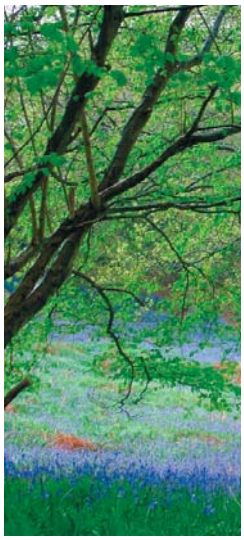
Eco-camping in the High Weald AONB:

A review of the potential environmental impacts and recommendations for future development





A report for the High Weald Joint Advisory Committee

Produced by Charles Winchester on behalf of the High Weald AONB

October 2012

The High Weald AONB Joint Advisory Committee provides guidance to local authorities and other bodies on implementing the statutory AONB Management Plan and on how local and government policy objectives can be accommodated without damaging the outstanding character of this nationally important landscape.

The High Weald Joint Advisory Committee's Research Programme

Furthering understanding of one of England's Finest Landscapes

The High Weald Joint Advisory Committee's management aims and priorities for the AONB are firmly based on an understanding of the fundamental and defining character of the whole area – that is, those components of natural beauty that have made the High Weald a recognizably distinct and homogenous area for at least the last 700 years and that will continue to define it in the future. It develops its understanding through undertaking work itself, through its specialist team, the AONB Unit, or by commissioning independent reports from others.

The primary purpose of its research programme is to better understand the components of natural beauty. The key components are:

- Geology, landform, water systems and climate: deeply incised, ridged and faulted landform of clays and sandstone. The ridges tend east-west and from them spring numerous gill streams that form the headwaters of rivers. Wide river valleys dominate the eastern part of the AONB. The landform and water systems are subject to and influence, a local variant f the British sub-oceanic climate.
- Settlement: dispersed historic settlements of farmsteads, hamlets and late medieval villages founded on trade and non-agricultural rural industries.
- Routeways: ancient routeways (now roads and Rights of Way) in the form of ridge-top roads and a dense system of radiating droveways. The droveways are often narrow, deeply sunken and edged with trees, hedges, wildflower-rich verges and boundary banks.
- Woodland: a great extent of ancient woods, gills and shaws in small holdings, the value of which is inextricably linked to long-term management.
- Field and heath: small, irregularly shaped and productive fields, often bounded by (and forming a mosaic with) hedgerows and small woodlands and typically used for livestock grazing. Small holdings and a non-dominant agriculture. Distinctive zones of heaths and inner river valleys.

By researching the key components – their history, development, distribution, special qualities, deterioration, damage and loss – we can develop an evidence base for the AONB Management Plan and other AONB policy and guidance.

The JAC's secondary purpose is to better understand how the High Weald landscape can contribute to society – food, energy, water provision, flood protection, recreation, biodiversity and fisheries – without damage to its natural beauty.

Further Information

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HIGH WEALD JOINT ADVISORY COMMITTEE

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1. Introduction

1.1 Definition and Scope of Eco-camping

Camping is usually defined as an outdoor recreational activity in which nature is enjoyed whilst spending one or more nights outside in a tent, caravan, cabin or other primitive structure. The use of the prefix "eco" in the term eco-camping, implies that, in this particular form of camping, greater care is taken to consider and mitigate any detrimental environmental impacts that may occur. Moreover, although camping can occur at a range of scales, eco-camping generally takes place at smaller sites, in less accessible, more rural locations. Whilst there is no national accreditation scheme for eco-campsites, some may subscribe to externally moderated management systems. "Glamping" – i.e. glamorous camping – is a recent term used to describe more luxurious camping facilities.

This report is not concerned with occasional bivouacking overnight in woods, but rather changes of use from land managed primarily for agriculture or forestry, to leisure use – in this case for camping. However, the issues and impacts associated with eco-camping may be equally applicable to other leisure uses that involve trampling or disturbance.

1.2 Background

Eco-camping and "glamping" are becoming increasingly popular leisure activities within the High Weald AONB. As planning applications for eco-camping developments become more frequent, questions are being raised regarding the extent to which the environmental impacts of this relatively new form of recreation are compatible with the objectives of the AONB Management Plan (High Weald AONB Joint Advisory Committee, 2009).

1.3 Purpose of this Report

This report was commissioned by the High Weald AONB Unit to help address this uncertainty. In order to achieve this, a summary of research addressing the various environmental impacts likely to be associated with eco-camping was undertaken. Due to the fact that eco-camping is a relatively new leisure activity, there is, to the author's knowledge, currently no research that specifically addresses its effects on the environment (a conclusion supported by personal communication with eminent recreation ecologist, David Cole (2012)). Consequently, this report makes use of a range of studies that investigate the environmental impacts associated with various camping and recreational activities, both from within the United Kingdom and from abroad. Relevant information and ecological principles are drawn out and used to shed light on the specific case of eco-camping in the High Weald AONB.

