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Evaluating the effectiveness of access management measures in ancient woodlands

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Summary

Access to the countryside is important for society and brings a range of benefits in terms of pro-environmental choices and public support for nature recovery, as well as health and wellbeing. However, such recreation use can also result in impacts to woodlands and these impacts vary. There are a wide range of techniques and approaches used to manage access in woodlands, and these can be tailored to local circumstances and the particular features of concern. This report has therefore been commissioned by the Forestry Commission to inform advice and guidance for ancient woodland owners and managers on suitable access management interventions.

In Section 2 of the report, we provide an overview and review of the nature conservation impacts of recreation in ancient woodlands, utilising a separate literature review (see Appendix 1) that summarises the ways in which access can affect ancient woodland habitats, and the species present within them. The review covers the following impact pathways:

- **Damage**: encompassing trampling and vegetation wear, soil compaction, and erosion. Trampling can also cause direct mortality for some fauna;
- **Contamination**: including nutrient enrichment (e.g. dog fouling), litter, and invasive species;
- **Disturbance**: relevant to fauna only, and relating to the avoidance of otherwise suitable habitat, direct flushing, and direct mortality (e.g. dogs killing wildlife);
- **Fire**: increased incidence and risk of fire; and,
- **Other**: all other impacts, including harvesting and activities associated with site management (e.g. the difficulties in achieving necessary grazing).

In Section 3 we list a number of approaches (52 different measures) that can be used to influence visitor behaviour and manage access within woodland settings. These are approaches that could be incorporated into management plans. We provide a range examples and illustrations, with measures grouped into the following broad categories:

- **Access infrastructure**;
- **Enforcement**;
- **Engagement and information provision**;
- **Reducing fire risk**;
- **Travel-related**;
- **Tree protection**; and,
- **Other**.

Section 4 then provides an evaluation of the 52 measures, drawing on results from an online survey of those involved in managing access in woodlands as to what measures they use and how well they work alongside detailed examples, case studies, and reference to the literature. The questionnaire data presented in the report suggests that the following measures are those for which there is the most confidence in their effectiveness in managing access within ancient woodlands:

- **Limiting the sale of disposable BBQs;**
- **Providing fenced areas for dogs;**
- **Fencing around individual trees;**
- **Toilet provision;**
- **Face-to-face engagement;**
- **Creation of refuge areas;**
- **Path improvements,**
- **Staffed visitor centres;**
- **Additional (alternative) greenspace,**
- **Dedicated BBQ areas;** and,
- **Unstaffed visitor centres**.

The results of the online questionnaire are summarised Figure 1 (repeated from Section 4).

In the final section of the report, we make broad recommendations as to which measures are likely to work best and in what circumstances, in relation to which impacts and the kinds of sites that particular approaches might work best. We highlight that decisions made as to how to best manage access at a given site will depend on a range of factors and there is no single, one-size-fits-all approach that can be recommended. A package of different measures that can be adapted and changed in response to monitoring is likely to be key. The list of 52 measures in this report should help site managers choose the most appropriate interventions for their sites. It is likely that a range of measures are best and need to be instigated together, potentially adapted over time in line with monitoring results.

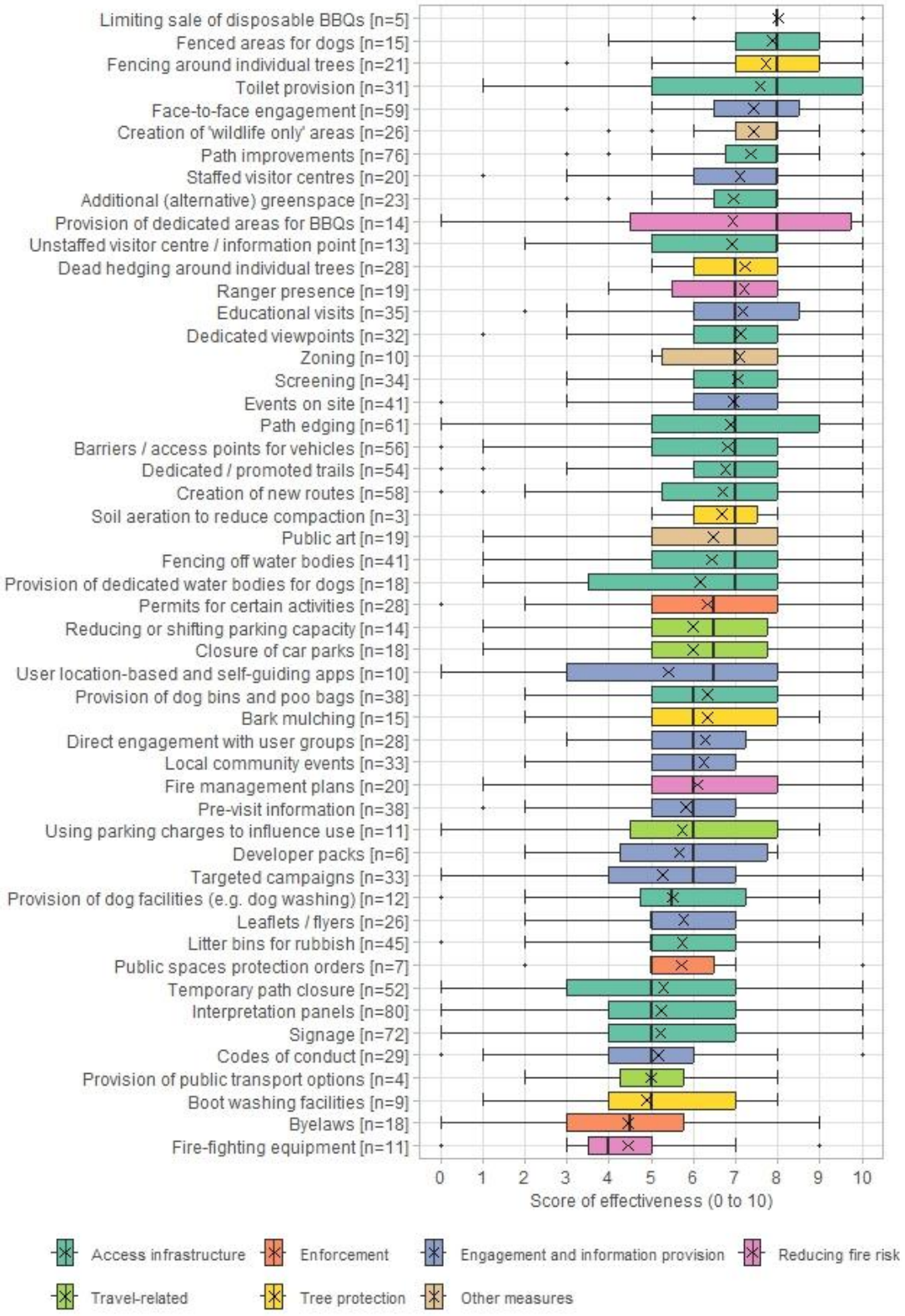

Figure 1: Scores awarded by ancient woodland managers in an online questionnaire discussing access management interventions (0 = least effective; 10 = most effective), ordered by median score. Sample size (n) is the no. respondents with experience of the measure, bold vertical lines show the median, crosses show the mean, the boxes show the interquartile range, and the whiskers the maximum and minimum values. Isolated dots comprise outlier values and the boxes are colour-coded by the questionnaire measure groupings.

Contents

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Cover photo: Signage and interpretation in Langley Wood (Heartwood Forest, Hertfordshire) © Phil Saunders/Footprint Ecology.

1. Introduction

1.1 In the UK, people use nearby greenspaces for a range of recreation, which includes dog walking and physical exercise. It is now increasingly recognised that access to the countryside is crucial to the long-term success of nature conservation projects, for example through enforcing pro-environmental behaviours and instilling a greater respect for the world around us (Richardson *et al.*, 2016). Access also brings wider benefits to society that include benefits to mental/physical health (Lee and Maheswaran, 2011; Bragg and Atkins, 2016; Kondo *et al.*, 2020) and economic benefits (Bateman *et al.*, 2014; Day, 2020; Dasgupta, 2021). In recent years there have been shifts in government policy (e.g. The Woodland Access Implementation Plan[1] and the new England Coast Path) and debate around enhancing access to the countryside.

1.2 There are also considerable challenges, as the use of sites for recreation can have negative impacts, including damaging the nature conservation interest and hindering potential for nature recovery (through trampling damage, disturbance, or increased fire risk, for example). A large increase in visitors to greenspaces during the Coronavirus pandemic (Lemmey, 2020; Ugolini *et al.*, 2020; Burnett *et al.*, 2021) has resulted in further significant visitor management challenges, at times putting a huge strain on sites.

1.3 A range of measures are possible to limit or resolve problems on sites, and thereby a means to accommodate access provision while ensuring impacts are minimised. Measures can include better awareness raising and engagement to influence behaviour (e.g. signage, social media, etc.), physical measures (e.g. changes to path structure, physical barriers, management of parking, etc.), and/or reducing visitor density in time or space (e.g. through redistributing or providing more space for access or restricting/limiting numbers). It is however often difficult for those responsible for managing sites to make decisions about when to change visitor management and what measures to focus on. While there is a range of guidance and examples of best practice available (Scottish Natural Heritage, 2004; Lowen *et al.*, 2008; Ham *et al.*, 2009; Leung *et al.*, 2018; Paths for all, 2018; Rare and The

[1] https://www.gov.uk/government/publications/woodland-access-implementation-plan/woodland-access-implementation-plan#the-woodland-access-implementation-plan

Behavioural Insights Team, 2019), much of this is general or in some cases dated.

1.4 Ancient woodlands comprise irreplaceable habitats of high value to biodiversity, having comprised woodland since the 1600s, and often also have longstanding cultural significance. Across England, the ecological value of many ancient woodlands has however declined over time. This has been driven by ongoing changes in management and extractive practices, exacerbated by a range of other factors. The latter include changes in grazing levels, browsing by deer, the spread of non-native species, pollution, and pests and disease (Forestry Commission, 2010). Recreation pressure has also been identified as an issue for ancient woodland sites, with many having legal rights of access (for example through Public Rights of Way or, in some cases, Open Access through the Countryside and Rights of Way Act (CRoW) 2000). The benefit of access to ancient woodlands is well recognised, but so too is the risk posed by high levels of recreation access and/or specific recreation activities, if not sensitively managed (Forestry Commission, 2010).

1.5 This report has therefore been commissioned by the Forestry Commission to inform advice and guidance for ancient woodland owners and managers, on suitable access management interventions.

Deciding when to intervene or make changes

1.6 It is almost impossible to define a precise level of access or recreation use at which impacts might be triggered for a particular woodland site. As such, relying solely on visitor numbers to inform management decisions or management planning will be misguided. There are a wide range of different impacts associated with recreation such as erosion, increased fire risk, disturbance, and contamination, and for each type of impact, different levels of use will have different scales of effect. Furthermore, the relationship between impact and visitor numbers will vary, such that in some habitats and types of impact the effect might be in direct proportion to the number of visitors (i.e. linear) while in others it may be curvi-linear (Cole, 1995; Coombes, 2007; Monz, Pickering and Hadwen, 2013). In very few cases there will be a clearly defined point at which impact occurs.

1.7 Furthermore, the scale of impact is likely to vary with a range of factors. For example, environmental factors that may increase or decrease plant sensitivities to trampling include soil moisture, canopy density, aspect, micro-climate, and drainage (Kuss, 1986). Similarly, trampling damage to

soils will vary markedly depending on how wet the soils are (e.g. Evju *et al.*, 2021) and therefore a given level of access will have a different impact at different times of year or during different weather conditions.

1.8 Visitor behaviour and the types of access will also have a marked effect. For example, impacts to vegetation and soils from trampling will vary between people on foot, on bikes, or riding horses (Liddle, 1997; Pickering *et al.*, 2010). Modelling of nutrient enrichment from dog fouling (De Frenne *et al.*, 2022) showed different levels of impact depending on whether the dog was on a lead or off-lead, highlighting the impact of visitor behaviour.

1.9 Decisions therefore need to be based on a range of information and data reflecting environmental (e.g. soils, weather), ecological (e.g. species data, condition), and social (e.g. visitor behaviour) factors. These factors need to be informed by an understanding of the potential impacts of recreation and the vulnerability of the site. Guidelines for the sustainable management of access at protected sites (such Leung *et al.*, 2018) stress the need to align conservation management and visitor management, recognising that the kinds of recreation that are appropriate for different sites will vary and may change over time. They argue that impacts from recreation and human use are inevitable and there is therefore a need for an integrated and adaptive programme of resource monitoring, self-evaluation, public engagement, and outreach.

Structure and approach

1.10 Our approach sets out to clearly present where there are concerns or risks associated with recreational use of ancient woodlands and we consider what options there are to address these risks, and how well such options work. This should therefore help those responsible for managing access in ancient woodlands to be aware of any risks and enable them to select appropriate interventions (where necessary) in their management plans. This will ensure the benefits of access can be realised while minimising impact.

1.11 The report has four sections:

- **Nature conservation impacts of recreation in ancient woodlands**, summarising how recreation can impact ancient woodlands, drawing on a detailed literature review (with the latter provided in Appendix 1);
- Provision of **access management measures appropriate for ancient woodland settings**, comprising a list of broad approaches

with examples and illustrations to provide an overview of the ways in which access can be managed in ancient woodland;

- An **evaluation of measures,** involving a survey of those involved in managing access in ancient woodlands as to what measures they use and how well they work, alongside case study examples; and,
- **Recommendations,** bringing out key themes from the above and providing general recommendations around management of visitors in ancient woodlands.

2. Nature conservation impacts of recreation in ancient woodlands

Introduction

2.1 Recreation can impact the biodiversity of ancient woodlands in a range of ways. It is important to understand what features are vulnerable and how they are affected in order to make informed decisions regarding managing access. With such an understanding it is possible to find positive solutions and identify the particular circumstances where some kind of management or intervention might be necessary.

2.2 A detailed literature review of the recreation impacts on ancient woodlands is provided in Appendix 1 and we summarise key elements in this section. It is nevertheless important to recognise that many impacts could relate to any kind of woodland and even extend to features (such as woodland ponds) that are not specific to woodlands. As such the review is general, but where there is particular relevance to ancient woodland this attribute is highlighted.

Types of impact

2.3 Impacts to the nature conservation interest of ancient woodlands can be categorised into five broad categories:

- **Damage**: encompassing trampling and vegetation wear, soil compaction and erosion. Trampling can also cause direct mortality for some fauna (i.e. accidental trampling of invertebrates);
- **Contamination**: including nutrient enrichment (e.g. dog fouling), contamination of water bodies, litter and invasive species;
- **Disturbance**: relevant to fauna only, and relating to the avoidance of otherwise suitable habitat, direct flushing and direct mortality (e.g. dogs killing wildlife);
- **Fire**: increased incidence and risk of fire; and,
- **Other**: all other impacts, including foraging and activities associated with site management (e.g. the difficulties in achieving necessary grazing).

2.4 These categories are summarised in Figure 2 and provide a framework for later sections of the report.

2.5 **Damage** relates primarily to vegetation wear and soils. Within many ancient woodlands with ground flora such as Bluebells *Hyacinthoides non-scripta*,

trampling damage can be easy to see in the spring, while poaching and path widening can often be more apparent in the winter when the ground conditions are muddier. Trampling damage is also relevant to trees as soil compaction can affect the root network, for example through reducing their ability to absorb nutrients. Veteran trees may be especially vulnerable.

2.6 The most widespread and common concern relating to **contamination** is dog fouling, which results in nutrient enrichment. Enrichment occurs from both dog faeces and urine and can result in changes to vegetation composition.

2.7 **Disturbance** affects a range of species, particularly birds and mammals. As humans (and their pets) are viewed as potential predators by most wildlife, the presence of people means species will avoid busy areas entirely, and disturbance can therefore act like habitat loss. Where people and wildlife occur in the same areas, wildlife will respond to the approach of people by changing their behaviour (such as fleeing). This can have energetic costs, health impacts (increased stress), and can also affect breeding success and survival.

2.8 **Fire** is a growing concern in semi-natural habitats as a result of climate change and hotter, drier, conditions. There is a direct link to recreation use through disposable BBQs, campfires, cooking stoves, etc. Deciduous woodland is, by its nature, much less vulnerable to fire than other habitats, such as heathland or moorland. Nevertheless, many ancient woodlands comprise small fragments in a wider landscape comprising other (more vulnerable) habitats and as such may be vulnerable themselves. Even if fires don't spread more widely in deciduous woodland, localised fires can still impact veteran trees and other important features.

2.9 Finally, there are a range of impacts that are perhaps less minor and fall under the '**other'** heading. This includes challenges for site managers in balancing conservation and visitor management with potentially limited resources. On busy sites staff time may be taken up responding to visitors, whether queries from the public, health and safety concerns (broken boardwalks, storm damaged trees, etc.), or issues posed by lost pets. There may be increasing demand and push for facilities or access for events (weddings, sports events, etc.) and achieving conservation management (e.g. extensive grazing) may prove challenging at sites with large numbers of people and dogs. On some sites with important fungi or other popular foodstuffs, wild foraging can create concern about overharvesting.

Damage

Description

Passage of feet and wheels resulting in vegetation wear, soil compaction and erosion. Also trampling of fauna (e.g. insects) and vandalism (e.g. carving on trees).

Relevant activities

All recreation. Particularly those involving lots of people or heavy ground pressure (vehicles, horses).

Vulnerable features

- Veteran trees
- Ground flora (e.g. Bluebells)
- Soils (particularly clayey, damp or wet soils)
- Slopes
- Marginal vegetation (e.g. ponds)

Contamination

Description

Pollution such as nutrient enrichment from dog fouling or chemicals from dogs. Also litter and spread of invasive species.

Relevant activities

All recreation. Dog walking in particular (contamination of waterbodies, nutrient enrichment from urine and faeces).

Vulnerable features

- Vegetation associated with low nutrient soils
- Veteran trees
- Lichens associated with the base of trees or boulders
- Ponds and waterbodies

Fire

Description

Increased incidence of fire associated with recreation, e.g. outdoor cooking, campfires etc.

Relevant activities

Any involving potential causes of fire. Most likely to relate to groups preparing food outdoors, events or people camping.

Vulnerable features

- Small woods
- Woods surrounded by habitat such as moorland or heathland
- Hollow trees
- Immobile species or those with one generation

Disturbance

Description

Impacts to fauna including avoidance of otherwise suitable habitat, direct flushing, and direct mortality (e.g. dogs killing wildlife) .

Relevant activities

All recreation. Particularly dogs off lead and any involving large groups of people.

Vulnerable features

Wide range of fauna, including:

- Birds (particularly ground-nesting, colonial or roost sites)
- Deer
- Bats (roosts)
- Adders
- Some invertebrates

Other

Description

Various other impacts, e.g. foraging. Also impacts to site management (e.g. the difficulties in achieving necessary grazing, resources diverted to visitor management)

Relevant activities

All activities relevant. Wild foraging and dogs (issues with grazing) particularly relevant.

Vulnerable features

- Sites with grazing
- Sites with limited resources for visitor management
- Sites with important fungi or other interest likely to be foraged

Figure 2: Summary of different recreation impacts

3. Access management measures appropriate for ancient woodland settings

Overview

3.1 In this section we describe and consider ways to influence visitor behaviour and manage access to minimise the recreation impacts on woodland sites identified in Section 2. We group measures using the following broader categories:

- Access infrastructure;
- Enforcement;
- Engagement and information provision;
- Reducing fire risk;
- Travel-related;
- Tree protection; and,
- Other.

Access infrastructure

3.2 Access infrastructure includes structures such as fencing, barriers, waymarking and bins. Such infrastructure is routinely provided at sites and is often necessary to ensure safety for visitors or accommodate access. Infrastructure is often the first thing visitors experience when visiting a wood and it can play a role from the outset in making visitors feel welcome and determining how they behave and where they go. There are therefore opportunities in the design, scale, and extent of provision of infrastructure to influence use and increase resilience, as well as to enhance visitor experience. Selected examples are listed in Table 1 and illustrated in Figure 3, Figure 4 and Figure 5.

3.3 The examples illustrated include permanent, large-scale, infrastructure such as car parks, and visitor centres, etc., which can reflect significant capital works. Other measures are more temporary and/or seasonal, and these can be adaptive and undertaken as issues occur. For example, staff at Burnham Beeches put out the temporary blue rope cordons (Figure 3d) around November each year and choose (non-Countryside and Rights Of Way Act 2000 access[2]) areas where visitors tend to take short cuts or where lots of

[2] https://www.legislation.gov.uk/ukpga/2000/37/section/14

small paths/desire lines form. The temporary cordons allow the selected areas to recover from such trampling effects. Over the winter of 2024/25 seven areas within the site were 'closed off' in total. At Hatfield Forest, hurdles are used by the National Trust to close-off individual paths over the winter, with the choice of which routes to close being based on vegetation monitoring and an annual assessment of the path network (see Figure 3j).

Table 1: Selected examples of access infrastructure

Measure	Description	Notes
Interpretation panels	Interpretation boards and direct provision of information to enhance visitor understanding and awareness of issues.	Probably most relevant to new / first time visitors. Can include wayfinding information, context, interest etc.
Path improvements	Surfacing or hardening paths to make them more resilient and create clear routes for people; includes boardwalks.	Can include drainage (culverts) and a range of different materials/surfacing.
Creation of new routes	Scope to deflect access to less sensitive locations through provision of new routes.	Routes can be outside woodland (e.g. around the edge) or linking with adjacent/other site-incorporated habitats
Barriers / access points for vehicles	Height restriction barriers to limit campervans, coaches etc. or barriers on tracks etc. to stop anti-social behaviour.	Very widespread. Can include bollards, boulders, dragon's teeth, logs etc. Can take place at formal car parks and verges, layby etc.
Screening	Use of vegetation or physical screens to hide people in the landscape, reducing visual impact of people (e.g. disturbance).	Most relevant where risks of disturbance to particular species at a given location
Additional (alternative) greenspace	Increasing the area available to visitors through creation of new sites or green spaces. Often referred to as SANG (Suitable Alternative Natural Greenspace) where implemented as European site mitigation.	Dedicated and discrete spaces created or enhanced with the specific purpose of deflecting recreation use. In some areas (e.g. Thames Basin Heaths, Ashdown Forest) these are a legal requirement to mitigate impacts from new development.
Temporary path closure	Path closure to allow ground recovery, usually temporary and done with hurdles, signs etc.	Can be linked to monitoring results and in response to change.
Path edging	Creating a clear edge to demarcate where to walk, with woven hazel, logs, low rail or fence etc.	Can involve local materials relevant to the site or conservation dead hedging
Dedicated viewpoints	Creates destinations within a site, allows visitors to see and view other areas while managing access	
Toilet provision	Provision of toilet facilities at select locations to prevent human waste around car parks etc. and potentially to also draw visitors to certain locations.	

