APPENDIX 1

National Vegetation Classification communities covered by Vegetation Condition Assessment

Sub-montane dry heath	
H4	Ulex gallii - Agrostis curtisii heath
H8	Calluna vulgaris - Ulex gallii heath
H9	Calluna vulgaris - Deschampsia flexuosa heath
H10	Calluna vulgaris - Erica cinerea heath
H12	Calluna vulgaris - Vaccinium myrtillus heath
H18	Vaccinium myrtillus - Deschampsia flexuosa heath
H21	Calluna vulgaris - Vaccinium myrtillus - Sphagnum capillifolium heath
U2	Deschampsia flexuosa grassland
U3	Agrostis curtisii grassland
U4	Festuca ovina - Agrostis capillaris - Galium saxatile grassland
U5	Nardus stricta - Galium saxatile grassland
U20	Pteridium aquilinum - Galium saxatile community

Wet heath	
M15	Scirpus cespitosus - Erica tetralix wet heath
M16	Erica tetralix - Sphagnum compactum wet heath
M25	Molinia caerulea - Potentilla erecta mire
U6	Juncus squarrosus - Festuca ovina grassland

Blanket mire	
M17	Scirpus cespitosus - Eriophorum vaginatum blanket mire
M18	Erica tetralix - Sphagnum papillosum raised and blanket mire
M19	Calluna vulgaris - Eriophorum vaginatum blanket mire
M20	Eriophorum vaginatum blanket mire
M25	Molinia caerulea - Potentilla erecta mire
H9	Calluna vulgaris - Deschampsia flexuosa heath
H12	Calluna vulgaris - Vaccinium myrtillus heath
H18	Vaccinium myrtillus - Deschampsia flexuosa heath
U6	Juncus squarrosus - Festuca ovina grassland

Montane lichen and moss heath	
U2	Deschampsia flexuosa grassland
U4	Festuca ovina - Agrostis capillaris - Galium saxatile grassland
U10	Carex bigelowii - Racomitrium lanuginosum moss heath
H13	Calluna vulgaris - Cladonia arbuscula heath
H18	Vaccinium myrtillus - Deschampsia flexuosa heath
H19	Vaccinium myrtillus - Cladonia arbuscula heath

APPENDIX 2a

Record cards for Raster Mapping technique

The following record cards were used in field trials of the raster mapping technique and are compatible with the MS Excel data entry files described in Appendix 3.

Completing record cards

- All the questions/boxes on the card must be answered/filled in. The only exception is where grazing indicators cannot be answered because the feature described is not present, for example there is no short vegetation present or the indicator species (e.g. *Vaccinium myrtillus*) is absent.
- Do not just tick off the pass boxes for the criteria, fill in the matrix to the right as well as this speeds up data entry. This is particularly important where a criterion has been failed!
- Where dwarf-shrubs are either absent or very scarce in a square, so that it is not possible to make an assessment of the grazing impact using the grazing indicators on the record card, then the grazing impact should be recorded as light.
- You cannot record "No evidence of being in a burning rotation" as "widespread" if you have recorded any of the burn patch size categories as being "widespread".

ENGLISH NATURE

Upland Vegetation Condition Assessment

Field record sheet for 0.25 km² survey unit

Site Name:		1 km² grid reference:		Date:	
Management unit:		0.25 km²:		Surveyor:	

DRY HEATH (without *Ulex gallii*)

CRITERIA:	pass (✓)
>75% cover of dwarf-shrubs	
At least 1 dwarf-shrub species other than the dominant species frequent & widespread	
Bryophytes &/or bushy *Cladonia* at least frequent & forming carpets	
< 5 individual alien tree or shrub plants present	

Cover of dwarf-shrubs:	>75%	25-75	5-25	<5%
Species present + DAFOR	Y / N			
Cover of bryophytes:	Freq	Occ	Rare	
Cover of lichens:	Freq	Occ	Rare	
No. of trees/shrubs:				
Species:	Y / N			

AGE STRUCTURE:

Calluna regenerating by layering ? Y / N

% cover of *Calluna* growth phases:	Pioneer & newly burnt (<10cm)	Building & early mature (10-25cm)	Late mature & degenerate (>25cm)

GRAZING IMPACTS *

Indicator	Impact level (circle indicators & overall impact) Light	Moderate	Heavy
Width of zone of heavy grazing of dwarf-shrubs on interface with preferentially grazed vegetation	<1m	1m - 10m	>10m
% of long shoots grazed			
(a) if shoot growth >4cm/yr	<33%	33 - 66%	>>66%
(b) if shoot growth <4cm/yr	<16%	16 - 33%	>>33%
Shoot material removed	tips only	mainly tips	tips & older woody growth
Frequency of grazing induced *Calluna* growth forms ("drumstick", "topiary" or "carpet")	± absent	local	frequent
Growth of *Vaccinium myrtillus*	regular but infrequent branching	compact and much branched	densely branched or short sprigs
Signs of grazing of *Empetrum nigrum, Vacinium vitis-idaea* or *Nardus stricta*, if present	± absent		some
Uprooting of dwarf-shrub seedlings in recent burns	± absent	present but not conspicuous	conspicuous
Herbivore dung in short vegetation	rare and difficult to find	easy to find but not conspicuous	very conspicuous
Trampled bare ground	none, other than sporadic sheep scars or rabbit scraps in recent burns		frequent

Assessment:

Outlook:

Land-use & management

Grazers (✓)					
	sheep	cattle	deer	rabbits	grouse
	horses	other			

Stock feeding points present ? Y / N

Burn patch size	small (<2ha)	medium (2 - 5ha)	large (>5ha)	no evidence of being in a burning rotation
None, Local, Widespread?:	L / W	L / W	L / W	L / W

* Field indicators taken from MacDonald *et al.* (in press) "A Guide to Upland Habitats. Surveying Land Management Impacts. Vol. 2"

ENGLISH NATURE

Upland vegetation condition assessment

Field record sheet for 0.25 km² survey unit

Site Name: | 1 km² grid reference: | Date:

Management unit: | 0.25 km²: | Surveyor:

DRY HEATH WITH ULEX GALLII

CRITERIA:

	pass (✓)		
>75% cover of dwarf-shrubs		Cover of dwarf-shrubs:	>75% / 25-75 / 5-25 / <5%
At least 1 dwarf-shrub species other than the dominant species frequent & widespread		Species present + DAFOR	Y / N
Ulex gallii cover <50%		Cover of U. gallii:	<50% / >50%
< 5 individual alien tree or shrub plants present		No. of trees/shrubs: Species:	Y / N

AGE STRUCTURE:

Calluna regenerating by layering ? Y / N

% cover of *Calluna* growth phases or height classes of other dwarf-shrub spp if *Calluna* absent:	Pioneer & newly burnt (<10cm)	Building & early mature (10-25cm)	Late mature & degenerate (>25cm)

GRAZING IMPACTS *

Indicator	**Impact level (circle indicators & overall impact)**		
	Light	**Moderate**	**Heavy**
Width of zone of heavy grazing of dwarf-shrubs on interface with preferentially grazed vegetation	<1m	1m - 10m	>10m
% of long shoots grazed			
(a) if shoot growth >4cm/yr	<33%	33 - 66%	>>66%
(b) if shoot growth <4cm/yr	<16%	16 - 33%	>>33%
Shoot material removed	tips only	mainly tips	tips & older woody growth
Frequency of grazing induced *Calluna* growth forms ("drumstick", "topiary" or "carpet")	± absent	local	frequent
Growth of *Vaccinium myrtillus*	regular but infrequent branching	compact & much branched	densely branched or short sprigs
Signs of grazing of *Empetrum nigrum, Vacinium vitis-idaea* or *Nardus stricta*, if present	± absent		some
Uprooting of dwarf-shrub seedlings in recent burns	± absent	present but not conspicuous	conspicuous
Herbivore dung in short vegetation	rare & difficult to find	easy to find but not conspicuous	very conspicuous
Trampled bare ground	none, other than sporadic sheep scars or rabbit scraps in recent burns		frequent

Assessment:

Outlook:

Land-use & management

Grazers (✓): sheep | cattle | deer | rabbits | grouse | horses | other

Stock feeding points present ? Y / N

Burn patch size	small (<2ha)	medium (2 - 5ha)	large (>5ha)	no evidence of being in a burning rotation
None, Local, Widespread?:	L / W	L / W	L / W	L / W

* Field indicators taken from MacDonald *et al.* (in press) "A Guide to Upland Habitats. Surveying Land Management Impacts. Vol. 2"

ENGLISH NATURE

Upland Vegetation Condition Assessment

Field record sheet for 0.25 km² survey unit

Site Name: | 1 km² grid reference: | Date:

Management unit: | 0.25 km²: | Surveyor:

WET HEATH

CRITERIA:	pass (✓)
50 - 75% cover of dwarf-shrubs	
At least 1 dwarf-shrub species other than the dominant species frequent & widespread	
Bryophytes (excluding *Polytrichum* & *Campylopus* spp) at least frequent & forming luxurient patches	
Total cover of graminoides <50%	
< 5 individual alien tree or shrub plants present	

Cover of dwarf-shrubs:	50-75	>75% or 25-75	5-25%	<5%
Species present + DAFOR	Y / N			
Bryophytes abundance:	Freq	Occ	Rare	
Cover of graminoides:	<50%	50-75%	>75%	
No. of trees/shrubs: Species:	Y / N			

AGE STRUCTURE:

Calluna regenerating by layering ? Y / N

	Pioneer & newly burnt (<10cm)	Building & early mature (10-25cm)	Late mature & degenerate (>25cm)
% cover of *Calluna* growth phases:			

GRAZING IMPACTS *

Indicator	Impact level (circle indicators & overall impact) Light	Moderate	Heavy
Width of zone of heavy grazing of dwarf-shrubs on interface with preferentially grazed vegetation	<1m	1m - 10m	>10m
% of long shoots grazed			
(a) if shoot growth >4cm/yr	<33%	33 - 66%	>>66%
(b) if shoot growth <4cm/yr	<16%	16 - 33%	>>33%
Shoot material removed	tips only	mainly tips	tips & older woody growth
Frequency of grazing induced *Calluna* growth forms ("drumstick", "topiary" or "carpet")	± absent	local	frequent
Growth of *Vaccinium myrtillus*	regular but infrequent branching	compact and much branched	densely branched or short sprigs
Signs of grazing of *Erica tetralix, Empetrum nigrum, Vacinium vitis-idaea* or *Nardus stricta*, if present	± absent		some
Encroachment by *Juncus squarrosus, Deschampsia flexuosa* or *Nardus stricta*	± absent	local	widespread
Uprooting of dwarf-shrub seedlings in recent burns	± absent	present but not conspicuous	conspicuous
Herbivore dung in short vegetation	rare and difficult to find	easy to find but not conspicuous	very conspicuous
Trampled bare ground	none, other than sporadic sheep scars or rabbit scraps in recent burns		frequent

Assessment:

Outlook:

Land-use & management

Grazers (✓)					
sheep	cattle	deer	rabbits	grouse	
horses	other				

Stock feeding points present ? Y / N

Drainage (✓)	None	Inactive (blocked)	Active

Burn patch size	small (<2ha)	medium (2 - 5ha)	large (>5ha)	no evidence of being in a burning rotation
None, Local, Widespread?:	L / W	L / W	L / W	L / W

* Field indicators taken from MacDonald *et al.* (in press) "A Guide to Upland Habitats. Surveying Land Management Impacts. Vol. 2"

ENGLISH NATURE

Upland vegetation condition assessment

Field record sheet for 0.25 km² survey unit

Site Name: | 1 km² grid reference: | Date:

Management unit: | 0.25 km²: | Surveyor:

BLANKET & RAISED MIRE

CRITERIA:	pass (✓)				
Bryophytes abundant, inc. frequent & widespread *Sphagnum*		Bryophyte/ *Sphagnum* cover	Bryos A Sph F & W	Bryos F/A Sph R/O	Bryos O Sph R/abs	Bryos R Sph abs
Dwarf-shrub cover >33% except where *Sphagnum* abundant & forming carpets		Dwarf-shrub cover	>33%	5-33%	<5%	
At least 1 dwarf-shrub species other than the dominant species frequent & widespread		Species present + DAFOR	Y / N			
Total cover of graminoids <50% unless *Sphagnum* abundant/ co-dominant & forming lawns beneath		Cover of graminoids	<50%	>50%	>75%	
Little or no bare ground, or ground covered by *Racomitrium lanuginosum, Polytrichum* spp, *Campylopus* spp, crust forming lichens or algal mats*		Cover of bare ground etc.	none	pres^{nt}	extens.	ubiq.
No erosion assoc. with human impacts		Extent of bare peat	none	pres^{nt}	extens.	ubiq.
No active peat extraction (Old works reveg. with mire spp are OK)		Extent of pear extraction	none	pres^{nt}	extens.	ubiq.
No trees or scrub on peat body		No. of trees/shrubs: Species:	Y / N			

Age structure:

Calluna regenerating by layering ? Y / N

% cover of *Calluna* growth phases:	Pioneer & newly burnt (<10cm)	Building & early mature (10-25cm)	Late mature & degenerate (>25cm)