Following this review, recommendations are put forward regarding future eco-camping development. These recommendations are designed to ensure that any future development is both environmentally sustainable and, crucially, in accordance with the objectives stated in the High Weald AONB Management Plan (High Weald AONB Joint Advisory Committee, 2009).

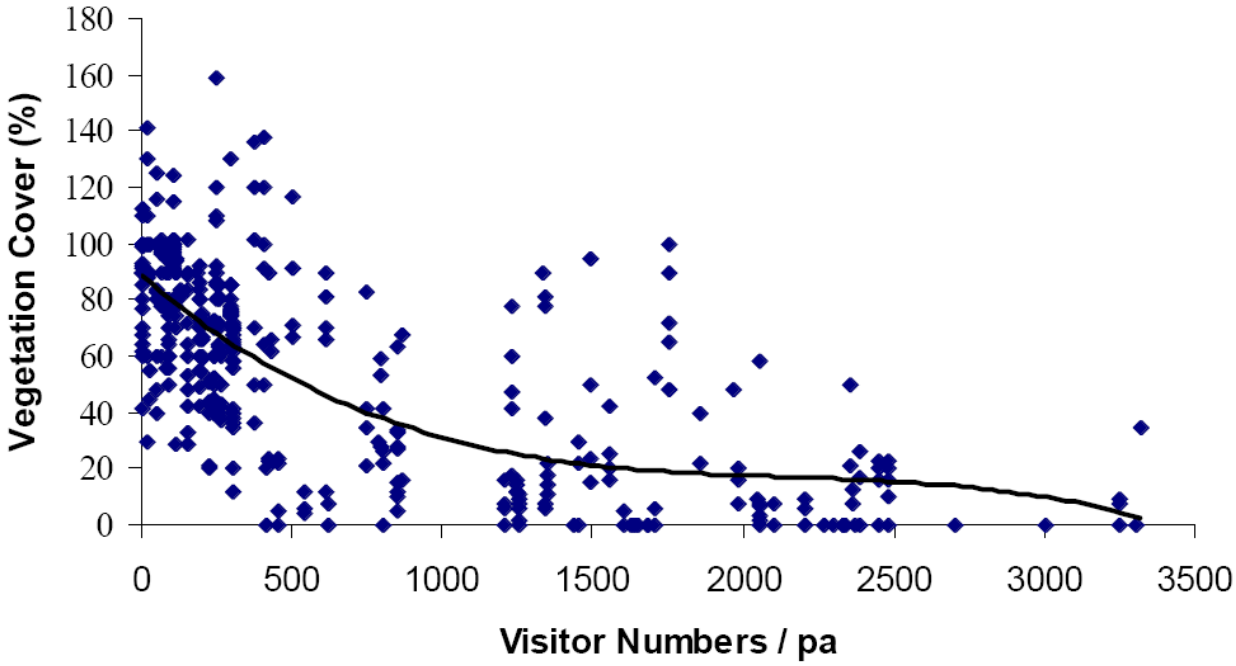
2. Potential Environmental Impacts

There are numerous studies that investigate the environmental impacts of recreational activities similar to eco-camping, with recreation ecologists paying particular attention to the effects of camping and trampling on soils and vegetation (Cole, 2004). Although this research does not examine the effects of eco-camping specifically and spans a wide variety of habitat types from around the world (including the UK), it nevertheless provides valuable insight into the various environmental impacts likely to be associated with eco-camping and highlights some important ecological principles applicable to the High Weald AONB.

2.1 Flora

- Activities associated with recreation – particularly trampling – cause a variety of adverse impacts, including decreases in vegetation cover, height and biomass, damage to trees and tree roots, changes in the competitive balance between species, altered community composition and reductions in species diversity (Littlemore and Barker, 2001; Cole, 2004; Littlemore and Barlow, 2005; Littlemore and Rotherham, 2008).
- The impact of eco-camping on flora – primarily ground flora – will largely be a function of *resistance* and *resilience* (Cole, 1995a; Littlemore and Barker, 2001). **Resistance** refers to the ability of an ecosystem to withstand impacts from use, whilst **resilience** describes the capacity of an ecosystem to recover from those impacts (Townsend et al., 2004)
- The relationship between the amount of use and degree of impact is curvilinear, meaning that damage to vegetation occurs most rapidly when levels of use are low, with subsequent damage occurring more slowly as levels of use increase (for a graphical depiction of this curvilinear relationship, see Figure 1 p. 2) (Merriam and Smith, 1974; Cole, 1985; Taylor, 1997; Littlemore and Barker, 2001; Cole, 2004; Cole and Monz, 2003; Cole and Monz, 2004; Roovers et al., 2004; Littlemore and Barlow, 2005; Littlemore, 2006; Littlemore and Rotherham, 2008).

