Natural England Technical Information Note TIN053

Guidance on dealing with the changing distribution of tree species

Native tree species are considered to be of higher value than non-native species for nature conservation because they are a link to the original natural conditions and are more likely to create and support the conditions needed by other elements of the natural woodland system. However, the definition of what should be considered native is the subject of debate. This note explores the issues and recommends a flexible approach to dealing with non-native species that are native on the near continent and which may naturalise in England. This approach should help reduce unnecessary conflicts in woods where there are other objectives, for example landscape, recreation, historic or wood production, for which the distinction between native and non-native species is less important.

Background

From a nature conservation point of view a high priority is given to maintaining the native trees and shrubs in our woods, because they provide a link to original natural conditions and are more likely to create or support conditions needed by other woodland species in England. For example in the generic guidance on setting conservation objectives for woodland Sites of Special Scientific Interest the target is predominantly 95% native tree and shrubs, although this can be varied for particular sites. The same approach is generally applied to other sites of high nature conservation value. However, this may lead to potential management conflicts with visual, cultural, wood-production or historical objectives, where the distinction between native and non-native species is often of lesser or no importance.

How native is defined depends on what geographic boundaries and what time periods are considered. Beech is native to Great Britain. At a finer scale it is not native to Scotland, but is to England and Wales. It is native to southern but not the extreme west of England, to south-east but not to northern Wales. Similarly Scots pine is native to Great Britain, but there are no recent native populations in England or Wales.

In previous inter-glacial periods a wider range of tree and shrub species were present in the British Isles.

As a consequence of expected climate change the distribution of tree species will alter in the future. It is unclear precisely what these changes will be. However, Natural England is encouraging habitat networks and increased landscape permeability. We are therefore encouraging species to move between sites. This could include spread to areas where they do not currently occur (ie are not currently locally native), and this will lead to changes in the woods into which they spread. Assisted migration might also be considered for some non-mobile species on account of the rate and magnitude of predicted climate change. At the same time there may be losses of species or reduction in their abundance in other regions.

Changes in species distribution are seen as part of the process of the nature conservation adaptation to climate change. It therefore becomes illogical to automatically rule out the spread of species that are not currently native, but which do occur on the near continent. Many of these have already been introduced into gardens and plantations and have naturalised to varying degrees.

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While such naturalised stands have almost certainly originated from planted individuals it is impossible to be sure that sycamore could not have spread naturally into southern England from northern France in the last millennium, for example, through seed blown on an exceptional south-westerly gale.

Thus, while in most cases it is reasonably clear what is native in any particular area, there are some species whose status is less clear-cut, for example because:

- They are very long-established introductions that have naturalised at least at some sites eg sweet chestnut in Kent.
- The limits of their past native distribution are debateable (beech in the north).
- The species was present in an area but has been absent for many centuries (Scots pine in northern England).
- The distribution/range of a species is changing or expected to change substantially as a consequence of climate change (beech).
- The current populations are clearly planted or are derived from plantations in the last 200 years.

These issues are discussed in more detail for particular species in the section, *The status and distribution of selected species in England*.

Debate or ambiguity on the status of a species in an area can lead to inconsistency in the advice that staff give on how to treat these species.

Much effort could be spent on assessing the precise status of these species without necessarily coming to a consensus, because the evidence may be missing or ambiguous. It may therefore be more productive to assess such species primarily in terms of the impact that they are having on the particular site in question in relation to the nature conservation objectives (whether formal or informal) for that site.

A site-specific framework for dealing with spreading or introduced tree species

Tree species whose ranges are increasing will alter the composition of the sites that they colonise to varying degrees. In some cases they may increase the potential richness of the woodland. Alternatively their presence can be part of the evolution of the site towards a future-natural/future cultural state. Any action taken to remove them may create damage or disturbance to the site.

There is a balance to be struck between more-or-less intensive intervention to remove the species and the future losses or gains from leaving them alone. The same arguments apply to the treatment of native species whose abundance is changing significantly (eg ash) and which have the capacity to alter the character of a woodland (eg holly).