GRAZING IMPACTS *

Indicator	Impact level (circle indicators & overall impact) Light	Moderate	Heavy
Amount of flowering of *Eriophorum* spp	widespread & abundant	patchy or thinly scattered	inconspicuous/absent
Sphagnum carpets	extensive	patchy	very local
Invasion by *Juncus squarrosus, Deschampsia flexuosa* or *Nardus stricta*	± absent	local	widespread
Frequency of grazing induced *Calluna* growth forms ("drumstick", "topiary" or "carpet")	± absent	local	frequent
Conspicuousness of grazing on *Calluna* & *Vaccinium myrtillus*	± absent	Grazed shoots easy to find (may be patchy)	
Trampling damage to *Sphagnum* hummocks or carpets	± absent	present	abundant
Presence of trampled bare ground, paths & enhanced hagging	± absent	present	conspicuous & extensive

Assessment:

Outlook:

Land-use & management

Grazers (✓): sheep | cattle | deer | rabbits | grouse | horses | other

Stock feeding points present ? Y / N

Drainage (✓): None | Inactive (blocked) | Active

Erosion (✓): sheep/deer scars | sheet | gulley | other

Burn patch size	small (<2ha)	medium (2 - 5ha)	large (>5ha)	no evidence of being in a burning rotation
None, Local, Widespread?:	L / W	L / W	L / W	L / W

* Field indicators taken from MacDonald *et al.* (in press) "A Guide to Upland Habitats. Surveying Land Management Impacts. Vol. 2"

ENGLISH NATURE

Upland Vegetation Condition Assessment

Field record sheet for 0.25 km² survey unit

Site Name:		1 km² grid reference:		Date:	
Management unit:		0.25 km²:		Surveyor:	

MONTANE HEATH

Criteria:	**pass (✓)**					
(a) *Carex bigelowii - Racomitrium lanuginosum* moss heath						
Racomitrium lanuginosum cover >66%		Cover *Racomitrium*:	>66%	33-66	5-33	<5%
Mean depth of moss/lichen/dwarf-shrub mat >5cm		Mat depth	>5cm	2.5-5	<2.5cm	
(b) *Vaccinium myrtillus - Cladonia arbuscula* lichen heath						
Cover of "bushy" *Cladonia* spp. >50%		Cover of *Cladonia* spp.	>50%	25-50	5-25	<5%
Mean depth of moss/lichen/dwarf-shrub mat >7cm		Mat depth	>7cm	2.5-7	<2.5cm	

GRAZING IMPACTS *

Indicator	**Impact level** (circle indicators & overall impact)	
	Light	**Heavy**
Grazing of any dwarf-shrubs present	negligible	evident
Grazing of sedge and grass leaves	< 10%	> 10%
Grazing of broad-leaved grass leaves	infrequent	most
Cover of *Galium saxatile* & *Potentilla erecta*	< 10%	> 10%
Presence of *Juncus squarrosus*	± absent	frequent
Collective cover of fine-leaved grasses	< 10%	> 10%
Collective cover of broad-leaved grasses	negligible/absent	frequent
Uprooting of plants	negligible	evident
Frequency of sheep dung pellet groups	< 5/100m²	> 5/100m²
Patches of bare ground (not gravel) in sheltered areas	± absent	frequent

Assessment:

Outlook:

Land-use & management

Grazers (✓)	sheep	cattle	deer	rabbits	grouse
	horses	other			

Stock feeding points present ?

Erosion (cause ✓)	Absent	Paths	Grazing	other

Burning (✓)	Absent	Controlled	Uncontrolled

Burn patch size	small (<2ha)	medium (2 - 5ha)	large (>5ha)	no evidence of being in a burning rotation
None, Local, Widespread?:	L / W	L / W	L / W	L / W

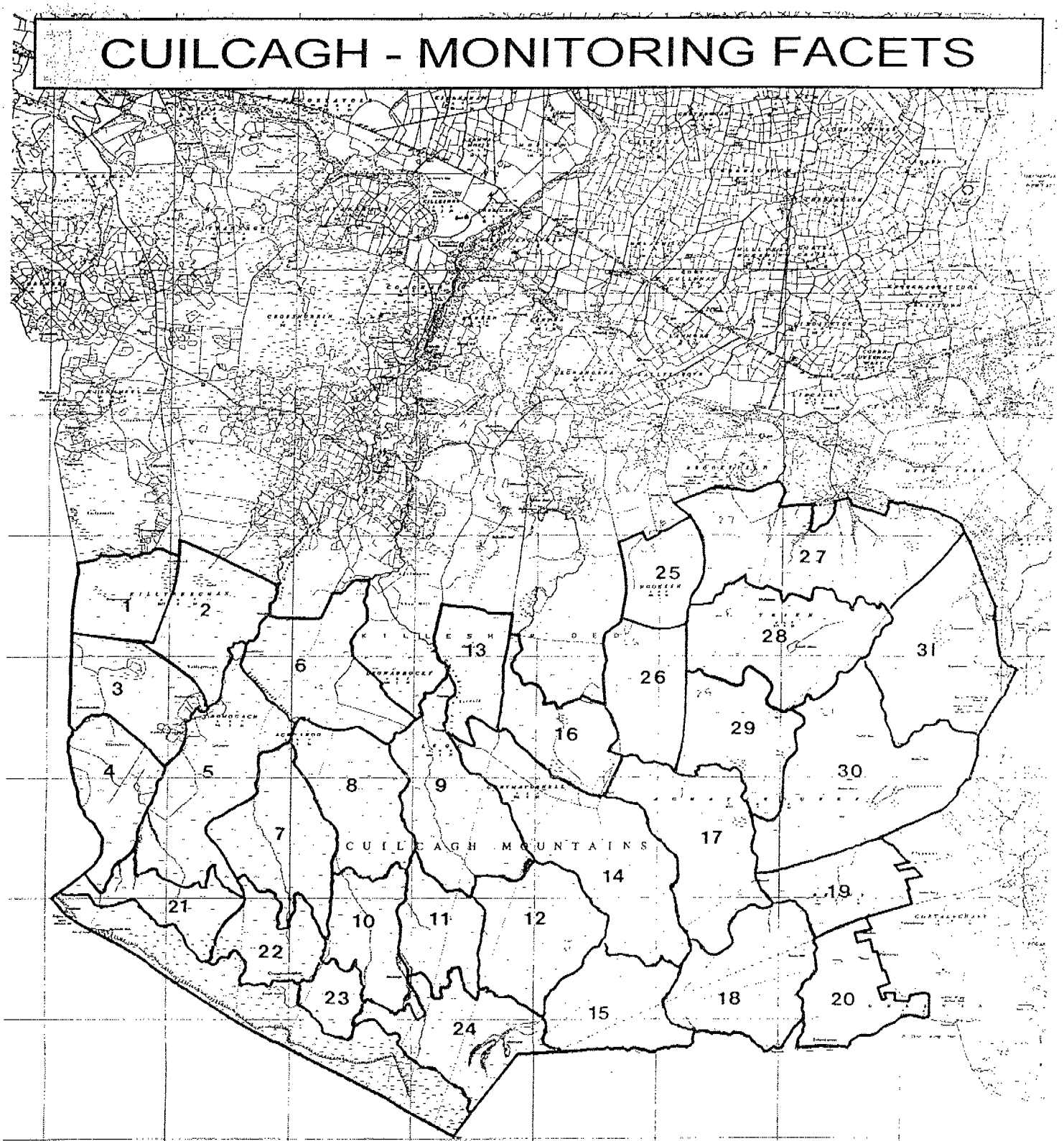
* Field indicators taken from MacDonald *et al.* (in press) "A Guide to Upland Habitats. Surveying Land Management Impacts. Vol. 2"

