

# Northern Ireland Countryside Survey 2007: Field Methods and Technical Manual



Research and Development Series 09/07

A report commissioned by the Northern Ireland Environment Agency

## Northern Ireland Countryside Survey 2007: Field Methods and Technical Manual

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**NIEA contract number:** CON 2/1 (182)

**This report should be cited as follows:** McCann, T. Rogers, D., Cooper, A. (2009) Northern Ireland Countryside Survey 2007: Field Methods and Technical Manual. *Northern Ireland Environment Agency, Research and Development Series No 09/07*. Belfast.

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The opinions expressed in this report do not necessarily reflect the current opinion or policy of the Northern Ireland Environment Agency.

## Prologue

### Northern Ireland Countryside Survey

In the late 1980s, a baseline land cover survey was carried out in Northern Ireland (NI) to estimate the area of different types of Primary Habitats from a random sample set of quarter kilometre grid squares. The Northern Ireland Countryside Survey (NICS) was carried out for Environment and Heritage Service DoENI. Survey results were subsequently used to guide land use decisions and to inform policy relating to AONBs, Environmentally Sensitive Areas (ESA) and the NI Biodiversity Strategy. A monitoring resurvey was carried out in 1998 (NICS 2000) to determine the extent of change using the same sample grid squares and methods as in the baseline. A third time series of the NICS will be carried out in 2007 to survey 287 grid squares.

### Field handbook structure

Standard field procedures for the baseline survey facilitated consistent recording between field surveyors and survey time series. NICS 2007 updates the procedures and takes account of developments in GIS, electronic data recording and the availability of colour aerial photography. Procedures were developed following field piloting carried out in 2006. They are described in 3 main sections:

Part 1. This section of the manual describes the habitat types you will be mapping and the habitat attributes you will be recording on the electronic data forms.

1. Woodland, Parkland and Scrub
2. Seminatural Vegetation
3. Agriculture
4. Landscape Features
5. Field Boundaries

Part 2. This section describes the field data recording procedures you will be using.

1. Field Survey Planning And Preparation
2. Field Survey Recording
3. Data Form Structure
4. Land Cover Recording
5. Land Cover Mapping
6. Aerial Photographs
7. Forestry Maps
8. Field Boundary – Recording
9. Field Boundary Mapping
10. PDA - Windows Mobile 5.0 User Guide
11. PDA - Terrasync Software User Guide
- Appendix 1. Backup Paper Data Recording Sheets
- Appendix 2. Descriptions of PDA Recording Codes
- Appendix 3. Terrasync Software - Quick Start User Guide
- Appendix 4. Trimble GeoExplorer XM Handheld User Guide
- Appendix 5. Trimble Recon Handheld User Guide

Part 3. Plant species identification and recording.

1. Introduction
2. Species recording
3. Species cover values
4. Species recorded in NICS

Detailed contents are included at the start of each section.

# NICS2007 FIELD MANUAL: PART 1.

## Habitat Type and Attribute Descriptors

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## Part 1: Habitat Type and Attribute Descriptors

### Classification of Primary Habitats

The NICS land cover classification that is used to map habitats, is project-specific. Habitats are separated into classes namely:

- ❖ Woodland (including parkland and scrub)
- ❖ Seminatural Vegetation (grassland, heath, bog, wetland, coastal)
- ❖ Agriculture (grassland and crops)
- ❖ Landscape Features (hard cover and water bodies)
- ❖ Field Boundaries (hedges, stone walls, earth banks etc.)

Each class contains a number of primary land cover types (Primary Habitats). Primary Habitat is defined in the following sections. Disregard any other field classifications you may have used in the past.

To allocate a parcel of land to a Primary Habitat in the field, you should be familiar with habitat descriptors. You should also know which dominant and characteristic plant species are present in the parcel of land you are classifying and understand the ecological structure and environment context (eg., geology, soils, elevation and management) of the parcel.

The NICS habitat classification should be interpreted and applied in the same standard way by each field surveyor, otherwise results will be biased.

NICS is a terrestrial survey extending to the HWMMT in coastal situations. Supralittoral parcels are denoted by attribute code on the field data forms or by target note. The intertidal (littoral) zone extends from the HWMMT to the LWMMT and is a separate stratum. In coastal sample squares field mapping procedures include habitats in the intertidal zone. Codes for upper and lower saltmarsh habitats etc. are included in the classification and on data recording forms to facilitate this. Attribute codes have also been added to the field data forms to denote intertidal parcels. An attribute code for *Sabellaria alveolata* reefs on rock has been included.

## WOODLAND, PARKLAND and SCRUB

NICS woodland includes established, transitional recently planted and recently felled parcels. Also included are scrub, parkland and orchard habitats. Blocks of woodland greater than the minimum mapping area (mma = 100m<sup>2</sup>) which are distinct or separated, for example, by roads, wire fencing, contrasting types of management, dominant species, structure or sudden changes in topography (eg. breaks of slope) are mapped separately. Treed areas within urban and rural curtilage (i.e. land demarcated as urban areas or farm buildings and gardens) are not recorded as woodland. All data records are made following a "W" walk through the whole mapped parcel. If Forest Service maps are used as a mapping aid, check the canopy species (the FS map is a plan – what happens in practice can be different). Compartment boundaries may have to be checked with a GPS or by measured pacing. Woodland stands on coastal dunes etc. are labelled with a "supralittoral" attribute so that they can be allocated to the Supralittoral Sediment Broad Habitat.

The NICS woodland classification consists of three components –

- I. **Habitat Type:** delimits stands based on species composition.
- II. **Habitat Structure:** delimits established woodland stands >5m from transitional habitats (<5m).
- III. **Plantation Status:** delimits stands which have the structural attributes of plantation from those which are seminatural.

### HABITAT TYPE

The main habitat types are woodland, scrub, parkland and orchard.

#### Woodland

Woodland comprises vegetation dominated by tree species, covering >25% of the mapped area. If the tree cover is <25%, do not record as woodland. Record scattered trees as an attribute of some other Seminatural or Agriculture land cover type. However, newly planted stands may have less than 25% canopy cover but should be recorded as transitional woodland if it is clear that they will achieve this. Parkland and orchard habitats can also have a tree cover <25% but must have a minimum of 3 trees. Woodland strips must be 2 or more trees wide. Note that in woodland % cover is not additive (100%) as canopies can overlap. Hazel (*Corylus avellana*) is classed as a tree species and can be recorded as a canopy dominant in woodland. Stunted stands of tree species (including hazel) whose growth is limited by environmental factors (eg., wind-pruned in exposed situations) are recorded as scrub.

#### Type

01. **Broadleaf:** woodland comprising broadleaf tree species such as ash (*Fraxinus excelsior*), willow (*Salix sp.*), hazel (*Corylus avellana*), oak (*Quercus sp.*), alder (*Alnus glutinosa*) or birch (*Betula sp.*) dominant (>25% canopy over the mapped area). Conifers can comprise up to 10% of the canopy. In established stands species such as holly (*Ilex aquifolium*), hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*) or gorse (*Ulex europaeus*) can occur in the understorey. Woodland with non-native tree species such as beech (*Fagus sylvatica*) and sycamore (*Acer pseudoplatanus*) is included. Broadleaf woodland on waterlogged soils around water bodies or on fen peat is recorded as Fen carr (code 48.).
02. **Mixed broadleaf/conifer:** woodland comprising trees with more than 10% broadleaf and more than 10% conifer species canopy cover (ie. each >10%). Sitka spruce (*Picea sitchensis*), larch (*Larix sp.*), non-native pines (*Pinus sp.*) and Scot's pine (*Pinus sylvestris*) are the main conifers. Ash (*Fraxinus excelsior*), beech (*Fagus sylvatica*), oak (*Quercus sp.*), birch (*Betula sp.*) and sycamore (*Acer pseudoplatanus*) are the main broadleaf trees. Seminatural stands can occur eg. where birch and pine colonise bog habitats. Note that established Mixed broadleaf/conifer woodland is assessed, based on canopy (>5m) trees, not planted or regenerating trees <1.3m or trees 1.3m - 5m. Conifer plantations with sapling regeneration, eg., birch (*Betula sp.*) or ash (*Fraxinus excelsior*), should not be recorded as a Mixed broadleaf/conifer woodland.

03. **Conifer:** woodland with conifer tree species comprising at least 90% of the canopy. Common dominants are, e.g., sitka spruce (*Picea sitchensis*), larch (*Larix sp.*), various non-native pines (*Pinus sp.*) and Scot's pine (*Pinus sylvestris*). Broadleaf tree species canopy cover can be up to 10%. Conifer woodland is mainly plantation characterized by trees with regular planting distances and uniform age structure.
47. **Bog woodland:** woodland on bog peat, often associated with former turf cutting or drains. Birch (*Betula sp.*) is usually dominant, often with willow (*Salix sp.*). Oak (*Quercus sp.*), rowan (*Sorbus aucuparia*) and sometimes Scot's Pine (*Pinus sylvestris*) can also occur. The ground layer is usually dominated by acidic indicator species. Dwarf shrubs such as ling (*Calluna vulgaris*) or bilberry (*Vaccinium myrtillus*) may occur, often with bracken (*Pteridium aquilinum*), bramble (*Rubus fruticosus agg.*), purple moor-grass (*Molinia caerulea*), soft rush (*Juncus effusus*) or ferns such as broad buckler fern (*Dryopteris dilatata*).
48. **Fen carr:** broadleaf woodland on fen peat or on waterlogged soils, usually around water bodies. Wetland trees mainly Sally (*Salix cinerea*), Goat Willow (*Salix caprea*) and alder (*Alnus glutinosa*) are usually dominant. Birch (*Betula sp.*) and ash (*Fraxinus excelsior*) can be present. The ground flora usually has wetland habitat indicator species, for example, Meadowsweet (*Filipendula ulmaria*), Lesser spearwort (*Ranunculus flammula*), sedges (*Carex sp.*) and rushes (*Juncus sp.*). Horsetails (*Equisetum sp.*), Common reed (*Phragmites australis*) or bulrush (*Typha latifolia*) can occur on wetter sites.

### Scrub

Vegetation less than 5m high dominated by shrub species covering >25% of the mapped area. Stunted tree species whose growth is limited by environmental factors (eg., wind-pruned in exposed situations) can also be a component of scrub. If scrub cover is <25% record the main scrub species as an invasive of another habitat type on the Seminatual or Agriculture datasheet. Scrub tends to act as a nursery for the development of tree species and thus woodland. If the cover of tree species exceeds the threshold (**25%**), a woodland habitat type is recorded.

Most shrub species are broadleaf, juniper (*Juniperus communis*) being the only native conifer shrub. Scrub is mostly seminatural but planted parcels can occur eg. on roadside verges. Wind-pruned (<50cm) gorse (*Ulex europaeus*), and dwarf gorse (*Ulex galli*) stands are recorded as Gorse heath (code S07) on the Seminatual datasheet. Dwarf willow (*Salix herbacea*) and prostrate juniper are recorded as constituents of heath.

#### Type

07. **Scrub:** vegetation less than 5m high dominated by shrub species and/or small stunted tree species whose growth is limited by environmental factors, covering >25% of the mapped area. The main shrub species are European gorse (*Ulex europaeus*), blackthorn (*Prunus spinosa*), hawthorn (*Crataegus monogyna*) and small willows (*Salix sp.*). There are sometimes small, regenerating trees, eg., ash (*Fraxinus excelsior*), birch (*Betula sp.*) and rowan (*Sorbus aucuparia*) with a discontinuous <25% canopy cover. Occasional trees >5m (but with canopy cover <25%) may occur. Bramble (*Rubus fruticosus*) is often a dominant. Scrub cover can range from 25% to 100% of a mapped unit.

## Parkland

Parkland is composed of open-grown mature, old or ancient trees set out over pasture. Parklands are usually associated with demesnes or former sites of such properties. Parkland is a composite habitat, which represents a vegetation structure rather than being a particular plant community. The tree layer habitat is recorded on the Woodland data form and the ground layer habitat is recorded on the Seminatural or Agriculture data form. This is to provide more detail on species composition, structure and management.

### Type

**09. Parkland:** Parkland typically comprises open-grown mature, old or ancient trees set out over pasture which is subject to grazing by domestic animals or deer. Tree species are mainly broadleaf, although there are sometimes conifers present. There may be associated recent planting of tree species as long-term replacement specimens, usually these have protective fencing. Tree cover includes individual specimens (scattered >20m between crowns), lines or clumps. Tree cover in Parkland can be less than 25% including open areas. There must be at least 3 tree components. In addition to tree cover and pasture, other habitats may be present. These should be mapped and recorded separately on the Woodland, Seminatural Vegetation, Agriculture, Landscape Features or Field Boundary data sheets as appropriate.

## Orchard

Orchard was previously recorded on the Agriculture data sheet. Soft fruit (raspberry etc.) is recorded on the Agriculture data sheet.

### Type

**12. Orchard:** includes old and recently planted stands of fruit trees. Species composition of the trees is primarily of the family Rosaceae, mainly apple. Tree canopy cover can range from dense with crown edges close together, to open (<25%) with crown edges >10m apart. There must be a minimum of 3 trees.

## HABITAT STRUCTURE

Delimits established woodland stands >5m from transitional habitats (<5m).

### Code

- W. Established Woodland:** comprises vegetation dominated by trees (ie. species with apical dominance), >5m in height and which cover >25% of the mapped unit. Planted or regenerating shrubs/trees <1.3m and shrubs/trees 1.3m - 5m can also be present. Stands can be seminatural or planted. Ornamental or other plantation on roadside verges etc. is included. Also included are stands of coppice >5m (usually dominated by hazel (*Corylus avellana*))
- T. Transitional woodland & scrub:** comprises vegetation dominated by shrubs and/or trees <5m in height which cover >25% of the mapped unit. Large trees (>5m) can be present but if so, their cover is always <25% of the mapped unit. Stands can be seminatural or planted. Newly planted stands may have less than 25% canopy cover but are recorded if it is clear that they will achieve this. Ornamental or other plantation on roadside verges etc. is included.
- F. Recently Felled:** stands of recently felled woodland where it is not clear if they are to be replanted and which have not been colonised by shrub or tree regeneration. Mainly occurs due to management of conifer plantations. Rosebay willowherb (*Epilobium angustifolium*) is a characteristic early coloniser.



## PLANTATION STATUS

This section separates stands which have the structural attributes of plantation from those which have arisen naturally, including self-sown non-natives.

### Code

- P. *Plantation*:** denotes stands which have the structural attributes of plantation, ie., regular planting distances and uniform age structure. In transitional stands tree protectors may be present. Newly planted transitional stands may have less than 25% canopy cover over the mapped unit but are recorded if it is clear they will achieve this. New plantation can also occur where there are already some sapling tree species growing eg. in recently felled stands resulting from forest crop management. Transitional (<5m) stands fully under-planted by conifers however, (eg. spruce) are recorded as conifer plantation (not mixed broadleaf/conifer), as management by brashing is usually carried out to remove unplanted species. Established woods which have been completely underplanted, but where the planted trees do not yet contribute to the canopy (ie. are <5m) are classed according to the existing canopy (>5m) species composition attributes.
- N. *Seminatural*:** denotes stands which have arisen naturally, ranging from ancient woodland to stands composed of self-sown non-natives. Old plantations where the age structure has become mixed due to natural regeneration is classed as seminatural.

## ATTRIBUTES

Note: total cover can add up to more than 100% as leaf canopies can overlap and where a number of layers are present.

### HABITAT TYPE

Select the type of woodland/parkland/scrub after walking the whole parcel.

### HABITAT STRUCTURE

Select one code.

### PLANTATION STATUS

Select one code.

## SPECIES COMPOSITION

### GROUND FLORA

Comprises all species except trees and shrubs (even regenerating).

### Ground flora type

Record one code.

- A. *Wet woodland*:** herb species such as meadowsweet (*Filipendula ulmaria*), remote sedge (*Carex remota*), marsh bedstraw (*Galium palustre*), golden saxifrage (*Chrysosplenium oppositifolium*) or ramsons (*Allium ursinum*) abundant.
- B. *Mesotrophic woodland*:** herb species such as bluebell (*Hyacinthoides non-scriptus*), primrose (*Primula vulgaris*), male fern (*Dryopteris filix-mas*), dog-violet (*Viola riviniana*), sanicle (*Sanicula europaea*), false brome (*Bromus sylvaticum*), enchanters nightshade (*Circaea lutetiana*) and wood anemone (*Anemone nemorosa*).
- C. *Acid / base-poor woodland*:** species such as great woodrush (*Luzula sylvatica*), hard fern (*Blechnum spicant*), bilberry (*Vaccinium myrtillus*), ling heather (*Calluna vulgaris*) or purple moor-grass (*Molinia caerulea*).
- D. *Eutrophic*:** with few typical woodland herbs: species such as nettle (*Urtica dioica*), bramble (*Rubus fruticosus*), rushes (*Juncus sp.*) or buttercup (*Ranunculus repens*) abundant.
- E. *Grass-dominated*:** usually grazed woods with few typical woodland herbs: the main species are Yorkshire fog (*Holcus lanatus*), bent-grasses (*Agrostis sp.*), sweet vernal-grass (*Anthoxanthum odoratum*) or rough-stalked meadow-grass (*Poa trivialis*).
- F. *Moss covered*:** with few other species present. The main species are *Eurynchium praelongum* and *Thuidium tamariscinum*.

### Ground flora main species

Record up to 3 main species of the ground layer with a cover value. Do not let bright flowers or distinctive species influence cover assessment.

### TREES and SHRUBS

Note: Included are all tree and shrub species.

#### TREES AND SHRUBS (<1.3m)

Record any trees and shrubs less than 1.3m. They can be planted or be regenerating naturally. Seedlings with cotyledon leaves but no true leaves, ie., the current seasons growth with no annual rings are excluded. Record up to 3 main species with a cover value.

#### TREES AND SHRUBS (1.3m to 5m)

Included are all tree and shrub species which are 1.3m to about 5m in height. The main species in Scrub (code 07) are usually recorded here. Record up to 5 of the most abundant species with a cover value. Note: check your assessment of 5m height against a standard.

#### TREES (> 5m)

The tree canopy is defined by trees > 5m in height. Large isolated trees occurring in Scrub (code 07) are recorded here. Record up to 5 main species with a cover value.

### INVASIVE SPECIES

Non-native woody species. The main species are rhododendron (*Rhododendron ponticum*), cherry laurel (*Prunus laurocerasus*), snowberry (*Symphoricarpos rivulare*), Japanese knotweed (*Renoutria japonica*) and fuchsia (*Fuchsia magellanica*). Record only if found during the standard walk around the parcel (ie., do not search for them). Record a code to denote the species. When non-native trees are present in plantations they are not classed as invasive. They are classed as non-native invasives when they occur in seminatural woodland or scrub.

## MANAGEMENT and STRUCTURE

### WOODLAND MANAGEMENT

Record where applicable.

- A. **Thinning:** evidence of recent selective felling and/or removal of trees. Cut/sawn stumps without moss etc. and bare ground and brash piles present.
- B. **Felling:** recent clear-felling.
- C. **Coppice:** most trees multiple-stemmed and even aged, except for occasional unfelled standards.
- D. **Brashing:** ground clearance and disturbance evident, with the trunks of trees cleared of lower branches and/or unplanted trees or shrubs cut.
- E. **Planting:** new plantings (usually <1.3m) within existing woodlands or a new plantation with a uniform size structure and spacing.

### GRAZING (Intensity)

Record grazing intensity as :

1. **Light:** well-developed understorey with no obvious woody shoots pruned. Ground vegetation with graze-sensitive species such as bramble (*Rubus fruticosus*), honeysuckle (*Lonicera periclymenum*) and ivy (*Hedera helix*). Occasional physical evidence of grazing by animals such as hoof marks.
2. **Moderate:** patchy understorey, with frequent evidence of woody shoot pruning and grazed ground flora. Ground vegetation with some close-cropped areas.
3. **Heavy:** absence of shrub layer. Browse line on trees and shrubs. Most ground vegetation close-cropped (<10cm tall). Abundant dung, paths, bare ground or other signs of grazing animals such as hoof marks.

**SURFACE STRUCTURE****Bare Soil**

Record the cover (%) of bare soil, ie., mineral/peat/mud/sand without a ground flora. Rock or stone and leaf litter are not included.

**Surface Rock/Boulders**

This includes rock outcrops (> ca. 50cm at widest point) and surface boulders (> ca. 20cm at widest point) on top of or protruding from the soil surface. They are often moss covered. Record a cover value.

**DUMPING**

Record the presence of small scale dumping less than the minimum mapping area as:

- A. **Earth/spoil.**
- B. **Rubbish.**
- C. **Abandoned vehicles.**

Note: If dumping is greater than the minimum mapping area, record it separately on the Landscape Features data sheet. Dumping usually occurs at the edge of parcels.

**INTERNAL FEATURES**

These are recorded if present. Record up to 3 features.

- A. **Glade:** open patch with no tree canopy resulting, eg. from grazing in seminatural woodland or poor establishment and wind-throw in plantations. A glade must be at least 5m in two directions at right angles and be greater than or equal to the minimum mapping area (but do not map).
- B. **Ride:** (access or firebreak corridors). On Forest Service land, unplanted rides are either 5m or 10m wide (10m rides often have drains either side). 5m rides tend to be over-topped by the growth of trees. 10m rides are used as access or firebreaks and have their own vegetation cover. Only 5m rides are recorded as internal features. Record the vegetation of 10m rides, eg. on the seminatural sheet.
- C. **Track:** used pedestrian access track.
- D. **Dead wood:** scattered standing or fallen trees (> 20cm dia.). Threshold number is 3-5 trees/ha equivalent.
- E. **Wind blow:** patch of wind-blown and or wind-snapped trees, often still living.
- F. **Flush:** seepage spring associated with slope.
- G. **Burning:** record if present. The physical evidence of burning is charred stems or blackened ground. Burnt areas can occur in conifer plantations and in gorse scrub.
- H. **Limestone pavement:** the weathering of bare limestone produces 'paving' blocks known as clints, the fractures are grikes and the gutter like features that cut the clints and drain into the grikes are called runnels. Most of the pavement in NI is quite fragmented and occurs as part of a natural habitat mosaic comprising bare pavement, pockets of mineral soils and peat which has subsequently covered some of the limestone. There is often patchy cover of stunted hazel (*Corylus avellana*) sometimes with small ash (*Fraxinus excelsior*). Under dense woody cover, the surfaces of the clints can be covered with woodland mosses.

## SEMINATURAL VEGETATION

### HABITAT TYPES

#### Seminatural Grassland

This is more heterogeneous in species composition and physical structure than agricultural grassland and has higher species diversity. Grasses are the dominant species, with herbaceous species also frequent. Sedges (*Carex sp.*) are often present. Note: while eutrophic herbs such as white clover (*Trifolium repens*) and mouse-ear (*Cerastium fontanum*) may be present, large cover values are usually indicative of an Agricultural grassland type.

#### Type

- 06. Calcareous grassland:** species-rich grassland with limestone outcrops, pavements or loose rocks on shallow soils. Characteristic species are crested hair-grass (*Koeleria macrantha*), hawkweed (*Hieracium agg.*), fairy flax (*Linum catharticum*), carnation sedge (*Carex panicea*), blue-grass (*Sesleria albicans*), lady's mantle (*Alchemilla vulgaris*), thyme (*Thymus praecox*), and lady's bedstraw (*Galium verum*). Species with a high frequency are yarrow (*Achillea millefolium*), bent-grass (*Agrostis sp.*), daisy (*Bellis perennis*), crested dog's-tail grass (*Cynosurus cristatus*), *Hylocomium splendens*, *Rhytiadelphus squarrosus*, cat's ear (*Hypochaeris radicata*), bird's-foot trefoil (*Lotus corniculatus*), plantain (*Plantago sp.*), devil's-bit scabious (*Succisa pratensis*), clover (*Trifolium sp.*) and fescue (*Festuca rubra/ovina*). It often occurs in a mosaic with other types of rushy grassland or heath which are on deeper pockets of soil. If a parcel lacks the characteristic limestone species but is species-rich, record as Species-rich dry grassland.
- 01. Species-rich dry grassland:** moderately well-drained and herb-rich. The grasses bent (*Agrostis sp.*) and fescue (*Festuca rubra/ovina*) are the major sward constituents and crested dog's-tail grass (*Cynosurus cristatus*), is usually conspicuous. Ryegrass (*Lolium perenne/sp.*) is usually absent. Herbaceous species such as knap-weed (*Centaurea nigra*), bird's-foot trefoil (*Lotus corniculatus*), cat's-ear (*Hypochaeris radicata*), yellow rattle (*Rhinanthus minor*), bulbous buttercup (*Ranunculus bolbosus*), red clover (*Trifolium pratense*), yarrow (*Achillea millefolium*) and ox-eye daisy (*Leucanthemum vulgare*) are characteristic (different species present under different conditions).
- 02. Species-rich wet grassland:** poorly-drained, herb-rich grassland containing soft rush (*Juncus effusus*), sharp-flowered rush (*Juncus acutiflorus*) or jointed rush (*Juncus articulatus*). Creeping bent-grass (*Agrostis sp.*), sedges (*Carex sp.*) and rough meadow-grass (*Poa trivialis*) can have high cover values. Characteristic species are ragged robin (*Lychnis flos-cuculi*), meadowsweet (*Filipendula ulmaria*), cuckoo flower (*Cardamine pratensis*), lesser spearwort (*Ranunculus flammula*), yellow-flag iris (*Iris pseudacorus*), marsh stitchwort (*Stellaria palustris*), marsh marigold (*Caltha palustris*), creeping Jenny (*Lysimachia nummularia*), marsh cinquefoil (*Potentilla palustris*), watermint (*Mentha aquatica*), marsh violet (*Viola palustris*) and marsh horsetail (*Equisetum palustre*). There is considerable variation in species composition between parcels.
- 65. Fen meadow:** a grassland vegetation of thin peaty or wet clay soils. Characteristic species are devil's-bit scabious (*Succisa pratensis*), bog thistle (*Cirsium dissectum*), sedges (*Carex sp.*) and bent-grass (*Agrostis sp.*). Other frequent species are purple moor-grass (*Molinia caerulea*), (single shoots, not tussocks), heath cinquefoil (*Potentilla erecta*), lesser spearwort (*Ranunculus flammula*), meadow buttercup (*Ranunculus acris*), jointed rush (*Juncus articulatus*) or sharp-flowered rush (*Juncus acutiflorus*) and the moss *Calliargon cuspidatum*. In the uplands, ling heather (*Calluna vulgaris*) and mat-grass (*Nardus stricta*) can also occur in small amounts. Heathers have <25% cover. In the lowlands Fen meadow grades into Species-rich wet grassland.
- 03. Bent/fescue grassland:** on moderately well-drained mineral or peaty soils, mainly hill land. Bent-grass (*Agrostis sp.*) and fescue (*Festuca rubra/ovina*) are dominant species, with sweet vernal-grass (*Anthoxanthum odoratum*) common. Characteristic species are heath cinquefoil, the moss *Rhytidadelphus squarrosus* and heath bedstraw (*Galium saxatile*). Mat-grass (*Nardus stricta*) and pill sedge (*Carex pilulifera*) can also be present. If fescue (*Festuca rubra/ovina*) is absent, the parcel will probably be better classified as Other agricultural grassland (A11). Record as species-rich dry grassland (with which it grades) if there is an abundance of characteristic forbs. Bent/fescue grassland often has small patches of rushes.

- 04. Mat-grass hill pasture:** Mat-grass (*Nardus stricta*) is dominant (>25%). Sweet vernal-grass (*Anthoxanthum odoratum*), heath bedstraw (*Galium saxatile*) and the moss *Rhytidiadelphus squarrosus* are often present. There is low species diversity and it grades to Bent/fescue grassland, Dry bog or Poor fen.

### Other grassland / bracken

#### Type

- 34. Tall herb/ruderal vegetation:** vegetation comprising tall herbaceous and tall grass species such as nettle (*Urtica dioica*), bramble (*Rubus fruticosus*), thistle (*Cirsium sp.*), dock (*Rumex sp.*), false oat-grass (*Arrhenatherum elatius*), couch grass (*Elymus repens*), cocksfoot grass (*Dactylis glomerata*), bent-grass (*Agrostis sp.*) and Yorkshire fog (*Holcus lanatus*). It occurs on eg. disturbed/waste ground, quarries or along ungrazed river banks. Tall herb and forb cover should be >50%. Tall under-grazed grassland in an agricultural context, or abandoned grassland where the tall herb and forb cover is <50% is recorded as Other agricultural grassland (A11). Abandoned grassland where grasses predominate should also be recorded as Other agricultural grassland (A11) with a "neglected/rank" code.
- 29. Inland cliff vegetation:** vegetation of cliff ledges and rock crevices with a cover >25%.
- 32. Bracken-dense:** dense bracken (*Pteridium aquilinum*) with a cover >75% when fronds fully open and usually with abundant litter. If bracken has a cover of less than 75% record it as an invasive species of some other habitat type.

### Heath

Heath vegetation has a dwarf shrub heath species cover >25%. If dwarf shrub heath cover is less than 25%, record some other type of seminatural vegetation. Dwarf shrub heath species include heathers ie. ling heather (*Calluna vulgaris*), bell heather (*Erica cinerea*), cross-leaved heath (*Erica tetralix*) and crowberry (*Empetrum nigrum*). Other dwarf shrub heath species are *Vaccinium sp.* (mainly bilberry - *Vaccinium myrtillus*) and dwarf gorse (*Ulex gallii*). Wind-pruned (<50cm) European gorse (*Ulex europaeus*) is also included. Compared with bog, *Sphagnum* is less abundant (<25%) and occurs usually in wet heath. If shrubs and/or tree species such as European gorse (*Ulex europaeus*) or birch (*Betula sp.*) have regenerated to form a canopy >25%, record as scrub or woodland. Shrubs and/or trees which are a minor component (<25% cover) within heath are recorded as an invasive attribute.

#### Type

- 07. Gorse heath:** dwarf gorse (*Ulex gallii*) or wind-pruned (<50cm) European gorse (*Ulex europaeus*) are the main dwarf shrub species. Dwarf shrub heath species can have a dense cover (>75%) or the habitat can be more open (>25% – 75%) cover, with grasses such as bent (*Agrostis sp.*), fescue (*Festuca rubra/ovina*) and mat-grass (*Nardus stricta*) frequent. Gorse heath can form a mosaic usually with patches of Bent/fescue grassland or occasionally Mat-grass hill pasture.
- 09. Dry heath:** ling heather (*Calluna vulgaris*) and bell heather (*Erica cinerea*) are the main dwarf shrub species. Dwarf shrub species can have a dense cover (>75%) or the habitat can be more open (>25% – 75%) cover. Grasses such as fescue (*Festuca rubra/ovina*), bent (*Agrostis sp.*) or mat-grass (*Nardus stricta*) often occur. *Hypnum cupressiforme* is frequent. Ling (*Calluna vulgaris*) is the main heather species and in the south-east (Mournes) bell heather (*Erica cinerea*) is common. Dry heath can form a mosaic usually with patches of Bent/fescue grassland or occasionally Mat-grass hill pasture.
- 57.1 Dry mixed heath:** heath vegetation with bilberry (*Vaccinium myrtillus*) as the main dwarf shrub species. Heathers are usually <25% cover. Dwarf shrub species can have a high cover (>75%) or the habitat can be more open (>25% – 75%) cover. Grasses such as fescue (*Festuca rubra/ovina*), bent (*Agrostis sp.*) or mat-grass (*Nardus stricta*) can be abundant. Mosses indicative of drier conditions, eg. *Hypnum cupressiforme* can be frequent. Ling (*Calluna vulgaris*) is usually the main heather species and in the south-east (Mournes) bell heather (*Erica cinerea*) can be abundant. Dry mixed heath can form a mosaic usually with patches of Bent/fescue grassland.

10. **Wet heath:** ling heather (*Calluna vulgaris*) and cross-leaved heath (*Erica tetralix*) are the main dwarf shrub species. Dwarf shrub heath species can have a dense cover (>75%) or the habitat can be more open (>25% – 75%). Wet heath is associated with peatland species, such as cotton-grasses (*Eriophorum angustifolium/vaginatum*), heath-rush (*Juncus squarrosus*), deer-grass (*Scirpus cespitosus*) and the mosses *Sphagnum* or *Polytrichum commune*. The *Sphagnum* cover is less than 25%. There is a relatively firm peat substrate. Wet heath grades to Wet bog (which occurs on deeper, waterlogged peat with *Sphagnum* cover >25%).
- 57.2 **Wet mixed heath:** wet heath vegetation with bilberry (*Vaccinium myrtillus*) as the main dwarf shrub species. Heathers are usually <25% cover. Dwarf shrub species can have a high cover (>75%) or the habitat can be more open (>25% – 75%). Wet mixed heath is associated with peatland species, such as cotton-grasses (*Eriophorum angustifolium/vaginatum*), heath-rush (*Juncus squarrosus*), deer-grass (*Scirpus cespitosus*) and the mosses *Sphagnum* and *Polytrichum commune*. The *Sphagnum* cover is less than 25%. Ling (*Calluna vulgaris*) and cross-leaved heath (*Erica tetralix*) are the main heather species. There is a relatively firm peat substrate.

## Mire (Bog / Wetland)

### Bog

Peatland species: common peatland species are deer-grass (*Scirpus cespitosus*), *Sphagnum*, hare's-tail cotton-grass (*Eriophorum vaginatum*), cotton-grass (*Eriophorum angustifolium*), purple moor-grass (*Molinia caerulea*) and heath rush (*Juncus squarrosus*). Other indicators of wetter conditions are bog asphodel (*Narthecium ossifragum*), cranberry (*Vaccinium oxycoccus*) and bog myrtle (*Myrica gale*).

### Type

14. **Wet bog:** main peatland species are *Sphagnum*, cotton-grass (*Eriophorum angustifolium*), hare's-tail cotton-grass (*Eriophorum vaginatum*), deer-grass (*Scirpus cespitosus*), bog asphodel (*Narthecium ossifragum*) or purple moor-grass (*Molinia caerulea*). *Sphagnum* is a dominant (>=25%). Heathers, mainly ling heather (*Calluna vulgaris*) and/or cross-leaved heath (*Erica tetralix*) can be present and can be dominant with a cover >25%. Wet bog can therefore have an overall dwarf shrub heath cover >25% similar to Wet heath vegetation but is usually differentiated by having *Sphagnum* as a dominant (>=25%). It occurs over waterlogged, usually spongy deep peat. Drainage and peat cutting can cause loss of *Sphagnum* sp. and create a firmer, drier structure grading into Wet heath (where the cover of heathers is >25%) or to Dry bog.
15. **Dry bog:** a less wet, heterogenous peatland habitat comprising peatland species, often with a major grass/rush component. The moss *Polytrichum commune*, hare's-tail cotton-grass (*Eriophorum vaginatum*), deer-grass (*Scirpus cespitosus*) and heath rush (*Juncus squarrosus*) can be dominant. Sweet vernal-grass (*Anthoxanthum odoratum*), wavy hair-grass (*Deschampsia flexuosa*), mat-grass (*Nardus stricta*) or soft-rush (*Juncus effusus*) can also be dominant. *Sphagnum* is often present but compared with Wet bog it is sub-dominant (<25%). Dwarf shrub heath species can also be present but have an overall cover of <25%.
05. ***Molinia* grassland:** purple moor-grass (*Molinia caerulea*) is dominant, with few other, mainly peatland species, present. It occurs on peaty soils and grades into Dry bog.
16. **Poor-fen:** rush-dominated vegetation with mainly jointed rush (*Juncus articulatus*) or sharp-flowered rush (*Juncus acutiflorus*). Soft rush (*Juncus effusus*), sedges (*Carex* sp.), bent-grass (*Agrostis* sp.) and Yorkshire fog (*Holcus lanatus*) are usually frequent. Poor fen occurs on wet peaty soils, largely in the unenclosed uplands or marginal uplands, or on wet heavy clay or peaty soils in the lowlands. In the uplands a sub-type transitional to Wet bog occurs. It has *Sphagnum* under a jointed/sharp flowered rush canopy. In the lowlands, Poor fen is transitional to Other agricultural grassland. In this case the soil is usually peaty and rushes are a major component. Rush-infested grassland on mineral soils should not be recorded as Poor fen. A wet peaty soil and litter/peat accumulation are features of Poor fen if it occurs in enclosed farmland. Peaty flushes in the uplands are classed as Poor fen.

## Wetland

### Type

18. **Fen:** primarily on waterlogged peaty soils behind the reedbed or swamp zone of a lake margin. Common species are tall sedges (*Carex* sp.), yellow flag (*Iris pseudacorus*), water forget-me-not (*Myosotis scorpioides*), creeping Jenny (*Lysimachia nummularia*), marsh horsetail (*Equisetum palustre*), marsh pennywort (*Hydrocotyle vulgaris*) and bog bean (*Menyanthes trifoliata*).
66. **Swamp:** vegetation (other than reedbeds) dominated by species such as common club-rush (*Scirpus lacustris*), marsh horsetail (*Equisetum palustre*), common spike-rush (*Eleocharis palustris*), lesser water-plantain (*Baldellia ranunculoides*) or tall sedges (*Carex* sp.). There is usually standing water associated with lake margins and slow moving rivers.
17. **Reedbeds:** stands dominated by common reed (*Phragmites australis*) or bulrush (*Typha latifolia*), usually with standing water.
19. **Freshwater vegetation:** floating aquatic vegetation of permanently inundated open water, comprising species such as water-lily (*Nymphaea alba* / *Nuphar lutea*) and pondweed (*Potamogeton* sp.).
68. **Water inundation vegetation:** ruderal vegetation of rocky freshwater shores usually disturbed by wave action or seasonally inundated. Common species include silverweed (*Potentilla anserina*), creeping bent (*Agrostis* sp.), watermint (*Mentha aquatica*), creeping Jenny (*Lysimachia nummularia*) and white clover (*Trifolium repens*).

Note: ditches 2.5m (the minimum mapping width) or more wide, with wetland vegetation usually with permanent standing water are recorded with the appropriate wetland habitat on the seminatural vegetation data sheet.

## Coastal

Coastal cliff vegetation, sand dune and saltmarsh habitats.

### Type

28. **Coastal cliff vegetation:** grassy vegetation with maritime species. Vegetation cover is >25%.
25. **Dune grassland:** stable dune vegetation with grasses and forbs. Bent (*Agrostis* sp.) and fescue (*Festuca rubra/ovina*) are major components.
24. **Foredune:** vegetation of sand dunes with marram grass (*Ammophila arenaria*) or sea-couch grass (*Elymus pycnanthus*) dominant. Only record if vegetation cover >25%.
22. **Shingle and gravel ridge vegetation:** tall herb and tall grass vegetation containing some salt-tolerant species. It is usually unenclosed. Shingle is defined as sediment with particle sizes in the range 2mm - 20cm.
23. **Strandline:** vegetation present just above high tide, excluding shingle and gravel ridges. The category can be similar in vegetation composition to ruderal vegetation occurring elsewhere but also includes halophytes.
21. **Saltmarsh:** upper to middle saltmarsh vegetation dominated by species such as saltmarsh grass (*Puccinellia* sp.), scurvy-grass (*Cochlearia danica*), sea aster (*Aster tripolium*), thrift (*Armeria maritima*), sea plantain (*Plantago maritima*), sea rush (*Juncus maritimus*) and cord-grass (*Spartina anglica*). Vegetation cover is >25%.
20. **Lower Saltmarsh:** lower saltmarsh vegetation of saline muds and sands dominated by species such as glasswort (*Salicornia* sp.) and eel-grass (*Zostera marina*). Vegetation cover is >25%. Note: named Intertidal in 1998 field survey.

## ATTRIBUTES

### HABITAT TYPE

Select the habitat type from the descriptor list after walking the whole parcel, stopping frequently to determine the main species present.

### SPECIES COMPOSITION

#### HABITAT MAIN SPECIES

##### Species (1 – 5)

Record up to 5 main species with cover values. Record species to reflect the species composition of the habitat, after walking the whole parcel, stopping frequently to assess. Cover can add up to more than 100%.

#### OTHER SPECIES

##### Herbs

Covers all broadleaf herbaceous species (including Agricultural Weeds). Excluded are grasses, sedges, rushes, ferns, mosses and trees/shrubs. Record total combined cover. Note: Where a parcel is dominated by tall herbs (>50%) and tall grasses, record as Tall herb/ruderal vegetation (S34). Examples of herbs in bogs are bog asphodel (*Narthecium ossifragum*) and heath cinquefoil (*Potentilla erecta*).

##### Agricultural Weeds

Record the combined cover of agricultural weed species. These comprise only the five species: Spear thistle (*Cirsium vulgare*), Creeping or field thistle (*Cirsium arvense*), Curled dock (*Rumex crispus*), Broad-leaved dock (*Rumex obtusifolius*) and Common ragwort (*Senecio jacobaea*).

##### Rushes

Record the combined cover of all rush species. Soft rush (*Juncus effusus*) forms tussocks whereas the individual shoots of sharp flowered/jointed rush (*Juncus acutiflorus/articulatus*) are more difficult to see, particularly in newly mown swards.

##### Bracken

Record the total cover of bracken (*Pteridium aquilinum*). If fronds have not fully unrolled, extrapolate to get a realistic assessment of cover. Note: if bracken cover is >75% the land cover type is recorded as Bracken – dense (S32).

##### Heathers

Record the combined cover of all heather. These comprise the species: ling heather (*Calluna vulgaris*), bell heather (*Erica cinerea*), cross-leaved heath (*Erica tetralix*), crowberry (*Empetrum nigrum*). Dwarf shrub species such as dwarf gorse (*Ulex galli*) and bilberry (*Vaccinium myrtillus*) are not classed as heathers.

##### Sphagnum

Record the combined cover of all *Sphagnum* species.

##### Lichens (bushy)

Record the combined cover of all bushy (fruticose) lichens (*Cladonia* sp.). Bushy *Cladonia* lichens recorded by NICS include bearded and antler-horn types.

### SHRUBS / TREES

Record both shrub and tree species established and/or regenerating. Usually, the species present are gorse (*Ulex europaeus*), blackthorn (*Prunus spinosa*), hawthorn (*Crataegus monogyna*), birch (*Betula* sp.), alder (*Alnus glutinosa*), willow (*Salix* sp.), and ash (*Fraxinus excelsior*) or occasionally conifers. Note: if the canopy cover of shrubs/trees is more than 25% record the parcel as woodland or scrub.

#### Total Cover

Record the combined cover of all shrub / tree species.



**Total Distribution/Density**

This gives an idea of the distribution and degree of establishment of shrubs/trees in the mapped seminatural parcel.

