Woodland variation and the use of the National Vegetation Classification woodland section

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Britain has one of the lowest levels of woodland cover in Europe, but despite that our woods are extremely variable. We no longer have some of species and communities that were found in the great forests - the wild wood - that spread back through Britain after the last ice age; on the other hand the landscapes and patterns that have been created through in some cases thousands of years of management have their own distinctive features. Every wood is different and the nature of this variation affects its importance from a nature conservation point of view, and how we describe and assess it.

One (but only one) of the tools we use to describe the composition of woodland is the **National Vegetation Classification** (NVC).

Section 1 provides an introduction to the main variations in woodland composition and how they can be described using NVC; Section 2 illustrates some of the main types; while Section 3 is a basic key to the woodland communities.

Section 4 explains the background to the NVC in more detail and how to 'read' the NVC woodland tables; Section 5 looks at the use of quadrats for identifying NVC types; section 6 gives a simplified recording form; while Section 7 covers some common questions and concerns;

Section 8 provides some background references and various lists.

1. Variation in British woodland composition and how we describe it using NVC

Britain has one of the lowest levels of woodland cover in Europe, but despite that our woods are extremely variable. We no longer have some of species and communities that were found in the great forests - the wild wood, that spread back through Britain after the last ice age; on the other hand the landscapes and patterns that have been created through, in some cases thousands of years of management, have their own distinctive features. Every wood is different and the nature of this variation affects its importance from a nature conservation point of view, how we describe and assess it.

One (but only one) of the tools we use to describe the composition of woodland is the National Vegetation Classification (NVC). This note provides an introduction to the main variations in woodland composition and how they can be described using NVC.

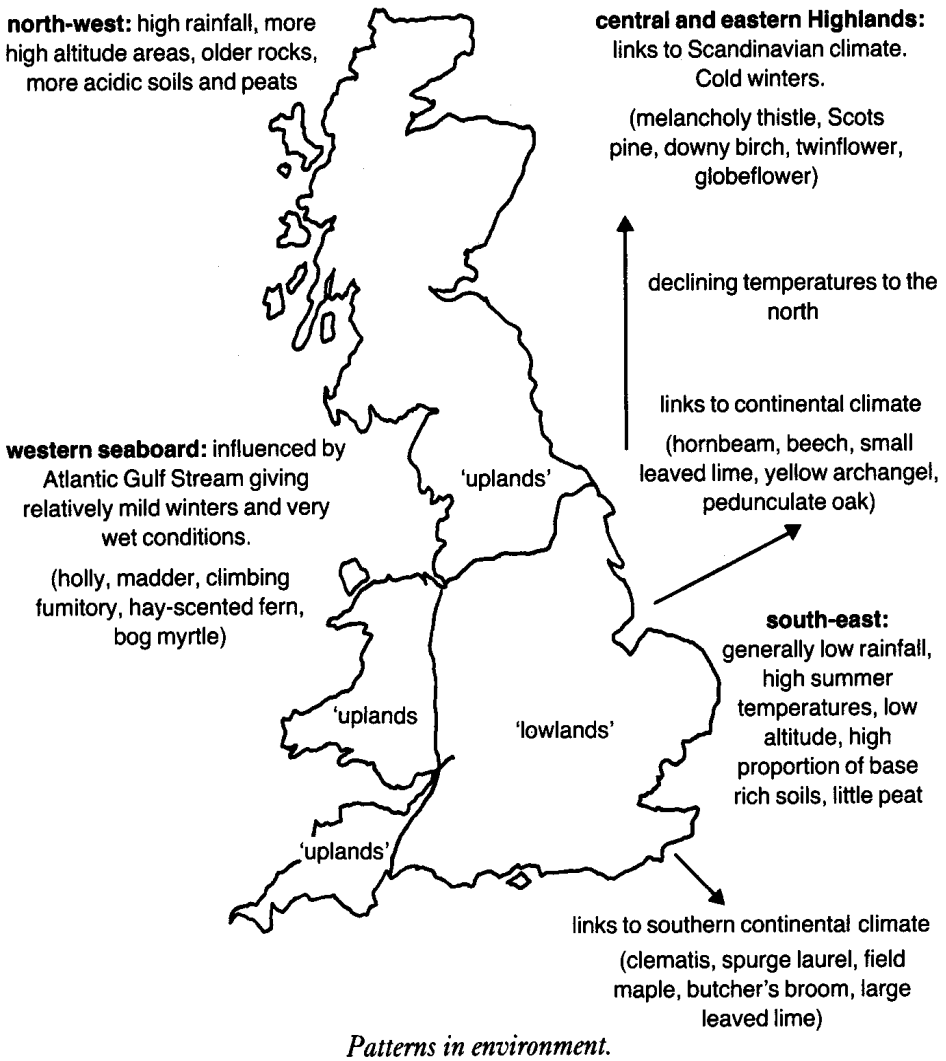
Sources of variation

The main factors that influence what sort of woods we find in a particular place are climate, soils, history and management. A combination of these factors leads to differences not only between our woods and those in France, Germany or Norway, but also what makes the woods in the south-east different to those in Norfolk or Sutherland. This note is primarily about the influence of the first two of these.

Climate

As Britain runs roughly north-south there is a strong latitudinal effect on the climate and there are a range of species whose distribution seems to reflect this temperature gradient. Amongst plants there are species such as field maple, herb Paris, hornbeam which show a strong southerly bias; while coming down from the north are a suite of species with strong links to Scandinavian or north-central Europe: globeflower, melancholy thistle, bird cherry, twin flower. In the case of small-leaved lime there is close link between its distribution and summer temperatures because these affect whether fertile seed will be set. There are also what appear to be temperature related trends in the distribution of various animal groups, but particularly invertebrates.

A second major factor is the effect of the Gulf Stream and the Atlantic Ocean, which gives us a much more even (and milder) climate than other countries of comparable latitude. This oceanicity is most pronounced on the west, but even in the east species occur (such as bluebell and ivy) which are uncommon on the Continent. There is also a pronounced west-east rainfall gradient, enhanced by the chance occurrence of most of the higher ground in the west - so the east is in something of a rain shadow. Much of East Anglia could be classed as semi-arid in terms of its annual rainfall, whereas the west coast has enough to support “temperate rainforest”. The most spectacular effect of our oceanic climate can be seen in the mosses, liverworts and ferns that thrive in western oakwoods. For example the hay scented fern has much of its world distribution down the west coast of Britain. Figure 1 illustrates some of the variations in conditions and affinities of our flora.



Patterns in environment.

Soils

Climate variations set up strong "north-south and east-west" gradients, but superimposed on this is the intricacies of British geology and soils. In East Anglia there are woods on sticky boulder clays where ash and maple thrive over dog's mercury or bramble; deep acid sands with birch and oak over bilberry and wavyhair grass, and woods on wet peats. It is in the uplands however that you can often see soil changes to best effect. In Roudsea Wood NNR in Cumbria you can go from shallow limestone to fenny pools to acid woodland all in a 15 minute walk.

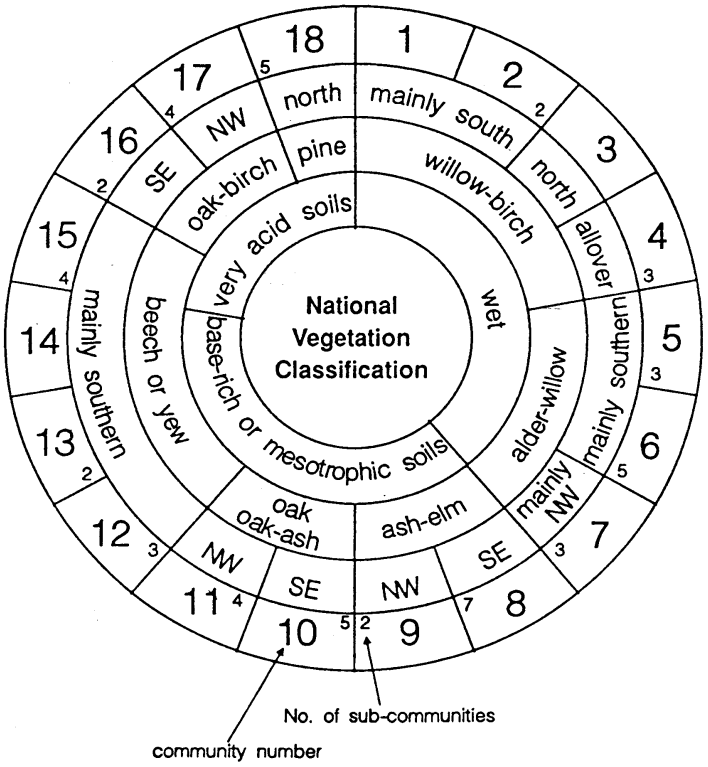
These two factors - climate and soils have stamped their mark so firmly on British woods that they are reflected in the patterns revealed by most attempts to classify British woods. The National Vegetation Classification similarly shows their influence.

Classification

Vegetation classifications are interesting scientific exercises, but they serve more practical ends. We need some way of grouping woods for the purposes of description, analysis of how they

work, and to help with deriving prescriptions for them. There is not one classification that is suitable for all situations. However National Vegetation Classification (NVC) is widely used to help identify which are the recurring patterns in woodland vegetation, which are more unusual; what species regularly occur together and where; how do woodland patterns relate to those in grassland or heathland; how do our woods relate to those on the continent.

The NVC project was started in 1975 by the Nature Conservancy Council http://jncc.defra.gov.uk/page-4259 . Nearly 2,800 samples from woodland across the country were collected (plus many others from other habitats) and these were clustered into 18 main woodland categories plus 7 types of scrub.



This provides a consistent framework for describing our woods. It is a *framework,* a set of points to which any new sample can be compared, not a set of pigeon holes into which the sample must fit unequivocably. Vegetation is a continuum; any stand will depart somewhat from the average as described by the NVC tables. The rest of this note illustrates some of the types, provide a simple key for identifying the main types; and then gives more detail on using NVC in surveys.

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2. An illustrated tour of British woodland types.

The pinewoods (W18)

Starting in the north the native pinewoods are separated out - these are perhaps the most distinctive of our woods forming the western end of the great Boreal forests that spread across northern Europe and Asia. Their openness is largely a consequence of the long history of grazing by cattle and more recently by deer.

Western oakwoods (W11,17)

Moving from the central and eastern highlands across to the west coast of Argyll and Lochaber oak replaces pine as the main tree in native woods. The similarity in the soils and the overriding effect of the high rainfall mean that there is much in common between these west Highland woods, those in Cumbria and North Wales and those on the north coast of Cornwall, in the Exmoor Coombes or fringes of Dartmoor.