The approach set out below is based on three elements:

1 The nature conservation value of the site

Management of colonising or spreading species should have a higher priority:

- In sites notified for a particular woodland type rather than in non-designated sites.
- In semi-natural woods rather than in plantations.
- In ancient woodland rather than in recent woodland.
- Where there is no particular cultural, social or historical value attached to the colonising species at that site.

2 The degree to which a particular species changes the nature of the site

Determined by the tree characteristics, rates of regeneration and other factors, for example:

- Replacement of one dense-shading species by another will have less of an impact than where the new species casts much more shade than the species it replaces.
- Conifer replacing conifer is likely to cause less change in shade than conifer replacing broadleaf.
- On any particular site a species that regenerates freely is more significant, because of potential future impacts, than one that is unlikely to regenerate.

- Does the species replace another as host for a rare or threatened species? (For example old sycamore trees may be hosts for lichens previously found on elm).

3 Resources

The ease and cost of control needs to be proportionate to the likely impact or threat:

- Management before the species has significantly altered a site is a higher priority than where the species is already long-established and changes to the woodland assemblage have taken place.
- One-off operations, or management that is part of work that will be taking place anyway, are more justifiable than those where extensive and on-going work will be needed specifically to manage the new species.

None of the above should be taken as absolute presumptions for or against management of a particular species and most are consistent with what is already accepted practice in some areas. For example, it is similar to the approach adopted towards sycamore in the *LIFE Ravine Project Management Handbook*.

Decisions at a site level should therefore be along the following lines

Presumption towards acceptance of a species in a particular site:

- Where the impact on characteristic species or assemblages has already happened or is not likely to be significant.
- Where mature or veteran trees of the new species are present, especially if they are part of uneven age structured population.
- Where the species is already widespread in the stand or wood, having largely replaced the former type, and is showing good regeneration.
- Where high level of management (particularly ongoing management) would be needed to remove the species, especially if this would be the main reason for having to carry out the management.
- Where the management to control the species would cause significant other disturbance.
- Where there are other major seed sources in surroundings such that ongoing work would be needed to prevent further regeneration.
- In minimum intervention stands.

Presumption towards management of a species in a particular site:

Where the stand being invaded is of high conservation value, with species or assemblages that would be impacted by a change of species and:

- The new species is present in small amounts, which could be eliminated readily and without causing significant damage.
- The new species is present in amounts that can be eliminated as part of ongoing management that would be undertaken anyway.
- Where there are largely young stems or young to mature stems showing little regeneration.
- Where there is no significant seed source in surroundings.
- In actively managed sites.

The result will be three types of site:

- Sites where the aim is to maintain the past native tree and shrub composition as closely as possible.
- Sites where a change of species is accepted alongside conservation of the main features of interest.
- Sites which are managed or allowed to develop towards a new state which may contain different suites of species.

The status and distribution of selected species in England

This section explores how the approach above might apply to particular species in different parts of England.

Beech in northern and western England

Past distribution

- The species first appeared in Britain fairly early in the post-glacial period, but the records remain sparse for several thousand years. It appears to have not been very competitive in

the wildwood, possibly because Britain is towards the edge of its range.

- The main spread and increase in abundance occurred around the Neolithic period and may have been facilitated by human disturbance and clearance of the wildwood. Even so it may never have reached the climatic limits of its potential range.
- As a major forest type, beech seems to have been limited to southern Britain and there is evidence for continuity of beech woodland presence through to the present in these regions. Beech woodland conservation is therefore focussed on these regions, see maps of beech woodland types in Rodwell (1991), Peterken (1980), Rackham (2003).
- There are outlier pollen records further north and west in England, some of which may have represented local populations, rather than long-distance pollen transport, but with no evidence for continuity of beech woodland or veteran trees.
- The oldest trees tend to be in designed parks or other situations where the trees seem likely to have been planted.
- Veteran beech trees seldom survive more than 350 years, so survival of individuals from the early medieval period is unlikely.

