall management.

38 The monitoring of the mapping element of CS2000 follows that adopted in the 1991 Quality Assurance exercise of the 1990 Countryside Survey; the revised protocol used is given in Annex A.

In each of the 38 squares visited, one quarter of the area was selected, usually the south-east quarter, and nine regularly spaced points marked on the map of the square. At each point features of the land cover and of the nearest boundary (if within 100m of the point) were recorded using exactly the same methodology as that of the original surveyors. The code strings produced for each point were compared, in the field, with those generated during the 1990 survey so as to check the changes that had occurred. For the four new squares assessed where no change element was involved the field comparison was made directly with the code strings and BAP categories assigned by the CS2000 surveyors.

Primary land cover codes

39. Table 10 presents the results of the comparison of primary land cover codes awarded.

(+) indicates concordance between the coding of CS2000 and the assessors at a point

(-) indicates a discrepancy.

The final column contains the codes given by the CS2000 surveyors where these differ from those of the assessors. Values in brackets indicate the number of times that a specific mis-match occurred. The complete list of CS2000 codes is given as Annex C.

Table 10. Primary land cover codes

Concordance

	+	-	CS 2000 codes where differing from those of the assessors
35	2	0	
37	1	0	
101	127	5	102(2), 121(1), 452(1), BAP8(1)
102	2	0	
114	0	1	101(1)
117	17	0	
118	14	1	404(1)
120	0	5	121(5)
128	5	0	
133	1	0	
134	1	0	
202	2	0	
205	1	0	
206	13	0	
210	8	3	206(1), 208 (2)
401	7	0	
402	2	0	
403	1	0	
404	2	3	405(2), 204 (1)
452	2	1	454(1)
Total	208	19	

40 The level of agreement is very good. In the great majority of instances the surveyors were both where they thought they were and coded the parcel sensibly. In a very few instances, as where a *Lolium*-rich pasture was coded as BAP 8 (Acid grassland) or where a barley field was coded as the nearby park, there were errors of location. The complete mis-match of codes 120 and 121 is a quirk of the relatively small sample size - in two lowland arable squares sugar beet was recorded as turnips (possibly by the same pair of surveyors).

41 When the results for the assessment of the BAP codes (Table 11) are included in the calculation of concordance the overall values are:

Total concordance (excluding BAP codes)	91.6%
BAP concurrence	77.4%
Overall primary land cover agreement	87.5%

This compares favorably with the figure of 84.3% calculated for the efficiency of this portion of the 1990 CS survey. The modest increase in percentage concordance is probably due to the relative ease of assigning BAP codes rather than the more troublesome unenclosed primary vegetation codes used previously. The main disparity between the assignment of BAP codes lay, predictably, between BAP 10, dwarf shrub heath and BAP 12, Bog. Areas of both dry and wet heath occurred, not infrequently, within larger areas of blanket or other bog - there was a tendency, largely inherited from previous surveys, to map large areas as bog and to ignore the presence within them of lenses of heath. The 1990 boundaries between BAP types should have been amended in more instances than was the case to more accurately reflect the true distribution of broad habitat types.

Table 11 . Comparison of BAP codes.

QA Assessment

		BAP 7	BAP 8	BAP 9	BAP 10	BAP 11	BAP 12	BAP 26	(101)	Total
CS 2000	BAP 7	**5**								5
	BAP 8		**9**		2		1		1	12
	BAP 9		1	**3**						4
	BAP 10		1		**24**		2			27
	BAP 11				1	**5**				6
	BAP 12				9	1	**26**	2		38
	Total	5	11	3	36	6	29	2	1	

Species awarded cover at landuse sample points

42 The values obtained are presented in Table 12. The overall concordance (63.0%) is better than might have been expected though this is due largely to the prevalence at the sample points of ryegrass-rich swards which are, in general, easy to identify. Marked differences were evident in the level of concurrence for the recording of other species. Thus, *Trifolium repens* was less often awarded high cover by the assessors than by the surveyors and its level of concordance (35.5%) was low. There seemed to be a tendency to retain the high clover cover recorded in 1990 often, in the view of the QA team, uncritically. Much closer agreement (62.5%) between surveyors and assessors with regard to clover cover was evident in 1990-1. The 1990-91 agreement for *Agrostis capillaris* (57.1%) was thought to be rather disappointing: by the present survey this rather modest percentage concordance had been halved (to 28.6%). The records for *Bromus*

hordeaceus and *Vulpia bromoides* almost certainly reflect a seasonal element in the sward and might justifiably be removed from the comparison.