In the Peterken Stand Type system these woods were separated into those where *Quercus robur* dominant and those where the main oak was *Q petraea*. Sessile oak is the more common but *Q robur* does sometime occur - for example in Wistman's Wood on Dartmoor, around Loch Lomond and at Loch a Mhuillin in Sutherland - one of the most northerly oak woods in Britain.

This oak species distinction is not made in NVC: rather the split is made on the nature of the ground flora: in the wettest conditions and on the thinnest, acid, soils bryophytes predominant (W17). On the rocks or tree bases there is an incredible variety of moss & liverwort species. Since these also occur in some of the cleanest air zones they are often rich in lichens even on relatively small trees; they are also particularly associated with wood warbler, pied flycatcher and redstart.

Where the soils are deeper grasses, bluebell and bramble become more common although there may be little change in the tree and shrub layer (i.e. still mainly oak and birch) (W11).

Upland mixed ash (W9)

A feature of western oakwoods are the patches of ash (sometimes also elm and sycamore and occasional relict limes) that occur along streamsides or at the base of slopes where the soils are richer (W9). In spring the stripes may be picked out quite easily by the grey bark of the ash contrasting with the olive green of the oak and reddish tinge to the birch.

Species such as dog's mercury, ramsons, wood avens come in, but the abundance of ferns, mosses and wood sorrel, as well as rowan in the shrub layer, help to distinguish these from similar woods on base-rich soils in the lowlands (W8, see later). In ungrazed stands flowers such as wood cranesbill, globe flower may occur: indeed the species found in northern hay-meadow community may have originated in these woods.

'Lowland' acid oak woods (W16)

Because of climatic differences woodland types in the south and east of the country differ from those on equivalent upland soils.

Thus on very acid soils in the south and east oak and birch still predominate (W16), but because of the warmer, and particular dryer conditions the moss carpet is virtually absent, or if present relatively species-poor. The ground flora may be more or less restricted to bracken, wavy hair grass, bilberry or heather. Such heathy soils are generally unproductive and often left as common grazing. Hence this type is not uncommon in wood-pastures such as at Sherwood Forest.

Lowland mesotrophic "oakwoods" (W10)

The deeper brown earths in the lowland are where the best displays of bluebells and anemones occur. Bramble and bracken may also be common. The type covers oak-hazel coppices and many stands with a variety of other trees such as lime, hornbeam and sweet chestnut. It is one of the commonest woodland types, and a similar ground flora occurs, in an impoverished form in a lot of plantations.

Lowland mixed ash woods (W8)

Another very common type are the lowland mixed deciduous woods with ash and dog's mercury, but also a wide range of other trees and shrubs - field maple spindle, dogwood, privet wayfaring tree. The Cambridgeshire boulder clay woods described by Oliver Rackham and the Lincolnshire woods studied by George Peterken include examples of this type. Canopy variants described in Stand Type terms as ash-maple, lime-ash, ash-hazel etc may need to be distinquished.

Beech and yew woods (W12-15)

Among the "dry ground" woods the NVC identified a beech-yew wood series - almost exclusively lowland although planted versions can be seen further north. These range from very acid stands (W15) - often old wood pastures (as at Burnham Beeches) - through beech bramble stands on brown earth soils (W14) to the beech and yew woods of shallow chalk and limestone soils (W12). Yew stands are classed as W13.

Beech dominated stands may be one of the more recent additions to our woodland cover. Although it is a native species, found in the pollen record from 9,000 years ago, its major expansion 3,000 - 4,000 years may have been associated with clearance of the former lime-dominated forest. The shade cast beechwoods lead to a distinctive if often rather poor flora - but this includes some fairly spectacular orchids, plant oddities like the yellow birds-nest and a good collection of fungi.

Wet Woods (W1-7)

Dry ground woodland now predominates because we have lost most of the great swamps and fens and the tall alluvial forests that would have occupied the valley bottoms.

However the wet woodland fragments left can be split into the willow carrs (W1-W3), alder woods on swamps (W5), along streamsides (W7) and the dryer scruffy transition stands (W6). On acid peat sites birch woods over *Sphagnum* and *Molinia* (W4) complete the tour.

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3. A modified English NVC key

Introduction

This is a simplified guide to the main NVC communities likely to be encountered in semi-natural woods. By itself it can never be 100% accurate. The result from the guide should be checked against descriptions or species tables.

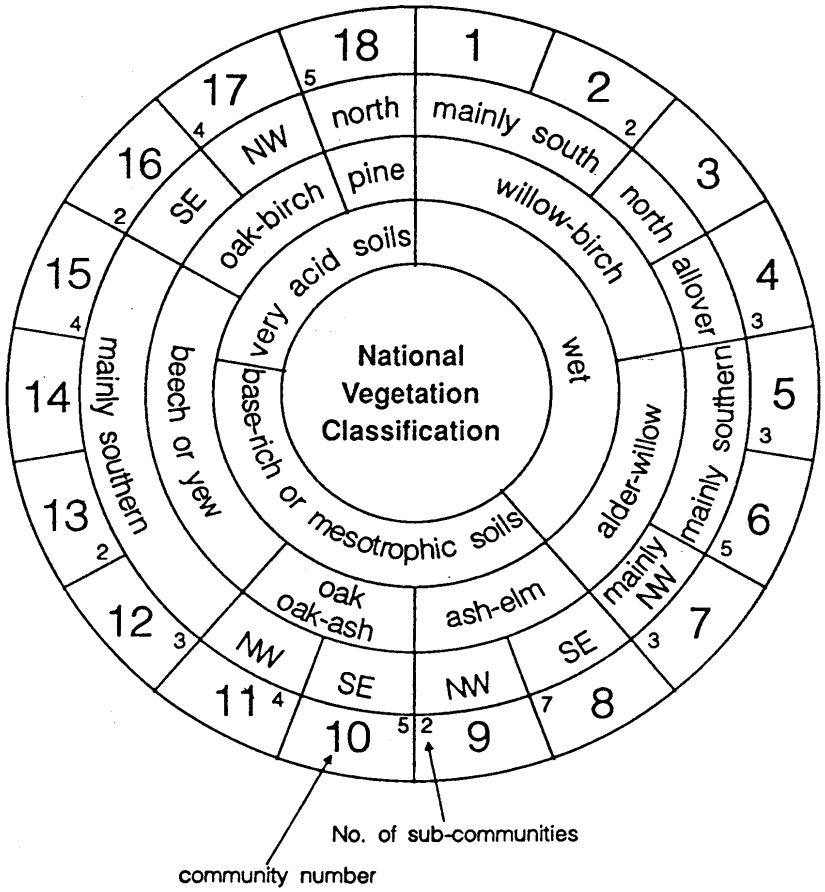
The key is arranged so that at each stage you are asked to make a choice between various alternatives. Follow the appropriate route until you reach a community "end point". These communities are the main divisions within the National Vegetation Classification. They can be further divided into sub-communities (although this is not done here).

Woodland vegetation does not divide up neatly into self-contained types, there are intermediates and transitions. Management may also affect the appearance of a stand and in recently cut areas the plants may have more in common with a meadow than with the vegetation under the adjacent canopy. Planted trees also complicate matters: you may have to ignore them for the purposes of using the key.

In making your decisions at different points in the key consider both the trees and shrubs and the ground flora. Sometimes one layer, sometimes the other will be most helpful. Don't just look at the most common species. Common species tend not to be very good at discriminating between types. Almost every stand you look at in lowland England contains oak and bramble, so they are only helpful in describing a type if other more-demanding or more-restricted species are absent. Hence in the key the more distinctive types tend to get picked out first.

Having worked through the key you will come up with a probable community type for the stand, but before you accept it check the description card to see that it seems reasonable. If it does not back track to see if you have gone wrong somewhere. Alternative pathways may need to be considered, particularly if the data are imperfect: eg important species such as wood anemone, *Anemone nemorosa*, may have been missed because the wood was recorded late in the year, or bryophytes may have been ignored because the surveyor could not identify them! The 'right' result is ultimately that which produces the best fit for a stand when judged against the summary tables.

Do not be off-put by the names given to the different communities. These are based on common species for the type, but these species do not necessarily occur in every single example of the type.



English names for the community types are used in the key, but here are the formal names.

W1 *Salix cinerea – Galium palustre* woodland
W2 *Salix cinerea – Betula pubescens – Phragmites australis* woodland
W3*Salix pentandra – Carex rostrata* woodland
W4 *Betula pubescens – Molinia caerulea* woodland
W5 *Alnus glutinosa – Carex paniculata* woodland
W6 *Alnus glutinosa – Urtica dioica* woodland
W7 *Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland
W8 *Fraxinus excelsior – Acer campestre – Mercurialis perennis* woodland
W9 *Fraxinus excelsior – Sorbus aucuparia – Mercurialis perennis* woodland
W10 *Quercus robur – Pteridium aquilinum – Rubus fruticosus* woodland
W11 *Quercus petraea – Betula pubescens – Oxalis acetosella* woodland
W12 *Fagus sylvatica – Mercurialis perennis* woodland
W13 *Taxus baccata* woodland
W14 *Fagus sylvatica – Rubus fruticosus* woodland
W15 *Fagus sylvatica – Deschampsia flexuosa* woodland
W16 *Quercus* spp. – *Betula* spp. – *Deschampsia flexuosa* woodland
W17 *Quercus petraea – Betula pubescens – Dicranum majus* woodland
W18 *Pinus sylvestris – Hylocomium splendens* woodland
W19 *Juniperus communis – Oxalis acetosella* woodland
W20 *Salix lapponum – Luzula sylvatica* scrub
W21 *Crataegus monogyna – Hedera helix* scrub
W22 *Prunus spinosa – Pteridium aquilinum* scrub
W23 *Ulex europaeus – Rubus fruticosus* agg. scrub

W24 *Rubus fruticosus* agg. – *Holcus lanatus* underscrub
W25 *Rubus fruticosus* agg. – *Pteridium aquilinum* underscrub

1. Is it a woodland or scrub community?

1a. Stand dominated by HAWTHORN often (but not necessarily) with BRAMBLE, some BLACKTHORNand DOGROSE. Saplings and young trees of canopy-forming species absent or very rare. Ivy is usually present among the ground flora sometimes with NETTLE and CLEAVERS. **W21 HAWTHORN-IVY scrub.**

1b. Stand dominated by BLACKTHORN, often with very little ground flora at all below, but BRAMBLE, NETTLES and CLEAVERS can be common. Saplings and young trees of canopy-forming species absent or rare.
W22 BLACKTHORN-BRAMBLE scrub.

1c. Stand dominated by JUNIPER with little or no overstorey on neutral-acid soils (i.e. not chalk juniper scrub). Ground flora usually includes BENT grasses, WOOD SORREL, WOOD-RUSH, TORMENTIL and HARD FERN. Mainly northern, on moorland fringes. **W19 JUNIPER-WOOD SORREL woodland.**

1d. Other trees and shrubs present although if the stand has been recently felled they may not be very abundant at present. Include WILLOW, HOLLY, BIRCH and HAZEL stands here as well as those with larger tree species. **GO TO 2**

2.* (from 1d) *Is it a "wet" or dry(-ish) woodland community?