APPENDIX 2b

Examples of record cards and facet boundary maps used by Northern Ireland Environment and Heritage Service

Note that vegetation condition assessment cards similar to those in Appendix 2a were completed for each facet in addition to the facet summary cover sheet and habitat recording sheets.

CUILCAGH - MONITORING FACETS



Scale 1:45000
Centre (212938, 331544)
metres
0 200 400 600 800 1000
0 200 400 600 800 1000

SUMMARY COVER SHEET

FACET NUMBER

	Percentage of facet covered by each habitat type %
Blanket Bog	
Pool systems within Blanket Bog	
Wet Heath	
Dry Heath	
Flushed Blanket Bog with no ericoids	
Wet *Juncus effusus* dominated grassland	
Species poor grassland selectively grazed by stock	
Other habitats	
_ _ _ _ _ _ _ _ _ _ _ _	

COMMENTS
(Records of damage management issues etc.)

DRY HEATH RECORDING SHEET

Site Name: _____ G.R. _____ Date: _____

Management Unit: _____ Facet: _____ Surveyors: _____

CRITERIA

Average

Dwarf-shrub Cover (%): | | | | | | | | | | | | | | | | | | | | |

Dominant Species:
Other frequent dwarf-shrub species
(Use species code)

Graminoid Cover (%): | | | | | | | | | | | | | | | | | | | | |

Bryophyte Cover (%): | | | | | | | | | | | | | | | | | | | | |

Lichen Cover (%): | | | | | | | | | | | | | | | | | | | | |

Trees or scrub
(spp present and no.) _____

AGE STRUCTURE

Dwarf-shrub Ht (cm): | | | | | | | | | | | | | | | | | | | | |

% Cover of *Calluna* growth phases
(Tally III*)*

Pioneer _____

Building & early mature _____

Late mature and degenerate _____

No obvious growth phases
(regen. by layering) _____

GRAZING IMPACTS

(Tally III*)*

Width of grazing zone in dwarf-shrubs on interface with preferentially grazed vegetation

No preferential grazing zone	< 1 m	1 m-10 m	> 10 m
_____	_____	_____	_____

	± Absent	Present	Frequent
Invasion by *J. squarrosus*, and *D. flexuosa* or *N. stricta*	_____	_____	_____
Frequency of grazing induced *Calluna* growth forms	_____	_____	_____
Uprooting of dwarf-shrubs	_____	_____	_____
Herbivore dung in short vegetation	_____	_____	_____
Poaching by sheep or cattle	_____	_____	_____

WET HEATH RECORDING SHEET

Site Name: _____ G.R. _____ Date: _____

Management Unit: _____ Facet: _____ Surveyors: _____

CRITERIA

Average

Dwarf-shrub Cover (%):

Dominant Species:
Other frequent dwarf-shrub species
(Use species code)

Graminoid Cover (%):

Bryophyte Cover (%):

Trees or scrub
(spp present and no.) _____

AGE STRUCTURE

Dwarf-shrub Ht (cm):

% Cover of *Calluna* growth phases
(Tally III*)*

Pioneer _____

Building & early mature _____

Late mature and degenerate _____

No obvious growth phases
(regen. by layering) _____

GRAZING IMPACTS

(Tally III*)*

Width of grazing zone in dwarf-shrubs on interface with preferentially grazed vegetation	No preferential grazing zone	< 1 m	1 m-10 m	> 10 m
	_____	_____	_____	_____

	+ Absent	Present	Frequent
Invasion by *J. squarrosus*, and *D. flexuosa* or *N. stricta*	_____	_____	_____
Frequency of grazing induced *Calluna* growth forms	_____	_____	_____
Uprooting of dwarf-shrubs	_____	_____	_____
Herbivore dung in short vegetation	_____	_____	_____
Poaching by sheep or cattle	_____	_____	_____

BLANKET BOG RECORDING SHEET

Site Name: _____ **G.R.** _____ **Date:** _____

Management Unit: _____ **Facet:** _____ **Surveyors:** _____

CRITERIA

Average

Sphagnum Cover (%):

Dwarf-shrub Cover (%):

Dominant Species:
Other frequent dwarf-shrub species
(Use species code)

Graminoid Cover (%):

Bare Peat Cover (%):

Trees or scrub
(spp present and no.) _____

AGE STRUCTURE

Dwarf-shrub Ht (cm):

% Cover of *Calluna* growth phases
(Tally III*)*

Pioneer _____

Building & early mature _____

Late mature and degenerate _____

No obvious growth phases
(regen. by layering) _____

GRAZING IMPACTS

(Tally III*)*

	± Absent	Present	Frequent
Invasion by *Juncus squarrosus* and *Deschampsia flexuosa*	_____	_____	_____
Poaching by sheep cattle	_____	_____	_____
Enhanced hagging	_____	_____	_____
Frequency of grazing induced *Calluna* growth forms	_____	_____	_____

APPENDIX 3

Using a Geographical Information System to display vegetation condition survey data

The following procedures are for data entry using Microsoft Excel 95 or 97 and MapInfo Professional v.4. Data entry using other spreadsheets and saving the results in either Excel or Lotus 1-2-3 formats will probably work, however the authors have no experience of this so cannot guarantee the results.

