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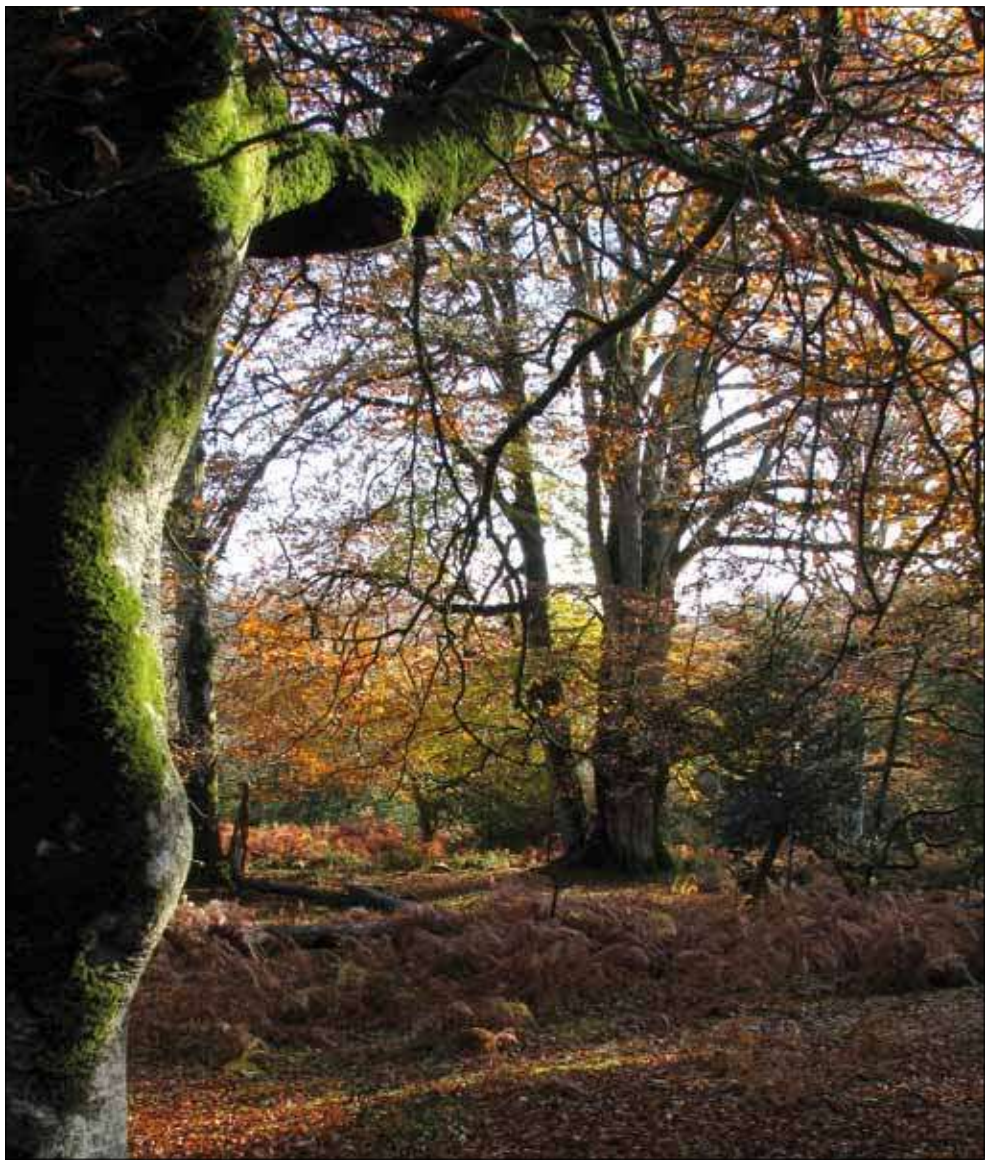

British Ecological Society

Naturalistic Grazing and Re-wilding in Britain

Perspectives from the Past and Future Directions

NATURAL ENGLAND

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Front cover photograph Beech woodland in the New Forest. Andrew Branson

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Preface

This special supplementary edition of *British Wildlife* was conceived as a result of listening to the numerous debates about future directions in conservation policy, many of which have been prompted by Frans Vera's work and his involvement with the inspiring example of practical conservation at Oostvaardersplassen, in The Netherlands. The idea was to bring together in one publication examples from a broad spectrum of the debate, both to show how influential discussions of large-scale conservation and naturalistic grazing have been on current conservation thinking and also to demonstrate that some of the issues go beyond the normal boundaries of targets, practice and monitoring. This aspiration was greatly helped by the publication in 2005 of a series of reviews of the key points of the debate by English Nature. These form the basis of two of the articles in this publication.

I have been greatly helped in trying to achieve this aim by my coeditor for this edition, Keith Kirby, of Natural England. Professor Bill Sutherland of the Department of Zoology, University of Cambridge, has also provided wise counsel throughout the long process involved. The contributors, Eric Bignal, Gareth Browning, Paul Buckland, David Bullock, James Bullock, Kathy Hodder, Keith Kirby, Davy McCracken, Rachel Oakley, Chris Thomas, Peter Taylor, and, of course, Frans Vera, are to be warmly thanked for the excellent papers.

The British Ecology Society and Natural England have generously sponsored this edition, making it possible to supply it as a free supplement to *British Wildlife*. I look forward to the continuing healthy and constructive debate on the issues raised in these pages.

Andrew Branson

The British Ecological Society is a scientific society for those interested in ecology. Our vision is: **Advancing ecology and making it count**. We will achieve this through:

- Developing ecological science and scientists
- Improving the quality of education and capacity building
- Promoting the use of ecological science
- Building collaborative partnerships

The Society was established in 1913 and has approximately 4,000 members worldwide, and membership is open to all with an interest in ecology.

Natural England works for people, places and nature to conserve and enhance biodiversity, landscapes and wildlife in rural, urban, coastal and marine areas. We conserve and enhance the natural environment for its intrinsic value, the wellbeing and enjoyment of people, and the economic prosperity it brings. We promote access and recreation and contribute to the sustainable management of our natural resources.

To do this, we support individuals and organisations in actions that will benefit the natural environment, increase opportunities to make it an enriching part of people's everyday lives, and bring together those who influence and shape our environmental future.

Introduction

Frans Vera's book, *Grazing Ecology and Forest History*, published in English in 2000, has generated considerable debate and not a little controversy. Whether one agrees with his views on the role of wild grazing in shaping pre-Neolithic European landscapes, or its potential to generate wildlife-rich countryside in the future, there can be no doubt that his book stimulated a re-evaluation of what we can really tell from palyo-ecological work (principally pollen analysis, but increasingly interpretation of sub-fossil insect assemblages). It chimed with discussions about how we 'do' conservation, particularly in Britain: is the emphasis of management for specific habitat or species targets always what we should be doing? Is there a place for wilderness and natural processes? His book was published at a time of increasing interest in wood-pastures and veteran trees – for which his 'half-open landscape' suggested a natural analogue. However, his ideas and arguments have not gone unchallenged.

What we have aimed to do in this special issue of *British Wildlife* is to bring together the essential points of Vera's hypothesis and some of the evidence that has been raised in challenge, at least so far as conditions in Britain, past, present and future, are concerned. We believe that this will help to set the framework for future discussions on this topic.

Kathy Hodder and colleagues set out the arguments presented in Vera's book and the main objections that have been raised against them with respect to the pre-Neolithic landscape. How likely is it that a 'half-open landscape' driven by large herbivores was dominant across even the lowlands of Britain? David Bullock expands on the interactions between our past mammal fauna and the landscape, highlighting insights arising from places such as the Yellowstone National Park, where large carnivores have been re-introduced. However, if the landscape was not very open, how might the current abundance and diversity of species that depend on open habitats be explained? Chris Thomas looks at whether our open-ground species must also have been abundant in the past or whether some could have invaded and spread from the Continent after post-Neolithic clearances.

The next three articles consider the role of large herbivores in present and future landscapes. Frans Vera challenges the assumption that we need to manage wildlife, through his account of Oostvaardersplassen (rapidly becoming a place of pilgrimage for British nature conservation workers). He cautions against the idea that because wildlife has existed alongside farming in the past, this is necessarily the way it must be in future. Kathy Hodder and James Bullock explore what naturalistic grazing might mean in British conditions. Could it fit with current approaches to nature conservation? Eric Bignal and Davy McCracken stress the importance of maintaining extensive, low-intensity grazing systems across Europe because of their associated wildlife. They do not see re-wilding as an option for most of Europe.

Peter Taylor stands apart from the bureaucratic issues to champion the case for wild places and wild animals (including large herbivores) to provide the spirit of wildness. Gareth Browning and Rachel Oakley bring us back to the reality of what can be done in a real place – Ennerdale, in the Lake District. Finally, Keith Kirby outlines some of the policy challenges that need to be addressed to allow a wilder approach to grazing for conservation in Britain.

We hope that you are stimulated by the ideas contained in these papers.

Keith Kirby and Andrew Branson

Stream near Pinnick Wood, New Forest, Hampshire. Andrew Branson

Can the pre-Neolithic provide suitable models for re-wilding the landscape in Britain?

A scene from Oostvaardersplassen, in The Netherlands, with Heck cattle, but could the landscape of Britain in the pre-Neolithic have resembled this? Ruben Smit/www.rubensmit.nl

Kathy H Hodder, Paul C Buckland, Keith J Kirby and James M Bullock

Palaeoecologists have been encouraging us to think about the relevance of the Holocene fossil record for nature conservation for many years (e.g. Buckland 1993) but this information seems slow to filter through to the conservation community. Indeed, Willis *et al*. (2005) report that recently published biodiversity reports and policy documents rarely look back more than 50 years and may ignore the historical context entirely. This has been a lost opportunity for understanding ecological systems. Many natural processes occur over timescales that confound our attempts to understand them, so the vast temporal perspective provided by palaeoecological studies can provide important guidance for nature conservation (Willis & Birks 2006).

However, accurate vegetation mapping is difficult enough in modern landscapes (Cherrill & McLean 1999), so the challenge of describing prehistoric environments is immeasurably greater. Nevertheless, pioneering work in the mid 20th century showed that pollen and spores extracted from peat bogs were so perfectly preserved that they could be used to demonstrate sequences

Box 1 Evaluation of the New Forest ecosystem using the Ratcliffe criteria (*Nature Conservation Review* Ed. Ratcliffe 1977)

Naturalness: with 5,000 years of recorded human interventions, the New Forest can hardly be regarded as natural in the sense of virgin wilderness. However, those interventions have maintained a wood pasture/heathland system which is likely to have continuity with prehistoric lowland Britain. Woodlands will have existed on many of the ancient woodland sites in the forest since those times, and canopy gaps will have supported grassland and heathland communities in a mosaic of mire and swamp, maintained by large wild grazing animals. Vera (2000) questions the widely held belief that a climax vegetation of closed forest covered the lowlands in prehistoric times before the onset of agriculture. He argues that vegetation communities were governed by the activities of large herbivores creating a prehistoric parkland landscape consisting of grasslands, scrub, solitary trees and groves bordered by a mantle and fringe vegetation. This is arguably analogous to the situation in the [New] Forest today, though in a greatly modified form, with commoners' animals having replaced wild herbivores.

(Extract from the *New Forest SAC Management Plan Part 2* (2001) http://www.newforestlife.org.uk/life2/part2.PDF)

Ponies grazing in the New Forest, Hampshire. Andrew Branson

of vegetation change since the last glaciation (Godwin 1956). Since then, the science has burgeoned: ancient deposits of beetles, snails, fungal spores and plant macrofossils add to the picture, as does the chemistry of ancient lake sediments (Bell & Walker 2004).

Many questions still remain to be answered by this fascinating research and one aspect has received considerable attention in the last decade. This concerns the nature of the 'primeval' landscapes, in other words our understanding of natural systems prior to significant human impact. The debate was kindled by a thesis by the Dutch forest ecologist Frans Vera in 2000 (see also Vera & Buissink 2007). Vera effectively challenged established views about the primeval landscapes and argued that the refutation, and the resulting alternative landscape models, had critical importance for modern conservation practice.

Vera's thesis is focused on the pre-Neolithic (*ca* 8000-5000BP) landscape in the lowlands of central and western Europe, with the assumption that this period represents an almost pristine or 'natural' state which should provide a suitable conservation benchmark. Vera contends (i) that this landscape was not closed woodland but a relatively open park-like mosaic of wood and grassland, and (ii) that large wild herbivores were an essential driving force behind woodland-grassland vegetation cycles. The advocacy in his argument and the timing of the publication, when grazing was seen as increasingly important in conservation in Europe, have combined to raise the profile of this issue. If Vera is correct, the open park-like landscapes were inherited rather than created by people; this may have implications for conservation practice in Europe.

The rapid adoption of Vera's ideas into conservation management plans in the UK (see Box 1) gives an indication of the influence that this work has had. Indeed, Vera's ideas have been described as a 'challenge to orthodox thinking' (Miller

2002) and considerable debate has been stimulated centering on the ecological validity of Vera's hypothesis and its relevance for modern conservation. In this article, we attempt to address these issues on the basis of results from a literature review, web-debate and discussions with Dutch and British ecologists, prepared for English Nature with a view to informing conservation strategies (Hodder & Bullock 2005a).

Key assumptions and arguments considered

- The pre-Neolithic period provides a suitable benchmark for conservation.
- The pre-Neolithic landscape was a relatively open park-like mosaic rather than closed forest. This is supported in Vera's thesis, using evidence from ecology, history, the pollen record and the history of language.
- Large wild herbivores were an essential driving force behind woodland-grassland vegetation cycles. These species drove a shifting mosaic in which tree seedlings were able to survive in the protection of thorny scrub.
- The established wisdom supports a dominance of closed-canopy forest in central and western Europe.

Does the pre-Neolithic period provide a suitable benchmark for conservation?

Although 'biodiversity baselines' are often encouraged as useful tools for planning conservation (e.g. Royal Society 2003), the idea of using any past landscape to guide action in a changing world needs caution (Egan & Howell 2001; Lunt & Spooner 2005; Willis *et al.* 2005). If the distant past is taken as a benchmark for conservation through a desire to achieve a more 'natural' landscape, the qualities of 'naturalness' proposed by Peterken (1996) are useful. He describes future-naturalness as the state that would prevail in areas where human influence is reduced or removed, as distinct from the original-naturalness of the pre-Neolithic forest. Differences in these states are inevitable because climate and soils have changed, as well as biotic changes such as extirpation of large predators and introduction of invasive alien species. Original-naturalness, of course, becomes more difficult to define if the influence of Mesolithic peoples is considered significant (Innes & Blackford 2003; Simmons 2003), but this is an issue whichever model (open or closed forest) is considered for the pre-Neolithic landscape.

Was the pre-Neolithic landscape a relatively open park-like mosaic?

Regeneration failure of oaks and Hazel in modern forests

Vera's (2000) key argument lies in the well-known paucity of regeneration of oaks *Quercus* and Hazel *Corylus avellana* under unmanaged forest canopies. Vera argues that if the mid-Holocene landscape consisted mainly of such closed-canopy forest, these species should not be so well represented in the fossil record. He concludes that oaks and Hazel thrived in the primeval landscape because there were large open areas for regeneration and because grazing animals reduced competition from more shade-tolerant species such as Beech *Fagus sylvatica*.

What may be underplayed is the influence of soil conditions and topography on the shade-intolerance that often prevents oaks from developing from seedlings to larger trees. In some situations oaks may be able to maintain themselves even where more shade-tolerant species are present (Mitchell & Cole 1998). On acid sandy soils, oaks were able to regenerate successfully within gaps in pine stands (Mosandl & Kleinert 1998; Paluch & Bartkowicz 2004). Oak competes well on very acid, nutrient-poor soils and in regions subject to summer drought, while Hazel can survive on steep slopes and floodplains (Coppins *et al.* 2002; Svenning 2002).

Also, in large parts of Britain, the absence of some shade-tolerant species such as Hornbeam *Carpinus betulus* and Beech during the mid-Holocene (Huntley & Birks 1983) may have provided a wider potential niche for oaks than would have been found on the Continent.

Lastly, the presence of Hazel pollen in the fossil record does not necessarily indicate large canopy gaps. Although very open conditions are generally necessary for full flowering of Hazel, substantial flowering, and so pollen production, can be frequent in very small gaps (K J Kirby unpublished data, in Hodder & Bullock 2005a).

So, although the poor regeneration of the light-demanding trees and shrubs in modern forests is cited as a major issue for the closed-forest hypothesis (Bradshaw 2002), there are explanations that do not require a half-open landscape or a major role for large herbivores.

Can the study of fossil pollen detect vegetation openness and thorny scrub?

Vera (2000) questions the potential for palynology to detect vegetation openness. Although it is accepted that models available in 1999 gave only a rough approximation of openness, and require improved testing (Sugita *et al.* 1999), the case against palynological insights may be overstated by Vera's reliance on early references. Many of the methodological weaknesses critiqued in Vera's thesis have largely been solved in more recent work (Mitchell 2001) and small-scale openness in some landscapes can now be recognised (Fyfe 2007).

For instance, studies of small hollows are excluded, yet these are far more sensitive to open-forest conditions because they tend to be dominated by local pollen rain, as opposed to data from lakes and bogs, which may collect pollen from tens of kilometres away (Bradshaw *et al.* 2003). Estimates of the source area for small-hollow sites vary from 20-30m (Bradshaw 1981; Mitchell 1988) to 50-100m (Sugita 1994), and observations from such sites tend to indicate a closed pre-Neolithic forest (Bradshaw 2002; Mitchell 2001, 2005). Any further debate on past forest openness should also be informed by the recent advances in pollen mapping and data model comparisons for vegetation dynamics and climatic change (e.g. Bradshaw 2008).

Vera (2000) also seeks to explain why the open-ground plants, such as grasses, and thorny scrub, which his thesis suggests should be very common, are rare in the pollen records. Obstruction provided by woodland-edge vegetation would minimise pollen dispersal from open grassy areas in forests to mires. This argument is, however, valid only if either woody vegetation grew preferentially around mire edges or the proportion of woody vegetation in the landscape was high.

It is also suggested that grass pollen deposits may have been uncommon in wood-pasture landscapes because of heavy grazing of the flowering heads. However, grass pollen can be well represented in palynological records; for instance, the European pollen record clearly shows increased proportions of grasses and herbaceous species with increasing evidence of Neolithic human activity, and grazing undoubtedly occurred during this period.

The contention in Vera's thesis that hawthorns *Crataegus* and Blackthorn *Prunus spinosa* are 'entirely or almost entirely invisible' to palynology also needs consideration. Insect-pollinated shrubs making up the marginal vegetation of open spaces in forest are proportionately poorly represented in pollen diagrams (Godwin 1956), but pollen from such scrubby species is recorded from floodplain sites in the previous interglacial (the Ipswichian) (Svenning 2002), demonstrating that it is certainly visible in ancient records.

What do other fossil and subfossil records tell us about landscape openness?

Non-pollen evidence has been used less frequently for interpreting past landscapes, but a combination of data sources may be used to add confidence to landscape models. Non-tree pollen records from interglacial sites correlate well with vegetation openness estimated from beetle, mollusc and/or plant macrofossils (Svenning 2002). In Svenning's review the various information sources pointed to predominant forest in the pre-agricultural Holocene of north-west Europe, with some open vegetation on floodplains, on some calcareous or poor sandy soils and in the continental interior. Whitehouse & Smith (2004) criticise Svenning's interpretation of the fossil beetle data, but in a review of data from two English Holocene sites, their conclusions are not radically different from Svenning's. They reported open woodland, but little sign of grazing animals, on a calcareous site in southern England, and primary forest, including a large proportion of old trees and dead wood, with few open taxa/dung beetles on a floodplain in the English Midlands.