2a. Woodland mainly COMMON SALLOW sometimes in mixture with BIRCH (usually DOWNY BIRCH), usually on wet or peaty soils; or BIRCH dominant on wet,peaty soils. Other trees and shrubs rare or absence. **GO TO 3**

2b. Woodland with ALDER and tall willows (such as CRACK WILLOW) common or OSIER BEDS; usually on wet soils, but includes fairly dry alder stands on the fringes of wetland where it grades into dryer ground. **GO TO 4**

2c. ALDER, SALLOWS and WILLOWS absent or present only as scattered individuals within woodland composed of other tree species (BEECH, YEW, OAK, ASH etc.); free-draining to poorly drained soils, but if the latter then usually mineral soils eg heavy clays, rather than organic ones. **GO TO 5**

Notes

BIRCH stands on dry sites such as the regrowth following felling of oak, or birch invasion of heathland should follow the "dry" route (2c above). GOAT WILLOW and COMMON SALLOW may also sometimes occur as patches on heavy clays in ash or oak woods. Usually these other species will be in the vicinity and again follow the `dry'route.

3. **(from 2a)** ***Dividing up the SALLOW/BIRCH wet woodland***

3a. COMMON SALLOW, BAY WILLOW mixtures with some DOWNY BIRCH; swampy field layer with BOTTLE SEDGE, BOGBEAN, WATER HORSETAIL, LADY'S SMOCK, MARSH BEDSTRAW, MARSH MARIGOLD, ANGELICA, MARSH VALERIAN, WATER AVENS, MARSH HAWK'S BEARD. Extensive moss in most stands.Wet, poor-fen counterpart of W5 (see later). Mainly in northern England and Wales. On moderately nutrient poor mires.

W3 BAY WILLOW-BOTTLE SEDGE woodland

3b. COMMON SALLOW (or EARED SALLOW in the north) usually with some DOWNY BIRCH. WATERMINT and MARSH BEDSTRAW are typical ground flora species, sometimes with a wide range of other herbs, sometimes more grassy, sometimes much bare ground or just a moss-mat (not SPHAGNUM). Usually found on wet mineral soils on the margins of standing or slow-moving water and in moist hollows, mainly in the lowlands. Often a narrow fringe around ponds, lakes, dune slacks etc. Canopy structure often irregular, with bushes of variable height.

W1 SALLOW-MARSH BEDSTAW woodland

3c. Usually both DOWNY BIRCH and COMMON SALLOW (or EARED SALLOW in the north) common in the tree/shrub layer. COMMON REED frequent and often abundant in the field layer, but the following species are usually absent or rare: TUSSOCK SEDGE, PURPLE LOOSESTRIFE, YELLOW LOOSESTRIFE. Tall sedges (LESSER POND SEDGE) - sometimes replace REED as the dominant ground flora species. There are two sub-communities. In one with a wide range of tall herbs and sedges COMMON ALDER may occur (cf W5, see later). In the other on more acid peats SPHAGNUM mosses are common, BIRCH more abundant and SALLOWS less frequent. The presence of REED and absence of PURPLE MOOR GRASS should help to separate this sub-community from W4 (see later).

W2 SALLOW-BIRCH-REED woodland

3d. DOWNY BIRCH abundant. COMMON SALLOW occasional. PURPLE MOOR GRASS usually abundant. *Sphagnum* mosses usually abundant. Acid conditions around nutrient-poor mires or raised bogs and in peaty hollows within woods. Although commoner in the north and west it does also occur quite frequently in the southeast and East Anglia and anywhere where there is some peat formation.

There are three sub-communities which cover the variation from drier to wetter stands. The driest stands may include some SILVER BIRCH, ROWAN, and OAK, over a field layer with BRAMBLE, BROAD BUCKLER-FERN and HONEYSUCKLE where *Sphagnum* species are rare. These are transitional to "dry" ground communities. The wettest stands have a field layer typical of wet heath or mire with dominant *Sphagnum* species. Intermediate stands have a grassy field layer with tussocks of rushes and sedges. This community typically lacks the tall herbs found in fens. **W4 DOWNY BIRCH - PURPLE MOOR-GRASS woodland**

4. (from 2b) ***Dividing up the alder and tall willow stands***

Alder, may occur scattered through what are essentially "dry ground" types (including poorly drained clays). If none of the following options fit, and alder and tall willows are only a minor part of the stand, consider one of the dryer alternatives. Note that often the alder community exists only as very narrow strip along a stream with most of the plot falling into another type.

4a. TUSSOCK SEDGE or WOOD CLUB-RUSH generally abundant in the field layer with some of the following: LESSER POND - SEDGE, MARSH THISTLE, BROAD BUCKLER FERN, HEMP AGRIMONY, MEADOW SWEET, MARSH BEDSTRAW, WATER MINT, BRAMBLE, COMMON VALERIAN. Usually on wet to water logged organic soils, quite nutrient-rich. Found mainly, but not exclusively in the lowlands. Often associated with fen peats and the transition to open water. Younger stands may have more SALLOW than ALDER. Large sedges are generally conspicuous, as well as tall herbs. REED may be present but is seldom as abundant as in W2. The three sub-communities vary in their herb-layer composition, but the combination of ALDER in the canopy and some TUSSOCK SEDGE is usually present. **W5 ALDER-TUSSOCK SEDGE woodland.**

4b. STINGING NETTLE abundant with two of CLEAVERS, ROUGH-STALKED MEADOW-GRASS, BRAMBLE, BROAD BUCKLER FERN Usually on fen peat with some nutrient accumulation or on rich alluvium. May contain other species of WILLOW. These are often rather "scruffy" stands on the border line between "dry ground" communities and real wetland ones. In some cases it is a sign of drying out of previously wetter woods, but natural examples do occur.
The drier stands may include DOWNY BIRCH, or some SYCAMORE, ASH or OAK sometimes with COMMON SALLOW or ELDER in the shrub layer. STINGING NETTLE and CLEAVERS and less abundant and the field layer may have more BRAMBLE, HONEYSUCKLE, BROAD BUCKLER-FERN or ENCHANTER'S NIGHTSHADE, WOOD AVENS and DOG'S MERCURY where there is local base enrichment. Wetter stands have more WILLOWS, with a field layer where STINGING NETTLE and CLEAVERS can be dense and luxuriant.
W6 ALDER-STINGING NETTLE woodland

4c. ALDER often not as abundant as in the previous types. ASH and/or SILVER BIRCH frequent with mixtures of COMMON SALLOW, HAZEL and HAWTHORN in the shrub layer. Ground flora includes MEADOW SWEET, YELLOW PIMPERNEL, LADY FERN, ROUGH-STALKED MEADOW-GRASS, CREEPING SOFT-GRASS, CREEPING BUTTERCUP and/or GOLDEN SAXIFRAGE. On base rich flushes with gleyed mineral soils. It is the commonest alder type in upland woods; it does occur in the lowlands but often in a rather fragmentary fashion along streams. 3 sub-communities occur, depending on the extent of waterlogging, the nature of the water supply and its movement. In one NETTLE can be abundant, in a second REMOTE SEDGE is usually common, whereas in the driest TUFTED HAIR GRASS predominates. In all cases there is usually a range of other herbs and grasses, with sedges, rushes, ferns. W7 (unlike W4) rarely has PURPLE MOOR GRASS and *Sphagnum* species. **W7 ALDER-ASH-YELLOW PIMPERNEL woodland**

5. (from 2c) Initial breakdown of dry-ground communities

5a. BEECH frequent and usually abundant in the canopy. (Moderate amounts of beech may cause problems, for example in regeneration gaps in otherwise beech-dominated canopies, where OAK or ASH may be more common in the gap; in oak woods in the south-west where beech is invading the stand; in old beech stands beyond the range of native beech, for example in northern England or Scotland. In small regeneration gaps consider the surrounding canopy and key through as appropriate; invading beech stands treat according to the abundance of the beech in terms of its contribution to the canopy; stands beyond the native range treat as if they were within the range).

GO TO 6

5b. YEW frequent and abundant in the canopy with virtually no large emergent trees forming an overstorey. (Some yew stands on the Downs may formerly have had a beech canopy, but where this has now been blown down and the yew forms the canopy, count as a yew stand). The shade of the yew is generally so dense that virtually nothing grows with it except in small gaps where DOG's MERCURY, NETTLE, IVY and FALSE WOOD-BROME may be found. Young ASH, WHITEBEAM, (in a few sites BOX), BEECH, ELDER may also occur. Commonest on moderate-steep limestone or chalk slopes with thin soils (more rarely on moderate acid rocks in the Lake District). Most common in south-east England.

W13 YEW woodland

5c. SCOT'S PINE frequent and abundant in the canopy over a heathy ground flora with some of HEATHER, BELL HEATHERS, BILBERRY, COWBERRY WAVY HAIR-GRASS. Mosses (including SPHAGNUM) may be abundant. Strictly speaking this applies only to native pine stands, so strictly speaking does not occur in England or Wales. See below for dealing with stands of trees outside their 'native range'. **W18 SCOT's PINE-MOSS woodland.**

5d. Woods not as above, commonly with OAK, BIRCH, ASH or ELM as the main species but also including stands of HORNBEAM, LIME, SWEET CHESTNUT, SYCAMORE etc., occurring a range of soil types from acid to base-rich, from sands to heavy clays. **GO TO 7**

Notes

Species outside their traditional range can present problems.

In general pine stands in southern England, such as on former heathland, are generally best assigned to W16 since their associated species tend to resemble this. However in Cumbria and parts of Northumberland there are pine stands on bogs and moor that are much closer to W18 in terms of their overall composition and should be classed as such, albeit they may lack some of the pinewood specialities in their flora. This is reflected in the NVC distribution map for W18 which includes some of this stands.

Yew groves in northern limestone woods are treated as W13.

See next page for dealing with beech stands out of range.

6. (from 5a) ***Dividing up the beech woods***

6a. Beech stands on base-rich, often thin soils, eg over chalk. The ground flora as always under beech may be sparse, but DOG'S MERCURY, WOOD FALSE-ROME, ENCHANTER'S NIGHTSHADE, LORDS & LADIES, SANICLE or other species suggesting base-rich conditions are likely to be present. Ivy is also often common. Associated trees and shrubs may include ASH, HAZEL, WHITEBEAM, YEW, HAWTHORN or SYCAMORE. Found on free-draining base-rich soils with a pH usually between 7 and 8. Largely in the south-east of Britain, often on the steep drift-free faces of chalk escarpments.