Measure	Description	Notes
Unstaffed visitor centre / information point	Focal point that can provide focus for engagement and weather-proof shelter for interpretation, etc. Permanently open and not usually staffed.	
Signage	Signs to direct people, influence where they go and how they behave.	Can include finger posts, waymarkers, plastic discs on posts etc.
Dedicated / promoted trail	Waymarked promoted trail to guide and facilitate route options for users	Focuses use and footfall on one route
Litter bins for rubbish	Litter bins provided to help keep woods free of rubbish.	Require emptying on a regular basis and can potentially be designed so that the wind doesn't blow the litter out and deters animal disturbance
Fence off water bodies	Fences in water bodies or around edge to limit access to water for people and dogs, with the aim of limiting trampling of banks, erosion and contamination of the water (e.g. from dogs entering).	May also be achieved using dead hedging resulting from the management of pond edge vegetation
Provision of dedicated water bodies for dogs	Either the creation of a new on-site water body, or the identification of an existing "sacrificial" one, within which access by dogs is allowed/encouraged, with access by dogs discouraged/not allowed within any other on-site water bodies.	
Provision of dog facilities (e.g. dog washing)	Facilities to draw dog walkers to particular locations and feel welcomed	Dog washes may provide a means to stop owners encouraging their pet into water bodies to get clean.
Fenced areas for dogs	Dedicated areas where dogs encouraged to be off lead. Scope for areas to be used for training etc and containing off-lead activity.	Can be undertaken outside woodland, e.g. on alternative greenspace, but still potentially within, or adjacent to, woodland sites
Provision of poo bags and dog bins	Free or easily obtainable compostable bags made widely available along with network of dog bins in appropriate locations.	Dog waste can also go in litter bins

Figure 3: Examples of access infrastructure measures: (a) the promoted 'Yellow Route' waymarked in Mad Bess Wood within the Ruislip Woods complex (London Borough of Hillingdon); (b) woven dead-hedging at Burnham Beeches (Buckinghamshire); (c) dog poo and litter bin provision at Hogmoor Inclosure (Hampshire); (d) seasonal rope and posting, and associated temporary signage, within non-CRoW access land at Burnham Beeches (Buckinghamshire); (e) unstaffed visitor centre at Knockan Crag NNR (North West Highlands, Scotland); (f) naturalistic step provision on slope near the Bowder Stone in Borrowdale (Cumbria); (g) path edging using brash at Dockey Wood on the Ashridge Estate (Buckinghamshire); (h) car park height restriction at Bayhurst Wood in the Ruislip Woods complex (London Borough of Hillingdon); (i) signage for Bog Lane (Suitable Alternative) Natural Greenspace (SANG) in Wareham (Dorset); (j) seasonal path closure in Hatfield Forest (Essex); (k) dedicated dog training area at Upton Country Park (Dorset); and (l) signposting in Epping Forest (Essex/London Boroughs of Waltham Forest, Redbridge, and Enfield).

Figure 4: Examples of information board (a) and associated instructional (b) and repeater signage (c) within sensitive Bluebell areas in Langley Wood, part of Heartwood Forest (Hertfordshire).

Figure 5: Easy access path at Burnham Beeches (Buckinghamshire). Surfaced with geotextile fabric with compacted hoggin and granite fines on top.

Enforcement

3.4 Some activities such as anti-social behaviour (which may not necessarily relate directly to recreational activities and access) may require enforcement, and byelaws or permit systems can provide means to limit certain activities or behaviours. Selected examples of enforcement options are provided in Table 2.

Table 2: Selected examples of enforcement options

Measure	Description	Notes
Public Spaces Protection Orders	Options to limit number of dogs per person, requirement to pick up, dogs on leads, etc.	Requite good evidence and consultation to implement
Community Protection Notices	Aimed at stopping anti-social behaviour from persistent, individual, offenders	
Byelaws	Byelaws in some areas may provide means to enforce certain activities, such as verge parking, and to prevent over-foraging or removal of material such as mushrooms and wildflowers beyond personal use	
Permits for certain activities	Permit systems mean responsible users can undertake their activity while agreeing to comply with given conditions, restrictions or codes of conduct	Permits can allow users particular rights (gate keys, parking, etc.) that can be withdrawn from individuals that do not follow conditions.

3.5 Public Spaces Protection Orders (PSPOs) have been applied to a range of activities across woodland sites. These include PSPOs targeting the use of BBQs and behaviour with potential to cause a fire (e.g. dropping a lit cigarette) within the New Forest, and control of dog fouling, and limitations on the number of dogs and the locations that they are allowed to access on and off lead, within Burnham Beeches.

3.6 PSPOs are enforced by authorised persons, who are either able to impose a fixed penalty notice on the spot or inform the offender of possible later prosecution within the courts.

3.7 Provision is made for the awarding of Community Protection Notices (CPNs) under the Anti-social Behaviour, Crime and Policing Act 2014[3]. A CPN may be issued by an authorised person upon either an adult individual or body if

[3] https://www.legislation.gov.uk/ukpga/2014/12/contents

their conduct is deemed unreasonable and is having a persistent, negative, effect upon those in the locality. If the Notice is breached, then similar penalties as for PSPOs may be applied. Examples of anti-social behaviour that may be subject to a CPN include vandalism, excessive noise, or irresponsible dog ownership.

3.8 Byelaws can be enacted by the relevant local authority or other authorised body and have a localised or limited application. Byelaws apply at a variety of woodland sites, including the New Forest, Epping Forest, Ashdown Forest, and Highgate Woods. They cover a wide range of site-specific activities, including damage to trees and habitats, wild foraging, the creation of fires, and visitor and dog behaviour. Byelaws are enforced by the relevant authority through the magistrates' court, with contravention potentially resulting in a fine upon conviction.

3.9 Permits may be required for certain activities within specific locales, with potential examples comprising sporting events and musical performances, community or group activities, regular fitness classes/training, or associated commercial activities. A range of sites (e.g. Burnham Beeches, the New Forest, and many other Forestry England sites) have established systems in place and apply conditions or refuse permissions where the use may have impacts on the site. Such systems allow woodland owners/managers to assess the cumulative impacts of particular activities and how they may impact regular visitors.

Engagement and information provision

3.10 Engagement and information provision form a key component of access management, particularly at more popular sites. Such measures can be grouped into those dependent upon face-to-face contact and those that can be produced electronically or in a paper format, with the latter potentially requiring more active engagement from site visitors. Selected examples are listed in Table 3 and illustrated in Figure 6. Some elements of engagement and information provision cross-over with the infrastructure measures listed in Table 1 – for example interpretation boards and signage.

Table 3: Selected examples of engagement and information provision

Measure	Description
Staffed visitor centres	Focal point/destinations that provide information, education, resources and interpretation.
Face-to-face engagement (rangers/ambassadors)	Rangers on site to talk to people, show wildlife and influence use. Can include volunteer ambassadors.
Targeted campaigns on social media, internet etc	Wide engagement to inform and influence behaviour. Can include targeted campaigns around particular issues, such as reducing fire risk, keeping to paths, dog fouling, BBQs, etc.
Provision of site information for visitors regarding facilities and background to visiting	Know before you go' information on web and apps etc.
Attendance at local community events	Attendance at community events (fetes, shows etc.) provides means to engage with local communities.
Events on site	Guided walks or meet and greet events at access points or events to encourage responsible dog ownership.
Educational visits	Education work directly with young people (both in and outside of the school environment) provides opportunities to influence and inspire future generations and reach a wide audience.
Developer packs	Information packs for residents in new housing or provided by letting agents, estate agents etc. Packs can comprise information on which sites to visit, responsible local access, disposal of garden waste etc.
User location-based and self-guiding apps (e.g. Pokemon Go, geocaching, etc.)	Interactive content (potentially incorporating augmented reality) provided through dedicated apps, scope to target messaging to particular locations, parts of site, activities etc.
Codes of conduct	Clear guidance on how to behave, where to go, etc. Can be general or targeted to particular activities (e.g. dog walking).
Direct engagement with user groups, activity providers and those posting/hosting online	Direct liaison with certain groups to provide messaging, support and influence where they go and behaviour.
Leaflets/fliers	Printed engagement material to inform and influence behaviour. Can include targeted campaigns around particular issues, such as keeping to paths, dog fouling, BBQs, etc.

3.11 Staffed visitor centres are a feature of many popular sites and can easily act as information hubs through which to promote expected behaviours (see Figure 6b). Dependent upon the size and format of the structure, they may incorporate a range of educational and interpretive resources and information and provide a host location for larger engagement events.

3.12 Face-to-face engagement can also be undertaken in the absence of a visitor centre, both on and off site and online. Such engagement may be supported by "pop-up" stalls or exhibition vans, which can act as mobile visitor centres, creating focal points for engagement and allowing the provision of a wider range of paper-based or electronic information to visitors. The mobile nature of vehicle-based pop-ups also mean that they can easily be used to target different localities/access points on a day-to-day basis (see visitor engagement at Great Wood (Borrowdale, Cumbria) case study).

3.13 Attendance at organised events, either on or off site, can help increase the reach of any engagement undertaken, and it may be possible to specifically target messaging at community events or particular user groups. The Dorset Dogs[4] initiative, for example, has provided pop-up events for many years which target the promotion of responsible dog walking behaviour (see Figure 6f).

3.14 Face-to-face engagement and information can be provided by a range of different people, including rangers/ambassadors, volunteers, or contracted communications specialists (such as story tellers, historians, etc). Dependent upon their role, individuals may comprise a day-to-day presence on site or a less frequent point of contact, the latter particularly being the case for specialists engaged for specific events.

3.15 Printed material (in the form of leaflets/fliers, maps, and information sheets) can be made available from access hubs, such as visitor centres, and more widely via other on- and off-site events. Relevant information can also be made available within developer packs, which are deposited within new housing constructed in proximity to the site, explaining site sensitivities and expected behaviours. Information can also be made available electronically, allowing for easy access on a range of devices and messaging concerning key issues can be promoted in more detail via online social media campaigns (see e.g. Figure 6g).

3.16 Codes of Conduct provide clear and concise information concerning expected on-site behaviours and can be targeted at specific user groups as needed. Examples include Dorset Dogs' "Doggy Do Code" and the "Pebblebed Dog Code" used on the Pebbled Heaths in Devon to target visitors with dogs (see Figure 6a).

[4] https://www.dorsetdogs.org.uk/

3.17 The provision of site-specific information pre-visit, including the presence/absence of on-site facilities, parking information, etc., allows visitors to make considered destination selections, to potentially plan their route on site, and to know what to expect on the ground. This can be of particular value to visitors with differing access needs. Important "live" information concerning the location of (e.g.) ongoing management works, car park closures, or grazing livestock can also be made available through such a portal. For example, the conservators of Ashdown Forest have a dedicated webpage with information about current grazing livestock on the site[5].

3.18 The incorporation of contextual/educational information, waymarking, and gaming into tablet or smartphone-hosted apps is relatively novel. Such apps can be used to communicate contextual information in a fun way whilst also influencing visitor routes/behaviour on site, often via the incorporation of augmented reality (see the example of The Gruffalo Spotter 2[6] app in Figure 6e). QR codes (such as the example shown in Figure 6d) can also be used to allow visitors to find additional information or go to particular websites.

[5] See https://ashdownforest.org/grazing-status/
[6] https://www.forestryengland.uk/news/the-gruffalo-returning-englands-forests-exciting-new-augmented-reality-app

Figure 6: Examples of engagement and information provision measures: (a) code of conduct for dog walkers on the Pebblebed Heaths (Devon); (b) staffed visitor centre in Ashdown Forest (East Sussex); (c) pop-up engagement at Burnham Beeches (Bucks) where dog faeces have been flagged to show number of incidents; (d) QR code as part of sensory trail at Burnham Beeches (Buckinghamshire); (e) Forestry England's "the Gruffalo Spotter 2" virtual reality app; (f) targeted engagement with specific user groups (Dorset Dogs); and (f) online campaign from the New Forest National Park Authority targeting BBQ use (Hampshire).

Reducing fire risk

3.19 The reduction of fire risk, and the speedy and effective control of any fires that do occur, are important considerations for ancient woodland sites, with fire incidence likely to increase under global climate change (Mansoor *et al.*, 2022). The measures available to assist with these objectives range from strategic implementation of management plans and liaison with local businesses to the strengthening of firefighting responses on the ground, including clear signage to show visitors what to do if they encounter a fire. Selected examples are listed in Table 4.

Table 4: Selected examples of measures aimed at reducing fire risk

Measure	Description
Provision of dedicated areas for BBQs	Provision of dedicated areas where BBQs allowed contains the activity and ensures it takes place in a location with no fire risk.
Limiting sale of disposal BBQs in local shops	Direct work with local outlets to restrict sale of disposable BBQs and/or engagement with local campaigns to limit sale (if direct contact at point of sale is not feasible).
Equipment available to fight fire effectively	Portable firefighting equipment such as sprayers, bowsers, beaters etc.
Signage and information provision	Can include on-site signage warning against fire risk, or (e.g.) road signage informing visitors that they are entering a high fire risk area, or one within which (e.g.) the use of disposable BBQs is barred
Ranger presence	Rangers can watch for fires and intercept or put out anyone starting a BBQ or portable stove.
Fire management plans	Support for relevant organisations in developing and coordinating fire management (including evacuation measures).

3.20 There are a range of potential management measures available for activities that may increase fire risk, such as the use of BBQs or portable camping stoves. Many sites, such as Epping Forest[7], have byelaws in place to enforce a blanket ban. If so, one option through which an element of control can be introduced is the provision of dedicated BBQ areas at locations on site with no fire risk. The ready availability of disposable BBQs has raised concerns of an increased risk of fires on many publicly accessible sites in recent years, although questions concerning their role as an ignition source remain. The placement of limitations upon their local availability at point of sale may nevertheless yet reduce risk.

[7] See https://www.cityoflondon.gov.uk/things-to-do/green-spaces/epping-forest/epping-forest-byelaws for the byelaws which cover starting any kind of fire, whether intentionally or not

3.21 The presence of rangers on site, and the availability of portable firefighting equipment, comprise two further measures of potential value in reducing fire risk. Rangers are able to directly engage with individuals on site who may be engaged in risky (or proscribed) behaviours and provide suitable guidance. In the event of a fire occurring, the ready availability of firefighting equipment, and/or fully trained on-site staff, can stop an initial outbreak becoming a conflagration (although deferral should always be made to specialist firefighters in the case of wildfire).

3.22 The measures identified above can also be incorporated within a dedicated fire management plan (FMP), These can cover vegetation management, fire load as well as the location and categories of all firefighting equipment, evacuation routes and muster points, and any relevant staff training needs. There is also potential to co-create a unified FMP with neighbouring landowners so that fire risk can be managed at a landscape scale.

Travel-related

3.23 Travel-related measures focus upon car park management or charging, and/or the provision of alternative public transport options, to manage access within ancient woodlands. Selected examples are listed in Table 5 and illustrated in Figure 7.

Table 5: Selected examples of travel-related options

Measure	Description
Close car parks and physically stop parking in certain locations	Directly closing car parks in sensitive locations likely to reduce visitor numbers in certain areas. Also includes managing verge parking etc.
Reduce / shift parking capacity	Redistribution of parking capacity to influence distribution of people and numbers, through car park opening times, number of spaces etc.
Provision of public transport options	Use of shuttle bus or similar to allow drop off and pick-up, focussing use away from sensitive areas. If unfeasible, then promotion of existing public transport options/routes that pick up and drop off from less sensitive locations
Use parking charges to influence use	Potential to limit how long people can park or cost of different times to redistribute visitors. Could be seasonal.

3.24 Car parks, both formal and informal, comprise the initial entry points for large numbers of visitors at many ancient woodland sites, and in rural areas cars are virtually the sole means that people will travel to the site.

3.25 By manipulating parking provision, it is therefore possible to influence how long people spend on site and where they go. Car parks can be closed or the number of spaces reduced in sensitive locations and new parking created in other areas. Upgrades to car parks (such as better surfacing and good design) can perhaps draw visitors while the design can also influence how visitors move from the car park (e.g. which path they take). Re-designed car parks (e.g. Figure 7c) can include interpretation, signage, space for engagement, height restriction barriers and signage at the entrance, many of the measures included under the access infrastructure heading. Car parks located in sensitive locations at both Sherwood Forest and Burnham Beeches have been closed in recent years (Figure 7a), with new, replacement, car parks created in less sensitive parts of the sites.

3.26 Even if car parks, or informal parking, are located in less ecologically sensitive areas, it may still be necessary to strategically manage access levels across the site over time. In such situations, parking can be managed adaptively (over the short or long term) via the institution of parking charges, changes to their capacity, and/or the permanent/seasonal closure of specific car parks or parking locations (see Figure 7a). The application of a differing fee structure across individual days, or across the week, may change when people tend to visit. Limitations can also be placed on the length of individual paid parking sessions. Woodland managers should however note the conditions of any grant funding before instigating car park charging, as some such funding may be subject to stipulations concerning the implementation of charges.

3.27 The creation of a dedicated shuttle bus route between off-site transport hubs (e.g. local rail or bus stations; see Figure 7b) and managed access points can also reduce the number of vehicles accessing a site. Furthermore, the institution of such a service may potentially increase the scope for positive messaging concerning promoted on-site behaviours, either through information incorporated within/on the shuttlebus or at a unified point of entry (e.g. visitor centre). Alternatively, it may instead be possible for site managers to promote the use of existing public transport routes, as long as pick-up and drop-off points are sensitively located and do not refocus footfall/parking in other sensitive locales.

Figure 7: Examples of travel-related measures: (a); sign detailing the permanent closure of a car park at Burnham Beeches (Bucks); (b) promotion of a dedicated bus route to Arne RSPB Reserve (Dorset) and (c) redesigned car park at the East Devon Pebblebed Heaths.

Tree protection

3.28 Tree protection within ancient woodlands includes measures targeted at individual trees and the implementation of more strategic interventions focussed upon soil and tree health. The measures may also help protect the public, as veteran tress are often more unstable and prone to (e.g.) limb drop. Selected examples are listed in Table 6 and illustrated in Figure 8.

Table 6: Selected examples of tree protection options

Measure	Description	Notes
Fencing around individual sensitive trees	Use of a fence to create a physical barrier around individual trees	Can be low (ankle height) or taller
Dead hedging around individual sensitive trees	Piling brash and cut vegetation around the base of trees, creating a visual and physical barrier to protect tree roots	Over time vegetation such as Bramble can become established (as a result of the protection afforded by the brash)
Soil aeration to reduce compaction	Pumping air into soil to reduce compaction	Can be done with an air space or air injector. Not necessarily appropriate where veteran trees are present.
Bark mulching	Use of bark mulch to protect base of trees and allow soil to recover	Mulch protecting the roots, providing nutrients and retaining moisture. Mulch applied in ancient woodlands should be sourced on-site to avoid the introduction of invasive species or disease
Boot washing facilities	Biosecurity / plant health mitigations to prevent the spread of plant invasives, pests, and/or diseases	Can include fixed boot washing stations

3.29 The restriction of access to the trunk and canopy of an individual tree, and/or its underlying root spread, may be achieved using a range of barriers, including fencing, dead hedging, or promoted scrub growth. Each of these methods clearly delineate the area within which access is prohibited but potentially convey different messaging.

3.30 The erection of permanent barrier fencing (see (e.g.) Figure 8a) emphasises the importance of the tree in question and formalises access (which may be preferred at very busy locations). The use of dead hedging or scrub growth (see (e.g.) Figure 8b), conversely, comprise 'natural' barriers that may be seen as more in keeping with the 'wild' nature of the site. These latter methods also benefit from using existing on-site materials or vegetation.

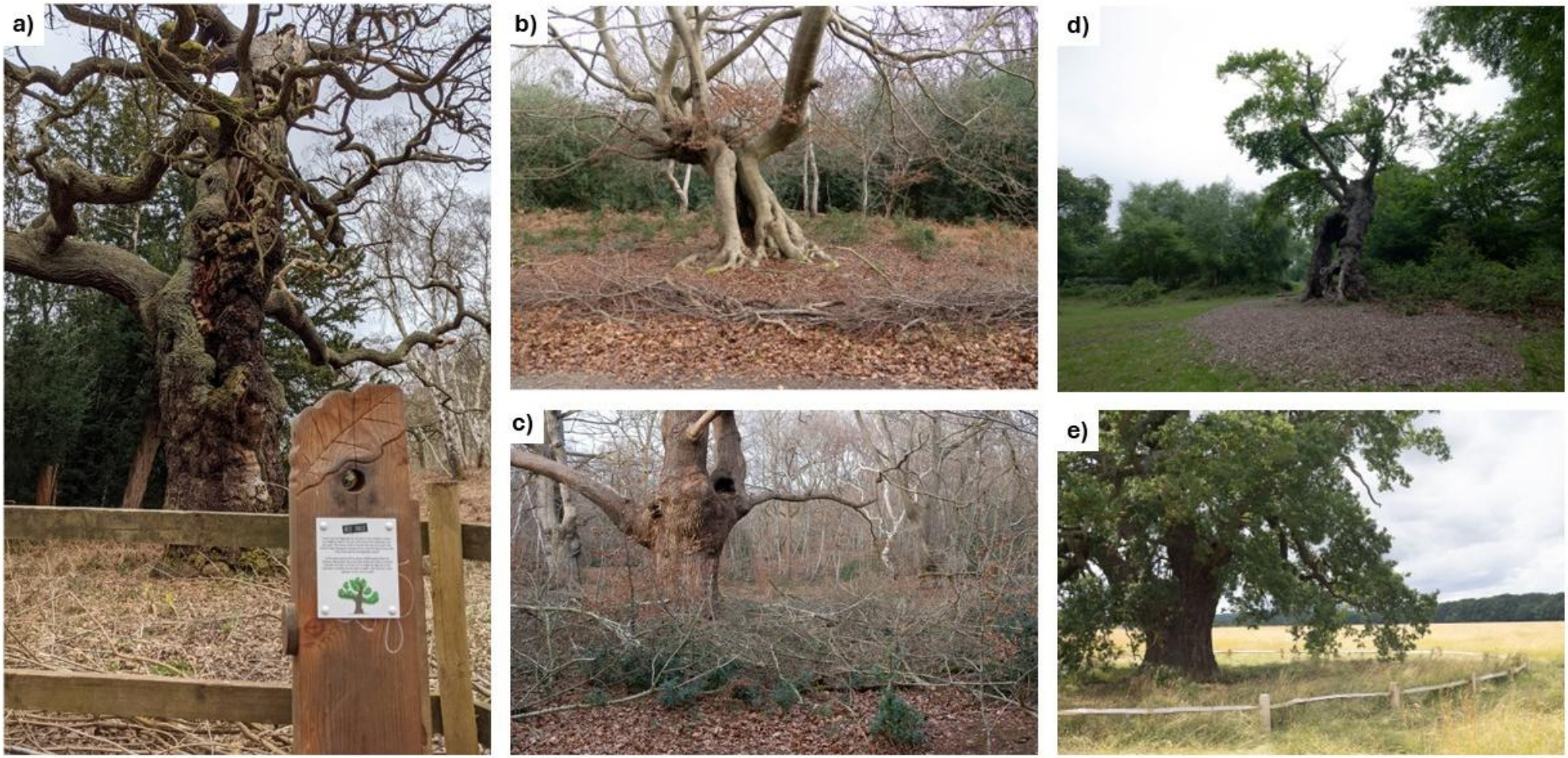

Figure 8: Examples of tree protection measures: (a) permanent barrier fencing (and associated information/engagement material) surrounding an ancient tree in Sherwood Forest (Nottinghamshire); (b) and (c) brash used around the base of trees at Burnham Beeches (Buckinghamshire); (d) bark mulching applied around the base of an ancient tree at Burnham Beeches; and (e) low fence around a veteran Oak in Windsor Great Park (Berkshire).

Other measures

3.31 A range of other measures that do not clearly fall within the previously discussed broad categories can also be used to manage visitor access within ancient woodlands. Selected examples listed in Table 7 and illustrated in Figure 9.

Table 7: Selected examples of other measures

Measure	Description
Zoning	Zones or application of approaches such as Limits of Acceptable Change can provide strategic direction/means to support other measures such as car park management.
Creation of 'wildlife only' areas	Managed no-go areas for people, creating refuges for wildlife.
Public art (sculptures, installations, murals, etc.)	Can be contextual, as well as providing information and (potentially) an emotional response.

3.32 Public art (and architecture) (see (e.g.) Figure 9a and c) may be used to encourage or divert access to particular locations on site and can also be of value as an engagement tool. It can also provide an opportunity for people to learn about the woodland, its habitats, and wildlife. Public art can comprise a range of media, including sculpture, live performances, installations, and exhibitions, and the subject matter may be contextual or more abstract (see, for example, the national Forestry England Arts programme[8]). It can provide a forum for local artists and a showcase for local materials, and community arts projects can actively include visitors and local people within activities on site.