Future distribution

- Beech has been widely planted in north and west England (and also in Wales and Scotland) over the last 300 years and has locally naturalised.
- Given that beech may not have reached its climatic limit before humans disrupted the landscape, the natural spread or re-colonisation (if the outlier pollen records did represent past populations) of northern and western England could still be happening, albeit masked by the effects of planting.
- Changing climatic conditions may put beech populations in southern England under increased stress and it may not be possible to maintain the current levels of beech in some sites. Most models suggest that conditions for beech in north-west England will remain favourable or improve. The significance of beech populations in Britain may increase if (as is likely from climate change projections) its range and abundance declines in southern Europe.

Consequences of increased beech in woodland

- Beech regenerates well under higher levels of shade than oak or ash and has the potential to become the canopy that is dominant across a wide range of soil types. The production of beech mast (seed) is irregular which will slow spread in woods. However, it may become more common if summers become warmer. There is evidence of a high frequency of mast years in southern England over the past ten years.
- The seed tends not to spread widely from parent trees so often there will be clusters of beech and then relatively large areas with little regeneration. Parent trees outside the site are therefore less of a concern in assessing impact than for some other species.
- Regeneration is limited by grazing (as is that of other species).
- Beech casts one of the heaviest shades of broadleaved species. Particularly on acid sites the ground flora and shrub layer (other than holly) can be greatly reduced in cover and richness.
- There is some overlap between the ground flora and shrub layer found under beech and that found under oak or ash, but but under beech there is reduced cover and frequency (Rodwell 1991).
- The assemblages that do develop under beech beyond its current native range are not dissimilar (allowing for climatic and soil variations) to those that occur in southern Britain, but some of the rarer beech woodland specialists may be missing (Wesche and others, 2007).
- Beech can develop a rich deadwood invertebrate fauna and in some sites in northern England (Dunham Massey, Duncombe Park) the veteran beeches are a significant part of the interest.
- Old beech in the north is not particularly rich in lichens (Francis Rose personal communication).
- Beech woods are considered rich in fungi but there are no known systematic surveys

comparing the richness of northern and southern beech woods.

Preliminary assessment

- Long-term dominance by beech is not inevitable in all sites, so concerns about beech takeover should be based on the actual regeneration occurring on the site.
- The impact of increasing beech dominance will be most significant where there are rich and important ground layer communities, whether of bryophytes on acid soils or higher plants on base rich soils.
- Veteran beech should be maintained for their contribution to the deadwood communities.
- If the distribution and abundance of beech is responding to climate change, accepting more beech in woods in the north and west is anticipating the process of climate change adaptation. The changes in ground flora and other woodland components are a further consequence of this.
- The cultural value of beech varies. On some sites it has been an important contribution to the cultural landscape (eg of designed parks) in other cases it may be diluting the traditional landscape eg oak coppice landscape.

Sycamore

Past distribution

- The species is first definitely recorded in Britain in the early medieval period (Jones 1945). There are claims for earlier occurrences (Green 2005), but the evidence for this is ambiguous and there is a difficulty in separating its pollen from that of field maple.
- There are some early archaeological finds. However, these are not convincing, for example the early medieval leaf carving on St Frideswides tomb (Oxford) could have been carved by a French mason, or a local mason who had seen the tree in France. A fourth century Roman bucket of sycamore occurs at a site which also contains other finds including silver fir and quern stones from Germany.
- If sycamore did occur pre-Medieval times it would appear not to have been abundant enough for anyone to notice, compared to more regular records from the seventeenth century onward. It is only comparatively recently it has been a significant part of woods or as trees in the landscape.