Figure 1: An example of the curvilinear relationship between level of use (measured in terms of annual visitor numbers) and impact on the percentage ground vegetation cover in semi-natural ancient woodlands in Warwickshire, UK.



Source: Littlemore (2006, p.32).

- This curvilinear relationship holds true across a huge variety of ecosystems around the world, including lowland heathland, grassland and British temperate woodlands (see, for example, Cole (1995b), Littlemore and Barker (2001), Roovers et al. (2004) and Littlemore and Rotherham, 2008).
- **Critically, this relationship means that eco-camping may cause significant ecological damage even when practiced at very low levels** (e.g. only one pitch with four or five people).

- In British temperate woodland, the capacity for vegetation to withstand recreational use is largely a function of resilience, rather than resistance (i.e. their ability to recover from, rather than to resist the effects of use) (Littlemore and Barker, 2001; Littlemore and Rotherham, 2008).
- In contrast, the extent to which heathland and grassland communities are able to withstand recreational use is largely a function of resistance (Cole, 1995a; Roovers et al., 2004).
- Moreover, whilst impact usually occurs rapidly, recovery often occurs much more slowly (Harrison, 1981; Hartley, 2000; Johnson and Clark, 2000; Littlemore and Barker, 2001; Cole, 2004; Roovers et al., 2004; Littlemore and Barlow, 2005).
- In ancient woodland, where many plant species are slow to re-colonise disturbed areas (Thompson et al., 2003), recovery is likely to be particularly slow and may take decades (Johnson and Clark, 2000; Littlemore and Barker, 2001; Cole, 2004; Littlemore and Rotherham, 2008). Indeed, much-loved British woodland plants like wood anemone (*Anemone nemorosa*) and bluebell (*Hyacinthoides non-scripta*) – both of which are ancient woodland indicator species – are highlighted in the literature as vulnerable to recreational activity (Littlemore, 2001; Littlemore and Barker, 2001), and once damaged are likely to be slow to recover and re-colonise (Thompson et al., 2003).
- Lowland heath dominated by *Calluna vulgaris* (common heather) – the same species that is dominant on at Ashdown Forest (Joint Nature Conservation Committee, 2012a) – has also been highlighted as a habitat that exhibits a very limited capacity for recovery. Indeed, several studies report significant recreation-induced damage persisting for several years, even after the complete cessation of impact (Harrison, 1981; Roovers et al., 2004).
- In contrast, grasslands have demonstrated a superior capacity to recover rapidly from disturbance – sometimes in less than one year (Harrison, 1981; Cole and Monz, 2003).
- However, resistance to recreational impacts is significantly less in unimproved meadows. This due to the fact that unlike the low-growing, rosette, tussocky and matted vegetation that dominates improved grassland, unimproved grassland has a vegetational structure that is taller, more erect and more brittle – and thus more vulnerable to trampling – due to a greater proportion of forbs (i.e. flowering plants other than grasses) (Cole, 1995a; Littlemore, 2001; Littlemore, 2006).
- Thus, eco-camping has the potential to cause significant and long-term damage to woodland, heathland and, to a lesser extent, unimproved grassland flora. Such damage will likely require the complete cessation of activity to repair (Littlemore and Rotherham, 2008).
- Even after areas denuded by recreational impacts recover, certain species may gain a competitive advantage during the re-colonisation, thus potentially transforming the species composition of the resultant plant assemblage (Roovers et al., 2004).
- In addition to impacts on ground flora, veteran and other large trees may potentially be lost or damaged as a result of eco-camping, due, for example, to their removal and/or pruning for health and safety and tidiness reasons (Johnson and Clark, 2000; Corney et al., 2008). Not only would this result in a reduction of valuable dead wood and other habitat, but also the loss of part of the region's natural and cultural heritage (Natural England, 2012).
- Generally, eco-camping will likely cause the greatest environmental impact in places where the ground flora is composed of tall, herbaceous, woody vegetation and erect forbs which exploit shady conditions of high environmental stress and competition (e.g. temperate deciduous woodland) (Cole, 1995a; Littlemore, 2001; Littlemore and Barker, 2001; Littlemore, 2006).
- Conversely, environmental impacts will be less in places with a ground flora composed of short, matted, rosette and tussocky vegetation growing in open or partially-shaded areas of high environmental disturbance (e.g. grassland) (Cole, 1995a; Littlemore, 2001; Littlemore, 2006).
- The observation that open, grassy habitats are more resistant and resilient than shady woodland habitats, is confirmed by a variety of studies both from the within Britain and from around the world (see, for example, Littlemore (2006) and Cole and Monz (2003)).
- However, as stated earlier, due to differences in plant morphology, unimproved meadows rich in forbs, will be much more vulnerable to the impacts associated with eco-camping than will improved grasslands dominated by short, matted, tussocky and rosette graminoids (e.g. the ryegrasses of the *Poacea* family that dominate the improved grasslands of the High Weald AONB (High Weald AONB Unit, 2012)) (Cole, 1995a; Littlemore, 2001; Littlemore, 2006).