There are three sub-communities, one usually found on deeper moister soils, a second on very shallow dry chalk or limestone soils; the third is characterised by a dense yew understorey and is closely related to W13 (YEW woodland).

W12 BEECH-DOG'S MERCURY woodland

6b. Beech stands on very acid "heathy" sites usually with some WAVY HAIR-GRASS, BILBERRY or HEATHER present at least near or under gaps. BRACKEN, BENT grasses and WOODRUSHES also often common. HOLLY, OAKS and BIRCHES are the commonest associated trees and shrubs. Found on very base-poor acid soils mainly in southern England but long-established plantations in the north have many of the same characteristics. Some stands were formerly treated as wood-pasture and contain large old pollards.

The four sub-communities largely reflect trends in the level of light below the canopy from virtually no ground flora in the densest shade to HEATHER under stands with a discontinuous canopy cover. **W15 BEECH-WAVY HAIR-GRASS woodland.**

6c. Beech stands often with a HOLLY understorey, and a ground flora showing neither indicators of very base-rich or of very acidic conditions. Frequently BRAMBLE or BRACKEN are common (depending on light) levels, but other species such as IVY, WOOD-MELICK, WOOD-MILLET, BUTCHER'S BROOM or TUFTED HAIR-GRASS are also frequent. Generally found on moderately acid brown earth soils, often superficial deposits (eg clay-with-flints) over the southern chalk. Mainly in southern England but long-established plantations in the north and in the south-west may have these characteristics. **W14 BEECH-BRAMBLE woodland.**

Notes

The native range for beech has generally been taken as from about the Wash to the Severn, but long-established stands do occur further north than this and there is evidence that it has previously occurred naturally further north. Hence such stands are best classed in the appropriate beech type. Stands of oak or ash types where beech has only recently invaded present more of a challenge. If the beech is still only in the understorey treat them as the relevant oak/ash type, but where the beech has established itself as a significant component of the canopy and is consequently starting to affect the cover of the ground flora through its shade, then it makes more sense to class them as a beech stand.

7. (from 5d) ***Splitting up oak and mixed deciduous woods***

7a. Woods on very acidic soils usually with OAK or BIRCH as dominants (sometimes self-sown PINE on lowland heaths and bogs), HOLLY and ROWAN are common understorey species, but often there is little shrub layer at all. Either BILBERRY, WAVY HAIR-GRASS or HEATHER present but with few other species, often with some BRACKEN, or extensive moss carpets. **GO TO 8**

7b. Woods on base-rich soils. ASH, usually present, often abundant, but a range of other species including ELM, LIME, SYCAMORE, or OAK (less often SWEET CHESTNUT, HORNBEAM) may be present. HAZEL is usually common in the understorey and in the south east is often joined by FIELD MAPLE, PRIVET, DOGWOOD, SPINDLE, WAYFARING TREE. Ground flora includes at least some species characteristic of base-rich conditions such as DOG's MERCURY, WOOD FALSE-BROME, ENCHANTER's NIGHTSHADE, NETTLE, HERB ROBERT, CLEAVERS, RAMSONS, ROUGH-STALKED MEADOW GRASS or GROUND IVY. **GO TO 9**

7c. Woods on moderately acid soils, often brown earths. OAK and BIRCH tend to dominate, but locally SWEET CHESTNUT, LIME and HORNBEAM may occur (also plantations of a variety of species) HAZEL and HAWTHORN are the commonest shrub species where an understorey is present. The ground flora usually has abundant BRAMBLE, BRACKEN, HONEYSUCKLE or BLUEBELL or is dominated by grasses (SOFT GRASSES, BENTS, WAVY HAIR-GRASS, SWEET VERNAL-GRASS). Species characteristic of base-rich conditions (see 7b) are absent (or very scarce). **GO TO 10**

Notes

The ground flora is generally the critical to making this decision since many of the trees and shrubs may occur across two or even three of the types, eg oak and hazel. So does the ground flora contain species suggesting very acidic conditions (question 7a, pointing towards types W16 or W17), or quite base-rich conditions (question 7b, pointing towards types W8 or W9). If there is little evidence of either then go for option 7c (pointing towards types W10, W110.

8. (from 7a) ***Dividing up acid oak-birch woods***

8a. OAKS or BIRCHES usually predominant (locally some pine on former heath and bog). Understorey may not be well-developed but HOLLY, ROWAN or HAWTHORN are the most likely species to occur. Ground flora species poor often BRACKEN dominated, but usually with WAVY HAIR-GRASS or BILBERRY and lacking species such as BLUEBELL, and others in the next group (see part 9 of the key). Mosses and liverworts may be common but with generally relatively few species and lacking "Atlantic" indicators (see 8b). This is found on very acidic, often sandy very free draining, soils in the lowlands and upland fringes. Some long-established stands are former coppice or wood-pasture, but it is also typical of stands developed on lowland heath. There are two sub-communities, one where BRACKEN and WAVY HAIR-GRASS predominate; in the second BILBERRY is more abundant. **W16 OAK-WAVY HAIR-GRASS woodland**

8b. OAKS and BIRCHES predominate. The type is characterised by extensive and very diverse moss and liverwort cover on the ground, over rocks, tree bases etc. (In ungrazed stands the abundance may be reduced but the diversity remains). Key species are *Dicranum majus, D. scoparium, Hylocomium splendens, Plagiothecium undulatum, Pleurozium scheberi, Polytrichum formosum, Rhytidiadelphus loreus, Thuidium tamariscinum,* four or more of which are likely to be present. BILBERRY, BRACKEN, WOOD SORRELL, WAVY HAIR-GRASS and HARD FERN are the most commonly occurring ground flora species.

There are 4 sub-communities partly reflecting variations from "Atlantic" to more "Continental" conditions; there is also a grassy version related to W11 (see below). Found on very acid soils, often shallow, rocky, mainly in the cooler, wet north-west of Britain. W17 may possibly occur in fragmentary form in the gill woods in the south-east but otherwise is absent from the lowlands where W16 replaces it. W16 does however spread into the uplands, particularly in south-west England, south Wales, Yorkshire and Northumberland. **W17 OAK-BIRCH-MOSS woodland**

Notes

The main difference between these types is in the richness and abundance of the moss and liverwort communities found in W17 (to a lesser extent W11) which are characteristic of oak woodland down the western/upland part of Britain (and also Ireland). In the dryer conditions of eastern Britain these are much reduced or non-existent and the acidic oak-birch woods fall into W16.

9. (from 7b) ***Dividing up base-rich woodland***

9a. ASH/OAK sometimes with occasional LIME, HORNBEAM, ELM. The understorey tends to have with FIELD MAPLE, DOGWOOD or SPINDLE, PRIVET or WAYFARING TREE. Ground flora often dominated by DOG's MERCURY, WOOD ANEMONE, TUFTED HAIR-GRASS, IVY RAMSONS and/or BLUEBELL. Other base-rich indicators may be common for example WOOD FALSE-BROME, ENCHANTER's NIGHTSHADE, LORDS & LADIES, NETTLES, CLEAVERS, GROUND IVY. 7 sub-communities, of which 3 or 4 occur in the NW of the overall range of the community. These sub-communities are more likely to have SYCAMORE, WYCH ELM and SESSILE OAK abundant, PEDUNCULATE OAK is rarer and the stands occur on light, well-drained but moist soils. On the moistest sites, RAMSONS is most distinctive, in a generally species-poor field layer with STINGING NETTLE and CLEAVERS, while the drier sub-communities have species-rich, floristically dissimilar field layers. The other sub-communities are commoner on heavy soils particularly in the south and east and may be very variable in their tree and shrub cover (although ASH is nearly always frequent). Calcareous mull soils, generally in warmer low rainfall areas.

W8 ASH-FIELD MAPLE-DOG'S MERCURY woodland

9b. ASH and ELM woods, found mainly in the uplands/upland fringe; ROWAN usually present but shrubs such as FIELD MAPLE, DOGWOOD, SPINDLE, PRIVET etc. absent or very rare. WOOD SORREL more frequent than in W8 above, LORDS & LADIES less so. The field layer species tend to form complex mosaics on irregular topography. DOG's MERCURY and BLUEBELL are sometimes dominant, ENCHANTER's NIGHTSHADE, WOOD AVENS, HERB ROBERT and SLENDER FALSE-BROME frequent. Ferns are very prominent and grasses may be frequent though not dominant.

The community occurs on permanently moist brown soils derived from calcareous bedrock and superficial deposits in the sub-montane climate of north and west Britain. **W9 ASH-ROWAN-DOG's MERCURY woodland**

Notes

Dividing up these two types is particularly difficult in the borders and upland fringes. The shrub species are often the best guide.

The main ground flora species tend to be common to the two types, but wild garlic/ramsons-dominated stands generally go into W8f, ivy-dominated ones with few other species W8d. Wood false-brome *Brachypodium sylvaticum* in the NVC tables is particularly characteristic of W8g – the type commonly found on the limestones of the Peak District and Welsh borders. However since the publication of the NVC this species has become much more abundant in lowland clay woods (more typically classed as W8a-c) as a consequence of deer grazing. In extreme cases even dog's mercury has been much reduced in cover.

10. (from 7c) ***Dividing up woods on mesotrophic soils***

10a. OAK/BIRCH, sometimes with small amounts of CHESTNUT, LIME, HORNBEAM. BEECH, ASH or SYCAMORE occur only rarely. HAZEL and HAWTHORN common in understorey. Ground flora of BRAMBLE, BRACKEN, HONEYSUCKLE with WOOD ANEMONE or BLUEBELL sometimes dominant, but lacking species typical of either very base rich or acidic conditions.
Found mainly on base-poor brown earths in the lowlands of Britain. In the upland fringes ASH and SYCAMORE may occur (they are usually absent) over stands with CREEPING SOFT GRASS, FERNS and WOOD SORREL (closely related to W11 below).
There are 5 sub-communities characterised by relative abundance of IVY, WOOD ANEMONE, FERNS or YORKSHIRE FOG along with the general ground flora species of the type. **W10 OAK-BRACKEN-BRAMBLE woodland**

10b. BIRCH and OAK stands often with HAZEL and ROWAN. BRACKEN and BRAMBLE do occur (cf W10) but also with several of the following WOOD SORREL, SWEET VERNAL-GRASS, WAVY HAIR-GRASS, CREEPING SOFT-GRASS BENT grasses, TORMENTIL, HEATH BEDSTRAW. Mosses are more abundant than in W10, and include some of the species also found in W17.

There are four sub-communities covering Atlantic to more Continental conditions, but all tend to have a very grassy appearance. The type occurs on free-draining moderately acid, base-poor brown earths in the cooler wetter parts of Britain, mainly the uplands and upland fringes. **W11 OAK-BIRCH-WOOD SORREL woodland**

Notes

Most sweet chestnut, lime and hornbeam stands tend towards W10, but some lime and hornbeam stands (less often chestnut) occur on richer soils, in which case W8 is likely to be the more appropriate type.
Bramble amounts in lowland woods (W10) have often decreased dramatically since the NVC was compiled because of increases in deer pressure.
By contrast some reduction in sheep numbers in the uplands and increased fencing of woods can lead to W11 type woods developing a bramble layer. The other species typical of the type may still be present but much reduced in abundance.