3.33 The application of zoning across ancient woodland sites, or across larger landscape areas that incorporate discrete areas of ancient woodland, comprises a strategic approach that may be used to support or underpin other on-site methods, such as changes to car park management or seasonal trail closures. Zones can also be created for different activities, such as dog walkers or horse riders.

3.34 Different zoning approaches may nevertheless still include provision for the identification of 'wildlife only' areas (see Figure 6c) within which visitor access is totally precluded. These may potentially comprise locations with populations of rare species, those subject to conservation grazing (with

[8] https://www.forestryengland.uk/arts

resultant scope for potential conflict with visitors), or where animal populations may take refuge from other areas with visitor access.

Figure 9: Examples of other measures: (a) owl sculpture at Walshes Park (East Sussex); (b) a dedicated 'wildlife only' area at Minsmere (Suffolk); and, (c) public art within a woodland setting at The Sculpture Park (Surrey).

4. Evaluation of measures

4.1 In this section we consider the effectiveness of the different measures identified in the previous section. We use the results of an online questionnaire (circulated to woodland managers and others involved in access provision to ancient woodlands) to summarise how widely different measures are used and views on their effectiveness. We supplement this with information from scientific and grey literature and draw on a range of case studies and examples from specific sites (some of which came out of the questionnaire).

4.2 The case studies were chosen following discussions with the Project Steering Group, with the majority subject to site visit and subsequent conversation with site managers. The sites comprise a range of ancient woodlands (in terms of area, location, management, etc.) and illustrate a variety of management measures. The specific locations are listed below:

- **Burnham Beeches** (Bucks) – 195ha in total extent. A lowland Beech woodland, with many veteran trees, designated as a National Nature Reserve (NNR), Special Area of Conservation (SAC), and Site of Special Scientific Interest (SSSI). Managed by the Corporation of London.
- **Borrowdale** (Cumbria) – 721ha in total extent. An upland Oak woodland, comprised of several large blocks with varying topography, designated as a National Park, NNR, SAC, and SSSI. Managed by the National Trust.
- **Hatfield Forest** (Essex) – 425ha in total extent. An almost complete former Royal Hunting Forest supporting a large number of veteran trees, designated as an NNR and SSSI.
- **Heartwood Forest** (Herts) – 347ha in total extent. A mixture of ancient and newly planted woodland, grassland and wildflower meadows, wetland and a community orchard. Managed by the Woodland Trust.
- **Wistman's Wood** (Devon) – 3.5ha in total extent. An upland Oak woodland on Dartmoor, designated as an NNR, SAC, and SSSI. Owned/managed by the Duchy of Cornwall and Natural England.

Online questionnaire with woodland managers and others

4.3 The questionnaire gathered information on the level of experience that woodland managers, owners, and other relevant professionals had with each of the measures described in Section 3, and asked how effective they had found each measure to be. Detailed information on the online questionnaire design and dissemination are provided in Appendix 2, with a copy of the questionnaire introduction and an example question provided in Appendix 3.

Number of responses and background

4.4 A total of 70 people completed the questionnaire, and 39 partial responses were also submitted and have been included in the analysis, giving a total of 109 respondents. These 'partial' responses comprised those submissions that included at least 10 completed questions or at least one free-text answer.

4.5 69 of the respondents (63%) provided information on their role. Over half of these respondents (55%) were directly involved in woodland management, 20% worked in ecology/conservation, 6% in visitor management, 4% in land advice, 1% in access and rights of way, and 13% in another role (e.g. farmer/landowner).

4.6 38 organisations were represented by the respondents, including private estates, local authorities, government agencies, Wildlife Trusts, the National Trust, and other environmental charities. As such the results reflect a wide range of different types of woodland and approaches to management.

Views on effectiveness

4.7 Respondents were asked to score each measure for its effectiveness (if they had experience of the measure). Effectiveness was scored between 0 and 10 (with 0 being least effective and 10 being most effective) and respondents were also able to provide extensive free-text responses.

4.8 The scores are summarised in Table 8, with the measures displayed in descending order of experience level (i.e. those measures deployed most frequently are at the top). Signage, interpretation panels, and face-to-face engagement comprised those measures with which the largest proportion of respondents had experience (each >70%). Fewer than 50% of respondents had experience of 42 of the remaining measures (81% of all measures), and

no respondents had experience of enforcement through the use of community protection notices.

4.9 Figure 10 presents the questionnaire response data graphically using a box and whisker plot, with the measures organised by descending median effectiveness score (irrespective of the number of respondents). The bars in the boxplot are colour-grouped into the broader measure categories used elsewhere in this report. The "whiskers" and points (the latter comprising outlier values) on the figure describe the full range of scores provided for each measure, the solid line the median score, and crosses the mean score for each.

4.10 Limiting the sale of disposable BBQs, providing fenced areas for dogs, fencing around individual trees, toilet provision, face-to-face engagement, creation of refuge areas, path improvements, staffed visitor centres, additional (alternative) greenspace, dedicated BBQ areas, and unstaffed visitor centres all received the largest median effectiveness score of 8. It should be noted however that the number of respondents with experience of each of these measures varied widely, ranging from 5 (limiting the sale of disposable BBQs) to 76 (path improvements).

4.11 The use of byelaws and provision of fire-fighting equipment received the lowest median effectiveness scores, namely 4.5 and 4 respectively. Across all measures there was however a weak positive correlation between the number of respondents with experience of each and the median effectiveness score (Pearson correlation co-efficient of 0.02), indicating that the measures that are most frequently used are ones that respondents tended to view as the most effective.

4.12 Interestingly, the majority of measures had a wide range of scores returned overall, with the following measures all having a range from 0-10 (meaning a very wide divergence of views on their effectiveness): dedicated areas for BBQs, path edging, barriers/access points for vehicles, promoted trails, creation of new routes, permits for certain activities, location-based and self-guiding apps, targeted campaigns, temporary path closures, interpretation panels, signage, and codes of conduct. This suggests that the (perception of the) success of specific intervention measures is very varied and may well be extremely site-specific.

4.13 The free text responses provide further detail and feedback on particular measures and are incorporated into the later text within this section.

Table 8: No. of respondents for each question (N), % who had experience of using the measure (% Yes) and the median effectiveness score (Median).

Measure	N	% Yes	Median	Measure	N	% Yes	Median
Signage	93	77%	5	Fencing around individual trees	71	30%	8
Interpretation panels	108	74%	5	Fire management plans	72	28%	6
Face-to-face engagement	81	73%	8	Public art	70	27%	7
Path improvements	108	70%	8	Ranger presence	73	26%	7
Path edging	95	64%	7	Closure of car parks	72	25%	6.5
Dedicated / promoted trails	93	58%	7	Staffed visitor centres	81	25%	8
Creation of new routes	103	56%	7	Additional (alternative) greenspace	95	24%	8
Barriers / access points for vehicles	100	56%	7	Byelaws	84	21%	4.5
Temporary path closure	94	55%	5	Bark mulching	71	21%	6
Events on site	77	53%	7	Provision of dedicated water bodies for dogs	90	20%	7
Litter bins for rubbish	91	49%	5	Reducing or shifting parking capacity	71	20%	6.5
Pre-visit information	77	49%	6	Provision of dedicated areas for BBQs	72	19%	8
Fencing off water bodies	89	46%	7	Fenced areas for dogs	90	17%	8
Educational visits	78	45%	7	Using parking charges to influence use	71	15%	6
Local community events	77	43%	6	Fire-fighting equipment	73	15%	4
Targeted campaigns	78	42%	6	Zoning	69	14%	7
Provision of dog bins and poo bags	91	42%	6	Unstaffed visitor centre / information point	94	14%	8
Dead hedging around individual trees	71	39%	7	Provision of dog facilities (e.g. dog washing)	90	13%	5.5
Creation of 'wildlife only' areas	69	38%	8	User location-based and self-guiding apps	78	13%	6.5
Codes of conduct	77	38%	5	Boot washing facilities	71	13%	5
Direct engagement with user groups	75	37%	6	Public spaces protection orders	86	8%	5
Screening	97	35%	7	Developer packs	76	8%	6
Leaflets / flyers	75	35%	5	Limiting sale of disposable BBQs	73	7%	8
Dedicated viewpoints	93	34%	7	Provision of public transport options	71	6%	5
Permits for certain activities	85	33%	6.5	Soil aeration to reduce compaction	71	4%	7
Toilet provision	95	33%	8	Community protection notices	85	0%	-

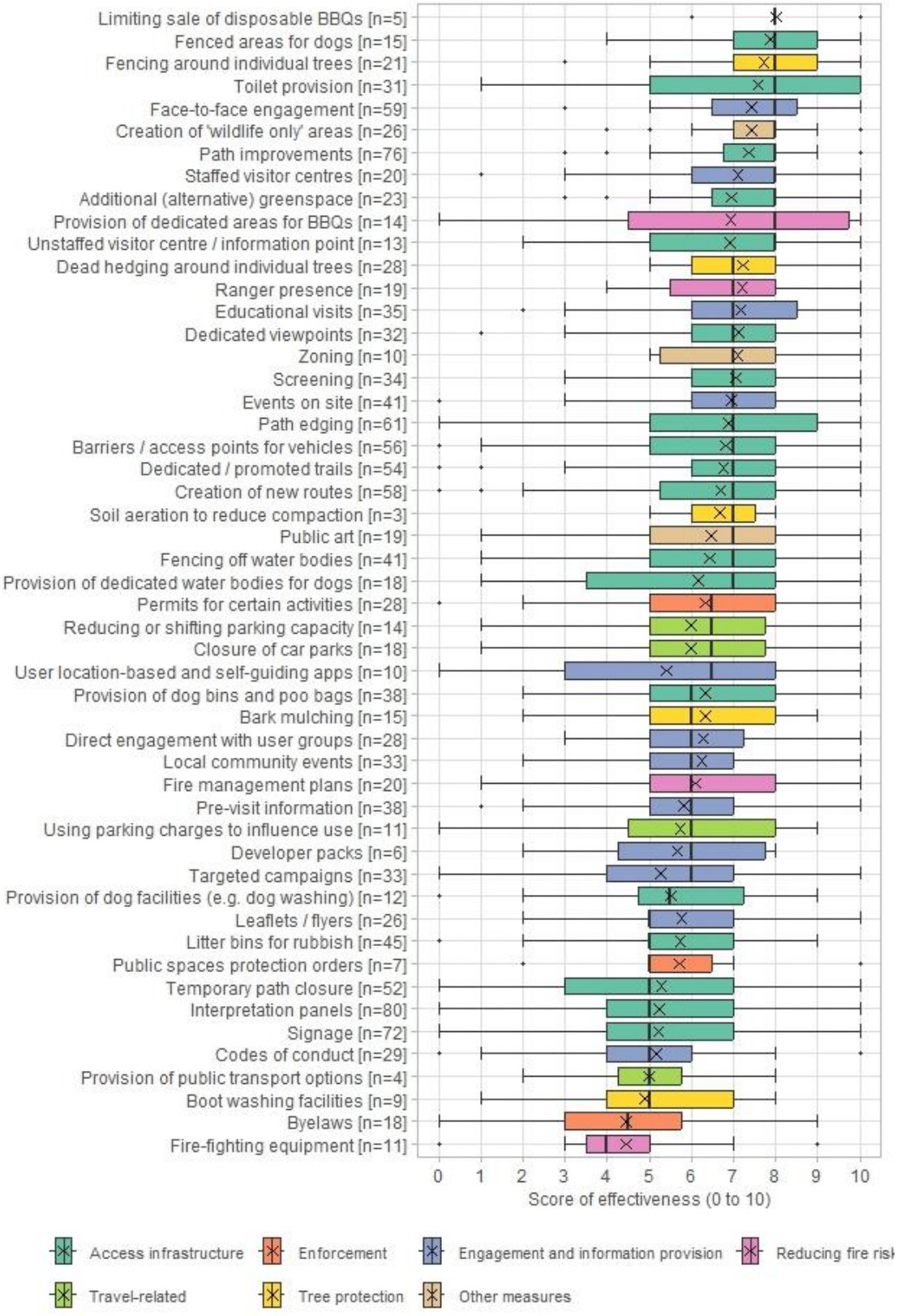

Figure 10: Scores given by respondents for each intervention measure, ordered by median score. Sample size (n) is the no. respondents with experience of the measure, bold vertical lines show the median, crosses show the mean, the boxes show the interquartile range, and the whiskers the maximum and minimum values. Isolated dots comprise outlier values and the boxes are colour-coded by the questionnaire groupings.

Further information on effectiveness: access infrastructure

4.14 **Interpretation panels** can operate in a range of ways, providing information on orientation and where to go, information on behaviour (what can be done and where), and educational information that increases visitors' understanding of the site and its importance (see Kuo, 2002 and Moscardo, Woods and Saltzer, 2004 for a review). In the case of educational information, there is an expectation that better informed visitors may develop a deeper understanding and be influenced to modify their behaviour over time. Clearly the messaging and content of any such provision is critical to their effectiveness and is considered in the later section on engagement and information provision.

4.15 Survey respondents in the online questionnaire found interpretation panels to be most effective when sited in a prominent position, such as site entrances, where they are likely to be seen. They stressed the importance of a clear, simple, visually appealing design using maps and images, and keeping text to a minimum. They suggested that they should also be sturdy to protect against both weather and vandalism. In order to remain effective in the long-term, information should be kept up-to-date and relevant, perhaps with a section of the panel that can display temporary notices (e.g. regarding spring flora or autumn fungi). Many of the respondents felt that interpretation panels were generally only looked at by first-time visitors, however, and that frequent/local visitors pay little attention to them. One respondent commented that "most problems occur with people who don't care and wouldn't have read/paid attention to instructions". However, another said that "it helps frame the conversation when challenging poor behaviours".

4.16 Views expressed in the online questionnaire on **path improvements** were generally positive, with many respondents finding that good path surfacing and maintenance can help to keep visitors in/on less sensitive areas or routes and prevent damage, such as widening of paths or new desire lines. This ties with the (non-wooded) example of the Pennine Way described by Pearce-Higgins and Yalden (1997). Also Lowen et al. (2008) who suggests that people will generally stick to attractive woodland paths which are well drained and marked, and surfaced with non-intrusive materials, such as woodchip. Improved paths are also considered more attractive by many visitors, including those with buggies or with mobility issues, which may again help in minimising path drift and desire line creation. Guidance on

path design, suitable materials, costs, etc., are available elsewhere (e.g. Paths for all, 2023).

4.17 Nevertheless, some of the online questionnaire respondents suggested that certain user groups, such as mountain bikers, find muddy paths more appealing. Research carried out by Doick et al (2013) in three English woodlands also indicated that visitors undertaking different activities preferred different path designs, and recommended including a range of path types in any woodland block. Path improvements used by questionnaire respondents included the creation of gravel paths, woodchip paths, and boardwalks, although the latter were avoided by some due to the expense of installing and maintaining them.

4.18 Questionnaire respondents suggested that the **provision of new route/s** needed to be carefully planned. It is important to avoid causing further damage to any sensitive features, whilst also making the new route appealing to visitors, perhaps by making use of existing desire lines. Respondents also suggested that new routes can be combined with other measures, such as interpretation and waymarking, to encourage visitors to make use of them. Nevertheless, some respondents indicated that local people, who had been visiting an ancient woodland site for many years, may be reluctant to deviate from their usual route. Some respondents also felt that the provision of new routes risked increasing the overall footfall on a site, especially if old routes are not closed off.

4.19 Respondents found **gates and height barriers** to be effective at reducing incidences of fly-tipping, overnight camping, and poaching, as well as in preventing large lorries or vans from entering. However, height barriers were identified as causing issues for some visitors (e.g. vehicles carrying motorised wheelchairs, or with bicycle roof racks). Respondents who had experience of using **screening** recommended the use of natural materials (e.g. hazel hurdles, reed/willow screens, or dead hedging).

4.20 **Alternative greenspaces** in the form of SANGs are now widely deployed (Beveridge *et al.*, 2024) and there are guidelines for the amount and design criteria necessary for such spaces to work (Natural England, 2008, 2021; Liley, Underhill-Day and Sharp, 2009; Liley, 2022). There are a range of visitor surveys that show SANGs to be well visited and to be deflecting use from the nearby protected site (e.g. Caals, Panter and Liley, 2022; Liley and Panter, 2022). Allinson (2018), in a postal survey of residents around the Thames Basin area, found more people visited SANGs than the protected sites they

were designed to protect. Her work also highlighted the need for better site promotion and awareness raising in order to influence where people go. Her results showed that word of mouth was the most common way in which interviewees found out about sites to visit and entrance signs were also important.

4.21 Many respondents to the online survey gave positive feedback about the effectiveness of alternative greenspaces, such as SANGs, with one commenting that they are 'probably the best thing that anyone can do to reduce visitor impact'. Respondents had found them to be most effective when designed to be attractive and accessible, with facilities for dog walkers and with well-maintained footpaths that can be used all year round.

4.22 A variation on the provision of SANG is the gateway option (Beunen, Regnerus and Jaarsma, 2008), where access infrastructure and visitor facilities are located away from the sensitive areas and outside the woodland boundary. There are relatively few examples where this has been tried and tested in the UK (Cheater, 2023), although the National Trust are looking to establish three gateway sites ('visitor hubs') at the Ashridge Estate.

4.23 The online questionnaire highlighted mixed experiences among respondents of using **temporary path closures** in woodlands. Some respondents had found them effective, especially when combined with clear messaging explaining the reasons for it (see Figure 11), whilst others had found that visitors (especially those with regular/established routes) tended to ignore path closures, even when they were in place for safety reasons.

Figure 11: Time-series photos from a fixed point in Hatfield Forest (Essex) showing the effect of temporary path closures on unsurfaced paths - photos taken (left to right) in February 2018, November 2019, and October 2024.

4.24 **Path closures** have been shown to be effective in reversing the effects of trampling, and resultant vegetation removal within woodlands in a number

of studies (see for example Roovers, Gulinck and Hermy, 2005). The type of material used to close of the path (i.e. the 'barrier') has been shown to vary in effectiveness, with Bayfield & Bathe (1982) finding the use of planks with notices, or barbed wire(!), much more effective in preventing access than (e.g.) logs laid on the ground. The same study noted that narrower paths were easier to close, and that specific user groups (in this instance birdwatchers and dog walkers) were more likely to ignore the path closure signs used.

4.25 Many respondents to the online questionnaire had used materials such as dead hedges, knee rails, and logs along **path edges to define routes** and encourage visitors to keep to paths. The measure received a median effectiveness score of 7, but the scores provided by respondents ranged from 0 to 10, suggesting that the relative effectiveness varied on a site-by-site basis. There was also recognition that such barriers/markers require ongoing maintenance in order to be effective, especially with respect to materials such as dead hedges which will rot down over time. The effectiveness of path edging at Heartwood Forest is highlighted in the boxed case study, overleaf.

4.26 Few respondents expressed experience of using plantings or regrowth (such as Bramble) as path edging, but those that did were enthusiastic about its effectiveness, with support for its use (and robustness) also found in the literature (Littlemore, 2001). One key consideration that was raised repeatedly, however, was the need for edged paths to be surfaced, or at least well-drained, as visitors were likely to walk outside of the demarcated area if the path was muddy or collected water.

4.27 **Dedicated viewpoints** have the potential to steer visitors towards particular routes or areas and had been widely applied amongst the questionnaire respondents. They also scored quite highly in effectiveness (median score; 7; range: 1 to 10). One respondent had found that the increased footfall resulting from the introduction of a viewing platform on their site had been contained within routes to and from the platform. Examples of suitable locations would be an attractive vista, an elevated viewpoint, the transition between different habitats or a view across a wildlife-only area.

Adaptive management of the tiered path network in Heartwood Forest (Hertfordshire)

Heartwood Forest is managed by the Woodland Trust and comprises England's largest continuous, newly created, native woodland. Over half a million trees have been planted across the site since 2008, with these areas of younger growth linking several, historically isolated, blocks of ancient woodland (See Figure 12). Langley, Pudler's/Well, and Round Woods all harbour carpets of spring flowers, including Bluebells, making them both attractive visitor locations and particularly susceptible to the negative effects of trampling.

Access management within each of these ancient woodlands has varied historically. Langley Wood has long been promoted as a destination site for those wishing to see Bluebells in bloom, and experienced extensive historic damage in the absence of appropriate access management measures. Permanent rope and posting, as well as geotextile matting, was therefore introduced along trails throughout the wood, with information boards detailing the impacts of trampling installed at every entry point, and repeater signs set out across the path network.

Figure 12: Locations of ancient woodland blocks (dark green areas) within Heartwood Forest, taken from Woodland Trust on-site information board.

Pudler's/Well Woods and Round Wood, conversely, have historically been managed to provide visitors with a more "natural" experience. Paths within them are delineated using branches or brash, whilst geotextile matting is incorporated within the main path network in Pudler's/Well Woods only. Minimal signage was deployed either, with no information boards or repeater signs.

Subseqent monitoring of visitor behaviour and path condition within the three woodland blocks, however, has shown that this approach requires moderation. Repeated incidences of "fence-hopping" were recorded from photographers in Langley Wood, and visitors within Round Wood (in particular) inadvertently trampled Bluebells either side of the edged route in order to avoid the unsurfaced muddy path centre. There was also evidence that people often only visited one or other of the woodland blocks on site with any frequency, with consequent concern that the extensive messaging within Langley Wood was not filtering through to the majority visitors within Pudler's/Well or Round Woods.

Figure 13: Path and access management variation across ancient woodland blocks in Heartwood Forest; (left to right) permanent rope and posting, repeater signs, and geotextile matting in Langley Wood, path edging and geotextile matting along a main path in Pudlers/Well Wood, and path edging along a subsidiary path in Pudlers/Well Wood (note the desire line/off-path trampling indicated by the yellow arrow).

As a result of this, the Woodland Trust have identified and promoted specific locations for Bluebell photography within Langley Wood, which incorporate logs for seating and lowered ropes to assist in framing. The Trust is also in the process of reducing the amount of signage in Langley Wood to improve visitor experience, and is installing (limited) signage and information boards within the other woodland blocks to target visitors there.

The results of these adjustments will continue to be monitored, with any further changes in the incidence of Bluebell trampling and/or path condition fed into future revisions to the way that access is managed on site.

4.29 There were mixed views from the online questionnaire responses on the **provision of toilet facilities**. The measure was identified as being largely effective (median score: 8) in both reducing the incidence of human waste on site and creating "honeypot" locations to focus visitors. Some sites that were not on the mains sewerage network had installed composting toilets, which had reduced the impact on their woodland.

4.30 Nevertheless, the measure received a wide range of scores (1 to 10) across all respondents with experience of deploying it. Some identified the need for regular/potentially costly maintenance and the occurrence of toilet-focused vandalism/anti-social behaviour from some visitors as potential downsides and also suggested that the provision of toilets had led to an increase in the number of overall visitors to their site (thus requiring further management interventions).

4.31 Relatively few respondents had experience of providing **unstaffed visitor centres**. Those that did have experience, however, found them reasonably effective, especially for tourists or first-time visitors. There were nevertheless concerns about ongoing maintenance and the risk of vandalism.

4.32 **Signage** at nature reserves is usually established as part of a package of different interventions and is likely to be most effective where combined with ranger presence and other measures (Medeiros *et al.*, 2007). Studies demonstrate the signage can be effective, but doesn't necessarily work for all user groups (Allbrook and Quinn, 2020). Furthermore, the effectiveness of its application, and the level to which it should be deployed, within woodland settings has also been questioned (Marzano and Dandy, 2012; Doick *et al.*, 2013; Backman *et al.*, 2018). Careful consideration also needs to be given as to whether signage is the best medium through which to convey more complicated messaging (Paths for all, 2018).