Data entry

Five data entry files can be provided by EN Uplands Team, one for each habitat type covered by this project (Dryheath.xls, UGallii.xls, Wetheath.xls, BlanketB.xls and Montane.xls). These files consist of two rows. Row 1 contains column headings in the order they will be read on the relevant record card from Appendix 2. Row 2 contains cells for data entry and, at the right hand end, cells which calculate the vegetation condition score for that row. Prior to data entry the cells containing calculations (these will be evident as they will display values such as ERROR) should be copied into the rows below by selecting both Row 2 and the rows into which the formulas are to be calculated and using the **Edit: Fill: Down** command. One row is required for each survey square recorded.

Data entry is straight forward, other than for the **Easting** and **Northing** columns. Data must be entered using the following formats (without spaces between numbers and symbols such as -, > or <). The appropriate data entry formats are underlined on the record cards.

Dry Heath			
Column	**Data Format**	**Column**	**Data Format**
Square_No	Four figure OS grid reference plus quadrant, e.g: 6795NW		
Easting	The first two numbers of the 4 fig grid ref. plus 25 for SW & NW 75 for SE & NE e.g: 6725	Northing	The second two numbers of the 4 fig grid ref. plus 25 for SW & SE 75 for NW & NE e.g: 9575
Dwarf_shrub_cover	>75, 25-75, 5-25, <5	Vaccinium_growth	H, M, L
Dwarf_shrub_diversity	Y, N	Grazing_of_Empetrum_etc	H, M, L
Bryophyte_abundance	F, O, R	Uprooting	H, M, L
Alien_trees	Y, N	Herbivore_dung	H, M, L
Calluna_layering	Y, N	Trampling	H, L
Pioneer_Calluna	a number or leave blank	Grazers	sheep, deer, etc
Building_mature_Calluna	a number or leave blank	Stock_feeding	Y, N
Mature_degenerate_ Calluna	a number or leave blank	Small_burns	L, W
Grazing_Impact	H, M, L	Medium_burns	L, W
Long_shoots_grazed	H, M, L	Large_burns	L, W
Shoot_material_removed	H, M, L	No_burning	L, W
Grazing_induced_growth_ forms	H, M, L		

Ulex gallii Heath			
Column	Data Format	Column	Data Format
Square_No	Four figure OS grid reference plus quadrant, e.g: 6795NW		
Easting	The first two numbers of the 4 fig grid ref. plus 25 for SW & NW 75 for SE & NE e.g: 6725	Northing	The second two numbers of the 4 fig grid ref. plus 25 for SW & SE 75 for NW & NE e.g: 9575
Dwarf_shrub_cover	>75, 25-75, 5-25, <5	Vaccinium_growth	H, M, L
Dwarf_shrub_diversity	Y, N	Grazing_of_Empetrum_etc	H, M, L
U_gallii_cover	<50, >50	Uprooting	H, M, L
Alien_trees	Y, N	Herbivore_dung	H, M, L
Calluna_layering	Y, N	Trampling	H, L
Pioneer_Calluna	a number or leave blank	Grazers	sheep, deer, etc
Building_mature_Calluna	a number or leave blank	Stock_feeding	Y, N
Mature_degenerate_ Calluna	a number or leave blank	Small_burns	L, W
Grazing_Impact	H, M, L	Medium_burns	L, W
Long_shoots_grazed	H, M, L	Large_burns	L, W
Shoot_material_removed	H, M, L	No_burning	L, W
Grazing_induced_growth_ forms	H, M, L		

Wet Heath			
Column	Data Format	Column	Data Format
Square_No	Four figure OS grid reference plus quadrant, e.g: 6795NW		
Easting	The first two numbers of the 4 fig grid ref. plus 25 for SW & NW 75 for SE & NE e.g: 6725	Northing	The second two numbers of the 4 fig grid ref. plus 25 for SW & SE 75 for NW & NE e.g: 9575
Dwarf_shrub_cover	50-75,>75, 25-75, 5-25,<5	Vaccinium_growth	H, M, L
Dwarf_shrub_diversity	Y, N	Grazing_of_Erica_etc	H, L
Bryophyte_abundance	F, O, R	Encroachment_by_Juncus _etc	H, M, L
Graminoid_cover	<50, 50-75, >75	Uprooting	H, M, L
Alien_trees	Y, N	Herbivore_dung	H, M, L
Calluna_layering	Y, N	Trampling	H, L
Pioneer_Calluna	a number or leave blank	Grazers	sheep, deer, etc
Building_mature_Calluna	a number or leave blank	Stock_feeding	Y, N
Mature_degenerate_ Calluna	a number or leave blank	Small_burns	L, W
Grazing_Impact	H, M, L	Medium_burns	L, W
Long_shoots_grazed	H, M, L	Large_burns	L, W
Shoot_material_removed	H, M, L	No_burning	L, W
Grazing_induced_growth_ forms	H, M, L		

Blanket Mire			
Column	Data Format	Column	Data Format
Square_No	Four figure OS grid reference plus quadrant, e.g: 6795NW		
Easting	The first two numbers of the 4 fig grid ref. plus 25 for SW & NW 75 for SE & NE e.g: 6725	Northing	The second two numbers of the 4 fig grid ref. plus 25 for SW & SE 75 for NW & NE e.g: 9575
Bryophyte_abundance	A, F, O, R	Sphagnum_carpets	H, M, L
Dwarf_shrub_cover	>33, 5-33, <5	Invasion_by_Jsquarrosus_ etc	H, M, L
Dwarf_shrub_diversity	Y, N	Grazing_induced_growth_ forms	H, M, L
Graminoid_cover	<50, 50-75, >75	Grazing_of_Calluna& Vaccinium	H, L
Bare_ground_etc	N, P, E, U	Trampling_of_Sphagnum	H, M, L
Erosion_features	N, P, E, U	Trampling	H, M, L
Peat_extraction	N, P, E, U	Grazers	sheep, deer, etc
Trees	Y, N	Stock_feeding	Y, N
Calluna_layering	Y, N	Drainage	N, I, A
Pioneer_Calluna	a number or leave blank	Erosion_features	SC, S, G, other (type in)
Building_mature_Calluna	a number or leave blank	Small_burns	L, W
Mature_degenerate_ Calluna	a number or leave blank	Medium_burns	L, W
Grazing_Impact	H, M, L	Large_burns	L, W
Eriophorum_flowering	H, M, L	No_burning	L, W