Buckland (2005) has reviewed the fossil-insect evidence for Britain in more detail in relation to Vera's ideas, utilising the BUGS Coleopteran Ecology Package of fossil record, habitat and distribution (Buckland & Buckland 2002, 2006). He concludes that, as in previous interglacials, species associated with dead wood were very frequent in the early to mid Holocene, but declined, often to regional extinction, from the Neolithic onwards. Species associated with grassland and other components of 'open habitats' occurred but were rare in the mid-Holocene, suggesting that there were open areas but that such habitats formed a limited part of the overall landscape. However, open-habitat species do become more common at the time that Neolithic humans are likely to have

opened up the landscape, and an apparently rapid diversification of dung-beetle faunas during the Neolithic suggests an increase in their food supply. As Britain was an island from about 7500BP (Preece 1995), it seems probable that much of this beetle fauna was already in residence. This would suggest that prior to the Neolithic clearances, wild herbivores were widespread but rare. Buckland (2005) also noted the occurrence of pyrophilic (fire-loving) species in the pre-Neolithic landscape, which indicates that fire, either natural or anthropogenic, is likely to have been a significant factor in creating and maintaining open conditions.

Macrofossils from trees may also be used to help understand the nature of past forests, although there is inevitable difficulty in interpretation of the small samples of these records. The park-like landscape postulated by Vera (2000) would be expected to include open-grown trees with low, spreading branches. However, tree remains from lowland bogs and fens generally have the characteristics of having grown in closed-canopy conditions: straight trunks, narrow girth and lack of low branches (Rackham 2003).

Can the abundance of modern open-ground assemblages inform us about the pre-Neolithic environment?

The abundance of species associated with open conditions in modern landscapes in Britain has been put forward as evidence that the primeval landscape must also have been open. For instance, Rose (2002) stresses the diversity of vascular plants, epiphytic bryophytes and lichens and butterflies found among woodland edges and clearings, and Miller (2002) points out that birds, such as the Corncrake *Crex crex* must have evolved to need grassland before human clearances for agriculture.

However, there is a logical flaw and a risk in extrapolating from where species occur today. In modern Swedish landscapes many saproxylic species associated with dead wood are more abundant when old trees are open-grown (Rannius & Jannson 2000). However, most sites where old trees grow at present are former wood-pastures, i.e. the trees grew in open conditions. Equivalent populations of invertebrates from 400-year-old trees that grew in closed forest can be compared only by use of the fossil record, because such stands no longer exist.

Also, limited understanding of the distribution, dispersal abilities and population characteristics of many species/organisms confound interpretations of landscape history. Motzkin & Foster (2002) note that in North America many butterfly and moth species thought to be grassland-indicators may also be common in woodland. The Heath Hen *Tympancuchus cupido cupido* has been used to document former abundance of grasslands and other open habitats in eastern North America, but most historical descriptions cite woodland or 'bushy plains' as the primary habitat for this species. Many 'woodland' bird species have different patterns of habitat use in Britain and mainland Europe, and changes in habitat use have occurred over time (Fuller 1995).

In Britain, species that depended on continuous closed forest would be expected to have declined in the last 5,000 years because woodland cover was reduced to about 5% by 1900, whereas conditions for species of open ground have generally increased (Kirby 2003), and this is abundantly clear from the fossil insect record (www.BugsCEP.com). Open-ground species may previously have been restricted to small 'refuges' such as cliff-tops during the pre-Neolithic period and then spread to the rest of Britain. Given continuous openness in marginal habitats, dispersal would need to happen only occasionally for species to survive (Marks 1983).

Arguments against spread from refugia, based on the poor dispersal of old-growth species under current conditions (Alexander 2004), may underestimate the significance of chance rare events and the role of large herbivores in long-distance dispersal (Schmidt *et al*. 2004; Eycott *et al*. 2004). It is also easy to under-estimate the scale of past movement of flora and fauna in ships' ballast (Buckland *et al*. 1995; Lindroth 1957), or even on human feet (Wichmann *et al*. 2009). This may well have influenced species' dispersal during the Neolithic migration.

Were large wild herbivores an essential driving force behind woodland-grassland vegetation cycles?

Cyclic succession and resulting mosaic patterns of vegetation have been observed for many decades and were given systematic treatment in a seminal paper by Watt (1947). The major contribution of Frans Vera and colleagues is to assert that large

What role did the large herbivores of the Mid-Holocene play in wooded landscapes? John Davis

herbivores, such as the Aurochs, would have been key drivers of such cyclic processes at the landscape scale, involving transitions between woodland and grassland (Olff *et al.* 1999). There are three stages in the cyclical turnover of vegetation that they propose: (i) grassland with patches of unpalatable scrub where tree seedlings can establish and grow because they are protected from grazing; (ii) groves of trees which eventually shade out the scrub, and harbour large ungulates which prevent regeneration; (iii) a break-up phase where trees in the centre of the grove decay, allowing light to enter, and grasses and herbs to establish – leading back to the first stage.

Olff *et al.* (1999) have elaborated the mechanism by which such vegetation cycling could occur, and different elements of the process can be seen at many sites, for example in the New Forest in southern England (Bakker *et al.* 2004). The question is not, therefore, whether such a regeneration cycle could have occurred, but whether it was the dominant mechanism for landscape regeneration and what temporal and spatial patterns it might have produced.

The mechanism does, of course, assume the presence of large herbivores in sufficient numbers to undertake this dominant role. The likelihood of this is difficult to address due to the paucity of good bone assemblages from the early to middle Holocene. This lack of evidence limits direct conclusions about the diversity and particularly the abundance of the large-herbivore fauna and its predators (Bradshaw & Hannon 2004; Vera 2000; Yalden 1999).

This leaves circumstantial evidence that can be surmised by comparison with modern populations of large herbivores. This is emphasised by Fenton (2004), who argues that the main limitation on herbivores was food supply, and that, if current landscapes (such as the Scottish Highlands) can be kept open by grazing, so might have those in prehistory. It may be that the role of large herbivores has been under-emphasised in forest ecology. For instance, it is known that deer can maintain small-scale grassy glades in British upland forests (Peterken 1996) and Elk *Alces alces* appear to prevent woodland succession in fenland sedge-communities in Poland (Svenning 2002). Rooting by Wild Boar *Sus scrofa* provides suitable places for trees and shrubs to become established, but equally damage to roots and bark may lead to the demise of trees through subsequent disease. One problem is that this ignores possible impacts of predators. Vera (2000) simply assumes that 'Whatever the influence the large predators had, the densities [of large herbivores] that are required

Factors such as fire and disease would have had a significant impact on the nature of the landscape. John Davis

for the regeneration of oaks and Hazel must have been the result.' which illustrates the level of speculation affecting this debate.

In recent years there have been fascinating insights into predator effects on the landscape, which should at least warn us to beware of assumptions about past environments based on limited data. For instance, the interactions between vegetation structure, predator hunting behaviour and herbivore response to predation risk are complex (White *et al.* 2003; Laundré *et al.* 2001; Hebblewhite *et al.* 2002). Ecologists in Yellowstone National Park were able to demonstrate how the reintroduction of Wolves to overgrazed forest generated a 'landscape of fear' by modifying the behaviour of grazing animals. At sites of high predation risk (e.g. low visibility or escape barriers), the riparian vegetation was released from browsing by Red Deer *Cervus elaphus*, whereas at low-risk sites (open areas) riparian vegetation was still suppressed (Ripple & Beschta 2003). Lynx *Lynx lynx* are also reported to have a significant impact on the distribution and behaviour of Roe Deer *Capreolus capreolus* in Switzerland, which could similarly lead to reduced deer impact on vegetation (Hetherington 2006, 2008).

We also need to improve our understanding of the extirpated herbivores before coming to firm conclusions. The Aurochs may not have required large open areas in the landscape (Van Vuure 2005). In fact, isotope research on Auroch bones indicates that these bovids had an essentially woodland diet (Noe-Nygaard *et al.* 2005). It remains to be seen whether further research with samples from a range of sites support these results.

To apply Vera's thesis specifically to British conditions, we need to allow for a reduced suite of large herbivores compared with that on the Continent. There is a very long gap in the British fossil record for 'horse' between the Mesolithic and the early Neolithic, and there is no convincing evidence for Elk after the Early Holocene, despite the one late date from the Cree River in Scotland (Kitchener *et al.* 2004). The European Bison *Bison bonasus* did not return to Britain during the present interglacial (Yalden 1999, 2003). Large herbivores were even more restricted in Ireland, where Aurochs were absent and Red Deer scarce or absent. Bradshaw & Hannon (2004) and Mitchell (2005) have therefore compared the pollen profiles from Ireland with those from Britain and the Continent. They conclude that the presence or absence of large herbivores does not significantly alter the vegetation patterns, and that large herbivores were therefore not the major factor driving forest composition. Erik Buchwald

(pers. comm.) has, however, pointed out that shade-bearing trees such as Beech and limes *Tilia* were also absent from Ireland; oaks and Hazel might thrive in Ireland in the absence of large herbivores, whereas in the presence of shade-tolerant competitors some grazing may be required for them to become well establised.

While we know that large herbivores can influence forest structure, there are huge areas of uncertainty and speculation about wild populations of these animals in prehistoric times. Whether their behaviour or abundance, both of which are difficult to reconstruct, could have enabled them to be the dominant driver of landscape composition in pre-Neolithic Europe remains open to debate.

Does evidence from literary sources inform us about the primeval landscape?

Early writings provide information about forest cover and wilderness and so give clues as to the ancient landscape. In terms of modern conservation decisions, it is therefore important to know what the medieval concept of wilderness entailed and whether it can be related to the pre-Neolithic landscape. Vera uses historical texts to argue that words such as 'silva', 'Forst', 'forest', 'Wald', 'wold', 'weald', 'woud' and 'wood' in classical and medieval texts did not necessarily indicate closed forest, and hence 'medieval' wilderness areas were relatively open. He assumes that these wildernesses may reflect the condition of the pre-Neolithic landscape.

Van Vuure (2005) argues against Vera's suggestion that the Latin 'silva' refers to a 'mosaic of groves and grassland', and he considers that closed forest is more consistent with the descriptions of German forests in classical accounts, although these texts themselves are not without bias. The 'Great Wilderness' in East Prussia in the medieval period, described as 'wald', was an area of extensive and closed forest, interspersed by marshes, despite retaining populations of Wild Horse, European Bison and Aurochs (Van Vuure 2005).

Vera (2000) interprets Eichwald's 1830s map of the Bialowieza Forest in Poland as showing that it was composed of groves interspersed with open grassland areas. Van Vuure produces a near-contemporary map (1826) which, while appearing also to show relatively open conditions, is accompanied by a written description that emphasises the closed nature of the forest. He concludes that the maps were an artist's interpretation, rather than a realistic depiction of the forest vegetation. So both pictorial and written accounts can be untrustworthy and social context may be crucial to interpretation.

Even if some shadows of the 'wildwood' survived into historic times on the Continent, in Britain, wilderness, waste and forest in the medieval sense cannot be equated with the state of the mid-Holocene landscape. Most of Britain had, by this time, been subject to some form of agricultural use for hundreds, if not thousands of years. Medieval wilderness or waste was strongly influenced by human management (grazing, burning, cutting of wood and bracken, etc) (Rackham 1986, 2003). Pollen and archaeological evidence increasingly point to the demise of major uncleared landscapes in Britain by the late Iron Age, which renders the literary debate somewhat futile.

Does the established wisdom support a dominance of closed-canopy forest in central and western Europe?

Although it is not difficult to find references to the 'widely held belief that a climax vegetation of closed forest covered the lowlands in prehistoric times' (Box 1), closer inspection of the literature reveals that this view has not necessarily been supported by experts in the field. While predominant tree-cover may be posited, vegetation dynamics and structural variation is clearly recognised. As early as 1945, Jones had suggested that 'climax forest' may be a 'concept only', never existing in practice, and Remmert (1991) introduced the concept of cyclical mosaics to forest ecology. Peterken (1996) concluded that in natural woodland, openings of various kinds form a permanent and sometimes common component.

Conclusions and discussion

Vera's (2000) work has stimulated an exciting debate. Unfortunately, the argument has often polarised around the false dichotomies that either the landscape was half-open and large herbivores were important or the landscape was completely closed and herbivores were not important at all. This ignores other possibilities such as that the landscape was open, but not herbivore-driven, or closed, but with large herbivores playing a significant role. The difference between the closed-forest hypothesis and the alternative of cyclical dynam-

A glade in Bramshaw Wood in the New Forest, with ancient Beech pollards forming the canopy. Some might describe this view as classic 'high forest' with a closed canopy, but compared to many modern, managed woodlands it also has a 'half-open' aspect. Andrew Branson

ics may be a matter of degree. Miller (2002), for example, asks whether the grassland or the forest provides the matrix in which the other may be found.

One of the major problems involved in applying the ideas in conservation is that there is no clear idea of spatial or temporal scale. Vera refers to a 'half-open' landscape but does not give any justification for this particular level of openness. Kirby's (2003, 2004) model, based on Vera's description of the phases in his cycle, shows that many different combinations of open and closed conditions could potentially occur.

Degrees of openness are likely to vary in different topographic, climatic and soil conditions, but at present there is no guidance on the patterns that might be expected. Future research may reveal more about the factors that influence temporal and spatial patterns of vegetation in the full range of environmental conditions. A focus on large herbivores as a single factor driving landscape structure is also rather limiting. Given the highly variable topography and geology that exists in Britain, a more realistic approach may be to consider that over much of the landscape there would have been several disturbance factors (grazing, flood, fire, disease, wind, human activity), all driving change to differing extents, the significance of which could also vary over time. In Britain, deciduous forest may rarely burn, but one rare lightning strike leading to extensive wildfire may have been sufficient to modify succession for long periods.

We agree that the openness of the landscape and the role of large herbivores have both been underplayed in past discussions, but conclude that Vera's argument – that the bulk of the lowland landscape was half-open and driven by large herbivores – is not currently supported by the evidence. Multidisciplinary studies of fossil and sub-fossil assemblages supported by studies of fossilisation, which help us to interpret this buried evidence, may eventually solve this problem.

Finally, does this debate have relevance for modern nature conservation? Is the pre-Neolithic landscape appropriate as a 'template' or guidance? The merits and limits of using any past landscapes in conservation planning have deservedly received significant attention (e.g. Andel & Aronson 2006, Egan & Howell 2001, Higgs 2003) and certain

conceptual and practical issues emerge repeatedly. How do you select the correct 'template' and how meaningful is this reference to the past in a world where biophysical conditions constantly change. Nature reserves in Britain are the product of their history, particularly the last 13,000 years since the *tabula rasa* of the last glaciation. Every accident of fire, disease or overgrazing has left a subtle mark on subsequent landscapes. It would seem reasonable to assume that no one really believes that past landscapes can be restored exactly, but that invaluable lessons may be learned by looking back, and that we can strive towards, but never reach, a future natural state.

There is, however, increasing interest in creating landscapes that are driven more by natural disturbance processes than by agricultural or forestry practices. Grazing by large herbivores has a role to play in such attempts, but not to the exclusion of other factors. In some cases, this may involve the descendants, albeit much modified both morphologically and behaviourally, of species that were present in the pre-Neolithic period; in other cases, a wider range of animals may be used. The outcomes of such efforts are by definition uncertain and unpredictable (Hodder & Bullock 2005b), and none of us will live long enough to see the outcome of these attempts to create new 'wildwood' or 'wild-parkland'.

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What larger mammals did Britain have and what did they do?

Elk feeding on birch in Finland. This large ruminant was a member of our native fauna in the Atlantic period.
Tomi Muukkonen/www.birdphoto.fi

David J Bullock

We are currently between Ice Ages, in the Holocene. In Britain, the previous geological time period, the Pleistocene (Ice Age), was interspersed with a series of warm (interglacial) periods in which warm-adapted mammals such as Hippopotamus *Hippopotamus amphibius,* Barbary Ape *Macaca sylvana* and Spotted Hyaena *Crocuta crocuta* migrated north through Europe. They were replaced by cold-adapted species (such as Woolly Mammoth *Mammathus primigenius,* Reindeer *Rangifer tarandus* and Wolverine *Gulo gulo*) when arctic conditions returned. The melting ice and consequent sea-level rise that signalled the end of the Pleistocene and the start of the Holocene hindered terrestrial mammals from colonising our islands, and by around 8000BP the landbridge between Britain and continental Europe had closed. The focus here is on the make-up and ecology of the larger (greater than 1kg body mass) mammal fauna of Britain in the Holocene prior to and after the arrival of Neolithic farming peoples.

Only a few of the larger mammals found in continental Europe at the beginning of the Holocene period returned to Britain before the landbridge closed. For example, bison *Bison* species, Hippo-

potamus and Lion *Panthero leo* did not get back. Others did, but disappeared subsequently as the climate warmed. So, whilst Giant (Irish) Elk *Megaloceros giganteus*, Reindeer, and Tarpan or Wild Horse *Equus ferus* were present in the early part of the Holocene (as late as 9000BP for Reindeer), the developing tree cover of warming Britain made it increasingly unsuitable for these open-ground tundra/steppe species.

By 7000BP the remaining larger mammals formed a subset of the Continental fauna. The large predators, in the shape of Wolf *Canis lupus* and Lynx *Lynx lynx*, and the omnivores and scavengers, represented by Humans *Homo sapiens* and Brown Bear *Ursus arctos* (and possibly Spotted Hyaena *Crocuta crocuta* for a while), hunted the larger herbivores, namely Wild Boar *Sus scrofa*, Red Deer *Cervus elaphus*, Roe Deer *Capreolus capreolus*, Elk *Alces alces* and Aurochs (Wild Ox) *Bos primigenius*, Mountain Hare *Lepus timidus* and Beaver *Castor fiber*. The smaller predators, such as Wild Cat *Felis sylvestris*, Otter *Lutra lutra,* Pine Marten *Martes martes*, Badger *Meles meles,* Polecat *Mustela putorius* and Red Fox *Vulpes vulpes*, hunted (or scavenged the carcasses of) other vertebrates and were themselves hunted by large mammals and birds.

The preceding is based on Yalden's (1999) exhaustive analysis. Here, I consider the ecology and behaviour of the larger mammals in the Holocene, with particular reference to the Atlantic period (7000 to 5000BP), when lowland Britain had a temperate climate and wooded landscape. This was the 'wildwood', a baseline prehistoric 'past natural' state that started to disappear towards the end of the Atlantic, when the predominantly hunting-and-gathering lifestyle of Mesolithic Man gave way to Neolithic farmers.

Mammals in Britain's wildwood

Vera's (2000) model of a half-open park-like landscape is largely based on the ecological driver of high numbers of two large grazers, Aurochs and Tarpan. By the Atlantic period, however, Britain had lost the latter, so, if its lowland landscapes were only partially closed, were Aurochsen alone keeping them partially open, and were other large herbivores, two deer species and boar, or other processes involved? We need to look at the biology of certain keystone mammal species that were present in the Atlantic period, starting with that key element of the anatomy of ruminants, the large fermentation chamber of their stomach, the rumen.

Amongst the ruminants there are three feeding styles, based on the anatomy of their rumens (Hofmann 1989). This classification allows a comparison of the 'past natural' of the Atlantic Britain and the present-day large-herbivore faunas (Box 1). Comparing the 'past natural' and present-day larger herbivores, which species are represented in the different feeding styles? Three 'bulk' feeders have replaced the Aurochs: two are livestock (in italics), and one an introduced deer, the Fallow *Dama dama* (in bold). In addition, there are now several populations of free-ranging ponies, another obligate grazer. The niche of the very large 'concentrate selector', the Elk (lost by 3925BP), has no modern equivalent, but we now have a tiny example, the Muntjac *Muntiacus reevesi*. The only native 'intermediate feeder', Red

Box 1

Bulk-roughage (BR) feeders have large rumens, supported by large body sizes, that ferment large quantities of abundant forage which is often poor quality, being low in nitrogen and high in fibre. BR feeders are obligate grazers of grasses, sedges and rushes, and typically live in herds in open landscapes.

Concentrate selectors (CS) have small rumens that process scarce but high-quality forage (high nitrogen, low fibre), such as tree leaves (browse) and fresh shoots of grasses. These ruminants, which can be large or small, tend to live in closed landscapes (such as woodland). They often hold defended territories, grouping up only in time of food abundance or for part of the year.

Intermediate feeders (IF) are medium-sized and can graze or browse. Typically, these are herd-living species using a variety of habitats.

	Atlantic 'wildwood'	Present day
Bulk-roughage feeders	Aurochs	*(cattle, sheep)* **Fallow Deer**
Concentrate selectors	Roe Deer, Elk	Roe Deer, **Muntjac**
Intermediate feeders	Red Deer	Red Deer, **Sika, Chinese Water Deer**, *goat*

Deer, has been augmented by two non-native deer species (Sika *Cervus nippon,* and Chinese Water Deer *Hydropotes inermis*) and the goat. Of the livestock, only the goat is widespread as a feral animal and so exhibits a wild existence; free-ranging sheep and cattle are the dominant large herbivores.