4.33 There is a large body of information on best practice for design and communication (e.g. Ham, 1992; Ham *et al.*, 2009; Rare and The Behavioural Insights Team, 2019) and these highlight the importance of understanding the motivations of visitors and the range of ways to influence their behaviour. Careful trialling and testing are likely to be important, and signs may need to be specific to particular locations. Furthermore, different users may respond to signage in different ways, with evidence from some woodland-focused studies that signage is more likely to benefit older visitors (e.g. Doick *et al.*, 2013).

4.34 A large number of questionnaire respondents had experience of using signage to manage access within their sites, although the median effectiveness score of 5 was at the lower end of the reported values (with a wide range of scores recorded overall). Some respondents had found signage with positive messaging to be most effective at influencing visitor behaviour, while others preferred a more direct approach with clear 'dos and don'ts'.

4.35 Many respondents had found temporary signage to be particularly effective, as it is temporally relevant and more likely to be noticed by regular visitors. One example that had worked well was signage informing dog walkers of the changing presence of sheep within grazing compartments. This signage was updated as the stock were moved to ensure that it was current, and it had been highly effective at both reducing incidents and engaging with regular visitors.

4.36 Data from Wistman's Wood (see boxed case study) shows that a clear message and the use of simple posts is sufficient to influence the behaviour of the majority of visitors.

Signage at Wistman's Wood (Dartmoor, Devon)

Wistman's Wood is one of the few remaining fragments of woodland on Dartmoor. The rocky graniter slope is covered in mosses and lower plants, including filmy ferns. The wood is a Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR) and the woodland habitat is one of the qualifying features of the Dartmoor Special Area of Conservation (SAC). The lichens and mosses are vulnerable to trampling damage with disturbance and recreational impacts one of the risks identified by Natural England for the SSSI. The wood is an iconic western oakwood site and example of Atlantic rainforest. It is well known, popular with photographers, and often publicised on social media.

The wood is owned by the Duchy of Cornwall and managed by Natural England. The wood is within the National Park and the area is designated as open country under the Countryside and Rights of Way Act 2000 (CRoW). Following the covid pandemic, when there was a marked upsurge in visitors to Dartmoor, Natural England became increasingly concerned about the damage from recreation use. Some simple signs (see Figure 14) were erected asking visitors to walk around the wood rather than enter the wood. Alongside the signs some brash was placed over some desire lines, but no other measures were put in place.

Figure 14: Signage examples from Wistman's Wood and the site in context.

Fifty visitors were interviewed at the start of the path to the wood in October 2024 (the school half-term) to check how many had seen the signs, whether they modified their behaviour as a result, and the extent to which the signage was working to reduce recreational pressure within the wood. The results (see Appendix 4 for details) show that the signage is largely effective. Assuming a random sample of people interviewed, the results suggest 72% of visitors saw the signs, 36% modified their behaviour and kept out of the wood (with a further 36% not intending to enter the wood anyway) and just 4% of visitors consciously chose to ignore the signs and enter the wood.

Limited feedback was received from interviewees concerning the design of the signs, although they were described as clear and well-sited by one respondent. Others suggested that the signs could be slightly bigger or more obvious, with some requesting a larger number of more permanent signs to be deployed providing more detailed information on the reasons behind the request not to enter the wood.

The map shown to the left depicts the routes that the interviewed visitors undertook on the day of the interview from the survey location at the Two Bridges Car Park. Overlapping routes are indicated in darker shades of orange/red, with the darkness increasing with route density (i.e. increasing numbers of overlapping routes). The map clearly shows that the fifty interviewees almost exclusively avoided entering the ancient woodland, with most content to view the wood from either immediately outside its boundary or from the higher tors located to the east.

The visitor routes therefore comprise a useful additional evidence strand that can be used to support the efficacy of on-site signage.

4.37 A large number of respondents had experience of using **dedicated or promoted trails** as an access management tool and found them to be relatively effective overall (median score of 7). The measure was identified as being popular with new or inexperienced visitors and effective both at reducing impacts (e.g. keeping people away from the most sensitive areas) and enhancing the visitor experience. Visitor survey results from the New Forest (discussed in Lake, Liley and Saunders, 2020), for example, found around 63% of the cycling undertaken by those cycling off-road was on promoted cycle routes.

4.38 **Litter bins** were thought to be beneficial by some respondents to the online questionnaire, but only if emptied regularly, as once full many people will continue to leave rubbish beside the bin (referred to as 'polite fly-tipping' by one respondent). Some respondents had found it more effective to not provide bins and to instead encourage people to take their litter home with them, promoting the principle of 'leave no trace'. One respondent commented that all of their bins had been removed, and they now saw less litter. These comments are in keeping with experiences at a variety of other, non-ancient woodland, sites[9] and are echoed by a number of Natural England and Forestry England site managers (*pers.comm*). Any reduction in littering as a result of bin removal will however also rely upon effective messaging and communication to visitors, both before arrival and during their time on site, as many visitors are likely to expect litter bins to be present (Keep Britain Tidy, 2021).

4.39 There is evidence from Headley Heath in Surrey, which incorporates a small area of ancient woodland, of temporary **fencing around ponds** working to concentrate dogs in certain areas, protecting other areas of ponds from the turbidity and contamination arising from dogs splashing (Denton and Groome, 2017). Low wattle fencing, within the water, served to keep dogs out of certain areas, and invertebrates and vegetation monitoring showed clear differences between them and unfenced areas. The authors suggest that subdividing ponds works best on bigger waterbodies. They also suggest that while permanent fencing will mostly reduce impacts in the long term, it will also potentially require the control of vegetation to maintain the open water and, as such, some occasional disturbance can be beneficial.

[9] See (e.g.) https://www.bbc.co.uk/news/uk-england-somerset-58307325

4.40 A relatively large proportion of questionnaire respondents had experience of fencing off waterbodies, and the measure scored relatively highly for effectiveness (median score of 7). Respondents had fenced of waterbodies using post and rail, dead hedging, or chestnut paling, and had found it to be successful at keeping people and dogs out of them. One said that 'our pond in the centre of the woods was railed off and the vegetation recovered dramatically'.

4.41 A relatively small proportion of respondents had provided **dedicated or 'sacrificial' water bodies for dogs**, with a mix of experiences reported. Some had found it to be effective, especially when the waterbody was well positioned close to a main path or signposted. However, others had found that despite providing a dedicated waterbody, other ponds and waterbodies on site continued to be used, so there was no benefit. Some suggested that an alternative water body is best located off-site, for example at a nearby SANG, which can be promoted to visitors whose dogs like to go in the water.

4.42 Relatively few respondents had experience of **providing dog facilities**, such as dog washing stations, and, of those that did, some were wary about consequently encouraging more dog walkers to visit their site. Others had, however, found it a useful way of promoting responsible dog walking, for example through the display of educational videos at the dog washing station.

4.43 Relatively few respondents again had experience of providing **fenced areas for dogs**, but those that did scored it highly for effectiveness (median score: 8; range: 4 to 10). Respondents had found the provision of fenced training areas for dogs to be useful, especially if owners were required to keep their dog on a lead elsewhere on site. Nevertheless, many of the respondents with experience said that this sort of facility is not suitable in an ancient woodland setting and would be best sited elsewhere, for example at a SANG or in a forestry plantation.

4.44 A relatively large number of respondents to the online questionnaire had experience of deploying **dog bins**, with a median effectiveness score of 6 recorded for dog bins and poo bags combined. Responses were similar to the earlier question regarding litter bins, with respondents stressing the importance of regular emptying and careful positioning of dog bins in order for them to be effective. Some respondents had found that despite providing dog bins, a lot of dog walkers were still not picking up. One commented that 'responsible owners will take it away, irresponsible ones will still litter'. There

is an additional issue of people using dog bins for general rubbish, meaning that they get full quickly.

4.45 Only a few respondents had experience of specifically providing **dog waste bags**, and they were unsure of their effectiveness as they felt that responsible dog owners will bring bags with them anyway, and there is a risk that people will take more than they need since they are free, leaving none for other people.

Further information on effectiveness: enforcement

4.46 While enforcement approaches can be effective at specific locations, there is also concern that they can be counterproductive, in terms of displacing users to other locations and antagonising visitors (Greer, Day and McCutcheon, 2017). In general, to be effective, any rules and regulations need to be clearly communicated to reach the right audiences, so that visitors are aware of them, the reasoning behind them, and any fines or penalties that may apply (Leung *et al.*, 2018). Clearly effectiveness will relate to how particular enforcement measures are applied as much as the statutory or regulatory instrument used. For example, the simple presence of a uniformed official will influence behaviour (Swearingen and Johnson, 1995), and this may be particularly effective when they have enforcement powers.

4.47 One study in the US compared blanket enforcement (a complete ban of campfires), restrictions to particular areas (i.e. partial), or no enforcement at all, and suggested that the partial approach was likely to be the most effective (Reid and Marion, 2004).

4.48 Only seven respondents to the online questionnaire had experience of using **PSPOs**, and none had experience of using Community Protection Notices. One respondent had a PSPO in place for lighting fires on their site and had found that the threat of a fine had considerably reduced the number of incidents. There is good evidence from Burnham Beeches (see separate boxed case study) that shows the effect of such orders on dog fouling and off lead/out of control dogs, as well as overall visitor numbers, at the site.

4.49 **Byelaws** received one of the lowest effectiveness scores from the 18 questionnaire respondents with experience of applying the measure (median score of 4.5). They were perceived by many respondents as being too expensive, difficult, and time consuming to successfully enforce, and they had only found them worthwhile in limited situations (e.g. dealing with

unauthorised encampments, 4x4 off-roading activities, or motorbike trespass, etc).

4.50 A sizeable proportion of respondents did however have experience of using **permits** in access management, and the measure scored relatively highly for effectiveness (median score of 6.5). Several respondents reported success with implementing permit systems for specific activities such as horse riding, bird ringing, scientific research, angling, and sponsored events. This had enabled them to stipulate conditions on the activities undertaken, and to control the number of people taking part and the areas of the site that they could access for the activity in question.

Public Spaces Protection Orders (PSPOs) at Burnham Beeches (Buckinghamshire)

In 2014, following extensive consultation, Dog Control Orders (DCOs) – which later became PSPOs when the legislation changed - were established by the City of London Corporation at Burnham Beeches. The orders were in response to growing concerns about dogs (e.g. in relation to dog fouling and incidents with dogs not being under control). Other interventions for example voluntary code of conduct and signage had not worked to address the issues and an observational study had shown that less than half of dog walkers picked up after their pet.

The PSPOs include 5 schedules, with Schedules 2 and 3 applying to roughly equal parts of the site:

- **Schedule 1** – fouling by dogs: dog faeces must be picked up at all times.
- **Schedule 2** – dogs on leads: areas are designated where dogs must be kept on leads at all times.
- **Schedule 3** – dogs on leads by direction: areas are designated where dogs can run free but must be put on a lead if requested by Ranger.
- **Schedule 4** – dog exclusion zone: area designated where dogs are not allowed (this is only around the café serving area).
- **Schedule 5** – maximum number of dogs: no more than four dogs can be walked at Burnham Beeches by one person at any time.

A breach of any schedule can result in an on-the-spot fixed penalty notice. Very few of these have been issued however, with all relating to persistent breaches. The introduction of the DCOs received much opposition from dog walkers and dog walking groups, with Schedules 2 and 3 proving particularly contentious. With time the approach has generally become accepted however, and it is clearly communicated to all visitors on the site website, leaflets, interpretation, and at the visitor centre.

Dog numbers reduced following the introduction of DCOs, from approximately 500 dog visits per day to 400 (Wheater 2021); a drop of around 20%. However, while overall visitor numbers dropped initially, they quickly recovered. Data collected at the site (2015-2022) showed that many more dogs were walked in the 'dogs off-lead' area, thereby focussing use in one location. Within the 'dogs on leads' area (Schedule 2) 75% of dogs were on lead, with the proportion barely changing following the introduction of the DCOs. Within the dogs off-lead area 28% of dogs were observed on lead.

Further information is available on the City of London website: https://www.cityoflondon.gov.uk/things-to-do/green-spaces/burnham-beeches-and-stoke-common/public-spaces-protection-orders

Further information on effectiveness: engagement and information provision

4.51 There is recognition that public engagement is a required part of the modern woodland managers toolkit (see for example Jones and Rotherham, 2012). There is also a large body of literature and research on how best to influence behaviour. Much of this information relates to communication and engagement. Many problematic behaviours (e.g. those that might damage a site) result from a lack of awareness (Ham *et al.*, 2009). Pivotal to influencing such behaviour is a good understanding of what visitors think about a given behaviour and what factors determine why people behave as they do. Comprehensive guidance on how to influence people visiting the outdoors, such as those by Ham (2009) and the behavioural insights team (Rare and The Behavioural Insights Team, 2019; Barker and Park, 2021), are common threads across many of the different approaches to engagement and are relevant to all.

4.52 **Staffed visitor centres** were identified as being an effective access management measure amongst respondents (median score of 8). They had found that such centres were effective at communicating messages regarding responsible access, as well as focussing visitor pressure within a specific area. The availability of staff meant that visitors could ask questions about the site and orientate themselves before exploring more widely and also showed that the site was cared for/managed.

4.53 Nevertheless, it was highlighted that the presence of staff was only a benefit if the centre was designed so that visitors and staff could interact freely (i.e. not partitioned). Some respondents also commented that regular visitors were unlikely to go into a visitor centre unless it offered other facilities, such as a café, and one respondent was worried that the presence of a visitor centre would increase overall footfall on site.

4.54 A large number of respondents (59) had experience of **face-to-face engagement**, and it was one of the most highly rated interventions (median score: 8; range: 3 to 10). The majority of respondents were extremely positive about its use, and many stated that, although potentially expensive and time consuming, it was the best way to engage with visitors and influence their behaviour. It was also highlighted that a large number of other measures would prove unsuccessful without on-site rangers/wardens. These views tend to match the literature which, where such studies have

been undertaken, tends to show the physical presence of rangers as an effective means to influence visitor behaviour (Swearingen and Johnson, 1995; Medeiros *et al.*, 2007; Saunders and Liley, 2022). Rangers that are local to an area may be particularly effective at engaging with the local community (Parker *et al.*, 2022).

4.55 There was recognition from respondents that not everyone possesses effective communication and engagement skills, and there was a suggestion from some respondents that a high level of ranger presence was required for effective engagement to occur. Furthermore, some stated that there was a propensity for many visitors to revert to previous behaviours post-engagement, and that staff needed to be prepared to deal with conflict and occasionally aggressive behaviour. There is little information in the literature to guide how much ranger time is necessary to influence visitor behaviour, and this could vary between sites.

4.56 As a guide, data from the Solent coast (where a mitigation ranger team has been long established) indicates rangers can speak to around 5-7 groups per hour on-site, depending on how busy the location is (Liley *et al.*, 2023). Dhanjal-Adams *et al.* (2016) highlight that the choice of patrol frequency and location is challenging. They suggest that where successive interactions with the same visitors lead to an exponential benefit then the greatest effect can be achieved by patrolling a large number of sites a small number of times (i.e. spreading ranger time widely across locations). If, however, the effect of speaking to a ranger has an incremental benefit and the relationship is linear, it is better to focus ranger time on a smaller number of sites and visit more frequently.

4.57 Approximately a third of respondents had experience of running **targeted campaigns**, although the reported effectiveness of the measure varied widely (median score: 6; range: 0 to 10). Several respondents had run social media campaigns, but most found it difficult to quantify the effect that it had had on visitor behaviour. Nevertheless, some respondents had experienced an increase in the reporting of issues or unwanted behaviours from members of the public following campaigns.

4.58 Specific recommendations included using resources (such as the Countryside Code) to reinforce local campaigns, the use of a more joined up approach to campaigns involving local councils and other NGOs, etc., and the maintenance of clear messaging and branding throughout. There was also recognition, however, that social media campaigns, in particular, could be

time consuming, with some respondents indicating that much of the work was unfunded and completed outside of work hours. Furthermore, many respondents expressed concerns that online campaigns largely targeted an existing following who were more likely to already be aware/on board with on-site conservation measures.

4.59 Baynham-Herd et al. (2022) suggest the use of social media campaigns to be effective for wider social identity campaigns – such as around littering where non-compliance is common, easily observable (e.g. seeing where others have littered) and hard to enforce. Threats and fear are therefore likely to be less effective than appeals to social identity. Timing is also likely to be important, for example Baynham-Herd et al. (2022) also recommend social media based awareness campaigns around preventing fires – such campaigns would be best in seasonal windows and be highly targeted towards those more likely to visit green spaces.

4.60 There was a wide mix of views in the online questionnaire with respect to the effectiveness of (mainly online) **pre-visit information**, with many respondents suggesting that visitors do not read the relevant information prior to visiting. Many were unsure how to measure its specific effectiveness other than by the number of website 'hits'.

4.61 Respondents found engaging with local communities **through face-to-face events** an effective way of reaching new audiences and gaining local support. Some had also run events in partnership with other community organisations (e.g. traditional fêtes or guided walks). There was however a suggestion from some that engagement at such events was more likely from those 'already on board' and that there was also scope for occasional aggressive encounters.

4.62 **Running events on site** was scored relatively highly for effectiveness in the online questionnaire (median score of 7), with a relatively wide level of experience amongst respondents. Several respondents had run events such as guided walks, courses, forest bathing, or pop-up outreach events and had found them an effective way of communicating directly with site users and building a relationship with them. However, many felt that these types of events only attract those who are already interested and want to learn and tend to be avoided by those exhibiting repeated unwanted behaviours (e.g. irresponsible dog owners), so the impact on reducing such behaviours is often limited.

4.63 There was a wide level of experience of providing **educational visits** and the measure scored highly for effectiveness (median score of 7). This was done through school visits, assemblies, Forest School, and guided walks for Guide and Scout groups. Respondents found this type of outreach most effective when there was regular engagement, rather than just one-off events. There is evidence that children can convey environmental messages to adults, for example through education work with children then influencing those children's parents (Rare and The Behavioural Insights Team, 2019).

4.64 Only 6 questionnaire respondents had experience of producing **developer packs for new residents**, and all were unsure as to how effective they were (median score of 6). Several respondents without direct experience of the measure furthermore expressed an interest in its use and/or suggested that their use had potential to be beneficial. Such packs are provided only to new occupants when they purchase a property and there is no evidence to show they might be retained by owners. There are examples of planning appeals where these packs have not been accepted as effective mitigation for recreation impacts to a woodland SAC[10].

4.65 A small number of questionnaire respondents had experience of **engaging with users of geocaching apps**, with varying degrees of success (median effectiveness score 6.5), whilst some respondents had used such apps themselves. Whilst some had established a positive relationship whereby geocache locations on their site are agreed in advance, other respondents had found that users continue to put them in inappropriate places, sometimes off paths, or in areas where forestry operations were taking place. Some also raised concerns that some apps depicted unsuitable routes, used inaccurate mapping, and/or encouraged people to go off paths.

4.66 The Countryside Code is the national **code of conduct** for recreational access and much work has been undertaken on how to promote the messages within the code (see Baynham-Herd *et al.*, 2022). A sizeable proportion of respondents had experience of using codes of conduct, although the overall effectiveness of the measure was assessed as being somewhat low (median score of 5). Several respondents who had no current experience were also in the process of producing a code of conduct. Respondents had found the measure to work most effectively when

[10] E.g. Appeal Ref: APP/B1605/W/22/3310113; Lilley Brook House, Cheltenham https://democracy.cheltenham.gov.uk/documents/s43914/Appeal%20Decision%203310113%20Lilly%20Brook%20House.pdf

focussed upon a specific user group (e.g. horse riders, mountain bikers, etc.), and when produced in collaboration with such visitors. Nevertheless, the deployment of signage displaying codes of conduct without any associated, direct, engagement with visitors was not generally found to be effective, with signs either ignored or vandalised. Several respondents also stated that codes of conduct were often ignored by a proportion of visitors or specific user groups (e.g. professional dog walkers), either from the outset or after a grace period following their roll out.

4.67 Approximately a third of respondents had experience of **direct engagement with user groups**, and the measure scored averagely for effectiveness (median score of 6). Such engagement had been used by some respondents to increase support for their work. For example, one respondent had provided opportunities for community groups, local businesses and site visitors to help with tasks such as invasive species clearance and trail maintenance, and this had been extremely successful in creating a sense of stewardship amongst participants.

4.68 **Leaflets/flyers** had been widely used by respondents but were perceived as being less effective than many other measures (median score of 5) – particularly face-to-face engagement. There was a recommendation for the use of an engaging design, with clear messaging to explain (e.g.) the reasons why specific actions were being taken on site or why certain behaviours were being requested. It was also highlighted that leaflets should be made available at focal points on site, as well as at off-site hubs frequented by key user groups (e.g. nearby cafés or garden centres).

Visitor engagement at Great Wood (Borrowdale, Cumbria)

Great Wood is one of several ancient and semi-natural woodland blocks that comprise the Borrowdale Woodland Complex Special Area of Conservation and Borrowdale Rainforest National Nature Reserve (managed by the National Trust). Borrowdale incorporates the most extensive and structurally diverse blocks of western old sessile oak woods in northern England which are particularly rich in mosses/lower plants and lichens.

The area has a varied topography, with viewpoints at higher elevations providing extensive views over the surrounding landscape and Derwentwater. It comprises an incredibly popular destination used for a wide range of activities, including hill walking, climbing, and ghyll scrambling, alongside more casual leisure visits.

Figure 15: A mobile/pop-up visitor engagement point in Great Wood car park, alongside detail from the National Trust information board and examples of path surfacing (on varying topography) on the route up to Walla Crag.

A small, metered, car park is located within Great Wood, which also incorporates an information board and map of the surrounding area. These information sources are however regularly supplemented by a mobile/pop-up visitor engagement point, hosted by a member of the National Trust Welcome Team. The Welcome Team member stations themselves in the car park, alongside their branded vehicle and sandwich boards bearing additional information and welcomes visitors to the location. One of their main roles is to understand visitor expectations with respect to their planned walks (e.g. the distances involved, path surfacing, gradient, etc.) and to then suggest appropriate routes and highlight their location on a map.

The path network has received a high level of investment (in terms of surfacing and edging) due to the varying topography and abundant rainfall, and limited evidence of off-path erosion was noted during a site visit undertaken in January 2025. The path from the car park up towards Walla Crag is cobbled to prevent erosion, but is still maintained as “rugged” path, whereas the main routes below the crag have a more gravelled surfaced. The latter provides visitors with a relatively level and dry route, meaning that most visitors normally stay on the defined path. Other Public Rights of Way are kept open but are neither surfaced nor signposted.

The one-to-one engagement carried out at the Great Wood can therefore reinforce messaging found on the static information board, advise visitors about path surfacing, topography, and route lengths, and help ensure that visitors do not leave the main path to look for an alternative route once underway. They are also able to provide information concerning alternative parking, if needed, helping ensure that cars are not left on woodland margins. The mobile nature of the pop-up engagement point additionally means that the Welcome Team can easily move between other woodland blocks within the Borrowdale complex as required.

Further information on effectiveness: reducing fire risk

4.69 Wildfire policy and management of wildfires has evolved in recent years (Gazzard, McMorrow and Aylen, 2016), in response to the increasing incidence of wildfires and climate change. Better data on fire incidence and increased awareness have led to organisations such as the Forestry Commission pioneering good practice in adaptive land management to build fire resilience (see Gazzard, McMorrow and Aylen, 2016; Belcher *et al.*, 2021 for review and discussion).

4.70 A small number of respondents had experience of providing **dedicated areas for BBQs**, but they indicated that the measure could be particularly effective (median score of 8). Some respondents had found them to work well and said that it had reduced usage of disposable BBQs. Another respondent provided fixed location firepits at their woodland campsite, which they found to be better than non-fixed ones that were moved about., and at another site they had inserted a metal plate into their picnic tables so that they wouldn't be damaged by disposable BBQs. Doick *et al.* (2013) found that the design of BBQ areas influenced their popularity with visitors.

