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Defining 'old growth' in the UK context

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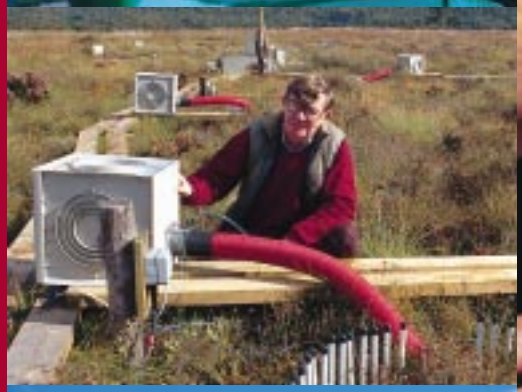

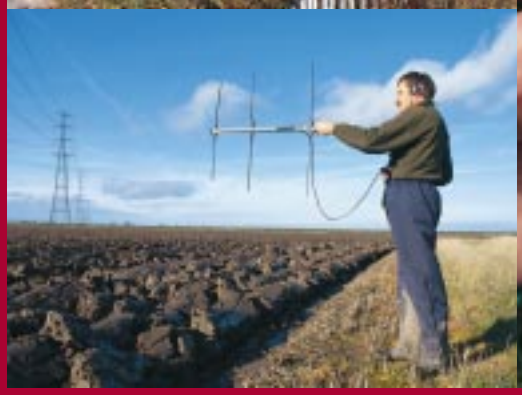

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Number 494

Defining ‘old growth’ in the UK context

A report prepared for English Nature by the Ancient Tree Forum

September 2002

Keith Alexander, Mike Smith, Roland Stiven and Neil Sanderson

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Preface

In the last two years it has been proposed in various public fora that an "inventory of old growth in the UK should be produced. However do we have any? Much depends on how "old growth" is defined. This report was commissioned to see if a consensus view could be reached. Good progress has been made but there is still need for further clarity on quantified field measures.

Some final editing of this report was carried out by me: any errors or inconsistencies introduced as a consequence are my fault.

Keith Kirby
English Nature
Northminster House
Peterborough
PE1 1UA

Acknowledgements

The Ancient Tree Forum's Steering Group for this report comprised Nev Fay, Keith Alexander, Jill Butler, Ted Green, plus the sub-contracted authors Mike Smith, Neil Sanderson and Roland Stiven.

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Summary

This report on "old growth" in the UK context is produced as a discussion document. It provides historical perspectives, discussion of views canvassed from a variety of contacts, and suggests a way forward for the UK which it is hoped will be acceptable to the conservation, ecology and forestry sectors.

The definition provided by the Convention on Biological Diversity web-site forms the basis for the recommended way forward and this is interpreted for application to the cultural landscapes of the UK and Europe: *Old growth forest stands are stands in primary or secondary forests (including wood pastures and parkland) that have developed the structures and species normally associated with old primary woodland of that type that have sufficiently accumulated to act as a woodland ecosystem distinct from any younger age class.*

The implication of this definition is that if sufficient species of old primary woodland are present then the structure must be such as to allow the ecosystem to function. However if the species are absent or very few then structure is insufficient or continuity has been broken and the woodland is not old growth.

Stand and habitat attributes are put forward that might be used to identify provisional old growth stands in the absence of species data. More work is needed on developing quantified field measures for these attributes.

If this approach is accepted, old growth could be identified as a special category within the Ancient Woodland Inventory but also in other land use registers, since not all old growth may be within ancient woodland. Old growth could then rightly become recognised as a priority for conservation at a landscape scale across the UK.

Contents

1. Introduction

There is a growing interest in all things old and trees and woods are no exception. Ancient and veteran trees and ancient woodland are increasingly recognised as something special and not just from a conservation perspective: time itself is somehow embodied within them. They have a unique cultural, historic and spiritual value.

The term 'old growth' has been used to express some of the values of this mix of old trees and woodland, particularly for their decaying wood and associated species. The term first came to prominence in the 1980s/90s over the conservation of the primary coastal conifer forests of Pacific North West America. As the relationship between tree age, woodland continuity and biodiversity has become more widely recognised, the term 'old growth' has also started to be used in Europe. Environmental campaigners, conservation managers, ecologists, woodland historians and others have adopted it. However, each has their own, often unspecified, interpretation of the term 'old growth' and other associated terminology. Frequently the term appears to be used to describe habitat structure without reference to species richness. Often it is used in the context of 'natural' woodland where the term 'natural' has equally vague connotations.

Most temperate European woodland has experienced thousands of years of human intervention. Over the centuries woodland has been increasingly compartmentalised as it has been worked more intensively for coppice, timber or grazed by domestic stock, species have been introduced and native species composition altered, eg Birks *et al* 1988, Salbitano 1988, Kirby & Watkins (1998), Butler *et al* (2002). This intervention has significantly interrupted natural processes. It has been assumed that European woods are very far removed from established ideas of natural or virgin[1] forest. "Even in Scandinavia, a virgin landscape is a fiction" (Fægri 1988). Forest histories in Western Europe and the UK are therefore very different from the Pacific Northwest and this has led to confusion over the interpretation and application of the term 'old growth'.

Are we justified in using the term 'old growth' for any woodland in western Europe; can we identify a set of characteristics, which are agreed and understood as being embodied in the term for use in the UK?

Butler, Rose and Green (2001) suggest that:

- ancient trees may be our best indicator of these last areas of the original deciduous wildwood in lowland Europe;
- the larger, older and more numerous the trees the richer the biodiversity of the habitat; and
- the saproxylic, mycorrhizal and epiphytic communities point to continuity of the sites least disturbed by man.

Their ideas reflect the current views of the Ancient Tree Forum and those of the Woodland Trust as expressed in their publications *Woodland biodiversity: expanding our horizons* (2000) and *Space for nature: Landscape-scale action for woodland biodiversity* (2002).

[1] Peterken (1996) defines this as "Natural woodland which has never been significantly influenced by people. The term implies that there has been an unbroken history of natural development"

Others however tend more towards the approach taken in the Pacific North West of America whereby old growth is characterised by its structure of big trees and irregular canopy.

This report was commissioned by English Nature to explore how these issues might be addressed. The specific objectives were:

- to produce a working definition of 'old growth' that has wide support across the UK conservation and forestry sector and is clearly related to how the term is used internationally;
- to develop a practical method for listing where 'old growth' occurs, initially for England, but with indications of how it might also apply in other countries.

The report includes a brief history of the term 'old growth' and a short literature review of current ecological definitions. It discusses issues over the use of the term in the UK and summarises the results of a questionnaire to canvass opinion on current usage.

A definition is formulated, discussed and recommended for the use of the term old growth in a UK context. Comments on the ideas expressed should be sent to Keith Kirby at English Nature, Northminster House, Peterborough PE1 1UA, UK.

2. Background

2.1 Old growth – the historical perspective

The term old growth originated in about 1900 in the western United States. It was first used by loggers to refer to 'forests with large trees with distinctive bark which were often slow-growing and with irregular crowns battered by time; the canopy dominants in most of these forests were over 350 years old' (IUFRO 1997). The term old growth, therefore, clearly referred to those parts of the forest that were in a late-succession age phase and excluded younger aged stands within the forest ecosystem. In the context of the European settlement of the western USA these stands would also have been 'original'[2] (as opposed to virgin), ie the condition the forests were in when first encountered by Europeans.

In the 1980s, again in the USA and Canada, the term started to take on more significance in the bitter struggle between the timber industry (looking for resources to maintain rural lumber mills) and conservationists seeking to conserve the remaining areas of biologically diverse original forest. Because the late-succession stands harboured both high volumes of quality timber and had accumulated rich, undisturbed ecological communities, there were widespread disputes and legal wrangling over the resource, and therefore, the term. 'Old Growth' became a campaign catchword argued about by ecologists, bureaucrats, conservationists, forest managers, politicians, loggers, wilderness-lovers and a wide array of North American interest groups. As there was no agreement on a mutually acceptable definition, the US Forest Service (USFS) set up an Old-Growth Definition Task Force that produced an interim definition:

[2] Peterken (1996) defines "original-naturalness" as "The state which existed before people became a significant ecological factor." He also points out that in North America it is commonly used to refer to the woodland structure and composition before European settlement, although at this time the forests were occupied and used by native Americans.

> "Old-growth stands must include at least six trees per acre that are more than 30 to 32" in diameter and more than 200 years in age. The stands must have multi-layered canopies (except within mixed evergreen forests) and hold minimal amounts of large standing snags more than 20 " in diameter and fallen logs at least 24" in diameter."

This definition was from a forestry perspective, with stands having to pass the various criteria if they were to be protected from logging.

By 1989 the debate had progressed, with more clearly defined biodiversity arguments being expressed. Old growth was associated with threatened species dependant on late succession stands, in particular, the lesser spotted owl. The USFS therefore produced a new definition intended to cover the whole of the USA (Lund 2001):

> Ecosystems distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function.
>
> The age at which old growth develops and the specific structural attributes that characterize old growth will vary widely according to forest type, climate, site conditions, and disturbance regime. For example, old growth in fire-dependent forest types may not differ from younger forests in the number of canopy layers or accumulation of fallen woody material. However, old growth is typically distinguished from younger growth by several of the following attributes:
>
> - large trees for species and site,
> - wide variation in tree sizes and spacing,
> - accumulations of large-size dead standing and fallen trees that are large in relation to earlier stages,
> - decadence in the form of broken or deformed tops or bole and root decay,
> - multiple canopy layers, and
> - canopy gaps and understorey patchiness.
>
> Old growth is not necessarily 'virgin' or 'primeval'. Old growth could develop following human disturbances.