Even with the addition of the Beaver and Wild Boar, Britain's 'past natural' large-herbivore fauna was smaller than it is today. The major change has been a shift to bulk-roughage and intermediate feeders and the loss of the big concentrate-selector browser, the Elk.

Extrapolating the Aurochs

Red Deer and Aurochs were the dominant large herbivores in the Atlantic period. Whilst the ecology and behaviour of Red Deer is well known (e.g. Clutton-Brock *et al.* 1982; Mitchell *et al.* 1977), what about the Aurochs? The lives of free-ranging and feral cattle (e.g. Bullock 2005), combined with historical accounts (Van Vuure 2005), allow us to build up a picture of the Aurochs in Atlantic Britain. They must have been bulk-roughage feeders, like cattle, and, given their body size (>400kg), had a minimum dry-matter intake of between 6kg and 10kg per day (based on free-ranging Highland cattle; Van Wieren 1992). Also, like cattle, Aurochsen must have needed water every day.

The Aurochs was thought to have been a woodland animal (Yalden 1999), but were the 'forests' where it persisted in central Europe for centuries more of a last refuge? In their forest retreat, possessing mythical qualities and protected for hunting under aristocratic patronage, Aurochsen were supplementary-fed in winter. The last cow died in captivity in 1627 (Van Vuure 2005), but by that time the Aurochs had long gone from elsewhere (probably over 3,000 years earlier in Britain). Where, in Atlantic Britain, would there have been enough primary production and water to support herds of Aurochsen? Only floodplains fit the bill. In these wetland habitats, the grasslands can be extremely productive. Cattle grazing solely on heaths lose condition (Wallis de Vries *et al.* 1992). Because of this and their large size and long legs, it is unlikely that Aurochsen herds were a feature of less fertile or steeper terrain in upland Britain.

Aurochsen would have interacted with other large herbivores, especially Red Deer. On the Isle of Rum, winter grazing by Highland cattle removed enough dead Purple Moor-grass *Molinia caerulea* leaves and other coarse vegetation in wet grasslands to stimulate growth of new nutritious shoots. This grazing attracts Red Deer, the condition of which increases significantly as a result of feeding on the better-quality forage where the cattle have grazed (Gordon 1988). Similar grazing facilitations may have occurred in Atlantic Britain.

The following, speculative, life of Aurochsen is based partly on that of the similar-sized African Buffalo *Syncerus caffer* (Prins 1987). As rivers recede to their primary channels after snowmelt in spring, cow herds move over floodplains to feed and calve. Large hungry herds (possible only because of the highly productive grasslands) provide lots of eyes and ears for predator detection, reduce an individual's fly-attack rate and provide focal points for rutting bulls. Mature bulls, alone or in small groups, live on the edges of floodplains, avoiding competition with, and parasite burdens of, cow herds. Here, they put on condition, sparring with peers to establish hierarchies. The cow herds, pushed by rising water in autumn to the edges of the floodplains, would encounter (and mate with) dominant bulls.

There is no evidence that floodplains were selectively used by Aurochsen. However, in Britain many of their remains (listed in Yalden 1999) are associated with floodplains and other wetlands. This could be an artefact of the better preserving qualities for bones in these habitats. However, it also rings true with an old name for the Aurochs, that of 'marsh walker' (Van Vuure 2005). If large herds of Aurochsen did indeed selectively use floodplains, their opportunity to drive a dynamic cycle from open grassland/heathland to closed-canopy woodland that produced a pasture-woodland-like wildwood (Vera 2000) would, at least in Britain, have been limited. It also conflicts with the fossil-insect evidence for the Atlantic wildwood, which suggests more wooded floodplains (e.g. see Buckland 2005).

The large predators and their prey

Of the four large predators in Atlantic Britain (humans, Lynx, Wolf and Brown Bear), the first three were highly selective. Wolves usually hunt deer, and especially Red Deer, which, for example, account for more than half the Wolf kills in Bialowieza Forest, Poland. When these are not

While predation by Wolves may not have significantly reduced numbers of herbivores, they may have concentrated the effects on vegetation caused by herds of large herbivores. Jari Peltomäki/www.birdphoto.fi

available, other deer species are hunted. Wild Boar and Bison are tackled only as a last resort (Okarma 1995). Lynx is a specialist stalker of Roe Deer (Hetherington 2006, 2008). Humans at the Mesolithic/Atlantic sites of Thatcham Moss and Star Carr hunted mainly deer (about 75% of prey remains), of which a majority were Red Deer (Yalden 1999). The huge size of adult Aurochsen, combined with their dangerous horns and herding instinct, meant that they would have been difficult prey for both Wolves and Man. Calves would have been defended by groups of cows from all but the most persistent large predators, including the Brown Bear.

Vera (2000) considered that the influence of large predators in shaping the character of the wildwood was negligible. In Britain, with the absence of Tarpan, as well as that of Aurochs from drier or steeper landscapes, were other large mammals able to produce the kind of park-like landscape envisaged by Vera? Red Deer, which uses a wide range of habitats, was the only other large herbivore that could have driven the cycle. It is, however, an intermediate feeder, switching between grazing and browsing according to season. As such, it is unlikely to have exerted a hard enough grazing pressure to drive the type of cycle envisaged by Vera. Are there interactions between deer and large predators that may have influenced the nature of the Atlantic wildwood? The experience from the reintroduction of Wolves in Yellowstone may be relevant.

The Wolves, which were reintroduced in Yellowstone National Park in 1995, immediately started hunting the abundant and widely dispersed Wapiti *Cervus [elaphus] canadensis*. Around Wolf dens and along their trails, scrub and woodland started to develop (White *et al.* 2003). In the zones between pack territories where Wolves were largely absent, Wapiti congregated to escape attack. There they continue to suppress woody vegetation such as Aspen *Populus tremula* and willows *Salix*. The result is a patchwork of transitions from grassland to woodland on the scale of a wolf-pack territory, which can be in excess of 100km^2. Wolf packs are also dynamic: they split up and new ones are formed. Disease and fatal encounters with neighbouring packs could leave territories vacant, or nearly so, for enough time for deer to recolonise and browse off woody vegetation. However, this is a rather different dynamic from that proposed by Vera.

Does the 'past natural' larger-mammal fauna inform the composition of future ones?

Over the last 4,000 years in Britain, the numbers of large wild ruminant species has declined from four to two, as the Aurochs and Elk became extinct. Introductions from the medieval period onwards have doubled the number of wild and feral ruminant species. Beaver, Wild Boar, and three large predators (Wolf, Brown Bear and Lynx) have become extinct within the last 1,000 years. Even without the current small and heavily constrained Wild Boar and Beaver populations (see *ECOS* 27 (1)), the number of wild/feral larger herbivores in today's Britain is higher than at any other time in the last 7,000 years. In terms of biomass, it is now dominated by cattle and sheep (Yalden 1999).

Body size profoundly influences the ecology and behaviour of ruminants. Aurochsen, at 1.5m or more at the shoulder (Van Vuure 2005), were substantially larger than most cattle. Do the cattle used as analogues in re-wilding projects function in the same way as their wild ancestors once did? The feral Heck cattle in Oostvardersplassen, in The Netherlands, are much smaller than Aurochsen, live in a world free of large predators and cannot undertake seasonal migrations. Given so many changes, restoration of an Atlantic large-mammal fauna in Britain based on feral cattle – as an analogue of Aurochsen – native deer, Beaver and Wild Boar plus their predators may be both an impossible goal and unnecessarily purist. We need to work with what we have.

Acknowledgements

I thank Andrew Branson for editorial assistance. The debt owed to Derek Yalden's treatise on the development of the British mammal fauna (Yalden 1999) is obvious.

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A speculative history of open-country species in Britain and northern Europe

The Ptarmigan is an 'open-country' species that arrived in Britain soon after the last glaciation.
Jari Peltomäki/www.birdphoto.fi

Chris D Thomas

Why are so many animal and plant species in Britain and in some other parts of northern Europe restricted to open habitats when the majority of the landscape would naturally be forested? I argue that the predominance of open-country species is chiefly a consequence of the history of glaciation in Europe, but that the current distributions of species are largely shaped by human activities.

Conditions during most of the last million years have been considerably colder and drier in Europe than they are now (IPCC 2001). Driven mainly by slight variations in the Earth's orbit, relatively brief warm and moist interglacial periods each of around 10,000 years (such as the current Holocene) have gradually given way to colder glacial periods, the last glacial maximum, with extensive ice cover, having occurred a mere 25,000 years ago. During these cold phases, open habitats are common.

One of the most ubiquitous patterns in ecology is the species-area relationship in which larger areas of a particular type of habitat contain more species. Large areas usually (a) contain large populations of each species, making them unlikely to die out; (b) contain a wide variety of microhabitat variation (e.g. topography, soils), making it possible for more species to co-exist; and (c) make a large target for potential colonists (ecological opportunity) that may then become adapted to the focal habitat (evolutionary opportunity). Open habitats have been widespread in Europe

for most of the last million years, so that it is not at all surprising that many species are associated with open and semi-open habitats. Towards the end of the last cold phase, some 12,000 years ago, summer radiation in central and southern Europe was high, despite low average annual temperatures. The 'frigid-but-bright' steppe-tundra supported many more species than does the 'nice-but-dim' northern tundra of today. Think prairie, not Scottish moor.

Why there are so many species that like open habitats is thus explicable by the glacial history of Eurasia. How they survived through the warm interglacial periods, once most of central and northern Europe became covered in dense forest, is more of an issue. This article concentrates on the origins of open-country species in northern Europe in the last 10,000 years, the Holocene, specifically concentrating on the species that are still present here. Did they (a) survive as small populations in naturally open habitats; (b) inhabit much larger areas of open habitats that could have been maintained by large vertebrate herbivores and natural physical processes; or (c) occupy relatively closed environments? The main alternative explanation is that these species colonised in the wake of human activities as new open habitats were created, spreading from naturally open habitats in southern Europe, the Alps, and elsewhere. The explanations are not mutually exclusive, and it would be misleading to look for a single factor that could explain the origins of all of our open-country species, of all populations of a single species, or even of all the genes within a single population.

Rates of spread

To assess each of these ideas, one has to contemplate the ability of species to colonise new regions. The northern range margins of species from many different invertebrate groups have recently been moving northwards in Britain, at an average rate of about 2km per year, in response to climate-warming (Hickling *et al.* 2006). Most expanding species achieved 1km to 10km per year. At 2km a year, it takes less than 1,000 years for species to reach Britain from southern Spain, or Scandinavia from the Balkans. Given this, there is no *necessity* to invoke special population refuges in northern Europe (explanations a-c) to explain the presence of open-country invertebrates. They could easily have reached British shores in the last two to four thousand years of large-scale habitat modification.

The residents

At least some of our existing open-country flora and fauna already inhabited Britain 12,000 years ago. Mountain Avens *Dryas octopetala* (the historical period is known as the Younger Dryas, after the plant) grew in a vegetation that was presumably grazed by Ptarmigan *Lagopus muta*, and where the caterpillars of the Netted Mountain Moth *Macaria carbonaria* nibbled on Bearberry *Arctostaphylos uva-ursi*. Some, but not all, of the species which we currently regard as 'northern' or 'arctic-alpine' either would have been present or would have arrived early in the Holocene. These species thrive in mountain, moor and bogland habitats, therefore it is not difficult to imagine how they survived to the present day in the British uplands (ungulate grazing included). Of course, some may have died out and recolonised since.

The Holocene invasion

Rapid climate-warming took place around 11,500 years ago, probably associated with major changes in the ocean currents of the north Atlantic, with warming of 7°C or more in a few decades in Greenland (IPCC 2001). Western Europe would have warmed extremely rapidly at this time, albeit not so fast as Greenland. In relation to the rate at which most plants spread and the vegetation changes, warming at the beginning of the Holocene was virtually instantaneous. The open landscapes of Europe suddenly had a highly favourable climate for many of the then southerly and open-country species; a northward invasion commenced. If recently observed rates of spread were achieved, animal species spreading from the south of France would have arrived within a few hundred years, at a time when Britain was still connected by land to continental Europe.

Succession to dense forest must have taken longer than this, waiting first for the trees to arrive, and then for continuous forest to form. Large grazing mammals are likely to have slowed succession, or even to have prevented it in areas with unproductive soils or climates. Wooded islands on Scottish lochs, tree regeneration on fenced roadsides and railways, and rapid succession in grazing exclosures that have been established to restore

Caledonian pine forest convincingly show that even very low densities of ungulates can deflect succession for long periods. This would have helped to provide open-country species with a sufficient window of time – of warm climate and open habitats – to colonise most of Europe. Not all species would have outpaced the expanding birch and pine forest, however, and species which we now regard as Pyrenean and Alpine endemics may not have spread fast enough. If they did, they were subsequently lost under the shade of the forest. Many plant-feeding insects with slow-moving host plants would not have made it.

Forests, extinction and refugia

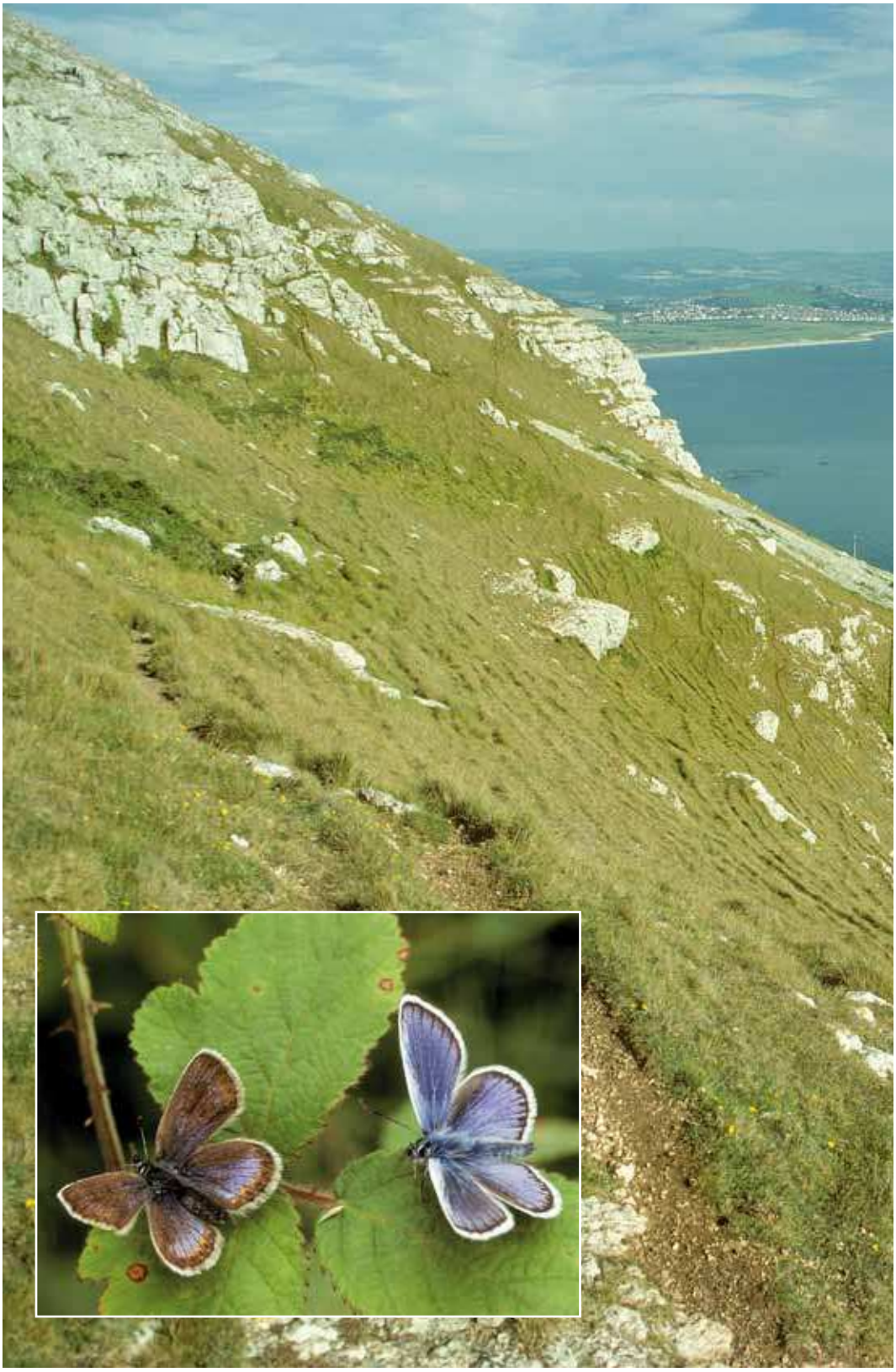
By 8,000 years ago the landscape was largely forested, according to the traditional view. The forests won out, with grazing mammals keeping open only the least productive and disturbed areas. Open-country species that had thrived are likely to have become restricted to a very small fraction of their former distributions, if not driven to extinction entirely. Supposing that most of our open-country species did arrive early in the Holocene, could they have survived to the present day?

On the basis of my incomplete observations of British butterflies, only a few of the resident species would have completely lacked habitat in Britain during the Holocene. Most could potentially have found suitable habitats on inland and sea cliffs, dunes, coast and lake shores, and possibly river-valley grasslands, fen, bog and mire, as well as above the tree-line, without the need to invoke major modification of the vegetation by large herbivores.

Great Orme's Head is a limestone headland in north Wales that has cliff faces pointing in all compass directions. The site supports endemic Silver-studded Blue *Plebeius argus* and Grayling *Hipparchia semele* butterfly races, both with unusually small individuals and distinctive markings, suggesting that the populations have experienced a long period of isolation. Large White butterflies *Pieris brassicae* soar up and down steep cliffs where Wild Cabbages *Brassica oleracea oleracea* grow. The grassland and some of the crags turn a delicate shade of pale yellow in spring as the local Hoary Rock-rose *Helianthemum oelandicum* comes into flower, and Spiked Speedwell *Veronica spicata* flowers on some of the rocky knolls. The presence of these and many other local rarities strongly implies that at least some open habitats existed on the crags throughout the Holocene, although not all of the limestone species would have survived there throughout this period. Just a few hundred such sites in the country would have provided a large pool of species ready to colonise open habitats once humans arrived.

To return to the butterflies, Wood White *Leptidea sinapis*, Lulworth Skipper *Thymelicus acteon*, Glanville Fritillary *Melitaea cinxia*, and Northern Brown Argus *Aricia artaxerxes* thrive today on under-cliffs in Devon, Dorset, the Isle of Wight and near Kirkcudbright, respectively. Most southern grassland butterflies can be found on sand dunes and under-cliffs, and the five northern species inhabit upland grasslands, or breed around bogs within forests. Swallowtail *Papilio machaon* and Large Copper *Lycaena dispar* lived in the fenlands of East Anglia, and so on. Of course, the existence of suitable habitat does not imply that there was enough of it, or that the species did survive throughout the Holocene. My guess would be that about two-thirds of the open-country butterfly species would have survived the Holocene in natural open habitats in Britain, the remaining species colonising anthropogenic habitats in the past few thousand years. Most of the 'survivors' are likely to have been supplemented more recently by further immigration from continental Europe.

My brother Jeremy speculated that some species may have survived in Britain by living in shadier conditions than those with which they are currently associated (Thomas 1993). Species that we think of as being confined to man-made woodland clearings in Britain often tolerate shadier forests further south in Europe, where the climate is warmer. Summers were relatively warm in the early Holocene (compared with the present), so the same logic is likely to apply to their historical habitat needs. They might have survived in partially shady habitats in the early Holocene and then have switched to man-made forest clearings as northern summers cooled. We also know that populations can rapidly become adapted to habitats associated with man (Singer *et al.* 1993), reinforcing the point that we should be cautious before concluding that current and past habitat requirements are the same. Whether this is what in fact happened is another matter. Most fritillary butterflies inhabit 'naturally' open habitats in the west, as well as woodland clearings, so they



could have colonised from these population reservoirs, or have spread northwards from continental Europe in the wake of clearances by humans.