Top of document

4. Understanding the NVC woodland section

These notes introduce the NVC woodland section and particularly the tables that are at the heart of the classification.

Why classify?

Classification is something we do all the time whenever we say that something is more like this (here) than like that (there). Classification systems group together like entities whether the units (entities) used are whole woods, bits of woods or quadrat records. They can be used in subsequent site description, to help identify relationships between vegetation and environment/history, and in the prediction of the effects of particular treatments (by knowing what happens on similar areas elsewhere).

Woods or bits of woods may be classified in a variety of ways: by structure (coppice, high forest, wood-pasture); by geology and soils (limestone woods, clay woods, woods on acid sands); by their history (ancient, recent); and by their vegetation (oakwoods, ashwoods, hornbeam woods). Essentially the variety of woodland is being codified to make it easier for someone else to understand and picture the area being referred to.

Often the variations in the vegetation are the main concern and hence the development of vegetation classifications such as NVC. However, things other than variations in plant composition are also important in nature conservation terms. Two woods may be of the same vegetation type, but if one is regularly coppiced and the other is high forest their bird life will be different; ancient and recent examples of the same type may differ in the frequency with which a species such as the oxlip occurs within them; a patch of "acid vegetation" in limestone country is of far greater significance than a similar patch of exactly the same community in areas where the geology is predominantly acid. The NVC provides us with a powerful vegetation classification, but often other cross-cutting classifications are also needed.

Development of the National Vegetation Classification

The National Vegetation Classification project was set up by the Nature Conservancy Council in 1975 to provide a classification of the majority of vegetation types in Britain using a "phytosociological" approach comparable to that which had long been practised and found useful on the Continent. The work was overseen by Professor Donald Pigott (Lancaster University), Dr Michael Proctor (Exeter University) and Dr John Birks (Cambridge University) and was coordinated throughout by Dr John Rodwell (Lancaster University). Volume I (woodlands) came out early in 1991, other volumes appeared over the next few years.

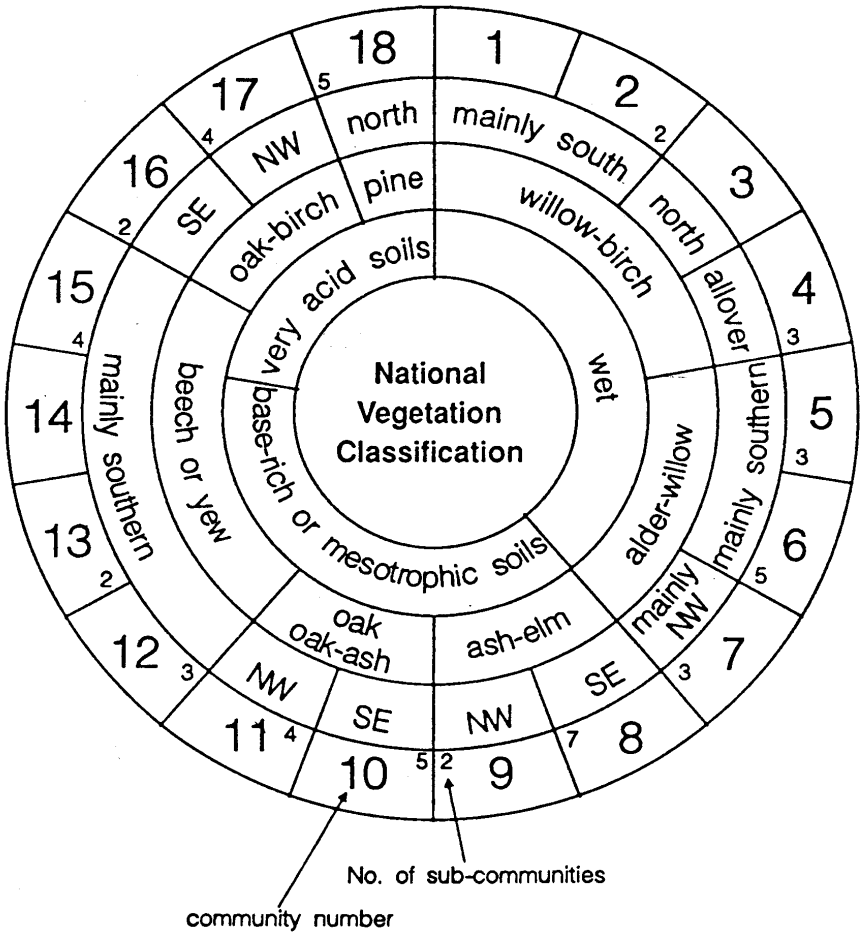
The “phytosociological” approach means simply that the types were defined purely on their plant composition. Soil conditions and past treatment etc were recorded but were not used in the classification, although they are used in interpreting the differences between types.

The woodland part of the classification is based on 2,800 samples (some from previous surveys, most new records), making it the biggest woodland data set yet analysed. Each sample was from a “homogenous stand”. A homogenous stand was defined simply as an area of woodland vegetation that looked reasonably uniform. No special test of uniformity was applied - if it looked uniform, it could be sampled. (In practice most people find no difficulty in identifying “homogenous stands” in the field).

Most samples consisted of a 50 x 50m record for the tree and shrub layer (a species list plus Domin scores) and a ground flora record of 4 x 4m (or 10 x 10m) depending on the type of vegetation. If the vegetation was rich and dense then the smaller size would be used; if sparse or species poor (eg solid bracken) then the larger size would be more appropriate. If the stand was too small or an odd shape, eg along a stream, such that a square quadrat would not fit then the quadrat shape was altered accordingly. Within the quadrat all vascular plants, bryophytes and larger lichens were identified and given a Domin rating. (For the purposes of identification of NVC types it is mainly the larger bryophytes that people need to try to learn (about 30 species, see section 9).

The data from the samples were then sorted, partly by computer and partly by hand, so that similar vegetation samples were brought together. This is the classification which consists of 18 main woodland communities and 7 ‘scrub’ communities.

Broad structure of the classification (dartboard)



The numbers round the outside are the 18 communities, most of which have been further divided into sub-communities, but this sub-division is not dealt with further. The communities are *defined* by their plant composition, but they can be grouped subsequently roughly according to their soil type, most common canopy species, and general geographic distribution. The geographic split reflects the broad division into upland and lowland Britain, the north-west/south-east climatic trend from strongly Atlantic to more Continental conditions. However that these are only general trends. "North-west" types may turn up in the south east and *vice-versa*.

The first major division is between types W1 to W7 (types tending to occur on wet soils) and the rest (W8-18), which are "dry" soil types (or sometimes poorly-drained clay). Within types W8-8, W15 to W18 on very acid soils are separated from W8-W14 on mesotrophic and base-rich soils. A further division might be made between W8, W9, W12 and W13, which are the most base-rich types, while W10, W11 and W14 are on the more mesotrophic soils.

Within the wet soil group (W1-7) W1-3 are most commonly willow or willow-birch, W4 has usually a birch canopy, while W5-7 are usually alder-willow woods. W1 and W2 are mainly

southern while W3 has a more northerly distribution. W5 and W6 are again more southerly while W7 is found more in the north and west.

On the dry woodland side the native pinewoods (W18) are entirely northern and on acid soils, and the yew woods on base-rich soils (W13) in the south might be contrasted. The beech woods W12, 14, 15, forming a series from base-rich to acid soils, are again a largely southern group, although long-established beech plantations in the north and west may have comparable vegetation.

This leaves the three pairs of oak/mixed deciduous woodland types (W8/9, W10/11, W16/17) covering the base-rich to acid soil spectrum, each of which has a broadly south-east (W8, W10, W16) and broadly north-west (W9, W11, W17) member. The ranges do overlap and the dividing zone is not the same in every case, but reflects the varying effects of a climatic trend on the different species making up each type.

Lime and hornbeam woods are part of the broad oak/mixed deciduous types in this classification. They are not separately listed.

The NVC species tables

The 2,800 samples were grouped according to the similarity of their plant lists to form the 18 woodland and 7 scrub communities; the NVC tables summarise the *composition of the samples* that were grouped to produce a particular community. The tables are the heart of the classification. Keys (paper or computer) and the descriptions will given an indication as where samples fit but the ultimate test is how well your sample or stand compares to what is in the tables.

Consider first the table for Wl (overleaf). Each table has a Community number and name. The name is a convenient label - it does <u>not</u> define the type so it is possible for one of these named species to be absent, particularly in some of the bigger communities. At the bottom of the table are details of the number of samples involved (38 in this case) and percentage cover details.

The tables list species followed by a Roman numeral and then Arabic numbers in brackets. Species names follow Flora Europaea. The Roman numeral gives the <u>frequency</u> (often called constancy) with which the species occurred within the (in this case) 38 samples that contributed to W1. The scale is:

V	=	present in 81-100% of samples
IV	=	present in 61-80% of samples
III	=	present in 41-60% of samples
II	=	present in 21-40% of samples
I	=	present in 1-20% of samples

Species present in 5 % or less of samples have been omitted from the tables to save space.