2.2 Fauna

- Human presence at eco-campsites – as well as any associated noise and light pollution – may adversely affect bird abundance, behaviour and reproductive success (Littlemore and Rotherham, 2008). Indeed, Corney et al. (2008) report the disturbance of birds occurring at a considerable distance, with woodcock taking flight when people pass up to 50m away.
- The presence of dogs will likely result in further negative impacts on bird species (Miller et al., 2001; Littlemore and Barlow, 2005; Corney et al., 2008). For example, Banks and Bryant (2007) report 35% and 41% reductions in bird diversity and abundance respectively in woodland on the urban fringe of Sydney, Australia, and state that disturbance induced by dogs is more than double that caused by humans walking alone.
- Ground-nesting birds are particularly vulnerable to disturbance, both from people and dogs (Banks and Bryant, 2007; Corney et al., 2008).
- Eco-camping may also negatively affect mammals. For example, disturbance to badgers can result in later emergence times and eventual set abandonment (Littlemore and Barlow, 2005), whilst reduced vegetation cover and soil compaction can lead to fewer invertebrates for small mammals to feed on. (Anderson and Radford, 1992; Littlemore and Rotherham, 2008).
- Indeed, disturbed and compacted soil can significantly reduce the population of soil and litter dwelling invertebrates (Anderson and Radford, 1992). Littlemore and Barlow (2005) report that in British woodlands, numbers can fall by as much as 89% in path centres and by 57% at path margins compared to undisturbed soil profiles.
- Saproxylic species may also suffer from the removal of dead and decaying wood and the trimming or removal of large, veteran trees that are considered unsafe for visitors (Hambler, 1990; Watkins, 1990; Warren and Key, 1991).
- Other invertebrates – such as butterflies and beetles – may also be adversely affected if trampling and other uses cause a reduction in vegetation structure and cover (Littlemore and Barlow, 2005).

2.3 Soils and Hydrology

- Eco-camping will likely lead to soil compaction, a reduction in the depth of the organic soil layer, the removal of leaf litter (and thus a reduced future supply of organic matter) and an increase in surface run-off and erosion (Johnson and Clark, 2000; Cole, 2004; Corney et al., 2008; Littlemore and Rotherham, 2008). Although such impacts will be most severe in the immediate vicinity of the eco-campsite, they will also likely be present to a certain extent wherever subsidiary use occurs.
- The aforementioned impacts will have significant knock-on effects on flora and fauna, including, for example, the inhibition of seed germination and plant growth, the exposure of and damage to tree roots, and even physically induced changes to soil chemistry and biota (Littlemore and Barker, 2001; Corney et al., 2008).
- The relationship between the amount of use and the degree of impact produces the same curvilinear response observed in vegetation change (Littlemore and Barker, 2001; Cole 2004). Thus, eco-camping may have significant adverse impacts on soil even where use is very light.
- Reduced soil porosity and increased surface runoff may result in changes in the local hydrological regime, such as waterlogging, reduced rates of groundwater recharge and locally significant increases in erosion (Johnson and Clark, 2000; Littlemore and Barker, 2001; Cole, 2004).
- Finally, there is a danger that eco-camping may cause local water pollution (e.g. from leakage from poorly maintained/inadequate sewage facilities).

2.4 Additional Potential Impacts

- Eco-camping and associated activities may damage historical/archaeological features, such as saw pits, wood banks and pond bays. This danger is particularly acute in ancient woodlands, as they harbour a significant amount of known and as yet undocumented archaeology (Bannister, 2007).
- The quantity of dead and decaying wood may be reduced, resulting in a decline in the abundance and/or diversity of saproxylic species (Hambler, 1990; Watkins, 1990; Warren and Key, 1991; Hall and Farrell, 2001). Firewood collection is known to be a particularly important contributor to this

problem (Johnson and Clark, 2000; Hall and Farrell, 2001), and if eco-camping businesses fail to prevent this activity (e.g. by supplying sustainably-sourced firewood), significant damage may occur.