Montane Heath			
Column	Data Format	Column	Data Format
Square_No	Four figure OS grid reference plus quadrant, e.g: 6795NW		
Easting	The first two numbers of the 4 fig grid ref. plus 25 for SW & NW 75 for SE & NE e.g: 6725	Northing	The second two numbers of the 4 fig grid ref. plus 25 for SW & SE 75 for NW & NE e.g: 9575
Racomitrium_cover	>66, 33-66, 5-33, <5	Uprooting	H, L
Cladonia_cover	>50, 25-50, 5-25, <5	Dung_pellets	H, L
Depth_of_moss	>5, >7, 2.5-5, 2.5-7,<2.5	Bare_ground	H, L
Grazing_Impact	H, L	Grazers	sheep, deer, etc
Grazing_of_dwarfshrubs	H, L	Stock_feeding	Y, N
Grazing_of_sedges_etc	H, L	Erosion	A, P, G, other (type in)
Grazing_of_broad_grasses	H, L	Burning	A, C, U
Galium_cover	H, L	Small_burns	L, W
Juncus_squarrosus	H, L	Medium_burns	L, W
Fine_grass_cover	H, L	Large_burns	L, W
Broad_grass_cover	H, L	No-burning	L, W

Troubleshooting data entry:

- Co-ordinates in the **Easting** and **Northing** columns will lose leading zeros, this will not cause a problem. Do not reformat these columns to retain leading zeros as MapInfo requires co-ordinates to be in a numerical format and will not recognise them if they are reformatted as text.
- Where a site lies in more than one 100km OS grid square the 100km grid square co-ordinates must be added to the Easting and Northing columns, otherwise MapInfo will get the sample square locations wrong. So, where a site lies in both the NZ and SE 100km squares the Easting and Northing co-ordinates 6725 and 9575 (which lie in the SE 100km square) will become 56725 and 49575, while the co-ordinates 6725 0575 (which lie in the NZ 100km square) will become 56725 and 59575.
- Where data is entered in an unrecognised format then ERROR will appear the relevant calculation cell, if this happens re-enter the data for the corresponding data cell. Note that with Montane.xls ERROR will appear in either the **Racomitrium** or **Cladonia** field as only one of these will be used and this can be ignored.
- Where grazing indicators on the record card have not been filled in because the square is entirely composed of grass the **Grazing Impact** should be recorded as L(ight).
- If all the squares in a data set are grass (<25% cover of dwarf-shrubs) then the columns **Age_calc2**, **Age** and **Condition_Score** will display either **#DIV/0!** or **###**. Where this happens manually enter 1 in the **Age** column for all the entries, otherwise the **Condition_Score** column will be invalid.

Once data is entered delete any unused calculation cells generated by **Fill: Down** as otherwise the age structure calculations will be incorrect.

Once this is done you will see that the file has automatically calculated the condition score of each sample square in the **Condition_score** column on the right hand side of the table. Note that as the age structure criterion in dry and wet heaths relies on calculations based on data from all the sample squares the condition scores generated by this file are only valid after data for all sample squares has been entered.

Make a note of the cell address of the bottom right hand cell of the data table (e.g. AP27) as this is needed when opening the file in MapInfo.

Save the data file with a different filename using **File: Save as...** (remember that if you are using MS Excel 97 you must save the file in version 5.0/95 format not version 97).

Age structure calculations in data entry files

The data entry files Dryheath.xls and Wetheath.xls calculate the proportion of late mature/degenerate *Calluna* over a site by taking the mean percentage cover of late mature/degenerate *Calluna* recorded. Squares which are predominantly grassland, that is have less than 25% cover of dwarf-shrubs are excluded from this calculation. Stands which are not burnt but are regenerating through layering may be recorded as being in the early mature age class. To account for this, the cover value for Building/early mature *Calluna* is added to the late mature/degenerate figure for those sample squares in which layering is recorded or where "no evidence of being in a burning rotation" is recorded as being "widespread". The UGallii.xls file also excludes sample squares with less than 25% dwarf-shrub cover from age structure calculations.

Creating a map of vegetation condition using MapInfo Professional v.4

1. Either obtain a digital map of your site or scan in your base map using your scanner software. MapInfo supports the commonly used bitmap image file formats BMP and TIF.

   Steps 2 to 10 assume that you are using a scanned bitmap image as a base map.

2. Open your base map image file using **File: Open Table...**

3. In the **Open Table** dialogue choose **Raster Image** from the **Files of Type** drop-down list.

4. Choose the file with your map and click **Open**. If you have not used this file in MapInfo before you will be asked if you wish to register it. Choose **Register**.

   MapInfo displays the **Image Registration** dialogue. A preview of the raster image appears in the lower half of the dialogue.

5. Specify the image's map projection by choosing the **Projection** button and completing the **Choose Projection** dialogue: from the **Category** drop-down list choose `British Coordinate Systems`, from the **Category Members** drop-down list choose `British National Grid` and click **OK**.

6. Specify the maps units by clicking the **Units** button and choosing **meters** (it is assumed that you are using a metric OS base map).

7. Move the mouse cursor over the image preview in the lower half of the dialogue to a spot where you know the map co-ordinates (e.g. a northing and easting gridline intersection) and click (use the scroll bars to move around the image and the **+** and **-** buttons to zoom in and out). MapInfo displays the **Add Control Point** dialogue.

8. Complete the **Add Control Point** dialogue by entering the map co-ordinates that correspond to the location where you clicked on the map image (use 8 figure grid references e.g. 6700 for **Map X** (easting) and 9500 for **Map Y** (northing) so that it corresponds to the grid references entered in the data table). Choose **OK**.

9. Repeat steps 7 and 8 until you have entered at least three control points. You should have at least one control point at or near each corner of the image.

10. Choose **OK** when you are done adding control points. MapInfo displays the raster image in a Map window.

    When you complete the **Image Registration** dialogue, MapInfo saves the registration information in a table (.tab) file. In later MapInfo sessions, you can re-open the table by choosing **File: Open Table**, without repeating the registration process, and without having to choose **Raster Images** as the **File Type** in the **Open Table** dialogue.

11. Open your data file using **File: Open Table...**

12. A dialogue box titled **Excel Information** will appear.

13. From the drop down list for **Named Range** select **other...** and alter the suggested cell range to `Sheet1!A2:AP27` (replacing `AP27` with whatever your last cell was) and click **OK**.

14. Check the **Use Row Above Selected Range for Column Titles** box and click **OK**.

    Your file will open in a Browser Window.

15. To associate your data table with the map you must specify the co-ordinate columns and map projection of the data table using **Table: Create Points...** to open the **Create Points** dialogue.

16. Check that your data table filename is selected in the **Create Points for Table** drop-down list, then in the **Get X Coordinates from Column** drop-down list of column names select Easting and in the **Get Y Coordinates from Column** drop-down list of column names select Northing.

17. Click on the **Projection...** button and select British Coordinates System from the **Category** drop-down list, from the **Category Members** drop-down list choose British National Grid and click **OK**. Click **OK** on the **Create Points** dialogue.