Table 12. Species awarded cover at landuse sample points

	Common	CS2000 only	QA only
Lolium multiflorum	0	2	0
Lolium perenne	93	12	6
Trifolium repens	11	17	3
Anthoxanthum odoratum	1	2	0
Phleum pratense	3	1	0
Dactylis glomerata	0	0	1
Cynosurus cristatus	7	3	3
Holcus lanatus	0	2	3
Agrostis capillaris	4	0	10
Juncus effusus	0	0	2
Molinia caerulea	0	0	1
Calluna vulgaris	5	0	0
Vaccinium myrtillus	6	0	0
Poa trivialis	6	3	2
Poa pratensis	3	7	0
Vulpia bromoides	0	1	0
Bromus hordeaceus	0	3	0
Agrostis stolonifera	1	0	2
Filipendula ulmaria	1	0	1
Blackthorn	2	0	2
Scots Pine	2	0	0
Sitka Spruce	1	1	0
Larch	0	0	2
Alder	1	0	0
Ash	1	0	0
Birch	2	0	0
Bramble	1	1	0
Elm	0	0	2
Oak	6	0	1
Gorse	7	0	0
Willow	1	0	1
Total	165	55	42

Species cover codes awarded

43 The matrix which forms Table 13 provides information on all those cases where both the surveyors and assessors awarded a percentage cover band to the same species at the same location. The concordance at this level of the survey is 74.4 %. Although there was a slight tendency for the surveyors to be more generous in their assessment of cover than were the assessors, the general agreement is good.

% of cases where surveyors awarded higher cover codes 15.0

% of cases where assessors awarded higher cover codes 10.6

Table 13. Species cover codes awarded.

QA Assessment

CS 2000

	175	176	177	178	256	257	258	Total
175	**69**	7	2					78
176	8	**21**	3	1				33
177	3	5	**11**	2				21
178			3	**1**				4
256					**8**	1		9
257					4	**2**	1	7
258						1	**7**	8
Total	80	33	19	4	12	4	8	

Other cover type qualifiers.

44 Comparisons were made of the codes used for :

use by stock

hay or silage

use of an area of trees

residential areas

sporting/recreational areas

Other use codes were so infrequent in the sample that no couplets were formed

45 The results, in the form of a matrix, comprise Table 14.

In this presentation, as in some subsequent tables, a distinction is drawn between two forms of non-concordance: values in brackets indicate that the assessors awarded a code which was omitted by the CS2000 surveyors. Thus, under code 193 [silage] there was concurrence in 22 cases but in a further five instances the assessors also noted silage whilst no equivalent code for use was entered by the surveyors. Values in other boxes indicate disparities in the awarding of codes: continuing the example provided by code 193, the assessors used the silage code on six other occasions; these points were coded as hay [194] by the surveyors in two instances, sheep pastures[189] (once) and beef cattle pasturage [185] (three times). Conversely, reading across the rows rather than down the columns, it is seen that on five other occasions it was the surveyors who recorded silage whilst the assessors noted sheep pasture [189] at the areas of all of these points.

46 The overall concurrence for these cover qualifiers was 71.9%. Since 17.3% of the discrepancies are accounted for by omissions from the surveyors code strings, it is seen that where both CS2000 and QA used a relevant code the actual code agreement was 89.2%. This is a remarkably high value especially since seasonal changes will have occurred between survey and assessment in stock type and where fields are shut up for hay/silage. The 1991 QA produced a figure for concordance of primary cover qualifying codes of 75.0%. This is equivalent to the sum of species cover codes plus cover qualifiers in CS2000; if these two sets are amalgamated for the current QA, the values for the two surveys are very similar

	1990	1998
Landuse primary qualifying code concordance	75.0	73.1

Table 14. Cover type qualifiers.