- If not properly disposed of, the waste/grey water produced by eco-camps may have a variety of detrimental effects on the environment. For example, careless on-site disposal of grey water (e.g. from dishwashing and hand-washing) may result in the introduction of chemicals from cleaning agents, as well as potentially harmful bacteria, into local soil profiles (Noah, 2002). Such pollution may harm vegetation and pollute nearby watercourses.
- Air pollution produced by vehicles, camping stoves and barbeques may cause ecological damage, with lichens in particular being extremely sensitive to emissions from kerosene-burning appliances (Johnson and Clark, 2000).
- Corney et al. (2008) point out that the effects of vehicle emission can be particularly insidious. For example, nitrogen oxides – primarily produced by vehicle emissions – have the potential to alter soil chemistry and in turn the competitive balance between plant species (Cole, 2004; Littlemore, 2006). Indeed, a study of woodland adjacent to the M6 motorway has shown that engine particulates may be deposited on trees as far as 200m away, and can cause a substantial reduction in the health of trees such as sessile oak (*Quercus petraea*) and beech (*Fagus sylvatica*) (Freer-Smith et al., 1997).
- Moreover, if new trackways are installed to service an eco-campsite, dust kicked-up by vehicles and people may become a source of pollution. This can cause eutrophication, changes in soil pH and damage to plants and tree trunks (Johnson and Clark, 2000).
- Pollution may also be caused by discarded rubbish, food waste and the faeces and urine of pets, particularly dogs (Littlemore and Barlow, 2005; Corney et al., 2008). Impacts include localised eutrophication due to pet urine (Johnson and Clark, 2000), the injury/death of wildlife from rubbish ingestion and shifts in species composition caused by increased food availability (e.g. woodland specialists birds being displaced by larger-bodied more aggressive species (Corney et al. (2008)).
- If not properly controlled, eco-camp fires may have a range of detrimental impacts – e.g. the loss of ground vegetation and the increased risk of uncontrolled fires, particularly in heathland (Anderson and Radford, 1992; Johnson and Clark, 2000; Littlemore and Barlow, 2005).

2.5 Scale

- When considering scale, it is important to distinguish between intensity (i.e. the magnitude of impact in a given area) and spatial extent (i.e. the area over which impact occurs).
- The spatial extent and intensity of environmental impacts will depend on the size of the eco-campsite (i.e. the size of the site, the scale and number of eco-camps and number of people), the extent to which visitors are confined/restricted in their use of the site and the nature of the activities in which visitors engage during their visit.
- Even infrequent, small-scale camping can have a surprisingly intense impact. For example, Cole (1985) reports that just one night of camping by three people generated 4000 steps in 100 square feet – an intensity that resulted in each 1m² of ground being trampled 406 times. Such intense impacts are well in excess of the carrying capacity of many plants species found amongst the ground flora of British woodlands. For example, the carrying capacity (defined as the maximum number of passes that leave at least 75% of vegetation cover one year after trampling) of blue bells (*Hyacinthoides non-scripta*) is estimated at no more than 35 walking passes per year, or only 25 if damage to flower and seed characteristics are considered (Littlemore and Barker, 2001).
- Moreover, although the most severe environmental impacts will likely occur towards the centre of eco-campsites (i.e. around pitches and fire sites), the curvilinear response of vegetation and soils to use, means that significant environmental impacts – particularly in habitats with low ecological resistance and resilience – have the potential to spread wherever recreational activity occurs.
- Attempting to limit environmental impacts by spreading use out will likely only succeed in degrading a larger area, particularly in habitats that lack ecological resilience (Cole and Monz, 2004).
- Similarly, in habitats where ecological recovery is generally slow, such as in woodlands (Hartley, 2000; Johnson and Clark, 2000; Littlemore and Barker, 2001; Cole, 2004; Littlemore and Barlow, 2005), rotating eco-campsites around a site in order to allow previously used areas to recover, will simply lead to more widespread degradation.

- Thus, the most effective way to limit the scale of impact is to concentrate use into a small area (Cole, 1995c; Farrell and Marion, 2000; Littlemore and Barker, 2001; Marion and Farrell, 2002; Cole, 2004; Cole and Monz, 2004; Littlemore and Rotherham, 2008).
- A variety of scales – from the individual site to the entire High Weald AONB landscape – must be considered in order to effectively evaluate the potential environmental impacts that eco-camping may have (Cole and Monz, 2004). Whilst impacts may be negligible on the landscape scale, they may be highly significant and damaging at a particular site, and even more severe within a site (e.g. where damage occurs to an individual historic feature, like a wood bank or pond bay).
- Regardless of scale, the significance of any impact will be magnified – both on the landscape and site scale – if it effects a scarce and highly valued character component of the High Weald AONB, such as ancient woodland, unimproved meadows or heaths (High Weald AONB Joint Advisory Committee, 2009).

3. Other Issues and Considerations

In addition to environmental impacts, there are a number of questions regarding the effect eco-camping will have on communities and the contribution it is likely to make the local and regional economy. It is beyond the scope of this report to address this topic in any great detail; however, there are a few brief comments that can be made.

- Due to the relatively small-scale of most eco-camping developments, wider economic benefits may be correspondingly small, but the economic value of the activity to the land owner and the knock-on benefits for local businesses may be considerable.
- For the same reason, large-scale employment opportunities are unlikely to be generated, but eco-camping may nevertheless make a modest contribution to local job opportunities.
- Noise pollution, light pollution and traffic congestion may become a problem if the location and layout of eco-camp sites are not carefully considered (Corney et al., 2008).
- By creating demand for fuelwood and other materials/commodities, well designed eco-camping businesses could contribute to revitalising traditional woodland management (i.e. coppicing).
- Eco-camping may also contribute to people's enjoyment, appreciation and understanding of the High Weald AONB's nationally important landscape.