Conclusions

Open-country species of the uplands and western fringes are predominantly survivors from the early Holocene. Most of the remaining species could *equally plausibly* have survived the mid Holocene in open areas, without the need to invoke grazed semi-parkland (Vera 2000), or have colonised in the recent anthropogenic era. Many of the latter would have colonised twice: in the early Holocene (failing to persist), and again more recently. Whatever the date of arrival, current distributions largely reflect recent conditions. The rates at which we see modern distributions adjust to new environmental conditions are sufficient to allow most animal species to assume new distributions within Britain in a few hundred years if conditions change. Current distributions reflect recent anthropogenic habitats far more strongly than they reflect the longer-term history of populations.

Part of the interest in this history relates to the potential for naturalistic grazing and large-scale ecosystem restoration to play an increasing role in conservation in north-west Europe, where conservation practice is currently dominated by the management of habitats in accordance with historical, and currently uneconomic, land-use practices (e.g. Sutherland 2004). If we knew where species survived in the past – their natural distributions – perhaps it would help us to understand where they will survive in the future? However, restoring natural processes is not the same as restoring natural distributions. What is natural? Hardly any of the species currently 'native' to the British Isles were present 25,000 years ago, and one of our best known 'aliens', *Rhododendron ponticum*, used to be native to northern Europe in an earlier interglacial (Coxon *et al.* 1994). Habitats and species distributions will continue to change under the onslaughts of climate change, new species invasions (non-native garden plants are more likely to establish as the climate warms), nitrogen deposition, and changing forestry and farming practices. If we 'let things go', ecosystems will not return to an imagined historical state, even if we release herds of roaming ungulates (although I'm all in favour of this). Distributions are dynamic. They carry on changing. If we cease to manage our habitats for rare open-country species, some species will die out in Britain, in part because the 'natural' open habitats where they might once have lived will have been irrevocably destroyed. This may not matter if these species are safe elsewhere in Eurasia. Only rarely are British races genetically 'unique'.

We are attached to many of our cultural landscapes and the species they contain. The current geographic distributions of these species, however, do not resemble those they had in colder glacial times, in the early-Holocene open period, in the mid-Holocene forested period, or in the various earlier stages of human occupation. We should decide which cultural landscapes we would most like to preserve, and then maintain the human artefacts (buildings and field boundaries) and land management that supported the traditional fauna and flora in these areas. It is not natural, but it is historically interesting. More naturalistic ecosystem-restoration approaches can then be adopted elsewhere, potentially bringing much larger long-term conservation gains, without risking the national extinction of the rare open-country species that would be maintained in the remaining cultural landscapes.

The Siver-studded Blue (inset) populations on Great Orme's Head, in north Wales, are distinct from those elsewhere in Britain, indicating a long period of isolation. It was perhaps in such sites that open-country species were able to survive in lowland Britain during the mid Holocene. Richard Revels

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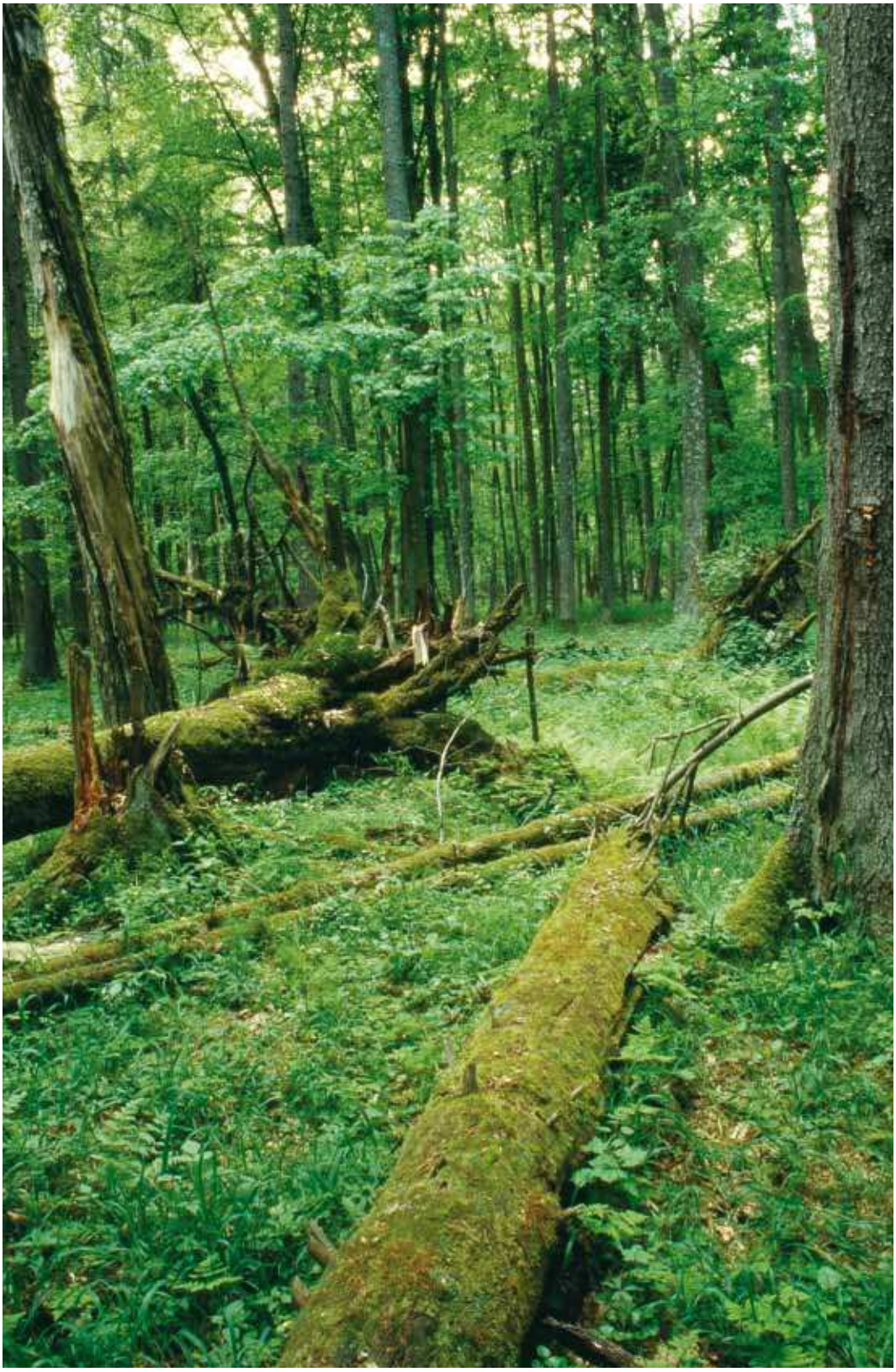

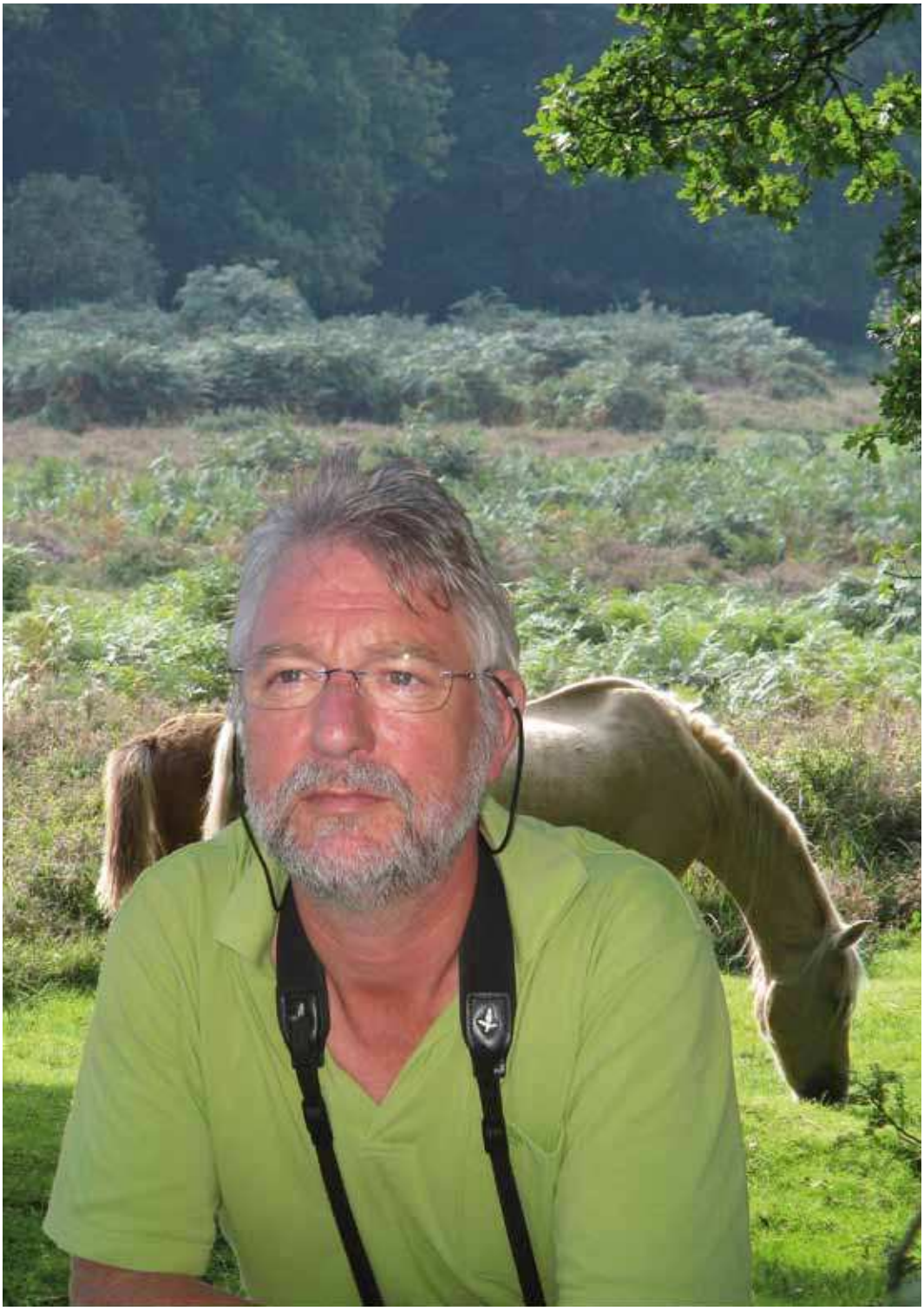

Above **Frans Vera, whose ideas about the role of wild grazing in shaping habitats has caused many ecologists and conservationists to reconsider their views.**
Left **A scene from Bialowieza Forest, in Poland, which for many decades was considered to represent the nearest that we have to a pre-Neolithic landscape in northern Europe.** Bob Gibbons

Large-scale nature development – the Oostvaardersplassen

Konik ponies and Red Deer grazing on the Oostvaardersplassen. Ruben Smit/www.rubensmit.nl

Frans W M Vera

Once, Europe was one large natural area, across which species of animals and plants were able freely to move and disperse. Today, a satellite image of Europe looks like a Persian carpet cut into millions of small rectangular pieces, each fashioned by the plough and the spade over thousands of years of cultivation. The consequence of this change is that species have disappeared. For example, animals such as the Aurochs *Bos primigenius* and the Tarpan *Equus przewalski gmelini* (wild progenitors of our domestic breeds of cattle and horse) have become extinct. Species that have survived have disappeared from large parts of their natural range. Examples include Red Deer *Cervus elaphus*, Elk *Alces alces*, Wolf *Canis lupus*, Lynx *Lynx lynx*, Common Crane *Grus grus*, White-tailed Eagle *Haliaeetus albicilla*, Pedunculate and Sessile Oak *Quercus robur* and *Q. petraea*, Large-leaved and Small-leaved Lime *Tilia platyphyllos* and *T. cordata*, Wild Pear *Pyrus pyraster* and Wild Service-tree *Sorbus torminalis*.

The shifting baseline syndrome

The remarkable thing is that many nature conservationists seem not to mourn this loss. At least that could be concluded from the fact that they protect the cultural landscapes that have caused the species to disappear; they even preserve them as nature reserves. Why do nature conservationists seem so tolerant of this loss of biodiversity, while at the same time maintaining that their efforts are aimed at preventing a loss of biodiversity?

The answer perhaps lies in a phenomenon known as the 'Shifting Baseline Syndrome', which was formulated by the fisheries scientist Daniel

Pauly in 1995. It arises when:

- each new generation does not know what nature may have looked like before mankind started to cultivate;
- the cultivated landscape and the wildlife within it changes almost imperceptably for each generation;
- each new generation defines what is 'natural' according to its own experience of the (changed) cultural landscape it has encountered, and uses this as a baseline against which to measure changes in the environment.

Lacking an understanding of a baseline of 'undisturbed nature', every new generation defines cultural landscapes and forests where there is some wildlife as 'nature' or 'natural', not being aware that compared with the experiences of former generations the wildlife has changed as a result of developments in agriculture and forestry. The consequences are (Pauly 1995; Sheppard 1995):

- each new generation tends to view as 'natural' the environment it remembers from its youth;
- the perception of ecological change alters from generation to generation;
- there is a continual lowering of the benchmark for what is 'natural';
- a degraded natural state is considered as normal;
- society as a whole becomes very tolerant of the creeping loss of biodiversity;
- a large educational hurdle is created to reset expectations and targets for nature conservation.

An example of shifting baselines can be seen in the way that many nature conservationists and laymen look to cattle in relation to nature, and the consequences that this perception has had for the baseline for nature conservation.

When scientists started to reconstruct the baseline for nature at the beginning of the 19th century through to the early 20th century, mankind with his plough, cattle and other livestock was considered to have altered the natural vegetation. German and Swiss foresters such as Cotta (1816) and Landolt (1866), as well as later British foresters and plant geographers such as Forbes, Moss, Tansley and Watt all assumed that if mankind ended ploughing and grazing livestock 'Mother Nature' would take over again. What developed on old fields and pastures abandoned by domestic livestock was considered as the return of the natural vegetation. Illustrative of this is what the British forester Forbes wrote in 1902: 'There is little reason to doubt, therefore, what the result of leaving land entirely to Nature would be. So far as indigenous species [of trees] are concerned we have only to fence off a piece of ground from cattle, sheep, and rabbits, and quickly get a sample of indigenous forest of one or other types mentioned above. . . . Even when unfenced, thousands of oak, ash, beech, and other seedlings spring up in every pasture after a good seed year, and where seed-bearing trees are within a reasonable distance. Such instances prove the capability of Nature to reassert herself whenever she gets the opportunity, and there is little doubt that this country would regain its original conditions in a hundred years or so if men and domestic animals were to disappear from it.'

The closed canopy forest as the baseline for the undisturbed, natural vegetation

So, at the beginning of the 20th century the common belief was that in an undisturbed situation forest covered Great Britain, as well as the mainland of Europe. This forest had been destroyed by ploughing and the grazing of livestock (Forbes 1902; Moss 1913; Moss *et al.* 1910; Tansley 1911). The forest would regenerate by the replacement of dead and windblown trees, either in gaps in the canopy or in large, open, windblown areas. Here, daylight would penetrate down to the forest floor where seedlings and saplings were waiting for the opportunity to get the amount of light that they need to grow successfully and fill in the open area with their expanding crowns, once again closing the canopy (Watt 1947; Leibundgut 1978).

At that time, it was very well known that large ungulates such as cattle and deer could prevent the regeneration of trees in the forest and change it slowly to grassland or heath. This process was called a retrogressive succession (Moss *et al.* 1910; Tansley 1911). Therefore these animals were considered as potential threats to the forest. The grazing of commoners' livestock in unenclosed forests that were part of a wood-pasture system was considered by foresters to be a particular nuisance. Foresters and plant geographers alike considered the livestock to be exotic species introduced by man, and therefore not belonging to nature (Forbes 1902; Tansley 1911; Moss 1913). Grasslands were considered to be artificial prod-

ucts, 'stolen' from the forest (Warming 1909). The sight of thousands of seedlings of oaks, Ash *Fraxinus excelsior* and Beech *Fagus sylvatica* springing up after a good seed year in grazed pastures, was interpreted as demonstrating the capability of the forest to return if the grazing was stopped. In this way, a closed-canopy forest became the baseline for undisturbed, natural vegetation. Tansley wrote about this: 'Grassland and heath have no doubt originated mainly from the clearing of the woodland, and the pasturing of sheep and cattle. . . . In some cases where grassland is not pastured, the shrubs and the trees of the formation recolonize the open land, and woodland is regenerated' (Tansley 1911).

As a consequence of accepting the closed-canopy forest as the baseline for natural vegetation, Red Deer and Roe Deer *Capreolus capreolus* were characterised as forest animals. They were supposed to have lived in a natural state in such numbers that there was an equilibrium between the seedlings that are eaten and the regeneration of the woodland. The situation was considered unnatural if the densities were so high that the regeneration of the forest was threatened (Tansley 1953). This meant that, under natural conditions, all known wild ungulates lived at very low densities, such as 0.5-3 Red Deer per 100ha or 4-5 Roe Deer per 100ha (Wolfe & von Berg 1988; Remmert 1991).

The shifted baseline for indigenous large ungulates

When scientists first constructed a baseline for natural vegetation in Europe, it was not known that the Aurochs was an indigenous species, nor that it was the wild ancestor of domestic cattle. It became extinct in 1627 and it was only in 1827 that the Aurochs was scientifically described. However, it was then considered to have been a species that lived in Europe in the Pleistocene and had become extinct around 15,000 years ago, when the present warm period, the Holocene, started. It was not until 1878, after the study of old historical sources, that it was concluded and published that the Aurochs lived in Europe during the Holocene through to historical times. It was not until 1927, after extensive studies of bone material, that the Aurochs was recognised as the wild ancestor of cattle (Van Vuure 2005). By then, the closed-canopy forest in Europe was already widely accepted in science as the baseline for natural vegetation.

An important confirmation of this view that forest was the natural vegetation of most of Europe came from palynology, the science that reconstructs past vegetations by means of identifying pollen found in sediments. From 1916 palynologists interpreted their pollen diagrams as the reconstruction of the history of the forest (Vera 2000). The concept of forest as a baseline for the natural vegetation was so strongly supported by the scientific fraternity, that when the existence of the Aurochs became widely known and accepted, the species was characterised as a forest animal, like Red and Roe Deer. As with deer, it was postulated that the Aurochs would have lived naturally in such low numbers that there was an equilibrium such that the survival of the forest was not jeopardised (Tansley 1953).

Until recently, the horse was not considered part of the indigenous fauna of Europe. The reason was that the only known (and still extant) wild horse, the Przewalski's Horse *Equus przewalskii*, as well as its relatives, Burchell's Zebra *Equus burchellii* and Grevy's Zebra *Equus grevyi*, and the Asian wild asses, the Kulan *Equus hemionus kulan* and Onager *E. h. onager*, all live in open grassy landscapes. All horse species were therefore considered to be open grassland species. The common view among palaeo-ecologists and archaeologists was that the wild horse disappeared from western and central Europe around 10,000 years ago, when the (reconstructed) forest invaded the area. Since this was not the natural habitat of the horse, it disappeared from these regions, surviving only in the steppes of eastern Europe and Asia.

What contributed to this view was that, initially, all the fossils of horses that were found in western and central Europe dated back to the Neolithic and later, the period when agriculture was established in Europe. Therefore, they were interpreted as being the remains of domestic horses, introduced by man (Van Wijngaarden-Bakker 1975). However, since then, fossils of horses have been found dating back to the time before agriculture, and doubts have arisen. The frequent occurrence of Aurochs and, to a lesser extent, of horse in the Atlantic and Sub-boreal periods – when a primeval dense forest is supposed to have been present – has recently led to the suggestion that their presence is an indication of a more open landscape

Konik ponies grazing amongst willow scrub and trees on the Oostvaardersplassen. Ruben Smit/www.rubensmit.nl

(Zeiler 1997; Laarman 2001; Peeters 2007). This horse would have been the Tarpan, a wild horse known from Europe in historic times.