- A. **Isolated individual:** one shrub/tree.
- B. **Isolated clump:** a clump, ie. defined as a number of individual shrubs/trees grouped together in a patch smaller than the minimum mapping area.
- C. **Scattered:** more than one isolated individual shrub/tree and/or isolated clump where they are obviously dispersed a distance away from each other. ie. they do not all fall within a single minimum mapping area. Note: they are not recorded as a woodland as total canopy cover is <25%

**Main Species**

Record a code for the main shrub / tree species present.

**MANAGEMENT and STRUCTURE****SWARD/VEGETATION STRUCTURE****Vegetation Height**

Record the average height of the vegetation sward. Ignore scattered individuals/clumps/patches (eg. rush tussocks or flowering stems above the main canopy).

Height Classes:

<b>Scale</b>	<b>Height</b>
1.	<= 5cm
2.	5 - 15cm
3.	15 - 30cm
4.	30 - 50cm
5.	50cm +

**Cutting**

Record as present if there are physical signs of cutting. The physical evidence of cutting is cut woody flowering stems of grasses just above the soil surface, flat-topped rush tussocks, scattered hay/silage, plastic wrapped big-bales, tractor tyre tracks across the whole parcel. Include rush-topping (machine-cut rush tussocks). Some swards are grazed as well as cut in the same season. It is difficult to tell early in the growing season what use they will be put to. If there is no physical evidence record uncut.

**Grazing**

Record as present if there are physical signs of grazing across the whole parcel. The physical evidence of grazing is: presence of animals, current or old hoof marks, dung or defoliation.

**Poaching**

Record as present if poaching has created current bare soil. The physical evidence of poaching is: bare patches or holes with bare soil created by the hooves of farm stock. Hoof marks that have not created bare soil or poach-holes with re-grown vegetation are not included. Note: large bare areas without vegetation (<25%) greater than the minimum mapping area are recorded on the Landscape Features data sheet.

**Vegetation Thatch/Litter**

Any vegetation type with a thick (>5cm) layer of litter, thatch with fibrous plant stems/stolons etc. Usually ungrazed and seemingly neglected. Record if present.

**Vegetation Management**

Record one of the following management practices if present.

- A. **Big bales:** record presence if plastic wrapped bales occur or are stored (at the side).
- B. **Rush topping:** rush-cutting by tractor, usually in grassland or poor fen. Rushes are usually left on the ground to decompose or sometimes burnt in contrast to hay cuts which are removed.
- C. **Heather brashing:** heather flailed mechanically. Usually large rectangular areas in heath.
- D. **Burning:** record if present. Physical evidence is charred stems or blackened ground. Past burning on heath/bog is visible for about 2-3 years following regrowth.

**PEAT CUTTING**

Record the presence of current/recent mechanical cutting and hand peat cutting. Note: mechanical and hand cut peat is sometimes laid out on other vegetation types such as grassland to dry. This should not be recorded as cutting in those parcels. Peat cutting can occur within parcels or at the edge (record as an attribute of the vegetation type being cut). Record both mechanical and hand cutting if they are present.

- A. **Mechanical peat cutting:** turf cut by either an extruder pulled by tractor or extracted by digger and loaded into a compressor. Cutting is not always obvious once the turfs have been removed; look for turf fragments, slits in the peat, flat microtopography and an impoverished species content (especially *Sphagnum*).
- B. **Hand peat cutting:** look for clean unvegetated turf banks.
- C. **Mechanical and Hand peat cutting:** as above.

**OTHER MANAGEMENT / STRUCTURE****Drainage**

Record the presence of functional drains within the parcel (ie. not associated with field boundaries). The physical evidence for a new/maintained functional drain is: clean sides and an open bottom (depth >25cm). Include old open drains which are largely functional but colonised with vegetation. Do not include drains around the outside of a parcel or old drains that seem to have lost their function.

**Bare Soil**

Record the cover (%) of bare soil ie., mineral/peat/mud/sand. Rock or stone is not included. Recently burnt areas are also not included. Note: large bare areas without vegetation (<25%) greater than the minimum mapping are recorded on the Landscape Features data sheet.

**Surface Rock/Boulders**

This includes rock outcrops (> ca. 50cm at widest point) and surface boulders (> ca. 20cm at widest point) on top of or protruding from the soil surface. They can be moss covered. Record a cover value.

**Dumping**

Record the presence of small scale dumping less than the minimum mapping area as:

- A. **Earth/spoil:**
- B. **Rubbish:**
- C. **Abandoned vehicles:**

Note: If dumping is greater than the minimum mapping area, record it separately on the Landscape Features data sheet. Dumping usually occurs at the edge of parcels.

**Other Features**

Record if present.

- A. **Rabbits:** heavily grazed turf with burrows, dung and physical disturbance.
- B. **Pools:** with permanent water, occurring as an integral part of the habitat, eg., bog pools (including revegetating) associated with old cutover habitats.
- C. **Erosion hags:** isolated or semi-isolated islands of peat with curved bare sides, usually showing signs of erosion.
- D. **Peat-cutting hags:** as a result of old hand cutting. Look for angular corners and straight lines, recolonised and often hidden by regrowth.
- E. **Cut edge:** disused domestic peat cutting at the edge of parcels, look for angular corners and straight lines, recolonised and often hidden by regrowth.
- F. **Shingle/gravel substrate:** defined as sediment with particle sizes in the range 2mm - 20cm at the widest point
- G. **Limestone pavement:** the weathering of bare limestone produces 'paving' blocks (clints), fractures (grikes) and gutter like features (runnels) that cut the clints and drain into the grikes. Most of the limestone pavement in NI is quite fragmented and occurs as part of a habitat pattern comprising bare pavement, pockets of mineral soils and peat which has subsequently covered some of the limestone. There is often patchy cover of stunted hazel (*Corylus avellana*) sometimes with small ash (*Fraxinus excelsior*).

## AGRICULTURE

### HABITAT TYPES

#### Agricultural Grasslands

Agricultural grasslands are productive swards with a low species diversity. They are dominated by one or more of the species: ryegrass (*Lolium perenne*/sp.), rough-stalked meadow-grass (*Poa trivialis*), bent-grass (*Agrostis* sp.), timothy (*Phleum pratense*), meadow fox-tail (*Alopecurus pratensis*) or Yorkshire fog (*Holcus lanatus*). Infestations of docks, thistles, rushes, ragworts or buttercups can occur.

Type

08. **Ryegrass grassland:** Low diversity grassland in which primarily perennial ryegrass (*Lolium perenne*), Italian ryegrass (*Lolium multiflorum*) and ryegrass cultivars are dominant (>25%), often with white clover (*Trifolium repens*). Other species that can have a high cover are bent-grass (*Agrostis* sp.), timothy (*Phleum pratense*), rough-stalked meadow-grass (*Poa trivialis*) and Yorkshire fog (*Holcus lanatus*). Note: now contains Italian ryegrass, previously coded (A07). Heavily sheep-grazed perennial ryegrass (*Lolium perenne*) looks like small rough meadow-grass (*Poa trivialis*) - always check.
09. **Mixed species grassland:** Ryegrass (*Lolium perenne*/sp.) cover is usually <25% and crested dog's-tail (*Cynosurus cristatus*) grass is usually frequent. Other frequent species are bent-grass (*Agrostis* sp.), white clover (*Trifolium repens*), sweet vernal-grass (*Anthoxanthum odoratum*), daisy (*Bellis perennis*), plantain (*Plantago* sp.) and self-heal (*Prunella vulgaris*). Species are indicative of drier less productive sites. Diversity is usually low but can be quite high, if so, there are few species-rich dry grassland indicators.
11. **Other agricultural grassland:** Dominant species include creeping bent-grass (*Agrostis* sp.), meadow foxtail (*Alopecurus pratensis*), Yorkshire fog (*Holcus lanatus*), rough meadow-grass (*Poa trivialis*) and buttercup (*Rununculus repens*). There is often infestation with rushes. Ryegrass (*Lolium perenne*/sp.) cover is usually <25%. Species composition can vary markedly between parcels but is usually fairly uniform within parcels. Species are indicative of wetter less productive sites. Diversity is usually low but can be quite high, if so, there are few species-rich wet grassland indicators.

#### Horticulture

Garden plots are not recorded. They are an integral part of curtilage. Orchard is recorded on the woodland data form.

Type

13. **Soft fruit:**
14. **Vegetables:**
15. **Flowers/Other:**

#### Arable Crops

Cereals are drilled in rows. Check seeds for identification if recently sown.

Type

01. **Wheat:** broad, glaucous blades with auricles.
02. **Barley:** dull green leaves with auricles.
03. **Oats:** soft glaucous leaves with no auricles.
35. **Maize:**
38. **Oilseed rape:**
05. **Brassicas:** eg. cabbage
06. **Legumes:** eg. peas / beans
04. **Potatoes:**
39. **Root crops:** eg. swedes / beet
10. **Ploughed land:** bare agricultural land not under grass or crops at the time of survey. Includes new sown parcels where crop identification is not possible.

## ATTRIBUTES

### HABITAT TYPE

Select the Agriculture type from the descriptor list after walking the whole parcel, stopping frequently to determine the main species present. The total cover can add up to more than 100%.

### SPECIES COMPOSITION

#### HABITAT MAIN SPECIES

##### Species (1 – 5)

Record up to 5 main species with cover values. Record species to reflect the species composition of the habitat, after walking the whole parcel, stopping frequently to assess. Cover can add up to more than 100%.

#### OTHER SPECIES

##### Herbs

All broadleaf herbaceous species (including Agricultural Weeds). Excluded are grasses, sedges, rushes, ferns, mosses and trees/shrubs. Record total combined cover. Note: Where a parcel is dominated by tall herbs (>50%) and tall grasses, record as Tall herb/ruderal vegetation (S34).

##### Agricultural Weeds

Record the combined cover of agricultural weed species. These comprise the five species: Spear thistle (*Cirsium vulgare*), Creeping or field thistle (*Cirsium arvense*), Curled dock (*Rumex crispus*), Broad-leaved dock (*Rumex obtusifolius*) and Common ragwort (*Senecio jacobaea*).

##### Rushes

Record the combined cover of all rush species. Soft rush (*Juncus effusus*) forms tussocks whereas the individual shoots of sharp flowered/jointed rush (*Juncus acutiflorus/articulatus*) are more difficult to see, particularly in newly mown swards.

##### Bracken

Record total bracken (*Pteridium aquilinum*) cover. If fronds have not fully unrolled, extrapolate to get a realistic assessment of cover. Note: if bracken cover is >75% the land cover type is recorded as Bracken – dense (S32).

### SHRUBS / TREES

Record both shrub and tree species established and/or regenerating. Usually, the species present are European gorse (*Ulex europaeus*), blackthorn (*Prunus spinosa*), hawthorn (*Crataegus monogyna*), birch (*Betula sp.*), alder (*Alnus glutinosa*), willow (*Salix sp.*), and ash (*Fraxinus excelsior*). Note: if the canopy cover of shrubs/trees is more than 25% (and greater than the minimum mapping area), record the parcel as woodland or scrub.

#### Total Cover

Record the combined cover of all shrub / tree species.

#### Total Distribution/Density

This gives an idea of the distribution and degree of establishment of shrubs/trees.

- A. **Isolated individual:** one shrub/tree
- B. **Isolated clump:** a clump ie. defined as a number of individual shrubs/trees grouped together in a patch smaller than the minimum mapping area.
- C. **Scattered:** more than one isolated individual shrub/tree and/or isolated clump where they are obviously dispersed a distance away from each other. ie. they do not all fall within a single minimum mapping area. Note: they are not recorded as a woodland as total canopy cover is <25%

#### Main Species

Record a code for the main shrub / tree species.

## MANAGEMENT and STRUCTURE

### SWARD STRUCTURE

#### Cutting

Record as present if there are physical signs of cutting. The physical evidence of cutting is cut woody flowering stems of grasses just above the soil surface, flat-topped rush tussocks, scattered hay/silage, plastic wrapped big-bales, tractor tyre tracks across the whole parcel. Include rush-topping (machine-cut rush tussocks). Some swards are grazed as well as cut in the same season. It is difficult to tell early in the growing season what use they will be put to. If there is no physical evidence record uncut.

#### Grazing

Record as present if there are physical signs of grazing across the whole parcel. The physical evidence of grazing is presence of animals, current or old hoof marks, dung or defoliation.

#### Poaching

Record as present if poaching has created current bare soil. The physical evidence of poaching is: bare patches or holes with bare soil created by the hooves of farm stock. Hoof marks that have not created bare soil or poach-holes with re-grown vegetation are not included. Note: large bare areas without vegetation (<25%) greater than the minimum mapping area are recorded on the Landscape Features data sheet.

#### Vegetation Thatch

Any vegetation type with a thick (>5cm) layer of litter, thatch with fibrous plant stems/stolons etc. Usually ungrazed and seemingly neglected. Record if present.

#### Vegetation Management

Record one of the following management practices if present.

- A. **Big bales:** record presence if plastic wrapped big bales occur on a parcel or as storage (usually at the side).
- B. **Rush topping:** rush-cutting by tractor, usually in grassland or poor fen. Rushes are usually left on the ground to decompose or sometimes burnt in contrast to hay cuts which are removed.

## OTHER MANAGEMENT / STRUCTURE ATTRIBUTES

### Drainage

Record the presence of functional drains within the parcel (ie. not associated with field boundaries). The physical evidence for a new/maintained functional drain is: clean sides and an open bottom (depth >25cm). Include old open drains which are largely functional but colonised with vegetation. Do not include drains around the outside of a parcel or old drains that seem to have lost their function.

### Bare Soil

Record the cover % of bare soil ie. mineral/peat/mud/sand resulting from agriculture. Rock or stone is not included. Note: large bare areas without vegetation (<25%) greater than the minimum mapping area are recorded on the Landscape Features data sheet. Note: does not include Ploughed land (code A10.).

### Dumping

Record the presence of small scale dumping less than the minimum mapping area as:

- A. **Earth/spoil:**
- B. **Rubbish:**
- C. **Abandoned vehicles:**

Note: If dumping is greater than the minimum mapping area, record it separately on the Landscape Features data sheet.

### Other Features

- A. **New sown:** record only if the crop can be identified.
- B. **Rush tussocks:** dominant, tall, undergrazed tussocks (>25%).

## LANDSCAPE FEATURES

This is the cover of largely unvegetated surfaces such as hard cover buildings and roads, bare ground and water bodies. It includes all associated curtilage. Curtilage is ground associated with buildings and their component gardens, grounds, carparks, grassland playing surfaces and amenity grassland (both are usually low diversity). These components of curtilage are mapped as a unit (*i.e.* not separated). Areas of woodland/scrub, seminatural vegetation or agricultural grassland/crops locked into curtilage or on verges/embankments are mapped separately.

### BUILDINGS/CURTILAGE

Type

01. **Urban:** blocks of land associated with towns and villages or areas in the countryside developed for housing. Include groups of three or more rural domestic building sites and their curtilage not separated by farmed countryside. Do not include groups of farm buildings
02. **Industrial/commercial/public:** land and its curtilage developed for industry or public use. Curtilage is mapped as a unit. Areas of woodland/scrub, seminatural vegetation or agricultural grassland locked into the curtilage should be recorded separately.
03. **Agricultural buildings:** farm houses (and their curtilage) and buildings or structures used for agriculture.
04. **Rural domestic buildings:** a single house or pair of houses (and their curtilage) not associated with agricultural buildings.
  - Attributes:
  - 25. **Modern:** non-traditional style or materials.
  - 26. **Vernacular:** traditional style and materials. Includes historic buildings.
  - 27. **Derelict:** uninhabited and usually in disrepair.

### OTHER CURTILAGE

Type

05. **Amenity grassland:** usually dominated by ryegrass (*Lolium perenne*/sp.) and of low species diversity. Includes mown grass associated with industrial/commercial/public buildings and recreation areas such as football pitches, public parks and golf courses.
- 06.1 **Verge/embankment (vegetated):** a verge/embankment ( $\geq 2.5$ m wide) with low diversity grassland vegetation. Woodland, scrub and seminatural vegetation types on verges/embankments are recorded separately on the appropriate data sheet. Do not record them on the Landscape Features datasheet.
- 06.2 **Verge/embankment (hard):** a verge/embankment ( $\geq 2.5$ m wide) with hard cover.
  - Attributes:
  - 45. **Scattered shrubs/trees:** (but not field boundary shrubs/trees).

### ROADS AND TRACKS

These are currently used features. Abandoned roads/tracks can be covered by woodland/scrub, seminatural vegetation or agricultural grassland habitats, and are recorded separately on the appropriate data sheets.

Type

10. **Road/track:** a road or farm track. These can be metalled (e.g., concrete or asphalt.) or unmetalled (eg. loose mineral material) or a farm track of (eg. soil or earth).
11. **Railway track:** hard surfaces.
  - Attributes:
  - 30. **Metalled:** usually asphalt or concrete.
  - 31. **Unmetalled:** loose mineral material.
  - 32. **Unmetalled:** earth/soil
  - 33. **With vegetated verge (1 – 2.5m):** usually low diversity grassland.
  - 45. **Scattered shrubs/trees:** (but not field boundary shrubs/trees).

**LAND FILL / DUMPING**

These are largely unvegetated (<25%) surfaces. Note: if below the minimum mappable area record as an attribute of a vegetation type on the appropriate datasheet.

*Type*

15. **Land fill/dumping:** includes large-scale land-fill sites used as public rubbish dumps and smaller scale fill/dumping greater than the minimum mapping area, eg. by the side of roads/ditches, woodland or bog. Note: small scale dumping (less than the minimum mapping area) is recorded as an attribute of the habitat in which it occurs.

*Attributes:*

47. **Earth/spoil:** including organic waste  
 48. **Rubbish:**  
 49. **Vehicles:**

**ROCK / OTHER SURFACES**

These are largely unvegetated surfaces. Any vegetation present is <25% cover. They include both natural and quarried surfaces. Note: if below the minimum mapping area record as an attribute of a vegetation type on the appropriate datasheet.

*Type*

- 16.1 **Bare soil / mud:** surface exposure with no (<25% cover) vegetation. Bare soil is largely a result of land use (eg. building or agricultural earth movement). Mud is defined as a mixture of silt and clay sediments with particles less than 0.0625 mm in diameter. Individual grains cannot be seen by the naked eye; it feels floury or soapy when rubbed between the fingers. Intertidal mud is recorded with this code.
- 16.2 **Bare peat:** record where the peat surface is exposed, and where there is no (<25%) surface vegetation. This is largely a result of activities such as land reclamation, or peat cutting.
- 17.1 **Sand:** particle size to 2mm. Any vegetation present is <25% cover. Sand feels gritty when rubbed between the fingers, individual grains can be seen by the naked eye.
- 17.2 **Gravel/pebble/shingle:** (2mm to 20cm at widest point). Any vegetation present is <25%.
- 18.1 **Boulders:** (greater than 20cm at widest point). Unvegetated (<25%) natural and quarried surfaces.
- 18.2 **Scree:** more or less unstable loose or shattered rock on slopes. Any vegetation present is <25%.
19. **Rock:** unvegetated surface rock. Any vegetation present is <25%.

*Attributes:*

35. **Natural:** hard or soft surfaces bared by geomorphological processes.
36. **Quarry:** unweathered soft mineral or hard rock.
37. **Bared by peat cutting:** bare peat as a result of mechanised cutting either by stripping the surface vegetation or by multiple auger cutting.
38. **Bared by land levelling:** for building or for farming etc.
45. **Scattered shrubs/trees:** but not field boundary shrubs/trees.
50. **Cliff:** a cliff greater than 5m.
51. **Limestone pavement:** the weathering of bare limestone produces 'paving' blocks (clints), fractures (grikes) and gutter like features (runnels) that cut the clints and drain into the grikes. Most of the limestone pavement in NI is quite fragmented and occurs as part of a habitat pattern comprising bare pavement, pockets of mineral soils and peat which has subsequently covered some of the limestone. There is often patchy cover of stunted hazel (*Corylus avellana*) sometimes with small ash (*Fraxinus excelsior*).
39. **Supralittoral:** coastal parcels just above the HWMMT which are influenced by wavesplash and sea-spray.
52. **Intertidal (Littoral):** the intertidal (littoral) zone extends from the HWMMT to the LWMMT (shown on the field maps).

53. **Sabellaria alveolata reef:** the polychaete worm *Sabellaria alveolata* lives in tubes constructed of sand grains cemented together. The species is normally intertidal and may occur in dense aggregations known as reefs. Reefs can form on a range of substrata from pebble to bedrock but these must be in an area of sufficient water movement to hold sand grains in suspension. *Sabellaria alveolata* reefs are generally limited to areas of hard substratum, adjacent to sand and with moderate to considerable wave exposure.

## WATER BODIES

This includes natural standing water systems such as loughs and other small water bodies as well as man-made water bodies such as reservoirs, ponds, gravel pits, sand holes and canals. Associated seminatural vegetation is mapped separately eg. as fen and swamp. Also included are rivers and streams. Note: on the OSNI 1:2500 map the convention is that linear water features <2.5m wide are denoted by single blue lines. Double blue lines are used to indicate a linear water feature 2.5m or more wide.

### Type

20. **Lough/small water body:** permanent natural and artificial freshwater water bodies. In this case the minimum mapping area is reduced to  $25m^2$ . Associated seminatural vegetation is mapped separately eg. as fen or swamp.
- 20.1 **Ditch (open water):** a permanently wet ditch with standing open water which is 2.5m (minimum mapping width) or more wide and  $>25m^2$ . Open water ditches are often a result of drain maintenance. Ditches  $\geq 2.5m$  colonised by wetland habitats such as fen, swamp or reedbeds are recorded on the seminatural vegetation data form. Ditches less than the minimum mapping width, (ie. <2.5m) are mainly recorded as an attribute of field boundaries, or as an internal attribute of a land cover parcel if not associated with a field boundary.
- 20.2 **Canal:** a man-made channel with open water and usually with a tow path designed for boat navigation.
21. **Reservoir:** water surface fluctuation usually leaves an unvegetated margin which should be mapped as if it is part of the water surface.
22. **River:** minimum width  $\geq 2.5m$ . The convention is that double blue lines on the OSNI 1:2500 map are used to indicate a linear water feature 2.5m or more wide. Check if a river is present.
23. **Stream:** less than 2.5m in width. Note: a stream should have a detectable water current (or evidence of erosion features if the weather is very dry). The convention is that single blue lines on the OSNI 1:2500 map are used to indicate a linear water feature less than 2.5m wide. This can represent a stream or a ditch. Check that a stream is present.

### Attributes:

40. **Seminatural edge:** shelving or banked by geomorphological processes, usually with seminatural vegetation.
41. **Canalised:** a river bank or lake/reservoir edge, raised artificially to prevent flooding.

**Stream width:** refers to the modal average/most common width.

42. **Stream width <1m:**

43. **Stream width 1m – 2m:**

44. **Stream width 2 - 2.5m:**

45. **Scattered shrubs/trees:** but not field boundary shrubs/trees.

46. **Fishing stands/platforms:**



## FIELD BOUNDARIES

All field boundaries are recorded except those within curtilage (*i.e.* gardens/land etc associated with urban areas, farm or domestic buildings) and within woodland. Field boundaries bordering curtilage are recorded as are those bordering woodland. Temporary electric fences are not recorded.

## TYPE DESCRIPTORS

### Primary Type

Hedges, Earth banks or Dry stone walls often have Fences erected on them or next to them (within 1m). Hedges have often been planted on Earth banks and can even be found growing on Dry stone walls. In cases where 2 or more field boundary types occur together, the recording hierarchy is Hedge -> Wall -> Bank -> Fence. Field boundaries which are >1m apart are recorded separately, eg. 2 hedges either side of a >1m ditch. In past NICS surveys, only the primary type was recorded. In NICS2007 all associated types for a single field boundary are recorded. The primary type can be post-processed from the database based on the previous hierarchy.

Occasionally features such as a ditch, half-bank or a line of trees can occur without being associated with a primary type such as a hedge, wall, earth bank or fence. These features can be given a parcel number and recorded as data on the field boundary data sheet (see section: Recording Features Not Associated with a Primary Type).

### Hedge Type

**02. Hedge:** a line composed of hedge-forming species covering more than 25% of the length of the boundary. There are two main types of hedge component:

(a) *Shrubby (Shrub-Growth-Form) hedge:* a hedge composed mainly of shrub growth-forms either natural or induced in tree species (see Annex 1.) with hedge-forming species covering more than 25% of the length of the boundary. Cover can be complete or gappy but with individual gaps not more than 20m.

(b) *Coppice Tree-Growth-Form hedge:* a hedge composed mainly of coppice tree growth-forms *ie.* multi-stemmed with dbh 5 – 15 cm (see Annex 1.) growing closely together and covering more than 25% of the length of the boundary. Cover can be complete or gappy but with individual gaps not more than 20m.

A mix of the components can occur. Individual gaps more than 20m would be recorded as some other field boundary type where applicable. The natural shrubs, gorse (*Ulex europaeus*) and broom (*Cytisus scoparius*) are not considered to be hedge forming species. Neither are the woody climbers/scramblers ivy (*Hedera helix*), honeysuckle (*Lonicera periclymenum*), dog-rose (*Rosa canina*) and bramble (*Rubus fruticosus*). These species are not part of the hedge component and are therefore excluded from decision making.

Hedges have usually been planted but may be formed by colonisation of eg. Earth banks or Dry stone walls. A Hedge can have associated types such as an Earth bank, Fence or Dry stone wall (including ruined) and additional features such as a ditch or half-bank. Tree growth forms can often be present in a hedge as can non-hedge forming shrubs and climbers/scramblers. The management of hedges can vary from activities such as flat-topping, flailing or coppicing to unmanaged.

**Wall***Type*

- 04. *Dry stone wall:*** a stone wall constructed without mortar. It is mainly hand-built but is sometimes built with machinery resulting in larger structures. The intact built structure must comprise at least 50% of the length of the boundary, ie., there should be no more than 50% gaps, otherwise record as a Ruined dry stone wall (type code 06). A gap is defined as a break in the built structure of the wall due to collapse, removal of stones or trampling by farm stock.
- 05. *Capped dry stone wall:*** a dry stone wall similar to above (04) but which has been cemented and capped on the top to strengthen the structure.
- 07. *Mortared brick/stone wall:*** a wall constructed with mortar and brick, concrete blocks or stone. They can often be coated with plaster.
- 06. *Ruined dry stone wall:*** a derelict wall where the built structure has collapsed but where the stones remain in place. This type also includes dry stone walls with >50% gaps in the built structure. Where ruined walls become >50% earthed up and adopt, eg., a grassland ecology, record as an earth bank. If gaps due to stone removal/dispersal account for >50% of the length of the boundary (individual gaps >20m are mapped separately) label the boundary as removed on the field data map. Old ruined dry stone walls have the appearance of a stone bank.

**Bank***Type*

- 10. *Earth bank:*** a mounded (ie. double-sided) bank higher than 25cm comprising mainly mineral or peaty soil, often with an integral dry stone component and sometimes stone faced. The vegetation is often a grassland habitat or occasionally heath. There are often shrubs or trees present. Hedges are often planted on Earth banks. Therefore Earth banks can develop if hedges have lost their hedge forming shrub/coppice component (to <25% cover). This can be by tree growth form development or by shrub death. Half-banks associated with a difference in levels between adjacent fields or along roads should not be recorded as Earth banks. The vertical bank of a ditch or stream should not be recorded as an earth bank. An earth bank gap is defined as  $\geq 1$  m in length with a height  $\leq 25$  cm. If gaps in the bank structure account for >50% of the length (individual gaps >20m are mapped separately), an Earth bank is not recorded.

**Fence***Type*

- 09. *Sheep wire fence:*** usually square-shaped wire mesh between wooden posts often with a strand of barbed wire above.
- 11. *Wood post and wire fence:*** these have several strands ( $\geq 2$ ) of usually barbed wire between wooden posts.
- 12. *Other fence:*** all other fences. These include wire or netted wire mesh strung between concrete or metal posts (mainly associated with roads). Also recorded with this code are wood post fences with a wooden rail.

Some field boundaries such as hedges may be double fenced, ie. one on either side within 1m. In these cases two separate fences would be recorded for that parcel. Where field boundaries consist of a ditch with a wire fence on both sides (>1m apart), or where a fence is erected >1m away from a hedge, two separate parcels would be recorded. Only record if the wire is complete.

## ATTRIBUTES

Select the field boundary types present and record the associated attributes. Attributes must be within 1m of the field boundary

## FIELD BOUNDARY TYPES / ASSOCIATED TYPES

Select the type/associated types of field boundary present from the descriptor list.

## MANAGEMENT and STRUCTURE

Attributes must be within 1m of the field boundary

### Gaps

Gappiness is assessed for the primary type only. In cases where 2 or more field boundary types occur together, the primary type is selected according to the hierarchy Hedge -> Wall -> Bank -> Fence. This order holds even if the primary type is more gappy than the next type in the hierarchy eg. a very gappy hedge on a relatively complete wall.

The total length of gaps is estimated visually by addition over the length of the field boundary and placed in best-fit total cover categories. Gaps are defined as >1m. Gaps more than 20m (the minimum mapping length) are recorded as some other field boundary type where applicable. Gates do not count as a gap.

*Hedge - gaps.* Gaps are defined as a lateral break (>1m) in hedge component along the length of the hedge. Gaps can be caused by death or removal of the hedge component or the development of tree growth-forms, usually by lack of management. Hedge gaps are also caused by stock over-grazing/trampling. Trees can be an integral part of a hedge when closely associated with the hedge component. Large tree growth forms with no associated hedge component are not considered as hedge cover when estimating cover/gappiness (see Annex 2.). If there is 20m of trees and no hedge component then a hedge would not be recorded for that section. Non hedge-forming shrubs gorse, broom and the climbers/scramblers bramble, honeysuckle, ivy and dog-rose are also not considered. Ignore vegetative growth from tall herbs and climbers/scramblers if they obscure underlying shrubs or gaps when trying to assess cover.

*Dry stone wall/Ruined wall - gaps.* A gap is defined as a break in the built structure of the wall. Collapse, trampling by stock and stone removal are the main causes of wall gappiness.

*Earth bank - gaps:* An earth bank gap is defined as >1m in length with a height <=25cm. Trampling by farm stock is the main cause of earth bank gappiness.

Gaps category codes:

**Scale      Gaps % cover**

- |    |              |  |
|----|--------------|--|
| 0. | Gaps 0 /<1%  | - more or less complete with no gaps or a minor gap (disregard one or two minor gaps (>1m) in a long boundary).  |
| 1. | Gaps < 10%   | - almost complete but with 2/3 minor gaps or gaps <10% of the field boundary length.   |
| 2. | Gaps 10-25%  | - obviously gappy.   |
| 3. | Gaps 25-50%  | - gaps are a major element.  |
| 4. | Gaps 50-<75% | - (for hedges only): a hedge with gaps 50-75% has largely scattered hedge-forming shrub/coppice components but with at least 25% cover overall and with individual gaps not more than 20m. Ignore the cover of non hedge-forming component when assessing gappiness. |

**Earth Bank Height**

Refers to a 2-sided mounded bank (Annex 3.), the minimum mapping height is >25cm. The modal average (most common) height is recorded. If an Earth bank has been recorded then the height must be recorded here. When estimating bank height, discount the height/depth of any associated ditches and half-banks associated with a difference in levels between sides, ie., use the shortest side.

Height Category codes:

**Scale    Height**

1.    <= 0.5m, ie. a small earth bank > 25cm and <= 0.5m.
2.    > 0.5 - 1m
3.    > 1 - 2m
4.    > 2m

**ASSOCIATED ATTRIBUTES/FEATURES**

These attributes apply to all field boundary types.

**Ditch**

A ditch is defined as having an average depth of greater than 25cm. This includes permanently wet ditches with either flowing or standing water in the bottom. Species indicative of wetland vegetation are usually present in permanently wet ditches unless there are signs of recent management. Included are streams/rivers with running water (often marked as streams on the OS map) immediately adjacent to a field boundary. The convention is that single blue lines on the OSNI 1:2500 map are used to indicate a linear water feature less than 2.5m wide while double blue lines are used to indicate a linear water feature 2.5m or more wide. This can represent a river, stream or a ditch. Also included are ditches which dry out seasonally, ie. not permanently wet (only so after heavy rainfall), where grasses and rushes often predominate.

Ditch category codes:

- A.    *Open water:*** a ditch with open water.
- B.    *Wetland vegetation:*** a ditch with wetland vegetation (eg. Fen, Swamp or Reedbeds from Seminalural habitats), reproduced below (Table 1.).
- C.    *Grasses/rushes:*** a ditch with grasses and/or rushes.
- D.    *Tall herb/other:*** a ditch with tall herb or other vegetation.

**Table 1. Wetland descriptors reproduced from Seminalural Habitats section.**

*Type (Wetland)*

- 18.    *Fen:*** primarily on waterlogged peaty soils behind the reedbed or swamp zone of a lake margin. Common species are tall sedges (*Carex sp.*), yellow flag (*Iris pseudacorus*), water forget-me-not (*Myosotis scorpioides*), creeping Jenny (*Lysimachia nummularia*), marsh horsetail (*Equisetum palustre*), marsh pennywort (*Hydrocotyle vulgaris*) and bog bean (*Menyanthes trifoliata*).
- 66.    *Swamp:*** vegetation (other than reedbeds) dominated by species such as common club-rush (*Scirpus lacustris*), marsh horsetail (*Equisetum palustre*), common spike-rush (*Eleocharis palustris*), lesser water-plantain (*Baldellia ranunculoides*) or tall sedges (*Carex sp.*). There is usually standing water.
- 17.    *Reedbeds:*** stands dominated by common reed (*Phragmites australis*) or bulrush (*Typha latifolia*), usually with standing water.

Ditches  $\geq 2.5$ m (the minimum mapping width for land cover), usually with standing water and wetland vegetation are also recorded with the appropriate wetland habitat on the seminalural vegetation data sheet. Ditches  $\geq 2.5$ m, with permanent standing open water without wetland vegetation cover (<25%) are also recorded on the Landscape Features data sheet. Rivers and streams are also recorded on the Landscape Features data sheet.

**Half-bank**

A one-sided bank associated with any field boundary type. The minimum mapping height is 50cm (0.5m) and the modal (most common) height is recorded. Half-banks occur, usually due to an obvious difference in land levels between adjacent fields on either side of a field boundary. They are often found along roadside boundaries (Annex 3.). The vertical sides of a ditch or stream should not be recorded as a half-bank. Therefore discount the height of any earth banks or depth of associated ditches.

Height Category codes:

<b>Scale</b>	<b>Height</b>
1.	= 0.5m (minimum height for a Half-bank)
2.	> 0.5 - 1m
3.	> 1 - 2m
4.	> 2m

**Ground Layer – Disturbance**

Bare soil apparent (>5%), associated with damage/erosion to the field boundary.

Category codes:

- A. Stock erosion:** trampling/digging erosion by farm stock eg. sheep and cattle.
- B. Rabbit disturbed:** heavily grazed with burrows, dung and physical disturbance.

**Ground Layer – Species Richness**

Record the presence (+/-) of a species-rich ground flora for any boundary, eg., of a hedge bottom or associated bank. Denotes if the ground flora of a field boundary is indicative of a broadleaf woodland herb flora. Species such as primrose (*Primula vulgaris*), dog-violet (*Viola riviniana*), wild strawberry (*Fragaria vesca*), bluebell (*Hyacinthoides non-scriptus*), orchids, ladies mantle (*Alchemilla vulgaris*), wood anemone (*Anemone nemorosa*), stitchwort (*Stellaria sp.*) and ferns are indicative. Record if 2 or 3 different species are present in small amounts or if there is substantial cover of at least 1.

**HEDGE ATTRIBUTES (ie. for Hedges only)**

These attributes are recorded for hedges (Type 02) only.

**Hedge with Mainly “Coppice” Multi-Stemmed (5cm – 15cm dbh) Tree Growth Forms**

Most hedges are shrubby ie. composed mainly of natural shrubs and/or induced shrub growth forms of tree species (see Annex 1.). However some hedges occur where the main component is “coppice” multi-stemmed (5cm – 15cm dbh) tree growth forms (see Annex 1.). Ash (*Fraxinus excelsior*) is a common species. Record (+/-) if the hedge falls largely into this structure category.

**Hedge Management**

Relates mainly to the current or recent management of the hedge.

Category codes:

i) *Current/recent*

- A. Flat-top hedge:** current or recently managed (1 - 2 year) hedge with signs of cutting to a flat top. Hedges which are flat-topped usually have the sides cut as well. Includes current flat-topping with no new growth and recent flat-topping with 1 or 2 years new growth. Therefore record as such when it is obvious that this management has taken place, even when the hedge has started to grow out. Do not record if very overgrown indicating that the flat-topping is not recent (ie. 3 or more years new growth).
- B. Sawn stump hedge:** main stems cut back/coppiced often close to ground level (usually within the last 5 years). Re-growth is in the form of multiple, thin woody stems.
- C. Flailed sides:** mechanically flailed sides only, with the top often left to grow. To be used if flailed in the last 1 - 2 years, recognisable by smashed and shattered ends to cut branches.
- D. Laid hedge:** the cut stems are positioned horizontally, to maintain function (usually within the last 1 - 2 years).

ii) *Old or historic*

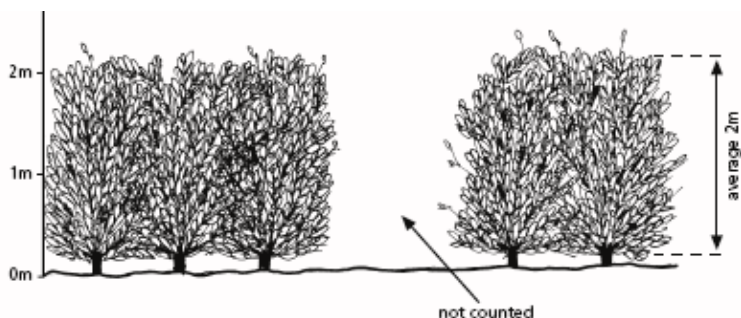
- E. Old management:** signs of old or historic management eg. very grown out flat-topping resulting in a bushy structure, a thicker bole due to coppicing/sawn stump, thinness in width due to old side flailing, old laying indicated by thick horizontal branches, ie. the hedge species have not grown with a natural shape.

### Hedge Shrubs/Coppice Component Height

Hedge height is taken as a modal average (most common height) of the hedge shrub growth form or coppice tree growth form canopy from the base of the stems at their ground level. Therefore exclude the height of any associated banks or half-banks (or where a hedge is planted on a wall). Gaps and tree growth forms are also excluded.

Height category codes:

Scale	Height
1.	≤ 2m:
2.	> 2 - 4m:
3.	> 4m:



### Hedge Shrubs/Coppice Component Lacking Base Lateral Shoot/Leafy Foliage Growth

Record if present (+/-). This denotes a hedge which has no lateral branch/shoot/leafy foliage growth at the base and refers to the hedge forming shrub/coppice species growth only. The hedge base is the lower 1m of a hedge as measured from the base of the stems at their ground level. An open base with bare woody stems is usually characteristic of leggy/overgrown hedges which are becoming derelict at the bottom (a). Some hedges that have been closely and frequently flailed/cut and/or browsed by farm stock are low and narrow, can also lack branches and foliage in the lower 1m (b). There is usually a clear open gap between the base of the stems at ground level and the bottom of the hedge foliage layer. A good guide is to visualise hedge component cover if the upper part (1m) of the hedge was removed. Cover of tall herbs or brambles which can infill where there is lack of grazing by stock is not included.



a) side view



b) cross-section view

### Hedge with woody outgrowths

A hedge with shrubs such as blackthorn or gorse on one or both sides spreading outwards due to lack of management or abandonment. Occasionally patches of tall brambles can occur. Outgrowths should only be included in the recording when >0.5m high. Note: when woody outgrowths result in a hedge being more than 5m wide at the base, then a "Woodland habitat" is likely to be recorded, eg. in abandoned fields/farmland.

**Mono-dominant Shrub/Coppice Growth-form Hedge**

Denotes if a hedge is mono-dominant, ie. a single species is contributing more than 50% of the total hedge-forming shrub/coppice growth-form cover. Hawthorn (*Crataegus monogyna*) is a common dominant with few other species present. Give the species code. If the hedge has a mixed species composition, ie. with 2 or 3 species each contributing less than 50% of the total hedge-forming shrub/coppice growth-form cover, then do not record, leave blank.

**SPECIES COMPOSITION**

These attributes apply to all field boundary types. This records the shrub and tree species composition of the field boundary. Shrubs are distinguished from trees by growth-form

**SHRUBS GROWTH FORMS**

The shrub growth-forms present are recorded for all field boundary types. See Annex 1. for a definition of shrub growth forms.

**Species (1 - 3)**

Record the presence of up to 3 main species. While shrubs such as gorse and broom are not considered to be hedge-forming species, they should be recorded if present as one of the main species. The woody scramblers/climbers such as ivy (*Hedera helix*), honeysuckle (*Lonicera periclymenon*), dog-rose (*Rosa canina*) or bramble (*Rubus fruticosus*) are not recorded here. Ignore individuals, need 2 or 3 present to be recorded.

**TREES GROWTH FORMS**

The tree growth-forms present are recorded for all field boundary types. Tree growth form is defined in Annex 1. Include trees growing within 1m of the boundary (but not associated with another habitat type, eg., Woodland). Also record here as trees, where a hedge has been selectively trimmed to favour the growth of individual small trees (at least twice the average height of the hedge).

**Species (1 - 3)**

Record the presence of up to 3 tree growth-forms. Includes single stemmed trees of all ages/sizes/dbh's and multi-stemmed tree growth forms (see Annex 1.).

**Total Tree Canopy Continuity (%)**

This measures how much of the length of the field boundary is covered by tree growth form canopy. Maximum is 100%, overlapping canopies are counted as single cover. Includes single stemmed trees of all ages/sizes/dbh's and multi-stemmed tree growth forms (see Annex 1.). Therefore record the combined canopy cover of all tree growth forms over the entire length of the field boundary. Ignore small gaps between crowns. Cover values are :

Scale	% cover range
1. =	<1 % (less than 1%)
2. =	1 - <5 % (1% to less than 5%)
3. =	5 - 10 % (5% to 10% inclusive)
4. =	11 - <25 % (more than 10% but less than 25%)
5. =	25 - <50 % (about 25% to less than 50%)
6. =	50 - <75 % (50% to less than 75%)
7. =	75 - <90 % (75% to less than 90%)
8. =	90 - 100 % (90% to 100%)

**Standard Trees – Number**

A tree is classified as a standard if it has a stem  $\geq 20$ cm dbh. Count the number of standard trees present in the boundary. This can often be done quickly by looking along the length of the boundary.