Future distribution

- Sycamore has been widely planted particularly in north and west England (and in Wales and Scotland) over the last 300 years and has locally naturalised. It is a characteristic feature of Pennine farmsteads and is likely to remain a significant part of future landscapes.
- It regenerates freely, particularly on moist neutral to base-rich soils; it is more likely to spread on such soils, rather than on acid soils.
- It is relatively shade-tolerant; hence it is capable of spreading within existing woods. Some studies suggest that regeneration tends to follow soil disturbance (work by Neil Riddle 2005, summarised in *Ravine Woodland Management Handbook*).
- Trees seed regularly and spread quite well, again encouraging spread. Some studies suggest possible alternation of regeneration with ash (Waters and Savill 1991).
- Regeneration is limited by grazing (as is that of other species) .
- The growth of sycamore may be reduced under future droughts compared to ash, which may encourage co-existence with ash and oak in some sites (Morecroft and others 2008).

Consequences of increased sycamore in woodland

- Sycamore regeneration tends to develop first into a dense pole-stand understorey and then into even-aged patches of mature timber with little understorey. Existing shrub layers may be lost through shading.
- The ground flora is often rather uniform under mature sycamore (eg a carpet of Dog's mercury) but this may be more to do with the tendency for these to be mature high forest stands, rather than the effect of sycamore shade *per se*. Ground flora richness may be maintained in other situations (Taylor 1985; Riddle 2005).
- On the continent sycamore is a characteristic component of the *Tilio-Acerion* Habitat Directive type. In some British sites it may occupy situations where either lime or elm would previously have been dominant.

However, it is unlikely to out-compete either species where these are healthy.

- Old sycamore can have a rich lichen flora distinct from that on oak on similar sites.
- Veteran sycamore can provide valuable dead-wood habitat.
- Its reputation as poor for invertebrates is based on a particular study of specialist faunas. It is richer than some native species and can carry a high biomass of invertebrates, which may be more significant if food for birds and mammals is a consideration.

Preliminary assessment

- Long-term dominance by sycamore is not inevitable, so the actual regeneration occurring on the site should be assessed. Management to remove existing trees may create the disturbance that favours increased sycamore regeneration.
- The potential impact will be most significant where there are rich and important ground layer communities of higher plants on base rich soils and where it is replacing ash, rather than former elm sites.
- Its reputation as having a low associated fauna has been challenged.
- Veteran trees should be maintained for their potential lichen and deadwood interest.
- On the continent sycamore is frequently associated with relatively cool, moist situations, such as gorges. Some of these may become under stress under future climate scenarios, with an expected range shift to the north and west. Allowing some spread in British woodland is compatible with the process of climate change adaptation.
- It has the potential to spread from parent trees in the neighbourhood. However, provided there is little ground disturbance the significance of such spread may be limited. By itself this is not a reason for not managing the species where it is considered to be undesirable.
- The cultural value of sycamore varies: in many non-woodland situations it is an important part of the local landscape - particularly as non-woodland trees in northern England. Also sycamore coppices were associated with the bobbin mills of the north-west.

Sweet chestnut

Past distribution

- Sweet chestnut was probably native originally to the Balkans and parts of south-central Europe. However, its value as a food source as well as for its wood meant that it has been widely spread throughout the rest of Europe, not least by the Romans.
- Rackham (2003) discusses the early controversy over whether or not it was native and the eventual conclusion was that it was a Roman introduction. However, he treats it as an honorary native at least on some sites, particularly in Kent and Essex and locally elsewhere in the south-east and the Welsh borders. The earliest localised record is in the reign of Henry II in the Forest of Dean.
- Its value, particularly as coppice, led to it being widely planted throughout the lowlands. It was also managed as pollards and as ornamental trees in parks.

Future distribution

- Although widely distributed the woods where it is abundant are relatively rare. In most instances the trees or stools have been planted. Natural regeneration and spread tend to be limited, not least because the nut crop is not very good in England. With increased summer temperatures nut set and natural regeneration may improve.
- The recent advance of chestnut blight *Cryphonectria parasitica* in northern Europe suggests strongly that it will extend its range into Britain. If it does the impact could be to reduce the dominance of chestnut in woodland in southern England.
- Rackham considers it predominantly a tree of acid soils, typically on sandy or silty soils, but Buckley and Howells (2004) suggest that it can occur on a wider range of conditions.