4.71 Only 5 respondents had experience of **limiting the sale of disposable BBQs** and the measure scored highly in effectiveness (median score of 8). Some respondents were working, or had worked, with local retailers to limit the sale of disposable BBQs, although some supermarkets were unable to support the move due to stocking decisions made at a national level.

4.72 Relatively few respondents had experience of **providing fire-fighting equipment on site**, and the measure received the lowest effectiveness score (median score of 4). A number of respondents had deployed beaters and/or fire extinguishers within their woodlands, but several suggested that the public would not know how to use them. A risk of vandalism was also identified by a few respondents. Some respondents who had previously deployed such equipment had since removed it (one on the advice of the local fire and rescue service), since it could put members of the public in danger by encouraging them to tackle a fire without appropriate training. As an alternative, some respondents had provided relevant staff with equipment (e.g. bowsers, beaters, etc.) and training.

4.73 A moderate proportion of respondents had experience of **using ranger presence to reduce the risk of fire**, and the measure scored relatively highly for effectiveness (median score of 7). There was recognition that

ranger presence could provide an extremely effective engagement and educational tool when it came to fire prevention and control. Some respondents had rangers on site to patrol and check for fires, including speaking to visitors with BBQs or campfires, and others suggested that such rangers often know which parts of the site are likely to be busiest or more at risk.

4.74 A similar number of respondents with experience of ranger deployment had experience of **the use of fire management plans**, and the latter measure scored similarly for effectiveness (median score of 6). The creation of fire management plans was almost exclusively seen as a useful exercise, although its relevance to access management and changing visitor behaviours was questioned by some. Nonetheless, there is growing awareness and understanding of how to reduce fire risk and the potential for fires to spread by managing vegetation to reduce fuel loads, create breaks in habitat etc (see Belcher *et al.*, 2021 for review).

Further information on effectiveness: travel-related measures

4.75 At many large woodland sites, the location and design of car parks dates back decades and were not necessarily designed to accommodate current recreation use. For example, images from the New Forest in the early 1970s show cars parked on lawns and amongst trees at random (see New Forest Joint Steering Committee, 1971 for details). Concern at the time regarding the lack of restrictions on camping and vehicular access led to extensive recreation management proposals and the provision of dedicated car parks, campsites, and restrictions on where people could drive. The network and distribution of car parks established at that time has changed relatively little since.

4.76 A moderate number of respondents to the online questionnaire had experience of **closing car parks**, and the measure scored relatively highly for effectiveness (median score of 6.5). Temporary or permanent car park closures had been implemented by some respondents, for example seasonal car park closures in the New Forest to reduce disturbance to ground nesting birds. There was however widespread concern about displacing parking into surrounding areas, and some respondents had experienced increases in verge parking, or vehicles blocking driveways, after car park closure.

4.77 A similar level of experience and effectiveness were reported for **shifting or reducing parking capacity** as for the closure of car parks (median

effectiveness score of 6.5). Respondents had experience of charging for parking and/or moving car parks in order to improve visibility/safety, or to influence visitor movements. As with the previous measure, several respondents identified the need to identify potential displacement locations prior to reducing capacity. Studies have shown that the institution of charging can have only a temporary effect upon site use, whilst reductions in capacity can induce longer-term changes in on-site parking distribution (see for example Beunen, Jaarsma and Regnerus, 2006).

4.78 Only 4 respondents had experience of **providing public transport options** and suggested that it had an average level of effectiveness (median score of 5). Public transport options, in the form of trains or buses, were available at (or near to) some of the respondents' sites, but the reported take-up was mixed. Some stated that the bus service was popular, but not regular enough, while another indicated that although there were bus stops close to their sites, few visitors used them. There was also support from several respondents who lacked direct experience of applying this measure, although there was a suggestion that it would be impractical for smaller/more remote sites and would benefit from Government funding/subsidies of rural transport networks.

4.79 A similar level of experience and effectiveness were reported for **parking charges** as for the closure of car parks and reducing or shifting parking capacity (median effectiveness score of 6). There was concern from some that, even if people pay, they may not change their behaviours. Nevertheless, some respondents had found that introducing parking charges had resulted in an increase in car sharing or had changed the areas that visitors go to. However, one respondent found that only 20% of visitors were actually paying, as the parking charges were not enforced.

4.80 There is little evidence in the literature to indicate parking charges reduce visitor numbers, and the opposite may well be the case (Weitowitz *et al.*, 2019), with numbers even tending to be higher at locations that charge. A study from the Netherlands found that during the first year following the introduction of parking charges there was an initial decrease (10%) of cars, but subsequently use increased again (Beunen, Jaarsma and Regnerus, 2006).

4.81 At Burnham Beeches, the City of London Corporation initially tried voluntary parking charges and after a year the donations averaged only 2p per vehicle. In 2011, charging was required for weekends and bank holidays only and

following this visitor numbers dropped by around 20%, but had recovered to 2011 levels by 2016 (Wheater and Cook, 2016). Charging was extended to cover all days of the week in 2020, and the number of vehicles did drop subsequently. However, there was little change in the numbers of visitors, suggesting that parking charges had influenced people's behaviour and choices around whether to drive and where they parked.

Further information on effectiveness: tree protection

4.82 A moderate number of respondents to the online questionnaire had experience of using **fencing to protect individual trees**, and its overall effectiveness was scored highly (median score of 8). Fencing around individual trees was generally found to be very effective at reducing trampling, soil compaction, and damage to tree roots. Some respondents indicated that fence installation could, however, be expensive, potentially had associated H&S concerns, and could act to increase interest in the tree amongst visitors. Interpretation can therefore be included alongside/as part of such fencing to ensure that visitors can engage with the reasons behind the fencing installation (see (e.g.) Figure 8a).

4.83 A moderate number of respondents to the online questionnaire had experience of using **dead hedging to protect individual trees**, and its overall effectiveness again scored relatively highly (median score of 7). Dead hedging was found to be effective by the majority of respondents, particularly the use of thorny materials such as Bramble cuttings. It was identified as being less expensive or visually intrusive as fencing, and also able to provide habitat for wildlife. One respondent suggested that dead hedging was often easy to push through if the visitor wished to do so, however, and that some activity types (e.g. wild campers) may remove dead hedging for other uses. As with fencing, interpretative signage may also be deployed to assist in engagement and understanding (see Section 4.82).

4.84 Only 3 respondents had experience of applying **soil aeration**, but it scored highly for effectiveness (median score of 8). One of these respondents suggested that mulching is their preferred management option however, and this view was widely shared amongst those respondents without experience of the technique. It should be noted that the use of soil aeration with respect to ancient or veteran trees has been questioned due to the potential for damaging newly formed roots and mycorrhizae, and impacts upon soil drainage (Fay and Bengtsson, 2011).

4.85 A moderate number of respondents had experience of using **mulching around tree bases**, and its overall effectiveness was scored moderately (median score of 6). It was generally considered by respondents to be beneficial for a tree's health, and this is supported in the literature (Fay and Bengtsson, 2011), although evidence for a beneficial effect upon ancient trees is sparse (Lonsdale, 2013). There were mixed views on whether mulching would deter visitors from approaching the tree, however, with several respondents suggesting that it would encourage access and trampling, and potentially dog fouling. See the boxed case study from Hatfield Forest for more information.

Experimental soil improvement at Hatfield Forest (Essex)

Hatfield Forest is an approximately 400ha area of ancient woodland in Essex, owned and managed by the National Trust. It is both a Site of Special Scientific Interest and a National Nature Reserve, located close to several large towns, and receives a high number of visitors across the year. The site can receive 10,000 visitors daily during the summer months, and much of its path network is therefore subject to a high level of footfall, historically resulting in extensive trampling and associated soil compaction.

Figure 16: Eroded and compacted rides within Hatfield Forest (Essex) taken in 2022, provided as illustrative examples (note that these do not necessarily comprise the rides used in the case study experiments).

Percival et al. (2023) undertook experimental research into two methods (namely, air spading and vertical mulching) that could potentially be used to address the decompaction of soils within Hatfield Forest over a 5-year period (2017 to 2021). These methods were applied both individually, and in combination with woodchip mulching and biochar application, within experimental plots across the site's path network. The effects of these treatments upon a variety of soil quality metrics were then assessed across the study period.

A combination of air spading, biochar application, and mulch was found to be the most effective treatment for improving soil quality and assisting decompaction but was also the costliest in terms of time and money. Air spading in isolation also worked reasonably well but again benefited from the application of mulch. Woodchip mulching was the most effective of the singly applied treatments, however, and also the most cost-effective method overall. The research ultimately showed that a range of methods are available to combat the effects of trampling upon woodland soils that can be tailored to suit available funding.

Further information on effectiveness: other measures

4.86 Only a small number of respondents had experience of deploying **boot washing facilities** and the measure scored averagely overall for effectiveness (median score of 5). Whilst respondents were supportive of biosecurity measures in general, they were unsure as to how effective boot washing facilities were and how they would be used in practice, with several suggesting that uptake of such facilities by visitors would be extremely low.

4.87 Only a small number of respondents in the questionnaire had experience of **zoning**, and the measure scored relatively highly for effectiveness (median score of 7). One respondent had used zoning to set out different levels of access e.g. 'wildlife only', dogs on leads, no dogs, no cycling, etc. Another had used zoning in their management plan, but it was too soon to tell how effective it had been. Others had only used zoning for health and safety reasons e.g. tree safety assessments.

4.88 A relatively large proportion of respondents to the online questionnaire had experience of creating **'wildlife only' areas** and they scored highly for effectiveness (median score of 8). Such areas were created for a variety of reasons: to prevent damage or disturbance from visitors, to protect coppice coups from deer, or for safety reasons such as areas of Ash Dieback. Such access areas were generally considered to be effective by respondents, as long as there was a physical barrier in place (such as fencing or dead hedging) to stop people (and dogs) from entering.

4.89 A relatively large proportion of respondents had experience of using **public art** and the measure scored relatively highly for effectiveness (median score of 7). Respondents had found art or sculpture installations to be well received by visitors, provoking interest and enjoyment, and a sense that the site is well managed, cared for, and invested in. Respondents also found it an effective way of directing visitors onto a particular route away from sensitive areas and an opportunity to work with local artists. There was also recognition that the installation of public art could increase the level of footfall on site, and that it was often difficult to measure the impact of art installation or link it directly to observed behaviour changes amongst visitors.

Other suggestions

4.90 Other suggestions made by respondents for managing the impacts of access within ancient woodlands included:

- Maintaining clear vistas to create a feeling of safety;
- Repairing any on-site damage as quickly as possible to show that the site is well managed;
- Installing fake CCTV cameras to deter anti-social behaviour and social pressures such as fly tipping; and,
- Planting new woodlands elsewhere to take some of the pressure off existing ancient woodland sites.

Summary

4.91 We have summarised the results from the online questionnaire and case studies presented above, informed by the associated information gleaned from the relevant peer-reviewed and grey literature, within Table 9. The table comprises a simplified reference of use to ancient woodland managers when assessing which measures may be most relevant, effective, and affordable prior to implementing novel access management on their site.

4.92 The table identifies the main impact pathways that each of the measures addresses, as well as each measure's relevance to some of the key activities undertaken by site visitors. The latter have been selected based upon both the frequency with which they occur at a national level and the potential scope for negative impacts arising from their on-site activities. The table also identifies whether the duration of a particular measure is more likely to be either short or long term (or equally either), as well as providing an indication of the cost of the intervention. The latter will vary from site to site for the majority of measures, so broad cost categories have been identified only.

Table 9: Summary of intervention measures, including relevant impacts, activity types, duration, and cost, as well as ease of implementation and median effectiveness score from the online questionnaire. Single ticks (and paler coloured shading) indicate relevance, with double ticks (and darker coloured shading) indicating those of most relevance and ticks within parentheses (unshaded) indicating potential relevance. Costs are categorised along a continuum of low (£), medium (££), and high (£££), and ease of implementation is categorised as easy, moderate, or difficult and coloured using a traffic light system (green, amber, red). The highest median effectiveness score across all measures is indicated in bold and italicised, and the lowest median score is underlined. Additional information is provided as relevant. Those measures identified with asterisks are further highlighted as being potentially most achievable and cost-effective for small woodland owners/managers due to their lower cost and relative ease of implementation at smaller scales.

Measure	Relevant impact					Activity type				Duration		Cost	Ease of implementation	Median effectiveness score from questionnaire	Additional information
	Damage	Contamination	Fire	Disturbance	Other	Dog walkers	Cyclists	Families	Anti-social behaviour	Long-term	Temporary/ adaptive				
Access infrastructure															
Interpretation panels*	✓	✓	✓	✓	✓	✓	✓	✓✓	(✓)	✓	✓	£ - ££	Easy	5	May be more relevant for new / first time visitors. There is evidence for a low level of awareness among recreational users of their potential impacts on wildlife (Gruas, Perrin-Malaterre and Loison, 2020; Barker and Park, 2021).
Path improvements	✓✓	✓		✓	✓	✓	✓	✓		✓		££ - £££	Mod	8	Improvements can include drainage as well as surfacing. Surfacing can be damaging for species and ground and therefore needs to be carefully considered.
Creation of new routes	✓✓	✓		✓	✓	✓	✓	✓		✓	✓	££ - £££	Mod	7	
Barriers / access points for vehicles	✓✓	✓		✓	✓	✓	✓	✓	✓✓	✓	✓	££	Mod	7	Barriers can both exclude specific type of visitors (e.g. height restrictions for camper vans), whilst gates/barriers can reduce overall visitor numbers.

Measure	Relevant impact					Activity type				Duration		Cost	Ease of implementation	Median effectiveness score from questionnaire	Additional information
	Damage	Contamination	Fire	Disturbance	Other	Dog walkers	Cyclists	Families	Anti-social behaviour	Long-term	Temporary/ adaptive				
Screening*				✓✓		✓	✓	✓	✓	✓	✓	£	Easy	7	
Additional (alternative) greenspace	✓✓	✓✓	✓	✓✓	✓	✓✓	✓	✓		✓		£££	Diff	8	Need for careful selection of sites to ensure work as alternative draw
Temporary path closure*	✓✓	✓		✓✓	✓	✓	✓	✓	✓		✓	£	Easy	5	
Path edging	✓	✓			✓	✓	✓	✓		✓	✓	£ - ££	Easy	7	Drainage needs to be considered, with path edging unlikely to work on sites with poor drainage
Dedicated viewpoints	✓			✓	✓	✓	✓	✓		✓	✓	£ - ££	Mod	7	
Toilet provision	✓	✓✓		✓		✓	✓	✓	(✓)	✓	✓	£ - ££	Easy	8	May help to draw visitors to particular locations. May also help reduce contamination. Can be seasonal (e.g. portaloos in overflow car parks).
Unstaffed visitor centre / information point	✓	✓	✓	✓	✓	✓	✓	✓		✓	(✓)	£ - £££	Mod	8	May help to draw people, provides focal point for engagement etc
Signage*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	£ - ££	Easy	5	Can be temporary or permanent. Also includes way marking.
Dedicated / promoted trail*	✓✓	✓		✓✓	✓	✓	✓✓	✓	(✓)	✓	✓	£	Easy	7	

Measure	Relevant impact					Activity type				Duration		Cost	Ease of implementation	Median effectiveness score from questionnaire	Additional information
	Damage	Contamination	Fire	Disturbance	Other	Dog walkers	Cyclists	Families	Anti-social behaviour	Long-term	Temporary/ adaptive				
Litter bins for rubbish	✓	✓✓	✓		✓	✓	✓	✓✓	✓	✓	✓	£ - ££	Easy	5	Site manager will also need to invest in regular emptying
Fence off water bodies	✓✓	✓✓		✓		✓✓		✓	✓	✓	✓	£ - ££	Mod	7	Can include barriers in the water to contain access within part of the water body or provide controlled entry point with infrastructure to prevent bank erosion.
Provision of dedicated water bodies for dogs	✓✓	✓✓		✓		✓				✓		£	Mod	7	
Provision of dog facilities (e.g. dog washing)		✓				✓				✓		£ - ££	Mod	5.5	May help soften other measures if there are dedicated facilities and places for dog walkers
Fenced areas for dogs	✓	✓✓		✓✓		✓✓				✓		£ - ££	Mod	8	
Provision of poo bags and dog bins		✓✓			✓	✓✓				✓		£ - ££	Easy	6	
Enforcement															
Public spaces protection orders	✓	✓	✓	✓	✓	✓	(✓)		✓✓	✓	✓	£	Mod	5	Difficult to enforce and may need dedicated enforcement to avoid hostility towards local conservation staff or rangers.

Measure	Relevant impact					Activity type				Duration		Cost	Ease of implementation	Median effectiveness score from questionnaire	Additional information
	Damage	Contamination	Fire	Disturbance	Other	Dog walkers	Cyclists	Families	Anti-social behaviour	Long-term	Temporary/ adaptive				
Community Protection Notices	✓	✓	✓	✓	✓	✓	(✓)	(✓)	✓✓		✓	£	Diff	N/A	Difficult to enforce and may need dedicated enforcement to avoid hostility towards local conservation staff or rangers.
Byelaws	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		£	Diff	4.5	Difficult to enforce and may need dedicated enforcement to avoid hostility towards local conservation staff or rangers.
Permits for certain activities	✓	✓	✓	✓	✓	✓✓	✓✓	✓	(✓)	✓	✓	£	Mod	6.5	Potential for permits to provide perks such as restricted access to encourage people to apply.
Engagement and information provision															
Staffed visitor centres	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓	✓	✓	✓		£££	Diff	8	Can influence where people go, what they do and how they behave as well as raise awareness.
Face-face engagement (rangers / ambassadors)	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓	£ - £££	Mod	8	Widely used as mitigation. Can be flexibly/seasonally deployed to areas where particular concerns.
Targeted campaigns on social media, internet, etc.	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	£ - ££	Easy	6	

Measure	Relevant impact					Activity type				Duration		Cost	Ease of implementation	Median effectiveness score from questionnaire	Additional information
	Damage	Contamination	Fire	Disturbance	Other	Dog walkers	Cyclists	Families	Anti-social behaviour	Long-term	Temporary/ adaptive				
Provision of site information for visitors regarding facilities and background to visiting*	✓	✓	✓	✓	✓	✓	✓	✓✓		✓	(✓)	£ - ££	Easy	6	Can influence where people go, what they do and how they behave as well as raise awareness. Can help publicise temporary routes and avoid people wanting to take routes that are closed. Potential to influence route promotion on websites/apps, such as Strava and Komoot.
Attendance at local community events*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	£	Easy	6	
Events on site*	✓	✓	✓	✓	✓	✓✓	✓	✓✓		(✓)	✓	£ - ££	Easy	7	
Educational visits*	✓	✓	✓	✓	✓			✓		✓		£	Easy	7	
Developer packs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		££	Mod	6	
User location-based and self-guiding apps	✓	(✓)		✓			✓	✓		✓	✓	£ - ££	Mod	6.5	Content can be varied through the year. Likely to be used more by casual/new visitors??
Codes of conduct	✓	✓	✓	✓	✓	✓✓	✓	✓	(✓)	✓		£ - ££	Mod	5	

Measure	Relevant impact					Activity type				Duration		Cost	Ease of implementation	Median effectiveness score from questionnaire	Additional information
	Damage	Contamination	Fire	Disturbance	Other	Dog walkers	Cyclists	Families	Anti-social behaviour	Long-term	Temporary/ adaptive				
Direct engagement with user groups, activity providers and those posting/hosting online	✓✓	✓✓	✓	✓✓	✓	✓	✓	✓	✓	✓	✓	£ - ££	Mod	6	Could target foragers, dog walking, tourist providers, stables, running groups, mountain biking groups etc., as well as accommodation and other visitor service providers (e.g.) cafes, bike repair shops, etc.
Leaflets/fliers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	(✓)	££	Easy	5	Can be left in a variety of locations / included with publication mail-outs, etc.
Reducing fire risk															
Provision of dedicated areas for BBQs		✓	✓✓		✓			✓✓	(✓)	✓		£ - ££	Easy	8	
Limiting sale of disposal BBQs in local shops			✓✓		✓			✓	(✓)	✓		£	Diff	8	Alternatively, could ensure guidance given out with any purchase.
Equipment available to fight fire effectively			✓✓		✓✓				✓	✓		£ - ££	Easy	4	
Ranger presence		✓✓	✓✓		✓✓			✓✓	✓✓	✓	✓	£ - £££	Easy	7	
Fire management plans		✓✓	✓✓		✓✓	✓	✓	✓	✓	✓		££	Mod	6	Risk of such areas encouraging BBQs in the countryside.

Measure	Relevant impact					Activity type				Duration		Cost	Ease of implementation	Median effectiveness score from questionnaire	Additional information
	Damage	Contamination	Fire	Disturbance	Other	Dog walkers	Cyclists	Families	Anti-social behaviour	Long-term	Temporary/ adaptive				
Travel-related															
Close car parks and physically stop parking in certain locations	✓✓	✓	(✓)	✓✓	✓	✓	✓	✓	✓✓	✓	✓	£ - £££	Diff	6.5	Needs to be thought out strategically, ideally as part of some kind of zoning study, and well communicated. Can be seasonal or permanent.
Reduce / shift parking capacity	✓✓	✓	(✓)	✓✓	✓	✓✓	✓	✓✓	✓	✓	✓	£ - £££	Mod	6.5	Needs to be thought out strategically, ideally as part of some kind of zoning study. Options to increase or decrease capacity (number of spaces) according to sensitivity of site. Can be seasonal or permanent.
Provision of public transport options	✓	✓		✓	✓	(✓)	(✓)	✓		✓		£ - ££	Diff	5	
Use parking charges to influence use	✓	✓		✓	✓	✓✓	✓	✓✓	✓	✓	✓	££ - £££	Mod	6	Needs to be thought out strategically, ideally as part of some kind of zoning study, and well communicated. Can be seasonal or permanent.
Tree protection															
Fencing around individual sensitive trees*	✓✓	✓		✓	✓	✓✓	✓	✓✓	✓	✓	✓	£ - ££	Easy	8	

Measure	Relevant impact					Activity type				Duration		Cost	Ease of implementation	Median effectiveness score from questionnaire	Additional information
	Damage	Contamination	Fire	Disturbance	Other	Dog walkers	Cyclists	Families	Anti-social behaviour	Long-term	Temporary/ adaptive				
Dead hedging around individual sensitive trees*	✓✓	✓		✓	✓	✓✓	✓	✓✓	✓	✓	✓	£ - ££	Easy	7	
Soil aeration to reduce compaction	✓					✓	✓	✓			✓	££	Mod	7	
Bark mulching*	✓✓			(✓)		✓	✓	✓		✓	✓	£ - ££	Easy	6	Mulch used in ancient woodlands should be sourced from trees on site to reduce the risk of spreading invasives or disease from off-site.
Boot washing facilities		✓				✓	✓	✓		✓	✓	£ - ££	Easy	5	Include messaging about arriving with clean footwear and avoiding bringing materials onto or removing them from the site.
Other measures															
Zoning	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓	✓		✓		£ - £££	Diff	7	
Creation of 'wildlife only' areas	✓	✓	✓	✓✓	✓✓	✓	✓	✓	✓	✓	✓	£ - £££	Mod	8	Can be temporary and also voluntary.
Public art	✓	(✓)		✓	✓	✓	✓	✓	✓	✓	✓	£ - £££	Mod	7	

5. Discussion and recommendations

Key findings

5.1 Access to the countryside is important for society and brings a range of benefits. However, recreation use also results in impacts to woodlands and these impacts can vary. There are a wide range of techniques and approaches used to manage access in woodlands, and these can be tailored to local circumstances and the particular features of concern. The questionnaire data presented in this report would suggest that the following measures are those for which there is the most confidence in their effectiveness:

- Limiting the sale of disposable BBQs;
- Providing fenced areas for dogs;
- Fencing around individual trees;
- Toilet provision;
- Face-to-face engagement;
- Creation of refuge areas;
- Path improvements,
- Staffed visitor centres;
- Additional (alternative) greenspace,
- Dedicated BBQ areas; and,
- Unstaffed visitor centres.