**Number of Woody Species per 30m.**

In addition to the main shrub growth-forms and tree growth forms recorded previously, the number of woody species present in a 30m long section of each hedge (Type 02) is also recorded. All shrubs and trees are recorded at the species level and not by growth-form. Scramblers/climbers such as ivy, honeysuckle, bramble and dog-rose are also included (Table 2.):

- Table 2.** Woody species from species code list (Part 3. of this manual).
- Climbers / Scramblers
  - Shrubs (ie species tending to grow naturally as shrub growth forms.)
  - Trees (ie species tending to grow naturally to tree growth forms.)

Randomise the starting point of the 30m section so that it is different between field boundaries, ie. so that the starting point is not always the same length from a hedge end point. Gates are not counted as part of the 30m section so extend the recording length to account for this. If the hedge is 30m or less in length record over the whole hedge.

The PDA will have fields for entering this data but if using a paper backup, then an additional recording sheet is used (Woody Species per 30m Recording Sheet). In the process of field survey, once a field boundary has been assessed as a hedge type, then it is useful to carry out the woody species per 30m list first, before recording the other attributes.

**RECORDING FEATURES NOT ASSOCIATED WITH A PRIMARY TYPE**

Occasionally features such as a ditch, half-bank or a line of trees can occur without being associated with a primary field boundary type such as a hedge, wall, earth bank or fence. These features can occur individually or together. They are usually recorded only when abutting agricultural habitats, seminatural grassland or those which have once been a primary field boundary type.

Ditches and/or half-banks can have shrub growth-forms and/or tree growth-forms occurring alongside. If this is the case, the main shrub growth-form species (1 - 3) and main tree growth-form species (1 - 3) should be recorded (as for primary field boundary types), as should Total Tree Canopy Continuity (%) and Standard Trees – Number.

**Ditch**

Ditches separating land cover parcels and not associated with a primary field boundary type are allocated a parcel number and the data is recorded in the “Ditch” column on the field data form.

Ditches  $\geq 2.5$ m (the minimum mapping width for land cover), with wetland vegetation usually with permanent standing water and are also recorded with the appropriate wetland habitat on the seminatural vegetation data sheet. Ditches  $\geq 2.5$ m, with permanent standing open water without wetland vegetation cover (<25%) are also recorded on the Landscape Features data sheet. Ditches internal to a land cover parcel and not associated with a primary field boundary type are not recorded on the field boundary data form. These are marked with a “D” on the field boundary map and are recorded as attributes of the land cover parcel.

**Half-bank**

A half-bank which is not associated with a primary field boundary type is allocated a parcel number and the height data is recorded in the “Half-bank” column on the field data form. Half-banks often occur along “bog roads” which now border mainly agricultural land. Note that banks/peat hags within seminatural habitats such as cut-over bogs are not recorded as half-banks. Changes in topography within agricultural parcels are also not recorded as half-banks.

**Line of Tree Growth-Forms**

Occasionally a line (one tree wide) of tree growth-forms ie. a “line of trees” occurs which is not associated with a primary field boundary type and is not alongside a ditch or half-bank,. These are allocated a parcel number and the data is recorded in the “Total Tree Canopy Continuity (%)” column on the field data form. The main tree growth-form species (1 - 3) should be recorded. Standard Trees – Number should also be recorded if present. If a line of trees is recorded on its own, there should be at least three trees. The usual minimum mapping length (20m) applies and there should not be more than 20m between individual tree trunks.



## Annex 1. SHRUB AND TREE GROWTH FORM

Woody species are defined as shrubs or trees by their growth form.

### Shrub growth-form

A shrub growth form can be natural or be induced by management. A combination of features are used to define the term shrub growth form:

- ❖ a bushy and/or multi-stemmed (3 or more) structure, either natural or induced.
- ❖ in the case of natural trees with several stems arising from the same bole, induced by previous coppicing or flat-topping, multi-stemmed means at least 3 stems near the base, ie., below about 1.3m. Individual stems are usually less than about 5cm dbh (1.3m).
- ❖ some leaf foliage and lateral branch/shoot growth generally within the bottom 2m (ie. not old, bare, leggy and very thickly wooded with a high canopy).
- ❖ a tendency to be less than about 5m in height from the base of the stems at ground level excluding the height of any associated banks etc., (not a hard/fast rule).

#### Natural

Some woody species tend to grow naturally as shrubs (see shrub species list), eg. Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*), Hazel (*Corylus avellana*), Holly (*Ilex aquifolium*), Gorse (*Ulex europaeus*) and Broom (*Cytisus scoparius*). They are bushy and/or multi-stemmed by nature and do not usually attain a height of more than 5m. Height is measured from the base of the stems at ground level excluding the height of any associated banks etc. These species are almost always recorded as shrub growth forms, except when very occasionally they have become old, large (>5m), leggy, thickly wooded and the bottom 2m has become completely bare and devoid of leaf foliage and lateral branch/shoot growth resulting in apical dominance. The management of natural shrubs can range from current or recent flat-topping/flailing, old flat-topping to long term unmanaged. Therefore almost always record natural shrubs as shrub-growth-forms

#### Induced

Woody species which grow naturally as trees (see tree species list) with apical dominance such as ash (*Fraxinus excelsior*) and sycamore (*Acer pseudoplatanus*), can be managed to induce a shrub growth form and therefore be recorded as an integral part of the shrub canopy, mainly of hedges. A bushy or multi-stemmed structure can be induced by management such as coppicing or flat-topping at or near the base. In this case multi-stemmed is defined as at least 3 stems below 1.3m (measured from the base). As a general guide individual stems are usually around 5cm or less dbh (1.3m). Regular management such as flat-topping, is required to maintain these species as shrub growth forms, otherwise a multi-stemmed "coppice" tree growth form will develop.

In some cases, trees with woody outgrowths at the base which might be, eg. failed to produce a dense leaf foliage growth would be recorded as having a shrub layer as well. Most trees readily adopt a shrub growth form if they have been cut or grazed by stock when young.

### Tree growth form

#### Single-stemmed

Woody species which grow naturally as trees usually have a single or forked stem with apical dominance, eg., Ash (*Fraxinus excelsior*), Beech (*Fagus sylvatica*) or Sycamore. All ages, sizes and dbh's are included. "Standard" tree growth forms arise when the dbh is  $\geq 20$ cm for single-stemmed or forked trees.

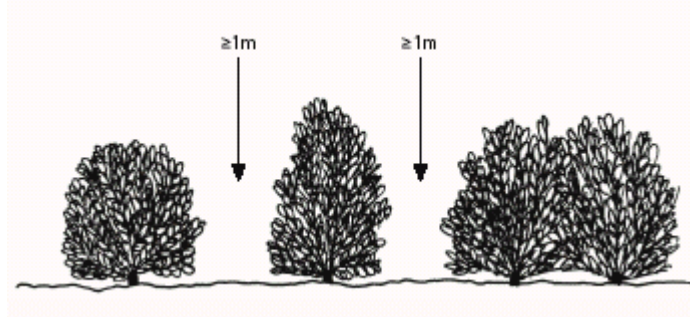
#### Multi-stemmed (coppice)

Included are multi-stemmed (ie. 3 or more stems) trees previously managed to induce a shrub growth form by coppicing or flat-topping. Left unmanaged they have grown out, become more thickly wooded with individual stems more than 5cm dbh and have regained apical dominance. They have the appearance of "coppice" (5cm – 15cm dbh). This structure reflects long term coppice management. If they continue to be unmanaged "Standard" tree growth forms can arise.

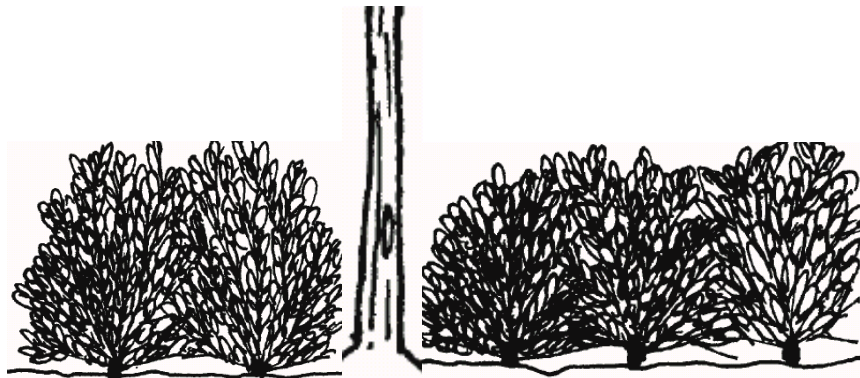
Also very occasionally classified as tree growth forms are former natural shrubs which have become very large with thickened woody stems and apical growth having out-grown their shrub growth form.

**Annex 2. HEDGE - GAPS.**

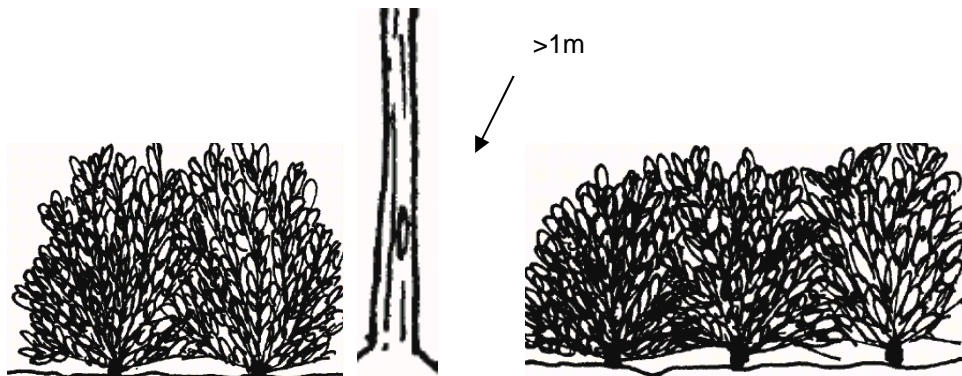
Gaps are defined as a lateral break ( $>1\text{m}$ ) in hedge component along the length of the hedge.



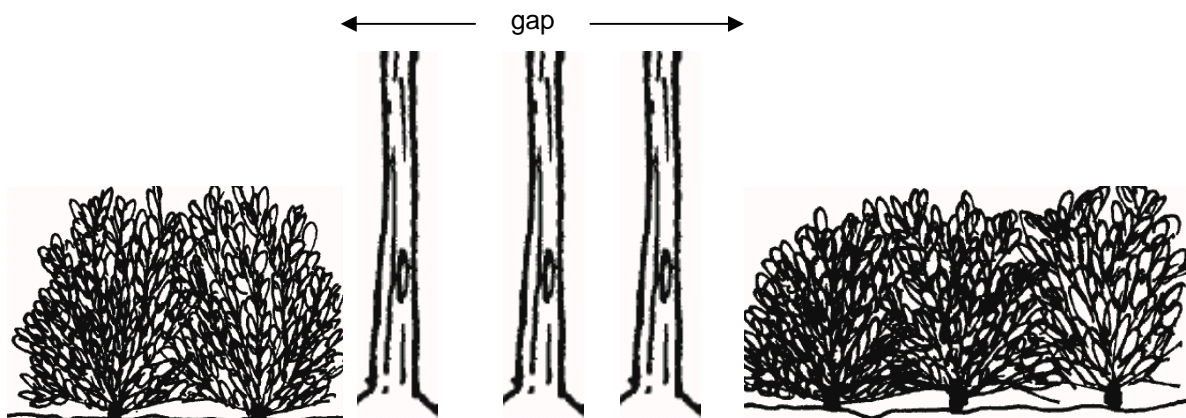
a) Shrubby hedge with gaps  $>1\text{m}$  – Gaps recorded



b) tree with closely associated hedge component:- No Gap recorded

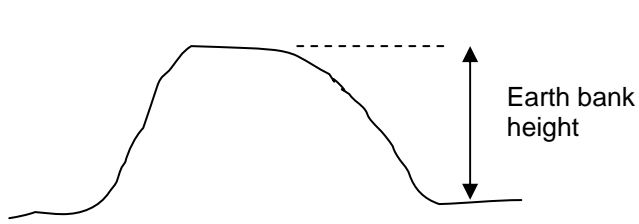


c) tree with no closely associated hedge component on one or both sides:- Gap recorded

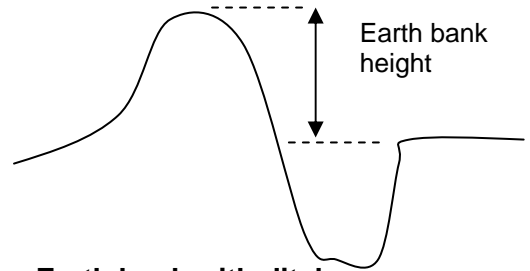


d) trees with no closely associated hedge component:- Gap recorded. When the gap length is more than 20m that section would no longer be recorded as a hedge.

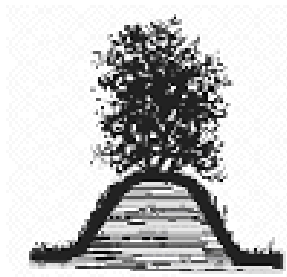
**Annex 3. EARTH BANK AND HALF-BANK HEIGHT AND STRUCTURE.**



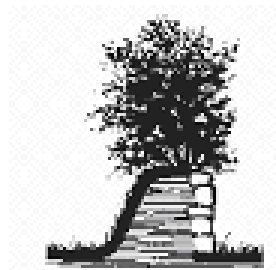
**Earth bank**



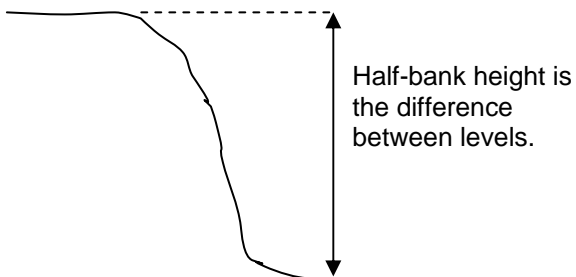
**Earth bank with ditch**



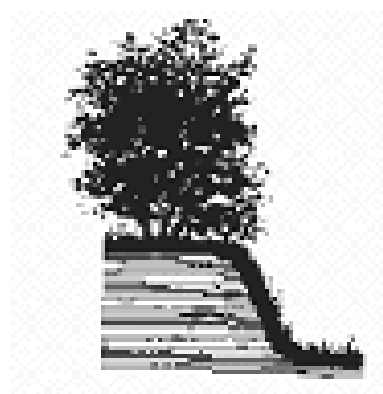
**Hedge on an Earth bank**



**Hedge on an Earth bank (stone-faced)**

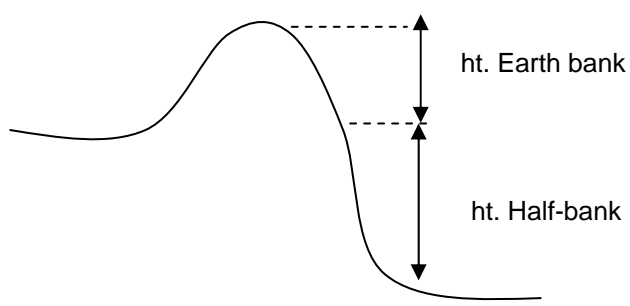


**Half-bank**

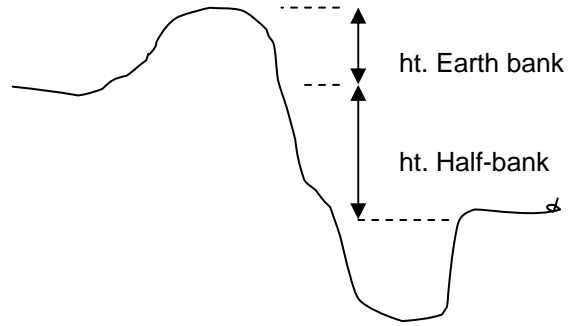


**A Hedge with a half-bank**

Annex 3. – continued.



**Earth bank with Half-bank ditch**



**Earth bank with Half-bank and**

# NICS2007 FIELD MANUAL: Part 2.

## Field Recording and Mapping Procedures

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## Part 2. Field Recording and Mapping Procedures

### 1. FIELD SURVEY PLANNING AND PREPARATION

#### 1.1 Weekly and daily schedule

The weekly schedule of sample squares to be surveyed is determined by the project Senior Research Associate. The schedule avoids unnecessary travel. It also corresponds to the timing of previous surveys. The daily schedule is controlled by you, the field survey team partners.

Apply common sense to keep car miles travelled to the minimum. Be flexible in the time you spend in the field to take advantage of the weather. Before setting out for survey, study the 1998 field survey map and paper data forms of the sample square to get an overview of the landscape and to plan a survey route. Reserve sample squares will be provided in case of access refusals or poor weather.

Take advantage of long summer days. Avoid the morning rush-hour in towns. Catch rural land-owners before they leave for work by aiming to arrive at a site by 9am. Plan each day so that no part of a square is left uncompleted and that sufficient time is left to check/tidy data sheets and backup electronic data. You also need to leave time to make plans for the next day. Be prepared to work a long day to avoid returning to the square twice. Work on Saturday if necessary, especially if a working week has had poor weather. Do not work after dark or on Sundays. Hours worked can be taken off as time in lieu, when the weather is unsuitable for field work and when all the survey sample squares have been surveyed. Each member of a survey-pairing should take time off at the same time. Do not disrupt your field partner with personal arrangements.

Based on previous NICS survey, each square will take two field survey-partners a day to complete (on average). The time includes pre-survey familiarisation with the 1998 field maps, time travelling to the squares, post-field checking procedures and record processing. Some grid squares will be easily accessible, consist largely of intensively managed grassland, have few field boundaries and weather conditions will be dry and warm. Other grid squares will have complex mosaics of seminatural vegetation and agricultural grassland, small fields, unenclosed hill land, difficult topography, access constraints and wet/windy conditions. It will average out. For efficient working, always carry replacement equipment, materials, provisions and clothing. When in the field adhere to NICS safety procedures.

#### 1.2 Safety Procedures

Drive carefully and within the law. Report all vehicle damage to the project coordinator.

Field work must be done in pairs. Away from roads and tracks, in rough terrain and along watercourse, keep in visual contact with your partner in a square. Always carry a mobile phone and test that it operates if you are in a remote area. If not, work closely with your partner.

Do not work when there is a warning of extreme weather (BBC radio, TV or website). The web *BBC Weather Service*, gives rain, cloud and wind forecasts that are updated every few hours and which can be tracked for a 24hr period. Use this, when possible, to plan your day, for example to get an early start if heavy rain and wind is forecast for the afternoon. Do not use the forecast to cancel field work because they can be wrong, especially in western Ireland and in the uplands. In windy conditions, do not work in woodland or next to field boundaries with old trees.

Accidents often happen when your attention is not fully on the job or when you "cut corners". Do not hurry the fieldwork. Do not read maps or enter data onto the field sheets when walking.

Wear boots with an ankle support and a good tread in rough terrain. Walking boots take a couple of days to dry out if wet. When it is raining, wear Wellington boots, a waterproof coat and waterproof trousers. In enclosed farmland, wear Wellington boots to keep dew and wet



grass off trousers. Jeans are tough against spines and barbed wire but if wet, are very cold and take overnight to dry. "Rohan" type, thin walking trousers are best.

Do not work when overtired or ill. Dehydration makes you tired. Drink water regularly. Stop for a break before you get overtired.

Always use gates for access to fields and close them behind you. Do not climb through hedges, or over wire fences, walls or gates unless absolutely necessary. Walls are prone to collapse. Barbed wire, in particular can cause deep cuts.

Be sure you have a firm footing if crossing a ditch or stream. Never jump across them. Never jump down from features such as gates and banks but if you need to, land on both feet, not one stretched in front. This risks a sprain or broken ankle. Do not wade rivers. Do not balance on wet rocks, as they can be slippery. Be aware of deep ditches on one side of hedge banks.

Some farm animals can be aggressive. Do not enter fields if you are doubtful, or work in parts of the field not being grazed.

Visit all parts of the square but not dangerous areas such as cliffs, quarries, derelict farm buildings, swallow holes and lough margins. They should be surveyed from a vantage point using binoculars.

Military areas should not be recorded without formal authority arranged by the project co-ordinator, who will negotiate access.

Before using a boat, clear the arrangements with the project co-ordinator. The project Research Technician will make arrangements and accompany you. Always wear a life jacket. Carry oars, flares, an anchor, life-line and fuel. Do not use a boat in poor weather.

Hedges have spiny vegetation that can cause nasty cuts. Protect your eyes with safety goggles in scrub long grass/rushes and alongside hedges.

In case of injury, a co-worker should not provide first aid unless asked. Go to the nearest hospital casualty department if necessary. If an injured person cannot be moved, make them comfortable and warm and seek assistance. Ask local people to use a phone if necessary. Any injuries should be reported to the project co-ordinator.

### **1.2.1 Medical precautions**

You should have a Tetanus vaccination or a booster if you have not had one in the last ten years. A polio booster is also recommended. Wash if you come into contact with slurry, manure or other farm wastes.

Take precautions against ticks by wearing trousers and ankle length boots. Tuck trousers into socks, shirt into waistband and wear a long-sleeved shirt. If bitten by a tick do not remove it forcibly as the proboscis can break off. Dab around the bite with salt, alcohol or vinegar until the tick loosens its grip and then remove. If the bite develops red weals running from it and you develop flu-like symptoms with aching joints, contact your doctor for an antibiotic against lymes disease. Keep the project co-ordinator informed.

Each team must carry a first aid box and safety equipment, spare food, drink and clothes at all times.

### **1.3 Biosecurity Measures**

When seeking permission of access on a farm, make sure that your boots, clothing and vehicle are clean. If there is a biosecurity alert, you will need to carry out disinfecting procedures as below.

#### **1.3.1 Disinfection equipment and procedures**

- (1) Approved disinfectant
- (2) Leakproof plastic bucket or container in which to mix the solution
- (3) Handheld brush and synthetic sponge
- (4) Disposable gloves or rubber 'washing up' type gloves and eye protection to prevent eyes being splashed with disinfectant concentrate
- (5) Plastic bags to contain items
- (6) A large container/box to carry items

A mix of disinfectant should be left in a secure place so that it is not accessible to children or animals. Disinfectants must be handled according to the manufacturer's instructions. When using brushes, brush away from the face/eyes. Equipment should then be stored safely in suitable sealed storage boxes or plastic bags. Wash hands with soap and water at the end of the disinfection procedure.

When using disinfectants, you should:

- (1) read the instructions on the packet and take note of safety information;
- (2) avoid contact with eyes and skin;
- (3) wear eye protection and gloves when handling concentrated disinfectant;
- (4) keep away from children.

#### **1.3.2 First-aid measures**

When using disinfectants always make sure you have a suitable supply of clean water or eye wash fluid readily available:

- (1) in the case of skin contact wash off immediately with copious quantities of water or eye wash. Seek medical advice if irritation persists; or
- (2) in case of contact with eyes, including any splashes, rinse IMMEDIATELY with plenty of water and seek medical advice;

#### **1.3.3 Storage/transport of disinfectants**

Concentrated disinfectants should be stored in accordance with manufacturer's instruction. Generally this means in leakproof containers in a cool dry place away from direct sunlight and segregated from other substances. Liquid concentrates should be transported in robust containers with tightly fitting leak proof lids, and be correctly labelled. The container should have its top securely screwed on and be placed in a plastic bucket or similar to safeguard against spillage whilst in the vehicle. Ensure that disinfectant is stored safely and NOT accessible to children, etc.

### **1.4 Gaining site access**

Permission from farmers or other land owners is needed to gain access to sample squares. It also contributes to your safety, conforms to biosecurity regulations, ensures goodwill and allays suspicion on rural crime. Permission should be sought where it is practical. It can take 15 minutes or up to an hour. When you call at a farm have clean footwear and a clean vehicle so that you do not appear to be a biosecurity risk. Refer to Section 1.3 for information regarding biosecurity measures.

Usually only two or three farmers, who own most of the land in any one grid square need to be contacted. The farms will usually be obvious from large buildings and the farm house. If you think it necessary, leave a copy of the NICS "calling card" at the houses with nobody around. There are often a large number of rural houses that sometimes own adjacent land. In many cases the owners work during the day. Do not spend time trying to contact them but if you see them, introduce yourself.

Farmers are used to having people such as farming contractors and public utility professionals on their land. Most will not mind you working and will welcome the social

contact. The 1998 survey has the names and addresses of some key farmers and landowners but not all. If you can add to this information, do so (e.g., if directed to a name or address by a neighbour), but do not ask for personal information directly. Farmers have been alerted to the survey via the farming newspapers but some will be unaware.

Contacting land owners on the day of survey is notoriously difficult and time-consuming. They often work away from the home farm. Some out-farms have nobody living on them. It is likely that not all owners will be located. In this case you must use your judgement as to whether to continue. If access is straightforward, such as on land with farm tracks, few people or animals (such as in the uplands or marginal uplands), carry on with survey. Neighbours can guide your decision on whether anyone will mind if you work. Usually nobody does, so long as you are careful and respectful.

### **1.5 Asking for permission**

When you meet a farmer or land owner, be open, polite and informative. Explain who you are and that you are carrying out scientific research for the university. Show your identification card and offer the NICS project card and letter, with contact details and a summary of the research aims. Speak openly about the project. Ask if you may do your work on their land. Explain that you will not trample silage, hay or crops or damage field boundaries and gates, i.e., that you are an experienced surveyor and will be no trouble.

If necessary, explain that the University carries out field survey at its own risk. Do not worry if an owner is uncommunicative. Do not ask about land management or ownership except in the context of permission for access and do not pry into personal affairs. Do not be led into comments on sensitive issues such as nature conservation, monitoring, countryside matters or politics, as replies can be misconstrued. Because the grid squares are part of a sample that has the potential for monitoring change, it is important that you do not influence land use by making comments, e.g., if you mention that a hay meadow is particularly rich or ecologically interesting, this could lead either to its protection or its reclamation.

If anyone asks for results to be sent to them, note this and inform the Senior Research Associate, but do not offer information. Do not ask for names, addresses or telephone numbers. If they are mentioned record them if they are different or additional to our existing information. If you survey without permission and a land owner approaches you, explain what you are doing, and ask if you can continue surveying. Explain that you did your best to contact everyone.

### **1.6 Procedure after gaining permission**

Ask if there are any animals that you should beware of. Ask advice on how to get to parts of the farm in the square. It can save time but can also constrain you from crossing ownership boundaries.

### **1.7 Access to Forest Service land**

We have permission to visit all Forest Service land. Use Forest Service tracks to gain access to uplands by vehicle. Keys to locked forestry gates are available from the Senior Research Associate. They should be kept in a zipped pocket and returned when the grid square has been surveyed.

### **1.8 Permission refusals**

In previous surveys there have been only three or four refusals in total. If permission of access is problematic for a farmer or is refused, explain that:

- the data remains confidential and anonymous
- you are not doing cross-compliance checks
- the work will not result in any "designation"
- the work has nothing to do with land acquisition for roads, housing etc.

If an owner asks you to leave his land whilst you are on it, do so immediately without acrimony on your part. Before you leave ask if the owner will point out other land that might belong to him. Try to survey the remaining land from roads or neighbouring land but do not cause offence. Inform the Project Co-ordinator, who will then visit the owner.

## **2. FIELD SURVEY RECORDING**

### **2.1 Introduction**

The 1998 baseline survey data of main species, structure, environment and management was recorded onto paper field data forms. In NICS2007, this information will be recorded onto electronic data forms with a hand-held Personal Digital Assistant (PDA). In an emergency (electronic failure), paper field data forms can be used. One member of each field team records land cover and one member records field boundaries.

Land cover parcels and field boundaries in 1998 were also recorded onto paper maps. This will again be the case in 2007. Any changes in land cover parcel or field boundary locations that have occurred since baseline need to be drawn onto the 1998 paper maps. Any spatial changes that have taken place also need to be recorded onto paper transition matrix sheets as soon as you complete field recording.

### **2.2 Grid square survey procedure**

Orientate yourself initially using a 1:50,000 Ordnance Survey map and compass to locate the grid square. Become familiar with the layout of the topography, road/tracks and buildings. Each land cover survey team has a global positioning system (GPS) with a copy of the OSNI map of the sample grid square as a location and mapping aid. Do not use the GPS at this stage unless you are lost (e.g., in complex, small-field landscapes or in the uplands) or the OS map has few features.

Confirm the square survey route with your partner. Survey the whole of the square. In the uplands, where there are no field boundaries, use the GPS if you need to check that you have reached the corners of the square. If need be, also use the GPS to validate baseline hand-drawn land cover or field boundary locations and to record any changes if they are not obvious on the hard copy OSNI map (Section 11.8). As you finish recording part of a square that your route takes you away from, check for omissions. When you have finished recording the whole square do a final check on completeness.

### 3. DATA FORM STRUCTURE

#### 3.1. Field Data Booklet:

A field data booklet has been prepared for each sample square in NICS2007. Booklets consist of the following sheets:-

##### **Land Cover**

1. Aerial photo of the sample square (laminated) scale 1:5000
2. 1998 Land Cover Map (laminated) scale 1:5000
  - the mapped distribution of baseline land cover habitat parcels, each labelled with a code to denote whether a Woodland, Seminalural Vegetation, Agriculture or Landscape Features habitat and a parcel number at baseline. Baseline habitat types are also given in tabular format.
3. 2007 Land Cover Map (paper)
  - an OSNI 1:2500 polyline map presented at 1:5000 scale unto which 2007 resurvey land cover habitat parcels can be mapped.
4. 2007 Land Cover Transitions (paper)
  - a data form unto which land cover transitions are recorded.

##### **Field Boundaries**

5. Aerial photo of the sample square (laminated) scale 1:5000
6. 1998 Field Boundary Map (laminated) scale 1:5000
  - the mapped distribution of baseline field boundary parcels, each labelled with its parcel number. A table listing parcel numbers and codes to denote the 1998 primary type is also given.
7. 2007 Field Boundary map (paper)
  - an OSNI 1:2500 polyline map presented at 1:5000 scale unto which 2007 resurvey field boundary parcels can be mapped. Also presented is the mapped distribution of baseline field boundaries, each labelled with a code to denote the parcel number at baseline. Baseline field boundary types (in tabular format) are given on the reverse of the laminated aerial photo above.
8. 2007 Field Boundary Transitions (paper)
  - a data form unto which field boundary transitions are recorded.

##### **Location**

9. 1991/1998 Permissions sheet copy (paper)
  - lists any information on landowners and access gained in previous surveys. Each land owner is given a number. An indication of the land owned is written on the associated map. Any additional permissions information obtained in 2007 can be written onto the copy.
10. Sample Square Location map 1:10000 (paper)
  - an OS map of the square and surrounding land (the scale is 1:10,000 or in some older versions, 6" to the mile).

##### **Backup Paper Data Recording Sheets**

In case of PDA failure a set of emergency paper data forms (Appendix 1.) designed for the recording of NICS2007 data is provided, ie. for

- a. Woodland
- b. Seminalural Vegetation
- c. Agriculture
- d. Landscape Features
- e. Field Boundary Type and Attribute Data
- f. Field Boundary Number of Woody Species per 30m (hedges)
- g. Queries/notes - about land cover parcel and field boundary mapping etc

The baseline data included with the booklet gives you an ecological and land use context against which 2007 data is recorded. The baseline booklet should be used just as a reconnaissance aid, and to gauge the scale at which baseline mapping is to be carried out. It should not be used to make decisions on current land cover or field boundary habitat types in the field.

### **3.2 Resurvey reference information**

All resurvey paper field data forms need to have the following information written on them in order to reference the NICS sample square under survey:

- study area name
- sample square number
- date on which survey was carried out
- name of the field surveyors.

### **3.3 Electronic Data Capture**

Data is recorded electronically by the use of a Personal Digital Assistant (PDA). The PDA holds electronic forms ie. for Woodland, Seminalural Vegetation, Agriculture, Landscape Features and Field Boundaries.

#### **3.3.1 PDA 2007 resurvey electronic form reference**

With the PDA electronic form, the file name of the grid square consists of the study area name and the square number e.g., FERM\_124\_LC and FERM\_124\_BOU.

#### **3.3.2. Writing queries**

Queries about land cover parcel and field boundary mapping etc., are recorded in an electronic query box (or on an emergency paper query form). Queries will be answered by the project co-ordinator. Keep queries short because there are only about 100 characters in the electronic box.

#### **3.3.3. Species codes**

Species have a unique botanical binomial latin name in the PDA dictionaries. A list of species codes is given in Part 3 of this manual.

### **3.4. Electronic form structure**

The electronic form structure is the same as that on the paper recording sheet except for additional query boxes. Electronic forms are in a vertical format. Each row on a paper data form is presented vertically on the electronic form. Because the PDA screen allows only part of a column to be viewed, it is useful to have the paper form in front of you when becoming familiar with the recording procedure. The paper data form also allows you to see the content of the electronic drop-down menus. To understand fully the structure of the electronic forms you need to be familiar with the habitat and field boundary descriptors and the habitat and field boundary attribute descriptors (Part 1. of this manual).

#### **3.4.1 Land cover electronic form structure**

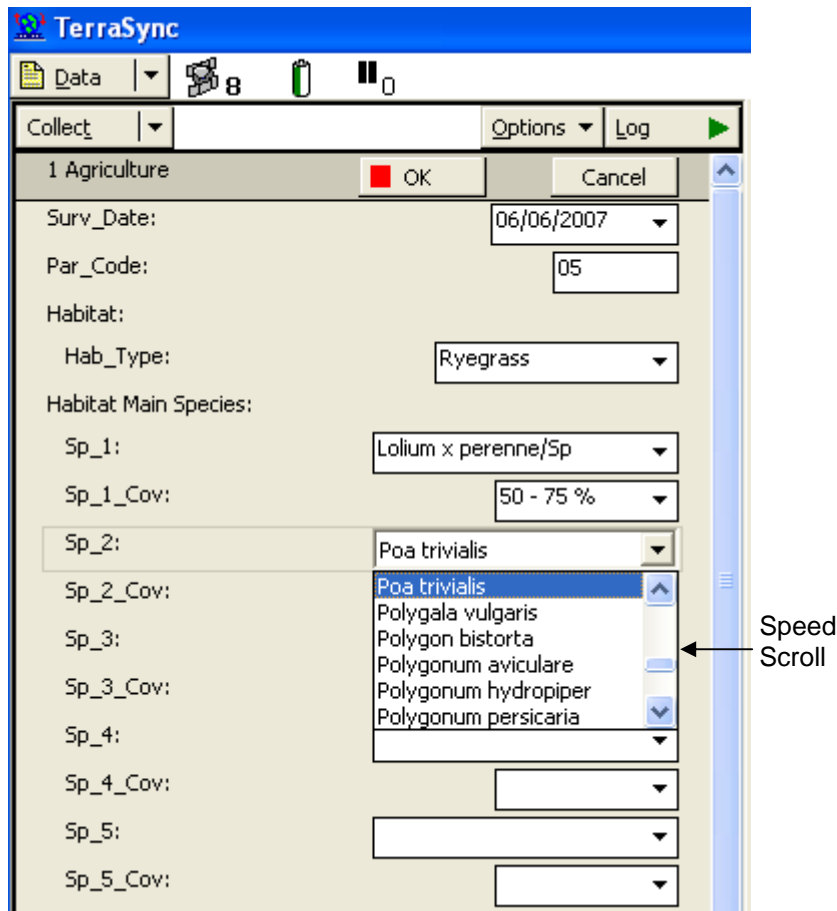
Fig. 3.4.1.1 is an example of the Agriculture electronic recording format. It consists of a series of text boxes and drop down menus.

**Fig. 3.4.1.1** Example of PDA recording structure for Agriculture.

Embedded within the drop down menus are options from which you must choose. Any code labelled with a “\_cov” refers to cover value of that attribute (cover values as in Part 3: Plant Species Identification and Recording).

The drop down menu for species is already in the PDAs. The botanical names of the species are in alphabetical order. Use the speed scroll to the right of the list to quickly scroll through the list.

A list of PDA codes for recorded attributes is given in Appendix 2.



**Fig. 3.4.1.2.** An example of a species drop down menu in an agricultural parcel.

Seminatural, woodland and landscape electronic recording forms follow a similar structure.

### 3.4.2 Field Boundary electronic form structure

Field boundaries have a similar vertical structure to that of the land cover consisting of text boxes and drop down menus. Figure 3.4.2.1 is an example of the electronic field boundary recording form.



- continued

**Fig. 3.4.2.1** Example of electronic field boundary recording form

### 3.5. Electronic Data Capture - Overview

In order to record data electronically using a PDA, the user must become familiar with the operating system ie. Windows Mobile 5.0 (Section 10.). The interface for electronic data forms is Trimble TerraSync software (Section 11.). A TerraSync software quick start user guide is given in Appendix 3.

Two PDA's have been chosen for use in NICS2007 field survey:

- i. **Trimble GeoExplorer XM handheld PDA.**  
This PDA has an integrated Global Position System (GPS) and is used mainly for recording land cover. A general user guide is detailed in Appendix 4.
- ii. **Trimble Recon handheld PDA.**  
This PDA has no integrated Global Position System (GPS) and is used mainly for recording field boundaries. A general user guide is detailed in Appendix 5.

### **3.6 Recording Data on Paper Forms**

Paper data forms are only used in an emergency. To understand the structure of the paper data recording forms you need to be familiar with the habitat and field boundary descriptors and the habitat and field boundary attribute descriptors (Part 1. of this manual). Data for Woodland, Seminalural Vegetation, Agriculture, Landscape Features habitats and Field Boundaries is recorded on separate paper data sheets. Data is then captured later by manual typing into a database. Examples of the paper data recording forms are given in Appendix 1.

#### **3.6.1 Resurvey reference information**

All resurvey paper field data forms need to have the following information written on them in order to reference the NICS sample square under survey:

- study area name
- sample square number

#### **3.6.2. Writing queries**

Queries about land cover parcel and field boundary mapping etc., are recorded on the paper query form. Queries will be answered by the project co-ordinator.

#### **3.6.3. Species codes**

Species have a unique botanical name which is represented by a 3 letter code on the paper data recording forms. A list of species codes is given in Part 3 of this manual.

## 4. LAND COVER RECORDING

The main objective of land cover recording is to map the type of land cover using the NICS Primary Habitats classification and to record habitat attributes (species cover, habitat structure and habitat management).

### 4.1 Classifying a land cover parcel

To assign a land cover parcel to a land cover type, walk the whole parcel, e.g., as a “W” pattern noting the species present. Reliable identification is essential. Stop frequently to assess species cover values. The objective is to understand the overall ecology of the parcel before making a decision on the land cover type. Base all decisions on your “parcel walk” and the NICS land cover types described in Part 1 of the manual. Decisions are made independently of the land cover type mapped in the 1998 baseline survey. They are based only on what you can see (not what you might infer).

Plant community theory views the species composition of communities, as varying gradually in space and time, therefore, some parcels will be border-line between one land cover type and another. Make a best professional decision based on the field evidence assessed against the NICS land cover descriptors. If you are uncertain about a decision on the land cover type, leave the baseline type unchanged. Decisions should be based on the evidence of what you see and record, not what you *think* has happened with time. Record a query, if necessary, in the box at the end of each electronic record (or on the query sheet if an emergency paper data form is used).

The reason a land parcel has been mapped with a different habitat compared with the 1998 baseline could be either real land cover change (e.g., scrub removed) or recording error (e.g., a mapping error or an interpretation difference between surveyors). It is often not possible to decide if there has been real change or recording error. Make a best professional decision on land cover type based on the evidence you see and the NICS land cover descriptors. If there is doubt, whether the difference is real or due to error, you should be conservative - only record *categorical* change.

Do not defer decisions on change. It will be more difficult in the car and a laboratory-based GIS processor will not be able to do it. Do not compare small differences due to type structure, management or species codes with the baseline data. This is too time-consuming. However the baseline data can give a useful ecological context for making a decision (but remember that a lot could have happened/changed since 1998 that you might not be aware of).

### 4.2 Minimum mapping size

The concept of minimum mapping size defines the scale of resolution for field mapping. The smallest parcel size mapped is 0.01ha (100m<sup>2</sup>), i.e., the *minimum mapping area*. It is set to stop you mapping in too much detail. Land should not be mapped as a separate parcel if it occupies less than 100m<sup>2</sup>. *Minimum mapping width* relates to long thin strips of land. If a strip is <2.5m wide (*minimum mapping width*), it is not mapped separately (i.e., incorporate it into an adjacent parcel). Exceptions to the minimum mapping size rules are:

- Patch-size can be larger than the minimum mapping area in a parcel with mosaics of two land cover types too complex to map.
- A small part-parcel at the edge of a square (i.e., belonging to a larger parcel outside the square)
- Permanent water bodies.
- Forest planting rides (5m) in conifer plantations are recorded as internal features/attributes of the plantation.

### 4.3 Structure of the land cover maps

For NICS 2007 land cover field survey, each sample grid square has two field maps:

#### a) 1998 Land cover map

This is a digitised version of the hand-drawn 1998 baseline field map. The baseline field map was photocopied from a published OSNI 1:10,000 paper map and expanded to a 1:5000

scale to make annotation in the field easier. Fig. 4.3.1 is an example of a 1998 NICS land cover map. Each parcel of land on the field map is labelled with a unique code which is referenced to a 1998 land cover type using the adjacent table. The table can be used to get a numeric code for any new land parcels you might map. Each corner of the square is referenced by a six-figure Irish National Grid reference easting (horizontal) and a northing (vertical) in metres e.g. E311000 and N366000.

**b) 2007 Land cover map**

This is a recent OSNI 1:2500 scale line map (Fig. 4.3.2) reduced to 1:5000 for annotation in the field. It has much more detail on it (e.g. buildings and water courses) than the OSNI 1:10,000 map. N.B. the 2007 land cover map does not contain any ecological boundaries. The 1998 land cover map may have ecological boundaries which were mapped during that survey. Some of these ecological boundaries may be slightly inaccurate (they were measured in the field by pacing) and may require checking using the GPS.

**4.4 Delimiting parcel boundaries**

Abrupt differences in vegetation structure/composition are usually used to delimit separate parcels. The differences usually coincide with field boundaries, land use and breaks of slope. Where there is no abrupt difference between two land cover types, e.g., along hill slopes or down to wet hollows. GPS does not help to make a decision. It just makes measuring/mapping easier. Sometimes, an aerial photograph (Section 6.) can help with decision making.

**4.5 GPS mapping**

If a land cover parcel is not present on the 2007 OSNI line map, check the aerial photograph. If the parcel outline can be seen on the photograph, draw it onto the photograph and also draw its approximate location the 2007 OSNI line map. It can then be put into GIS in the lab.

Record a GPS line (Section 11.8) to mark a new land cover parcel or to correct a baseline mapping error. GPS should be used as a mapping aid but it should not be used to re-map at a scale of resolution different from baseline or to re-map with criteria that are different to NICS protocols.