4. Recommendations for the Future Development of Eco-camping in the High Weald AONB

In light of the preceding review, there are a number of recommendations that can be made in order to minimise the various environmental impacts associated with eco-camping and ensure that the future development of this leisure activity does not conflict with the objectives of the High Weald AONB Management Plan (High Weald AONB Joint Advisory Committee, 2009).

4.1 Locations Unsuitable for Eco-camping

- In view of the fact that even light use can significantly degrade vegetation, that recovery from disturbance may take decades, that the vegetation of British temperate woodland is neither particularly resistant or resilient, and that ancient woodland is considered a key component of the natural beauty of the High Weald AONB and a nationally irreplaceable resource of considerable value (High Weald AONB Joint Advisory Committee, 2009; Natural England, 2012), eco-camping should *not* be permitted in ancient woodland on *any scale* (this includes both ancient semi-natural woodland (ASNW) and plantations on ancient woodland sites (PAWS)).
- Eco-camping development in ancient woodland would not only be environmentally damaging, but would also be at odds with both Objective W1 of the High Weald AONB Management Plan (High Weald AONB Joint Advisory Committee, 2009) and the requirements stated under paragraph 118 of National Planning Policy Framework (NPFF) (cited on p.5 of Natural England's (2012) Standing Advice for Ancient Woodland).

- Eco-camping adjacent to ancient woodland, or where activity associated with eco-camping is likely to spill-over into nearby ancient woodland, requires careful consideration (Corney et al., 2008) and, if permitted, would necessitate a comprehensive site and visitor management plan. Even if eco-camping near to ancient woodland is tightly controlled and access is restricted, there is a danger that disturbance along the edges of ancient woodland will increase vulnerability to potentially harmful edge effects, such as microclimatic change (Broadbent et al., 2008). Such edge effects may in turn alter species composition and diversity, and reduce overall ecosystem resilience (e.g. to future climate change), whilst unforeseen positive feedback loops and non-linear ecosystem responses may further aggravate any such changes (Broadbent et al., 2008; Ewers and Didham, 2008; Cumming et al., 2012).
- Eco-camp sites located in, or adjacent to, non-ancient woodland also merit careful consideration and, if permitted, will also require a comprehensive site and visitor management plan. This is particularly true for woodland of high biodiversity value, due to the fact that wooded ecosystems are generally less able to withstand recreational impacts than more open habitats (Littlemore and Rotherham, 2008). Indeed, as Littlemore (2001 p.130) states: "Unfortunately, the ability of woods to accommodate free-roaming visitors is much lower than previously thought."
- Eco-camping on lowland heath should *not* be permitted. This is due primarily to the fact that heathland, like woodland, is recognised as being vulnerable to the impacts associated with recreation, due to its low-levels of resistance and resilience (Harrison, 1981; Roovers et al., 2004; Littlemore, 2006). Moreover, lowland heath is extremely scarce, both in the High Weald AONB and nationally (Joint Nature Conservation Committee, 2012b), and is recognised in the High Weald AONB Management Plan (High Weald AONB Joint Advisory Committee, 2009) as part of one the five key components – i.e. field and heath – that define the region's character and natural beauty.
- In addition, lowland heath is an extremely valuable habitat for a variety of rare species, such as the smooth snake and nightjar (the latter being a ground nesting species especially vulnerable to disturbance from recreational activities), and is recognised as a priority habitat by the UK Biodiversity Action Plan (Joint Nature Conservation Committee, 2012b). The fire risk from campsites is also particularly acute on heathland (Anderson and Radford, 1992).
- Eco-camping on unimproved meadows should also *not* be permitted. Whilst grassland is generally more ecologically resistant and resilient than woodlands and heathlands, unimproved meadows are much less resistant to the impacts associated with recreation than improved grassland. This is due primarily to differences in plant morphology associated with the higher proportion of forbs found in unimproved meadows (Cole, 1995a; Littlemore, 2001; Littlemore, 2006).
- In addition, unimproved meadows are extremely scarce in the High Weald AONB (the High Weald AONB Management Plan (High Weald AONB Joint Advisory Committee, 2009) estimates that there are less than 655ha of unimproved species-rich meadows within the AONB) and constitute part of the Field and Heath character component that contributes to the natural beauty recognised by the region's AONB designation.
- Finally, eco-camping in fields or parkland containing veteran trees also requires careful consideration. There is a danger that these trees may be damaged (e.g. through visitor use or felling/trimming for health and safety reasons), resulting in the loss of valuable dead wood and other habitats. Moreover, any damage or loss would contravene the statutory requirement to protect veteran trees stated in paragraph 118 of the NPPF (Natural England, 2012 p.5).