Circular reasoning

The baseline of a close-canopy forest for the natural conditions has greatly influenced the view of both foresters and nature conservationists on the role of large indigenous ungulates in nature. It meant not only that under natural conditions wild ungulates live in very low densities, but also that they follow vegetational succession, as in theory the outcome of unhindered succession without large, wild ungulates is no different to that with them. However, the reconstruction of dense forest as the baseline for the natural vegetation and the influence of large wild ungulates is a example of circular reasoning, namely: the forest vegetation that develops in the absence of any influence of indigenous large ungulates is the natural vegetation, and because the natural vegetation is a forest, the indigenous large, wild ungulates do not have any influence on the development of the natural vegetation.

Oostvaardersplassen

In The Netherlands, the Oostvaardersplassen changed all this. This nature reserve arose in 1968, when the South Flevoland polder was reclaimed from Lake IJssel. Oostvaardersplassen consists of 6,000ha of open water, marshland, wet and dry open grasslands and flowering communities with trees and shrubs. The soil is very fertile calcareous clay. The reserve has revealed that nature is highly resilient and has demonstrated a baseline for a more species-rich and more complete naturally functioning ecosystem. Bird species, such as the Spoonbill *Platalea leucorodia*, Bittern *Botaurus stellarus*, Marsh Harrier *Circus aeruginosus* and Bearded Tit *Panuris biarmicus*, that had become very rare in The Netherlands, established themselves as breeding birds in numbers that were high in comparison to other nature reserves in north-western Europe (Vera 1988). The area also attracted species which had disappeared as breeding species from The Netherlands, such as the Greylag Goose *Anser anser*, Great White Egret *Ardea alba* and White-tailed Eagle *Haliaeëtus albicilla*, a pair of which established a territory in the area and has bred since 2006. A pair of Ospreys *Pandion haliaetus* built a nest in 2002 but did not breed.

A paradigm shift

Up to 30,000 (non-breeding) Greylag Geese retreat to the marshes to moult their wing feathers

Heck cattle and Greylag Geese amongst the extensive reedbeds of Oostvaardersplassen.
Ruben Smit/www.rubensmit.nl

(Van Eerden *et al.* 1997). They graze the marshland vegetation, especially the Common Reed *Phragmites australis* and the bulrushes *Typha*, to such an extent that closed reedbeds have turned into open water, something which up until then it was thought only human management could achieve. The Greylag Geese have created a mosaic of open water and marsh vegetation from which countless species of wild animal and plant have benefited, enabling them to continue to exist in the area. Contrary to the common belief that herbivores follow only the succession of the vegetation, the Greylag Geese were instrumental in driving it.

Fluctuations in the marshland's water level, influenced by precipitation and evaporation, and by wet and dry years, also affected the behaviour of the geese. When the marshland is dry, the geese seek out other areas in which to moult. Sightings of birds with specific coloured rings showed that the Greylag Geese switched between the Oostvaardersplassen, the Danish island of Saltholm and the Swedish island of Öland (Zijlstra *et al.* 1991; Nilsson *et al.* 2001). During the geese's absence from the Oostvaardersplassen, the grazed vegetation recovered.

Because of the grazing of the geese, in combination with fluctuations of the water level, the traditional human management of reed-cutting was not needed. But, as a result of the geese grazing, up to 45 pairs of Bittern and more than 1,000 pairs of Bearded Tits are present. This example of the role of a large herbivorous bird in directing succession has caused a shift in the thinking about the potential for creating conditions where ecosystems can function naturally.

A more complete ecosystem

Greylag Geese also need open grasslands on dry land adjacent to the marshy areas in which to congregate before and after the moult. Without grassland Greylag Geese could not congregate before and after their moult, which in turn would prevent the Greylag Geese from creating a mosaic of open water and marsh vegetation, and countless animal and plant species would disappear from the marsh. In order to develop and maintain the grassland, it was proposed by some that farming should be incorporated into a dry area adjacent to the marsh. The reasoning was that domestic cattle were needed to create and maintain open grasslands. Others, myself included, argued that if this was so, their wild ancestor, the Aurochs must have also been able to do this (Vera 1988; Vulink & Van Eerden 2001). This also applied to that other indigenous specialised grass-eater, the Tarpan. But as the Aurochs and the Tarpan are extinct, suit-

able replacements were sought among these species' descendents, namely breeds of cattle and horse which could act as proxies for their wild ancestors. Heck cattle and Konik ponies were chosen, because they have undergone very little selective breeding and may therefore have many of the characteristics of their wild ancestors. These natural characteristics could then be redeveloped by allowing the animals to live in the wild and become feral (Vera 1988).

Nature conservationists, as well as scientists, opposed this approach, arguing that a closed-canopy forest would then develop, because – as the reconstructed natural vegetation forest proved – wild, large indigenous ungulates would not be able to prevent a closed-canopy forest from developing. In their opinion, grassland could only be developed in an artificial way through farming. After much discussion, the argument was settled in favour of the wild cattle and horses.

Great White Egret feeding with Koniks at Oostvaardersplassen.
Ruben Smit/www.rubensmit.nl

The Heck cattle and Koniks live in the nature reserve year round. This means that the number of animals grazing during the growing season is determined by the number of animals that have survived the preceding winter. During the winter, part of the population of animals dies off as a result of the lack of food. This causes undergrazing during the following spring and summer, as the remaining animals are unable to eat as much plant growth as would a larger herd. The animals do not graze every part of the reserve equally intensively (Cornelissen *et al.* 2004). The areas which are not grazed or are grazed less during the growing season turn into long grass and forbs, which benefits mice and the birds which feed on them, such as Great White Egrets, Marsh Harriers and Buzzards *Buteo buteo*.

More species of ungulates

However, the natural environment was home not just to grass-eating wild ungulates, such as horses and cattle, but also to animals which feed on a combination of grasses and the leaves of trees and shrubs, such as Red Deer, or specialised browsers such as Roe Deer and Elk. All these animals have different effects on the natural vegetation, because of their different food preferences (Van de Veen & Van Wieren 1980; Van Wieren 1996). The specialised grass-eaters generally promote the establishment of trees and shrubs through grazing, while mixed feeders such as the Red Deer that browse and debark shrubs and trees slow down this effect. The range of feeding strategies of the different species of ungulate constitute a system of checks and balances, preventing any single type of vegetation from becoming totally dominant. Together, all the herbivores ensured a varied vegetation, which enabled the continued existence of a full range of wild species of plants and animals (Vera 2000; Duffy 2003). Like the Greylag Geese in the marsh, at the Oostvaardersplassen the large herbivores similarly play a key role in maintaining diversity in the dry areas (Sinclair & Norton-Griffiths 1979; Vera 2000; Vera *et al.* 2006). In order to augment the effect of horse and cattle grazing at the Oostvaardersplassen as described above, Red Deer were introduced.

These large ungulates nowadays create open grassland, where, besides the 30,000 Greylag Geese, up to 14,000 Barnacle Geese *Branta leucopsis* winter, and more than 10,000 Wigeons

Anas penelope also graze. More than 10,000 Lapwings *Vanellus vanellus* and Golden Plovers *Pluvialis apricaria* can regularly be seen there, the former breeding successfully in the grassland. These are all bird species that, because of shifted perspectives in nature conservation, are supposed to need pastoral farming for their survival. They certainly do not. They need an ecosystem on fertile soils that is complete with indigenous, wild large ungulates, as had been the case before farming took place.

In other parts of the dry areas of the reserve the large ungulates create the conditions for the establishment of thorny shrub species such as Blackthorn *Prunus spinosa* and Hawthorn *Crataegus monogyna*. These spiny so-called 'nurse' species make it possible for seedlings of larger trees to grow up successfully in the presence of very high densities of large ungulates. In this way, large wild ungulates can create a park-like landscape known as wood-pasture (Vera 2000; Vera *et al.* 2006, 2007). To what extent this will happen in a fertile young area such as the Oostvaardersplassen, is a question that has yet to be answered. Seedlings of Blackthorn and Hawthorn have already been found in parts of the area that the animals use only during the winter, that is, outside the growing season of the plants. Tree and shrub species such as oaks, elms, Ash, Elder *Sambucus nigra*, roses and Hazel have also established themselves in a thorny scrub that originated from Blackthorns that were introduced to the area. The remarkable thing is that once these spiny species were established, other woody species grew spontaneously in the scrub in an area with densities of three Red Deer per ha during the winter, when they browse trees most intensively.

Regulation of the number of large ungulates

Animal numbers have increased steadily in the Oostvaardersplassen. Over the summer they can put down enough fat to last them through the winter. Eventually, however, the increase in numbers comes to a halt when food sources run out. Animals become emaciated and some die through lack of food (Gill 1991; Mduma *et al.* 1999; Grange *et al.* 2004; Höner *et al.* 2005). This sequence of events takes place in natural areas such as the Serengeti and the Ngorongoro crater in Tanzania, Africa. In, for instance, the Serengeti, where there are also large predators such as Lion *Panthera leo* (average density: 1 per 1,000ha) and

The death of large herbivores on the Oostvaardersplassen has highlighted the problems of adapting animal welfare concerns with naturalistic grazing regimes. Ruben Smit/www.rubensmit.nl

Spotted Hyena *Crocuta crocuta* (average density: 3 per 1,000ha), it is the amount of food that regulates the numbers, not large predators. Research has shown that only 25% of Wildebeest *Connochaetes taurinus* deaths were caused by large predators. This means that the remaining 75% of deaths were the result of malnutrition. What is also remarkable is that only 6% of the animals in poor shape that died were killed by large predators (Sinclair *et al.* 1985; Mduma *et al.* 1999; Kissui & Packer 2004). But at the Oostvaardersplassen it was considered that animal welfare in the nature reserve was being compromised, as the animals were becoming thin and some were dying. Also, there was a fence around the area preventing them from migrating to areas where there was still food.

Once again, the situation at the Oostvaardersplassen became victim of a different type of shifting baseline. Animal welfare was being compared against an agricultural benchmark. The Dierenbescherming, an animal welfare NGO, sued Staatsbosbeheer, the government agency responsible for the reserve. In court, the deteriorating condition of cattle and horses in winter was compared by them with the condition of farm livestock. With the disappearance of wild cattle and horses, an understanding of their welfare has disappeared, and, for these species, has been redefined according to experiences with domesticated animals on farms. The fact that wild-living cattle and horses in the Oostvaardersplassen had a completely free life with a natural social order, that the calves and foals stay with their mother, and have a natural social order like that of other large bovine ungulates and equids living in the wild, did not seem to matter. This aspect of their freedom is forgotten or ignored. The animal welfare group lost, appealed and lost again. The most remarkable part of the verdict was that the judge said that Staatsbosbeheer introduced the cattle, horses and Red Deer without the intention of getting them back under its disposal. Therefore, Staatsbosbeheer has lost the animals as its 'property'. They belong to nobody and so are *de jure* 'wild animals' (*res nullius*: nobody's object).

The percentage die-off at the Oostvaardersplassen over the last four years, when, according to the numbers without supplementary feeding, saturation densities seem to have been reached, varied in cattle between 6% (2008) and 34% (2005), in horses between 15% (2008) and 24% (2007) and in Red Deer between 10% (2008) and 25% (2009). The numbers of cattle have more or less stabilised, horses have almost stabilised, and the Red Deer population seems to have stabilised, with only 10 less compared with 2008, after the winter of 2009.

The die-off figures cannot be deemed exceptional, and are, according to an international commission (International Committee on the Management of Large Herbivores in the Oostvaardersplassen – ICMO) definitely not unnatural (Young 1994; ICMO 2006). Although there is a fence around the reserve, there is no difference in die-off percentages when compared with natural functioning ecosystems without a fence. Staatsbosbeheer does, however, intervene for the sake of animal welfare on the basis of the advice of the commission (ICMO 2006). It is a reactive management, which means that if an animal's behaviour indicates that its death is impending, it is shot. This almost always occurs at the end of the winter, so the amount of food is regulating the number of animals, as is the case in natural functioning ecosystems (ICMO 2006).

The Red Deer carcasses, which, according to the Dutch Law on the destruction of animal carcasses, may be left where the animals fall, serve as food for large birds of prey such as the White-tailed Eagle. Since 2006, a pair of White-tailed Eagles have bred in the area (they raised one young in 2006 and 2007 and two in 2008). With Europe's largest eagle as a breeding bird, the Oostvaardersplassen has disproved the conventional wisdom that eagles cannot breed in densely populated countries such as The Netherlands. On 16th March 2005, a Black Vulture *Aegypius monachus* arrived in the area and stayed there for months. She may still have been there had she not been killed on 15th August by a train on the railway that borders the nature reserve.

The future

The Oostvaardersplassen represents an option for the future for nature and nature conservation in Europe. Are we going to base our plans on the benchmark of the cut-up Persian carpet (Quammen 1996)? If so, the agricultural man-made landscape will be the only baseline for nature and its management, and consequently the standards and values applied to the biodiversity that has survived on agricultural land and the welfare of domestic

livestock will be the baseline applied to the wider natural world and the welfare of large ungulates living in the wild. If we follow this path it will be impossible for many plant and animal species that disappeared as a result of the introduction of agriculture to return.

The other option is to develop large, natural-functioning areas where natural processes get the chance to evolve. In that case, a new baseline for nature as well as for the welfare of wild-living large mammals, including wild cattle and horses, alongside that in existence for domestic livestock will need to be developed. We shall then also have to learn to co-exist with animals living a truly wild existence, periodically losing condition, and a number dying off as a result of lack of food. If we are unable to do this, we run the risk of making the presence of unfettered nature impossible.

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Really wild? Naturalistic grazing in modern landscapes

New Forest Ponies grazing by a pond at Redshoot Wood. Andrew Branson

Kathy H Hodder and James M Bullock

From neat fields and hedgerows to wind-swept moors and mountains, the present landscape of the crowded islands of Britain has been shaped by people. Although 18th-century landscape architects unashamedly created scenery to please the eye, our domination of plant and animal life, and of nutrient, water and energy flows, has generally been a product of economic necessity. Even features once considered natural, such as the Norfolk Broads, can have artificial origins.

As urbanisation, agriculture and forestry intensified during the 20th century there was little room left for the diversity of species and ecosystems characteristic of earlier times. Growing concern for our diminishing wildlife led to the development of the nature conservation movement, with the aim of safeguarding our flora and fauna (Sheail 1998). This in turn engendered the practice of targeted conservation management, combining low-intensity and traditional techniques with the growing science of ecology. This mainstream approach has often been accompanied by a counter-current, recently voiced in *British Wildlife*, that 'Nature is becoming subservient to Nature Conservation' (Oates 2006), that something intangible or spiritual is lost through too much management. Alternatives where intervention is reduced, or even withdrawn, have periodically entered conservation literature and discourse. Sixteen years ago, the 'Edwards Report' suggested that a 'number of experimental schemes on a limited scale should be

set up in the [upland] National Parks, where farming is withdrawn entirely and the natural succession of vegetation is allowed to take its course'. Today, this would be called 'Re-wilding'.

Re-wilding has received increasing support in the UK and interest extends beyond advocacy groups, as evidenced by a consortium of 38 ecologists and policy-makers who recently placed re-wilding and its consequences in the top 100 ecological questions of high policy relevance for the UK (Sutherland *et al*. 2006). It has even been advocated as the 'optimal conservation strategy for the maintenance and restoration of biodiversity in Europe'. Specifically, this includes the restoration of grazing and browsing by wild large herbivores i.e. 'naturalistic grazing' (Vera 2000). It was in this climate that English Nature commissioned us to investigate the ecological, cultural and welfare implications of naturalistic grazing and re-wilding in modern English landscapes.

What is 'naturalistic' grazing?

What makes naturalistic grazing distinct from other types of extensive grazing for conservation? After all, visitors to nature reserves in most parts of western Europe are accustomed to seeing horses, cattle, goats and sheep grazing over wide areas as part of the management regime. In fact, a large body of research has developed on the science and practice of conservation grazing. This research recognises the key importance of large herbivores and their strong direct and indirect influences on ecosystem dynamics. Indeed, most countries in western Europe have grazed reserves that are outstanding in terms of biological diversity: the Camargue in France, the New Forest in England, Mols Bjerge in Denmark, Öland in Sweden, the Borkener Paradies in Germany and the Junner Koeland in The Netherlands. So, the utility of *extensive* grazing for conservation of unenclosed habitats is well established, but conservation managers have been considering adopting *naturalistic* grazing methods as pioneered in the Oostvaardersplassen, Netherlands (Wigbels 2001).

Two decades ago, conservationists in the Oostvaardersplassen started an unusual project described as 'new nature below sea level'. In an area reclaimed from the sea with dykes (a polder), but never developed as a result of economic recession, they let domestic livestock form semi-wild populations. A wetland area developed into an important nature reserve, and since the 1980s 2,000ha of grassland, which had been partly developed for agriculture, have been added to the reserve and grazed by free-ranging herds of Heck cattle, Konik ponies and Red Deer *Cervus elaphus*. The idea was to allow the animals to regulate themselves, without human intervention. They are not fed when their grazing runs low. Disease is left untreated, and there is no attempt to protect animals from bitter winters or dry summers. However, animals are culled when their condition and behaviour indicate that they are near death (Tramper 1999).

Based on the Oostvaardersplassen model, the key features that differentiate naturalistic grazing from other forms of extensive grazing are:

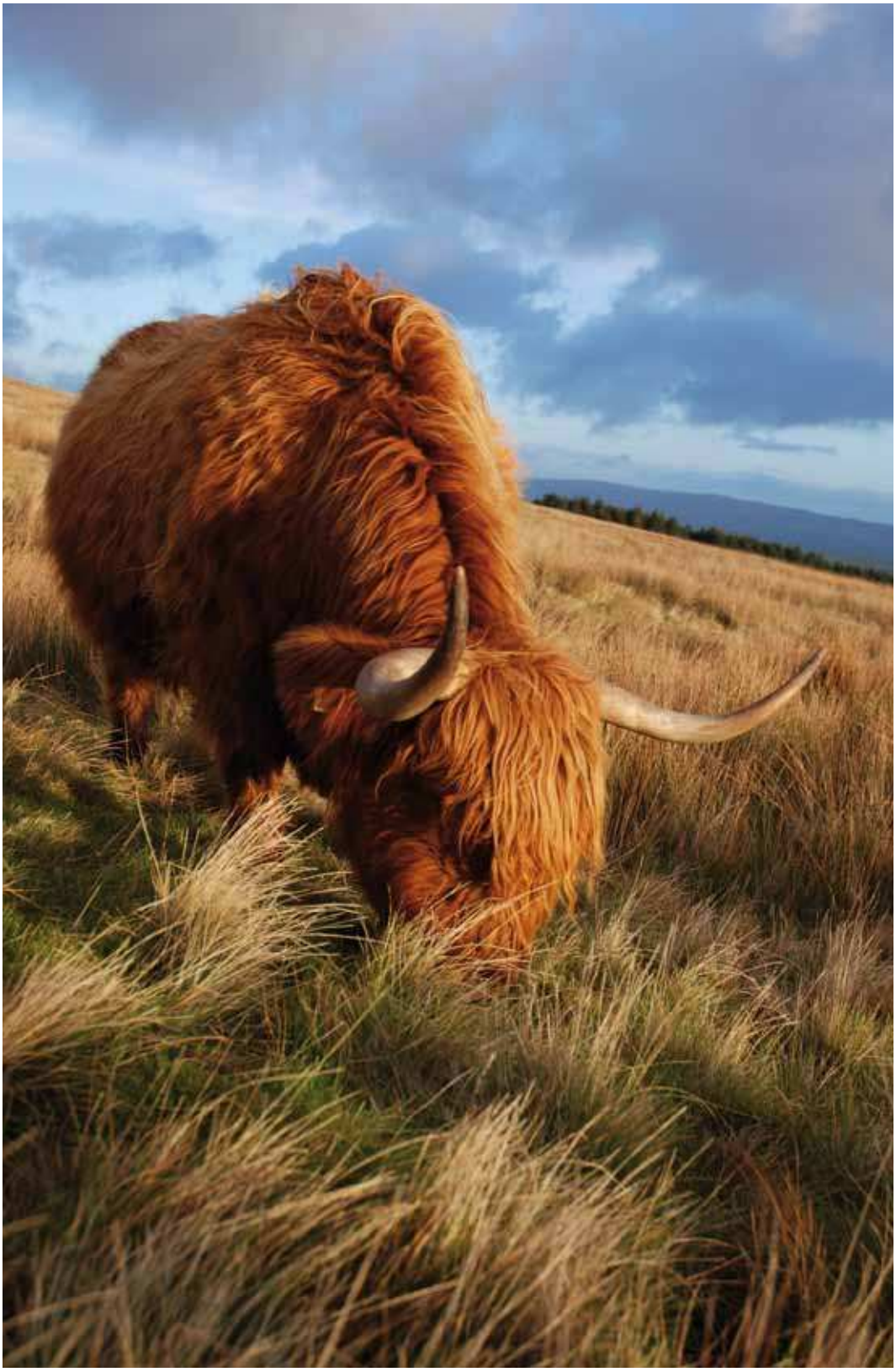
- No specified herbivore density; instead, populations are resource-limited, so that numbers fluctuate according to factors such as food availability, climate, pathogens and parasites.
- Grazing animals are assumed to drive the ecosystem, and natural processes are allowed to act, rather than being aimed at targets for habitat and species composition.
- Direct management intervention is reduced to a minimum, and the natural process is seen as an aim in itself.