QA Assessment

CS 2000

	185	186	187	188	189	191	193	194	197	266	267	268	269	270	282	421	429	Total
185	**12(4)**				1		3											16
186		**18(2)**																18
187			**8(3)**															8
188				**3**		2												5
189				2	**45(9)**		1											48
191						**4(3)**												4
193					5		**22(5)**											27
194	3				2		2	**4**										11
197									**1**									1
266										**6**								6
267											**1(1)**							1
268												**0(2)**						0
269													**0(1)**					0
270														**0(1)**				0
282															**1**			1
421																**5**		5
429																	**3(1)**	3
Total	19	20	11	5	62	9	33	4	1	6	2	2	1	1	1	5	4	

Primary boundary codes.

47 An even greater level of consistency between the pair of Countryside Surveys is demonstrated when the results for concordance between survey and quality assurance assessments of primary boundary features are compared

The values for the CS2000 survey and for its assessment are given in Table 15. The matrix is in the same form as that introduced in Table 14 in the foregoing section. Code 410 [embankment] is included in the matrix since both surveyors and assessors independently used it as a boundary type even though it is technically an 'area' feature.

In summary:

Total concordance	85.0%
CS2000 omissions	7.0%
Code concordance	92.0%

The value of 85.0% concordance compares with a figure of 85.8% derived for the same comparison in the 1991 QA of the CS1990 survey !

48 The commonest discrepancy in the coding of primary boundaries involves code 323, mixed hedge, with CS2000 awarding the code to 19 boundary sections compared to 24 by the assessors. Rather more significantly, the surveyors recorded boundaries on five occasions when the assessors noted that the feature was no longer present - evidence of an occasional 'Friday afternoon' disposition on the part of the surveyors to tick the 1990 code without checking it for change (see paragraph 54).

CS 2000

Table 15. Primary boundary codes

QA Assessment

	56	58	301	302	311	312	313	314	321	322	323	331	332	333	410	(999)	Curt.	Total
56	1																	1
58		2																2
301			30(1)													1		31
302				2(1)														2
311					12													12
312						2												2
313							117(7)									3		120
314							1	1										2
321									38(2)	3	5					1		47
322							1			7(1)	1							9
323							1		3		15(2)							19
331												0(1)						0
332			2										11(4)					13
333														3(1)				3
410															3			3
999																0		0
Curt.											1						11	12
Total	1	2	33	3	12	2	127	1	43	11	24	1	15	4	3	5	11	

CS 2000

Table 16. Boundary features

QA Assessment

	305	306	307	308	309	310	357	358	359	360	364	371/2	374	375	376	377	378	380	Total
305	2	1																	3
306		7(1)																	7
307	3	8	2																13
308				1															1
309					3														3
310					1	3													4
357							2												2
358								2											2
359								1	2(1)										3
360										14(1)									14
364											5								5
371/2												4(1)							4
374												1	19(10)				1		21
375														1					1
376													1		1				2
377														1					1
378																	3(2)		3
380								2					1					7(1)	10
Total	5	17	2	1	4	3	2	5	3	15	5	6	31	2	1		6	8	

Boundary features.

49 Table 16 provides information on the distribution of codes awarded for wall condition and hedge shape and condition. The overall concordance for this series of codes was 67.5% with 14.8% of the mis-matches seemingly attributable to omissions from the code string by the surveyors.

The introduction of new codes [374-380] to partition hedge shapes appears to have been only a limited success; most hedges in the sample squares could be accommodated within code 374, box-shaped hedge, but in a substantial number of instances the CS2000 surveyors omitted any code for hedge shape. A more intriguing mis-match was that between codes 306 and 307 which relate to the condition of dry stone walls. The assessors tended to use code 306 'sound and stockproof with minor defects' where CS2000 surveyors classed the same section of wall as 307; 'major signs of advancing or potential deterioration' but still stock proof. The only explanation which comes to mind is the assessors long association with North West Wales where any wall not approaching dereliction is considered to be perfectly adequate; the same wall in the Cotswolds would probably be classed as a pile of stones.