4.2 Considerations and Strategies to Help Minimise the Environmental Impacts of Eco-camping

- Rest-rotation strategies, in which impacted areas are "rested" and fresh sites used, are unlikely to be effective due to the long time-scales associated with recovery (Hartley, 2000; Johnson and Clark, 2000; Littlemore and Barker, 2001; Cole, 2004; Littlemore and Barlow, 2005), and the small size of many High Weald woodlands (Harris, 2003). Such a strategy would likely only result in degrading a larger area rather than reducing the scale of any impact.
- Thus, the fact that many eco-camping facilities are mobile, or are constructed on movable platforms, will be of little help in minimising negative environmental impacts.
- The environmental impacts associated with eco-camping will be most effectively reduced by concentrating activity rather than dispersing it (Cole, 1995c; Farrell and Marion, 2000; Littlemore

and Barker, 2001; Marion and Farrell, 2002; Cole, 2004; Roovers et al., 2004; Cole and Monz, 2004; Littlemore and Rotherham, 2008). This is due to the fact that environmental impacts (e.g. the reduction of ground flora cover and soil compaction) occur most rapidly during the initial stages of use, even if it is light (i.e. the curvilinear relationship), and the fact that recovery to pre-disturbance conditions often takes decades (Hartley, 2000; Johnson and Clark, 2000; Littlemore and Barker, 2001; Cole, 2004; Littlemore and Rotherham, 2008).

- In order to effectively limit eco-camping's environmental impacts, spatial concentration must not only pertain to the location of the pitches themselves, but also to all the associated activities and facilities (e.g. walking/hiking, fire sites and toilet facilities).
- To help mitigate the environmental impacts associated with eco-camping, attention must be paid to the distinction between *resistance* and *resilience*. Resistance refers to the ability of an ecosystem to withstand impacts from use, whilst resilience describes the capacity of an ecosystem to recover from those impacts (Townsend et al., 2004).
- Generally, it would be better to locate eco-camp sites in ecologically resistant localities rather than relying on a sites' ability to recover (i.e. its resilience). This is due to the fact that recovery from disturbance is often associated with long time-scales – particularly in the case of ancient woodland (Johnson and Clark, 2000; Littlemore, 2001) – and relies on the complete cessation of use (Cole, 2004; Littlemore and Rotherham, 2008).
- Places that are generally more ecologically resistant – and therefore less susceptible to the adverse environmental impacts associated with recreational activities – include: open areas dominated by short, rosette and tussocky vegetation (e.g. improved grassland), and woodlands of low biodiversity value and with limited ground cover (e.g. conifer plantations).
- Even in these habitats, care should be taken to avoid citing eco-camps in locations where visitor activity may degrade or damage important archaeological features, or where the construction of amenities (e.g. roads and gateways) will disrupt historic field patterns and associated boundary features (see objectives FH2 and FH4 on pages 32 and 33 of the High Weald AONB Management Plan (High Weald AONB Joint Advisory Committee, 2009)).
- In light of the fact that significant environmental impacts can occur rapidly even at low-levels of use, eco-camp sites should generally be small-scale – e.g. no more than three pitches, or around 15 people. Such small-scale development will not only ensure that this leisure activity is more environmentally sustainable, but also more in keeping with the "wild"/"secluded" experience eco-camping businesses seek to provide.
- Larger-scale developments may be sustainable on the most ecologically resistant and resilient sites (e.g. large areas of improved grassland), but even in these places serious consideration must still be given to the potential visual impact on the landscape and to any potentially adverse effects on historic field boundaries and archaeological features, as well as any associated transport and infrastructure issues.
- Once established, eco-camp sites should be carefully managed in accordance with a comprehensive site and visitor management plan. Management strategies should include a combination of visitor education and exclusion (i.e. the prevention of access to places identified as environmentally and/or archaeologically sensitive, creating what are known as "sanctuary areas"), in order to minimise adverse environmental impacts (Roovers et al., 2004; Littlemore and Rotherham, 2008).
- Visitors should be discouraged from collecting firewood and should instead be supplied with fuel by the eco-camping business in which they are staying. Ideally, this fuel should come from sustainably managed sources either on-site (e.g. coppiced woodland), or locally from within the wider High Weald landscape. Fire sites should also be strictly controlled and spatially concentrated in order to limit impact and the use of kerosene camping stoves should be prevented.
- Eco-campsites should have appropriate facilities for the disposal of waste/grey water and food waste (e.g. bins for solid waste and receptacles for waste/grey water that drain, or are emptied into the mains drainage system). The dumping of waste/grey water directly onto the ground should be strictly prohibited, as should the use of local rivers, streams or ponds to wash or bath (Martin, 2012). In order to limit damage if spillage does occur, the use of biodegradable soaps should be encouraged (Martin, 2012).
- Visitor car parking should, as far as possible, make use of existing facilities in order to minimise the spread of adverse impacts from vehicle emissions and dust particulates from new tracks/roadways.