Floristic table W1

Salix cinerea	V (4–10)
Betula pubescens	II (3–7)
Quercus robur	I (4–5)
Betula pendula	I (4–7)
Crataegus monogyna	I (1–5)
Alnus glutinosa	I (4)
Frangula alnus	I (4–8)
Corylus avellana	I (3–5)
Salix viminalis	I (6)
Salix purpurea	I (5)
Betula pubescens sapling	I (2–4)
Quercus robur sapling	I (1–3)
Alnus glutinosa sapling	I (3–9)
Galium palustre	IV (1–4)
Juncus effusus	III (1–6)
Mentha aquatica	III (1–6)
Holcus lanatus	II (3–6)
Eurhynchium praelongum	II (1–6)
Angelica sylvestris	II (2–5)
Rubus fruticosus agg.	II (1–6)
Ranunculus flammula	II (1–6)
Solanum dulcamara	II (1–7)
Lycopus europaeus	II (1–6)
Ranunculus repens	II (1–6)
Equisetum fluviatile	II (1–4)
Hedera helix	II (1–6)
Epilobium palustre	II (2–4)
Agrostis canina canina	I (3–7)
Filipendula ulmaria	I (1–8)
Cirsium palustre	I (3–4)
Agrostis stolonifera	I (1–7)
Rumex sanguineus	I (1–4)
Hydrocotyle vulgaris	I (3–4)
Potentilla palustris	I (1–5)
Chiloscyphus polyanthos	I (1–4)
Caltha palustris	I (4–8)
Phragmites australis	I (2–4)
Molinia caerulea	I (4–8)
Iris pseudacorus	I (1–4)
Dryopteris carthusiana	I (4–6)
Rumex acetosa	I (1–4)
Cardamine flexuosa	I (1–3)
Lotus uliginosus	I (3–4)
Carex remota	I (1–5)
Rhytidiadelphus squarrosus	I (1–3)
Calliergon cuspidatum	I (1–4)
Carex paniculata	I (1–8)
Brachythecium rutabulum	I (3–5)
Lychnis flos-cuculi	I (4–5)
Lonicera periclymenum	I (2–4)
Juncus acutiflorus	I (3–8)
Plagiomnium undulatum	I (1–4)
Thuidium tamariscinum	I (1–5)
Lophocolea bidentata s.l.	I (2–4)
Callitriche stagnalis	I (2–6)
Equisetum palustre	I (2–5)
Calliergon cordifolium	I (3–4)
Galium uliginosum	I (3–5)
Valeriana officinalis	I (3)
Agrostis capillaris	I (2–4)
Dactylis glomerata	I (3–4)
Myosotis scorpioides	I (2–3)
Carex riparia	I (1–8)
Phalaris arundinacea	I (5–6)
Lemna minor	I (3–4)
Apium nodiflorum	I (4–5)
Glyceria fluitans	I (1–4)
Galium aparine	I (2–3)
Carex nigra	I (2–4)
Number of samples	38
Number of species/sample	17 (3–32)
Tree/shrub height (m)	6 (1–15)
Tree/shrub cover (%)	82 (40–100)
Herb height (cm)	56 (5–200)
Herb cover (%)	82 (10–100)
Ground height (mm)	18 (10–30)
Ground cover (%)	24 (0–100)
Altitude (m)	102 (1–390)

Extract from Rodwell (1991)

Species recorded in classes IV and V are described as "constant". In this community, there are only 2 constants *Salix cinera* (V) and *Galium palustre* (IV), but in other communities there may be more.

The Arabic figures in brackets after the frequency figure are the range of Domin cover values for that species in the samples in which it was present. The Domin scores range from 1, just

one or two plants, to 10, 91-100% cover of the quadrat. The frequency values (Roman numerals) are however generally the more important in using the classification.

Domin scores (1-10)

1,2,3 species rare, occasional or frequent species, but less then 4% cover

	% cover
4	4-10
5	11-25
6	26-33
7	34-50
8	51-75
9	76-90
10	91-100

The species are first broken down by vegetation layers. Species recorded from the canopy *(Salix cinerea* to *Salix purpurea),* then species recorded in the understorey including any saplings, coppice shoots etc *(Betula pubescens* to *Alnus glutinosa);* then the ground flora (including bryophytes and lichens). For one or two communities eg W3 no division was made between canopy and understorey and in practice the layer in which a species is most abundant is very affected by past management.

Within each group of species the order is determined by the frequency rating, widespread species first, then in decreasing order. The actual percentage frequency was used to order species within the same class, which is why *Quercus robur* precedes *Betula pendula,* although this is not apparent. Constant species (only *Galium palustre* in this instance) are usually separated out from the rest *(Juncus effusus, Mentha aquatica* etc)..

Species tables when there are sub-communities

The principles for grouping species are the same for all subsequent tables but with some additional complications introduced by the presence of sub-communities. The table for W2 (overleaf) thus has three columns and each species has three entries, one for sub-community (a), one for sub-community (b) and for the community as a whole (final column, headed 2). The names of the sub-communities are at the bottom of the table!

The species are still grouped into canopy, understorey and ground flora, but there are further sub-groups within each layer which pick out the species that help you differentiate between the sub-communities.

Taking the groups in order for the table for W2 (below):

- *Betula pubescens* - *Salix aurita* are canopy species found more-or-less equally in both sub-communities.
- *Alnus glutinosa* - *Rhamnus catharticus* are again "canopy" species (some are shrubs!) but were more common in samples for (a) than (b).
- *Alnus glutinosa* sapling - *Fraxinus excelsior* sapling are understorey species found in both sub-communities (not differential).
- *Betula pendula* in the understorey is a weak differential for sub-community (b).
- *Phragmites australis is* a constant for the community in the ground flora.
- *Filipendula ulmaria, Brachthecium rutabulum* etc differential ground flora for (a).

Floristic table W2

	a	b	2
Betula pubescens	III (3–8)	V (6–9)	IV (3–9)
Salix cinerea	III (3–9)	IV (2–6)	IV (2–9)
Frangula alnus	I (1–9)	II (4–6)	I (1–9)
Quercus robur	I (6)	I (1)	I (1–6)
Salix aurita	I (4)	I (3)	I (3–4)
Alnus glutinosa	III (4–10)	I (1–4)	II (1–10)
Fraxinus excelsior	II (3–6)	I (1)	I (1–6)
Crataegus monogyna	II (2–5)	I (1–2)	I (1–5)
Viburnum opulus	II (1–6)		I (1–6)
Salix fragilis	I (5–8)		I (5–8)
Rhamnus catharticus	I (3–5)		I (3–5)
Alnus glutinosa sapling	I (3–4)	I (5)	I (3–5)
Fraxinus excelsior sapling	I (1–5)	I (1–7)	I (1–7)
Betula pendula sapling		II (4–6)	I (4–6)
Phragmites australis	V (2–9)	IV (2–8)	IV (2–9)
Filipendula ulmaria	IV (1–7)	II (3–4)	III (1–7)
Brachythecium rutabulum	IV (2–7)	II (2)	III (2–7)
Urtica dioica	III (2–7)	I (1)	II (1–7)
Eupatorium cannabinum	III (3–6)	I (1–3)	II (1–6)
Plagiomnium undulatum	II (2–5)	I (2)	I (2–5)
Galium palustre	II (1–4)	I (1–3)	I (1–4)
Cirsium palustre	II (1–4)	I (2)	I (1–4)
Carex acutiformis	II (2–9)		I (2–9)
Epilobium hirsutum	II (1–4)		I (1–4)
Galium aparine	II (2–5)		I (2–5)
Angelica sylvestris	II (1–4)		I (1–4)

Extract from Rodwell (1991).

Further down the table other groups occur.

- *Sphagnum squarrosum - Menyanthes trifoliata,* differential ground flora for sub-community (b).

Sphagnum squarrosum	I (4)	V (2–7)	III (2–7)
Sphagnum fimbriatum	I (5)	V (4–7)	III (4–7)
Sphagnum recurvum	I (3)	IV (2–6)	III (2–6)
Sphagnum palustre		IV (3–8)	III (3–8)
Lonicera periclymenum	I (3–5)	III (1–6)	II (1–6)
Mnium hornum	I (1–3)	III (1–3)	II (1–3)
Plagiothecium denticulatum	I (1)	III (1–3)	II (1–3)
Holcus lanatus	I (1–5)	III (2–5)	II (1–5)
Juncus effusus	I (2–3)	III (2–5)	II (2–5)
Dryopteris carthusiana	I (3–4)	II (1–3)	I (1–4)
Hydrocotyle vulgaris	I (4)	II (3–4)	I (3–4)
Molinia caerulea	I (5)	II (2–6)	I (2–6)
Potentilla erecta	I (3)	II (2–4)	I (2–4)
Calypogeia fissa	I (2–3)	II (1–2)	I (1–3)
Myrica gale		II (5)	I (5)
Dryopteris cristata		II (1–3)	I (1–3)
Aulacomnium palustre		II (2)	I (2)
Rhizomnium pseudopunctatum		II (2–3)	I (2–3)
Agrostis canina canina		II (3–7)	I (3–7)
Agrostis stolonifera		II (1–4)	I (1–4)
Carex vesicaria		I (4–6)	I (4–6)
Calliergon giganteum		I (3–7)	I (3–7)
Deschampsia flexuosa		I (4)	I (4)
Sphagnum subnitens		I (1–4)	I (1–4)
Thelypteris phegopteris		I (3–8)	I (3–8)
Carex nigra		I (2)	I (2)
Thelypteris limbosperma		I (3–4)	I (3–4)

Extract from Rodwell (1991)

- *Eurhynchium praelongum* etc, ground flora common to both sub-communities.

Eurhynchium praelongum	III (2–6)	III (2–5)	III (2–6)
Dryopteris dilatata	II (1–4)	II (2)	II (1–4)
Poa trivialis	II (2–7)	II (3–4)	II (2–7)
Rubus fruticosus agg.	II (2–8)	II (2–4)	II (2–8)
Thelypteris palustris	II (4–5)	II (1–5)	II (1–5)
Ajuga reptans	I (3–4)	II (2–4)	I (2–4)
Lotus uliginosus	I (3–4)	II (3)	I (3–4)
Rosa canina agg.	I (2–4)	II (2–4)	I (2–4)
Athyrium filix-femina	I (1–4)	I (2–4)	I (1–4)
Berula erecta	I (4)	I (3)	I (3–4)
Carex paniculata	I (3–7)	I (1)	I (1–7)
Carex remota	I (1–3)	I (1–3)	I (1–3)
Cladium mariscus	I (2–4)	I (1–3)	I (1–4)
Equisetum palustre	I (1–4)	I (2–3)	I (1–4)
Peucedanum palustre	I (3)	I (1–3)	I (1–3)
Lythrum salicaria	I (3–4)	I (1–3)	I (1–4)
Lysimachia vulgaris	I (2)	I (1–3)	I (1–3)
Juncus subnodulosus	I (4)	I (1–3)	I (1–4)

Extract from Rodwell (1991)

The biggest community is W8 with 7 sub-communities and hence the most complicated table. The eight columns are for the seven sub-communities a-g and for the community as a whole (right hand column, headed 8). Sub-communities' names are again at the bottom of the table.

Taking the groups in turn:

- *Fraxinus excelsior* to *Alnus glutinosa,* canopy species found across all sub-communities.
- *Quercus robur* to *Sorbus torminalis,* canopy species found more often in (a) to (d).
- *Acer pseudoplatanus* to *Tilia platyphyllos,* canopy species found more often in (e)-(g).

These last two groups reflect a broad split within W8 between (a) to (c) which is very much lowland south-east, and (e) to (g) which is more on the upland/lowland border, with sub-community (d) tending to occur in both geographic areas.

- *Corylus avellana* to *Taxus baccata* saplings, understorey species found across all subcommunities.
- *Crataegus laevigata* to *Ulmus spp.* suckers, differential understorey species for (a-d).
- *Acer pseudoplatanus* sapling to *Prunus padus,* differential understorey species for (e-g).