The North American struggle to conserve the old growth forests was (and continues to be) a major media campaign. Much of the imagery associated with it is stunningly powerful with cathedral-like stands of huge stems, draped in lichens with snags and moss-covered deadwood.

Events in the USA/Canada had a strong influence on both conservation campaigning and on forest ecology. Because use of the term in Europe largely post-dates its USA/Canada history,

it comes heavily image and value-laden. This legacy or 'baggage' has two major implications for how the term is currently viewed:

- Firstly 'old growth' inevitably implies a valiant struggle for something good. 'Old Growth' is good for wildlife, good for the environment and good for the soul.
- Secondly, the woodland structure typical of the Pacific Northwest resonates through the term suggesting a presumption for high forest, late succession stands of shade tolerant, long-lived species producing multi-layered canopies.

Much of the confusion that now surrounds the use of the term arises from these early associations.

2.2 Current international usage

2.2.1 International

The term 'old growth' remained largely specific to the USA until the end of the 1980s when it was adopted more widely in the scientific literature. A search of Centre for Ecology & Hydrology (CEH) held texts demonstrates the recent history of 'old growth' in scientific literature (Table 1).

Table 1. Number of articles with keyword 'old growth' in CEH-held literature, by country and by year

Year	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**01**	Total
USA/CAN	6	7	4	7	16	8	13	11	8	12	83	72	101	70	96	105	106	106	129	148	133	**1241**
Japan										1	1	2			7	5	3	2	7	6	4	**38**
Rest			1	1			1	1	3	2	10	2	8	21	20	29	34	38	39	46	55	**311**
All	6	7	5	8	16	8	14	12	11	15	94	76	109	91	123	139	143	146	175	200	192	**1590**

A website on forest definitions (Lund 2001) includes 74 definitions of old growth, many from within the USA or Canada but also from Australia and Russia. Another website (IUFRO 1997) is an archive of a discussion group on old growth with contributions from Canada, USA, Netherlands, Australia, and Poland.

Recent work which sets out a hierarchical terminology for woodland across Europe describes old growth as ecosystems at a site scale with a high degree of naturalness that are distinguished by old trees and related structural and ecological function (Buchwald in press). Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of structural and ecological characteristics.

The website for the Convention on Biological Diversity (developed in Rio in 1992) offers an international definition:

> Old growth forest stands are stands in primary or secondary forests that have developed the structures and species normally associated with old primary forest of that type that have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class.

2.2.2 North America

The generic 1989 USFS definition (see earlier) reflects ecological use within North America. However, more detailed definitions have been produced for individual forest types, ranging from the stand ages over which old growth conditions typically develop, to complex statistical analysis. These are highly dependent on local conditions and tree species.

The environmental perspective is mainly concerned with the protection of existing original stands. There is a tendency to use the term old growth as a loose synonym for all virgin or original stands. However if old growth is used simply as a synonym of 'natural' or 'virgin' it is not worth maintaining as a distinct term (IUFRO 1997). On the other hand, if old growth is something different, that can develop from younger disturbed stands then expansion of old growth by management is possible albeit on a very long timescale.

Given the forest resource history of the Pacific Northwest, old growth stands are inevitably going to be closely linked to original, pre-European settlement, forest. They may not be virgin stands but continuity of woodland cover in the locality is going to be the norm. In areas with a longer history of European settlement, definitions start to put more deliberate emphasis on continuity, eg Bouchard's contribution on Québec (IUFRO, 1997):

> "In my point of view, one of the most desirable structural and visible quality of such a forest is the fact that the age of this forest (if it means anything for uneven-aged stand) must be much older than the age of the oldest trees in the stand, a quality that could be indirectly inferred from the distribution and the dimension of the dead trees (lying on the ground or still standing up)."

This continuity of old trees is not necessary related to lack of human influence. Bouchard and others (Selva 1994; White & Lloyd 1994) emphasise that in the east of North America many old growth stands were disturbed between the 15th and 17th centuries. Their definitions of old growth do stress low levels of human disturbance, but this often appears to be simply defined by the survival of old trees.

2.2.3 Europe

The European Forestry Institute website glossary retains two definitions of 'Old Growth Forest', one referring to natural forest, the other providing a qualified structural definition:

> "Natural forests in which a proportion of the trees have reached (or nearly reached) their maximum age, and which maintain natural structural characteristics, species composition etc."

> "Ecosystems distinguished by old trees showing structural features characteristic of later stages of stand and successional development. These differ from earlier stages in structure, composition and function. The term is mostly used in North America and generally refers to forests that are either wholly natural or have remained undisturbed by humans for several hundred years."

Some European contributions are linked to forest ecosystems that are defined as being 'natural' and many do not appear to consider that the old growth phase is significant enough to draw out from this.

More specific definitions give tree age-related criteria of between 120 to 250 years old, with 200 years the most commonly quoted (Lund, 2001). More flexible are suggestions that old growth features tend to develop at a set time after commercial maturity is exceeded.

In Finland, in boreal forest, stands exceeding the regular cycle by 20 years have been suggested as old growth (Lund 2001). Thompson and Angelstam (1999) summarise work in boreal forests which indicates that particularly high diversities of old growth-dependent species occur in stands 50 – 100 years older than the age at which trees are normally harvested in boreal forests, (usually 80 – 120 years). Densities of old trees are mentioned in several entries in Lund (2001), eg (over 6 or 8 per acre) as well as numbers of standing dead trees (snags).

The Finnish Forest and Park Service set up an official working group on Old Growth Forest protection in northern Finland. They described old-growth (taiga) forest as 'a pristine boreal forest that is rich in decaying wood. Such forests are characterised by a varied age structure and continuous subtle changes'. This led to the decision to preserve significant areas (over 239,600 ha) of northern Finland's old growth forest (Metsahallitus 1996). The same group also considered southern Finland to have no old growth forest remaining but proposed that stands be left to develop into the old growth forests of the future. In their 1998 environmental guidelines for practical forest management, Metsahallitus (1998) describe old growth as 'those stands which have appreciably exceeded regeneration maturity.... stands are generally in a natural state and vary as to size and age…dead and decaying trees and fallen logs of various ages are abundant.'

The environmental campaigning Taiga Forest Network (Lloyd 1999) concerned with logging of the European boreal forest, bases its analysis of conservation needs on the following definitions of old growth:

> A Russian definition: 'Old growth forests are forests originated through natural successions, unaffected by destructive human impact over a significant period of time and having the area sufficient for self-maintenance in the absence of catastrophic disturbances.'
>
> A Fennoscandian definition: 'Old growth forests are characterized by stands originating through natural successions with a significant contribution of old trees and dead wood, often with a multi-layered tree structure. These forests contain globally, regionally or nationally significant concentrations of biodiversity values (eg endemism, endangered or threatened species, endangered or threatened ecosystems, refugia) or are large landscape level forests, where viable populations of most, if not all, naturally occurring species exist in natural patterns of distribution and abundance.'

The WWF also applies the term old growth to temperate deciduous European forests as a synonym for 'largely undisturbed forest' (WWF 2001).

Across Europe therefore the term old growth is used in two distinct ways. Firstly it is used as purely a structural term to describe tree and stand age and levels of decaying wood. Secondly the structural definition is used in conjunction with species richness as in the Fennoscandian definition above. Similarly, the Swedish Environmental Protection Agency have adopted species richness as the key attribute. It is actively seeking to conserve woodland biodiversity using cryptogam 'signal –species' as the mechanism to identify particularly valuable key habitats and sites (Nitare 2000). They recognise that rare and endangered species sometimes aggregate in great numbers in the forest landscape like local 'hot spots'. They state that continuity of mature trees throughout historical times on a given site, or at least in the immediate vicinity, is of particular importance, and do not rely on structure alone.

2.3 The UK Context

2.3.1 Introduction

The UK does not have anything that could be described as virgin forest and terms relating to naturalness usually imply 'distinct from plantation' rather than original; hence the introduction of the term semi-natural. The major old growth campaigning organisations Greenpeace and WWF (eg the WWF scorecard exercise) do not count the UK as having any such resource although they are keen to recognise and promote the protection of ancient woodland.

Peterken (1992, 1996) concluded that old growth is an imprecise term and difficult to apply as a standard to different woodland types. He quotes Whitney (1987) as suggesting 3 criteria:

- a high degree of patchiness and heterogeneity at the stand scale;
- massiveness, eg of trees and downed (fallen) wood and
- steady-state conditions (until the next disturbance).

In general Peterken sees the term as relating to the structure and composition of 'climax' or late-succession stands but does not limit this to natural woodland: managed woodland may also demonstrate old growth characteristics. He suggests a general European application of the term to stands of trees that show 200 years of undisturbed growth (Peterken 1996). Note that this refers to continuity of undisturbed growth, not to continuity of woodland cover in the area. More recently he has proposed that the stand age for old growth should be reduced to 150 years for the purposes of developing an inventory (Peterken 2000).

Peterken (2000) has suggested that a Minimum Intervention Reserve series could be a subset of a wider old-growth series – implying that some old growth sites could be managed with varying degrees of intervention. Indeed much of the scientific rationale for a minimum intervention series relies on there being comparable managed sites.

Forest Enterprise has recently produced a publication on managing dead wood in Forestry Commission forests (Forest Enterprise 2002). This does use the term old growth in the context of 'old growth' reserves in 20th century conifer plantations. The text initially uses inverted commas around 'old growth' and explains that the reserves provide 'a semblance of old growth habitat conditions'. Old growth is defined in the glossary as:

> A forest stand which has developed free from large scale disturbance over a long period of time (80 – 500) years + and contains large old trees, large fallen and standing deadwood in various states of decay, and a wide variation in tree size and spacing.