5.2 There was a wide range of scores given for each measure, suggesting that given measures work in some places/situations and not others, and no single measure was consistently scored highly. The fact that a given measure might work better in some places compared to others would suggest that success is perhaps also dependent on a range of factors, such as resources, the people involved, types of access, and the characteristics of the site. Furthermore, the options identified as the most effective did not necessarily reflect those most commonly deployed, which included signage and interpretation panels.

5.3 Clearly decisions made as to how to best manage access at a given site will depend on a range of factors and there is no single, one-size-fits-all, approach that can be recommended. A package of different measures that can be adapted and changed in response to monitoring is likely to be key. The list of measures in this report (see Table 9) should help site managers choose the most appropriate interventions. Few of these are ever deployed

or instigated in isolation and many will work synergistically. For example, face-to-face ranger presence can reinforce messaging on signage and also be conveyed through social media. Similarly, the redesign of a car park can work with the promotion of a particular route and path improvements, ensuring visitors leave the car park along a particular path.

Adaptive management

5.4 Visitor management approaches have tended to move away from a focus on a target level of access (i.e. a fixed notion of capacity) to instead identifying key metrics to monitor and targets to set for different areas or zones, based on clearly defined objectives. These objectives can relate to the impacts of recreation and vulnerability of the site.

5.5 For example, the Recreation Opportunity Spectrum (ROS) is a framework for identifying zones and then targeting management (of both the conservation interest and recreation) as appropriate to each zone and the social and resource conditions present (Stankey, 1998; Leung *et al.*, 2018). The Limits of Acceptable Change (LAC) (Stankey *et al.*, 1985) approach works through managers setting management actions to achieve or maintain particular conditions, linked to monitoring data. Managers have to identify where, and to what extent, varying degrees of change are appropriate and acceptable. ROS or LAC provide a framework whereby site managers can be clear of what needs to be monitored and what trigger might lead to particular interventions.

5.6 Such frameworks can be used to underpin site management plans or even specific visitor management plans. Having clarity on what the key concerns are from recreation and when particular steps are necessary avoids knee-jerk reactions and provides the opportunity to be clear to visitors as to why particular interventions are necessary.

Other pressures on woodlands including climate change

5.7 The role of monitoring and adaptive management is particularly relevant given the changes taking place in English woodlands. Access and recreation use is just one of a number of pressures on our woodlands; climate change (affecting species distributions and also resulting in more extreme weather events), disease (such as Ash Dieback) and changing deer numbers (Fuller and Gill, 2001; Dolman *et al.*, 2010; Newson *et al.*, 2012) are all also having a marked impact. Impacts from recreation may operate synergistically with

these other effects, for example, trampling from people along with dog fouling may affect soil health, which in turn may make trees more vulnerable to disease (as discussed in Appendix 1, para 6.14). These synergistic effects and scope for rapid changes highlight the importance of monitoring and management that can be flexible to change.

Dispersed or more focussed distributions

5.8 There are a range of studies that show where levels of use are low, small changes in access can result in marked trampling damage. However, on heavily used paths, similar levels of change in use may have limited impact (see Figure 17). The implication of this is that reducing use on well-established moderate- to high-use trails will result in a relatively small reduction in impact. By contrast, diverting use within low use areas, where impacts occur rapidly, can lead to substantial benefits. Hence management in moderate to high use areas is likely to be best targeted towards containment (i.e. focussing use around main car parks and down promoted routes) whereas in lower use areas there is merit in looking to disperse impacts or reduce footfall (spreading use by having multiple entry points, a wide range of paths, etc). The difficult decision at many sites where levels of use are increasing slowly over time, is when to make the switch from dispersed access to more contained access, and monitoring will be key to informing this.

Visitor management outside the woodland boundary

5.9 Recreation use of a woodland is unlikely to be constrained to the woodland boundary and at many sites visitor use will spread into the surrounding countryside, particularly if there are good opportunities to do so. For example, visitor survey results from the New Forest (Liley *et al.*, 2020) reflect visitor use from a large and extensive area of woodland and associated open habitats; the median route length for dog walkers was 2.8km, for runners it was 5.7km, and for off-road cyclists it was 13.7km. Such routes would take those groups of visitors around 922m, 1.6km, or 2.8km, respectively, from the starting point (e.g. car park) before they turned back.

5.10 Few woodland blocks, and particularly fragments of ancient woodland, will be able to fully accommodate such lengths without visitor routes extending into adjacent areas of the landscape. If access is constrained to those woodland blocks, it will mean that there is little scope to vary visitor levels, create zones within the site, or rest areas over time. However, if there is

scope for access to extend more widely, there is scope to either concentrate use and facilities outside the woodlands (such as is the case with the gateway visitor hubs approach used by the National Trust at Ashridge), to direct use around the outside of the woodland (such as at Wistman's Wood), or to enlarge the woodland (by planting new areas, such as at Heartwood Forest).

5.11 Clearly management plans and visitor management will therefore often benefit from being able to incorporate areas outside a woodland boundary and not be limited to specific patches of ancient woodland. Strategic approaches to access management, at a landscape level, are likely to be helpful, for example through the provision of SANG. These in turn may create wider benefits such as scope for tree planting in the vicinity of ancient woodlands.

Recommendations

5.12 We suggest the following as recommendations and general principles for managing access in ancient woodlands:

5.13 **Strategic principles**

- A wide range of impacts can occur, but these will vary between woodlands – it is essential to understand which are relevant to a given site and which pose the greatest risk;
- Using the review detailed in Section 2, and particularly the headings of damage, contamination, increased fire incidence, disturbance and 'other', provides a means to systematically identify all risks that might be relevant at a given woodland;
- Access is important and has a wide range of benefits. As such, any management of access within a woodland should seek to minimise the risks in as least a restrictive way as possible, with many interventions potentially serving to benefit the site's nature conservation interest as well as enhancing access;
- Monitoring is important, as access will change over time and the conditions/scale of impacts will also change. Management should therefore be adaptive and able to respond to change;
- Frameworks such as the Limits of Acceptable Change (LAC) and the Recreation Opportunity Spectrum (ROS) provide established means to establish adaptive management and link interventions to monitoring results; and,
- There may be opportunities to look beyond the woodland boundary, and any access management planning should ideally work at a landscape scale.

5.14 Recommendations around specific interventions

- Access infrastructure
    - Containing access/focussing use in particular areas or particular routes is likely to be most effective where levels of use are high – access infrastructure, such as the provision of parking, barriers, promoted routes, surfaced paths, etc. are likely to be the best ways to do this;
    - Where opportunities allow, infrastructure such as car parking, visitor centres, etc. are likely to be best located outside the woodland boundary; and,
    - Be aware that different user groups/activities may favour different types of (e.g.) path surfacing or layout – do not automatically adopt a 'one size fits all' approach.
- Enforcement
    - Enforcement measures (e.g. PSPOs or Community Protection Notices) may prove difficult to enforce without the use of dedicated officers separate to the ranger/conservation team; and,
    - The introduction of permit systems will likely require logistical and administrative support to function effectively.
- Engagement and information provision
    - Having someone present on site (face-to-face) is widely used and likely to be one of the most effective ways to engage with visitors – such engagement can be targeted to particular individuals and locations;
    - Recognise that the core skills required for effective engagement are not natural to everyone, and it is therefore important to identify team members who have them and/or provide suitable communication training;
    - In order to instigate behavioural change, there is a need to clearly define the problem behaviour and the factors that influence people to behave that way – this is the starting point to effective messaging;
    - It may be necessary to have specialist help with the design of signage, interpretation, and engagement material in order to convey messages effectively and influence visitors accordingly; and,
    - It is important to provide information to site users that conveys any proposed changes to access management on site, and access infrastructure in particular, well in advance of the event.
- Reducing fire risk
    - Ranger presence, alongside the designation of specific areas for BBQs (or outright bans), are likely to comprise the

most effective way of engaging with site users and policing the incidence of on-site fires;
    - The creation of a fire management plan is highly recommended for any site with public access, as it will allow co-ordination with the local fire service and (potentially) other landowners, ensuring that you are prepared in the event of a conflagration; and,
    - Any decision to provide fire-fighting equipment on site should be carefully thought through, and the fire service should always be contacted in the event of a fire.
- Travel-related
    - A certain level of opposition is to be expected with respect to any proposed changes to parking provision or cost. If possible, ensure that site users have been consulted on any such plans in advance of their roll out;
    - Carefully consider the potential for vehicle displacement following any closure or reduction in parking availability on site. Apply a holistic approach, where possible, to ensure that alternative (informal) parking locations are suitable and robust; and,
    - Dependent upon the fee collection method used (online payment, apps, parking meters, etc.) it may be necessary to target additional staff time for fee collection and/or enforcement if parking charges are introduced.
- Tree protection
    - For veteran trees, standard advice is for a root protection area 15x the diameter of the trunk at breast height or 5m beyond the crown whichever is the greater, this is a minimum and individual trees may need greater protection; and,
    - If dead hedging is to be used, consider the sustainability of harvesting suitable material on site to ensure that barriers can be maintained.
- Other
    - The application of a LAC or ROS approach will benefit from the inclusion of as wide a body of relevant stakeholders as possible; and,
    - Public art can be an inclusive and engaging way of managing access, but it is important to recognise that the presence of pieces within a woodland block does potentially also have potential to increase footfall.

5.15 The recommendations above are provided as guidance only because, as stated previously, the scale and frequency of specific impacts, the size and context of the woodland block, and any variation in management and/or

funding availability will mean that the measures implemented will often be site-specific. Nevertheless, it is hoped that this report will still provide a useful and timely reference for anyone managing access within England's ancient woodlands.

Knowledge gaps and future research

5.16 The research carried out during the production of this report has identified several key areas where our knowledge of recreation impacts and/or their management within ancient woodlands and/or woodlands in general is currently sparse. These areas are identified in the following bullets, alongside potential research methods that could be employed to target them (where relevant):

- The effects of soil compaction and nutrient enrichment on long term tree health;
- Dog fouling impacts on soil health;
- Contamination of waterbodies by dogs – more detail is needed on how many ponds are affected by pesticides, etc. and potential solutions require identification;
- Controlled, experimental, studies of the bird disturbance effects of dog walking in UK woodlands, testing the relative abundance and occurrence of birds in areas with no dogs, dogs on leads only, and dogs off lead;
- The prevalence and impact of fire within UK ancient woodlands;
- How to optimise face-to-face ranger deployment given staff-time costs;
- Strategic management of access – more case studies, and examples/trials of managing access at a landscape level are needed (for example via the use of "gateways");
- Wider applications and assessment of frameworks such as LAC or ROC within the UK;
- Use of big data sets, such as mobile phone data, to better understand levels of visitor use and their temporal/spatial distribution within UK woodlands; and,
- Identifying the relative vulnerability of UK woodlands to the cumulative impacts of access using GIS modelling – individual woodland areas may be potentially vulnerable to a different range of impacts (such as fire, disturbance, etc.) based upon the species and vegetation communities present within them. Overlaying such models with access infrastructure, and other relevant access layers, can help in identifying areas where cumulative risks are potentially high. This can then be used to identify specific locations/opportunities to target future support (e.g. through new

woodland planting, creation of additional access areas in less sensitive locations, support for visitor management, etc).

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Appendix 1: Review of nature conservation impacts of recreation in ancient woodlands

Introduction and scope

6.1 This appendix is a literature review that summarises the ways in which access can affect ancient woodland habitats, and the species present within them. With an understanding of the risks from recreation and specific types of impact it is possible to find positive solutions and identify circumstances where some kind of management or intervention might be necessary.

Source material for the review

6.2 There is an extensive body of literature on topics such as trampling damage and bird disturbance, and the wide range of woodland habitats and species found across England are vulnerable to recreation in different ways. Systematically compiling a complete database of relevant material for the review would therefore involve tens of thousands of references. Instead, our approach is to draw upon existing reviews, our own experience, and studies from individual woodland sites, to synthesise the issues and signpost the reader to relevant sources of further information. There is a wide body of work we can draw on, including:

- Existing reviews of recreation impacts to woodlands or the countryside (e.g. Anderson and Radford, 1992; Buckley, 2004; Corney *et al.*, 2008; Lowen *et al.*, 2008; Liley *et al.*, 2010, 2019; Marzano and Dandy, 2012; Ryan, 2012); and,
- Studies from particular sites, such as the New Forest (Lake, Liley and Saunders, 2020); Chilterns Beechwoods (Panter *et al.*, 2022); and Burnham Beeches (Liley *et al.*, 2022).

Types of recreation

6.3 We consider all types of general recreation activity related to the presence of people and their pets in the countryside in terms of their potential impact on wildlife. Relevant activities therefore include walking (with and without a dog), jogging, cycling, horse riding, wildlife watching, photography, etc. We do not include the impact of motor vehicles (i.e. impacts such as changes in air quality from increased traffic, damage to plants on road verges, direct damage from off-road vehicles such as illegal use of quadbikes, etc.), and we do not specifically include organised events (e.g. outdoor theatre, concerts, fairs, fireworks, etc).

Types of impact

6.4 We structure the review into five main sections, representing impact categories that have been used in other general reviews (e.g. Liley *et al.*, 2010) and that provide a useful way of breaking down the issues:

- **Damage**: encompassing trampling and vegetation wear, soil compaction, and erosion. Trampling can also cause direct mortality for some fauna (i.e. accidental trampling of invertebrates);
- **Contamination**: including nutrient enrichment (e.g. dog fouling), contamination of water bodies, litter and invasive species;
- **Disturbance**: relevant to fauna only, and relating to the avoidance of otherwise suitable habitat, direct flushing and direct mortality (e.g. dogs killing wildlife);
- **Fire**: increased incidence and risk of fire; and,
- **Other**: all other impacts, including foraging and activities associated with site management (e.g. the difficulties in achieving necessary grazing).

6.5 Recreation impacts upon heritage features are not included within the review; however, listed buildings, monuments and archaeological features may all be vulnerable. Similarly, impacts relating to the quality of experience or site infrastructure (such as car park wear and tear) are also outside the scope of the review.

Geographical scope, definition of ancient woodlands, and relevant habitats

6.6 We have limited the review to ancient woodlands in England, although we have drawn from examples and literature from other countries where relevant and applicable.

6.7 Ancient woodlands comprise areas that have been continuously wooded since c.1600. Such woodland can be identified through documentation, archaeology, structure, and/or vegetation (Rackham, 2006). Many ancient woodlands have been intensively used and managed, and even periodically felled over time. They can encompass a range of woodland habitats (see Lake *et al.*, 2020 for overview) and sizes and can be upland or lowland. We do not limit the review to any particular type of woodland.

Damage

6.8 Damage relates to the impacts of footfall, hooves, or wheels/tyres, and primarily upon vegetation and soils. Issues relate to vegetation wear, soil compaction and erosion (i.e. largely unintentional consequences from the

passage of people, pets and vehicles, although note that damage can be deliberate (for example vandalism, such as people carving names in trees or peeling bark). While the focus is on plants and soils, changes in habitat structure can also have consequences for a range of species, and trampling can result in direct mortality for some fauna.

Mechanisms

6.9 Liddle (1997) summarises the differences between different types of recreation in terms of the ground pressure and different forces involved. In general, for a given load the ground pressure is inversely related to the area in contact with the ground (Table 10). Trail bikes and horse riding both exert a particularly high level of pressure compared to other activities due to the small area of ground contact.

Table 10: Weights and ground pressure associated with different recreational activities (summarised from Liddle, 1997).

Activity	Average total weight (g)	Ground contact area (g/cm^2)	Pressure (g/cm^2)
Human bare foot	73,000	262	297
Human Vibram-soled boots on hard ground	73,000	406	180
Trail-bike	229,000	114	2,008
Horse (shod) and rider	613,000	140	4,380
Saloon car and driver	1,282,000	1,355	1,550

Effects on soils and habitats

6.10 There are many direct effects of human footfall within woodlands. Mechanical damage to plant tissue causes a loss of vegetation cover, changes in plant composition and loss of species, a reduction in the genetic diversity of clonal species (such as Bluebell and Wood Anemone *Anemonoides nemorosa*), and a reduction in plant height. Trampling can cause damage to root systems and increase water run-off, soil erosion, and compaction with consequences for decomposition and nutrient cycling. Compaction can also cause a reduction in organic matter, affecting fertility and the water infiltration capacity of the soil. Mycorrhizal fungi may also be affected by compaction, consequently affecting plant uptake of nutrients from the soil.

6.11 Other effects of human trampling include the widening of paths and path erosion, particularly on slopes. Ancient woodlands species are more effected than those within secondary woods, and more damage results from trampling during spring than later in the season (Burden and Randerson, 1972; Thomas, 1991).

6.12 The rate of reduction in plant cover that occurs as a result of wear typically shows a curved and non-linear relationship with the level of recreation use. There is usually a sharp decline in plant cover following initial trampling, as the most vulnerable vegetation is lost. As the amount of trampling increases the rate of change in vegetation cover then decreases (as much of the vegetation has already been removed), until finally no living vegetation remains. This relationship between impact and level of use is however different for different vegetation communities and is not always the same shape (see Cole, 1995; Liddle, 1997; Coombes, 2007).

6.13 There are also impacts on soil from trampling, including compaction which increases bulk density and decreases porosity, leading to a shortage of oxygen and changed water regime in the soil (Kozlowski, 1999; Kissling *et al.*, 2009). Trampling can also potentially result in changes to soil organic matter, pH and nutrient content (Liddle, 1997; Kissling *et al.*, 2009). Soil microbes may respond to these changes, potentially leading to changes in the production of soil enzymes responsible for nutrient cycling and the microbial biomass in the soil (Kissling *et al.*, 2009).

6.14 As a result there is strong evidence that access results in a different soil chemistry and soil structure and this has been clearly demonstrated in woodlands by comparing soils in areas with and without access (Özcan, GÖkbulak and Hizal, 2013). Impacts are likely to be focussed around paths, but may extend well beyond the trail network, for example decreased microbial biomass in the soil has been reported 20m from a path (Ballantyne and Pickering, 2015). These changes to the soil, alongside direct physical damage from feet (e.g. to roots) have the potential to affect tree health.

6.15 There is general evidence that trampling damage leads to a reduction in transpiration (Komatsu *et al.*, 2007), lower levels of mycorrhizae (Waltert *et al.*, 2002), impacts to foliage (Azlin and Philip, 2004), overall growth (Ciapała, Adamski and Zielonka, 2014; Matulewski, Buchwal and Makohonienko, 2019; Matulewski *et al.*, 2021), seedling establishment (Waltert *et al.*, 2002) and damage to roots (Pelfini and Santilli, 2006; Zingraff-Hamed *et al.*, 2022). The study by Ciapala *et al.* (2014), highlights that the levels of recreation use and

trampling intensity are discernible in the growth rings (measured from cores) back to the 1950s, when recreation levels changed markedly.

6.16 A number of studies have looked at the relative resistance to trampling and subsequent recovery of different species and types of plant. In a meta-analysis of a wider range of studies, Pescott & Stewart (2014) conclude that plant functional traits are more important than intensity of use, meaning that even relatively low intensity trampling could be as damaging as high intensity trampling in some plant communities. The most resistant plants are tufted or matted grass-like species, followed by rosette forming species and those with underground storage organs such as bulbs or rhizomes. The least resistant are erect broadleaved plants with their buds above the ground, including sub-shrubs (Pescott & Stewart 2014).

6.17 High levels of initial damage do not necessarily lead to long-term effects, however. Those vegetation types that were least able to tolerate a complete cycle of damage and recovery were those less able to recover during periods of reduced trampling pressure, rather than those that were damaged most initially (Cole, 1995; Littlemore and Barker, 2001). For example, woody sub-shrubs (chamaephytes) may die-back after showing initial high resistance. However, they may also show better recovery following a period without trampling, unlike other groups which may be more affected by other factors such as changes to soil characteristics. The effects of chronic trampling are not adequately covered by experimental work or a meta-analysis carried out by Pescott and Stewart (2014).

6.18 Overall, it appears that the creation of new paths and routes can be particularly damaging. Note that this analysis does not take into account the consequences of trampling for conservation (i.e. the rarity or declining status of individual species). Furthermore, wet woodland areas are more sensitive to trampling (although they can also recover more quickly than drier areas) (Roovers *et al.*, 2004).

6.19 Most trampling studies have looked at the effects of footfall on paths and trails, but off-path trampling can also be a problem (for example if visitors leave the path to look at wild flowers (Mason *et al.*, 2015). One study in Australia found evidence that plant community composition along the edges of wider, formal, trails (i.e. surfaced) was different to those alongside narrow, informal, trails (Pickering and Norman, 2017), although it was noted that resultant changes in microclimate and canopy cover could also be at play.

6.20 Another study from the Southern Hemisphere estimated the cumulative impacts to a protected area from a network of small, informal, trails (Barros and Pickering, 2017); within a 237ha study area it estimated that the total area of vegetation lost to trampling was 11.5ha and that 81% of randomly sampled plots showed signs of vegetation damage. This is one of the few studies to quantify the cumulative impacts of informal paths and desire lines at a near-landscape scale.

Impacts of damage for other species

6.21 Trampling can also cause direct mortality for invertebrates (Ciach *et al.*, 2017), reptiles (Edgar, 2002), and birds (Liley and Sutherland, 2007). Ciach's work on insects killed on hiking trails identified a diverse range of affected species, including a tiger beetle, wasps, ground beetles, flies, butterflies, a grasshopper, and a dragonfly. While many of the species were relatively common and the number killed relatively small, the list included some rarities, and it was inferred that trampling may have a negative impact upon the populations of some species.

6.22 Species impacts may also be indirect and as a consequence of damage to habitat structure. For example, soil compaction or repeated churning of substrates is likely to be damaging to some species of burrowing invertebrate. In the UK, a wide range of such invertebrate species are now very scarce and dependent on paths, tracks, and areas of bare ground. Access may therefore play a role, to some extent, in creating such habitats in the first place (although high levels of access and trampling may also be damaging).

6.23 Some woodland butterfly species, such as Duke of Burgundy *Hamearis lucina*, will be dependent upon a varied vegetation structure, which may be damaged by trampling. Other species, such as the Wood White *Leptidea sinapis*, may also have areas of suitable larval habitat restricted to narrow strips along rides or woodland edges. Saproxylic species may also be vulnerable to damage, through the removal of deadwood. Deadwood, both standing and fallen, is important for a wide range of species, yet it is often not left *in situ*. At sites with high levels of visitor access, deadwood may be collected by visitors (e.g. for den making, for firewood, etc.), tidied up, or removed for safety reasons.

Known thresholds

6.24 A range of trampling studies from a variety of countries, involving different habitats and types of situation, have consistently documented a nonlinear relationship between the amount of footfall and impacts such as vegetation damage or soil damage (Cole, 1995; Littlemore and Barker, 2001; Monz, Pickering and Hadwen, 2013). A hypothetical example is shown in Figure 17. Identifying a point on such a curve at which impact occurs is clearly difficult. Furthermore, such a relationship means management interventions will have different outcomes depending on the shape of the curve and the level of existing use. For example, a relatively large drop in the number of people on well-established moderate- to high-use trails (e.g. changing use from a to b) may result in a relatively small reduction in impact.