Defining these objectives highlights the considerable contrast between naturalistic management and most other extensive managements, the latter seeking to achieve conservation targets (such as species composition) through application of specific grazing pressure.

Case studies in the English landscape

To focus on practical issues, we used questionnaires and interviews with site managers, owners and advisors from three contrasting English landscapes of approximately 3,000-5,500ha in which re-wilding was an issue. These landscapes encompassed a range of possible scenarios: a scenic upland area, a lowland site consisting largely of fertile agricultural/forestry land, and a coastal site of varied habitats with high conservation value. This was very much a 'What if?' study, because the resource-limitation aspect of cattle and pony

Hardy native breeds of livestock, such as Highland Cattle, are often used in conservation grazing schemes, such as here near Malham in North Yorkshire. Peter Roworth



populations central to the naturalistic approach would be prohibited by animal-welfare legislation in the UK.

Opinions differed within and between sites with regard to priorities and approaches (not surprisingly), but three common themes emerged:

- bigger is better,
- aiming without a target, and
- wilderness views.

Bigger is better

As would be expected, it was clear that scaling-up of management had great potential ecological benefits, such as reducing isolation, in addition to potential economic savings. However, landscape-scale management was seen as a separate matter from the prospect of managing with minimum intervention, and any move towards the use of naturalistic or resource-limited grazing animals was a distinct issue.

Aiming without a target

The practical difficulty of attempting to reconcile 'naturalistic' ideology with the day-to-day issues of site management was a major theme. Although vision statements, and the like, might describe creating wilderness areas, removing artificial boundaries and allowing room for natural processes, on closer deliberation these aspirations were not always compatible with more specific objectives. None of the managers expressed an intention to give natural processes entirely 'free rein'. Even when a general ambition to 'allow nature to take its course' was expressed, managers were understandably reluctant to accept losses when pressed about individual species or valued habitats.

Limits to acceptable change that could be more flexible than prescriptive management targets were often mooted as an alternative approach. Change in the proportion of habitat types (e.g. grassland and scrub) could be monitored and, if necessary, action taken. The preferred method for this was the manipulation of grazing levels. However, this may not be easy for free-ranging animals that have formed social groups. Where a site has high biodiversity value, acceptable limits to change would be likely to differ very little, if at all, from existing management targets.

The wood-pasture type of landscape that has been envisaged for naturalistic lowland areas depends on the development of a shifting mosaic including open grassland and woodland glades (Olff *et al*. 1999). Managers, in some cases, hoped that shifting mosaics of vegetation would develop as a result of 'natural processes', and particularly through naturalised grazing. However, the scope for shifting mosaics to operate if stock levels are manipulated to maintain proportions of habitat within certain limits must surely be low. If herbivores were kept at sufficient density to maintain species-rich grassland areas, this would not permit the woodland-regeneration phase of the shifting mosaic to occur. Herbivore population crashes would be required to provide windows of opportunity for scrub and tree regeneration. This could potentially be managed by simulating population crashes by periodically reducing stock density, but this, of course, would not be 'naturalistic'.

Also, timescales would need to be long, at least decades, to allow woodland regeneration (Harmer *et al*. 2001), and there is no evidence that 'natural half-open parkland' would result from naturalistic grazing. In the Oostvaardersplassen, more than 20 years after the start of grazing by cattle, ponies and deer, the fertile soil supports a high density of the herbivores on a close-cropped turf. There are patches of scrub (mainly willow *Salix* and Elder *Sambucus nigra*) that colonised or were planted in the marginal area prior to its addition to the grazing reserve, but since then most have been killed through bark-stripping by the herbivores. There is virtually no sign of tree or scrub regeneration, and it seems likely that a major population crash would be required to start this process. There is no way of accurately predicting the temporal or spatial patterns that might emerge.

Wilderness views

The importance of management to create an *appearance* of wilderness, particularly the need to provide unobstructed views, and to remove unsightly artificial boundaries, was not underestimated in our case studies. This was reflected in the visions, or overall aims, of the sites, which were much concerned with creating wilderness areas and allowing room for natural processes. In some cases, though, conflation of the wilderness experience (which often has to be managed for) with increased scope for natural processes (deliberate removal of management) resulted in impasse and could even be in conflict.

The creation or preservation of a sense of

A sense of wildness, such as can still be experienced in upland regions of Britain, as here in the Ennerdale valley, Cumbria, is an important consideration for many visitors to nature reserves. Gareth Browning

remoteness, particularly in upland areas, may be a significant factor guiding reserve design and management. Visitors to Ennerdale, in Cumbria, for example, enjoy views of spectacular craggy mountains. Unimpeded regeneration of conifers could block these views, significantly detracting from the sense of wildness. These landscape-management aims should not, however, be confused with an intention to allow unchecked natural processes to act in an area. The 'Wild Ennerdale' scheme cites the preservation of a 'sense of wildness' as a key aim (Browning & Yanik 2004), and provides an excellent example of a large-scale and extensively managed initiative where great care is being taken to disentangle the various distinct goals (landscape and ecological) in order explicitly to state them and hence effectively to manage towards them.

The heart of the matter: why is re-wilding so beguiling?

Probably the most fascinating question raised in our appraisal of naturalistic grazing was that of why these ideas are so appealing. Attempting to answer this question entails trespassing into environmental philosophy, but, far from being purely academic, it gives an opportunity to step back and re-evaluate some of the motivation and rationale behind nature conservation.

Marketing

Although not normally articulated, the most simplistic aspect of the appeal of re-wilding may be its marketing potential. Politicians, managers of public lands and the public themselves are much more likely to buy proposals that sound romantic and appealing – which 'landscape-scale conservation' does not. Naming a place a 'wilderness' or 'wildland' gets us away from what Dave Foreman aptly describes as the 'cold-potato' language of science. Protection of the diversity of life requires clever marketing, and 'piggybacking onto the popular wilderness preservation movement is a good way to do it' (Foreman 2004).

'Getting away from it all'

Although focus on virgin wilderness has been described as one of the 'true idiosyncrasies in the American character' (Shepard 2002), the emotional pull of 'self-willed land' has extended across the Atlantic, despite the fact that nearly all European ecosystems are certainly not wilderness in the untrammelled sense. In fact, writing from the Aldo Leopold Wilderness Research Institute in the US, David Cole is convinced that the ubiquity of human disturbance forces us to 'confront the fact that we cannot have wilderness that is truly wild or natural' (Cole 2001). However, re-wilding still seems to offer an antidote to the all-pervasive

influence of humans in this 'anthropocene' era.

People cling tightly to the flawed perception that they are experiencing pristine nature. For instance, in the Val Grande National Park (an 'alpine wilderness area' in Italy), 62% of polled visitors came to experience 'untouched nature', despite the fact that large areas had been cultivated for centuries (Hochtl *et al*. 2005).

The importance of the natural beauty of 'wild country in which one can escape from the strain of modern life' was recognised by early conservationists (Tansley 1945), and even enshrined in the British National Parks and Access to the Countryside Act (1949). What was once called 'getting away from it all' by enjoying the wilder countryside is now reframed as 'ecopsychology', an emerging academic discipline and service industry providing spiritual renewal to beleaguered citizens of the over-comfortable rich nations. The benefits of wild landscapes for outdoor recreation have even been formalised as 'wilderness therapy' (Russell 2001). Educational attributes of wilder areas were also espoused in mid-20th-century writings and more recently described as a moral resource to inspire us to live sustainably (Nash 2001).

The problem arises when the complementary but distinct goals of managing for wildland attributes become overly conflated with a laissez-faire approach to conservation based on replacing targets with a notion of natural processes. The former may well require active intervention that would negate the basis of the latter. Therein lies much of the difficulty in defining wild land, as acknowledged in the web pages of the fledgling UK Wildlands Network.

Managing for change

Adopting flexible limits to ecological change rather than rigid targets must gain considerable credence from constant reminders that we are entering a period of accelerated change due to climatic perturbations. Range shifts and changes in phenology (the seasonal timing of biological events, e.g. fruiting or migration) are already being recorded for a wide variety of taxa, including birds, butterflies and plants. The fossil record shows us that sudden catastrophic changes have occurred in the UK, where entire ecosystems have been wiped out within periods far shorter than the human lifespan.

Facilitating natural processes may seem at first glance to be a pragmatic response to these challenges. However, it is not clear how processes can be evaluated (except in clear-cut cases, such as reinstating natural fire regimes in some North American forests). An alternative viewpoint is that acknowledging the existence of a dynamic landscape does not absolve one from a duty of stewardship. To keep with tradition, a quote from Aldo Leopold's *Round River* would seem appropriate: 'To keep every cog and wheel is the first precaution of intelligent tinkering.' In contemporary terms, David Western puts forward a similar argument for managing the wilds: 'Clear goals, scientific understanding, and measurement of human impact are far better guides for protecting and managing biodiversity than our feelings of what constitutes the wilds.' (Alpert *et al*. 2004).

Intelligent tinkering

Enlarging and linking nature reserves so that whole landscapes can be managed is better than trying to conserve biodiversity in small, fragmented sites. If we are to conserve biodiversity in Europe, this approach is likely to be essential. Extensively managed herds of large herbivores would undoubtedly play an important role in these networks and large reserves. But it is not clear what added benefit may be gained by leaving them entirely unmanaged.

Throughout the UK and Europe there are now excellent opportunities for developing large interconnected nature reserves, such as Wild Ennerdale in Cumbria and the planned expansion of Wicken Fen (National Trust 2007). There are concerns about how to maintain biodiversity in such large areas within limited budgets. But replacing management targets for species and habitats with a vague notion of 'natural process' conservation cannot be the solution, for many reasons. For one, 'natural process' is, sadly, something of a misnomer: nature reserves will be affected by pollution, exotic species and falling groundwater levels, and will lose key species, to name just a few 'unnatural' problems. Perhaps 'naturalistic' belongs in the aspirant language of conservation politics – good for rallying support, but less useful when vision statements are converted into practice. Even in larger reserves than those of our case studies, such as Wicken Fen, active management is expected: grazing pressure will be controlled to prevent succession from open fen to fen-woodland (Friday

& Moorhouse 1999).

Cronon (1996) warns against fleeing into a mythical wilderness to escape history and the obligation to take responsibility for our own actions that history inescapably entails. Rather, we should focus on how our impacts can be managed and designed to allow people to coexist 'more generously with other living things' (Higgs 2003). In the words of one of the pioneers of British ecology and conservation, we need to seek 'some wise principle of co-existence between man and nature, even if it has to be a modified kind of man and a modified kind of nature' (Elton 1958).

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Herbivores in space: extensive grazing systems in Europe

Cattle grazing in the high summer pastures of the Covadonga National Park, in northern Spain. Bob Gibbons

Eric Bignal and Davy McCracken

Our interest in extensive grazing systems developed through a concern for the future of extensive (low-intensity) farming systems that were, and continue to be, integral to the continued biological richness and diversity of large areas of western Europe. This interest in pastoralism started as an offshoot of our conservation work on the Red-billed Chough *Pyrrhocorax pyrrhocorax* (Bignal & Curtis 1989), developing first into research on low-intensity agricultural land in the UK (McCracken *et al.* 1992) and currently through the activities of the European Forum on Nature Conservation and Pastoralism (EFNCP). With the current emphasis placed by nature conservation organisations on the importance of grazing, it is hard now to imagine that the work on low-intensity farmland was begun in the early 1980s, partly because the emphasis then (by UK conservation organisations) was on 'site-based' conservation, neglecting enormous areas of land dominated by semi-natural vegetation in the form of virtually all the well-recognised habi-

tats of nature conservation importance, such as maritime grasslands and heaths, wetlands, various types of grassland, moorlands and mountain plant communities. Grazing was generally regarded by nature conservationists as negative to many of their aims.

We have tried to emphasise (e.g. McCracken *et al.* 1995; Poole *et al.* 1998; Pienkowski & Jones 1999; EFNCP 2004) that, in the UK and much of the European Union, management of the vegetation and wildlife of most open habitats regarded as being of high biodiversity is a by-product of long-established agricultural practice (Bignal 1998; Bignal & McCracken 2000), and that these practices are rapidly changing in response to market, social and policy pressures. It was for this reason that the EFNCP was established, placing a focus clearly on pastoralism and the interactions between long-established pastoral farming systems and nature. Without a continuation of the characteristic grazing regimes and associated farming practices, especially the subtleties in timing and intensities of grazing, the underlying habitats would change markedly. In the majority of cases, the grazing achieved by re-wilding would not maintain the characteristic pressures needed at specific times of year and which are required to maintain the vegetation types and structures that are associated with species-rich habitats.

So, for us, extensive grazing is not about whether management mimics natural processes *per se*, nor whether the results of this produce vegetation communities and habitats similar to those that were around during the Neolithic period or some other pre-historic period. Rather, we are concerned about changes to currently ecologically benign farming systems, with detrimental consequences for nature. Our success has been limited, and the prognosis is not encouraging; it is possible that the 're-wilding' debate will contribute little to the real long-term prospects for wildlife in Europe. Indeed, it is ironic that the farming systems of highest ecological value are being lost somewhere between the re-wilding debate (most appropriate, if at all, for nature reserves) and the drive to remove subsidies for farming in the belief that this will automatically produce ecological benefits (perhaps true for the intensive industrial farmland of lowest biological value).

Starting points of high biological diversity

Rodwell (2003) has pointed out that the physical features of the contemporary European agricultural landscape is made up of layer upon layer of earlier management systems – a palimpsest. There are good examples of this from many parts of Europe, particularly in the agriculturally marginal areas. For instance, the 600ha farmed by one of the authors (EB) in the west of Scotland (Kindrochaid, Isle of Islay) are currently extensively managed with suckler cows and sheep. The site is a mosaic of cliff communities, coastal heath, calcareous grassland, wet and dry heaths, and a suite of mires, plus still and running water. Parts are acidic and peat-covered, but there are localised outcrops of calcareous rocks, as well as sand

Corn 'huts' at Kindrochaid, Islay. The rich wildlife of this area is intimately related to the changes in farming practice that have evolved over thousands of years. Eric Bignal

dunes and grassland over blown shell-sand (machair) (Harris 2002).

Much of the current high nature value relates to physical and biological features created under former systems of management dating back to the Mesolithic (Mithen 1999). The landscape includes Bronze Age field systems with prominent earth banks, post-Medieval rig and furrow, 17th-century mountain pastures and field-clearance cairns (RCAHMS 1984), post-Second World War large single-furrow drainage ditches across moorland and heath, fire-plagioclimax *Calluna* vegetation dating to the management of the 1950s and 1960s, and grass fields reflecting pre-Common Agricultural Policy grants for pasture drainage and reseeding. Some of the current vegetation communities relate to the cessation of former management. For example, Bracken *Pteridium aquilinum* is now more common because, even in the recent past, it was harvested for livestock bedding (in the same way as Box *Buxus sempervirens* would have been in many parts of the Continent, e.g. Les Causses, in France). Many of these features are integral to the biology of the area (invertebrates, reptiles, plants), but they owe as much, if not more, to historic rather than to current management. However, the current management is at least allowing the retention of the benefits provided from those historic aspects, rather than destroying them.

So, the question for any particular area or region is: 'How much does the current nature value relate to the legacy from centuries of former agriculture activities and how much to current management?' It also raises the question of whether nature is there because of current management or despite it? Similarly, would the dramatic possibility of re-wilding be better than maintaining or introducing some form of low-intensity pastoral system? There is a need to look closely at what is valued from a biodiversity perspective, and how best to maintain this, or at least not change it such that the underlying importance of the land is lost.

Extensive-grazing farming systems in Europe

Extensive pastoral systems are very diverse, reflecting the climate and the topographical and cultural traditions that have shaped them. The regions in Europe where we still find these systems are usually mountainous or remote. They may be too dry for intensive agriculture (much of the Mediterranean falls into this category) or they may be too wet (such as the north-west fringes of Britain and Norway), while in other areas the land may be too cold or steep. Large areas still exist in many of the countries of central and eastern Europe where semi-subsistence agriculture has survived for political and economic reasons.

In some systems, the pastures are so large that a semi-natural grazing behaviour develops. Cattle wander in herds, utilising the pastures in a systematic way, as did their wild ancestors; for example, sheep tend to be territorial and 'heft' to the area where they were born. In such instances, many of the breeds used in traditional systems retain many of the grazing characteristics of wild herbivores. But that does not mean that they produce the same impacts as wild herbivores would, or that wild herbivores can be used as a substitute for them. Even where the livestock are managed in a very extensive way, the combination of grazing by cattle and sheep and goats produces different impacts on the vegetation from that of browsers such as deer or other large herbivores.

In many extensive systems, traditional livestock management involves a large amount of human intervention, and the grazing behaviour of the animals on the pastures is guided by shepherds. Additionally, in many places the flocks and herds are moved long distances to seasonally available pastures, a practice known as transhumance. Before the heat of summer dries up the low-ground pastures, flocks and herds travel to the mountain grasslands. The process is reversed before winter, with the animals led back to the plains. These long-distance livestock movements can also serve to disperse wildlife, by means of seeds passing through herbivores' guts, or on their wool and feet. Even insects, such as grasshoppers, may be carried on wool. Grazing by wild herbivores cannot mimic the scale of impacts on the vegetation of such herds and flocks.

Mediterranean areas experience pronounced drought in the summer, which influences the location and timing of grazing practices. In La Crau, in south France, a complex system of sheep-rearing has evolved over time, linking the distant summer alpine pastures with spring grazing on the local open pseudo-steppe habitat and autumn and winter use of the aftermath grazing on the unique (high-quality) hay fields. In the past, the transhumant journeys to and from the Alps were on foot,

Sheep grazing on high pastures in the Hohe Tauern National Park, Austria. The transhumance traditions that have allowed a rich variety of wildlife to flourish in these 'wild' areas of Europe are increasingly under threat. Bob Gibbons

but now a fleet of lorries is used. The pseudo-steppe, known as coussoul, is an integral part of this system of pastoralism and it is also very important for its vegetation and wildlife, including birds such as Little Bustard *Tetrax tetrax* and the Pin-tailed Sandgrouse *Pterocles alchata*.

In mountainous areas, the short growing season and the difficulty of the terrain limit the potential for intensive agriculture. Whether in the Carpathian mountain area of Romania or in the Gredos Mountains of central Spain, sheep, goats and cattle need to move from the lower ground to higher pastures in summer. Some of these shifts are relatively short, more local movements, while others cover hundreds of kilometres to the high-level summer shepherd camps. While the livestock are away, the lower ground is mown for hay to provide winter fodder. This process creates an unenclosed mosaic of mixed habitats, many of which are of biological importance in their own right.

Hay-making is a widespread and traditional method of management, and hay-meadow landscapes that do not receive artificial fertilisers are very rich wildlife habitats, especially for flowering plants, insects and birds.

What is happening to these systems?

The second half of the 20th century has seen a massive decline in biodiversity, primarily through the industrialisation of farming, driven by the post-war agricultural policies of European governments and latterly through the CAP agriculture and forestry policies.

The environmental policies that have more recently accompanied these have all tended to succumb to the management notion that animals and plants and the habitats which they comprise can be considered in isolation from the farming systems of which they are, or were, integral parts. Few conservation organisations go beyond the physical aspects of habitat management,

Small-scale subsistance farming in eastern Europe, as seen here in Romania, has produced a rich open semi-natural habitat. Sally Huband

neglecting the fact that the functional and social components of farming systems have changed much more radically. But even these limited environmental goals are in huge contradiction with the CAP policy-driving forces of agricultural production, farm modernisation, animal welfare, hygiene, food safety, animal transportation, global trade and so on.