Consequences of increased sweet chestnut in woodland

- Chestnut stands are often poor in vascular plants, partly because of the nature of the soils on which they occur, but also because of the density of its shade, frequently compounded by its growth as well-stocked coppice. In addition its litter, composed of large, slow to

decay leaves, may suppress some smaller ground flora species.
- The shrub layer, other than coppice regrowth, also tends to be poor, again because of the competitive nature of chestnut.
- The value of chestnut coppice means that it is more likely than many other species still to be worked, and there are benefits from the diverse structures that this creates.
- There appear to be few species strongly associated with the tree.
- Veteran chestnuts can provide valuable dead-wood habitat and are a significant component of the interest at sites such as Croft Castle.

Preliminary assessment

- To date chestnut has not been viewed as a particularly invasive species in the way that sycamore or beech in the north have been. In future this may change, although increased invasiveness might be countered by increased attack by chestnut blight.
- Where sweet chestnut becomes dominant the effects are likely to be reduced ground flora abundance under the canopy. However, if it is managed as coppice this effect may be off-set by increases in ground flora in the recently cut stands.
- The woods where it seems most likely to spread are oak-bramble-bracken (W10) and oak-wavy hair-grass (W16) woods. However, its impact on these communities is likely to be less than its impact in ash (W8) woodland.
- Locally the species has high cultural value. For example it is associated with hop production in Kent and the Welsh borders.
- Where it is a long-established component of the wood (>200 years) there is no particular reason not to treat it as a naturalised species, particularly in the south-east and Welsh borders.
- Veteran chestnuts should be maintained for their dead-wood value.

Where it has been planted and forms dominant stands two approaches should be considered:

- If it can be effectively managed as coppice there may be a case for maintaining the stand largely as chestnut since this is likely to provide a better economic crop and the coppice is more likely to be worked. The aim should be to achieve structural diversity through the coppice system.
- In other stands management should allow or encourage the gradual diversification of the composition through spread of other tree species (usually oak and birch).

Holm oak *Quercus ilex*

Past distribution

- This is primarily a Mediterranean species, although it occurs into central France.
- It has been cultivated in Britain since the 16th century, widely planted in the 18th century and was recorded in the wild in 1862 (Preston and others 2002).

Future distribution

- It currently occurs through much of southern England and appears to be spreading.
- It is likely to be favoured by climate change.
- It seeds prolifically and can regenerate freely on appropriate soils.

Consequences of increased holm oak in woodland

- As an evergreen species it changes the character of the woodland community in a way that the species discussed previously do not. The nearest native equivalents are stands of yew and holly.
- There is very limited information on the ecology of the species in Britain, but casual observation at Lyme Regis Undercliff suggests that the ground flora underneath it is likely to become dominated by ivy, ferns and a scatter of other highly shade-tolerant plants.

Preliminary assessment

- It is likely that this species will continue to spread under climate change.
- Where it does not currently occur, or is present as only a few trees, it is probably best, if practical, to try to keep this species out.
- Controlling or removing it where it is established is likely to involve major felling. Gradual thinning out is unlikely to be effective since it may simply increase the regeneration

of the species in the gaps created. Hence where it is already well-established and regenerating, it may be less disruptive to accept it as a future-natural new woodland type.
- Holm oak ecology in Britain should be a priority for future research.