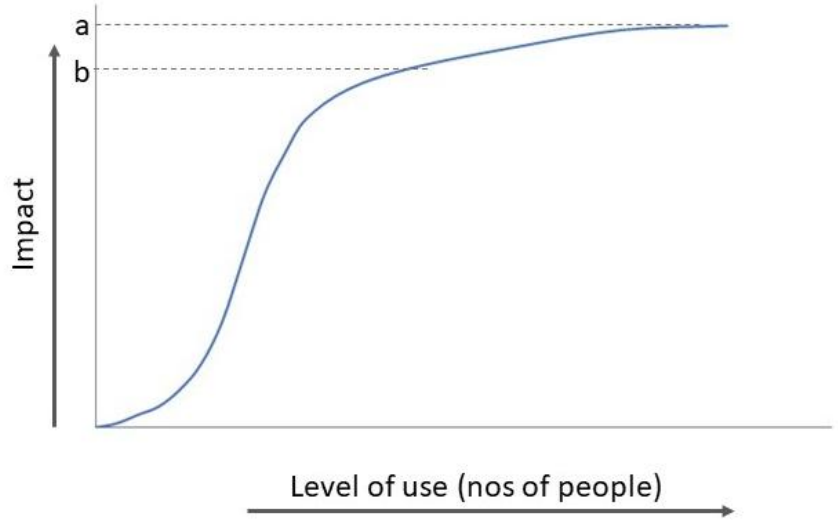

Figure 17: Generalised relationship between impact and level of use (adapted from Marion *et al.*, 2020)

6.25 The scale of any impact will also depend on a range of factors, including slope angle, weather conditions, and the forces exerted. Studies suggest that damage can occur at very low levels of trampling. Some examples of thresholds include:

- Just 12 passes of a single person on foot is enough to reduce vegetation biomass by 50% in certain habitats (Liddle, 1997);
- 48 passes of someone on foot is sufficient to reduce vegetation cover or biomass to 50%, within spruce woodland ground flora in Finland (Liddle, 1997); and,
- Comparison of a small number of paths at Burnham Beeches, with different levels of recreational use, indicated that paths with an average of 20 people or more passing per day (recorded using trail

cameras during January/February) were those with clear signs of damage in terms of increased path width, loss of leaf litter, and exposed roots (Liley *et al.*, 2022).

Vulnerable features and themes

6.26 Key points to consider when identifying vulnerable features and themes are that:

- Impacts can occur rapidly, while recovery is usually slow, indicating it is easier to avoid impact rather than restore damaged sites (Cole, 2004; Marzano and Dandy, 2012);
- Impacts can occur at relatively low intensities of use, and increases in the number of people using a route tends to result in a disproportionately lower impact per person (i.e. curvi-linear relationship between impact and passes);
- The relationship between the width of a path (in terms of bare ground) and number of people using it is also curvi-linear, with an initial fast rise and then a slower but steady increase in width with increased use (Liddle, 1997);
- Impacts tend to increase more significantly as a result of new places being damaged than from deterioration of places that are already damaged, in other words creating new access is likely to have a greater impact than more footfall in existing areas (Cole, 2004; Marzano and Dandy, 2012);
- Damage will be more severe on slopes compared to flat ground, with, for example, forest floor vegetation shown to be 6x more vulnerable to damage on slopes of 15 degrees compared to flatter areas (Weaver and Dale, 1978);
- Comparison of motorbikes, horses, and walkers showed walkers and horses were most damaging going downhill whereas bikes more damaging going uphill (Weaver and Dale, 1978);
- Horses, vehicles, and bikes are likely to be more damaging than people on foot (Weaver and Dale, 1978);
- Single events involving large numbers of people can cause significant soil degradation along trails and not all impacted features necessarily recover (Ng *et al.*, 2018);
- Hemicryptophytes (plants such as Daisy *Bellis perennis* and Dandelion *Taraxacum* agg. with buds on or near the soil surface) and geophytes (plants with bulbs or rhizomes) are more resilient to trampling impacts and Chamaephytes (woody plants with perennating buds close to the soil surface, such as Bilberry *Vaccinium myrtillus*) are particularly vulnerable (although studies of chronic trampling are lacking);
- Insects associated with bare ground, particularly those that have burrows or pits, may be vulnerable to marked changes in access

levels or types of access, with trampling potentially damaging both the burrows and causing adult mortality. However, path disuse may also lead to loss of habitat;
- Saproxylic species, particularly those that are particularly scarce, may be affected by removal of deadwood material; and,
- Veteran trees are vulnerable to soil compaction, damage to exposed roots and potentially from climbing.

Contamination

6.27 Contamination includes pollution and nutrient enrichment and also encompasses the spread of non-native species. Here we cover the following:

- Nutrient enrichment from dog fouling;
- Contamination of ponds and waterbodies from dogs; and,
- The spread of invasive species.

Nutrient enrichment from dog fouling

6.28 Relatively few authors have (perhaps unsurprisingly) studied dog fouling. However, a number of reviews have addressed the issue (Bull, 1998; Taylor *et al.*, 2005; Groome, Denton and Smith, 2018; Harris, 2023). Dogs will typically defecate within 10 minutes of a walk starting, and as a consequence most (but not all) deposition tends to occur within around 400m of a site entrance (Taylor *et al.,* 2005). In addition, most faeces are deposited close to the path, with a peak at approximately 1m from the path edge (Shaw, Lankey and Hollingham, 1995). Dogs will also typically urinate at the start of a walk, but they will also urinate at frequent intervals during the walk. The total volume of dog waste deposited on sites may be surprisingly large. At Burnham Beeches NNR over one year, Barnard (2003) estimated total amounts of 30,000 litres of urine and 60 tonnes of faeces from dogs.

6.29 Dogs are fed high-protein diets and act as an outside source of nutrients. Nutrient levels in soil (particularly nitrogen and phosphorous) are important factors determining plant species composition, and enrichment from dog fouling can therefore have a marked effect. In semi-urban woodlands in Belgium, one study attributed fertilisation rates from dogs as an average 11kg of nitrogen (more or less equally from faeces and urine) and 5kg phosphorous (predominantly from faeces) per ha per year (De Frenne *et al.*, 2022). The authors suggest the substantial levels estimated would influence biodiversity and ecosystem functioning.

6.30 The persistence of dog faeces and nutrients in the soil will be subject to a number of factors, but primarily the soil type, soil water, weather and temperature. Dog faeces can take up to two months to break down; however, if the weather is cold and dry this is likely to take longer, whereas if it is warm and wet it is likely to take less time (Taylor et al., 2005).

6.31 Dog urine can also directly scald vegetation (Taylor et al., 2005).

Contamination of woodland ponds and waterbodies by dogs

6.32 Ponds and small water bodies are often popular with dogs and dog walkers will often seek such features out, particularly in hot weather. Heavy use by dogs leads to turbid water, an impoverished invertebrate flora and a loss of vegetation (Denton and Groome, 2017; Groome, Denton and Smith, 2018).

6.33 Shampoos, wormer, tick and flea treatments are a further concern (Groome, Denton and Smith, 2018; Harris, 2023). There is growing evidence of contamination by pesticides including flea treatments such as fipronil and imidacloprid in watercourses (Perkins *et al.*, 2020, 2021, 2024). Preliminary studies of waterbodies at four locations in the New Forest where dogs are known to regularly enter the water revealed the presence of imidacloprid and at one site levels were nearly double the internationally agreed toxicity threshold for aquatic invertebrates[11].

6.34 Dogs may also act as vectors for non-native invasive plant species, such as New Zealand Pigmyweed *Crassula helmsii* (Groome, Denton and Smith, 2018) and the trampling impacts around the edge of the waterbody may lead to a loss of surrounding vegetation, exacerbating impacts.

Contamination from fly tipping, litter, etc.

6.35 Litter is a ubiquitous problem and can range from large volumes of roadside fly tipping, piles of debris where people have stopped (e.g. to picnic or drink), to small items of discarded food wrappings scattered or accidentally dropped by people walking in woodlands. It can occur anywhere, regardless of habitat, although generally more prevalent in areas with greater public access. The impacts are perhaps predominantly aesthetic, and litter and dumping of rubbish are rarely explicitly identified as a nature conservation issue.

[11] Reported by the BBC: https://www.bbc.co.uk/news/uk-england-hampshire-68400630

6.36 Plastic debris is an environmentally persistent and complex contaminant of increasing concern. Microplastics were found in all of the soil samples collected in a study from Epping Forest (Weaver *et al.*, 2024). Elevated microplastic concentrations deeper into the forest suggest that the sheltered environment creates a preferential accumulation zone. Recreation, littering and atmospheric deposition were suggested as the sources, although the specifics of recreation-associated activities weren't specified. It is however possible that such littering could extend to items thrown from vehicles or dropped in car parks/around cafes, etc., as opposed to litter generated by people out walking, for example.

Spread of invasives

6.37 Recreation is one of the major pathways for the spread of non-native species. A systematic review and meta-analysis by Anderson *et al.* (2015) found that the abundance and richness of non-native species was significantly higher at sites with recreation and showed a consistent pattern across terrestrial and aquatic environments and with a range of different activity types (e.g. horses, walkers). Allen, Brown & Stohlgren (2009) also found a positive relationship between the number of non-native species present on sites and the number of visitors.

6.38 Wichmann *et al.* (2009) show that walking humans can disperse seeds on their shoes for very long distances, up to at least 10km. Pickering & Mount (2010) document 754 species of plant for which seeds have been found to be transported unintentionally. Seeds were collected from personal clothing, horse/donkey hair, horse dung and vehicles. Besides plants, deliberate introductions of fish, reptiles and other species can occur. A full list of species examples is given by Manchester & Bullock (2000).

6.39 Species that are long-established and with stable populations may not necessarily be a cause for conservation concern - issues potentially relate to a small number of non-native species. Deliberate introductions are controlled by legislation, but it is the unintentional dispersal of species that is of concern here. Detrimental impacts of non-native species on native biota within the UK relate to competition, predation, herbivory, habitat alteration, disease and genetic effects (i.e. hybridization) (Manchester and Bullock, 2000). Species of particular concern in terms of their nature conservation impact (drawn from Manchester and Bullock, 2000) where there could be links to recreation include:

- Giant Hogweed *Heracleum mantegazzianum:* forms dense stands that can out-compete other plant species;
- Himalayan Balsam *Impatiens glandulifera:* forms dense stands that can out-compete other plant species; and,
- New Zealand Pigmyweed*:* forms dense stands that can out-compete other plant species.

Spread of pathogens

6.40 Recreation activities have been shown to act as vectors for pathogens (Allen, Brown and Stohlgren, 2009), and of particular concern is the pathogen genus *Phytophthora*, which cause a range of diseases, for example Sudden Oak Death. Systematic sampling of soils across 44 forest sites in Spain (Štraus *et al.*, 2023) found that in chestnut and beech forests, the likelihood of finding an invasive Phytophthora in forest with high recreational use was more than 3x higher than in forests with low recreational use.

6.41 *Phytophthora* has been a concern at sites such as Cannock Chase where large areas of Bilberry have been infected and have died. Studies of Phytophthora have demonstrated a higher incidence of the spores on paths and on sites with recreation access (Cushman and Meentemeyer, 2008). It should be noted that, *Phytophthora* spores may also be spread in watercourses or by flooding, and that some species show adaptations to aerial and rain-mediated spore dispersal. Climate change is likely to increase the potential for all dispersal pathways.

Vulnerable species and features

6.42 We can identify the following as potentially vulnerable to contamination:

- Ponds and other waterbodies with good water quality and supporting vulnerable species. Incursions from dogs are a particular concern;
- Vegetation communities associated with low nutrient soils;
- Sites with veteran trees where contamination could affect tree health and survival;
- Sites with important lichen flora associated with the base of trees or boulders; and,
- Sites where pathogens such as *Phytophora* are a concern.

Disturbance

Defining disturbance

6.43 Disturbance occurs where human activity influences an animal's behaviour or survival. By far the majority of the literature (and there are thousands of studies), focuses on birds (for general reviews see Hockin *et al.*, 1992; Hill *et al.*, 1997; Brawn, Robinson and Thompson III, 2001; Lowen *et al.*, 2008; Whitfield, Ruddock and Bullman, 2008; Showler, 2010; Steven, Pickering and Guy Castley, 2011). Disturbance can also affect mammals, herptiles (see Edgar, 2002 for review) and invertebrates. Disturbance can also have wider management implications, for example displacement of browsing deer within woodlands.

General principles

6.44 The presence of people in the countryside will influence wildlife in many ways. For many species, the people or their pets (e.g. dogs) are a potential threat and as such it is to be expected that the response will be to modify behaviour, for example fleeing. The relative trade-off as to when to change behaviour and respond to the threat will relate to the perceived scale of the threat and the costs involved (e.g. lost foraging time). This perspective can be used to understand the behavioural responses to human disturbance and led one author to describe human disturbance as predation-free predators (Beale and Monaghan, 2004).

6.45 With people (and their pets) viewed as potential predators, there is clearly a greater threat posed (and therefore a greater behavioural response) when , for example, there are more people, in larger groups (Beale and Monaghan, 2004, 2005) or when people approach directly (Smith-Castro and Rodewald, 2010) or faster (Bellefleur, Lee and Ronconi, 2009).

6.46 The presence of people may also draw particular predators, for example a study in America showed the Crow (corvid) populations were centred around campgrounds (Marzluff and Neatherlin, 2006), while Kays *et al.* (2017) used camera traps to show a range of predators actively selected human-made paths. As such the presence of people may also influence the distribution and abundance of predators with a knock-on effect for potential prey species. People may also attract, or more commonly disturb/disperse, deer populations within woodlands, which can lead to changes in browsing pressure and habitat composition (Larson *et al.*, 2016; Visscher *et al.*, 2023).

Impacts of disturbance

6.47 Disturbance can therefore have a range of different impacts (see Table 11), potentially affecting distribution, breeding success and health. Impacts can be chronic, for example otherwise suitable nesting habitat being completely avoided (e.g. Liley and Sutherland, 2007) or more short-term in nature, for example birds becoming alert and then resuming the initial activity (e.g. Fernandez-Juricic, Jimenez and Lucas, 2001).

6.48 Impacts can also include direct mortality, for example through predation. In the example of the Peregrine *Falco peregrinus* nests studied by Brambilla *et al.* (2004), increased nest predation by Ravens *Corvus corax* was recorded when the Peregrines were disturbed by rock-climbers. There are also examples of direct predation by pet dogs on ground-nesting birds, including adults and chicks (Pienkowski, 1984; Liley *et al.*, 2021). Some studies have shown evidence of visitors treading directly on nests and young, including herptiles (Edgar, 2002) and birds (Liley and Sutherland, 2007) – and we consider such trampling as damage (see paragraph 6.21).

Table 11: Examples of broad impacts of disturbance for birds

Impact	Examples
Otherwise suitable habitat not used	Fernández-Juricic & Tellería (2000); Liley & Sutherland (2007); Mallord *et al.* (2007); Morrison et al. (2011); Bötsch *et al* (2017)
Flushing, resulting in short-term abandonment of areas and energetic costs of flight	West *et al.* (2002); Møller (2008); Møller (2008)
Reduction in breeding success as a result of reduced parental care, increased predation, even direct nest loss	Verhulst et al. (2001); Madsen et al. (2009); Beale & Monaghan (2005); Liley & Sutherland (2007); Eyre & Baldwin (2014); DeRose-Wilson et al. (2018)
Breeding delayed resulting in reduced productivity	Murison *et al.* (2007)
Physiological impacts such as stress, elevated heart rate, etc	Weimerskirch et al. (2002); Ellenberg et al. (2013); Viblanc et al. (2012)
Reduction in foraging time/reduced foraging intake	Kerbiriou et al. (2009); Collop et al. (2016)

Types of access relevant

6.49 Disturbance has been shown to occur with a range of different types of activities. It is often difficult to separate different types of activities as at many sites multiple activities tend to overlap in space and time. Nonetheless, dogs are often identified as having a disproportionate effect (Lafferty, 2001;

Thomas, Kvitek and Bretz, 2003; Banks and Bryant, 2007; Taylor, Green and Perrins, 2007; Liley and Fearnley, 2012; Cavalli *et al.*, 2016); dogs are likely to be perceived as a greater threat, will actively chase birds and are able to track wildlife by smell. More recent studies have highlighted emerging activities such as drones (Mulero-Pázmány *et al.*, 2017).

Vulnerable species

6.50 While virtually all species will respond negatively to the presence of people if approached too close, it is possible to highlight situations and particular groups of species that are more vulnerable to disturbance:

- Ground-nesting birds as nests will be vulnerable to trampling and there is a risk of flushing and predation of chicks by dogs;
- Breeding raptors such as Goshawk *Accipiter gentilis*, as large birds tend to flush at bigger distances and raptors can often be sensitive to people around the nest;
- Colonies of breeding birds, where lots of nests occur in a limited area, e.g. heronries;
- Roost sites of raptors or herons;
- Very rare species, as there is a greater risk of local extinction for species with small population sizes;
- Bat roosts, particularly hibernacula that are accessible to people;
- Tiger Beetles and other species associated with trackways, paths and bare ground (e.g. Arndt, Aydin and Aydin, 2005); and,
- Reptiles such as Adder that bask in areas likely to be passed by people and dogs (see Edgar, 2002 for review; also Worthington-Hill, 2015).

Habituation

6.51 Some studies suggest that wildlife may be able to moderate or compensate for increased levels of disturbance, for example by adjusting feeding rates (Urfi *et al.*, 1996). A number of studies have shown that animals in habitats or locations with higher levels of human activity tend to flee at shorter distances and therefore appear to be tamer (A. P. Møller, 2008; Keeley and Bechard, 2011; Cavalli *et al.*, 2016; Vincze *et al.*, 2016). This leads to the suggestion that wildlife in some circumstances can become habituated to higher levels of access.

6.52 There are however relatively few studies that rigorously test for habituation (Walker, 2006; see Baudains and Lloyd, 2007; Rodriguez-Prieto *et al.*, 2008; Vincze *et al.*, 2016), and the evidence is typically anecdotal (Nisbet, 2000). To reliably demonstrate habituation, observations of the same individuals over

a period of time are necessary. If the same individuals are not followed, any pattern observed could be linked to individual variation, rather than habituation (Runyan & Blumstein 2004; Bejder *et al.* 2009; Carrete & Tella 2010). Furthermore, it is not necessarily the case that any pattern in behavioural response (which are most often measured) is matched to physiological responses (e.g. heart rate, hormone levels).

6.53 Evidence for habituation is therefore relatively slight, and while it may occur, some studies suggest it may not occur with particular activities such as dogs (Lafferty, 2001).

Population consequences

6.54 While behavioural and physiological studies show an impact of disturbance, it is usually difficult to understand whether the disturbance does actually have an impact on the population size of the species in question. For example, the fact that an animal flees when a person approaches is to be expected, and such behaviour is of course unlikely to have a major impact on the individual in question, let alone the population as a whole. Where such impacts involve a marked redistribution or change in how species use a site, then this is potentially impacting the ability of the site to support a given population and may make the species more vulnerable to other impacts, even if the disturbance itself doesn't cause a population effect.

6.55 Certain impacts of disturbance are perhaps more likely to have a population impact. Direct mortality resulting from disturbance has been shown in a few circumstances (Yasue and Dearden, 2006, Liley, 1999) and many (but not all) studies have shown a reduction in reproductive success where disturbance is greater (e.g. Arroyo and Razin, 2006, Ruhlen et al., 2003, Bolduc and Guillemette, 2003, Murison, 2002). There are also many examples of otherwise suitable habitat being unused as a result of disturbance (Gill, 1996, Kaiser et al., 2006, Liley et al., 2006a, Liley and Sutherland, 2007).

6.56 In a neat experimental study with woodland birds, Bötsch, Tablado & Jenni (2017) demonstrated a 15% reduction in both the number of territories and species richness in disturbed plots compared to controls. Physiological impacts or energetic costs are perhaps particularly challenging to place in a population context. For example Arlettaz *et al* (2015) suggest that the energetic costs of disturbance for Black Grouse *Tetrao tetrix* could mean an increased daily energy expenditure of >10%. However, what this means for the fitness of the birds is much harder to estimate, as there could be consequences for breeding productivity or survival etc.

6.57 Placing behavioural responses into context to understand the implications of disturbance at a population level is difficult and complex, as it means developing population models that are based on behavioural choices. There are few studies that go that far, however population impacts have been shown for a range of breeding and wintering species (West *et al.*, 2002; Liley and Sutherland, 2007; Mallord *et al.*, 2007; Kerbiriou *et al.*, 2009; Stillman *et al.*, 2012). None of these studies relate to birds associated with woodland and typically they relate to open habitats.

Conclusions

6.58 Most disturbance events covered in this section are not intentional and the impacts are, on the whole, non-lethal. Disturbance has been the subject of a wide range of studies and a large volume of literature, yet the number of studies that address population-level impacts is still limited. This is due to the complexities of placing physiological effects (stress, increased heart rate) and short-term behavioural responses into a population context. Nonetheless, there is compelling evidence for a range of species and situations whereby disturbance is a real issue.

6.59 One of the key ways in which disturbance impacts are often evident is the avoidance of areas with high levels of access. Such avoidance could be attributed to different habitat structure or the effects from access infrastructure. For example, wildlife could avoid paths or rides in woodland simply due to the different habitats present. However, evidence suggests that it is the presence of people that is critical (Bötsch *et al.*, 2018).

6.60 It is also important to highlight that deliberate disturbance of some species is illegal. The offence of intentionally disturbing protected species occupying places used for shelter or protection was first introduced in section 9 of the Wildlife and Countryside Act 1981 ('WCA') and applied to species listed on Schedule 5 of the Act. Section 9 of the WCA was later amended by the Countryside and Rights of Way Act 2000 to include both intentional and reckless disturbance.

Fire

6.61 Fires can be caused accidentally as a result of sparks from cooking stoves, BBQs, fireworks etc. They can also be started deliberately (e.g. campfires, arson). While wildfires are most often initiated by human activity, the intensity and scale of any fire will be driven by factors such as fuel condition and availability, vegetation structure and meteorological and topographic

conditions (see Forestry Commission, 2023 for discussion).Cigarettes and shards of glass (acting as a magnifying glass) are often cited as sources of wildfires, however evidence for this is weak (Forestry Commission, 2023). While there are clear links to recreation use (e.g. picnics using a disposable BBQ), some fires are the result of anti-social or criminal behaviour that could take place regardless of any responsible public access.

6.62 Fire incidence on heathland sites (where it is a more major threat and more closely monitored) have been directly attributed to recreation use and surrounding urbanisation (Miller and Miles, 1984; Anderson, 1986; Tantram, Boobyer and Kirby, 1999). Where public access occurs, fire incidence is therefore more likely, however high levels of responsible use may also deter people from starting fires and lead to faster reporting of any incidents. In the Chilterns Beechwoods, systematic mapping of recreation impacts at a range of ancient woodland sites recorded multiple instances of campfires within the woods, often associated with dens and tucked away, but close to access points (Panter *et al.*, 2022). Some were directly in the vicinity of veteran trees. Lake *et al.* (2020) provide examples of campfires and BBQ occurrence within the New Forest, again showing fires can occur in a woodland setting.

6.63 Deciduous woodland is, by its nature, much less vulnerable to fire than other habitats, such as heathland or moorland, nonetheless a small fragment of ancient woodland in wider landscape of such habitats could be severely damaged by wildfire. Recreation use will not necessarily be confined to a woodland boundary and in many places public access will extend beyond the woodland boundary (e.g. via the footpath network). Within ancient woodlands even small fires could pose localised damage, for example to veteran trees and the invertebrate interest within them.

6.64 Climate strongly influences wildfire risk and climate change is likely to increase the risks of wildfire and the types of habitat affected (Jolly *et al.*, 2015). The incidence of forest fires globally has doubled since 1984 as a result of global warming (Mansoor *et al.*, 2022). It is likely that wildfire incidence will occur in situations and vegetation communities where it has previously been rare or very limited (anon, 2017) and various authors highlight the need for new strategies and modified approaches to assessing the risks from wild fire (Arnell, Freeman and Gazzard, 2021; Mansoor *et al.*, 2022).