18. Open a new Map window using **Window: New Map Window** and select your base map in the first **Map Tables** drop-down list box and your data table in the second box, click **OK**.

19. To display the distribution of condition grades use **Map: Create Thematic Map...**, select **Ranges** in the dialogue, click **Next>**;

20. Select your data table in the **Table:** drop-down list and **Condition_Score** in the **Field:** drop-down, click **Next>**;

21. Click the **Ranges...** button. The **Customize Ranges** dialogue displays. Select **Custom** in the **Method:** drop-down list box, **3** in the **# of Ranges:** box and **none** in the **Round By:** box. Click the **Recalc** button.

22. Select the first line in the large box in the centre of the dialogue. In the **Custom Ranges** panel below the box enter 0 in the **>=Min:** box and 1 in the **< Max:** box.

23. Select the second line in the large box. In the **Custom Ranges** panel below the box enter 1 in the **>=Min:** box and 6 in the **< Max:** box.

24. Select the third line in the large box. In the **Custom Ranges** panel below the box enter 6 in the **>=Min:** box and 24 in the **< Max:** box.

25. Click **Recalc** and then **OK**.

26. Back in the **Create Thematic Map** dialogue click the **Styles...** button.

27. Check that **Color** is selected in the **Auto Spread** panel of the **Customize Range Styles** dialogue.

28. Click the top button with a star on it to open the **Symbol Style** dialogue.

29. Select a filled (shaded) symbol from the **Symbol:** drop-down list.

30. Select a colour from the **Color:** drop-down (note that if you want to print your map and you only have a black and white printer then you should only select a black, white or a shade of grey). As this symbol will represent sample squares in favourable vegetation condition white is suggested.

31. From the **Font:** drop-down select a font size, a large one, e.g. 48 points, is suggested. Click **OK**.

32. Click on the bottom of the stack of three buttons.

33. Repeat steps 29 to 31, but for the colour choose a dark one as this will represent severely unfavourable squares. If you have a black and white printer then it is suggested that you

choose a moderately dark shade of grey rather than black as this will not obscure the base map detail.

34. When you have returned to the **Create Thematic Map** dialogue click on the **Legend...** button.
35. In the **Customize Legend** dialogue type a title and, if required, a sub-title, in the **Title:** and **Subtitle:** boxes (you can change the fonts of these title lines by clicking on the font buttons if you want).
36. Uncheck the **Show Record Count** box.
37. In the **Range Labels** box select **0 to 1** and type `Favourable` in the **Edit selected Range here:** box and ensure that the **Show this Range** box is checked.
38. Select **1 to 6** and type `Unfavourable` in the **Edit selected Range here:** box and ensure that the **Show this Range** box is checked.
39. Select **6 to 24** and type `Severely unfavourable` in the **Edit selected Range here:** box and ensure that the **Show this Range** box is checked.
40. Select **all others** and ensure that the **Show this Range** box is unchecked. Click **OK**.
41. Check that **Ascending** is checked in the **Legend Label Order** panel in the **Create Thematic Map** dialogue and click **OK**.
42. Select the map window with your thematic map in it.
43. Reorder the layering of the map by opening the **Layer Control** dialogue: **Map: Layer Control...**
44. Select your data table in the **Layer:** box, check the **auto label** box (the fourth box along in the row of check boxes alongside the name of your data table) and then click on the **Label...** button.
45. In the **Label Options** dialogue select **Condition_Score** from the **Label with:** drop-down list (note that you could display the contents of one of the other data columns, say **Grazing_Impact**, by selecting that column name rather than **Condition_Score** if you are interested in that component of the vegetation condition).
46. Ensure that the **Display within Range** box is unchecked.
47. Check the **None** box is checked in the **Styles: Label Lines** panel.
48. Click the **Style** button and change the font size to 8 points and check the **Halo** box (to make the label stand out against the shading of the symbol).
49. In the **Position** panel click on the central **Anchor Point** button and set the **Label Offset** to 0 to centre the label. Click **OK** and click **OK** again in the **Layer Control** dialogue to close it.
50. You will find that the base map obscures the symbols. To make the base map transparent open **Table: Raster: Adjust Image Styles...**
51. Check the **Transparent** box. Click the **Select Color** button, move the mouse pointer over a white area on the portion of map that is displayed and click (it is assumed that the base map is black and white). Click **OK**.

52. If the base map does not display over the top of the condition score symbols reopen the **Layer Control** dialogue, select the base map layer, click on the **Display** button, and uncheck the **Display within Zoom Range** box and click **OK**. Click **OK** to close **Layer Control**.

53. Resize the **Thematic Map Window** to see it properly by dragging the window frames with the mouse so that the window is as tall as you can get it and as wide as is required to accommodate the maps width (if you just wish to view the map on screen without printing it then you can simply maximise the window, however you will need to resize the window to the shape of the base map to print map, so you might as well do that now). If the whole map does not display, or the map does not fill the screen open the **Map: View Entire Layer...** dialogue, select the base map from the drop-down list and click **OK**. (If you find that resizing the map changes the map scale use **Options: Preferences: Map Window...** to open the **Map Window Preferences** dialogue and set **When Resizing Map Window** to **Preserve Current Scale** (click **OK** twice to exit)).

    You now have a map showing the distribution of vegetation condition for the selected habitat across the site. The vegetation condition grades are shown as shaded symbols, while the actual condition score is shown as a number overlaid on the symbol.

54. To print the map you must place it in a **Layout Window**, you could print the thematic map window, however this would not include the **legend**.

55. Resize the **Thematic Map Window** so that there is no white space around the edges of the base map: **Map: Change View...** In the **Zoom (Window Width):** box enter the width of the base map in terms of the number of km squares (note however that MapInfo has shifted the decimal point one place to the right, displaying 4.5km as 0.45km, go along with this lunacy and enter your width as 10% of what it actually is, i.e. enter 4.5km as 0.45). Click **OK**. Alternatively play around with the window frame with the mouse. You can also use the **Grabber tool** to move the map inside the window.

56. **Open the New Layout Window** dialogue: **Window: New Layout Window...**

57. Check the **One Frame for Window** box if it is not already checked and select your thematic map from the drop-down list (both of these options are usually selected by default), click **OK**.

58. Maximise the **Layout Window**. Then increase the size of the page: **Layout: View Entire Layout**

59. Size the **Legend** frame so that it displays the entire frame by selecting the frame (click over the **Legend**) and then click on one of the **corner anchors** and drag it until the frame is the right size.

60. Move the **Legend** to a position where it doesn't obscure any of the map by selecting the legend frame and dragging it to the desired position.

    The map position can also be moved by selecting and dragging it.