Scots pine in northern England and on southern heaths

Past distribution

- Scots pine was widespread across England during the early Holocene period. There is debate as to whether these populations were the same as, or continuous with, those that spread in Scotland or whether there were different origins and invasion routes.
- Subsequently Scots pine declined in the pollen record as broadleaved species spread. However, from comparisons with its behaviour elsewhere in Europe pine may have remained a component of high altitude woodland in England, of woodland on dry acid sands and, probably as scattered trees, on acid bogs.
- Past management, particularly coppicing, would act against pine as it tends not to regrow well after cutting.
- There appears to be little, if any, direct evidence for survival of native pinewoods in Britain into the historic period, except in the Scottish Highlands. There is apparently a medieval record for firs in the Lake District that might refer to pine, but these do not seem to have survived thereafter.
- The occasional occurrence of old native-looking pines in northern England and a distinct saproxylic pine beetle assemblage in East Anglia and some Surrey heaths have been interpreted as possible continuity of scattered trees, if not woodland, through historic times in these areas (Roger Key personal communication).

Future distribution

- It has long been planted widely throughout Britain, both within its native Scottish range and elsewhere. Hence it is now almost ubiquitous in England.
- It spreads naturally very well from planted stands, particularly on heathy soils.
- Pine regeneration in woods is likely to be limited by its need for relatively open conditions and some soil disturbance for seedlings to establish.
- Hotter summers may favour pine spread on some soils where other species can currently out-compete it.
- Increased extreme events could provide more large scale disturbances that would favour pine regeneration.
- Increased fires might favour pine spread.

Consequences of increased pine in woods in England

- In general pine is not likely to spread much in most existing broadleaved woodland, particularly if this is managed by minimum intervention, coppicing or as high forest using low intervention methods.
- Where it occurs as small stands or as a component of woods on acid soils the ground flora is not dissimilar to that under oak and birch stands on those soils.
- Some pine-specific associated species do occur in such stands from time to time, increasing local diversity.
- Oak and birch are able to establish in association with pine, so it is unlikely that pure pine stands will remain pure in the long-term without regular disturbance.

Preliminary assessment

- This is a different situation to those considered previously in that it is re-introducing a species south of where it currently survives as a native species in Britain. The whole of England is within its climatic range and some sites may become more suitable for Scots pine under hotter summers.
- If we accept there were woods with a native pine component (even if not the dominant tree) on some soils and situations in the past then it is not unreasonable to consider it as a component of new woodland in such areas (although not necessarily pure stands).
- Generally pine should not be introduced into ancient or other long-established woods where it does not occur, but there is no need to be assiduous in cutting out natural regeneration if the soil and site appear appropriate.

- In northern England, if new pine stands are being created there is a case for considering using a mixture of provenances from the native pinewoods (albeit there will be some risk to this from moving them south, against the climate change trend).
- In the south no particular provenance selection is recommended from a nature conservation point of view.

Species this approach does not apply to!

The following are examples only of species where the presumption should remain that, where nature conservation is important, they should be removed if they occupy a significant area of the wood or are spreading.

Norway spruce, European larch and silver fir

These species do occur on the continent but at present the arguments against them are:

- They are not particularly suited to the current or future climates in Britain.
- They do not appear to have naturalised regularly, despite several hundred years of being planted in woods.
- They change the character of the woods significantly, through the nature of the shade that they cast and their litter type.

Turkey oak

This species is alternate host for the knopper gall which attacks the acorns of native oaks. Hence it should not be encouraged.

North American species

The basic assumption behind this approach is that our woods are part of a broader continental continuum and hence species on the continent might spread in time to them anyway. This does not apply to North American species. In addition North American species most widely spread through the countryside are the dense shading conifers which change the character of our woods and wildlife significantly. The broad-leaved tree *Robinia* also has the potential to spread more than it has to date under climate change projections.

Rhododendron, snowberry, laurel

These species spread to form dense thickets replacing existing understories, shading out ground flora.

Eucalypts

These produce a very different type of woodland structure and composition (albeit there is very limited data from UK conditions) and are taxonomically very different to British or continental species.

Further information

Natural England Technical Information Notes are available to download from the Natural England website: [redacted]. Other notes on woodland include:

- TIN001 - *The historic environment and woodland management*

For information on other Natural England publications contact the Natural England Enquiry Service on 0845 600 3078 or e-mail [redacted].

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This note was developed by Keith Kirby, Natural England.

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