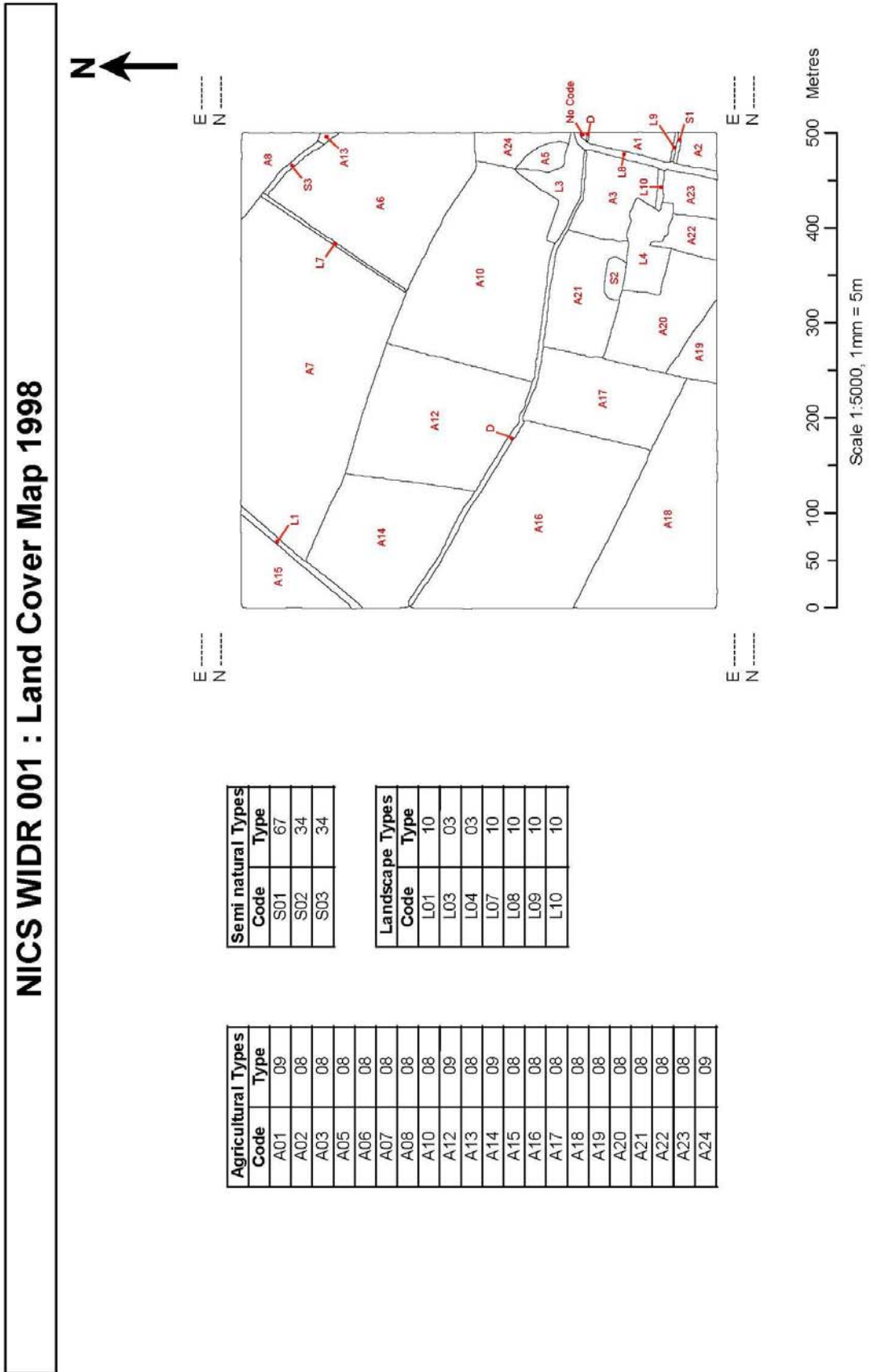


Fig. 4.3.1 An example of a NICS 1998 land cover map (WIDR 001). The table shows parcel numeric codes and land cover type codes recorded in the field

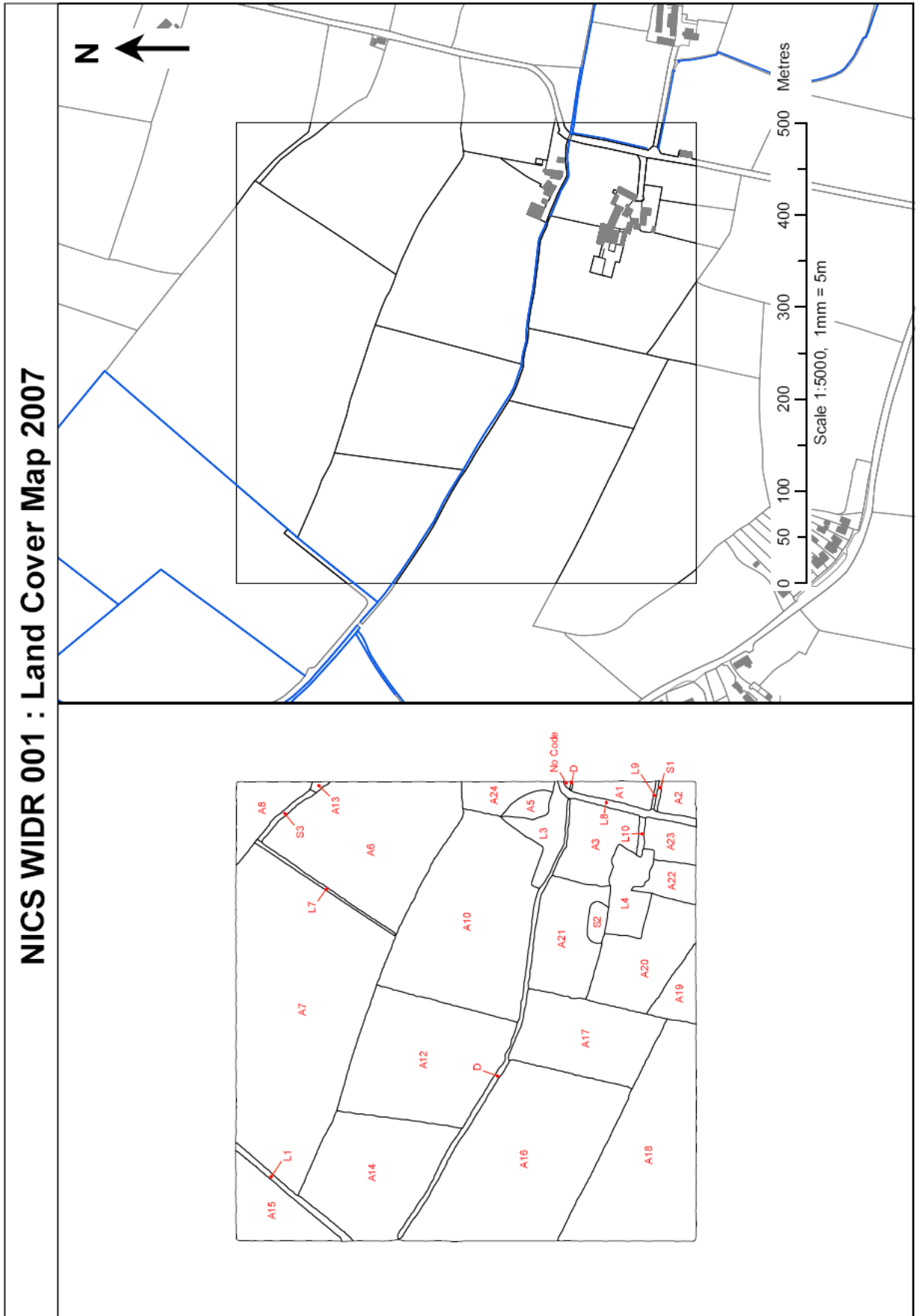


Fig. 4.3.2 An example of a NICS 2007 OSNI line map (WIDR 001)

#### **4.6 Mosaics**

If there is a complex pattern of two or more land cover types (Primary Habitats), each greater than the minimum mapping area (10m x 10m), that can not be mapped separately (i.e., it is impractical), they should be combined and mapped as a single parcel. This is for pragmatic reasons (usually in the uplands).

Mosaic parcels are often associated with the physical structure of the land, e.g., a mosaic of Poor fen and Wet heath land cover types coinciding with hollows and banks in cut-over bog. They can also be a result of management such as grazing, e.g., a mosaic of Dry heath and Bent-fescue hill pasture land cover types.

A mosaic parcel is given two parcel numbers on the paper land cover map and each land cover type in the mosaic is described as a separate record on the field data form. The percentage of each land cover type in the parcel is recorded in the electronic query box (or on the left margin of the paper data sheet). In 1998 the land cover type and attributes (species, structure and management) of some mosaic parcels was mapped as just a single record. This error should be corrected in 2007.

If the scale of mosaic cover is less than the minimum mappable area (e.g., in grazed heaths with small grassy patches), only one land cover type (the main type) should be mapped and only one record made on the field data form. Do not record mosaic parcels unless absolutely necessary (i.e. when mapping is impractical). Record any mosaic queries that arise.

The baseline field maps from 1998 should be used as a reference context for the scale at which to map, i.e., use the same resolution as on the baseline map. Use the colour aerial photographs as an interpretation aid but not to re-map at a scale of resolution different from baseline or use different criteria.

#### **4.7 Recording change between baseline and re-survey**

If the location of a land cover parcel has changed compared with the 1998 baseline ecological map, it needs to be recorded on the paper 2007 OSNI line map. The procedure for doing this is described in Section 5.3. The changed location should be logged on the transition matrix paper sheet (Section 5.4) using the letter "C". If there has been a baseline location error, record the letter "E" on the transition matrix sheet.

#### **4.8 Checks for completion**

When land cover recording in a square is finished, read through the electronic records, checking for omissions and data entry errors. Check that all land cover parcels have a code number on the paper map, that all locational changes have been drawn onto the 2007 OSNI line map, that the change matrix has been completed and that the recording is complete. This cuts out returning to the square at a later date. Ensure that all locations and codes on maps are legible.

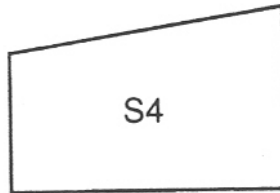
**5. LAND COVER MAPPING**

**5.1 Instructions for labelling land cover map**

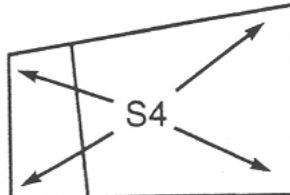
Write on the map with a 0.5 HB propelling pencil. Erase with a soft white rubber. Rub out all errors completely. Writing should be neat and legible. Pay close attention to tidiness. Do not write over existing map lines or use shading/cross-hatching which hide them. Clarity throughout is essential so that GIS interpretation can be done. Each separate parcel of land is labelled by writing the parcel code number in its centre. The parcel number is prefixed by a capital letter:

- W - Woodland
- S - Seminatural vegetation
- A - Agricultural grassland/crops
- L - Landscape features

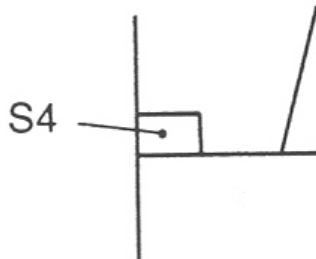
Only one label (e.g S4) is used unless there is a mosaic of two land cover types, in which case the parcel is labelled as, e.g., S4/S5. The parcel border lines are drawn to delimit the parcel area. They usually coincide with field boundaries in farmed landscapes (fences, hedges, earthbanks or walls), but there may be an ecological boundary.



In complex parcels, pencilled arrows can be used to show the extent of the parcel, eg., if a field boundary has been removed (e.g. by field enlargement) or is non-functional or the parcel extends across a field boundary.

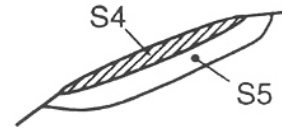
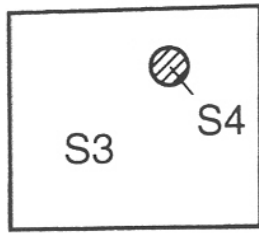


In small parcels, where there is insufficient space to write the parcel number clearly, a bold dot attached to a pointer and identified by a code number written outside the parcel can be used.

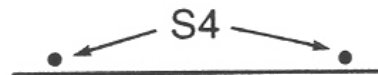
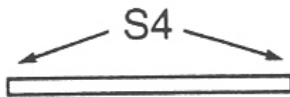


Shading or cross-hatching should be used sparingly. It can be used to delimit a parcel area when it is small/irregularly shaped or where smaller parcels occur within or between larger parcels.





Long narrow strips of land  $\geq 2.5\text{m}$  wide and  $\geq 0.01\text{ha}$  (the minimum mappable area), should be denoted by arrows so that the area is not made artificially large by a blunt pencil (*note*:  $1\text{mm} = 5\text{m}$  at a scale of 1:5000). Similarly, when marking small or narrow areas on the map, do not mark a larger area than exists. Arrows with dots can be used to delimit the length of narrower parcels.



Record the measured width (m) of narrow vegetation strips against the parcel number in the left margin of the map. Measurement is done by pacing. Calculate how many paces you make in 30m over different types of terrain. Handheld GPS is not accurate enough to measure the width of strips.

Where a mosaic of two different land cover types can not be mapped effectively, a single parcel is drawn and allocated two land cover code numbers representing the mosaic components. The percentage cover of each type is noted on the field map and in the text box (labelled Mosaic\_Cov) of the electronic data entry forms. If an emergency paper form is used, the percent of each type is recorded in the left margin of each land cover type record.



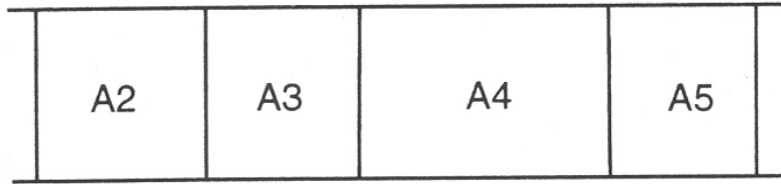
## 5.2 Instructions for drawing land cover change

If a parcel outline has changed, draw it on the 2007 OSNI line map in pencil and record its location with a GPS line (if the line is not evident on the 2007 OSNI line map or aerial photograph). If part of a land cover parcel has changed type, draw a new line to create a separate parcel. If several parcels have been merged, cross out lines. All drawn edits will be digitised into a GIS so they should be unambiguous and explicit.

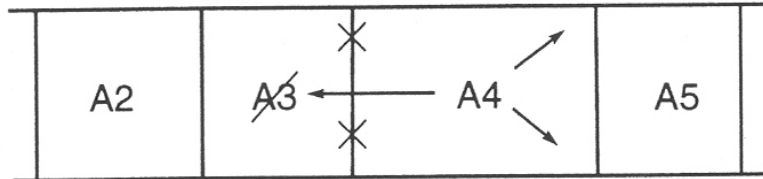
### 5.2.1 Labelling land cover change

Land cover parcels can change type, increase in size (e.g., with field boundary removal) or decrease in size (e.g., with agricultural reclamation). A boundary between two different land cover types can be delimited by a permanent field boundary (e.g., a hedge), temporary electric fencing or an ecological boundary. A parcel boundary which no longer exists is labelled by marking "x" "x" on the line. A parcel type code that no longer applies can be crossed out and a new label written.

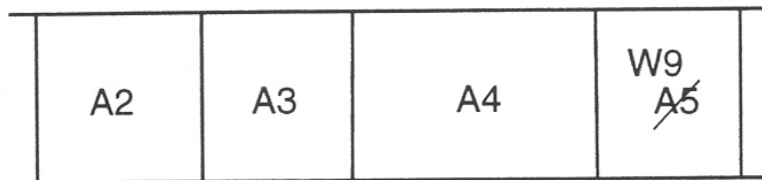
In the example below, parcels have been labelled at baseline as:



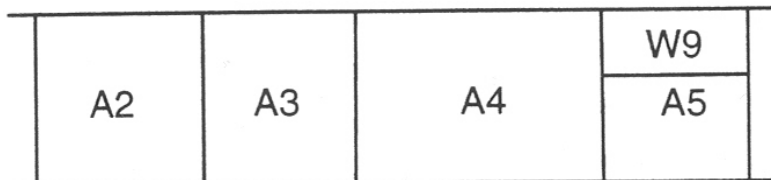
At resurvey, parcel A3 is now contained within parcel A4, following boundary removal.



Parcel A5 has been completely planted with woodland. It is now labelled parcel W9.



Parcel A5 has been partly planted with woodland. There is now a new parcel labelled W9.



### 5.3 Mapping land cover change - annotated example

A partly completed resurvey field map is shown in Fig. 5.3.1. Changes have been written onto the hand-drawn 1998 baseline survey map (A) and copied onto the blank 2007 OSNI line map (B). The land cover codes that have not changed have also been copied onto the OSNI line map. Because Map B will be transferred to a GIS, the copying should be unambiguous and explicit, therefore Map B should be fully annotated with all land cover parcel codes and boundary change (even if boundaries have been recorded on the GPS).

Examples of mapping practice in Fig. 5.3.1 are:

- If a parcel has the same area as at baseline (map A) and has not changed land cover type, the same code as on the baseline map is written onto the 2007 OSNI map (B). Take, e.g., parcels A5 and A6 (bottom left corner). Nothing needs changed on the 1998 map while the same code just needs to be written onto the 2007 OSNI line map.
- If a parcel has the same area as at baseline but has changed land cover type, the baseline code is crossed out on the 1998 map and a new code is written onto the 2007 map. Take, e.g., parcel A22 (bottom left) beside road L1. This has been built on, hence A22 has been crossed out on the 1998 map and the new L22 code added beside it. L22 is then written onto the 2007 map. *Note:* the parcel number 22 was used because 21 had already been used (top left).
- If parcels need to be split, compared with baseline at resurvey, to give two parcels, one new code needs to be added. Draw a line where you judge the boundary between the two parcels to be. Also draw the line on the OSNI map. Take for example parcel A14 (right centre). A new field boundary has been added on the right-hand side. Both fields are still agricultural grassland. Hence A14 is retained for one of the parcels. The other parcel is given a new code, A32 (the lowest available agricultural parcel number). If parcels need to be merged, e.g., because of field boundary removal, cross out one of the parcel codes (A2, bottom left), draw an arrow from the other parcel code (A1) into the second parcel (A2) to indicate the merge. Finally put "x" "x" on the boundary line to indicate it does not exist.
- A second example of merged parcels is the reclamation of S5 to A27 (middle left). *Note:* a second arrow has been added to the baseline map to indicate parcel area unambiguously.

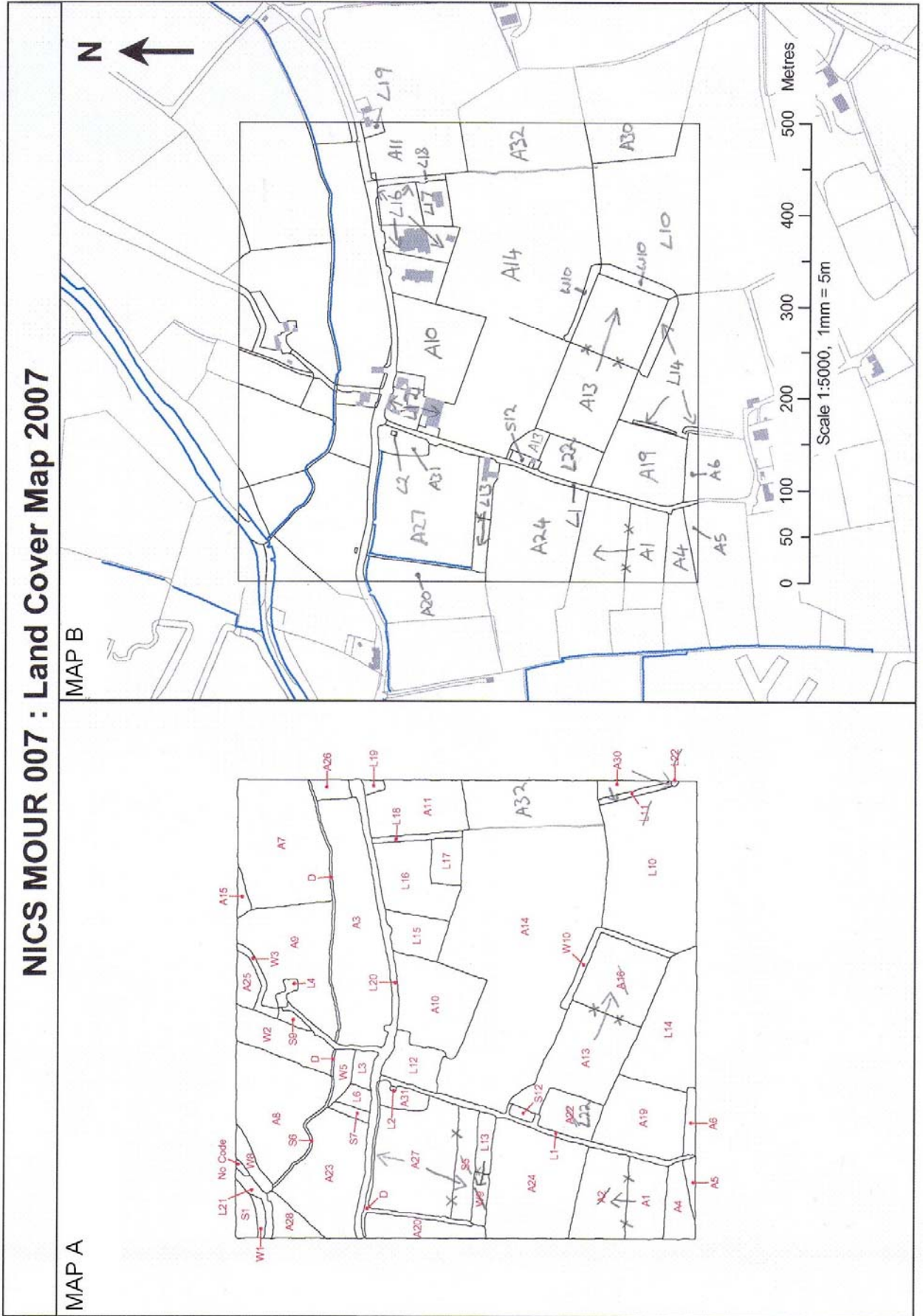


Fig. 5.3.1 Example of an annotated NICS land cover map (MOUR 007)

#### 5.4 Land cover transition matrix

When there has been a spatial change in land cover, a record must be made on the *paper* transition matrix form. NICS currently has no electronic way of recording this information in the field. Instances of records are:

- Land cover parcels which have been split, merged or created. Spatial changes due to a different map scale or hand drawn lines from 1998 (refer to Section 5.5) are not recorded. They can be extracted using GIS at a later date.
- Spatial changes resulting from methodological differences between 1998 and 2007.
- “No code” parcels (i.e. parcels which failed to be recorded in 1998) (refer to Section 5.5) that are merged with an existing parcel. However, note that a record of the land cover type of “No code” parcels is recorded.
- Categorical errors that give spatial change.

Note that changes of type (ie., non-spatial changes) are not recorded in the transition matrix. They can be extracted using GIS at a later date.

When filling in the paper transition matrix the following rules must be adhered to:

- Only real spatial changes are recorded on the transition matrix.
- Change is always recorded on a “from – to” basis.
- Parcel numbers below 10 are preceded with “0”.
- When there are several changes in a parcel these are listed in order.
- Habitat group prefixes are recorded before each parcel number. “Sht” refers to the sheet (form) on which the group i.e. Woodland (W), Semintaural (S), Agricultural (A) or Landscape (L) occurs.
- In the column named “code” insert an “E” to denote a location error or a “C” to denote a categorical location change.
- Enter a note if it will help with GIS or ecological interpretation.

The change matrix for the annotated example square MOUR 007 (section 5.3) is shown in Fig. 5.4.1. Parcels with the same area are not recorded on the transition matrix, e.g., parcel A22 (agricultural parcel) changes to parcel L22 (a hard cover landscape parcel), however it is not necessary to record this on the transition matrix as there has been no spatial change. If L22, however, had extended into parcel A13 then this would be recorded on the transition matrix.

If parcels are split, the transition is recorded, e.g., A14 has a new field boundary added on the right-hand side making two fields. Both fields are still agricultural grassland, but because this is a spatial change it is recorded on the matrix.

If parcels are merged a transition is recorded, e.g., parcels A1 and A2 are now one field reflecting a spatial change and hence a record is made on the transition matrix. Similarly S5 changes to A27, A16 changes to A13 and W9 changes to L13.

Land Cover Transitions Data Recording Sheet NICS2007										Sample ID:	MOUR	007	Page	1
Record	Baseline 1998			Resurvey 2007			C/E	Notes:	Transition Codes: C. - Change and E. - Error & Notes					
	Sht	Par	Typ	Sht	Par	Typ								
1	A	14	09	A	32	11	.	C						
2	A	2	11	A	1	09	.	C						
3	S	5	02	A	27	11	.	C						
4	W	9	08	L	13	04	.	C						
5	A	16	11	A	13	08	.	C						
6							.							
7							.							
8							.							
9							.							
10							.							
11							.							
12							.							
13							.							
14							.							
15							.							
16							.							
17							.							
18							.							
19							.							
20							.							
21							.							
22							.							
23							.							
24							.							
25							.							
26							.							
27							.							
28							.							
29							.							
30							.							
31							.							
32							.							
33							.							
34							.							
35							.							

Fig. 5.4.1 Example land cover transition matrix (MOUR 007)

### 5.5 Errors in mapping change

There are three types of mapping error you will experience.

1. **Lines drawn by hand in the 1998 baseline NICS.** These were mainly, a) vegetation (ecological) boundaries, b) the outlines of new rural buildings, c) new field boundaries. Hand-drawn lines can be spatially inaccurate. In Fig. 5.5.1, e.g., the hand-drawn line in 1998 does not represent the woodland parcel accurately. This time, some hand-drawn lines will need to be remapped using a GPS line or (as in the case below) using clear lines on aerial photographs.



Fig. 5.5.1 Aerial photograph (2006) with 1998 field survey lines.

2. **Parcels without a baseline code.** These are land cover parcels missed by the 1998 NICS. GIS has been used to add a “No code” label to the 1998 baseline maps. If the parcel is an extension of the parcel next to it, use an arrow and cross-out lines (“x”) to merge the extension. If not, a new code (and electronic record) is needed. In Fig. 5.5.2, the “No code” parcel could be an extension of L21 or W8, or it could be some other land cover type needing a different code.

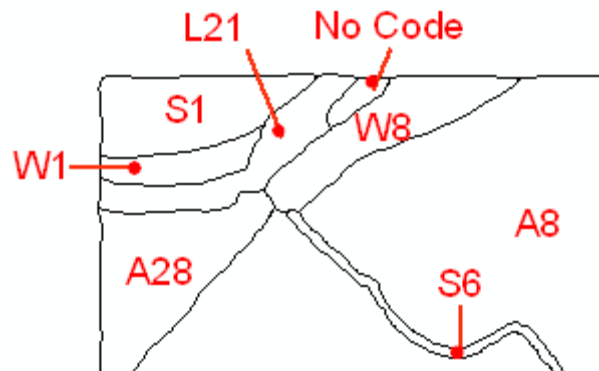
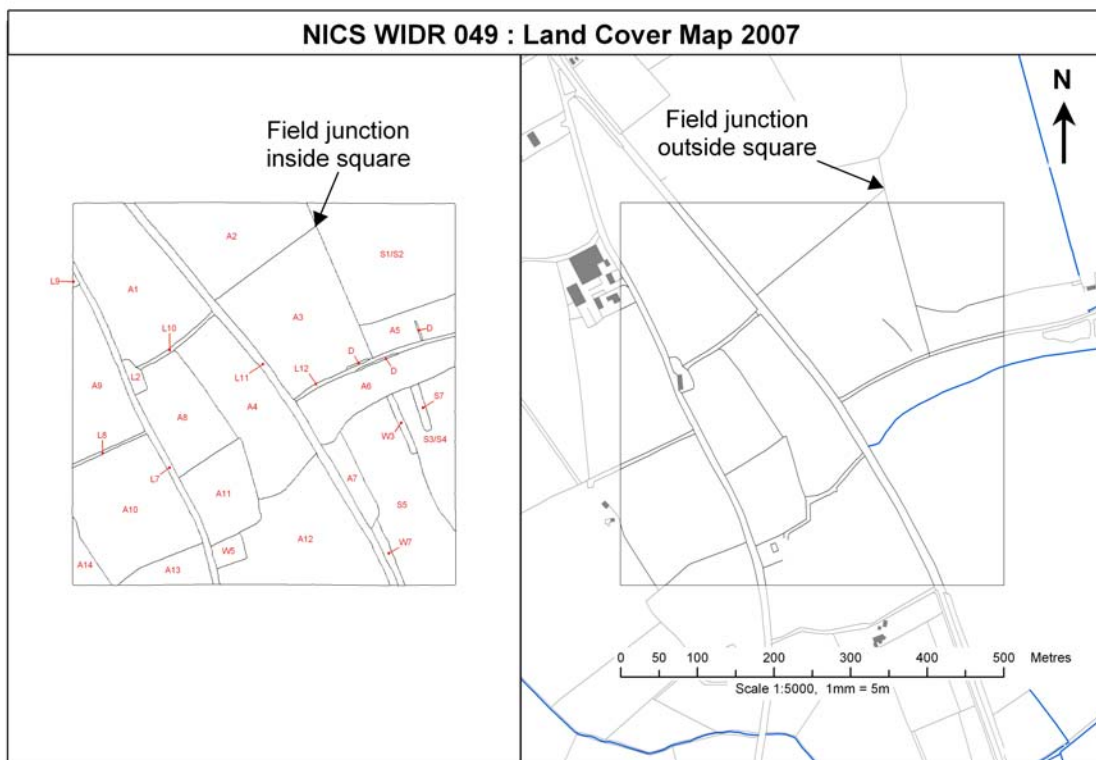


Fig. 5.5.2 Field map (1998) showing a parcel with no land cover code mapped.

3. **Field mapping uncertainty caused by the change in map scale.** Previous NICS survey recorded information onto 1:10000 scale maps from the 1970s. The OSNI 2007 line maps (1:2500 scale) show more detail, e.g., building outlines, road verges and narrow strips of vegetation. Much of this detail did not feature on the 1:10000 maps so it was drawn by hand. Strips on the OSNI 2007 maps that do not have a land cover code should be given one. However, a decision on whether uncoded strips are map artefacts or real change can be difficult and can lead to mapping errors.

Fig. 5.5.3 shows an example of mapping uncertainty. The 1998 map shows the junction of parcels A2, A3 and S1/S2 (top centre) to fall within the survey square. However the 2007 OSNI line map shows the junction to occur outside the survey square. This is not real change but a consequence of 1998 mapping error (i.e., drawing the boundary between A2 and A3 in the wrong place). If parcel shape is roughly the same yet there are slight positional inaccuracies, it is likely to be a mapping error. However, you should be aware that positional differences in a vegetation boundary between 1998 baseline and 2007 resurvey, could be due to natural dynamics, such as bracken extension or scrub growth into grassland.

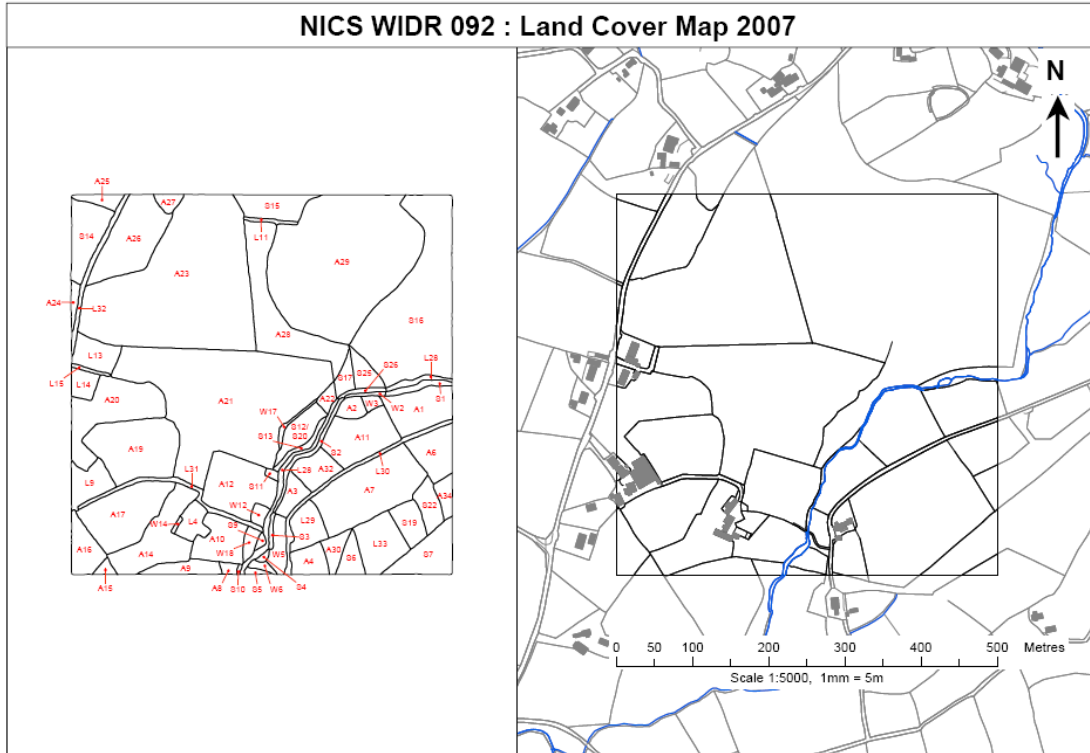


**Fig. 5.5.3** An example of mapping uncertainty (WIDR 049)



**5.6 Mapping ecological boundaries example**

Ecological boundaries mapped in 1998 by NICS are not usually mapped by OSNI and therefore are not usually on the OSNI 2007 line map (as illustrated by Fig. 5.6.1). Notice the lack of lines in the top right on the OSNI 2007 line map. The boundary between A29 and S16 is clearly an ecological boundary – as are those between A28 and A29 (also not mapped). Of course, if the ecological boundaries recorded at baseline are not obvious when you are in the field, the land cover type has probably changed, e.g., the track L11 (top centre of survey square) is not on the OSNI line map.



**Fig. 5.6.1** An illustration of missing ecological boundaries from a 2007 OSNI line map (WIDR 092)

Ecological boundaries should be drawn onto the OSNI 2007 line map in their approximate location. A GPS line should also be recorded (if not evident on the aerial photograph) so that the location can be put onto a GIS. If the ecological boundary is evident on the aerial photograph, there is no need to create a GPS line – it just gives you extra work in the field and extra GIS work.

Some fixed field boundaries, such as low earth banks, which were not on the 1970s 1:10 000 maps, were hand-drawn in previous NICS. OSNI have now put some of these onto the 2007 map, therefore do not assume that every hand drawn line is an ecological boundary. Some fixed field boundaries (e.g., hedges) may also be spatially inaccurate on the 1998 map. Do not confuse this with real change.

## 6. AERIAL PHOTOGRAPHS

### 6.1 Field mapping guidelines

Aerial photographic cover was not available for baseline survey. For survey in 2007, we have colour aerial photographs (projected at 1:5000 scale) dated from April 2003 to July 2006. They can be used as an interpretation aid but not to re-map at a scale of resolution different from baseline or to re-map with different criteria. This would bias the survey results.

Sources of aerial photograph error are:

- they are 1-3 years out of date (recent land cover change not shown)
- they can have contrasting colours if compiled from two flights (Fig. 6.1.1)
- they do not show the species composition of vegetation (just dominant species with a contrasting colour)
- not all parcels or linear features such as wooden post and wire fences are visible on the aerial photographs and will probably need GPS.

These sources of error can make decisions on land cover change in the field, unreliable and difficult. If in doubt leave land cover unchanged. Also, aerial photographs might not be re-flown for future re-survey. Therefore, all mapping decisions should be made *in the field* using the NICS field mapping criteria and protocols.

Where field boundaries, roads and other OSNI-mapped features delimit parcels of land, field surveying and mapping is straight-forward and aerial photographs are not needed. In simple situations such as a field corner with species-rich wet grassland, where an ecological boundary (e.g., a break of slope) separates two land cover types and you can walk along it, either the aerial photograph can be used or a GPS line can be recorded. If a line is on the aerial photograph, it is less work than recording a GPS line and less work for GIS in the lab.

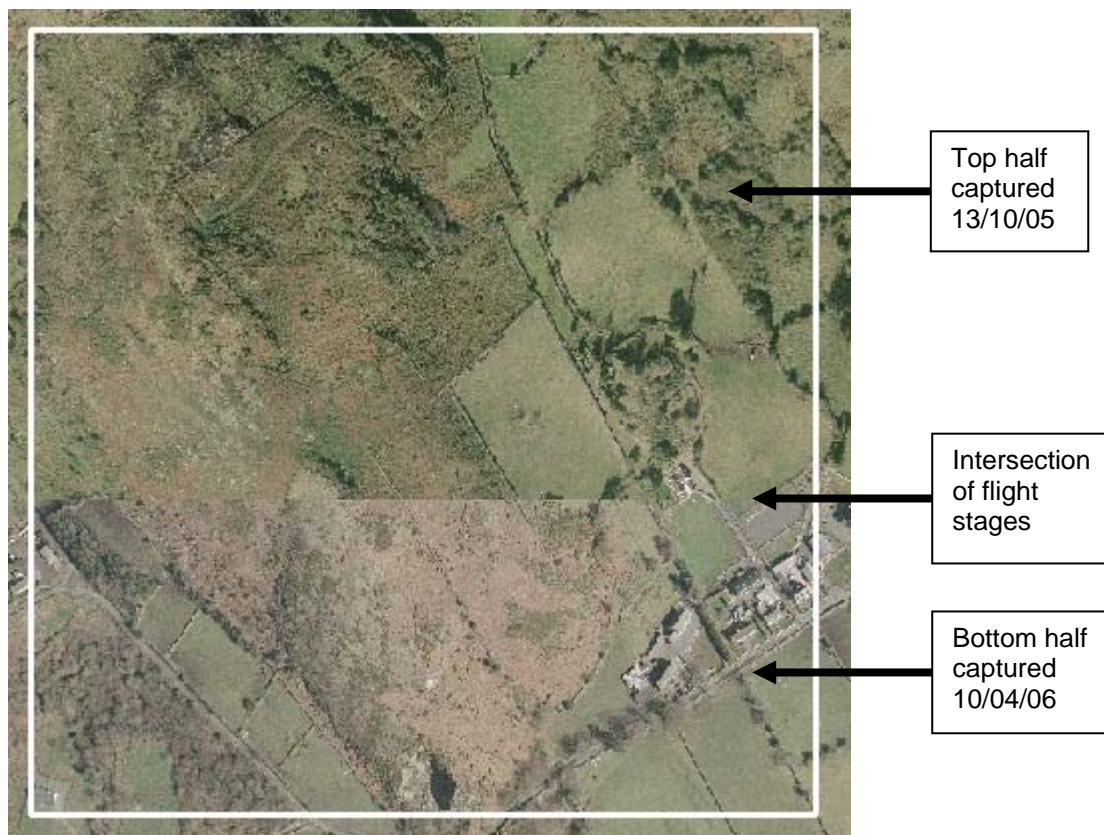


Fig. 6.1.1 Aerial photograph of sample square MOUR 036.

Where there are complex patterns of different types of land cover and few OSNI features (e.g., in the unenclosed uplands), aerial photographs can provide an overview which can clarify patterns of variation not obvious in the field.

A clear ecological boundary on an aerial photograph is usually linked to an abrupt break of slope, burning or vegetation management. For this, an aerial photograph can be used to confirm its location, so making GPS unnecessary. An aerial photograph can also be used to help decide in the field, where to locate a fuzzy land cover boundary. In both instances the decision is made in the field based on the NICS mapping criteria and protocols.

If you use an aerial photograph as an aid to mapping, you should be clear that the decision has not been influenced by mapping at a scale of resolution different from baseline or by re-mapping with different criteria.

## **6.2 Land cover mapping protocol**

The protocol for using aerial photographs to aid land cover field mapping is:

- Check if a major ecological boundary is on the 2007 OSNI line map. If it is, then no further mapping is needed.
- If it is not mapped on the 2007 OSNI line map, check the aerial photograph. If the vegetation boundary is clear on the photograph, draw the outline onto the photograph and copy its approximate location the 2007 OSNI line map. This allows the outline to be put into a GIS in the lab.
- If the parcel is not mapped on the 2007 OSNI line map or visible from the aerial photograph and you need to map it, use a GPS. Unnecessary GPS shortens the battery life on the PDA, reduces the amount of squares you can get on the PDA and gives a greater amount of GIS work in the lab.

## **6.3 Example of using aerial photographs as a land cover mapping aid**

Fig. 6.3.1 shows how an aerial photograph of the upland blanket bog square ANTR 050, was used as a mapping aid. The vegetation is complex, with ecological boundaries between land cover types being both gradual (S6/S9) and abrupt (S3/S11 boundary) and with lines representing drains (S16), upland watercourses (draining S5) and machine peat cutting (S17).

Mapping every small patch in the aerial photograph is not practical. There are also the constraints that the photograph could be 1-3 years out of date and does not show the species composition of vegetation. Without an aerial photograph, mapping the main ecological boundaries with a GPS would also be time-consuming.

The aim is to use the aerial photograph and field observation, to record a relatively small number of GPS lines, thus cutting field survey time and increasing mapping accuracy.



**Fig. 6.3.1** Vegetation boundaries mapped using field observation, the aerial photograph (wavy boundaries) and about 20-30 key GPS points (straight/angular boundaries).

Parcel S10 (top right) is a good example of how an aerial photograph was used to map a land cover parcel seen in the field to be dominated by bracken. The bracken parcel was not on the 2007 OSNI line map. Hence the protocol question needed to be asked – is the parcel visible on the aerial photograph or does it need mapped in the field using GPS? In this instance S10 is clearly visible as a parcel on the aerial photograph. Consequently its outline was mapped on a paper version of colour aerial photograph and then drawn approximately onto the 2007 OSNI line map. No field GPS lines were needed. Similarly parcels S11 and S13, for example, were mapped using the aerial photograph but after confirming in the field that they were poor fen.

Once the parcels had been identified in the field and confirmed to be visible on the aerial photograph, the Research Associate then digitised them in the lab using the aerial photograph and field notes recorded in the electronic query box of the land cover parcels record.

The ecological boundary between S11 and S13 was located in the field and recorded as a GPS line.

Fig. 6.3.1 also shows that some parcels cannot be mapped using the aerial photograph, for example, there are no abrupt ecological boundaries visible between S5 and S6. In the field however, it was clear that one (S5) was wet bog (flat topography dominant *Sphagnum* and *Scirpus*) and one (S6) was wet heath separated by a break of slope, abundant *Calluna vulgaris* and *Erica tetralix* with a minor *Sphagnum* component. The aerial photograph was of no use in mapping in this instance, because it did not show either the slope break or the differences in species composition at the ecological boundary. GPS was therefore used in the field to do the mapping by walking the line.