As a counter-balance to this production-led model, agri-environment schemes should be the major positive driving force on agricultural land generally. In the past, it has often resulted in nothing much happening in the intensive areas (maintaining the *status quo* of the peripheral features, e.g. hedgerows, that are present despite farming), and much 'fiddling about' in the marginal agricultural areas, with dubious biological benefits.

Over and above these policy-driven forces there are strong social and cultural forces (in the absence of suitable incentives to stop them), tending to accelerate the decline in traditional extensive grazing systems and their replacement with more modern (less biologically diverse) systems. We found a good example of this in the marginal farming areas of Ireland (EFNCP 2004), where a combination of the move to part-time farming and the abandonment of the poorest land is replacing the long-established mixed farming systems. Despite the high sheep numbers associated with the eight western counties, it is here that biological diversity in Ireland is highest.

Frankly, it is hard to see where the re-wilding option would be appropriate, or could fit into the European landscapes that are currently (or were until recently) managed by the types of extensive grazing systems outlined above.

So, where now for re-wilding?

Even if agreement can be reached in principle on the appropriateness, practicability and sustainability of the *process* of 'letting areas go wild', much attention needs to be focused on current management systems and biological value and past history. So starting with, for instance, the *tabula rasa* of a polder reclaimed from the sea in The Netherlands is not the same as starting with a wood-pasture in Romania, a large tract of moorland in the Hebrides or, indeed, a mountainside in the Pyrenees.

Since the end of the last Ice Age, nature has been under the continuous influence of humans. The influence of early hunter/gatherers and the shifting cultivation that followed caused a considerable loss of the megafauna and of forest, but at the same time created a varied landscape with extensive tracts of open habitat. The concept of great postglacial ecological diversity – rather than

millennia of unbroken forest cover – is now widely accepted. Human communities modified the landscape into a wide variety of farming systems, but not without over-exploitation, as reflected in the historical record by famines and the breakdown of cultures and civilisations in Central Europe and the Mediterranean (Wright 2004). But the loss of (or the prevention of development towards) the dominant natural vegetation cover (forest) did not initially result in a decrease in species richness. For instance, from ancient times the number of plant species continuously increased in Central Europe up to about 1850 (Plachter 1996). Similarly, Tubbs (1997) suggests that the period of maximum biodiversity in southern England was around the middle of the 18th century. In the Mediterranean, it was probably earlier. So, loss of 'naturalness' was more than compensated for (in biodiversity terms) by the new open semi-natural habitats, increase in habitat diversity per area and new ecological processes, such as the dispersal of plants and animals by man and his livestock. A feature of these new landscapes is the mosaic of habitats ranging from the semi-natural to the wholly artificial.

However, this initial biodiversity gain was not sustainable. Sophisticated systems of nutrient transfer were developed, linking the management of pastures with that of forests and arable land. Many pastures and forests were impoverished by nutrient depletion. Ironically, many present-day habitats (moorland, heathland, grassland) that are now protected for their biodiversity originate from degrading uses.

Re-wilding is not an option for most of Europe, both in the sense that it would not help to maintain the features and species considered of interest or because it would not be possible to implement it in such areas.

We should like nothing more than to see large tracts of the intensively farmed areas of Europe returned to nature. Our concern is that the re-wilding debate may detract from addressing the more immediate and pressing issues faced by extensive farming systems of high biodiversity value, which already go a long way to achieving the biological objectives of creating 'naturalistic' grazing. The current prognosis for these systems is not good.

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Further information on EFNCP can be found at www.efncp.org.

Re-wilding the grazers: obstacles to the 'wild' in wildlife management

Could this be a possible scene in parts of Britain if landscape-scale re-wilding schemes are implemented? John Davis

Peter Taylor

British wildlife habitats have a multi-dimensional quality that can easily be overlooked. The most obvious dimensions might appear, to the less enquiring eye, as a mosaic of woodland, heath, dry and wet grassland, reedbed, saltmarsh and mudflats, with associated communities of plants and animals. The professional eye, however, sees a layer of activity required to maintain these habitats in some kind of optimal condition, according to a set of management objectives or targets. Then there is a further dimension that contains the processes whereby these objectives are set. It is with regard to this last dimension, related to the role of grazing animals and wildlife, that I would like to contribute some discussion.

I was recently asked to present a radical view, based upon my book *Beyond Conservation* and the work of the Wildland Network, to a special meeting of PONT (the equivalent in Wales of the Grazing Animals Project). After this there followed a day of discussions on the theme of 'How wild should Wales be?'. I was arguing for a radical system of core areas and corridors of 'wildland' that would go beyond the current network of small and increasingly beleaguered 'nature reserves' surrounded by agricultural or forestry

land. In recent times, a huge, costly and largely failing effort has been aimed at managing these essentially industrial and economic systems to make them more 'wildlife-friendly'.

Participants – drawn from a range of practical land-management professionals from government agencies, farming, forestry and the voluntary sector – had recognised a wave of interest in 're-wilding' and, in particular, the return of the larger and more charismatic of the exterminated mammals, as now practised in some of the nature reserves in The Netherlands. However, as the day progressed, I became increasingly doubtful that anything really wild was likely to emerge from the meeting. As with all paradigm shifts, it takes time for old ways of thinking to change, and, as in so many areas of human endeavour, the most resistant force in the face of new thinking is bureaucratic.

The ancient and modern guild of grazers in Britain.
Peter Taylor

The dimension of the desk seeps into all aspects of British wildlife conservation, and for the most part its aspects are hidden from ordinary view. It is at the desk that objectives and targets are set. It would be a worthy exercise on any field excursion if, whenever a species is being observed, a backdrop of a desk and a manager were projected on to the habitat behind it. It is in this bureaucratic dimension that there are forces at work at least as potent as climate or geology at shaping habitats, but far less studied and understood.

If we examine the case of grazing animals in the context of landscape-scale re-wilding projects, the following unfolds.

The need for grazers

There is a general acceptance of the need for grazing animals to maintain a diversity of habitats and species in virtually all of Britain's nature reserves, and, with a marked decline in the economics of grazing, this is proving problematic. The Grazing Animals Project and PONT have thus had plenty to do in brokering grazing agreements, and we have seen an increased use of hardy breeds of pony such as Koniks and Exmoors and of cattle such as Highland, Belted Galloway, Old Gloucester and Longhorns in wildlife reserves. Debates have emerged about 'naturalistic' grazing and the reinstigation of natural processes, an essential element of large-scale re-wilding schemes, but there is a wide spectrum of understanding regarding what these terms might mean.

A natural grazing regime could not be natural unless it operated over a sufficiently large area for effective dispersal and utilisation by grazing animals of a range of habitats, particularly during harsh weather in the uplands, or flooding in lowlands. It would not be natural if there were no predator-prey interactions affecting dispersal patterns, mortality and fitness selection, if not actual population sizes, which tend to be controlled more by available food supplies. There needs also to be a 'guild' of grazers and browsers – a range of large mammals occupying different niches. In the latter respect, the megaherbivores that co-evolved with northern temperate forest structure, such as the Straight-tusked Elephant *Elephas antiquus*, Forest Rhinoceros *Dicerorhinus kirchbergensis*, and Northern Hippopotamus *Hippopotamus amphibius*, were exterminated about 30,000BP. These animals created clearings and maintained riparian meadows which were then grazed and browsed by Woodland Bison *Bison schoetensacki*, Elk *Alces alces*, forest cattle *Bos*, Tarpan *Equus przewalski*, Wild Boar *Sus scrofa* and Eurasian Beaver *Castor fiber*, four of which species are now found only in wilder areas of eastern Europe. In its natural dynamic state, this herbivore guild would have had European Lion *Panthera leo*, sabre-tooth cat *Homotherium*, Leopard *Panthera pardus*, hyena *Hyaena*, bear *Ursus*, Wolf *Canis lupus* and Lynx *Lynx lynx* to prey on adults and young. It is seldom appreciated that previous interglacials were only marginally warmer than today and that north-adapted equivalents of modern African or Asiatic fauna roamed the Eurasian oak forests and riparian meadows.

It is clear, therefore, that the term 'natural' can be of little guidance – even if qualified as 'near' natural, or naturalistic. A line can be drawn anywhere with regard to biological era or the degree of naturalness envisaged. It is at this point that the bureaucratic mind can make decisions which may conceal all manner of reasonings related to processes within its ministry. If nothing can be entirely natural, then compromises are easier to make. Where this compromise is drawn will depend very much upon the strength of other forces represented at the desk, such as farming, forestry, tourism, recreation, access, veterinary security, public safety, accountability, land tenure, and cultural identities, in addition to any interests on the part of the wildlife lobby.

Wild grazers or hardy domestic breeds?

How much easier, then, for land managers and planners to opt for safer and perhaps more economically proven options!

As I listened to plans for a large-area scheme in the North Cambrians, headed by Montgomeryshire Wildlife Trust, and seeking to model the collaboration of voluntary bodies with government and the water industry (such as the collaboration among the National Trust, Forestry Commission and Water Company project in Ennerdale, in the Lake District), I could see the radical vision of a true core area beginning to fade into the compromise zone of Site of Special Scientific Interest (SSSI) targets for grazed heath and Tir Gofal-type Single Farm Payments forming a co-ordinated landscape-scale buffer zone, with the Forestry Commission restructuring its plantations to incorporate grazed zones and more native woodland. The grazers could range from the current hardy breeds of sheep, through Highland or Galloway or Welsh Black to the various breeds of Welsh pony. Every economic interest would be appeased in some way as unprecedented new levels of finance were accessed. Undoubtedly, Biodiversity Action Plan (BAP) targets and SSSI favourable conditions would be met. In ten years or more, there may be more plovers, Red and Black Grouse *Lagopus lagopus* and *Lyrurus tetrix*, Ring Ouzel *Turdus torquatus*, Red Kite *Milvus milvus* and Stonechat *Saxicola torquatus*, as well as fritillaries and orchids. Eco-tourism might prosper under a branded regional identity, and upland organic meat could be marketed as wildlife-friendly.

There is no doubt that such a model – as now being developed in Ennerdale – would reverse some of the decline of species in our uplands. It may help to solve the decline in farming and give more meaning to what is on many sites an entirely uneconomic forest enterprise. Water companies might also benefit from reduced costs in maintaining water quality and silting. Flood control in lowland areas might also benefit.

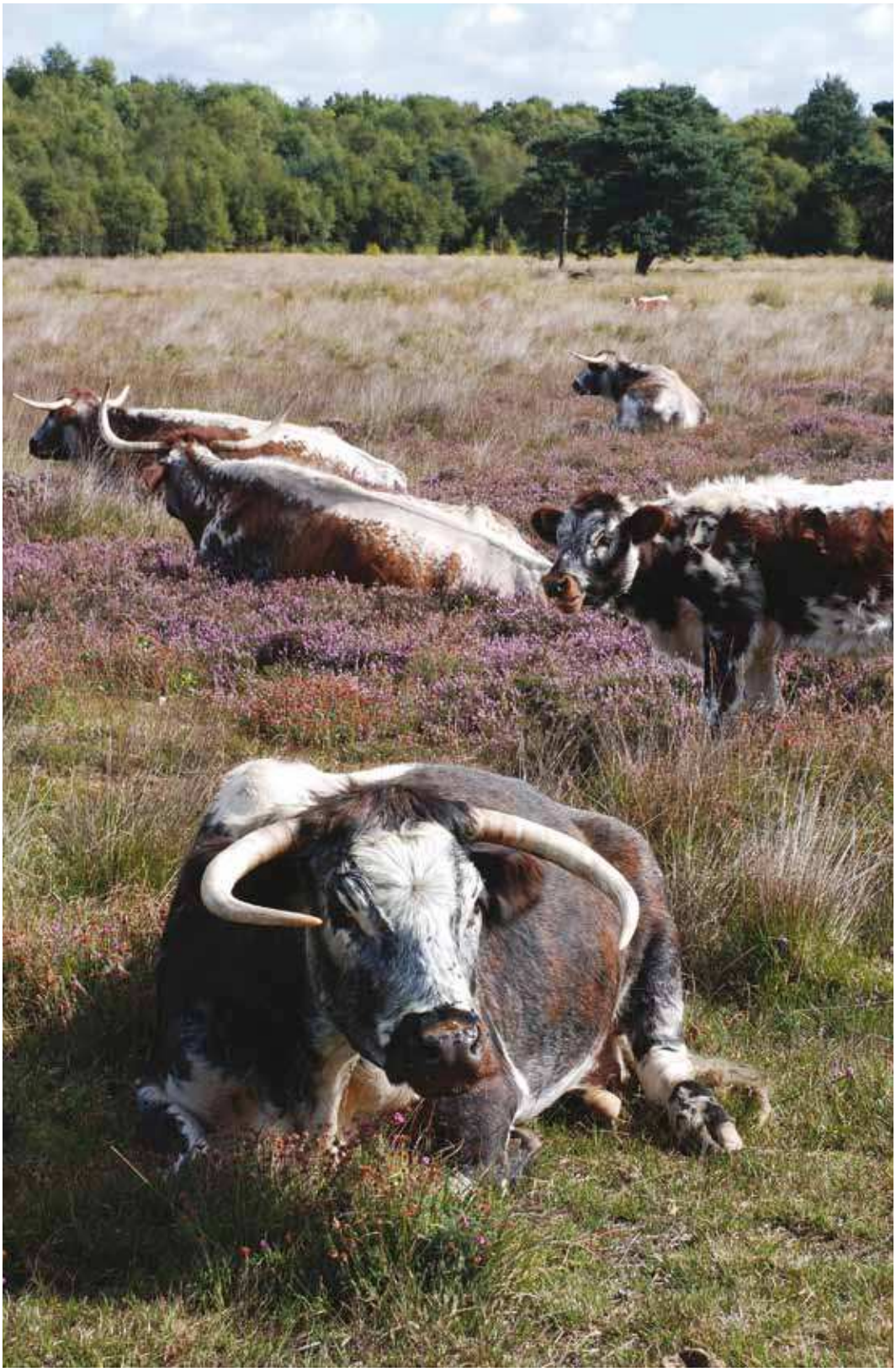
However, what about the 'wild' in the wildlife of Britain? The model above is management-oriented. It maintains a bureaucracy, and, although each member rightly sees itself as pursuing a worthy objective on behalf of nature conservation, each should reflect upon its own interests and how this affects the final managerial outcomes. If every interest has to be appeased in the final outcome, then we end up with a situation where a large and extensive public movement towards re-wilding is thwarted by narrow self-interest and an unimaginative bureaucracy.

There is no doubt that truly wild grazing animals present major problems for the bureaucracy. The list of such issues might include:

- the absence of any developed grant structure for non-economic grazing animals;
- veterinary safety (foot-and-mouth disease, for example) and domestic-water safety (cryptosporidium);
- animal welfare in non-intervention regimes during harsh winters, or in fighting and general disability with cattle, and more especially horses;
- public safety for walkers, and open access;
- the introduction of predators such as Lynx (and Wolf in the Highlands) would raise issues of compensation for livestock kills;
- new populations of Red Deer *Cervus elaphus* or reintroduction of Roe Deer *Capreolus capreolus* raises issues of damage to plantations;
- Wild Boar can be destructive of croplands;
- European Beaver interfere with drainage.

In the light of these problems and of the influence of the 'low-risk, try-to-please-all-stakeholders manual of bureaucracy', what chance then of a truly wild-zone experiment in England or Wales? There is a much better chance in Scotland

Long-horned cattle at Skipwith Common, Yorkshire. Hardy breeds of livestock such as this are already being used in more naturalistic grazing schemes.
Peter Roworth



Creating truly wild areas in Britain will need to encompass the reintroduction of top predators such as the European Lynx. Bob Gibbons

– especially now that the pioneering Trees For Life group is purchasing a 4,050ha estate contiguous with the Forest Enterprise and National Trust for Scotland land in Glen Affric, an area that has been the subject of a prize-winning programme of Caledonian Forest regeneration. This zone extends to a possible 1,500km^2 collaborative enterprise with other estates and public land – large enough for a wider herbivore guild, to include Wild Boar, European Beaver, Wild Horse and wild cattle, and perhaps Elk and European Bison, as well as Lynx, Wolf and possibly also Brown Bear *Ursus arctos*.

In England, we have several developing smaller-scale schemes that are nevertheless revolutionary in their potential. At Knepp, in Sussex, an area of 1,215ha is mooted for wild or hardy breeds to graze freely, and in the fens the National Trust has targeted 4,050ha for purchase next to its reserves at Wicken Fen, where it already grazes the almost wild-type Polish Konik pony. Ennerdale has pioneered co-operative management among forestry, agricultural and water interests over a large upland area. Such schemes could be developed in Wales if ways can be found to integrate common grazing interests on the moor, with uneconomic forestry plantations that could be restructured, and with water-industry interests and their potentially available finance. However, the chances are that the current bureaucratic paradigm will prevent anything truly wild from happening for some time yet.

It is not that the land is not available; there are suitable sites where these interests could be integrated. Nor is it an absence of finance; funds can be found within the current structures with a little bending of the rules. The obstacles are largely cultural: farmers want to continue within a small-business, semi-industrial production model, with deference to environmental objectives for which they are paid extra. The land managers of voluntary bodies and conservation agencies, together with the wildlife scientists themselves, are still locked into an old set of BAP targets and managerial practices that have already been subject to the compromises fought for in relation to these other economic interests. Many of the target species depend upon a stasis of secondary habitat that can be maintained only by intensive management. Letting things go wild could have uncertain impacts.

The one potential agent for more radical change is the growing realisation that upland farming has deluded itself about its economic prospects. Very few farmers are free agents economically. They are maintained by state subsidy, and hence subject to political forces beyond their control. Rural decline is a fact of life in the hills, despite the raft of schemes designed to keep it going. It is doubtful whether unimaginative environmental schemes will sufficiently appease a growing public unease at farming subsidies. The future for the uplands may lie in integrated large-area land-management schemes for water, forestry, carbon sequestration, and wildlife enhancement where traditional farming has a role mainly in buffer zones.

I believe that the wildlife-enhancement component now needs to take a leap of imagination which is connected more to the *meaning* of wildlife than to esoteric biodiversity targets. There is a huge groundswell of public concern for wild places that now includes a global consciousness relating to biodiversity loss, climate change and the place of nature in our lives. This represents both an opportunity and a crisis. The world is faced not just with the loss of iconic species such as the Tiger *Panthera tigris* and Polar Bear *Ursus maritimus*, but with a future of degraded ecology, including our own life-support systems. Yet it continues to follow a development model and a set of material values which have signally failed to grapple with these issues in an effective way. We in the western industrial nations have promulgated this model and, from the pioneering work of the last ten years, we know that the model is amenable to change if the values change. The Dutch Government has demonstrated this with extended reserves, re-introduced species, core areas, corridors and even wildlife bridges over motorways. Wild areas are not incompatible with industrially advanced society, even in the most populated of countries – the secret is connectivity and an inclusive mosaic of habitats.

This, I would argue, is the true value and meaning of *wild* grazers. They signify and represent this shift in paradigm. They *communicate* through their iconic status. The *wild* in wildlife means something – there is an element of risk, of potential loss, and, perhaps most importantly, a statement that we, the managers, are not in total control. In this there is a potential renewed reverence for nature and natural processes, and it is this that provides the greatest chance to 'save the planet'. No-one is talking of turning *all* farmland or forestry into wildland, not even all grouse-moors, wild heath or reedbed. Rather, that we should select a few large core areas and make room, in this crowded land, for the spirit of wildness itself. Nothing symbolises this more than a herd of wild grazers, with the chance, perhaps, of sighting a stalking Lynx or hearing the howl of a Wolf.

The return of potentially dangerous predators to a crowded island is not necessarily fanciful. Within a half-hour's drive of San Francisco there are well-visited country parks, such as Point Reyes, where Pumas *Felis concolor* raise their kits, and deer and ranch cattle maintain the coastal heath. In Britain, ecologists, farmers and foresters could show us similar breeding territories for our own feral big cats that now regularly appear on the country policeman's beat. I would argue for a more relaxed attitude to risk – indeed, that such is a moral imperative if we are to entreat Indian villagers to tolerate Tigers on their boundary, or Africans the Lion and Leopard. It is time for our local wildlife organisations to move to a wider stage; what we do here could have global resonance, if we are bold enough.