Floristic table W8 *(cont.)*

	a	b	c	d	e	f	g	8
Acer campestre	II (1–6)	I (3)	III (2–5)	III (1–7)	III (1–6)	II (2–4)	III (1–5)	III (1–7)
Fraxinus excelsior sapling	II (1–8)	II (1–3)	IV (2–6)	II (2–6)	III (1–5)	I (3)	III (1–5)	III (1–8)
Sambucus nigra	I (1–5)	II (1–7)		II (1–7)	III (1–6)	II (1–5)	II (1–6)	II (1–7)
Cornus sanguinea	II (2–8)	I (3)	II (2–4)	I (2–4)	I (2–3)	I (3)	III (1–6)	II (1–8)
Prunus spinosa	I (1–8)	I (1–4)	II (2–5)	I (2–5)	I (1–6)	I (1)	I (2–3)	I (1–8)
Euonymus europaeus	I (2–3)		I (2)	I (1–5)	I (1–5)	I (3)	I (1–3)	I (1–5)
Fagus sylvatica sapling	I (1–10)	I (1–4)		I (3)	I (1–4)	I (1)		I (1–10)
Malus sylvestris	I (1–2)		I (1–2)	I (1–3)	I (1)			I (1–3)
Taxus baccata sapling				I (1)	I (1)		I (1–4)	I (1–4)
Crataegus laevigata	I (3–6)	I (3)	I (3–4)	I (5)				I (3–6)
Quercus robur sapling	I (2–3)		I (2–3)	I (3)				I (2–3)
Viburnum lantana	I (4)	I (3)		I (1–8)	I (1–4)			I (1–8)
Crataegus hybrids	I (3–5)	I (2)		I (3)				I (2–5)
Carpinus betulus	I (2–10)	I (3–10)		I (3)				I (2–10)
Betula pendula sapling	I (2–6)	I (2)						I (2–6)
Castanea sativa sapling	I (3)	I (3–4)						I (3–4)
Ulmus carpinifolia suckers	I (3–7)							I (3–7)
Ulmus spp. suckers	I (3–9)							I (3–9)
Acer pseudoplatanus sapling	I (1–4)	II (1–5)	II (1–5)	I (2–6)	III (1–5)	II (2–4)	I (1–2)	II (1–6)
Ilex aquifolium	I (3–4)	I (6)	I (4)	I (1–3)	II (1–4)	II (1–4)	II (1–8)	II (1–8)
Ulmus glabra sapling		II (1–5)	II (1–4)	I (3–4)	II (1–6)	II (1–4)		I (1–6)
Viburnum opulus	I (2–4)	I (1–3)	I (2–4)	I (2–5)	I (1–2)		III (1–4)	I (1–5)
Sorbus aucuparia		I (1–2)			I (1–3)		III (1–6)	I (1–6)
Rhamnus catharticus							III (1–6)	I (1–6)
Prunus padus		I (1)					II (1–5)	I (1–5)

Extract from Rodwell (1991)

Now for the ground flora:

- *Mercurialis perennis* to *Rubus fruticosus*, constants for the community and potentially found in all sub-communities.

Prunus padus		I (1)						
Mercurialis perennis	IV (1–10)	III (1–10)	II (2–6)	V (2–10)	IV (1–10)	V (4–9)	V (4–10)	V (1–10)
Eurhynchium praelongum	IV (1–9)	IV (1–7)	III (3–6)	II (1–8)	IV (1–8)	V (4–7)	V (1–6)	IV (1–9)
Rubus fruticosus agg.	IV (1–10)	III (2–8)	V (3–8)	IV (2–9)	III (1–9)	III (1–6)	II (2–4)	IV (1–10)
	III (1–9)	II (1–8)	II (3–5)	I (1–7)	I (1–5)		I (1–3)	II (1–9)

The next seven groups are the key ones for differentiating the various sub-communities.

Poa trivialis	III (1–9)	II (1–8)	II (3–5)	I (1–7)	I (1–5)		I (1–3)	II (1–9)
Glechoma hederacea	III (2–8)	II (1–4)	I (3–4)	I (2–6)	I (1–5)		I (1–4)	II (1–8)
Primula vulgaris	III (1–4)	II (3–5)	I (3)	I (2–6)	I (1–4)	I (1)	I (1–2)	II (1–6)
Viola riviniana/reichenbachiana	II (2–6)	II (2–5)	II (4–6)	II (1–7)	I (1–5)		II (1–4)	II (1–7)
Ajuga reptans	II (1–6)	II (2–3)	II (2–3)	I (2–5)	I (3)			I (1–6)
Primula elatior	I (2–7)	I (4–5)	I (3)	I (4)				I (2–7)
Primula vulgaris × *elatior*	I (5)	I (5)						I (5)
Anemone nemorosa	I (2–6)	V (1–9)	I (4)	I (1–5)	I (1–8)	II (1–4)	I (1–3)	I (1–8)
Ranunculus ficaria	I (1–5)	IV (1–7)		I (2–5)	I (1–6)	II (2–4)		I (1–6)
Lamiastrum galeobdolon	I (1–6)	II (1–4)	I (1–6)	I (1–6)	I (1–6)	I (2–4)	I (1–5)	I (1–6)
Rumex sanguineus	I (1–4)	II (2–3)		I (1–3)	I (1–4)			I (1–4)
Deschampsia cespitosa	I (1–4)	I (1–4)	V (4–9)	I (1–4)	I (2–7)	I (4)	II (2–7)	I (1–9)
Filipendula ulmaria	I (1–4)	I (5)	II (3–7)	I (4)	I (2–5)	I (3)	II (1–3)	I (1–7)
Potentilla sterilis	I (1–4)	I (1–2)	II (3–4)	I (3)	I (1–3)		I (1–4)	I (1–4)
Lysimachia nemorum	I (1–3)	I (2–3)	II (1–2)					I (1–3)
Juncus effusus			II (1–5)					I (1–5)
Hedera helix	II (2–9)	II (1–7)	II (4–6)	IV (2–10)	III (1–10)	III (2–8)	II (2–5)	III (1–10)
Urtica dioica	II (1–8)	II (1–7)		I (1–5)	III (1–9)	III (1–4)	III (1–6)	II (1–9)
Galium aparine	I (1–7)	II (1–7)	I (4)	I (2–5)	III (1–6)	III (2–5)	II (1–4)	II (1–7)
Geranium robertianum	I (1–4)	I (3)		I (1–7)	III (1–7)	II (2–3)	II (1–3)	II (1–7)
Eurhynchium striatum	I (1–6)	I (1–6)		I (3–7)	III (1–7)	II (3–5)	II (2–5)	II (1–7)
Thamnobryum alopecurum	I (1–8)	I (3–4)	I (5–6)	I (1–6)	II (1–7)	II (4–6)	I (1–4)	I (1–8)
Phyllitis scolopendrium				I (1–8)	II (1–5)	II (1–4)	I (3)	I (1–8)
Ctenidium molluscum					I (1–7)	I (3)	I (1–5)	I (1–7)
Allium ursinum	I (3–4)	I (2–5)	I (4)	I (3)	II (1–4)	V (6–10)	I (1–2)	I (1–10)
Brachypodium sylvaticum	II (2–8)	I (4–5)	II (3–4)	III (2–7)	II (1–8)	I (1)	IV (1–6)	II (1–8)
Teucrium scorodonia		I (3)		I (4)	I (2–4)		IV (1–4)	I (1–4)
Melica uniflora	I (2–6)	I (2–4)	I (5)	I (2–5)	I (2–7)		III (2–4)	I (2–6)
Arrhenatherum elatius					I (1–5)	I (3)	III (1–4)	I (1–5)
Campanula latifolia		I (2)			I (1–2)		II (1–4)	I (1–4)
Polystichum aculeatum	I (2–4)				I (1–6)		II (1–4)	I (1–6)
Myosotis sylvatica					I (1–3)		II (1–3)	I (1–3)
Plagiothecium denticulatum					I (5)		II (1–5)	I (1–5)
Convallaria majalis					I (1–3)		II (1–7)	I (1–7)

Extract from Rodwell (1991)

- *Poa trivialis* to *Primula vulgaris x elatior picks* out sub-community (a), although these species can also be common in (b) and (c).
- (b) is characterised by the *Anemone* to *Rumex* group as well:
- (c) has more of the *Deschampsia* to *Juncus* group.
- Sub-community (d) is characterised by *Hedera helix* and a scarcity of other species,

- The *Urtica* to *Ctenidium* group pick out sub-community (e);
- *Allium* dominance subcommunity (f);
- *Brachypodium* to *Rosa villosa* sub-community (g).

The rest of the table from *Hyacinthoides* onwards consists of species that may be more-or--less common across the whole range of sub-communities. To understand and use the species tables learn to spot which are the groups that help you to differentiate the various sub-communities, and which are the species found more widely.

Points to bear in mind

Most of the species in the table will not occur in a given stand. The tables are the summary results from a wide range of samples in different parts of the country. Consequently, in any one stand there will be a much shorter 'tail' of infrequent species. On the other hand, some of the infrequent (or rarely frequent) species in an individual stand, may not be on the summary tables, which give only species present in more than 5% of the original samples.

One, sometimes more, of the 'constant species' (even those used to name the community) may be absent. Constant species are those present in 61% or more of the original samples so that, where four or more constants are specified for a type, one of these may be absent by chance sampling effects. More intensive survey may reveal the missing species, but not if they are absent for particular regional, historic or treatment reasons that apply to the whole stand.

In most cases the trees and shrubs are less critical for type identification than the ground flora. Consequently lime and hornbeam stands may be split across several NVC types. Also, plantations, provided they have some vegetation under them, may be classified to particular types.

Quadrat recording was used to produce the classification but with experience it is possible to map many areas by 'eye' without recording quadrats in every stand. Do however record quadrats periodically (see next section) and if quadrats are not recorded make good notes on each stand.

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5. Quadrat recording in NVC surveys.

(Modified from Kirby, K.J., Saunders, G. R. & Whitbread, A. M. 1991. The National Vegetation Classification in nature conservation surveys - a guide to the use of the woodland section. *British Wildlife* 3, 70-80.)

Identifying homogeneous stands

In the surveys for the original classification all samples were taken within what appeared to be homogeneous stands, that is within an area that did not show obvious discontinuities in the vegetation from one part of the stand to the next. Minor heterogeneity within stands was not ruled out – indeed it is an integral part of the woodland flora mosaic. Where the mosaic in the ground flora was relatively coarse 10x10m quadrats were used, although 4x4m plots were usually large enough to contain the characteristic species in a stand.

The presumption is that other surveyors using NVC in their mapping and classification will recognise boundaries to 'homogeneous' areas similarly. This is a subjective decision which is affected by the expertise of the surveyor. However, most surveyors, on most sites, tend to recognise finer-scale variations than the main NVC communities or sub-communities present, for example changes in the structure or local abundance of species. Rarely will samples be taken or areas mapped which are subsequently discovered to cross major vegetation boundaries.