Height and stockproof nature of boundaries.

50 The two small Tables 17 (a) and (b) present the matrix of agreement for these features. In summary:

	Boundary height	Stockproof condition
Total concordance (%)	89.2	83.8
CS2000 omissions (%)	3.6	5.6
Code concordance (%)	92.8	89.4

51 Boundary heights were recorded with a very high level of efficiency by the surveyors; only rarely was the relevant code omitted. There were, inevitably, some differences of opinion concerning the stockproof nature of boundaries but there was no evidence of bias towards one type or the other by surveyors or assessors; the former rated 74.3% of boundaries as stockproof whilst the equivalent figure produced by the assessors was 75.6%.

Table 17 (a). Boundary height codes.

QA Assessment

CS 2000	340	341	342	343	Total
340	**3**				3
341	5	**18**	2	1	26
342		2	**175(8)**	1	178
343			7	**26(1)**	33
Total	8	20	192	29	

Table 17 (b). Stockproof *versus* non-stockproof boundaries.

QA Assessment

CS 2000

	351	352	Total
351	**152 (13)**	10	162
352	12	**44 (3)**	56
Total	177	57	

52 The 1991 QA report included a value for the concordance of the summed primary boundary qualifying codes; this is roughly equivalent to the sum of Tables 17 (a) and 17 (b) introduced here.

Boundary qualifier concordance (%) 1990 = 81.1; 1998 = 82.9.

A very good agreement especially in view of the additional codes introduced.

Recording of change, 1990 - 1998.

53 A sample of instances of alterations to the 1990 code string involving changes made either by the CS2000 surveyors or by the assessors was analysed in order to test the level of agreement in the nature of boundary and landcover fluctuations.

The following recorded changes were **not** included in the sample:

changes in stock type or number

alterations to species cover unless of a magnitude as to differ by two cover bands e.g. 175 to 177 or *vice versa*

changes in tree age or canopy proportions

changes in boundary height unless by two code bands

changes in physiographic features

The sample contained 177 instances of change: of these 29 (16.4%) were considered by the assessors to reflect errors or omissions in the 1990 survey.

The results are summarised in Table 18

Table 18. Landuse code change

		(+)	(0)	(-)
Changes in primary code		14	8	4
Changes in species cover:				
	(i) Decrease	4	3	0
	(ii) Increase	1	2	0
Change in species attaining cover				
	(i) Species added to string	7	8	4
	(ii) Species deleted from string	14	11	1
Crop change		10	1	2
Changes in hedge type		11	8	5
Fence changes		11	5	2
Change in stockproof nature of boundary		8	0	4
Miscellaneous		11	14	4
	Total	91	60	26

(+) Concordance in assigning change

(0) Assessors noted change but CS2000 retained original code or did not add new code

(-) Either wrong i.e. a crop change but giving an incorrect code for the new crop

or adding a new cover species which the assessors judged not to be making more than 25% cover

or changing codes which appeared still to apply. Example; deleting Alder [231] when the species remained a cover element; changing non-stockproof to stockproof when the hedge appeared still to be non-stockproof,

or making apparently spurious additions, probably due to problems of location: Example 322 [hedge other] string added to 313 [post and wire fence]string when boundary at the sample point was and is a post and wire fence.

54 The level of concordance in the recording of change is disappointingly low;

Overall change concurrence	51.4%
Change not noted by CS2000	33.9%
Change recorded but not substantiated by assessors	14.7%

Even assuming that half of the change noted by the surveyors was real but missed by the assessors, the level of accurate change recording would seem to be less than 60% of that actually occurring. The surveyors seemed reluctant to indicate changes where CS1990 strings contained incorrect codes or where codes had been omitted from the 1990 strings. Of the 29 instances where the assessors considered change to be other than real only five were unambiguously so recorded by the surveyors though 16 of the cases were recorded as changes, the remaining 13 being missed.