- Visitors should be discouraged from bringing dogs to eco-campsites (Johnson and Clark, 2000). However, if dogs are permitted, they should be strictly controlled (i.e. kept on a lead and with their owners at all times). This will help reduce disturbance to wildlife (Corney et al., 2008) and limit the spread of adverse impacts (e.g. eutrophication) from faeces and urine (Johnson and Clark, 2000).
- In order to maximise benefits to the local economy, eco-camping businesses should be encouraged to source food and raw materials locally. The appropriate management of on-site woodland resources may be able to supply some of this demand.

In addition to these recommendations, please see Appendix A (p.13). This presents a scheme for calculating an index of vulnerability that may be used to help determine the suitability of a site for eco-camping.

Ultimately, however, it is important to recognise that environmental impacts are inevitable wherever use occurs – whether this use involves eco-camping or the myriad other uses that take place throughout the High Weald AONB. Thus, determining whether an activity like eco-camping is unsustainable, or is in conflict with the objectives of the High Weald AONB Management Plan (High Weald AONB Joint Advisory Committee, 2009), will depend on defining: i) limits of acceptable change (i.e. the boundaries beyond which change away from pre-disturbance conditions is considered unacceptable/environmentally damaging (Cole, 2004; Littlemore, 2006)), and ii) acceptable time-scales of recovery (i.e. the time-scales over which recovery to pre-disturbance conditions – if such a recovery is even ecologically possible – is likely to occur). Whilst these limits/scales will necessarily involve a considerable degree of uncertainty, uncertainty which must itself be factored into decision making, they can nevertheless provide valuable yardsticks against which eco-camping's impacts may be judged.

5. Conclusion

By providing an opportunity for informal open air recreation, eco-camping has the potential to contribute positively to Objective UE4 of the High Weald AONB Management Plan (High Weald AONB Joint Advisory Committee, 2009 p.36). Eco-camping would be particularly suited to more ecologically resistant areas of the High Weald AONB, such as those dominated by improved grassland. Indeed, when such ecologically resistant sites are combined with well-informed site and visitor management, eco-camping has the potential to provide opportunities to enjoy the High Weald landscape, contribute to its management and deliver benefits to the local economy, all whilst minimising adverse environmental impacts.

However, as the research indicates, even apparently low-impact, "green" activities, like eco-camping, can have significant and lasting environmental effects. If the future development of this new recreation activity is not undertaken with great care, there is a danger that it may reduce the ecological integrity of the region and degrade some of the High Weald AONB's most valuable characteristics.

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Appendix A: An index of vulnerability for proposed eco-camping sites in the High Weald AONB (modified from Littlemore (2006 p.34)). Sites for evaluation are graded 0, 1, or 2 points on each of the impact factors, producing a score from 0 to 20 points (0-5: not vulnerable; 6-10: intermediate; 11-15: vulnerable; 16-20: extremely vulnerable). Vulnerability indices aim to provide guidance on the suitability of a given site for eco-camping by quantifying its environmental vulnerability to associated impacts. Indices apply regardless of the scale of eco-camping proposed (i.e. whether it is one pitch with 4 people or 10 pitches with 40 people).

Site Characteristics	**Score**		
	2 points	*1 point*	*0 points*
Main habitat classification	Ancient woodland, non-ancient deciduous woodland, wet woodland	Unimproved meadows, heathland	Improved grassland, low-biodiversity coniferous plantation
Site designation	Ancient woodland, SSSI, National Nature Reserve, Local Nature Reserve	N/A	None
Light conditions	Heavy shade	Partial shade	Open
Soil moisture status	Wet	Dry	Moist
Dominant vegetation	Dicots	Mixed	Monocots
Vegetation stature	Tall	Intermediate	Short
Dominant vegetation growth form	Erect, woody	Branched, layered, woody	Rosette, tussock, matted
Archaeological/historic features	A number of features across the site, or a single very significant feature	A single isolated feature of lesser value	No features
Visual impact on the landscape	Significant	Moderate	Insignificant
Size of proposed site (ha)	Small	Medium	Large

Although this scheme can help identify places more environmentally suited to eco-camping, determining the exact number of people and pitches that a given site can support is much more difficult. Such decisions must be made on the basis of a variety of characteristics unique to that site (e.g. the size of the field or wood in which the campsite will be located, the ease with which the site may be accessed and the availability of associated infrastructure) and, from an environmental perspective, will depend on what are considered to be limits of acceptable change (i.e. the boundaries beyond which change from pre-disturbance conditions is considered unacceptable/environmentally damaging (Cole, 2004; Littlemore, 2006)) and acceptable time-scales of recovery (i.e. the time-scales over which recovery to pre-disturbance conditions – if such a recovery is even ecologically possible – is likely to occur).