Peterken (1987) was one of the earliest proponents of allowing the development of "old growth" stands in planted forest, based on the known value of such stands for biodiversity in natural conifer forests in North America and Scandinavia. Humphrey and Quine (2001) point out that site history is also of key importance as there is some evidence (Humphrey *et al* 2000) that old plantations that were established on, or near to, ancient semi-natural woodland sites have a much higher diversity of woodland fungi, bryophytes and vascular plants than their counterparts established on previously open ground. Isolated plantations of non-native trees left to develop naturally will produce scientific interest and be valuable for wildlife but it is much less likely that they will attain the conservation interest of sites with continuity of old trees.

Butler, Rose and Green (2001) suggest that arbitrary time limits are inappropriate and that age and tree species should be taken into consideration in our definitions of old growth. Oaks usually only reach biological (as opposed to commercial) maturity at 300 years of age, beech is entering its post mature stage at 200 years, whereas birch in most circumstances in the lowlands would be considered ancient at 100 years. They consider that continuity, by which they mean 'a continuous presence of old trees dating back into the past' or 'dating back to original forest cover', should be an additional criterion for categorising 'old growth' woodland. They cite evidence that biodiversity values (lichen and Coleoptera species-richness) are reduced in isolated sites where old tree cover has been interrupted (eg Rose 1992; Alexander 1998). The latter in particular demonstrates the relationship between historical continuity and species richness in saproxylic Coleoptera.

Ascertaining continuity on a wide range of sites requires specialist survey backed by historical research (Selva, 1994). The existing survey methods use the richness of the more immobile lichen, invertebrate and fungal communities to create a reference index of ecological continuity such as those devised by Rose (1976, 1993) and Alexander (1988; updated in Harding & Alexander, 1994). These appear to be adaptable across west European deciduous woodland providing supporting evidence for a link to the original forest cover. Speight (1989) provides a list of saproxylic insects applicable across Europe. In the main, indexes are higher in wood-pasture scenarios where considerable numbers of ancient trees have survived.

Rose (1974, 1976 and 1988) investigated the relationship between woodlands of known age and lichen species-richness across a large number of sites in Britain and France. In the main, indexes were higher in wood-pasture scenarios where considerable numbers of ancient trees have survived. This work thus established the break in continuity independently of the species in a significant number of sites.

Research on the epiphytic lichen flora of chronosequences (stands of known age) back 600 years old (Sanderson 1996, 1998) has shown that the lichen indexes do reflect continuity in the New Forest. This continuity, however is at a site level, not stand level, and that continuity is destroyed by isolation of more than a kilometre or so over this time scale.

There is regional variation in indicator species across the UK and between different wooded structures. Hazel scrub in the north west of Scotland supports a different suite of lichen species than the southern beech woods and this variation needs to be reflected in the choice and range of indicator species (Hodgetts 1992).

The key to understanding the indicator species approach is to consider the degree of completeness of the full range of communities represented within the habitat, with the most species-rich examples considered to be the most complete. This approach is widely accepted amongst specialists in lichens, bryophytes, vascular plants, invertebrates and, increasingly, fungi – provided air pollution history is taken into account in the case of lichens. Sub-fossil studies provide a reference point to some extent. Research on fossil insect assemblages provides good evidence that key beetle indicator species were species of primary forest before it was disturbed by human activity, and knowledge of the number of extinctions of saproxylic Coleoptera following the break-up of the natural forest cover continues to grow (Buckland & Dinnin 1993, for example). The impact of the increasing fragmentation and isolation of individual surviving populations is also being increasingly demonstrated. Buckland and Dinnin (1993) state that the remaining refuges for old forest insects are the ancient wood pastures, including managed park woodland localities, and that these species are hanging on in areas of parkland "a managed habitat which is perhaps the oldest in Britain". Buckland (2002) provides further examples of species currently showing an extreme relict old forest distribution which were more widespread in the Neolithic period.

2.3.2 Related UK terminology

There are a few widely accepted woodland age-related definitions used in the UK. English Nature's *Ancient Woodland Inventory* is based on the following definitions (Spencer & Kirby 1992):

- Ancient Woodland.

  Land that has had continuous woodland cover since at least 1600 AD and may be:

  i. **Ancient Semi-natural woodland**
  Ancient woodland sites that have retained the native tree and shrub cover that has not been substantially planted, although it may have been managed by coppicing or felling and allowed to regenerate naturally.

  ii. **Ancient Replanted Woodland**
  Ancient woodland sites where the original native tree cover has been felled and replaced by planting, usually with conifers.

In Scotland, the comparable reference base is the 'Inventory of Ancient, Semi-natural and Long-established Plantation Origin Woodland' using map evidence from 1750 to define 'ancient' (Roberts *et al* 1992)

The Forestry Commission's *The management of semi-natural woodlands* series *(Forestry Practice Guides 1-8)* suggests various terminology that considers site age, woodland age, structural type and naturalness. The term old growth is not used.

Some terms such as Ancient Woodland now have significance relating to inventories, regulations and grants and are therefore commonly used in conservation management. However, by themselves these terms do not imply anything about the current structure, detailed species composition, or management of a site. Many ancient woods have been neglected in recent years and suffer from external factors such as invasion by rhododendron and over-grazing by sheep. Only a minority have developed or retained substantial areas with old trees.

Recently more attention has been given to both veteran or ancient trees and associated wood-pasture and parkland habitats in the UK, for which a Habitat Action Plan (HAP) now exists. The HAP definition of wood-pasture refers primarily to wooded habitats of at least medieval origin (Watson 2002). The definitions reflect the fact that wood-pasture (as with the term 'coppice') refers to a type of land-use and ranges from entirely semi-natural habitats through to the more heavily modified designed landscapes (formal parks). They are no more or less 'culturally modified' than any other semi-natural woodland type in the UK. Hence, in Scotland 'ancient wood-pasture' is distinguished as wood-pasture with veteran trees present (Holl & Smith 2002).

Definitions of veteran trees are rarely absolute, eg Read (2000) notes:

> "The term veteran tree is one that is not capable of precise definition but it encompasses trees defined by three guiding principles:
>
> - trees of interest biologically, aesthetically or culturally because of their age;
> - trees in the ancient stage of their life;
> - trees that are old relative to others of the same species."

Many of the oldest stands of trees in the UK are in ancient parkland or wood-pasture situations – whether or not still actively managed in these ways.

Phillips (1998) has recently emphasised the importance to nature conservation of disturbed ecosystems including cultural landscapes such as wood-pastures. 'Agri-biodiversity' is a resource to be protected along with wild biodiversity. He identifies "the declining power of the idea of pristine wilderness". The separation of culture and nature, of people from the environment which surrounds them, which has been a feature of western attitudes and education over the centuries, has blinded us to many of the interactive associations which exist between the world of nature and the world of culture. However, it may be that in the case of wood-pastures there may be more of a link to the former natural forest cover than previously recognised.

2.3.3 Links with the original forest cover

In a European and UK context there is currently ecological debate on woodland origin and the extent to which temperate deciduous European forest developed as high forest or as something more akin to wood-pasture, regenerating in patches on open ground under grazing pressure (Rackham 1998; Vera 2000). The development of old and ancient trees in the wood-pasture model of Vera (2000) would be either as groves or groups of trees or individual open grown trees within a matrix of open habitat (although see also Kirby (2003) for a discussion as to the possible openness of a "Vera" landscape). Such groves and individual trees would

be found within a mosaic patchwork of differently aged stands, differently aged individual trees, open glades and thorny scrub. Extensive old 'high forest'-type stands, if Vera's model is correct, would be restricted to areas with less grazing (screes, gorges, steep slopes, etc.).

Butler, Rose and Green (2000) and Vera (2000) suggest that remnant wood-pastures with veteran trees - with their rare and endemic flora and fauna - are closer to the original forest cover than lightly grazed high forest that has been perceived as the more 'natural' model (Peterken 1996).

Whether more natural or not, the ancient or veteran trees in wood-pasture, where there is less competition from young trees, are generally older than trees in the high forest stands (which in the UK usually have had a coppice history) and have richer associated biological communities.

At a landscape scale sites that have the species associated with old age-class woodland, and remnant habitat structures, are immensely important for their potential to help secondary habitats to develop greater species diversity.

2.3.4 High Forest emphasis

There has been a high forest emphasis to definitions of old growth because of its origin in the Pacific north-west, and this has tended to exclude grazing-maintained wood-pastures from old growth definitions.

The high forest emphasis is expressed in terms of:

- structure; the presumption towards multiple level canopies, patchy sunlight reaching the forest floor, down dead wood, etc.;
- naturalness; wood-pastures have been seen as culturally modified/maintained landscapes since grazing is now controlled;
- ecosystem integrity.

This may be unjustifiably restrictive and in the US old growth definitions have now been developed for natural woodland ecosystems with a savannah-type structure (White & Lloyd 1994). In the wood-pasture model the grassland, scrub and tree canopy tiers are all present but are horizontally distinct allowing for regeneration of light-demanding species such as oak. Deadwood on the ground may be proportionally less, given the more open canopy, but levels of standing deadwood and ancient tree biodiversity may be higher.

Grazing is a natural part of a woodland ecosystem. Since many of the wild herbivores that were present in natural forests are long gone, Vera (2000) argues that it is the protected (from grazing), closed canopy, high forest model that is un-natural. What is unclear, however, is how much of the landscape - at any given time - would have been operating according to his model as open woodland with areas of the 'old grove phase' with veteran trees (Kirby 2003).