Vulnerable species, habitats and features

6.65 Fires can have major impacts on the soil, vegetation and fauna present, and recovery can take many years. Fire can change water filtration within soils and result in loss of nutrients (Mallik, Gimingham and Rahman, 1984). Vegetation recovery may depend on the intensity of the fire and whether litter (protecting rootstock. and seeds) is burnt (Alchin, 1997). While virtually all habitats/species will respond negatively to wildfire, it is possible to highlight ancient woodland situations and features that will be more vulnerable. We highlight the following as potentially vulnerable:

- Small woodland sites surrounded by more flammable vegetation types such as lowland heathland or moorland, also potentially extending to grassland, dunes, reedbeds, scrub, plantation, etc;
- Woodland supporting abundant bracken, which can build a deep litter or thatch that can be a fire hazard early in the year (Read, 2000);
- Veteran trees, particularly hollow trees, as these can hold dry litter inside the trunk and the trunk can serve as a chimney, fuelling the fire with air (Read, 2000). Such trees can support highly specialised and very rare invertebrates;
- Woodlands on south facing slopes; and,
- Woodlands on dry organic peat soils.

6.66 Particularly vulnerable species include those that are not adapted to fire resistance or are relatively immobile, overwinter as eggs or larvae, and/or have only one generation per year.

Other types of impact

6.67 In this section we consider other types of impact that do not conveniently fit under Damage, Contamination, Disturbance and Fire. These include:

- Impacts to site management;
- Public opposition and demand; and,
- Harvesting.

6.68 Public opposition can halt or delay management programmes associated with conservation, such as the control of invasive species (Bremner and Park, 2007). It can be a particular problem where livestock grazing is needed, such as Wood Pasture. Dog-walkers and horse riders may be concerned about interactions with livestock, while walkers and others may be concerned about the impact of fencing and gates on open access areas or about disease.

6.69 In some cases, livestock grazing (particularly sheep) is found to be untenable on sites popular with dog walkers due to worrying and death of sheep by dogs (e.g. Taylor *et al.* 2005). Of the fifty four cattle attacks upon people accessing the countryside documented by Fraser-Williams *et al.* (2016), around 1 in 4 were fatal and two-thirds involved dogs. Walking with dogs among cows, particularly when calves were present, was a particular issue identified in the paper.

6.70 Another potential issue relates to demand for access and pressure for particular interventions, infrastructure, or facilities. On sites with current recreation use, visitors may well wish for better path surfacing, toilets, cafes, dog bins etc. Where access is not encouraged or there is no access there may be demand from local people and visitors for access to be provided. These issues can bring added pressure for site managers or a need to compromise between nature conservation and recreation.

6.71 There is increasing interest in wild foraging. Non-commercial foraging is often seen as a valuable way in which people engage with the natural environment and general guidelines[12] are available including the Woodland Trust's own guidelines[13]. However, commercial foraging can be at a completely different scale and there is concern that it may in some cases be impacting on features of nature conservation importance, although this is debated[14]. Commercial collecting is in some places prohibited, such as in the New Forest[15]. We have found no data on the impacts of wild foraging at the population level in England. Nevertheless, research from Switzerland found that harvesting did not impair future yields of fruiting bodies or reduce fungal diversity, although trampling reduced the number of fruiting bodies (Egli *et al.*, 2006).

6.72 Note that all plants are protected against unauthorised uprooting by the Wildlife and Countryside Act (1981). In addition, it an offence to intentionally pick, uproot or destroy wild plants that are included in Schedule 8 of the Act. Where there is public access provision (for example Countryside and Rights of Way Open Access land or where a public right of way is present) the right of public access does not extend to the foraging and gathering for wild food,

[12] https://www.plantlife.org.uk/uk/about-us/news/picking-wild-flowers-is-a-good-thing
https://britishlocalfood.com/foraging-etiquette/
[13] https://www.woodlandtrust.org.uk/visiting-woods/things-to-do/foraging/foraging-guidelines/
[14] https://www.theguardian.com/environment/2006/aug/16/food.society
https://www.telegraph.co.uk/food-and-drink/features/are-we-foraging-too-much/
[15] https://www.forestryengland.uk/fungi-the-new-forest

or byelaws may be in place that specifically restricts foraging. On protected sites, permission may be needed from Natural England, which is only able to issue consent to legally notified owners and occupiers of SSSI land[16]. In reality, it is unlikely that this situation stops people from picking, say, blackberries from a hedge on a SSSI.

[16] See relevant part of Natural England website

Appendix 2: Online questionnaire design and distribution

Questionnaire design

7.1 The online survey question was designed using Snap XMP software and was hosted on the Snap website. It introduced each of the intervention measures with a description and an image, followed by three questions:

- **Do you have any experience of using [this measure] as a means of encouraging wanted behaviours and reducing impacts of access in ancient woodlands?**
  [Yes / No]
- [If Yes] **In your experience how effective is [this measure] as a means of encouraging wanted behaviours and reducing impacts of access in ancient woodlands?**
  [Score from 0 to 10, where 0 is not at all effective, 5 is moderately effective, and 10 is extremely effective]
- **Do you have any comments, specific examples or views on how [this measure] might be best deployed to encourage wanted behaviours and reduce impacts of access within ancient woodlands?**
  [Open-ended question]

7.2 These questions were asked in respect to the 52 measures detailed in Table 9 within the main body of this report, followed by a final additional question (with a free-text box for responses) within which respondents could provide details of any other measures not already identified within the questionnaire of which they had experience.

7.3 A final set of questions allowed respondents to identify their personal circumstances with respect to access management within woodlands (e.g. managing woodlands that have public rights of access, private woodland owner or manager, managing woodlands for conservation, etc.) and their professional work area. The last section of the questionnaire asked whether the respondent would be happy to be contacted subsequently and/or receive a copy of the resultant report, followed by fields for their contact details. If contact permission was not granted, then the respondent remained anonymous.

Timing and distribution

7.4 The online survey went live in mid-October 2024 and closed on 31st December 2024, and the URL was subsequently promoted via the following channels:

- Through the Project Steering Board (comprising the Forestry Commission project team and representatives from a number of partner organisations);
- The Forestry Commission national eAlert system;
- Social media (including Twitter/X, Bluesky, Facebook, and LinkedIn);
- More than 100 direct e-mails to Forestry Commission contacts; and,
- Direct emails to relevant Footprint Ecology contacts.

7.5 An initial round of promotion was undertaken in mid-October, with subsequent pushes made at regular intervals prior to the closing date, and all social media posts and e-mail correspondence included a request for recipients to further share the questionnaire URL with other relevant individuals/organisations within their network.

Appendix 3: Online questionnaire introduction and example question

Forestry Commission

Managing Access in Ancient Woodlands

Footprint Ecology has been commissioned by the Forestry Commission to evaluate the effectiveness of access management measures in ancient woodlands. This questionnaire is designed to gather information from site managers and those involved in the management of ancient woodlands. We're looking to gather information on access measures you've implemented and found most effective in protecting and reducing/preventing impacts to ancient woodlands.

Within 7 broad themes, we have listed a number of measures that might be used within areas of ancient woodland to reduce or avoid impacts associated with recreation use. For each one, we would like to know whether you have experience of it, and if so, how effective you would consider it (on a scale of 0 to 10), along with any other comments, specific examples or further details that you would like to add.

We anticipate that the survey will take approximately 20-30 minutes to complete. If you wish to save your answers and return to the survey at a later date then click the 'save' button on the final page. This will generate a personalised link which you can bookmark to resume the survey. You will also have the option of having the link emailed to you.

If you would like the survey in a different format, please email info@footprint-ecology.co.uk.

The results of this survey will be used to inform the Forestry Commission's advice and guidance on design of access and implementation of management measures in ancient woodlands. The specific results from this survey will be made available to those who participate (if requested at end of survey).

We really appreciate the specialist input from a range of sources, please feel free to circulate the survey link more widely to your own network.

The survey will close on **31st December 2024**.

1) Access infrastructure: Interpretation panels

Interpretation boards and direct provision of information to enhance visitor understanding and awareness of issues.

Q1a Do you have any experience of using interpretation panels as a means of encouraging wanted behaviours and reducing impacts of access in ancient woodlands?

- ◯ Yes
- ◯ No

Q1b In your experience how effective are interpretation panels as a means of encouraging wanted behaviours and reducing impacts of access in ancient woodlands?

0 - Not at all effective	1	2	3	4	5 - Mode rately effective	6	7	8	9	10 - Extr emely effective
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Q1c Do you have any comments, specific examples or views on how interpretation panels might be best deployed to encourage wanted behaviours and reduce impacts of access within ancient woodlands?

Appendix 4: Details of Wistman's Wood visitor survey

Methods

Survey logistics

8.1 The visitor survey took place on Friday 1st November and Saturday 2nd November 2024, coinciding with the autumn half-term. The surveyor stood at the small car park at Two Bridges (at the start of the track to Wistman's Wood). Face-to-face interviews were conducted with a random selection of visitors, with the surveyor selecting the next person they saw after completing the previous interview, with only one person interviewed per group or party.

8.2 Alongside the interview data, a tally of all people passing was maintained, recording the number of groups (of any size), individuals, minors, dogs and cyclists. These counts allow a comparison across survey points in terms of visitor volume/footfall and indicate the proportion of visitors that were interviewed at each location.

Questionnaire design

8.3 The questionnaire (see Appendix 5) was designed using Snap XMP software and was conducted using tablet computers running the Snap Offline Interviewer app. The route that the interviewee had taken on site (or was planning to take) was drawn by the surveyor onto a paper map, using a unique reference number to match it to the corresponding questionnaire data and these routes were subsequently digitised into GIS.

Survey timings

8.4 A total of 16 hours of survey work were undertaken, evenly split between the two dates. Surveys were split into 2-hour periods to provide breaks for the surveyor and comparable survey windows across both dates. Survey times comprised: 07:00 - 09:00, 09:30 - 11:30, 12:30 - 14:30, and 15:00 - 17:00hrs.

Results

8.5 50 interviews were conducted in total, with slightly more (28 interviews; 56%) on the Friday rather than the Saturday (22 interviews; 44%).

Activities

8.6 Most (76%) of interviewees were walking (see Table 12) and this was the most frequently cited main activity. Notably, more than one in four interviewees (28%) cited photography as an activity that they were undertaking that day. 'Other' activities that did not fit into the pre-determined categories within the questionnaire included wild camping, climbing on the tors, "wanting to visit the wood on my birthday", collecting firewood, and litter picking. Three interviewees specifically stated some botanical interest, of which one was looking at lichens and one at mosses and lower plants.

Table 12: Number (%) of interviewees by activity. Interviewees were asked what their main activity was that day as well as any other secondary activities that they were undertaking. Interviewees could only name one main activity but could name multiple secondary activities, hence the total % >100.

Activity	Number (%) main activity	Number (%) secondary activity	Total (%) interviewees undertaking activity
Walking	36 (72)	2 (4)	38 (76)
Dog walking	7 (14)	1 (2)	8 (16)
Outing with family	2 (4)	0 (0)	2 (4)
Photography	2 (4)	12 (24)	14 (28)
Jogging / running	1 (2)	0 (0)	1 (2)
Bird/wildlife watching	0 (0)	6 (12)	6 (12)
Picnic	0 (0)	1 (2)	1 (2)
Meeting up with friends	0 (0)	1 (2)	1 (2)
Other	2 (4)	4 (8)	6 (12)
Total	**50 (100)**	**27 (54)**	**77 (154)**

Visit frequency

8.7 Around three-quarters (76%) of interviewees hadn't visited the location in the past year (see Table 13), indicating that most visitors were infrequent or first-time visitors. Just two interviewees (4%) were daily visitors.

Table 13: Number (%) of interviewees by frequency of visit (roughly how many times in past year interviewee had visited the location).

Activity	Daily	Once a month (6-15 visits)	Less than once a month (2-5 visits)	First visit / haven't visited in past year	Total
Walking	0 (0)	1 (3)	7 (19)	28 (78)	36 (100)
Dog walking	2 (29)	0 (0)	1 (14)	4 (57)	7 (100)
Outing with family	0 (0)	0 (0)	0 (0)	2 (100)	2 (100)
Photography	0 (0)	0 (0)	0 (0)	2 (100)	2 (100)
Jogging / running	0 (0)	1 (100)	0 (0)	0 (0)	1 (100)
Other	0 (0)	0 (0)	0 (0)	2 (100)	2 (100)
Total	**2 (4)**	**2 (4)**	**8 (16)**	**38 (76)**	**50 (100)**

Choice of location

8.8 It was clear that Wistman's Wood was a particular draw for visitors to the location. In response to Question 5 "why have you chosen to visit this specific location today, rather than somewhere else on Dartmoor?" six interviewees (12%) specifically mentioned temperate rainforest and 23 interviewees (46%) mentioned the woodland, the wood, ancient woodland, or some other aspect of the wood. Many interviewees were also potentially drawn to the location because of the woodland, despite not specifically mentioning it. For example, 10 interviewees (20%) stated that they had been recommended to visit, four interviewees (8%) commented on the uniqueness of the location, and a single interviewee (2%) was undertaking a geography project, all without specifically mentioning the trees or woodland.

Entering the wood and response to signage

8.9 The majority of those surveyed (46 interviewees; 92%) did not enter the wood (Q7). Two interviewees (4%) stated that they did enter, and another two interviewees (4%) were uncertain or didn't know.

8.10 Most interviewees had seen the signs (Q8), with 36 interviewees (72%) responding that they had seen the 'walk around' signs (pictures of which were held up on a show card as part of the interview). Of the 36 interviewees that had seen the signs, 18 (36% of all interviewees) modified their route to avoid entering or going close to the wood. The remaining 18 interviewees (36% of the total) didn't need to change their route as they weren't planning on entering the wood. Whilst including both of the daily visitors, this latter group predominantly comprised those on their first visit or who hadn't

visited in the past year, with five interviewees specifically visiting to see the wood.

8.11 Both interviewees that entered the wood had seen the signs and had chosen to ignore them. Both were walkers, and both had visited the wood before (although one not for a long time). One commented that they understood the need to protect the habitat but were careful during their visit. The other was also generally supportive of making people aware but commented that it was more important to exclude livestock (sheep and cows) than people. One of the two walkers was visiting on their own, while the other was part of a group of eight people (including four minors).

8.12 These results clearly show that the signage is largely effective. Assuming a random sample of people were interviewed, the results suggest that 72% of visitors saw the signs, 36% modified their behaviour and kept out of the wood (with a further 36% not intending to enter the wood anyway), and just 4% of visitors chose to ignore the signs and enter the wood.

Views about the signage

8.13 The 36 interviewees who had seen the signs were asked for any views and comments on the signs. 14 interviewees were generally positive, while eight stated that they thought there should be more signs, stronger messages, or more information (i.e. an increase in the signage). Two interviewees suggested that they would like to see some limited access within the wood, such as a single route within the trees or some kind of viewing area just inside them. Three interviewees specifically stated that it was a shame that access wasn't possible (even if they agreed with the need to ask people to keep out), with one suggesting it was a particular shame that their children couldn't enter it. Two interviewees felt that the signs weren't effective enough, as they had seen people within the wood.

8.14 Overall, just over half of the interviewees felt well informed about the conservation importance of Wistman's Wood, and there was clearly very strong support for the idea that it was possible to enjoy a visit to the site without entering the wood (see Figure 18). This would suggest that the signs and requests to keep out of the wood have had little impact on visitor's perceived enjoyment of the site and their visit.

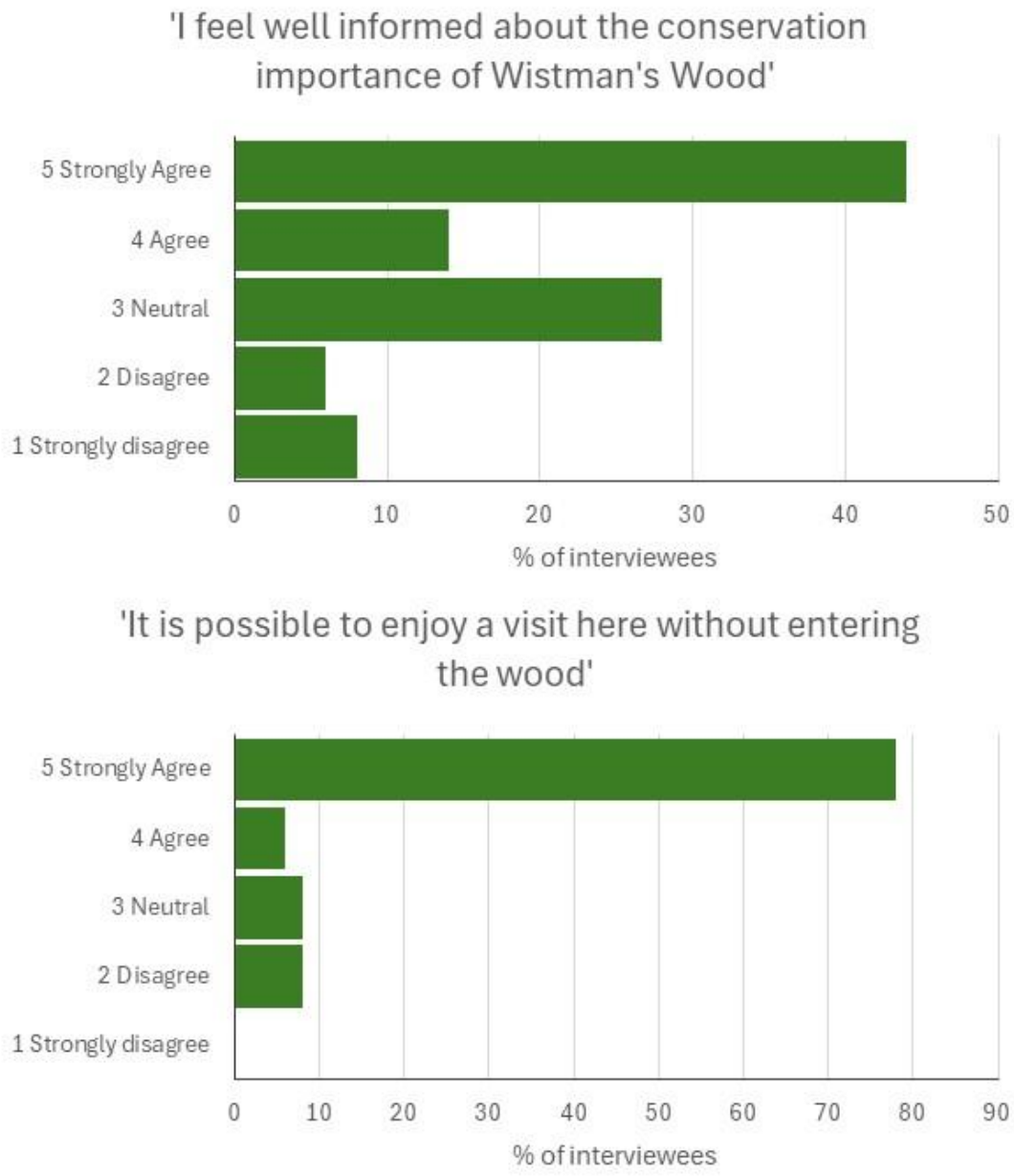

Figure 18: Responses to Q11 and support for given statements

Appendix 5: Wistman's Wood Questionnaire

FOOTPRINT ECOLOGY
www.footprint-ecology.co.uk

Good morning/afternoon. I am conducting a visitor survey on behalf of the Forestry Commission, to find out how people use this area for recreation. In particular we want to find out more about why people choose to come here, the attraction of Wistman's Wood and where people go. Can you spare me a few minutes please?

Q1

- ◯ Yes, happy to be interviewed (this starts the questionnaire)
- ◯ No, refusal (this options takes you end of questionnaire and logs a refusal)

Q2 **What is the main activity you are undertaking here today?** *Tick closest answer. Do not prompt. Single response only. Record any additional activities on the next page (Q3).*

- ◯ Dog walking
- ◯ Walking
- ◯ Jogging / running
- ◯ Outing with family
- ◯ Cycling / mountain biking
- ◯ Bird/wildlife watching
- ◯ Photography
- ◯ Meeting up with friends
- ◯ Visiting cafe/restaurant/pub
- ◯ Picnic
- ◯ Horse riding
- ◯ Fitness/formal sports
- ◯ Other, please detail:

Further details

Q3 **Are there any other activities that you (or members of your group) are doing whilst you are here today?** *Tick all that apply. Do not prompt. Leave blank if not applicable.*

- [ ] Dog walking
- [ ] Walking
- [ ] Jogging / running
- [ ] Outing with family
- [ ] Cycling / mountain biking
- [ ] Bird/wildlife watching
- [ ] Photography
- [ ] Meeting up with friends
- [ ] Visiting cafe/restaurant/pub
- [ ] Picnic
- [ ] Horse riding
- [ ] Fitness/formal sports
- [ ] Other, please detail:

Further details

Q4 **Over the past year, roughly how often have you visited this location?** *Tick closest answer, single response only. Only prompt if interviewee struggles.*

- ◯ Daily
- ◯ Most days (180+ visits)
- ◯ 1 to 3 times a week (40-180 visits)
- ◯ 2 to 3 times per month (15-40 visits)
- ◯ Once a month (6-15 visits)
- ◯ Less than once a month (2-5 visits)
- ◯ First visit / haven't visited in past year
- ◯ Don't know
- ◯ Other, please detail

Further details:

Q5 **Why have you chosen to visit this specific location today, rather than somewhere else on Dartmoor?** *Free text, open ended. Do not prompt.*

Q6 **Now I'd like to ask you about your route today. Looking at the area shown on this map, can you show me where you started your visit today, the finish point and your route please.** *Probe to ensure route is accurately documented, in particular check whether they entered the Wistman's Wood. Use **P** to indicate where the visitor parked (if applicable), **E** to indicate where they started and **X** to indicate where they finished. Mark the route with a solid line for the route already taken, a dotted line for the expected or remaining route, with arrows to indicate the direction.*

Enter the map reference below, or write 'no map' if no route map completed.

Q7 Did you or any of your group go into Wistman's Wood at all during this visit?

- ◯ Yes, entered wood
- ◯ No, didn't enter wood
- ◯ Not sure/uncertain/don't know

Q8 Did you see any signs like this during your visit? **Show interviewee image of signs**

- ◯ Yes, saw signs
- ◯ No, didn't see signs
- ◯ Not sure/uncertain/don't know

Q9 As a result of seeing the signs, did you alter your intended route today? **Do not prompt or read out options, record closest response (this question only asked for those who had seen the signs)**

- ◯ Yes, modified route to avoid going in or close to the wood
- ◯ No, ignored signs and did enter wood
- ◯ No, no need to change route as wasn't planning to enter wood
- ◯ Not sure/uncertain/don't know

Q10 Do you have any comments or views about the signs? **(this question only asked for those who had seen the signs)**

Q11 Please score the following statements, giving a score from 1 to 5 to indicate whether you agree or not with the statement, with 5 indicating you strongly agree, 3 indicating you do not feel strongly either way and 1 indicating you strongly disagree. **Read each statement. Check each answer as you log it by reading it back to the interviewer. Number of statements shown does vary according to previous answers**

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
I feel well informed about the conservation importance of Wistman's Wood	◯	◯	◯	◯	◯
It is possible to enjoy a visit here without entering the wood	◯	◯	◯	◯	◯

Q12 **Finally, to identify how far people have travelled to visit this location, what is your full home postcode?** *This is an important piece of information, please make every effort to record correctly. If necessary, reassure them that we don't want their full address, and it will only be used to work out where people are coming from.*

That is the end. Thank you very much indeed for your time.

TO BE COMPLETED AFTER YOU HAVE FINISHED SPEAKING TO INTERVIEWEE

Number of people in group (including minors)	
Number of minors in group (under 18s)	
Number of dogs with group	
Number of dogs with group seen off lead	

Q13 **Did the interviewee struggle with answering questions because English was not their first language?**
Tick if you feel this may have influenced their responses.

☐

Q14 **Did the interviewee appear to be part of an organised group (such as students, a walking group etc)?**

○ Yes
○ No

Q15 **Surveyor comments**. *Note anything that may be relevant to the survey, including any changes to the survey entry that are necessary, e.g. typos/mistakes/changes to answers/additional information.*