To avoid the mapping being biased by the aerial photograph, it is important that you first identify in the field what is the land cover type of the parcel and where approximately are its boundaries (using the land cover map in the background layer of the PDA), before you consult the aerial photograph. When you are confirming ecological boundaries in the field you will need to assess whether a GPS line needs to be logged or whether the aerial photograph can be used.

Do not map parcels to fit the aerial photograph (i.e., do not re-map). Map what you see on the ground to be the important vegetation boundaries and ignore features such as drainage patterns and small-scale pattern.

If the aerial photograph reflects what you see on the ground then no GPS is needed. If the vegetation boundary you see in the field is not on the photograph, you should map it with a GPS line.

## 7. FORESTRY MAPS

The Forest Service produces maps of all its land. Forestry maps are provided for NICS squares which contain parcels of Forest Service land. These maps are reproduced from a Forest Service GIS. They are assumed to be correct as of the 22/11/06 and are therefore relatively up-to-date. The Forest Service maps link to OSNI 1:2500 line data only in terms of the outside forest boundary, i.e., the forest edge. Internal compartments, rides, tracks, car parks etc. are mapped by Forest Service independently of OSNI hence internal mapping variations exist between OSNI and Forest Service maps as shown in Fig. 7.1. You will be provided with a labelled forestry map projected at 1:5000 scale with a list of Forest Service species codes as a mapping aid (Fig. 7.2).

Notice in Fig. 7.1 that the forest edge corresponds in both maps, however, there are key differences in the internal features of the forest. OSNI mapped the track much narrower for example, probably as a result of using aerial photographs as a mapping tool which meant that the forest canopy overlapped with the track somewhat. These are just subtle differences but be aware of them. The OSNI line map does not contain any information concerning forest compartments.

Fig. 7.1 Forest Service Map A shows a forest divided into compartments. Each compartment is labelled with a Forest Service species code and a planting date. Usually several adjacent compartments will have the same planting date. The Forest Service usually uses a two letter code indicating what species is planted (e.g. 'SS' is Sitka spruce). If there is more than one species planted (e.g. SS/LP, which is Sitka spruce and Lodgepole pine), they will be written in order of proportion in the mixture (e.g. for SS/LP, there will be a greater proportion of Sitka spruce than Lodgepole pine in the mixture). Note however, that sometimes, what was planted can differ from the Forest Service planting plan. The colour aerial photograph is helpful with this. Unplanted land is indicated by the code UP. In the above example UP refers to a car park.

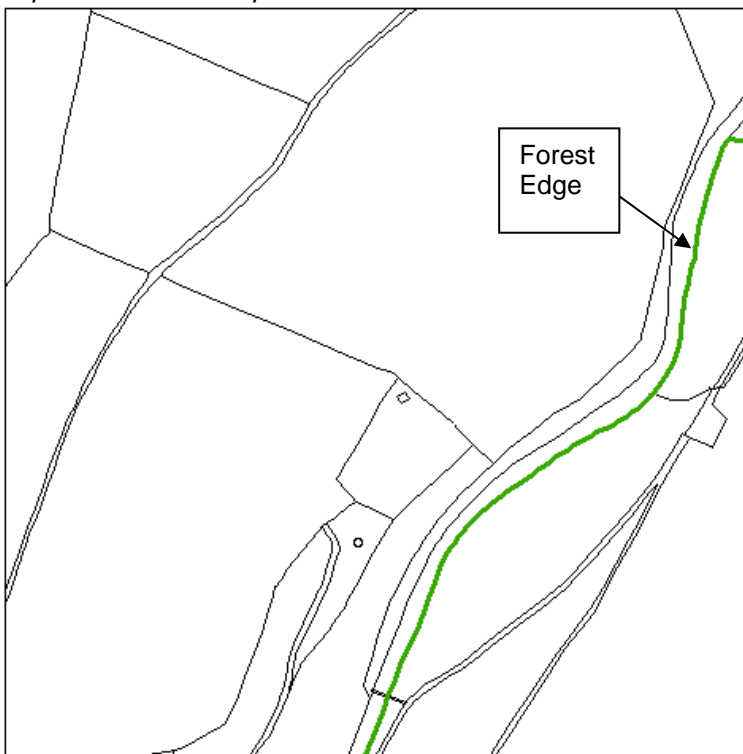
The protocol for using forestry maps is to use it as an additional information source.

- The forestry map is just a reference, all annotations and mapping have to be completed on the 2007 OSNI line map.
- If you confirm a forest compartment as one of your land cover parcels then roughly draw this onto the 2007 OSNI line map and label the parcel – no GPS is needed, (you are unlikely to receive a good GPS signal within forests anyway). A GIS hybrid of the two maps will then be produced in the lab.
- If a new compartment or land cover parcel is evident in the field within the forest but not on the forest map, again draw a line on the 2007 OSNI line map to represent it. If you are receiving a good GPS signal, use the GPS system, to map it. If not receiving a GPS signal then try to ensure the hand drawn line is as accurate as possible (measured by pacing).
- In 1998 some isolated areas of seminatural vegetation surrounded by conifers, were not mapped. The aerial photograph can be used to correct these errors.

Map A : Forest Service map



Map B : OSNI line map 1:2500



**Fig. 7.1** A comparison of a Forest Service (map A) and an OSNI line map (map B)

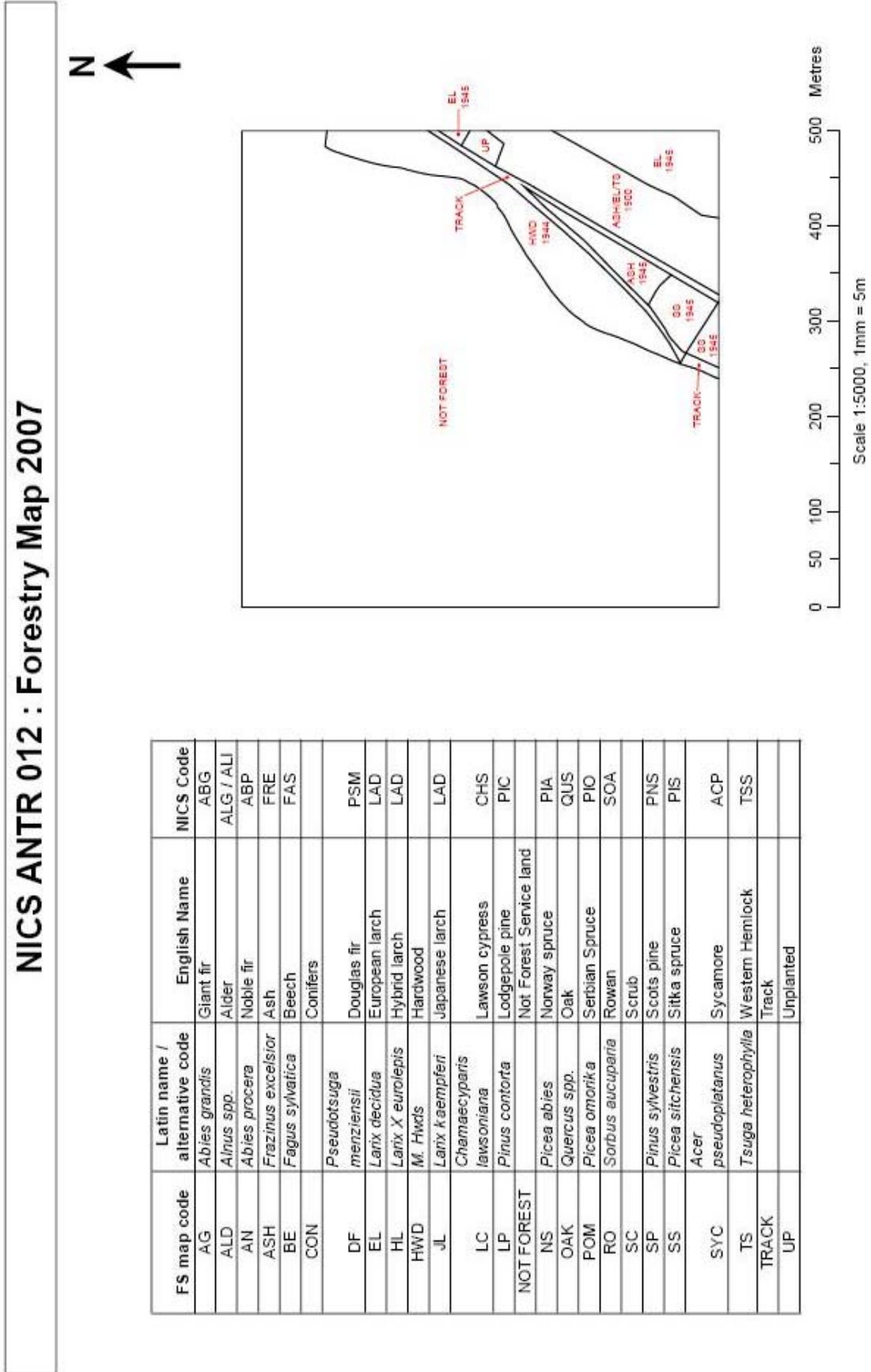


Fig. 7.2 An example Forestry map (ANTR 012). The table shows Forest Service species codes, latin and common names and corresponding NICS codes



## 8. FIELD BOUNDARY RECORDING

The main objective of field boundary recording is to map the types of field boundaries using the NICS classification. Decisions on field boundary type should be made independently of the types on the baseline map, because this would bias the survey results.

Depending on whether there has been boundary removal with time or whether mapping errors were made during baseline, the distribution and types might not coincide with the baseline map.

### 8.1 Classifying a field boundary

To assign a linear feature to a field boundary type, walk the whole length. Stop frequently to assess, the main species, shrub/tree growth forms structure and environment/management attributes. Some field boundary types will be border-line between one type and another (e.g., hedges can lose shrubs with time and develop into earth banks with trees). Make a best professional field decision based on the evidence. Base all decisions on your observations and the NICS Field Boundary descriptors. If you are uncertain about a decision on the field boundary type, check what baseline type was recorded and leave it unchanged.

Only record field boundaries associated with curtilage (land demarcated as urban areas or farm buildings and gardens) when they abut agricultural land, i.e. do not record linear features within curtilage.

### 8.2 Minimum mapping length

The concept of *minimum mapping length* defines the scale of resolution for field boundary mapping. The minimum mapping length (MML) is 20m. No field boundary should be mapped as a separate element if it is less than this. The MML is set to stop you mapping in too much detail. An exception to the MML rule is a short length at the edge of a square (i.e, that is part of a longer boundary outside the square).

### 8.3 Structure of the Field Boundary maps

Each sample square has a 1998 baseline field boundary map and an OSNI field boundary 2007 map (Fig. 8.3.1). There is also a field boundary database reference table (Fig. 8.3.2):

#### 1. 2007 OSNI field boundary map

This is a recent 2007 OSNI 1:2500 scale line map reduced to 1:5000 for writing on in the field (Fig. 8.3.1). It has more detail on it than the 1:10,000 map, used for the baseline 1998 survey. The detail includes streams/water bodies (blue lines) and buildings.

#### 2. 1998 Field boundary type

This is a scan of the labelled 1998 field boundary map (Fig. 8.3.1). It is located on the left hand side for reference.

The field boundary database reference table (Fig. 8.3.2) details the 1998 boundary type and gaps value for each boundary code (Fig. 8.3.2). Boundary codes are referenced to the labelled scanned 1998 map (Fig. 8.3.1). The table is quick reference to the boundary types recorded in the 1998 baseline. It can be used to get a numeric code for any new boundaries you might record.

### 8.4 Recording procedure

Locate the field boundary on the 1998 baseline map. If it is still present, record the code number on the OSNI 2007 field boundary map. Try to record field boundary data with a single walk along its length. Assess its overall structure from a distance (the aerial photograph can help to assess gappiness), then walk the length noting the main shrub/tree growth forms, the internal structure and what is on the other side. Record the number of woody species from a random 30m length. Check that each database record is correct. Finally, complete the paper change matrix form. Any change in the type, location or length is logged on the transition (change) data recording sheet.

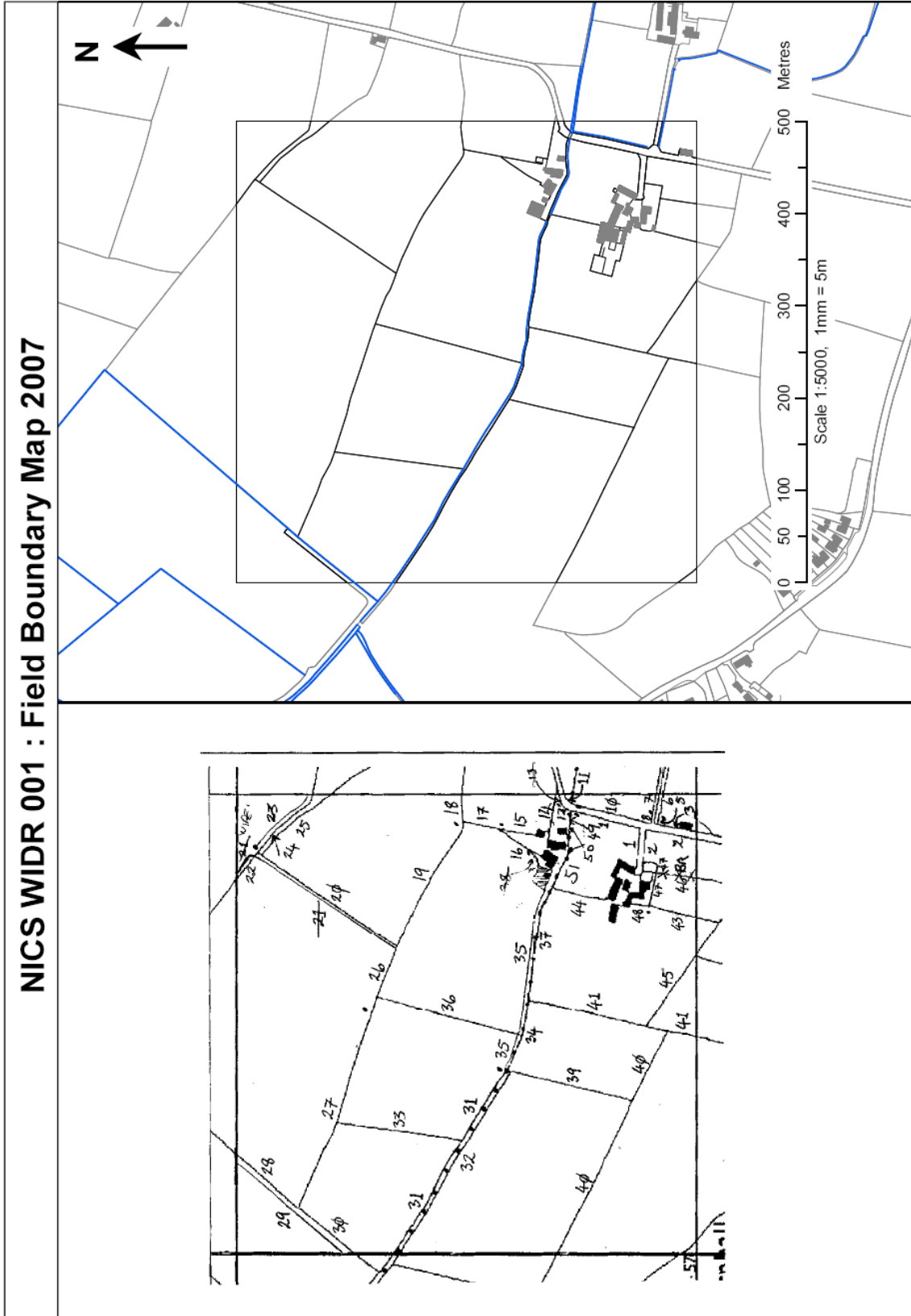


Fig. 8.3.1 WIDR 001 baseline field boundary map (1998) and OSNI 2007 line map.

NICS			WIDR 001			Field Boundary data 1998		
par	typ	gaps %	par	typ	gaps %	par	typ	gaps %
001	02	0 - 1	041	02	25 - 50			
002	02	0 - 1	042					
003	02	0 - 1	043	02	0 - 1			
004			044	02	0 - 1			
005	12	0 - 1	045	02	0 - 1			
006	02	0 - 1	046					
007	02	10 - 25	047	02	0 - 1			
008	12	0 - 1	048	02	0 - 1			
009			049	02	10 - 25			
010	02	0 - 1	050	07	0 - 1			
011	07	0 - 1	051	02	10 - 25			
012	07	0 - 1						
013								
014	02	0 - 1						
015	02	0 - 1						
016	02	25 - 50						
017	02	0 - 1						
018	02	0 - 1						
019	02	1 - 10						
020	02	0 - 1						
021								
022	02	0 - 1						
023								
024	02	25 - 50						
025	02	10 - 25						
026	02	25 - 50						
027	10	0 - 1						
028	11	0 - 1						
029	11	0 - 1						
030	09	0 - 1						
031	11	0 - 1						
032	11	0 - 1						
033	02	0 - 1						
034	02	10 - 25						
035	11	0 - 1						
036	02	0 - 1						
037	02	25 - 50						
038								
039	02	0 - 1						
040	02	0 - 1						

Types	
02. Hedge	
10. Earth bank	
04. Dry stone wall	
06. Ruined dry stone wall	
07. Mortared brick/stone wall	
09. Sheep fence	
11. Wood post & wire	
12. Other fence	

Note:	
Code	Gaps %
0.	0 - 1
1.	1 - 10
2.	10 - 25
3.	25 - 50
4.	50 - 75

Fig. 8.3.2 Baseline (1998) field boundary database showing boundary code, type and gaps value (WIDR 001).

### 8.5 Mapping field boundary change

If a new field boundary has been constructed, measure its location by pacing and draw it on the 2007 OSNI field boundary map (the surveyor mapping land cover can GPS it if pacing is impractical). The aerial photograph can also be used. Give it a unique boundary number on the map. Boundary length is calculated in the GIS laboratory. Make it clear where each separate boundary length starts and stops. Indicate field boundary removal by crossing it out on the map. Ditches are shown as lines on OS maps: do not record hedge removal in error if they are present.

### 8.6 Recording differences between baseline and re-survey maps

The reason a field boundary has been mapped with a different type or length compared with the 1998 baseline could be real change or recording error (due to mapping error or an interpretation difference between surveyors). It may not be possible to decide if there has been real change or recording error. Make decisions based on the evidence you see and the field boundary descriptors, not what you think has happened with time. If there has been categorical change write "C" on the change transition sheet.

If there is doubt, whether the difference is real or due to error, you should be conservative and record only *categorical* change. If you decide there has been a categorical baseline error, make a record on the transition matrix paper data form. Do not defer decisions on change. It will be more difficult in the car and a laboratory-based data processor will not be able to do it.

Do not compare differences in the structure, management or species codes with baseline data in terms of real change or error. This is too time-consuming. However the baseline data can give a useful context for making a decision.

### 8.7 Aerial photographic mapping protocol

The protocol for using aerial photographs to aid field boundary mapping is:

- Check if a field boundary is on the 2007 OSNI line map. If it is, then no further mapping is needed.
- If a field boundary is not on the 2007 OSNI line map, check the aerial photograph. If the field boundary can be seen on the photograph, draw a line onto the photograph and copy its location onto the 2007 OSNI line map. This allows it to be put into a GIS.
- Not all field boundaries are visible on aerial photographs (e.g., wire fences). If they are not on the 2007 OSNI line map or visible from the aerial photograph, use pacing (or a GPS line) to map them. It is best to use GPS.

### 8.8 Checks for completion

When Field boundary recording in a square is finished, read through the records, checking for omissions. Ensure that all locations and codes on maps are legible and that all field boundaries at the edge of the square have been recorded. Check that all field boundaries are accounted for and that the recording is complete. This cuts out returning to the square at a later date.

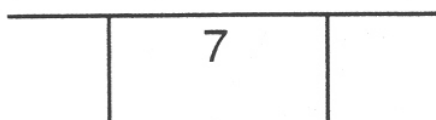
Make sure that the transition matrix is complete.

## 9. FIELD BOUNDARY MAPPING

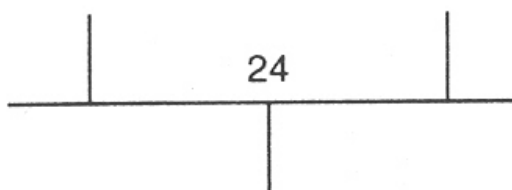
### 9.1 Instructions for labelling field boundary maps

Boundaries should be written onto the 2007 OSNI line map. Indicate field boundary length clearly. Usually the end-points are intersections with other field boundaries. Pace out these locations if necessary. If end points are not at intersections with other boundaries then use a dot to indicate where one boundary type finishes and another one starts (as in Fig. 9.2.1, boundaries 26 and 27). Landscape features such as roads, rivers and farm ownership divisions act as spines from which other field boundaries branch. Such spines can be recorded as continuous lengths of the same field boundary type if they are uniform. Ditches within land cover parcels are labelled with a "D" on the 2007 OSNI line map.

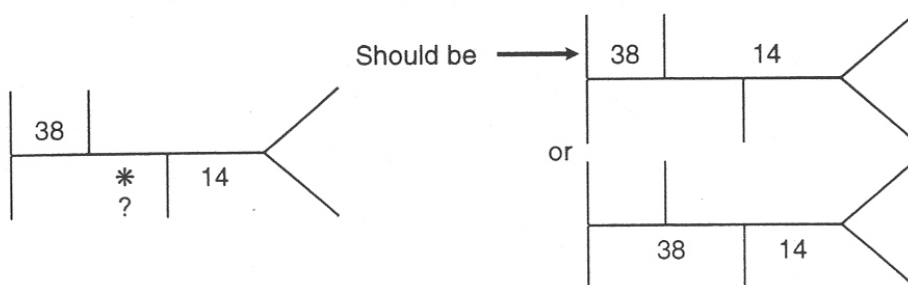
Field boundary end points used to determine the length are usually the intersections of field boundaries. The boundary parcel number should be written onto the field boundary map between the intersections.



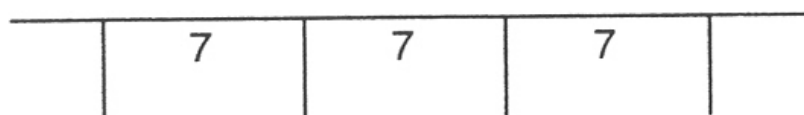
There may be intersections on both sides of a boundary therefore put the boundary number against the greatest extent of its length.



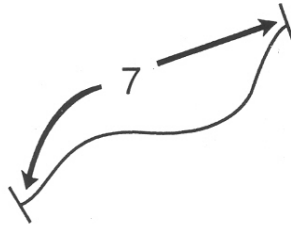
In the example below, it is unclear whether the section in the middle belongs to parcel 38 or 14.



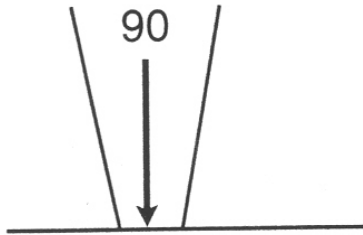
If a boundary runs along several fields (e.g. roadside) ensure that it is numbered in several places and that it is clear where the boundary end points are. In this case the boundary acts as a spine with other boundaries intersecting at intervals.



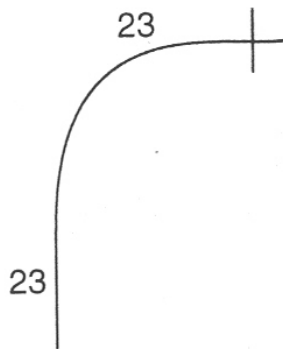
The extent of a boundary should be shown with arrows when it is sinuous or its intersection with other boundaries is not obvious. Use arrows sparingly otherwise the data sheet becomes cluttered.



It is difficult to write a parcel number beside a boundary, use an arrow to point to the location.



If a boundary changes direction sharply such as round a corner then label it twice.



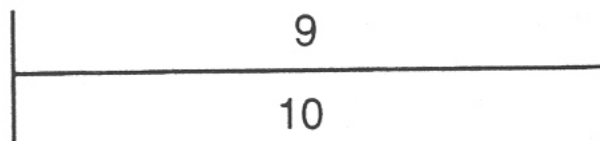
Field boundary end points sometimes do not coincide with boundary intersections. In such cases, two separate field boundary types may be identified or the field boundary may occupy only part of the length. Dots can be used to delimit end-points. For example show if a boundary goes past a house/curtilage or just up to it.



If two or more boundaries are identified between intersections, define the length of each using the boundary intersections and dots to the side of the boundary. This procedure is also useful where two boundaries meet.



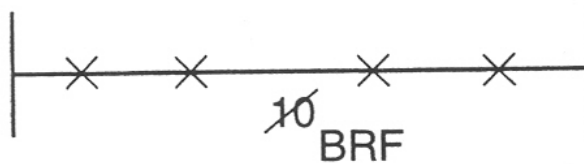
Double boundaries e.g. on either side of a stream should be labelled on each side of the boundary line. Note: do not draw double lines as 1mm = 5m at a scale of 1:5000



Mark any new field boundaries on the map, clearly defining the two end points. Removed boundaries are not recorded as parcels on the field datasheet. They are labelled with a code on the field boundary map as follows:

- BRF** - active removal for field enlargement mainly in agricultural land
- BRB** - removal due to building work
- BRW** - boundaries lost due to afforestation or occasionally woodland succession
- BWC** - boundary removal/loss through curtilage development
- BRD** - non-functional boundaries due to lack of management, trampling by farm stock, or grazing by rabbits

Any removed boundary line is crossed out. The baseline parcel number is written on the map with a line drawn through it and one of the above codes is attached.



## 9.2 Mapping boundaries - annotation example

A partly completed resurvey field boundary map is shown in Fig. 9.2.1. Changes have been written onto the scanned 1998 baseline survey boundary map (A) and onto the blank 2007 OSNI line map (B). The OSNI line map has also been marked with the boundary codes that have not changed. Because Map B will be transferred to a GIS, the mapping should be clear and detailed, therefore Map B should be fully annotated with all boundary codes.

Examples of mapping practice in Fig. 9.2.1 are:

- If a boundary is the same length as in baseline, then no edits are required on Map A but the code has to be labelled on the OSNI line map (Map B). Take, e.g., boundary 39, it has the same length as in baseline and therefore does not need a new code or changed on Map A. All that is required is for boundary to be labelled as 39 on the 2007 OSNI line map (B).
- If a new boundary is recorded, it should be drawn onto Map A and also labelled on Map B. Most new boundaries should already be on the OSNI line map – if not then draw this new boundary onto Map B. Take, e.g., boundary 52, it is a new boundary and has been drawn onto Map A and labelled 52. Note 52 is used as the code as this is the lowest available code. The boundary is also drawn and labelled onto Map B as it is not mapped. If it was mapped by OSNI it would just require labelling.
- If a boundary is found to be removed take, e.g., boundary 33, then just put “x” “x” on the boundary line in Map A, cross out the old code (33) and add an appropriate removal code. In this case BRF indicating field enlargement. If the boundary is also found on the OSNI line map also use “x” “x” to indicate it does not exist.
- If you find a single boundary in 1998 has now two distinct types, the boundary needs split. Take e.g., boundary 36 on Map A. This was a complete hedge in 1998 but now part of it has been removed and replaced by a wood post and wire fence. As a result a dot is used to split the boundary (after pacing and measuring the distance) and a new code of 53 is used as the code for the other record. This is labelled on both Map A and B.
- If you find two boundaries in 1998 are now just the one type then just use the one code. Take e.g., boundaries 26 and 27 on Map A, these were a complete hedge (26) followed by wood post & wire fence (27) in 1998 but now the hedge has been removed and replaced by just a wood post & wire fence. As this is now one uniform boundary then use only 27 as the boundary code. Cross out the 26 on Map A and replace it with 27 and on Map B just label the complete boundary as 27.
- Note Boundary 29 on top left of the square. Part of this boundary has been removed. Mark the point at which it has been removed with a dot (after pacing and measuring). Label part of it as 29 on Map A and put “x” “x” on the part of the boundary which has been removed. Finally label the boundary on Map B as 29. In this instance the 2007 OSNI line map reflects this change.



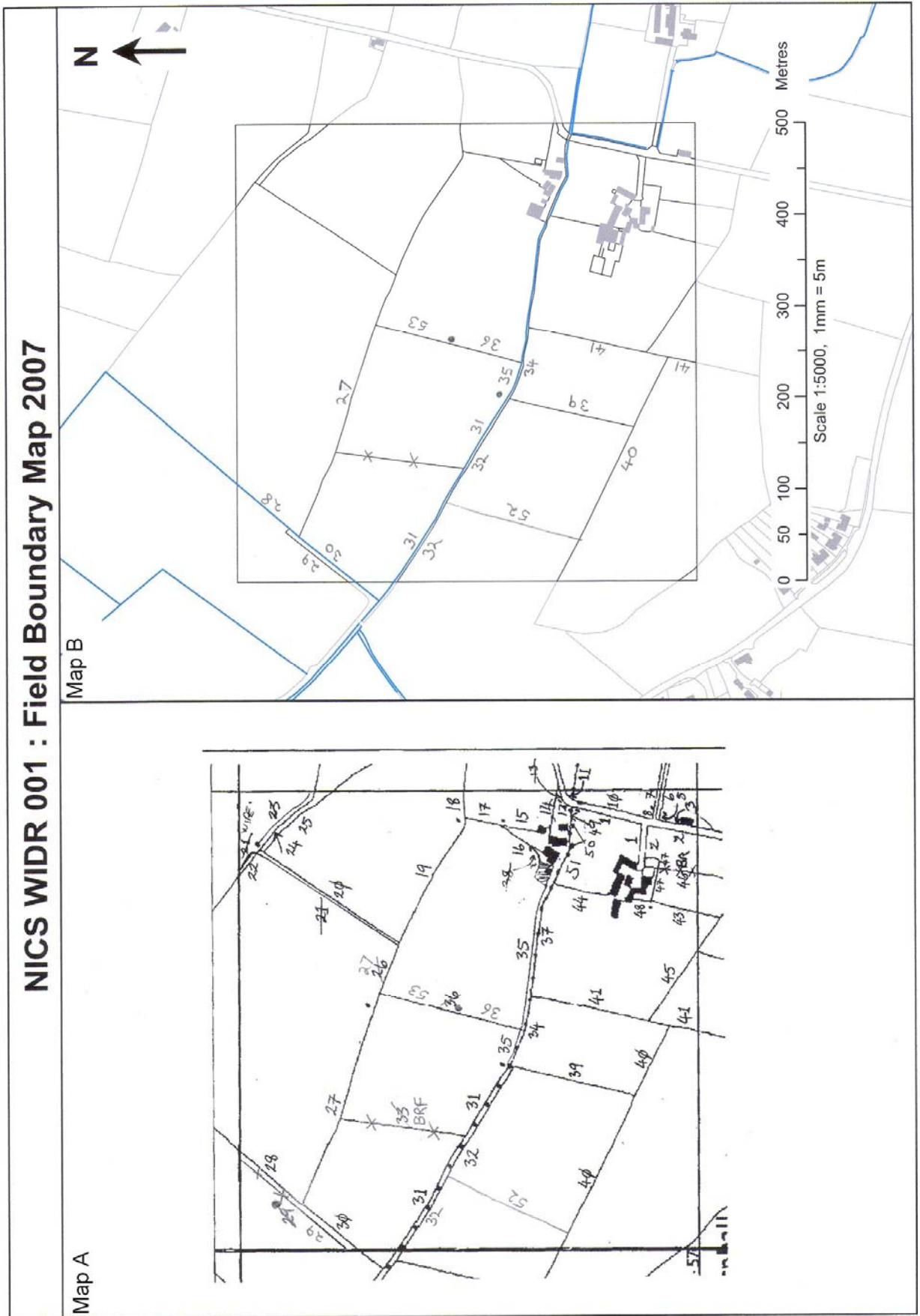


Fig. 9.2.1 Example of an annotated NICS field boundary map (WIDR 001)

### 9.3 Field boundary transition (change) matrix

A record of change to the field boundary map must be made on a paper transition matrix form. All boundary changes are recorded in the transition matrix. The changes are changes to the type of field boundary and spatial changes in location, length, loss or creation. This is different from the changes recorded for land cover, which are only spatial changes. The reason is that field boundary digital capture on GIS is not yet finished.

Fig. 9.3.1 illustrates a completed field boundary map (FERM 124) and Fig. 9.3.2 shows the corresponding transition matrix (partially complete). Should an error be evident (mapping error or a categorical error in recording field boundary type in 1998, an "E" recorded. If a categorical change has occurred then a "C" should be recorded, followed by a process code. Process codes are used to describe the change that has occurred. They are described below and are listed on the paper field boundary transition recording form. The recording form also has a column for recording a note on change or error that will help with digitising (GIS) or ecological interpretation.

If a boundary has changed type, enter the baseline boundary code and 1998 type followed by the resurvey boundary code and type.

If a boundary is removed, enter the baseline boundary code and type followed by a process code and leave the resurvey columns blank.

If a new boundary has been created, leave the baseline columns blank and just enter the resurvey boundary code and type followed by a process code.

#### 9.3.1 Field Boundary Transition Matrix Descriptors

##### Transitions (Change and Error)

Records where there is categorical change or error in baseline recording.

Code:

**C - Change:** a categorical transition from one field boundary primary type to some other, eg., replacement of a hedge with a wire fence, or a hedge, trampled by stock that has lost its shrubs but retained some trees and has change to an earth bank with trees.

**E - Error:** a categorical error at baseline, eg., a baseline location error or a baseline omission.

##### Description of the change process

Up to three codes (1,2,3) can be used in combination to describe change in a boundary.

##### Type transition

A field boundary has changed from one primary type to another, from one parcel to another or a new boundary has been created.

Code:

**FEN:** fencing has been erected.

**HEP:** hedge planting has taken place to form a hedge.

**CHS:** the shrub cover has increased (colonised hedge species) to form a hedge.

**COP:** tree growth forms cut below one metre (coppiced), often with some larger trees remaining to form a hedge.

**SGT:** the size/dbh of shrubs has increased (shrubs grown out), now approaching tree size so that a hedge is no longer recorded.

**LHE:** loss of hedge shrub cover (eg., usually by physical removal) so that a hedge is no longer recorded.

**WAL:** wall built either new or rebuilding of a Ruined dry stone wall.

**MOR:** mortaring of a dry stone wall usually by capping, ie., type changed to a capped dry stone wall.

**BNK:** earth bank constructed.

**WEO:** wall earthed over to form a bank (uncommon).

**DER:** a boundary change due to dereliction of one of the associated types (eg. >50% of a dry stone wall structure missing or gappy).

**GRZ:** a boundary change due to stock effected dereliction of one of the associated types (eg. hedge grazing/trampling leading to increased gappiness).

**BX\_**: a boundary which existed in eg. curtilage etc. is now active due to curtilage etc. removal

### **Removal or loss**

The field boundary is no longer present or should no longer be recorded.

*Code:*

**BRF**: boundary removal through field enlargement

**BRW**: boundary removal through woodland development. The boundary has become an integral internal component of a wood

**BRB**: boundary removal through building work

**BWC**: boundary now within curtilage due to development and now no longer recorded.

**BRD**: boundary removal through dereliction so that no field boundary type can now be recorded.

### **Non-type transitions**

A field boundary has joined with or split from another or has been relabelled.

*Code:*

**JWA**: joined with another adjacent boundary of the same type, eg. due to similar management.

**SFA**: split from an adjacent boundary of the same type, eg. due to dissimilar management.

**R**: a re-labelled boundary.

**CWP**: combined with a parallel boundary eg. due to error in baseline recording.

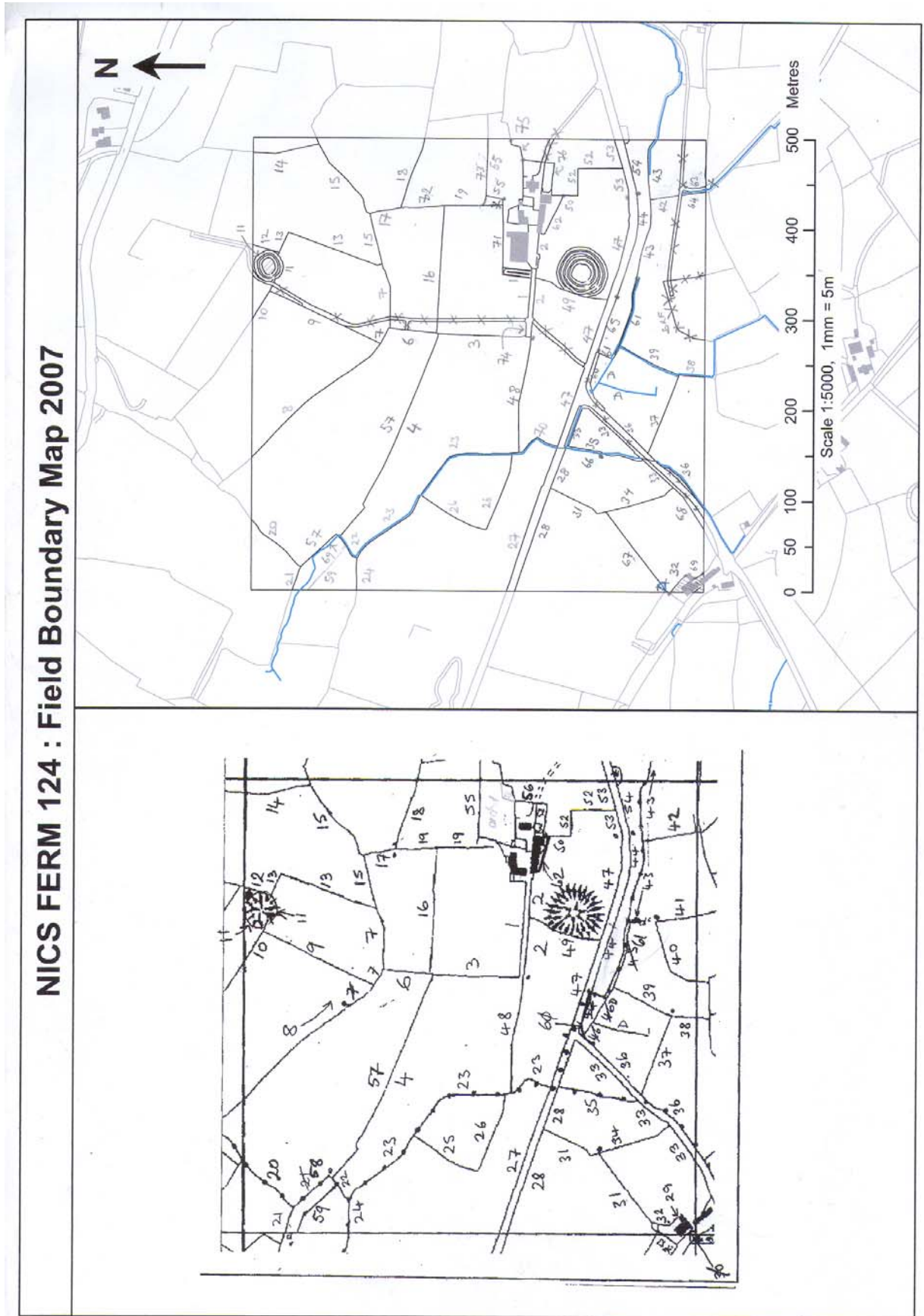


Fig. 9.3.1. A completed field boundary map (FERM 124)

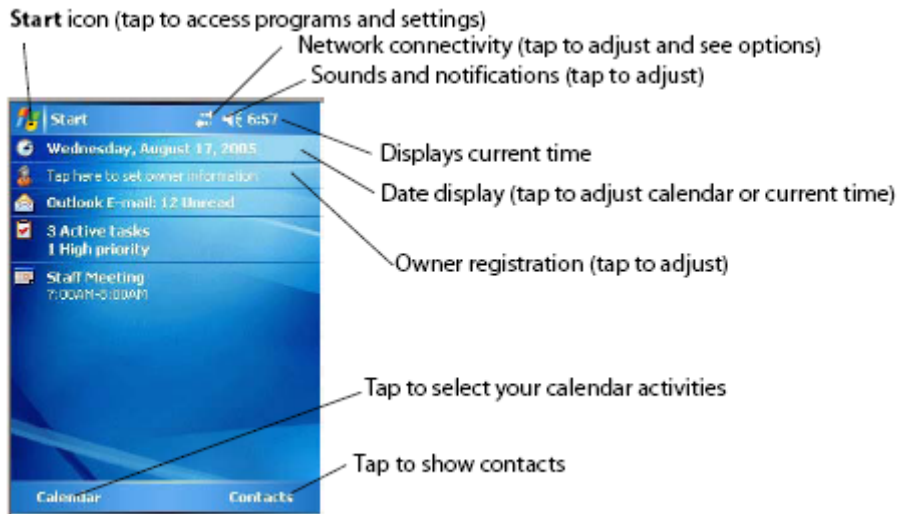
Field Boundary Transitions Data Recording Sheet NICS2007										Sample ID:	FERM	124	Page	1	
Record No	Baseline 1998			Resurvey 2007			Transition Codes			Transition Notes			Code Descriptors		
	Par	Typ	Len	Par	Typ	Len	C/E	1	2	3	Notes:			Change/Error (C/E)	
1	3	02	96	3	10	96	C	LHE	GRZ					C.	- change
2	21	10	35	21	02	35	C	CHS	FEN		ESA fencing			E.	- error
3	25	02	79	26	02	79	C	GRZ	JWA		residential change				
4	29	02	18	32	09	18	C	FEN							
5	32	10	19	32	09	19	C	FEN							
6	40	02	90			90	C	BRF			agriculture - reclamation			<b>Type transitions:</b> ie. boundary recorded.	
7	41	02	46			46	C	BRF						FEN	- fencing
8	42	02	63	42	10	63	C	LHE	GRZ					HEP	- hedge planting
9	58	11	53	57	11	53	C	FEN	JWA					CHS	- colonising shrubs
10			79	59	11	79	C	FEN			ESA fencing missed at baseline			COP	- coppicing etc.
11			26	63	10	26	E							SGT	- shrubs grown out
12														LHE	- removal of shrubs
13														WAL	- wall building
14														MOR	- mortaring
15														BNK	- bank formation
16														WEO	- wall earthed over
17														DER	- due to dereliction
18														GRZ	- der. by stock graz.
19															
20															
21														<b>Removal/loss:</b>	
22											ie. no longer recorded.				
23														BRF	- field enlargement
24														BRW	- within woodland
25														BRB	- building work
26														BWC	- within curtilage
27														BRD	- dereliction
28															
29															
30														<b>Non-type transitions:</b>	
31											ie. boundary recorded.				
32														JWA	- joined with adjacent
33														SFA	- split from adjacent
34														R.	- relabel
35														CWP	- comb. with parallel

Fig. 9.3.2 A completed field boundary transition matrix (FERM 124)

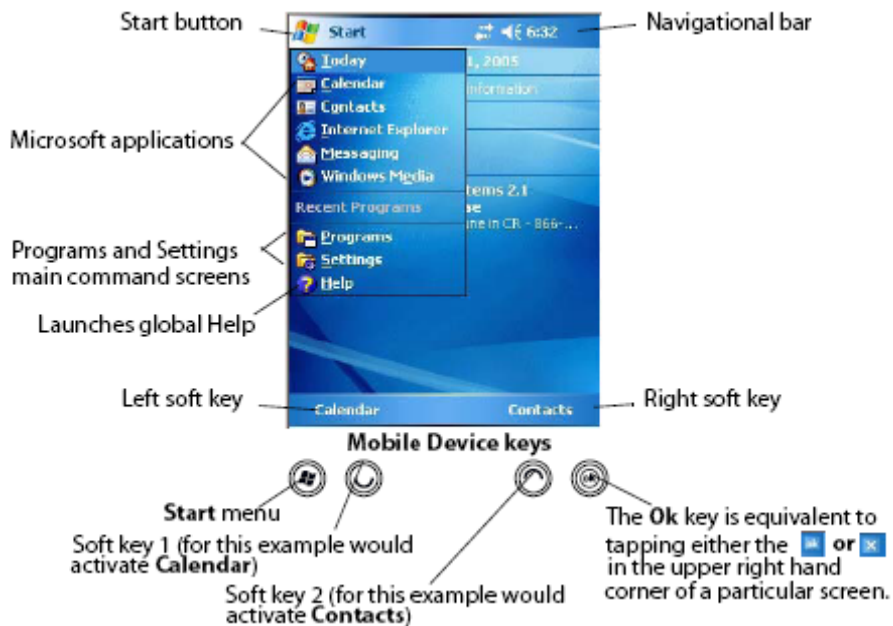
## 10. PDA - WINDOWS MOBILE 5.0 USER GUIDE

### 10.1 Introduction

Turning on your PDA the first time brings up the **Today** screen. Tap the **Start** icon to access programs and settings. Usually it is the TerraSync program for recording field data.