Fragmentation of the landscape and agricultural encroachment does mean, however, that there is less scope for maintaining the ecological integrity of the wood-pasture or grazed mosaic model. Often the more open areas have been developed towards open pasture. Where trees do persist, the grassland is often "improved" for agricultural productivity,

aesthetics or recreation. Inevitably therefore the areas of wood-pasture that are still recognised as such are usually remnant elements of wider, once intact ecosystems. The same however could be argued for many small, enclosed high forest stands.

In fact, many uncommon communities of epiphytic lichens, saproxylic fungi, and mycorrhizal fungi – each with their equally uncommon associated invertebrates (and probably other organisms) - are associated with the more open conditions found within grazed woodlands, ranging from trees in glades to high forest kept more open by disruption of the shrub layer (eg Chatters & Sanderson 1994, Sanderson & Wolseley 2001, Jonsell, Weslien & Ehnström 1998). These communities are widely recognised as having a close association with sites that have documented long continuity as wood-pasture, often derived from medieval forest (Harding & Rose 1986, Alexander 2002) The longevity of ancient trees that can be achieved under wood-pasture also allows for considerable habitat continuity for old bark and wood decay species.

Other examples of old growth may have been overlooked because they do not fit the high forest model typical of the Pacific North-west. Stahle (1997) points out that old growth stands of non-commercial tree species are quite widespread in the USA but are a neglected subject. Orwig *et al* (2001) for example recently identified an area of old growth on one of the most visited mountains in the eastern USA. In the UK stands of ancient hazel or downy birch in north-west Scotland can support 'old growth'-dependent lichen floras (Averis & Coppins, 1998) that do not fit conventional views as to what old growth should look like.

3. Canvassing opinion

In order to canvass opinion on the use of the term old growth in the UK context, a short questionnaire was developed (see Annexes B &C) and sent out to a limited target audience - 37 interested individuals and organisations in the UK and to 35 across the rest of Western Europe.

The selection was based on:

- a list of people known to be interested in the general subject area, compiled by Keith Kirby and Roland Stiven;
- attendees of the recent Eurosite NACONEX course on "Tools for Preserving Woodland Biodiversity" held at Burnham Beeches in September 2001;
- Board Members of the Ancient Tree Forum.

3.1 UK responses

From the 19 UK responses received, a wide diversity of views was apparent. These have been categorised below into three approaches.

i) Old growth does not occur in UK, rather it refers to ancient forests with no, or minimal, human intervention.

This view is reflected in the following comments:

- "We all feel it is a completely inappropriate expression to use about forests in the UK."
- "To try to apply this term to our highly modified and managed forests is to undermine the significance of this term in its proper application."
- "The term is sometimes applied to ancient woodland or old trees but this is confusing and unnecessary as we already have adequate terms for them."

ii) Old growth, as often used internationally, is a structural term relating to late-succession high forest stands.

A number of respondents proposed that it was equally valid to apply the term to any high forest with the appropriate structure, including stands in plantations of introduced species. Some were adamant that open wood-pastures would not count as they were not forest stands.

- "Old growth should refer to structural characteristics of the stand rather than individual trees...certainly not be confused with ancientness of site as woodland or even depend explicitly on age of the stand."
- "As a structural type – old growth is not related to site history and continuity of forest cover..."
- "With such an objective [structural] definition, it is clear that both native and non-native stands can be defined as old growth ...I know of a number of 150 years + plantations which are clearly getting into the old growth phase.... "

iii) Old growth should be applied to areas showing evidence of continuity of mature woodland habitat, reaching back into the distant past. This is most likely to be found in wood-pasture type stands.

Butler, Rose and Green (2001) see this as being the most suitable application of the term 'old growth' in the UK. The Woodland Trust (2000, 2002) also uses the term in this way, providing a label for stands with uncommon, species-rich accumulations of mature habitat lichens, fungi and Coleoptera. Comments received included the following:

- "What's important is that stands of trees over 200 years, with a continuity of old trees stretching back into the past, in this country need to be valued for the unique biodiversity they support ...the only credible term to use for them would appear to be old growth."
- "Woodlands that have been on a site dating back more than 1000 years would be old growth to me"
- "Individual veteran trees represent old growth in every sense"
- "The richest sites for old growth communities are those with greatest stability in management intervention"
- "Old growth communities can be very rich on pre-veteran stage trees"
- "We do need lists of old growth indicator species….epiphytes and saproxylics….not ancient woodland indicator species as these were developed for use in ungrazed systems"

Old growth is therefore useful as an adjective when describing features or elements of old age-related habitats, eg 'old growth features', or cryptogam and invertebrate communities of old woodland ecosystems. Both the second and third groups of respondents recognise that such structures or species can be found in UK woodland that are typical of long established habitats and more intact woodland ecosystems in other temperate or boreal countries.

3.2 Responses from other European countries

Five responses were received from continental European countries. A difficulty was that we were asking people, with their own comparable array of specific/unspecific terminology, to choose one term that they would translate as 'old growth' when there is not yet consistency in its use in English. In Denmark for example, the term can be used to describe stands that are 'over-mature', ie older than harvesting age (A.-S. Forfang, pers comm.). However, in the Danish Natural Forest Strategy, "gammel skov" literally 'old forest' refers to forest stands older than 1805 (like our 'ancient woodland') and this is also translated as 'old growth' (K. Thomsen, pers comm.).

In Finland, the lead country for commercial forestry in Europe, the term old growth is used in much the same sense as it was applied in North America, ie relatively unmodified natural forest with a high proportion of late succession stands. Finland however is probably the one European state with directly comparable natural conifer forests to America. Similarly the strong influence in Europe of the conservation organisations such as IUCN, WWF and Taiga Forest Network reinforces the use of old growth as applying to primary, natural forest threatened (mostly) by logging.

3.3 Discussion of responses

There is thus a wide array of strongly held views on use of the term "old growth" in relation to UK woods. The pros and cons of the three potential UK approaches outlined in 3.1 merit some further comment.

Approach (i) – not to use the term "old growth" at all

The main arguments for this approach are:

- an inherent presumption that old growth should only be used for intact ecosystems capable of hosting a full range of appropriate species;
- a belief that we already have specific terminology that can be used to describe most UK situations (see for instance *FC Forest Practice Guides* 1-8 (Forestry Commission 1994)) and there is no need for a special term.

There are indeed many terms that are currently used to refer to intact forest ecosystems, eg virgin, pristine, primeval, natural, primary (in the context of the Convention on Biological Diversity), wildwood. However, the terms used in the *Forestry Practice Guides – The Management of Semi-Natural Woodlands*, do not address issues relating to species richness associated with continuity of old trees and decaying wood structure. Both ancient woodland and ancient semi-natural woodland include sites where only young trees are present. In coppiced ancient semi-natural woodland no old trees may be present and decaying wood may be minimal. Equally many wood-pasture sites with veteran trees were not included (for

methodological reasons) on the ancient woodland inventories and therefore their significance may be overlooked.

Approach (ii) – confine usage to a structural term relating to high forest stands with large old trees

The second approach largely follows the historical use of the term in the forests in the USA. There was an implicit assumption, at least by campaigning groups, that the old growth stands to which they were referred retained a great deal of decaying wood structure and species richness. Also there has been a belief that human disturbance of these stands, especially in terms of removal of timber, has been low.

Old growth thus tends to be used as an adjective to refer to ancient woodland and secondary woodland communities with particular elements typical of long established stands (eg old growth features). UK woodlands that have been in minimum intervention for decades or even centuries do contain elements of mature ecosystems that are important to identify and conserve. However, the risk, as one contributor put it, is that it results in rolling into these terms all the attributes of woods that people consider to be desirable or beneficial for conservation value, irrespective of whether or not they are associated with old growth".

Simple criteria, such as >200 or 150 years growth, could provide a standard, with additional structural qualifiers if appropriate. The criteria could be equally applied to both semi-natural stands and to stands within introduced species plantations, substantial areas of which are likely to be set aside as extended rotation areas under the UK Woodland Assurance Scheme. Agreement would be needed on minimum numbers of ancient or veteran trees and maximum allowable disturbance for a stand to qualify structurally.

The proposal to establish Minimum Intervention Areas in woodlands has already been raised. Light demanding forest trees and shrubs may not regenerate and thrive in such conditions except after rare catastrophic events (Vera 2000). 'Old growth' stands of light-demanding species may therefore only be found in grazed wood-pastures. In the light of this it would be inappropriate to apply the term 'old growth' purely to ungrazed stands with dense high forest structure.

From a nature conservation point of view old growth structures are important because they represent the development of an ecosystem with structure and species, distinct from younger age classes. Structure may develop over time and some natural processes may be present but if the secondary forest is isolated from species rich old primary forest, it is unlikely to develop the full species richness of old primary forest.

Old growth in the structural context is defining a stage in a process and this is always going to be a snapshot in a stand's history. Old trees are ultimately going to be temporary individuals in any wooded landscape (although on a scale of centuries not decades) whether it is in the coniferous shade-tolerant forests of the boreal or Pacific Northwest or ancient wood pastures of temperate oaks. In one sense this is the strength of this approach - the stands are relatively easily defined both conceptually and on the ground. Should it matter however if the regenerating cohort is either a separate individual or distinct patch or indeed, not yet present but awaiting a temporary break in grazing pressure to get established? The important criterion is that the species associated with the old trees can survive in the ecosystem.