If quadrat samples have been taken across a heterogeneous area, this may be apparent because there will be species with contrasting ecological affinities in different quadrats. If the quadrats are re-sorted, then they may fit well with two (or more) sub-communities.

Quadrat size and shape

Some stands sampled in the original surveys were of a size or shape that would not encompass the square quadrats usually used. In such cases either the shape of the plot was altered, eg long thin plots for streamside vegetation, or the whole stand was sampled. More than one ground flora plot might be recorded with each tree and shrub record, since the two layers may vary more or less independent of each other.

Quadrats may be recorded in future surveys for a variety of reasons, eg to estimate tree density, the frequency of a particular species, or as part of a vegetation-monitoring exercise. These other objectives may dictate the size of quadrat used and the nature of any ancillary measurements. NVC is sufficiently robust not to be tied to a particular quadrat size within broad limits. This robustness also means that a simplified (and hence quicker) record may be made where the *aim is solely to use the data for NVC identification purposes*.

The following procedure, which has been tried in a variety of situations, gives reasonable results under most conditions and may be regarded as a 'minimum quadrat record' system for NVC identification.

a) Identify a more or less homogeneous stand based on an overall visual assessment of the tree, shrub and ground floras.

b) Within this stand take five samples scattered through it. Use a systematic or random distribution of quadrats within the stand, but major heterogeneity within the stand (saw-dust heaps, rides etc) should not normally be included in any quadrat.

c) Each sample should consist of a list of the vascular plants, bryophytes and regeneration and their cover from an area of about 5x5m (we prefer this size because it fits better with previous surveys). Also record the tree and shrub layer over the 5x5m plot and in the immediate c10m around so that a total area of 25-30m is examined, ie the area generally visible from the centre of the quadrat. List the tree and shrub layer species in this larger area and give cover values (if possible separate the tree and shrub layers but this is not essential). The procedure is not sampling as big an area as the 50x50 used in the original NVC surveys, but it is very unlikely that the difference between what is recorded in 50x50m and in this reduced area will be significant for classification purposes.

d) Combine the five plot records in a species table and key it through or compare it with the NVC summary tables. (It is helpful to note other obvious species that seem to be part of the stand but have not been recorded in any quadrats).

e) Repeat for the next stand.

Are quadrats always necessary?

In surveys in mid and south Wales more than 900 separate NVC stands were recognised in 266 woods, and there would not have been the time or other resources to record five quadrats in each stand. Types were identified in the field, with the surveyor looking around at the vegetation in a particular stand. Even with the key much depends on the experience of the surveyor with this approach, and quadrat recording must not be abandoned altogether.

Recording sets of quadrats is most valuable for identification purposes in the following circumstances.

- First, when surveyors are learning the classification, because they can be used by the trainers as an independent check on the surveyors' identifications.
- Secondly, they can be used periodically through a survey, eg 5% of sites, as a 'quality control' check.
- Thirdly, they are a good idea where a type is first encountered in unusual situations or regions – the equivalent to a 'voucher specimen' for species.
- Finally, quadrats are useful wherever or whenever surveyors themselves find difficulties in assigning a particular stand to a type.

Where quadrats have not been taken, sufficient notes should be made of the species present in the stand such that it is clear why the surveyor has classified that stand in a particular way.

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6. NVC simplified quadrat recording form: trees and shrubs

Domin 1 rare, 2 sparse 3 frequent but all less than 4%: 4 4-10%; 5 11-25%; 6 26-33%; 7 34-50%; 8 51-75%; 9 76-90%; 10 91-100%.

Notes

Trees and shrubs	Sample (quadrat number) – enter domin value					
Tree/canopy layer	1	2	3	4	5	Frequency
Shrub/understorey layer						

NVC simplified recording form: ground flora

Domin 1 rare, 2 sparse 3 frequent but all less than 4%: 4 4-10%; 5 11-25%; 6 26-33%; 7 34-50%; 8 51-75%; 9 76-90%; 10 91-100%.

Notes

	Sample (quadrat number) – enter domin value					
Ground flora	1	2	3	4	5	Frequency

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7. Common concerns and queries when using National Vegetation Woodland section

Most of the species in the table do not occur in a give stand.
The tables are the summary results from a wide range of samples in different parts of the country. Consequently, in any one stand there will be a much shorter 'tail' of infrequent species. On the other hand, some of the infrequent (or rarely frequent) species in an individual stand, eg creeping bent, *Agrostis stolonifera*, may not be on the summary tables, which give only species present in more than 5% of the original samples:

One, sometimes more, of the 'constant species' (even those used to name the community) may be absent.
Bracken, *Pteridium aquilinum*, for example may be missing from what otherwise seems to be W10. Constant species are those present in 61% or more of the original samples so that, where four or more constants are specified for a type, one of these may be absent by chance sampling effects. More intensive survey may reveal the missing species, but not if they are absent for particular regional, historic or treatment reasons that apply to the whole stand.

Monocultures of species may occur in the ground flora, which are very distinct but difficult to assign beyond community level.
For example, large areas of dog's mercury, *Mercurialis perennis*, may occur in shaded woods on base-rich soils with virtually no other accompanying species on the scale at which most sampling occurs. Great wood-rush, *Luzula sylvatica*, may dominate upland woods on ungrazed sites, while stands of hornbeam, *Carpinus betulus*, may have large areas with no ground flora at all. These are usually examples of W8, W10 or W11, and W10 respectively, but there may not be any single good sub-community fit.

Variations in the tree and shrub composition, often caused by forestry treatments, can impart a distinctive appearance and character to many stands without altering their NVC type.
This is particularly the case in lowland Britain with stands of small-leaved Lime, *Tilia cordata*, or hornbeam. In these circumstances the ground flora is a better guide overall to the NVC type than are the woody layers.

The appearance of an area (and sometimes its type) may change, at least temporarily, following felling.
When this occurs, species richness increases dramatically. What were previously open herb dominated communities become very grassy. Indeed, for a few years they may fit more closely to a grassland type. On sites which have not previously been subject to large-scale fellings some of these changes in species composition will be permanent, while on others they may be part of a cyclical pattern.

In the uplands differences in grazing levels lead to changes in the appearance of types.
At low levels of grazing in types W11, 16 and 17, species such as bilberry, *Vaccinium myrtillus*, and great wood-rush are likely to be prominent, whereas high grazing favours some grasses and bryophytes. Often these shifts in relative abundance do not affect the overall classification of the type, but in woods where grazing differences have been maintained for many years the boundaries between sub-communities may be determined by these grazing patterns.

Not all samples, however carefully collected, can be matched to just one set of summary tables.
The NVC types are a series of reference points with which the individual stand is compared not a system of rigid, mutually exclusive boxes into which every stand must fit. Intermediate stands, between for example W10a and W10b or between W10 and W11, do occur, reflecting the fact that communities are not fixed entities.

A type may be identified in a place not shown on the published distribution maps.
These maps show on a 10-km-square basis where the samples came from that were classified together to define a type. They give a good indication of the likely range of the type, but are not definitive. For example, no points are shown for W16 in Wales, although it has since been found to be quite common there. The published distribution maps also provide no information on the abundance of the type within a 10-km square.

The maps have been updated in: Hall, J E, Kirby, K J, & Whitbread, A M (2001). *National Vegetation Classification field guide to woodland*. Joint Nature Conservation Committee, Peterborough.

The type has been keyed out to an NVC type but does not pick out the important variation in canopy composition or structure.
NVC is just one classification system and classification is only part of nature conservation evaluation. NVC describes the range of variation in British woods more completely than previous systems. However it does not distinguish all the variants which may be of high nature conservation value, such as the distinction between lime and oak dominated examples of W10, or the variations in structure (and hence in fauna) between coppice, high forest and wood-pasture variants of the same NVC type. Other classifications will continue to be needed for this.

My samples do not fit NVC.
NVC is not complete. New variants, sub-communities, perhaps even communities may need to be described. However this should not be done lightly. Most woodland vegetation so far sampled does "fit", once surveyors have become adjusted to the range of variation within each community.

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8. Useful references for NVC and its use in woodland

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9. Key bryophytes and their frequency in the NVC tables, excluding scrubs.

NVC community	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Species																			
Atrichum undulatum		I		I			II	II	III	I	I			I					
Brachythecium rivulare							II												
B. rutabulum	I	III	II	I	IV	II	I	III	I	I		II		I					
Calliergon cuspidatum	I	I	V	I	II		I												
Cirriphyllum pilulifera							I	I	II	I									I
Climacium dendroides			III					I											
Dicranella heteromalla				I				I		I				I	III	I	I		
Dicranum fuscens																I	I	II	
D. majus											III						IV	III	II
D. scoparium				I					I	I	II			I	I	I	III	V	III
Diplophyllum albicans															I		II	I	
Eurhynchium praelongum	II	III	III	I	IV	III	IV	IV	IV	II	II	II	I	I	I	I	I		I
E. striatum							I	II	IV	I	I								
Fissidens taxifolius								II	I			I							
Hylocomium splendens									I		IV				I		IV	V	V
Hypnum cupressiforme		I	I	I	I			I	II	I	II			I	II	I	II	I	III
H. jutlandicum				I												I	II	III	I
Isothecium myosuroides				I				I	I	I	II			I		I	II		
Leucobryum glaucum														II	I	I	I		
Lophocolea bidentata	I	I	I	I	I		II	I	II	I	III					I	II	III	III
Mnium hornum		II	IV	I	III		III	II	III	II	II	I	I	III	III	I	III		II
Pellia epiphylla		I		II		II	I	I	I										
Plagiochila asplenoides			I				I	I	II	I							I		III
Plagiomnium affine			II			I		I			I								
P. rostratum			I		I			I	I	I									II
P. undulatum	I	I		II	I		III	III	IV	I	II	I							II
Plagiothecium denticulatum		II		I	I	I	I	I	I	I	I			I		I	I		II
P. undulatum										I	I			I	I	I	IV	IV	III
Pleurozium scheberi							I				III				I	IV	V	III	
Polytrichum formosum				I					I	I	II			I	II		V	I	II
Ptilium crista-castrensis																	I	III	I
Rhizomnium punctatum		I	IV		II		I	I	I								I		
Rhytidiadelphus loreus								I	I		I		I		I	I	IV	IV	III
R. squarrosus	I			I					I		IV						II		III
R. triquetrous								I	II		III					I	I	III	III
Scapania gracilis																	I	II	I
Pseudoscleropodium purum				I						I	IV					I	II	III	III
Sphagnum cappilifolium				I														III	
S. recurvum		III	I	III			I												
S. fimbriatum		III		II	I												I		
S. palustre		III	I	II	I		I										I		
S. quinquefarium											I						I	III	
S. squarrosum		III	I	I	I		I												
Thuidium tamariscinum	I						II	I	IV	I	IV		I	I	I	I	III	I	IV

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