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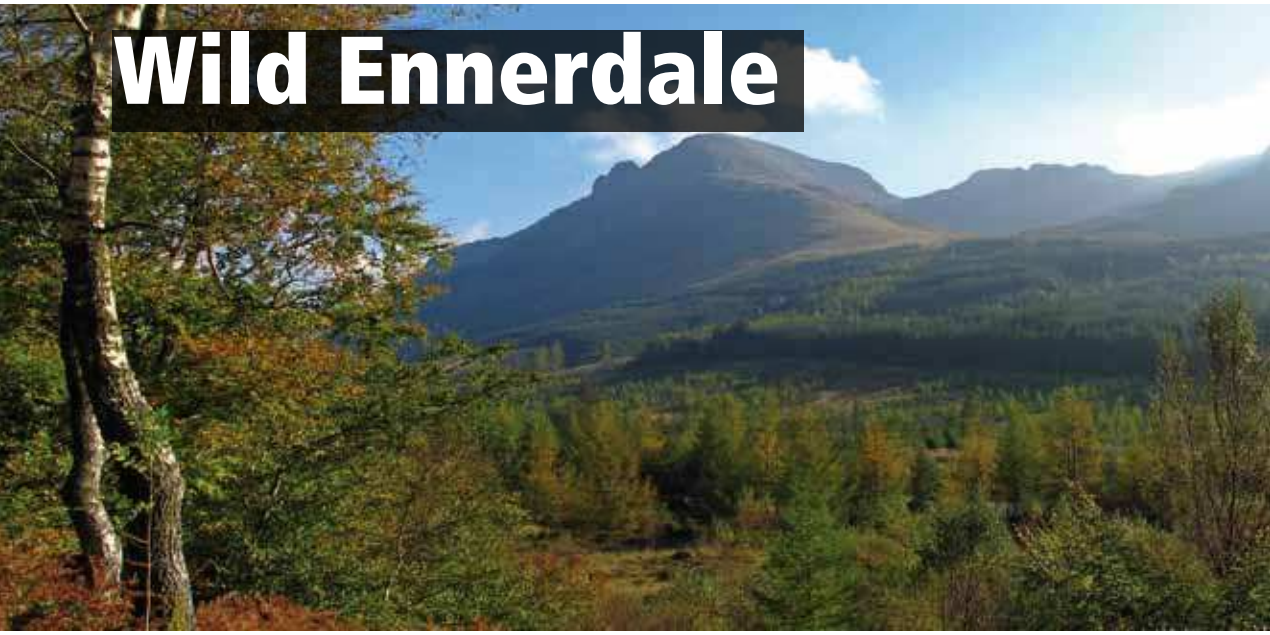
Wild Ennerdale



A view across Ennerdale. Gareth Browning

Gareth Browning and Rachel Oakley

'Wild land', 'wilderness' and 're-wilding' are becoming increasingly common terms used in Britain by land managers and in wider media circles, such as tourist literature and the national press and radio. In addition, 'naturalistic grazing' and 'natural processes' are being linked to wild land, but what do people think about these terms? Do we all agree on them and where should they be applied?

These are by no means easy questions to answer – for the simple reason that, as humans, we are a diverse species with a range of perspectives, philosophies and experiences. Inevitably, this leads people to express a whole range of perceptions and views on what a wild place is, or where such a place might exist. In the Wild Ennerdale Partnership, over a six-year period we have been engaging and involving people in developing a new vision for a valley in the Lake District, a vision to 'allow the evolution of Ennerdale as a wild valley for the benefit of people, relying more on natural processes to shape its landscape and ecology'.

As managers of Ennerdale, we believe that the wildlife that inhabits the valley regards the valley as home, not as wild. It is people who see the valley as a different place from our homes, describing a visit to it with words such as remote, beautiful, dangerous, enticing, challenging, dramatic, adventurous, spiritually refreshing, tranquil, and more. Whilst people may not describe the valley as 'wild', we believe that the words which they use can be summed up by using the single word 'wild' to convey a wide range of emotions, and experiences. We have come to call this the 'sense of wildness'. Nevertheless, we should clarify that we also believe that natural ecological processes are of parallel importance to the human experience of wildness, as it is these that shape the dramatic scenery and underlie our interaction with the landscape. Here, we concentrate on people's experiences and response to wild land.

So, what do people think about Ennerdale as a wild place? Over the course of the last six years, the valley has played host to many visiting groups, but ask two groups of visiting students what a 'wild' place means to them, and you will get a huge range of enthusiastic answers (see box). Simply gaining people's views on Ennerdale as a wild valley, and on the 'wild land' concept generally, has been an important factor in influencing our thinking.

A recurring concern when discussing the poten-

Discussing concepts of 'wildness' at Ennerdale, in the Lake District. Gareth Browning

tial for wild land in Britain is that people cannot be a part of the landscape. A wild area must somehow be 'ecologically pure' and devoid of any human contact, and as a result there is (understandably) apprehension and a misconception that labelling an area as 'wild' will result in a loss of livelihoods, abandonment of land and exclusion of people.

As land managers in Ennerdale, we therefore have an important, yet challenging, message to tell. We believe that people can be part of a wild place, and furthermore that they should be – experiencing a place as 'wild' is a human emotion, after all. We believe that it is the extent to which humans interact with the landscape that is important. We are striving to reduce the scale and intensity of human intervention to a point where natural processes are given much greater freedom to operate and shape the landscape than they have been in the past.

One of the main concerns expressed by people, especially professionals in the field of land management, is that our plans for a wilder Ennerdale will see the valley becoming increasingly out of control and looking untidy or messy. They are concerned with the uncertainty of giving over the reins of land management to natural processes. This is understandable, as much of our recent history of land management has been about man

Responses to the question: What does a wild place mean to you?

'I think the only true wild places in Britain are really remote places of Scotland and possibly Wales, because there are no roads and the land is untouched by people.'
'Nature exists in Britain, but not wild places – the country is too densely populated. Wild places exist abroad, but they are diminishing.'
'I don't believe that there are any truly wild places left in Britain – although there is potential for them to be re-created.'
'The term "wild" is ambiguous to me – it conveys a sense of untouched nature, that which has not suffered at the hands of man and development, which much of Britain has. No ecosystem is fully functioning without management; no top predators means a vital link in the food chain is missing. Truly wild places I have read about are those ancient forests in Central Europe – Poland, Germany, etc. – where the system is self-regulating and diverse.'
'How wonderful would it be to exist without control and barriers – a cuckoo, for example – to not be concerned about what is "right" and "wrong". Perhaps these sensations, stimulated here in Ennerdale, are what wilderness is truly about.'
'I do consider this place (Ennerdale) wild, especially considering its scale, relative to other supposedly "wild" places I have visited. I find it unfortunate that to find a place as tranquil and natural as this requires a 200-mile journey from home.'
'I think wild places exist everywhere; you just have to know where to look.'

Galloway cattle crossing the river at Ennerdale. Gareth Browning

dominating natural processes. As a society, we like to be in control, we like to garden our countryside, to keep it tidy: no place, then, for ugly torn tree trunks or for a river majestically crashing its way through a farmer's field and leaving trees dumped on dry land after a storm.

Many of the people with whom we discussed our ideas thought that we would be seeking an end to farming in the valley. However, we believe that wild land does not have to mean the end of farming. There may be changes to 'traditional' farming practices, but that is happening anyway, as a result of changing subsidy and regulation. Initiatives in Ennerdale are starting to demonstrate that a greater integration between farmed land and forested land is possible, opening up a whole new range of opportunities for farmers previously restricted by an array of legislation, tradition and misunderstanding. Two small herds of Galloway cattle are now successfully grazing and trampling their way around 300ha of the valley, land owned by the Forestry Commission, comprising heath, mire, woodland, recent clear-fell and conifer forest.

When we proposed the introduction of naturalistic grazing, we received mixed reactions from many in the farming community. Some were keen to try, and we were pointed to other examples already operating, whilst other people said that we were doomed to failure. Our cows have seen all those concerns away as they have presented their newborn calves to us each April, having given birth in a Bracken-bed, unaided, and without any sign of distress. Naturally, a third herd is to be introduced in 2009. A couple of people have complained at the dung left on the right of way, but many people have said how great the cattle look in the woodland, and are excited by something they see as new.

Support for and interest in wild land in Britain are gaining momentum. To facilitate this trend, it is important to refrain from being too prescriptive and target-driven. What is beneficial is to offer clarity on those attributes which make a place both look and feel wild, and how these can be enhanced through more sensitive management, such as naturalistic grazing, in the long term. In addition, it is important to recognise that people can make judgements about wild land, natural processes and naturalistic grazing only on the basis of their past experiences. Often these experiences leave people – visitors, professionals and ourselves – lacking in relevant knowledge. We have found that by treading carefully and slowly, giving as many people as possible the time to catch up with our thinking and the opportunity to see Ennerdale through new eyes, we have won over new friends and partners.

Gareth Browning is a forester with the Forestry Commission and is responsible for 5,600ha of forest, mountains, rivers and farmland in Cumbria. He has been a passionate partner in Wild Ennerdale since its formation. Rachel Oakley is the Wild Ennerdale Project Officer, working for the Forestry Commission, National Trust and United Utilities, and has been involved in the process since 2005.

Policy in or for the wilderness?

Keith J Kirby

Marsh Harriers circling into a roost in the Norfolk Broads.
Bob Gibbons

For much of our history, the wilderness has been the place whence prophets came and whither outlaws were banished. I am not one of the former and have no desire to be among the latter. What follows is not the official position of Natural England or any other government body but, rather, a personal reflection on policies in relation to the current debate on 'wild lands'.

Medieval references to wilderness and waste in England do not refer to totally natural areas. Even in the remotest areas the land had an owner and was part of the local economy, providing rough grazing, fuel, and Bracken for animal bedding or other goods (Rackham 2003). Landscape historians in Scotland similarly stress that what may be perceived as 'wild' nevertheless has a long cultural history (Smout 2003).

The general trend for most of the last 1,000 years has been for land management to become more intensive, because this was economically and politically desirable. Policies and regulations have generally been framed to encourage such intensification or, more recently, to curb what came to be perceived as undesirable effects resulting from such policies, e.g. large-scale hedge removal and blanket conifer afforestation. Regulations tend to cope less well with situations where management is substantially reduced or withdrawn.

Policies tend also to be based around particular sectors – farming, forestry, water supply, recreation,

nature conservation – which again creates problems where a new approach to land use, such as naturalistic grazing, emerges (see illustration opposite) that has implications that cut across sectors.

Unlike the Dutch, we are not reclaiming any more land. Indeed, in places, we are giving it up to the sea. So areas where we might wish to develop a wilder approach to land management with naturalistic grazing are already subject to existing land and water policies and regulations (Hodder *et al.* 2005). These areas have a long and complicated history which has usually involved varying intensities of management; what we see today reflects that history. If we want to explore wild-land creation, we need to be aware of these issues.

Policy issues

Agricultural policy

Much of Britain is currently farmed to some degree. Over the last decade, until the last 18 months, the trend has been towards more extensification and lower food prices, which has created a climate where opportunities for 're-wilding' and naturalistic grazing have been more acceptable. While there is no requirement that particular levels of production should be achieved, if the landowners are in receipt of Single Farm Payments then there are accompanying requirements, enforced through cross-compliance. These may include limiting the spread of unwanted vegetation such as scrub, the tagging of stock, etc. Even if no grants are involved, landowners may be obliged to manage land to prevent the spread of weeds such as Common Ragwort *Senecio jacobaea*.

Forestry policy

Like agriculture, production forestry in Britain has largely been in the doldrums since about 1996. Therefore, 're-wilded areas' and developing near-natural forests with higher landscape or recreation potential have potentially provided part of an alternative justification for both state and private forest ownership (Worrell *et al.* 2002). However, if the areas of woodland increased or decreased rapidly under naturalistic grazing regimes, would this be classed as afforestation or deforestation and therefore require a formal Environmental Impact Assessment? Woodland owners who allow overgrazing of existing woods to the point of widespread bark-stripping of the trees are criticised and may be subject to loss of grants. Why, legally, should this be different from damage to trees by stock in a naturalistic grazing system, even if such bark-stripping is part of the process whereby areas of forest are opened out?

Animal welfare and disease legislation

Cattle and horses, even if feral, are covered by animal-welfare legislation. In the event of a major disease outbreak, such as foot-and-mouth disease, they could be subject to the same culling rules.

Health and safety

In England and Wales, 'downland, heath and moor' are covered by the 2000 CRoW Act's 'right to roam' legislation. Furthermore, much lowland farmland is criss-crossed by public footpaths and bridleways. Where free-ranging stock may be present on such land, there are consequent responsibilities on landowners connected with the safety of people and riders.

Licensing for introduced animals

Various animals, such as European Beaver *Castor fiber* and Elk *Alces alces*, that might be desired as part of new wildernesses would need to be introduced, and this will require licences if they are free-ranging.

Concerns regarding water quality

There may be issues around potential contamination of water supplies from free-ranging herbivores. In addition, there is the potential on some sites for new patterns of erosion that might affect water quality.

Changes in habitat and species abundance

Wild lands under naturalistic grazing are likely to change in unpredictable ways. Woodland may open out, while open areas may scrub up. There is no certainty about what balance of habitats will occur over the next 50 years, and hence no certainty that particular species will be maintained. The patterns that develop may be richer or poorer, but they will certainly be different, which poses problems if conservation targets are set in a prescriptive way, particularly on designated sites (Kirby *et al.* 2004).

Landscape and historic-environment legislation

The European Landscape Convention has recently

A bold new wilderness, as at Oostvaardersplassen, or a series of headaches for the regulators? Keith Kirby

been adopted by the UK Government. Its definition of landscape is human-centred. Historic environments, i.e as developed and maintained under management, are also often valued. There can be no guarantee that these values will be maintained under naturalistic grazing. Historic monuments may be damaged by free-ranging Wild Boar *Sus scrofa*, while scrubbing-up of monuments is also generally undesirable.

The above review list is not exhaustive, nor is it meant to discourage an interest in wild lands. However, these are genuine issues that must be recognised and properly addressed. Various benefits are claimed for wild land and for naturalistic grazing, but many of these could also be met by some form of low-intensity managed agricultural or forest system. These might comply more easily with current legislation and regulation.

It is argued that only truly wild land can deliver the full spiritual and psychological appreciation of wilderness and that 'lightly managed' land, with grazing animals that in the final analysis are not wild, do not deliver the same thing. However, are enough people concerned sufficiently about this distinction to justify the extra efforts needed to go completely wild? There are eloquent arguments for these values on the VINE (www.vineproject.org.uk) and Wildland Network (www.wildlandnetwork.org.uk) websites, but they are still not necessarily widely shared, even among members of conservation organisations.

How might policy develop?

In the last 18 months, there has been a shift in many of the underlying drivers regarding agricultural land use. Food prices and agricultural land values have increased greatly; biofuel crops have been extensively promoted (at least for a while); the set-aside requirement has been reduced to zero; some climate-change scenarios see northern Europe (including Britain) as having an increasing role to play in future food production; and 'food security' is on the political table again. In an era when many natural supporters of conservation initiatives are also concerned about such issues as 'food miles', is it right that in Britain we should revert potentially productive land to wilderness and then import food from countries where true wilderness may be under threat?

As with agriculture, there have been significant changes in fortune regarding forestry in recent months. The timber price is starting to rise; some

key producers are cutting back on exports to Britain either because of production difficulties, or because they wish to redirect to other markets (such as China) or to process more of the timber themselves (Lawson & Hemery 2008). Managed forests and their products can contribute significantly to carbon sequestration and climate-change policies. The production element of forestry policy and regulation is becoming more visible: we may yet see the return of the 'strategic timber reserve' argument.

It is probably not coincidental that the 're-wilding' idea blossomed at a time when returns from agricultural and forest production tended to be low. The policy environment may now be less receptive to the suggestion that large areas might be taken out of production for naturalistic grazing. However, National Parks legislation and proposals for the Nature Conservancy had their origins in the Second World War, when the need for food production was certainly greater than it is now. We are also about to enter the start of discussions on the next round of Common Agricultural Policy reform which could be an opportunity as well as a potential threat.

Should there be national policies on wild land for the various countries? The nearest that I am aware of is that produced by Scottish Natural Heritage. However, this does not resolve or override the limitations that follow from other policies and regulations; it emphasises the importance of people's perceptions of what is wild and accepts that much of what is considered wild land has been and will continue to be managed to varying degrees.

Should we try to identify a few large areas for 'wild land development' with the idea that special derogation from the full range of other legislation would be sought to allow for naturalistic grazing just of these areas? There would inevitably be much argument about how far derogations could go and about the boundaries of the areas concerned. There is also a risk that this would be seen as an elitist approach, the outcome of which only a relatively small number of people would have the opportunity to appreciate.

A third model views wild land and naturalistic grazing as more a 'direction of travel' that is worthwhile in its own right, even when the distance travelled is often quite small; perhaps no site will go so far as has Oostvaardersplassen. This is recognised in the Scottish Natural Heritage policy, which refers to elements of wildness, even in cities. Under this model, there would not necessarily be overall derogations from general land-use regulations; rather, on individual sites there would be negotiation and consensus reached about what might or might not be possible. For example, certain aspects of welfare legislation would probably be inviolate, but equally some aspects of health-and-safety concerns might be soluble.

This consensus model would need respect from all sides if it is to work. There would have to be agreed research and monitoring along the way. Those who are unhappy with the concept could be reassured that agreement on each inch does not mean that a mile is taken; those in favour could at least see progress and the laying of foundations on which it might be possible to build in future.

There would still be challenges: for conservationists, who may have to give up some of the target-focused approach; for regulators, who would have to deal with 'messy' grazing regimes that do not fit schemes and regulations; and for land managers, who find that animals may not do what is expected of them. We shall all also have to persuade the public that they wish to support such moves.

Despite all the problems, I would prefer to see trials of 'wilder', albeit controlled, grazing schemes started, rather than spend time in debating whether we are re-wilding, wilding, doing limited intervention or just undertaking extensive farming.

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Conclusions

It may not be possible to reach consensus over Vera's hypothesis for how the pre-Neolithic landscape functioned; some elements, such as whether the herbivore population was large enough to have the impact he proposes, are simply unknowable. However, the evidence currently seems to point more towards a more closed landscape and lesser role for grazing disturbance than he suggests. While this is a debate of considerable academic interest, it is perhaps less critical for modern conservation than the question of what sorts of landscape naturalistic grazing might produce in the future.

In Britain, most land is likely to remain in some form of production, whether for farming or for timber; wildlife areas are mostly small and often there is little scope for their expansion. There is, however, a general recognition that conservation needs to be practised over larger areas. Conservation has therefore to fit in with other land-uses and conservationists need to define their priorities for these areas, and setting clear targets in terms of habitats and species are frequently an effective and efficient way forward.

Low-intensity agricultural systems often provide the best opportunities for landscape-level promotion of wildlife. Managed grazing will often play a key role in maintaining and enhancing both reserves and their links to their surroundings.

However, we should not be confined to the managed conservation approach: trialling naturalistic grazing and re-wilded areas allows us to better appreciate what we may have gained and lost through farming. We need more evidence to assess the effects of these approaches on vulnerable populations of plants and animals. It may also give us insights into how landscapes functioned in the past, although we can never recreate those past conditions.

We do need to be realistic and clear as to what we are seeking from wild landscapes – is it specific species, habitats, or natural processes; is it a feeling of wilderness, or spiritual renewal; is it a new form of recreational experience? They may not all be compatible; they may not all have the same level of support both within the conservation community and the wider public.

The extent of re-wilded areas must be through negotiation between the interested parties and stakeholders, both public and private. Individual landowners in Britain do not have absolute rights over what they can do with their property, but equally there are limits on the degree to which government agencies and others can impose their ideas on a landowner. It should, however, be possible to discuss more 'extreme' positions (whether with respect to public safety, animal welfare, or land allocation) as long as it is accepted that if these were to lead to changes in legislation this would only be after open debate and due process.

Re-wilding and naturalistic grazing should perhaps be seen as steps along a journey, where different people and different places may move at different rates and reach different points along the way.

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