Approach (iii) – apply to areas with old trees and decaying wood habitat showing evidence of long continuity

It is relatively straightforward to identify old trees and decaying wood structure. However, demonstrating evidence for continuity of old trees in an ecosystem reaching back into the past, is more exacting and requires assessment by specialist ecologists. In primary old forest, continuity is implicit and does not need to be separated out. In our modified and fragmented cultural landscape, however continuity of habitat is believed to be an important factor in the conservation of certain relatively immobile species and/or rare communities.

The presence of species of old primary woodland indicates a degree of past continuity of ecosystem structure and processes, even where there are just old trees standing in very modified environments. Where there are sites which retain unusually large numbers of species associated with intact ecosystems, the special biodiversity value of these sites needs to be recognised, greater emphasis given to their conservation, and their value promoted to the public. There is a need for a special term to emphasise the value of these ecosystems and to promote the values to wider audiences. 'Old growth' could provide that term.

Continuity of the old and mature trees and decaying wood habitat into the future should also be considered, ie the presence of a subsequent cohort ready to inherit the old primary woodland flora and fauna. This may be within the site or on adjacent areas, including secondary woodland.

This leaves open the question of what counts as 'unusually large numbers of species', in order for a site to qualify as old growth under this approach.

The various indices that have been developed do focus on threshold levels, above which a particular site is said to have regional, national or even international significance. Threshold indices do seem a practical way forward. Sites with appropriate structures, eg approach II above, but which have not yet been studied for their species composition could be regarded as 'provisionally' old growth until the necessary research is carried out.

4. Defining Old Growth

4.1 Difficulty of definition

The questionnaire returns and resulting discussions over the use of the term old growth show a wide diversity of interpretation – relating primarily to differences of opinion between the structuralist approach and the biodiversity richness approach and between high forest and open grazed forest scenarios.

4.2 What is the term "old growth" signifying that is different from other terminology?

Figure 1 summarises a range of individual attributes that people think contribute to defining old growth. The elements have been loosely separated into structural characteristics and habitat/species quality criteria. Most would agree that old growth sits happily at the centre of the arrows.

Some clear points do arise from international usage. The term originated to emphasise factors including:

- large old trees;
- natural processes of aging and decay;
- species dependent on large old trees;
- implicit long-term continuity of woodland cover;
- that old growth is not synonymous with virgin/untouched/undisturbed forest;
- that old growth could develop following human disturbances.

Difficulties may arise when structural definitions add attributes that apply only to certain types of old growth such as multiple layer canopies, canopy gaps and understorey patchiness, or density of tree cover, if these are seen as absolute requirements for all examples.

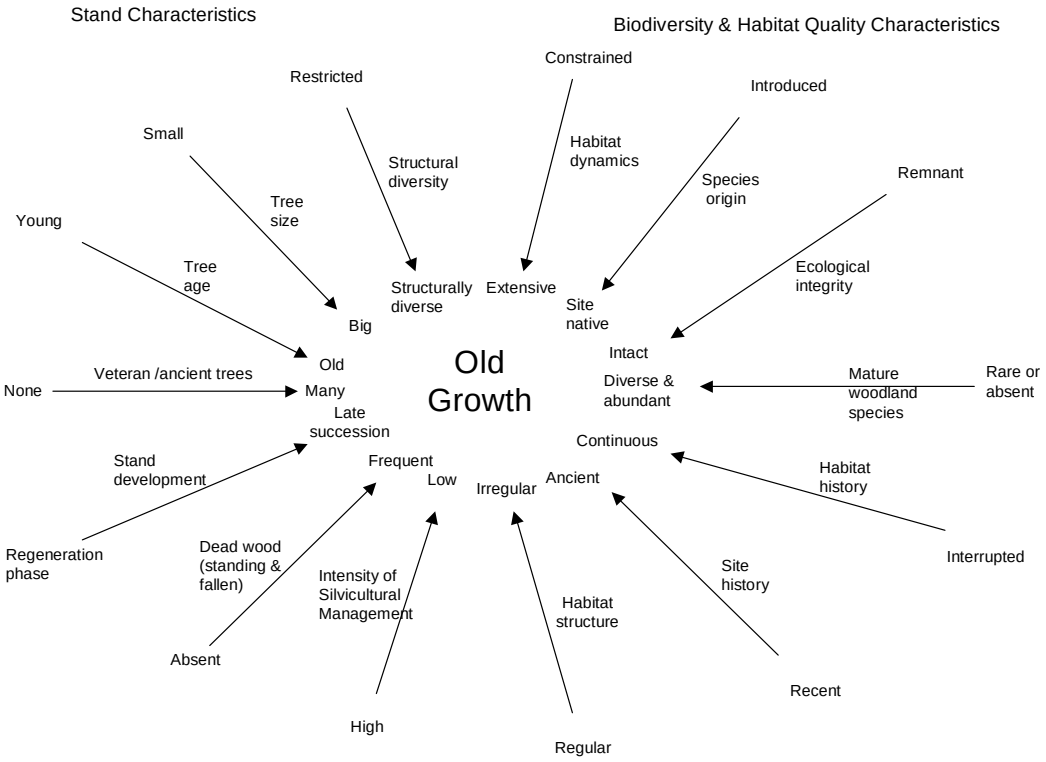

Figure 1. Various suggested defining attributes of old growth

The tendency for definitions of old growth to move towards ideas of natural forest, untouched by people, has made the term less useful in ecological terms because the distinction from ideas of virgin habitats becomes blurred. Old growth as a term then becomes redundant other than as an environmental campaigning tool.

In addition the degree of human influence is a complex continuum; even apparently “natural” forest has usually been affected by human activities, whether by indigenous peoples or by pollution from industrialised societies.

If ‘old growth’ is to have a distinct and different meaning then it should be as a determiner of value and not a catch-all for a wide range of habitat types including those with little species richness.

4.3 Structure, process and biodiversity

The carefully worded international definition provided on the Convention on Biological Diversity website appears to be an appropriate starting point for UK and European use:

> Old growth forest stands are stands in primary or secondary forests that have developed the structures and species normally associated with old primary forest of that type that have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class.

The key phrase is “developed structures and species normally associated with old primary forest of that type”. It therefore combines the structure, process and species. The terminology of “Forest” may be interpreted broadly to include ancient woodland, wood pasture and some parkland.

The CBD definition is explicit that structure and ecological processes are closely linked. Structural diversity, habitat dynamics and species composition are all indicators of ecological integrity and the stand and biodiversity/habitat indicator characteristics (the criteria set out in Figure 1) are measurable subsets of these. The structural characteristics provide the physical habitats that allow the range of communities necessary for many of the ecosystem processes to exist, while, conversely, structure without the key communities is clearly not old growth within the CBD definition.

4.4 Recommendation

Adoption of the CBD definition (provided that as above ‘forest’ can include wood-pasture) has many advantages:

- by including primary and secondary forests it recognises that woodland ecosystems may move across landscapes;
- it does not exclude cultural landscapes as long as they have the structures and species sufficiently accumulated to act as a woodland ecosystem;
- structure, species and process all feature;
- it links with old primary forest features;
- the distinction from younger forest is clearly stated.

Since the UK has no undisturbed virgin forest, an old growth series would consist of sites with stands showing continuity of tree cover and old growth species/characteristics that have been actively managed by people to varying degrees in the past and which may or may not still be being managed.

'Old growth' with a high degree of ecological integrity would show a diversity of biological communities and other habitat quality indicators that depend on one or more of the structural attributes described above, for example:

- site history - Ancient Woodland Inventory site or other earlier documentation or tree age analysis;
- habitat history - based on broader land use analysis recognising that not all potential sites may be 'ancient woodland';
- ecological integrity - providing some assessment of habitat condition (as per Site Condition Monitoring);
- habitat dynamics - a measure of habitat scale and connectivity of the stand with particular regard to scope for the inheritance of existing old growth characteristics by connected mature woodland habitat.
- indices of species continuity – providing some assessment of the presence of species normally associated with old primary woodland.

Old growth would be differentiated from sites of native composition where active management and exploitation has ceased, for various reasons, and where "minimum intervention" is planned or adopted. Some minimum intervention stands may be 'old growth', and most should eventually develop towards such a state. However, they may not be there yet. These latter may become part of an old growth conservation strategy but cannot properly be termed old growth in the short term.

In the New Forest for example it may take as much as 300 years before colonisation by characteristic lichens from neighbouring old growth woodlands actually begins to take place – the *Lobarion* community has spread for up to 200m into a plantation dated at about 1700 (Rose, 1992). The creation of new 'old growth' is therefore a very long term project. For most practical purposes however, "old growth is a non-renewable, but perishable, resource with a highly variable and uncertain 'shelf life'" (Carey 1998).

Old growth as defined above would also be distinguished from woods of non-native species which are developing the structures and processes of old woodland. These non-native stands either do not have or are unlikely to develop the structures and species associated with primary European woodland. Such stands might be of high conservation interest but would not be classed as 'old growth'.

In summary, the UK lacks virgin forest, but retains features of special nature conservation value particularly associated with certain types of cultural landscape that appear to be consistent with old growth as defined by the CBD. A minor addition to the CBD would make this clear and could be adopted as a definition of old growth for the UK, as follows:

Old growth forest stands are stands in primary or secondary forests (including wood pastures and parkland) that have developed the structures and species normally associated with old primary woodland of that type that have sufficiently accumulated to act as a woodland ecosystem distinct from any younger age class.