To open a program shown on your **Today** screen, tap the button. You can switch from one program to another by selecting it from the **Start** menu.



The buttons below the display activate the on-screen soft keys. Soft keys are the default set by individual applications. The key on the left side corresponds to the left option and the key on the right corresponds to the right option in any particular screen. These keys assist in operating the device without using a stylus.

### 10.2 Using the Stylus

The touch screen on your PDA works like a mouse on a PC. Use the stylus to navigate and select objects on the screen.

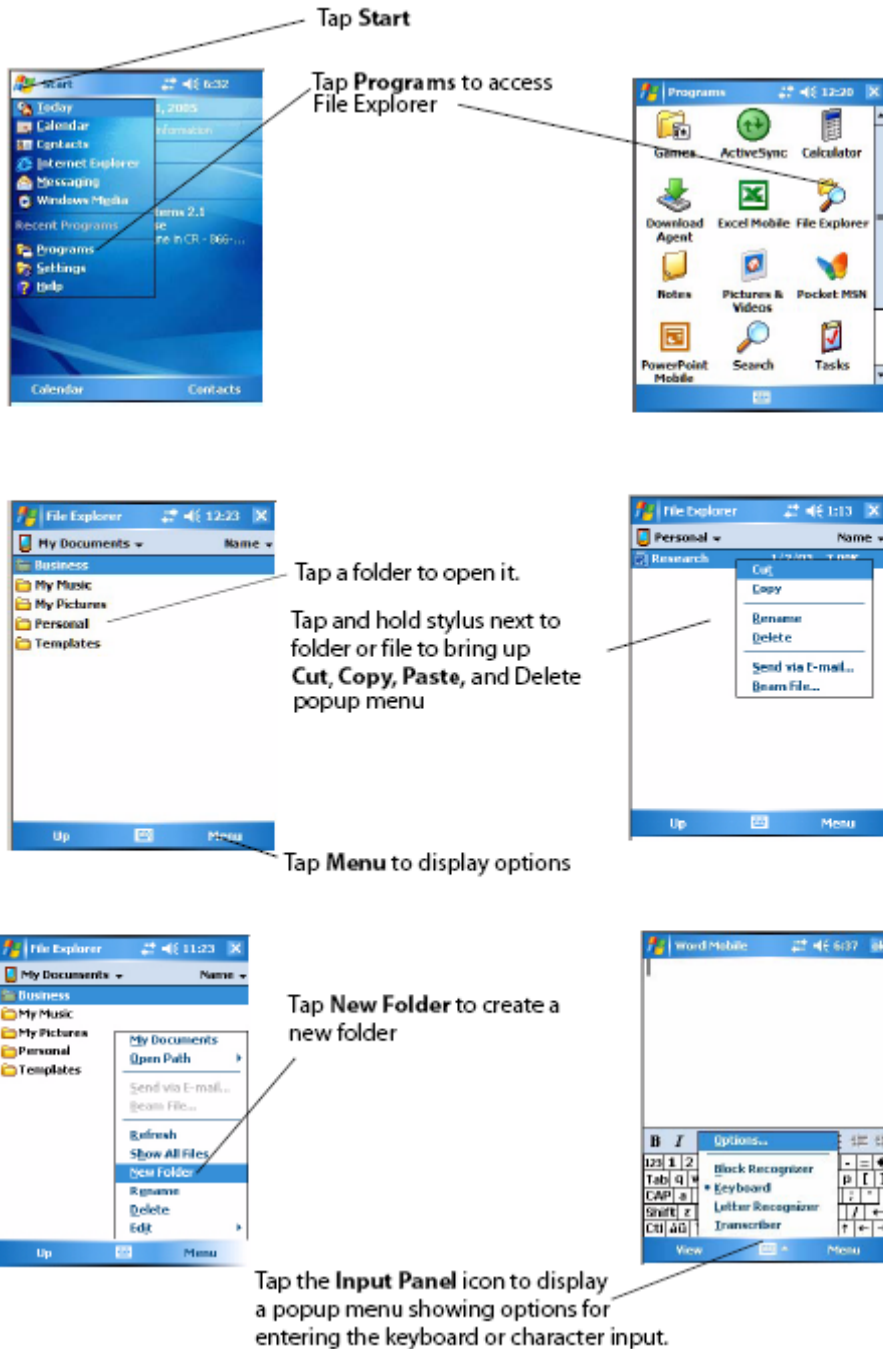
**Tap:** Tap the screen with the stylus to select or open an item. Tapping is equivalent to clicking an item with the mouse on a PC.

**Touch and hold:** When you touch and hold, a circle of red dots appears around the stylus to indicate that a pop-up menu will soon appear. Touching and holding is equivalent to right-clicking your PC mouse button.

**Drag:** Hold the stylus on the screen and drag across the screen to select text and images. Drag in a list to select multiple items.

### 10.3 Finding and Organizing Information

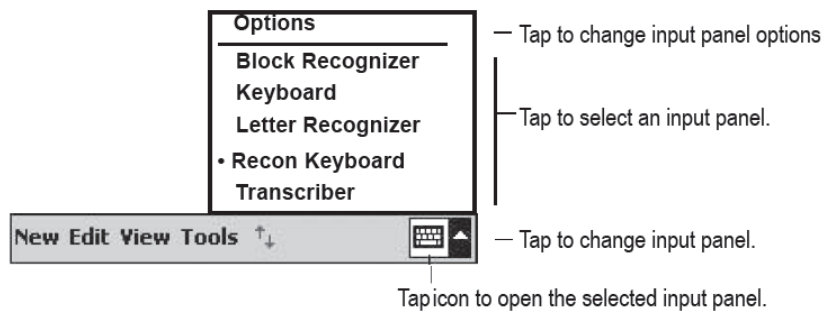
You can use the File Explorer to find files on your mobile device and to organize the files into folders. The files will usually be files holding land cover or field boundary data you record in the field. Tap **Start > Programs > File Explorer**. You can move files in File Explorer by tapping and holding the file you want to move, and then tapping **Cut** or **Copy** and **Paste** on the pop-up menu.




### 10.4 Entering text

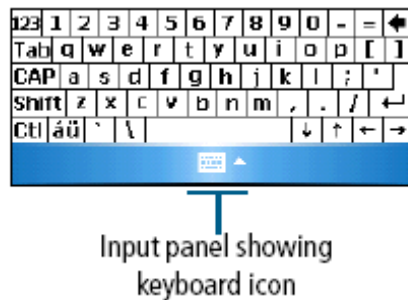
The handheld does not have a physical keyboard. To enter text, use the on-screen keyboard. This is normally how you would enter field data. Alternatively, you can write directly onto the screen. You can select how you want to enter text using the Input Panel. The Input Panel automatically appears in the menu bar of any application. The default selection is the on-screen keyboard. To change the text input method (first open an application e.g. tap **Start** > **Programs** > **Notes**)

- In the menu bar (blue bar at bottom of screen), tap the arrow on the **Input Panel** button. (You may have to activate and then hide the keyboard for the arrow to appear.) A list of input methods pops up. The currently selected method is indicated by a check mark.
- Tap the method you want to use to select it. You can write using Onscreen Keyboard, Block Recognizer, Letter Recognizer, or Transcriber. The characters appear as typed text on the screen. Select the input panel that is easiest for you to use. The on-screen keyboard is probably the easiest input panel to use. Recognizer and transcriber modes can take a little time to get used to depending on your hand writing style.







### 10.5 Using the on-screen keyboard

Tap **Start** > **Programs** > **Notes** (bottom left soft key) > **New** to open Notepad. To activate the on-screen keyboard, tap the keyboard icon  on the Input Panel displayed in the menu bar. The on-screen keyboard appears. To enter text, tap the appropriate keys on the on-screen keyboard. When you have finished entering text change the input panel and test which is most suitable for you. The on-screen keyboard is probably the easiest option.



Note: A tap on the “Shift key allows you to use the % key.

### 10.6 Accessing help

To access help, tap  / *Help* or, if available, tap  in the application window. If there is an application running, context-sensitive help for the current screen appears. To view the main Help Contents page, tap the *Contents* soft key in the menu bar. Help files installed on the handheld work in the same way as a Web page. Tap hyperlinks to navigate around the help and use   to retrace your steps.

### 10.7 Caution

Windows Mobile Version 5.0 software does not include a Recycle Bin. If you delete files from the flash disk, they are deleted permanently therefore if in doubt, don't delete.



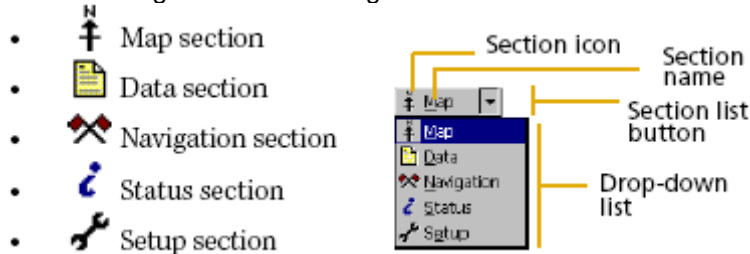
## 11. PDA - TERRASYNC SOFTWARE USER GUIDE

### 11.1 About TerraSync Software

The TerraSync software is designed for recording (collecting) data, GPS map lines and for navigation.

### 11.2 Introduction






Open TerraSync by tapping **Start** and then tapping **Terrasync** from the popup menu. The TerraSync software is arranged in the following five sections:



One of these sections is always active and visible. The Section list button shows the section that is currently active. You can move between sections at any time (e.g. to look at a map, record data or to navigate) without closing any open data forms you are recording on. To switch to a different section, tap the Section list button and then select the section you want from the drop-down list. For example, to switch from the Map section to the Data section, tap the **Section list** button and then select **Data**. The button now shows **Data**, and the Data section is active. When you return to the Map section, the screen or form that was open when you left the Map section appears again.

#### 11.2.1 Sections

The TerraSync software sections are used as follows:

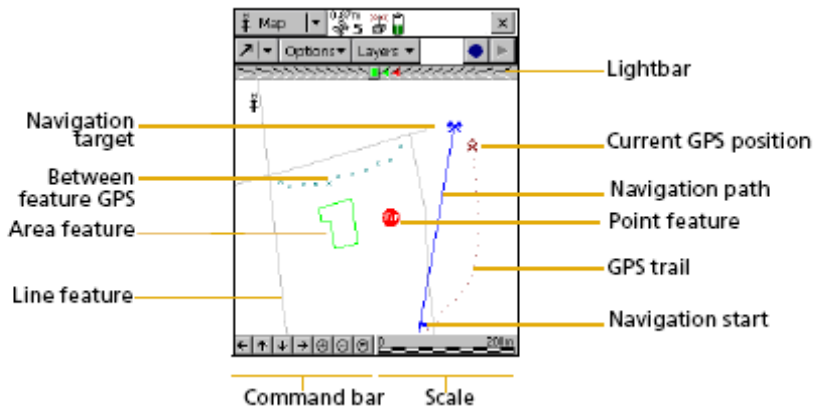
-  **Map section** – shows you a 2007 OSNI vector line map of survey square. It can be displayed in the background for reference. The map section is used as a navigational aid to locate the survey square or if you get lost in a square.
-  **Data section** – you record/collect field data onto forms here and record/collect GPS positions
-  **Navigation section** – to navigate to specific locations, you use real-time differential GPS.
-  **Setup section** – systems will already be setup for NICS 2007 prior to you starting work. However it is necessary to explain some of the setup options in the event that any of the systems need to be reset at any stage.
-  **Status section** – used to view summary or detailed information about the software, the GPS receiver and the location and health of the satellites the receiver is tracking. This section is really only relevant for taking GPS lines - the status section gives an indication of how accurate the GPS is at a particular moment in time.

A summary quick-start user guide to PDA – TerraSync is also given in Appendix 3.

### 11.3 Map Section

#### 11.3.1 Elements and controls in the Map section

To open the Map section, tap the **Section list** button and then select **Map**.

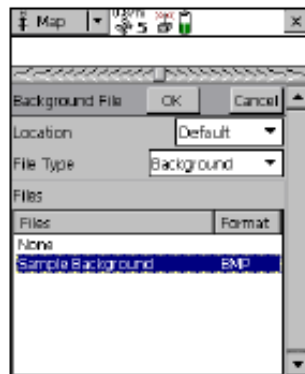


#### 11.3.2 Map layers

There is an OSNI 2007 vector line map, or map layer file (known as a background file) available to you of which you also have a paper copy. The map layers needed for the sample grid squares you will be recording each week will be preloaded onto your handheld each week. The OSNI line map files are named according to their area of ecological study (AOES) and square number e.g. ANTR\_002\_MAP (i.e. Antrim sample square 002).

To open a *Background File*, in the Map section tap **Layers** and then select **Background file**. For file type, select **Background** from the drop down menu and a list of the available backgrounds are shown. From this list **highlight** the 2007 OSNI vector line map (e.g. **ANTR\_002\_MAP**) of your study area and click **OK**. This map should now be displayed. It is now possible to zoom, pan and measure anything on the map using the map tools (as described in section 11.3.3). Lines captured by GPS are also displayed in the background and these will appear as red lines once captured.

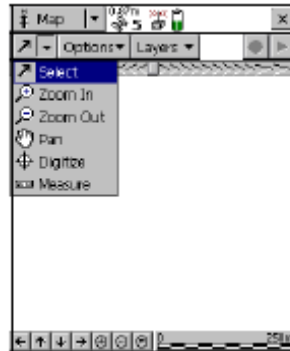
Any data file in the TerraSync software can be selected as the background file, provided it is not already open in the Data section i.e. provided you are not using it as a recording form. When you open a data file in the background, its features are visible but cannot be selected, edited, or deleted. Do not edit any background layer files. They should be used for navigational purposes only.



If the GPS is switched on (Section 11.8 explains how to connect to the GPS), a cross hair will appear indicating your position (this is useful when navigating to the square. If you tap **Layers** > **GPS Trail**, this will create a trail of your recent movements within the square. The GPS has to be connected to allow a cross hair or trail to be viewed. Note: a GPS trail can only be viewed using the GeoXM handheld (used for land cover recording) as no GPS is available on the Recon handheld (used only for boundary recording).

### 11.3.3 Map tools

The Map section has six map tools (available in the drop down menu just below **Map**). Only one map tool is active at a time. To change to a different map tool, tap the Map Tools button and from the drop-down list select the tool you want to use. The tools allow you to select, zoom in, zoom out, pan, digitise and measure.

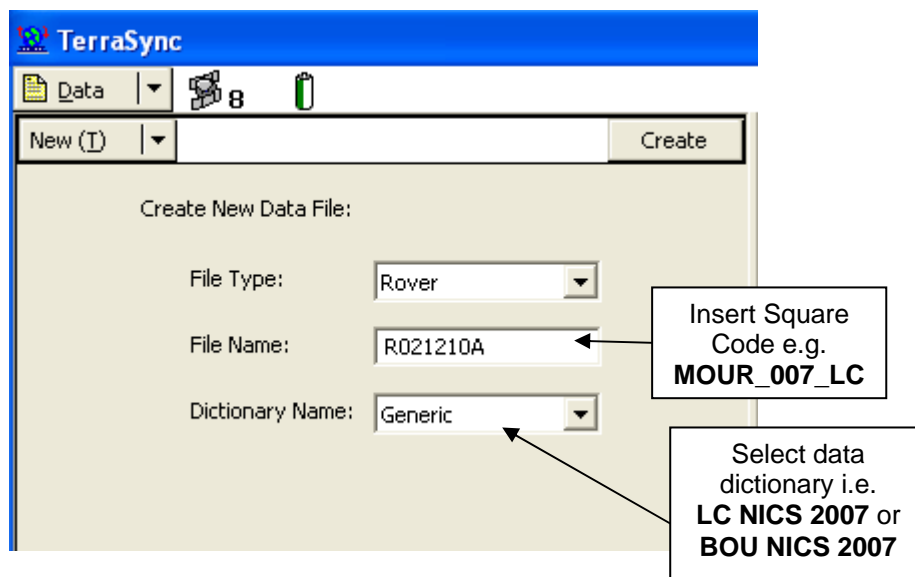


## 11.4 Data Section

### 11.4.1 Recording NICS data

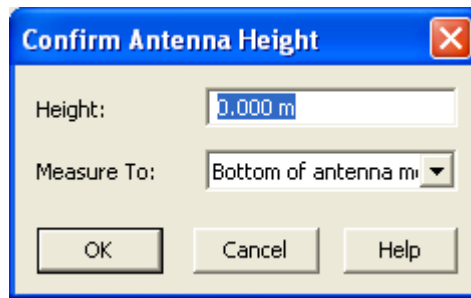
The Data section is used to record the land cover parcel and field boundary information or GPS line data. You will be provided with a primary data dictionary containing the field data forms onto which you record. There is one primary data dictionary for land cover recording (called **LC NICS 2007**) and one for field boundary recording (called **BOU NICS 2007**).

In the Data section, select **New**. Select **Rover** as file Type, and type the unique square code as the file name e.g. **MOUR\_007\_LC** or **MOUR\_007\_BOU** depending on whether recording land cover or field boundaries. Select the NICS dictionary (**LC NICS 2007** if recording land cover or **BOU NICS 2007** if recording boundary attributes) under Dictionary Name. Then click **Create**, this sets up the form structure that allows you to record field data.

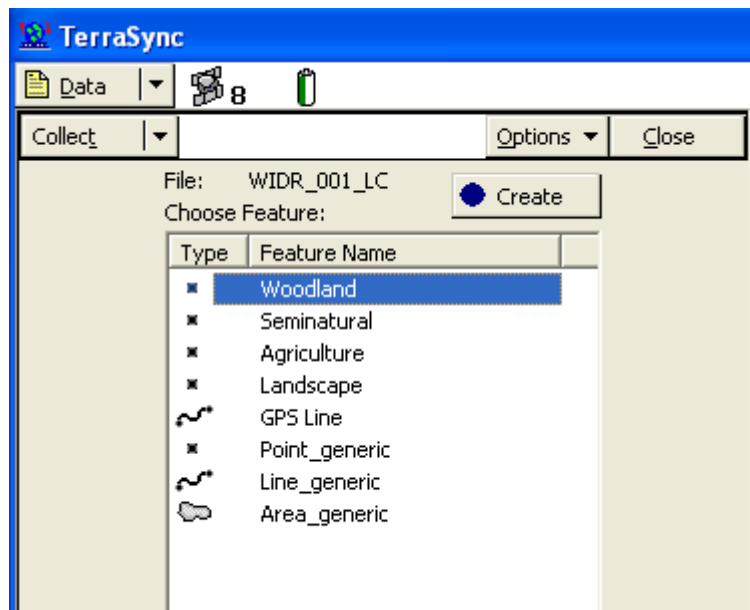


The Navigation tool is generally only useful in navigating to isolated upland squares and hence it will probably not be required extensively throughout this survey. Most squares are accessible by road.

A message asking to confirm antenna height appears. This is mainly to ensure accurate measurement of altitude. In our case this is irrelevant, hence just select **OK**.



If you have selected **LC NICS 2007** (i.e. land cover recording) as the data dictionary and hit **create**, you will be confronted with the screen below.



The four main habitat groups (woodland, seminatural vegetation, agricultural grassland/crops and landscape features) are shown. **GPS Line** is the only feature that can be logged using GPS (Section 11.8). Ignore **Point\_generic**, **Line\_generic** and **Area\_generic**. These are created by default and are not to be used to record data.

If your first parcel is a woodland parcel, either double click **Woodland** under the **Feature name list** or highlight **Woodland** (one click) and then click **Create**. This brings up the woodland recording form as shown overleaf. When creating a new data entry form, **Collect** is selected in the top left corner. If you wanted to edit an existing record, you would change this to **Update**.

The woodland form (as with the seminatural, agricultural and landscape forms) is structured using text-boxes and drop-down menus. The drop-down menus contain the options available to you to choose. Some drop down menus, in particular the species lists, are quite long. It is possible to use speed scroll down these long drop-down menus using the scroll bar at the side to speed up the process. Alternatively if you tap on a drop-down menu and then tap a letter (e.g. L) on your on-screen keyboard, the drop-down menu will automatically display those species with a three letter code beginning with L.

Survey date is generated automatically. A parcel code in the form of two digits is used to identify the parcel e.g. 01 (Note it is important to record parcel code as 01 as opposed to 1). In the instance illustrated below, this record will correspond to parcel W1 on the 2007 OSNI

line map. Parcel code has to be entered first otherwise the software will not allow you to continue. (Remember, text is entered using the input panel located on the bottom menu bar).

The screenshot shows the TerraSync data entry form. The title bar is blue with the TerraSync logo and name. Below the title bar is a menu bar with 'Data' and a mobile phone icon. The main form area has a 'Collect' dropdown menu, 'Options', and 'Log' buttons. The form is titled '1 Woodland' and has 'OK' and 'Cancel' buttons. The fields are as follows:

- Surv\_Date: 04/05/2007
- Par\_Code: 01
- Habitat:
  - Hab\_Type: Broadleaf
  - Hab\_Str: Est. Woodland
  - Hab\_NP: Seminalural
- Ground Flora:
  - GF\_Type: Mesotrophic - h
  - GFSp1: Anemone nemorosa
  - GF\_Sp1\_Cov: 10 - 25 %
  - GFSp2: < 1%
  - GF\_Sp2\_Cov: 5 - 10 % (selected in dropdown)
  - GFSp3: 25 - 50 %
  - GF\_Sp3\_Cov: 50 - 75 %

If the drop down species list does not contain the species you want, select “NEW SPECIES” in the drop down menu (this is found at the bottom of all the species lists). With “NEW SPECIES” selected in the drop down menu, (as shown below), you specify what the species is in the text box labelled *New\_Sp* at the bottom of the form. Type in the species number, for example if it refers to Ground Flora Species 2 then type GFSp2 followed by what the additional species is. If there is more than one new species and you need more, use the Query box. The majority of the species you will encounter will appear in the drop down species list. Any new species recorded by field surveyors will be added to an updated data dictionary as the field work progresses.

This screenshot shows the same TerraSync form as above, but with 'NEW SPECIES' selected in the GFSp2 dropdown menu. The GF\_Sp2\_Cov dropdown is also open, showing a list of species: Vicia sepium, Viola palustris, Viola riviniana, Zea mays, NEW SPECIES (highlighted), and UNKNOWN. The GF\_Sp3\_Cov dropdown is also open, showing UNKNOWN. The Trees\_Shrubs field is set to <1.3m.

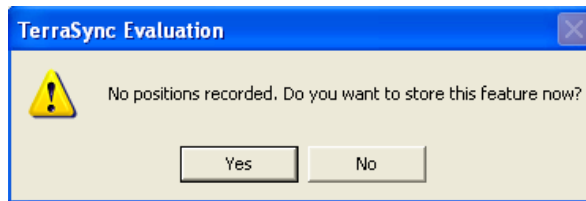
This is a close-up of the bottom right section of the form. It shows the 'Int\_Fea3' dropdown menu, the 'Mosaic\_Cov' text box, the 'New\_Sp' text box containing 'GFSp2 - Silene Dioica', and the 'Query' text box.

If you are unable to identify a species, bag the species and bring it back to the lab for identification. All species lists contain an "UNKNOWN" option at the bottom of this list. Make sure you select this if the species is unknown and then make a written note of the square number and parcel number of this species. Likewise label the bagged species with square and parcel number.

If a parcel is part of a mosaic there is a text box to record the percentage of each parcel type which makes up that mosaic. Remember a mosaic will have a separate record for each land cover type in it. For example a mosaic parcel containing 25% S2 (species rich wet grassland) and 75% W3 (dense scrub) - in the mosaic text box (*Mosaic\_Cov*), type S2-25%, W3-75%. Do this in both the S2 record and the W3 record. There is also a text box for you to write a query concerning any parcel, however it only allows 100 letters so the query has to be quite brief.

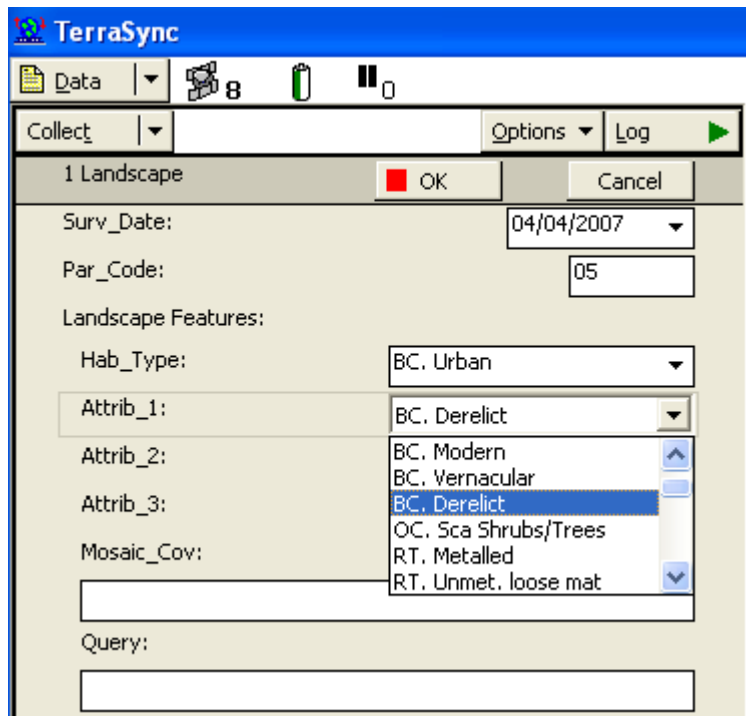
When finished, double check to make sure the data form is complete. Leave blank any boxes which are not applicable. However make sure that all applicable boxes are filled. Note that when you put data into a box, you automatically jump to the next field thus facilitating recording. It is easy to record a species you did not mean to record when using the species dictionary. Check that you do not record the wrong species.

When the form is complete click **OK**, (the red button at the top of the form), this stores this record and returns you to the list of feature names again, ready for another record to be entered. You are likely to be confronted with the following message. It just refers to the GPS. No GPS points need to be recorded for individual parcels, hence just tap **Yes** to store the feature attributes.



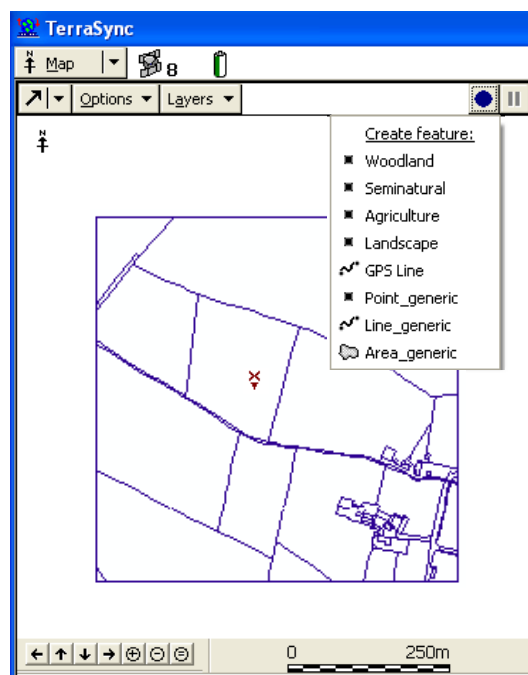
Consider for example, you now progress to an agricultural parcel, you would either double click **Agriculture** under the **Feature name list** or highlight **Agriculture** (one click) and then click **Create**. Again make sure **Collect** is selected in the top left corner. This creates and brings up the agricultural form which is completed in the same way as the woodland form. Note that instead of using W as the prefix for the parcel code, now A is used as the prefix to represent this agricultural parcel. If it was a seminatural parcel, S is used and if landscape feature, then L is used. Again, when form is complete, tap **OK** to save it and return to feature name list.

Landscape forms require a certain degree of understanding in order to complete successfully. Each landscape type has its own set of attributes associated with it. There are six main type categories Buildings/Curtilage (BC), Other Curtilage (OC), Roads and Tracks (RT), Landfill/Dumping (LF) Rock/Other Surfaces (RO) and Water Bodies (WB). Within the electronic landscape forms, each of the types within these six categories is preceded by a code such as BC, OC, RT, LF, RO and WB. Likewise in the drop-down menu for the attributes of a landscape type is a list of attributes which are also preceded by BC, OC, RT, LF, RO and WB depending on which landscape type they relate to. It is important you pick attributes with the same prefix code as the landscape type. Therefore if you choose a landscape type beginning with BC, then you must only choose an attribute beginning with BC (as shown overleaf). Alternatively if you choose a landscape type beginning with RT, then you must only choose an attribute beginning with RT.



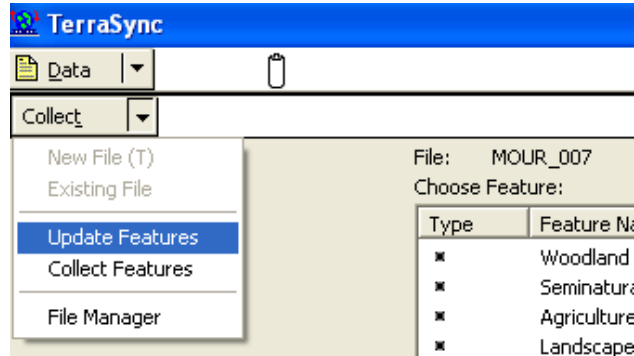
Boundaries are recorded in a similar manner to that described, but using **BOU NICS 2007** as the data dictionary. Similar procedures are applied in terms of recording, however for parcel code, just enter a 3 digit code e.g. 001 as opposed to a letter as a prefix for parcel code.

It is also possible to access new forms from the map section. For example, if you are in a complex landscape and need the GPS to orientate yourself and to make sure you are in the correct parcel simply click the blue circle (the create button) at the top right of the screen and you can select which new form you want to create (as illustrated below). This will bring up a new blank form ready to input data, however a data file must be created and open e.g., MOUR\_007\_LC to allow this option. If you GPS new lines they will appear as red lines on the map below.

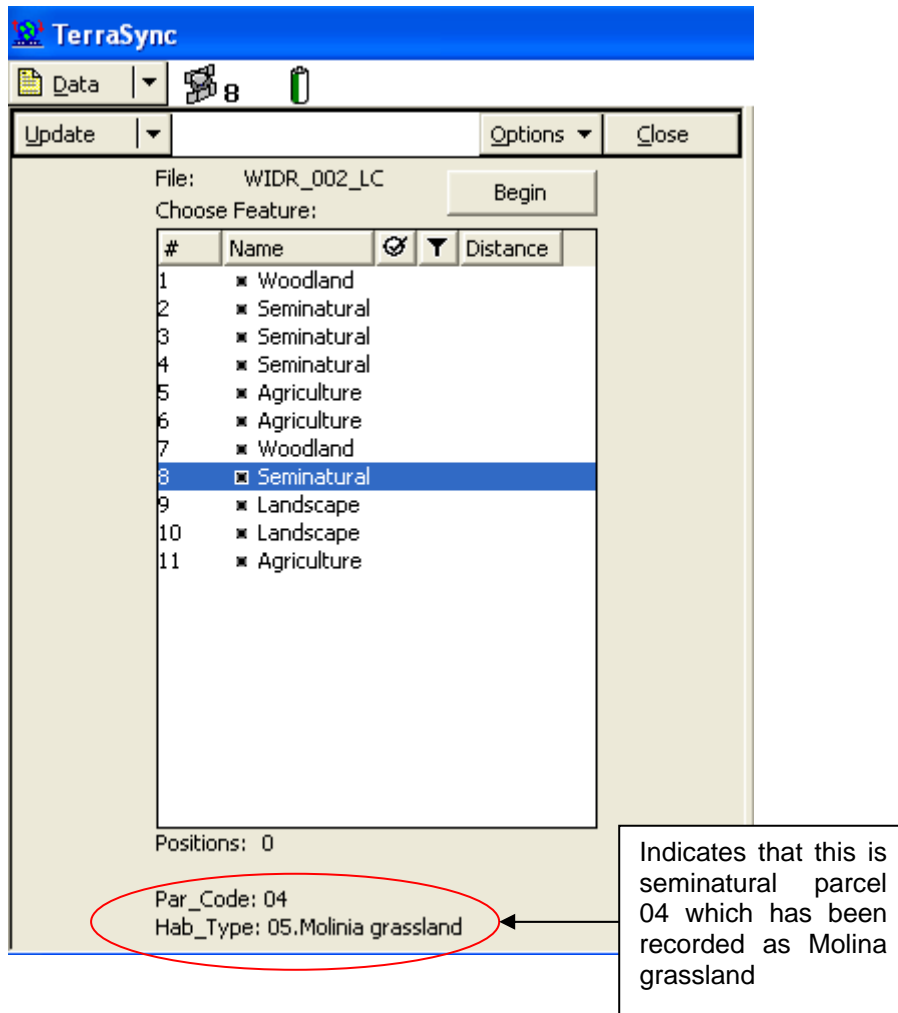


### 11.4.2 Updating existing records

If you want to view or edit a previously recorded parcel, you need to return to the features name list. To do this change **Collect** to **Update Features** in top left hand corner.



This brings up a list of the recorded parcels in the order in which they were created.



Parcels are listed in the order in which they were created and if you highlight a record in the list, the parcel code and habitat type are detailed at the bottom (as shown above). To open a record, just highlight it on the list and hit **Begin** and the form will appear to which you can make edits again. Click **OK** to save your edits and return to list. If you want to collect a new record again, just change **Update** to **Collect** in the top left hand corner of the screen.




### 11.4.3 Ending the data collection session

When the data collection session is complete, close the data file and exit the TerraSync software.

To close the open data file:

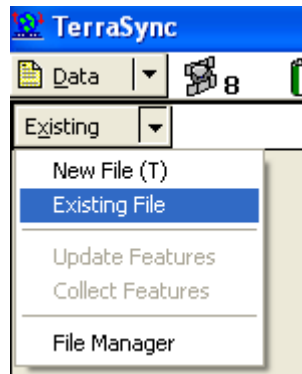
- Tap **Close** in the *Collect Features* screen. A message appears, asking you to confirm that you want to close the open file.
- Tap **Yes** to close the current data file and return to the *New File* screen.

To exit the Terrasync software:

- Tap the Close button  in the upper right corner of the screen. A message appears, asking you to confirm that you want to exit the TerraSync software.
- Tap **Yes** to exit the TerraSync software.

### 11.4.4 Open an existing grid square file

If you have to return to a survey square and finish it the following morning or you close your survey form it can be easily reopened. Restart TerraSync by tapping **Start** and then tapping **Terrasync** from the popup menu. Select **Data** and then select **Existing File** from the drop down menu. Note existing file will not be available if you already have a data entry form open – once you close any open form (tap **Close** button), only then will **Existing file** become available.




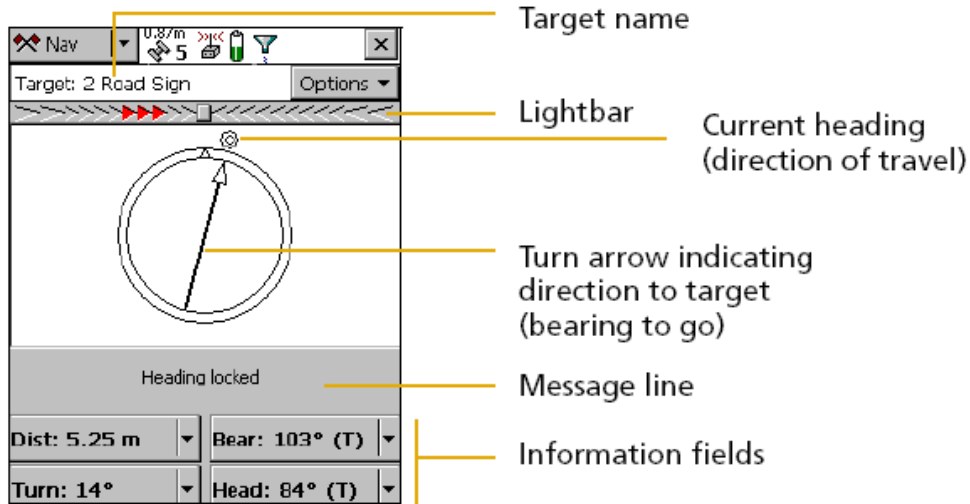
A screen showing a list of the survey forms for each individual square (which should be named e.g. MOUR\_007\_LC or ANTR\_002\_BOU) is shown. Highlight the one you want and then click **Open**. Again when asked to confirm antenna height, just click **OK**. This brings up a list of the previously recorded parcels for that particular square (same screen shown on previous page).

To collect new features for that square, continue in the manner described in section 11.4.1 making sure **Collect** is selected in top left corner. To edit any existing records continue in the same manner described in section 11.4.2 making sure **Update** is selected in top left corner.

## 11.5 Navigation Section

### 11.5.1 Using Navigation tool to locate a survey square

With the GPS activated, the navigation tool may prove useful in locating unenclosed upland squares where there are no field boundaries and it is difficult to orientate yourself. Firstly a target must be set in the **Map section**. With the OSNI 2007 vector line map displayed as in section 11.4.2, and the **select arrow** activated (arrow just below map), click once on the location within the survey square where you want to navigate to. The northing and easting will appear onscreen and then click **Options > Set Nav Target > Map Point**. The target icon  will appear indicating your navigation target. Now that the target has been set, tap the **section list** and select **Navigation**. Use the information displayed on the direction dial screen to navigate to the target location.



This screen displays all the information that you need to navigate to the target. The information fields at the bottom of the screen displays different types of navigational information. To navigate to the selected target, start moving. This enables the TerraSync software to calculate your initial heading. When the direction dial shows the turn arrow, keep moving and turning until the arrow points to the top of the screen. The top of the screen indicates your current heading. Then move towards the target, adjusting your direction to ensure you are always heading toward the target.

When you are within 5 metres of the target location, TerraSync starts beeping and the view switches to a close up screen of the target. You have reached the position when the GPS cross hair is over the top of the bulls eye symbol.



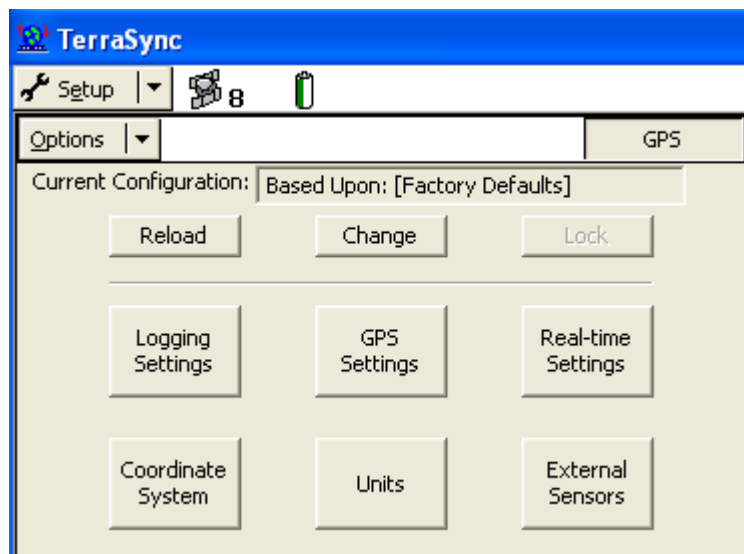
To clear a navigation target, in the section list tap **Map > Options > Clear Nav Target**.

Once in the square use the **Map** section to navigate around the square. The red cross hair moves in real time with your movement and with the OSNI vector line map displayed, your precise position within the survey square is shown.

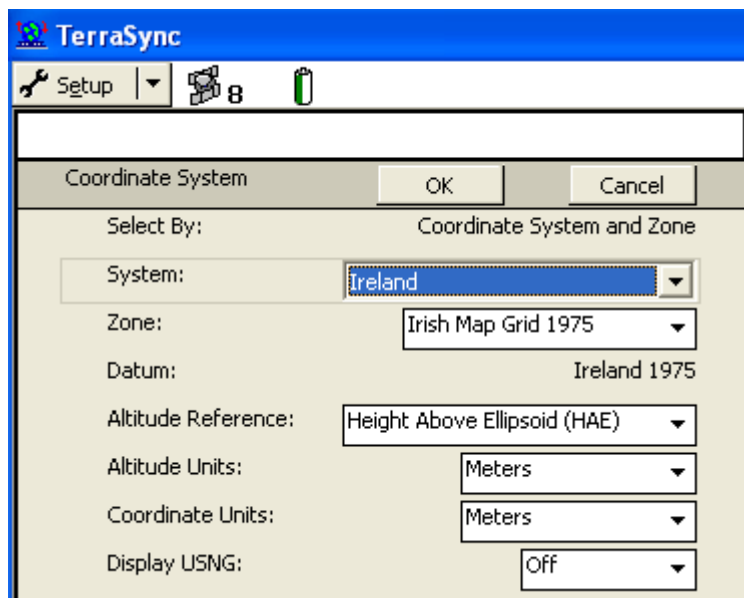
## 11.6 Setup Section

### 11.6.1 Setting Coordinate System

The Geo XM handheld is already referenced to the Irish National Grid. The Recon handheld has no GPS and hence this does not apply to these systems. However, if your Geo XM is reset at any stage, here follows a description of how to change coordinate systems. At the beginning of each day of field work before you start taking any GPS points it is a good idea to check if the Geo XM is actually set to Irish National Grid. In the top left hand corner of the screen, select **Setup**. The setup screen appears as follows.