61. Print the map using **File: Print...**

    The map can be saved as a bitmap which can be used or printed by other applications using: **File: Save Window As...**, but first resize the **Layout Window** so that it frames the page exactly, then in the **Image Size** panel of the **Save Window As** dialogue select **Custom** and enter a height or width corresponding to the size of the paper the map will be printed on, MapInfo will automatically adjust the other size to maintain the aspect ratio.

62. To save the map in an editable MapInfo form you must have the thematic map, data table, base map and layout windows open and use **File: Save Workspace...** to save the entire workspace.

APPENDIX 4

Sites visited during field trials

Table 1 Sites visited to assess the validity of initial draft of criteria for favourable vegetation condition

Site	Habitats present
Tripsdale, North York Moors	dry heath
Bollihope Common, Co. Durham	dry heath and flushes
Dark Peak, Derbyshire	dry heath, blanket mire
Leek Moors, Staffordshire	dry heath, wet heath and blanket mire
Ingleborough, Lovely Seat-Stainton Moor, Harkerside Moor & Arkengarthdale, Yorkshire Dales	dry heath, blanket mire and flushes
Dartmoor	dry heath, wet heath, blanket mire and flushes
Exmoor	dry heath, blanket mire and wet heath
Stiperstones, Shropshire	dry heath and flushes
Long Mynd, Shropshire	dry heath and flushes
Black Mountain, Herefordshire	dry heath and blanket mire
Cheviot, Northumberland	dry heath and blanket mire
Kielderhead, Northumberland	blanket mire
Moorhouse and Crossfell, North Pennines	montane heath, blanket mire and flushes
Buttermere Fells, Lake District	dry heath and montane heath

Table 2 Sites visited during trials of the vegetation condition assessment criteria

Site visited	Habitats assessed
Quantock Hills, Somerset	dry heath
Fox Tor/Caters Beam and Headland Warren, Dartmoor	blanket mire and dry heath
Grisedale Pike and Grasmoor, Lake District	dry heath and montane heath
Ilkley Moor, West Yorkshire	dry heath
Birkdale and Askrigg Commons, Yorkshire Dales	dry heath and blanket mire
Moor House NNR and Middleton Common, North Pennines	blanket mire and dry heath

Table 3 Sites visited during trials of vegetation condition grades	
Site visited	**Habitats assessed**
Dunkery Beacon, Porlock Common and North Hill, Somerset	dry heath
Lockton and Levisham Moors and Fylingdales Moor, North York Moors	wet and dry heaths
Skiddaw and Caldbeck Common, Lake District	dry heath, blanket mire and montane heath
Kielderhead and Emblehope Moors, Border Uplands	dry heath and blanket mire
Moor House and Cross Fell, North Pennines	montane heath, blanket mire and dry heath

APPENDIX 5

Field Trials of Raster Mapping Methodology

During August, September and October 1997 field trials of the Raster mapping technique were carried out on whole management units on four sites in northern England. The trials involved a full-scale survey of the management units, surveying each 25ha square or part square within the unit using the methodology described in Section 4.2.1.2 and the record cards in Appendix 2. Data was entered into MS Excel files and subsequently into MapInfo to produce the following maps of vegetation condition and permutations of the data recorded on the cards, as described in Appendix 3.

Skiddaw Forest, Cumbria

The map of dry heath shows a gradation in vegetation condition across the management unit. Much of the north-east quarter is in favourable condition, though this is marred by the presence of a very extensive burn on the side of Great Calva. Elsewhere the site is in unfavourable condition due to factors such as grazing impact and reduced cover of dwarf-shrubs. On the southern side of the unit, where dwarf-shrubs are largely replaced by *Nardus* grassland, the vegetation is in severely unfavourable condition.

The blanket mire in the centre of the unit is almost entirely in favourable condition, despite the presence of a number of drains. Stands of blanket mire on the side of Great Calva have however been invaded by grasses, particularly *Deschampsia flexuosa*, following the large fire.

Areas of montane heath are present on the western edge of the unit below the summit of Skiddaw. These stands are in unfavourable and severely unfavourable condition due to the very high cover of grasses and low cover of *Racomitrium* and *Cladonia* spp and thin moss/lichen/dwarf-shrub layer.

Fylingdales Moor, North Yorkshire

Wet heath is the predominant vegetation type on this site. All the wet heath has been classified as unfavourable as less than 50% of this habitat is in the late mature/degenerate age class. Within this it can be seen that bryophyte abundance, or rather lack of it, is the main contributing factor pushing sample squares into the severely unfavourable category.

The majority of the dry heath is also in unfavourable condition, almost entirely due to a lack of bryophytes. In contrast to the wet heath, 50% of the dry heath is in the late mature/ degenerate age class.

College Valley, The Cheviot, Northumberland

The lower slopes of this management unit are dominated by dry heath, though in the western half of the unit most of this is now dominated by grasses, hence the dominance of unfavourable and severely unfavourable vegetation condition. Moderate grazing impacts affect the site around West Hill and Bizzle Crags. To the east there are areas of favourable dry heath on the mid slopes, while lower down bryophyte abundance is the main factor determining favourability. Over 70% of the dry heath on this management unit was recorded as being in the late mature/degenerate age class.

The higher ground is largely covered by blanket mire, all of which is in unfavourable condition, largely due to poor bryophyte abundance. Around the summit of The Cheviot and along the Pennine Way there are extensive areas of eroding peat, making these areas severely

unfavourable. At the western end of the site however, cover of dwarf-shrubs is also a factor contributing to the poor vegetation condition.

Scattered stands of montane heath are in unfavourable and severely unfavourable vegetation condition due to low cover of *Cladonia* spp, thin moss/lichen/dwarf-shrub mats and grazing impacts.

Whitfield Moor, Northumberland

Two management units were surveyed here. The northern moor is predominantly blanket mire. This is either in favourable condition or close to favourable condition over most of the moor. A variety of factors result in unfavourable condition where it occurs, with grazing impact the main one to the north-east, while bryophyte abundance and poor dwarf-shrub diversity plays a part elsewhere. The entire moor is burnt for grouse and there is an extensive network of drains.

Dry heath is largely confined to sloping ground in the southern half of the moor, where grazing impacts and poor dwarf-shrub cover, together with a low proportion of late mature/ degenerate *Calluna* contribute to the unfavourable and severely unfavourable condition.

Bryophyte abundance, dwarf-shrub cover, dwarf-shrub diversity, graminoid cover, grazing impacts and the presence of erosion features all contribute to the poor vegetation condition of the blanket mire in the southern management unit. Dwarf-shrubs are almost entirely absent from the dry heath in this management unit, so that all the samples squares with this habitat are in severely unfavourable vegetation condition.