5. Towards an inventory of old growth sites

5.1 Rationale for an inventory of old growth

An inventory of old growth sites or sites demonstrating appropriate woodland species, structures and processes may contribute to scientific understanding, biodiversity management, site protection and the development of landscape-scale strategy objectives:

- **Scientific understanding**: to allow the study of natural dynamic processes in old growth stands for application to forest management and conservation management. Forest Research are keen to identify a series of long-established stands within introduced conifer plantations for research into plantation management and design for conservation. The distinction between native and non-native, semi-natural and planted, and "minimum intervention" and "old growth" becomes important here.

- **Biodiversity Management:** to provide a reference list of woodland sites that warrant appropriate management for species normally associated with old primary woodland. Identifying species-rich old growth habitats would also help to ensure their expansion and linkage into habitat networks. However we would be looking for networking of other woodland types, structures and phases as well.

- **Site protection:** a list of old growth sites should help to draw attention to its current scarcity and the degree to which it is or is not adequately represented within the current system of protected sites. The existing protective designations (eg NNRs, SSSIs), include sites containing old woodland stands and sites with rare species typical of old primary woodland. However many other sites do not have adequate protection at the moment as they are not recognised as of importance. The Native Woodland and Wood Pasture and Parkland Habitat Action Plans offer some support for protection of sites although even so some may fall through the net. UK BAP Species Action Plans only include a small number of examples of old primary woodland species that are under threat and are therefore not likely to make much difference to the conservation of the resource as a whole.

- **Development of landscape-scale strategies**: to promote greater connectivity of semi-natural habitats including old growth, enhancing the sustainability of habitats. We cannot suddenly recreate old growth in the short-term but the vulnerability of individual sites can be reduced by targeting conversion of agricultural landscapes with veteran trees to more extensive wooded conditions, particularly if these are close to existing areas of old growth.

5.2 Existing inventories

"An inventory of areas of conservation value for the invertebrate fauna of the mature timber habitat" was commissioned by the Nature Conservancy Council in 1975 (Harding, 1978a, b, c, d), which, although focusing on saproxylic beetles, drew on site information provided by lichenologists (see Key 2000 for a historical summary of this project). The "mature timber habitat" is thus close to old growth, as defined by the modified version of the CBD definition provided above in section 4.4.

The sites identified were primarily the ancient wood-pastures and parklands. These were identified as a wildlife conservation priority (Peterken 1977a,b) but were subsequently largely neglected – despite the key publication of Harding & Rose (1986) - until the recent development of the UK Biodiversity Action Plan.

The 1980s saw the development of the Ancient Woodland Inventory (Spencer & Kirby 1992, Kirby *et al* 1998), which documents sites where there appears to have been evidence for continuous woodland cover since AD 1600. The emphasis is on enclosed woodlands, combining evidence from historical documentation (mainly old maps) with field archaeology (eg presence of old wood banks) and plant species composition. This inventory does include some sites with "old growth" characteristics, as defined in Figure 1, but these are exceptions rather than the rule as the sources used to identify ancient woodland were unlikely to pick up old wood pastures or parkland.

Some 'old growth' sites may be on the Register of Historic Parks and Gardens (developed by English Heritage) but this only includes designed landscapes and so does not necessarily cover other parks that are still essentially semi-natural in character. Others will be on the National Inventory of Woods and Trees and the Commons Register, but with none of these will have flagged up the 'old growth' nature of the site.

More recently, inventories of ancient or veteran trees – in response to the Veteran Tree Initiative - as well as of parklands and wood-pastures have been developing in response to the UK Habitat Action Plan. The Ancient Tree Forum is developing its own inventory of sites with concentrations of ancient trees and with, for example, key saproxylic, epiphytic and mycorrhizal communities. The British Lichen Society maintains its own database.

The need therefore may not be for a separate inventory of old growth but for national guidelines to ensure that these various projects are generating compatible data that can be brought together to inform national conservation work. In effect this is part of the role of the Wood-Pasture Information System being developed by English Nature as a module of the National Biodiversity Network (a trial version of this is currently available at www.wapis.org.uk).

5.3 Methodologies

Inventories of relict old growth in the cultural landscape – as defined in the preceding section - need to draw on a wide range of sources. Direct fresh field survey will often be the only way to discover and identify important sites. However, in the short term, this is impractical and other approaches based on the combination of various indirect methods, will be needed. These include:

- aerial photography;
- existing survey data:
    - OS maps, especially 1: 50 000 and 1: 25 000;
    - Phase 1 Habitat data;
    - Mature Timber Habitat project of NCC (1976-78), which lists sites and includes descriptions, some detailed;
    - miscellaneous surveys of saproxylic fungi and invertebrates, and epiphytes;

- Biological Survey of Common Land (Department of Environment, now Defra) - all English counties are now covered; these surveys however map vegetation communities and can be very difficult to use for identification of ancient wood pastures;
- Wildlife Trust survey data;
- National Trust survey data;
- Ancient Tree Forum data;
- British Lichen Society surveys, especially *Survey & Assessment of Epiphytic Lichen Habitats* (1982);
- Historic Parks and Gardens Register (EH) and equivalents in other countries;
- discussions with knowledgeable individuals;

- historical sources:
  - *The Medieval Parks of England - A Gazetteer* (Cantor 1983), which lists all known documented medieval deer parks by county and provides the date of the earliest reference to each park;
  - various published accounts of deer parks, notably Whitehead (1950), but also Shirley (1867), Whitaker (1892) and others, which list extant deer parks at various times and often contain valuable information on their historical use and condition;
  - old maps old maps held at County Archive Departments, including the Tudor maps of Saxton and Speed which locate deer parks and forests in that period – in some cases these have been re-published, eg the Saxton maps individually by the British Museum, or collectively (Ravenhill, 1992).

Existing initiatives also need to be included, notably:

- Ancient Woodland Inventory;
- the developing Parkland and Wood Pasture Information System.

Special attention will need to be given for types of sites that may be missed using the above sources. Rough hill pastures with scattered ancient trees are very much a case in point, eg as in the Lake District valleys and along the Cotswold escarpment. Other types of situation with concentrations of ancient trees include river floodplains and old fenland.

The above sources will collectively generate a list of sites that will include many sites that hold relict old growth. These will need to be surveyed in due course, to determine to what extent the structural features of old growth are represented, and this will in turn need to be followed up with surveys by specialists in epiphyte, saproxylic and mycorrhizal communities. Without the species information sites would be regarded as only provisionally old growth.

However, if sites support ancient trees and continuity of ancient trees can reasonably be surmised from their history, then species data may be less important. The recommendation of Spencer & Kirby (1992) with regard to the Ancient Woodland Inventories for England and Wales provides a sensible rationale:

‘..... the inventories needed to be *inclusive* rather than exclusive; that is, the default position for borderline sites, or those for which data were lacking, was that they were to be retained on the inventory. This ensured that such sites were considered for future surveys, which would

enable a decision to be made on their correct status and that woodland losses caused through ignorance of the possible value of particular sites would be minimised. An inevitable consequence of this approach was that the inventories could not be completely accurate.....'

The Countryside Council for Wales have already carried out a national parkland survey based on aerial photographs and follow-up site survey data. Some county inventories of parkland habitat have already been produced in England, eg Norfolk and Bedfordshire, as a pilot within the Veteran Trees Initiative project (Reid & Wilson, 1995), and Staffordshire, as part of the county Biodiversity Action Plan (Webb & Bowler, 2001). Scottish Natural Heritage have established the foundations for an inventory of wood pasture in Scotland (Holl & Smith, 2002; and see Annex D).

5.4 Conclusions and recommendations

A landscape approach is needed, which acknowledges that old growth may occur in:

- historic forests, chases and parklands, common land and other types of wood-pasture;
- ancient woodland;
- old agricultural landscapes, including floodplains and rough hill pastures, as in the Cotswold Hills and the Lake District.

It is recommended therefore that:

- the Parkland and Wood Pasture Information System is completed and joined to the Ancient Woodland Inventory;
- sites are tagged as *old growth* within existing and developing inventories,
- county or regional inventories are initiated as soon as possible;
- in the longer-term agreed structural definitions and habitat context qualifiers could form part of assessments of habitat types undertaken within the National Inventory of Woodland and Trees and similar exercises;
- agreement is sought on appropriate species index thresholds for defining 'old growth'.

For any site being proposed there must be a full justification as to how it qualifies. Otherwise the term is likely to become used as a generalised campaigning term with the danger that that its currency is devalued. Quantifiable assessments of the attributes that define old growth (structural and habitat quality measures such as species indices as outlined above) that can be practically measured in the field need to be agreed.

This project has clarified some of the issues surrounding the definition of old growth as it applies in the UK. English Nature would welcome further comment and discussion, in particular on how the attributes that might define old growth could be quantified for field assessment.