For example, the two instances where a 1990 mixed hedge [323] has been recorded as a hawthorn hedge [321] seem very likely to have arisen from original miscodings (in neither case was the hedge newly planted). Though it is conceivable that the reverse change could have occurred over eight years, the change from mixed to hawthorn dominance seems unlikely in the extreme and the 323 code should have been circled. It seems that, contrary to the expectation that most changes would be analysed in the field, there will be a requirement for a considerable degree of interpretation during data entry. Of greater concern is the indication that, if the assessed sample is representative of the survey as a whole and the assessment reasonably accurate, a substantial proportion of the changes that have occurred since 1990 will have been missed and that it will be the plot data which provide the more reliable basis for the evaluation of change.

Annex A. Protocol for Quality Assurance Exercise

Method

1. Chose one quarter of the square which ideally:
   a) includes 6 different plot types (X, Y, B, H, S/W, R/V plus a U plot where applicable)
   b) has few land owners
   c) is easily accessible

2. Seek permission to access land, using the approach that we are looking at seasonal variation in vegetation and have taken a small sub-sample for study. If you fail to negotiate access, try a different part of the square.

Mapping land cover and boundary features

3. Place grid of nine points to cover the quarter of a square that you have chosen. A specimen is attached. Label Q1 -Q9 as follows:

Q1	Q2	Q3
Q4	Q5	Q6
Q7	Q8	Q9

4. Locate each position and code <u>the mappable area within which the point occurs</u> (might be a whole field), using the CS2000 code list. If the point falls on a boundary, move to one side (further from other points). If the point falls on a road, or on houses etc. record accordingly.
5. For each position, locate the <u>nearest</u> boundary, if within 100m, and code as a mappable length. If the position is more than 100m from the nearest boundary, record 'no boundary'. Record the approximate direction of the boundary from the Q position. Use convention of QB1 -Q B2 to identify boundaries.

Vegetation

6. For <u>one</u> only of each plot type locate the metal plate using the sketch map and then the metal detector. In upland squares where there are unlikely to be B or H plots, substitute additional X, Y or U plots.
7. Record the plot using the standard CS2000 proceedure, on a new form.
8. If you are unable to locate the plate, record this and survey where you believe the plot to be.

ANNEX B. Dates of survey and measures of surveyor efficiency.
Squares also surveyed during the 1991 QA exercise are shown in bold.

Landscape type	Square	Date CS2000	Date QA	% Efficiency	% Agreement
1	**111**	3/6	22/7	39.5	36.4
	311	21/8	13/10	70.6	65.5
	331	27/8	13/10	81.1	73.5
	336	3/6	13/7	39.9	37.8
	364	3/6	17/7	49.9	44.7
	366	3/6	18/7	42.2	37.4
	561	3/6	15/7	67.0	61.8
	898	17/6	30/7	57.3	54.3
	912	4/9	21/9	71.8	68.0
2	**40**	9/6	6/9	71.7	63.8
	63	2/7	7/9	61.2	53.1
	68	16/7	13/10	71.7	60.9
	110	10/6	7/9	57.8	53.5
	205	2/9	15/10	46.7	45.5
	518	24/6	8/7	62.5	45.3
	545	3/7	6/8	61.3	57.6
	569	31/7	9/10	51.7	48.7
	657	18/6	27/7	56.2	46.8
	672	1/6	29/7	77.8	70.2
	676	5/6	14/7	67.5	61.6
3	**351**	19/8	2/10	69.4	63.0
	431	12/7	6/10	61.5	56.2
	539	10/7	8/10	65.1	60.5
	540	23/6	9/7	66.9	50.8
	692	14/7	23/9	70.6	67.2
	847	18/6	31/7	55.0	48.9
	1152	9/6	2/8	59.6	45.2
	1212	3/7	5/8	58.0	51.1
4	**773**	29/7	18/9	70.4	62.3
	804	16/6	22/9	60.7	54.3
	955	10/7	19/9	72.1	64.6
	1090	9/6	2/8	68.3	62.6
	1118	7/8	20/9	52.2	47.4
	1163	7/6	3/8	70.6	63.6
New: 1	83	19/6	12/10	71.7	60.2
New: 3	492	1/7	6/10	72.7	60.0
New: 3	618	30/6	21/9	68.5	62.6
New: 3	661	5/6	23/9	71.9	60.8