Click **Coordinate System** and a screen similar to the one below appears.

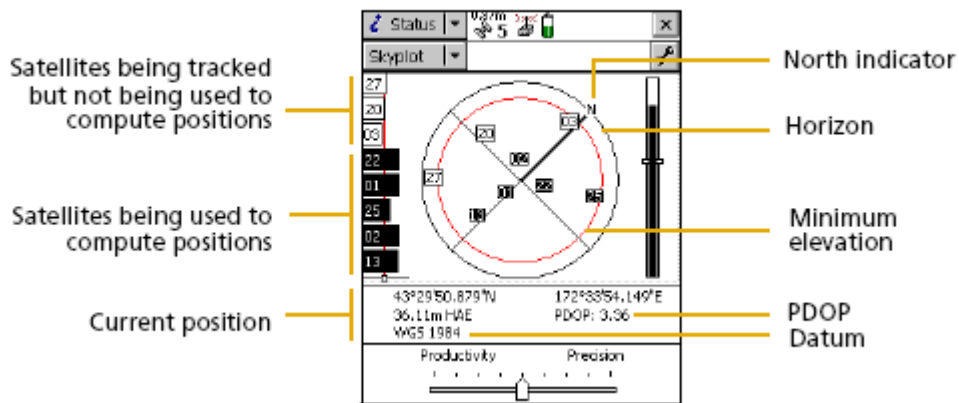


Under system select **Ireland** and under Zone select **Irish Map Grid 1975** and under coordinate units select **metres** then hit **OK**. This sets the coordinate system to Irish National Grid.

**11.7 Status Section** (Relevant only to Geo XM and land cover recording)

**11.7.1 Skyplot**

Use the Skyplot screen to view a graphical display of the satellites available to the receiver. The Skyplot screen is the default screen displayed when you open the Status section (top left hand corner). To access the Skyplot screen when another screen in the **Status** section is visible, tap the arrow on the Subsection button and from the drop-down list select **Skyplot**. When you turn on the receiver (**Setup > Options > Connect to GPS**), it begins to track visible satellites and to calculate the current position. Once the first position is displayed, subsequent positions are updated once per second.



**11.7.2 SNR graph**

The Signal-to-Noise Ratio (SNR) bar graph to the left of the skyplot is a graphical representation of the L1 frequency signal quality of each satellite that the GPS receiver is currently tracking. A black bar represents a satellite with signal strength above the configured minimum level. An empty bar represents a satellite that is not being used to compute GPS positions because its signal strength is below the configured minimum level. The more black bars mean greater accuracy of position. The black filled boxes in the Skyplot show the satellites currently being used to calculate the position.

**11.7.3 Message line**

The message line is displayed midway down the Skyplot screen, below the skyplot. The message line displays error or warning messages. Messages only appear when there is a problem or a condition you should be aware of. For example, if satellite geometry is good, no message appears; when it is poor, a message appears. "Too few satellites" appears as a message when the GPS receiver is not tracking enough satellites to compute a GPS position. The current position - a northing and easting six figure Irish national grid reference is also displayed just below the Skyplot. This grid reference can help locate whether you are inside or outside of square as the four corner Irish national grid references are given on the 1998 paper land cover maps

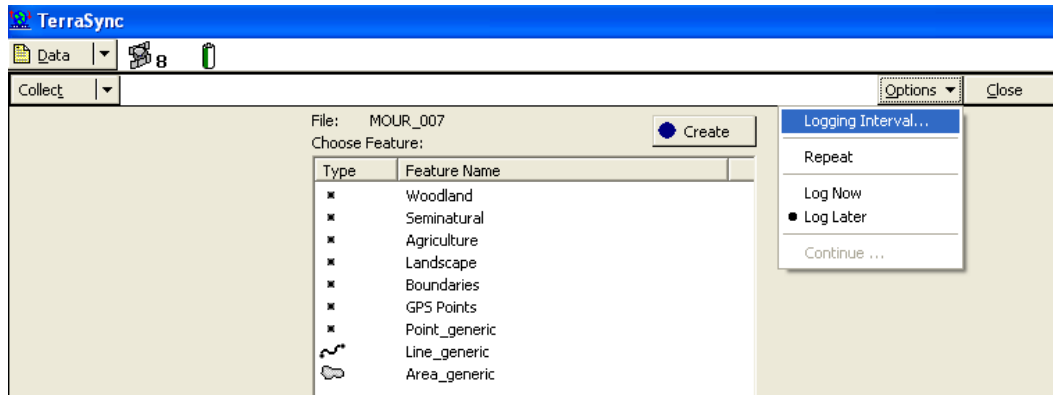
**11.8 GPS a new ecological or fixed boundary** (Relevant only to land cover recording)

First, check aerial photograph – if an ecological boundary is visible on the aerial photograph, mark it on the aerial and also roughly draw it on 2007 OSNI line map. If the boundary is clear and unambiguous on the aerial photograph then there is no need to GPS it. If not, the boundary has to be mapped using the dGPS (accuracy of 1-3m). The field surveyor doing the land cover recording maps these new ecological boundaries using the GPS. The field boundary surveyor marks the location of new field boundaries on the field boundary map, measuring its location by pacing.

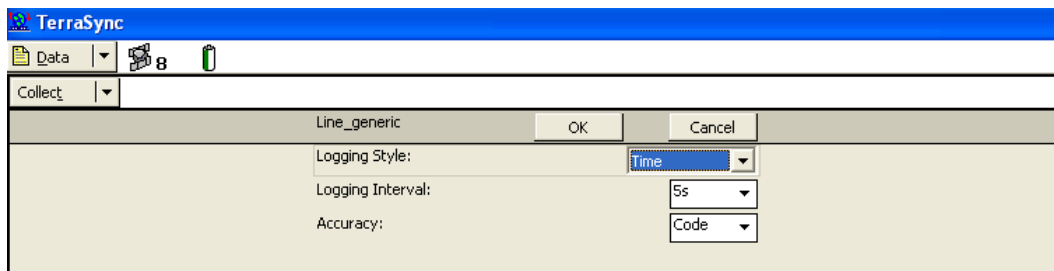
To GPS a new ecological boundary a new line feature needs to be created.

GPS needs connected in order to take GPS positions. Do this by selecting **Setup** (top left), tap **Options** and select **Connect to GPS**. If this is not available then you are already connected. Here follows how to GPS a new boundary.

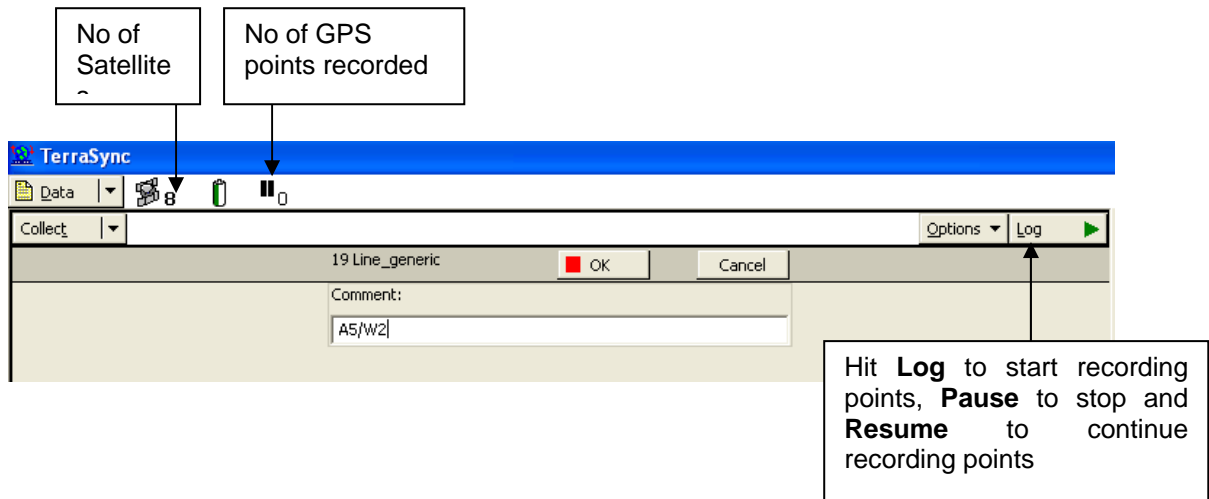
You need a data form open to record a GPS feature. With a data form open (**Data > Existing file > e.g. Mour\_007\_LC > Open**) make sure Collect is selected in the sub-menu. Under **Options** on the data collect screen make sure **Log later** is selected (i.e. point highlighted beside it) to delay GPS logging. The logging interval is already set for you. If you want to confirm the logging settings, select **Logging Interval**.



The logging interval options box appears as below. Logging interval refers to how frequently you want to take GPS points as you walk along a boundary. It can be set to either time or distance. Set the **Logging Style** to **Time** and the **Logging Interval** to **5 seconds** and tap **OK**. (This will be the default value, however it is always best to check from time to time in case handhelds are reset). This means that as you walk along a boundary, the GPS takes a point every 5 seconds and joins these points to make a line. The handheld beeps with every point recorded – make sure you wait for the beep at the end of the boundary. Again make sure **Log Later** is selected under **Options** to delay logging of positions until you are ready.

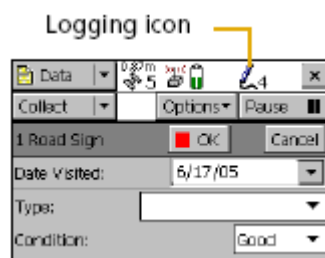


Highlight the **GPS Line** in Feature Name List on the Collect data screen and hit **Create**. The following screen appears and in the text box, a **comment** can be entered to clarify what boundary this is. As the GPS is in Log Later mode, attributes can be added before logging any GPS positions. In this example A5/W2 has been entered as the comment telling us that this is the boundary between the agricultural parcel A5 and woodland parcel W2.



In the above instance the GPS has not started (as a result of the **Log later** option). When you have assessed where the ecological boundary is to be located in the field, walk to the start of the boundary and tap **Log** to begin logging GPS positions every second and start walking along the boundary. The number of GPS points is counted on the top bar of the screen when logging commences. When you reach the end of the boundary you are logging, tap **OK** (red button) to close the boundary feature. If when walking a boundary, you need to pause the logging, tap **Pause** (this is the log button which changes to pause once logging starts). If you click **Resume** (this is the log button which changes to resume once logging is paused), the GPS records more points. Try to walk the boundary in one take without pausing, hence less room of error. In the map section you can see the GPS line which you have just mapped - these will be indicated by a red line. If you want to pause, leave your rucksack at the location to make sure you restart recording the line in the same place.

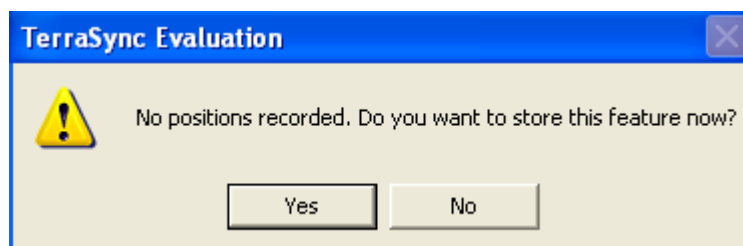
The screenshot below shows the icon which appears when logging is taking place. The number refers to the number of points recorded (one every 5 seconds). Note that the **Log** button has changed to **Pause** and you would click this if you wanted to pause the logging.



When you have finished recording a line disconnect from the GPS. Do this by tapping **Setup** (top left), tap **Options** and select **Disconnect to GPS**. This can help conserve the battery. Allow enough time to track enough satellites to achieve an accurate position once you reconnect to the GPS (**Setup>Options>Connect to GPS**), before continuing to log GPS i.e. consult the Skyplot (Section 11.7.1)

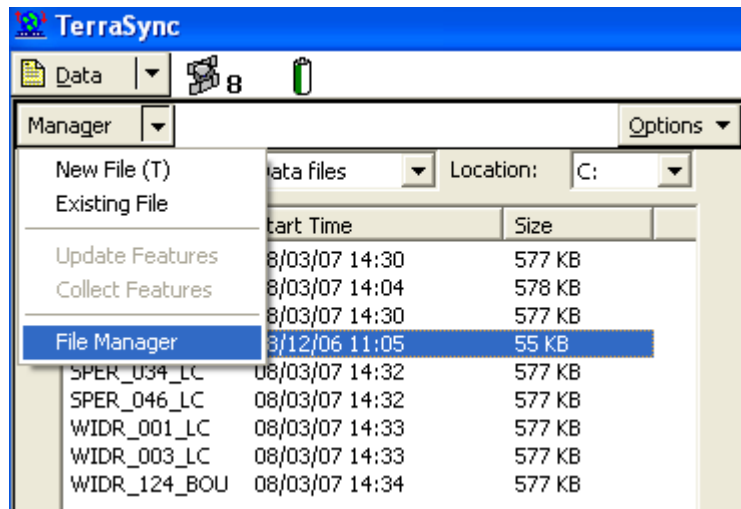
### 11.9 Backing up data

Each feature (i.e. parcel attributes) is saved when you tap the red OK button on the parcel recording form, and then tap Yes to the following message.



This automatically saves to the default drive on the PDA (i.e. *My Device/My documents/TerraSync*). As each parcel or field boundary is saved individually, we can expect little data to be lost should a problem occur such as loss of power. It is however still important to backup data onto a memory card, especially as you are likely to build up a weeks work of 4 or 5 squares on your PDA before any of it is transferred. The end of each working day is the obvious time to backup onto a memory card.

Data is backed up using SD and Compact Flash cards. Data can easily be sent from the PDA to a memory card using the **File Manager** section within TerraSync. Select **Data** (top left corner) and then select **File Manager** and choose **Data files** as File Type and make sure you have the correct location ("default"). This brings up a list of all the files created as shown overleaf. These are the data files for each of your surveyed squares, MOUR\_007\_LC or ANTR\_002\_BOU etc.



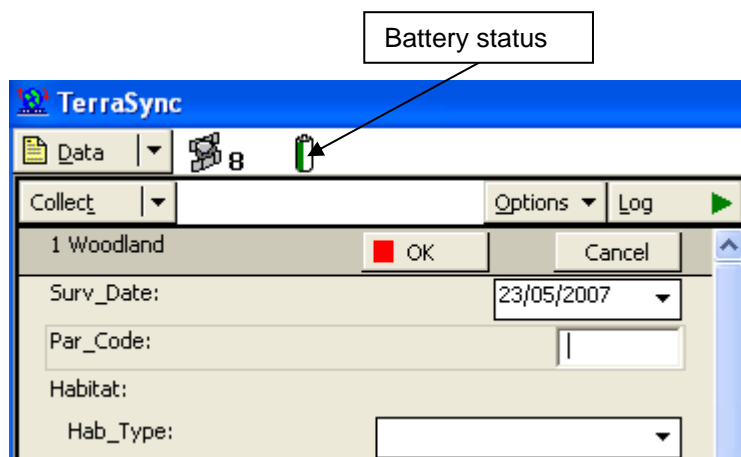
To transfer a file to the memory card **highlight the desired file**, tap **Options** on the above screen and from the drop down menu select **Copy to > Storage card**. This creates a copy of the data file on the memory card. If a message appears saying unable to save to storage card, remove the storage and re-insert it and try again. You can also create a copy on the default drive. Do not delete the original file on the device, keep all files in case of any unexpected errors. Files can also be renamed using the **Options** function.

GPS lines can be backed up by writing them to a shapefile. **Highlight the desired file**, tap **Options** and from the drop down menu select **Write Data to Shape**. **Specify a location**, probably the memory card and then tap **OK**. This creates a shapefile of the GPS lines captured and is also a means of backing up the GPS data.

#### 11.10. Additional Battery Tips

Always be aware of the possibility of losing data. The main threat is battery loss, which if occurs may result in the lost of any data created since the last save (usually your last land cover parcel or field boundary). TerraSync shows the battery status on the top menu bar (as shown below). If you put the stylus over the battery icon it will tell you the battery status. Alternatively if you tap **Start** (from the Windows menu) **>Settings>System tab** (at bottom) **>Power**, this also shows the remaining battery power. Note that it is only the Main Battery level and not the Backup Battery level that is significant.

Make sure all handhelds are recharged fully each night. Turn them off (20 sec press) when recharging as this speeds up the process. Recharging may take between 8-12 hours if a full recharge is needed. Also note that the recon is permanently on a standby/suspend state which uses a little of the battery (i.e. it never really switches off). Therefore rather than recharge on a Friday afternoon and leave it over the weekend – it is best to always recharge the night before field work, that way you can be sure of a fully charged battery.



## **Appendix 1. Backup Paper Field Data Recording Sheets.**

In case of PDA failure a set of emergency paper data forms designed for the recording of NICS2007 data is provided, ie. for

- Woodland (Fig. 1.1)
- Seminatural Vegetation (Fig. 1.2)
- Agriculture (Fig. 1.3)
- Landscape Features (Fig. 1.4)
- Field Boundaries (Fig. 1.5)
- Field Boundary Number of Woody Species per 30m (Fig. 1.6)
- Queries/notes - about land cover parcel and field boundary mapping etc (Fig. 1.7)









Landscape Features Data Recording Sheet NICS2007				Sample ID:	Page
Landscape Features		Landscape Features			Type and Attribute Codes
Parcel no.	Type	Parcel no.	Type	Attributes	
	1		2	3	
					<b>Buildings/Curtilage</b>
					01. Urban
					02. Industrial/commercial/public
					03. Agricultural buildings
					04. Rural domestic buildings
					Attributes:
					18.1 Boulders ( > 20cm )
					18.2 Scree
					19. Rock
					Attributes:
					35. Natural
					36. Quarry
					37. Peat cutting
					38. Land levelling etc.
					45. Scattered shrubs/trees
					Attributes:
					50. Cliff
					51. Limestone pavement
					39. Supralittoral
					52. Intertidal (Littoral)
					53. Sabellaria alveolata reef
					<b>Roads and Tracks</b>
					10. Road/track
					11. Railway track
					Attributes:
					20. Lough/small water body
					20.1. Ditch (open water) >= 2.5m
					20.2. Canal
					21. Reservoir
					22. River (width >=2.5m)
					23. Stream (width < 2.5m)
					Attributes:
					40. Seminal
					41. Canalised
					42. Stream width < 1m
					43. Stream width 1 - 2m
					44. Stream width 2 - 2.5m
					45. Scattered shrubs/trees
					46. Fishing stands
					<b>Water Bodies</b>
					30. Metalled: asphalt etc.
					31. Unmet.: loose mineral
					32. Unmet.: earth/soil
					33. with veg. verge (1-2.5m)
					45. Scattered shrubs/trees
					<b>Land Fill / Dumping</b>
					15. Land fill/dumping
					Attributes:
					47. Earth/spoil/organic
					48. Rubbish
					49. Vehicles

Fig. 1.4 Landscape Features paper data recording sheet



Field Boundaries: List of Woody Species Per 30m Length NICS2007		SAMPLE ID:	Page
Par.			
1		Notes	
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Fig. 1.6 Field boundaries number of woody species per 30m paper data recording sheet



**Appendix 2. Descriptions of PDA recording codes.**

**Woodland**

<b>Code</b>	<b>Description</b>
Surv_Date	Survey Date
Par_Code	Parcel Code
Hab_Type	Habitat Type
Hab_Str	Habitat Structure
Hab_NP	Plantation Status
GF_Type	Ground Flora Type
GFSp1	Ground Flora Species 1
GF_Sp1_Cov	Ground Flora Species 1 Cover Value
GFSp2	Ground Flora Species 2
GF_Sp2_Cov	Ground Flora Species 2 Cover Value
GFSp3	Ground Flora Species 3
GF_Sp3_Cov	Ground Flora Species 3 Cover Value
RP1	Trees & Shrubs(<1.3m) Species 1
RP1_Cov	Trees & Shrubs(<1.3m) Species 1 Cover Value
RP2	Trees & Shrubs(<1.3m) Species 2
RP2_Cov	Trees & Shrubs(<1.3m) Species 2 Cover Value
RP3	Trees & Shrubs(<1.3m) Species 3
RP3_Cov	Trees & Shrubs(<1.3m) Species 3 Cover Value
TS1	Trees & Shrubs(1.3 – 5m) Species 1
TS1_Cov	Trees & Shrubs(1.3 – 5m) Species 1 Cover Value
TS2	Trees & Shrubs(1.3 – 5m) Species 2
TS2_Cov	Trees & Shrubs(1.3 – 5m) Species 2 Cover Value
TS3	Trees & Shrubs(1.3 – 5m) Species 3
TS3_Cov	Trees & Shrubs(1.3 – 5m) Species 3 Cover Value
TS4	Trees & Shrubs(1.3 – 5m) Species 4
TS4_Cov	Trees & Shrubs(1.3 – 5m) Species 4 Cover Value
TS5	Trees & Shrubs(1.3 – 5m) Species 5
TS5_Cov	Trees & Shrubs(1.3 – 5m) Species 5 Cover Value
TL1	Trees (> 5m) Species 1
TL1_Cov	Trees (> 5m) Species 1 Cover Value
TL2	Trees (> 5m) Species 2
TL2_Cov	Trees (> 5m) Species 2 Cover Value
TL3	Trees (> 5m) Species 3
TL3_Cov	Trees (> 5m) Species 3 Cover Value
TL4	Trees (> 5m) Species 4
TL4_Cov	Trees (> 5m) Species 4 Cover Value
TL5	Trees (> 5m) Species 5
TL5_Cov	Trees (> 5m) Species 5 Cover Value
Inv.Sp	Invasive Species
Manag_Type	Management Type
Graz_Int	Grazing Intensity
Bare_Soil	Bare Soil Cover Value
Rock_Bould	Rocks/Boulders Cover Value
Dump_Type	Dumping Type
Int_Fea1	Other Features 1
Int_Fea2	Other Features 2
Int_Fea3	Other Features 3
Mosaic_Cov	Mosaic Cover Value
New_Sp	New Species
Query	Query



**Descriptions of PDA recording codes: SeminatURAL Vegetation**

<b>Code</b>	<b>Description</b>
Surv_Date	Survey Date
Par_Code	Parcel Code
Hab_Type	Habitat Type
Sp_1	Main Species 1
Sp_1_Cov	Species 1 Cover Value
Sp_2	Main Species 2
Sp_2_Cov	Species 2 Cover Value
Sp_3	Main Species 3
Sp_3_Cov	Species 3 Cover Value
Sp_4	Main Species 4
Sp_4_Cov	Species 4 Cover Value
Sp_5	Main Species 5
Sp_5_Cov	Species 5 Cover Value
Herb_Cov	Herbs Cover Value
Agr_wd_Cov	Agricultural Weeds Cover Value
Rush_Cov	Rushes Cover Value
Brack_Cov	Bracken Cover Value
Heathr_Cov	Heathers Cover Value
Sphag_Cov	Sphagnum Cover Value
Lich_Cov	Lichens Cover Value
Sh_Tr_Cov	Shrubs/Trees Cover Value
Sh_Tr_Dens	Shrubs/Trees Abundance/Density
Ma_Sp	Main Shrub/Tree Species
Veg_ht	Vegetation Height (cm)
Cutting	Cutting
Grazing	Grazing
Poaching	Poaching
Thatch	Thatch
Assoc_Man	Associated Management
Peat_cut	Peat Cutting Type
Drainage	Drainage
Bare_Soil	Bare Soil Cover Value
Rock_Bould	Rocks/Boulders Cover Value
Dump_Type	Dumping Type
Oth_Fea1	Other Features 1
Oth_Fea2	Other Features 2
Mosaic_Cov	Mosaic Cover Value
New_Sp	New Species
Query	Query

**Descriptions of PDA recording codes: Agriculture**

<b>Code</b>	<b>Description</b>
Surv_Date	Survey Date
Par_Code	Parcel Code
Hab_Type	Habitat Type
Sp_1	Main Species 1
Sp_1_Cov	Species 1 Cover Value
Sp_2	Main Species 2
Sp_2_Cov	Species 2 Cover Value
Sp_3	Main Species 3
Sp_3_Cov	Species 3 Cover Value
Sp_4	Main Species 4
Sp_4_Cov	Species 4 Cover Value
Sp_5	Main Species 5
Sp_5_Cov	Species 5 Cover Value
Herb_Cov	Herbs Cover Value
Agr_wd_Cov	Agricultural Weeds Cover Value
Rush_Cov	Rushes Cover Value
Brack_Cov	Bracken Cover Value
Sh_Tr_Cov	Shrubs/Trees Cover Value
Sh_Tr_Dens	Shrubs/Trees Abundance/Density
Ma_Sp	Main Shrub/Tree Species
Cutting	Cutting
Grazing	Grazing
Poaching	Poaching
Thatch	Thatch
Assoc_Man	Associated Management
Drainage	Drainage
Bare_Soil	Bare Soil Cover Value
Dump_Type	Dumping Type
Oth_Fea	Other Features
Mosaic_Cov	Mosaic Cover Value
New_Sp	New Species
Query	Query

**Descriptions of PDA recording codes: Landscape Features**

<b>Code</b>	<b>Description</b>
Surv_Date	Survey Date
Par_Code	Parcel Code
Hab_Type	Habitat Type
Attrib_1	Attribute 1
Attrib_2	Attribute 2
Attrib_3	Attribute 3
Mosaic_Cov	Mosaic Cover Value
Query	Query

**Descriptions of PDA recording codes: Field Boundaries**

<b>Code</b>	<b>Description</b>
Surv_Date	Survey Date
Par_Code	Parcel Code
Hedge	Hedge Type
Wall	Wall Type
Earth_Bk	Earth Bank Type
Bank_ht	Bank height (m)
Fence1	Fencing Type
Fence2	Fencing Type
Gaps_Prim	Gaps Cover Value of Primary Type
Ditches	Ditches Type
HalfBank	Half-bank height (m)
Gr_dist	Ground Disturbance Type
Gr_sp_rich	Ground Flora Species Rich
Mainly Coppice TGF	Mainly Coppice Tree Growth Form
Manage	Hedge Management Type
Height	Hedge Height (m)
Open_base	Open base
Wdy_out	Woody Outgrowth
Sp>50	Species > 50%
Sh_1	Shrub Species 1 (Growth Form)
Sh_2	Shrub Species 2 (Growth Form)
Sh_3	Shrub Species 3 (Growth Form)
Tr_1	Tree Species 1 (Growth Form)
Tr_2	Tree Species 2 (Growth Form)
Tr_3	Tree Species 3 (Growth Form)
Tr_Cov	Tree Canopy Cover Value
Stand_no	Number of Standards
Wd1	Woody Species 1
Wd2	Woody Species 2
Wd3	Woody Species 3
Wd4	Woody Species 4
Wd5	Woody Species 5
Wd6	Woody Species 6
Wd7	Woody Species 7
Wd8	Woody Species 8
Wd9	Woody Species 9
Wd10	Woody Species 10
Wd11	Woody Species 11
Wd12	Woody Species 12
New_Sp	New Species
Query	Query

## Appendix 3. TERRASYNC SOFTWARE - QUICK START USER GUIDE

### 3.1 Open TerraSync

Open TerraSync by tapping **Start** and then tapping **Terrasync** from the popup menu.

### 3.2 View OSNI 2007 vector map of grid square as background layer

Select **Map**, then tap **Layers** and select **Background File**. Select **File Type** as **Background** in the drop down menu, then **highlight the desired background file** and tap **OK**. If you want to view your GPS trail, tap **Layers > GPS Trail**,

### 3.3 Set Coordinate System

Select **Setup** (top left corner), tap **Coordinate System** button, select **Ireland** under **System**, **Irish Map Grid 1975** under **Zone** and select **Metres** under **Coordinate Units**, then tap **OK**. This sets everything to Irish National Grid.

### 3.4 Create NICS survey square data file

Select **Data** then select **New**. In subsequent screen, select **Rover** as **File Type**, type square code (e.g. **MOUR\_007**) into **Field Name** and select **LC NICS 2007** (if recording land cover) or **BOU NICS 2007** (if recording field boundaries) as **Dictionary Name**, then hit **Create**. Just tap **OK** when asked to confirm antenna height.

### 3.5 Recording parcel attributes


#### 3.5.1 Collecting new attributes

With the NICS survey square data file open make sure **Data** and **Collect** are selected (top left corner), **highlight desired parcel Feature Name** from the list (woodland, agricultural, seminatural, landscape, boundary or GPS line), then tap **Create**. This brings up a recording form. **Enter or select** all data in the **text boxes** or **drop down menus**. When complete tap **OK** which returns to the Feature Name list.

#### 3.5.2 Updating attributes

With the NICS survey square data file open make sure **Data** and **Update** are selected (top left corner). A list of each previously recorded parcels appear, **highlight** the desired parcel and tap **Begin**. This opens the form for that particular parcel. Any changes are made and once finished tap **OK** to return to the parcel list.

### 3.6 Ending the data collection session

When the data collection session is complete, close the data file and exit the TerraSync software. To close the open data file and exit the TerraSync software, tap **Close** in the **Collect Features** screen. A message appears, asking you to confirm that you want to close the open file. Tap **Yes** to close the current data file and return to the **New File** screen. Tap the **Close** button  in the upper right corner of the screen. A message appears, asking you to confirm that you want to exit the TerraSync software. Tap **Yes** to exit the TerraSync software.

### 3.7 Open existing file

Select **Data** and **Existing File** in the sub menu (top left corner). Note existing file will not be available if you already have a data entry form open – once you close any open form (tap **Close** button), only then will **Existing file** become available. **Highlight** the **desired survey square** from the list, tap **Open** and again tap **OK** when asked to confirm antenna height. This brings up a list of all the recorded parcels for that survey square. **New parcels** can be added using the **Collect** function or **parcels edited** using the **Update** function (both described above).

### 3.8 Connecting to the GPS

Select **Setup** (top left), tap **Options** and select **Connect to GPS**. If this is not available then you are already connected.

### 3.9 Disconnecting from the GPS

Select **Setup** (top left), tap **Options** and select **Disconnect from GPS**. If this is not available then you are already disconnected.

### 3.10 GPS a new vegetation boundary

With the NICS survey square data file open make sure **Data** and **Collect** are selected (top left corner). **Highlight GPS line** in Feature Name List and tap **Create**. **Enter boundary description** in **comment box** and then move to start of boundary. Hit **Log** to start GPS and walk to end of boundary and tap **OK**. This records a GPS line of the boundary just walked.


### 3.11 Backing up attribute data

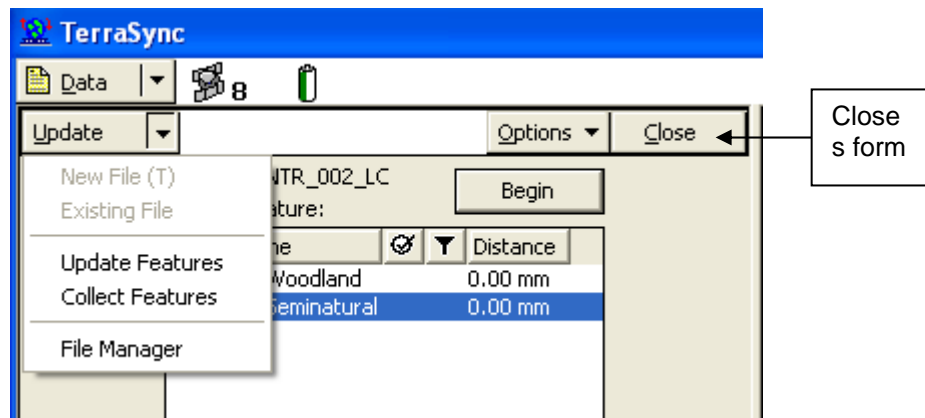
Make sure **Data** is selected and then select **File Manager** (top left corner). Choose **Data files** as **File Type** and make sure the correct location is selected (“default”). **Highlight** the file you want copied to the memory card and then tap **Options** and from drop down list choose **Copy to > Storage card**.

### 3.12 Writing GPS lines to a file

Make sure **Data** is selected and then select **File Manager** (top left corner). Choose **Data files** as **File Type** and make sure the correct location is selected. **Highlight the desired file**, tap **Options** and from the drop down menu select **Write Data to Shape**. **Specify a location**, probably the storage card and then tap **OK**. This creates a shapefile of the GPS lines captured.

### 3.13 Troubleshooting

If at any time, an option is not available, then it is likely that you may already have a data form open. For example you will not be able to open an existing file if you already have a data form open as shown below. Need to tap **Close** button (NOT  as this will close TerraSync) and only then will existing file become available.



Note if the PDA stops operating in the field it is likely that the battery has run down. Do your best to make sure the PDA never fully loses power. An alternative is that the PDA has “froze” (sometimes with the screen still lit). If the PDA has frozen, hold down the green power button for at least 15 seconds and it will power-off. If the battery is still charged, you will be able to switch it on again after a minute or so, usually without data loss.

When saving data to the storage card, if a message appears saying unable to save to storage card, remove the storage and re-insert it and try again.

#### Appendix 4. TRIMBLE GeoExplorer XM HANDHELD USER GUIDE

The Trimble GeoExplorer XM handheld has been chosen mainly for land cover digital field data capture.



*Trimble Geo XM handheld and accessories.*

This is a rugged PDA system with integrated GPS. It has 1-3 metre accuracy and an all day internally rechargeable battery. When fully charged (this takes approx. 8 hours), the internal battery provides enough power for a full working day using GPS. Working practice is to keep the GPS turned off unless you want to use. Take care not to scratch the “touch” screen. When not recording always keep the PDA in the holding pouch on a belt with the screen facing towards you.

##### 4.1 Accessories

- Support module with power supply and USB data cable
- Getting Started Guide
- Hand strap
- Pouch with belt loop
- Stylus kit (included is a cord which can be attached to the stylus in order to keep it safe).

#### 4.2 Parts of the GeoExplorer 2005 series handheld

The following pages show the main features of the handheld.

##### Integrated GPS receiver

- High-performance
- Integrated SBAS (WAAS / EGNOS / MSAS) receiver
- EVEREST multipath rejection technology (GeoXT and GeoXH only)
- H-Star technology (GeoXH only) for improved accuracy with shorter occupation times

##### External antenna connector

Connection to an optional external GPS antenna.

##### Integrated Bluetooth and WLAN radios

- Connect to external devices using Bluetooth™ wireless technology.
- Connect to networks and the Internet using Wireless Local Area Network (WLAN) connectivity.

##### Pocket PC

Field computer running Windows Mobile Version 5.0 software for Pocket PC.

##### Advanced TFT color display

- 16-bit color (65,536 colors)
- Interactive touch screen
- ¼ VGA display
- Backlight

##### Keypad

Provides 11 buttons for fast, easy access to common actions, including OK and Start. Also provides Display and Power buttons, and buttons for navigation

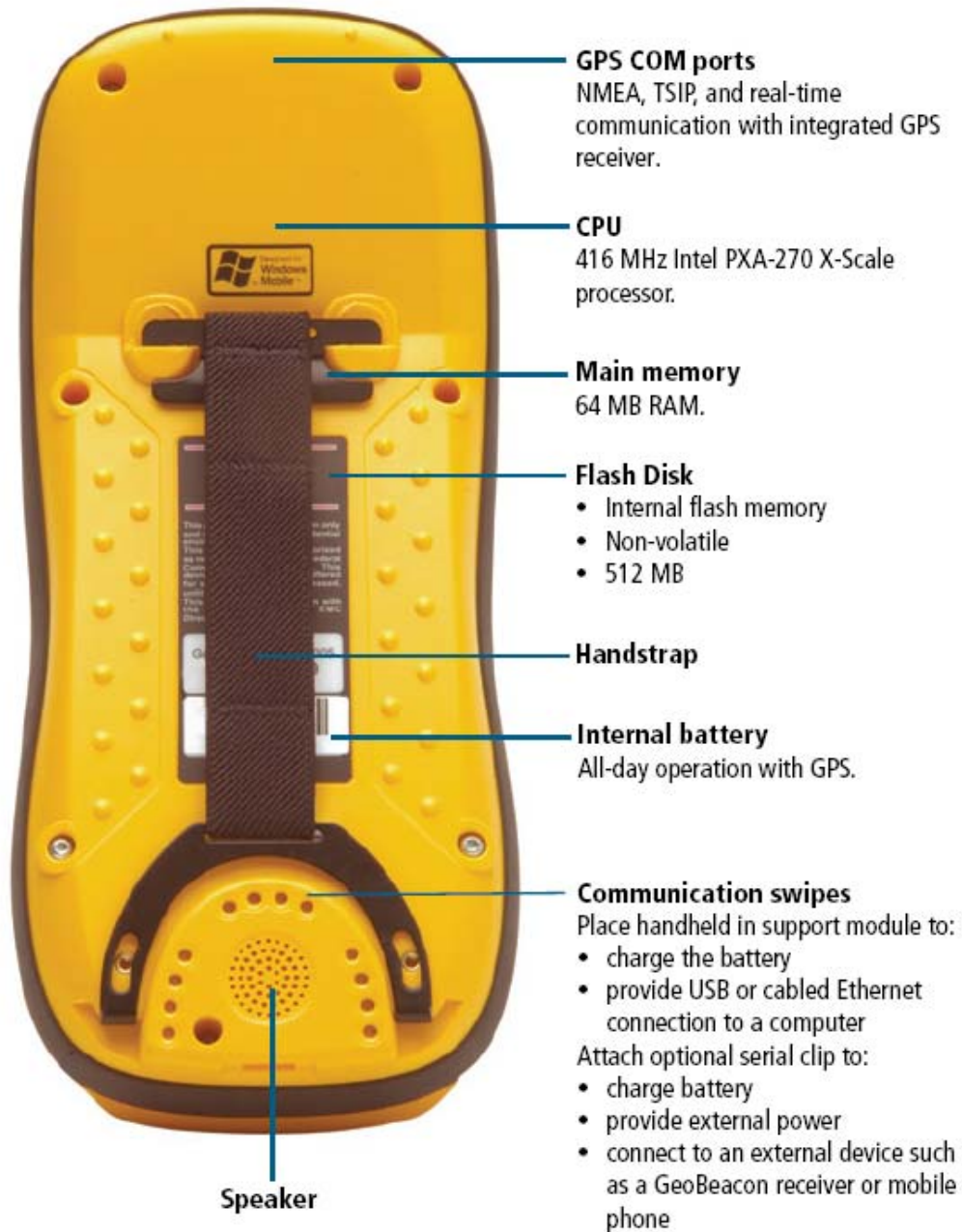
##### Microphone

Run Notes and use the Recording toolbar to record.



##### SD card slot

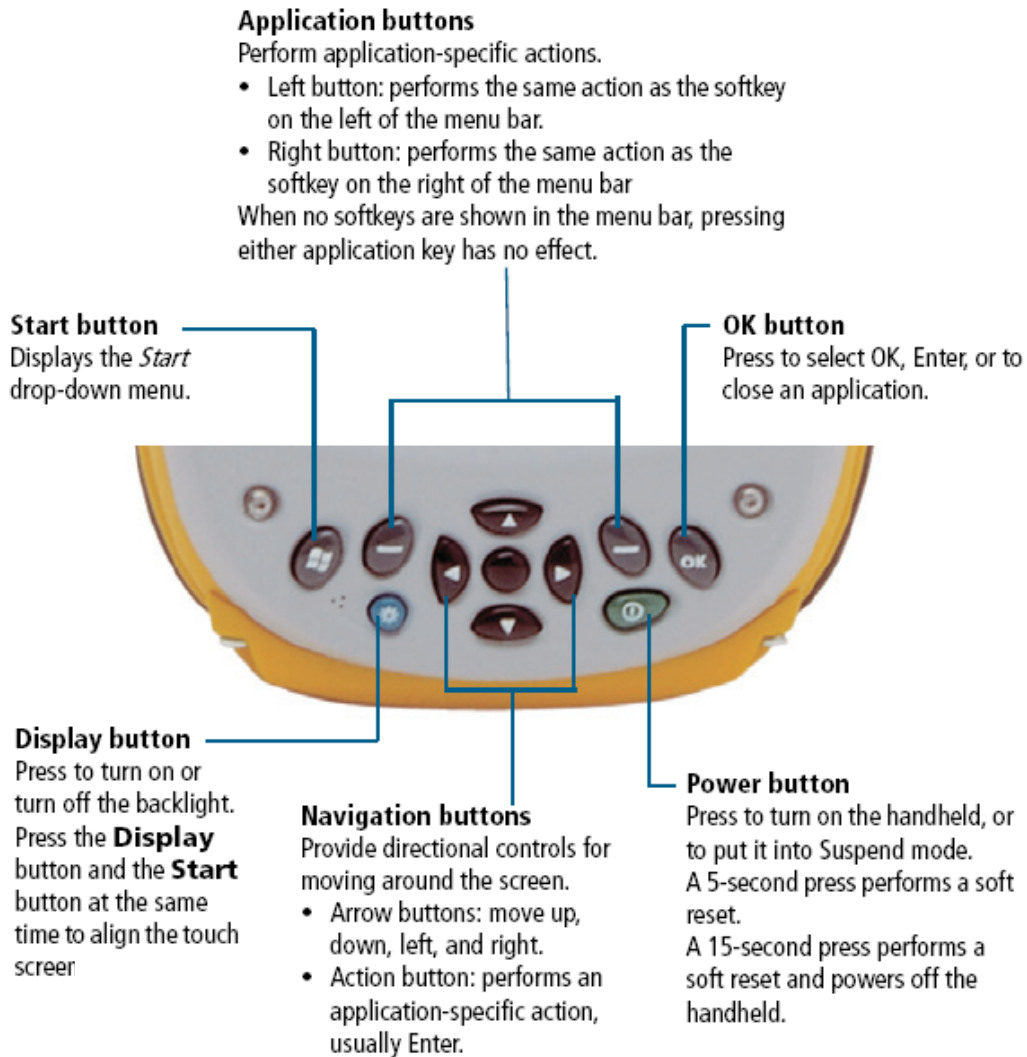
Provides removable storage using SD (Secure Digital) memory cards





### 4.3 Keypad

The keypad provides 11 buttons for fast, easy access to common actions. The diagram below provides information about each button.