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Annex A. Consultees

Name	Organisation	Response?
UK		
Ben Averis		yes
Andy Barnard	Corporation of London, Burnham Beeches	
John Blyth	Edinburgh University	
Jeff Burley / Peter Savill	Oxford Forestry Institute	yes
Jill Butler	Woodland Trust	yes
Brian Coppins	British Lichen Society	
Jes Dagley	Corporation of London, Epping Forest	
Jim Dickson		
Forest Stewardship Council	FSC	
John Healy	School of Agricultural & Forest Sciences, University of Wales, Bangor	yes
Paul Hibberd	FC, Lyndhurst	yes
Kate Holl	SNH	yes
Jonathon Humphrey	FC, Edinburgh	yes
Roger Key	English Nature, Peterborough	yes
David Lonsdale	Forest Research	
Paul Mitchell	Department of Agriculture & Forestry, Aberdeen University	
Gordon Patterson	FC, Scotland	yes
George Peterken	Consultant	
Peter Quelch	FC, Scotland	yes
Beatrix Richard	WWF	
Neil Sanderson	Consultant	yes
Richard Smithers	Woodland Trust	yes
Scott M Wilson	Forestry Consultant	yes
	Ancient Tree Forum	
Keith Alexander	National Trust	yes
Bill Cathcart	Crown Estates, Windsor	
David Clayden	English Nature	
Caroline Davis	Tree Council	yes
Neville Fay	Treework Environmental Consultancy	
Roy Finch	Arboriculture Consultant	
Vikki Forbes	National Trust	yes
Ted Green	Environmental Consultant	yes
Andy Law	Countryside Council for Wales	yes
Dan Lewis	Local Authority Tree Officer	
Helen Read	Corporation of London, Burnham Beeches	yes
John P Smith	Mapping Consultant	
Mike Smith	Environmental Consultant	
Bob Warnock / Adam Curtis	Corporation of London, Ashtead Common	yes
Rest of Europe		
	Naconex Contacts	
Leif Andersson	Sweden	
Kjell Antonsson	Sweden	
Rolands Auzins	Latvia	
Carlos Norman Barea	Spain	
Ola Bengtson	Sweden	
Res Bohumil	Czech Rep	yes
Andrzek Czech	Poland	
Anne-Sofie Forfang	Denmark	yes
Guy Herremans	Belgium	
Piret Kiristaja	Estonia	

Name	Organisation	Response?
Tina Laebel	Denmark	
Agnieszka Lopata	Poland	
Roger Marciau	France	
Riina Martverk	Estonia	
Hannes Nilsson	Sweden	
Ciara O'Mahony	Eire	
Juan Pagola	Spain	
Anneli Palo	Estonia	
Heidi Paltto	Sweden	
Gerard Passola Parcerissa	Spain	yes
Roman Perevalov	Moldova	
Eckhard Schroder	Germany	
Lubos Starka	Czech Rep	
Maria Sterzynska	Poland	
Anne Thill (returned email)	France	
Karsten Thomsen	Denmark	yes
Ilze Vilka	Latvia	
Monica Wolfe	Germany	
	English Nature recommended contacts elsewhere in Europe	
Udo Bonn	Germany	
Milan Chytry	Czech Republic	
Martin Hermy	Belgium	yes
Colman O'Criodain	Eire	
Sandro Pignatti	Italy	
Joop Schaminee	Netherlands	
Axel Ssymank	Germany	

Annex B. Questionnaire for UK

Defining 'Old Growth' in a UK /European context

A Questionnaire (UK)

Introduction

This questionnaire contributes to a short piece of work being undertaken by the Ancient Tree Forum on behalf of English Nature.

There is increasing interest in the value of old trees and old stands of trees in the UK. These are often being referred to as 'old growth'. However there is no agreed definition of what should be called 'old growth' in the UK. Nor is there an inventory of where it occurs. English Nature want a working definition of 'old growth' as it refers to woodlands in the UK and would like to ensure that it can be related to definitions used in the comparable landscapes of continental Europe.

Using this questionnaire we hope to learn:

- how the term 'old growth' is currently being used; and
- your opinion on how to define and identify old growth.
- Which woodland sites in the U.K. you think represent 'old growth'.

We have kept this questionnaire quite short so it shouldn't take you long to go through it. If there are parts where it would be easier/quicker to talk on the phone rather than write things down please just indicate and I'll get back in touch with you.

Mike Smith
Director, Ancient Tree Forum

Please complete and email this document back to rolandstiven@talk21.com

1. Name	
Organisation	
Address	
Telephone no.	
Email	

2. Do you, or the organisation you represent, currently apply the term 'old growth' to aspects of the UK woodland resource? **Yes** ☐ **No** ☐

If yes, in what context? Please expand on this where appropriate !	
Forests / woodlands	
Stands of trees,	
Wood Pasture or Parkland	
Individual veteran trees,	
Habitats within veteran trees,	
Ancient woodland ('indicator') species	
Other	

3. If old growth woodland sites are to be defined as something distinct we should be able to identify a set of characteristic features which are typical. Some features may have to be regionally qualified. The following table contains suggested features. You may think some are a necessary requirement of old growth woods, or just desirable features or perhaps irrelevant. We would welcome any comments on these and please suggest any additional features you think should be considered.

Feature	**Requisite or desirable**	**Qualifier or other Comment**
Naturalness		
Stands of site native trees over a certain age (eg 150 years old)		
Concentration of veteran trees (eg x/ha)		
Continuity of old trees and shrubs on site reaching back into the past		
Continuity of standing and fallen deadwood resource		
Historic / long-established pattern of management intervention		
Historic / long-established pattern of grazing		
Varied age structure		
Diversity of stand structure		
Presence of 'indicator species' associated with long-established / continuous woodland.		

4. **It would be useful to have a list of sites which people consider 'old growth'. This would allow field testing of the most appropriate set of criteria/characteristics to see how well they apply in practice. A number of sites have already been suggested including; Windsor Great Park, Savernake Forest in Wiltshire, the New Forest, Melbury Park, Boconnoc Park in Cornwall, Brampton Bryan Park in Herefordshire, Parham Park in West Sussex, Dolmellyn Lyn in Wales and Abernethy Forest on Speyside.**

   It may also be useful in future to create an inventory of 'old growth' woodland sites in the UK or to identify 'old growth' woodland sites within existing inventories (such as the Ancient Woodland Inventory).

Are you familiar with other sites which you would expect to see within an inventory of 'old growth woodland sites'?	
If yes, roughly how many sites could you suggest? (eg a handful, tens, hundreds)	
Would you be prepared to contribute to an initial list of suggested 'old growth' sites	
Would you like to see a formal inventory of 'old growth' woodland sites?	
Comments?	

5. **Please add any further general comments below**

Please complete and preferably email this document back to rolandstiven@talk21.com or alternatively post to Mike Smith, 23 Colinton Mains Green, Edinburgh EH13 9AG

Thank you

Mike Smith
Director, Ancient Tree Forum

Annex C. Questionnaire for Europe

Defining 'Old Growth' in a UK /European context

A Questionnaire

Introduction

This questionnaire contributes to a short piece of work being undertaken by the Ancient Tree Forum on behalf of English Nature (the government agency responsible for biodiversity conservation in England).

There is increasing interest in the value of old trees and old stands of trees in the UK. These are often being referred to as 'old growth' but there is no agreed definition of what 'old growth' means in the UK or where it occurs. All woodland areas of the UK have experienced considerable modification by people so there are no virgin or pristine woodlands left.

English Nature want a working definition of 'old growth' as it refers to woodlands in the UK and would like to ensure that it can be related to definitions used in the comparable landscapes of continental Europe.

Using this questionnaire we hope to learn:

- how the term 'old growth' (or comparable translation) is used in your country; and
- how you define and identify 'old growth woodlands'.
- Examples of woodland sites in your country which you think represent 'old growth'.

We have kept this questionnaire quite short so it should not take a long time to complete. If there are parts where it would be easier/quicker to talk on the phone rather than write, please indicate and I will telephone you.

If you fill in the questionnaire on your computer the boxes should expand to fit what you write. You can then save the file and email it back.

Please complete and email this document back to rolandstiven@talk21.com

1.	**Name**	
	Organisation	
	Address	
	Country	
	Telephone no.	
	Email	

2. Do you, or the organisation you represent, currently apply the term 'old growth' (or comparable translation) to woodlands in your country? **Yes** ☐ **No** ☐

If yes, in what context? Please provide further comment if you want !	
Forests / woodlands	
Stands of trees,	
Individual veteran trees,	
Habitats within veteran trees,	
Ancient woodland ('indicator') species	
Other	

3.	**Do you have an agreed definition of 'old growth' woodlands?**	**Yes** ☐	**No** ☐
	If YES, can you provide details or a reference and answer question 5		
	If NO, please answer question 4		

4. If 'old growth' woodland sites are to be defined as something distinct we should be able to identify a set of characteristic features. The following table contains suggested features. You may think some are a necessary requirement of 'old growth' woods, just desirable features or perhaps not useful. We would welcome any comments on these and please suggest any additional features you think should be considered.

Feature	**Necessary Desirable or Not Useful**	**Comment**
Naturalness		
Stands of site native trees over a certain age (eg 150 years old)		
Concentration of veteran trees (eg x/ha)		
Continuity of old trees and shrubs on site reaching back into the past		
Continuity of standing and fallen deadwood resource		
Historic / long-established pattern of management		
Historic / long-established pattern of grazing		
Varied age structure		
Diversity of stand structure		

Presence of 'indicator species' associated with long-established / continuous woodland.		

5. Is there an inventory of old growth woodland sites in your country?

YES	☐ please give details or reference	
NO	☐	please answer question 6.

6. It may be useful to have a European list of sites which people consider 'old growth'. This would allow field testing of the most appropriate set of criteria/characteristics to see how well they apply in practice and relate across Europe. In the UK, suggested sites include; Windsor Great Park, Savernake Forest in Wiltshire, the New Forest, Melbury Park, Boconnoc Park in Cornwall, Brampton Bryan Park in Herefordshire, Parham Park in West Sussex, Dolmellyn Lyn in Wales and Abernethy Forest on Speyside.

It may also be useful to create an inventory of 'old growth' woodland sites in Europe.

Are you familiar with woodland sites in your country which you would expect to see within an inventory of 'old growth woodland sites'?	
If yes, roughly how many sites could you suggest and what area would they cover?	
Would you be prepared to contribute to an initial list of suggested 'old growth' sites	
Would you like to see a formal European inventory of 'old growth' woodland sites?	
Any further comments?	

7. Please add any further general comments below.

Please complete and preferably email this document back to rolandstiven@talk21.com or alternatively post to Mike Smith, 23 Colinton Mains Green, Edinburgh EH13 9AG/, Scotland, UK

Thank you

Mike Smith
Director, Ancient Tree Forum

Annexe D. Ancient wood pasture inventory in Scotland

Ancient Wood Pastures are sites where the woodland and grazing history have evolved in tandem to produce a grazing maintained habitat with elements of both woodland and pasture. These dynamic processes have resulted in woodland structure composed of open grown trees, which can attain a great age, over a range of semi-natural ground floras.

Wood pastures have developed in both lowland and upland situations but their presence can often be masked by more recent management practices. Unenclosed examples in remote locations have gone largely unrecognised, as have those sites where the open woods have been in-filled with underplanting or regeneration. Remnants can be found at field edges, as part of boundary features in the lowlands or associated with old settlements.

Ancient Wood Pastures (AWP), in Scotland, have only recently started to be investigated and there are still many questions to be answered. In an attempt to summarise the situation in Scotland, as it is known at present, ancient wood pastures have been split into structure types as an aid to defining the resource. These are set below:

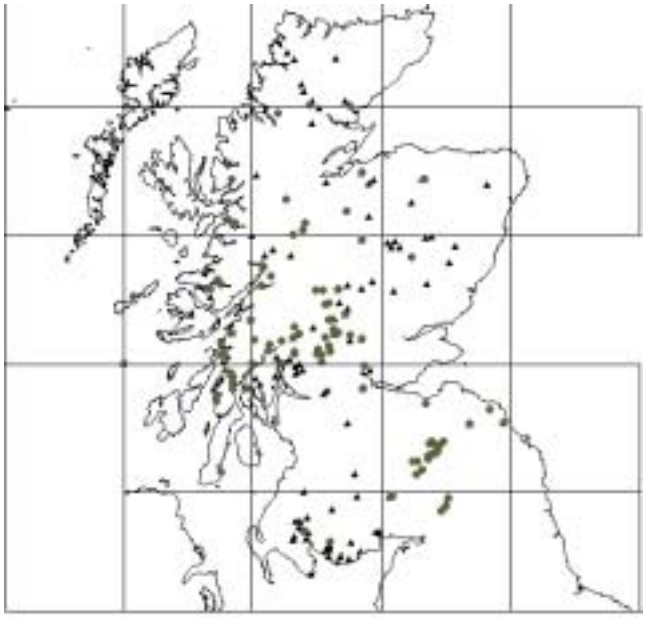
1. Ancient wood pasture with long established open semi-natural ground flora and an element of woodland ground flora.
2. Ancient wood pasture with improved grassland.
3. Ancient wood pasture with rank grasses and scrub.
4. Ancient wood pasture on arable, urban and other land.
5. Parkland and orchards.
6. Long abandoned ancient wood pasture with established secondary woodland.
7. Ancient wood pasture underplanted with mature conifers or non-native broadleaves.
8. Recently abandoned ancient wood pasture with scrub and regeneration.
9. Ancient wood pasture underplanted with young conifers or non-native broadleaves.

If we use structure as the most important defining criteria of wood pasture then it is possible for any native woodland type or community to have a wood pasture derivative including the minor woodlands.

Anywhere where there are semi-natural remnant woodlands, patches of wood pasture structure can occur in mosaic with ex-coppice, coppice with standards, and near natural structures. The latter can occur in any true refugia, eg islands, crags and gullies.

The extent and distribution of the habitat is of primary concern. Responses to an earlier questionnaire led to the development of the *Initial inventory of Ancient Wood Pastures in Scotland*. This showed that AWPs were distributed throughout Scotland (see Map below).

Map 1 showing distribution of wood pasture site from initial survey



▲ Unconfirmed
● Confirmed

A subsequent project has started to examine the extent and condition of the resource. The aim of the project was to try and identify potential wood pasture sites through remote sensing. This was carried out by undertaking an analysis of existing maps and map-based inventories. The object was not to identify every possible site but to find a practical methodology that would help to identify candidate sites within the limited timescale and budget.

It was thought that wood pasture sites could be identified by comparing sites with open woodland cover, as recorded by the Scottish Semi-Natural Woodland Inventory (SSNWI), with those that are mapped as open woodland on the OS 1st Edition Maps of 1860; the premise being that sites with open woodland on both are potentially ancient wood pastures. Ascertaining wood pasture status was only possible by ground truthing to establish whether the site still maintains populations of trees that were present in both 1860 and the present day. This methodology would be able to pick up the first five AWP structures types as described above.

By combining data from the SSNWI and the 1st OS Edition maps with the ground truthing exercise it is possible to come up with an estimate of the number of SSNWI polygons that contain AWPs and, from this, to estimate the area. A statistically useful sample of the sites was selected and these were visited to confirm their AWP status. The results of the ground truthing exercise could then be combined with information derived from the remote sensing part of the project to estimate the proportion of the SSNWI polygons that are Ancient Wood Pastures.

Map 2 Illustration of open woodland as compared to closed canopy woodland from OS 1st Edition Maps of 1860.

Illustration of open woodland as compared to closed canopy woodland from OS 1st Edition Maps of 1860.

Map 3 showing randomly selected sites for ground truthing

Of the sites visited

- 11 of the 19 sites (1-10ha) were confirmed as AWP
- 25 of the 34 sites (>10ha) were confirmed as AWP

From this it is estimated

	1-10 ha	**> 10ha**	**Total**
Estimated number of real AWP polygons	517	245	**762**
Lower 95% confidence limit	343	197	**571**
Upper 95% confidence limit	780	305	**1018**

This number of polygons can then be converted to areas

	1-10 ha	**> 10ha**	Total
Estimated total area of wood pasture	1946	7460	**9406**
Lower 95% confidence limit	1110	4955	**6654**
Upper 95% confidence limit	3411	11233	**13298**

Details of the analysis are given in the SNH report

The inventory of ancient wood pastures has been set up on ArcView GIS software which indicates sites as either point or polygon themes. These can be displayed over OS map data at an appropriate scale or alongside other SNH GIS based inventories. This will allow AWP to be shown as part of Forest Habitat Networks or wider habitat networks as they are developed. Individual veteran trees of note can be recorded as points allowing for them to be put in the context of the 1st Edition OS maps, where they may have been part of an historic wood pasture site.

The inventory is not a definitive list of potential wood pasture sites rather an aid to understanding the resource in Scotland. The initial inventory of wood pasture sites (2001) was created by questionnaire with sites being proposed as candidate sites. The further development of this inventory will be an ongoing process with potential sites being proposed as candidate sites. In addition remote sensing is likely to identify further candidate sites, as resources become available. The estimate of number of sites and areas cover only those with an open canopy cover. Areas with a more closed canopy cover have not been included in this estimate.

The understanding of the resource of ancient wood pastures in Scotland is still preliminary but has come along way since these unenclosed upland wood pasture types were included in the Habitat Action Plan in 1999. The inventory gives the first estimate of the extent of the resource, which will become more statistically accurate as new sites are added.

Annex E. Glossary

The Convention on Biological Diversity website provides the following definitions for terminology used in this report:

Forest

“The group considers the FAO definition of a forest as the basic one (FAO, 1998; FRA 2000), but acknowledge that many other useful definitions of "forest" exist in published form. The fact that "forest" has been defined in many ways is a reflection of the diversity of forests and forest ecosystems in the world and of the diversity of human approaches to forests. In this document, a forest is a land area of more than 0.5 ha, with a tree canopy cover of more than 10%, which is not primarily under agricultural or other specific non-forest land use.In the case of young forests or regions where tree growth is climatically suppressed, the trees should be capable of reaching a height of 5 m *in situ*, and of meeting the canopy cover requirement.”

Forest Ecosystem

“A forest ecosystem can be defined at a range of scales. It is a dynamic complex of plant, animal and micro-organism communities and their abiotic environment interacting as a functional unit, where trees are a key component of the system. Humans, with their cultural, economic and environmental needs are an integral part of many forest ecosystems.”

Primary Forest

“A primary forest is a forest that has never been logged and has developed following natural disturbances and under natural processes, regardless of its age. It is referred to "direct human disturbance" as the intentional clearing of forest by any means (including fire) to manage or alter them for human use. Also included as primary, are forests that are used inconsequentially by indigenous and local communities living traditional lifestyles relevant for the conservation and sustainable use of biological diversity. In much of Europe, primary forest has a different connotation and refers to an area of forest land which has probably been continuously wooded at least throughout historical times (eg, the last thousand years). It has not been completely cleared or converted to another land use for any period of time. However traditional human disturbances such as patch felling for shifting cultivation, coppicing, burning and also, more recently, selective/partial logging may have occurred, as well as natural disturbances. The present cover is normally relatively close to the natural composition and has arisen (predominantly) through natural regeneration, but planted stands can also be found. However, the suggested definition above would include other forests, such as secondary forests.”

Secondary Forest

“A secondary forest is a forest that has been logged and has recovered naturally or artificially. Not all secondary forests provide the same value to sustaining biological diversity, or goods and services, as did primary forest in the same location. In Europe, secondary forest is forest land where there has been a period of complete clearance by humans with or without a period of conversion to another land use. Forest cover has regenerated naturally or artificially through planting.”

Old growth forest

“Old growth forest stands are stands in primary or secondary forests that have developed the structures and species normally associated with old primary forest of that type have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class.”

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Peter Wakely/English Nature 21,792
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Paul Glendell/English Nature 23,020
Main: Identifying moths caught in a moth trap at Ham Wall NNR, Somerset.
Paul Glendell/English Nature 24,888