Note: A soft reset (a 5 second press on the Power button) stops all running applications but does not erase any programs or saved data. Put into suspend mode when not entering data (e.g. when assessing a field parcel of boundary or walking between them).

### 4.4 Charging the battery

To charge the battery, connect one end of the AC adaptor cable to the support module and the other to an AC power outlet. Put the handheld in the support module as shown overleaf. It should click into place easily and the green light on the charger should come on. Do not force the PDA into the charger socket pins. It should just push in easily.



Leave to charge for up to eight hours to provide enough power for a full working day. To remove the handheld from the support module, press the release button on the support module, then lift the bottom of the handheld upward. Always charge the battery fully overnight ready for the next days field work. Make sure charging is occurring before you leave it. To remove the AC adaptor cable from the support module just turn the connector plug clockwise and pull to release.



#### 4.5 Conserving the battery

In daylight you don't need the backlight. If you press the **display** button (blue button), the backlight will switch off. Pressing the **display** button again turns the backlight on. Do not forget to turn it off again. Polaroid sun glasses make the screen more visible. The backlight will automatically turn off if device is not used for 1 minute to conserve battery power. To switch back light on again just tap the screen with the stylus.

After 3 minutes the PDA will automatically go into suspend mode - a low-power mode that maintains the main memory contents but does not allow you to operate any of the handheld's functions. Again this is to conserve the battery. When this happens, just tap the **Power** button which returns to the same screen where you left off. When in suspend mode the device uses very little battery – it is much the same as turning off the device. Alternatively, you can suspend the PDA manually by pressing the **Power** button (e.g. when assessing a field parcel or field boundary, or when moving between field parcels or field boundaries) to increase the battery life.

#### 4.6 Turn on/off and suspend

Press and release the **Power** button to turn on or to suspend the handheld. When you press the **Power** button to turn off the handheld, the handheld goes into Suspend mode. This is a low-power mode that maintains the main memory contents but does not allow you to operate any of the handheld's functions. The handheld appears to be turned off. The integrated GPS receiver is turned off and any application using GPS is disconnected. To turn on the handheld when it is in Suspend mode, press the **Power** button. The handheld is ready for operation. There may be a delay of up to 30 seconds while the integrated GPS receiver automatically reactivates. To turn off the handheld, press and hold the **Power** button for 20 seconds.

In order to conserve battery you may want to suspend the handheld by pressing the **Power** button for example, when assessing vegetation and walking between parcels. The device will automatically go into suspend mode when idle for 3 minutes. Again press the Power button to turn device on again for operation – and switch the back-light off each time. If the PDA “hangs”, keep the **Power** button held down for 20 – 30 seconds and the software will reboot.



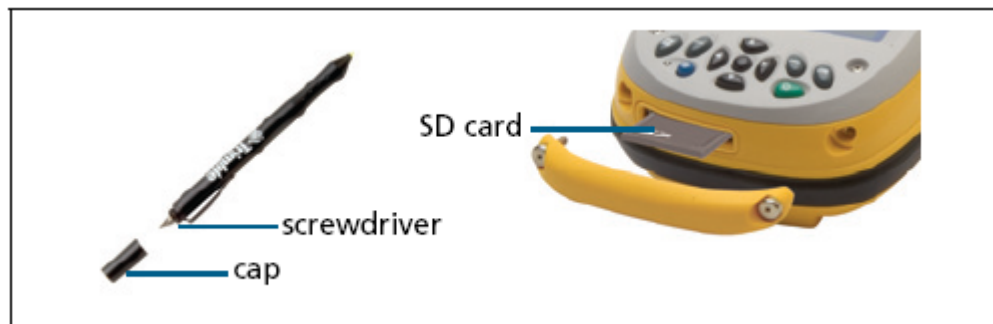
#### 4.7 Storage / Backup data

The system has two kinds of memory, flash and RAM. Flash memory is permanent storage; the contents of flash memory are unaffected if the battery is removed or discharged. RAM memory is volatile. This means the contents will be lost if the battery is disconnected or discharged.

For NICS 2007, data is automatically saved in the flash memory within TerraSync folder in *My documents*, (this is covered in Section 11.9 ) It is important that data is backed up regularly during the day on to SD storage card as well as on the flash memory, therefore if battery fails, minimum data is lost. To save data in an alternative location to the flash disk, the handheld has a **Secure Digital (SD) Memory Card slot**. You should use SD memory cards to make copies of a completed square or at the end of the day.

*To insert an SD memory card:*

1. Unscrew the stylus cap to access the screwdriver.



2. Use the screwdriver to undo both screws on the SD door.
3. Insert the SD memory card into the SD slot (label side up).
4. Reattach the SD door, insert both screws and tighten. Ensure that it is attached correctly.
5. Replace the stylus cap.

*To remove an SD memory card:*

1. Remove the SD door (see steps 1 to 2 above).
2. To eject the SD card from the SD card slot, push the card in. The card pops out.
3. Remove the card and, if you want to, insert a new SD card.
4. Reattach the SD door, insert both screws and tighten.
5. Replace the stylus cap.

Documents and program files that are stored on the flash disk are not affected by power loss or resetting. This means that if you turn the PDA off at any stage, your data is safe. However, you can lose data if you accidentally delete or overwrite the file containing it. Windows Mobile Version 5.0 software does not include a Recycle Bin. If files are deleted from the flash disk, they are deleted permanently therefore be careful.

## 4.8 What is GPS?

The Global Positioning System (GPS) is a satellite-based positioning system. A constellation of operational NAVSTAR satellites orbit the earth every 12 hours, providing worldwide, all-weather, 24-hour time and position information.

### 4.8.1 Getting a clear view of the sky

To receive signals from GPS satellites, the receiver must have a clear view of the sky. *GPS does not work indoors*. Hold the handheld with the screen toward you. The internal antenna is located above the screen under the Trimble logo. You do not have to hold the handheld perfectly level, but keep the antenna facing upward, not downward or sideways. Anything that blocks light also blocks signals. Satellite signals can be blocked by people, buildings, heavy tree cover, large vehicles, or powerful transmitters. GPS signals can go through leaves, plastic, and glass, but these all weaken the signal.

### 4.8.2 Using GPS

The integrated GPS receiver is normally switched off. To use GPS, take the handheld outside to a location with a clear view of the sky. From the *Today* screen, tap the *GPS* softkey in the menu bar (or alternatively open the TerraSync program). The skyplot of the default GPS software appears (in our case this is TerraSync software). Taking GPS locations is covered in the TerraSync user guide – section 11.8. When recording data in a sample square, you will be using the TerraSync software and will access the GPS within this program. Do not use GPS during lightning.

### 4.8.3 Factors that affect accuracy

The accuracy that you obtain from your GeoXM handheld is affected by whether you are logging a point feature using static GPS positions, or a line feature (in stream mode). The accuracy of the data increases with the number of satellites being used. Trimble data collection software only logs GPS positions when four or more satellites are visible. Accuracy also decreases if the view of the sky is partially blocked causing a weak signal. Tree canopy is likely to result in a weaker signal and slightly less accurate GPS position. Thick canopy may mean no signal at all, however in most cases you should receive a relatively strong signal except when in forest.

## 4.9 Use and Care

- Keep the outer surface free of dirt and dust.
- Keep the communication swipes, the external antenna port and the SD card slot free of dirt and dust.
- Protect the touch screen from pressure and sharp or abrasive objects. Trimble recommends applying a screen protector to the device. However this can reduce the effectiveness of the stylus in which case feel free to remove the screen protectors.

## 4.10 Cleaning

To clean the handheld, wipe it with a clean dry cloth. Do *not* immerse the handheld in water.

## Appendix 5. TRIMBLE RECON HANDHELD USER GUIDE

The Trimble Recon handheld has been chosen mainly for field boundary data capture. There is no GPS associated with this system. If necessary the land cover field surveyor will GPS any additional boundaries using the Trimble Geo XM system. Normally, however you should be able to pace out distances.



*Trimble Recon*

This is a rugged PDA system with an internal rechargeable battery. When fully charged (approx 8 - 12 hours charging time) it should provide between 12-15 hours of battery life.

### 5.1 Accessories

- International AC battery charger (100–240 V)
- 10 screen protectors
- 2 stylus pens
- Getting Started Guide
- Hand strap
- USB data cable

## 5.2 The Device

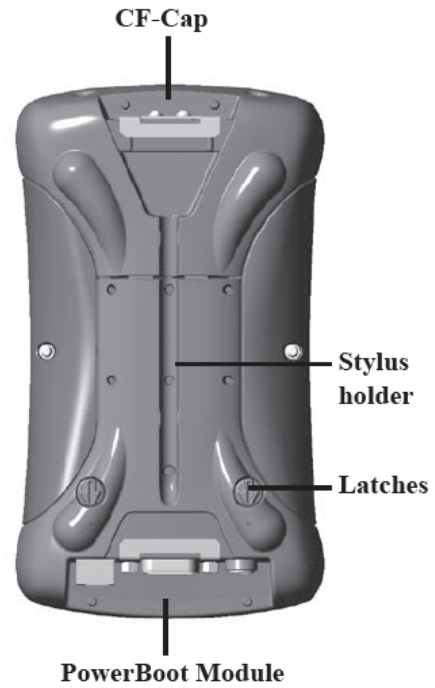
The main features of the handheld are illustrated below.

### Front Panel

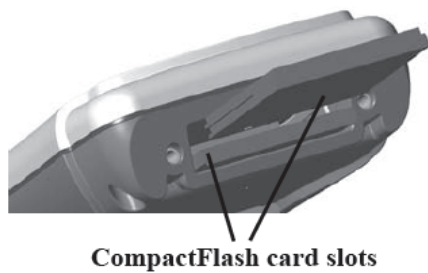


\* Assignable application buttons; see Settings.

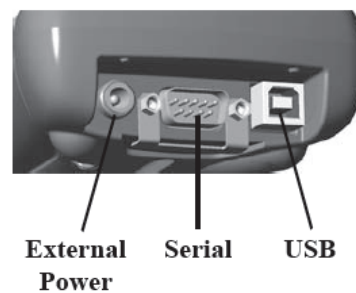
### Back Panel



### Top View- without Cap



### Bottom View



### 5.3 Charging the Battery

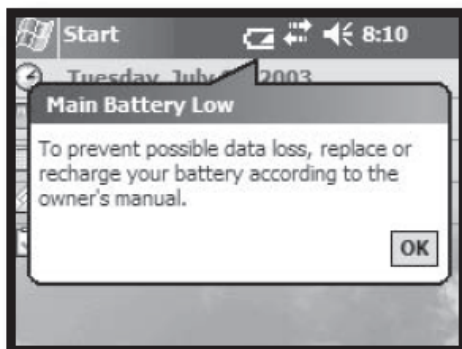
Connect the AC adapter to the external power port on the Recon. Charge the PowerBoot for at least 12 hours. For faster charging, turn the Recon off while charging the PowerBoot.



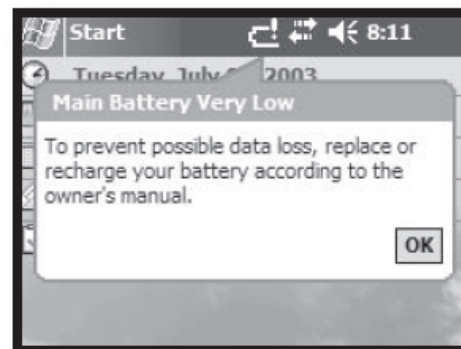
The Recon PowerBoot module contains a generous 3800 mAh of battery power and typically you can expect around 15 hours of battery life. A tip to extend the battery life is to use the backlight only when necessary. Tap on **Settings/ System / Backlight** to minimize the amount of time the backlight stays on when the unit is idle.

**Low Battery Warnings:** The Recon provides two different warnings when the battery life is getting low:

Low Battery Warning



Critical Battery Warning



The Main Battery Low warning is just a reminder that you should recharge your battery at the next convenient opportunity. You have approximately 30% of your battery life remaining, so there is no imminent danger that you are about to lose your data. The Main Battery Very Low warning means you that you have less than an hour (and possibly only a few minutes) before the Recon will turn itself off. It is recommended that you save your work immediately and turn the Recon off.

### 5.4 Turning the Recon on and off

To start working, press the power button. When you have finished working, turn by pressing the power button. After 3 minutes the recon will automatically go into suspend mode - a low-power mode that maintains the main memory contents but does not allow you to operate any of the handheld's functions. Again this is to conserve the battery. When this happens, just tap the power button which returns to the same screen where you left off. When in suspend mode the device uses very little battery – it is much the same as turning off the device. You should normally use the suspend mode when not recording, e.g., when assessing a filed boundary or walking between boundaries. The backlight will automatically turn off if device is not used for 1 minute to conserve battery power. To switch back light on again just tap the screen with the stylus.

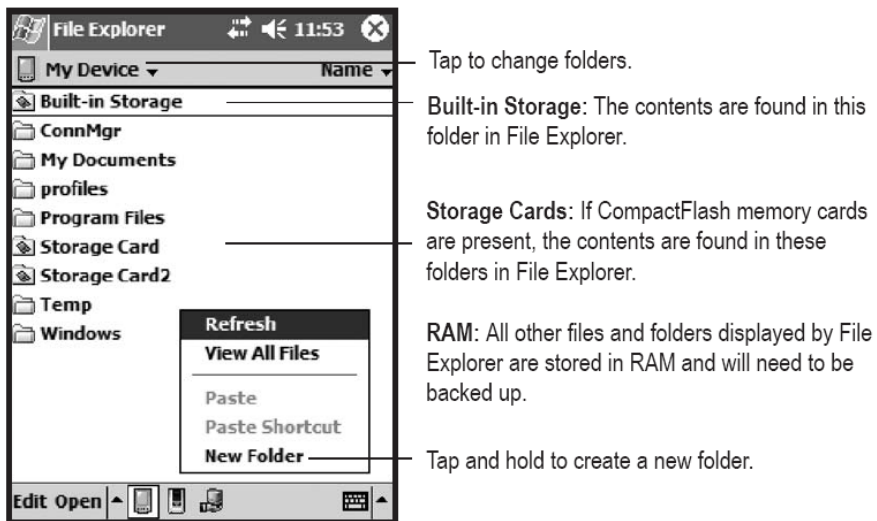
### 5.5 Using the CF Expansion Slots

To use the CompactFlash expansion slots, you must first remove the CF-Cap™. To do this, unscrew the two screws on the top of the CF-Cap. Slide the cap off the main unit. Gently insert a CompactFlash card or device into one of the two CF slots. Do not force the card into the slot. Cards must be inserted with the face toward the display side of the Recon. Replace the CF-Cap and tighten the screws to reseal.



### 5.6 Storage / Backup data

The Recon has two kinds of memory, flash and RAM. Flash memory is permanent storage; the contents of flash memory are unaffected if the battery is removed or discharged. RAM memory is volatile. This means the contents will be lost if the battery is disconnected or discharged. The picture BELOW shows the kinds of memory as they appear within the File Explorer (Start / File Explorer). The non-volatile built-in flash storage is at the top of the list.



For NICS 2007 data is automatically saved in the flash memory within TerraSync folder in *My documents*, (this is covered in Section 11.9). It is important that data is backed up regularly during the day onto the compact flash storage card, therefore if battery fails, minimum data is lost. Windows Mobile Version 5.0 software does not include a Recycle Bin. If files are deleted from the flash disk, they are deleted permanently therefore be careful.

### 5.7 Cleaning and Care

Clean the Recon with a soft cloth dampened with either water or a diluted mild detergent. Use only the included stylus or other devices specifically designed for use with touch screens. The use of ballpoint pens, sticks, nails or other sharp objects to operate the touch screen will scratch and/or damage the unit. Abrasives may scratch touch screens. Keep the touch screen clean by gently wiping the display, using a soft cloth dampened either with clean water or glass cleaner.



# **NICS2007 FIELD MANUAL: PART 3.**

## **Plant Species Identification and Recording**

### **CONTENTS**

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2. Species recording	1
3. Species cover values	1
4. Species recorded in NICS	3

## Part 3: Plant Species Identification and Recording

### 1. Introduction

Classifying habitats reliably and efficiently depends on being able to recognise common plant species in the field. The abundance of dominant species can be assessed easily if you are able to distinguish them from other less abundant species. Species you already know will catch your eye (as will colourful or distinctive species). Species you do not know will be anonymous. Being unaware that other species are present is a major source of survey error. Species identification skills are of primary importance.

### 2. Species recording

The botanical names (generic and specific) of the most common species are held in the electronic PDA dictionaries. By selecting names from a dictionary, you do not make spelling errors. Take care not to select the wrong species from the dictionary in error.

The dictionaries contain genera unattributed to a species, eg., *Carex spp.*, or *Agrostis spp.* This recognises the difficulties you will have in identifying to species on every occasion. In preference, identify to species. If this is time-consuming in practice, use the unattributed generic name.

If a species is found which is not listed in the PDA dictionary, always check the species ID by keying out with a flora. New species names can be added to the dictionary. Keys to some common species will be provided as part of the NICS2007 training course.

### 3. Species cover values

Species cover values are expressed as a % of the land cover parcel (mapped unit) they occur in. Where a number of layers are present (e.g. in woodland), the total species cover values can add up to more than 100%.

In the past, NICS recorded only species with a cover greater than the threshold of 25%. In some cases, therefore, only one or two species would have been recorded. For NICS2007, there is no threshold cover value, the most abundant species of the habitat are recorded. The species with the greatest cover is usually recorded first. Figure 1. is a pictorial aid to assessing cover values. Cover is recorded using the following scale:

Scale	% cover range
1. =	<1 % (less than 1%)
2. =	1 - <5 % (1% to less than 5%)
3. =	5 - 10 % (5% to 10% inclusive)
4. =	11 - <25 % (more than 10% but less than 25%)
5. =	25 - <50 % (about 25% to less than 50%)
6. =	50 - <75 % (50% to less than 75%)
7. =	75 - <90 % (75% to less than 90%)
8. =	90 - 100 % (90% to 100%)

To standardise your assessment of cover, make blind records with your field partner and compare the values you each select.

Vegetation cover - percentage charts

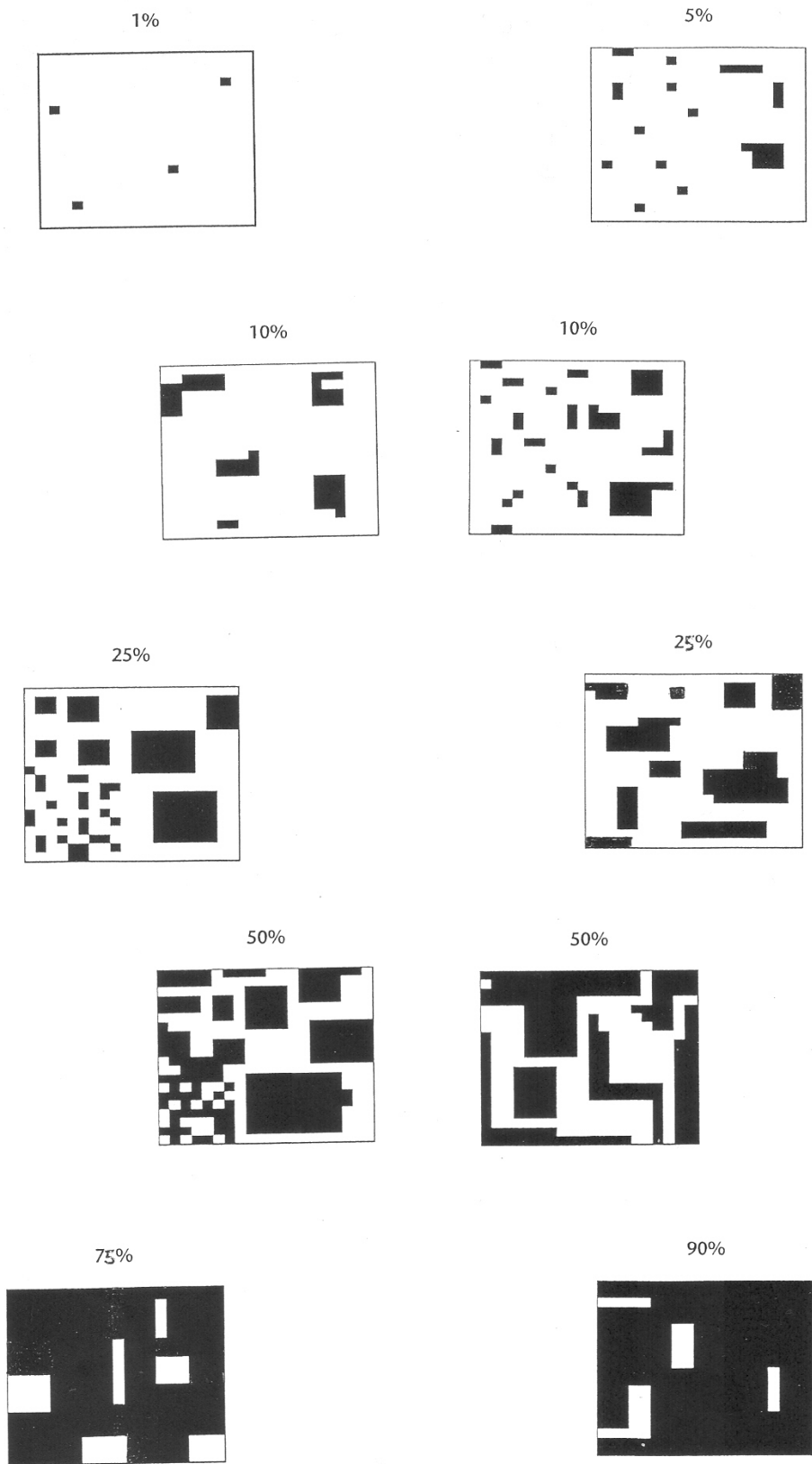


Figure 1. A Pictorial Aid To Assessing Species Cover Values

#### **4. Species recorded in NICS.**

Species recorded in NICS are separated into broad categories:-

- A. Vascular plants - Herbs, Grasses, Sedges, Rushes, Ferns & Horsetails
- B. Mosses (common)
- C. Lichens (bushy)
- D. Climbers / Scramblers
- E. Shrubs (ie species tending to grow naturally as shrub growth forms.)
- F. Trees (ie species tending to grow naturally to tree growth forms.)

Note that “Woody” species recorded in the Field Boundary 30m length include D. Climbers / Scramblers, E. Shrubs and F. Trees.

Grasses are the most common species you will encounter in NICS. Flowering specimens are easily identified but for much of the growing season there are no flowers present. In the grazed or cut forms, you need to be able to sort through a sward, where individuals are small and different species are intimately mixed and be able to identify each individual you see by vegetative structure.

There are large numbers of moss and liverwort species in Irish habitats but only a few species regularly contribute greatly to overall vegetation cover. Commonly abundant moss species should be reliably identified in the field by their vegetative characters.

The bushy Cladonia lichens (ie. bearded and antler-horn types) are used to assess lichen cover but matchstick and cup types are excluded. Note: bushy lichens often occur in bogs but can also occur in some woodland ground floras. They tend to grow in patches.

A list of the plant species recorded in NICS is given in Table 1.

**Table 1. Species botanical names and codes recorded in NICS.**

Species are separated into broad categories:-

- A. Vascular plants - Herbs, Grasses, Sedges, Rushes, Ferns & Horsetails
- B. Mosses
- C. Lichens
- D. Climbers / Scramblers
- E. Shrubs (ie species tending to grow naturally as shrub growth forms.)
- F. Trees (ie species tending to grow naturally to tree growth forms.)

**A. Vascular plants - Herbs, Grasses, Sedges, Rushes, Ferns & Horsetails**

<b>Botanical</b>	<b>Common</b>	<b>Code</b>
Achillea millifolium	Yarrow	ACM
Achillea ptarmica	Sneezewort	AHP
Aegopodium podagraria	Ground elder	AEP
Agrostis canina	Velvet Bent	AGN
Agrostis capillaris	Common Bent	AGC
Agrostis sp.	Bent grasses	AGX
Agrostis stolonifera	Creeping Bent	AGS
Ajuga reptans	Bugle	AJR
Alchemilla vulgaris	Lady's mantle	ALV
Alisma plantago-aquatica	Water plantain	APA
Alliaria petiolata	Garlic mustard	AIP
Allium ursinum	Wild garlic	ALU
Alopecurus geniculatus	Marsh foxtail	AOG
Alopecurus pratensis	Meadow foxtail	ALP
Ammophila arenaria	Marram-grass	AMA
Anemone nemorosa	Wood anemone	ANN
Angelica sylvestris	Angelica	AES
Antennaria dioica	Mountain cudweed	AND
Anthoxanthum odoratum	Sweet vernal-grass	ANO
Anthriscus sylvestris	Cow parsley	ANS
Apium nodiflorum	Fools watercress	APN
Arctium minus	Lesser burdock	ARM
Armeria maritima	Thrift	AEM
Arrhenatherum elatius	False oat-grass	ARE
Arum maculatum	Lords and Ladies	AUM
Aster tripolium	Sea aster	AST
Atriplex sp.	Orache	ATS
Avena sativa	Oats	AVS
Baldellia ranunculoides	Lesser water-plantain	BAR
Bellis perennis	Daisy	BEP
Beta maritima	Sea beet	BET
Bidens tripartita	Trifid bur-marigold	BIT
Bolboschoenus maritimus	Sea club-rush	BOM
Brassica oleifera	Oil seed rape	BRO
Briza media	Quaking grass	BRM
Bromus hordeaceus	Soft brome	BRH
Butomus umbellatus	Flowering-rush	BUU
Callitriche stagnalis	Water starwort	CST
Calluna vulgaris	Ling heather	CAV
Caltha palustris	Marsh marigold	CAP
Cardamine flexuosa/hirsuta	Wavy/Hairy bittercress	CDF
Cardamine pratensis	Lady's smock	CDP
Carex elata/paniculata	Tufted tussock sedge	CAE
Carex sp.	Sedge	CAS
Centaurea nigra	Knapweed	CEN

<b>Botanical</b>	<b>Common</b>	<b>Code</b>
Centaurium erythraea	Centaury	CEE
Cerastium fontanum	Mouse-ear	CEF
Chamomilla suaveolens	Pineapple weed	CMS
Chenopodium album	Fat hen	CHA
Chrysosplenium oppositifolium	Oppis. lvd. Golden saxifrage	CHO
Cicuta virosa	Cowbane	CCV
Cirsium arvense	Creeping/Field Thistle	CIA
Cirsium dissectum	Bog thistle	CID
Cirsium palustre	Marsh Thistle	CIP
Cirsium vulgare	Spear Thistle	CIV
Cochlearia danica	Scurvy-grass	COD
Cochlearia officinalis	Common scurvy-grass	COO
Conopodium majus	Pignut	COM
Convolvulus arvensis	Bindweed	CNA
Cynosurus cristatus	Crested dogs-tail	CYC
Dactylis glomerata	Cocksfoot	DAG
Dactylorhiza maculata/fuchsii	Heath spotted/common orchid	DAM
Deschampsia caespitosa	Tufted hair-grass	DEC
Deschampsia flexuosa	Wavy hair-grass	DEF
Digitalis purpurea	Foxglove	DIP
Dryopteris dilatata	Broad Buckler fern	DRD
Dryopteris filix-mas	Male fern	DFM
Eleocharis palustris	Common spike-rush	ELP
Elodea canadensis	Canadian pondweed	ELC
Elymus farctus	Sand couch	ELF
Elymus pycnanthus	Sea couch	EPY
Elymus repens	Common couch	ELR
Empetrum nigrum	Crowberry	EMN
Epilobium angustifolium	Rose-bay willow-herb	EPA
Epilobium hirsutum	Great willowherb	EPH
Epilobium palustre	Marsh willowherb	EPP
Equisetum sp.	Horsetail	EOS
Erica cinerea	Bell heather	ERC
Erica tetralix	Cross-leaved heath	ERT
Eriophorum angustifolium	Common Cotton-grass	ERA
Eriophorum vaginatum	Hare's-tail Cotton-grass	ERV
Eupatorium cannabinum	Hemp-agrimony	EUC
Euphorbia sp.	Spurge	EUS
Euphrasia sp.	Eyebright	EUO
Festuca gigantea	Giant fescue	FEG
Festuca ovina	Sheep's Fescue	FEO
Festuca pratensis	Meadow fescue	FEP
Festuca rubra	Red Fescue	FER
Festuca rubra/ovina	Fescue	FES
Filipendula ulmaria	Meadowsweet	FIU
Fumaria muralis	Common ramping-fumitory	FMM
Galium palustre	Marsh bedstraw	GAP
Galium saxatile	Heath bedstraw	GAS
Galium verum	Lady's bedstraw	GAV
Gallium aparine	Cleavers	GAA
Geranium robertianum	Herb Robert	GER
Geum rivale	Water avens	GUR
Geum urbanum	Wood avens	GEU
Glaux maritima	Sea-milkwort	GLM
Glyceria sp.	Sweet-grass	GLS
Helictotrichon pubescens	Downy Oat-grass	HEP

<b>Botanical</b>	<b>Common</b>	<b>Code</b>
Heracleum sphondylium	Hogweed	HES
Hieracium sp.	Hawkweed	HIS
Hippophae rhamnoides	Sea buckthorn	HIR
Hippuris vulgaris	Marestail	HIV
Holcus lanatus	Yorkshire fog	HOL
Holcus mollis	Creeping soft-grass	HOM
Honkenya peploides	Sea sandwort	HOP
Hordeum sp.	Barley	HOS
Hyacinthoides non-scriptus	Bluebell	HNS
Hydrocotyle vulgaris	Marsh pennywort	HYV
Hypericum tetrapterum	Square-stalked St. Johns-wort	HYT
Hypochaeris radicata	Cat's-ear	HPR
Impatiens glandulifera	Himalayan balsam	IMG
Iris pseudacorus	Yellow flag	IRP
Juncus acutiflorus/articulatus	Sharp flowered/jointed rush	JUA
Juncus bufonius	Toad rush	JUB
Juncus bulbosus	Bulbus rush	JBS
Juncus conglomeratus	Compact rush	JUC
Juncus effusus	Soft rush	JUE
Juncus gerardii	Saltmarsh rush	JUG
Juncus inflexus	Hard rush	JUI
Juncus maritimus	Sea rush	JUM
Juncus squarrosus	Heath rush	JNS
Lathyrus palustris	Marsh pea	LTP
Lathyrus pratensis	Meadow vetchling	LAP
Lemna sp.	Duckweed	LES
Leontodon autumnalis	Autumn hawkbit	LEA
Leucanthemum vulgare	Ox-eye daisy	LEV
Lobelia vulgaris	Water lobelia	LOD
Lolium x perenne/sp.	Perennial ryegrass/cultivars	LOP
Lotus corniculatus	Birdsfoot trefoil	LOC
Lotus uliginosus	Greater birdsfoot trefoil	LUO
Luzula campestris	Field rush	LUC
Luzula sylvatica	Great wood rush	LUS
Lychnis flos-cuculi	Ragged robin	LFC
Lycopus europaeus	Gipsywort	LYE
Lysimachia nummularia	Creeping-Jenny	LYM
Lysimachia vulgaris	Yellow loosestrife	LYV
Lythrum salicaria	Purple loosestrife	LYS
Matricaria maritima	Sea mayweed	MAM
Matricaria perforata	Scentless mayweed	MAP
Mentha aquatica	Water mint	MEA
Menyanthes trifoliata	Bogbean	MET
Mercurialis perennis	Dog's mercury	MEP
Mertensia maritima	Oyster plant	MEM
Molinia caerulea	Purple moor-grass	MOC
Montia fontana	Blinks	MOF
Myosotis arvensis	Forget-me-not	MYA
Myosotis sp.	Water Forget-me-not	MYS
Myrica gale	Bog myrtle	MYG
Nardus stricta	Mat-grass	NAS
Narthecium ossifragum	Bog asphodel	NRO
Nasturtium officinale	Water cress	NAO
Nuphar lutea	Yellow water-lily	NUL
Nymphaea alba	White water lily	NYA
Oenanthe sp.	Water dropwort	OES

<b>Botanical</b>	<b>Common</b>	<b>Code</b>
Orchis mascula	Early purple orchid	ORM
Oxalis acetosella	Wood sorrel	OXA
Pedicularis sylvatica	Lousewort	PES
Petasites hybridus	Butterbur	PTS
Phalaris arundinacea	Reed canary-grass	PHA
Phleum pratense	Timothy	PHP
Phragmites australis	Common reed	PHC
Plantago lanceolata	Ribwort plantain	PLL
Plantago major	Greater plantain	PAM
Plantago maritima	Sea plantain	PLM
Poa annua	Annual meadow-grass	POA
Poa pratensis	Smooth-stalked meadow-grass	POP
Poa trivialis	Rough-stalked meadow-grass	POT
Polygala vulgaris	Milkwort	POV
Polygonum bistorta	Bistort	PIB
Polygonum aviculare	Knotgrass	PYA
Polygonum hydropiper/minus	Water-pepper	PYH
Polygonum persicaria	Redshank	PYP
Potentilla anserina	Silverweed	PEA
Potentilla erecta	Tormentil	POE
Potentilla palustris	Marsh cinquefoil	PTP
Potentilla reptans	Creeping cinquefoil	POR
Potamogeton natans	Broad-leaved pondweed	PON
Primula vulgaris	Primrose	PRV
Prunella vulgaris	Selfheal	PUV
Pteridium aquilinum	Bracken	PTA
Puccinellia spp.	Saltmarsh-grass	PUS
Pulicaria dysenterica	Common fleabane	PUD
Ranunculus (Batrachium)	subgenus Water-Crowfoots	RNB
Ranunculus acris	Meadow buttercup	RAA
Ranunculus aquatilis	Common water crowfoot	RNA
Ranunculus ficaria	Celandine	RAF
Ranunculus flammula	Lesser spearwort	RNF
Ranunculus repens	Creeping buttercup	RAR
Raphanus maritimus	Radish	RAM
Renoutria japonica	Japanese knotweed	REJ
Rhinanthus minor	Yellow rattle	RHM
Rorippa sylvestris	Creeping yellowgrass	ROR
Rumex acetosa	Common sorrel	RUA
Rumex obtusifolius	Broad leaved dock	RUO
Rumex sp.	Dock	RUS
Sagina procumbens	Pearlwort	SAP
Sanicula europaea	Sanicle	SAE
Schoenoplectus tabernaemontani	Grey club-rush	SCT
Schoenus nigricans	Bog rush	SCN
Scirpus cespitosus	Deer-grass	SCC
Scirpus lacustris	Common club-rush	SCL
Sedum acre	Biting stonecrop	SDA
Senecio aquaticus	Marsh ragweed	SEA
Senecio jacobea	Ragweed	SEJ
Senecio vulgaris	Groundsel	SEV
Sesleria albicans	Blue moor-grass	SSA
Silene uniflora	Sea campion	SIU
Silene vulgaris	Bladder campion	SIV
Sinapis arvensis	Charlock	SIA
Sium latifolium	Greater water-parsnip	SIL



<b>Botanical</b>	<b>Common</b>	<b>Code</b>
Solanum nigrum	Black nightshade	SON
Sonchus oleraceus	Sow thistle	SOO
Sparganium sp.	Bur-reed	SPR
Spartina townsendii	Townsend's cord-grass	SPT
Spergula arvensis	Corn spurrey	SPA
Spergularia marina	Sea spurrey	SPM
Stachys palustris	Marsh woundwort	STP
Stellaria alsine	Bog stitchwort	STA
Stellaria media	Chickweed	STM
Succisa pratensis	Devils-bit scabious	SUP
Symphytum officinale	Comfrey	SYO
Taraxacum officinale	Dandelion	TAO
Teucrium scorodonia	Wood sage	TES
Thymus praecox	Wild thyme	THP
Trifolium pratense	Red clover	TRP
Trifolium repens	White clover	TRR
Triglochin maritima	Sea arrowgrass	TRM
Triticum aestivum	Wheat	TRA
Tussilago farfara	Coltsfoot	TUF
Typha latifolia	Bulrush	TYL
Ulex galli	Dwarf gorse	ULG
Urtica dioica	Nettle	URD
Utricularia vulgaris	Common bladderwort	UTV
Vaccinium myrtillus	Bilberry	VAM
Valeriana officinalis	Common valerian	VAO
Veronica anagallis-aquatica	Water speedwell	VAA
Veronica beccabunga	Brooklime	VEB
Veronica chamaedrys	Germander speedwell	VEC
Veronica persica	Common field speedwell	VEP
Vicia sepium	Bush vetch	VIS
Viola palustris	Marsh violet	VIP
Viola riviniana	Dog violet	VIR
Zea mays	Maize	ZEM

**B. Mosses**

<b>Botanical</b>	<b>Common</b>	<b>Code</b>
Aulaconium palustre	Moss	AUL
Brachythecium rutabulum	Moss	BRR
Calliergon cuspidatum	Moss	CLC
Dicranum scoparium	Moss	DIS
Eurynchium praelongum	Moss	EUP
Hylocomium splendens	Moss	HYS
Hypnum sp.	Moss	HYP
Pleurozium schreiberi	Moss	PZS
Polytrichum commune	Moss	POC
Pseudoscleropodium purum	Moss	PSP
Racomitrium lanuginosum	Moss	RAS
Rhytidiadelphus squarrosus	Moss	RHS
Rhytidiadelphus triquetrus	Moss	RHT
Sphagnum sp.	Bog-moss	SPS
Thuidium tamariscinum	Moss	THT

**C. Lichens**

<b>Botanical</b>	<b>Common</b>	<b>Code</b>
Cladonia sp. (fruticose - bushy)	Lichens (fruticose - bushy)	CLS

**D. Climbers / Scramblers**

<b>Botanical</b>	<b>Common</b>	<b>Code</b>
Clematis vitalba	Old man's beard	CLV
Hedera helix	Ivy	HEH
Lonicera nitida	Wilson's Honeysuckle	LNN
Lonicera periclymenum	Honeysuckle	LNP
Rosa canina/sp.	Wild rose	ROS
Rubus fruticosus	Bramble	RUF
Rubus idaeus	Wild raspberry	RUI
Solanum dulcamara	Bittersweet	SOD

**E. Shrubs (ie species tending to grow naturally as shrub growth forms.)**

<b>Botanical</b>	<b>Common</b>	<b>Code</b>
Berberis sp.	Berberis	BES
Buddleja davidii	Buddlea	BUD
Buxus sempervirens	Box	BUS
Corylus avellana	Hazel	COA
Cotoneaster sp.	Cotoneaster	COS
Crataegus monogyna	Hawthorn	CRM
Cystisus scoparius	Broom	CYS
Escallonia sp.	Escallonia	ESS
Euonymus europaeus	Spindle	EUE
Fuchsia magellanica	Fuchsia	FUM
Ilex aquifolium	Holly	ILA
Ligustrum ovalifolium	Garden privet	LIO
Ligustrum vulgare	Privet	LIV
Prunus domestica	Wild Plum	PRD
Prunus laurocerasus	Cherry laurel	PRL
Prunus spinosa	Blackthorn	PRS
Rhododendron ponticum	Rhododendron	RHP
Ribes nigrum	Blackcurrant	RIN
Ribes sanguineum	Flowering currant	RIS
Ribes uva-crispa	Gooseberry	RIC
Salix aurita	Eared willow	SAA
Sambucus nigra	Elder	SAN
Spiraea sp.	Spiraea	SPI
Symphoricarpos rivulare	Snowberry	SYM
Syringa vulgaris	Lilac	SYV
Ulex europaeus	European gorse	ULE
Viburnum opulus	Guelder-rose	VIO

**F. Trees (ie species tending to grow naturally to tree growth forms.)**

<b>Botanical</b>	<b>Common</b>	<b>Code</b>
Abies alba	Common silver fir	ABA
Abies grandis	Giant fir	ABG
Abies procera	Noble fir	ABP
Abies sp. (various)	Firs (various other)	ABV
Acer campestre	Field maple	ACC
Acer platanoides	Norway maple	ACN
Acer pseudoplatanus	Sycamore	ACP
Acer rubrum	Red maple	ACR
Aesculus hippocastanum	Horse chestnut	AEH
Alnus glutinosa	Alder	ALG
Alnus incana	Grey alder	ALI
Amelanchier laevis	Snowy mespil	AML

<b>Botanical</b>	<b>Common</b>	<b>Code</b>
Araucaria araucana	Monkey-puzzle tree	ARA
Betula pendula	Silver birch	BPP
Betula pubescens	Birch (Common)	BEP
Carpinus betula	Hornbeam	CAB
Castanea sativa	Sweet chestnut	CSA
Cedrus sp.	Cedar	CES
Chaemycyparis x leylandii	Leyland cypress	CHL
Cupressaceae sp.	Cypress species (Family)	CHS
Cupressus macrocarpa	Monterey cyprus	CUM
Eucalyptus spp.	Eucalyptus	ECS
Fagus purpurea	Copper beech	FAP
Fagus sylvatica	Beech	FAS
Fraxinus excelsior	Ash	FRE
Laburnum sp.	Laburnum	LBS
Larix sp.	Larch	LAX
Malus domestica	Apple	MAD
Malus sylvestris	Crab apple	MAS
Nothofagus sp.	Southern beech	NOS
Picea abies	Norway spruce	PIA
Picea omorika	Siberian spruce	PIO
Picea sitchensis	Sitka spruce	PIS
Pinus contorta	Lodgepole pine	PIC
Pinus nigra	Corsican pine	PIN
Pinus radiata	Monterey pine	PNR
Pinus sylvestris	Scot's pine	PNS
Populus nigra	Black Poplar	PPN
Populus sp.	Poplar	POS
Populus tremula	Aspen	PPT
Prunus avium	Gean	PRA
Prunus cerasifera	Cherry plum	PRC
Prunus padus	Bird cherry	PRP
Prunus x sp.	Prunus x (unident.)/hyb./orn.	PRX
Pseudotsuga menziensis	Douglas fir	PSM
Pyrus communis	Pear	PYC
Quercus petraea	Sessile Oak	QUP
Quercus robur	Pedunculate Oak	OUR
Quercus sp.	Oak	QUS
Salix caprea	Goat willow	SCA
Salix cinerea	Sally (willow)	SAC
Salix sp.	Willow	SAS
Sequoia sempervirens	Coast redwood	SES
Sequoiadendron giganteum	Wellingtonia	SEG
Sorbus aria	Whitebeam	SRA
Sorbus aucuparia	Rowan	SOA
Taxus baccata	Yew	TAB
Thuja occidentalis	White cedar	THO
Thuja plicata	Western red cedar	THP
Tilia sp.	Lime	TIS
Tsuga sp.	Hemlock-spruces	TSS
Ulmus sp.	Elm	ULS
Ulmus glabra	Wych Elm	UGL
Ulmus procera	English Elm	UPR

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